



**PowerComputing**

# Users' Guide

Everything you need  
to know about setting up and  
operating your PowerTower Pro™ system

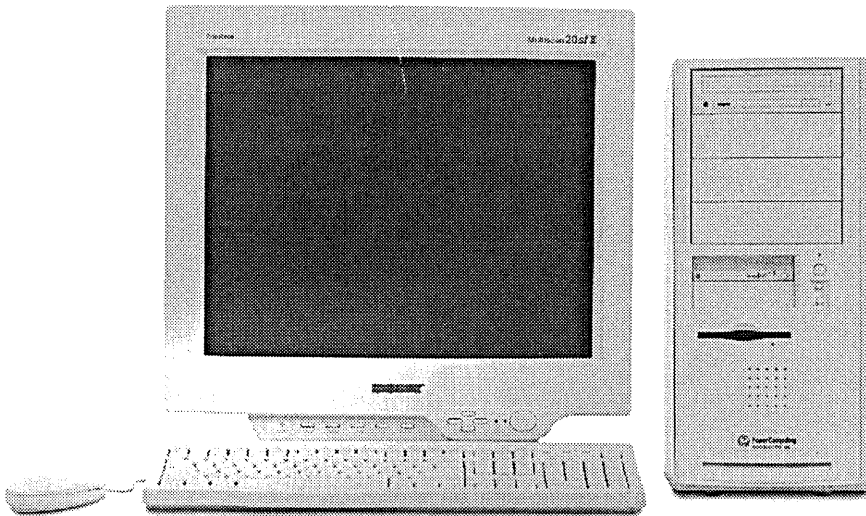


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Part number 72810  
Rev. number 960823

# PowerTower Pro User's Guide



Part number 72810  
Rev. number 960823

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Power Computing was chosen by Apple as the first licensed manufacturer of Mac OS systems. We created our company with the focus on providing customers with more choice, better service, and more affordable systems.

Our top priority is you. We offer toll-free lifetime technical support and an inexpensive optional on-site warranty plan, which provides service at your location. We would love to hear from you. Call us with any questions, or just to let us know how you like the system. Our customer service number is 1-800-671-6227; our e-mail address is, **info@powercc.com**.

We hope this is the beginning of a long relationship between us. We look forward to your continued support. Enjoy your new Power Computer.

Sincerely,



Steve Kahng

President and CEO



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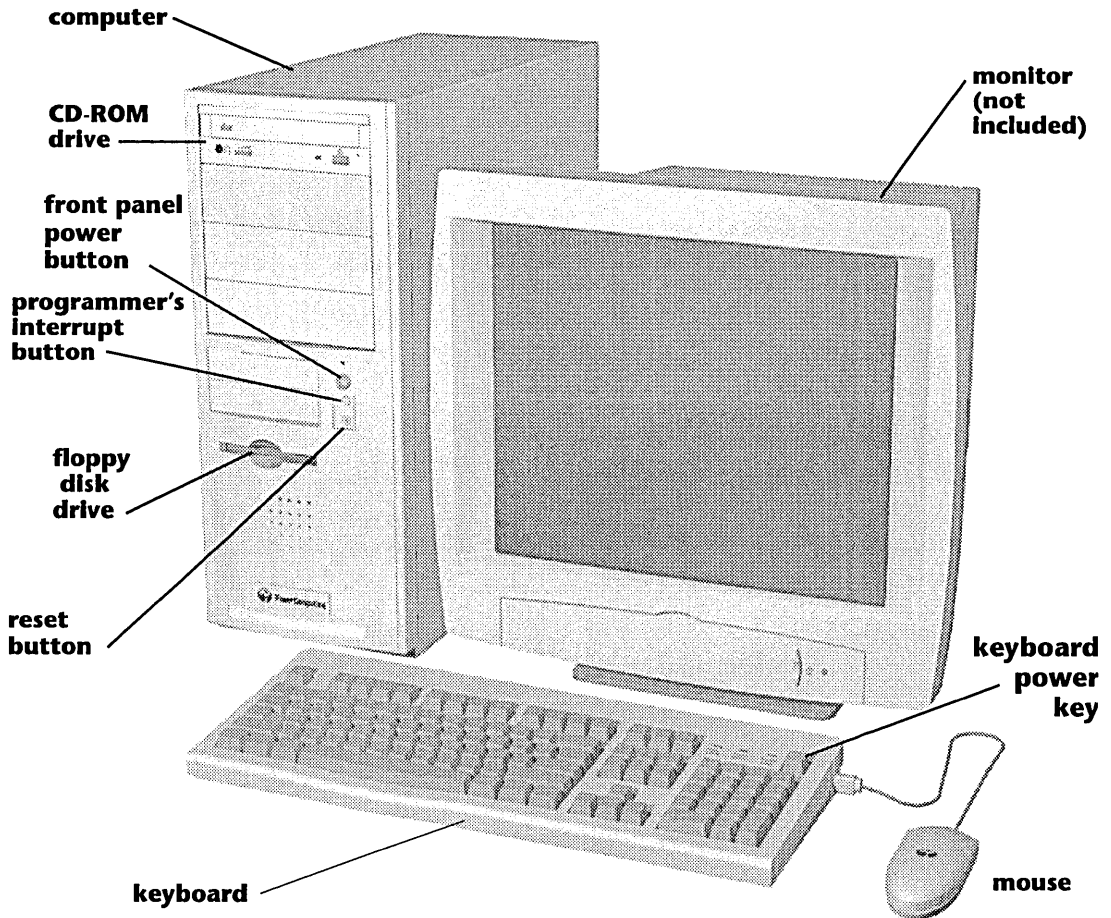




# System Overview

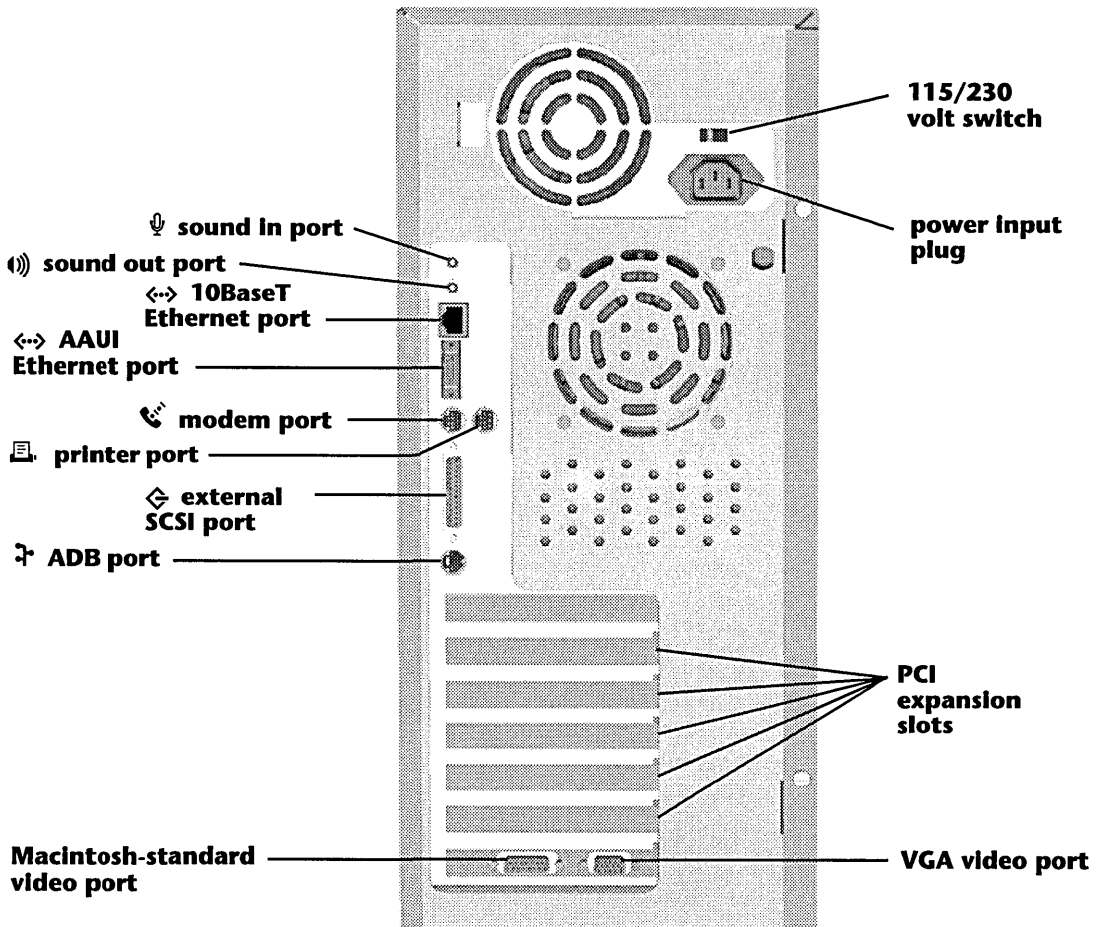
## System front view

Here are the key features of the system from the front.



# System rear view

Here are the key features of the system from the rear.



# Return, Support, Warranty, Satisfaction Guarantee, and License Information

## RETURN POLICIES

If you received equipment (“Hardware”) from Power Computing Corporation (“Power”) in a damaged shipping container or if your Hardware was otherwise damaged in shipment to you, please contact the shipper immediately. All Hardware and packaging were fully inspected prior to shipment from Power, and you must file a claim with the shipper for any damages that may occur in shipment. Retain all shipping materials. Contact Power's Customer Service Department if you need assistance with any such claims.

Customers who did not purchase systems directly from Power Computing must contact the dealer they purchased their system from for assistance.

### Returns for refund

To return Hardware manufactured by Power Computing Corporation and purchased under Power's thirty-day money back guarantee, see the terms of the Customer Satisfaction Guarantee. You must contact Customer Service for a Return Merchandise Authorization (“RMA”) before returning the merchandise. If you have already registered your Product for warranty purposes (see “Warranty registration” on page xix for details), processing will be simplified.

After your return request is received, Power's Customer Service will issue you an RMA number, along with shipping instructions for return of the Hardware. This number is valid for ten (10) days from the date of issuance. The Hardware

must be received by Power on or before the tenth day after issuance of the RMA number. Returns will not be accepted without a valid RMA number written on the box.

**Note:** A sample shipping label is included in the back of the manual.

## **Returns for repair**

In order to return Hardware for warranty or non-warranty service, you must request an RMA by contacting Power's Technical Support or Customer Service Department.

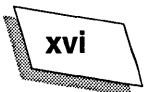
You must back up all data stored on the Hardware before returning your Hardware to Power for repair, as Power will format your drive with a new disk image. Power is not responsible for any loss of data.

If Power finds defective components, materials or workmanship in your Hardware, Power will use reasonable efforts to repair or replace the Hardware. If the Hardware is under warranty, there shall be no charge to you for such repairs or replacement, and the Hardware will be returned to you using the same class of service for shipping. Otherwise, Power's standard charges for parts, labor, shipping and handling will apply.

## **Shipment of hardware to Power**

For both types of returns, all Hardware should be returned in the original packaging material, accompanied by all components that might affect the Hardware's performance, and the Hardware must have the RMA number clearly written at least three (3) times on the outside of each box. You bear all costs and risks of loss in connection with shipping the Hardware back to Power Computing. We recommend that the package(s) be insured for the full purchase amount.

These policies are subject to change at the discretion of Power Computing, except that any changes in these policies will not apply to Hardware sold to customers prior to the effective date of any policy change. If you have any questions regarding these policies, please contact Power Computing Customer Service.



Dealers, Distributors, Leasing Companies, VARs, and other resellers of Power Hardware are not eligible for the Satisfaction Guarantee return and refund policies. Sales to those entities will be final unless otherwise agreed to in writing by Power. Customers who did not purchase systems directly from Power Computing must contact the dealer they purchased their system from for assistance.

## Support information

For basic customer and technical support information, as well as product information and other news, visit our Web Site at:

<http://www.powercc.com>

### Direct or dealer support?

Customers who purchased systems directly from Power Computing should contact Power Computing for assistance. Customers who did not purchase systems directly from Power Computing must contact the dealer they purchased their system from for assistance.

### Contacting Customer Service

To contact Power Customer Service call (800) 671-6227, fax (512) 388-6798, or e-mail [custserv@powercc.com](mailto:custserv@powercc.com) and describe in detail any problems or issues you need resolved with respect to Power Computing. Be sure to include your order or quote number, serial number, and phone number with all correspondence.

Customer Service telephone hours are as follows: (All times are United States Central Time.)

<b>Customer Service</b>	If you have a question or a problem with an order you have received	M – F 8 AM to 6 PM Sat 10 AM to 4PM Sun 10 AM to 6 PM	1-800-671-6227
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## Contacting Technical Support

To contact Power Technical Support call (800) 708-6227, fax (512) 388-6798, or e-mail **support@powercc.com** and describe in detail the problem that you are having with your Hardware.

For details on contacting Technical Support, see "Contacting Technical Support" on page 134.

Be sure to include your model number, serial number, date of purchase and phone number with all correspondence. We advise you to confirm receipt of all fax or e-mail requests.

Technical Support telephone hours are as follows: (All times are United States Central Time.)

<b>Technical Support</b>	For help with a technical problem	M – F 8 AM to 8 PM Sat 10 AM to 4 PM Sun 10 AM to 4 PM	1-800-708-6227
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# LIMITED WARRANTY

## One-year limited hardware warranty

### Warranty registration

You should register your Product with Power by completing the **Power Owner Registration Card**, enclosed in the pizza box along with the keyboard and mouse, and mail the completed card to Power. If you prefer, you can register your purchase on Power's web site at [www.powercc.com](http://www.powercc.com). You should register within 3 months from the date of purchase. Once you register your purchase, you will receive an on-site registration validation sticker and card for you to use to validate your limited warranty.

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## Obtaining warranty service

To obtain warranty service, you must return your Hardware, freight pre-paid, to a service facility authorized by Power in accordance with Power's then-current Return Policy. All Power Hardware must be returned in original packaging material.

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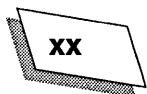
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2. Repack and seal the Hardware and all documentation, software, accessories, registration cards and other materials originally supplied with the Hardware in the original packing material.
3. Make sure that the RMA number is visibly legible on the box in at least three places.
4. Ship the Hardware to Power Computing at the address shown on the sample Merchandise Return Form shown at the back of this manual. Make sure the shipper does not cover the form. The Hardware must be received by Power Computing on or before the thirtieth day after you receive the system(s).
5. You should pre-pay shipment, and assume all risks of loss or damage in connection with shipping the system back to Power Computing. We recommend that package(s) be insured for the full purchase amount.
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7. Hardware received with any shipping charges due or after the thirtieth day after receipt of the system(s) by the customer will be refused by Power Computing and returned to the sender. We will also return any Hardware that

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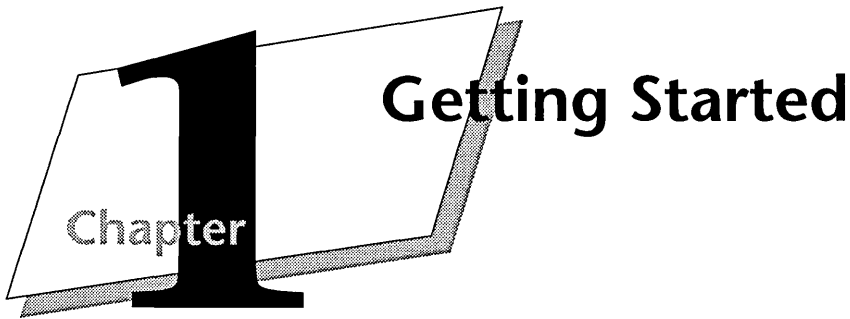
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**Note:** The Apple Software Registration Card is in the back of the manual.



# Chapter 1 Getting Started

Your computer has been designed for easy plug-and-play setup in four simple steps - if you are in need of technical assistance after completing the setup process described in this chapter, please feel free to call Power Computing Technical Support at 1-800-708-6227.

- Find a place for the computer and monitor
- Plug in the computer
- Plug in and connect the monitor
- Connect the mouse and keyboard

## Finding a place for the computer and monitor

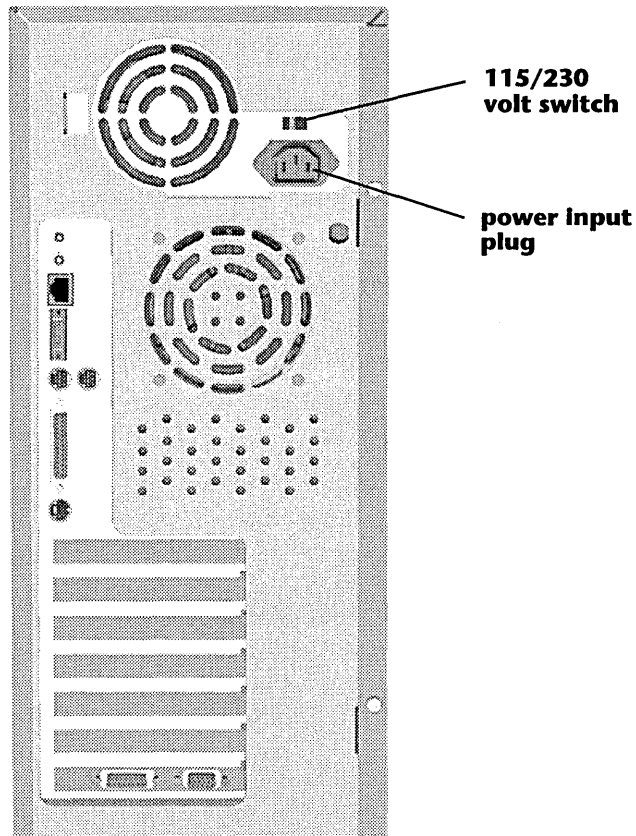
Think carefully about where to place your computer and monitor. Here are some suggestions to help you find a good place:

- Make sure there is a grounded, three-hole electrical outlet within a few feet.
- Use a sturdy, level table or desk as a work surface. Make sure that you can position your monitor, keyboard, and mouse so that you can work comfortably. See Appendix A, "Safety and Health Information," on page 141 for detailed instructions.
- Leave a few inches of space around the computer and monitor for air to circulate.



## Plugging in the computer

Set up and plug in the computer before connecting the monitor, keyboard, and other devices. Plugging in the computer ensures that it is grounded and protected from electrical damage. The key components for plugging in the computer are shown below.



**WARNING!** *For your safety, the computer is equipped with a three-prong plug designed to be used with a grounded electrical outlet. If you do not have access to an appropriate outlet, have an electrician install one. Do not use your computer with a three-prong adapter in an ungrounded outlet.*

### To plug in the computer:

**CAUTION: Do not press the power switch on the front panel of the computer or the keyboard power switch until you have completed all of the setup instructions.**

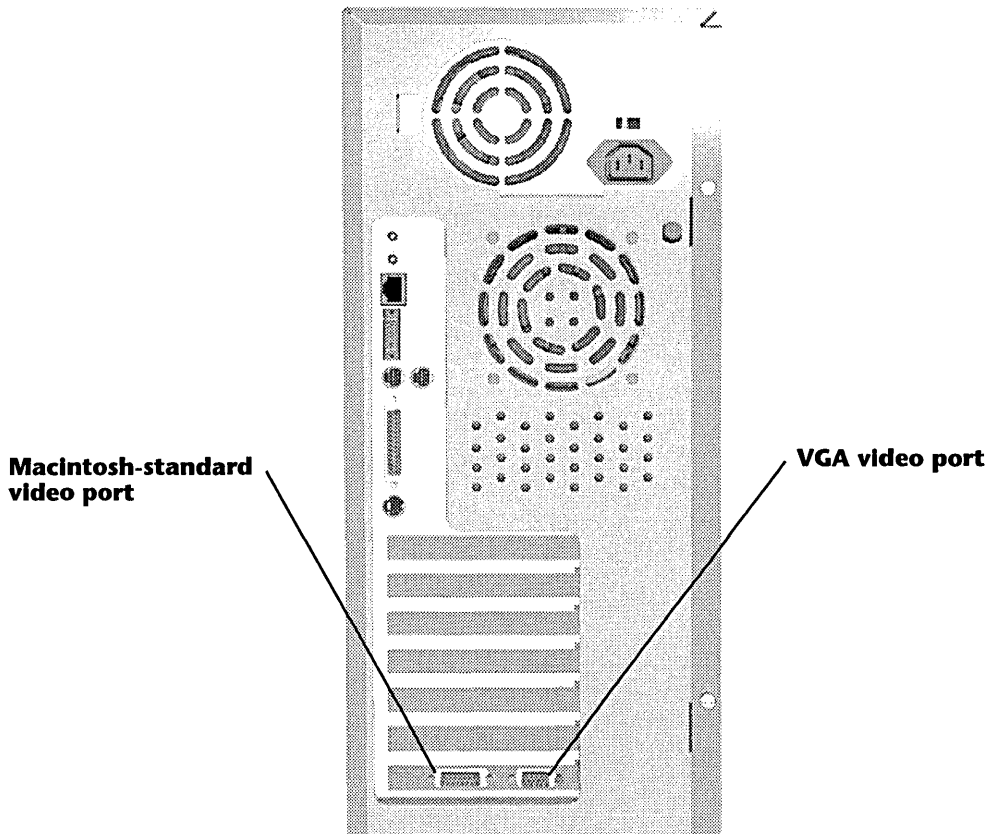
1. Place the computer in the location you have chosen.
2. Set the 115/230 volt switch to the correct setting for your country.  
Set the switch to 115 volts for the U.S., Canada, and Japan. Use the 230-volt setting in most European countries.
3. Connect the socket end of the power cord to the power input plug on the back of the computer.
4. Plug the prong end of the power cord into a grounded, three-hole electrical outlet. If you have any expansion cards to be installed at this time, follow the instructions in Chapter 4, "Installing PCI Expansion Cards," to install them now.

## Connecting the monitor

Your computer can be used with a wide variety of monitors.


The basic system comes with a video card containing 8MB of VRAM. “VRAM information” on page 148 provides details of various monitor sizes, resolutions, and numbers of colors supported by the standard 8 MB video card.

The key components for connecting the monitor are shown below.



- The Macintosh-standard monitor port allows you to connect a monitor with a Macintosh-style connector.
- The VGA monitor port allows you to connect a standard VGA or SVGA monitor and use a PC-style connector.

**CAUTION:** Do not connect monitors to both video ports simultaneously.

Use the **Monitors and Sound** control panel in Mac OS to control how the monitor is configured. See Macintosh Guide (available through the Guide menu, marked with ) in the top right corner of your screen, or *Macintosh System 7.5 for Dummies* for additional information about using the **Monitors and Sound** control panel.

Connecting the monitor involves two steps: plugging in the monitor and connecting the monitor cable.

### To plug in the monitor:

1. Place the monitor in the location you have chosen.
2. If necessary, connect the power cord to the monitor.  
Some monitors have permanently attached power cords.
3. Plug the monitor power cable into a grounded, three-hole electrical outlet.

### To connect the video cable:

1. If necessary, attach the video cable to the monitor.  
Some monitors have video cables permanently attached.
2. Connect the video cable to the monitor port on the back of the computer.

There are two types of video port connectors on the back of your computer: Macintosh-standard and VGA. Connect your monitor to the appropriate port for your monitor. See the figure on page 4 to tell which one you have.

Do not connect monitors to both built-in ports. The on-board video automatically senses which port you are using.

## Chapter 1, Getting Started

- If you are using a monitor with a Macintosh-standard video connector, connect the monitor cable to the built-in Macintosh-standard port (the larger of the two connectors).
- If you are using a VGA monitor with a PC-style connector, connect the monitor cable to the built-in VGA port (the smaller of the two connectors).

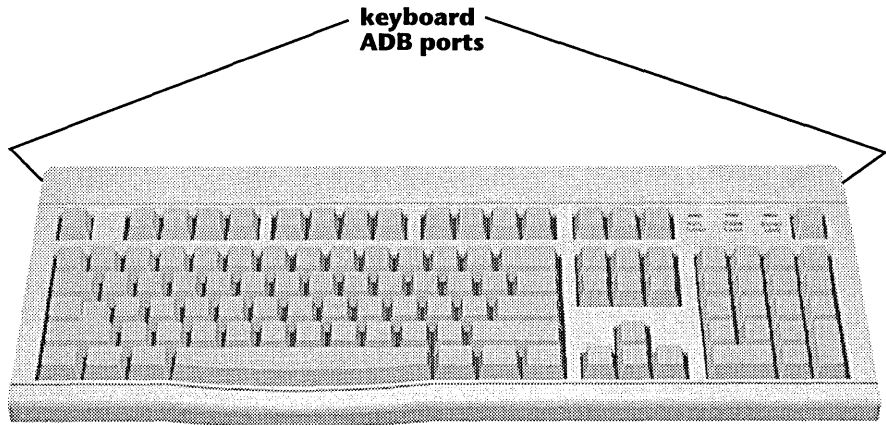
## Connecting the mouse and keyboard

Once you have connected the monitor, you can connect the mouse and keyboard.

### To connect the mouse and keyboard:

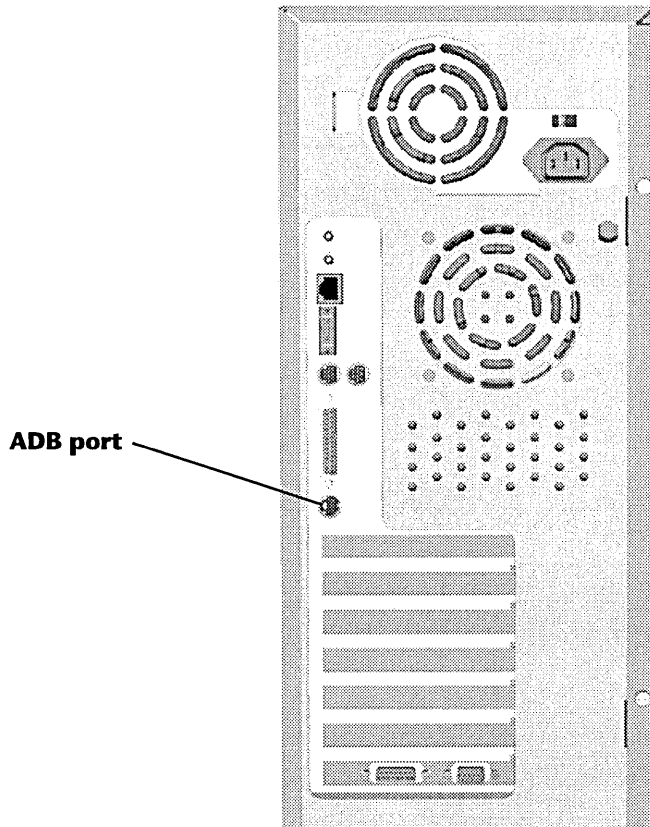
#### 1. Plug the mouse cable into an ADB port on the keyboard.

There is an ADB port at each end of the keyboard; use whichever one you prefer.



2. Plug the keyboard cable into the ADB port (marked with ) on the back of the computer.

The keyboard end of the cable is hardwired into the back of the keyboard.



# Turning the computer on

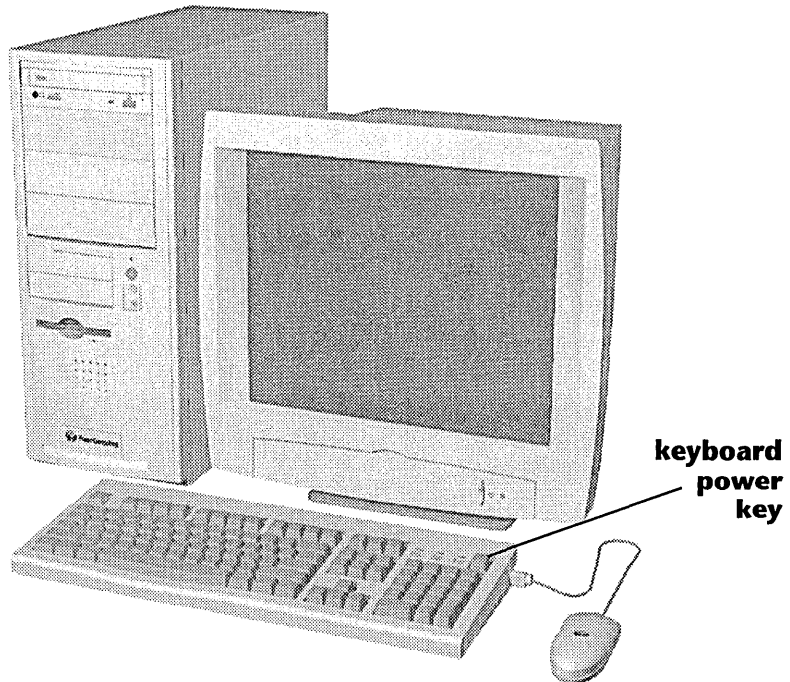
When the computer, monitor, keyboard, and mouse are connected, you can turn the computer on.

### To turn the computer on:

#### 1. Turn on the monitor.

See the documentation that came with the monitor for the location of the power switch.

#### 2. Turn the computer on by pressing the keyboard power key (marked with a triangle) on the upper right corner of the keyboard.



When the computer finishes its start-up procedure, you should see the Mac OS desktop. If you see a blinking question mark, you need to install the system software on your hard disk. See Chapter 7, “Troubleshooting and System Software.” If you see a blank screen or anything not already described, see the next section, “Problems starting up”

When you need to shut your computer down, follow the instructions in “Shutting down the computer” on page 25.

### Problems starting up

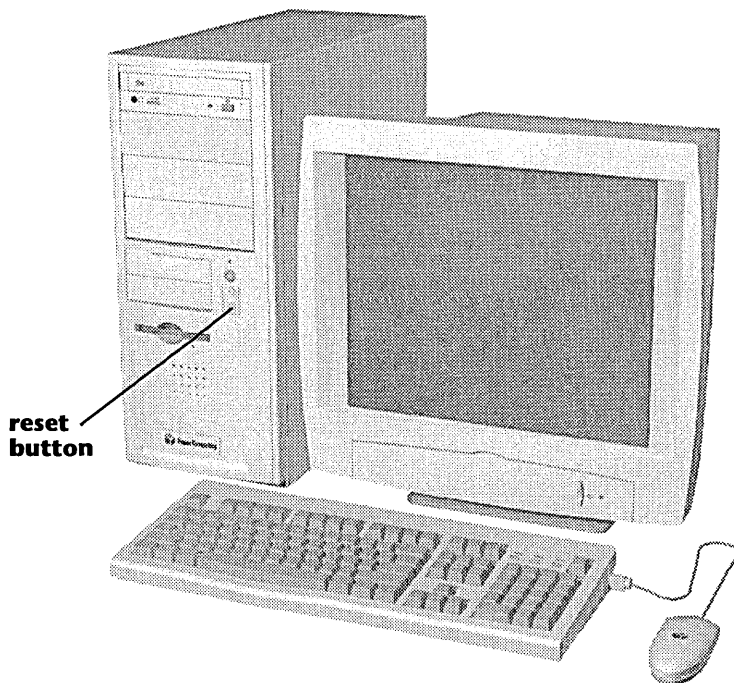
If you see a blank screen when you start up, check the following items to identify the source of the problem:

- Are the computer and monitor plugged in? If they are plugged into a power strip, is the power strip plugged in and turned on?
- Are the computer and monitor turned on? The power button on the front of the computer should be lighted. Most monitors also have power lights, which should also be on if the monitor is on.
- Is the video cable securely connected to the monitor and computer? (If you need to reattach the cable, first turn off the computer and monitor.)
- Are the keyboard and mouse properly connected to the computer? (If you need to reconnect them, first turn off the computer to avoid damage.)
- Is the brightness control on the monitor turned too far down? Check the documentation that came with your monitor for instructions.



## Chapter 1, Getting Started

- Press the reset button on the front of the computer (the bottom of the three front-panel buttons) firmly and release it. Frequently a simple reset will rectify a minor problem.



If none of the procedures above solve the problem, see Chapter 7, "Troubleshooting and System Software." If those procedures don't resolve the problem, contact Technical Support. Procedures for contacting Technical Support are described in "Contact Technical Support" on page 134.

### Warranty Registration

Once your system is set up, you should register your purchase with Power by completing the Power **Owner Registration Card**, enclosed in the pizza box along with the keyboard and mouse, and mail the completed card to Power. If you prefer, you can register your purchase on Power's web site at [www.powercc.com](http://www.powercc.com). You should register within 3 months from the date of purchase. Once you register your purchase, you will receive an on-site registration validation sticker and card for you to use to validate your limited warranty. Terms of the Power warranty are described in "LIMITED WARRANTY" on page xix.

You should also send in your Apple warranty registration card, found in the back of this manual. Terms of the Apple warranty are described in "Apple Computer, Inc. System Software License Agreement" on page xxiii.

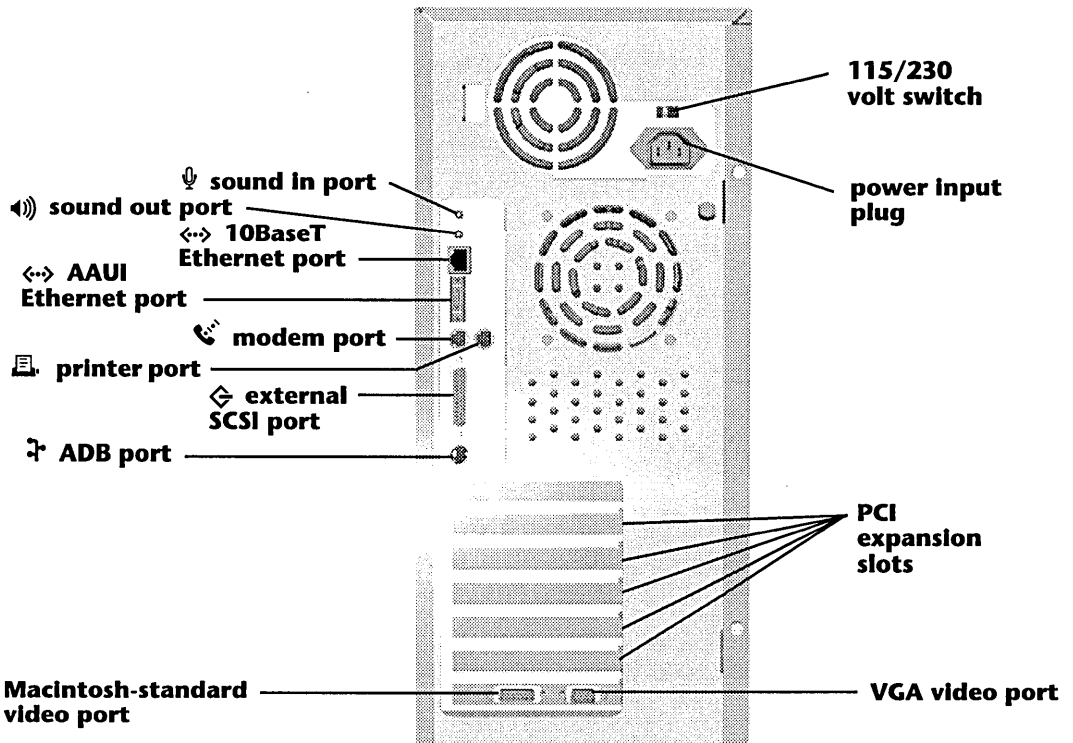
## Chapter 1, Getting Started

# Chapter 2

## Connecting Peripheral Devices

Your computer has a number of ports for connecting peripheral devices such as printers, storage devices, audio equipment, network cabling, and modems.

See the figure below for the location of the ports.



# Using SCSI devices

Your computer has two separate SCSI buses—a high-speed 10 MB per second internal SCSI bus for the built-in devices like the hard disk and the CD-ROM drive and a 5 MB per second bus primarily for external devices. You can connect up to seven devices in a *SCSI chain* to each bus.

External SCSI devices, such as scanners, hard drives, CD-ROM drives, and removable-cartridge drives can be connected to your computer through the SCSI port on the back of your computer. Note that there is also an internal SCSI cable connected to this SCSI 5 MB per second chain in case the main internal SCSI bus is completely filled.

Connecting a SCSI device involves four steps:

- Setting the device's SCSI ID number
- Ensuring proper termination
- Connecting the device
- Installing a software device driver (if one is required)

## Setting the SCSI ID

Each device in a SCSI chain requires a unique number called a SCSI ID, which the computer uses to identify the device. The computer itself is assigned SCSI ID 7 and the internal hard disk is assigned SCSI ID 0. Every other device you install must have a unique number from 1 to 6.

Drives provided by Power normally come with SCSI ID pre-set as follows:

SCSI ID	Device
0	primary internal hard drive (terminated)
1	optional additional hard drive
3	CD-ROM drive
5	optional removable-cartridge drive
7	motherboard (self-terminated)

The way you assign SCSI IDs varies from device to device. On most external devices, the ID is displayed on the back of the device. You usually change it by pressing small buttons above or below the number display. For some external and most internal devices, changing the ID requires setting switches or moving jumpers. Refer to the documentation that came with the device for exact instructions.

The important thing to remember is that each device must have an ID that is unique within its bus. If there is an ID conflict, your computer and the SCSI devices connected to it will malfunction.

### Ensuring proper termination

For a SCSI chain to work properly, it must be terminated correctly. The basic rule about SCSI termination is simple: the device at the end of the chain must be *terminated*. Devices located between the computer and the end of the chain must be unterminated.

On the internal SCSI bus, any devices you install should be unterminated because the computer's hard disk at the end of the bus is terminated and all of the internal connectors are in the middle of the chain.


On the external bus, you need to consider where the device is placed in the chain and whether it has an internal terminator. (Most SCSI devices use removable external terminators, but some older devices have built-in terminators that are difficult to remove.)

- If you have an internally terminated device, place it at the end of the chain and remove or disable external terminators from other devices in the chain.
- If none of the devices is internally terminated, place an external terminator on the last device in the chain and on no other device.

See the documentation that came with each device for information about how it is terminated.

# Connecting the device

## Connecting an external SCSI device

The SCSI port, marked with , provides 5 MB per second communication between the computer and devices such as hard disks, CD-ROM drives, scanners, printers, tape backup drives, and so on.

To connect a single SCSI device (or the first device in a chain), you need a SCSI cable with a 25-pin connector on one end and a 50-pin connector on the other. For each additional external device, you need a cable with 50-pin connectors on both ends. The cables you use should be double-shielded and have approximately 110-ohm impedance. Most SCSI problems are the result of low-grade cables.

**Note:** External SCSI devices which are connected to the computer have independent power systems and must be turned on and off at the device; internal SCSI devices are powered by the computer and turn on and off when the computer does. Devices on the SCSI bus which are turned off can cause system errors.

### To connect an external SCSI device:

1. Shut down the computer and the SCSI device.
2. Make sure that the device has a unique SCSI ID from 0 to 6.  
For details, see "Setting the SCSI ID" on page 14.
3. Connect the device to the computer's SCSI port or to the last device in the chain, using the appropriate cable.
4. Make sure that the last device in the chain is terminated.  
Some devices require an external terminator, while others are internally terminated.

When you are ready to start up, turn on your SCSI devices before you turn on the computer. If you do not, your computer will not recognize the devices.


### Connecting an internal SCSI device



You install internal SCSI devices in one of the computer's internal storage bays. See "Installing internal storage devices" in Chapter 3 for instructions on installing internal SCSI devices.

### Installing software device drivers

Some SCSI devices require special software called device drivers to operate with your computer. If a device driver is required, it is normally supplied with the device; if you are unsure whether one is required, contact the manufacturer of the device. Follow the installation instructions supplied by the manufacturer. If a device driver is not supplied, you can assume that the device does not need one.


### Connecting a printer

Your computer has a port (marked with ). This port can be used for direct printer connections or for LocalTalk network printer connections.

You can also connect a printer to the modem port (marked with ) or one of the Ethernet ports (marked with ). Use the Chooser program to tell the Mac OS which port you are using. See Macintosh Guide for information about the Chooser.

To connect the printer, follow the instructions that came with it.


### Connecting input devices

Use the computer's ADB port (marked with ) to connect input devices such as a mouse, trackball, graphics tablet, or bar-code reader. Depending on their power consumption, you can connect up to three input devices in a chain from the ADB port.

The total power used by all the ADB devices must not exceed 500 milliamperes (mA). Check the documentation that came with your ADB devices for information about their power consumption.



### Connecting a modem or telecom adapter

Your computer is equipped with an enhanced telecommunications port (marked with ) , which can be used with a standard modem or the Apple GeoPort Telecom Adapter. The GeoPort Telecom Adapter offers advanced communications features not available with standard modems. It is available from authorized Apple dealers.


To connect a modem or GeoPort Adapter, follow the instructions that came with it.

### Connecting to a network


Your computer has built-in support for two different networking systems—LocalTalk and Ethernet. Other networking systems are possible, but they require expansion cards.

Use the **AppleTalk** control panel in Mac OS to choose a networking system. See Macintosh Guide for information about using your computer on a network.

### Connecting to a LocalTalk network

Use the computer's printer port (marked with ) to connect to a LocalTalk network. LocalTalk connectors and cables are available from several vendors. Follow the instructions that came with the connector and cabling.

### Connecting to an Ethernet network

The computer has two built-in ports (marked with ) for connecting to high-speed Ethernet networks. Using the appropriate AAUI adapter, you can connect to standard Ethernet wiring such as 10Base-T, thick coax, and thin coax. Adapters are available from several vendors. Follow the manufacturer's instructions for connecting the adapter. If you are connecting to a 10Base-T network, you can plug the network RJ45 connector into the 10Base-T port.

If both the AAUI and the 10Base-T connectors are connected, only the 10Base-T connection will be active.



### Connecting to a Token Ring network

You can connect to a Token Ring network by installing an expansion card and appropriate networking software. Token Ring cards and software are available from several vendors.

### Using audio equipment

Using the sound in and sound out ports of your computer, you can record and play high-quality stereo audio. You can connect audio devices such as microphones, stereo equipment, and speakers. (You can also use an external or internal CD-ROM drive to play audio CDs. See “Playing audio CDs on a CD-ROM drive” on page 22 later in this section.)

### Understanding the sound ports

Your computer has two sound ports—a sound output port (marked with ) and a sound input port (marked with ). Use these ports to connect audio devices.

The sound ports accept a connector called a *stereo mini-plug*, the same kind of connector used to connect headphones to a personal stereo. If an audio device has a different kind of connector, you can buy an adapter at an electronics store.

### Connecting an audio device

To play or record sounds, connect an audio device to your computer.

- If you want to use your computer to work with the sound produced by a device like a microphone, CD, or tape player, attach it to the sound input port.
- If you want to use a device such as a tape recorder or external speakers to work with sound produced by the computer, attach it to the sound output port.

A device that can both record and play (such as a tape deck) can be connected to both the sound input and sound output ports.

## Chapter 2, Connecting Peripheral Devices

The following section gives general instructions for connecting an audio device. If you plan to connect a microphone or external speakers, read “Connecting a microphone” on page 21 or “Connecting external speakers” on page 20 later in this section.

### To connect an audio device:

1. Make sure that the device has a stereo mini-plug connector. Attach an adapter if necessary.
2. Shut down your computer and turn off the audio device.
3. Connect the audio cable to the device and to the appropriate sound port of the computer.
4. Turn on the computer and the device.

After starting up the computer, use the Mac OS **Monitors & Sound** control panel to select the device as the **Sound Input** or **Sound Output** source. See the Macintosh Guide for information about using the **Monitors & Sound** control panel.

## Connecting external speakers

You can connect external, amplified speakers to your computer to take advantage of its high-quality, stereo sound output.

You need a cable with stereo mini-plugs on each end to connect the speakers. In some cases, you connect the cable to one of the speakers and then use speaker wire to connect the second speaker. In other cases, you use a Y-shaped, two-plug adapter on the end of the cable and attach one plug to each speaker. Refer to the instructions that came with the speakers for more information.

### To connect external speakers:

1. Turn off the computer and the speakers.
2. Connect one end of the cable to the sound output port of the computer.

### 3. Connect the other end of the cable to the speakers.

If necessary, use a Y-shaped adapter.

### 4. If necessary, connect the speakers with speaker wire.

### 5. Turn on the computer and speakers.

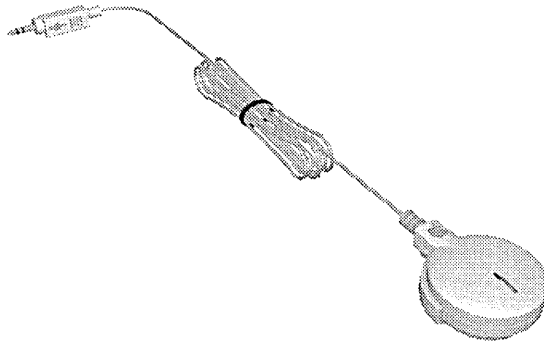
The sound output of the computer is heard through the speakers.

You can control the speaker volume in the Mac OS **Monitors & Sound** control panel. In some cases, the speakers themselves may also have a volume control. See the Macintosh Guide for information about controlling the volume.

## Connecting a microphone

You can connect a microphone to your computer via the sound input port. The microphone can be used for recording sounds or for issuing spoken commands to your computer.

The computer requires the Apple PlainTalk Microphone, pictured below. PlainTalk software is required for voice commands. PlainTalk microphones and software are available from authorized Apple dealers.



### Playing audio CDs on a CD-ROM drive

You can use a CD-ROM drive to play audio CDs on your computer. The sound will be heard through the computer's built-in speaker (or through external speakers or headphones if you have them).

Use audio CD software (such as AppleCD Audio Player, part of Mac OS) to play the CD and the **Sound Output** and **Sound Out Level** popups in the **Monitors & Sound** control panel to select the CD-ROM drive and control the volume. If you use headphones plugged into the front of the CD-ROM drive, volume can be adjusted using the volume control next to the headphone plug.

See the Macintosh Guide for further information about playing audio CDs on a CD-ROM drive.

# Chapter 3 Getting Started With Mac OS

Your computer uses the Mac OS operating system, which offers a unique combination of power and ease of use. This chapter offers very basic instructions about how to use the built-in learning features of Mac OS. It also explains how to shut down your computer properly. For more detailed information about the Mac OS, refer to Macintosh System 7.5 manual, which came with your computer.

## Running the Basics tutorial

Mac OS includes a tutorial program called Mac™ OS Tutorial that shows you how to use the fundamental features of the software. If you are brand new to Mac OS, we suggest you complete the tutorial before you begin working with your computer.

In Mac OS, you use the mouse for tasks such as choosing menu commands or starting programs. When you move the mouse, the *mouse pointer* (☞, the small arrow on the screen, sometimes referred to as the *cursor*) moves in the same direction. By placing the tip of the mouse pointer over an icon and clicking twice quickly (*double-clicking*), you can open a folder or launch a program.

## Chapter 3, Getting Started With Mac OS

### To run the Basics program:

1. In the Mac OS desktop, if your hard disk window is not already open, double-click the icon that represents your hard disk (located in the upper-right corner of the screen). Be careful to place the mouse pointer over the icon, not on the words below.

The hard disk icon “opens,” displaying a “window” containing the files and folders stored on the hard disk.

2. Double-click the folder called Mac™ OS Tutorial.


The folder opens, displaying the Mac™ OS Tutorial Part 1 icon.

3. Double-click the Mac™ OS Tutorial Part 1 icon.

The program starts up, displaying an introductory screen.

4. Follow the on-screen instructions to complete the tutorial.


## Using on-line help

Mac OS (and many applications that run under it) include an on-line help system with information about using the software. The help system for Mac OS is called Macintosh Guide and is available through the Guide menu (marked with ).

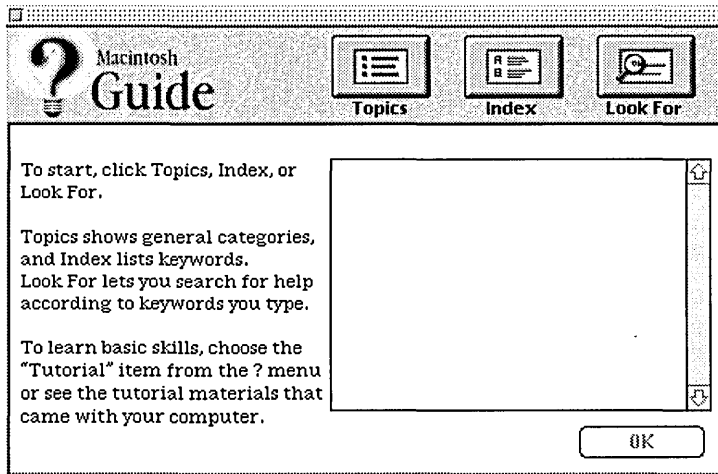
### To use Macintosh Guide

1. Choose Finder from the Application menu (in the upper-right corner of the desktop) to make it the active application.



2. Choose Macintosh Guide from the Guide menu (marked with ) or press **⌘-?**.

The Macintosh Guide window appears.



3. Follow the on-screen instructions to get the information you need.

## Shutting down the computer

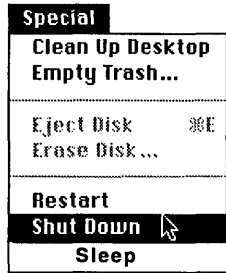
When you are finished working with your computer, it is very important to shut it down correctly.



### ❑ To shut down the computer:

#### 1. Choose **Shut Down** from the **Special** menu in Mac OS.

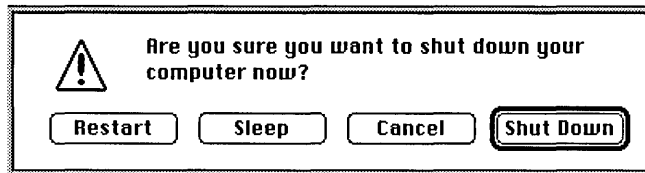
You are prompted to save any unsaved files before shutting down.



OR

#### 2. Press the **power key** on the keyboard

A Shut Down dialog box is displayed



Choose the Shut Down option by pressing the *return* key.

**CAUTION: Do not use the power button on the front panel to turn off the computer. If you do, unsaved or open documents may be lost and you may damage System files.**

#### 3. In the unlikely event that the system does not respond to mouse movement or the keyboard, see "Restarting the computer" on page 129.

### Sleep

If you choose the **Sleep** option in the Special menu or shutdown dialog, the system enters energy-saving “sleep” mode. The monitor will dim if it is an energy-saving monitor running on sleep-savvy video, and the mouse will stop responding to movement.

To wake the system up, press the keyboard power key.

# Chapter 3, Getting Started With Mac OS

# Chapter 4

## Installing PCI Expansion Cards

This chapter explains how to enhance the capabilities of your computer by adding PCI expansion cards.

### Removing the cover

In order to install a PCI expansion card, you remove the computer's cover.

### Tools required

- A small regular (slot-head) screwdriver or a small coin.

#### CAUTION!

***1. If you are not proficient with electronic equipment, Power Computing Corporation recommends that you have a certified technician install RAM, drives, and expansion cards. If you attempt to install RAM, drives, or cards yourself, any damage you may cause to your equipment will not be covered by the limited warranty on your computer. Please call technical support at 1-800-708-6227 for additional information about this or any other warranty question.***

***2. If an anti-static bracelet is available, put it on and ground it to the computer chassis before touching any components inside the computer.***

***3. Never turn the computer on or operate the computer with the cover removed.***

## Chapter 4, Installing PCI Expansion Cards

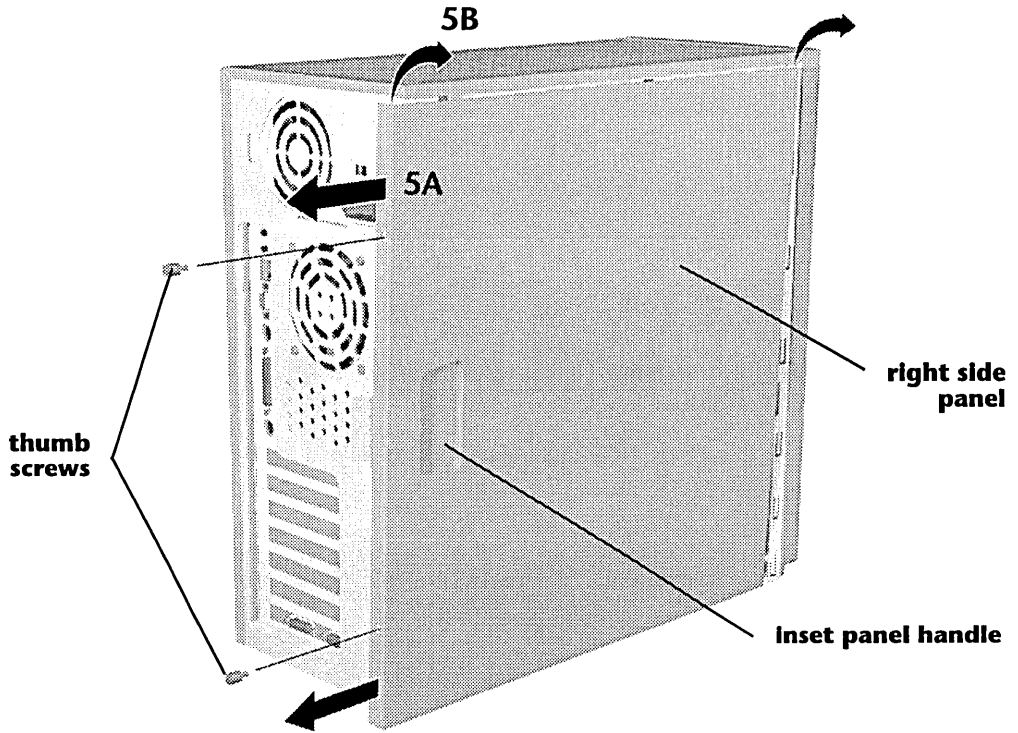
### To remove the cover:

1. Shut down the computer and turn off the monitor, but leave the computer plugged in to the electrical outlet.

Leaving the computer plugged in ensures that it is grounded.

2. Disconnect everything but the power cord from the back of the computer.
3. Rotate the computer so that its rear panel faces you.

4. Remove the two thumb screws from the rear of the right side panel.



Put the thumb screws somewhere safe where you'll be able to find them when you're ready to replace the cover.

## Chapter 4, Installing PCI Expansion Cards

**5. A. Grasp the inset panel handle and slide the right side panel back about an inch.**

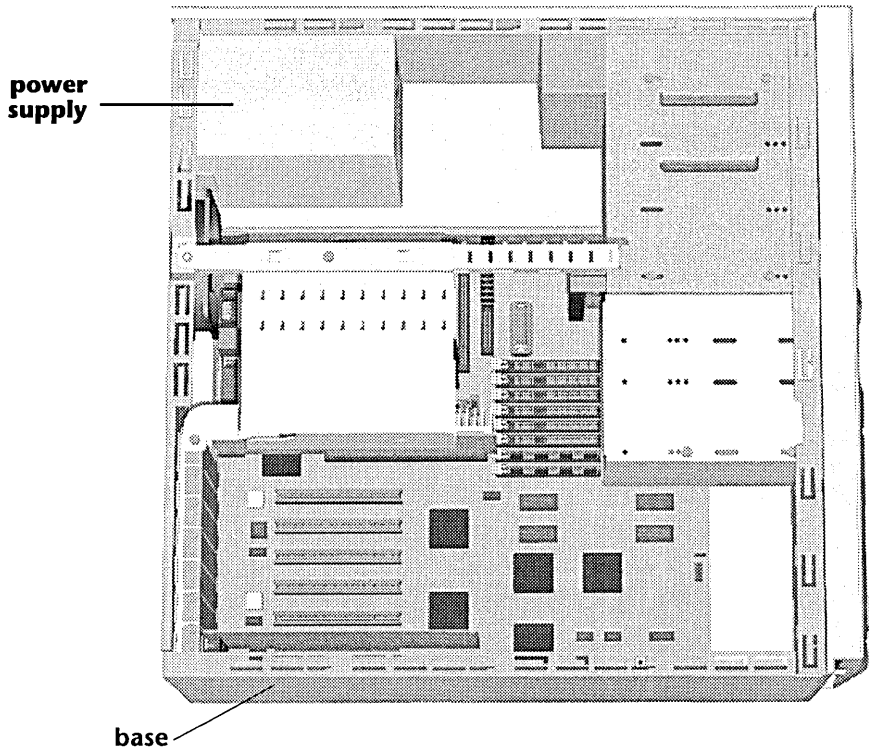
**B. Gently, but firmly, pull the top of the side panel to the rear and away from the chassis.**

Set the side panel aside.

**6. Lay the computer down with its open side up and rotate it so that the base faces you.**

**7. Before touching any components inside the computer, touch the metal plate over the power supply to discharge any static electricity that might have built up on your clothes or body.**

The system must be plugged in (see step 2 on page 30) for this to work.



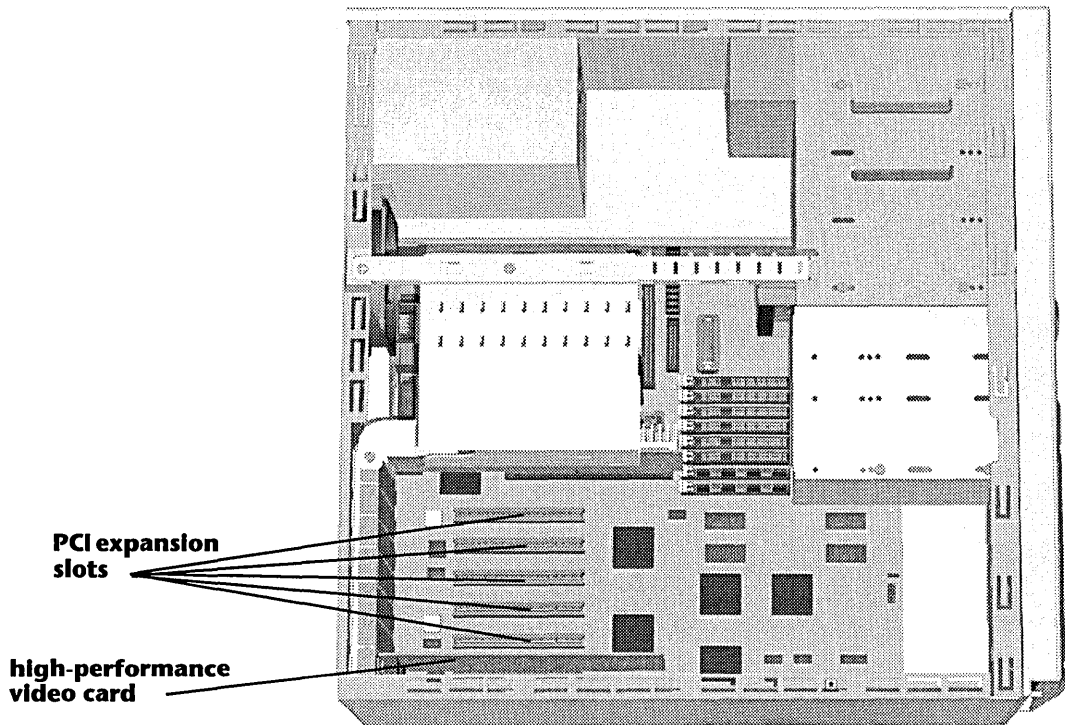
8. To replace the side panel, reverse steps 4 through 7; then you can re-connect everything.

**CAUTION!** *Be careful not to get any of the cables caught in the cover or stuck in the fan housing when you put the cover back on the computer.*



### Installing expansion cards

You can install PCI cards in the PCI expansion slots on your motherboard to enhance your computer's capabilities. For example you can add video, networking, special-purpose acceleration, or communications capabilities to your computer by adding PCI cards. The motherboard allows you to install up to six standard PCI cards, one of which is normally the high-performance video card which comes with system.



## Chapter 4, Installing PCI Expansion Cards

Before you install any expansion cards, be sure to follow these guidelines to protect your computer:

- Do not remove factory-installed cards from inside the computer. Removing a card incorrectly can damage it and the computer. Contact Technical Support if you believe a factory-installed card requires repair or replacement.
- The combined power consumption of the expansion cards you install must not exceed the limits of your computer. Refer to the documentation that came with your cards for their power consumption rating and to “Power requirements” on page 150 in this manual for the power consumption limit for your computer. PCI cards are normally limited to 15 Watts or less power consumption per card.
- Some cards may need to be installed by an authorized service provider. Refer to the documentation that came with the card.

### Tools required

- A small Phillips-head screwdriver.

#### □ To install an expansion card:

1. Remove the computer's cover.

See “Removing the cover,” starting on page 29 for instructions.

