



Professional Workstation AP500

Reference Guide

First Edition (July 1998)
Part Number 338521-001
Compaq Computer Corporation

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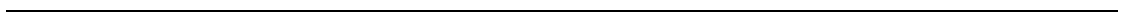
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About This Guide

This guide is designed to be used as step-by-step instructions for installation, and as a reference for operation, troubleshooting, and future upgrades.

Text Conventions

This document uses the following conventions to distinguish elements of text:

Keys	Keys appear in boldface. A plus sign (+) between two keys indicates that they should be pressed simultaneously.
USER INPUT	User input appears in a different typeface and in uppercase.
<i>FILENAMES</i>	File names appear in uppercase italics.
Menu Options, Command Names, Dialog Box Names	These appear in initial capital letters.
COMMANDS, DIRECTORY NAMES, and DRIVE NAMES	These always appear in uppercase
Type	When you are instructed <i>to type</i> information, type the information without pressing the Enter key.
Enter	When you are instructed <i>to enter</i> information, type the information and then press the Enter key.

Symbols in Text

These symbols may be found in the text of this guide. They have the following meanings.



WARNING: Indicates that failure to follow directions in the warning could result in bodily harm or loss of life.



CAUTION: Indicates that failure to follow directions could result in damage to equipment or loss of information.

IMPORTANT: Presents clarifying information or specific instructions.

NOTE: Presents commentary, sidelights, or interesting points of information.

Symbols on Equipment

These icons may be located on equipment in areas where hazardous conditions may exist.



Any surface or area of the equipment marked with these symbols indicates the presence of electrical shock hazards. Enclosed area contains no operator serviceable parts.

WARNING: To reduce risk of injury from electrical shock hazards, do not open this enclosure.



Any RJ-45 receptacle marked with these symbols indicates a Network Interface Connection.

WARNING: To reduce risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.



Any surface or area of the equipment marked with these symbols indicates the presence of a hot surface or hot component. If this surface is contacted, the potential for injury exists.

WARNING: To reduce the risk of injury from a hot component, allow the surface to cool before touching.



WARNING: To reduce the risk of electric shock or damage to the equipment:

- Do not disable the power cord grounding plug. The grounding plug is an important safety feature.
 - Plug the power cord into a grounded (earthed) electrical outlet that is easily accessible at all times.
 - Disconnect power from the workstation by unplugging the power cord from either the electrical outlet or the workstation.
-

Getting Help

If you have a problem and have exhausted the information in this guide, you can get further information and other help in the following locations.

Compaq Website

The Compaq website has information on this product as well as the latest drivers and Flash ROM images. You can access the Compaq website by logging on to the Internet at <http://www.compaq.com>.

Telephone Numbers

For the name of your nearest Compaq Authorized Reseller:

In the United States, call 1-800-345-1518

In Canada, call 1-800-263-5868

For Compaq technical support:

In the United States and Canada, call 1-800-386-2172

For Compaq technical support phone numbers outside the United States and Canada, visit the Compaq website at:

<http://www.compaq.com>

Chapter 1

Product Features

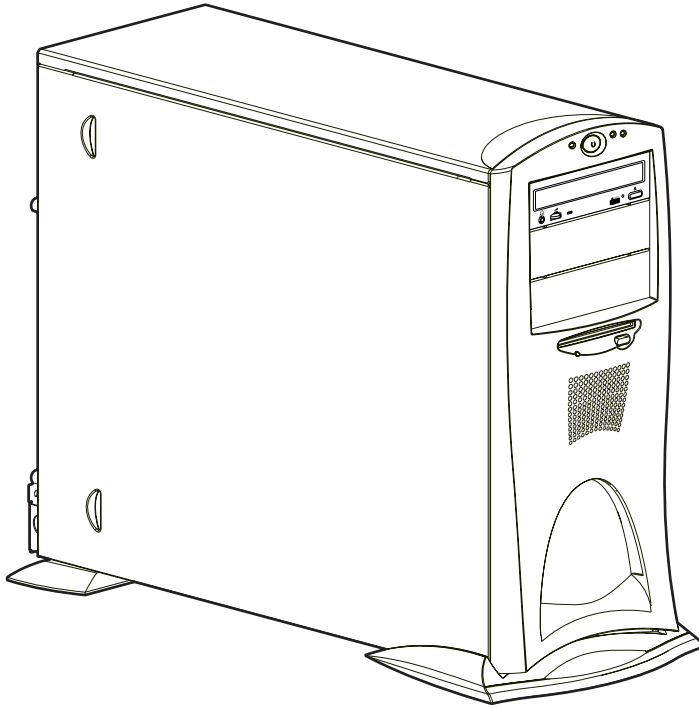


Figure 1-1. Compaq Professional Workstation AP500

Standard Features

The Compaq Professional Workstation AP500 offers the following standard features. Features may vary depending on your model. For a complete listing of the hardware and software installed in your workstation run the INSPECT utility in Chapter 2.

Table 1-1
Standard Features

Feature	Compaq Professional Workstation AP500
Processors	Standard with one 400-MHz or 450-MHz Intel Pentium II processor
Number of Processors	One processor, upgradable to two
L2 Cache Size	512 KB
Memory	64-MB or 128-MB, 100-MHz Registered SDRAM DIMMs (upgradable to 1 GB).
Optional Memory Upgrades	Supports 100-MHz ECC 32-MB, 64-MB, 128-MB, or 256-MB Registered SDRAM DIMMs.
Memory Controller	800MB/s single channel memory controller
Error Checking and Correcting (ECC) Memory	Uses an encoding scheme for memory error detection and correction. (Specifically, this feature detects and corrects all single-bit memory errors, and detects and reports double-bit errors.)
Graphics Controller	Ships with 2D/3D or 3D graphics controller. Refer to the appropriate guide on the SmartStart for Workstations CD under X:\DOCS\GRAPHICS, where X is your CD-ROM drive designation.
Expansion Slots	Six slots with five open. Three dedicated PCI slots. One shared PCI/ISA slot (1 full-length PCI/ISA). One dedicated short ISA slot. One Accelerated Graphics Port (AGP) slot located on system board.
Drive Controller	Integrated IDE controller and Integrated Wide-Ultra SCSI controller on PCI local bus.

Continued

Standard Features *Continued*

Feature	Compaq Professional Workstation AP500
Network Controller	Compaq Fast Ethernet Embedded NIC NC3121 (10/100Mbps with RJ-45 connector only).
Hard Drive Types	Ultra ATA (IDE) or Wide-Ultra SCSI (To find your specific hard drive size, double-click on <i>My Computer</i> , then click on the drive you want to check. Click <i>File</i> , then click <i>Properties</i> .)
Secondary Storage	3.5-inch diskette drive and CD-ROM drive
Drive Bays	Seven drive bays with four open.
Standard External Connectors/Jacks	Serial (two available) Parallel USB-hardware ready (two available) Wide-Ultra SCSI Ethernet (RJ-45) Headphone and microphone jacks Stereo line in/line out Keyboard Mouse VGA (AGP) on selected models
Audio	Integrated/ported speaker built into the front bezel Integrated audio chip provides stereo sound and FM synthesis Headphone jack Microphone jack Stereo line in/line out
ROM	Software upgradable ROM via ROMPaq Utility
Power Supply	325-Watt power supply with Power Factor Correction (PFC)
Software	Microsoft Windows NT Workstation, Compaq support software, and Compaq utilities (preinstalled)

Continued

1-4 Product Features

Standard Features *Continued*

Feature	Compaq Professional Workstation AP500
Intelligent Management	Remote ROM update Remote Security Management Remote Wakeup and Remote Shutdown Establishment of Power Management Settings Advanced Configuration and Power Interface (ACPI) capable Enhanced Support Software CD and support from Compaq website DMI 2.0 For more information, see Chapter 3
Asset Management	Compaq Diagnostics for Windows NT Workstation For more information, see Chapter 3
Security Features	Keyboard password Administrator password QuickLock/QuickBlank Diskette Write Control Diskette Boot Control Serial Interface Control Security Lock Provision
Diagnostic Tools	Power-On Self-Test (POST) Diagnostics (DIAGS) Computer Setup and Inspect ROMPaq utilities to upgrade ROM
Warranty	3-year limited (3/1/1)

SmartStart for Workstations

If the preinstalled software on your workstation has been deleted, you can install Microsoft Windows NT Workstation, Compaq support software, and Compaq utilities using SmartStart for Workstations. For more information about SmartStart for Workstations, refer to the *Software Installation Guide* shipped with the workstation. There are also online help files located on the SmartStart for Workstations CD.

For information about the graphics controller installed on your workstation, refer to the appropriate guide on the SmartStart for Workstations CD under X:\DOCS\GRAPHICS, where X is your CD-ROM drive designation. To view one of the .pdf files, use Adobe Acrobat Reader. To install Adobe Acrobat Reader, refer to the *Software Installation Guide*.

Front Panel Components

The following figure identifies the front panel components. See Table 1-2 for a description of each component.

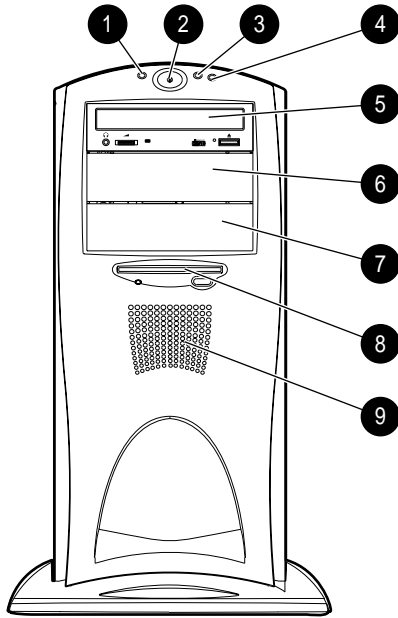


Figure 1-2. Identifying front panel components

Table 1-2
Front Panel Components

Ref.	Component	Description
1	Power on/off LED	<p>After plugging the power cord into a grounded AC outlet and the workstation, if the LED is:</p> <p>Off - Workstation is ready to be powered up.</p> <p>Steady Amber - The expansion board assembly is not seated properly.</p> <p>After pressing the power button, if the LED is:</p> <p>Steady Green - Workstation is turned on, and the expansion board assembly is seated properly.</p> <p>Blinking green - Workstation is in standby mode</p>
2	Power button	Turns the workstation on or off
3	Hard drive activity LED	When lit, indicates the workstation is reading or writing data to the hard drive(s)
4	Network activity LED	When lit, indicates the workstation is receiving or sending data on the network
5	Bay 4 - CD-ROM drive	5.25-inch, half-height drive bay
6	Bay 5	5.25-inch, half-height drive bay
7	Bay 6	5.25-inch, half-height drive bay
8	Bay 7 - diskette drive	3.5-inch, third-height drive bay
9	Speaker	PremierSound with fixed equalization

Rear Panel Components

The following figure illustrates the location of the external connectors and jacks.

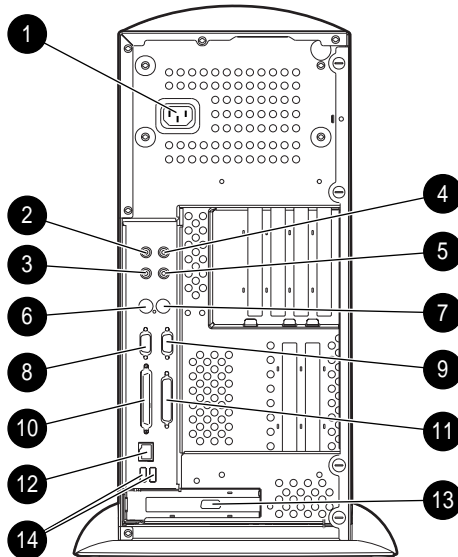


Figure 1-3. Identifying rear panel components

Table 1-3
Rear Panel Components

Ref.	Component	Function
1	Power cord connector	Connects the power cord
2	Headphone jack	Connects to headphones
3	Audio line-out connector	Connects to an external amplifier that powers additional speakers or a tape deck for recording

Continued

Rear Panel Components *Continued*

Ref.	Component	Function
4	Microphone jack	Connects to a microphone
5	Audio line-in connector	Connects a device that supplies sound such as a tape deck or CD player
6	Keyboard connector	Connects to a keyboard (orange icon)
7	Mouse connector	Connects to a mouse (green icon)
8	Serial connector	Connects to a serial device
9	Serial connector	Connects to a serial device
10	Wide-Ultra SCSI connector	Connects to a SCSI device
11	Parallel connector	Connects a parallel device such as a printer
12	RJ-45 connector	Connects to the Ethernet network
13	VGA (AGP) connector	Connects to a monitor (available on select models)
14	USB connectors (2)	Connect to USB devices

Keyboard and Mouse

The Compaq Professional Workstation AP500 ships with a keyboard and a three-button mouse.

Special Mouse Functions

Most software applications support the use of a mouse. The functions assigned to each mouse button depend on the software application you are using.

The Logitech OEM MouseWare software provides special drivers and an applet that allows you to define the functionality of the mouse buttons. For more information on installing this software, refer to the Workstation Software Reference, which is located on the SmartStart for Workstations CD at `X:\DOCS\REFERENC\INDEX.HTM` (where *X* is your CD-ROM drive designation).

Special Keyboard Functions

Some keys on the keyboard provide special functions, depending on the software application you are using. The following figure identifies all special function keys. Refer to the corresponding table for a description of each key.

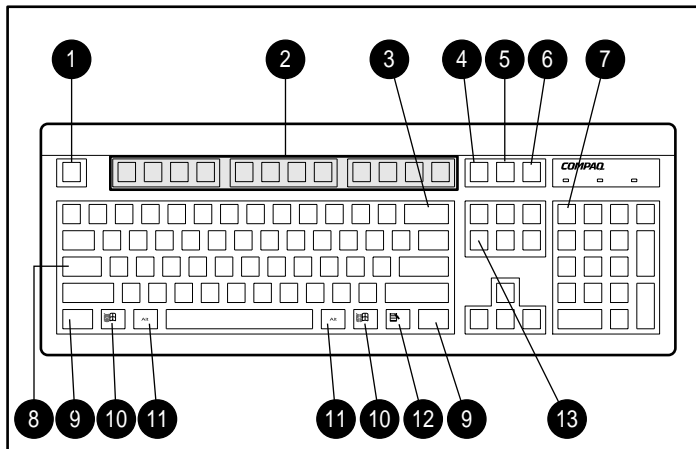


Figure 1-4. Identifying special function keys

Table 1-4
Special Function Keys

Ref.	Key	Function
1	Esc	Often assigned a specific task by the application. Frequently used as an exit key (for quitting an application), for moving back one screen, or for canceling a command.
2	F1 - F12	Used for specific effects in applications and operating systems. Refer to the application software documentation.
3	Backspace	Moves the cursor left and deletes characters as it moves to the left.
4	Print Scrn	Depending on the software you are using, prints the displayed screen to a printer. Using this key may not print the entire file.
5	Scroll Lock	When the Scroll Lock light is on, the screen is prevented from scrolling.
6	Pause	Temporarily suspends screen scrolling or some operations.
7	Num Lock	When the Num Lock light is on, the numeric keypad is activated and the arrow keys are deactivated. (The arrow keys to the left of the keypad perform the same functions as the arrow keys on the keypad.)
8	Caps Lock	When the Caps Lock light is on, all letters typed are capitalized.
9	Ctrl	Used in combination with another key, its effect depends on the application software you are using.

Continued

Special Function Keys *Continued*

Ref.	Key	Function
10	Windows Logo*	Used to open the Start menu in Windows NT Workstation. Used in combination with other keys to perform other functions. (See next table.)
11	Alt	Used in combination with another key, its effect depends on the application software you are using.
12	Application*	Used (like the right mouse button) to open pop-up menus in a Microsoft Office application. May perform other functions in other software applications.
13	Delete	Used to delete characters.

*Keys available in select geographic regions.

Windows Logo Key

The following table shows you how to use the Windows Logo key in combination with other keys to perform certain functions in Windows NT Workstation.