**WARNING!** *Make sure the computer is powered down before removing the cover.*

**CAUTION!** *Touch the metal plate over the power supply to discharge any static electricity that might have built up on your clothes or body.*

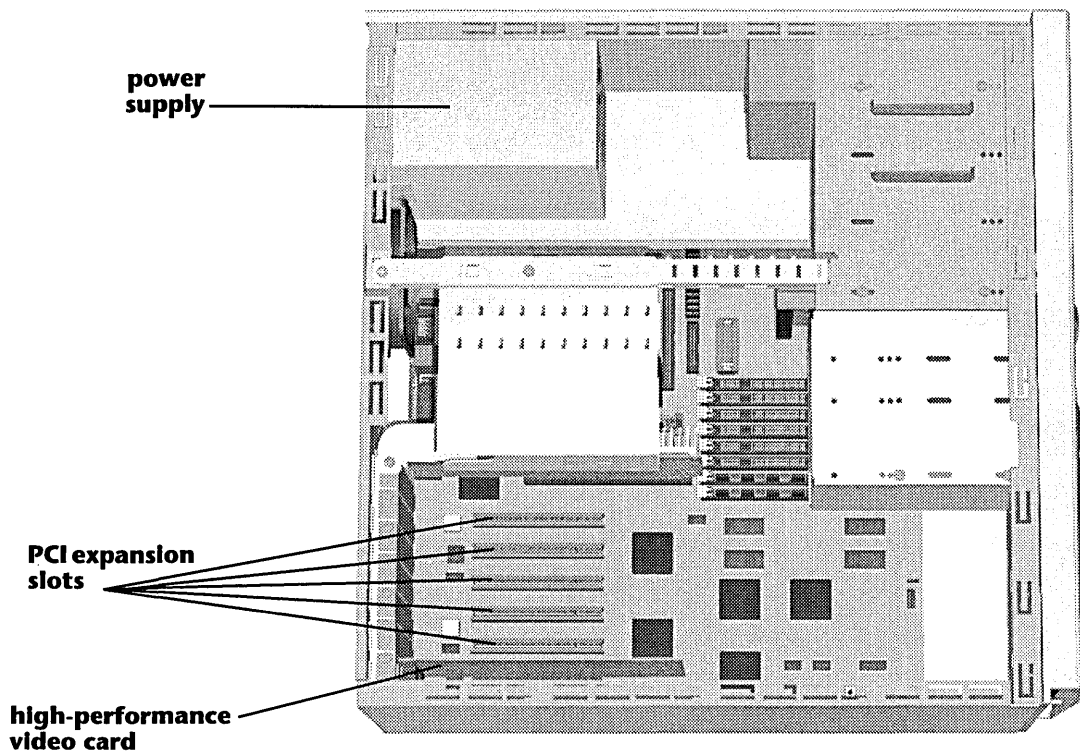
The system must be plugged in (see step 2 on page 30) for this to work.

***Use an anti-static bracelet and handle cards by the non-metallic edges only.***

## Chapter 4, Installing PCI Expansion Cards

2. Select an unoccupied PCI expansion slot on the motherboard to install the expansion card into.

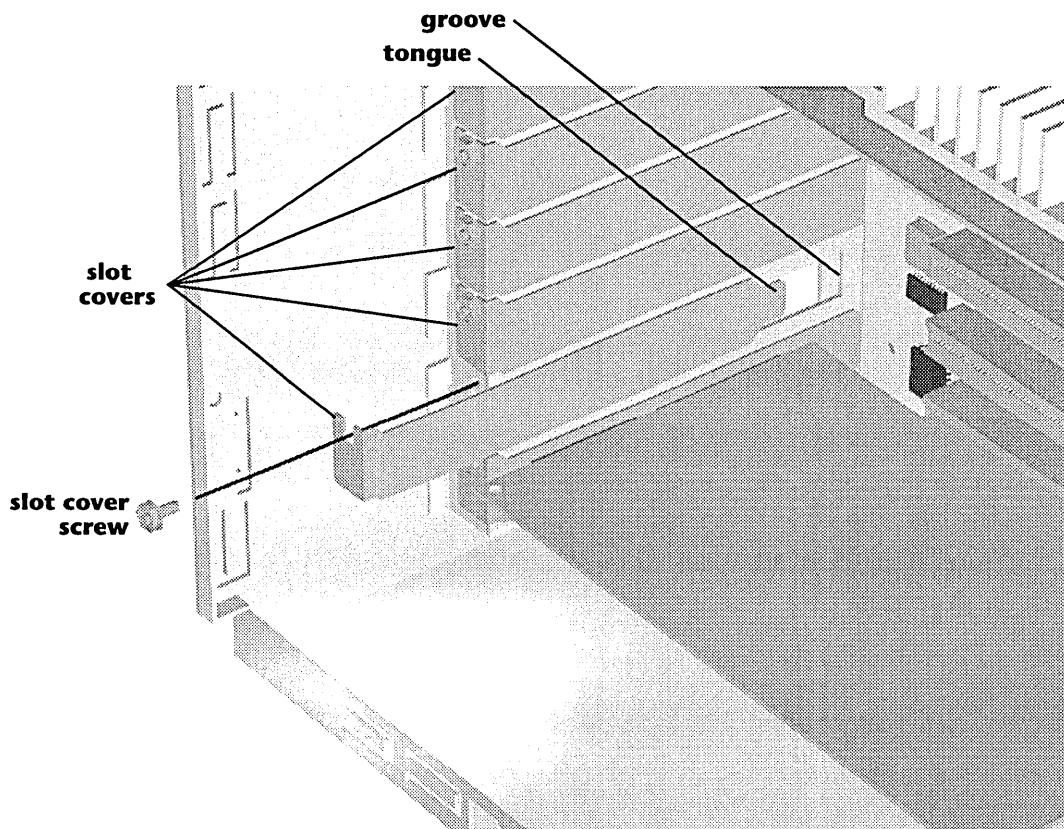
There is no inherent reason to pick one slot over another, however, practical considerations, such as clearance for connectors, cooling considerations, etc. often dictate the choice of slot.



## Chapter 4, Installing PCI Expansion Cards

3. Remove the metal slot cover from the back of the chassis for the slot you want to use.

Remove the screw holding the slot cover at the top of the slot and put it somewhere you will be able to find it later; then pull the cover toward you so that the tongue at the bottom of the cover slides out of the groove the chassis



## Chapter 4, Installing PCI Expansion Cards

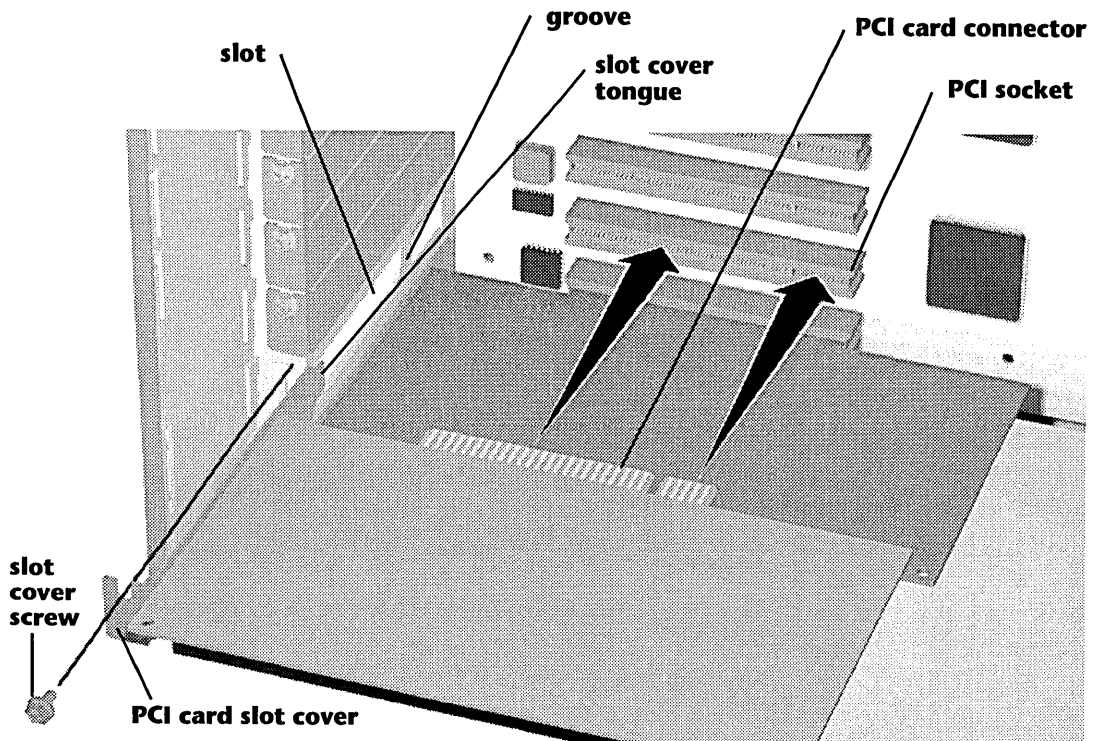
### 4. Remove the card to be installed from its static-proof bag.

Hold the card by its non-metallic edges and its metal slot cover to avoid touching components or connector contacts on the card.

### 5. Align the card over the card slot.

Make sure that

- the PCI connector on the bottom of the card lines up with the PCI socket on the riser card.
- the slot cover on the PCI card lines up with the slot in the back panel.
- the slot cover tongue fits into the groove at the base of the slot.



## Chapter 4, Installing PCI Expansion Cards

6. Push the card into the PCI socket until it is firmly seated.

Do not force the card. If you feel a lot of resistance, pull the card out, realign it, and insert it again.

7. Replace and tighten the slot cover screw you removed earlier.

8. If you have no more internal components to install, replace the side panel, and the thumb screws which hold it in place, and re-connect everything.

**CAUTION!** *Be careful not to get any of the cables caught in the side panel or the case when you put the panel back on the computer.*

**WARNING!** *To prevent electrical shock, always replace the side panel before turning on the computer.*

# Chapter 4, Installing PCI Expansion Cards

# Chapter 5 Adding Memory

This chapter explains how to enhance the capabilities of your computer by adding additional memory.

## Removing the cover

To install RAM, you must first remove the computer's cover.

## Tools required

- A small regular (slot-head) screwdriver or a small coin.

### CAUTION!

***1. If you are not proficient with electronic equipment, Power Computing Corporation recommends that you have a certified technician install RAM, drives, and expansion cards. If you attempt to install RAM, drives, or cards yourself, any damage you may cause to your equipment will not be covered by the limited warranty on your computer. Please call technical support at 1-800-708-6227 for additional information about this or any other warranty question.***

***2. If an anti-static bracelet is available, put it on and ground it to the computer chassis before touching any components inside the computer.***

***3. Never turn the computer on or operate the computer with the cover removed.***



## Chapter 5, Adding Memory

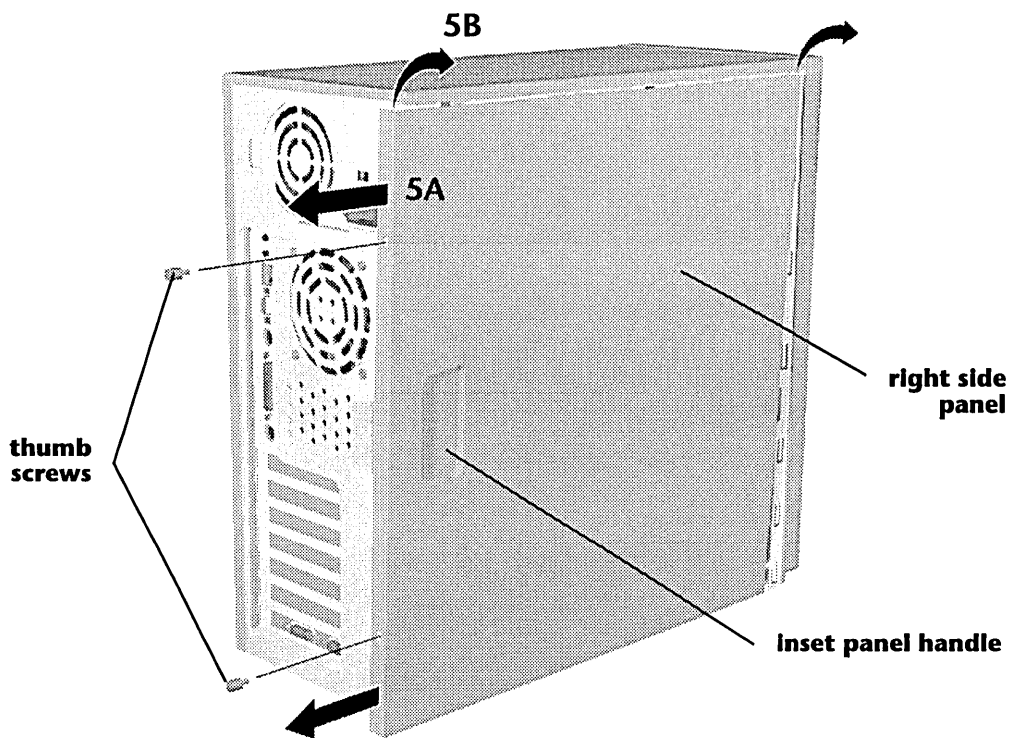
### To remove the cover:

1. Shut down the computer and turn off the monitor, but leave the computer plugged in to the electrical outlet.

Leaving the computer plugged in ensures that it is grounded.

2. Disconnect everything but the power cord from the back of the computer.
3. Rotate the computer so that its rear panel faces you.

4. Remove the two thumb screws from the rear of the right side panel.

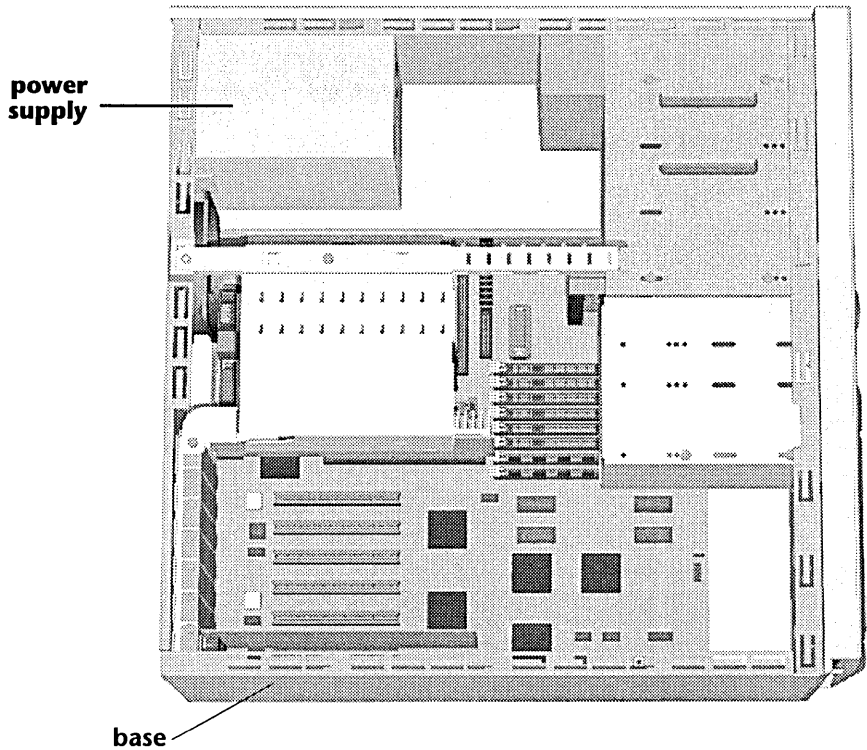


Put the thumb screws somewhere safe where you'll be able to find them when you're ready to replace the cover.

## Chapter 5, Adding Memory

5. **A. Grasp the inset panel handle and slide the right side panel back about an inch.**  
**B. Gently, but firmly, pull the top of the side panel to the rear and away from the chassis.**  
Set the side panel aside.
6. **Lay the computer down with its open side up and rotate it so that the base faces you.**
7. **Before touching any components inside the computer, touch the metal plate over the power supply to discharge any static electricity that might have built up on your clothes or body.**

The system must be plugged in (see step 2 on page 42) for this to work.



8. To replace the side panel, reverse steps 4 through 7; then you can re-connect everything.

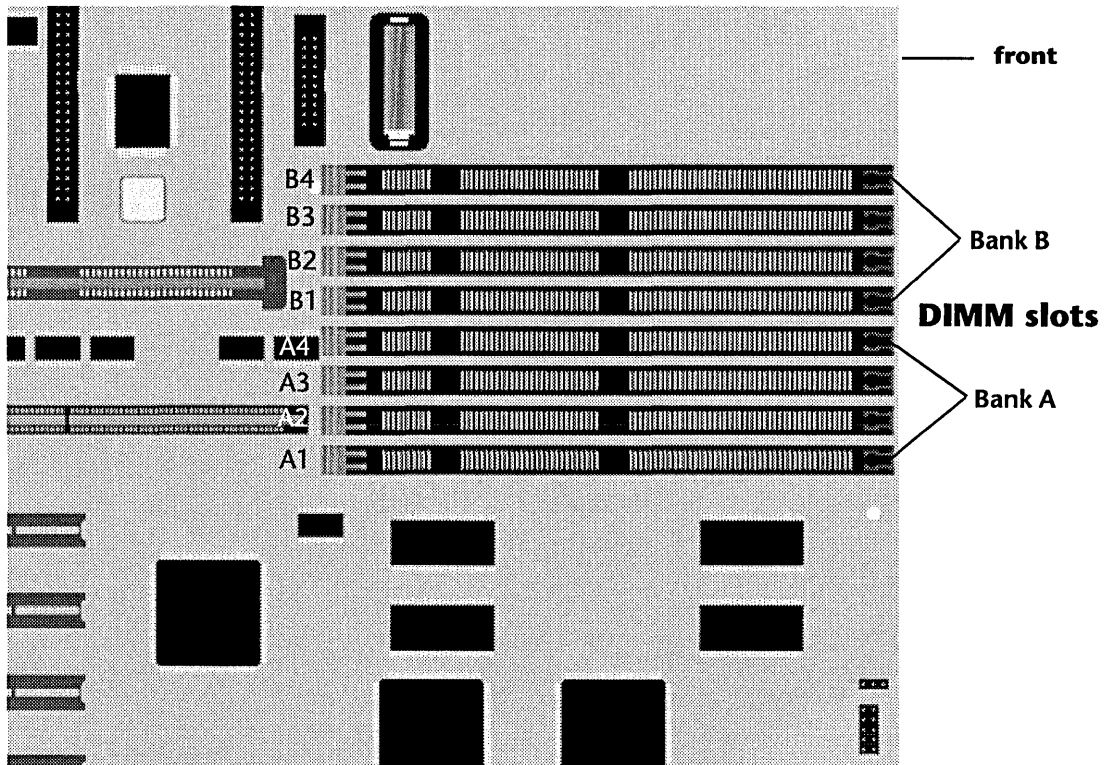
**CAUTION!** *Be careful not to get any of the cables caught in the cover or stuck in the fan housing when you put the cover back on the computer.*

## Adding memory

Your computer's random-access memory (RAM) can be increased. Memory is increased by installing or replacing memory modules. The computer uses DIMMs, or dual in-line memory modules for RAM. Make sure that the memory modules you purchase are the right ones for your computer. See Appendix B, "Technical Information," on page 145 for technical specifications.

### What you need to know about adding RAM

The computer has eight DIMM slots on the motherboard, near the front of the computer, (see the motherboard illustration below).



The DIMM slots are organized into two banks, A and B. Bank A is toward the bottom and Bank B is above it, as labeled on the motherboard. Each bank has four slots, numbered A1– A4 and B1– B4.

DIMMs can be inserted in any order, but to achieve best performance, insert DIMMs of the same capacity in corresponding slots (A1 with B1, A2 with B2, etc.), to interleave RAM memory.

All DIMMs must be 168-pin, fast-paged mode, 70-nanosecond RAM access time or faster. You can install 8 MB, 16 MB, 32 MB, 64 MB, or 128 MB DIMMs up to a total capacity of 1 GB (i.e. 1024 MB).

To increase your system's RAM, install additional DIMM modules in vacant DIMM slots; if there are no vacant slots, remove one or more lower-capacity DIMMs (see "Removing a DIMM." on page 54) and replace them with modules of higher capacity. (see "Inserting a DIMM" on page 55.)

### Required tools

- A small Phillips-head screwdriver.

### Installing and removing RAM

- CAUTION!**
- 1. If you are not proficient with electronic equipment, Power Computing Corporation recommends that you have a certified technician install RAM, drives, and PCI expansion cards. If you attempt to install RAM, drives, or cards yourself, any damage you may cause to your equipment will not be covered by the limited warranty on your computer. Please call technical support at 1-800-708-6227 for additional information about this or any other warranty question.***
  - 2. If an anti-static bracelet is available, put it on and ground it to the computer chassis before touching any components inside the computer.***
  - 3. Handle DIMMs by the ends and avoid touching their contacts or other metal components.***

## Chapter 5, Adding Memory

**4. Always store DIMMs in anti-static bags.**

**5. Take your time; don't hurry.**

### Prepare the computer

1. If you haven't done so, remove the cover from the computer.

See "Removing the cover," starting on page 41 for instructions.

**WARNING!** *Make sure the computer is powered down before removing the cover.*

**CAUTION!** *Touch the metal plate over the power supply to discharge any static electricity that might have built up on your clothes or body.*

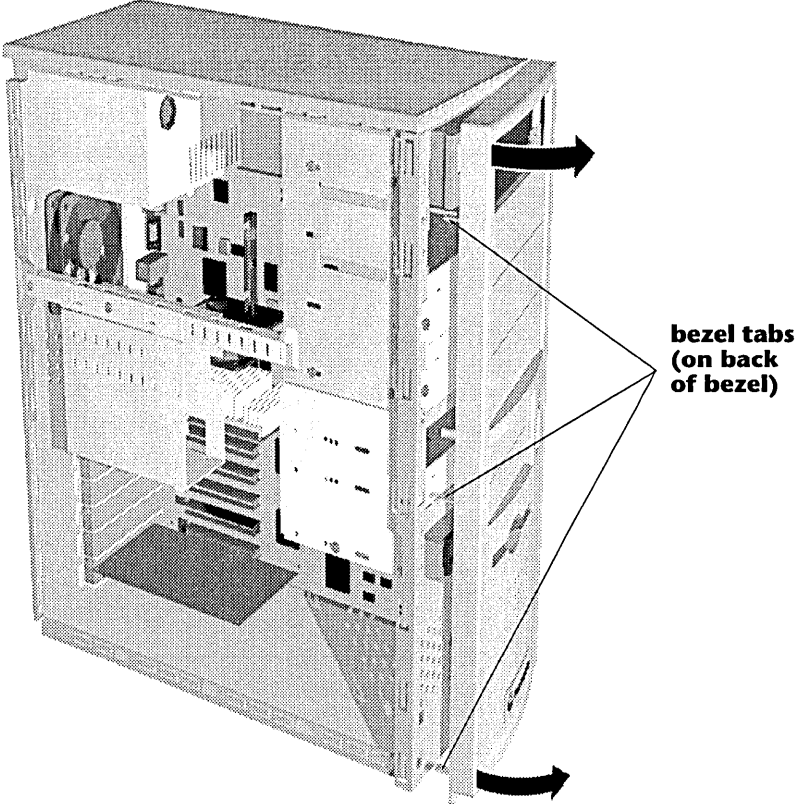
The system must be plugged in (see step 2 on page 42) for this to work.

***Use an anti-static grounding strap and handle DIMM modules by the non-metallic edges only.***

2. Set the computer upright.

Starting with the top bezel tab, push on the three tabs on the left side which hold the bezel in place.

Press up on the top tab and down on the other two, and pull the tabbed side of the bezel away from the case until the tabs on the other side of the bezel clear the front of the computer, and set the bezel aside.





## Chapter 5, Adding Memory

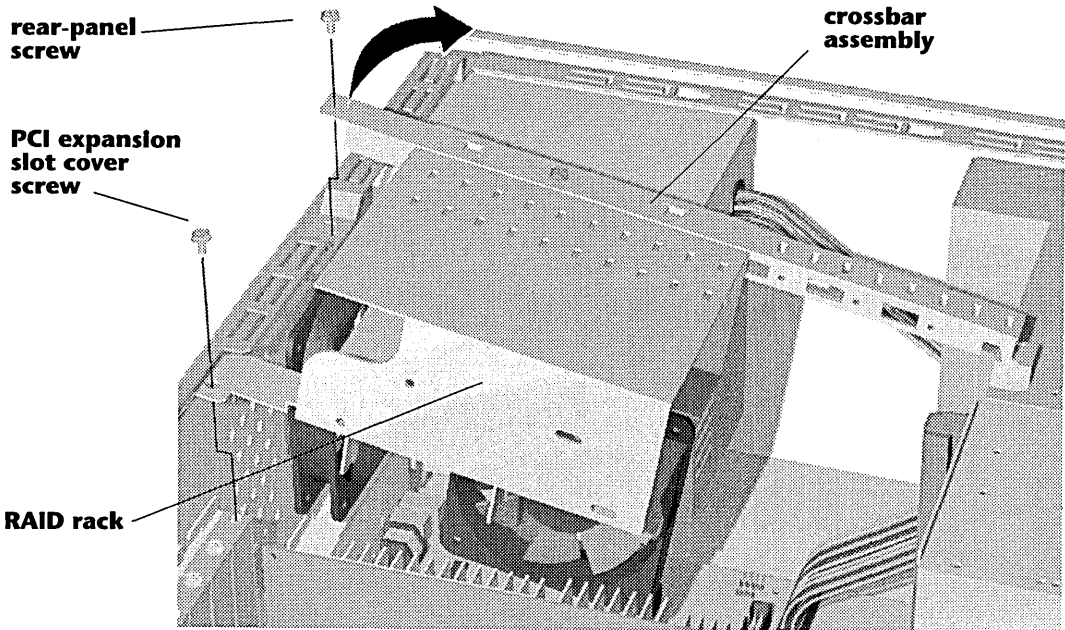
### 3. Remove the crossbar assembly.

The crossbar assembly consists of a crossbar, a RAID rack, and a fan; the entire assembly must be removed to install RAM.

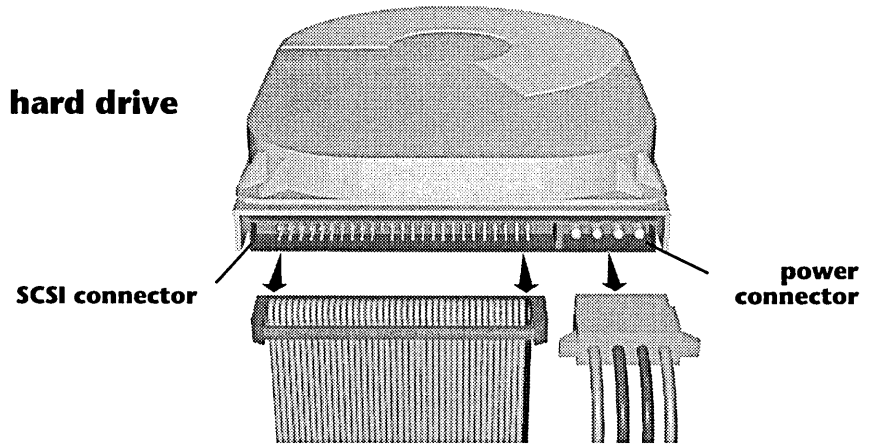
Place the computer on its side with its open side up.

Remove the screw that secures the crossbar to the rear panel.

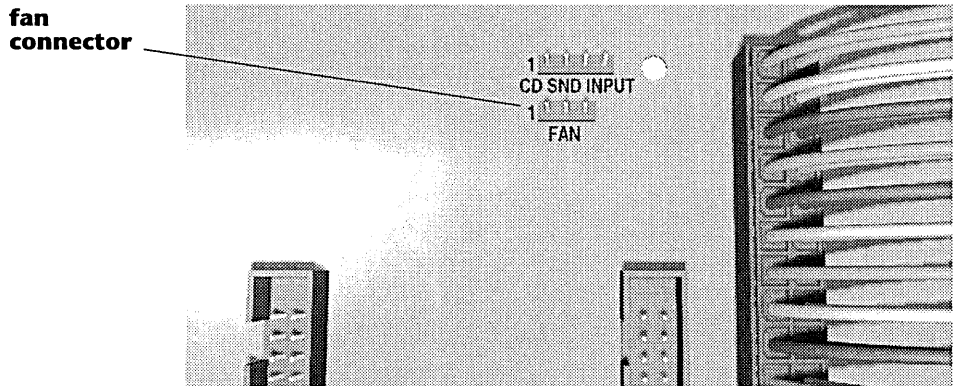
Remove the screw that secures the crossbar to the PCI expansion slot cover.



If there are drives installed in the RAID rack, lift the crossbar assembly high enough to have access to the RAID drive power and SCSI cable connectors, and then disconnect the cables from the RAID drives. Note which cable attaches to which RAID drive.



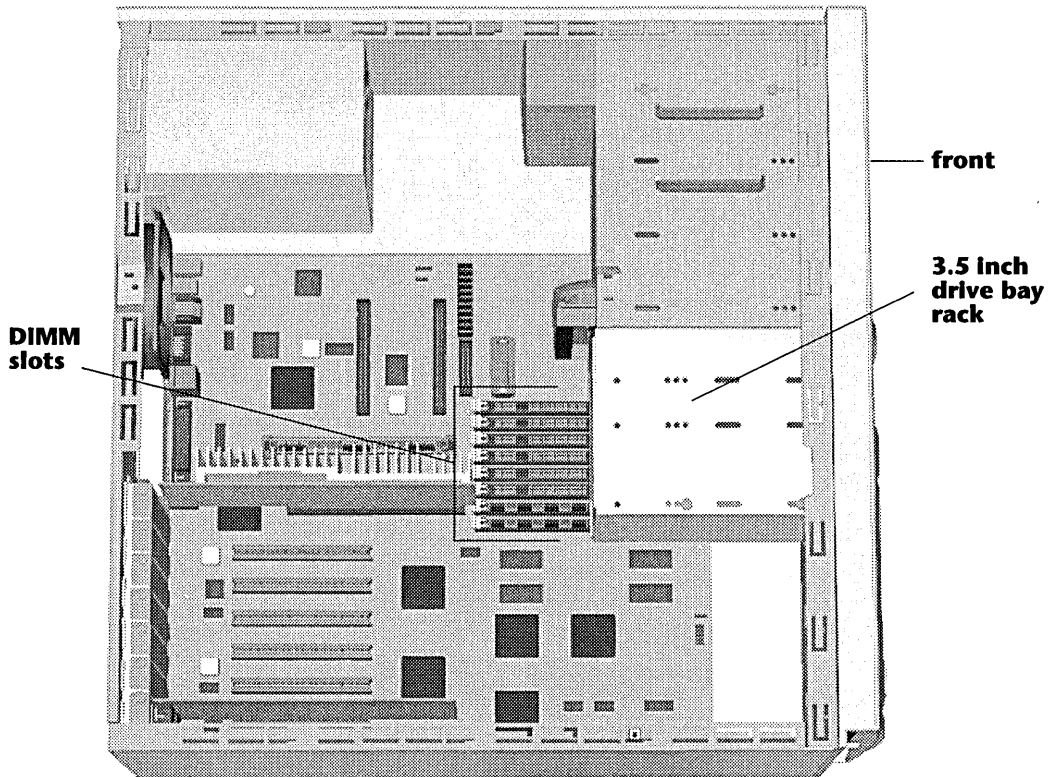
Lift the crossbar assembly higher to access the fan cable connector, and disconnect the fan cable from the connector.



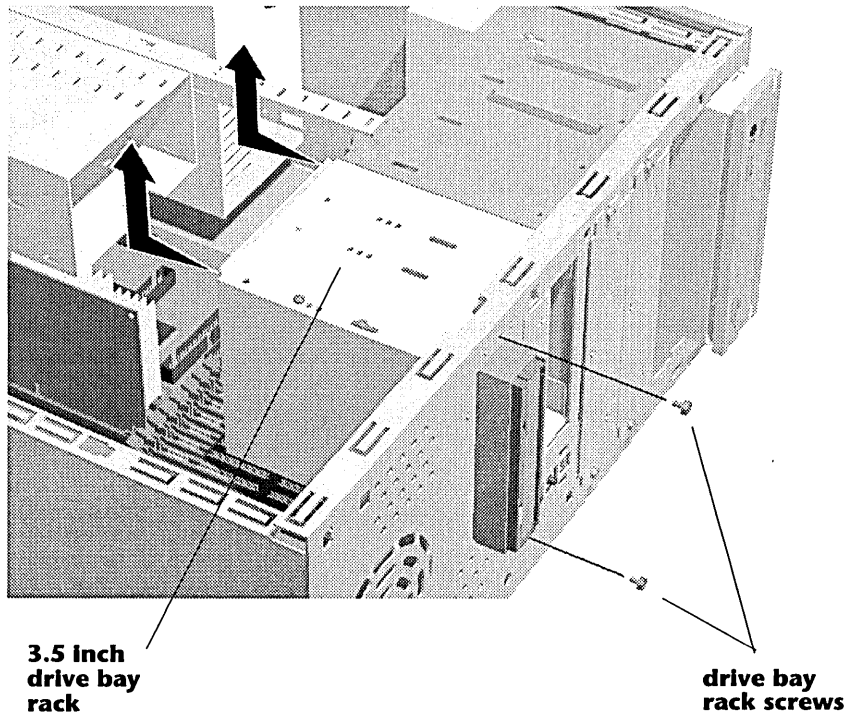
## Chapter 5, Adding Memory

Place the crossbar assembly, the expansion slot cover, and the screws in a safe place where you will be able to find them later.

Disconnect the cables from the drives in the front 3.5 inch drive bay rack above the DIMM slots.



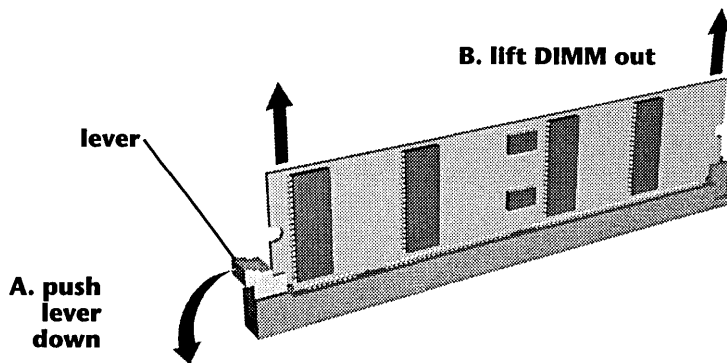
4. Remove the two screws holding the front 3.5 inch drive bay rack to the front of the chassis, and slide the drive bay rack back to remove it from the chassis.



## Chapter 5, Adding Memory

### ❑ Removing a DIMM.

1. If you need to remove a DIMM module to make room for a higher-capacity one, reach in and push down on the tiny lever at the end of the DIMM slot.



2. The DIMM should pop loose from the slot at the lever end.
3. If the DIMM module does not come free, press the DIMM lever down again.
4. Grasp the DIMM module with one hand at each end and pull the module up and out of the slot.
5. When you are finished with DIMM removal and insertion, put the cover back on the computer, and re-connect the external cables.

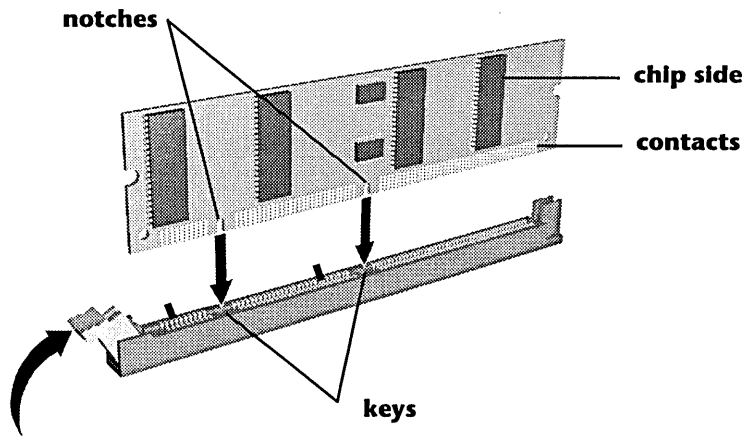
**CAUTION!** *Be careful not to get any of the cables caught in the cover or stuck in the fan housing when you put the cover back on the computer.*

### □ Inserting a DIMM

**CAUTION!** *Touch the metal plate over the power supply to discharge any static electricity that might have built up on your clothes or body.*

The system must be plugged in (see step 2 on page 42) for this to work.

*Use an anti-static bracelet and handle memory modules by the non-metallic edges only.*



1. To insert a DIMM module, hold the module with one hand at each end with the contacts down and the chip side of the DIMM toward the front of the computer.

Notice that there are two notches in the contact edge of the DIMM module.

2. Lower the DIMM squarely into the slot so that the notches line up with the raised key areas of the DIMM socket.

## Chapter 5, Adding Memory

- 3. Slide the contacts straight into the slot and make sure the contacts are firmly seated in the slot.**

Don't force the DIMM module into the slot; if the motherboard starts bending significantly, pull the DIMM out, reposition it, and try again.

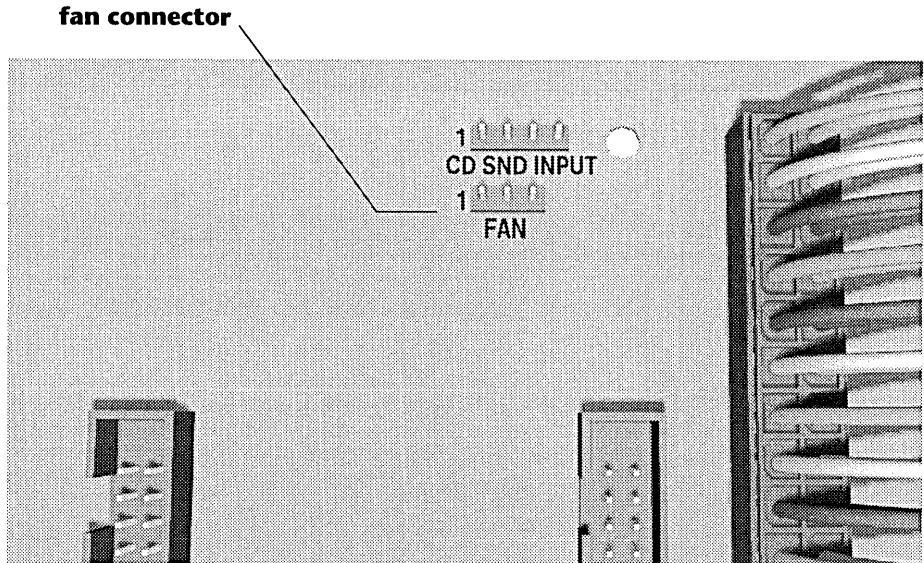
**Note:** Some DIMM modules have sharp, square edges which are difficult to get into the DIMM slot. If you have repeated difficulty getting the DIMM into the slot, return it to your vendor for replacement.

- 4. If the DIMM module is seated, the DIMM lever should rise by itself so it lines up with the other levers.**
- 5. When you are finished, replace the front 3.5 inch drive bay cage, and re-connect the drives in the drive cage.**
- 6. Re-assemble the computer as described in "Putting the computer back together" on page 57.**

## Putting the computer back together

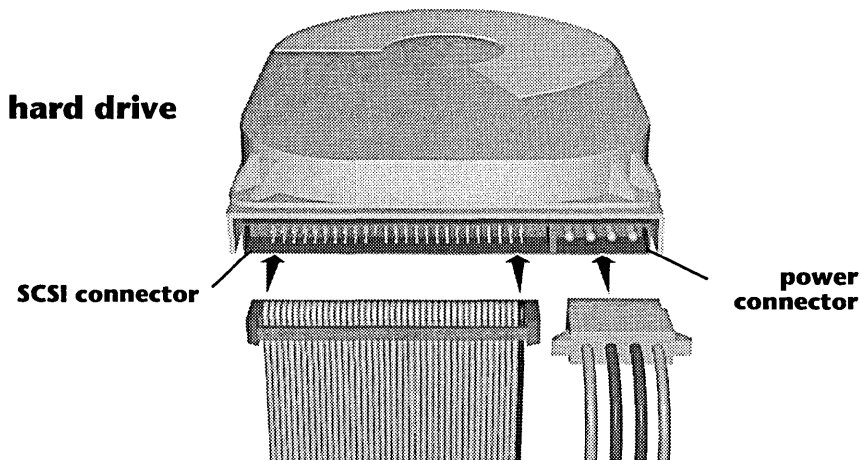
Follow the instructions in this section to put the computer back together and to verify that the installed drive is operating properly.

1. Re-connect the crossbar assembly fan cable to the fan connector on the motherboard.





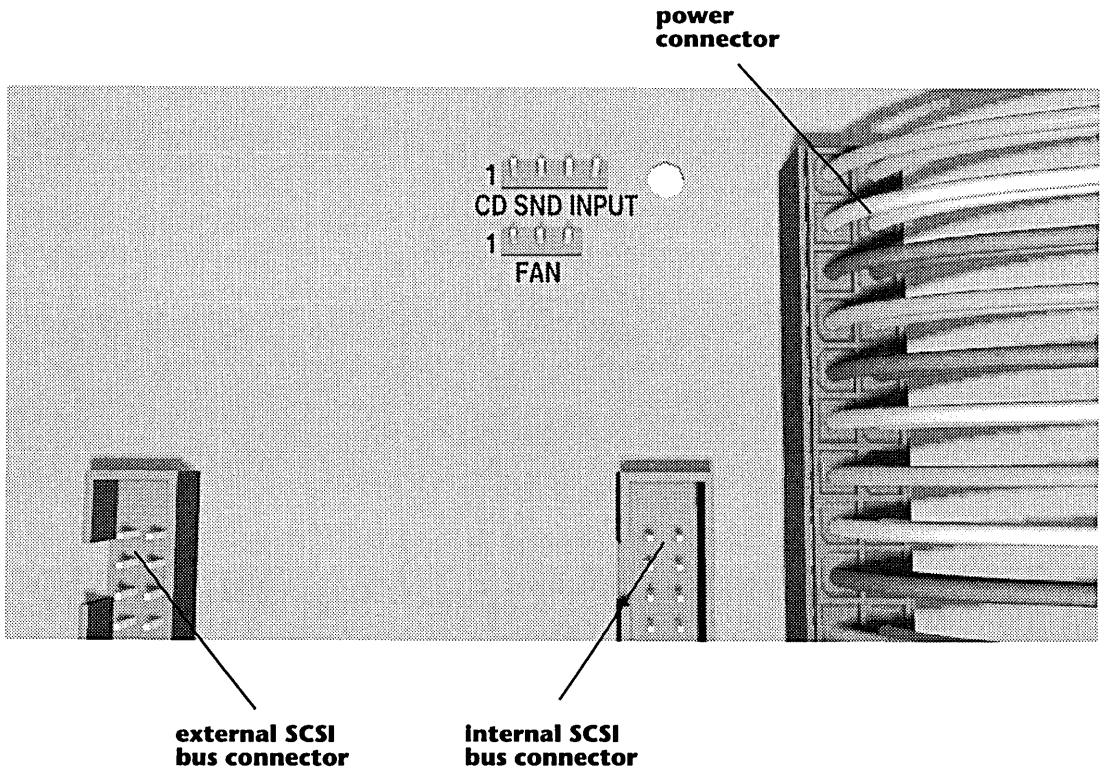
2. If drives are installed in the RAID rack, connect the RAID drive power and SCSI cable connectors.



Find the internal SCSI cable inside the computer (it is the wide flat ribbon cable connected to the hard drive). The internal SCSI cable should have one or more unused connectors on it. You may have to detach and re-attach the SCSI connectors on one or more other drives to get connectors where you need them. Remember, this is SCSI, so the ends have to be terminated. See “Ensuring proper termination” on page 15 for details.

**Note:** Because this system has a total of 9 drive bays, and a SCSI chain can handle a maximum of 7 devices, including the pre-installed hard drive and the CD-ROM drive, there is a separate cable, connected to the external SCSI chain, to be used if the internal SCSI chain is filled to capacity. The external SCSI cable is set up to be used for devices in the RAID rack. The internal SCSI bus operates at 10 MB/sec; the external SCSI bus operates at 5MB/sec.

If you are installing a drive in the RAID rack and there are no other SCSI connectors available, connect these drives to the external bus cable.



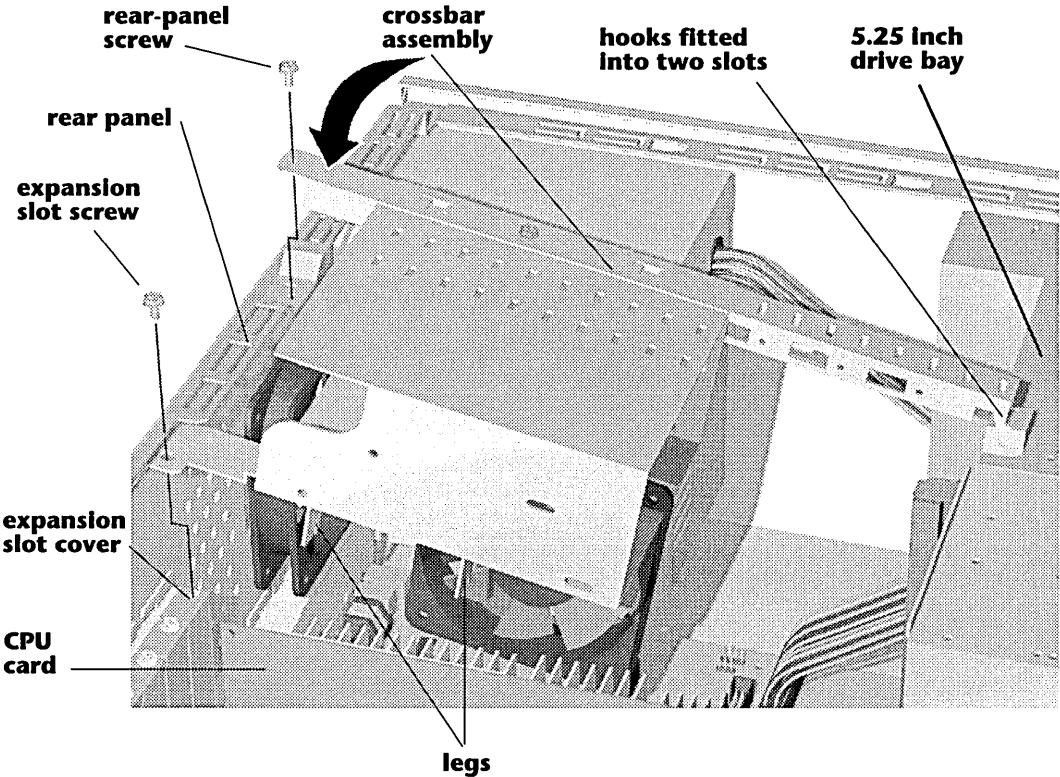
## Chapter 5, Adding Memory

- 3. Place the expansion slot cover over the PCI expansion slot, but do not reinsert the screw.**
- 4. Read this step before proceeding.**

This step is intended to provide an overview of the crossbar assembly installation procedure. Use the following illustration for reference only. Detailed installation instructions follow.

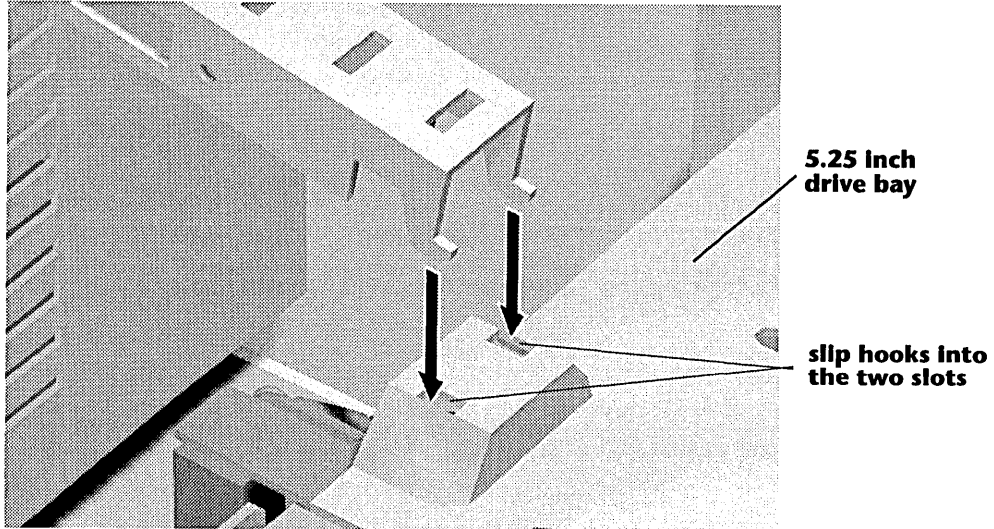
In general, the crossbar assembly must be secured to the chassis by two hooks on the front end of the beam, which fits into two slots on the 5.25 inch drive bay rack.

A screw attaches the rear of the beam to the rear chassis panel, and a second screw attaches the RAID rack cage to the PCI expansion slot closest to the CPU card. The RAID rack rests on two legs on top of the CPU card.

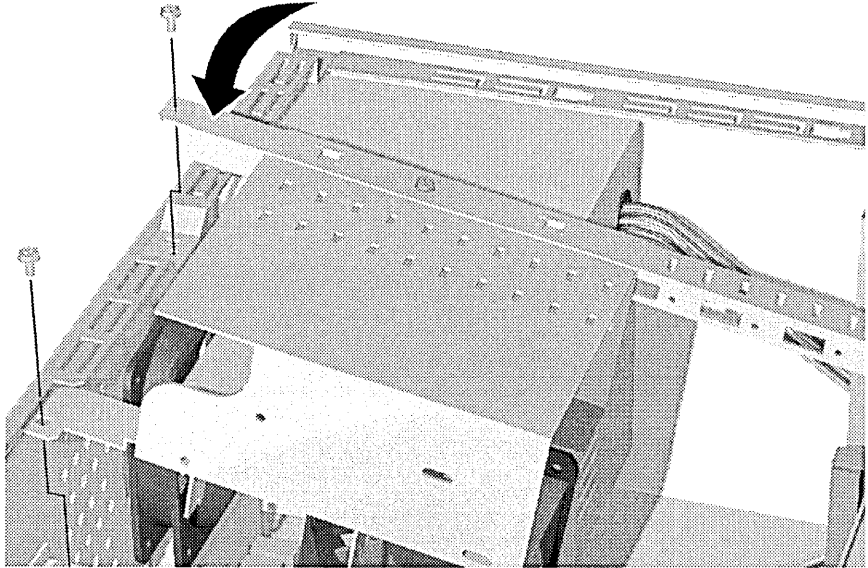


## Chapter 5, Adding Memory

5. To re-install the crossbar assembly, first slip the two hooks on the front end of the crossbar beam into the two slots on the 5.25 inch drive bay rack.

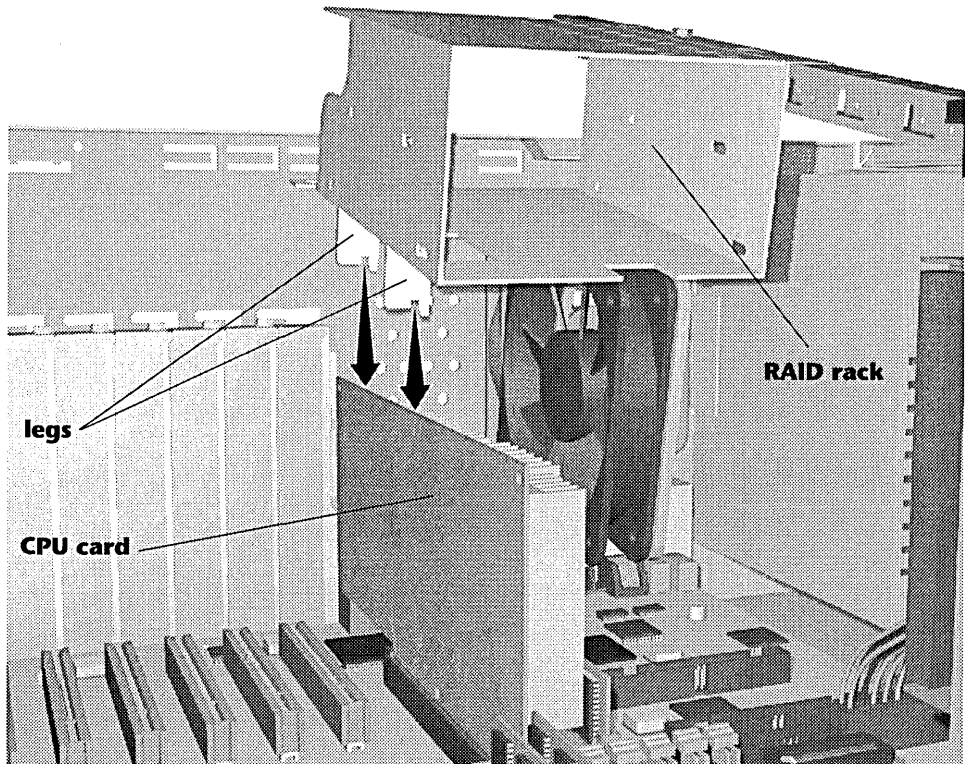


6. Lower the crossbar until the other end is almost to the rear panel.

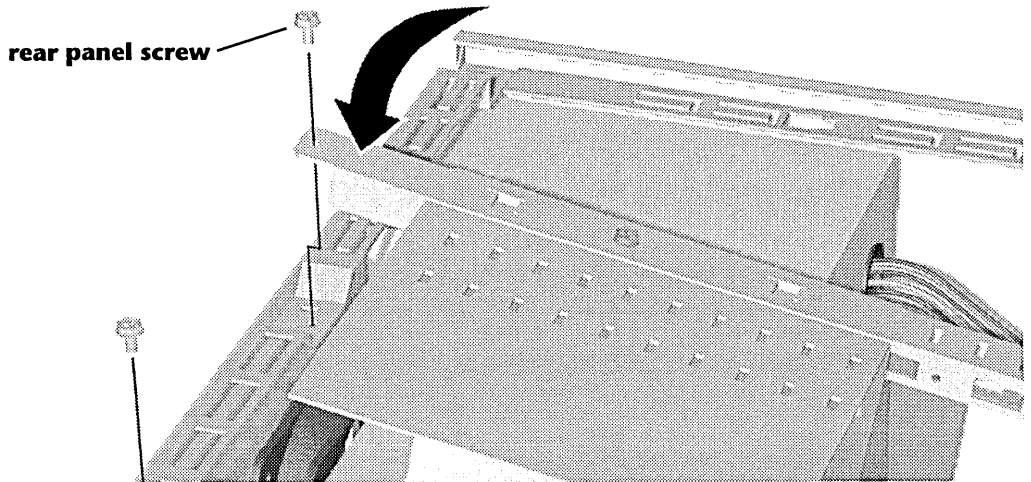


## Chapter 5, Adding Memory

7. Make sure the slots on the two legs on the bottom of the RAID rack are aligned with the CPU card.



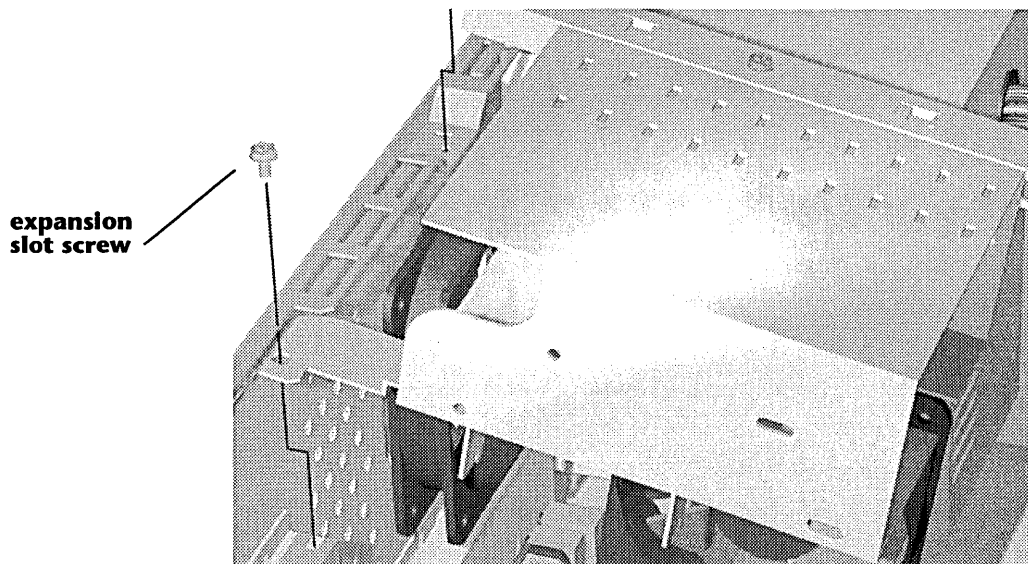
8. After making sure of proper alignment, lower the end of the crossbar so that it is flush with the rear panel, and re-insert the rear-panel screw.





## Chapter 5, Adding Memory

9. Align the holes in the crossbar assembly and expansion slot cover, and then re-install the expansion slot screw.



10. Replace the side panel, re-connect system components, and restart the computer.

**CAUTION!** *Be careful not to get any of the cables caught in the cover or stuck in the fan housing when you put the cover back on the computer.*

# Chapter 6 Installing Drives

This chapter explains how to enhance the capabilities of your computer by adding internal devices such as an additional hard disk.

## Removing the cover

In order to install internal drives into your system, you must first remove the computer's cover.

## Tools required

- A small regular (slot-head) screwdriver or a small coin.

### CAUTION!

**1. If you are not proficient with electronic equipment, Power Computing Corporation recommends that you have a certified technician install RAM, drives, and expansion cards. If you attempt to install RAM, drives, or cards yourself, any damage you may cause to your equipment will not be covered by the limited warranty on your computer. Please call technical support at 1-800-708-6227 for additional information about this or any other warranty question.**

**2. If an anti-static bracelet is available, put it on and ground it to the computer chassis before touching any components inside the computer.**

**3. Never turn the computer on or operate the computer with the cover removed.**

## Chapter 6, Installing Drives

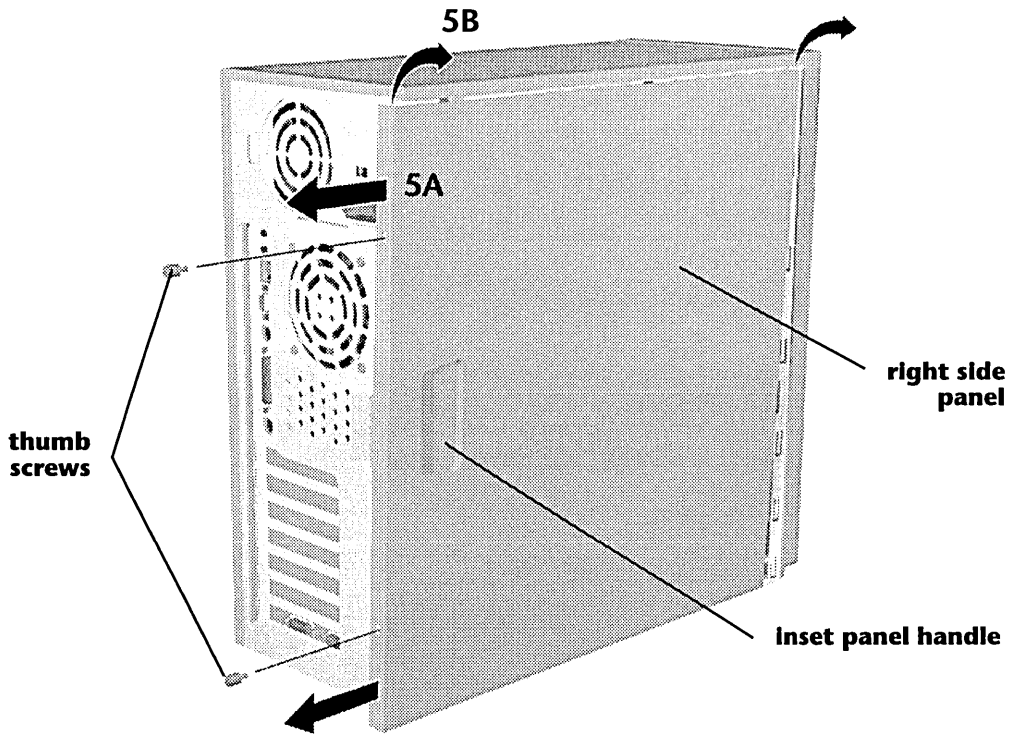
### To remove the cover:

1. Shut down the computer and turn off the monitor, but leave the computer plugged in to the electrical outlet.

Leaving the computer plugged in ensures that it is grounded.