Table 1-5
Key Combinations

Windows Logo Key Combination	Function in Windows NT Workstation
Windows logo key + F1	Displays a pop-up menu for the selected object.
Windows logo key + Tab	Activates the next Taskbar button.
Windows logo key + E	Launches Explore My Computer.
Windows logo key + F	Launches Find Document.
Windows logo key + Ctrl+F	Launches Find Computer.
Windows logo key + M	Minimizes all open applications.
Shift+Windows logo key + M	Undoes Minimize All.
Windows logo key + R	Displays Run dialog box.

Keyboard Lights

The following figure identifies the location of the three keyboard lights. For a description of each light, refer to the corresponding table.

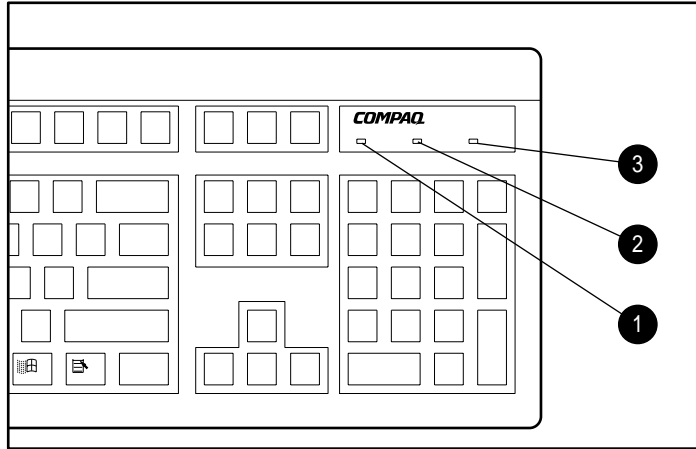


Figure 1-5. Keyboard lights

Table 1-6
Keyboard Lights

Ref.	Description	Function
1	Num Lock	When Num Lock is enabled (light is on), the numeric keypad is activated.
2	Caps Lock	When the Caps Lock is enabled (light is on), all text appears in uppercase when typed.
3	Scroll Lock	When Scroll Lock is enabled (light is on), the screen is prevented from scrolling.

Chapter 2

Compaq Setup and Diagnostic Software

Your workstation provides setup and diagnostic utilities that you can use to configure your workstation's hardware, resolve resource conflicts, run diagnostic tests on your workstation, and view information about your workstation. This software includes Compaq Utilities that are preinstalled on a hard drive partition and ROM BIOS (Read Only Memory Basic Input/Output System). This chapter explains how to access the Compaq Utilities menu, describes the options available in Compaq Utilities, and discusses the ROM BIOS.

NOTE: If you have reformatted your hard drive and removed the hard drive partition that contains the Compaq Utilities, you can reinstall it by using the Compaq SmartStart for Workstations CD, or you can download Setup and User Diagnostics from the Compaq website at <http://www.compaq.com> in the Compaq Services and Technical Help area, under Downloadables.

NOTE: For information on another Compaq diagnostic tool, Compaq Diagnostics for Windows NT, refer to Chapter 3.

Accessing the Compaq Utilities Menu

To access the Compaq Utilities menu, follow these steps:

1. Turn on or restart the workstation. If Windows NT Workstation is running, click *Start, Shut Down, Restart the computer*.
2. When you see the words "**F10=Setup**" in the bottom-right corner of the screen, press the **F10** key.

NOTE: If you do not press the **F10** key while the message is displayed, you must turn off the workstation, then on again, to access the utility.

3. Press the **Enter** key to bypass the title and welcome screen. The Compaq Utilities menu appears.

The Compaq Utilities menu consists of the following choices:

- Computer Setup
- Computer Checkup (TEST)
- View System Information (INSPECT)
- Create a Diagnostics Diskette
- Manage Diagnostics Partition
- Exit from this Utility

These options are described in the following subsections.

Computer Setup

Computer Setup allows you to configure your workstation's hardware and resolve resource conflicts. Computer Setup provides information you will need about your workstation if you need assistance from Compaq Customer Support. Setup can also be used:

- To change factory default settings, and to set or change the system configuration, which may be necessary when you add or remove hardware.
- To determine if all of the devices installed on the workstation are recognized by the system and functioning properly.
- To determine information about the operating environment of the workstation.
- To solve system configuration errors detected but not automatically fixed during the Power-On Self-Test (POST).
- To establish and manage passwords and other security features.
- To establish and manage energy-saving timeouts.

IMPORTANT: Be sure to configure new options and drivers in your operating system after they have been configured by Computer Setup.

Using Computer Setup

To use Computer Setup, select *Computer Setup* from the Compaq Utilities menu. The following table describes the features available in Computer Setup.

Table 2-1
Computer Setup Features

Task	Computer Setup Selection
View the product name, processor type/speed/stepping, CPU serial number, system ROM date, system board revision, installed memory size, and asset tracking number	Click <i>Built-in Devices</i> , then click <i>System Information</i> .
Set the system time and date	Click <i>Built-in Devices</i> , then click <i>System Information</i> . Click <i>Date/Time</i> .
Set the Asset Tag. For more information, see section "Security Management" in Chapter 3.	Click <i>Built-in Devices</i> , then click <i>System Information</i> . Under <i>System Parameters</i> , enter the new <i>Asset Tag</i> .
Set the POST mode (QuickBoot or FullBoot) and enable/disable POST messages	Click <i>Built-in Devices</i> , then click <i>System Information</i> . Select the appropriate options under <i>Quick Boot</i> and <i>POST Messages Descriptive/Clean Mode</i> .
Set ISA back-to-back I/O (fast/legacy) delay and bus priority (ISA/PCI)	Click <i>Built-in Devices</i> , then click <i>System Information</i> . Under <i>System Parameters</i> , select the appropriate <i>I/O Delay</i> .
View the currently installed drive A: (preinstalled diskette drive) and drive B: devices and set resources for diskette drives	Click <i>Built-in Devices</i> , then click <i>Storage</i> . The information is displayed under <i>Diskette</i> .
Enable/disable diskette booting and diskette writing NOTE: After saving changes to Removable Media, the workstation will restart. Turn the workstation off, then on, manually.	Click <i>Built-in Devices</i> , then click <i>Storage</i> . Select the appropriate option under <i>Removable Media</i> .

Continued

Computer Setup Features *Continued*

Task	Computer Setup Selection
View information regarding IDE devices connected to the system NOTE: ATAPI devices (CD-ROM, tape) are listed as ATAPI devices.	Click <i>Built-in Devices</i> , then click <i>Storage</i> . The information is displayed under <i>IDE Devices</i> .
Set the hard drive to Ultra-DMA (Ultra-ATA), EDMA, or PIO mode operation	Click <i>Built-in Devices</i> , then click <i>Storage</i> . Under <i>IDE Devices</i> , select the appropriate <i>Drive Timing</i> .
Enable/disable IDE drive translation	Click <i>Built-in Devices</i> , then click <i>Storage</i> . Under <i>IDE Devices</i> , select <i>IDE Drive Translation</i> .
Specify the boot order of installed peripheral devices (such as LS-120 drive, diskette drive, hard drive, or CD-ROM devices)	Click <i>Built-in Devices</i> , then click <i>Storage</i> . Click <i>Boot Order</i> .
Enable/disable serial and parallel port and/or set resources for onboard system devices (serial port, parallel port, etc.)	Click <i>Built-in Devices</i> , then click <i>Communications</i> . Select the appropriate options under <i>Serial Ports</i> or <i>Parallel Port</i> .
Set the printer mode (flexible/standard)	Click <i>Built-in Devices</i> , then click <i>Communications</i> . Under <i>Parallel Port</i> , select the appropriate <i>Bi-directional Port</i> .
Set the Num Lock state at power-on	Click <i>Built-in Devices</i> , then click <i>Input Devices</i> . Under <i>Keyboard</i> , turn on <i>Num Lock State At Power-on</i> .
Disable energy save mode	Click <i>Built-in Devices</i> , then click <i>Power Management</i> . Select <i>Energy Save Disabled</i> .
Select timeout values NOTE: These selections appear only when energy save mode is set (default).	Click <i>Built-in Devices</i> , then click <i>Power Management</i> . Under <i>Hard Drive</i> and/or <i>Monitor</i> , select the <i>Timeout</i> value.
Enable/disable power LED blink in suspend mode NOTE: This selection does not appear if the energy saver mode is disabled.	Click <i>Built-in Devices</i> , then click <i>Power Management</i> . Select <i>Blink LED during Energy Save</i> .

Continued

Computer Setup Features *Continued*

Task	Computer Setup Selection
Enable the Power-on Password. For more information, see the section "Security Management" in Chapter 3.	Click <i>Built-in Devices</i> , then click <i>Security Management</i> . Under <i>Power-on Password</i> , click <i>Set</i> .
Enable/disable network server mode, keyboard QuickLock, QuickBlank screen when locked, and QuickLock in energy saver mode. For more information, see the section "Security Management" in Chapter 3. NOTE: These selections appear only if a Power-on Password is set.	Click <i>Built-in Devices</i> , then click <i>Security Management</i> . Under <i>Power-on Password</i> , select the appropriate options.
Enable the Setup (administrator) Password. For more information, see the section "Security Management" in Chapter 3.	Click <i>Built-in Devices</i> , then click <i>Security Management</i> . Under <i>Setup Password</i> , select <i>Enable Setup Password</i> .
View the current settings of Plug and Play (PnP) devices and set resources for installed boards	Click <i>Integrated and Add-in Devices</i> , then click <i>ISA Boards</i> .
View the currently installed PCI devices and view and/or reconfigure settings (IRQ, I/O, DMA, Memory)	Click <i>Integrated and Add-in Devices</i> , then click <i>PCI Boards</i> .
Enable/disable the SCSI controller boot order for Compaq SCSI options	Click <i>Integrated and Add-in Devices</i> , then click <i>PCI Boards</i> . Under <i>SCSI Controller Boot Order</i> , select <i>Enable Boot Order</i> .
Enable/disable PCI bus mastering, PCI VGA palette snooping, and interrupt sharing	Click <i>Integrated and Add-in Devices</i> , then click <i>PCI Boards</i> . Under <i>System Options</i> , select the appropriate options.
Restore factory default settings and exit Computer Setup	Select <i>File</i> , then select <i>Set Defaults and Exit</i> .
Exit Computer Setup without applying or saving any changes	Select <i>File</i> , then select <i>Exit Without Saving Changes</i> .
Save changes to the system configuration and exit Computer Setup	Select <i>File</i> , then select <i>Save Changes and Exit</i> .

Computer Checkup (TEST)

NOTE: Computer Checkup (TEST) will detect Compaq hardware. Devices from other manufacturers may not be detected.

Use Computer Checkup (TEST) in the following instances:

- To determine if all the devices installed on the workstation are recognized by the system and functioning properly. Running TEST is optional but recommended after installing or connecting a new device.
- To save, print, or display the information generated by TEST. You should run TEST and have the printed report available before placing a call to the Compaq Customer Support Center.
- To assist your Compaq authorized dealer, reseller, or service provider in analyzing the system by allowing the service provider to reproduce the same environment on another workstation for testing.

To run Computer Checkup (TEST):

1. Turn on only the external devices that you want to test. You may want to leave the printer connected to log error messages.
 2. Access the Compaq Utilities menu.
 3. From the Compaq Utilities menu, select *Computer Checkup (TEST)*.
 4. When the test option menu appears, select the option to view the device list.
 5. Verify that TEST correctly detected the devices installed.
 - If the list is correct, select *OK* and go to step 6.
 - If the list is incorrect, be sure that any new devices are installed properly. If you do not find an installation problem, call your Compaq authorized dealer, reseller, or service provider.
-

6. Select one of the following from the test option menu:
 - ❑ *Quick Check Diagnostics*—This option runs a quick, general test on each device with a minimal number of prompts. If errors occur, they are displayed when the testing is complete.
 - ❑ *Automatic Diagnostics*—This option runs unattended, maximum testing of each device with minimal prompts. You can choose how many times to run the tests, to stop on errors, or to print or file a log of errors.
 - ❑ *Prompted Diagnostics*—This option allows maximum control over the device testing process. You can choose attended or unattended testing, decide to stop on errors, or choose to print or file a log of errors.
7. Follow the instructions on the screen as the diagnostic tests are run on the devices. Record any error message numbers and have them available when you contact your Compaq authorized dealer, reseller, or service provider for assistance.
8. Exit to the Compaq Utilities menu.

View System Information (INSPECT)

NOTE: View System Information (INSPECT) will detect Compaq hardware. Devices from other manufacturers may not be detected.

Use View System Information (INSPECT):

- To view information about the system once it has been configured.
- To save, print, or display the information generated by INSPECT. You should run INSPECT and have the printed report available before placing a call to the Compaq Customer Support Center.
- To assist your Compaq authorized dealer, reseller, or service provider in analyzing the system by allowing the service provider to reproduce the same environment on another workstation for testing.

The information provided by INSPECT includes:

- Contents of the operating system startup files
- Current memory configuration
- ROM versions
- Type of processor and coprocessor
- Diskette, CD-ROM, tape, or hard drives installed
- Active printer and communications interfaces
- Modem type installed
- Graphics settings

NOTE: Categories or items of information displayed by View System Information (INSPECT) are similar to but may vary slightly from those available in Compaq Diagnostics for Windows NT.

Create a Diagnostics Diskette

This option allows you to create *both* Setup or Diagnostics diskettes from the diagnostics partition. To create these diskettes, follow these steps:

1. Access the Compaq Utilities menu.
2. From the Compaq Utilities menu, select *Create a Diagnostics Diskette*.

One Diagnostic and two Setup diskettes will be created.

NOTE: The Diagnostics and Setup diskettes can also be created by downloading the latest version from the Compaq website at <http://www.compaq.com> in the Compaq Services and Technical Help area, under Downloadables.

Manage a Diagnostics Partition

This option allows you to create, delete, or upgrade the diagnostics software on the hard drive partition. This must be performed from a diagnostics diskette.



CAUTION: Creating a diagnostics partition involves performing a low-level format on the hard drive. Normally this is only done to add diagnostics to a new replacement hard drive. If the diagnostics software is deleted, you will no longer be able to access the Compaq Utilities Menu.



CAUTION: If you install an operating system without first installing the diagnostics partition, you will not be able to install a diagnostics partition without losing all data on your hard disk.

Exit from This Utility

Use this option to exit the Compaq Utilities menu.

ROM BIOS

Your workstation contains a set of software called Basic Input/Output System (BIOS), which is stored in Read Only Memory (ROM) on the system board. The BIOS contains a set of routines for running Power-On Self-Test (POST) and for accessing hardware specific information. The ROM is upgradable via the ROMPaq software utility.

Power-On Self-Test

When you turn on your workstation, the BIOS runs a number of tests, called Power-On Self-Tests (POSTs). These tests check and initialize many hardware components. The basic sequence for POST is:

1. Check and initialize low level hardware.
2. Count memory.

3. Detect and spin up all drives.
4. Boot from, in sequence, either a CD, a diskette, or the hard drive.

Refer to Appendix D, “POST Error Messages,” for a listing of POST error codes and steps you can take to resolve an error condition.

Runtime Services

After your workstation boots to the operating system, the BIOS still provides some runtime services to the operating system. For instance, the BIOS provides information to the operating system on how many processors are installed, how the system interrupts are configured, and information on the disk drives. BIOS also provides information about your workstation’s configuration and maintenance.

Upgrading the ROM BIOS

Since the BIOS is stored in ROM on the system board, the upgrade procedure is different than the upgrade procedure for other software.

New versions of BIOS may be downloaded from the Compaq website at <http://www.compaq.com>. BIOS upgrades are called ROMPaq.

To upgrade your ROM BIOS, execute the ROMPaq software and follow the directions.

Boot Block ROM

The Boot Block ROM cannot be upgraded.

For more information about Boot Block ROM, see the section “FailSafe Boot Block ROM” in Chapter 3.