2. Disconnect everything but the power cord from the back of the computer.
3. Rotate the computer so that its rear panel faces you.

4. Remove the two thumb screws from the rear of the right side panel.



Put the thumb screws somewhere safe where you'll be able to find them when you're ready to replace the cover.

## Chapter 6, Installing Drives

**5. A. Grasp the inset panel handle and slide the right side panel back about an inch.**

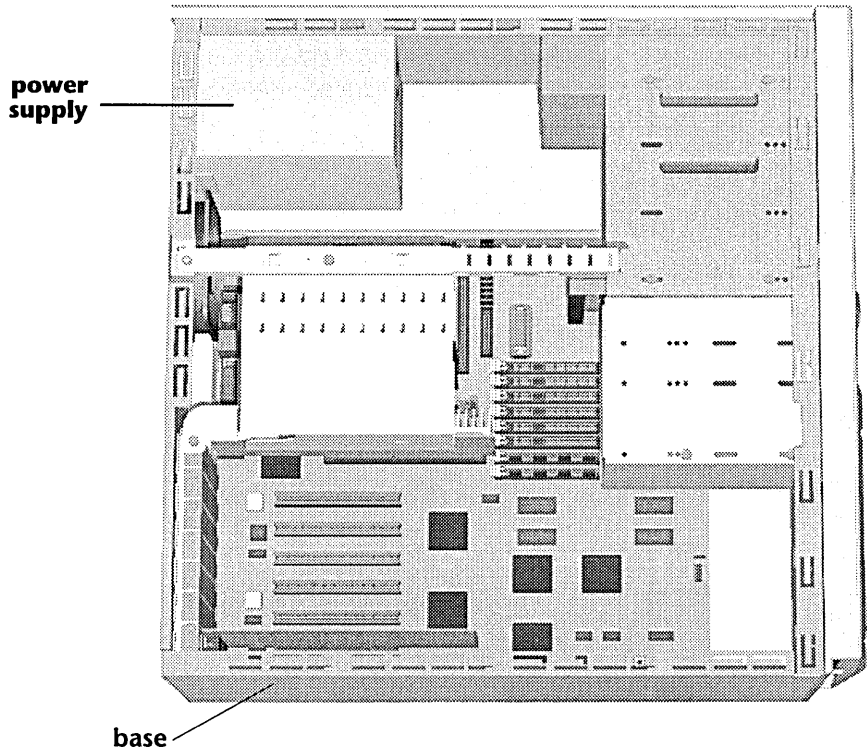
**B. Gently, but firmly, pull the top of the side panel to the rear and away from the chassis.**

Set the side panel aside.

**6. Lay the computer down with its open side up and rotate it so that the base faces you.**

**7. Before touching any components inside the computer, touch the metal plate over the power supply to discharge any static electricity that might have built up on your clothes or body.**

The system must be plugged in (see step 2 on page 68) for this to work.



8. To replace the side panel, reverse steps 4 through 7; then you can re-connect everything.

**CAUTION!** *Be careful not to get any of the cables caught in the cover or stuck in the fan housing when you put the cover back on the computer.*

## Installing internal drives

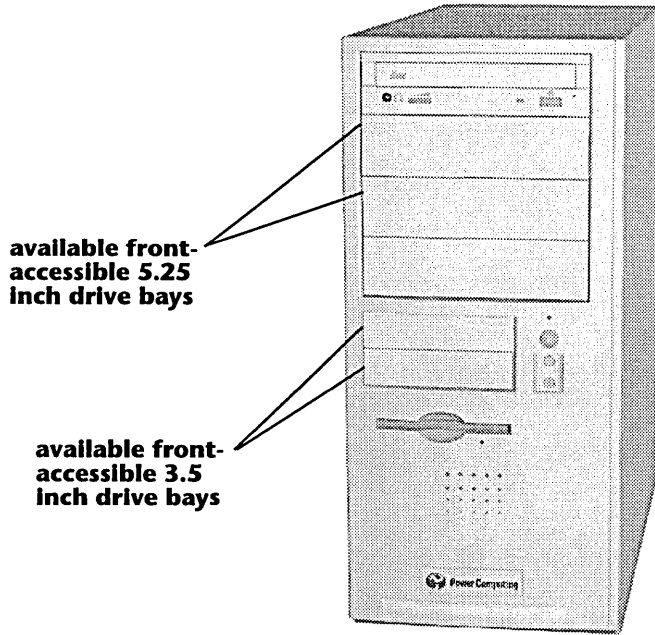
- CAUTION!** *1. If you are not proficient with electronic equipment, Power Computing Corporation recommends that you have a certified technician install RAM, drives, and expansion cards. If you attempt to install RAM, drives, or cards yourself, any damage you may cause to your equipment will not be covered by the limited warranty on your computer. Please call technical support at 1-800-708-6227 for additional information about this or any other warranty question.*
- 2. If an anti-static bracelet is available, put it on and ground it to the computer chassis before touching any components inside the computer.*
- 3. Never turn the computer on or operate the computer with the cover removed.*

## What you need to know about installing internal drives

The PowerTower Pro uses two SCSI (Small Computer Systems Interface) buses to connect drives; a 10 MB/sec. internal bus and a 5 MB/sec. external bus. For a discussion of how the SCSI bus on your computer is set up, see "Using SCSI devices," starting on page 14. Pay particular attention to the discussion of SCSI termination, discussed in "Ensuring proper termination" on page 15.

Besides the floppy disk drive, the built-in hard disk, and the CD-ROM drive, the computer has two front-accessible 5.25-inch drive bays below the CD-ROM drive. Each of these drive bays allows you to install one full-height or two half-height drives.

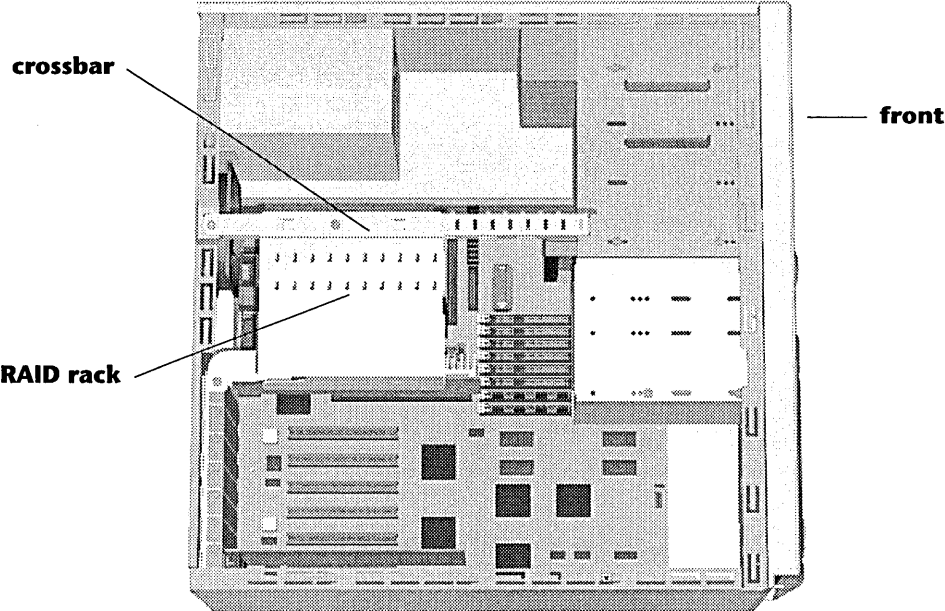
There are also two front-accessible 3.5 inch drive bays above the floppy disk drive.





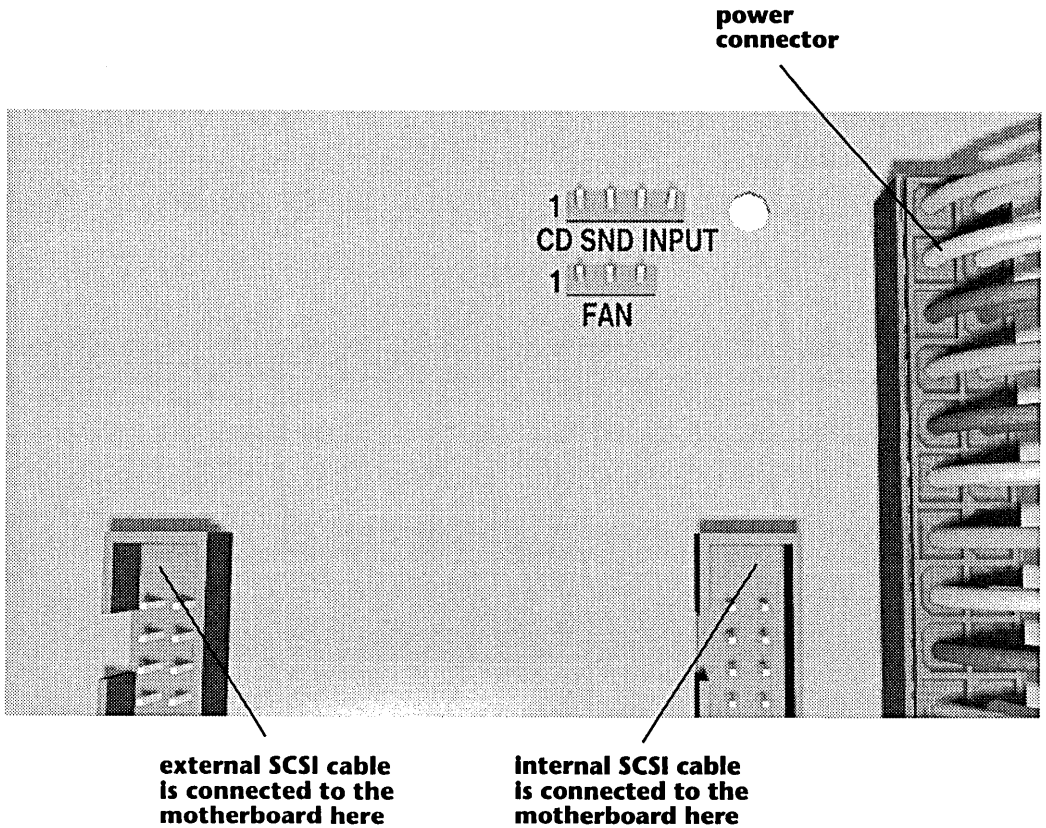
# Chapter 6, Installing Drives

You can also install 3.5 inch hard drives in the RAID rack attached to the crossbar.



## Chapter 6, Installing Drives

If you install 3.5 inch drives in the RAID rack and there are no other SCSI connectors available, connect these drives to the external SCSI bus cable.



## Chapter 6, Installing Drives

The power supply for the computer will support a total of nine internal drives, including the floppy drive. Do not exceed a total of nine such drives in the internal drive bays, and do not exceed the power consumption levels specified in “Power requirements” on page 150. Additional *external* drives, with their own power supplies, are fine, however.

If you wish to install a 3.5 inch drive in the 5.25 inch drive bay, adapters for installing 3.5 inch drives in 5.25 inch bays are available at most computer parts stores.

### Required tools

A small Phillips-head screwdriver.

A 3.5 inch to 5.25 inch drive adapter, if you are installing a 3.5 inch drive in a 5.25 inch bay.

A drive rail, if you are installing a drive in a 5.25 inch bay other than the bottom one.

Software drivers, if required.

### Installing a drive

- CAUTION!**
- 1. If you are not proficient with electronic equipment, Power Computing Corporation recommends that you have a certified technician install RAM, drives, and expansion cards. If you attempt to install RAM, drives, or expansion cards yourself, any damage you may cause to your equipment will not be covered by the limited warranty on your computer. Please call technical support at 1-800-708-6227 for additional information about this or any other warranty question.***
  - 2. If an anti-static bracelet is available, put it on and ground it to the computer chassis before touching any components inside the computer.***
  - 3. Handle drives carefully and avoid touching their contacts or moving parts.***

***4. Always store drives in anti-static bags.***

***5. Take your time; don't hurry.***

### □ Prepare the drive

#### 1. Set the SCSI ID

Following the instructions which came with your device, set its SCSI ID.

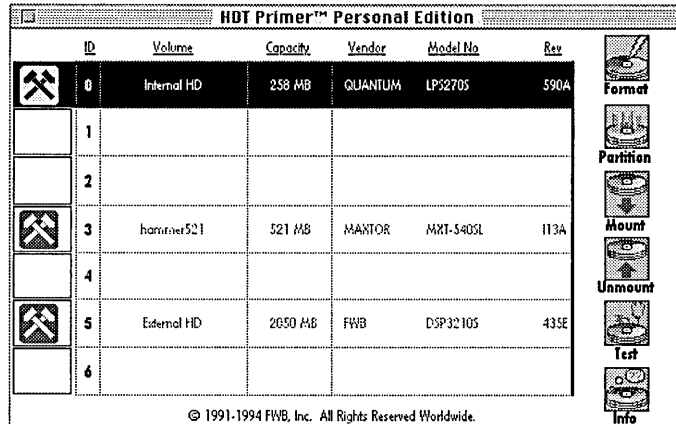
Each device in a SCSI chain requires a unique number called a SCSI ID, which the computer uses to identify the device. The computer itself is assigned SCSI ID 7 and the primary internal hard disk is assigned SCSI ID 0. Every other device you install must have a unique number from 1 to 6.

Drives provided by Power normally come with SCSI ID pre-set as follows:

SCSI ID	Device
0	primary internal hard drive (terminated)
1	optional additional hard drive
3	CD-ROM drive
5	optional removable-cartridge drive
7	motherboard (self-terminated)

## Chapter 6, Installing Drives

To determine what SCSI IDs have already been assigned to which devices, go to the **Hard Disk Toolkit™ PE** folder in the **Utilities** folder on your hard disk and run **HDT Primer™ PE**. HDT Primer will scan your SCSI bus and display the SCSI ID, name, and other parameters of all of the SCSI devices on the bus (see the following example).



The screenshot shows the HDT Primer Personal Edition software interface. It features a table with columns for ID, Volume, Capacity, Vendor, Model No, and Rev. To the right of the table is a vertical toolbar with icons for Format, Partition, Mount, Unmount, Test, and Info. The table contains the following data:

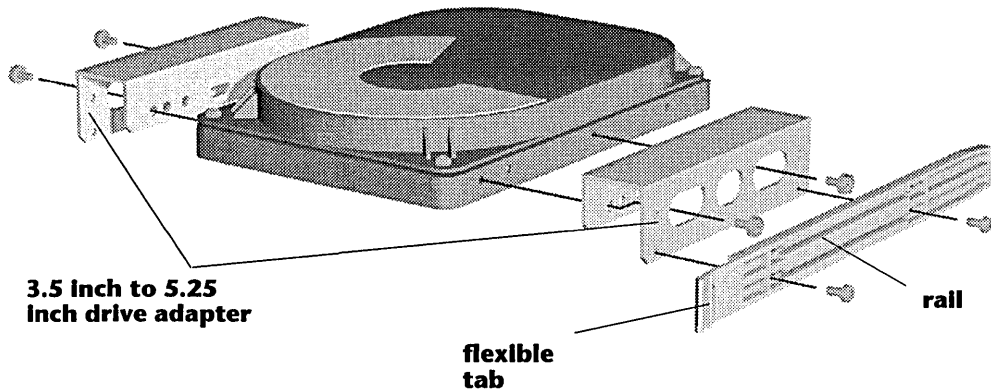
ID	Volume	Capacity	Vendor	Model No	Rev
0	Internal HD	258 MB	QUANTUM	LP32705	590A
1					
2					
3	harvme521	521 MB	MAXTOR	MMT-540SL	113A
4					
5	External HD	2050 MB	FWB	DSP32105	43SE
6					

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## Chapter 6, Installing Drives

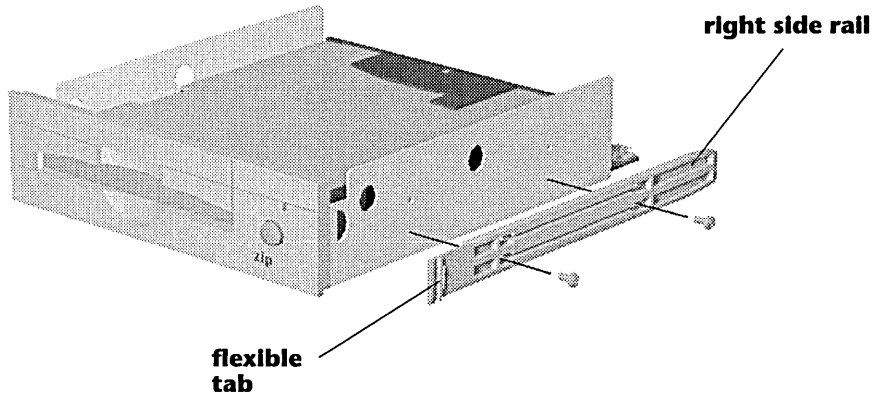
### 2. Attach a 3.5 inch drive in a 3.5 to 5.25 inch adapter

Since the internal drive bays are designed to accommodate 5.25 inch drives, if you are installing a 3.5 inch drive in a 5.25 inch drive bay other than the bottom one, you will need to mount it in a 3.5 to 5.25 inch adapter, and then install a rail on the right adapter. The end of the rail with the flexible tab goes toward the front. 3.5 to 5.25 inch adapters are available at most computer parts stores.



### 3. Install a drive rail on the right side of the drive.

If you are installing a drive in a 5.25 inch drive bay, install a drive rail on the right side of the drive. The end of the rail with the flexible tab goes toward the front. If rails did not come with your drive, they are available from Power Computing for a nominal fee through our Sales Department at 1-800-999-7279. Rails, as well as adapter trays for installing 3.5 inch drives in the 5.25 inch bays, are also available at most computer parts stores.





## Chapter 6, Installing Drives

### Prepare the computer

1. If you haven't done so, remove the cover from the computer.

See "Removing the cover," starting on page 67 for instructions.

**WARNING!** *Make sure the computer is powered down before removing the cover.*

**CAUTION!** *Touch the metal plate over the power supply to discharge any static electricity that might have built up on your clothes or body.*

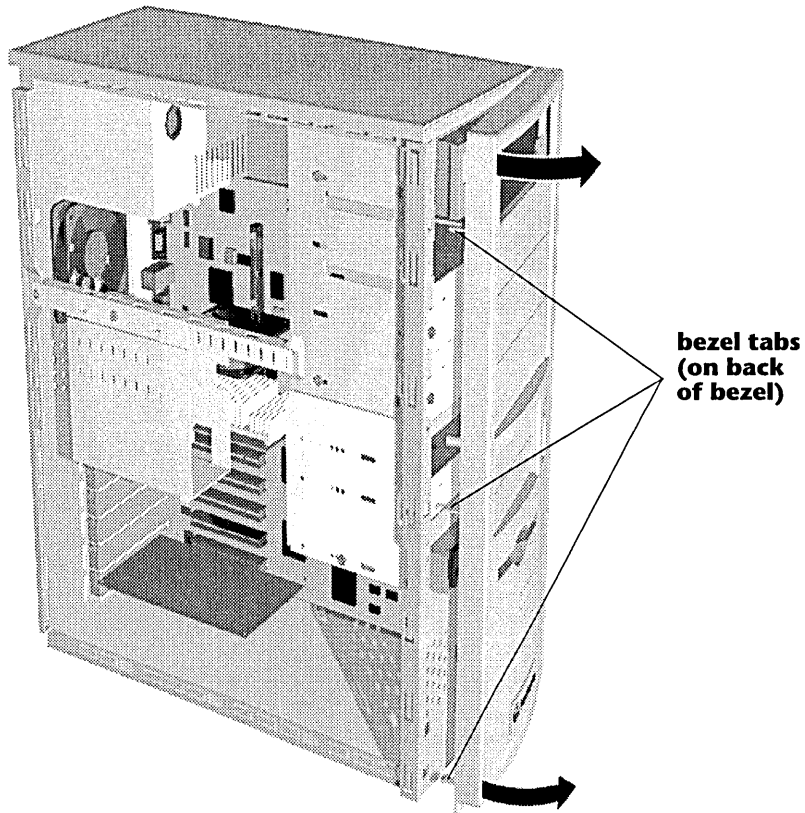
The system must be plugged in (see step 2 on page 68) for this to work.

***Use an anti-static grounding strap and handle hard drives by the housing only; avoid touching any exposed electronics or connectors.***

### 2. Set the computer upright.

Starting with the top bezel tab, push on the three tabs on the left side which hold the bezel in place.

Press up on the top tab and down on the other two, and pull the tabbed side of the bezel away from the case until the tabs on the other side of the bezel clear the front of the computer, and set the bezel aside.



## Chapter 6, Installing Drives

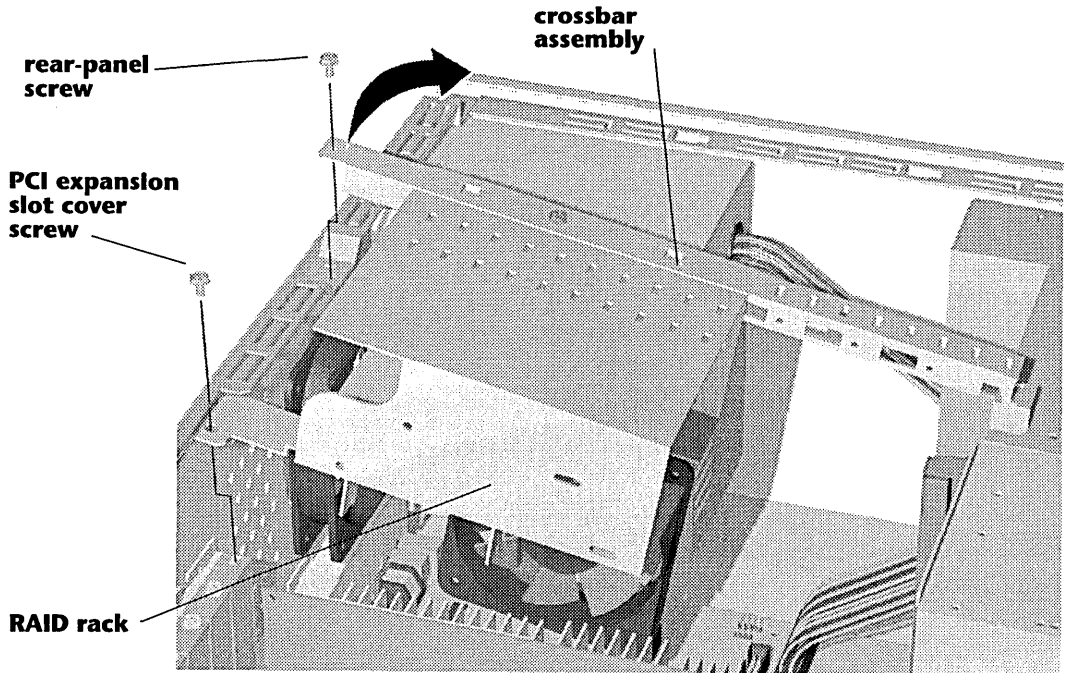
### 3. Remove the crossbar assembly.

The crossbar assembly consists of a crossbar, a RAID rack, and a fan; you must remove the crossbar assembly to install internal drives.

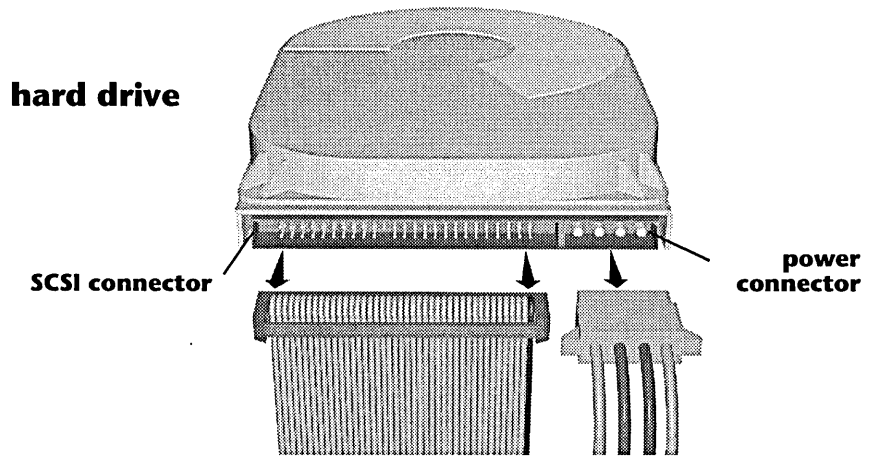
Place the computer on its side with the open side up.

Remove the screw that secures the crossbar to the rear panel.

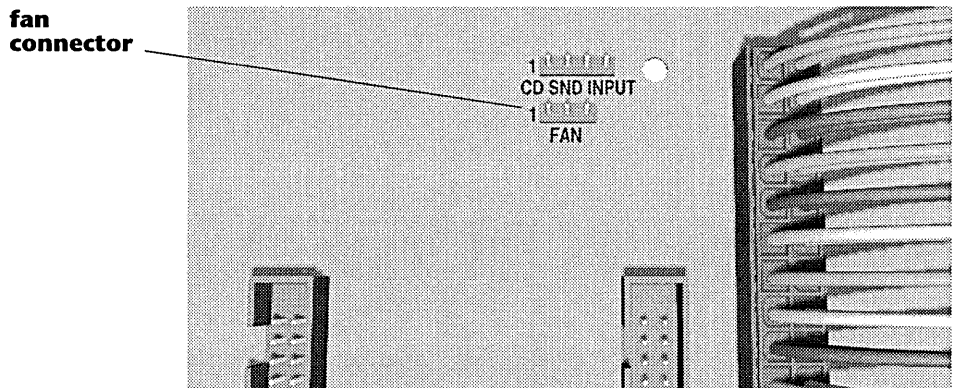
Remove the screw that secures the crossbar to the PCI expansion slot cover.



If there are drives installed in the RAID rack, lift the crossbar assembly high enough to have access to the RAID drive power and SCSI cable connectors, and then disconnect the cables from the RAID drives. Note which cable attaches to which RAID drive.



Lift the crossbar assembly higher to access the fan cable connector, and disconnect the fan cable from the connector.



Place the crossbar assembly, the expansion slot cover, and the screws in a safe place where you will be able to find them later.

### □ Replacing and installing drives

Before installing a drive in the computer, you should first consider the best location for its purpose. Obviously, a 5.25 inch drive must be installed in the 5.25 inch drive rack. If you are installing a 3.5 inch drive, it may go in any drive bay, although it will require a 3.5 to 5.25 inch drive adapter if it is installed in a 5.25 inch bay.

If a 3.5 inch hard drive is installed in the RAID rack, and there are no available SCSI cables to connect to it, then it must be connected to the external bus, which operates at 5 MB/sec. (For a discussion of how the SCSI bus on your computer is set up, see “Using SCSI devices,” starting on page 14. Pay particular attention to the discussion of SCSI termination, discussed in “Ensuring proper termination” on page 15.)

Another consideration is power. The power supply for the computer will support a total of nine internal drives, including the floppy drive. Do not exceed a total of nine such drives in the internal drive bays, and do not exceed the power consumption levels specified in “Power requirements” on page 150. Additional *external* drives, with their own power supplies, are fine, however.

Therefore, after deciding where you want to install the drive, refer to the appropriate section for instructions on:

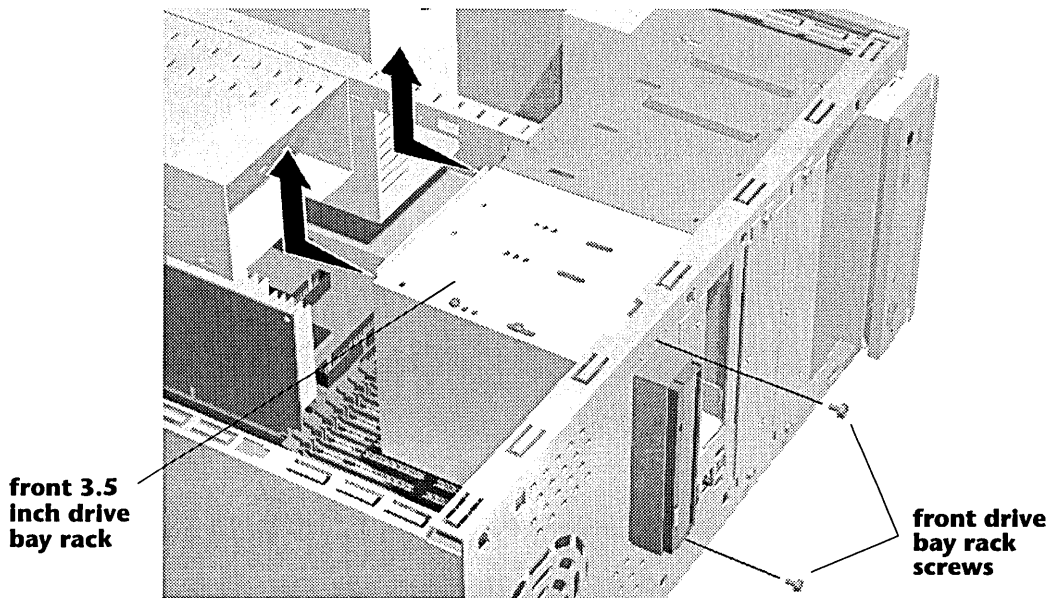
- “Replacing a drive in the bottom 5.25 inch rack position” on page 87
- “Replacing and installing drives in the other 5.25 inch rack positions” on page 95
- “Replacing and installing drives in the front 3.5 inch rack positions” on page 107
- “Replacing and installing drives in the RAID rack” on page 113

## Replacing a drive in the bottom 5.25 inch rack position

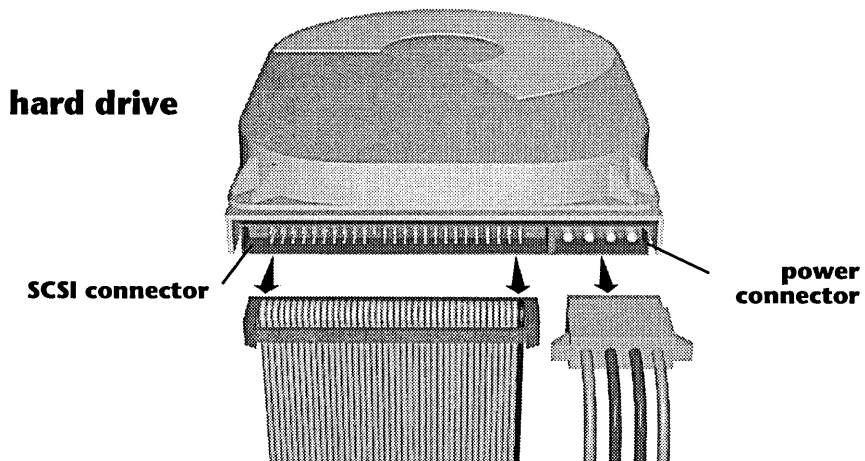
1. If you are replacing the bottom front primary hard drive, the front 3.5 inch drive bay rack, which is below the 5.25 inch drive bays, must first be removed.
2. To remove the front 3.5 inch rack, remove the two screws holding the front drive bay rack to the front of the chassis.

Remove the drive bay rack by sliding it to the rear.

Rest the rack on the metal power supply cover until you are ready to re-install it.

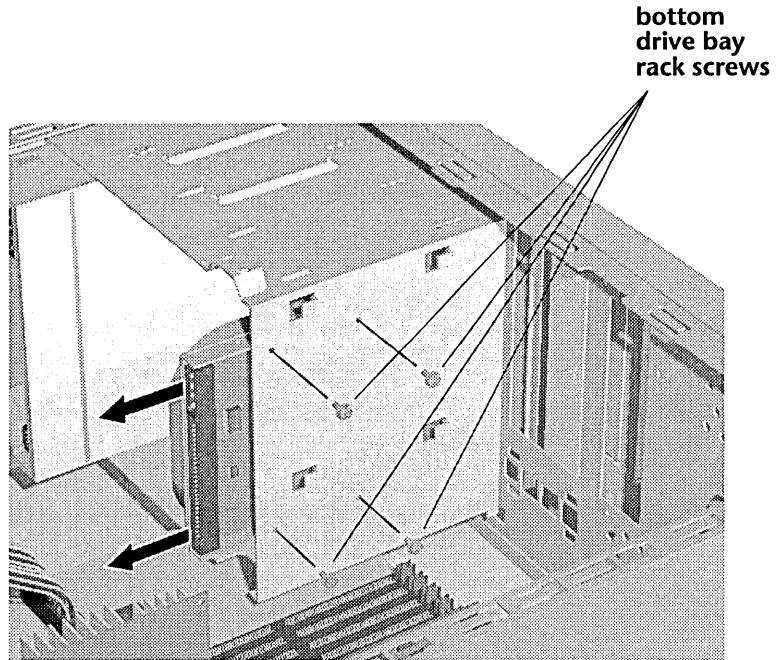


3. Disconnect the power connector and the SCSI connector from the rear of the bottom hard drive.



## Chapter 6, Installing Drives

The bottom hard drive is secured to the 5.25 inch drive bay rack by four bottom drive bay rack screws. Remove and save the four screws. Gently slide the hard drive backward until it clears the chassis.

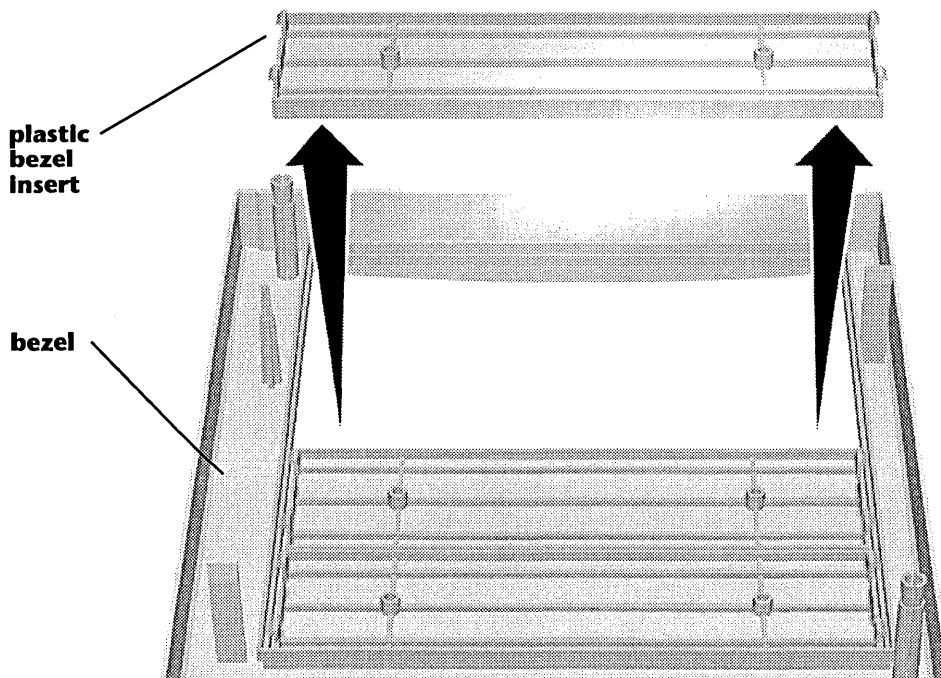




## Chapter 6, Installing Drives

4. If you are installing a removable-media drive, remove the plastic bezel insert covering the bay you are planning to use. To remove the insert, press it out from the inside.

The plastic insert is very flexible and should pop out quite easily.

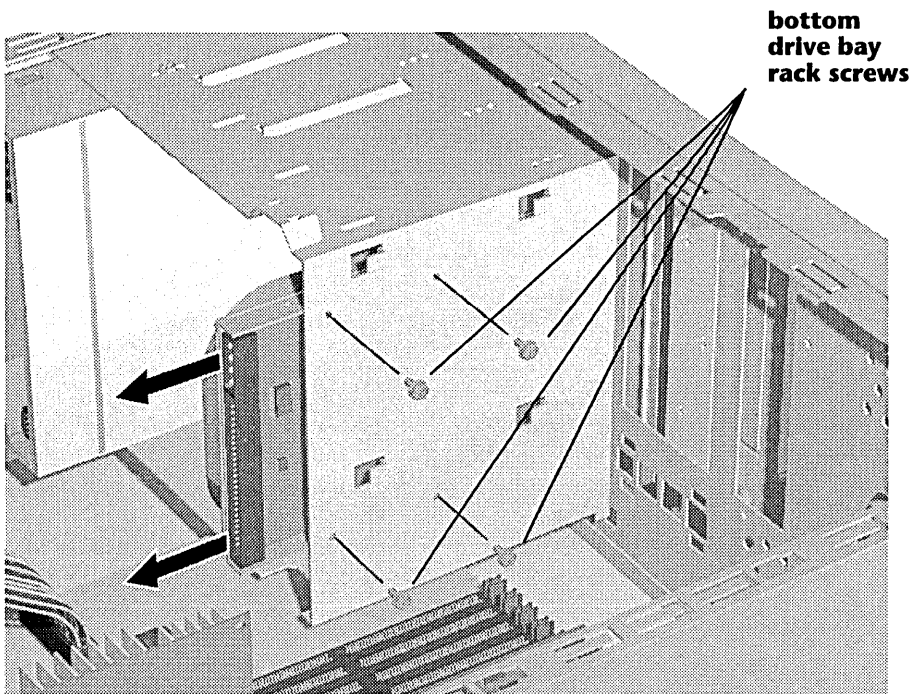


Once you have prepared the drive (see "Prepare the drive," starting on page 78) and the computer (see "Prepare the computer," starting on page 82), you are ready to install the drive.

5. Slide the drive into the bay from the front, being careful not to crimp or fold any cables.

Install the drive so that it faces up; if it isn't clear which way the drive should face (e.g. hard drives), assume that the SCSI connector (see illustration at the beginning of this procedure) should be in the back and the SCSI connector key should face up.

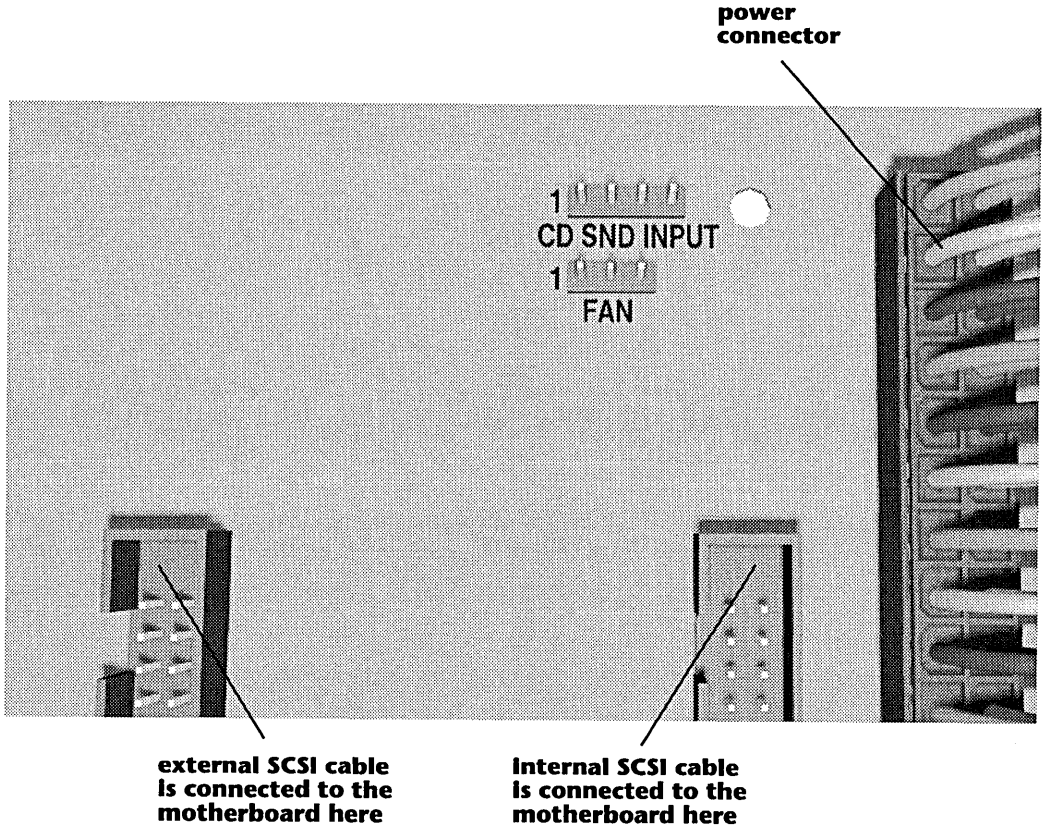
6. Secure the drive to the bottom 5.25 inch drive bay rack position by replacing the four bottom drive bay rack screws.



## Chapter 6, Installing Drives

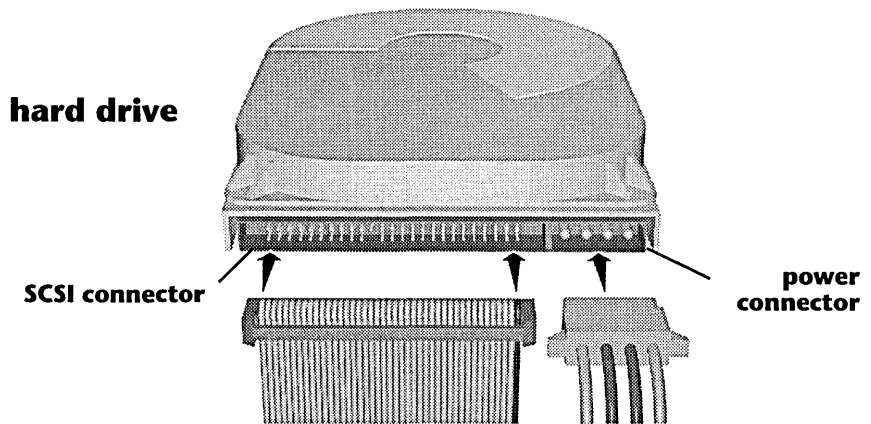
7. Connect one of the unused connectors on the SCSI cable to the wide connector on the drive (see illustrations following).

Find the internal SCSI cable inside the computer (it is the wide flat ribbon cable connected to the motherboard connector to the immediate left of the power cable).



The internal SCSI cable should have one or more unused connectors on it. You may have to detach and re-attach the SCSI connectors on one or more other drives to get connectors where you need them. Remember, this is SCSI, so the ends have to be terminated. See “Ensuring proper termination” on page 15 for details.

**Note:** There is a *key* in the middle of the top of the SCSI connector and a *notch* in the cable connector which matches the key, to ensure that the cable is not plugged in upside down. If the cable resists being plugged in, check to make sure the key and slot are mating correctly.



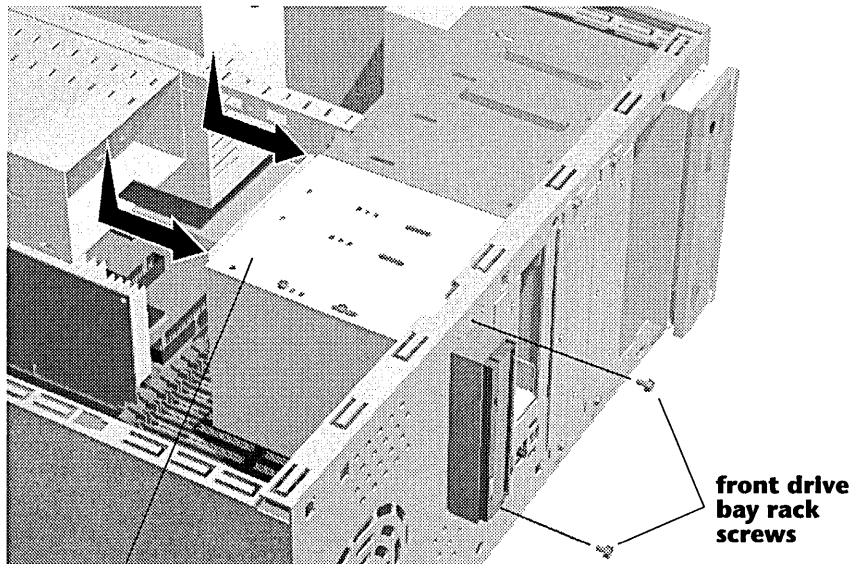
8. Find an unused four-pin power cable in the set of cables coming from the power supply (the power supply is in the right rear of the computer, on the bottom) and connect that cable to the rear of the drive, being careful to match the beveled corners of the plug to those of the socket.

Make sure the connectors are replaced and snug.

Check the instructions that came with the drive for jumper or switch settings and check to make sure that they are properly set before going to the next step.

## Chapter 6, Installing Drives

9. Replace the front 3.5 inch rack by sliding it to the front, and secure the drive to the front of the chassis with the two front drive bay rack screws.



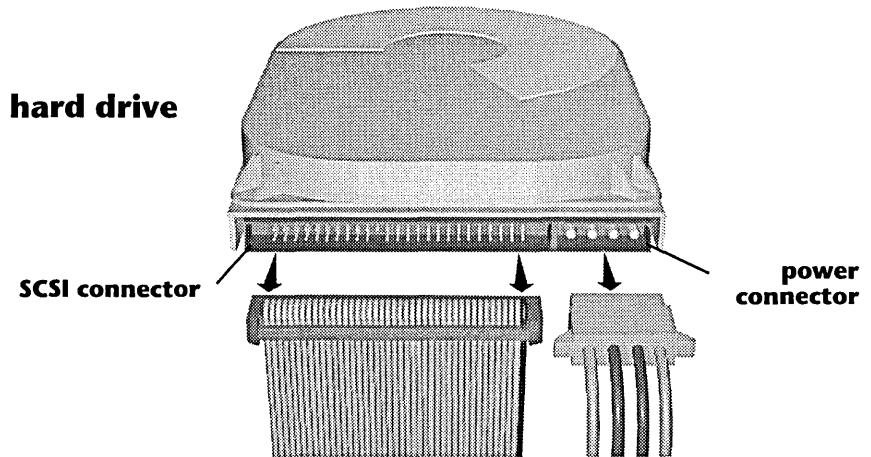
**front 3.5 inch  
drive bay rack**

10. Replace and re-connect any drives removed to obtain access to the drive bay.
11. If you are finished, proceed to "Putting the computer back together" on page 116.

## Replacing and installing drives in the other 5.25 inch rack positions

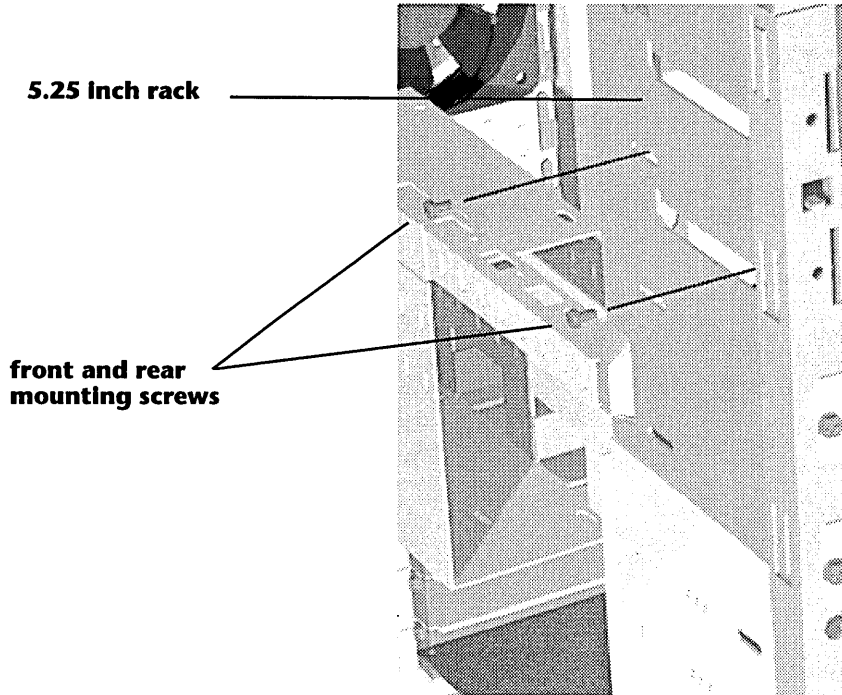
1. If you are removing a hard drive located above the bottom front primary hard drive, the 3.5 inch drive bay rack does not have to be removed.

Disconnect the power connector and the SCSI connector from the rear of the installed hard drive.



## Chapter 6, Installing Drives

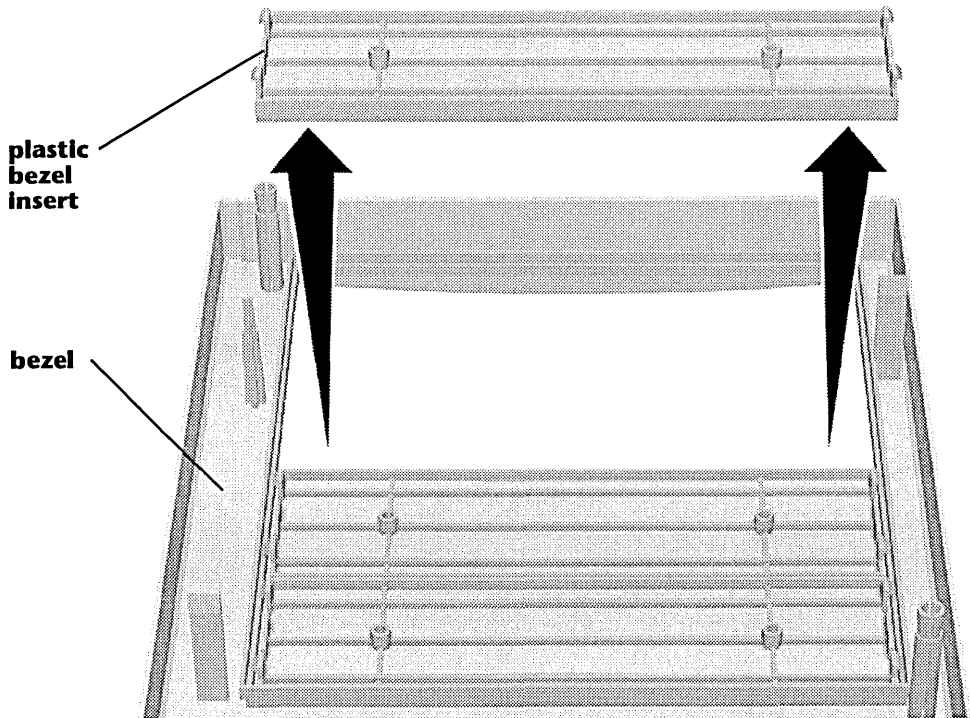
Remove the two front and rear mounting screws from the side of the hard drive. Be sure to save the screws.



Gently slide the hard drive forward until it clears the chassis.

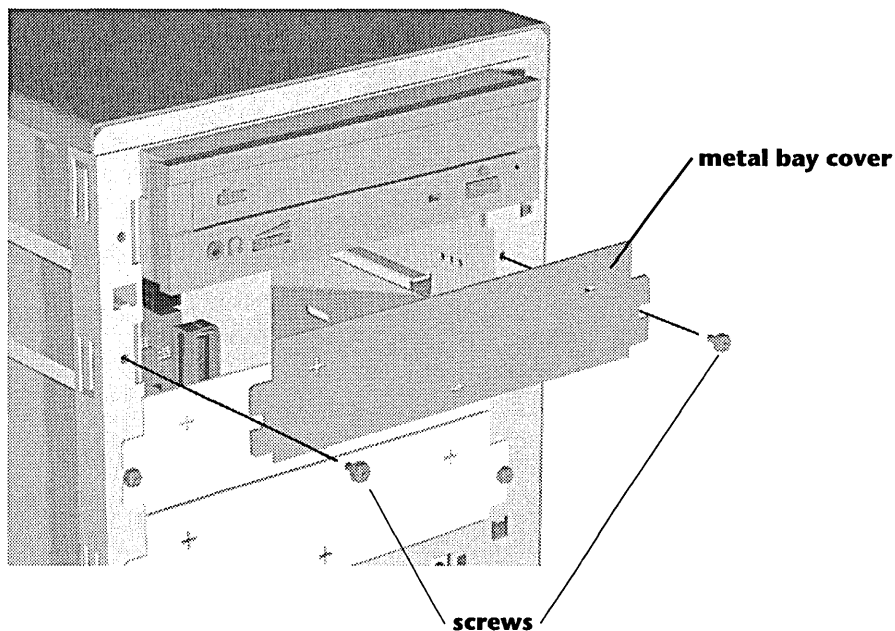
2. If you are installing a removable-media drive, remove the plastic bezel insert covering the bay you are planning to use. To remove the insert, press it out from the inside.

The plastic insert is very flexible and should pop out quite easily.





3. If you are installing a removable-media drive, unscrew the two screws holding the metal bay cover, if there is one, in front of the drive bay and set them aside.



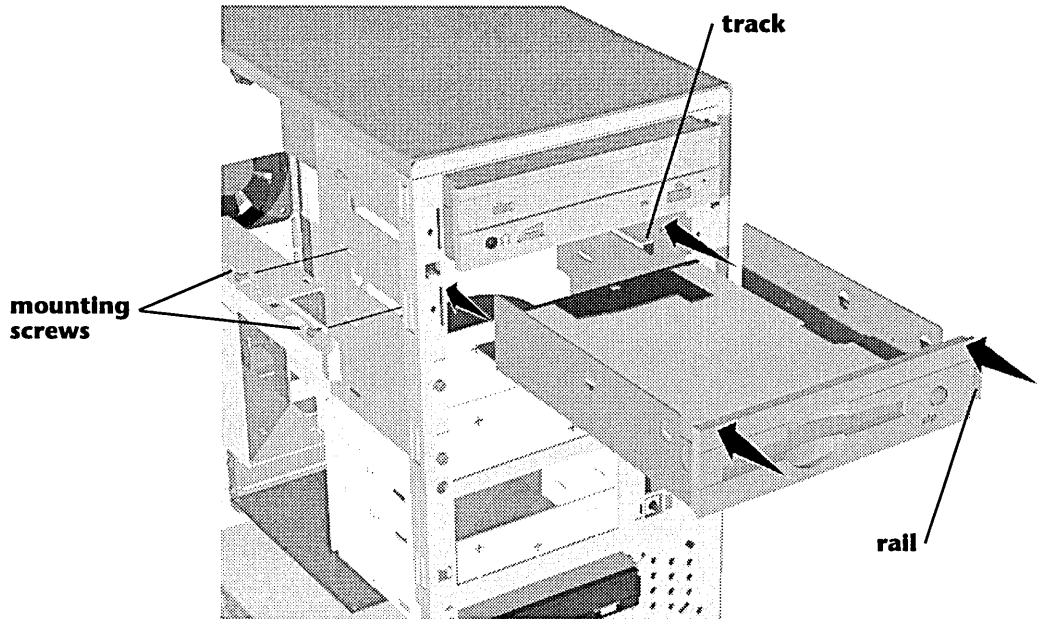
Once you have prepared the drive (see “Prepare the drive,” starting on page 78) and the computer (see “Prepare the computer,” starting on page 82), you are ready to install the drive.

**Note:** Connectors are keyed, which means that there is only one correct way to mate them. If a cable is very hard to connect, examine it carefully to make sure you have it oriented so that it fits the connector it goes onto. Once cables are connected, make sure they are snug.

4. Slide the drive into the bay, being careful not to crimp or fold any cables.

Install the drive so that it faces up; if it isn't clear which way the drive should face (e.g. hard drives), assume that the SCSI connector (see illustration on next page) should be in the back and the SCSI connector key should face up.

The 5.25 inch drive bays above the bottom 5.25 drive bay use mounting screws on the left side and a rail on the drive which slides from the front into a track in the drive bay on the right side of the bay.

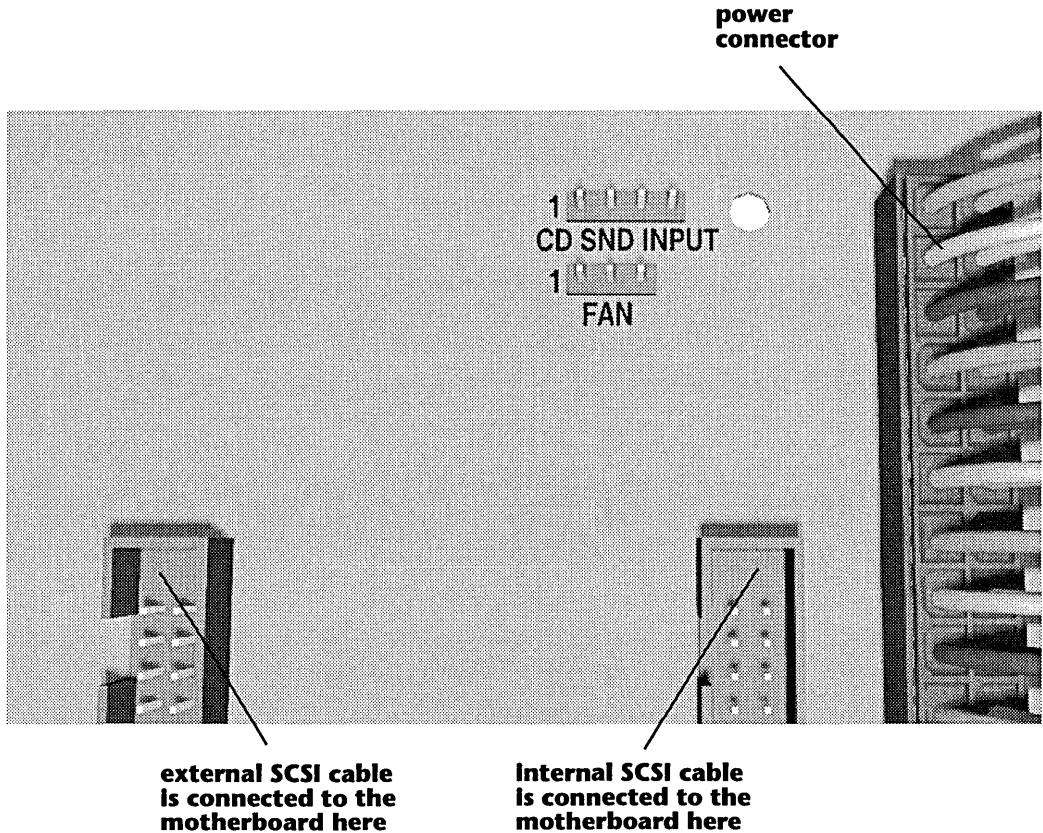


5. Line the screw holes on the side of the drive up with the slots in the drive housing, and insert the mounting two screws, front and rear, on each side of the drive. Tighten screws firmly, but don't overtighten (see the illustration on the preceding page).

## Chapter 6, Installing Drives

6. Connect one of the unused connectors on the SCSI cable to the wide connector on the drive (see illustrations following).

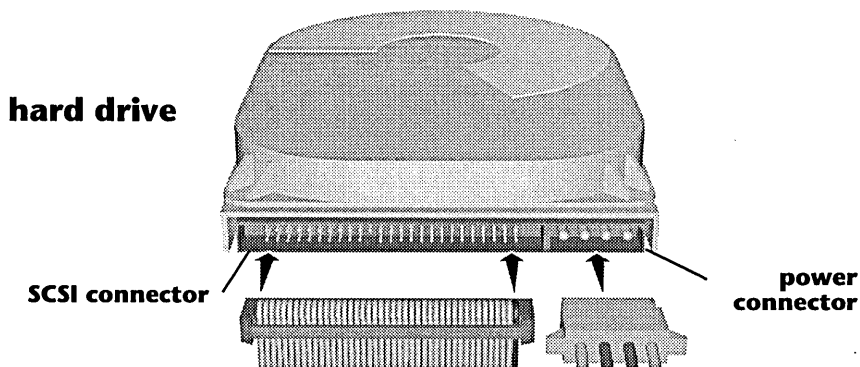
Find the internal SCSI cable inside the computer (it is the wide flat ribbon cable connected to the motherboard connector to the immediate left of the power cable).

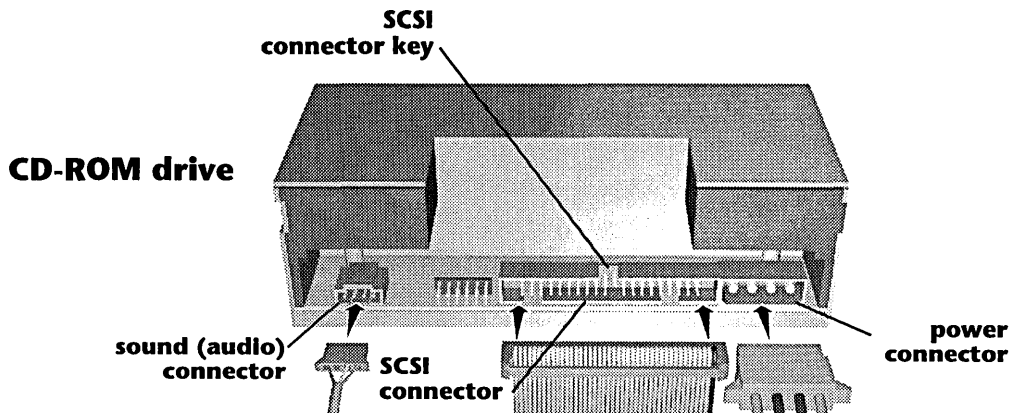


The internal SCSI cable should have one or more unused connectors on it. You may have to detach and re-attach the SCSI connectors on one or more other drives to get connectors where you need them. Remember, this is SCSI, so the ends have to be terminated. See "Ensuring proper termination" on page 15 for details.

**Note:** Because this system has a total of 9 drive bays, and a SCSI chain can handle a maximum of 7 devices, including the pre-installed hard drive and the CD-ROM drive, there is a separate cable, connected to the external SCSI chain, to be used if the internal SCSI chain is filled to capacity. It is set up to be used for devices in the 3.5 inch drive bays. The internal SCSI bus operates at 10 MB/sec; the external SCSI bus operates at 5MB/sec.

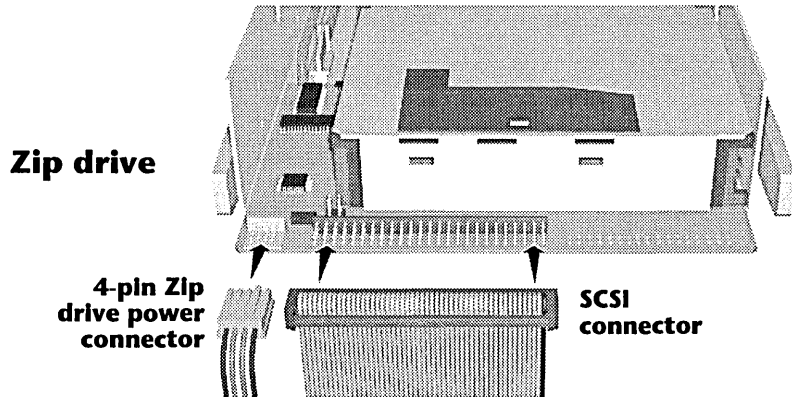
There is a *key* in the middle of the top of the SCSI connector and a *notch* in the cable connector which matches the key, to ensure that the cable is not plugged in upside down. If the cable resists being plugged in, check to make sure the key and slot are mating correctly.





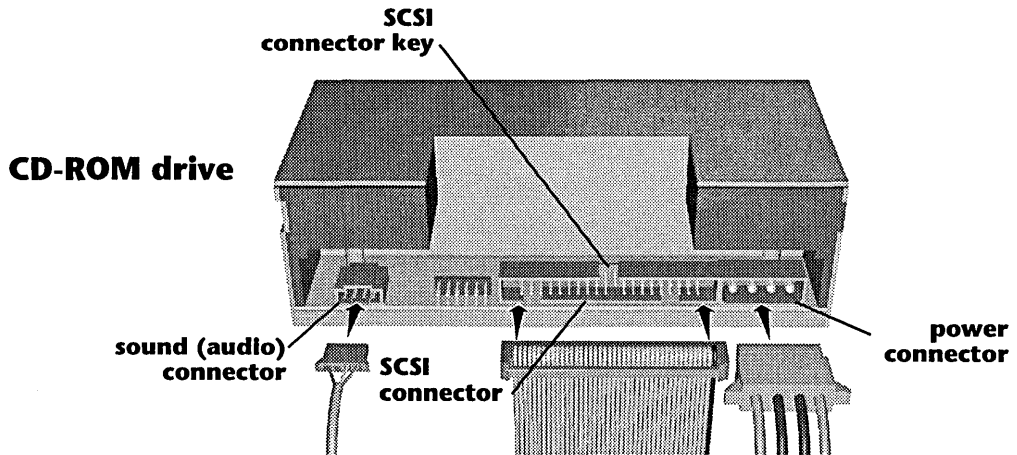
7. Find an unused four-pin power cable in the set of cables coming from the power supply (the power supply is in the right rear of the computer, on the bottom) and connect that cable to the rear of the drive, being careful to match the beveled corners of the plug to those of the socket (see the illustrations on the preceding page).

8. If you are installing a Zip drive, use the small *four-wire* four-pin power connector and plug it into the keyed four-pin connector near the left end of the rear of the Zip drive.



### 9. If you are installing a CD-ROM drive,

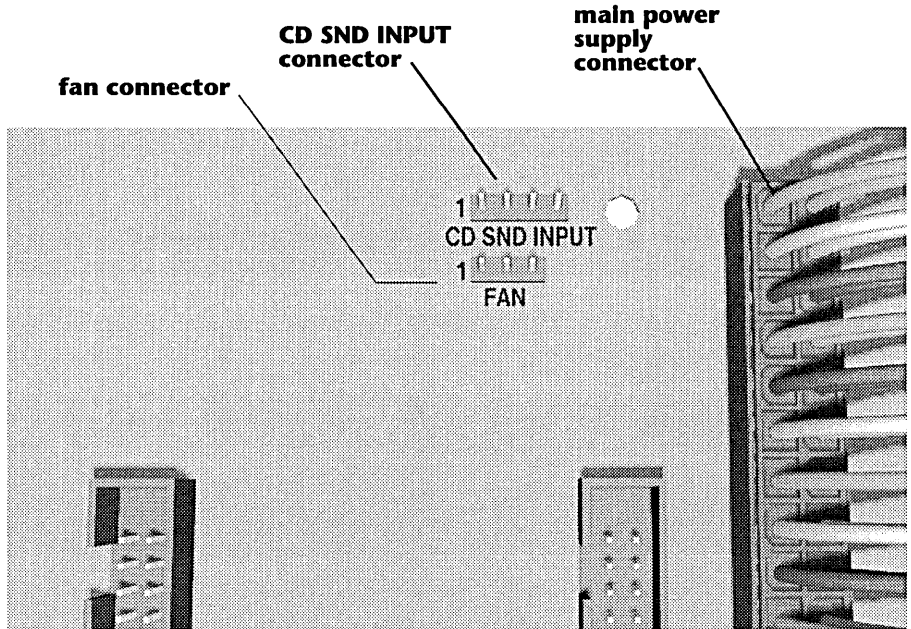
Connect the small white 3-pin end of the CD-ROM cable firmly to the keyed 3-pin audio connector on the CD-ROM drive.



Be careful not to get the small four-wire power supply cable, which is intended for a Zip drive; the four-wire power cable is connected to the power supply. The audio cable goes to the motherboard.

The 3-pin audio connector is keyed; so if you have trouble getting it on, try turning it over. The larger, 4-pin connector should be connected to the four-pin connector on the motherboard, labeled **CD SND INPUT**.

The **CD SND INPUT** connector is near the power supply edge of the motherboard, above the fan connector and next to the main power supply connector.



The four-pin audio connector should be connected so that the lip on the connector faces away from the drive bay edge of the motherboard. You may have to temporarily remove some of the other cables from their connectors to be able to reach in and seat the CD-ROM connector.



## Chapter 6, Installing Drives

Make sure all four pins are enclosed in the connector.

Make sure the connectors are replaced and snug.

Check the instructions that came with the drive for jumper or switch settings and check to make sure that they are properly set before going to the next step.

- 10. Replace and re-connect any drives removed to obtain access to the drive bay.**
- 11. If you are finished, proceed to "Putting the computer back together" on page 116.**

### **Replacing and installing drives in the front 3.5 inch rack positions**

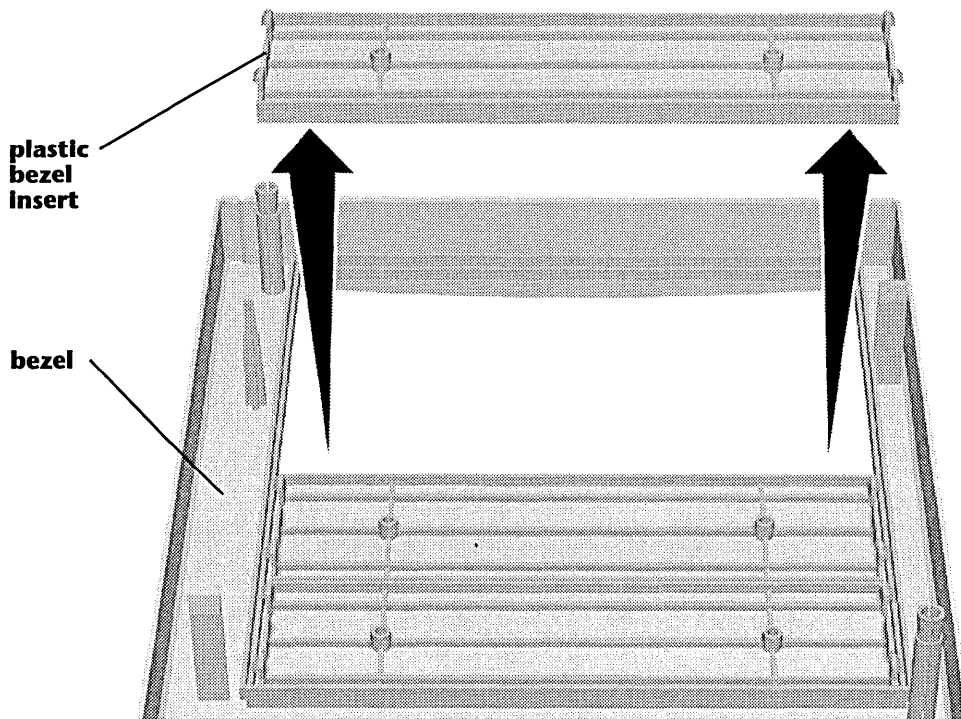
Once you have prepared the drive (see “Prepare the drive,” starting on page 78) and the computer (see “Prepare the computer,” starting on page 82), you are ready to install the drive.

Connectors are keyed, which means that there is only one correct way to mate them. If a cable is very hard to connect, examine it carefully to make sure you have it oriented so that it fits the connector it goes onto. Once cables are connected, make sure they are snug.

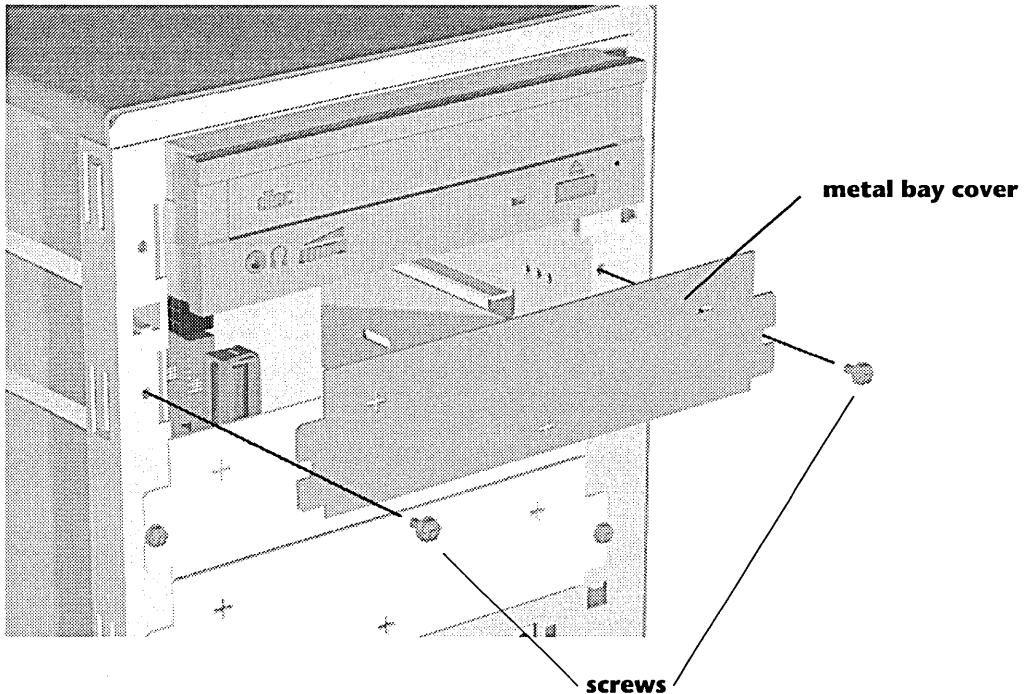
## Chapter 6, Installing Drives

1. If you are installing a removable-media drive, remove the plastic bezel insert covering the bay you are planning to use. To remove the insert, press it out from the inside.

The plastic insert is very flexible and should pop out quite easily.



2. If you are installing a removable-media drive, unscrew the two screws holding the metal bay cover, if there is one, in front of the drive bay and set them aside.

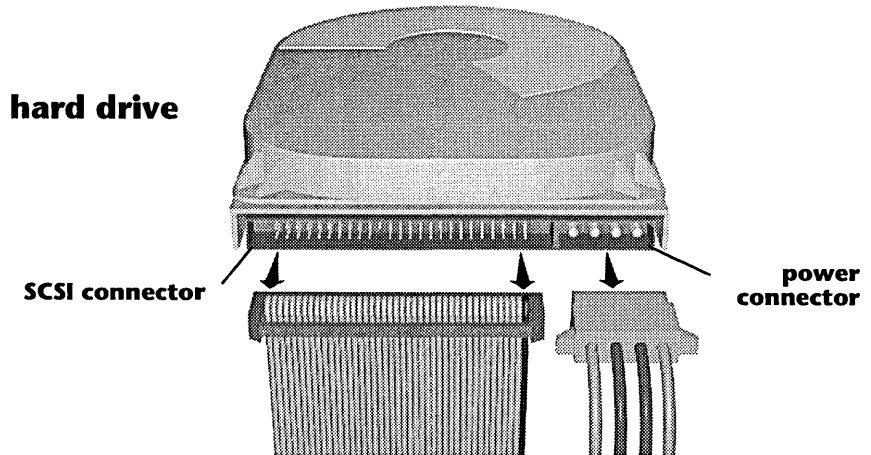


**Note:** The 3.5 inch slots may have metal plates without screws, which are attached by thin strips of metal. To remove *that* type of plate, simply bend it back and forth several times until it comes loose, and remove it.

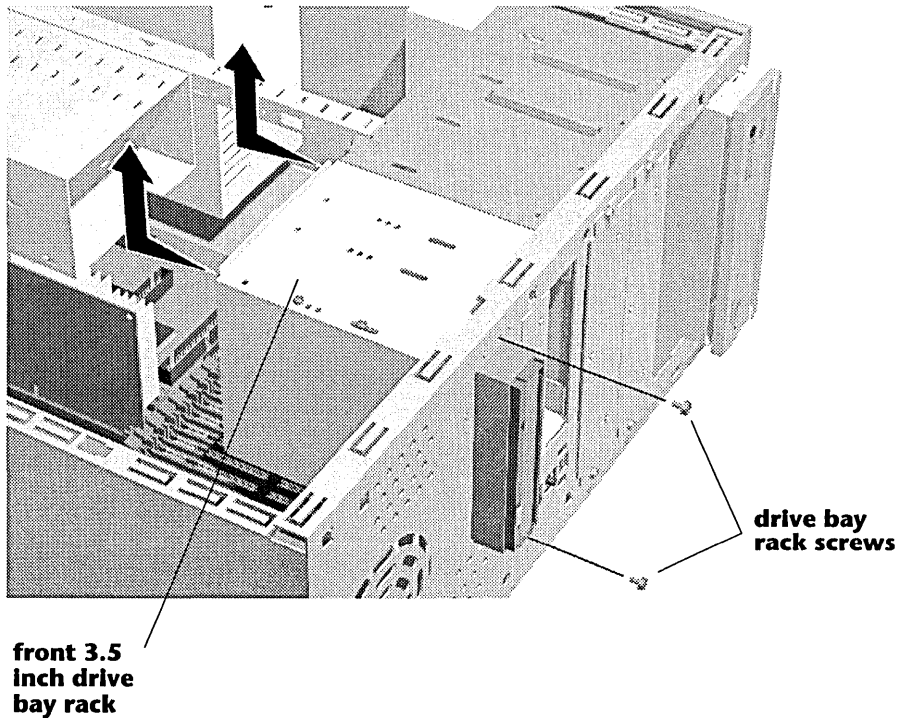
## Chapter 6, Installing Drives

3. Disconnect the cables from the drives in the 3.5 inch drive bay rack, which is below the 5.25 inch drive bays.

For hard drives, disconnect the power connector and the SCSI connector from the rear of the bottom hard drive. For the floppy drive, there is only one cable to disconnect.



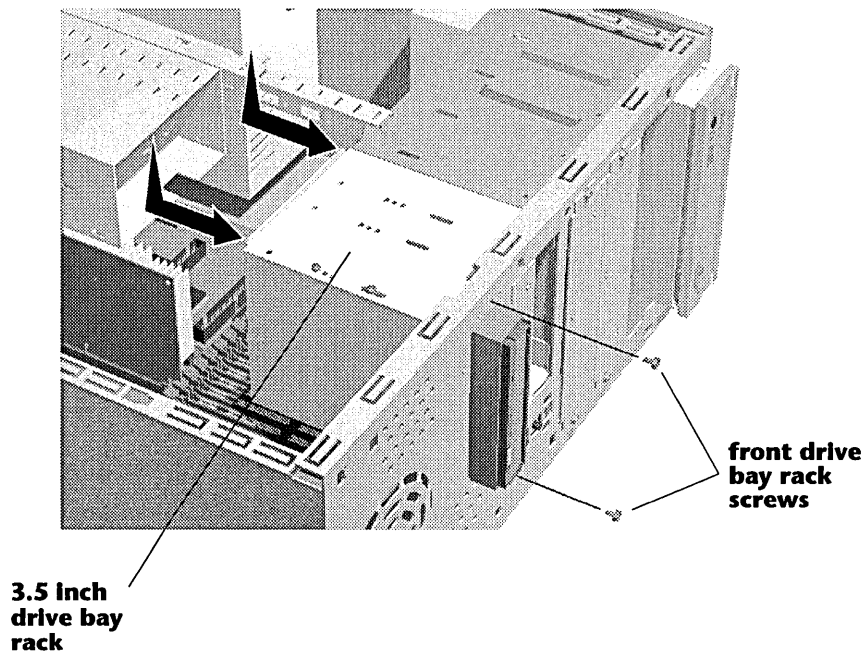
4. Remove the two Phillips-head front drive bay rack screws, slide the front drive bay rack back and remove it from the chassis.



5. If you are replacing a drive, remove the mounting screws of the drive, and remove the drive. If you are installing a drive, insert the drive into the 3.5 inch rack, and install its four mounting screws, two on each side.

## Chapter 6, Installing Drives

6. Replace the 3.5 inch rack by sliding it to the front, and secure it to the front of the chassis with the two front drive bay rack screws.



7. If you are finished, proceed to "Putting the computer back together" on page 116.

### Replacing and installing drives in the RAID rack

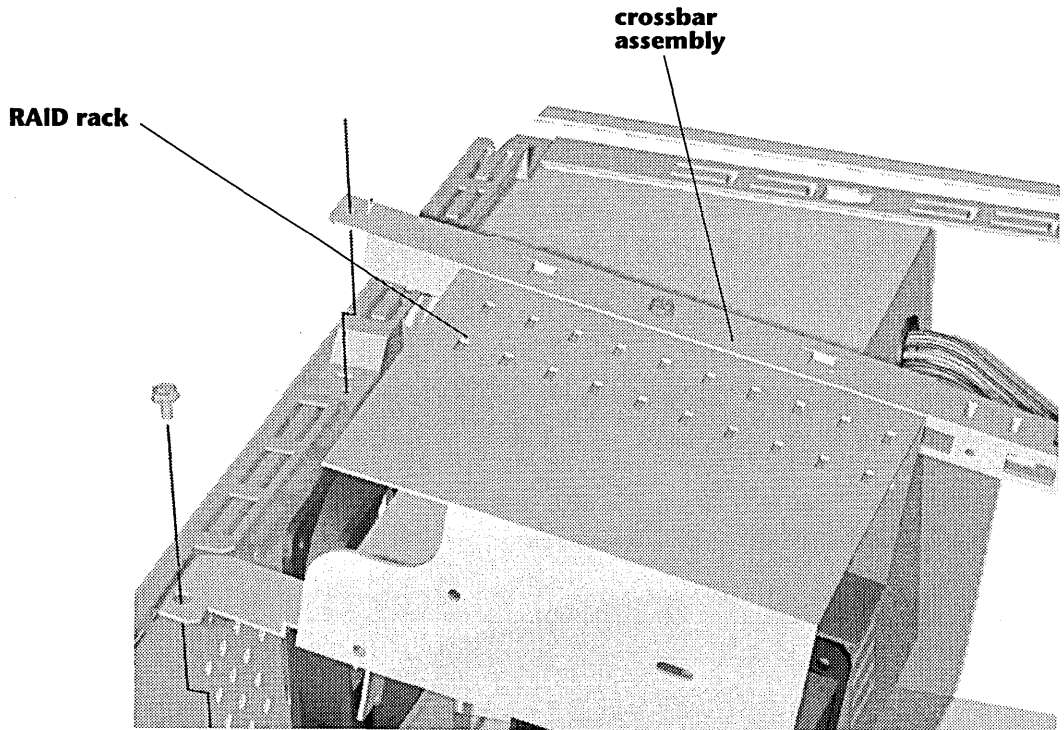
Once you have prepared the drive (see “Prepare the drive,” starting on page 78) and the computer (see “Prepare the computer,” starting on page 82), you are ready to install the drive.

Connectors are keyed, which means that there is only one correct way to mate them. If a cable is very hard to connect, examine it carefully to make sure you have it oriented so that it fits the connector it goes onto. Once cables are connected, make sure they are snug.

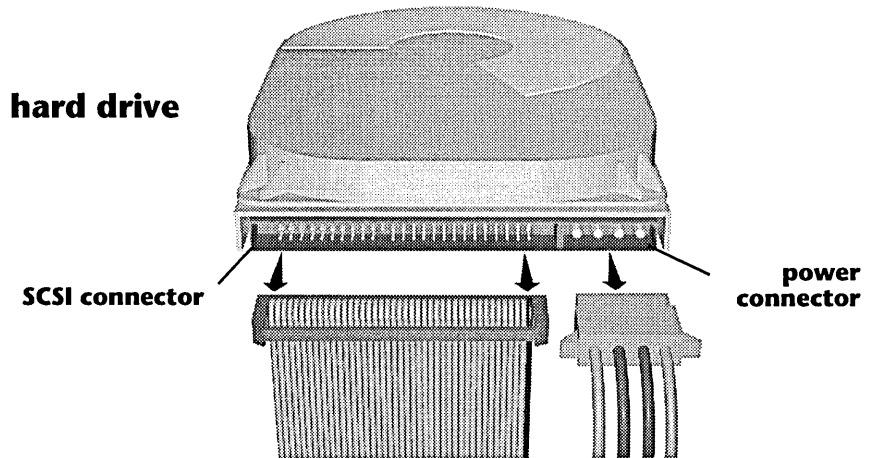


## Chapter 6, Installing Drives

1. The RAID rack is located on the crossbar assembly that you earlier removed.



2. If you are replacing a hard drive, disconnect the power connector and the SCSI connector from the rear of the hard drive.

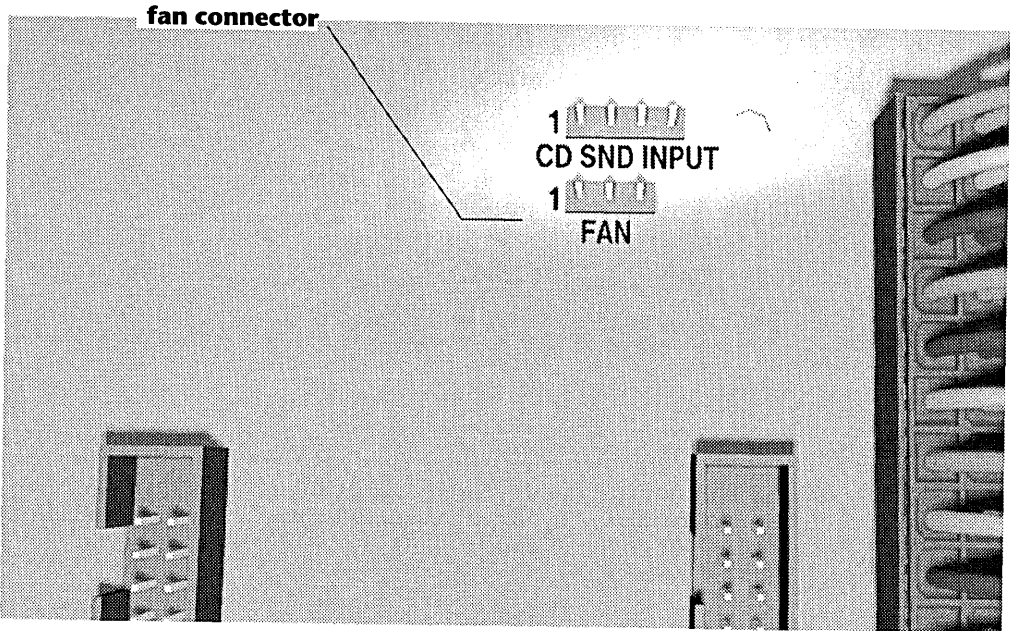


3. If you are replacing a drive, remove the mounting screws of the drive, and remove the drive. If you are installing a drive, insert the drive into the RAID rack, and install four mounting screws, two on each side.
4. If you are finished, proceed to "Putting the computer back together" on page 116.

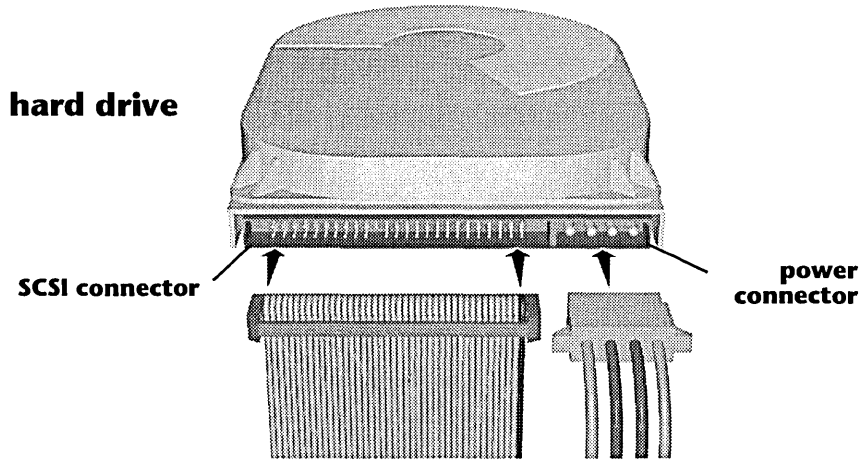
### Putting the computer back together

Follow the instructions in this section to put the computer back together and to verify that the installed drive is operating properly.

1. Re-connect the crossbar assembly fan connector.



2. If drives are installed in the RAID rack, connect the RAID drive power and SCSI cable connectors.

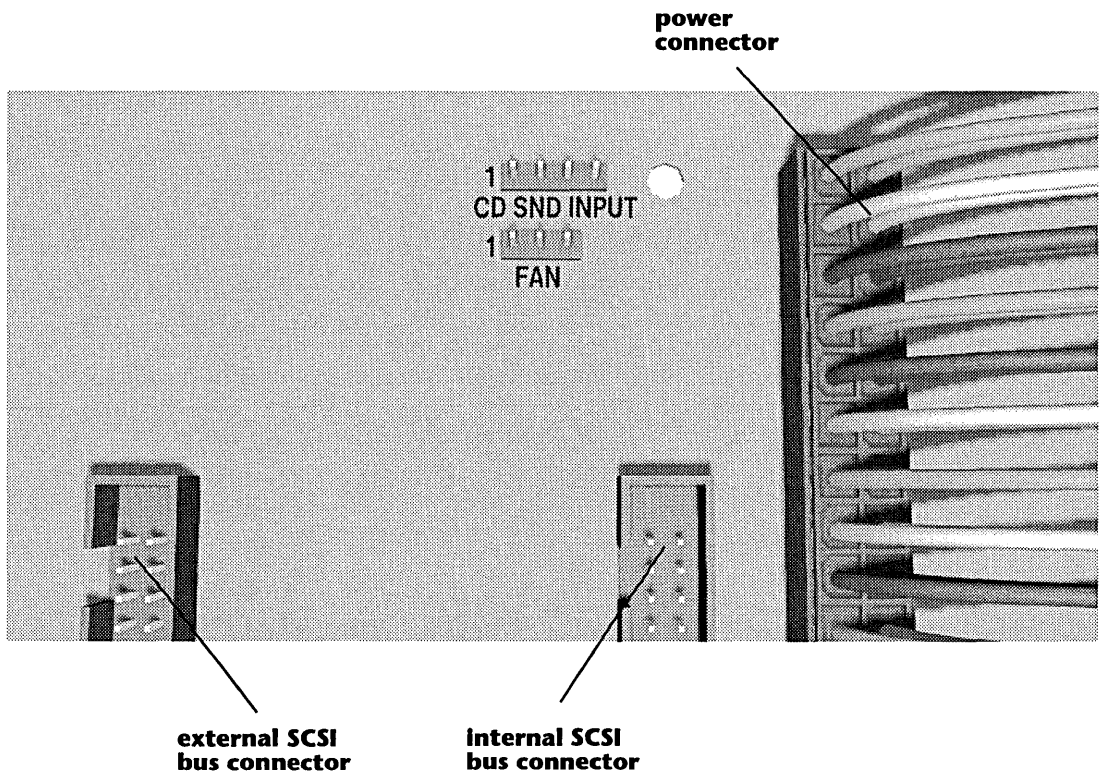


Find the internal SCSI cable inside the computer (it is the wide flat ribbon cable connected to the hard drive). The internal SCSI cable should have one or more unused connectors on it. You may have to detach and reattach the SCSI connectors on one or more other drives to get connectors where you need them. Remember, this is SCSI, so the ends have to be terminated. See "Ensuring proper termination" on page 15 for details.

## Chapter 6, Installing Drives

**Note:** Because this system has a total of 9 drive bays, and a SCSI chain can handle a maximum of 7 devices, including the pre-installed hard drive and the CD-ROM drive, there is a separate cable, connected to the external SCSI chain, to be used if the internal SCSI chain is filled to capacity. It is set up to be used for devices in the 3.5 inch drive bays. The internal SCSI bus operates at 10 MB/sec; the external SCSI bus operates at 5MB/sec.

If you are installing a drive in the RAID rack and there are no other SCSI connectors available, connect these drives to the external bus cable.



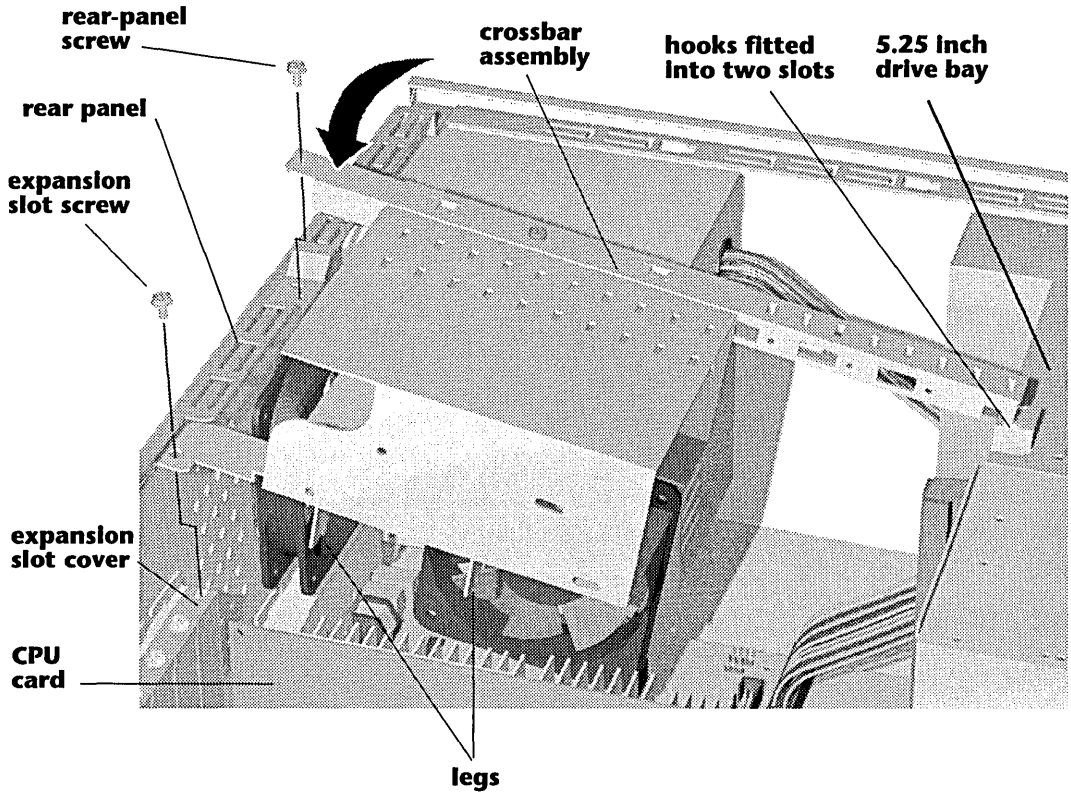
- 3. Place the expansion slot cover over the PCI expansion slot, but do not reinsert the screw.**
- 4. Read this step before proceeding.**

This step is intended to provide an overview of the crossbar assembly installation procedure. Use the following illustration for reference only. Detailed installation instructions follow.

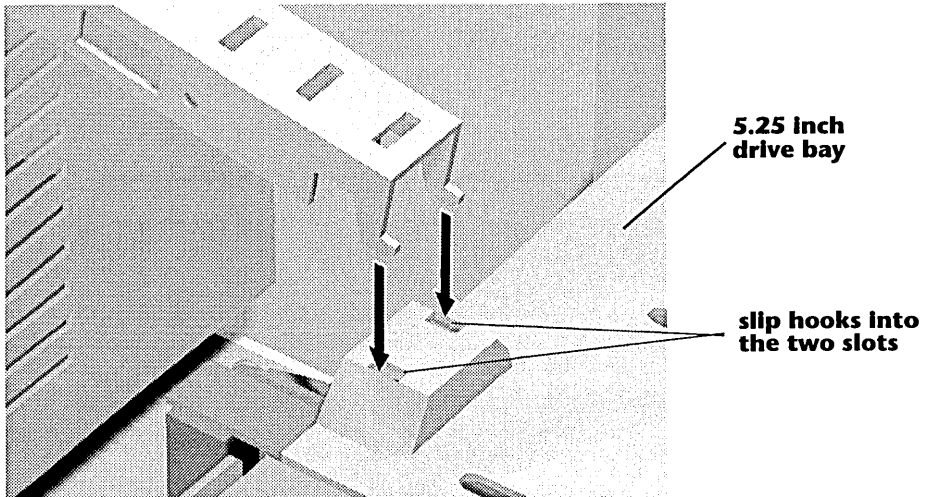
In general, the crossbar assembly must be secured to the chassis by two hooks on the front end of the beam, which fits into two slots on the 5.25 inch drive bay rack.

A screw attaches the rear of the beam to the rear chassis panel, and a second screw attaches the RAID rack cage to the PCI expansion slot closest to the CPU card. The RAID rack rests on two legs on top of the CPU card.

## Chapter 6, Installing Drives

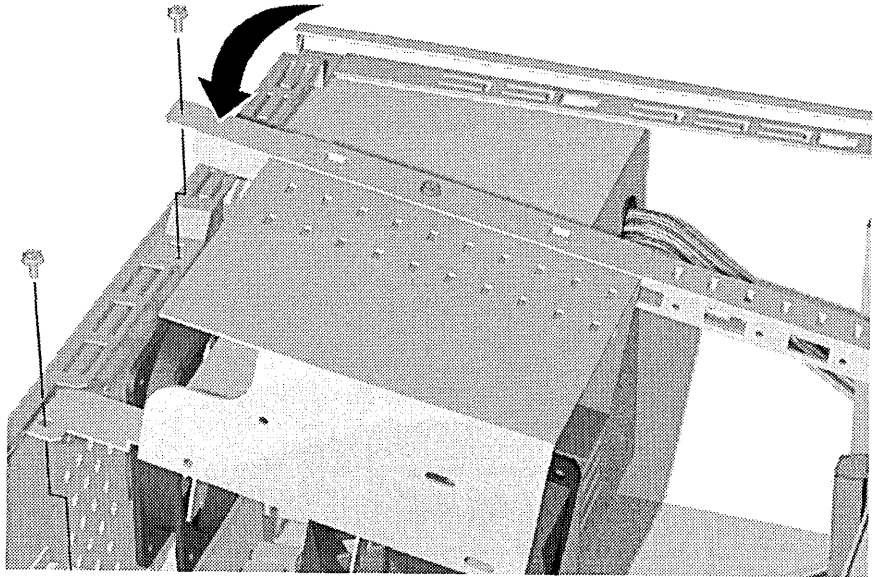


5. To re-install the crossbar assembly, first slip the two hooks on the front end of the crossbar beam into the two slots on the 5.25 inch drive bay rack.

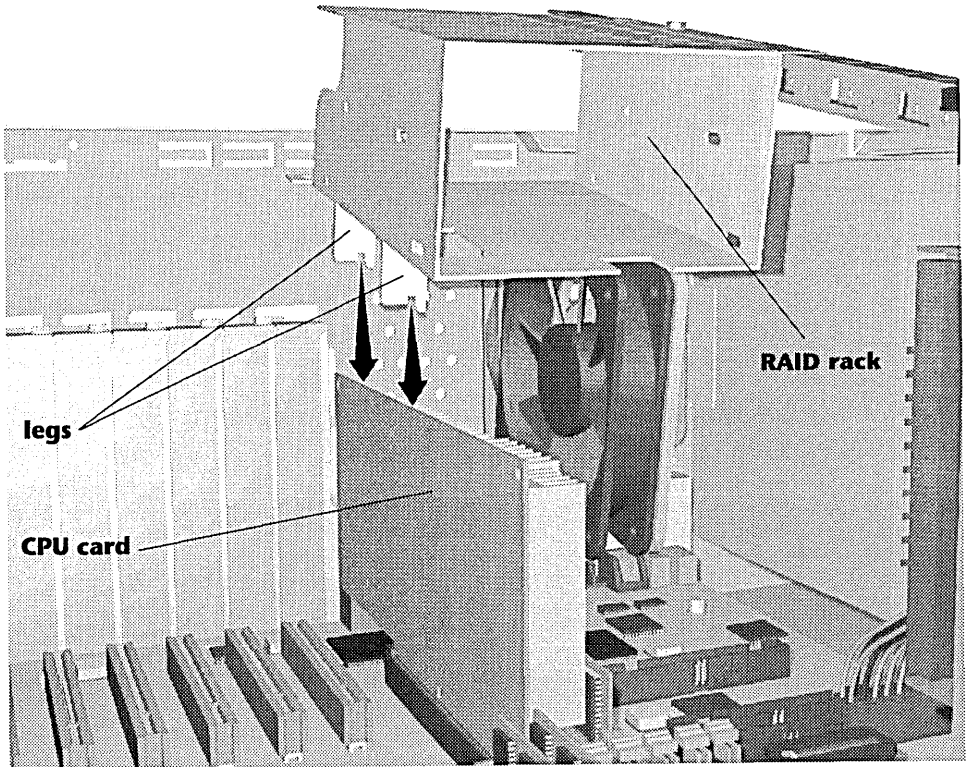




6. Lower the crossbar until the other end is almost to the rear panel.

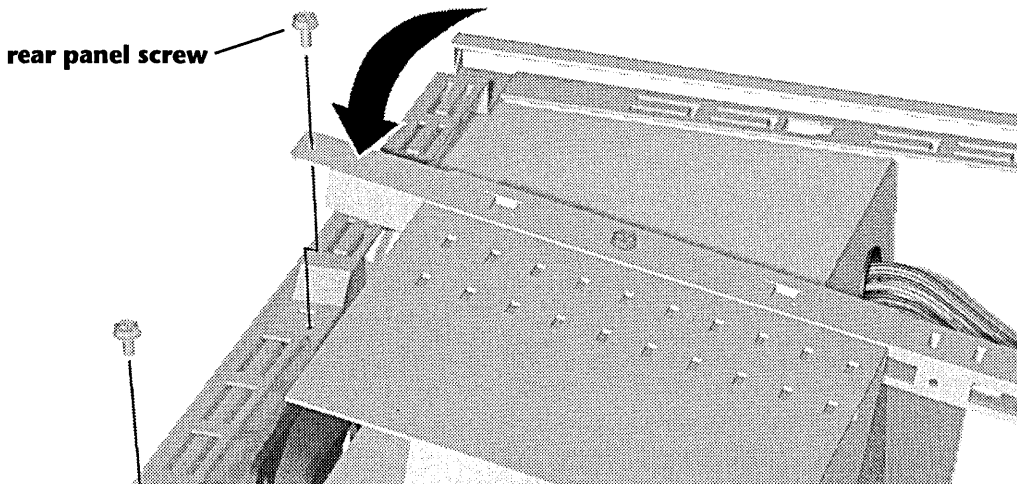


7. Make sure the slots on the two legs on the bottom of the RAID rack are aligned with the CPU card.

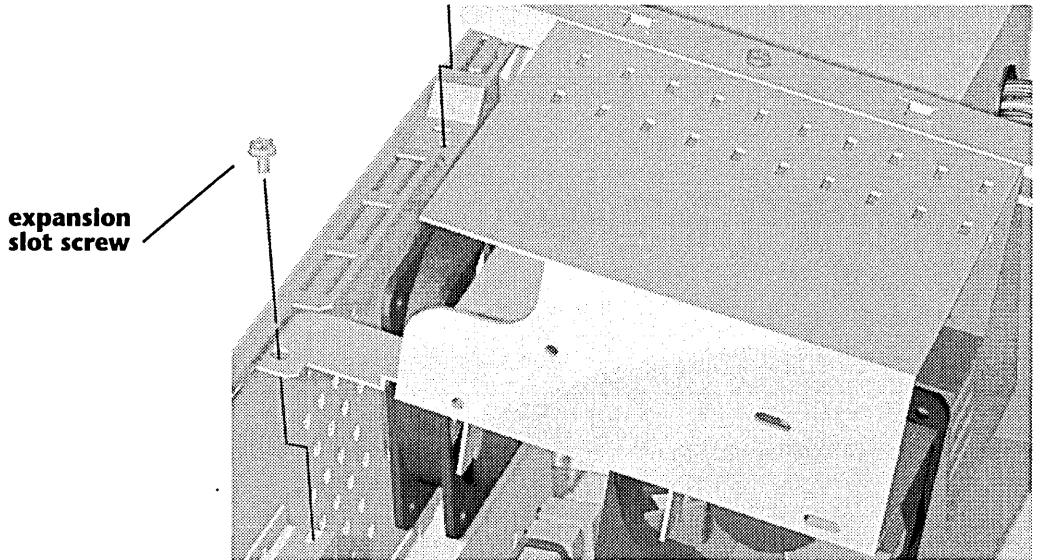


## Chapter 6, Installing Drives

8. After making sure of proper alignment, lower the end of the crossbar so that it is flush with the rear panel, and re-insert the rear-panel screw.



9. Align the holes in the crossbar assembly and expansion slot cover, and then re-install the expansion slot screw.



10. Replace the side panel, re-connect system components, and restart the computer.

**CAUTION!** *Be careful not to get any of the cables caught in the cover or stuck in the fan housing when you put the cover back on the computer.*

11. Install software drivers

Some SCSI devices require special software called device drivers to operate with your computer. If a device driver is required, it is normally supplied with the device; if you are unsure whether one is required, contact the manufacturer of the device. Follow the driver installation instructions supplied by the manufacturer. If a device driver is not supplied, you can generally assume that the device does not need one. The drives pre-installed in your system have pre-installed drivers.

### If the drive does not work,

1. Make sure that any required drivers are properly installed. See the drive's documentation for more information.
2. Turn the system off, unplug the system components, and remove the cover.
3. Make sure that the drive's SCSI connector is plugged in and seated firmly.  
If the connection seems loose or crooked, check to make sure that no pins are bent and that the connection is keyed properly. Bent pins may be carefully straightened with a very small screwdriver.
4. Make sure that the drive's power cable is plugged in and seated firmly.
5. If it is a CD-ROM drive, make sure the audio cable is properly connected and seated firmly at both ends.
6. Make sure that each device in the internal SCSI chain has its own unique SCSI ID: the primary hard drive (in the lower bay) should be set to ID 0, a secondary hard drive is normally set to 1, and the CD-ROM is normally set to 3. (See "Set the SCSI ID" on page 78.)
7. Make sure there are no internally-terminated devices in the middle of the SCSI chain. The only internally-terminated device on the internal SCSI chain should be the pre-installed primary internal hard drive.
8. Replace the cover on the computer, replace and tighten the three thumbscrews, re-connect the external cables, and restart the computer.

**CAUTION!** *Be careful not to get any of the cables caught in the cover or stuck in the fan housing when you put the cover back on the computer.*

## Chapter 6, Installing Drives

If these steps do not correct the problem, contact the drive manufacturer for assistance, follow the troubleshooting procedures in Chapter 7, "Troubleshooting and System Software," visit our Web Site at

**<http://www.powercc.com>**

for troubleshooting and installation tips.

If you are unable to resolve the problem, contact Power Computing Technical Support at 1-800-708-6227 for assistance.

## Chapter 6, Installing Drives

# Chapter 7 Troubleshooting and System Software

If you have a problem using your computer, use the suggestions in this chapter to identify the source of the trouble.

If you are unable to resolve a problem using these suggestions, visit our Web Site at

<http://www.powercc.com>

for troubleshooting and installation tips or follow the instructions at the end of the chapter to get technical support.

**Power Computing's Technical Support Department can be reached toll-free in the United States at 1-800-708-6227.** Customers who did not purchase systems directly from Power Computing should contact the dealer they purchased their system from for assistance.

## Restarting the computer

You can eliminate some common problems by restarting the computer, which clears the computer's memory.

- If the mouse is still working, choose Restart from the Special menu. If an error dialog box is displayed, it may have a Restart button.
- If the mouse is not working, try holding down the ⌘ and Control keys while pressing the Power On key. This key combination restarts the computer, but should only be used when you cannot use the Restart menu command.
- If you cannot restart the computer from Mac OS, use the Reset button on the front panel. See "System Overview" on page xiii at the beginning of this manual for the location of the button. Be careful not to confuse the Reset button with the Interrupt button, used by programmers.
- If the Reset button does not work, use the power button on the front panel to turn off the computer. Wait at least ten seconds before turning it back on. (You need to wait to give the hard disk time to spin down.)



# Problems and solutions

This section lists some problems you might experience along with suggestions for solving them.

### **The monitor is dark after you turn on the computer.**

- Follow the suggestions under “Problems starting up” on page 9.

### **You see a question mark icon instead of the Mac OS desktop when you start up.**

The blinking question mark indicates that the computer cannot find its system software. This may indicate a problem with the start-up disk or a problem with the system software. There may be a problem with a SCSI device connected to the computer.

- Disconnect all the external SCSI devices, then restart your computer. If your computer starts up normally, verify that the SCSI devices are connected and terminated properly, and that all devices in each bus have unique SCSI IDs. See “Using SCSI devices” on page 14 for more information.
- Start up your computer from the Disk Tools floppy disk or Power Computing Mac OS CD-ROM. Use the Disk First Aid program to check and repair your disk. (See the Disk First Aid entry in Macintosh Guide for instructions.)
- System software is not installed on the computer, or needs to be re-installed. Follow the instructions in “Reinstalling system software” on page 139 to install the software.

### **A floppy disk icon with an X in it appears.**


You inserted a non-start-up floppy disk during the start-up process. If you wait a few seconds, the computer will start up normally from the hard disk. Remember to insert floppy disks only after the start-up process is complete—when the Mac OS desktop is visible.

### **An icon with a sad face appears when you start up.**

This can indicate a problem with the system software or with the computer hardware.

- Try starting up from a different disk—the Disk Tools floppy disk or the Power Computing Mac OS CD-ROM, for example. If you can start up with a different disk, it means that there is a problem with your system software.
- If the sad face icon continues to appear, contact an authorized service provider. There is most likely a problem with the computer hardware.

### **A hard disk icon does not appear on the Mac OS desktop.**

- If the start-up hard disk is internal, restart your machine.
- If the hard disk was recently installed, verify that all connections are snugly in place that the drive has a unique SCSI ID.
- If the hard disk is external, verify that it is connected and terminated properly, and that it has a unique SCSI ID. Make sure that there are no SCSI ID conflicts. See “Using SCSI devices” on page 14 for information.
- If the disk is your start-up disk, start up your computer from the Disk Tools floppy disk or Power Computing Mac OS CD-ROM. You can remove the internal drive from the startup sequence (and force your system to boot from a floppy or the CD-ROM if you have it in place) by holding down the **command, shift, option, and delete** keys (the **command** key also called the  key) when you start up. Use the Disk First Aid program to check and repair your disk. (See the Disk First Aid entry in Macintosh Guide for instructions.) If repairing the disk does not solve the problem, reinstall the system software as described in “Reinstalling system software” on page 139.

### **You cannot read a floppy disk.**

This can indicate a damaged disk or one that is not initialized.

- If a floppy disk has never been used, it may not be initialized. See Macintosh Guide for instructions on how to initialize disks.
- If the disk is damaged, try using the Disk First Aid program to repair it. See Macintosh Guide for instructions about using Disk First Aid.

### **The mouse pointer does not move when you move the mouse.**

This can indicate a system software problem, a problem with your mouse, or a problem with a program that you are running.

## Chapter 7, Troubleshooting and System Software

- Turn off the computer by pressing the power button on the front panel and verify that the mouse is connected properly. See “Connecting the mouse and keyboard” on page 6 for information.
- Try using a different mouse or input device. If it works, there is a problem with the original mouse.
- Try using a different start-up disk—the Disk Tools floppy disk or the Power Computing Mac OS CD-ROM, for example. If the mouse works, there is a problem with the system software on your normal start-up disk. Reinstall the system software as described in “Reinstalling system software” on page 139.
- If the problem continues, you may be using an incompatible program. Verify that the applications, system extensions, and control panels on your computer are compatible with your system software.

### **No characters appear on the screen when you type.**

- Use the mouse pointer to click in the window in which you want to type. This ensures that the program is active and that you have an insertion point for your text.
- Shut down the computer and verify that the keyboard is connected properly. See “Connecting the mouse and keyboard” on page 6 for information.
- Try using a different keyboard. (Turn off the computer before switching keyboards.)
- Try using a different start-up disk—the Disk Tools floppy disk or the Power Computing Mac OS CD-ROM, for example. If the keyboard works, there is a problem with the system software on your normal start-up disk. Reinstall the system software as described in “Reinstalling system software” on page 139.

### **You see a dialog box with a bomb.**

This most likely indicates a software problem.

- If there is a number in the dialog box, write it down for future reference. Make note of what you were doing when the error occurred.

## Chapter 7, Troubleshooting and System Software

- Restart the computer. See “Restarting the computer” on page 129 earlier in this chapter.
- Verify that the applications, system extensions, and control panels on your computer are compatible with your system software. You may need to update some of your software.
- Restart your computer without extensions. (To restart without extensions, hold down the Shift key as you restart.) If your software works properly, you probably have an incompatible system extension or control panel. See Macintosh Guide for information about using the Extensions Manager control panel to isolate the problem.

### **You cannot launch a program or it quits unexpectedly.**

This usually indicates that there is not enough RAM for the program to run. A dialog box may appear, indicating insufficient memory as the source of the problem.

- Quit programs to free up memory, then launch the application you want to use.
- Restart the computer to clear memory. See “Restarting the computer” on page 129, at the beginning of this chapter.
- Use the Get Info window to allocate more memory to the program. See Macintosh Guide for information about Get Info.
- Rebuild the desktop by restarting with the command and option keys depressed. Answer Yes when the computer asks you if you want to rebuild the desktop.
- Turn on virtual memory to use some of the computer’s hard disk space as RAM. See Macintosh Guide for information about turning on virtual memory.
- Install additional memory modules. See Chapter 5, “Adding Memory,” for information.

# Contact Technical Support

If you have a problem with your computer that you can't resolve with the information in this manual and the troubleshooting section of the MAC OS manual which came with your computer, or information on our Web Site at

<http://www.powercc.com>

contact Technical Support at 1-800-708-6227 for assistance.

## Contacting Technical Support

Before contacting Power Computing Technical Support, please complete the following troubleshooting steps and collect the following information:

### Additional Troubleshooting Steps

These steps are in general order. Not all of them will apply to you at any one time; use them as a troubleshooting and information-gathering tool before you call technical support.

#### 1. Rule #1 (and yes this is a rule): Read the manuals.

By using the troubleshooting suggestions at the beginning of this chapter as well as those in the troubleshooting section of the MAC OS manual which came with your computer, you may well be able to resolve the problem without having to call and wait in a phone queue.

#### 2. Answer the Three Basic Questions:

**A. Is the component you are having trouble with plugged in and connected to the right place?**

**B. Is the power on?**

**C. Have you made sure that all cables are firmly connected, twice?**

Checking these three things on your system resolves a surprising number of problems.

### 3. Rebuild the desktop.

You can complete this by holding down **command-option-shift**. This keystroke helps to solve problems with the way icons appear on your screen, or the way icons address other applications.

### 4. Zap the PRAM.

Restart your computer and hold down **command-option-P-R**. It's not a bad idea to repeat this restart procedure a couple of times. Each time you reset holding down **command-option-P-R**, the computer will reset its operating parameters back to its factory defaults, and clear out your ports.

### 5. Hold the shift key down and restart your system with extensions turned off.

Turning off the extensions is one of the best ways to track down an extension problem. With the release of the new MAC OS (7.5.x), new Power Mac technology, the way that software is being written is changing dramatically. Some software is written in native code, while others are not. Turning off extensions can help to track such problems down. If restarting with extensions off eliminates the problem, you have an extensions conflict, not a hardware problem. This is important and useful information in resolving your problem. If an extensions conflict is indicated, use the Extension Manager, following, to resolve the conflict.

### 6. Hold the SPACE bar down and restart your system to bring up the Extensions Manager.

The Extensions Manager allows you to selectively eliminate extensions as you track down the offending extension. See the troubleshooting section of the MAC OS manual which came with your computer (and Rule #1) for how to track down extension conflicts, which are a surprisingly common source of system problems. The Extensions Manager allows you to select "System 7.5.x" only and allows you to save and re-use sets of extensions which differ by a single extension.

### 7. Boot from another device.

Most problems that customers call in with are software related. By booting from another device, preferably a System CD or Disk Tools Disk, you can figure out whether or not the problem is related to *system* software and extensions or if it is related to something else. If the problem does disappear when boot from another device, you may want to consider either reinstalling system software or disabling extensions.

To boot from a CD-ROM Disk. You will need to restart the machine and hold down **command-option-shift-delete**.

### 8. Can you re-create the problem?

The ability to re-create a problem in a specific software is a pretty good indication that the problem is associated with that software. This information is very valuable to the tech support rep when they ask questions. Another good test is to see if you can re-create the problem on another machine. This will help in deciding whether the problem is related to the operating system or hardware compatibility.

### 9. Installation

If the problem seems to be associated with a particular piece of software then make sure that when you installed the software that you did it properly. Many times people will select a none-native installation or they will drag the application from another disk and copy it to their current drive. This may not install all of the software pieces needed and will cause problems down the line.

Also when you are installing from a 3.5 inch disk make sure that you install with your extensions off. Extensions can cause interference when installing. If you must install from a CD ROM you may want to create a special set in your Extensions Manager that only uses CD extensions.

Don't forget the troubleshooting tips in "Problems and solutions," starting on page 130, in this chapter and in the troubleshooting section of the MAC OS manual which came with your computer.

## Chapter 7, Troubleshooting and System Software

### Pre-Contact Information

Please collect the following information before you call Technical Support. It will allow us to diagnose and resolve your problem much more quickly and easily.

1. **Know the versions of both the software and the MAC OS that you are using.**

There are significant differences between some versions of software, many of which will conflict with other specific versions of software. The more information of this type we have the easier it will be for us to solve such problems.

2. **Know your serial number and your invoice number.**

This will help in identifying you and getting any service with your order taken care of more quickly.

3. **Back Up and Save.**

It is a good idea to back up and save your information before calling technical support.

4. **Be in front of the computer when you call.**

Unless the question is VERY simple it is hard for a technical support to provide a good level of service without having you do things on the system and reporting the results. If your phone won't reach the computer, use a cordless phone, add an extension to your regular phone, or move the computer. Otherwise, it could take a **very** long time to troubleshoot and resolve your problem while you run back and forth or try things and call back.

5. **Have your system disks and disks for any other software which may be involved easily available.**

Waiting for you to find your disks can eat up a lot of time.



## Chapter 7, Troubleshooting and System Software

### 6. Be prepared to explain your problem.

Take notes and formulate your thoughts. If you do this it will help you and us to better understand the problem you are having. Sketchy descriptions can result in false problem identification and make it take much longer to resolve the issue.

### 7. Have enough time set aside to work on your machine.

The average tech support call is about 8-12 minutes. Depending on the problem, the call can last for a bit longer. Make sure that you have time set aside to spend with the tech support rep, and time set aside to follow any instructions that they may give to you to resolve the issue. Although you can always do it later, completing the task quickly will keep it fresher in your mind and make it much more likely to succeed.

### 8. Finally, listen carefully to the tech support rep.

Although it may seem at times they are doing things you do not understand, they really know what they are doing. There is nothing more frustrating and counterproductive than having a customer who believes that they already know the answers and who keep doing things that they have not been asked to do. Technical support requires a carefully structured process of trial and elimination; by doing things on your own in the middle of this process this can throw a wrench in the plan.

## Installing System Software

Mac OS system software was pre-installed on your computer's hard disk. Under normal circumstances, you should not have to reinstall system software.

If a problem occurs—for example, if you see a question mark icon on the screen when you try to start up—you may need to reinstall the system software.


## Starting up

Mac OS software is supplied on a CD-ROM. You must start up from the CD-ROM before installing the system software.

### □ To start up from a CD-ROM:

1. Turn on your computer.
2. Place the Mac OS disk label side up into the CD-ROM tray, then close the tray.

The computer starts up and displays the Mac OS desktop.

**Note:** You should only use the CD-ROM disc to start up when your normal start-up disk is malfunctioning or when you need to install system software. You can remove the internal drive from the startup sequence (and force your system to boot from a floppy or the CD-ROM if you have it in place) by holding down the **command**, **shift**, **option**, and **delete** keys (the **command** key also called the  key) when you start up.

## Reinstalling system software

Once you have started your computer, you can use the Installer program to reinstall the system software.

3. Open the System Software Installers folder on the CD-ROM and double-click the Install System Software icon to start the Installer.
4. Click OK in the introductory dialog box.

The Install dialog box appears, displaying a list of software and the hard disk on which it will be installed.

5. If you want to install on a different hard disk, click the Switch Disk button until the correct disk appears.
6. Click Install.

A status bar informs you of the progress of the installation. A dialog box informs you when the installation is complete.