Chapter 3

Intelligent Manageability

Intelligent Manageability combines innovative hardware technology with systems management tools from Compaq and other leading vendors to make Compaq workstations easier to inventory, troubleshoot, protect, and maintain. Intelligent Manageability features focus on:

- Asset Management
- Fault Management
- Security Management
- Configuration Management
- Integration Management

Asset Management

The Compaq Asset Management solution begins with AssetControl, hardware designed and built into new Compaq workstations, key components, and monitors. AssetControl features make it easy and inexpensive to maintain an accurate, up-to-date inventory of these devices. These features:

- Provide detailed inventory information about various components, including:
 - Manufacturer, model, and serial number of Compaq workstations, monitors, hard drives, and dual inline memory modules (DIMMs)
 - Asset Tag
 - System board and ROM revision level
 - Allow you to view, print, or electronically save inventory information and other system configuration details, using:
 - Compaq Diagnostics for Windows NT
 - Compaq Insight Manager
 - System management products from the Compaq Management Solutions Partners
 - Management software products supporting the Desktop Management Interface revision 2.0 (DMI 2.0)
 - Simplify and help ensure the accuracy of inventory and accounting procedures
 - Streamline service calls by giving the administrator fast access to the Compaq workstation configuration and history
 - Simplify remote software distribution procedures by allowing the system administrator to identify software and revision levels remotely
-

Compaq Diagnostics for Windows NT

Compaq Diagnostics for Windows NT is a component of Intelligent Manageability that allows you to view, print, or electronically save the following:

- System overview
- AssetControl information
- Input devices
- Communications ports
- Storage devices
- Graphics information
- Memory configuration
- Security management settings
- System health
- Operating system
- Windows version

Using Compaq Diagnostics for Windows NT

1. Select the Compaq Diagnostics for Windows NT icon or the Compaq Diagnostics icon, located in the Control Panel.

The screen displays an overview of the workstation hardware and software.

2. For specific hardware and software information, select a category from the Categories menu or from the toolbar.

NOTE: As you move your cursor over the toolbar icons, the corresponding category names appear near the cursor.

3. To display more detailed information in a selected category, click *More* in the Information Level box.

NOTE: Categories or items of information displayed by Compaq Diagnostics for Windows NT are similar to but may vary slightly from the information presented in View System Information (INSPECT).

4. Review and print this information and, if necessary, discuss it with your authorized Compaq reseller or service provider.

NOTE: To print the information, click *File*, then select *Print*. Select one of the following options: Detailed Report (All Categories), Summary Report (All Categories), or Current Category. Click *OK* to print the report you selected.

5. To exit Compaq Diagnostics for Windows NT, click *File*, then click *Exit*.

Fault Management

Fault Management features combine innovative hardware and software technology to prevent the loss of critical data and minimize unplanned downtime.

When a fault occurs, the workstation displays a Local Alert message containing a description of the fault and any recommended actions. You can then view current system health by using Compaq Diagnostics for Windows NT. If the workstation is connected to a network managed by Compaq Insight Manager or other Simple Network Management Protocol (SNMP)-based management products (e.g., HP OpenView or IBM Tivoli TME10 NetView), the workstation also sends a fault notice to the network management application.

SMART III Hard Drive Fault Prediction

SMART III is an extension of SMART II capability. A SMART III hard drive is able not only to monitor and report on its own health, but to fix problems before they become failures that result in data losses. The SMART III drive periodically executes read scans of the entire disk. These read scans take place during periods of inactivity. During the scan, the disk drive will determine the “health” of each data sector and move data from any questionable areas of the disk to known good areas of the disk. To determine the health of the data during the scan, the drive uses sophisticated methods of Cyclic Redundancy Codes (CRC) and Error Checking and Correcting (ECC) codes to flag potentially bad areas of the disk. With today’s multi-gigabyte hard drives, there are areas of the disk that are not read or written by applications for long periods of time. The SMART III technology will patrol the entire disk so that when unused or infrequently used parts of the disk are called upon, the data will be available.

ECC Fault Prediction and Prefailure Warranty

When the workstation encounters an excessive number of error checking and correcting (ECC) memory errors, the screen displays a Local Alert message. This message contains detailed information about the errant memory module, allowing you to take action before you experience non-correctable memory errors. The Prefailure Warranty for ECC memory modules allows you to replace these modules, free of charge, before the modules actually fail.

Proactive Backup

Proactive Backup software initiates a tape backup upon receiving notice of an impending SMART III hard drive failure. Third-party products that provide this feature include Seagate Backup Exec SMART Client and Cheyenne SMART Drive Agent.

Surge-Tolerant Power Supply

An integrated surge-tolerant power supply provides greater reliability when the workstation is hit with an unpredictable power surge. This power supply is rated to withstand a power surge of up to 2000 volts without incurring any system downtime or data loss.

Thermal Sensor

The thermal sensor is a hardware and software feature that tracks the internal temperature of the workstation. This feature displays a warning message when the normal range is exceeded, which gives you time to take action before internal components are damaged or data is lost.

Security Management

Your workstation includes security features to protect the workstation and data from unauthorized access. You can view Security Management features and current settings by using Compaq Diagnostics for Windows NT (locally), Compaq Insight Manager (remotely), or system management applications from the Compaq Management Solution Partners.

Table 3-1
Security Features

Feature	Purpose
Diskette Drive Boot Control	Prevents booting from the diskette drive.
Diskette Drive Write Control	Prevents writing to the diskette drive.
Serial or Parallel Interface Control	Prevents transfer of data through the integrated serial or parallel interface.
Power-on Password	Prevents use of the workstation until the password is entered. This can apply to both initial workstation startup and restarts.
Setup Password	Prevents reconfiguration of the workstation (the use of the Computer Setup utility) until the password is entered.
QuickLock/ QuickBlank	Disables keyboard and mouse interface and can blank the screen without exiting applications. The Power-on Password must be set to enable QuickLock/QuickBlank.
Cable Lock Provision	Inhibits access to the interior of the workstation, which prevents unwanted configuration changes or component removal.

The following subsections describe how to access these features.

Disabling Diskette Boot or Diskette Write

IMPORTANT: If you disable the diskette drive, the FailSafe Boot Block ROM ignores the disabled component to accommodate a system ROM recovery in the event a system ROM failure occurs.

To disable the factory settings (that is, to prevent boot from a diskette or prevent save to a diskette), follow these steps:

1. Turn on the workstation.
2. When you see the words “**F10=Setup**” in the bottom-right corner of the screen, press the **F10** key.

NOTE: If you do not press the **F10** key while the message is displayed, you must turn off the workstation, then on again, to access the utility.

3. Press the **Enter** key to bypass the welcome screens and display the Compaq Utilities menu.
4. From the Compaq Utilities menu, select *Computer Setup*, then press the **Enter** key.
5. In the Computer Setup window, click *Built-in Devices*.
6. In the Built-in Devices window, click *Storage*.
7. Under *Removable Media*, select the function that you want to disable.
8. Save the configuration and exit the utility.
9. Restart the workstation.

Disabling a Serial Port or Parallel Port

To disable either of the serial ports or the parallel port, follow these steps:

1. Turn on the workstation.
2. When you see the words “**F10=Setup**” in the bottom-right corner of the screen, press the **F10** key.

NOTE: If you do not press the **F10** key while the message is displayed, you must turn off the workstation, then on again, to access the utility.

3. Press the **Enter** key to bypass the welcome screens and display the Compaq Utilities menu.
 4. From the Compaq Utilities menu, select *Computer Setup*, then press the **Enter** key.
 5. In the Computer Setup window, click *Built-in Devices*.
 6. In the Built-in Devices window, click *Communications*.
 7. To disable a Serial Port:
 - a. Under *Available Serial Ports*, select the port that you want to disable.
 - b. Under *Settings*, select *Disabled*.
 8. To disable the Parallel Port, under *Settings*, select *Disabled*.
 9. Save the configuration and exit the utility.
 10. Restart the workstation.
-

Password Security

The workstation supports security password features, which can be established through the Compaq Computer Setup menu.

Establishing a Setup Password Using Computer Setup


Establishing a Setup Password through Computer Setup prevents reconfiguration of the workstation (use of the Computer Setup utility) until the password is entered.

1. Turn on or restart the workstation.
2. When you see the words “**F10=Setup**” in the bottom-right corner of the screen, press the **F10** key.

NOTE: If you do not press the **F10** key while the message is displayed, you must turn off the workstation, then on again, to access the utility.

3. Press the **Enter** key to bypass the welcome screens and display the Compaq Utilities menu.
4. From the Compaq Utilities menu, select *Computer Setup*, then press the **Enter** key.
5. In the Computer Setup window, click *Built-in Devices*.
6. In the Built-in Devices window, click *Security Management*.
7. Under *Setup Password*, select *Enable Setup Password* and follow the instructions on the screen.
8. Save the configuration and exit the utility.
9. Turn off the workstation, then turn it on to establish the password.

Establishing a Power-on Password Using Computer Setup

Establishing a Power-on Password through Computer Setup prevents access to the workstation when power is turned on, unless the password is entered. The password must be entered each time the workstation is turned on, when the key icon () appears on the monitor.


1. Turn on or restart the workstation.
2. When you see the words “**F10=Setup**” in the bottom-right corner of the screen, press the **F10** key.

NOTE: If you do not press the **F10** key while the message is displayed, you must turn off the workstation, then on again, to access the utility.


3. Press the **Enter** key to bypass the welcome screens and display the Compaq Utilities menu.
4. From the Compaq Utilities menu, select *Computer Setup*, then press the **Enter** key.
5. In the Computer Setup window, click *Built-in Devices*.
6. In the Built-in Devices window, click *Security Management*.
7. Under *Power-on Password*, click *Set* and follow the instructions on the screen.
8. Save the configuration and exit the utility.
9. Turn off the workstation, then turn it on to establish the password.

Entering a Power-on Password


To enter a Power-on Password, complete the following steps:

1. Turn on or restart the workstation.
2. When the key icon () appears on the monitor, enter your current password.

NOTE: Type carefully; for security reasons, the characters you type do not appear on the screen.

If you enter the password incorrectly, a broken key icon () appears. Try again. After three unsuccessful tries, you must turn off the workstation, then turn it on again before you can continue.

Changing a Power-on or Setup Password


1. Turn on or restart the workstation. To change the Setup Password, run Computer Setup.
2. When the key icon () appears, type your current password, a slash (/) or alternate delimiter character, your new password, another slash (/) or alternate delimiter character, and your new password again as shown:

current password/new password/new password

NOTE: Type carefully; for security reasons, the characters you type do not appear on the screen. Refer to the section “National Keyboard Delimiter Characters” in this chapter for information about the alternate delimiter characters.

The new password takes effect the next time you turn on the workstation.

Deleting a Power-on or Setup Password

1. Turn on or restart the workstation. To delete the Setup Password, run Computer Setup.
2. When the key icon () appears, type your current password followed by a slash (/) or alternate delimiter character as shown:

current password/

NOTE: Refer to the “National Keyboard Delimiter Characters” section in this chapter for information about alternate delimiter characters.

Chapter 4

Network Communications

This chapter provides information about networks and the hardware connectors and software device drivers that allow you to access a network. Once your network connection is active, you can share resources such as a printer, to exchange information from device to device and to run common software programs.

NOTE: For more information about installing your network driver, refer to the *Software Installation Guide*.

Your workstation comes Ethernet network ready, which means that it has a preinstalled network controller and preinstalled network drivers. The Compaq Fast Ethernet Embedded NIC NC3121 (10/100 Mbps) is a PCI bus mastering, dual speed 10BaseT, and 100BaseTX controller that will automatically detect network connection speed and adjust accordingly. The controller supports full duplex Ethernet, allowing two-way transmission between nodes for up to 20 or 200 Mbits/sec aggregate bandwidth.

NOTE: Your workstation is also Token Ring Network capable. To connect to a Token Ring Network, you must install a Token Ring board.

Connecting to an Ethernet Network

An RJ-45 Ethernet network connector is included on your workstation.

Refer to the following illustration to connect a network cable to the RJ-45 connector.

IMPORTANT: If you are connecting to a 100BaseTX network, you must use a Category 5 UTP cable.

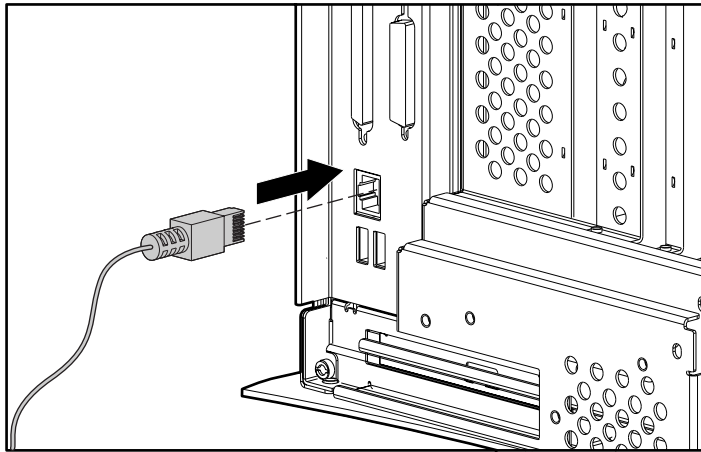


Figure 4-1. Attaching the network cable to the RJ-45 connector



Any RJ-45 receptacle marked with these symbols indicates a Network Interface Connection.

WARNING: To reduce risk of electrical shock, fire, or damage to the equipment, do not plug telephone or telecommunications connectors into this receptacle.

Installing the Network Driver

The network device driver enables the workstation to communicate with the network. The network driver is preinstalled on your workstation. For information about installing the driver, operating system, and other support software, see the *Software Installation Guide*.

Chapter 5

CD-ROM Drive and PremierSound Audio System

Your workstation includes a CD-ROM drive (IDE) and a PremierSound Audio System. The CD-ROM drive is a random access, read-only storage device capable of retrieving data from a removable compact disc. The PremierSound Audio System provides sound capabilities for increased productivity in the Windows NT Workstation operating environment.

Using the Tray-Load CD-ROM Drive

To insert a CD, refer to the illustration below:

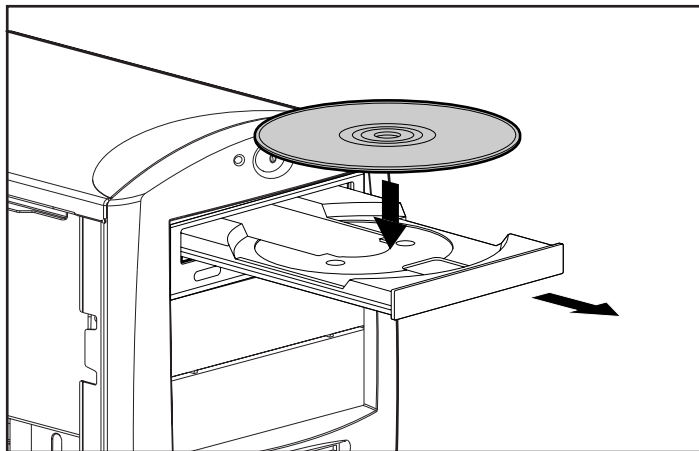


Figure 5-1. Opening the CD-ROM Tray and then inserting a CD

The drive performs a diagnostic check and automatically begins reading the table of contents (TOC). The busy indicator turns amber while the drive reads the TOC.

When the busy indicator turns green, the drive is ready to receive commands and data may be retrieved from the disc.

To remove the compact disc, press the **Eject** button.



CAUTION: Do not apply labels to CDs. The presence of a label will cause the CD to be unbalanced and may cause either inconsistent operation or drive failure.

IMPORTANT: Certain applications or operating system software may disable the Eject button to prevent accidental damage to the disc. If the Eject button is disabled by the application software, it will not operate.

Using CD-ROM Software

The first time you use a software program that comes on a compact disc, it may load a certain amount of program data onto the hard drive of your workstation. This enables the program to run more efficiently and quickly in the future.