7. Click Restart in the dialog box to start up your computer from the hard disk.

## Chapter 7, Troubleshooting and System Software

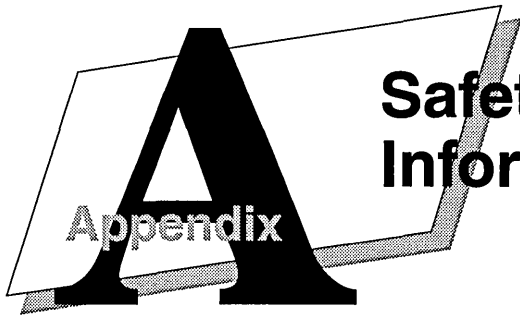
- 8. If your CD-ROM drive is not operating properly, you may need to re-install the CD-ROM driver software.**

To re-install the CD-ROM driver software:

- A. Start your computer with the Power Computing Mac OS CD-ROM disk in the CD-ROM player.**

If CD-ROM drive will not work, place the Power Computing Mac OS CD-ROM disk in another CD-ROM player and copy the CD-ROM Toolkit files from the CD-ROM disk to a floppy disk; then insert the floppy into your Power Computing system and install the CD-ROM toolkit software from the floppy disk.

- B. Open the System Software Installers folder on the CD-ROM drive.**
- C. Double-click on the Install System Software icon and follow the instructions to re-install the CD-ROM Toolkit.**



# Safety and Health Information

Use this appendix to learn about safety and health issues related to computer use.

## Safety instructions

Follow these guidelines to protect yourself from electrical shock:

- Plug the computer into a grounded, three-hole outlet. Do not use a three-hole adapter in a two-hole outlet.
- Do not use your computer if the power cord is frayed or damaged.
- Keep the computer away from moisture and liquid. Do not use it if you spill liquids on it.
- Turn off the computer before removing its cover.
- Never operate the computer without its cover.
- Follow the safety instructions in this manual. A *warning* alerts you of a potential health or safety hazard. A *caution* notice alerts you of potential harm to your computer or its components.

# Health-related information about computer use

The way you set up and use your computer can affect not only your productivity but also your comfort and well-being. No set of guidelines can cover every situation, but if you follow a few common-sense suggestions, you can prevent the eye fatigue and musculoskeletal discomfort sometimes experienced by computer users.

## Preventing eye strain

Whenever you focus your eyes on a nearby object for a long time—whether you are reading, sewing, or working on a computer—your eyes can get tired. Follow these suggestions to prevent eye strain:

- Take frequent breaks. Periodically look away from the screen and focus your eyes on something farther than 20 feet away.
- To prevent glare on the screen, avoid working with a window or light source behind you. Turn off lights or close drapes if necessary.
- Place your monitor, chair, and work table so that the top of the monitor is slightly below the top of your head and the screen is 18-28 inches away from you. This may require placing something under the monitor.

## Preventing discomfort and fatigue

Like any activity that involves sitting for long periods of time, using a computer can make you tired and stiff. In addition, using a keyboard and mouse improperly can sometimes be associated with RSIs (repetitive stress injuries), particularly in the wrists. Follow these suggestions to prevent discomfort:

- Take frequent breaks. Stand up, stretch, and walk around. These breaks are not wasted time. They help you work more effectively in the long run.
- Adjust your chair so that your lower back and thighs are supported and your feet are flat on the ground (or on a footrest).

## Appendix A, Safety and Health Information

- Adjust your chair and work table so that you can type and use the mouse with your elbows at a 90° angle, your forearms level, and your hands in a straight line with your forearms. A work table equipped with an adjustable keyboard tray may make this easier.
- Do not place your wrists on the hard edge of your table. Use a wrist pad.
- Sit up straight in your chair. Slouching puts unnecessary strain on your back.
- Do not strike the keys any harder than necessary.

**Appendix A, Safety and Health Information**

# **B** Technical Information

## Appendix

This appendix contains technical information and specifications for the PowerTower Pro 604/200 and 604/225 systems.

## Specifications

### Processor

- PowerPC 604e, with 64 Kb L1 cache, at 180, 200 or 225 MHz

### Memory

- Minimum 16 MB RAM, expandable to a maximum of 1024 MB
- 4 MB read-only memory (ROM)
- 4 Kbytes of non-volatile parameter memory
- 1 MB of synchronous burst static RAM used as a Level 2 cache for the PowerPC processor

### Disk drives

- 1.4 MB high-density MFM/GCR floppy disk drive supporting Mac OS, DOS and ProDOS diskettes
- Internal SCSI hard disk drive, 2 GB AV to 4 GB
- Internal 8x CD-ROM drive; 1200 KB sustained transfer rate; CD XA/Photo-CD, multi-session compatible.



## Appendix B, Technical Information

### Video

- High performance IMS TwinTurbo-128M8 128-bit graphics accelerator installed
- Horizontal refresh rate up to 75 Hz
- On-the-fly resolution switching
- 8 MB VRAM on graphics card
- Supports 640 x 480 to 1920 x 1080 resolution

### Audio system

- Stereo sound generator capable of driving stereo mini-plug headphones or audio equipment
- CD-quality 16-bit stereo, 44.1 kHz sample rate, in and out
- Sample rates of 44.1 kHz, 22.05, and 11.025 kHz
- Input line level: 2 volts peak-to-peak nominal into 6.5 k $\Omega$
- Input through output signal-to-noise ratio: >86 decibels (dB) with no audible discrete tones
- Bandwidth: 10 Hz–19 kHz (+/- 2 dB) at 44.1 kHz sample rate
- Total harmonic distortion plus noise: Less than 0.06%, measured 30 Hz–60 kHz with a 2 V p-p sine wave input

### Interfaces

- Internal fast SCSI (10 MB/sec) bus and external SCSI (5 MB/sec) bus
- Dual SCSI buses support up to seven devices each.
- One Apple Desktop Bus (ADB) port for up to three input devices daisy-chained through a low-speed, synchronous serial bus
- Six PCI bus expansion card slots (one used for video card)
- Two RS-232/RS-422 serial GeoPort-compatible ports, 230.4 Kbits per second maximum (up to 2.048 Mbits per second clocked externally)
- Built-in Ethernet AAUI and 10BaseT connectors
- Sound output port for stereo CD audio and computer-generated sound
- Powered sound input port for stereo sound input

### AC line input

- Line voltage: 100–240 volts AC, RMS single phase (not auto-ranging)
- Frequency: 50–60 Hz
- Power 460 Watts

### DC power

- 300 watts maximum

Current type	Total
+3.3 V	14 A
+5 V	30 A
–5 V	0.6 A
+12 V	12 A
–12 V	0.5 A

### Clock and calendar

- CMOS circuitry with long-life 3.6-volt lithium battery (1/2 AA cell)

### Keyboard and mouse

- Supports all ADB-compatible keyboards and mice

### Operating environment

- Operating temperature: 10°C to 40°C (50°F to 104°F)
- Storage temperature: –40°C to 50°C (–40°F to 122°F)
- Relative humidity: 5% to 95% (noncondensing)
- Altitude: 0 to 3048 m (0 to 10,000 ft)

### Dimensions

- Size: 7.7" W X 16.9" H X 17.3" D (196 mm X 429 mm X 439 mm)
- Weight: 27 lb (12.3 kg).

### RAM configurations

The PowerTower Pro has eight slots for memory modules (or DIMMs). The computer will work with a number of different memory configurations, from a minimum of 16 MB to a maximum of 1024 MB. Follow these guidelines when configuring your system's RAM:

- DIMM slots can accept 8, 16, 32, 64, and 128 MB DIMMs.
- All DIMMs must be 168-pin, 64-bit fast-paged mode, 70-nanosecond RAM access time or faster. Slower DIMMs will not work reliably. SIMMs from older Macintosh computers are not compatible.
- DIMMs should be installed in pairs of equal value and in corresponding slots to take advantage of interleaved memory.

### VRAM information

Video memory (VRAM) for the video ports is provided in VRAM modules installed on the graphics card. The system comes with 8 MB of VRAM. See the table below for information about how many colors at what resolution can be displayed on a monitor of a particular size with different amounts of VRAM.

## Monitor resolution/color table

The following table displays the numbers of colors available to monitors of various sizes connected to the computer's monitor ports.

**Table B-1. Built-in monitor port color levels**

Monitor	Resolution	Colors*
		8 MB VRAM
12" Color	512 X 384	Millions
13 or 14" VGA	640 X 480	Millions
15" Mono Portrait	640 X 870	Millions
16 or 17" Color	800 X 600	Millions
	832 X 624	Millions
19 or 20" Color	1024 X 768	Millions
21" Color	1152 X 870	Millions
	1280 X 960	Millions
	1280 X 1024	Millions
	1360 X 1024	Millions
	1600 X 1200	Millions
	1920 X 1080	Millions

\*256 Grays maximum for all monitors

### Power requirements

#### Apple Desktop Bus

- Maximum power draw for all devices: 500 mA
- Mouse power: up to 10 mA
- Keyboard power: 25–80 mA (depending on keyboard model)

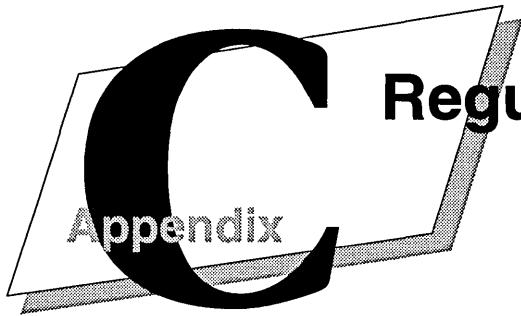
#### Audio and telecommunications input devices

Device	Voltage	Current	Power
Microphone	+5 V	20 mA	100 mW
GeoPort Telecom Adapter	+5 V	500 mA	2.5 W

#### Expansion cards and devices

When you add PCI cards or internal storage devices, make sure the combined power consumption of all devices meets the following guidelines:

Device	Voltage	Current	Power
PCI card (per slot)	+5 V	3 A	15 W
	+12 V	0.5 A	6.0 W
	-12 V	0.1 A	1.2 W
PCI cards total (6 slot maximum)	+5 V	10 A	50 W
	+12 V	2.5 A	30 W
Internal storage device (such as a CD-ROM or hard disk drive)	-12 V	0.5 A	6 W
	+5 V	4.5 A	22.5 W
	+12 V	1.7 A	20 W



# Regulatory Information

This appendix contains information required by regulatory agencies.

## FCC statement

This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in Part 15 of FCC rules. See instructions if interference to radio or television reception is suspected.

## Radio and television interference

The equipment described in this manual generates, uses, and can radiate radio-frequency energy. If it is not installed and used properly—that is, in accordance with the manufacturer’s instructions—it may cause interference with radio and television reception.

This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in Part 15 of FCC rules. These specifications are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

You can determine whether your computer system is causing interference by turning it off. If the interference stops, it was probably caused by the computer or one of the peripheral devices.

If your computer system does cause interference to radio or television reception, try to correct the interference by using one or more of the following measures:

- Turn the television or radio antenna until the interference stops.
- Move the computer to one side or the other of the television or radio.

## Appendix C, Regulatory Information

- Move the computer farther away from the television or radio.
- Plug the computer into an outlet that is on a different circuit from the television or radio. (That is, make certain the computer and the television or radio are on circuits controlled by different circuit breakers or fuses.)

If necessary, consult an authorized service provider or consult an experienced radio/television technician for additional suggestions. You may find the following booklet helpful: *Interference Handbook* (stock number 004-000-00493-1). This booklet, prepared by the Federal Communications Commission, is available from the U.S. Government Printing Office, Washington, DC 20402.

**Important:** Changes or modifications to your computer not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This product was tested for FCC compliance under conditions that included the use of shielded cables and connectors between system components. It is important that you use shielded cables and connectors between system components to reduce the possibility of causing interference to radios, television sets, and other electronic devices.

## DOC statement

*DOC Class B Compliance* This digital apparatus does not exceed Class B limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of the Department of Communications.

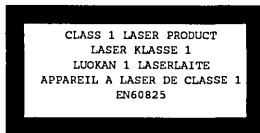
*Observation des normes—Classe B* Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Class B prescrites dans la norme sur le matériel brouilleur: "Appareils Numériques", NMB-003 édictée par le ministre des Communications.

## CD-ROM drive

**WARNING!** *Making adjustments or performing procedures other than those specified in your equipment's manual may result in hazardous exposure.*

**WARNING!** *Do not attempt to disassemble the cabinet containing the laser. The laser beam used in this product is harmful to the eyes. The use of optical instruments, such as magnifying lenses, with this product increases the potential hazard to your eyes. For your safety, have this equipment serviced only by an authorized service provider.*

If you have an internal CD-ROM drive in your computer, your computer is a Class 1 laser product. The Class 1 label, located on the computer, indicates that the drive meets minimum safety requirements. A service warning label is on the CD-ROM drive inside the computer.



## Lithium battery warning

The computer contains a lithium battery to power the clock and calendar circuitry.

**CAUTION:** Danger of explosion if battery is replaced incorrectly. Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

**ATTENTION:** Il y a danger d'explosion s'il y a un remplacement incorrect de la batterie. Remplacer uniquement avec une batterie du même type ou d'un type recommandé par le constructeur. Mettre au rebut les batteries usagées conformément aux instructions du fabricant.

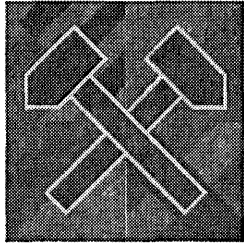


## Appendix C, Regulatory Information

### For use in European countries

Use an HAR approved power cord with proper plug configuration.

Bitte nur mit zugelassener HAR-Stromkabel benutzen.



# Hard Disk ToolKit • *Personal Edition* User Guide

FWB, Inc.  
1555 Adams Drive  
Menlo Park, CA 94025-1439

- Phone number: 415-325-4392
- Technical Support fax number: 415-833-4662

#### **E-mail addresses**

- AppleLink: FWB
- eWorld: FWB.INC
- America Online: FWBINC
- CompuServe: 71320,1034
- Internet: 71320.1034@compuserve.com





## Hard Disk ToolKit•Personal Edition End-User Software License Agreement

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1. License. The Software enclosed is licensed, not sold, to you by FWB Software, Inc. (FWB) for use under the terms of this software license. This non-exclusive license allows you to:
  - a. Use the Software only on a SINGLE computer at any one time. You may only use the software on one CPU and only on drives physically connected to that single CPU.
  - b. Only use the software to format, partition, test, measure or otherwise modify or manipulate only SCSI storage devices that are connected to a SINGLE computer that is used by you.
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## Hard Disk ToolKit•Personal Edition

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# Part 1: Introduction

## Welcome to Hard Disk ToolKit•*Personal Edition*

Thank you for purchasing FWB's Hard Disk ToolKit•*Personal Edition*—the most complete personal SCSI formatting and partitioning software available. Use Hard Disk ToolKit•*Personal Edition* to improve the overall SCSI performance of your Macintosh or Power Macintosh and to make your SCSI drives run faster and more efficiently.

## System Requirements

- Macintosh or Power Macintosh (includes full support for a Macintosh with a Power Macintosh Upgrade card installed)
- A supported SCSI hard disk, SyQuest disk, or magneto-optical disk
- System 6.0.8 or later (includes full support for System 7.5)
- At least 2MB of RAM (more RAM is recommended)

**Not supported:** pre-1986 ST-506 drives that have been converted to SCSI drives through add-on SCSI controllers; IDE drives

## What Is Hard Disk ToolKit•*Personal Edition*?

Hard Disk ToolKit•*Personal Edition* is a versatile, configurable SCSI utility that provides total control over SCSI storage devices. Hard Disk ToolKit•*Personal Edition* optimizes the performance of a wide variety of SCSI storage devices, including hard drives, optical drives, and removable media drives. In addition to standard hard disk utility functions such as formatting drives and installing drivers, Hard Disk ToolKit•*Personal Edition* adds professional features such as:

- Flexible Partitioning
- Password Protection
- Diagnostics

Install Hard Disk ToolKit•*Personal Edition*'s high-performance driver to all your SCSI drives to minimize incompatibilities and eliminate down time caused by poorly written driver software. Driver software runs transparently every second your Macintosh is on, making it imperative you use the best. Standardize on Hard Disk ToolKit•*Personal Edition* company-wide to minimize support problems and, more importantly, to ensure that different vendors' storage devices can work together. SyQuest cartridges and optical cartridges, for example, can be exchanged between different vendor's drives without



compatibility problems.

Hard Disk ToolKit•*Personal Edition* replaces your system's current hard drive software when it installs itself. Then, whenever the drive is on, Hard Disk ToolKit•*Personal Edition's* intelligent driver software works to maximize performance, anticipate problems, and prevent crashes. It also eliminates the need to run any third-party or public domain utilities to manage your storage systems.

With Hard Disk ToolKit•*Personal Edition*, you don't have to wait for a vendor to update driver software, which is often written by another party. Hard Disk ToolKit•*Personal Edition* is designed to support many specific drives, but it also has generic modes to support virtually all standard SCSI drives with embedded controllers. Hard Disk ToolKit•*Personal Edition* is the most up-to-date and versatile personal utility package for all fixed and removable SCSI drives.

Hard Disk ToolKit•*Personal Edition* will also see you into tomorrow's technology: All modules fully exploit the new features of System 7.5, including SCSI Manager 4.3, Power Mac systems, 4GB volumes, and 32-bit addressing. ToolKit's partitioning fully supports Apple's A/UX 2.X, and can be used with A/UX 3.0. ToolKit also supports SCSI-2, the new specification standard used in modern storage devices.

### **Easy to Use, Yet Powerful**

All features are automatically optimized for the drive you use. Novices will appreciate Hard Disk ToolKit•*Personal Edition's* concern for safeguarding your data, and its ready-to-use default settings.

Hard Disk ToolKit•*Personal Edition* includes online help under the Apple menu or through System 7's balloon help. Use this resource to answer questions that arise when using the program.

### **SCSI Manager 4.3**

Hard Disk ToolKit•*Personal Edition* is fully compatible with Apple SCSI Manager 4.3. After disk updating or initialization, the latest FWB driver will allow you to exploit the capabilities of Apple's SCSI Manager on Apple's AV, Power Macintosh, and Macintosh computers with PowerPC Upgrade cards installed. The SCSI Manager 4.3 System Extension is also installed on Centris and Quadra machines running System 7.5. FWB's latest driver coupled with Apple's SCSI Manager 4.3 provides higher overall data throughput through:

- reduced SCSI I/O processing overhead
- asynchronous SCSI I/O
- maximized SCSI bus utilization

### **Use Hard Disk ToolKit•Personal Edition to:**

- increase the speed and performance of your drives. Hard Disk ToolKit•*Personal Edition* tunes your drives to operate at their highest and most efficient levels.
- divide a drive into separate partitions for individual projects or applications, or for different users. This can save time, boost productivity, ensure security, and increase your drive's performance and longevity.
- secure any or all of the data on your disk. Hard Disk ToolKit•*Personal Edition's* password protection is built in at the lowest level possible and cannot be defeated.
- test any drive surface for defects. ToolKit will automatically reallocate any bad blocks to prevent data loss.

### **Using Hard Disk ToolKit•Personal Edition**

You should consult the Read Me file before performing any operations with Hard Disk ToolKit•*Personal Edition*. The Read Me file on the original program disk contains information that was not available at the time this manual was printed.

Hard Disk ToolKit•*Personal Edition* is divided into three areas of functionality. Each is contained in a separate module.

#### **HDT Primer PE**

This module sets up your drive and prepares it for use, and can test a disk for bad blocks.

Use HDT Primer PE to:

- Format a new hard drive or reformat an existing drive with optimal parameters.
- Replace the old device driver of your current drive for improved performance without affecting the data on the drive.
- Divide the drive into partitions for separate applications or users.
- Secure all or part of a drive through password protection.
- Test the drive for media defects or reliability.
- Expand or shrink partitions at any time to effectively store your data.
- Create and select boot partitions for different system software.

Primer's first task will probably be to format your drive. Afterwards, the formatting function will rarely be needed. HDT's diagnostics and testing features are only needed when you have encountered problems with your drive. HDT Extension and HDT Prober, however, are intended for repeated use.

## **HDT Extension**

This INIT, known as a System Extension in System 7, can be used to automatically load device drivers for removable media drives, such as SyQuest, opticals, and Bernoulli.

## **HDT Prober**

Prober is a Control Panel device (CDEV) that can be accessed any time to check the SCSI bus. Use Prober to:

- Scan/rescan the bus for SCSI devices, and determine which are mounted on the Desktop and which have device drivers loaded.
- Mount drives that did not mount during start-up or were unmounted.
- Reset the SCSI bus to clear communication problems.
- Get detailed information about a drive, such as its configuration, manufacturer, and partitioning scheme.
- Get detailed information about your CPU and system.

## **Warning!**

Hard Disk ToolKit•*Personal Edition* is a very powerful tool. Although it contains many safeguards, caution must be exercised to prevent accidental formatting, initialization, interrupted write testing, etc. that could result in significant irretrievable data loss.

Please observe the warnings and notes in the manual, and backup files whenever performing any function that involves erasing or updating data.

# Part 2: Installing Hard Disk ToolKit•Personal Edition

You must install Hard Disk ToolKit•*Personal Edition* from the diskette included with this package before you can use it. Part 2 of the Hard Disk ToolKit•*Personal Edition* User Guide explains the installation procedure; it contains the following topics:

- Installing Hard Disk ToolKit•*Personal Edition*
- Creating a startup disk
- Personalizing your Hard Disk ToolKit•*Personal Edition*

**NOTE:** The diskette in your Hard Disk ToolKit•*Personal Edition* package cannot be used as a Startup disk. See **Section II —Creating an HDT Primer PE Startup diskette** to build a System 6 or a System 7 Startup disk. The increased number of devices supported and additional features have prevented us from creating a Startup disk with this version.

Before installing Hard Disk ToolKit•*Personal Edition*, be sure to:

- Make a working backup copy of the original Hard Disk ToolKit•PE diskette. **DO NOT USE** the original master disks when personalizing the program.
- Disable any virus protection software.
- If you are already an HDT user, remove older HDT modules with version numbers in their names (e.g., HDT Primer PE 1.2, HDT Prober 1.3, HDT Extension 1.5.1) from your hard disk, including modules in the Control Panel and Extension folders. The modules of Hard Disk ToolKit•*Personal Edition*'s version 1.6 and higher do not have version numbers in their names, and the Installer will not replace these older modules.

## Section I — Installing Hard Disk ToolKit•Personal Edition

The Hard Disk ToolKit PE Installer will automatically install these modules:

- HDT Primer PE (into a folder on the hard disk)
- HDT Util (into a folder on the hard disk)
- HDT Prober (into the Control Panels folder in the System Folder)
- HDT Extension (into the Extensions folder in the System Folder)

Under System 7, the Installer will install HDT Prober and HDT Extension directly into the Control Panel and Extension folders of your System Folder. Under System 6 these modules are placed directly into the System folder.

To install Hard Disk ToolKit•Personal Edition:

1. Insert the Hard Disk ToolKit•*Personal Edition* backup diskette. Its icon will mount to the desktop (Figure 2.1). Double click on this icon to open its window.



*Figure 2.1: The Hard Disk ToolKit™ PE diskette icon*

2. Double click on the Installer icon (Figure 2.2). A splash screen for the Hard Disk ToolKit PE Installer application appears (Figure 2.3).

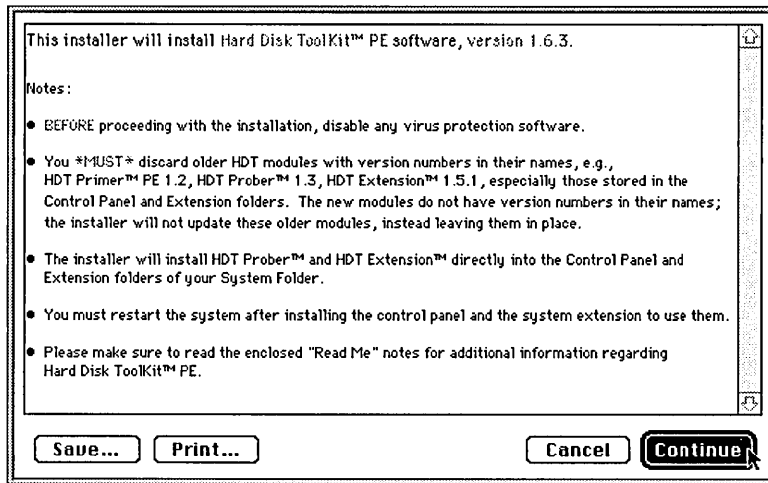


*Figure 2.2: The Hard Disk ToolKit PE Installer icon*



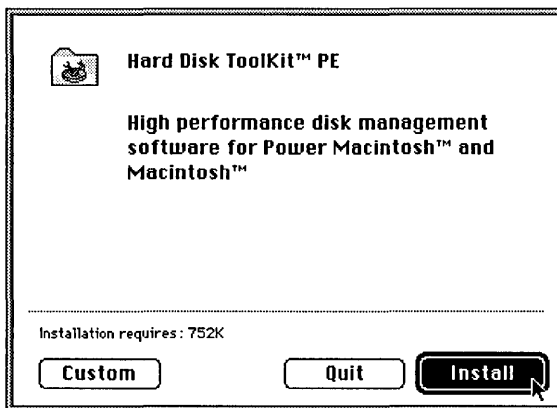
*Figure 2.3: This splash screen appears when the Installer is launched.*

3. Click on the **Continue** button at the bottom of the splash screen. A warning screen appears (Figure 2.4). Read it to make sure you have followed all instructions so far.



*Figure 2.4: The Installer warning screen.*

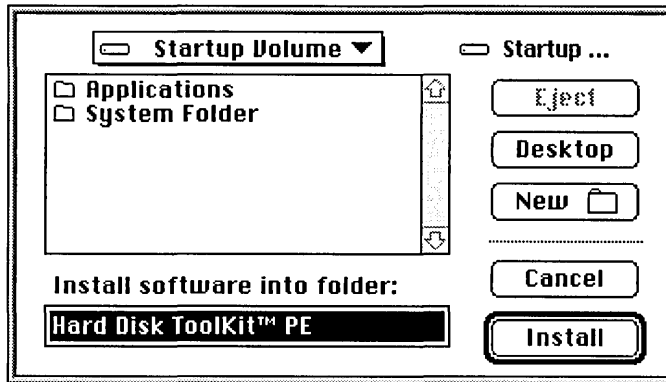
4. Click on the **Continue** button at the bottom of the warning screen. Another dialog box appears (Figure 2.5).



*Figure 2.5: The Install dialog box.*

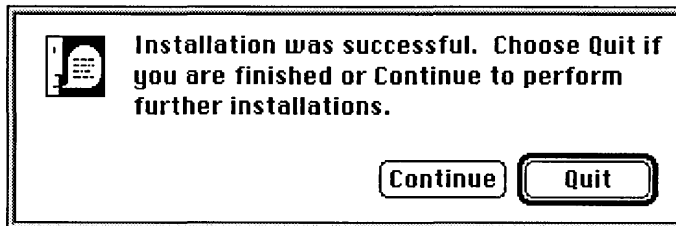
5. Click on the **Install** button to install all of the Hard Disk ToolKit•*Personal Edition* software. A dialog box appears (Figure 2.6.) where you can select the location of the Hard Disk ToolKit PE folder. (Advanced users may click on the **Custom** button to install selected modules only—use the shift-click technique to select multiple

modules.)



*Figure 2.6: The folder selection dialog box.*

6. Select a location for the Hard Disk ToolKit Personal Edition folder, then click on the **Install** button. After the installation process is complete, a confirmation dialog box appears (Figure 2.7).



*Figure 2.7: The confirm install dialog box.*

7. Click on the **OK** button to quit the Installer application.

You are now ready to use Hard Disk ToolKit•*Personal Edition*. You may want to run the HDT Primer PE module to install the Hard Disk ToolKit•*Personal Edition* high-performance drivers or to format a drive.

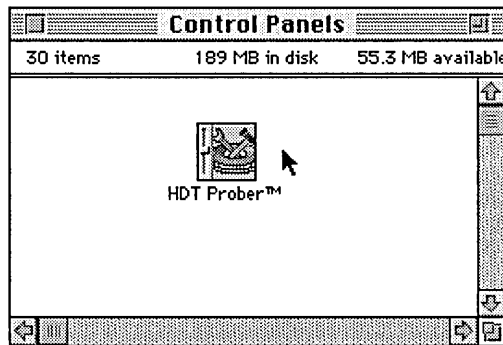


## Check your hard disk to double-check the Installation process (optional)

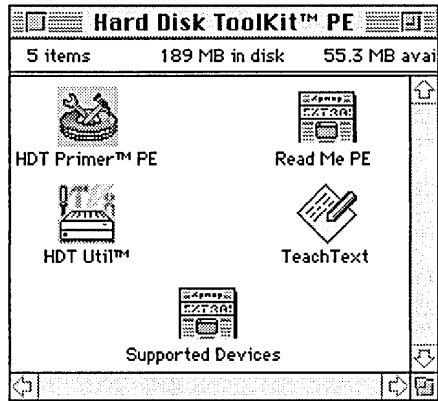
The HDT Extension (Figure 2.8) and HDT Prober (Figure 2.9) modules are automatically stored into the System Folder. The remainder of the Hard Disk ToolKit•*Personal Edition* software (including HDT Primer PE and HDT Util) is stored in a folder named **Hard Disk ToolKit•PE** on your hard disk (Figure 2.10).



*Figure 2.8: The HDT Extension module icon.*



*Figure 2.9: The HDT Prober module in the Control Panels folder of the System Folder*



*Figure 2.10: The contents of the Hard Disk ToolKit•PE folder.*

## Section II — Creating an HDT Primer PE Startup diskette

Because HDT Primer PE cannot format, initialize, partition, or test the disk from which it is run, Macintosh/Power Macintosh users with only one SCSI drive must run HDT Primer PE on a *startup diskette*. This section describes how to create an HDT Primer PE startup disk for both System 7.x and System 6.x users.

**CAUTION:** DO NOT attempt this on an IDE drive with this version of HDT, e.g., a Quadra 630 or PowerBook 150.

### Creating a Startup Disk

You will need the following to create an HDT Primer PE startup disk:

- the Apple Disk Tools diskette that came with your Macintosh System software
- the Hard Disk ToolKit•*Personal Edition* distribution diskette
- a blank, initialized, high-density diskette—name the blank diskette “HDT Primer Startup Diskette.”

These procedures require some disk swapping. To copy a file or folder from one diskette to another, you will have to:

1. Insert the first diskette in your computer.
2. Copy the file or folder to your Desktop.
3. Remove the first disk and insert the second.
4. Copy the file or folder from your Desktop to the second diskette.

#### To create a System 7 startup disk:

1. From your Disk Tools diskette, copy the System Folder to the HDT Primer PE Startup Diskette.
2. From the For Emergency Boot Disk Only folder of the Hard Disk ToolKit PE diskette, copy the Finder into the System Folder of the HDT Primer PE Startup Diskette to replace the existing Finder. You have just created a startup diskette that will automatically launch HDT Primer PE when you start up from this diskette.

#### To create a System 6 Startup Disk:

1. Start up your computer with a System 6 System Tools diskette.
2. From the System Tools diskette, copy the System Folder from to the HDT Primer Startup Diskette.
3. From the For Emergency Boot Disk Only folder of the Hard Disk ToolKit PE diskette, copy the Finder into the System Folder of the HDT Primer PE Startup Diskette to replace the existing Finder. You have just created a startup diskette that will automatically launch HDT Primer PE when you start up from this diskette.

**NOTE:** To personalize HDT Primer PE, the disk must be write-enabled. You can run the program from a write-protected disk, but you cannot save the personalization information.

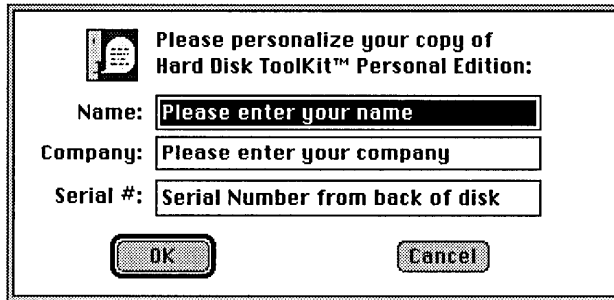
**Macintosh models that have an 800K floppy drive**

If your Macintosh is an older model machine equipped with a double density 800K floppy drive, fax your name, mailing address and your Hard Disk ToolKit™ Personal Edition's serial number with your request for Hard Disk ToolKit•*Personal Edition* on double density (800K) floppies to our Technical Support fax number: (415) 833-4662. (U.S.A. and Canadian residents only!). If you are outside the U.S.A. and Canada, contact your local distributor.

Once you have formatted and set up your start-up hard drive, it is highly recommended that you run Hard Disk ToolKit•*Personal Edition* from the hard drive and not the floppy. If HDT Primer PE is run from the floppy, the risk of unintentionally telling it to perform a destructive procedure, such as formatting or initializing, is greater.

## Section III — Personalizing your copy of Hard Disk Toolkit•Personal Edition

The first time you run HDT Primer PE, you will be asked to personalize your copy of the software. You will be prompted to enter your name, company name, and a serial number. You can find your serial number on the label of your original Hard Disk Toolkit•*Personal Edition* diskette.



The image shows a dialog box titled "Please personalize your copy of Hard Disk Toolkit™ Personal Edition:". It contains three input fields: "Name:" with the placeholder text "Please enter your name", "Company:" with the placeholder text "Please enter your company", and "Serial #:" with the placeholder text "Serial Number from back of disk". At the bottom of the dialog box are two buttons: "OK" and "Cancel".

*Figure 2.11: Personalization information must be entered the first time HDT Primer PE is launched*

**NOTE:** The serial number is case sensitive—all letters must be entered in upper case (capitals). Your serial number looks like this: XX#####X#X, where X represents a capital letter and # represents a numeral. Be careful when entering your serial number; it is easy to confuse 0 (zero) with O (capital o) and 1 (numeral 1) with I (capital i).

# Part 3: HDT Primer PE



HDT Primer™ PE

## Section I — What is HDT Primer PE?

HDT Primer PE, the main module of Hard Disk ToolKit•*Personal Edition*, is a powerful application that will optimize all of your SCSI storage devices through its ability to format, initialize, partition, and test any SCSI storage device attached to your Macintosh/Power Macintosh. HDT Primer PE also installs a high-performance driver that will further increase performance of your SCSI storage device.

HDT Primer PE is used primarily to:

- Install a high-performance driver to all SCSI storage devices—hard disks, SyQuest disks, and magneto-optical disks
- Create, modify, and delete partitions
- Mount and unmount partitions
- Test the drive for defects
- Get information about the drive and computer

### **PowerPC-native and 680x0-native application**

HDT Primer PE has been designed as a *fat* application; it contains both 680x0 and PowerPC code, which allows it to automatically run native in either 680x0-based or PowerPC-based Macintoshes. A *fat* application uses more disk space and memory than a regular application, but it provides better performance for both platforms.

**NOTE:** Certain HDT Primer PE operations will erase existing data on a SCSI storage device. Be sure that all valuable data on your SCSI storage device is backed up before using HDT Primer PE.

## The HDT Driver

Hard Disk ToolKit•*Personal Edition*'s high-performance disk driver must be installed on a device before you can use all of HDT Primer PE's functions on that device. HDT Primer PE has a unique "intelligent update" feature that checks each SCSI ID and asks if you would like to automatically install an optimized HDT driver for the device. The HDT driver increases performance and functionality of all your SCSI storage devices. If you do not install the HDT driver, you will not be able to mount, unmount, or modify partitions on devices that do not contain the driver.

When you launch HDT Primer PE, it automatically scans the SCSI bus for drives that are not using the HDT driver. This includes drives pre-formatted with Apple's HD SC Setup and drives using proprietary third-party software.

HDT Primer PE can *take over* most drives that have been formatted by other programs without causing any data to be lost. However, as always, *all* data should be backed-up before trying this procedure, and *all* extensions should be disabled.

### Driver configuration

You may have to configure the HDT driver for some drives or drive hardware that are not completely compatible with the high-performance capabilities of the HDT driver. For example, Daystar's Turbo 040 accelerator boards do not support blind transfers. Users of Daystar's Turbo 040 accelerator boards will need to turn off the blind transfer mode of the Hard Disk ToolKit•*Personal Edition* driver, which is on by default. For more information, refer to **Turning off Blind transfers** on page 217.

## Section II — Using HDT Primer PE

You cannot format, initialize, partition, or test the drive from which the HDT Primer PE application has been launched. To perform these operations on a specific drive, HDT Primer PE must be launched from secondary hard disk or diskette. Because HDT Primer PE has many other functions that are frequently useful, FWB does recommend installing HDT Primer PE onto your hard drive (after formatting and initializing).

### **Users that have more than one hard disk**

HDT Primer PE cannot perform formatting, initializing, and certain other operations on the hard drive from which it is run. If you plan to reformat the hard disk that serves as your start-up disk, be sure to copy the HDT Primer PE application on a different hard drive and run it from there.

### **Users that only have one hard disk**

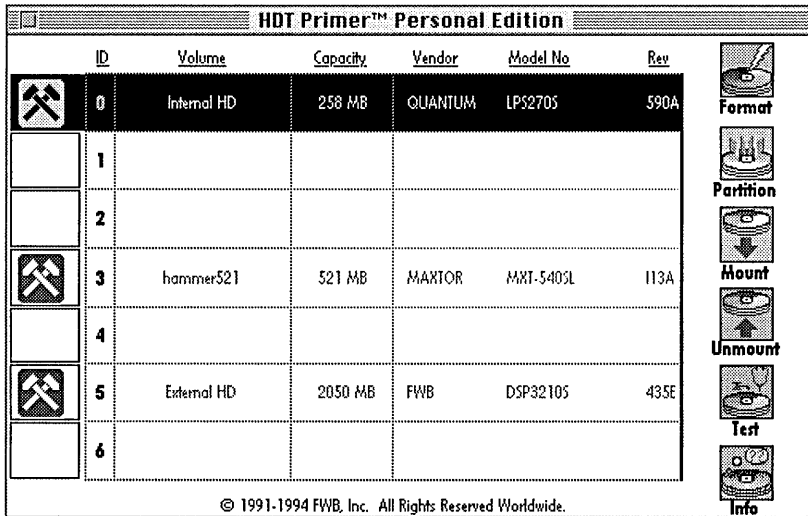
If you have only one hard drive and wish to format it, you must run HDT Primer PE from a diskette. To use HDT Primer PE from a diskette, you will need to create an HDT Primer PE startup diskette (HDT Primer PE will not run from the diskette included with the Hard Disk ToolKit•*Personal Edition* package.)

See **Section II —Creating an HDT Primer PE Startup diskette** on page 172 for step-by-step instructions on creating a startup disk from which HDT Primer PE can be launched to format a hard disk.



## Launching HDT Primer PE

1. Double-click on the **HDT Primer PE** icon. The main window appears—see Figure 3.1. If a SCSI drive does not show up in this display because it has just been powered on, try the **Rescan** command in the **File** menu, or the **SCSI Bus** menu.



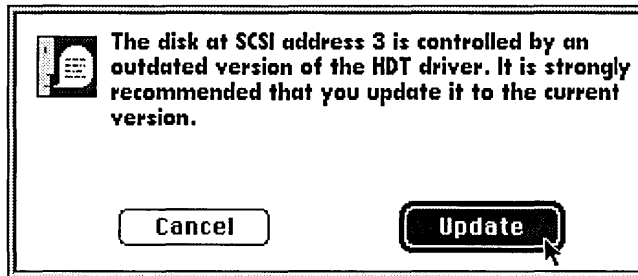
*Figure 3.1: The of HDT Primer PE main window, also referred to as the volume selector window. The currently selected drive is highlighted*

2. HDT Primer PE's main window is where SCSI devices are displayed and selected. The main window includes an icon for each drive, its SCSI ID, the volume name (if the drive has more than one partition on it, the name of the first Macintosh partition will be the name listed), the drive's capacity, and the make, model number, and revision number of the drive.

The **Format**, **Partition**, **Mount**, **Unmount**, and **Test** buttons on the right side of the main window perform common HDT Primer PE tasks. Other HDT Primer PE functions, such as **Initialize** and **Update Driver**, are available in the HDT Primer PE **File** menu.

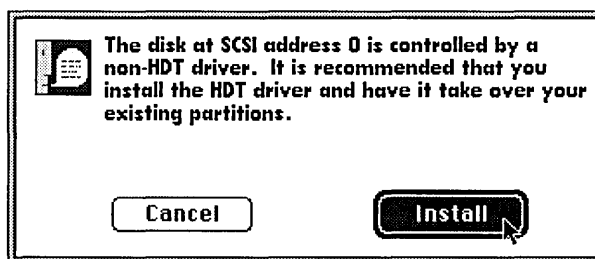
**NOTE:** On dual SCSI bus machines with SCSI Manager 4.3, HDT Primer PE will display all on-line devices connected to the internal SCSI bus by default. Use the **SCSI Bus** menu to display devices attached to the external SCSI bus. See "SCSI Bus menu" on page 198 for more information.

3. *If you are using an older HDT driver* (you are upgrading from a previous version of Hard Disk Toolkit•*Personal Edition*), when you start HDT Primer PE, a dialog box will appear encouraging you to update to the new driver (see Figure 3.2.)



*Figure 3.2: Warning message*

4. *If you are using a non-HDT-formatted drive*, HDT Primer PE will ask you to replace any obsolete drivers with the HDT universal driver. If it finds a non-HDT driver, HDT Primer PE will display a warning message when started (Figure 3.3). In most cases, you can update the driver software and have it take over your existing partitions without reformatting. However, if a driver is converted, the device will lose special proprietary attributes such as its partition expandability information. Click **Cancel** to leave the drive untouched, or click **Install** to install the HDT driver. Upon successful driver installation, you should quit all programs and restart your computer to allow the changes to take effect.



*Figure 3.3: Warning message*

**NOTE:** If you had decided not to update/replace your device driver to the latest HDT driver when you started HDT Primer PE, you can do so at any later time. You don't need to reformat your drive to install the new driver. To update your driver, choose **Update Driver** from the HDT Primer PE File menu.

The **Update** or **Install** procedure may need to create a larger partition into which the latest HDT Driver can fit. Because your existing data is exposed to some risk during this type of procedure, you should back up the data on the drive. However, in most cases Hard Disk ToolKit•*Personal Edition* will successfully convert your drive to use the HDT driver.

## Formatting

To ensure optimum performance and compatibility of every storage device, HDT Primer PE's **Format** command can be used on every drive. Formatting maps out the magnetic surface of the storage media into error-free sectors, zones, and tracks. A SCSI storage device must be formatted before it can store data.

Most hard drives and many other storage devices are preformatted. FWB suggests that you format each drive **once** with HDT Primer PE to standardize your disk formatting and to ensure format quality. Because formatting is a low-level operation, it is very time-consuming, and should be performed rarely. It is more efficient to choose the **Initialize** command for frequent disk optimization

**WARNING!** Formatting (and initializing) destroys all data on the drive. Be sure that you have backed up the drive before proceeding.

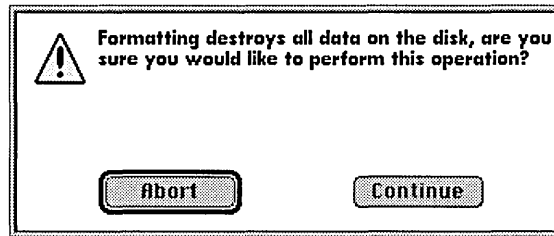
If your drive is not directly supported by the program, HDT Primer PE will use a generic mode that is not optimized to adjust all the specific parameters the drive supports. You can contact FWB to let us know what type of drive you have so we can add direct support in the future.

When you format a drive, you are given the option to initialize it when the format is complete.

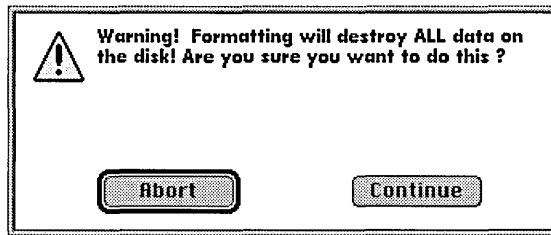
To format a drive using HDT Primer PE:

1. Double-click on the **HDT Primer PE** icon. The main window appears (See Figure 3.1).
2. Click on the drive you wish to format. The selected drive will be highlighted.

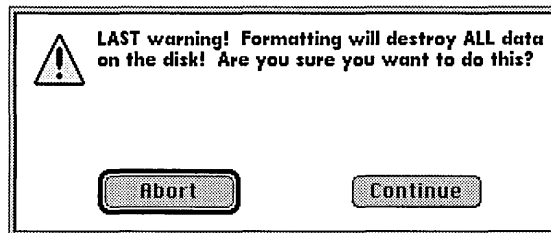
3. Click the **Format** icon.
4. Three separate dialog boxes will appear letting you know that formatting will destroy *all* the data on the disk (Figures 3.4, 3.5, and 3.6). **Data will be lost *permanently* (beyond the help of all data/file rescue programs) when you format a drive.**



*Figure 3.4: The Format command's first warning message*



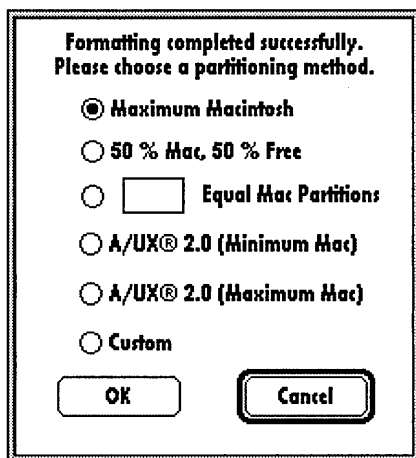
*Figure 3.5: The Format command's second warning message*



*Figure 3.6: The Format command's third and final warning message*

5. Click on **Continue** in all three warning dialog boxes to proceed with formatting. After clicking on **Continue** in the third dialog box, all data on the selected drive will be completely erased. Ensure that all valuable data has been backed up.

6. A status box appears telling you that formatting has begun and about how long it will take. The size and speed of the drive affect how long it takes to format. Once formatting has begun, it cannot be aborted or cancelled.
7. When the formatting is completed, the Choose Partitioning Method dialog box appears (Figure 3.9). FWB strongly recommends that you proceed with the initialization of your drive at this time. See "Initializing" on page 183 for more information.



*Figure 3.7: Partitioning method options dialog box*

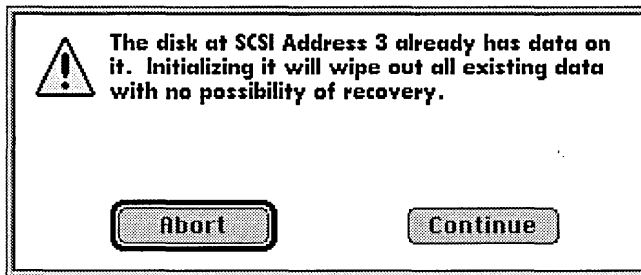
## Initializing

Initialization removes existing software from the drive, and then writes new partitions and installs the latest HDT driver. Initialization allocates partitions without the need to reformat the drive. Initialization is recommended for drives that have data corruption and/or software malfunction problems, and for drives that have become very fragmented. Initializing will wipe out *all* previous partitions and the data in them.

**CAUTION:** If you are re-initializing a drive, make sure you have backed up all your files.

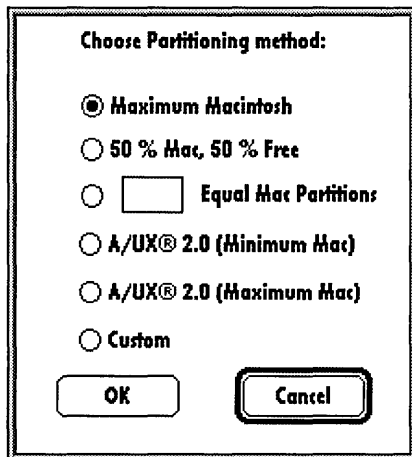
To initialize your drive:

1. Choose the **Initialize** command from HDT Primer PE's File menu. A warning message appears (Figure 3.8). Make sure that there is nothing on the disk that you want to save before continuing



**Figure 3.8:** *This warning message appears after choosing the **Initialize** command*

2. Click on the **Continue** button. The Partitioning Method dialog box will appear (Figure 3.9.) It contains six radio buttons from which a preset initialization profile can be selected. Information on these radio buttons follows.



*Figure 3.9: Partitioning method options dialog box*

- **Maximum Macintosh:** uses the entire hard disk space for the Mac OS. This is the default selection. Most users will use this default option to create a single partition with the maximum amount of usable storage space.
- **50% Mac, 50% Free:** uses half the disk for a Mac OS partition, leaving the rest free.
- **Equal Mac Partitions:** creates a number of equally sized Mac OS partitions that use up all free space. Type in the number of equal partitions you wish to create.
- **A/UX® (Minimum Mac):** partitions the drive for use with Apple's A/UX, allocates the minimum amount of space (2 megabytes for A/UX 2.0) for a Macintosh partition, and gives the rest to A/UX.
- **A/UX® (Maximum Mac):** partitions the drive for use with Apple's A/UX, creates the standard A/UX partitions, and allocates the rest of the free space to the Macintosh partition. The size of this Macintosh partition will vary with the capacity of the drive. **Important:** A/UX 3.0 requires using Apple's HD SCSetup software to initially create new A/UX partitions.
- **Custom:** presents the Partition Directory window. See "Partitioning" on page 185 for details.

3. Select the desired radio button, then click on the OK button to begin initialization.
4. The newly created partitions will automatically mount on the Desktop. You can now quit HDT Primer PE and begin normal use of the drive.

## Partitioning

Use HDT Primer PE to customize SCSI storage devices through its powerful **Partition** feature. Partitioning divides the disk into separate volumes. Even though each of these volume are on the same physical device, they are treated by the Macintosh like separate hard drives, and are represented by its own icon on the Desktop (Figure 3.10).



*Figure 3.10: Volumes (or partitions) as they appear on the desktop.*

HDT Primer PE creates low-level hard partitions which are physical areas of the disk that are assigned as separate volumes. This is in contrast to other programs that create 'soft' partitions that are really invisible files on the disk.

Multiple users can have their own partition, or, if the same disk is used for different purposes (e.g., word processing, accounting, programming, graphics, etc.), a partition can be created for each of these uses and dedicated exclusively to it. This lowers seek time, reduces fragmentation, and saves wear on the drive. For example, if an 80-MB disk has been divided into volumes of 20 MB each, the computer, looking at a particular assigned partition, only needs to search a 20-MB area for data instead of the entire 80-MB area. You can also use partitions to divide groups of files for different projects, for file sharing, or for public access. Partitions are also used to hold different operating systems (such as Apple's A/UX) or to hold different versions of the Macintosh OS, such as System 6 and System 7. Each bootable partition used for the Macintosh OS will need its own System Folder.

Partitions can also reduce allocation block size, the minimum unit of storage a volume allocates for storage. For example, partitions with an allocation block size of 2KB would

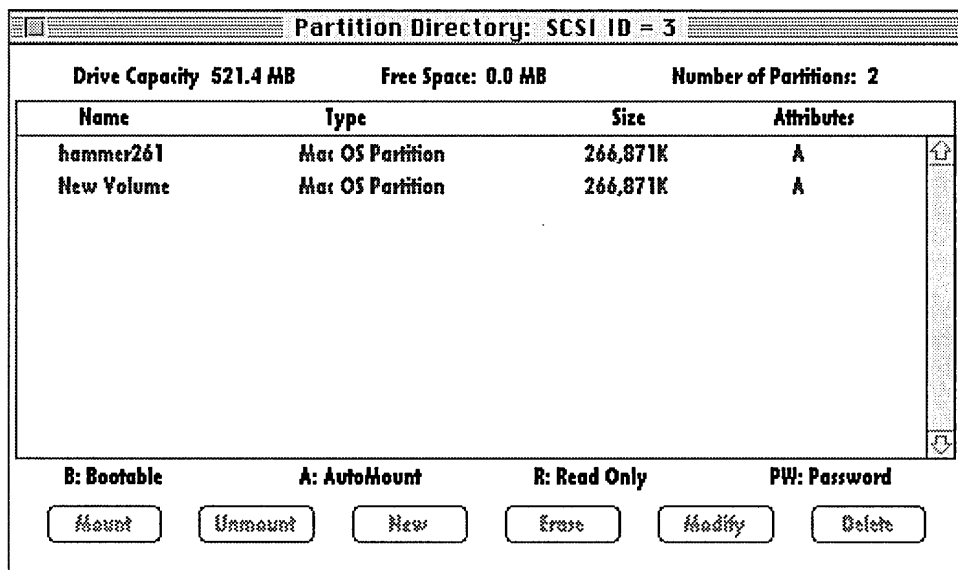


use 2KB of disk space for any file or piece of a file less than 2KB, even if it contained only one character. Reducing allocation block size means you can store more real data.

To partition with HDT Primer PE:

1. Select the drive you wish to partition in the main HDT Primer PE window to highlight it (Figure 3.1), then click on the **Partition** icon. The Partition Directory window for that SCSI storage device will appear (Figure 3.11.) The SCSI ID number of the drive appears in the window title bar.
2. From the Partition Directory window, you can inspect the current partition layout, create or delete partitions, secure partitions with passwords, and modify existing partitions.

**NOTE:** You cannot partition a drive that was not formatted with Primer without updating the HDT driver. See "Launching HDT Primer PE" on page 178 for details.



*Figure 3.11: The Partition Directory window*

The following information about the drive appears at the top of this window:

- **Drive Capacity:** The total size of the drive in megabytes.
- **Free Space:** The total amount of partitionable free space. The free space on the disk cannot be accessed until it has been put into a partition. If you do not wish to have multiple partitions, a single partition can be created utilizing all free space.

- **The Number of Partitions:** The total number of partitions.

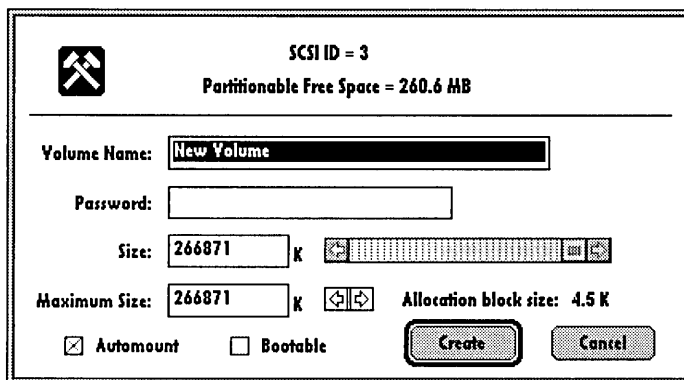
The scroll box area provides detailed information about individual partitions:

- **Name:** The name of the partition when it appears on the desktop, if the partition is a Macintosh OS partition. For non-Macintosh OS partitions, the name describes what it contains.
- **Type:** The file system used by the partition. This will usually be Macintosh OS.
- **Size:** The size of the partition in kilobytes (KB).
- **Attributes:** The attributes given to the Mac OS partitions when they are created or modified, such as (A) Automount, (B) Bootable, (R) Read-only, or (PW) Password protected.

### To create a new partition:

Creating a new partition on a drive is simple with HDT Primer PE.

1. From the main Drive Selection window, select a drive.
2. Click on the **Partition** icon to bring up the Partition Directory of that drive.
3. Click on the **New** button at the bottom of the Partition Directory. This will be accessible (black instead of gray) only if there is free space available on the drive for a new partition. A dialog box will appear (Figure 3.12).



*Figure 3.12: Set volume name and size in this window.*

4. Fill in the dialog box fields. Use the following descriptions to determine the best values.

- **Volume Name:** This sets the name for a Mac OS partition that you will see when the partition's icon mounts on the Desktop.
- **Password:** To enable password protection, enter a password. The password is case sensitive and can be up to 24 characters in length. If this space is left blank, no password will be assigned. Once the partition has been password protected, you cannot gain access without the password. Take precautions to remember your password. **DO NOT FORGET YOUR PASSWORD!** If you forget your password, your data is unrecoverable. There is **no way** to bypass this protection to recover the data.
- **Size:** HDT Primer PE will automatically show the maximum allowable size for the partition in the size field. You can edit the text in the size box or use the scroll bar to adjust the partition size. Space is allocated in 0.5-kilobyte units. (1,024 kilobytes equals one megabyte.)
- **Maximum Size:** Partitions can be expanded at any time without data loss, but their maximum size must be preset at creation time. Set the Maximum Size to the greatest size you think you may one day want the partition to be. This number is typically the size of the hard drive. Edit the text in the size box or use the bar to the right to adjust the partition size. The Maximum Size affects the amount of free space in the drive because directory space for the Maximum Size will be allocated when the partition is created. For example, if you are setting up a partition that will contain approximately 11 MB of files, but you expect it to grow as you add to it, you might set the initial size to 12 MB and the Maximum Size to 40 MB. The partition will occupy only 12 MB on the disk, but the directory space used is the size needed for a 40 MB partition. The Maximum Size also affects the allocation block size (see below). The larger the Maximum Size, the larger the allocation block size of the partition. Expandable partitions should be erased only from within HDT Primer PE and should not be erased using the Finder's Erase Disk command. The Finder will erase all expandability information. If you do not want the partition to be expandable, simply enter the same number as entered in the size box.
- **Allocation Block Size:** The minimum storage unit that can be allocated in HFS is the allocation block size. If the allocation block size is 2KB, a file containing one character will occupy one 2KB block on your disk, even though the block is almost empty. This can waste a lot of space on drives with many small files. Allocation block size grows by .5KB for every 32 MB increase in partition size. One advantage of partitioning is reducing allocation block size; each partition has its own allocation block size, which generally is smaller than that of the entire drive.
- **Bootable:** Select this to use this partition as the start-up partition. This is useful if you use different operating systems, such as System 6, System 7, etc. Otherwise the Macintosh will boot off the first HFS partition listed in the Partition Directory, provided that it has a System Folder. Select only one partition as bootable.

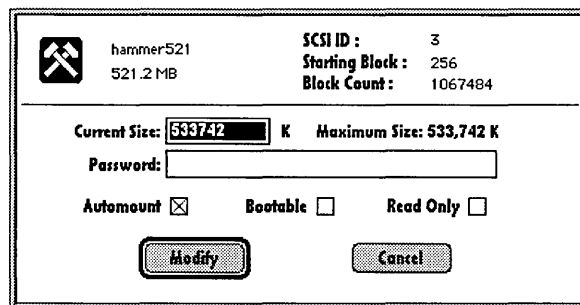
- **Automount:** Select this to automatically mount the partition on the Desktop upon start-up. Otherwise, the partition will have to be mounted through HDT Primer PE.

5. Click on the **Create** button to create the partition with the currently entered parameters. HDT Primer PE will then return to the Partition Directory window and list the partition you have just created, including its characteristics and attributes. Click on the **Cancel** button to abort the creation process and leave your drive unchanged. HDT Primer PE will automatically optimize free space when creating partitions, making them contiguous.

### Modifying a Partition

Sometimes you'll want to change the attributes set when you created a partition. You can change the size and/or attributes of an existing partition at any time. To modify a partition:

1. From the main Drive Selection window, select the drive you wish to modify.
2. Click on the **Partition** icon. The Partition Directory window appears.
3. Select the partition you want to modify.
4. Click on the **Modify** button. If the partition is password protected, you will be asked to enter the password. The Modify dialog box appears (Figure 3.13).



*Figure 3.13: The Modify dialog box*

5. From this dialog box you can change the partition attributes:
  - shrink or expand the partition (you cannot enter a size larger than Maximum Size) To shrink or expand the partition, click on the Current Size indicator and enter the new size
  - add, remove, or change the password for the partition

- enable/disable the Read Only check box.

**NOTE:** You can shrink a partition down to the amount of data stored on it. A partition can be further reduced in size if all files within it are moved to the front of the partition with an optimizer, a program that defragments the disk. The Starting Block indicates where the partition resides on the disk and the Block Count refers to how many blocks the partition occupies.

6. Click on the **Modify** button when you're through with your changes. HDT Primer PE will immediately make your changes, and return you to the Partition Directory window. Click on the **Cancel** button to abort any changes.

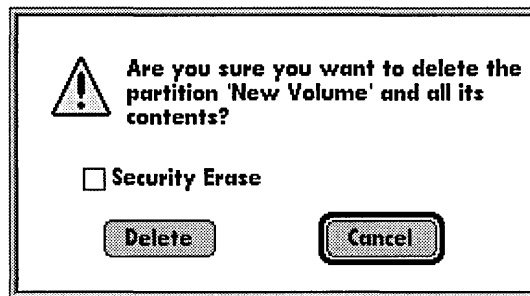
### Deleting a Partition

You can use this command to delete a partition from your drive. You can also choose to securely erase the data in the partition at the time of the deletion, preventing anyone—including yourself—from ever recovering that data.

To delete a partition:

1. From the main Drive Selection window, choose the target drive.
2. Click on the **Partition** icon. The Partition Directory window appears.
3. Select the partition you want to delete.
4. Click on the **Delete** button.