NOTE: Some software compact discs take control of the hardware volume controls. If this occurs, adjust the sound before starting the software.

Read the software manufacturer's instructions that accompany the compact disc before you attempt to use it. Information to look for includes:

- How much hard disk space will this program require? Do you have enough disk space?
 - Will you activate the disc from Windows NT Workstation or from the system prompt?
-

- Have you connected any special devices this program requires, such as a joystick?
- Do you have the required information (such as serial number) available to answer any questions during the setup program?

Using Audio Compact Discs

To play an audio CD:

1. Select *Programs* from the Start button.
2. Then select *Multimedia* from the Accessories menu.
3. Click *CD Player*, found in the Multimedia group box, to control audio compact disc play.

Information on using CD Player can be found in the online help for that utility.

CD-ROM Drive Precautions

To ensure that the CD-ROM drive operates properly, observe the following precautions:

- Do not move the drive during operation. This may cause it to malfunction during reading.
- Avoid exposing the drive to sudden changes in temperature, as condensation may form inside the unit. If the temperature suddenly changes while the drive is on, wait at least one hour before you turn off the power. If you operate the unit immediately, it may malfunction while reading.
- Avoid placing the drive in a location that is subject to high humidity, extreme temperatures, mechanical vibration, or direct sunlight.
- Clean the panel and controls with a soft, dry cloth or a soft cloth lightly moistened with a mild detergent solution. Never spray cleaning fluids directly on the unit.

- Avoid using any type of solvent, such as alcohol or benzene, which may damage the finish.
- If any object or liquid falls into the slot, immediately unplug the workstation and have it checked by an authorized Compaq service provider.

PremierSound Audio System

The PremierSound audio system included on your workstation allows you to integrate voice messages and music directly into your files. Using a microphone, you can record sounds as data on the hard drive. This sound data may be used in many ways, for example; you can enhance presentation data with voice and music.

If you choose to upgrade your audio system, you must disable the integrated audio controller:

IMPORTANT: Do not remove the ESS 1869 driver from the Drivers window in the Control Panel. Follow the instructions below.

1. From the Control Panel in Windows NT Workstation, select Devices.
 2. From the Devices window, select the *AudioDrive* device.
 3. Select the *Stop* button to stop the AudioDrive device.
 4. Select the *Startup* button.
 5. Select *Disabled* as the Startup Type for the AudioDrive.
 6. Select *OK*.
 7. Close the Devices window.
 8. Restart the workstation for the changes to take effect.
 9. Proceed with the installation process for your upgrade audio controller board.
-

Chapter 6

Hardware Upgrade Preparations

This chapter explains how to prepare the workstation for the installation of optional hardware upgrades. Information about reconfiguring the workstation is also discussed to ensure that newly installed components are recognized by your system. This chapter also identifies all internal components.

IMPORTANT: Compaq recommends that you finish the setup procedures for the preinstalled software *before* you install any optional hardware or third-party devices that were not included with the workstation. For more information about the setup procedures, refer to the *Software Installation Guide*.

To install the following upgrades or optional equipment, see the related chapter.

- Memory (Chapter 7)
- Drives (Chapter 8)
- Expansion Boards (Chapter 9)
- Processors (Chapter 10)

Installation Sequence

This chapter begins with an overview of the installation and configuration sequence. Follow this sequence of steps to ensure the proper installation of any optional equipment. Before you begin, observe the following precautions:



WARNING: To reduce the risk of personal injury from hot surfaces, allow the internal system components to cool before touching.



CAUTION: Static electricity can damage the electronic components of the workstation or optional equipment. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object. Refer to Appendix B for more information.

1. Turn off the workstation and disconnect the power cord from the grounded AC outlet and the back of the workstation.
 2. If you are installing or removing drives in the front bays, refer to the section “Removing the Front Bezel” in this chapter for instructions.
 3. Open the workstation by removing its outside side access panel. Refer to the section “Removing the Side Access Panel” in this chapter for instructions.
 4. Install any optional equipment: ISA or PCI expansion board, Accelerated Graphic Port (AGP) graphics controller, processor upgrade, memory, or drive. Refer to the applicable chapters in this manual or the documentation provided with the optional equipment for instructions.
 5. Replace the front bezel, if necessary, and the side access panel.
 6. Reconnect the power cord to the back of the workstation and plug in the power cord to a grounded AC outlet.
 7. Turn on the monitor, workstation, and any devices you installed.
 8. Reconfigure the workstation, if necessary. See Chapter 2 for instructions.
 9. Test the workstation (optional) using the TEST utility.
-

Reconfiguring the Workstation

System configuration is the process of specifying the devices and programs that make up a system. When you add or remove optional equipment, you must reconfigure the workstation by running Computer Setup in order for the changes to be recognized.

Run the Computer Setup utility *after* you complete the installation. To configure in Windows NT Workstation, use Control Panel and configure your specific option.

If configuration settings are incorrect, one or more devices may not work properly, and you may receive an error message. If this occurs, run the Computer Setup utility again. See Chapter 2 for more information on Computer Setup.

Removing the Side Access Panel

To remove the side access panel:

1. Turn off the workstation and disconnect the power cord from the grounded AC outlet and the back of the workstation.
2. Refer to the following illustration to remove the side access panel.

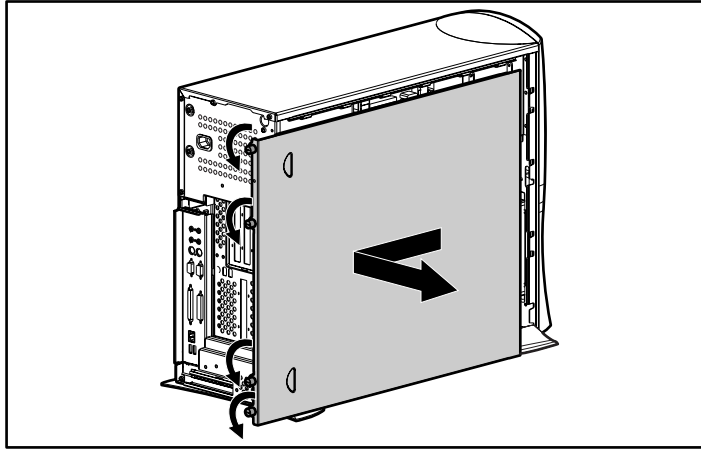


Figure 6-1. Loosening the four rear panel thumbscrews and removing the side access panel

IMPORTANT: When replacing the side access panel, be sure to tighten all four thumbscrews.

NOTE: The hood labels attached to the inside of the side access panel provide system configurations and the installation of additional components.

Removing the Front Bezel

You will need to remove the front bezel when you are installing or removing drives in the front bay. To remove the front bezel:

1. Turn off the workstation and disconnect the power cord from the grounded AC outlet and the back of the workstation.
2. Remove the side access panel.
3. Refer to the following illustration to remove the front bezel.

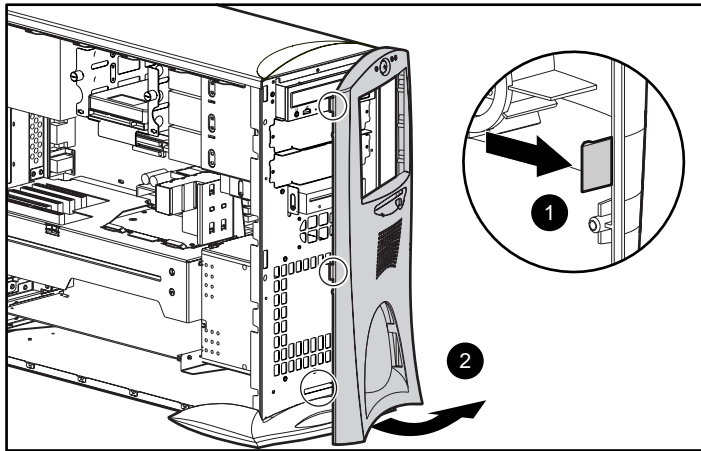


Figure 6-2. Depressing front bezel release latches and removing front bezel

Identifying Internal Components

The following illustration and table identify the internal components of your workstation.

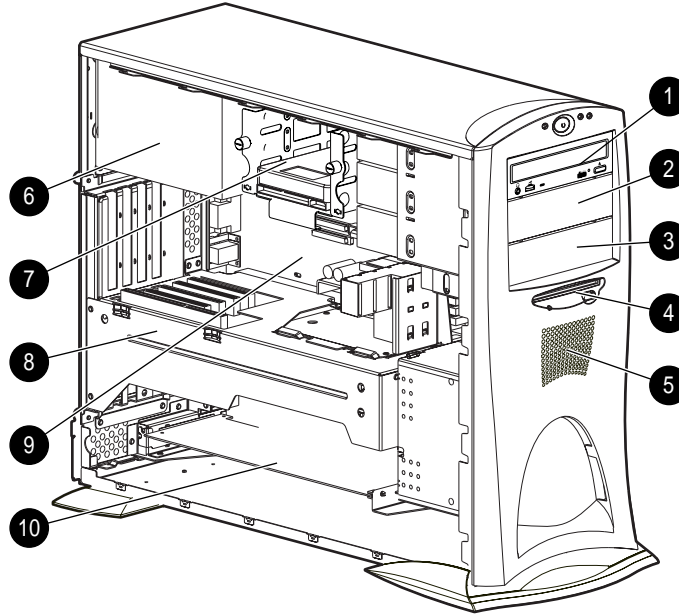


Figure 6-3. Identifying internal components

Table 6-1
Internal Components

Ref.	Component
1	CD-ROM drive, drive bay 4
2	5.25-inch drive bay, drive bay 5
3	5.25-inch drive bay, drive bay 6
4	3.5-inch diskette drive, drive bay 7
5	Speaker with PremierSound and fixed equalization

Continued

Internal Components *Continued*

Ref.	Component
6	Power supply
7	3.5-inch removable hard drive cage that supports either three 1.0-inch drives or two 1.6-inch drives. Drive bay 1 on bottom, bay 2 in middle, and bay 3 on top.
8	Expansion board assembly (includes riser board, PCI expansion slots, and ISA expansion slots)
9	System board (includes SW1 switch, AGP expansion slot, four DIMM sockets, two processor slots, and other connectors)
10	Accelerated Graphics Port (AGP) graphics controller (preinstalled on selected models)

Removing the Expansion Board Assembly

To remove the expansion board assembly:

1. Turn off the workstation and disconnect the power cord from the grounded AC outlet and the back of the workstation.
2. Remove the side access panel.
3. Refer to the following illustration to remove the expansion board assembly.

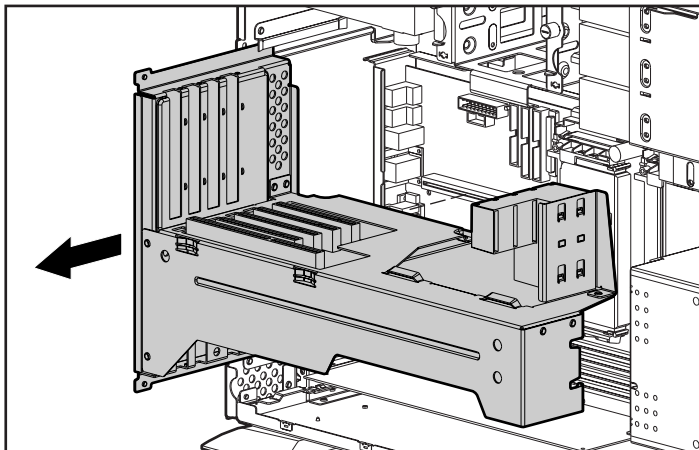


Figure 6-4. Removing the expansion board assembly

4. Reassemble the workstation, and connect the power cord to the grounded AC outlet and to the workstation.

IMPORTANT: After connecting the power cord to the grounded AC outlet and to the workstation, **DO NOT** turn the power button on if the Power LED is a steady amber color. A steady amber color indicates that the expansion board assembly is not seated properly. Disconnect the power cord and reseat the expansion board assembly.

IMPORTANT: When replacing the side access panel, be sure to tighten all four thumbscrews.

Removing the Removable Hard Drive Cage

To remove the removable hard drive cage:

1. Turn off the workstation and disconnect the power cord from the grounded AC outlet and from the back of the workstation.
2. Remove the side access panel.
3. Refer to the following illustration to remove the removable hard drive cage.

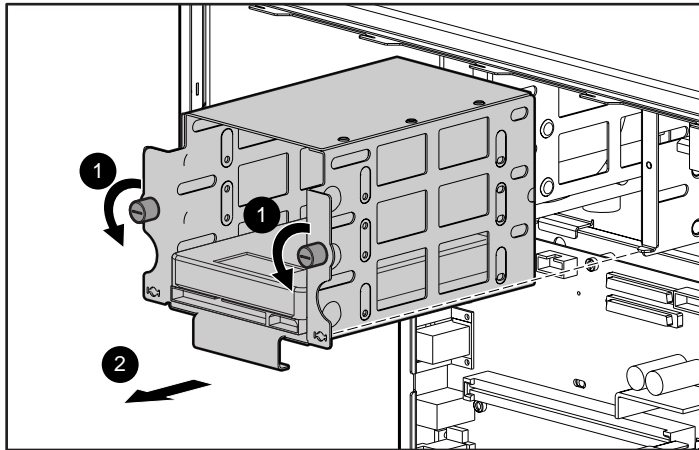


Figure 6-5. Loosening the two thumbscrews and removing the removable hard drive cage

6-10 Hardware Upgrade Preparations

When reinserting the removable hard drive cage, be sure to align the tab on the bottom corners of the cage ③ with the workstation chassis.

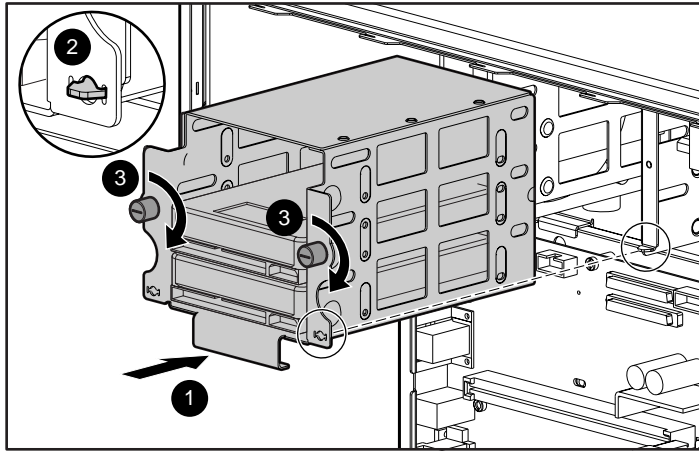


Figure 6-6. Reinserting the removable hard drive cage

Identifying the System Board Components

The following illustration and table identify the internal system board components of your workstation.

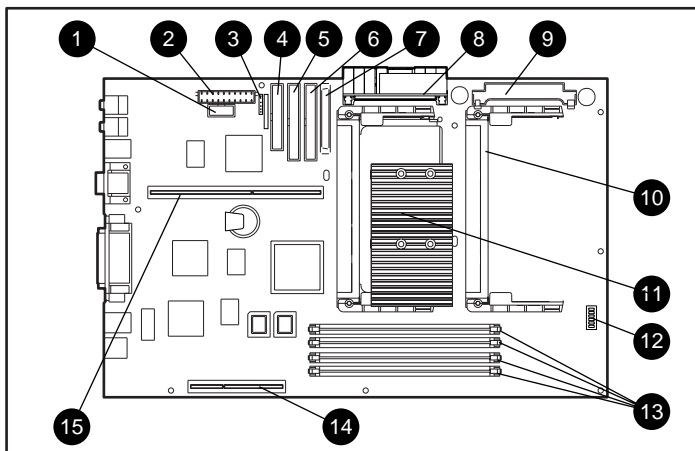


Figure 6-7. Identifying system board components

Table 6-2
System Board Components

Ref.	Component
1	Power switch and power LED connector
2	Power connector
3	External battery connector
4	Diskette drive connector
5	Secondary IDE connector
6	Primary IDE connector
7	Wide-Ultra SCSI connector

Continued

6-12 Hardware Upgrade Preparations

System Board Components *Continued*

Ref.	Component
8	Processor power module connector for primary processor
9	Processor power module connector for secondary processor
10	Secondary processor slot
11	Primary processor slot
12	SW1 switch
13	DIMM sockets 1-4
14	AGP expansion slot
15	Riser board connector

Chapter 7

Memory Upgrades

This chapter explains how to install additional memory.

For information on preparing the workstation for upgrades, see Chapter 6.

Installing Additional Memory

Your workstation supports Registered 100-MHz Error Checking and Correcting (ECC) SDRAM dual inline memory modules (DIMMs). Additional DIMMs (32-MB, 64-MB, 128-MB, or 256-MB) are available to upgrade the memory. The workstation has four DIMM sockets on the system board to support up to a maximum of 1 GB. The four DIMM sockets are numbered from DIMM1 through DIMM4.

7-2 Memory Upgrades

The following figure illustrates the physical location of all DIMM sockets. Note that DIMMs do not need to be installed in pairs, and can be installed in any of the available DIMM sockets.

IMPORTANT: Before installing additional DIMMs, read “Important Guidelines for DIMM Installation” in the following section.

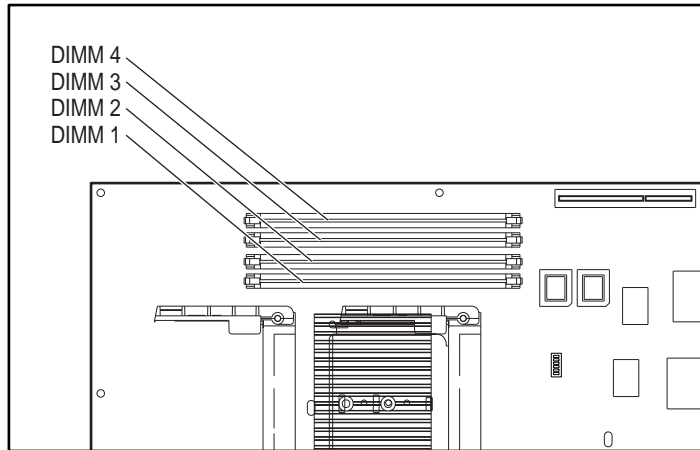


Figure 7-1. Location of DIMM sockets: ❶ DIMM sockets 1-4

NOTE: The DIMM sockets are numbered in sequence from 1-4. DIMM1 is located closest to the processor, and DIMM4 is located closest to the edge of the board.

Important Guidelines for DIMM Installation

When installing DIMMs, you **MUST** follow the following guidelines:

- Use only 32-, 64-, 128-, or 256-MB, Registered 100-MHz Error Checking and Correcting (ECC) SDRAM DIMMs.
- Registered DIMMs must be used.
- DIMMs must have a 4 KHz refresh rate.
- **DO NOT INSTALL DIMMS THAT DO NOT SUPPORT ERROR CHECKING AND CORRECTING (ECC).**
- A DIMM can be installed one way only. Be sure to match the two *key slots* on the DIMM with the tab on the DIMM socket. Push the DIMM down into the DIMM socket, ensuring that it is fully inserted and properly seated.
- When upgrading, do not exceed 1 GB total. Upgrades exceeding 1 GB will cause the system to halt.

Installing DIMM Modules



CAUTION: When handling a DIMM, be careful not to touch any of the contacts. Doing so may damage the module.



CAUTION: Static electricity can damage the electronic components of the workstation or optional boards. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object. Refer to Appendix B, "Electrostatic Discharge," for more information.

IMPORTANT: Prior to installing additional DIMMs, read "Important Guidelines for DIMM Installation" in the previous section.

To install a memory module:

1. Turn off the workstation and disconnect the power cord from the grounded AC outlet and the back of the workstation.
2. Remove the side access panel.

7-4 Memory Upgrades

3. Remove the AGP graphics controller, if necessary.
4. Refer to the following illustration to install a DIMM module.

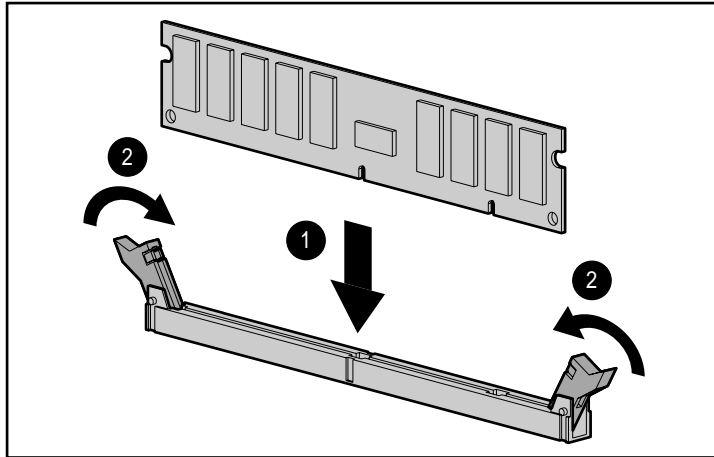


Figure 7-2. Installing a DIMM module

To remove a memory module, reverse the above procedure.

Chapter 8

Drives

This chapter explains how to install additional hard drives, CD-ROM drives, and tape drives. This chapter also provides guidelines for installing SCSI drives. For additional information about installing optional SCSI and non-SCSI drives, refer to the documentation included with the device or contact your Compaq authorized dealer, reseller, or service provider.

For information on preparing the workstation for upgrades, see Chapter 6.

Installing Additional Drives

Your workstation supports up to seven individual drive bays. All models ship with a CD-ROM drive installed in bay 4 and a diskette drive installed in bay 7. See Table 8-1 for a description of the drive bay components.

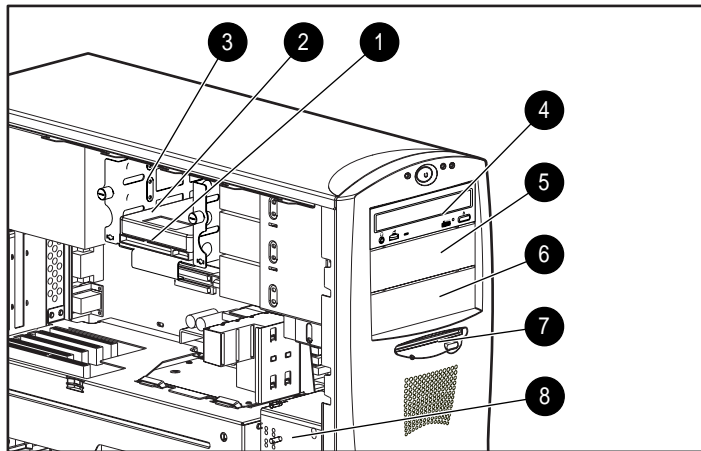


Figure 8-1. Identifying drive bay components

As shown in Figure 8-1, drive bays 1 through 3 are located in the removable hard drive cage, which is located behind the side access panel of the workstation. Drive bays 4 through 7 are located on the front of the workstation. They support various drive configurations.

Table 8-1
Drive Bay Components

Ref.	Component	Description
1	Bay 1	Part of the removable hard drive cage. A 3.5-inch, third-height bay that supports a 1.0-inch hard drive or a 1.6-inch hard drive.
2	Bay 2	Part of the removable hard drive cage. A 3.5-inch, third-height bay that supports a 1.0-inch hard drive. Bay 2 is not available when a 1.6-inch drive is installed in bay 1 or bay 3.
3	Bay 3	Part of the removable hard drive cage. A 3.5-inch, third-height bay that supports a 1.0-inch hard drive or 1.6-inch hard drive.
4	Bay 4	5.25-inch, half-height bay that supports 1.0-inch or 1.6-inch storage devices. A CD-ROM drive is shipped in bay 4.
5	Bay 5	5.25-inch, half-height bay that supports 1.0-inch or a 1.6-inch storage devices. An optional hard drive, diskette drive, CD-ROM drive, or tape drive can be installed in bay 5.
6	Bay 6	5.25-inch, half-height bay that supports 1.0-inch or 1.6-inch devices. An optional hard drive, diskette drive, CD-ROM drive, or tape drive can be installed in bay 6.
7	Bay 7	3.5-inch, third-height bay that supports a 1.0-inch device. A standard 3.5-inch diskette drive is shipped in bay 7.
8	Air plenum (cooling chamber)	Side of air plenum provides temporary storage for the hardware screws used to install optional mass storage devices in the removable hard drive cage and in the front bays.

Removing a Blank Drive Bezel for Removable Media Storage Device Installations

A blank drive bezel covers bays 5 and 6 when they are not occupied with a storage device. You will need to remove a drive bezel before installing any removable media storage device (e.g., tape drive, CD-ROM, diskette, etc.) in these bay locations. You will not need to replace the drive bezel after the drive installation.

To remove a blank drive bezel:

1. Turn off the workstation and disconnect the power cord from the grounded AC outlet and the back of the workstation.
2. Remove the side access panel and front bezel.
3. Refer to the following illustration to remove a blank drive bezel.

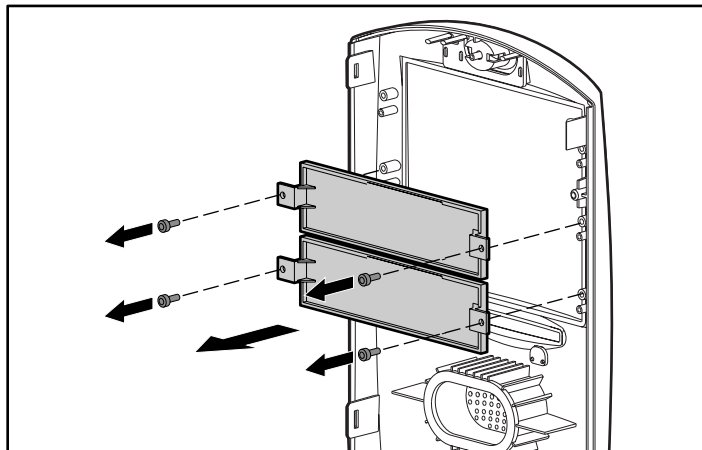


Figure 8-2. Removing a blank drive bezel

Removing a Cooling Shield for a Hard Drive Installation

A cooling shield covers bays 5 and 6 to provide proper cooling and EMI protection.

To remove a cooling shield:

1. Turn off the workstation and disconnect the power cord from the grounded AC outlet and the back of the workstation.
2. Remove the side access panel and front bezel.
3. Refer to the following illustration to remove a cooling shield.

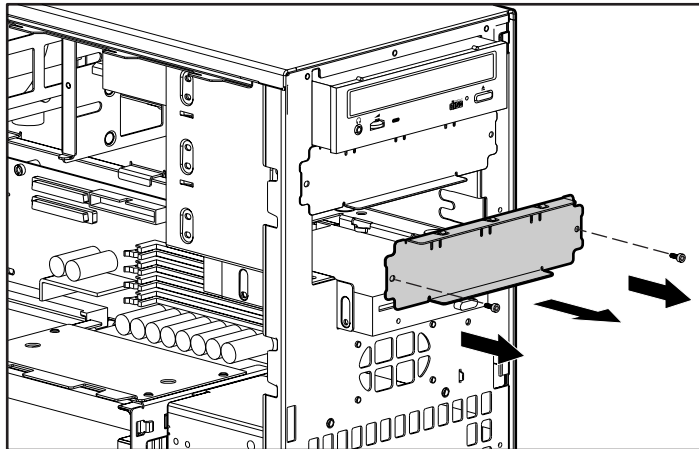


Figure 8-3. Removing a cooling shield

IMPORTANT: You will also need to replace the shield after the drive is installed in the bay.

To replace the cooling shield, reinsert the two screws.

Locating the Optional Hardware Screws

A total of 17 extra hardware screws are provided on the side of the air plenum. The top group of eight screws ❶ is for installing hard drives in the removable hard drive cage. The bottom group of nine screws ❷ is for installing removable media storage devices in the front drive bays.

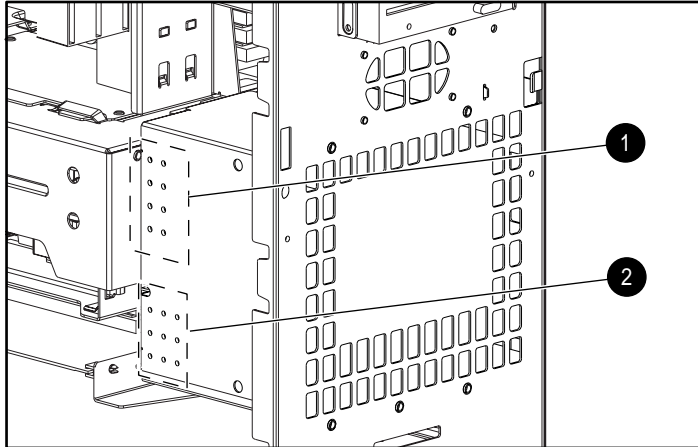


Figure 8-4. Locating the hardware screws for drive bay installations

Installing a Hard Drive in Bay 5 or 6

Drive bays 5 and 6 can be configured with either 1.0-inch or 1.6-inch hard drives. Other than using different screw holes, the installation for both drives is basically the same. To install a 1.6-inch hard drive:

NOTE: Before installing a SCSI device, please read “SCSI Cables and Guidelines” later in this chapter.

1. Turn off the workstation and disconnect the power cord from the grounded AC outlet and the back of the workstation.
2. Remove the following components:
 - ❑ side access panel
 - ❑ front bezel
 - ❑ cooling shield
3. Refer to the following illustrations to install a 1.6-inch hard drive in bay 5 or 6.