If the partition is password protected, a dialog box will appear asking you to enter the password before you can delete the partition. The Delete dialog box will appear (Figure 3.14), asking if you are sure that you want to delete the partition.



*Figure 3.14: The Delete dialog box*

5. Click on the **Delete** button. HDT Primer PE will delete the partition and, if you selected the Security Erase option, erase all the data. The partition area will become

free space that can be used to create new partitions on the disk.

### **Mounting/Unmounting Disks and Partitions**

A partition must be mounted on the Desktop before it or any of its files can be opened. If you had enabled the automount or bootable attributes when you created the partition, they will mount automatically upon start-up. If you did not enable the automount or bootable attributes, you will need to use HDT Primer PE to mount the partition before you can access it. You can also mount drives with removable media after the media have been installed. (For more information, see the Prober chapter.)

#### **To mount the entire drive:**

1. From the main Drive Selection window, choose the drive you wish to mount.
2. Click on the **Mount** icon. The drive is mounted.

#### **To mount selected partitions on the drive:**

1. From the main Drive Selection window, choose the drive you wish to mount partitions from.
2. Click on the **Partition** button to open the Partition Directory.
3. Select any partitions you wish to mount.
4. Click on the **Mount** button. The partitions are mounted.

#### **To unmount the entire drive:**

1. From the main Drive Selection window, choose the drive you wish to unmount.
2. Click on the **Unmount** icon. The drive is unmounted.

#### **To unmount selected partitions on the drive:**

1. From the main Drive Selection window, choose the drive you wish to unmount partitions from.
2. Click on the **Partition** icon to open the Partition Directory.
3. Select any partitions you wish to unmount.
4. Click on the **Unmount** button. The partitions are unmounted.

If Mount and Unmount are both grayed out, these options are not available for this type of partition.

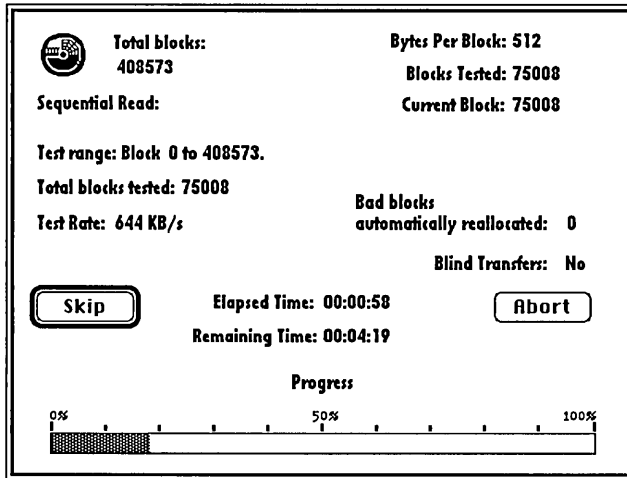
## Testing a Drive

The **Test Drive** option will test the drive for bad blocks. Use this command whenever you question the integrity of the drive's medium. To test a drive:

1. From the main Drive Selection window, select the drive to test.
2. Click on the **Test** icon. HDT Primer PE will first test the computer's RAM to determine the reliability of the other tests. The time needed for a RAM test differs with the speed of the computer and the amount of RAM. HDT Primer PE then performs three diagnostic tests: Sequential, Random, and Alternating Read.
  - **Sequential Read** looks at the data on the disk without changing it, in numerical ascending order (block 0, 1, 2, 3...)
  - **Random Read** transfers data from random blocks on the disk. This tests both the data transfer and seek capabilities of the drive.
  - **Alternating Read** accesses the data from alternating ends of the test range, switching from end to end, working in towards the center. This means it tests the first block and then the last, the second block and the second to last, etc.

If a drive gets many (10+) bad blocks in a row, it likely has a media problem and should be reformatted. If the drive exhibits the same problem after reformatting, you may have a hardware problem beyond HDT Primer PE's capabilities to repair.

3. The test information dialog box will appear (Figure 3.15). You can see:
  - the total number of blocks being tested
  - the bytes per block
  - the number of blocks tested thus far
  - the current block being tested
  - the test range
  - the total blocks tested
  - the test rate in kilobytes per second
  - the number of bad sectors found thus far
  - whether blind data transfers are enabled
  - the elapsed-time and remaining-time figures
  - a bar graph showing test progress**Abort** stops all the tests, while **Skip** stops the current test and starts the next.



*Figure 3.15: The Test Drive dialog box*

When the test is finished or has been aborted, a dialog box will appear informing you of any bad blocks encountered during the test.

If bad blocks are encountered, they will automatically be reallocated to prevent data loss. If no bad blocks are encountered and you continue to experience problems with the drive, please check the Troubleshooting section in the back of the manual.

## Information Capabilities

Primer can provide information on the type and configuration of each of the drives and the computer running the system.

### Drive Information

You can use this information to see how the drive and driver are set up. You can determine what, if any, changes you needed to correct problems or increase performance, or to look for options and ideas, which could be useful in deciding how to format or configure a drive.

To get information on the drive:

1. From the main Drive Selection window, select the drive.



- Click on the **Info** icon. The Drive Information window (Figure 3.16) appears, containing the following information:

SCSI Device Information	
SCSI ID Number:	5
Drive Type:	Random Access Device
Drive Class:	SCSI-2 (ANSI X3T9.2/86-110)
Partition Style:	Inside Mac V
Total Partitions:	4
Driver Name:	FWB Async Bus:0 ID:5 v1.6.0
HDT Driver Version:	31040
Block Size:	512 bytes per block
Mirroring:	No
Striping:	No
Free Partition Space:	0 K
Bus Controller Family:	NCR 53c96
Bus Controller Type:	Unknown...

*Figure 3.16: The Drive Information dialog box.*

- **SCSI ID number:** The SCSI address, from zero to six, assigned to the drive.
- **Drive type:** The kind of SCSI device the drive is.
- **Drive class:** The class of the drive: SCSI-1, SCSI-1/CCS, or SCSI-2.
- **Drive capacity:** The size of the drive in megabytes.
- **Partition style:** The Apple partition style (*Inside Mac IV* or *Inside Mac V*).
- **Total partitions:** The total number of partitions on the disk.
- **Driver name:** The name or ID of the driver currently installed.
- **HDT Driver Version:** The version number of the HDT driver (if the driver is a ToolKit driver).
- **Block size:** The number of bytes per block in the disk format. The standard is 512 bytes per block.
- **Mirroring:** Indicates whether the drive is being used for automatically duplicating data onto another drive.
- **Striping:** Indicates whether the drive is being used for storing pieces of information on more than one drive.
- **Free partition space:** The amount of space that has not been partitioned out.

3. Click anywhere to close this window.

### **Computer Information**

You can get information about your entire computer system.

To get information on the computer:

1. From the **File** menu, select **Get Computer Info**. The Computer Information window appears, containing the following information (Figure 3.17.)

<b>Computer Information</b>	
<b>Environment Version:</b>	<b>2</b>
<b>Computer Model:</b>	<b>Power Macintosh 7100/66</b>
<b>System Version:</b>	<b>7.1.2</b>
<b>Processor:</b>	<b>PowerPC</b>
<b>Floating Point Coprocessor:</b>	<b>PowerPC</b>
<b>Color QuickDraw:</b>	<b>565</b>
<b>Keyboard Type:</b>	<b>Extended ADB Keyboard</b>
<b>AppleTalk Version:</b>	<b>58</b>
<b>System VReflum:</b>	<b>-32525</b>
<b>Total Memory:</b>	<b>25165824 bytes</b>
<b>Free Memory:</b>	<b>243680 bytes</b>

*Figure 3.17: The Computer Information dialog box.*

This provides basic information on the Macintosh including its processor, keyboard, System version, and memory capacity.

## Section III — HDT Primer PE Menu Commands

This section explains HDT Primer PE's pull-down menu commands.

### Apple Menu

#### About HDT Primer

Displays the HDT Primer PE version number and FWB Inc. contact information.

#### Help

Displays Help for HDT Primer PE. Information about the various commands and features of HDT Primer PE can be found here. HDT Primer PE also has extensive Balloon Help when used under System 7.

### File Menu

File	
Select Drive...	
Close	⌘W
Format Drive...	
Update Driver	
Initialize...	
Partition Drive...	
Test Drive...	⌘T
Get Info	⌘I
Rescan SCSI Bus	⌘R
Quit	⌘Q

*Figure 3.18: The File Menu of HDT Primer PE*

#### Select Drive

Brings up the Drive Selection window if it has been closed.

#### Close

Closes the front-most window.

**Format Drive**

Begins the disk formatting process.

**Update Driver**

Installs the latest version of the Hard Disk ToolKit•Personal Edition driver.

**NOTE:** Daystar's Turbo 040 accelerator boards do not support blind transfers. Users of Daystar's Turbo 040 accelerator boards will need to turn off the blind transfer mode of the Hard Disk ToolKit•Personal Edition driver, which is on by default. For more information, refer to **Turning off Blind transfers** on page 217.

**Initialize**

Erases information on the drive so that it can be repartitioned.

**Partition Drive**

Brings up the Partition Directory window so that partitions can be created and maintained.

**Test Drive**

Tests the drive for defects and remaps them.

**Get Info**

Displays information on the computer.

**Rescan SCSI Bus**

Rescans the bus and adds to the Drive Selection window any drives turned on and removable media loaded since launching HDT Primer PE.

**Quit**

Quits the HDT Primer PE application and returns you to the Desktop.

**Edit Menu**

This is included for use mainly with Desk Accessories.

## SCSI Bus menu



*Figure 3.19: The SCSI Bus menu*

The **SCSI Bus** menu allows HDT Primer PE to access additional SCSI buses from other motherboard SCSI buses, and PDS and SCSI NuBus cards on computers with SCSI Manager 4.3. The additional SCSI buses must be SCSI Manager 4.3 compatible and the accompanying PDS and NuBus card software must have loaded its SCSI Manager 4.3-savvy drivers during bootup time. Refer to your PDS or NuBus SCSI bus hardware and software installation manual for more details. FWB's SCSI JackHammer is fully compatible with this option.

# Part 4: HDT Extension



*Figure 4.1:* Quickly load drivers for removable media drives upon start-up

## What is HDT Extension?

HDT Extension is a uniquely intelligent start-up program. It will automatically search your SCSI bus for removable devices or erasable optical drives that do not have cartridges inserted. HDT Extension will pre-load drivers into memory for these drives so that cartridges inserted after startup will automatically mount.

**NOTE:** If you do not have any removable devices or erasable optical drives, you do not need to use HDT Extension.

## Important information regarding HDT Extension

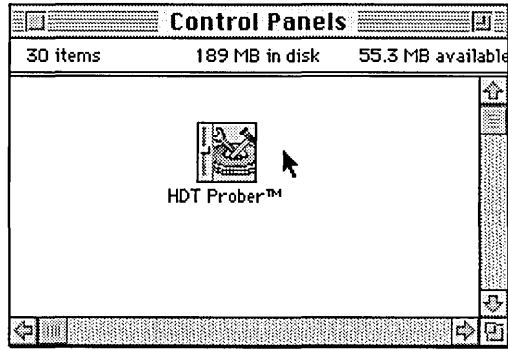
Be sure you have removed any other INIT or Control Panel device that automatically mounts or loads drivers for removable drives. This includes any file within the System Folder that was included with any other formatting software or removable drive.

On startup, HDT Extension will search through the SCSI bus to find any removable devices that do not have a cartridge inserted. The Extension will then pre-load drivers for these devices, allowing cartridges inserted after bootup to automatically mount. If it loads a driver for a device, it will display an icon in the startup sequence with that device's SCSI ID number.

## **HDT Extension**

- For each SCSI ID that the extension loads a driver, it displays the device's ID in an icon at the time of startup. If the icon has a question mark, then either an unsupported removable drive was found, the disk has a foreign driver on it, or the extension could not allocate itself enough memory.
- The Desktop icon representing removables mounted with an HDT Extension-loaded driver is the default icon stored inside HDT Extension (not one chosen by HDT Primer PE).

# Part 5: HDT Prober



*Figure 5.1:* Quickly mounts and inspects SCSI devices

HDT Prober is an easy to use utility that gives you quick access to the following functions:

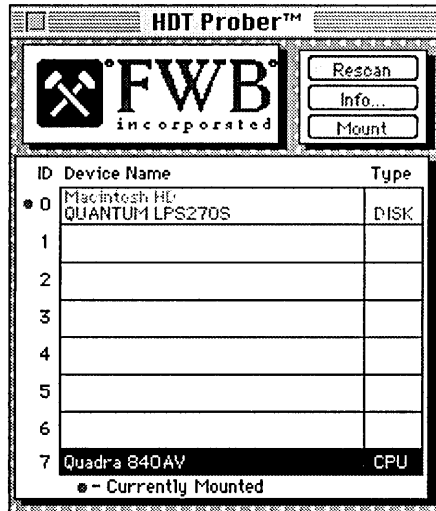
- Scan or reset the SCSI bus
- Mount drives that were turned on after start-up or had been unmounted
- Mount removable-media devices if the cartridge was inserted after start-up
- Get detailed information on drives

Prober can be opened while running other programs. If you are experiencing SCSI communication problems, or have had a drive crash, Prober can reset the bus and possibly fix SCSI communications problems. HDT Prober is a control panel device designed to mount SCSI devices quickly and see what drives are on-line, and is a quick way to scan or reset the SCSI bus, mount drives, and get detailed information on drives.



## Using HDT Prober

1. Select the Control Panel desk accessory from under the Apple menu in the top left corner of your screen. Scroll down the list of cdevs to find the HDT Prober icon and click on its icon. Prober will open and automatically scan the SCSI bus. It then displays the IDs of the drives connected to your Macintosh, including any drives that did not mount correctly or are unmounted. Prober will list the drive by the name of its first partition.



*Figure 5.2: HDT Prober's main window*

2. When you open Prober by opening the control panel and selecting its icon, it will automatically scan the bus and display the addresses and names of all active drives. Drives that are mounted will have a dot next to their ID bar. To see which drives have drivers loaded, press the option key. The mounted dots will now indicate where there is a driver installed.
3. To mount a drive, select it and click on Mount. Prober will mount all partitions on the drive that are defined as automounting. (See page 189 for explanation of Automount.)
4. To get information on a drive, select that drive and click on the Info button. To get more information on the partitions of that drive, hold down the Option key. The Info button will change to More Info. Click on More Info to get detailed information.

## Scanning the SCSI Bus

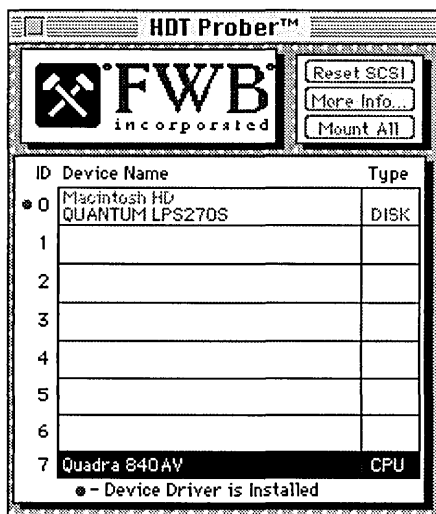
If a connected drive did not show up in the list of devices, click on Rescan. If it still does not show up and the device is powered up, it may be in a frozen state. You can reset the device by holding down the **Option** key, which causes the Rescan button to change to **Reset SCSI**. Clicking on the **Reset SCSI** button will reset the SCSI bus. If this fails, try shutting down your computer and checking all cables and termination.

### To rescan the SCSI bus:

1. Click on the **Rescan** button.

### To reset the SCSI bus

2. Press and hold down the option key. The **Rescan** button will change to **Reset SCSI**.
3. Click on the **Reset SCSI** button (Figure 5.3).



*Figure 5.3: The HDT Prober window (hold down the Option key to change the buttons)*

**NOTE:** On dual SCSI bus machines with SCSI Manager 4.3, e.g., Power Macintosh 8100 and Quadra 900/950 with a PowerPC upgrade card, HDT Primer PE and HDT Prober will display all on-line devices connected to the internal SCSI bus by default. Use the **Next Bus** button (visible while the Command key is pressed) on HDT Prober to display other devices attached to the external SCSI bus.

## Drive Information

Click on the drive's name to highlight it. To get information on the highlighted drive, click on Info... in the upper right-hand corner of the Control Panel window, or double-click on the ID bar for that device.

Prober will give basic information on the drive, including:

- The SCSI ID number
- The manufacturer
- The type of drive (fixed, removable, optical, etc.)
- The block size and total capacity
- The Macintosh partition scheme it uses
- The total number of partitions

To close the information window, click on it anywhere. To get more specific information on the driver descriptors, their addresses, and the partition scheme of the drive, press the Option key. Info... will then change into More Info. Click on this button and a full probe of the drive will result.

## Mounting a Drive

The dots next to the ID bars in the Prober control panel indicate whether the drive is mounted. To mount a drive, click on its ID bar to select it, and then click on Mount in the upper right-hand corner of the window.

Prober will mount all partitions that are defined as automounting. This program will also mount most drives even if they have not been formatted by Primer.

## Device Driver Installed

If you hold down the **Option** key while in the main dialog, the dots for currently mounted drives will change to indicate whether a device driver is installed. This diagnostic function can determine if HDT Extension has correctly loaded a device driver for this SCSI ID. The device driver function can prove especially helpful with cartridge drives. If there is no cartridge in the drive but the device driver is installed, it will mount on the Desktop when you insert a cartridge into the drive.

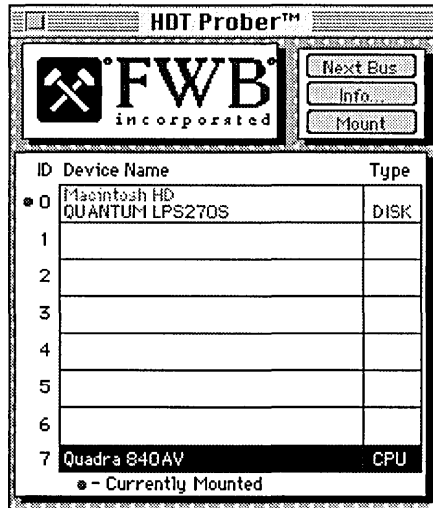
## HDT Prober 'power user' keys:

**Return** = Mount the selected drive

**Arrow keys** = Select a different drive

**Option-Return** = Mount all drives

**Command key** = Select Next SCSI Bus (see Figure 5.4.)



*Figure 5.4: Hold down the command key while the HDT Prober window is up, then click on the Next Bus button to scan for drives on a different SCSI bus.*



# Part 6: HDT Util



*Figure 6.1: The HDT Util™ application*

## HDT Util: for System 6 users only

HDT Util allows you to customize some crucial settings of Apple System Software.

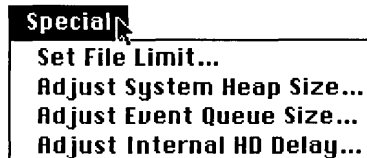
To use HDT Util:

1. Double-click on the HDT Util icon (Figure 6.1).

The HDT Util application becomes active. No dialog box is presented, but the menu bar will change. All HDT Util commands are accessed through the **File** and **Special** menus. Information on these menus and menu commands follows.

## The HDT Util menu commands

### The Special Menu



*Figure 6.2: The Special Menu*

### ***Set File Limit***

Applies to System 6 only. The default value for the number of files that can be open is 40. If you have many partitions being mounted, you should increase this number to allow for the increase in volumes that are open. You must reboot for changes to take effect.

### ***Adjust System Heap Size***

Applies to System 6 non-MultiFinder only. You need to increase the System Heap Size if you are getting system heap errors in HDT Primer™ PE. In the dialog box, enter the new figure for your system heap size. The System heap defaults to 131072 bytes. We recommend increasing the number in 30,000-byte increments, until the program succeeds, any crashing problems subside, or the Finder About window shows a healthy amount of white in the indicator bar. You must reboot for changes to take effect. The minimum value of this should be 196608.

### ***Adjust Event Queue Size***

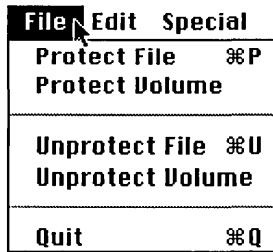
Applies to System 6 only. The event queue stores operating system events. Events include keyboard presses, mouse clicks, and even disk mounting. If you are automounting many partitions, you need to adjust the event queue size to accommodate the larger number of mount events. The default value is 20. This should be adjusted upwards to allow many partitions to mount successfully. You must reboot for changes to take effect.

### ***Adjust Internal HD Delay***

Allows you to set the amount of time the computer waits for an internal drive at SCSI ID 0 to become ready for bootup. (Macintosh II family and newer.)

Older drives often take longer to spin up, which can cause startup problems if it's the boot drive. You can adjust the Internal HD Delay upward to give the device at SCSI ID 0 more time to become ready at startup.

## The File Menu



*Figure 6.3: The HDT Util File menu*

### **Protect File**

1. Choose Protect File in the File menu, or press Command-P.
2. A dialog box will appear allowing you to select the file you wish to protect. Clicking on **Drive** will allow you to switch to other drives.
3. Select the file to protect by double-clicking on it, or by selecting it and clicking on Protect. A window will appear telling you that the file has been protected.
4. The file is now protected against copying in the Finder.

### **Protect Volume**

1. Click on **Drive** until the volume you wish to protect is shown. Check the Applications box if you want to protect only the applications present on the volume and check the Documents box if you want to protect all the non-applications.
2. After the desired options are set, click on **Select** to begin the operation. **Cancel** will abort the process.
3. HDT Util can be halted in the middle of this operation, but certain files will have already been protected. You can unprotect the entire volume to eliminate the protection.

### **Unprotect File**

1. The procedure is the same as protecting a file, except you begin by selecting Unprotect File in the File menu.

### **Unprotect Volume**

1. The procedure for unprotecting a volume is the same as for protecting a volume, except that you begin by choosing Unprotect Volume from the File menu. Again, you will see an indicator as Util notes each file it is unprotecting. When the operation is completed, the following dialog box will appear:





# Part 7: Troubleshooting

Many things can happen to create errors and crashes on your hard drive; power surges or outages, viruses, and system errors are just a few. These errors can corrupt data the Macintosh uses to keep track of the contents of the drive. Depending on what data has been corrupted and how badly it has been corrupted, the result can be barely noticeable or could render your hard drive unusable.

**NOTE:** The **Read Me** file on the original program disk contains late-breaking information that was not available at press time. Please consult the **Read Me** file before continuing.

The following is a list of common problems, their probable causes, and what you can do to correct them. If the proposed solutions fail to correct the problem, reformatting the drive and reinstalling a clean System Folder may do the trick. Remember that formatting will erase all data on the disk. Make sure that the replacement System Folder is not corrupted and has no special INITs or System Extensions in it.

## Section I — Common problems by category

### ToolKit Operation Problems

**Symptom:** HDT Primer PE does not accept the serial number on the back of the floppy disk, saying "The serial number you have entered is invalid."

**Cause:** Serial number not entered correctly.

**Solution:** Make sure you have entered the full serial number on the back of the floppy disk. The form is XX#####X#X, where X represents a capital letter and # represents a numeral. There are no spaces in the serial number. Make sure that you have not entered the numeral "0" (zero) instead of the letter "O" or the numeral "1" (one) instead of the letter "I".

**Symptom:** Using System 6, System Heap space message appears while performing operations in HDT Primer PE.

**Cause:** System Heap space is not adequate.

**Solution:** Use MultiFinder in System 6. It can dynamically increase System Heap space. This will even work on a Macintosh with only one megabyte of RAM. Or, upgrade to System 7. HDT Util provides the ability to adjust system heap size.

**Symptom:** The message "Cannot unmount volume" appears when attempting to test, format, or modify the partitions on a drive.

**Cause:** Busy files on disk, Primer cannot unmount volume.

**Solution:** Switch back to Finder and try to drag the icon of the drive to the trash in order to unmount it. If this does not work, restart with extensions disabled. In System 7, restart while holding down the Shift key until the "Extensions disabled" message is displayed in the "Welcome to Macintosh" screen. In System 6, drag the System and Finder into a folder by themselves and restart the computer.

## Happy Mac Problems

**Symptom:** The Happy Mac appears briefly, then disappears, and a floppy disk icon appears with a question mark.

**Cause:** Bad boot blocks, corrupted System files, or disk data structures.

**Solution:** Run a recovery program; reinstall the Apple system software; update the driver on the hard drive.

**Symptom:** Happy Mac flashes on and off, and the drive does not boot.

**Cause:** The boot blocks or System files have become corrupted.

**Solution:** Run a recovery program; reinstall the Apple system software.

**Symptom:** Happy Mac appears but the drive seeks repeatedly before booting.

**Cause:** A "dirty" shutdown, due to a bomb or power outage. All data structures were not properly updated before shutdown. The Mac sees this upon start-up and re verifies these structures.

**Solution:** None needed, once the Macintosh has verified the structures. You may want to run Apple's Disk First Aid to verify that the disk is in good condition. Use Restart to reboot the computer and Shutdown to turn off the computer.

## Sad Mac

The sad Mac appears when the Macintosh fails one of its diagnostic tests on start-up. The characters below the sad Mac indicate what has gone wrong. For Macintosh Plus and earlier, if the first two characters are "OF," there is a software problem. Any other two characters indicate a hardware failure. For Macintosh SE and later, if the first four characters are "000F," the problem is software, and the last four characters indicate the specific problem. (The error codes can be found in Inside Macintosh or in some public domain programs.)

## Drive Problems

**Symptom:** The drive doesn't spin up and the LEDs don't light up.

**Cause:** No power or a blown fuse.

**Solution:** Check the power cable. Make sure the outlet is active. Check the drive's fuse. If it is burnt, replace it with a fuse having the same specifications. Make sure the fuse is the fast-blow type. If the problem continues or the fuses repeatedly blow, you may have a power supply problem; contact technical support of your drive's manufacturer.

**Symptom:** Multiple icons appear on the Desktop for the same drive. If you have partitioned your drive, there should be a separate icon for each partition that is mounted, but no more.

**Cause:** SCSI ID conflict, usually drive is set to ID 7 or extension.

**Solution:** Make sure that no two SCSI devices share the same SCSI-ID, and that the ID numbers range between zero and six (seven is reserved for the Macintosh). Make sure cabling and termination are OK.

**Symptom:** The drive does not mount.

**Cause:** There are many software or hardware possibilities.

**Solution:** Make sure your drive is properly connected to the Macintosh and properly terminated. Check the SCSI ID of the drive as well as any other devices on the SCSI bus. Use Primer to test the media and update the driver.

**Symptom:** The drive starts to mount, but then crashes. This could have many causes. We explore possible Causes and appropriate Solutions below.

**Cause:** The hard disk's System Folder or the SCSI drivers may have been corrupted by a system crash or virus.

**Solution:** Replace the System Folder on the hard disk first by booting initially off a floppy disk and reinstalling using the Installer. If after the reinstalling the System Folder, the problem persists, use the Primer to update the drivers on the hard disk.

**Cause:** Multiple System Folders on the drive.

**Solution:** Make sure you have only one System and Finder pair on your drive. Find any extra ones using Find File, and delete them. If you try to remove an active System/Finder, you will get an error indicating it is in use. Remove all inactive System and Finder files.

**Cause:** The Desktop file may be corrupt.

**Solution:** Rebuild the invisible Desktop file; hold down the Command (Open Apple key) and Option keys while the computer is starting-up; a dialog box will ask you if you want

to rebuild it, click OK. This does not damage your data, but does remove any file comments.

**Cause:** The Desktop file may be too big. With System 6, disks with Desktop files larger than about 275KB would cause resource manager problems.

**Solution:** Upgrading to System 7 solves these problems as does partitioning the drive.

**Cause:** The Finder may not have enough memory. Under the System 6 MultiFinder, the Finder is normally allocated 160KB. You can see how much memory it is using by bringing up "About The Finder" from the Apple menu.

**Solution:** Increase the Finder's memory partition by doing a Get Info on the Finder. Try allocating 256K or more.

**Cause:** The directory on your hard disk may be damaged.

**Solution:** Repair the directory with Apple's Disk First Aid. Use a recovery program or restore the data from previous backups.

**Cause:** A virus may have infected your hard disk.

**Solution:** Check your hard disk with a virus detection and eradication program.

**Symptom:** A "Disk is full" message appears when the disk is not full.

**Cause:** Invisible or temporary files, or the directory is corrupted.

**Solution:** Run a recovery program or Disk First Aid.

**Symptom:** The drive mounts but cannot be used as a start-up disk.

**Cause:** Bad boot blocks on the disk, or a hardware problem with the drive.

**Solution:** Make sure drive is marked as start-up device in the control panel. Check the hardware connections. Reinstall the System software. Macintosh Plus will only start up off the device with the highest SCSI ID number.

**Symptom:** A dialog box appears saying "This disk is unreadable. Do you want to initialize it?"

**Cause:** Corrupted data structure on the disk.

**Solution:** Do not click on OK; this will erase the data on the disk. Run a recovery program.

**Symptom:** A dialog box appears saying "This is not a Macintosh disk. Do you want to initialize it?"

**Cause:** Corrupted data structure on the disk.

**Solution:** Do not click OK; this will erase the data on the disk. Run a recovery program.

**Symptom:** A dialog box appears saying "This disk needs minor repairs. Do you want to repair it?"

**Cause:** The Desktop file has become corrupted due to abrupt shutdown.

**Solution:** Click OK. The Macintosh will rebuild the Desktop file.

## Removable Media

**Symptom:** The drive does not mount.

**Cause:** Incorrect SCSI ID, faulty cabling, or an inappropriate cartridge.

**Solution:** Make sure the cabling and SCSI ID of the drive are correct and secure. Make sure the cartridge is formatted for the Macintosh and contains valid data. If you have not installed the HDT Extension in your boot drive's System Folder and you booted up without a cartridge in the drive, you need to mount the cartridge by running Primer or from within the Prober control panel device.

**Symptom:** Light is flashing in the front of drive without media inserted.

**Cause:** Hardware problem.

**Solution:** If termination and cabling are correct, the drive may have a hardware problem. Contact the drive manufacturer.

## File-Oriented Problems

**Symptom:** Errors reading or writing files in the Finder; "Some files couldn't be read/written and were skipped" message.

**Cause:** Cabling or termination problems. Bad blocks on the media.

**Solution:** Check for proper cabling and termination. Use Primer to test the drive for bad blocks and to remap them or reformat the drive. Try reformatting the disk.

**Symptom:** A file cannot be opened from within an application.

**Cause:** The file is corrupted. The application is the wrong version for the file. The file type code is incorrect.

**Solution:** Check the Get Info box on the file. Reinstall the application. Check the application for version compatibility.

**Symptom:** The parent application cannot be opened by double-clicking on the file icon.

**Cause:** The Desktop file is corrupted. The application is corrupted or missing. The file's type code is inconsistent with the application or its bundle information is erroneous.

**Solution:** Reinstall the application. Rebuild the Desktop file.

**Symptom:** A file cannot be thrown away or the trash cannot be emptied.

**Cause:** The file or folder is busy, locked, or protected. There is an invisible file in the folder. The directory is corrupted.

**Solution:** Close and unlock the file or folder. Rebuild the Directory. Restart and try throwing it away again. Run recovery program.

**Symptom:** A folder cannot be renamed.

**Cause:** A locked disk. The Directory is corrupted.

**Solution:** Unlock the disk. Run a recovery program.

**Symptom:** A folder takes a long time to open.

**Cause:** Too many files in folder. The Desktop file is corrupted.

**Solution:** Reorganize the folder hierarchy. Rebuild the Desktop file.

**Symptom:** Programs bomb when launched.

**Cause:** Corrupted application or INIT conflict.

**Solution:** Reinstall the application. Turn off all INITs and re-boot.

**Symptom:** The icons appear and then disappear or become generic icons.

**Cause:** The Desktop file has become corrupted.

**Solution:** Rebuild the Desktop file by restarting and holding down Command and Option keys until asked if you want to rebuild the Desktop.

**Symptom:** A file or folder disappears.

**Cause:** The directory has become corrupted.

**Solution:** Run Disk First Aid or a recovery program.

**Symptom:** Files and folders appear with garbage names.

**Cause:** Cabling and or termination problems.

**Solution:** Immediately TURN OFF the computer and check cabling.

## **System Bomb**

**Symptom:** The Bomb System Error Dialog box appears.

**Cause:** This can be caused by many software problems including conflicts with an INIT, too little system heap, or another application.

**Solution:** Attempt to restart the system. If the bomb continues, check for free system heap space, disable INITs or System Extensions, and reinstall the software. System error code

descriptions are available in public domain programs or in Inside Macintosh.

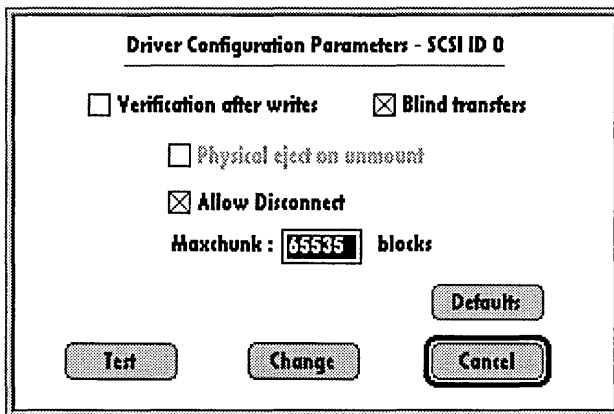
**Important:** Make sure you have disabled all System extensions before performing any operations with HDT Primer PE. In System 7, this can be done by holding down the shift key at startup until the "Extensions disabled." message appears; in System 6, this can be done by dragging the System and Finder into a folder by themselves and restarting.

## Turning off Blind transfers

You may have to configure the HDT driver for some drives or drive hardware that are not completely compatible with the high-performance capabilities of the HDT driver. For example, Daystar's Turbo 040 accelerator boards do not support blind transfers. Users of Daystar's Turbo 040 accelerator boards will need to turn off the blind transfer mode of the Hard Disk ToolKit•Personal Edition driver, which is on by default.

To turn off the Blind Transfer mode:

1. Simultaneously hold down the **command**, **shift**, and **option** keys while selecting the **Update driver** menu item. A dialog box will appear (Figure 7.1.)



*Figure 7.1: Blind transfer mode is deselected in this dialog box.*

2. Click on the **Blind transfers** check box to deselect it. Do not change any of the other parameters. (Any inadvertent changes made to the other parameters available in this dialog box can be reset to their default settings by clicking on the **Default** button.)
3. Click on the **Change** button. Restart your computer to make this change take effect.



## Section II — Frequently asked questions

The FWB technical support department has compiled a list of its most frequently asked questions. The questions, along with comprehensive answers, are presented in this section.

### **What are blind transfers? How and when should I turn them off?**

In Blind Data Transfer mode, the CPU allows the SCSI chip to oversee transfers, freeing the CPU for other tasks. The CPU checks in only once before a block of data is transferred, requiring constant timing of the computer rather than a polling method, where the CPU would have to check for a Request/Acknowledge handshake with every byte transferred. The polling method requires more CPU time, so blind transfers complete much faster.

You should turn blind transfers off when the device is not fast enough to keep up, has irregular timing with the SCSI chip, or when using Daystar™ or other third party CPU accelerators that are incompatible with blind SCSI transfers. See **Turning off Blind transfers** on page 217 for more information.

**NOTE:** In the TEST function of HDT Primer PE, you may notice that the test will say BLIND TRANSFERS: ON. This just means that they are automatically used for the test. It doesn't mean that blind transfers are used for the driver.

**When I format my drive, I get a message that says "Generic Mode Enabled Successfully." What does that mean?** "Generic Mode" means that the drive model you are using has not been fine tuned by FWB's engineering department. FWB's drive engineers configure the mode pages (or Mode Page parameters) of each drive we receive for maximum compatibility and performance. Every drive listed on the "Supported Devices" list has been evaluated by the drive engineering team at FWB.

New drives are released every week and FWB receives many from vendors wishing our support. In most cases, if a device is not specifically supported, you will be able to format it in Generic Mode and experience no problems at all. FWB will send generic (i.e. default) parameters to the drive. As new drives are released, we add support as soon as possible.

**Formatting aborts with an error, and pressing "Details" gives data like, "SCSI Error/Check Condition/Sense Key/No Additional Sense." What does this mean? Should I be concerned?**

SCSI Error/Check Condition...is how a drive tells your computer that something is wrong. The message is not generated by HDT•PE, but by the drive directly. If the details lists "MEDIUM ERROR" or "HARDWARE ERROR," this can be a notification that there is a mechanical problem with the drive or a bad cartridge/optical.

### **What are the differences between FORMAT and INITIALIZE?**

A format (referred to as low-level format) in HDT Primer PE:

- Sends a message to the drive to make sure that it is fully spun up and ready to be accessed
- Sends Mode Page Settings to the drive, which are parameters that define the settings (i.e., size of the cache, unit attention, etc.) the drive will use
- Sends the FORMAT UNIT command to the drive. The drive goes through each and every block and usually sets it to 0 (zero). If the drive detects a bad block, it will remap it. If there are any unrecoverable errors during the format, the format will abort with an error and you will get DETAILS on the error.
- Displays a window, when the drive is done formatting all of the blocks, that says "Format Completed Successfully. Choose Partitioning method"

INITIALIZE (referred to as high-level format) in HDT Primer PE:

- Writes a partition map to the drive (a partition map defines how many partitions can be made) into its own special partition
- Writes a driver in a special partition
- Creates the HFS (Hierarchical File System) partitions (what you normally see on your desktop). The number and size depend on what partitioning method is chosen in HDT Primer PE.

### **I keep getting a message saying that it is an invalid serial number. Why won't my serial number work?**

Make sure that you enter information into the **name**, **company** and **serial number** fields. Name and company must have AT LEAST two characters. If you don't have a company, then put your first name in the NAME field and your last name in the COMPANY field. There are no spaces in the serial number. See **Section III —Personalizing your copy of Hard Disk Toolkit•Personal Edition** on page 174 for more information.

### **When I try to access a drive in HDT•PE Primer, it says that there are files open. I don't think there is anything open. Why can't I access the drive?**

File sharing is probably turned on, you booted off of or are running an application off the drive, you have an extension which is accessing something on the drive. Quit out of all applications, then choose restart under the Special menu. When you hear the Mac chime, hold down the SHIFT key. This will turn extensions off. Try your task in Primer again. Remember if the drive needs to be unmounted at any time, you can't be running HDT Primer PE or booting off of the drive you are trying to modify. Create a bootable floppy and boot from it.

**I have an OEM version. Why can't I get technical support directly from FWB? What do I have to do to get a registration upgrade? What does that entitle me to?**

FWB sells the HDT•PE OEM (Original Equipment Manufacturer) software to other vendors to bundle with their drives. You receive it with another company's hard disk, Syquest, or Optical drive (there will be a sticker on the manual that says "OEM Version, Not for Individual Sale"), and that company provides technical support. If you would like technical support directly from FWB, you can purchase a Registration Upgrade for \$29; this includes new disks with the latest version of the software, a new serial number, and a registration card. There are no exceptions to OEM support, you must upgrade for FWB support.

**Are there any known incompatibility issues with HDT•PE and third party products?**

Not very many. FWB is an industry leader in the Macintosh market for driver software. Most companies test with Hard Disk ToolKit, but from time to time some incompatibilities may occur. If you are using a PowerMac or AV computer, you cannot use Stac Electronics Stacker with HDT•PE. If you have versions of HDT•PE prior to 1.5.1 and more than 32MB of RAM installed, there is a problem with Norton Utilities Speed Disk v. 3.1. Please upgrade your HDT•PE to the latest version before using Speed Disk. Please refer to the "Readme file" included on your disk for a list of any other known problems.

**My removable doesn't mount on the Desktop when I insert them into my drive. How can I get it to mount?**

Removable media (Syquest/Bernoulli/Optical) do not automatically show up on the Desktop unless:

- You boot up your computer with an initialized cartridge/optical in the drive
- You have a removable extension, like HDT Extension, installed in your System Folder.

When you first turn on your Macintosh this is the sequence in which items are loaded.

1. RAM check
2. ROM code loads
3. Drivers (including SCSI drivers are loaded)
4. System loads
5. Extensions load
6. Control Panels load
7. Finder (or desktop) loads

SCSI drivers are normally loaded right off of the media before the System Software loads. To put in a cartridge after the system has loaded and have it show up, you need to have a convenience extension, such as HDT Extension, that polls your removable drive every few seconds to see if a cartridge/optical has been inserted.

If you are having problems mounting cartridges/opticals you should check to see if there are any other extensions in your computer's Extension or Control Panel folders that are trying to control removable disks, or make sure that the cartridge is not formatted for DOS systems.

You can experience problems when multiple programs are trying to mount and control the same removable drive. Try restarting with your extensions turned off (by holding down SHIFT key at bootup) with the cartridge/optical in the drive. Does it mount up on the desktop? Can you mount it manually with HDT Primer PE by choosing that drive and clicking the MOUNT button? If it shows up, then you probably have an extension conflict. Common culprits are DOS Mounter, SCSI Probe, PLI init, and any other extension included with other removable drives. Remove all but HDT Extension. If you still have problems, try another cartridge/optical or run HDT Primer PE and then insert the cartridge.

**Every time I insert my optical disc into the drive, it takes a second and then ejects it right back out. Why?**

While some opticals are listed as being pre-formatted, they are usually not initialized. The HDT Extension is trying to mount it, but because it hasn't been initialized, there are no partitions to mount. To initialize, restart and turn your extensions off, then open the HDT Primer PE software, select the MO drive, and then initialize the optical disk.

**Why do I have SCSI problems with System 7.5 or SCSI Manager 4.3 compliant machines like PowerMacs/AVs?**

If you are having SCSI problems and are running System 7.5, FWB recommends that you disable the SCSI Manager 4.3 Extension. The problems are widespread and are occurring with all SCSI vendors and software drivers. Apple is working to resolve these issues, The SCSI Manager built into the Macintosh ROM does not seem to exhibit the same problems and is fine.

The new SCSI Manager built into the PowerMac and AV computers is very advanced. It uses complex SCSI commands for more efficient SCSI transfers. However, the general Mac market has found that it seems to be more susceptible to problems on the SCSI chain than the previous SCSI Manager. Make sure that your computer has good quality SCSI cables and that all devices on the SCSI chain are turned on. If you have devices turned off, but plugged into the chain, termination power levels may drop below 2.5 volts, which can cause symptoms such as hangs on large copies, problems booting up or loading the finder and applications hanging on large writes to any device on the SCSI chain. If you are experiencing SCSI problems, check your cables, try an active terminator, try disconnecting all external SCSI devices and then adding them one by one to see if you can isolate a particular device or cable that may be causing the problems on the SCSI chain.

**After I format a drive and I choose the partitioning icon, why does initialize cause a hang on the computer, or the**

### **beach ball just spins and spins?**

This can usually be attributed to problems on the SCSI chain causing a reset and hanging the SCSI bus. Rebooted with extensions off and check your SCSI chain for cable or termination problems.

### **Why can't I see my drive in HDT Primer PE or HDT Prober?**

If you are using a Quadra 900/950 with a PowerMac Upgrade Card or running SCSI Manager 4.3 extension on a PowerMac 8100, PowerMac 8150, or PowerMac 9150, you have 2 (two) SCSI buses. The internal drive is usually on Bus 0 (internal). The internal CD-ROM drive, any drives in the second drive bay and all external devices are usually on Bus 1 (internal/external). To see these devices on HDT Primer PE, choose **Bus 1** (internal/external) from the **SCSI bus** menu. To see Bus 1 in HDT Prober, hold down the COMMAND key; the RESCAN button will turn into NEXT BUS. Click on that button and it will scan Bus 1.

### **Why do I get "this is not a Macintosh disk" on my computer and my hard drive/removable doesn't show up?**

There may be an extension trying to control your removable device other than the HDT extension. Try re-starting with your extensions off and mounting the cartridge with HDT Primer PE. If it still has problems mounting the drive or if you still get "this is not a Macintosh disk" the file directories of the drive/cartridge/disk may be corrupted. Scan it with a file recovery program like Norton, Public Utilities, MacTools or Disk First Aid.

### **The message "there is not enough contiguous partitionable free space" appears. What does that mean?**

**When attempting to update my driver HDT Primer PE asks me if I would like to try shrinking an existing HFS partition. I click "Yes" and it says that there is not enough free space. I have a lot of space available on my drive, what does this mean and how can I get around this to install or update my driver?**

There is not enough space for where the driver needs to be installed or expanded.

If there is not enough unpartitioned (or Free Space) available to update or install a driver, HDT•PE will try to shrink an HFS partitions just a little bit to accommodate the space needed. If there is any data on the outer edge of the partition that HDT•PE is trying to shrink, it will say that it is not able do so. To circumvent this problem:

- Run a disk optimizer (like Speed Disk). It will try to move the data from the outer edge of the partition to the middle.
- The software called "File Saver," which is included in Norton Utilities, sometimes saves it's file on the outer edge of the main HFS partition. Try turning it off.
- Shrink the partition by clicking on PARTITION and then choosing a partition and clicking on the MODIFY button. Reduce the size and then click change. **BACK UP YOUR DATA FIRST!**

**When I try to format my cartridge, I get a SCSI error which says that it is write protected, I've checked the lock and it's not locked. What is wrong?**

Syquest drives can only format the cartridges which they are intended for. For example, the 200MB 5 1/4" drive (or SQ5200X) can only format the 200MB (SQ2000) cartridge. It cannot format the 88MB (SQ800) or 44MB (SQ400) cartridges. This is a limitation of the hardware.



# Glossary

**Address**

The ID number of a device on the SCSI bus,.

**Backup, Back-up (verb, noun)**

To make duplicates of files on a separate medium; the duplicated data itself.

**Bit**

Bit is a contraction formed of 'binary' and 'digit'; all computer information is represented as a unique combination of the binary digits 0 and 1, which are also called 'ons' and 'offs.'

**Blind Data Transfer**

Data transfer that forgoes request/acknowledge handshakes and thus is much faster than regular data transfer.

**Block**

The smallest "chunk" of memory accessed or transferred by the disk drive. Usually 512 bytes in size, it can be larger in multiples of 512. The number of bytes in a block is the same as block size.

**Buffer**

A temporary storage area for data being transferred from one place in the computer system to another. When accessing a single sector, the controller may read the entire track and store it in a buffer.

**Bus**

A means of transferring information usually referring to a set of wires.

**Byte**

A group of eight bits. The basic unit of information.

**Cache**

Similar to buffer but more configurable. Cache can reside in RAM or on the drive's controller. It is used to store and quickly transfer recently used data.

**Central processing unit, or CPU**

The brains or 'central switching station' of any computer.

**Controller, or Controller Board**

Circuitry, usually built into a drive, that interprets signals between the host and the peripheral; it acts upon these commands, thus providing the device with 'intelligence.'



**Data Error**

Any discrepancy between recorded data and recovered data.

**Defragment**

To reorder the files on a platter so that all the sectors of each file are contiguous, which results in improved access times. (See Fragmentation.)

**Device-independent**

Operating at the systems level and not requiring specific customization to run.

**Drive, Hard Disk**

A data storage device that employs one or more rigid disks as the medium.

**Drive, or Disk Drive**

The physical components necessary to transfer data to and from the recording medium.

**Driver, or Device Driver**

The software program that translates commands between the Macintosh's operating system and the SCSI device.

**Formatting**

The process of preparing a disk for use. The drive maps the disk into blocks, sectors, and tracks. Bad blocks are marked and placed on a defect list.

**Fragmentation**

Fragmentation occurs when your computer writes a file to your hard disk and puts the pieces in different physical locations on the disk surface. This can occur for a variety of reasons. Over time, more and more files become fragmented. The disk mechanism works harder to read fragmented files, increasing wear and tear. Plus, it takes longer to read fragmented files.

The solution is to defragment your disk. You can back up all your files, re-initialize the disk (initializing will erase all data on the disk), reallocate partitions, and recopy the files onto the disk. This will eliminate fragmentation because the files will be recopied onto the disk in contiguous sectors.

**Gigabyte (GB)**

1024 Megabytes or 1,073,741,824 bytes.

**ID, SCSI**

A device's unique address on the SCSI bus is referred to as its ID, or identification.

**Initialization**

The process of laying down directory information the operating system needs to locate files and folders. Usually destroys only directory information, not the actual data, so that

recovery program can still recover files from initialized disks.

### **Inside Mac IV and V**

Technical manuals provided by Apple. Also used to denote partitioning schemes.

### **Intelligent**

Refers to a device capable of processing commands on its own.

### **Interface**

The go-between that provides a common basis for communication between two otherwise incompatible devices.

### **Kilobit**

One thousand bits (actually 1024).

### **Kilobyte**

One thousand bytes (actually 1024).

### **Logical Unit**

A physical or virtual device that is addressable as a target.

### **Logical**

An abstract representation of something that physically exists.

### **MB/s**

Megabytes per second. Equal to 8 Megabits per second.

### **Mb/s**

Megabits per second. Equal to 1/8 or 0.125 Megabytes per second.

### **Megabit**

One thousand kilobits (actually, 1024 Kb).

### **Megabyte**

One thousand kilobytes (actually, 1024 KB).

### **Mount**

To appear on the Desktop; that is, to show an icon on-screen.

### **Nibble**

A half-byte, or four bits, of data.

### **Partition Map**

A map detailing the layout of the medium, which the operating system and drivers use to find partition locations.

**Partition**

A portion of a storage area allocated to a particular use or user.

**Peripheral**

A device that is attached to the computer, either directly or via the bus.

**Proprietary**

Vendor-unique technology or devices that are incompatible with other products in the industry.

**RAM, or Random Access Memory**

Temporary memory usually found on single in-line memory modules (SIMMs) on the motherboard of the computer. RAM is lost when power is turned off.

**ROM, or Read-Only Memory**

Permanently stored data in the computer memory. Also refers to storage media that may only be read (not erased or written to.)

**SCSI Manager**

The SCSI Manager is part of the Macintosh Operating System that provides the interface between a program such as a driver or formatter and the actual hardware SCSI port.

**SCSI**

Small Computer Systems Interface. A standard interface via which computers and their peripherals communicate with each other.

**Sectors**

Sectors are the smallest subdivisions of tracks, and usually contain exactly 512 bytes of data.

**Tape Drive**

A type of storage, similar to an audio tape recorder, that stores data on a magnetic tape. Tape drives are usually used for data back-up.

**Tracks**

invisible magnetic "grooves," in the form of concentric circles that store data on a platter. Each track is a single line of magnetic domains.

**Volume**

Also known as a partition. Represented by an icon on the Desktop and used to store files and folders of information.

**Word**

A set of two bytes.

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A special configurable extension allows mounting of removable or slow disks through delayed device scanning.

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.....  
•

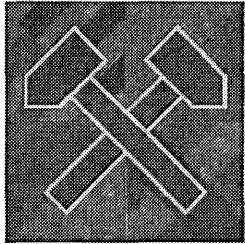
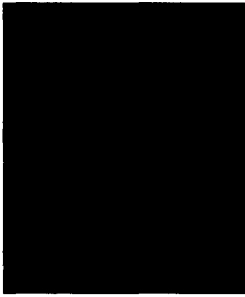
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## CD-ROM ToolKit User Guide

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## **Credits**

This manual was written by Stuart Saraquse, James Merkle, Robert Seretny, Alex Lau, Mike Michelletti, and Norman Fong.

Electronic publishing expertise was provided by Bruce Dundas.

The CD-ROM ToolKit program was written by James Merkle.



# Section I — Introduction

Thank you for purchasing FWB's CD-ROM ToolKit! CD-ROM ToolKit consists of a high performance SCSI CD-ROM device driver, an integral caching utility for CD-ROM drives, and an application for playing audio CDs.

CD-ROM ToolKit's universal device driver allows most SCSI CD-ROM drives to communicate flawlessly with your Macintosh. The caching module works in the background to make CD-ROM drives access data faster. The CDT Remote application provides a convenient way to access audio CDs on your Mac.

## Before You Begin

The Read Me First file on the CD-ROM ToolKit disk contains late-breaking information that was not available when this manual was written. Please open this file if you have any questions that are not addressed in this manual. This manual is divided into the following sections:

### I. Introduction

This is a brief explanation of what CD-ROM ToolKit is and what it can do for you. It also outlines the minimum hardware and software configuration.

### II. QuickStart

Quick overview of the main features and basic installation of CD-ROM ToolKit. This section is designed for advanced users who are familiar with Macintosh software.

### III. Installation and Removal Specifics

Provides step-by-step instructions for installing or removing CD-ROM ToolKit on your system.

### IV. Instruction Guide

Complete descriptions of each component of CD-ROM ToolKit, as well as detailed instructions for every function and option.

### V. Troubleshooting

Identifies problems you may encounter while using CD-ROM ToolKit, and offers solutions. A list of error messages and appropriate responses are included.

### VI. Technical Information and Tips

Important information and tips on devices, CDs, digital audio extraction, AIFF files and a variety of other topics of interest to CD-ROM ToolKit users.

## **VII. Glossary**

Important and frequently used terms are explained.

## **VIII. Index**

All relevant topics are cross-referenced for quick access.

## **What is CD-ROM?**

CD-ROM stands for Compact Disc-Read Only Memory. It's based on the popular Compact Disc format, best known for storing digitally-recorded sound. In addition, compact discs are capable of storing up to 650 Megabytes of computer readable information equal to over 250,000 pages of text.

CD-ROMs can be written to only once, but can be read from many times. In some ways, this is a disadvantage when compared to other optical storage media. However, the fact that new data can not be added to a standard CD-ROM makes them ideally suited for distributing large amounts of unchanging information. Because they can be pressed in large volume at a low per unit cost, CD-ROMs represent one of the most cost effective storage mediums available.

Software and book publishers have found CD-ROMs to be perfect for distributing large amounts of data such as encyclopedias, dictionaries, games, collections of public domain software and clip-art. Use of CD-ROM has recently been expanded to include application software, documentation, training and support materials, periodicals, entertainment, and digital photographs.

CD-ROMs can now be recorded by anyone using relatively inexpensive CD Recorders. This recent technology also allows you to produce a music CD in much the same way that the pros do it.

CD-ROM drives can tell the difference between audio information and other data. They can play music through headphones or an amplifier and pass other data on to the computer for processing.

## **Why CD-ROM ToolKit?**

Perhaps the most frequent complaint with CD-ROMs is that access times and data transfer rates are slower than other means of mass storage. In other words, it takes a long time to find information on a disc, and to get the information from the disc to the computer.

CD-ROM ToolKit helps alleviate this problem in two ways. First, CD-ROM ToolKit provides a highly efficient SCSI device driver that supports all popular CD-ROM drives and

data formats. Second, CD-ROM ToolKit performs driver-based caching using your hard disk and RAM as a cache, which allows information on the CD-ROM to be accessed much faster.

CD-ROM ToolKit accomplishes this by caching important file and folder information from a CD-ROM onto your hard disk. Requests for data, such as those made when finding files and opening folders, can now take place ten to twenty times faster. CD-ROM ToolKit's unique read-ahead caching delivers improved transfer rates for most CD-ROM drives by intelligently anticipating what information is needed next and placing this data in a temporary buffer on the hard disk or RAM. When the Macintosh requests this data, it is available instantly.

The CDT Remote program allows you to play audio tracks through headphones or an amplifier. It includes sophisticated features such as fast forward and shuffle play and allows digital audio extraction, which is explained later in this manual.

CDT Remote supports Compact Disc and Graphics (CD+G) media (also known as CD Karaoke titles). These special CDs usually offer lyrics and video to accompany music.

In addition, the device driver included in CD-ROM ToolKit allows you to access all the most popular CD formats, including Kodak Photo CD, Macintosh HFS, ISO 9660, High Sierra, and ProDOS discs.

CD-ROM ToolKit includes custom support for most SCSI CD-ROM drives. CD-ROM ToolKit is compatible with most of the newest CD-ROM drives and improves performance even on these faster devices.

Many of these newer drives now include the ability to read "multisession" discs (such as Kodak's Photo CDs). These multisession discs are unique because they can be written to more than once. The "secondary" writes are essentially written after the first. To read these secondary writes requires special CD-ROM drives that are multisession compatible. CD-ROM ToolKit supports most multisession hardware available. Please consult the list of supported devices in the "Supported Devices" file on the original CD-ROM ToolKit program disk.

## **Registration**

Please take a moment to complete the registration card and mail it to FWB, Inc. so we can inform you of changes or updates to CD-ROM ToolKit.

## Hardware and Software Requirements

- Macintosh Plus or better
- System 6.0.4 or better (System 7.x recommended)
- Four megabytes of RAM or greater (more is helpful)
- A supported SCSI CD-ROM drive
- Disk caching requires 1 to 3 MB of free contiguous hard disk space (more is helpful)

If you are unsure whether your CD-ROM drive is supported by CD-ROM ToolKit, please consult the "Supported Devices" file on the original program disk. If you have a drive that is not supported, please contact FWB to let us know what model it is, so that we can add support for it in the future.

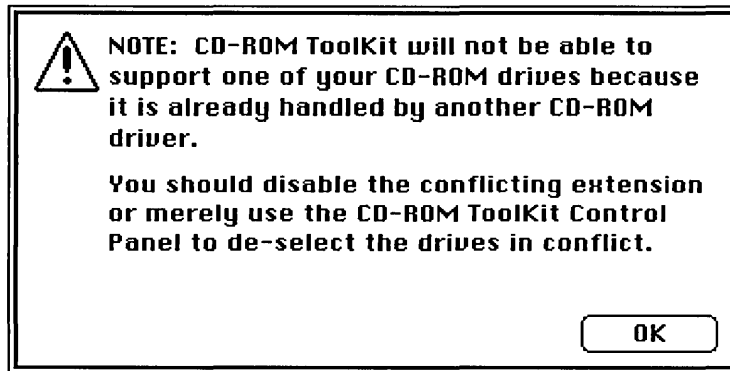
Before using CD-ROM ToolKit, you should already be comfortable using the Macintosh environment. If you need to familiarize yourself with the terminology and operations common to all Macintosh programs, please consult the manuals and other materials that were supplied with your computer.

## Removing Old Driver Software

CD-ROM ToolKit contains special software that enables your CD-ROM drive to communicate with your Macintosh. This software is referred to as a device driver and must be installed on your Macintosh to use CD-ROM ToolKit.

If you already own a CD-ROM drive and have used it before on your Macintosh, then you already have driver software installed on your computer. That software will conflict with CD-ROM ToolKit, preventing it from loading. It is necessary to remove or replace any existing CD-ROM device driver on your Macintosh in order to use CD-ROM ToolKit's

high performance device driver.



*Figure 2: Extension Conflict Message*

If you are using a new CD-ROM drive with your Macintosh for the first time or CD-ROM ToolKit was included with your CD-ROM drive, you may skip to the QuickStart section.

If you have an Apple or another third party CD-ROM driver already installed on your computer, it should be disabled by removing it from your System Folder. The driver will be replaced by the one in CD-ROM ToolKit. System 7.x users will usually find the CD-ROM device driver in either the Extensions Folder or Control Panels Folder inside the System Folder. System 6 users will find the device driver in the System Folder itself. See the list (Figure 2) of common device driver names to help you locate the file. Please note, this list is for information only and is not meant to be exhaustive. If you have problems locating your CD-ROM driver software, check with the manufacturer of the CD-ROM drive you have.



<b>Manufacturer</b>	<b>File Name</b>
Apple	Apple CD-ROM; PowerCD Extension
CD Technology	COTECH 1.x.x
Casa Blanca Works	Drive7Rem; DriveCD
Charismac	CD-ROM Extension; AutoCache Extension; TurboCD™-ROM Init; Anubis™ CD-ROM
Chinon	CDINIT (Mac Plus); CDINIT (Mac II)
Corel	~CorelSCSI
Insignia	RapidCD
MetroCD	MetroCD INIT 1.x.x
NEC	NecCDDrvr
OAC	Spirit™CD
PLI	PLJCDDrvr
Pioneer	CLD Access
Trantor	TSLCDDrvr
Toshiba	Toshiba CD-ROM Driver 1.x.x

*Figure 3: Common device drivers, by manufacturer*

After locating the file, disable it by dragging it out of your System Folder or dragging it to the Trash. It is unlikely you will need this file again, but it is recommended that you maintain a back up copy just in case.

In addition, the latest version of Apple's Foreign File Access software is included as a courtesy to you. It is used by the Macintosh to mount Audio, ISO, and Photo CD discs. If you are not using the most current version, remove the old files and replace them with the included files.