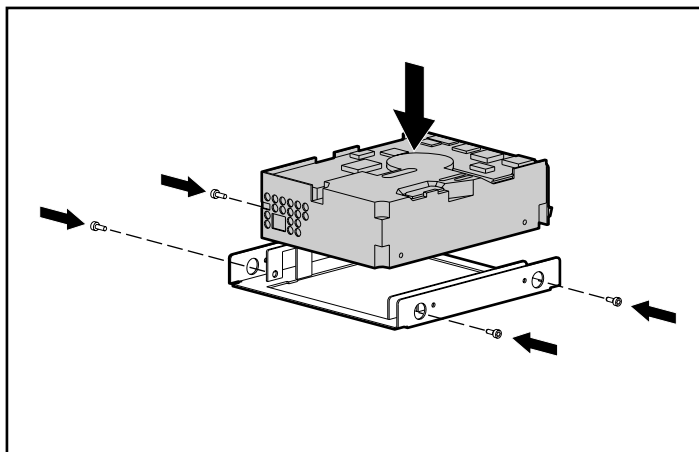


Figure 8-5. Installing a 1.6-inch hard drive in the hard drive bracket

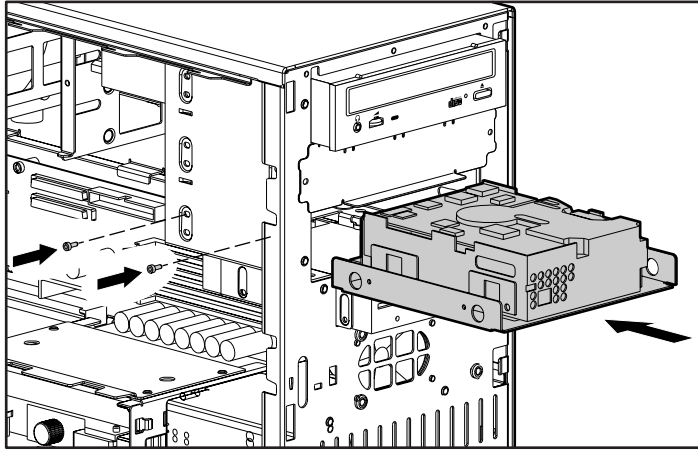


Figure 8-6. Installing a hard drive

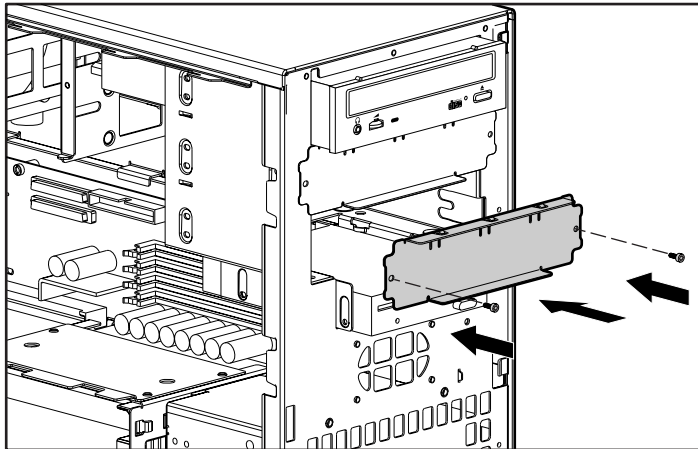


Figure 8-7. Replacing the cooling shield

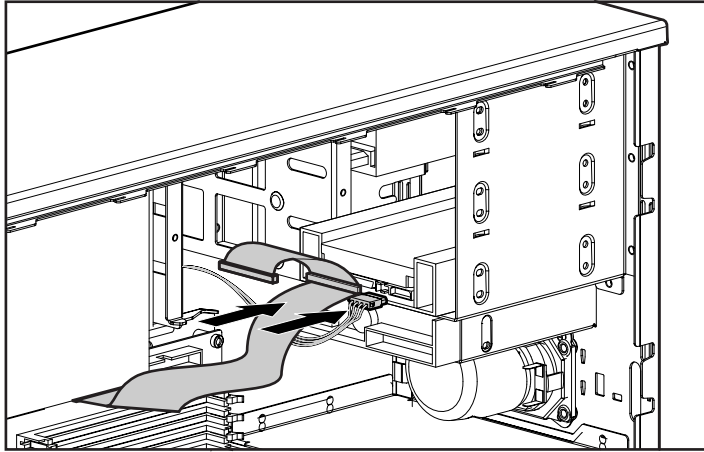


Figure 8-8. Connecting the SCSI signal cable and power cable

4. Reassemble the workstation.

Installing a Hard Drive in the Removable Hard Drive Cage (Bays 1 - 3)

The removable hard drive cage is capable of being configured with up to three 1.0-inch hard drives or with two 1.6-inch hard drives. Other than using different screw holes, the installation for both drives is basically the same.

To install a 1.0-inch hard drive in the removable hard drive cage:

NOTE: Prior to installing a SCSI device, please read "SCSI Cables and Guidelines" later in this chapter.

1. Turn off the workstation and disconnect the power cord from the grounded AC outlet and the back of the workstation.
2. Remove the side access panel and the removable hard drive cage.
3. Remove four screws (top group of screws) from the air plenum located at the front of the workstation.
4. Refer to the following illustrations to install an optional hard drive.

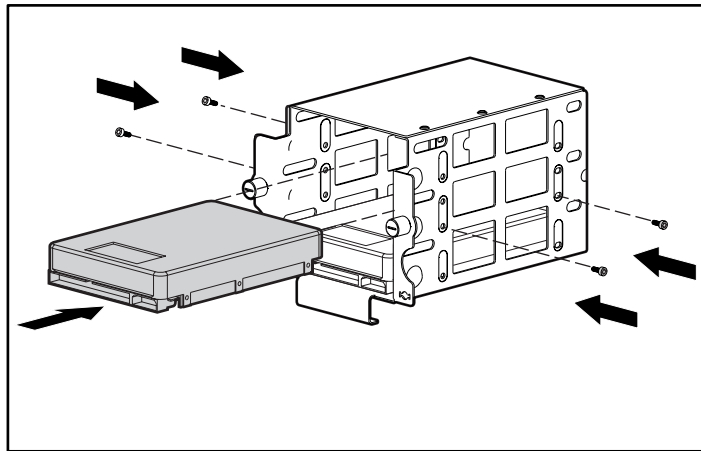


Figure 8-9. Installing a 1.0-inch hard drive in bay 2

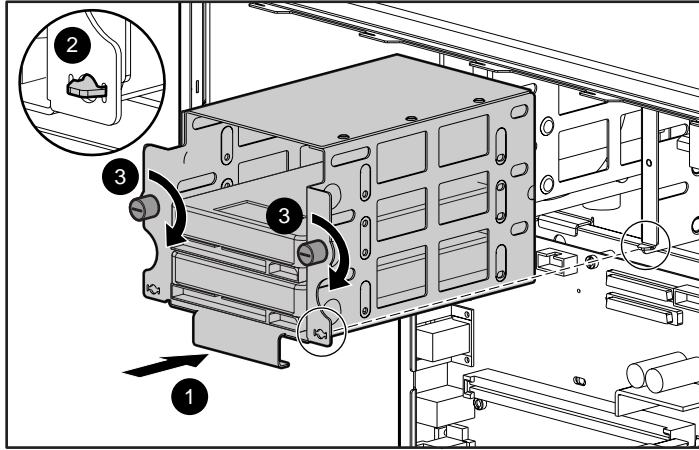


Figure 8-10. Reinstalling the removable hard drive cage

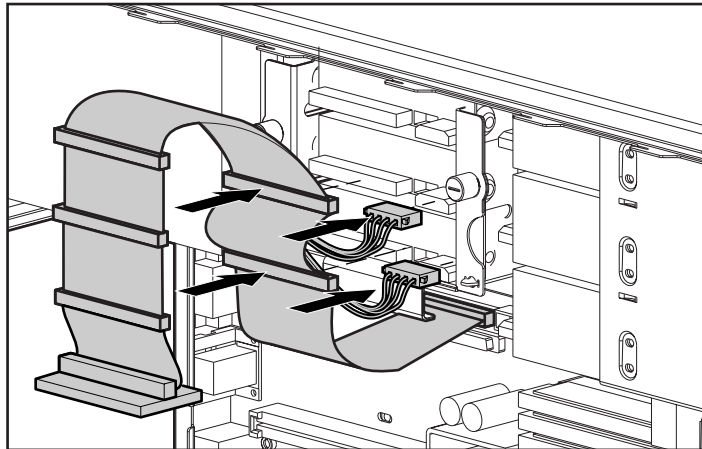


Figure 8-11. Connecting the signal and power cables

5. Reassemble the workstation.

SCSI Cable and Guidelines

All workstation models use three areas for connecting mass storage SCSI devices: internally with hard drives in the removable hard drive cage, internally with storage devices in the front panel drive bays, and externally with external storage devices. The workstation has an integrated Wide-Ultra SCSI controller that has one internal connector on the system board and one external connector on the rear panel.

SCSI Cables

The workstation ships standard with a 5-device Wide-Ultra SCSI cable ❶ that has a terminator on one end. One end of this cable connects to the internal Wide-Ultra SCSI connector on the system board, and the other end (first device connector) of the cable connects to the hard drive in the removable hard drive cage. The cable has five connectors to handle up to five SCSI devices, a maximum of three in the removable hard drive cage and two in the front drive bay area.

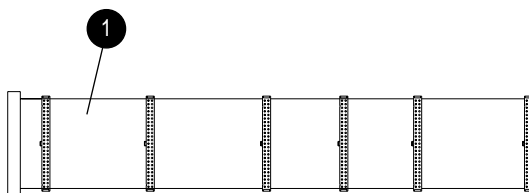


Figure 8-12. 5-device Wide-Ultra SCSI cable

NOTE: The SCSI cable included with your workstation may look slightly different than the one pictured.

SCSI Guidelines for Installing SCSI Devices

- If you are installing a narrow SCSI device, you will need to attach a 68- to 50-pin SCSI adapter to the narrow SCSI device.
 - A maximum of seven SCSI devices may be installed on the integrated Wide-Ultra SCSI controller.
 - A unique SCSI ID (0-6 and 8-15) must be set for each SCSI device installed.
 - Before you install a SCSI device, verify the SCSI ID of the drive and, if necessary, set the SCSI ID to a unique ID number.
 - The controller identifies a SCSI device by its SCSI ID (SCSI ID 1) number rather than its bay location (bay 2). Therefore, moving a SCSI device from one bay location to another or changing the position of the device on the SCSI chain does not affect the communication between the controller and the SCSI device.
 - The reserved and available SCSI ID numbers for SCSI devices are as follows:
 - SCSI ID 0 is reserved for the primary hard drive (bootable drive).
 - SCSI ID 7 is reserved for the controller.
 - SCSI IDs 1-6 and 8-15 are available. 8-15 should not be used with narrow devices on the same SCSI bus.
 - Bay 4 is reserved for the CD-ROM drive. Do not install a SCSI device in this bay.
 - If only one SCSI hard drive is used, it should be installed on the lowest numbered bay (bay 1).
 - Every SCSI chain must be terminated (closed) at both ends.
 - SCSI devices may not have terminating jumpers on the device. Determine if the device ought to have termination enabled or disabled. Set the termination if necessary. Termination on these devices must be achieved with a terminated cable.
 - Turn on an external SCSI device before turning on power to the workstation. This enables the system board controller to recognize the external SCSI device.
-

- When an external SCSI device is connected to the external SCSI connector on the rear panel of the workstation, that device becomes the end of the SCSI chain and must be terminated.
- SCSI drives on the SCSI controller must be either internal or in an external storage system, but not both.

SCSI Guidelines for Optimizing Performance

- To maintain Ultra speeds, do not install more than four SCSI devices on a SCSI bus.
- Do not mix Wide-Ultra and narrow SCSI devices on the same SCSI chain or the same controller. For example, if you plan to connect SCSI devices to both the internal and external Wide-Ultra SCSI connectors, do not install Wide-Ultra SCSI devices to the external Wide-Ultra SCSI connector and narrow SCSI devices to the internal Wide-Ultra SCSI connector.

For additional information about optional SCSI devices, refer to the documentation included with the device or contact your Compaq authorized dealer, reseller, or service provider.

Chapter 9

Expansion Boards

This chapter provides instructions for installing and removing PCI or ISA expansion boards, and an Accelerated Graphics Port (AGP) graphics controller.

NOTE: The following instructions also apply to installing and removing graphics boards. For information about the graphics controller installed on your workstation, refer to the appropriate guide on the SmartStart for Workstations CD under X:\DOCS\GRAPHICS, where X is your CD-ROM drive designation.

For information on preparing the workstation for upgrades, see Chapter 6.

Identifying the PCI and ISA Expansion Slots

Your workstation contains five expansion slots: three PCI expansion slots, one shared PCI/ISA expansion slot, and one ISA expansion slot. The following figure identifies the physical locations. See Table 9-1 for component names.

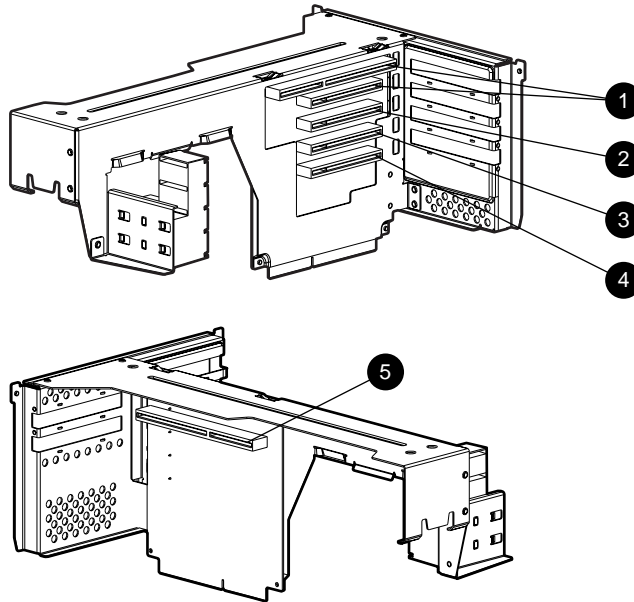


Figure 9-1. Identifying the expansion slots

Table 9-1
PCI/ISA Expansion Slots

Ref.	Component
1	PCI/ISA shared expansion slot. They cannot be used simultaneously/
2	PCI expansion slot (full-length)
3	PCI expansion slot (full-length)
4	PCI expansion slot (full-length)
5	ISA expansion slot (short)

NOTE: PCI=Peripheral Component Interconnect
ISA=Industry Standard Architecture

Installing a PCI or an ISA Expansion Board

To install a PCI or ISA expansion board:

1. Remove the expansion board assembly from the workstation chassis.
2. Refer to the following illustration to remove an expansion slot cover.

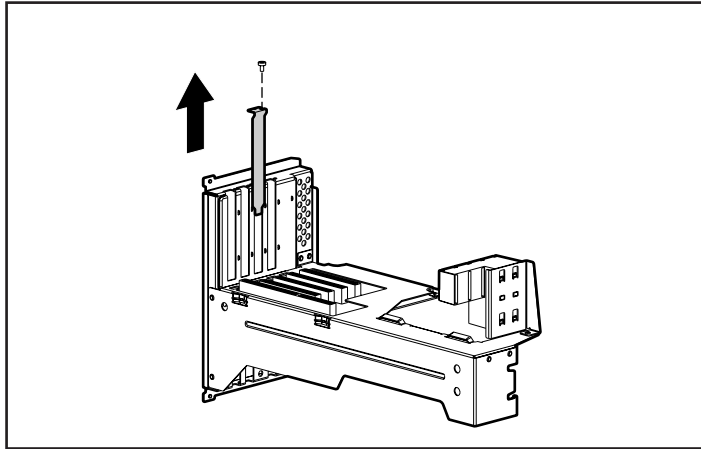


Figure 9-2. Removing the screw and expansion slot cover

To replace an expansion slot cover, reverse the above procedure.

3. Refer to the following illustration to install a PCI or ISA board.

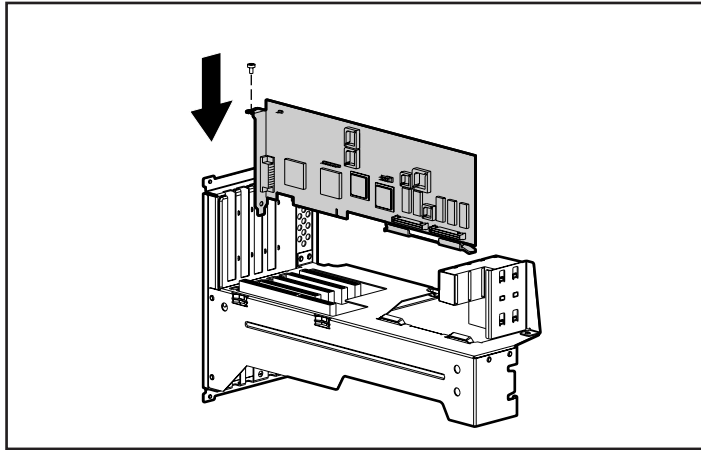


Figure 9-3. Installing an expansion board

IMPORTANT: When you install an expansion board, be sure to press firmly on the board so that the whole connector seats properly in the expansion board slot. If you are installing a full length expansion board, be sure to engage the card guide.

IMPORTANT: To remove a PCI or ISA board, hold the board at each end and carefully rock it back and forth until the connectors pull free from the slot. Be sure not to scrape the board against other components. Store the board in an anti-static package. Remember to reattach the expansion slot cover.

Identifying the Accelerated Graphics Port (AGP) Graphics Controller Expansion Slot

Your workstation also ships with an AGP expansion slot on the system board. The following figure shows the location of this slot.

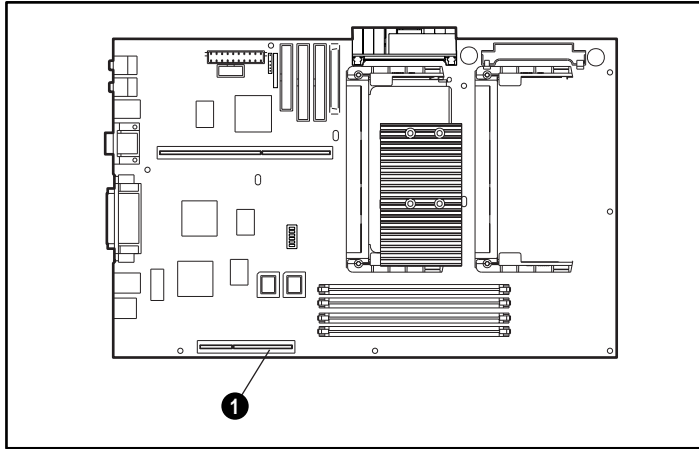


Figure 9-4. Identifying the AGP graphics controller expansion slot ❶

Installing and Removing an AGP Graphics Controller

To install the AGP graphics controller, remove the metal slot screw and cover, insert the board in the APG slot, and press firmly into place.

IMPORTANT: To ensure the board fits properly, be sure to use AGP graphics controllers with APX format brackets.

IMPORTANT: When you install an AGP board, be sure to press firmly on the board so that the whole connector seats properly in the AGP slot. If you are installing a full length expansion board, be sure to engage the card guide.

To remove the AGP graphics controller, hold the board at each end, then pull up. Be sure to replace the metal slot screw and cover.

Chapter 10

Processors

This chapter explains how to install an additional processor and how to upgrade an existing processor.

For information on preparing the workstation for upgrades, see Chapter 6.

Installing an Additional Processor

You can upgrade the workstation to a multi-processor system by installing a second Pentium II processor of the same speed and type in the second processor slot.



WARNING: To reduce the risk of personal injury from hot surfaces, allow the internal system components to cool before touching.



CAUTION: Installing the processor incorrectly may cause damage to the system board. Compaq recommends that you have a Compaq authorized reseller or service provider install the processor. If you plan to install it yourself, read all the instructions carefully before you begin.

To install a second processor:

1. Turn off the workstation and disconnect the power cord from the grounded AC outlet and the back of the workstation.
2. Remove the following components:
 - side access panel
 - expansion board assembly

3. Refer to the following illustrations to install an additional processor.

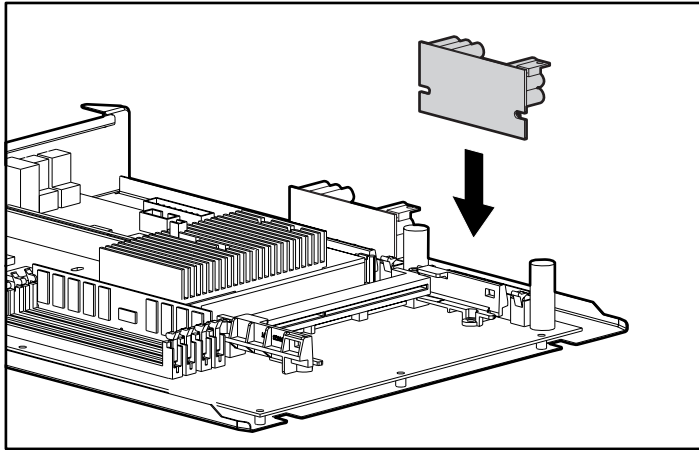


Figure 10-1. Installing the processor power module

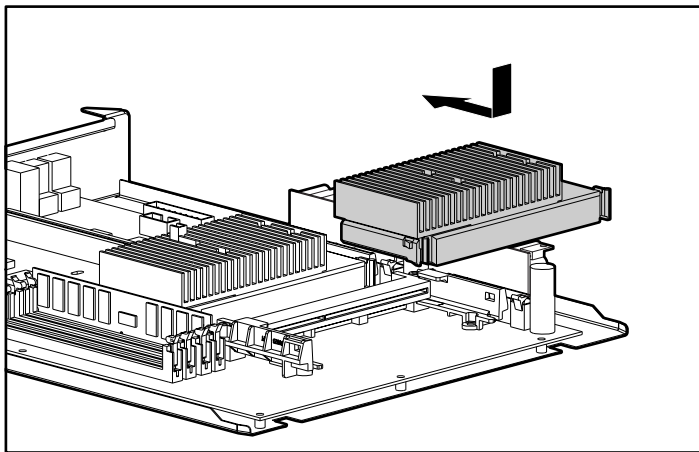


Figure 10-2. Installing a second processor/heat sink assembly

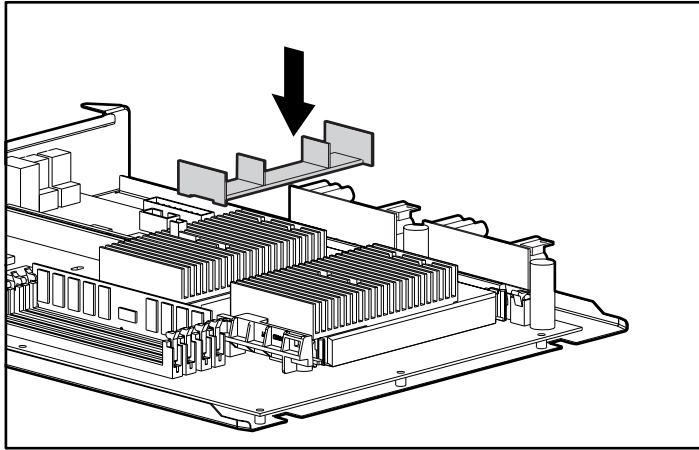


Figure 10-3. Installing a heatsink bridge

4. Reassemble the workstation and connect the power cord to the grounded AC outlet and to the workstation.

IMPORTANT: When replacing the side access panel, be sure to tighten all four thumbscrews.

Upgrading the Processor

To upgrade the processor, follow the installation procedures included with the processor upgrade kit.

Chapter 11

Troubleshooting

This chapter provides information on how to identify and correct some common disk, display, memory, network, SCSI, and software problems. It also identifies and explains some common messages you may receive on the screen.

Consult Appendix D, “POST Error Messages,” for an explanation of specific messages that may display during the Power-On Self-Test (POST) at startup.

Checklist for Minor Problems

If you encounter a minor problem with your workstation, refer to the following list of general suggestions before taking further action:

Check that the workstation and monitor are plugged into a working grounded AC outlet.

- Check to see that the workstation is turned on and the green power light is on.
- Check to see that the monitor is turned on and the green monitor light is on.
- Turn up the brightness and contrast controls of the monitor if the monitor is dim.
- Press and hold any key. If the system beeps, then your keyboard is operating correctly.
- Check all cable connections for loose connections or incorrect connections.

11-2 *Troubleshooting*

- Be sure all the needed device drivers have been installed (for example, if you are using a mouse, you need a mouse device driver).
 - Ensure that all printer drivers have been installed for each application.
 - Take out all diskettes from the diskette drives and all CDs from the CD-ROM drives before you turn on your system.
 - If you have corrupted your Windows NT Workstation configuration, reboot the workstation. When the startup program prompts you to press the spacebar to invoke the last known good menu, press the spacebar. Windows NT Workstation remembers your last working configuration and runs it.
-

Troubleshooting Common Problems

Although your workstation is configured for your particular hardware and software, problems you encounter while working may not be unique. Eliminating the typical problems described in this section may save you time and money. If you do have a problem with your workstation, consider the problems and possible solutions outlined in the following series of tables. You may discover something you can resolve easily for yourself. If the condition persists contact your Compaq authorized reseller or service provider. Refer to “Getting Help” in the front of this guide for a list of Compaq worldwide technical support telephone numbers.

Minor Problems

Table 11-1
Solving Minor Problems

Problem	Possible Cause	Possible Solution
Workstation won't turn on.	Workstation is not connected to a working grounded AC outlet.	Connect to a working grounded AC outlet.
	Cable to the electrical outlet is loose.	Ensure that cable is connected properly.
	A defective PCI or ISA card has been installed.	Remove any expansion board that was just installed.
	Boards, processor, or expansion board assembly may not be properly installed.	Ensure boards and processor are properly seated. Ensure assembly is properly installed in unit.

Continued

11-4 Troubleshooting

Minor Problems *Continued*

Problem	Possible Cause	Possible Solution
Workstation doesn't automatically display the date and time.	RTC (real-time clock) battery may need to be replaced. Battery life is approximately 5 years.	Replace the RTC battery. Refer to Appendix E, "Installing a New Battery," for installation instructions, or contact your Compaq authorized reseller or service provider for RTC battery replacement.
Workstation does not beep during the power-on self-test (POST).	Speaker cable is not properly attached	Ensure that speaker cable is connected.
	Headphones plugged in	Unplug headphones
System will not boot.	Expansion board assembly may not be seated properly.	If the LED is a steady amber color, reseal the expansion board assembly.
Workstation reset automatically.	The unit temperature was exceeded. The fan may be blocked.	<ol style="list-style-type: none">1. Unit is in an exceedingly hot environment. Let it cool down.2. Be sure internal cables are not blocking the air intake of the power supply.3. Contact your Compaq authorized reseller or service provider.

Diskette Drive Problems

Table 11-2
Solving Diskette Drive Problems

Problem	Possible Cause	Possible Solution
Diskette drive light stays on.	Diskette is damaged.	Run CHKDSK on the diskette.
	Diskette is incorrectly inserted.	Remove diskette and reinsert.
	Diskette not fully inserted.	Eject and try inserting again.
	Software program is damaged.	Check the program diskettes or reinstall software from original media.
	Drive cable is not properly connected.	Reconnect drive cable.
Diskette drive cannot write to a diskette.	Diskette is not formatted.	Format the diskette.
	Diskette is write-protected.	Use another diskette or remove the write protection.
	Writing to the wrong drive.	Check the drive letter in your path statement.
	Not enough space is left on the diskette.	Use another diskette.
	Diskette write control is enabled.	Check your security feature settings by running the Setup utility.
A problem has occurred with a disk transaction	The directory structure is bad, or there is a problem with a file.	Run CHKDSK to check for fragmentation.

Continued

Solving Diskette Drive Problems *Continued*

Problem	Possible Cause	Possible Solution
Drive cannot read a diskette	Diskette is not formatted.	Format the diskette.
	You are using the wrong diskette type for the drive type.	Check the type of drive you are using and use the correct diskette type.
Drive not found	Cable is loose.	Check connections.
Nonsystem disk message	The system is trying to start from a diskette that is not bootable.	Remove the diskette from the drive.

Display Problems

Table 11-3
Solving Display Problems

Problem	Possible Cause	Possible Solution
Blank screen	Monitor is not turned on and the monitor light is not on.	Check that the monitor is on and light is on.
	The cable connections are not correct.	Check the cable connection from the monitor to the workstation and to the grounded AC outlet.
	The QuickBlank feature has been enabled through Computer Setup.	Run Computer Setup and disable the QuickBlank feature.
	The energy saver feature has been enabled.	Press any key or type your password and wait a few moments for the screen to activate.
	The RGB (Red, Green, Blue) input switch on the back of the monitor is incorrectly set (select monitors only).	Set the monitor's RGB input switch to 75 ohms and, if there is a sync switch, set it to External.

Continued

Solving Display Problems *Continued*

Problem	Possible Cause	Possible Solution
Blank screen <i>(Continued)</i>	You are using a fixed-sync monitor and it won't sync at the resolution chosen.	Be sure that the monitor can support the selected resolution and refresh rate.
Monitor does not function properly when used with energy saver features	Monitor without energy saver capabilities is being used with energy saver features enabled.	Disable monitor energy saver feature.
Blurry display or requested resolution cannot be set.	If the graphics controller was upgraded, the correct display drivers may not be loaded.	Refer to the documentation in the upgrade kit for more information on display drivers.
The picture is broken up; it rolls, jitters, or blinks.	Monitor cable may be loose.	Be sure the monitor cable is securely connected to the workstation.
	In a 2-monitor system or if another monitor is in close proximity, the monitors may interfere with each other's magnetic field.	Move the monitors farther apart.
Monitor overheats	There is not enough ventilation space for proper airflow.	Leave at least 3 inches (7.6 cm) of ventilation space. Also, be sure there is nothing on top of the monitor to obstruct airflow.
Video colors are wrong	This indicates that either the cabling or monitor impedance is* incorrect.	<ol style="list-style-type: none"> 1. Ensure that the Red, Green, and Blue BNC cables are connected to the corresponding monitor connectors. 2. Be sure your monitor's RGB inputs are set to 75 ohms.

Audio Problems

Table 11-4
Solving Audio Problems

Problem	Possible Cause	Possible Solution
Sound does not come out of the speaker	Software volume control is turned down in Microsoft Sound System Control Panel.	In Windows NT Workstation, select Volume Control under Accessories and adjust volume.
	Headphones are plugged in.	Unplug headphone jack.
	Speaker cable is loose.	Ensure that the speaker cable is properly connected.
Sound does not come through the headphones	Headphones are not plugged in correctly or volume control is turned down.	<ol style="list-style-type: none"> 1. Check the headphone cable connection. 2. Adjust the headphone volume control.

Printer Problems

Table 11-5
Solving Printer Problems

Problem	Possible Cause	Possible Solution
Printer will not print.	Printer is not turned on and online.	Turn the printer on and make sure it is online.
	The correct printer drivers for your application are not installed.	Install the correct printer drivers for your application.
	If you are on a network, you may not have made the connection to the printer.	Make the proper network connections to the printer.

Continued

Solving Printer Problems *Continued*

Problem	Possible Cause	Possible Solution
Printer will not turn on.	The cables may not be connected properly.	Reconnect all cables and check the power cord and grounded AC outlet.
Printer prints garbled information.	The correct printer drivers for your application are not installed.	Install the correct printer driver for your application.
	The cables may not be connected properly.	Reconnect all cables.
Printer is offline.	The printer may be out of paper.	1. Check the paper tray and refill it if it is empty. 2. Select online.

Hardware Installation Problems

Table 11-6
Solving Hardware Problems

Problem	Possible Cause	Possible Solution
A new device is not recognized as part of the system	Computer Setup has not been run to configure the new device.	Run Computer Setup or the SCSI software utility.
	Cable(s) of new external device are loose or power cables are unplugged.	Ensure that all cables are properly and securely connected and that pins in the cable or connector are not bent.
	Power switch of new external device is not turned on.	Turn off the workstation, turn on the external device, then turn on the workstation to integrate the device with the system.

Network Problems

Table 11-7
Solving Network Problems

Problem	Possible Cause	Possible Solution
Setup utility does not detect a network controller.	Possible resource conflict with another expansion board.	Either remove and reconfigure the conflicting expansion board, or reconfigure the network controller. If the address is changed, ensure that the drive parameters match the new I/O address for the network controller.
Setup utility reports unprogrammed EEPROM.	Possible resource conflict with another expansion board.	Either remove and reconfigure the conflicting expansion board, or reconfigure the network controller. If the address is changed, ensure that the drive parameters match the new I/O address for the network controller.
	The network controller is defective.	Contact your Compaq authorized service provider.
	Network drivers are not loaded.	Boot the workstation without the network drivers, using a system boot diskette, and reconfigure the network controller.

Continued

Solving Network Problems *Continued*

Problem	Possible Cause	Possible Solution
Diagnostics reports a failure.	Possible resource conflict with another expansion board.	Factory default is 300h to 30Fh for Ethernet. Either remove and reconfigure the conflicting expansion board, or reconfigure the network controller. If the address is changed, ensure that the drive parameters match the new I/O address for the network controller.
	The cable is not securely connected.	Ensure that the cable is securely attached to the network connector and that the other end of the cable is securely attached to the correct device.
	The cable is attached to the incorrect connector.	Ensure that the cable is attached to the correct connector.
	There is a problem with the cable or a device at the other end of the cable.	Ensure that the cable and device at the other end are operating correctly.
	The network controller is defective.	Contact your Compaq authorized service provider.
	Network controller interrupt overlaps the interrupt of an expansion board.	Run the Setup utility and modify the network controller memory value.