## Section II — QuickStart

If you are already familiar with operating a CD-ROM drive and your Macintosh, you may find the following instructions sufficient to use most of CD-ROM ToolKit's features.

### Basic Installation

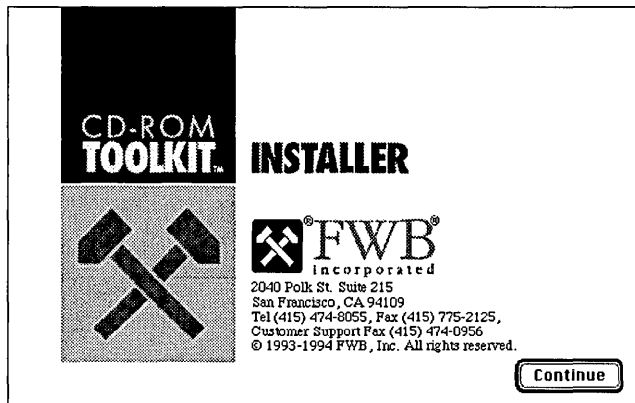
If you have been using your CD-ROM drive with your Macintosh prior to installing the CD-ROM ToolKit, you must disable any previously installed driver software before installing the ToolKit's device driver.

To disable Apple's or any third-party device driver, simply drag the file out of the System folder and restart your Macintosh. Please refer to Installation and Removal Specifics for additional information on this procedure.

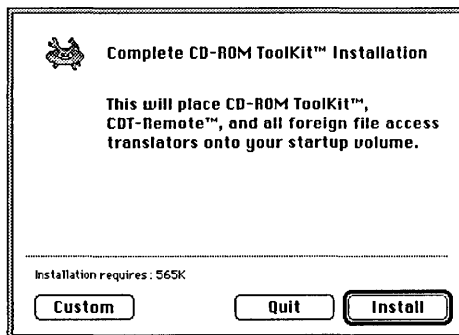
**NOTE:** Before proceeding with the installation, restart your computer with all extensions off, making sure to disable any virus protection software.

Begin the installation by inserting the original CD-ROM ToolKit diskette in your floppy drive. Now simply double click on the "CD-ROM ToolKit™ Installer" file located on the CD-ROM ToolKit disk.

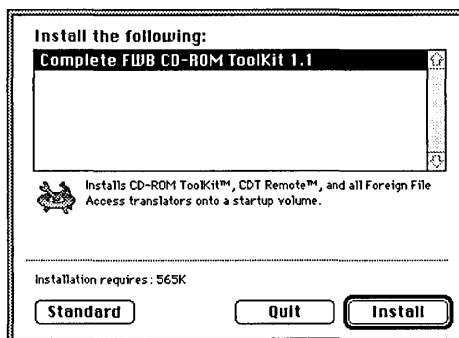
You will be presented with the CD-ROM ToolKit™ Installer window. Click the Continue button. You will have the option of choosing Standard installation, Custom installation, or quitting the Installer.



*Figure 4: Installer screen*



*Figure 5: Standard Installation Dialog*



*Figure 6: Custom Installation Dialog*

The **Standard** installation will place CD-ROM ToolKit directly into the Control Panels folder, CDT Remote into the Apple Menu Items folder, and Audio CD Access, Foreign File Access, High Sierra File Access, ISO 9660 File Access into the Extensions folder inside your System Folder.

The **Custom** installation will allow you to choose which components you wish to install.

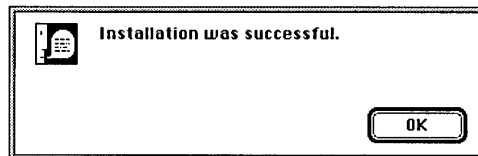
We recommend the Standard installation, as it will properly install all of the components

necessary to properly run CD-ROM ToolKit:

- Audio CD Access, Foreign File Access, High Sierra File Access, and ISO 9660 File Access will be placed into your Extensions folder
- CD-ROM ToolKit™ will be placed into your Control Panels folder
- CDT Remote™ will be placed into your Apple Menu Items folder
- Read Me files will be placed into the installer-created folder labeled "CD-ROM ToolKit Extras"

**NOTE:** If you are using System 6.0x, all system files will be placed into your System Folder, and CDT Remote and the Read Me First files will be placed into a newly-created folder called "CD-ROM ToolKit Extras".

When the installation has completed, click OK in the completion dialog (Figure 6). Eject the original CD-ROM ToolKit disk. Store the original program diskette in a safe place.

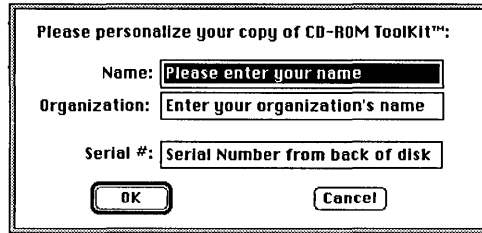


*Figure 7: Installation Completion Message*

After restarting your computer, the CD-ROM ToolKit icon should appear briefly at the bottom of your screen while the "Welcome to Macintosh" banner is displayed.

Open the Control Panels folder from the Apple Menu. Locate and double click on the

CD-ROM ToolKit icon to launch the Control Panel and personalize CD-ROM ToolKit.



*Figure 8: Personalization Dialog*

## Personalizing CD-ROM ToolKit

The first time you run it, the Control Panel will ask you to enter your name and the program's serial number in the Personalization dialog (Figure 7). The serial number can usually be found on the back of the CD-ROM ToolKit program disk. The Control Panel will not run until a valid serial number has been entered.

If you receive an "invalid serial number" message, make sure that the number has been entered correctly. The format of the serial number will appear as follows: ZZXXXXXXXX, or ZXXXXXXXX, where Zs are letters and the Xs are numerals. Do not enter any spaces. Make sure that you have installed the Control Panel before attempting to enter the serial number.

If you receive the message: "Unable to change settings because your System Folder is locked", CD-ROM ToolKit will not load because your System volume is write-protected. You must turn off write protection of your System Folder so the serial number can be recorded to CD-ROM ToolKit. Changing CD-ROM ToolKit's default settings also requires that write protection is disabled.

After the serial number has been entered, the Control Panel will appear on your screen. The top section displays a list of devices attached to your computer. The lower portion of the Control Panel allows you to customize the default settings for acceleration.

After installing the software, CD-ROM ToolKit will automatically load into memory

every time you start your computer.

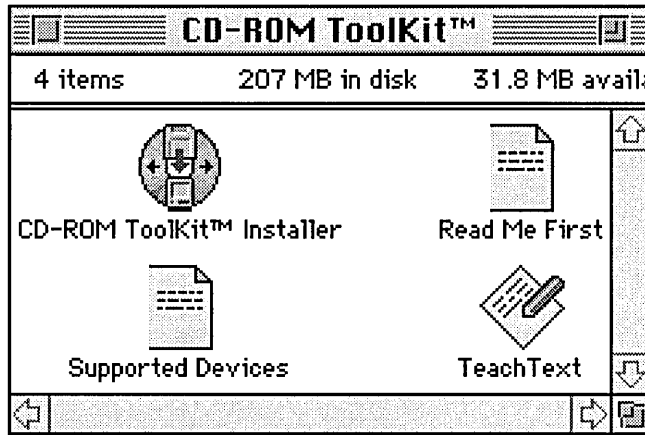
## **Congratulations!**

You have completed the CD-ROM ToolKit installation. While it is not absolutely necessary to read the rest of this manual, we suggest that you refer to "Section IV - Instruction Guide" to get full enjoyment from CD-ROM ToolKit.

## Section III — Installation and Removal Specifics

### Installing CD-ROM ToolKit

CD-ROM ToolKit is shipped on a single floppy disk. The disk contains the CD-ROM ToolKit Installer, Read Me First and Supported Devices files. The Read Me First and Supported Devices files are text files which may be viewed or printed by running TeachText, which is provided for this purpose.



*Figure 9: Contents of CD-ROM Toolkit Disk*

**NOTE:** Before proceeding with the installation, restart your computer with all Extensions off, making sure to disable any virus protection software.

Begin the installation by inserting the original CD-ROM ToolKit diskette into the floppy drive. Double click on the "CD-ROM ToolKit™ Installer" file located on the CD-ROM ToolKit disk.

You will be presented with the CD-ROM ToolKit™ Installer dialog. You will have the option of choosing Standard installation, Custom installation, or quitting the Installer.

The **Standard** installation will place CD-ROM ToolKit directly into the Control Panels folder, CDT Remote into the Apple Menu Items folder, and Audio CD Access, Foreign File Access, High Sierra Files Access, ISO 9660 File Access into the Extension folder inside your System Folder. The Installer will also create a CD-ROM ToolKit Extras folder containing the Read Me files. System 6 users will find the CDT Remote application in

the CD-ROM ToolKit Extras folder.

The **Custom** installation will allow you to choose which components you wish to install.

We recommend the Standard installation, as it will properly install all of the components necessary to properly run CD-ROM ToolKit.

Once the installation has completed, drag the original CD-ROM ToolKit disk icon to the trash to eject the disk. Store the original program diskette in a safe place.

CD-ROM ToolKit is installed and working properly if the icon appears briefly at the bottom of your screen (Figure 9) while the “Welcome to Macintosh” banner is displayed.



*Figure 10: Normal Startup Icon*

If the CD-ROM ToolKit icon briefly appears with an X through it after restarting (Figure 10), then a startup error has occurred and CD-ROM ToolKit did not load properly.



*Figure 11: Problem Startup Icon*

If you have this problem, try disabling other System Extensions by removing them from your System Folder or by using an Extension management program, and restarting your Macintosh. After isolating which Extension is causing the conflict, you may find that renaming the Control Panel, or putting a space before it's name, will solve the problem. This will change the loading order because Extensions and Control Panels load in alphabetical order.

CD-ROM ToolKit will display a question mark over its icon (see Figure 11) upon startup



if it has not been configured to support any CD-ROM drives, or if your CD-ROM drive is not recognized by CD-ROM ToolKit (check the Supported Devices list). This would typically occur if you have a newer drive that is not yet supported by CD-ROM ToolKit, or perhaps if you have an older, discontinued drive. Please contact FWB to let us know what model it is so we may support it in the future.



*Figure 12: Missing Device Startup Icon*

The most common causes for this error are not having your CD-ROM device powered on startup, a conflict with another Control Panel or Extension, or failure to remove old CD-ROM driver software. Another possible cause could be that there is not enough memory to load CD-ROM ToolKit.

If you add one or more CD-ROM drives to your computer after installing CD-ROM ToolKit, you must open the CD-ROM ToolKit Control Panel and check the boxes next to the drive ID of the new CD-ROM drive to tell it to support those devices.

Likewise, if you change the SCSI ID of your CD-ROM drive after having installed CD-ROM ToolKit, or if you start up without the CD-ROM drive powered up, you must open the CD-ROM ToolKit Control Panel and check the boxes next to the desired new SCSI ID to enable them to be used.

You have now finished installing CD-ROM ToolKit. If you are an experienced user, you may consult the QuickStart section for basic information needed to configure CD-ROM ToolKit. Otherwise, please consult the Instruction Guide for detailed information on each module.

The first time you open the CD-ROM ToolKit Control Panel, it will ask you to enter your name and the program's serial number. Please refer to Personalizing CD-ROM ToolKit in the QuickStart section for personalization information.

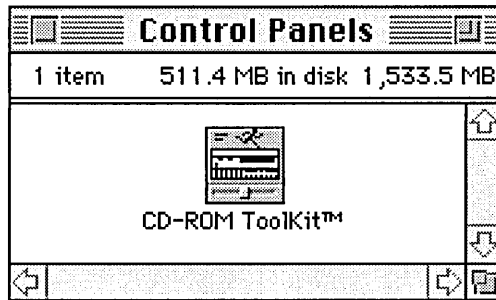
If you encounter any of the problems described above, please refer to the Troubleshooting section for additional instructions.

## Removing CD-ROM ToolKit

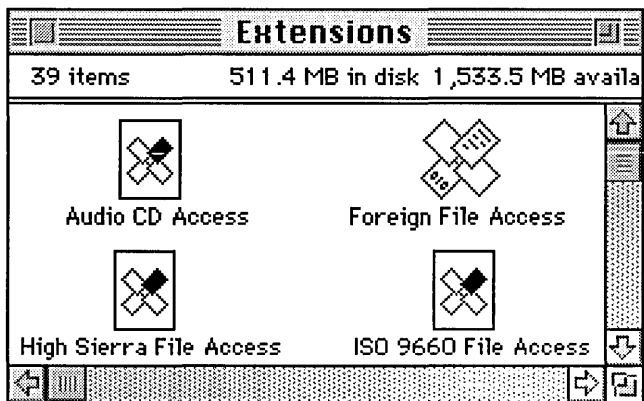
CD-ROM ToolKit's driver may be deactivated by using the Control Panel to turn off the driver. Please see the section on the CD-ROM ToolKit Control Panel in the Instruction Guide for additional information on this option.

CD-ROM ToolKit can be removed from your computer by dragging all the files installed completely out of the System Folder or into the Trash. Additionally, drag the CDT Remote application from the Apple Menu Items folder completely out of the System Folder or into the Trash. You will also want to remove the FWB CD-ROM Cache File xx, FWB CD-ROM ToolKit Prefs, and FWB CDT Remote Player Prefs from the Preferences folder in the System Folder to be complete. The next time you restart your Macintosh, CD-ROM ToolKit will not load into memory.

To remove the product, begin by opening the System Folder on your start-up drive. Locate all the CD-ROM ToolKit's file icons listed below. System 7.x users will find some of the CD-ROM ToolKit icons in the Extensions folder and one in the Control Panels folder. System 6 users will find all necessary CD-ROM ToolKit files in the System Folder.



*Figure 13: File Installed by CD-ROM ToolKit into Control Panels Folder*



*Figure 14: Files Installed by CD-ROM ToolKit into Extensions Folder*

## Section IV — Instruction Guide

Now that you have successfully installed CD-ROM ToolKit, you can immediately begin to enjoy the added performance and compatibility offered by this powerful utility.

This section of the manual includes detailed information on:

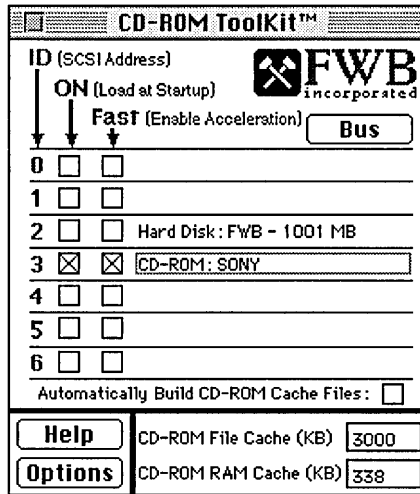
- The CD-ROM ToolKit Control Panel
- Reading Different CD-ROM Formats
- Prescanning CDs for Acceleration.
- Playing Audio CDs with CDT Remote

### The CD-ROM ToolKit Control Panel

Most users will find acceleration to be a fast and effective way to improve all aspects of CD-ROM performance. CD-ROM ToolKit includes a convenient Control Panel that allows users to automatically accelerate and configure all discs for optimum performance.

#### Accessing the Control Panel

1. Select Control Panel from the Apple Menu.
2. Scroll the Control Panels list until you see the CD-ROM ToolKit icon.
3. Double click on the CD-ROM ToolKit icon to open the Control Panel. (System 6 users should click only once.)



*Figure 15: CD-ROM ToolKit Control Panel*

The top section of the Control Panel displays a list of devices attached to your computer. The lower portion allows users to customize the default settings for acceleration.

After opening the Control Panel, CD-ROM ToolKit will automatically scan the SCSI bus and identify the device at each SCSI address in the right column. Devices displayed within boxes are CD-ROM drives. Other SCSI peripherals attached to your system are identified for your information only. This can be helpful when diagnosing SCSI ID conflicts.

**NOTE:** If your CD-ROM drive does not appear in the Control Panel window, it is likely that it is not turned on, not connected correctly to your computer, or conflicting with another device. Please consult your CD-ROM drive's operation manual for information on connecting the drive to your computer and resolving conflicts.

CD-ROM ToolKit must be reconfigured if you add CD-ROM drives, change their SCSI IDs after having installed it, you must open the Control Panel and check the boxes next to the SCSI IDs of the newly added devices to enable support.

The column titled ON allows you to designate whether you want CD-ROM ToolKit's device driver to load at startup. Most users will use the default ON setting to automatically load CD-ROM ToolKit's driver into memory at startup so that CDs will mount.

This feature provides users with an easy way to turn off CD-ROM ToolKit's driver should they wish to run a third party driver, such as Apple's, instead. To turn-off CD-ROM ToolKit's driver for a specific CD-ROM drive, simply click on the ON check box to toggle to the off position.

The column titled Fast allows you to turn acceleration on or off for individual SCSI IDs. By checking ON, acceleration for the chosen device is enabled.

Unchecking the ON box for individual CD-ROM drives provides an easy way to defeat all acceleration features. This also allows you to use all of CD-ROM ToolKit's audio and driver software without any of the caching features (in case you suspect the caching features to be causing problems).

The Bus button allows you to view devices on any active SCSI Manager 4.3 compatible bus on your Macintosh, such as the FWB SCSI JackHammer bus, if installed. Simply click on the Bus button to view any CD-ROM drives on other busses for driver loading and acceleration. The Bus button will not appear unless more than one SCSI bus is present.

CD-ROM ToolKit is fully compatible with Apple's SCSI Manager 4.3. CD-ROM ToolKit's drivers allow you to exploit the capabilities of Apple's SCSI Manager 4.3 on Macintosh AV, Power Macintosh, Power PC Upgraded Macintosh computers, and any Macintosh equipped with the SCSI JackHammer. The SCSI Manager 4.3 System Extension is installed on Centris and Quadra machines running System 7.5. The benefits of FWB's latest driver coupled with SCSI Manager 4.3 are: support for devices on multiple buses, DMA support, reduced SCSI I/O processing overhead, asynchronous SCSI I/O, high-speed synchronous data transfers, and maximized SCSI bus utilization which translates to higher overall data throughput.

The lower portion of the Control Panel offers several settings that allow you to further customize the program.

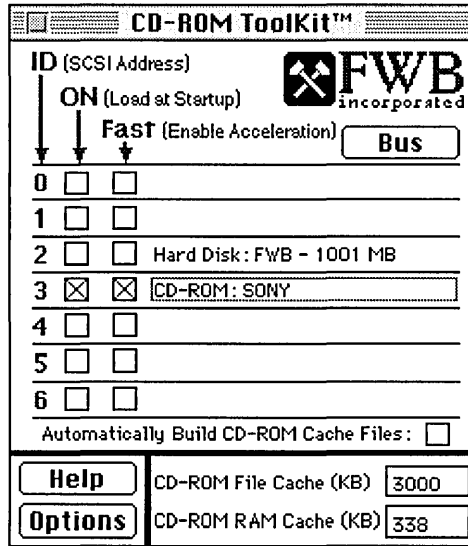
The **Automatically Build CD-ROM Cache Files** option starts the acceleration of CD-ROM discs without asking for user confirmation. By checking this option, CD-ROM ToolKit will begin caching file and directory information to the hard disk automatically when you insert a CD-ROM disc.

Most users will prefer to turn this option ON. This will allow you to bypass the dialog

that prompts you to accelerate each disc. Writing the cache files takes place entirely in the background, is fairly quick, and uses 1 to 10 megabytes or more of hard disk space you have allocated in the Control Panel. When CD-ROM ToolKit builds the cache file, it will always overwrite any existing cache file to prevent consuming additional hard disk space. Reboot after checking the ON checkbox for acceleration to take effect.

At the bottom of the Control Panel are two text boxes that allow you to edit the amount of memory allocated to the cache. The upper box titled "CD-ROM File Cache", refers to the maximum amount of hard disk space you wish to assign to the cache (per drive). 3000KB is the default which equals approximately 3 megabytes of disk space and is generally an optimal setting for most uses of your CD-ROM drive. This number can be changed by clicking in the box and typing in a new number. The cache can utilize from 1500 to 10000KB of hard disk space. Users with large amounts of available disk space will benefit by allocating the maximum 10000KB to the cache. Some CD-ROMs that contain very large collections of files (greater than 16,000) require at least 3000KB for maximum acceleration effect. We recommend a minimum of 3000KB of available disk space for CD-ROM ToolKit. If you increase this number, you should slightly increase RAM cache as well to retain the same performance.

If your startup hard disk volume is heavily fragmented or nearly full, preventing the creation of the standard 3000 KB cache file, CD-ROM ToolKit will attempt to allocate less disk space to the disk based cache file.



*Figure 16: CD-ROM ToolKit Control Panel*

### Caching settings

The text box at the very bottom of the Control Panel titled “CD-ROM RAM Cache” refers to the maximum amount of Random Access Memory you wish to assign to the cache. The default of 335K is generally an optimal setting for most uses. This number can be changed by clicking the in the editable area and typing in a new number. The RAM cache can utilize from 65K to 10000K of memory. Because RAM is more precious and more expensive than hard disk space, allocating RAM to the CD-ROM caching scheme is optional. Users with excess available RAM will see performance gains from allocating small amounts of RAM to the cache. Most users will designate between 335KB and 1000KB of RAM to the cache, depending on the amount of memory available.

### Dynamic vs. Static Cache

CD-ROM ToolKit provides both a dynamic and static cache to maximize the performance of CD-ROMs. A lot can be said about the fundamental differences between dynamic caching and static caching, however we will try to summarize this complex topic as simply as possible. Cache should be thought of as data that is meant to be read



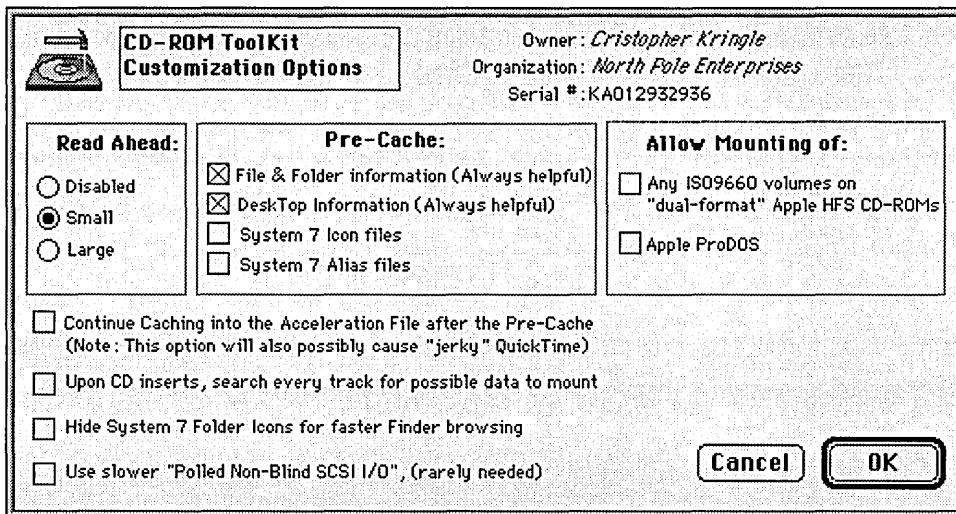
often which is stored in alternate locations for future faster accesses. Some information has a much higher probability of being used frequently and is conveniently stored in a "static" cache instead of the more volatile and ever-changing "dynamic" cache. A "dynamic" cache stores information in a reusable pool replacing older data that was not recently referenced. A static cache never deletes data stored in it until another CD-ROM insertion. The static cache is usually filled with information prescanned (or pre-cached) immediately after CD-ROM insertions and includes megabytes of Finder related information such as icons, file names, and folder information. The static cache is mostly stored in a large file CD-ROM ToolKit maintains. The size of this file is totally configurable in CD-ROM ToolKit's Control Panel. Dynamic caching should not have to be a function of a storage device driver using a modern operating system, yet CD-ROM ToolKit offers this feature to gain every speed improvement possible. Dynamic cache is helpful because it is exceptionally fast and even helps speed up data normally accessed first from the static cache.

Stunningly fast performance can be seen with our new dynamic RAM cache capability. Dynamic caching is on by default, and uses 128k of the default RAM cache of 335k. Suggested values for optimal dynamic caching include: 335k, 467k, 725k, 1241k, 2273k, 4337k, and 8465k. These values maximize caching structure efficiency. The maximum amount is determined by how much memory your computer has and how many System Extensions are being loaded. Although 10000K is the maximum supported, most Macintoshes cannot support it unless they have an abundance of memory. To eliminate any slowdown from overhead of static disk cache and static RAM cache technologies, you may deselect all four of the prescanning options in the CD-ROM ToolKit Control Panel. If done, only Dynamic cache is performed, though Static Cache prescanning benefits will be sorely missed and most people will not choose to deselect the Prescanning options.

Changes made to the Control Panel will only take effect after restarting your computer.

### **Customization Options**

At the very bottom of the CD-ROM ToolKit Control Panel is an Options button that provides access to specific caching features. Click on the Options button to open the Customization Options dialog.



*Figure 17: Configuration Options Dialog Box*

These options are automatically configured to the optimum settings for most users. Some users may choose to change these defaults to experiment with potential performance differences, or to minimize system overhead required by caching.

**NOTE:** Changes made to the customization options will only take effect after restarting your computer.

### Read Ahead Options

Read ahead caching (often referred to as prefetching) is designed to anticipate the next request for data from the CD-ROM by reading information physically adjacent to the previous request. It functions in both forward and reverse directions. Read ahead caching improves performance particularly for applications that are inefficient in how they handle requests for data.

**Disabled** - Selecting this option will turn off all read ahead caching. Disabling all read ahead caching may slow down file transfers when the requesting program is inefficient in how it handles requests for data.

**Small** - Selecting this option will turn on read ahead caching using 2K data blocks. By

prefetching data in small 2K increments, users may enjoy the performance gains associated with read-ahead caching while using fewer CPU cycles to refresh the cache.

**Large** - Selecting this option will turn on read ahead caching using 32K data blocks. By prefetching data in larger 32K increments, users may enjoy insreased performance gains associated with larger cache files by dedicating additional resources to the cache. The disadvantage to the this option, is that QuickTime users may find video to be "jerky" due to fluctuating data transfer rates. Heavy QuickTime users should choose the Read Ahead Small option, or disable it altogether. This option functions better on 2x or faster drives, and on faster Macintoshes.

## **Pre-Caching Options**

Pre-caching is designed to copy repeatedly used information to a "buffer" on your hard drive. This process off-loads basic information requests to the faster storage device and is the primary acceleration technique used by the CD-ROM ToolKit.

**File & Folder information** - Selecting this option copies basic file information to the hard drive, significantly improving your ability to find files and folders on the disc. This caching option represents the best opportunity to improve overall performance of CD-ROM drives and therefore should be left on. This information consumes the largest portion of the cache file on the hard disk.

**Desktop Information** - Selecting this option copies icons and other file specific information to the hard drive which improves the speed of window refresh and Get Info operations. This information will utilize a smaller portion of the cache file on the hard disk.

**System 7 Icon files** - Selecting this option will copy custom icon information to a buffer on the hard drive and improves Finder operations and icon drawing speed. Enabling Pre-scanning System 7 Alias files and System 7 folder icon files options in the CDT Control Panel can easily result in exhausting all caching buffers. Many CDs that contain color icons have hundreds of them that occupy a lot of cache space and require lots of pre-scanning time, especially public domain and clip art collections. By default, these two caching options are not enabled. Be aware that enabling these options may result in extremely long pre-scanning times for titles with lots of icons.

**System 7 Alias files** - Selecting this option copies small alias records to a buffer on the hard drive and improves Finder access to these files. "Caching Aliased files" consumes a small amount additional hard disk space.

**Continue Caching into Acceleration file after Pre-Cache** - If this option is enabled, the computer will continue to store the most accessed CD-ROM information into the static

cache file and static RAM cache, even after prescanning has concluded. The prescanned information is stored first, but because extra space is usually left over, you may want to continue storing CD-ROM data until it is filled up. This may cause slower QuickTime performance, but is best used if a single title is repeatedly accessed.

**Upon CD inserts, search every track for possible data to mount** - If this option is enabled, the program will be able to mount multi-volume multisession CD-ROMs. This does not refer to normal multisession Photo CDs, but rather Desktop CD recorded media with data written in many tracks, or in tracks following an audio track. These CD-ROMs usually are golden instead of silver colored. If this option is used, mounting some Photo CDs, 'flawed' disks that no other driver can mount, or other CDs with large numbers of sessions will take longer to mount than if the option is off. You should also turn off this option if the "Table of Contents" area of the CD is meant to be ignored when mounting for speed, or when using "Active Audio™" audio CDs. "Active Audio™" technology allows Macintosh and MS Windows accessible information to be stored on audio CDs in a way very similar to CD-ROMs. Contact BMG Australia LTD at Internet addresses of Chris@PAMS.com.au, or advmedia@singnet.com.sg for information on new audio CDs containing "Active Audio™". Leave this option off if you are not sure if you need to use multisession multi-volume CDs.

**Hide System 7 Folder Icons for faster Finder browsing** - If this option is enabled, CD-ROMs that have System 7 Color Icons placed over the folders will have them hidden when mounted. This speeds up browsing CD-ROMs that overuse these folder icons because large icon files are not read from the CD-ROM. The speedup is very significant but, as a consequence, folder icons are suppressed. Selection of this option is merely a matter of preference.

**Use slower "Polled Non-Blind SCSI I/O", (rarely needed)** - This option should not be used unless you are trying to determine if a problem is eliminated when fast blind SCSI I/O is avoided. Some CPU acceleration boards cannot reliably use blind SCSI I/O on all devices. Devices that cannot use Blind SCSI I/O on all normal Macintoshes operate no differently when this option is used because the software is written to already use slower "Polled Non-Blind SCSI I/O" for these older devices. Leave this option off unless your CD-ROM drive manufacturer's manual or technical support advises you to use it.

### **Allow Mounting Options**

Many CD-ROM titles now include both Macintosh HFS partitions and ISO 9660 (or Apple II ProDOS) partitions on the same disc. Usually, these partitions are disabled and only the Macintosh HFS partitions will appear on the desktop. CD-ROM ToolKit has the unique ability to mount both Macintosh and non-Macintosh partitions.

**NOTE:** In order to eject these multiply-mounted discs, you must drag the non-HFS partition to the trash first. Dragging the HFS partition, or all partitions at the same time, to the trash may cause errors to occur.

**Any ISO 9660 volumes on "dual-format" Apple HFS CD-ROMs** - Selecting this check box turns on the ability to mount ISO 9660 partitions on multiple-volume CD-ROMs. For instance, if you have a clip art CD-ROM that has popular Macintosh graphic file formats on the Macintosh HFS partition and popular PC graphic file formats on the ISO 9660 partition, you can select this check box and mount both partitions.

**NOTE:** Application programs on PC-based partitions are not written to run on the Macintosh. You will need a PC emulator in order to run these programs.

**Apple ProDOS** - Selecting this check box turns on the ability to mount ProDOS partitions on multiple-volume CD-ROMs. The early Apple developer CD-ROMs came with Apple II-style ProDOS partitions in addition to the Macintosh partitions. In order to mount both the Macintosh and the ProDOS partitions, you must have the ProDOS File System Extension loaded and this box checked. The ProDOS File System Extension is available with the Apple IIe Card for LC software, and it is also downloadable from AppleLink.

## Reading Different CD-ROM Formats

CD-ROM ToolKit includes all the special software to read non-Macintosh formats including Photo CD, ISO 9660, High Sierra, and audio discs.

CD-ROM ToolKit has unique support of dual format CD-ROM titles. It can simultaneously mount CD-ROMs that have both Macintosh HFS, ISO 9660, and ProDOS formats. Open the CD-ROM ToolKit Control Panel and enable this via the Options button. CD-ROM ToolKit requires that the ISO 9660 partition be unmounted BEFORE the Mac HFS partition is unmounted.

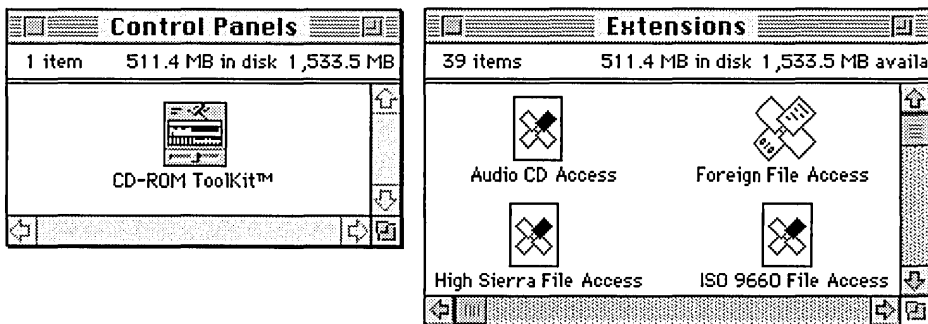
Early Apple Developer CD-ROMs (Volumes 1-7) contain both an Apple II ProDOS partition and a Macintosh HFS partition. To mount the ProDOS partition, you must have the ProDOS File System Extension in your System Folder, and the ProDOS mounting option enabled in CD-ROM ToolKit's Control Panel. This file is part of the Apple IIe card software for the Macintosh LC family. You can download this software from AppleLink from the following path:

Software Sampler  
Apple SW Update

Macintosh; Peripherals  
Apple IIe Card for LC  
IIe Card for LC Startup 2.2

Most CD-ROMs designed for the Macintosh are HFS compatible and are exclusively for Macintosh computers. However, a growing number of titles are created in a format called ISO 9660 which can be used on PC compatible computers and other systems that recognize this international format.

The CD-ROM Toolkit program discs are shipped with several files that allow your Macintosh to recognize non-Macintosh discs. These files will be placed into the appropriate area of your System Folder during installation. With this software installed, you can use non-Macintosh discs without further setup. If you have removed these files from your System Folder or have outdated versions, refer to the section on Installation in this manual for installing them.



*Figure 18: Correct Location of Files in System Folder.*

## Photo CD discs

Kodak's Photo CD discs allow you to open and view digital images created from photographs or developed from film and stored on a CD-ROM for use with your Macintosh.

For best use of Kodak's Photo CDs, we recommend using two Apple Extensions: QuickTime 1.5 or later and Apple Photo Access. QuickTime is available through resellers and on several online services and on AppleLink; the Apple Photo Access Extension is available on the Internet and on AppleLink. We recommend using QuickTime 2.0 or newer.

**NOTE:** QuickTime does not operate on "68000" computers such as the Macintosh

Plus, SE, Classic, Portable, and Powerbook100.

To view images stored on Photo CDs, you can use any program that can view PICT files in conjunction with QuickTime, or you can use a specialized program such as Adobe's Photoshop to view and edit the images.

"Apple Photo Access" is a System Extension file that will allow the Finder to present nice looking icons and folder structures on Photo CD media. Macintosh systems without that Extension can use Photo CD, but its absence makes it impossible to select photos to load and use the Finder to browse photographs without additional software. This means you will need some type of Photo CD compatible graphics program, such as Adobe Photoshop, to view Photo CD pictures. This file is available directly from Apple or by downloading from information systems such as AppleLink. Users of Photo CD should obtain this file to make Photo CD access more Mac-like. You can download this software from AppleLink from the following path:

Software Sampler

Apple SW Update

Macintosh

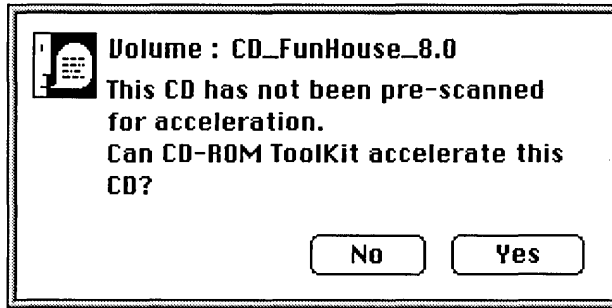
Peripherals

Macintosh CD-ROM Setup 5.0

**NOTE:** CD-ROM ToolKit provides single session Photo CD capabilities to most drives. Multisession Photo CD discs require multisession compatible CD-ROM drives. Multisession compatibility is an advanced hardware feature, and only exists in certain devices introduced after October 1992. Please refer to your CD-ROM drive's owners manual or the Supported Devices file included with CD-ROM ToolKit to determine whether your drive is multisession compatible.

## Prescanning CDs for Acceleration

Begin by inserting a CD-ROM into the drive. A dialog will appear asking if you would like to activate acceleration for the disc. (This can be suppressed by choosing the Automatically Build CD-ROM Cache Files option within CD-ROM ToolKit's Control Panel.)



*Figure 19: CD-ROM ToolKit asks for permission to pre-scan your CD*

If you would like this disc accelerated, click on Yes or hit the Return key and CD-ROM ToolKit will do the rest. Once the CD-ROM mounts on the Desktop, CD-ROM ToolKit begins working entirely in the background caching information from the CD-ROM to your hard drive and RAM. You have control of the Macintosh during this process and can open folders, copy files, or launch applications as you normally would. CD-ROM ToolKit will complete the caching process within seconds, depending upon the number of files on the disc. You should notice significant improvements in your ability to quickly navigate around accelerated CD-ROM discs.

If you do not want acceleration, click on No, and the CD-ROM will not be accelerated; all requests for data from the CD-ROM will occur at the drive's normal access speed. Not enabling acceleration will not affect CD-ROM ToolKit's ability to play audio CDs, read Photo CDs, or otherwise access CD-ROMs.

**NOTE:** The use of the word "acceleration" in the preceding paragraphs refers exclusively to pre-scanning, and has nothing to do with dynamic or static caching or read-ahead. The other caching technologies are always engaged if enabled.



## Playing Audio Discs with CDT Remote

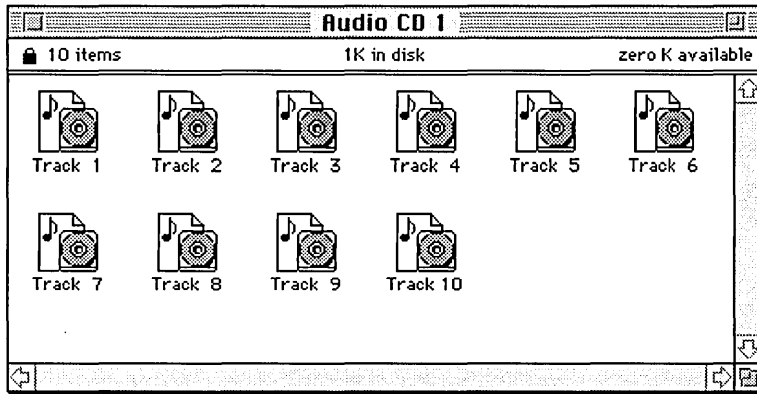
If your CD-ROM drive is equipped with audio jacks or speakers it can play audio CDs, or data CDs that contain audio tracks, using the CDT Remote program. This program is designed to look like a standard remote control unit for a home stereo. You can use CDT Remote to start, stop, play, and otherwise control the disc.

The CDT Remote application is normally copied to your hard drive during installation. If CDT Remote cannot be found, please refer to the section on Installation in this manual for installation instructions.



*Figure 20: CDT Remote*

There are two types of CD that contain music: traditional audio discs, and multimedia CDs. Traditional audio discs appear on the Desktop when mounted with files named track 1, track 2, etc... (Figure 20). You can play these by simply double-clicking on individual tracks.



**Figure 21:** Traditional Audio CD Icons

Some multimedia discs contain audio tracks as well as other types of data. As they are encoded differently, you can not play audio tracks on these discs by opening or clicking on their icons. Use CDT Remote to play these audio tracks. They will always start after track "1" in audio player programs.

## Using CDT Remote

**NOTE:** Using the CDT Remote program requires that a CD-ROM driver is available. If CDT Remote gives an error message, make sure that the CD-ROM drive was powered on at startup and that the CD-ROM ToolKit Control Panel has been configured correctly.

Insert a CD in the drive. Be sure that the disc contains audio information. CDT Remote will only play audio files. You will normally access CDT Remote from the Apple Menu.

Double Clicking (opening) an audio file icon of an inserted audio CD in the Finder will play that single track and automatically launch CDT Remote. If you have multiple CD ROM devices connected, remember that CDT Remote will display the first device on the SCSI bus. If it appears that CDT Remote is not playing the selected track, even though you are getting the correct output through your headphones or speakers, go to the Player pull down menu and choose the Select Device menu item to select the correct CD-ROM drives' SCSI ID to view and control the playback.

CDT Remote automatically scans the disc inserted in the drive and displays the first track in the Elapsed Time Window. The following section describes each of CDT Remotes' buttons.

**Stop:** Clicking this button stops play and resets to the start of the current track.

**Play:** Clicking this button starts playing the track displayed in the Elapsed Time Window.

**Pause:** Clicking this button stops play without losing your place on the disc. After pausing you can resume play exactly where you left off by clicking on the pause button a second time or clicking play.

**Elapsed Time Window:** This window displays status information about the current track (stop, play, pause, etc...). The time elapsed since the track began playing is shown on the right side of the display.

**Track >>:** Clicking this button will skip to the beginning of the next track.

**Track <<:** Clicking this button will skip to the beginning of the current track. Subsequent clicks will go to the previous track. Using the track buttons is much faster if the drive is stopped first.

**Scan >>:** Holding this button down while playing an audio track will repeatedly skip forward in the audio portion played through the headphones or amplifier. Smooth hardware-assisted fast forward audio scanning is not supported on all CD-ROM drives, yet is simulated on all others. Please see the Supported Devices file to see if your drive is supported.

**Scan <<:** Holding this button while playing an audio track will repeatedly skip backward in the audio portion played through the headphones or amplifier.

**Shuffle:** Clicking this button will enable playing the tracks on the inserted CDs in random order until each is played.

**Audio Channels:** Clicking this button will allow you to select different audio channels for play through your headphones or amplifier. It cycles through left only, right only, both channels left, both channels right, monophonic, and stereo.

**NOTE:** Not all CD-ROM drives can actually emit monophonic audio.

**Volume:** This slider bar will adjust the volume from the CD-ROM drive output to your headphones or amplifier. Dynamic software volume control is not supported by every

CD-ROM drive; please see the Supported Devices file to see if your drive is supported. The bar can be moved to the right to increase volume and to the left to lower the volume. The default position of the slider is controlled by the specific device and its driver.

**Eject:** Clicking this button at any time will stop play and eject the disc from the drive. This can also be accomplished by dragging the CD icon to the Trash.

**Time:** Clicking this button toggles between displaying the elapsed time for the current track and the time remaining for the current track.

### The CDT Remote Menu

CDT Remote also includes a menu from which additional commands may be selected.



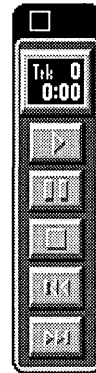
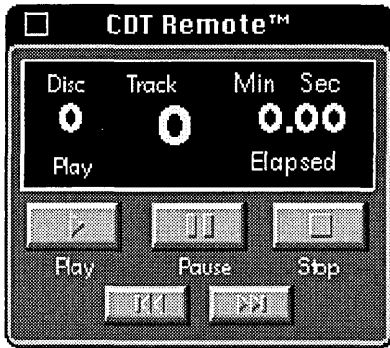
*Figure 22: CDT Remote Player Menu*

**Select Device** - If you have more than one CD-ROM drive with an audio disc inserted, CDT Remote automatically picks the drive with the lowest SCSI ID number. You can select another drive by choosing Select Device from the CDT Remote menu.

**Show Fewer Controls** - If you prefer to have CDT Remote take up less room on your screen, you can choose Show Fewer Controls and the CDT Remote window will shrink to less than half the size while still keeping the most important control buttons. Your selection will be saved, so the next time you run CDT Remote it will display the preferred size. This command will eventually take you to the CD+G window if your device supports this feature.

**Transfer Digital Audio...** CDT Remote allows flawless stereo digital audio extraction on some drives, if QuickTime 1.6 or newer is installed. Our driver supports over 19 different devices for digital extraction. See the Technical Information and Tips section for more information on digital audio extraction. This menu item will not be displayed if QuickTime is not present or if drive does not support it.

**Play an AIFF file...** Playback of AIFF files at 16 bit quality, when possible, is also supported. The playback will function in the background, while you work, and will give much better performance than tools such as Apple's MoviePlayer 2.0. This menu item will not be displayed if QuickTime or Sound Manager 3.0 is not present.

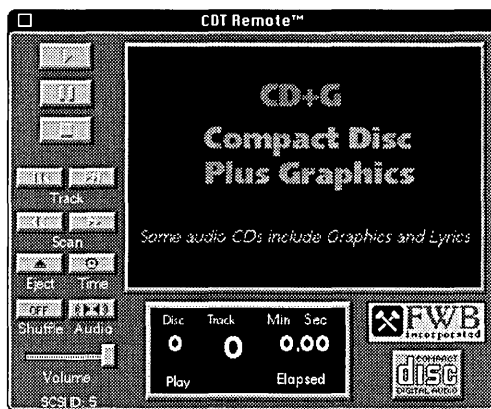


**Figure 23:** Fewer Controls for CDT Remote

**Figure 24:** Even Fewer Controls for CDT Remote

The first time you choose Show Fewer Controls, you will see the window displayed above left. The second time, you will see the window displayed above right. The third time, if supported by your CD-ROM device, you will see the window displayed below, displaying Compact Disc & Graphics (CD+G) media. These special CDs offer lyrics and video to accompany music. Please refer to the Read Me First file for a list of CD+G titles. If your CD-ROM does

not support this feature, you will be returned to the default CDT Remote window.



*Figure 25: CDT Remote CD+G Window*

**Play Only Chosen Track** - This command will restrict CDT Remote to playing only the track that is currently displayed in the Elapsed Time Window.

## Section V — Troubleshooting

This section will attempt to address items that may cause trouble and that are not covered elsewhere in the manual. If you are having problems using or installing CD-ROM ToolKit, please read through the relevant section in the manual first, then consult this section.

### CD-ROM ToolKit Q & A

#### CD-ROM Disc Mounting Issues

***Using my new CD-ROM drive I get “This is not a Macintosh Disk” when I insert my disc into the drive.***

If you have an NEC drive such as the CDR-84, CDR-84-1, CDR-401, CDR-510, CDR-550, or CDR-900, the DIP switches on the rear of the unit may be set up to operate in the SCSI-1/CCS mode rather than the supported SCSI-2 command mode. All NEC drives were shipped from the factory set to the SCSI-2 mode. This must be changed back to the SCSI-2 setting for proper operation of your CD-ROM subsystem. *Do not inadvertently switch your SCSI ID number!*

Other possible problems include: dirty or damaged disc, dirty lens, marginal cabling or termination, or alien volume format. As there are over 15,000 circular spirals per inch, it follows that a CD does not require a great deal of damage to render it unusable.

Furthermore, there may be defects in the manufacture of the disc which are invisible to the naked eye. Even though there are several layers of error correction designed into the standard, damage to the Table of Contents located at the innermost tracks can render a disc completely inoperative. Also, the error correction strategies are more tolerant of radial scratches and abrasions (spoke-like, perpendicular to the direction of rotation) than tangential (circular) defects.

If there is dirt or smudges on the disc, using a soft tissue not impregnated with lanolin, carefully wipe the disc from inside to outside in a straight line. Never wipe the disc in a circular pattern. You may clean the drive's lens with a cleaning kit recommended by the manufacturer of your drive or with compressed air. Several of the high quality audio CD player cleaning kits work very well.

Another possible cause of this message for non-audio CDs is not having the proper Foreign File Access modules installed (and enabled by your Extensions/INIT Manager utility). These include Audio CD Access, ISO 9660 File Access, Foreign File Access, High Sierra File Access, and optionally the Apple Photo Access and ProDOS File System modules. These System Extensions allow your Macintosh to mount these foreign volume formats in the same way as standard (HFS) Macintosh volumes. These modules rely upon

the Foreign File Access Extension, which must be present in the Extensions folder (or System Folder if you are running System 6.0.x).

***Using a CPU accelerator, I get "This is not a Macintosh Disk" dialogs when I insert data discs, but not for audio discs – they work just fine.***

Some CPU accelerators, such as Daystar's Turbo 040 board, are incompatible with SCSI blind transfers. Open CD-ROM ToolKit. Turn off blind transfers by checking the Polled Non-Blind SCSI I/O option in the Options dialog.

***Are there any problems with SCSI Probe 3.5 or DOS Mounter 3.0.1? When I have DOS Mounter 3.0.1 turned on, I cannot mount ISO/High-Sierra or Audio CDs.***

The primary compatibility issue with SCSI Probe is its option to close the driver when the user unmounts removable volumes. This is very dangerous as there is no bootstrap-loadable driver present on CDs as there is with hard disks. You must not enable this option while using version 3.5 of SCSI Probe.

DOS Mounter 3.0.1 interferes with the normal process of mounting foreign volume formats, preventing non-HFS volumes from appearing on the desktop. Since it identifies the disc as "Not a Macintosh Disk" before the operating system can use Foreign File Access translation software to mount it, there is nothing CD-ROM ToolKit can do to work around this problem. We recommend avoiding DOS Mounter 3.0.1 if mounting non-HFS discs is a requirement for your system.

***I am having problems with multi-volume multisession discs. Only the first session mounts on my Desktop.***

First, verify your drive is capable of mounting all of the sessions on multiple-session discs from the Supported Devices list on the CD-ROM ToolKit program diskette. Most modern CD-ROM drives have multi-volume multiple-session mounting capability. Furthermore, insure that Upon CD inserts search every track for possible data to mount in the *Options* area of the Control Panel if you are experiencing problems mounting these discs.

Once you are certain your drive supports multiple session discs, ascertain what type of disc you are trying to mount. There are known mounting problems with discs mastered by Pinnacle drives with pre-IBBK firmware, as well as those mastered with certain options in the Pinnacle software. Furthermore, discs which have blown sessions or an improperly fixated table of contents may fail to mount at all. If your drive ejects the disc without your Macintosh giving you a "Not a Macintosh Disk" dialog, it is likely that the disc was not properly mastered.

There are problems with Apple's CD300 Plus (Matsushita Tray-Loader) drives which seem to prevent it from mounting non-Photo CD multiple-session discs.



***When I mount a Photo CD, I do not get the Slide Show Viewer application or thumbnail icons of the pictures.***

You must have the Apple Photo Access Extension installed in your System Folder for this functionality. Apple Photo Access can only be obtained from Apple Computer, Inc. Sources include AppleLink, Apple Dealers, or wherever Apple products are sold.

If Finder memory is low, discs such as the Apple System 7.5 CD and QuickTime CD will not display the thumbnail icons.

## **CD-ROM Hardware Setup & Configuration Issues**

***My drive does not show up on the list in the CD-ROM ToolKit Control Panel.***

The CD-ROM device may not be: powered up, connected correctly to the Macintosh, or set to a unique SCSI ID. Please double-check each of these, making sure all cables are securely fastened and the proper termination is provided. Remember, every SCSI device connected to the Macintosh must be set to a unique ID number from 0 to 6. ID 7 is reserved for the Macintosh.

If your Macintosh has multiple SCSI buses and is running SCSI Manager 4.3 software from ROM, through our SCSI JackHammer, or with Apple's SCSI Manager 4.3 Extension for Quadras provided by System 7.5, try clicking on the Bus button in the upper right side of the main Control Panel screen. You may have connected your CD-ROM device to a different SCSI bus than you expected; unlike most other CD-ROM utilities, each SCSI bus is logically as well as electronically separate from each other. CD-ROM ToolKit fully exploits SCSI Manager 4.3 functionality, which allows you to control 7 devices per SCSI bus present in your computer.

**NOTE:** The Bus button will not appear unless you are running SCSI Manager 4.3 and have more than one SCSI bus available on the Macintosh.

***During system startup, I get a CD-ROM ToolKit icon with a Question Mark through it and discs won't mount.***

Open the CD-ROM ToolKit Control Panel, and verify that each connected CD-ROM device you wish to operate is enabled. If the drive is connected to a SCSI bus other than your normal internal Apple-supplied bus, you may need to click on the Bus button to find your drive. If you cannot find your drive, refer to the Installation and Removal Specifications section for more help.

***I think my drive is on the list, but it has a slightly different name (or is equivalent to another drive made by the same manufacturer for an OEM customer).***

In some cases subtle differences in the model number (or firmware revision levels) of a drive have little or no impact on CD-ROM ToolKit's ability to support it. There are instances where certain firmware revisions were insupportable or had major reductions

in functionality, and so, no compatibility relationship among similarly (but not identically) labeled firmware labels can be reliably inferred. The best way to determine CD-ROM ToolKit's support for your drive is to connect and try to enable it with the Control Panel. If CD-ROM ToolKit does not support it, you will receive a message detailing the drive's firmware identification, which you can pass along to your drive supplier for an update.

***When starting up my system, I receive a message that a CD-ROM driver has already been loaded preventing CD-ROM ToolKit from loading its driver for that device.***

If you wish CD-ROM ToolKit to control all of your CD-ROM devices, search through your Extensions and Control Panels folders for other CD-ROM drivers. Some of them may not have the word CD in their names, please refer to the list on page 5 and make sure none of them are present in your System Folder.

If you must use other drivers in addition to CD-ROM ToolKit, whether because of certain drive compatibility or functionality issues or personal preference, CD-ROM ToolKit must load before the other CD-ROM driver(s) that do not have configuration dialogs. To accomplish this: 1) Make an alias of the CD-ROM Control Panel. Move the CDT Control Panel into the Extensions folder while leaving the CDT alias in the Control Panels folder. 2) Remove the auto-mount Extension for the removable drive from the Extensions folder. Please make certain you have removed the original CD-ROM Extension from the Control Panels folder.

CD-ROM ToolKit can be disabled on an ID-by-ID basis, and uses a loading mechanism which is guaranteed to never conflict with another driver. Disable CD-ROM ToolKit on the SCSI IDs which have devices you wish other drivers to control.

To further hedge your compatibility bets, set your CD-ROM ToolKit-controlled device's SCSI IDs lower than the IDs controlled by other drivers.

***The sound from my internal Apple CD player is not working (I cannot hear it from my Macintosh).***

For Sound Manager 3.0 users, open the Sound Control Panel, click on the *Alert Sounds* pop-up menu and select *Sound In*, make sure *Built-in* is selected. Click on the *Options* button, and then be sure the *Internal CD* is set to be the internal source, and that the *Playthrough* box is checked. Some AV programs, such as the demo FusionRecorder provided with the Quadra AVs, disable the *Playthrough* option when you exit.

If you are still unable to hear sound while the CD is playing audio, the electrical connection between your internal CD-ROM device and your computer may be broken or disconnected. If you've recently had your Macintosh serviced or taken apart (to install additional RAM or VRAM for example), the audio connector may have come undone.

**NOTE:** For best quality CD-Audio playback on Quadra AV & PowerMac models, be sure Stereo, 16-bit, and 44.1 KHz sampling rate options are selected. All Quadoras except for the 605, 610, 630, and 650 models have 16-bit stereo Digital/Analog Converters.

***Why can't I hear my external drive's audio from my Macintosh speaker?***

To hear sound from your Macintosh speaker requires your CD-ROM drive's audio outputs to be connected to an audio input port located on the Macintosh motherboard itself. On post-900 model Quadoras, there is a capability to mix the Internal CD audio with the normal Macintosh sound. In theory, specialized software along with audio extracting CD-ROM drives, could play through the Macintosh speaker, but it is yet to appear commercially.

**Application Compatibility & Performance Issues**

***What are the best settings for the cache?***

The default settings of 335 KB for RAM cache, and 3000 KB for File Cache are optimal for most discs and applications. Increasing either cache setting should improve performance providing you have sufficient resources to do so.

For optimal QuickTime playback, it is usually best to disable caching. QuickTime needs the most consistent data rate from the drive, and almost never re-reads the same data, hence will nearly always encounter cache misses, and so caching would generally be a hindrance. Small Read Ahead generally benefits QuickTime playback by caching remnants of a physical disc block not requested by QuickTime.

**NOTE:** If you are running with Virtual Memory enabled, avoid the temptation to set your RAM cache very large. It will reduce the amount of Physical RAM available to your system and impair overall performance. For best performance do not use Virtual Memory.

***QuickTime or Multimedia playback is very jerky. Audio does not synchronize properly with video. Will allocating additional caching memory help?***

There could be several causes for these problems: heavy network service activity, numerous background processing or periodic tasks, Virtual Memory, RAM Doubler, or very slow CD-ROM drives. Most multimedia playback programs prefer 6-8 MB of real (not-Virtual) RAM for optimal performance. Also, most QuickTime movies (compressed with the Apple Video compressor) playback best on screens set to 16 bit (thousands) color mode.

Additional caching memory will not significantly improve QuickTime playback,

although avoiding static cache may help somewhat. To do so, turn off the Continue Caching option.

***I am getting a message from Apple's Foreign File Access about multiple ISO 9660 files, etc. (And I use System 7 or newer).***

You have multiple copies of the Foreign File Access translator modules installed in either your System or Extensions folders. This can happen to long-time CD-ROM users who have had the Foreign File Access software installed in their System Folder, and then manually upgraded to newer versions which the Finder places in the Extensions folder, failing to replace the older files in the System Folder. System 7.x users will find the duplicate files in the Extensions Folder, Control Panels, or the System Folder itself. Performing a Find File will assist you in locating them.

***Using Rebel Assault from LucasArts, I get an error which states the application cannot locate certain files on the disc.***

LucasArts has released a patch to upgrade the application to version 1.01 which completely fixes the problem.

***When I attempt to launch CDT Remote, I get an obscure message from the Finder about not being able to find QuickTimeLib, aborting the launch.***

On Power Macintosh models, the QuickTime PowerPlug supplied with your System Software must be installed in your Extensions folder along with QuickTime, or QuickTime will not function when used.

***Some applications and games crash while running them. (Some crash when I run them from the CD).***

Most multimedia applications prefer to be copied to your hard disk, and launched from there. Furthermore, the applications may run better with additional memory allocated to them (use the Get Info menu command from the Finder and increase the Preferred Size field of the application once you have copied it to your hard disk). Increase the memory by 1000k or more. Remember that increasing the memory and taking all the available RAM can adversely affect the Macintosh operating system.

Try disabling the acceleration options, although the chances of this working are negligible.

If you have an another CD-ROM driver, such as Apple's, you may also try using it to verify that specific CD-ROM drivers are not related to the problem.

**NOTE:** Many applications designed before the release of the Quadra AVs are incompatible with the Sound Manager 3.0 built into them. If your titles crash while running on a 660AV or 840AV, but not on other Quadras (without Sound Manager 3.0), then ask

your CD-ROM vendor for an update.

***When I double-click on a document icon on a disc, no application can be found to open it.***

This is a common problem with non-HFS CDs, such as ISO 9660 volumes. ISO 9660 discs can show icons within the Finder, but only if the applications (and their respective icons) responsible for opening those documents are present on your hard drive. The manual included with your CD-ROM title will help you determine how to access files on that disc.

***When I try to eject or unmount the disc from my drive, the Finder displays "Unable to eject (Volume Name) because it is currently in use."***

Before the Macintosh will allow you to unmount volumes, all open files and applications residing on the disc must be closed or exited. Due to a long-standing File Sharing problem, even if Sharing is not enabled for the volume you are trying to unmount, the operating system will not unmount the disc until you deactivate File Sharing on your Macintosh. It is also necessary to wait for CD-ROM ToolKit to finish building the cache file before ejecting the CD-ROM disc.

***"Unable to speed up this CD-ROM because you do not have sufficient contiguous disk space to create the cache."***

Whatever value you enter for File Cache size will need to be one contiguous allocation of space available on your startup volume (where CD-ROM ToolKit resides) for speed improvement. Under System 7.x, cache files are created within the Preferences folder. If there are more cache files present than there are CD-ROM drives connected to your computer, remove them and reboot. Also, you may try using a third-party defragmentation program to optimize the free space on your startup volume.

***Using CD-ROM drives equipped with CD-ROM ToolKit, what types of typical usage should we see substantial improvements? What technologies achieve this?***

FWB's CD-ROM ToolKit provides a multitude of performance enhancements for CD-ROM drives, including background pre-scanning of volume oriented directory data, read-ahead/behind caching, fast dynamic cache, static cache stored in RAM and/or hard disk, scatter-gather block prefetch for 2,048-byte-per-block devices, streaming optimizations for multimedia playback applications such as QuickTime and Macromind Director.

### **Pre-Scanning**

CD-ROM ToolKit is unique in providing background pre-scanning of directory and icon database information. In addition, no other product provides pre-scanning for ALL CD data volume formats: HFS, Apple ProDOS, ISO 9660, etc. All other products monopolize your computer for extended periods during pre-scanning; because of this deficiency, many pre-scanning drivers use up inordinate amounts of space on the

user's startup volume creating different cache files for each volume inserted into the drive. CD-ROM ToolKit's fast and unobtrusive pre-scanning algorithm permits the use of a single cache file per CD-ROM device.

Pre-scanning provides hard-disk browsing speeds for the user, enabling rapid and effortless location of files and information. We have found most users are annoyed when forced to wait for the drive to update Finder windows while browsing through Compact Disc volumes. The Finder can locate a particular file on a volume with over 16,500 files in under two seconds. Without pre-scanning the directory information, finding a file would require over forty seconds on some drives. We consider pre-scanning to be the most important part of a performance enhancement strategy from the user's perception.

### **Read-ahead/behind Caching**

Read-ahead and its companion read-behind caching refer to anticipating further data requests when three or more contiguous requests are issued to the driver. This technology primarily assists older devices which lack intelligent cache logic. Until CD-ROM ToolKit, this technology was primarily used during the pre-scanning stage; now it has been extended to improve all aspects of drive use.

### **Fast Dynamic Cache**

CD-ROM ToolKit also introduces dynamic caching to RAM, providing rapid access to repetitively requested data and speeding most types of device access by users. Few products even offer true dynamic caching, and fewer still permit you to disable it. There are streaming applications which are actually hampered by dynamic caching, as the percentage of cache misses become high. Another reason few products offer dynamic caching is because caching is best accomplished outside of the driver at the highest level of the File System Manager.

The result of months of intense development effort, CD-ROM ToolKit provides unparalleled dynamic cache performance. Throughput as high as 32 MB/sec has been recorded (on a PowerMac 7100/66 without cache card) when the File System requests blocks resident in the RAM cache of our driver. Even a Quadra 610 achieves 15.6 MB/sec on the same test. In a dynamic cache implementation, it is crucial to keep cache "miss" and cache "hit" overhead to a minimum. FWB has tested many drivers and configurations and discovered many implementations do not optimize cache hits at all.

***Under what rare circumstances could a caching CD-ROM driver cause a drive's performance to remain flat or slower, relative to a non-caching driver?***

To completely answer this question, it is important to consider what caching is and how

it works. Caching introduces extra layers & steps into the driver execution path in order to fetch some data from a faster storage medium than the hardware for which the driver was written. In order for caching to be considered beneficial, it needs to have a sufficiently high hit rate. If one had 100% cache misses, the overall performance would be significantly lower than if the driver performed no caching at all. In some ways, it's a gamble: you want a sufficiently high percentage of cache hits to offset the overhead of the caching layers.

Caching technology must be intelligently designed and implemented to a) increase the statistical hit rate and b) impose the smallest overhead on cache misses. One way CD-ROM ToolKit increases the chances of cache hits is to anticipate sequential data requests made of the driver, and to read larger hunks of data than requested. This way, if an additional request is made from locations contiguously beyond the prior I/O operation, the driver can immediately return data which was previously fetched into the read-ahead cache buffer. It is critical that proper thresholds and limits be placed on this operation, otherwise this read-ahead burdens every I/O operation with additional overhead with little (or negative) overall benefit.

Drivers which cache volume information to hard disk, such as FWB's CD-ROM ToolKit, can also suffer when the target hard drive is slow. Since there is overhead in re-vectoring CD-ROM requests to the hard disk, a slow hard disk would reduce the overall performance improvement. For example, an old 80 MB internal hard drive which lacks a deferred write capability will be dramatically slower for static cache technologies, as the computer is held up until the write operation completes.

The cache file resident on the startup disk is made contiguous for performance. Furthermore, most large CD-ROM volumes require a 3 MB disk cache to fully capture the volume information. If the disk cache setting is insufficient to copy the volume and desktop information, there will be significant chances for cache misses, thereby impeding overall performance.

Note that CD-ROM ToolKit disk cache ships with a default of 3 MB and very conservative RAM cache settings (335 KB, which is enough for basic cache structures to manage the disk based caching of a 16,500 file disk). If additional performance is desired, increasing the RAM cache to 1 MB or more would have dramatic improvements in CD-ROM ToolKit. Some other CD-ROM products work well only when their settings are set to "maximum," and even then with mixed results; some large requests are efficiently handled but small cache misses are laden with high overhead. CD-ROM ToolKit's RAM cache algorithms are exceptionally light-weight, and impose nearly no perceptible overhead on I/O operations.

It's been said that "Cache + Cache = Trash," which reflects the common wisdom regard-

ing the dangers of introducing caching at too many levels of the I/O path. There is little benefit in caching at every layer, as what invariably happens is simply buffer copying from cache to cache. Buffer copying is slow, and is nothing but overhead. Studies have shown caching is best performed at the highest (File Manager) layer. CD-ROM ToolKit's default configuration avoids overusing RAM resources.

Apple's System 7.5 introduces new caching technologies which enhance the performance of all devices. Its new caching algorithms will obviate the need to design a cache into most device drivers for optimal performance. System 7.5 still does not address write collection of blocks to be posted to disk as well as some other cache issues, however it should be regarded as an intermediate step in the evolutionary path towards maximum performance. Pre-scanning will always be an important enhancement regardless of what cache technologies are employed in the future.

No driver could be written to improve the speed of a CD-ROM application which reads large amounts of data only once, and issues large requests to the driver with no delays between requests. Such an application is merely exercising the physical medium transfer rate of the drive. Fortunately, few applications are such "worst-case" clients of CD-ROMs.

#### ***What type of testing is made to measure performance enhancement when using CD-ROM ToolKit?***

We test with all popular titles and optimize speed for the real world. There are some facts to consider when assessing the performance improvements of caching CD-ROM devices. Even the quickest quad-speed drive has a maximum media transfer rate of 600 KB/sec, which is much slower than the Macintosh SCSI bus transfer rate limits for all except the older 68000-based products. Data resident in the drive controller cache can be transferred at its controller's limit, which is usually 2 MB/sec. Since all but the oldest Macintosh models are capable of that data rate, all CD-ROM device drivers will perform actual SCSI transfers at the same rate.

Therefore, fundamental differences in performance are solely due to different algorithms and implementation overhead – how well the caching system works from a statistical analysis, how small the overhead of cache misses, and the throughput of cache hits all figure into the overall performance of the caching driver.

In our tests, we have attempted to measure the overhead of the cache layers in both hit and miss scenarios. Each caching driver exhibits differing levels of throughput for cache hits. The methodology we used was to patch the Random seed to return 0, so multiple tests could run with identical test data. Note that cache hits mean the driver returned data from the machine's RAM and represents the maximum theoretical transfer rate of the driver.



CD-ROM ToolKit provides lightning speed access to files and folders while browsing in the Finder, which is something everyone does with their CD-ROMs. And it does so without tying up their computer every time they insert a CD, or gobbling indeterminate amounts of storage space on their startup device. Users can complete a standard System 7.x Finder file find within four seconds on any data CD, rather than just HFS discs; they do not experience annoying pauses while browsing through their volumes.

***Can CD-ROM ToolKit improve the performance of low throughput drives (single spin) more, or less than it would benefit higher-throughput (double, triple, quad spin) drives?***

Most multi-speed devices provide larger cache buffers in addition to increasing the spindle speed, thereby increasing more than just raw throughput and complicating the answer to this question. In addition, there are cost-conscious consumer multi-speed CD-ROM devices which offer small caches and have inferior performance to identically spun units with larger caches under many conditions.

Multiple-speed drives often have two (or more) advantages over their single-speed counterparts: larger cache memory, lighter optical assemblies (fast average access), lower rotational latencies, and improved cache algorithms. This makes it difficult to assess what the direct ramifications of merely increasing the spindle speed has on performance. Furthermore, multiple-speed drives are of modern design and optimized for streaming read-ahead, which permits them to continue reading data between requests from the host.

Since the cache hit rate, cache throughput, and SCSI hardware are unchanged variables, it follows that the improvement ratio will be smaller for higher throughput drives when compared with single-speed units. However, overall system throughput will be significantly improved because the "floor," or cache miss level, of performance has been raised. The "ceiling" performance is fixed by the limitations of the driver, machine, cache settings, etc. But unless the floor and the ceiling are similar, there will always be an improvement by using caching technology. So long as CD-ROM devices have huge access times (greater than 100 ms), there will always be a vast benefit by caching data to a 12 ms access time device, let alone to RAM.

***If a device has poor hardware caching, does CD-ROM ToolKit improve its performance more or less than it benefits drives with better hardware caches?***

If it is the sole variable between two drives, poor controller cache algorithms may actually impede performance, affecting throughput only when the driver cannot fulfill a request from its own cache buffers. Drives which employ poor caching have a lower floor performance than drives with good caching algorithms, which section the cache buffers into stream-ahead and most-recently-used pages. Just as with slower (single-speed) devices, CD-ROM ToolKit sports a higher improvement ratio for devices with poor hardware caching.

### ***What factors are more important than mere performance?***

With all of this discussion about performance, there is a risk of focusing on minute numerical differences to judge a product. In reality, performance differences amongst modern CD-ROM drivers are usually quite small. More important is the driver's functionality, compatibility, degree of device support, and robust design. Important questions which need asking:

### ***Does the driver fully implement all of Apple's CD-ROM driver calls?***

Apple's CD-ROM driver specification details over 100 commands (including the 36 audio playback methods) which comprises their multimedia specification. Since many CD-ROM titles have no audio tracks and do not require the use of Apple's CD-ROM driver calls, many driver designers do not properly implement the audio commands. However, all CD-ROM application designers work from this standard and expect any CD-ROM driver they use to fully implement its functionality.

The sad truth is that few drivers even attempt to implement all of the calls, and fewer still implement them properly and completely. In fact, only Apple's CD-ROM driver and our CD-ROM ToolKit provide complete conformance to their CD-ROM Multimedia specification.

While the idea of mixing audio and data tracks within a CD-ROM multimedia application was exciting a few years ago (refer to Interplay's Battle Chess for a good example), perhaps the endless sea of incomplete and defective CD-ROM drivers discouraged the active development of such exciting titles. After all, if the user could not hear the audio properly no matter what audio calls were issued, why bother at all?

### ***Does the driver offer a superset of Apple's CD-ROM driver functionality?***

Apple's CD-ROM driver contains an impressive array of capabilities such as CD+G subcode streaming during playback, digital audio extraction, undocumented audio playlist commands, and asynchronous I/O capabilities. Not only is CD-ROM ToolKit unique in supporting all of these wonderful technologies, our product goes several steps beyond. Our CDT Remote™ audio playback application provides enjoyable CD+G playback as an option for those CDs which contain graphics subcodes.

CD-ROM ToolKit versions 1.09 and later support Apple's new AppleCD Audio Player 2.0 on every supported device – few other third party drivers support it.

Since November 1993 with version 1.05, CD-ROM ToolKit has supported all of the digital audio extraction commands. QuickTime as well as forthcoming audio editors can take advantage of this powerful technology, which provides key resources for multimedia developers.

Additionally, CD-ROM ToolKit permits the user to access ISO volumes on discs mastered with both HFS and ISO 9660 sections, Apple ProDOS partitions for Apple II users, as well as mounting multiple session/multiple volume discs mastered by some CD Recorders such as the FWB Hammer CDW 4x. We are not aware of any other products which provide this support.

***Does the driver fully exploit all features present in supported devices?***

FWB's CD-ROM ToolKit provides complete audio sourcing control (e.g., left, right, stereo, mono), hardware-assisted fast-forward/reverse audio scanning, and software controlled volume control on all devices which support these controls. On devices which lack hardware audio scanning, it is simulated in software for all other CD-ROM devices. Many drivers support neither proper audio sourcing control nor hardware-assisted audio scanning commands on Apple hardware!

***Does the driver fully support all available CD-ROM devices?***

Only FWB's CD-ROM ToolKit provides full and complete support for 69 CD-ROM devices as of October 27, 1994. Unlike most driver designers, FWB doesn't simply install a driver for a device it does not recognize. In our experience, it is not sufficient to assume a driver written towards the ANSI X3T9.2-1992 (SCSI 2) specification will correctly operate every CD-ROM device in existence. It is grossly irresponsible to install a driver for an unvalidated drive. We've gone as far as adding Photo CD support to drives which were otherwise thought to be incompatible with Photo CD media, such as the Panasonic 501, Apple CD SC, and NEC CDR-80 and several others. Every CD-ROM drive we support is at least Photo CD single session compliant, except for four devices.

***Is the driver fully compatible with all Macintoshes which have SCSI ports?***

CD-ROM ToolKit provides full functionality on all versions of Apple System Software (6.0.4 or better), from the Macintosh Plus to the most advanced PowerMac 8100/80AV equipped with several SCSI JackHammer cards. CD-ROM ToolKit 1.5 exploits SCSI Manager 4.3 and supports multiple SCSI buses. FWB has every Macintosh model ever sold in-house, some of the most advanced audio/video hardware available, and most of the popular CD titles. CD-ROM ToolKit undergoes a battery of sophisticated systematic tests and validations to ensure there is absolutely no data corruption or system integrity compromises. For example, all of our data access test suites involve huge keylength CRC checks to ensure data integrity.

It is not enough to simply ensure the product doesn't crash, it must never return corrupt or invalid data to the user. It is not enough to merely provide Apple's level of functionality, we must recognize where improvement is needed and blaze our own trail. And it is not enough to stand by and judge our product by comparison with Apple's or anyone else's and be complacent if we just do more, better, and faster than they do: when users entrust their data to our products, nothing less than perfect will do.

## Section VI — Technical Information and Tips

### Care of Manual Ejecting CD-ROM Drives

It is vital to remember that a few CD-ROM drives require special attention when removing media. The Macintosh was not designed to have an application's resources improperly removed, at any arbitrary time while the computer is running. To prevent this, and speed up performance, storage devices are instructed to prevent the manual eject button from functioning when files are open on the disk. A few CD-ROM devices will not prevent media removal when instructed. These drives are usually the lower-cost portable drives that have floptops or have manual eject buttons. Because they are manually ejected, they must NEVER have their cartridges ejected, or media removed, unless all the mounted CD volumes are first unmounted (dragged to the trash) and only then after at least one second of time elapses. CD-ROM ToolKit will not accommodate incorrect removal of discs. Always remember to unmount CD volumes before removing the CDs!

#### *Manual eject drives include:*

- Apple PowerCD (Philips CDF080).
- Chinon CDU-525
- LMS/Philips CM-2xx Series
- Media Vision Reno
- NEC CDR-25
- NEC CDR-36
- NEC CDR-37
- NEC CDR-38
- Texel DM-5024 (DM-3024)
- Toshiba XM-4100A
- and other flip-top CD ROM drives.

**NOTE:** Some floptop CD-ROM drives require that the hinged access cover be open at boot time if there is a CD in it. Starting up the Macintosh with a CD inserted in this type of CD-ROM drive with the access door closed may cause bootup problems. Please consult the instructions provided with your CD-ROM drive.

### CD Recorders

This past year has seen the aggressive marketing and deployment of Compact Disc recorders, with end-user prices falling below \$3,000. Bringing the reality of Desktop CD Mastering to fruition, these drives, along with specialized mastering software, allow

users to make standard audio discs for consumer audio CD players, mixed-mode CD-ROMs with CD audio and data, or even multiple session archival discs capable of retaining an entire company's data on very inexpensive and reliable media.

CD-ROM ToolKit offers special support for multiple-session discs mastered by these recorders. Since each session requires a new track to be laid down, these sessions create new origin points, delineated by the track boundaries. Using the "Search All Data Tracks..." option invokes special logic to look for mountable volumes on each data track boundary. This will allow your multiple-session compliant hardware to mount multisession discs properly mastered by CD recorders.

**NOTE:** Some recorder systems make discs which do not adhere to proper Orange Book standards, and hence will not and CAN NOT mount in any CD-ROM drive, other than the drive which mastered the disc. Furthermore, if the mastering process failed in either the I/O or FIXATION phases, the disc is ruined. There is strong hope for a technology which will recover these ruined discs, at least permitting the unused space to be mastered in subsequent sessions.

## **All About Multisession Multi-Volume CD-ROMs**

FWB's CD-ROM ToolKit has supported the mounting of multisession multi-volume CD-ROMs since November 1993 when CD-ROM ToolKit was released. These are rare CD-ROMs and do not exist as mass-produced items but as inter-corporate media distribution and archives.

All previous versions supported mounting multiple volumes, such as multiple Mac HFS volumes and multiple Apple ProDOS volumes as well as any ISO 9660 partitions if present. The previous versions all support multisession Photo CD ISO 9660 volumes also. Due to the anticipated popularity of Desktop CD Recorders, very special capabilities were added to CD-ROM ToolKit to allow more exotic types of CD-ROMs to be supported. For example when a CD is inserted the program scans the Table of Contents, and all other possible key locations for potential volumes to mount. This thorough search allows CD-ROMs to be supported that contain more than one data track, and have complete volumes, or portions of volumes (Photo CD), on those data tracks. These data tracks may be either recorded in the first and only session of a CD-ROM, or recorded in multiple sessions at different times. Additionally, CD-ROM ToolKit can properly accommodate audio tracks intermixed on the CD-ROM, including the rare situation where an audio track is the first track on the CD-ROM and data tracks follow it. The FWB CD-ROM ToolKit driver is the only Mac product that performs any of these capabilities.

If the CD-ROM, including all of its tracks and multiple volumes, is recorded in one session, the CD-ROM can be mounted on any CD-ROM drive in existence with a driver

such as CD-ROM ToolKit. Only one "session" is created if the recording is performed in one sitting and using proper software that allows multiple tracks and volumes to be recorded in one session, otherwise it may be a multisession recording.

Desktop CD Recorders are all different and they are further limited by the mastering programs that command them. The existing common CD Recorder manufacturers are:

- JVC
- Kodak
- Philips
- Pinnacle
- Sony
- Yamaha

Many newer CD Recorders will become available soon, including devices that will be affordable to all.

All these CD Recorders support the international standards for multisession CD-ROM creation, referred to as the Orange Book specification. Media created under the Orange Book specification is documented PHYSICALLY with great detail but the Orange Book does not mandate LOGICAL treatment and conventions. Therefore multiple volume or multi-version ISO 9660 is not part of Orange Book, nor Kodak Photo CD, and certainly not even multi-version or multi-volume Mac HFS, or anything of the sort. The ISO 9660 standard does not document what to do with multisession. It was finished before Orange Book was proposed. ISO 9660 is used as a subset of a Kodak Photo CD and those CDs have some limited Extension capabilities dependent on driver-level block remapping so that newly recorded photographs can magically appear inside the folders as extra photographs.

Because these standards do not exist, and because multisession CD-ROMs can only contain 24 sessions maximum and 99 tracks in total, few people have advanced the discussion of how to handle the multisession multi-track multi-volume technologies that this document has been discussing.

Nevertheless, CD-ROM ToolKit offers support today. The method we use is very direct and very simple. When a CD-ROM is inserted, all the efforts expended while examining the first CD track for mountable volumes is extended to all the tracks on all the sessions on a CD-ROM, and Photo CD sessions and audio tracks are accounted for as normal.

Two problems can be commonly encountered when using the CD Recorders: Blown Sessions, and old firmware or software.

## Blown Sessions

The most common way to create a "Blown Session" is data underrun when mastering. Data underrun is a condition where a device that is busy recording a single long spiraling CD-Track consumes all the data in its buffer and has to terminate the session as a blown session. The way to prevent it is to either provide more data to the recorder at a faster and consistent rate, or to operate the recorder at a slower recording rate. The slowest recording rate is normally called "Single Speed" and is 75 blocks per second where each block is 2352 bytes of data per block (the recording technology actually uses 7,203 bytes per block within the recorder). If a CD Recorder is rotating at 75 blocks per second the Macintosh must provide about 173K/sec. If the device has a large buffer (enough to hold a few seconds) then the recording software and technology can be lax in feeding the recorder. Some CD Recorders however uses a rather small 64K buffer that exhausts almost three times per second. This means that the Macintosh must always provide data to the recorder without fail without ever delaying for a third of a second. If a whole CD is recorded this must be maintained for an hour without fail. If not... Kaboom, the session is blown and you will need to try recording again in a new session.

In addition, any CD created with the some CD Recorders' software containing even a single Blown Session is referred to as a "Frisbee" because it has no value except on the CD Recorder that created it, or as a psychedelic flying discus. The root cause is that the Blown Sessions are marked bad using a technique in the software. It marks the Table of Content entry as MISSING for that track entry. Normal CD-ROMs may not contain missing references to tracks, though the CD Recorder that created it does not mind reading them. Not all CD recording software uses this questionable technique.

Thermal recalibrating hard drives, and busy network tasks can cause problems, so it is recommended that the recording computer be unencumbered while performing the recording, and that the thermal recalibration be disabled. Thermal recalibration is an annoying but necessary function of high-temperature fast rotating hard disks that periodically evaluate the horizontal expansion of platters so that future head positioning can be performed accurately at maximum speed. This recalibration should not be performed if the SCSI device or bus appears very active but the devices do not include such useful logic and abruptly seize up every now and then to perform thermal recalibration. FWB's HammerTime™ Extension and FWB drivers can temporarily disable thermal recalibration on key FWB products when capturing QuickTime video, but HammerTime does not help in this instance. Luckily, owner's of FWB's Hard Disk ToolKit can use the "World Control" program on Seagate Drives and DEC drives if they are skilled power-users and comfortable manipulating vendor-unique SCSI MODE SELECT PAGES. Note that using World Control is only a temporary 15 minute reprieve from future thermal recalibration delays.

To avoid Blown Sessions with a CD Recorder: use a fast computer with non-thermal recalibrating hard drives, and only record complete IMAGES of volumes on a spare or scratch hard drive instead of HFS multiple file selection recording (HFS on-the-fly).

## **Old Firmware**

Get the latest firmware for your CD Recorder to utilize special optimization to locate the final session of a CD. The mounting optimization scans for the last session FROM THE OUTSIDE EDGE INWARD instead of the normal direction starting at the inside hub and chaining outward.

## **Summary**

What this means is, uncorrupted CDs with no blown sessions can reliably be mounted on all drives we support, including multiple session multiple volume CD-ROMs. Corruption is very common on some CD Recorders because of the small buffer in conjunction with either HFS On-the-fly recording or when thermal recalibrating hard disks are present. If both are avoided and no sessions are blown that CD can be mounted and all sessions can be seen on any CD-ROM drive, so long as recent firmware was present in the recorder. The sole exception is the newer AppleCD 300+ drives (Matsushita CR-8004), though all other CD-ROM drives we have access to seem to work with these "perfect" CD-ROMs.

The number one reason some CD Recorder created multisession multi-volume CD does not stay inserted or mount is the disk contains a blown corrupted session and is illegally missing track information in its TOC. This occurs because of a method some CD Recorders use to "Mark" a bad track by striking it from the TOC.

There is a side note, some multisession drives can handle some types of blown sessions, if the blown session was the final session. We do mount this type of disk despite the defect, though sometimes not all sessions appear.

## **All about Digital Audio Extraction**

Digital audio extraction is a process whereby standard audio track information is transferred from a CD-ROM drive to a computer system through the SCSI cable, rather than through an analog interconnect wire. Digital audio extraction is capable of producing an almost exact copy of the digital information contained on the CD media. Audio CDs consist of sound samples recorded at 44.1 KHz in stereo with each channel using 16 bits of amplitude, providing for very high quality audio. Currently, there are few commercial software applications which use digital audio extraction with computers, but the preliminary steps of transferring the audio into a computer file are now possible. It is a fun and powerful new tool which will become increasingly common over the next few years.



Few CD-ROM drives are actually capable of supporting digital audio extraction. One reason may have been the music publishing industry's fears and legal concerns about uncontrolled duplication. Just as the home VCR helped triple the size of motion picture industry, digital audio extraction may do the same for the music industry. FWB's CD-ROM ToolKit for the Macintosh supports digital audio extraction on all known drives capable of extracting audio. Version 1.0.5, released November 1993 supported over 10 devices for audio extraction and several more have been added in recent versions.

Drives which support digital audio extraction include:

- Apple 300, 300i, (Sony CDU-8003, CDU-8003A)
- Apple 300+, (Matsushita CR-8004)
- Chinon CDS-535, (needs v2.0 firmware "Q20" or "R20")
- Compaq CR-503BCQ, (OEM is Matsushita)
- Compaq CDU-561, (OEM is Sony)
- Hitachi CDR-6750,
- NEC CDR 400, (MultiSpin 3xp portable)
- NEC CDR 500, CDR 510, CDR 600, (MultiSpin 3x series)
- NEC CDR 501, (MultiSpin 4xe quadruple speed)
- NEC CDR 900, (MultiSpin 4x Pro quadruple speed)
- Sony CDU-55S, (needs firmware 1.0f or newer)
- Sony CDU-561
- Sony CDU-561SUNCD, (Sun)
- Plextor PX-43CH (45CH), (aka 4Plex caddy high-end)
- Plextor PX-43S (45S), (aka 4Plex sliding tray midrange)
- Toshiba XM 3301TE, (Silicon Graphics version)
- Toshiba XM 3401TA, XM 3401B, (found in FWB's HammerCD)
- Toshiba XM 3401TE, (Silicon Graphics, and Sun versions)
- Toshiba XM 3501B,
- Toshiba XM 4100A,
- Toshiba XM 4101TA, XM 4101B
- See the "Supported Devices" file for updated information.

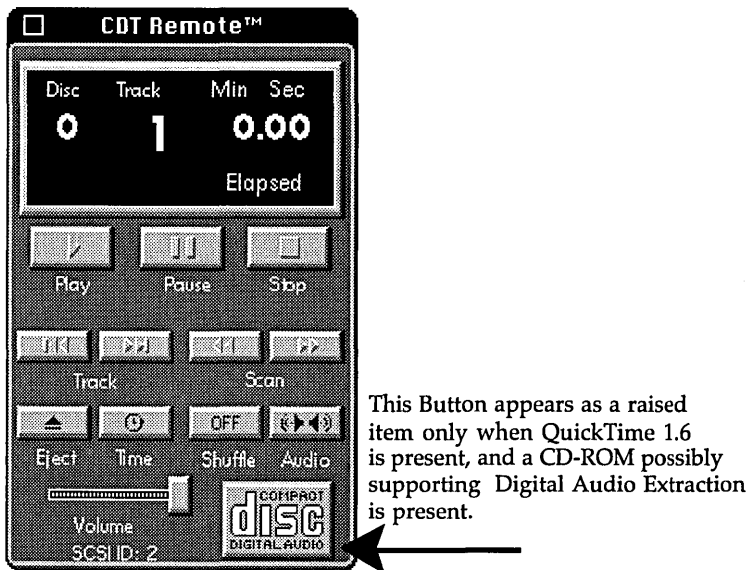
Any Macintosh programmer can easily utilize digital audio extraction because Apple standardized its use in technical documentation for CD-ROM drives in 1993. Few commercial software packages take advantage of extraction yet, despite Apple selling over a

million CD-ROM drives capable of extraction. To remedy this Apple provided digital audio extraction through the services of QuickTime 1.6 and newer and added a conversion button to the dialog used for selecting a QuickTime file. Any QuickTime program can allow you to extract a track of CD audio.

In addition to capable hardware and driver software fully compliant with Apple's newest CD-ROM commands, you should also have QuickTime 1.6 or later installed. FWB's CDT Remote player relies on QuickTime 1.6 or newer to permit digital audio extraction.

### How to extract using CDT Remote

CDT Remote makes the task fun and simple. First, insert a standard audio disk, not a multimedia disk containing audio tracks, into your CD-ROM drive. If you have the right equipment, and QuickTime 1.6 or newer installed, and an audio disk is inserted, you will see a raised button in the lower right of CDT Remote: Pressing this button is equivalent to selecting "Command-T" in the menu bar for CDT Remote as shown below:

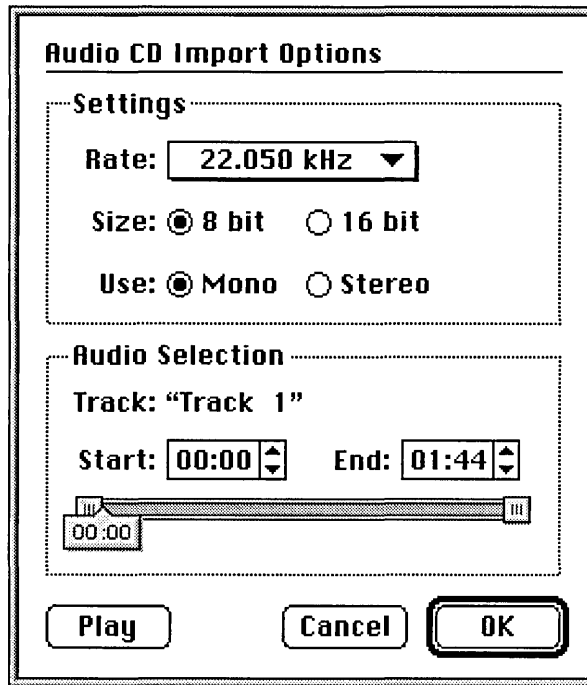


**Figure 26:** CDT Remote Ready for Digital Audio Extraction



*Figure 27: CDT Remote Player Menu*

You will then be presented with a dialog asking you where to save the large file that will be created. Select a destination with lots of space, because it may be a gigantic file (40 megabytes or so) depending on the options you are about to select. You must select a fast storage device for best quality because digital audio extraction must be done live without hesitation, because audio tracks stream data much the same way an old record player needle tracks a vinyl groove. Any hard disk should be fast enough but network drives with low sustained write speeds may cause portions of audio to be "garbled" during the transfer. After naming your "AIFF" export file, another dialog will appear. It is shown here:



*Figure 28: Audio CD Import Options*

This dialog is somewhat interactive, which you may use to find the exact portions of the track you would like to extract. It offers several quality options which have trade-offs in terms of storage space requirements. The best quality (and largest) sample rate is 44.1 KHz, however you should select 22 KHz if you have normal Macintosh sound equipment as your files will be larger than you personally will be able to enjoy them. If you own a Quadra AV or PowerMac series machine you may use the 44.1 KHz sample rate. The 16 bit sound option will make your files twice as large as the "8 Bit" option and is also unneeded if your system does not have a third party sound card or is not a Quadra AV or PowerMac series machine. Stereo is generally preferable, but is double the size of Mono files. Monophonic sound is ideal for non-musical samples, such as voice. If you are making a System Beep, most owners do not use stereo speakers so stereo could be eliminated to save disk space.

In summary, the highest CD pure digital extraction setting is 44.1 KHz, 16 bit, Stereo

and the each of those options makes the file twice as large as their lower quality counterparts. A 22 KHz 8 Bit Mono signal is 8 times smaller than a 44.1 KHz 16-bit Stereo signal, with audio quality nearly equivalent to an AM Radio broadcast.

There is a sliding start position marker and end position marker. Additionally the center marker can be positioned anywhere in the audio track and the Play button may be used to enable/verify digital audio extraction. Sound will come from your internal Mac sound source, not your CD output lines! This sampling technique may sound choppy and have hesitating gaps because it is not possible to perfectly stream digital audio to be played in this manner. This is not a problem because the extracted audio (recorded to the file) will be free of hesitating gaps and choppy sound. Clicking OK initiates the process.

At this point a dialog with a progress bar will appear. Digital Audio extraction takes a long time as most devices require the same amount of time as the duration of the audio clip you are copying. Some devices are much faster, however even if you've selected some low quality options all the data must be sent to the computer as if you selected the highest quality. When the dialogs disappear your AIFF file is ready for use.

## **What is an AIFF file?**

AIFF stands for Audio Interchange File Format. It is a full featured audio file specification which allows many programs on multiple platforms to share standards for audio storage. It is primarily a digital music instrument specification however over the years it has been enhanced to provide compressed digital sound (AIFC). AIFF files have been used on IBM Clones, Amigas, Ataris, Macintoshes, Apple IIGS, Unix workstations, etc. Electronic Arts published the AIFF specification in 1985. Large AIFF files are especially well suited to the Macintosh because Apple provides developers with routines to play them without fully loading them into memory. Most professional digital sound editing programs will import and export AIFF files, which may also be used with CD and DAT audio mastering products.

CDT Remote version or later provides for playing a selected AIFF file as a background process allowing you to use other applications without the music stopping. The file is read from the disk in small hunks, and if your hard disk is fast enough, the audio should be as good as a CD player if the right output equipment is available. To use this feature you must have Sound Manager 3.0 or newer installed or inherently present in your system (System 7.5 and newer has it pre-installed). In fact, if Apple's Sound Manager 3.0 is not installed the menu command in CDT Remote titled "Play an AIFF File" will be absent. It will not even appear as grayed out. Sound Manager 3.0 is provided with Apple's Hardware Update disks and on many Electronic Network services. It consists of two

files: an Extension and a Control Panel shown below:



*Figure 29: Extension*



Sound  
Sound Manager v3.0

**Kind:** control panel  
**Size:** 46K on disk (46,530 bytes used)

*Figure 30: Control Panel*

These files are very helpful for all but the oldest of Macintoshes, and should be installed by everyone. Their primary purpose is to provide sophisticated sound input and sound output capabilities, but they enhance all Macintoshes' sound capabilities even if no specialized sound equipment is present. CDT Remote requires these files to play AIFF files. If you own a third party sound card such as MediaVision's ProAudio Spectrum 16, or Digidesign's AudioMedia II you are probably already familiar with these two files. They are vital to allow any Mac program to emit 16 bit stereo audio output at 44.1 KHz sample rate. The Apple Quadra 660AV, 840AV, and PowerMac series do not need a third party sound card to output high quality sound.

### Common Problems

Digital audio extraction with CDT Remote only works on Audio CDs, not multimedia CDs containing audio tracks. Other third party extraction programs may not have that limitation.

Digital audio extraction with CDT Remote requires QuickTime version 1.6 or newer. But other third party extraction programs may not have that limitation. Properly written digital audio sound extraction programs use Apple's official digital audio extraction commands and therefore will work with FWB's CD-ROM ToolKit driver even without QuickTime 1.6.

Digital audio may be played back in the background from CDT Remote only if Sound Manager 3.0 or its equivalent is present in your system. Please make certain the QuickTime Extension loads before the Sound Manager Extension as it normally should under Apples default environment.

AIFF file playback is broken up with periodic gaps of silence when CDT Remote's menu command is used if your hard disk is slow, your computer is slow, or if your hard disk

does not read ahead when data is being streamed from it in small frequent requests. Use a professional audio program to playback 16 bit high frequency AIFF files instead of the CDT Remote desk accessory if this happens to you, or avoid 16 bit sound and try 8 bit.

Digital Audio will sound hissy if you do not own 16 bit audio sound output equipment, because the Mac uses 8 bit digital sound hardware.

Digital audio will also sound hissy on 8 bit hardware when pre-hearing audio selections in the digital audio extraction dialog because it is monitoring using 8 bit audio rather than 16 bit.

Digital audio will sound less than 16 bit quality in most Macintosh programs written prior to 1994. This is because Sound Manager 3.0 is needed to officially use 16 bit output. Luckily, CD Remote has a 16 bit audio file playback option in the menu. It can play huge files as a background task even with the mouse held down in a menu for extended periods of time (no other programs at this time are known to do this).

AIFF files do not play when double clicked in the finder. An AIFF file can be converted into a system beep or system sound file with sound editing programs such as Sound Edit Pro v1.0.5.

Some CD-ROM drive models do a better job of extracting audio than others. There is little we can do to remedy this, though new devices with improved extraction capabilities continue to appear. The HammerCD 4X, Chinon 535, Sony CDU-55S and Toshiba XM 4101TA extract digital audio perfectly. In fact, the HammerCD 4X can extract at nearly quadruple speed and the Sony CDU-55S at double speed.

QuickTime versions 1.6 and 1.6.1 swap audio channels between left and right sources when extracting; third party programs which do not employ QuickTime might avoid this problem. QuickTime 2.0 fixes all known extraction problems related to QuickTime, though still requires lots of spare memory within the application to convert to AIFF files.

Some extraction imperfections often occur due to the design characteristics of audio CDs. Audio CD blocks are located along a spiral track: devices do not have precise ways of locating a particular block without estimation. Digital markers indicating the position along the spiral are not present at every location for audio tracks. A symptom of flawed extraction is choppy low frequency pops in the sequence, caused when data could not be taken from the device at sufficiently frequent intervals.

Another culprit is older versions of QuickTime such as QuickTime 1.6.2, which asks the device to reread audio data that was sent in the previous request. Such an action requires the CD head to move out of track, thus interrupting the stream of digital audio. Third

party professional extraction programs which avoid older versions of QuickTime entirely while adhering to Apple's CD driver commands for digital extraction will probably yield the best results. We know of no such extraction tools yet. It appears that QuickTime 2.0 should be good enough for most drives.

Some extraction defects are caused by debris, scratches or pressing defects. Audio CDs are allowed approximately 200 pressing defects per disc according to industry standards. You will not hear such defects because they result in a minor audio fidelity loss averaged over a block, and all CD-ROM drives will transfer the extrapolated and corrected audio for you as a favor.

High quality 16 bit stereo 44.1 KHz CD sound is not necessary for average use. This format demands a great deal of space, which is why CD-ROMs can hold so much information. An audio disk can reliably hold a maximum of 4,400 seconds of sound, however because the data is pressed as a spiral track, there is no exact finite limit. That amounts to 740 megabytes of digital sound. You should expect an average four minute song to require 40 megabytes if fully extracted at the highest quality settings.

To many people such high quality audio is unnecessary and consumes excessive disk space. People involved in music production, multimedia arts, QuickTime creation and editing demand such quality, while common everyday SysBeep sounds gain little from it. You be the judge. FWB is just providing the best tools to allow you to experience what was merely a dream in 1992.

### **Playing Audio Tracks on Multimedia disks**

Our player (and others) will not allow you to play the first track on most multimedia disks because that first track is not an audio track. It is a computer data track. There is no problem regarding this except for the confusion it may create. Renumbering the tracks to hide the first data track is not an honest solution, but would have eliminated the problem. Some multimedia CDs containing audio tracks include: "Battle Chess" and "Just Grandma & Me".

### **Using True Multimedia Titles (CDs with both Audio and Data tracks)**

If a CD-ROM's installation manual instructs you to run a copy of the program from your hard disk, be sure to do so. True multimedia titles use digital audio tracks as well as data stored in computer format. There are few of these titles in existence. One reason is that the user must setup audio output from the CD-ROM drive, usually to headphones or an amplifier. The other reason is that most of these titles suffer small audio quirks on non-Apple drives without a flawless CD-ROM driver such as FWB's CD-ROM ToolKit. There is a third reason that they are rare. Audio output can sometimes be inadvertently stopped due to requests for file information. Any request for information from a file must imme-



diately cancel whatever audio was playing because the CD drive must fetch it. The best solution is to move the application and its key files from the CD to the hard disk before starting. An example of a multimedia title that could be affected includes "So You Want to be a Rock and Roll Star?"

### **Avoid Virtual Memory**

Virtual memory adversely affects many titles that play sequences of images or sound from a CD-ROM in a sustained manner. The reason is that many applications assume that large amounts of RAM exist without realizing that this memory is "virtual" and actually stored primarily on a storage device. The symptom is choppy audio, reduced video frame rates, or video jerkiness. You will want to avoid starting the computer with virtual memory enabled when running many QuickTime based CD-ROMs if the applications suffer from jerkiness on your system. This is common to all CD-ROM driver products, including CD-ROM ToolKit.

### **Helpful Hint for Interactive Titles**

There is a way to get additional performance. Many interactive CD games are built using Macromedia's "Director" program. It has been observed that many of these titles prefer to have as much memory as possible allotted to them. Most title publishers pre-configure their titles to run with as little memory as possible, maximizing the target audience. Copy the main application to the hard disk and set the amount of RAM allotted to the application to a much larger value, but not all the memory. Your performance should increase, though not dramatically.

## Section VII — Glossary

**Access Time:** The time period from issuance of a command to access a single sector to the time when the disk drive's head reaches the sector. Access time equals latency plus seek time plus command overhead.

**Adaptive Delta Pulse Coded Modulation:** This audio compression algorithm outlined and employed by the White Book Standard, provides for a user-configurable reduction in audio bandwidth required by stereo digital audio. Standard digital audio requires 176,400 bytes per second, while ADPCM can reduce this by a factor of four or more, permitting other data to be interleaved with audio. Of course, the greater the reduction in bandwidth, the lower the resulting quality of the audio stream.

**Address:** The ID number of a device on the SCSI bus, or of a block of data in storage.

**ANSI, or the American National Standards Institute:** ANSI is a private, nonprofit membership organization that performs two functions: It coordinates the United States' voluntary consensus standards system, and; it approves American National Standards. ANSI ensures that a single set of non-conflicting American National Standards are developed by ANSI-accredited standards-developers, and that all interests concerned have the opportunity to participate in the development process. These requirements for due process have resulted in a high level of confidence and credibility, and thus broad acceptance, for American National Standards. It is important to remember that ANSI does not develop standards. Rather, it provides the means for determining the need for standards, ensures that qualified organizations develop those standards, and coordinates standards approval. If you wish to contact ANSI, write or call: ANSI, 1430 Broadway, New York, NY 10018; (212) 354-3300.

**Average Seek Time:** The time in milliseconds to do all possible seeks on the drive divided by the number of seeks possible.

**Bit:** Bit is a contraction formed of 'binary' and 'digit'; all computer information is represented as a unique combination of the binary digits 0 and 1, which are also called 'offs' and 'ons.'

**Block:** The smallest "chunk" of memory accessed or transferred by the disk drive. Usually 512 bytes in size, it can be larger in multiples of 512. The number of bytes in a block is the same as block size.

**Buffer:** A temporary storage area for data being transferred from one place in the computer system to another. When accessing a single sector, the controller may read the entire track and store it in a buffer.

**Byte:** A group of eight bits. The basic unit of information.

**Cache:** Similar to buffer but more configurable. Cache can reside in RAM or on the drive's controller. It is used to store and quickly transfer recently used data.

**CD ROM (Compact Disk, Read-Only Memory):** Data is stored as pits on the platter surface, which are read by a laser in the CD ROM drive. The data can only be read; data cannot be erased, new data cannot be added.

**CD-ROM/XA:** Acronym for CD-ROM Extended Architecture - an Extension of the original CD-ROM standard which adds the capability for interleaving data to enhance real time playback of time based data. One notable substandard of the CD-ROM/XA specification is the ADPCM audio compression definition. CD-ROM/XA multimedia discs are not commonly found because superior technologies for motion video, such as Quick-Time and ISO Whitebook have superseded it.

**CD-I:** An acronym for compact disc interactive - a compact disc technology similar to CD-ROM but intended for the consumer of electronics market. CD-I discs require special CD-ROM drives to operate.

**CD-W (CD Recorder):** Bringing the reality of Desktop CD Mastering to fruition, these drives, along with specialized mastering software, allow users to make discs themselves.

**Central Processing unit, or CPU:** The brains or 'central switching station' of any computer.

**Controller, or Controller Board:** Circuitry, usually built into a drive, that interprets signals between the host and the peripheral; it acts upon these commands, thus providing the device with 'intelligence.'

**Data Error:** Any discrepancy between recorded data and recovered data.

**Data Transfer Rate:** A measure of how quickly data is supplied to the computer from the CD-ROM drive.

**Device-Independent:** operating at the systems level and not requiring specific customization to run.

**Drive, Hard Disk:** A data storage device that employs one or more rigid disks as the medium.

**Drive, or Disk Drive:** The physical components necessary to transfer data to and from

the recording medium.

**Driver, or Device Driver:** The software program that translates commands between the Macintosh's operating system and the Macintosh's SCSI Manager.

**Firmware:** An often-used microprogram or instruction stored in ROM. Usually refers to the ROM-based software that controls a drive.

**Fragmentation:** With use over time, the sectors of a file are written in different areas across the platter's surface. This slows access time.

**Green Book (CD-I):** This is a proprietary superset of the White Book building upon the logical organization of audio/video discs. It goes on to specify an operating system (a special version of OS/9, a complete Application Programmatic Interface), and playback hardware specifications. Currently, only Philips (N.V.) markets this technology. Special hardware or sophisticated emulators are needed to use these.

**Gigabyte (GB):** 1024 Megabytes or 1,073,741,824 bytes.

**HFS:** Hierarchical File System

**ID, SCSI:** A device's unique address on the SCSI bus is referred to as its ID, or identification.

**Input/Output (I/O):** The communication flow between the Mac and its peripherals.

**Intelligent:** Refers to a device capable of processing commands on its own.

**Interface:** The go-between that provides a common basis for communication between two otherwise incompatible devices.

**ISO 9660:** ISO is an acronym for the International Standards Organization and ISO 9660 is an established international standard file structure for CD-ROM discs adopted by ISO.

**Kb/s:** Kilobits per second.

**KB/s:** Kilobytes per second.

**Kilobyte:** One thousand bytes (actually 1024).

**Latency:** The time, in milliseconds, it takes for the spinning platter to bring around the desired sector to where the read/write head can access it. Does not include head position-

ing time. Contributes to access time. (See Interleaving.)

**Mb/s:** Megabits per second, equal to 1,048,576 bits per second, or 131,072 bytes per second.

**MB/s:** Megabytes per second, equal to 1,048,576 bytes per second, or 131,072 bytes per second.

**Media:** Another term for the disk platter, but more specifically the magnetic coating that covers the platter. The surface of the platter that holds the data.

**Megabyte:** 1,048,576 bytes.

**Motion Picture Experts Group:** This compression algorithm, like its audio counterpart (q.v. ADPCM), provides configurable compression for video data, employing complex Discrete Cosine Transformation and frame differencing algorithms. Simply put, it allows the Author to control the amount of data required by the video portion of his media, sacrificing quality for greater compression. As the degree of compression increases, picture detail and color range decreases; video footage with a great deal of full-screen changes do not compress nearly as compactly because of this algorithm's assumptions about most video footage remaining largely static from frame to frame.

**Mount:** To appear on the Desktop; that is, to show an icon on-screen.

**Multisession:** An ISO standard CD-ROM format often referred to as "Orange book" that allows additional information to be added to a CD-ROM disc that has already been written to once. Multisession discs are most commonly associated with Kodak's proprietary digital photograph format called Photo CD. Multisession Photo CDs use special CD-ROM production equipment and allow digital photographs to be written to a CD-ROM disc more than once through "data interleaving". Reading the "secondary" writes on these multisession discs requires special CD-ROM hardware that is multisession compatible.

**Optical Drive:** A method of storing data by encoding information data on a disk with a laser.

**Orange Book Standard (CD-WO System Description):** Another Sony/Philips collaboration which details physical and optical characteristics of Compact Disc Write Once media, and hybrid ROM/WO discs which have read-only and write once areas on the same disc. As of this writing (1994 Oct), this technology is rapidly becoming more cost effective. Within a year, CD recorders may cost in the \$1000 range, with media costs currently at \$14 per disc. New generation recorders offer high speed (4 or 6x standard CD

rate) writing as well as reading. Discs for recording use gold as a substrate metal instead of the aluminum employed by mass-market stamped discs, but may employ both.

**Overhead:** The incidental command processing time that is necessary to complete a task.

**Partition:** A portion of a storage area allocated to a particular use or user.

**Peripheral:** A device that is attached to the computer, either directly or via the bus.

**Platter:** The rigid disk that is used for storing data on hard disk drives.

**Prefetch:** Similar to buffering, except prefetching can read ahead to the next track. These larger reads get more data ready for the CPU's next request, thus speeding up access time.

**Proprietary:** Vendor-unique technology or devices that are incompatible with other products in the industry.

**QuickTime:** An Extension of the Macintosh system software that provides facilities for managing time based data.

**RAM, or Random Access Memory:** Temporary memory usually found on single in-line memory modules (SIMMs) on the motherboard of the computer. RAM is lost when power is turned off.

**Red Book:** Refers to the specifications for the compact audio disc format developed by Philips and Sony and is the standard format of commercial audio CDs.

**Red Book Standard (Compact Disc Digital Audio System Description):** In 1983 a consortium of Philips (N.V.) and Sony drafted a comprehensive document to thoroughly define the Compact Disc Digital Audio standard. This document, eponymous for the color of its cover, describes the physical dimensions, optical characteristics, and logical organization, including the table of contents, track, and audio stream formats. This is the seminal Compact Disc document, from which all subsequent standards are derived.

**ROM, or Read-Only Memory:** Permanently stored data in the computer memory. Also refers to storage media that may only be read (not erased or written to).

**SCSI Manager:** The SCSI Manager is part of the Macintosh Operating System that provides the interface between a program such as a driver or formatter and the actual hardware SCSI port.

**SCSI:** Small Computer Systems Interface. A standard interface by which computers and

their peripherals communicate with each other.

**Sectors:** Sectors are the smallest subdivisions of tracks, and usually contain exactly 512 bytes of data.

**Seek Time:** The time it takes the read/write head to move back and forth in search of the appropriate track; does not include latency or command overhead. (See Access Time.)

**Single-session:** Refers to standard CD-ROM discs where multisession format is not present.

**Time Based Data:** Data that can be stored as samples taken over time, such as audio, video, and animations.

**Tracks:** On a CD-ROM, tracks are logical divisions of the total data capacity. A CD may contain up to 99 tracks in its Table of Contents. Tracks on hard drives are invisible magnetic "grooves," in the form of concentric circles that store data on a platter. Each track is a single line of magnetic domains.

**Volume:** Also known as a partition. Represented by an icon on the Desktop and used to store files and folders of information.

**White Book Standard (Video CD System Description):** JVC, Matsushita, Sony, and Philips co-authored this specification, also known as the "Video CD Standard." MPEG compression plays a major role in this standard. This remains a nascent technology, waiting for CD-ROM technology and the right marketing approach.

**NOTE:** MPEG is neither designed nor controlled by any of the co-authors of this standard.

**Yellow Book Standard (CD-ROM System Description):** A subsequent standards document which builds upon the Red Book Standard, allowing for the presence of data tracks on a Compact Disc. The Yellow Book standard specifies that CD-ROM must encode the first track as data. In addition to the two layers of error correction outlined in the Red Book (modulation-based & CIRC), standard 2048 bytes-per-block data is further protected by a third layer of error detection & correction for added security (known as ECC).

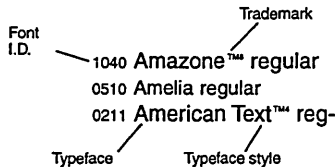
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1154	<b>AdLib™ regular</b>	0812	<i>Calligraphic 810 italic</i>
1040	<i>Amazone™ regular</i>	0581	Caslon Openface™ regular
0510	<b>Amelis™ regular</b>	1055	Century 725 roman
0043	American Garamond roman	1059	<i>Century 725 roman italic</i>
0044	<i>American Garamond italic</i>	1056	<b>Century 725 bold</b>
0045	American Garamond bold	1060	<b>Century 725 black</b>
0046	<i>American Garamond bold italic</i>	1057	Century 725 condensed
0211	<i>American Text™ regular</i>	1058	<b>Century 725 bold condensed</b>
0498	Americana™ roman	0282	Clarendon light
0499	<i>Americana italic</i>	0283	<b>Clarendon roman</b>
0500	Americana bold	0284	<b>Clarendon bold</b>
0501	<b>Americana extra bold</b>	0351	<b>Clarendon black</b>
1152	Baker Signet™ roman	0846	Clarendon condensed
0589	<b>BANK GOTHIC™ LIGHT</b>	0228	<b>Clarendon bold condensed</b>
0590	<b>BANK GOTHIC MEDIUM</b>	0277	Classical Garamond roman
1024	<b>Belwe bold</b>	0278	<i>Classical Garamond italic</i>
0986	<i>Bernhard Tango™ regular</i>	0279	Classical Garamond bold
0643	Bitstream Amerigo*1 roman	0972	<i>Classical Garamond bold italic</i>
0644	<i>Bitstream Amerigo italic</i>	0757	<b>Cloister Black™ regular</b>
0645	<b>Bitstream Amerigo bold</b>	0938	<b>Cloister Openface™ regular</b>
0772	<i>Bitstream Amerigo bold italic</i>	9025	Commercial Pi regular
0770	Bitstream Amerigo medium		♣♠★R♀♂☞☞▼✓☑☐♦
0771	<i>Bitstream Amerigo medium italic</i>	0976	<i>Commercial Script™ regular</i>
0630	<b>Bitstream Cooper black</b>	0421	<b>COPPERPLATE GOTHIC BOLD</b>
0631	<b>Bitstream Cooper black italic</b>	0423	COPPERPLATE GOTHIC CONDENSED
1178	Bitstream Oz Handicraft™ regular	0424	COPPERPLATE GOTHIC BOLD CONDENSED
1044	<b>Blackletter 635</b>	0195	<b>DAVIDA™ BEBE</b>
0511	<b>Blippo™ black</b>	0604	<b>Dom™ casual</b>
0055	Bodoni roman	0769	<b>Dom bold</b>
0056	<i>Bodoni italic</i>	0921	<b>Dom diagonal bold</b>
0037	<b>Bodoni bold</b>	0588	<i>Embassy regular</i>
0038	<i>Bodoni bold italic</i>	0840	<i>English 157 regular</i>
1231	<b>BREMEN™ BOLD</b>	0212	<b>Engravers' Old English™ regular</b>
1232	<b>BREMEN BLACK</b>	1045	<b>Engravers' Old English bold</b>
0131	<b>Broadway™ regular</b>	0587	ENGRAVERS' ROMAN REGULAR
0802	<b>Broadway engraved</b>	0974	ENGRAVERS' ROMAN BOLD
0990	<i>Brush 445 regular</i>	0626	Exotic 350 light
0806	<i>Brush 738 regular</i>	0627	Exotic 350 demi bold
0199	<i>Brush Script™ regular</i>	0628	<b>Exotic 350 bold</b>
1139	Calligraphic 421 roman	0916	<i>Flareserif 821 light</i>
0811	Calligraphic 810 roman	0917	<i>Flareserif 821 roman</i>

0916	Flareserif 821 light	0292	<b>Humanist 521 bold</b>
0917	Flareserif 821 roman	0293	<i>Humanist 521 bold italic</i>
0918	<b>Flareserif 821 bold</b>	0294	<b>Humanist 521 extra bold</b>
0591	<i>Flemish Script regular</i>	0295	<b>Humanist 521 ultra bold</b>
1141	Formal 436 regular	0497	<b>Humanist 521 extra bold condensed</b>
0609	<b>Formal Script 421 regular</b>	0857	Humanist 777 roman
0983	Fraktur regular	0858	<i>Humanist 777 italic</i>
0714	<b>Freeform 710 regular</b>	0859	<b>Humanist 777 bold</b>
0997	Freeform 721 roman	0860	<i>Humanist 777 bold italic</i>
0998	<i>Freeform 721 italic</i>	0264	<b>Humanist 970 roman</b>
0999	<b>Freeform 721 bold</b>	0265	<b>Humanist 970 bold</b>
1000	<i>Freeform 721 bold italic</i>	1177	HUXLEY VERTICALTM REGULAR
1001	<b>Freeform 721 black</b>	0352	Imperial roman
1002	<i>Freeform 721 black italic</i>	0353	<i>Imperial italic</i>
0418	<i>Freehand 471 regular</i>	0354	<b>Imperial bold</b>
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1046	<i>Freehand 575 regular</i>	0725	<i>Impuls™ regular</i>
1043	<i>Freehand 591 regular</i>	0387	Incised 901 light
0625	<i>Gando regular</i>	1115	<b>INFORMAL 011 ROMAN</b>
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1127	Geometric 231 roman	0726	<i>Kaufmann™ regular</i>
1128	<b>Geometric 231 bold</b>	0727	<i>Kaufmann bold</i>
1129	<b>Geometric 231 heavy</b>	0761	Kuenstler 480 roman
0306	Geometric Slabserif 703 light	0762	<i>Kuenstler 480 italic</i>
0307	<i>Geometric Slabserif 703 light italic</i>	0763	<b>Kuenstler 480 bold</b>
0312	<b>Geometric Slabserif 703 extra bold</b>	0764	<i>Kuenstler 480 bold italic</i>
0313	<b>Geometric Slabserif 703 extra bold italic</b>	1026	<b>Kuenstler 480 black</b>
1021	<b>Geometric Slabserif 703 extra bold condensed</b>	0489	Latin 725 roman
0485	<b>Geometric Slabserif 712 medium</b>	0490	<i>Latin 725 italic</i>
0486	<i>Geometric Slabserif 712 medium italic</i>	0493	<b>Latin 725 bold</b>
0487	<b>Geometric Slabserif 712 bold</b>	0494	<i>Latin 725 bold italic</i>
0488	<b>Geometric Slabserif 712 extra bold</b>	0507	LATIN EXTRA CONDENSED™ REGULAR
0807	<b>Gothic 821 condensed</b>	0987	<i>Liberty™ regular</i>
1054	Goudy Catalogue™ regular	0847	<i>Lucia regular</i>
1053	Goudy Handtooled™ regular	8730	MICR 012 0 1 2 0 1 2 3 4 5 6 7 8 9 C . ' * **
0768	<b>Handel Gothic™ regular</b>	1221	<b>Mister Earl™ regular</b>
0057	<b>Hobo™ regular</b>	0793	Modern 735 roman
9832	Holiday Pi™ regular (TrueType only)	0596	Monospace 821 roman
0290	Humanist 521 roman	0597	<i>Monospace 821 italic</i>
0291	<i>Humanist 521 italic</i>	0598	<b>Monospace 821 bold</b>
		0599	<b>Monospace 821 bold italic</b>

0608	<i>Murray Hill</i> ™4 regular	0371	Swiss 721 light extended
0318	<b>News 701 roman</b>	0372	Swiss 721 extended
0319	<i>News 701 italic</i>	0373	<b>Swiss 721 bold extended</b>
0320	<b>News 701 bold</b>	0813	<b>Swiss 721 bold rounded</b>
1011	<b>Normande™ roman</b>	0815	<b>Swiss 721 black rounded</b>
1012	<b>Normande italic</b>	0105	<b>Swiss 911 extra compressed</b>
0981	<i>Nuptial regular</i>	1151	<b>Fango™ regular</b>
0395	OCR-A 01234abcdABCDE	0606	™
7009	<b>Old Dreadful No. 7™ regular</b> ABCDabcd123456{}	0939	<i>Typo Upright™ regular</i>
0519	<i>Onyx™ regular</i>	1074	<b>UMBRA™ REGULAR</b>
0755	Orator 10 pitch	0756	<b>VAG Rounded regular</b>
0758	Orator 15 pitch	0215	<b>Vineta™ regular</b>
0213	<b>Orbit-BT™ regular</b>	0985	<i>Middling Text™ regular</i>
0720	P.T. Barnum™4 regular	0015	Zapf Humanist 601 roman
1064	<i>Parisian™ regular</i>	0016	<i>Zapf Humanist 601 italic</i>
0362	<i>Park Avenue™ regular</i>	0017	<b>Zapf Humanist 601 bold</b>
0592	<i>Piranesi Italic™ regular</i>	0018	<b>Zapf Humanist 601 bold italic</b>
0867	<b>Playbill®9 regular</b>	0136	<b>Zapf Humanist 601 ultra</b>
0129	<b>Poster Bodoni roman</b>	0137	<b>Zapf Humanist 601 ultra italic</b>
1080	<b>Raleigh demi bold</b>	0176	Zurich™ light
0207	<i>Ribbon 131 regular</i>	0177	Zurich light italic
0208	<i>Ribbon 131 bold</i>	0178	Zurich roman
1114	<b>Schadow™ black condensed</b>	0179	<i>Zurich italic</i>
0940	<i>Script 12 pitch roman</i>	0180	<b>Zurich bold</b>
0820	<b>Seagull heavy</b>	0181	<b>Zurich bold italic</b>
0593	<i>Shelley®2 andante</i>	0182	<b>Zurich black</b>
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0610	<i>Staccato 222 regular</i>	0297	Zurich light condensed italic
1153	<i>Staccato 555 regular</i>	0298	Zurich condensed
0191	<b>STENCIL™ REGULAR</b>	0299	<i>Zurich condensed italic</i>
0980	<i>Stuyvesant regular</i>	0300	<b>Zurich bold condensed</b>
0003	<b>Swiss™ 721 roman</b>	0301	<b>Zurich bold condensed italic</b>
0004	<i>Swiss 721 italic</i>	0958	Zurich light extra condensed
0005	<b>Swiss 721 bold</b>	0959	Zurich extra condensed
0006	<b>Swiss 721 bold italic</b>	0960	<b>Zurich bold extra condensed</b>
		0970	<b>Zurich extra black</b>

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