Continued

Solving Network Problems *Continued*

Problem	Possible Cause	Possible Solution
Diagnostics passes, but the workstation does not communicate with the network.	Network drivers are not loaded, or driver parameters do not match current configuration.	Make sure the network drivers are loaded and that the driver parameters match the configuration of the network controller.
	The network controller is not configured for this workstation.	In Windows NT Workstation, select the Network icon at the Control Panel.
	Network controller interrupt overlaps the interrupt of an expansion board.	Run the Setup utility and modify the network controller memory value.
Network controller stopped working when an expansion board was added to the workstation.	Network drivers are not loaded, or driver parameters do not match current configuration.	Make sure the network drivers are loaded and that the driver parameters match the configuration of the network controller.
	The cable is not securely connected.	Ensure that the cable is securely attached to the network connector and that the other end of the cable is securely attached to the correct device.
	Network controller interrupt overlaps the interrupt of an expansion board.	Run the Setup utility and modify the network controller memory value.

Continued

Solving Network Problems *Continued*

Problem	Possible Cause	Possible Solution
Network controller stopped working when an expansion board was added to the workstation. <i>(Continued)</i>	The network controller requires drivers.	Verify that the drivers were not accidentally deleted when the drivers for a new expansion board were installed.
	The files containing the network drivers are corrupted.	Reinstall the network drivers using your Compaq SmartStart for Workstations CD.
Network controller stopped working without apparent cause.	The files containing the network drivers are corrupted.	Reinstall the network drivers using your Compaq SmartStart for Workstations CD.
	The cable is not securely connected.	Ensure that the cable is securely attached to the network connector and that the other end of the cable is securely attached to the correct device.
	The network controller is defective.	Contact your Compaq authorized service provider.

Memory Problems

Table 11-8
Solving Memory Problems

Problem	Possible Cause	Possible Solution
Out of Memory error	Memory configuration may not be set up correctly.	Run Computer Setup or Windows NT Workstation utilities.
	You have run out of memory to run the application.	Check the application documentation to determine the memory configuration requirements.
Memory count during POST is wrong	The memory modules may not be installed correctly.	Check that the memory modules have been installed correctly and run the Setup utility.
Insufficient memory error during operation	You have run out of memory for your application.	Check the memory requirements for the application, or add more memory to the workstation.

CD-ROM Drive Problems

Table 11-9
Solving CD-ROM Drive Problems

Problem	Possible Cause	Possible Solution
System will not boot from CD-ROM drive.	The CD-ROM boot is not enabled through the Setup utility.	Run the Setup utility and set the drive priorities.
Data read from CD-ROM drive is inconsistent or drive cannot read data	Paper or plastic label has been applied to surface of the CD in use.	Remove label and any adhesive residue.
CD-ROM devices are not detected, driver is not loaded.	CD-ROM drive is not connected properly or not properly terminated.	Refer to the documentation included with the CD-ROM.

Appendix A

Regulatory Compliance Notices

Federal Communications Commission Notice

Part 15 of the Federal Communications Commission (FCC) Rules and Regulations has established Radio Frequency (RF) emission limits to provide an interference-free radio frequency spectrum. Many electronic devices, including computers, generate RF energy incidental to their intended function and are, therefore, covered by these rules. These rules place computers and related peripheral devices into two classes, A and B, depending upon their intended installation. Class A devices are those that may reasonably be expected to be installed in a business or commercial environment. Class B devices are those that may reasonably be expected to be installed in a residential environment (i.e., personal computers). The FCC requires devices in both classes to bear a label indicating the interference potential of the device as well as additional operating instructions for the user.

The rating label on the device shows which class (A or B) the equipment falls into. Class B devices have an FCC logo or FCC ID on the label. Class A devices do not have an FCC logo or ID on the label. Once the class of the device is determined, refer to the following corresponding statement.

Class A Equipment

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at personal expense.

Class B Equipment

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or television technician for help.

Modifications

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Compaq Computer Corporation may void the user's authority to operate the equipment.

Cables

Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods in order to maintain compliance with FCC Rules and Regulations.

Declaration of Conformity for Products Marked with FCC Logo, United States Only

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions regarding your product, contact:

Compaq Computer Corporation
P. O. Box 692000, Mail Stop 530113
Houston, Texas 77269-2000

Or, call
1-800-652-6672 (1-800-OK COMPAQ)
(For continuous quality improvement, calls may be recorded or monitored.)

For questions regarding this FCC declaration, contact:

Compaq Computer Corporation
P. O. Box 692000, Mail Stop 510101
Houston, Texas 77269-2000

Or, call
1-281-514-3333

To identify this product, refer to the part, series, or model number found on the product.

Mouse Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canadian Notice (Avis Canadien)

Class A Equipment

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Class B Equipment

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Union Notice

Products with the CE Marking comply with both the EMC Directive (89/336/EEC) and the Low Voltage Directive (73/23/EEC) issued by the Commission of the European Community.

Compliance with these directives implies conformity to the following European Norms (in brackets are the equivalent international standards):

- EN55022 (CISPR 22) - Electromagnetic Interference
 - EN50082-1 (IEC801-2, IEC801-3, IEC801-4) - Electromagnetic Immunity
-

■ EN60950 (IEC950) - Product Safety

Japanese Notice

ご使用になっている装置にVCCIマークが付いていましたら、次の説明文をお読み下さい。

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

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Taiwan Notice

警告使用者：

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

Laser Devices

The CD-ROM drive contains a laser device. All Compaq systems equipped with a laser device comply with safety standards, including International Electrotechnical Commission (IEC) 825. With specific regard to the laser, the equipment complies with laser product performance standards set by government agencies as a Class 1 laser product. The product does not emit hazardous light; the beam is totally enclosed during all modes of customer operation and maintenance.

Laser Safety Warnings



WARNING: To reduce the risk of injury from laser radiation or damage to the equipment, observe the following precautions with the CD-ROM drive:

- Do not open any panels, operate controls, make adjustments, or perform procedures to a laser device other than those specified herein.
 - Allow only Compaq Authorized Service Technicians to repair the laser equipment.
 - Do not stare into the laser beam.
-

Compliance with CDRH Regulations

The Center for Devices and Radiological Health (CDRH) of the U.S. Food and Drug Administration implemented regulations for laser products on August 2, 1976. These regulations apply to laser products manufactured from August 1, 1976. Compliance is mandatory for products marketed in the United States.

Compliance with International Regulations

All Compaq systems equipped with CD-ROM drives comply with appropriate safety standards including IEC 825.

Laser Product Label

The following label or equivalent is located on the surface of your CD-ROM drive.



This label indicates that the product is classified as a CLASS 1 LASER PRODUCT. This label appears on a laser device installed in your product.

Laser Information

Laser Type	Semiconductor GaAlAs
Wave Length	780 nm +/- 35 nm
Divergence Angle	53.5 degrees +/- 0.5 degrees
Output Power	Less than 0.2 mW - or - $10,869 \text{ W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$
Polarization	Circular 0.25
Numerical Aperture	0.45 inches +/- 0.04 inches

Battery Replacement Notice

Your computer is provided with a Lithium battery. There is a danger of explosion and risk of personal injury if the battery is incorrectly replaced or mistreated. Replacement is to be done by a Compaq Authorized Service Provider using the Compaq spare designated for this product. For more information about battery replacement or proper disposal, contact your Compaq Authorized Reseller or your Authorized Service Provider.



WARNING: Your computer contains an internal lithium battery. There is risk of fire and burns if the battery pack is not handled properly. To reduce the risk of personal injury,

- Do not attempt to recharge the battery
 - Do not expose to temperatures higher than 60°C.
 - Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.
 - Replace only with the Compaq spare designated for this product.
-



Batteries, battery packs, and accumulators should not be disposed of together with the general household waste. In order to forward them to recycling or proper disposal, please use the public collection system or return them to Compaq, your authorized Compaq Partners, or their agents.

Appendix B

Electrostatic Discharge

To prevent damaging the system, be aware of the precautions you need to follow when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.

To prevent electrostatic damage, observe the following precautions:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free workstations.
- Place parts on a grounded surface before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when touching a static-sensitive component or assembly.

Grounding Methods

There are several methods for grounding. Use one or more of the following methods when handling or installing electrostatic-sensitive parts:

- Use a wrist strap connected by a ground cord to a grounded workstation or computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm \pm 10 percent resistance in the ground cords. To provide proper ground, wear the strap snug against the skin.
- Use heel straps, toe straps, or boot straps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats.

- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

If you do not have any of the suggested equipment for proper grounding, have an Authorized Compaq Reseller install the part.

NOTE: For more information on static electricity, or assistance with product installation, contact your Authorized Compaq Reseller.



Appendix C

Power Cord Set Requirements

The power cord set meets the requirements for use in the country where you purchased your equipment. The voltage selection switch allows you to select the appropriate line voltage for your computer.

Power cord sets for use in other countries must meet the requirements of the country where you use the server. For more information on power cord set requirements, contact your Authorized Compaq Dealer.

General Requirements

The requirements listed below are applicable to all countries:

- The length of the power cord must be at least 6.0 feet (1.8 m) and a maximum of 12 feet (3.7 m).
- The power cord set must be approved by an acceptable accredited agency responsible for evaluation in the country where the power cord will be used.
- The power cord set must have a minimum current capacity and nominal voltage rating of 10 A/125 volts AC, or 10A/250 volts AC, as required by each country's power system.
- The appliance coupler must meet the mechanical configuration of an EN60320/IEC 320 Standard Sheet C13 Connector, for mating with the appliance outlet on the computer.

Country-Specific Requirements

Use the following table to identify the appropriate accredited agency in your country.

Table C-1
Power Cord Set Requirements - By Country

Country	Accredited Agency	Applicable Note Numbers
Australia	EANSW	1
Austria	OVE	1
Belgium	CEBC	1
Canada	CSA	2
Denmark	DEMKO	1
Finland	SETI	1
France	UTE	1
Germany	VDE	1
Italy	IMQ	1
Japan	JIS	3
Norway	NEMKO	1
Sweden	SEMKO	1
Switzerland	SEV	1
United Kingdom	BSI	1
United States	UL	2

Notes:

1. Flexible cord must be <HAR> Type HO5VV-F, 3-conductor, 1.0 mm² conductor size. Power cord set fittings (appliance coupler and wall plug) must bear the certification mark of the agency responsible for evaluation in the country where it will be used.
2. Flexible cord must be Type SVT or equivalent, No. 18 AWG, 3-conductor. Wall plug must be a two-pole grounding type with a NEMA 5-15P (15A, 125V).
3. Appliance coupler, flexible cord, and wall plug must bear a "T" mark and registration number in accordance with the Japanese Dentori Law. Flexible cord must be Type VCT or VCTF, 3-conductor, 1.0 mm² conductor size. Wall plug must be a two-pole grounding type with a Japanese Industrial Standard C8303 (7A, 125V) configuration.

Appendix D

POST Error Messages

Error Messages

This appendix lists the error codes that you may encounter during the Power-On Self-Test (POST) or after restarting the workstation, the probable source of the problem, and what steps you can take to resolve the error condition.

POST Error Messages and Codes		
Error Code	Probable Source of Problem	Action
101-ROM Error	System ROM checksum	Contact your Compaq authorized service provider.
101-Option ROM Checksum Error	Options ROM checksum	Contact your Compaq authorized service provider.
102-System Board Failure	DMA, timers, etc.	Replace the Expansion Cage System Board. Run the Computer Setup utility.
162-System Options Error	No diskette drive or mismatch in drive type	Run Computer Setup or Windows NT Workstation utilities.
162-System Options Not Set	Configuration incorrect	Run Computer Setup or Windows NT Workstation utilities.
163-Time & Date Not Set	Invalid time or date in configuration memory	Run Computer Setup or Windows NT Workstation utilities.
164-Memory Size Error	Configuration memory incorrect	Run Computer Setup or Windows NT Workstation utilities.

Continued

POST Error Messages and Codes *Continued*

Error Code	Probable Source of Problem	Action
172-1 Configuration Nonvolatile Memory Invalid	NVRAM Configuration error	Allow system to complete boot. Reboot. If condition persists, contact your Compaq authorized service provider.
201-Memory Error	RAM failure	Contact your Compaq authorized service provider.
202-Memory Type Mismatch	RAM failure	Contact your Compaq authorized service provider.
203-Memory Address Error	RAM failure	Contact your Compaq authorized service provider.
205-Memory Error	Cache memory error	Run the Computer Checkup or Diagnostics utility.
206-Secondary cache controller failure	Cache memory controller or RAM failure	Run Computer Setup and Diagnostics utilities.
207-ECC Corrected Single Bit Errors in DIMM Pair(s)	A memory error on one of the installed DIMMs has been detected and corrected with the system's ECC logic. The workstation will continue to operate correctly with this error.	Run Diagnostics to get more information; then contact your Compaq authorized service provider.

Continued

POST Error Messages and Codes *Continued*

Error Code	Probable Source of Problem	Action
212-Failed Processor	Failed processor (X is 0 or 1)	Contact your Compaq authorized service provider.
301-Keyboard Error	Keyboard failure	Check that you do not have a key stuck or something on the keyboard. Ensure that the keyboard is plugged in. Replace the keyboard if necessary.
303-Keyboard Controller Error	I/O keyboard controller	Contact your Compaq authorized service provider.
304-Keyboard or System Unit Error	Keyboard	Contact your Compaq authorized service provider.
40X-Parallel Port X Address Assignment Conflict	Both external and internal ports are assigned to parallel port X.	Run Computer Setup or Windows NT Workstation utilities.
402-Monochrome Adapter Failure	Monochrome display controller	Replace the monochrome display controller.
404-Parallel Port Address Conflict Detected	Both external and internal ports are assigned to parallel port X.	Run Computer Setup or Windows NT Workstation utilities.
501-Display Adapter Failure	Graphics display controller	Replace the graphics display controller.

Continued

POST Error Messages and Codes *Continued*

Error Code	Probable Source of Problem	Action
601-Diskette Controller Error	Diskette controller circuitry	Contact your Compaq authorized service provider.
605-Diskette Drive Type Error	Mismatch in drive type	Run Computer Setup or Windows NT Workstation utilities.
611-Primary Floppy Port Address Assignment Conflict	Configuration error	Run Computer Setup or Windows NT Workstation utilities.
612-Secondary Floppy Port Address Assignment Conflict	Configuration error	Run Computer Setup or Windows NT Workstation utilities.
1151-System Board COM Port 1 Address Assignment Conflict	Configuration Error	Run Computer Setup
1152- System Board COM Port 2 Address Assignment Conflict	Configuration Error	Run Computer Setup
1155-COM Port Address Assignment Conflict	Both external and internal serial ports.	Run Computer Setup or Windows NT Workstation utilities.
1610-Temperature violation detected	The system is too hot.	Turn off the workstation and let it cool off. If the condition persists, Run Diagnostics to get more information; then contact your Compaq authorized service provider.

Continued

POST Error Messages and Codes *Continued*

Error Code	Probable Source of Problem	Action
1611-Fan failure detected	The fan is not operating properly.	Run Diagnostics to get more information; then contact your Compaq authorized service provider.
1720-IntelliSafe Hard Drive Detects Imminent Failure	IDE hard drive(s)	Contact your Compaq authorized service provider.
1720-SMART Hard Drive Detects Imminent Failure	SCSI hard drive(s)	Contact your Compaq authorized service provider.
1771-Primary Disk Port Address Assignment Conflict	IDE configuration	Run Computer Setup
1772-Secondary Disk Port Address Assignment Conflict	IDE configuration	Run Computer Setup
1780- Disk 0 failure	IDE hard drive failure	Contact your Compaq authorized service provider.
1781-Disk 1 Failure	IDE hard drive failure	Contact your Compaq authorized service provider.
1782-Disk Controller Failure	IDE circuitry failure	Contact your Compaq authorized service provider.
1790-Disk 0 Failure (Secondary)	IDE hard drive failure	Contact your Compaq authorized service provider.
1791-Disk 1 Failure (Secondary)	IDE hard drive failure	Contact your Compaq authorized service provider.
1792-Secondary Disk Controller Failure	IDE circuitry failure	Contact your Compaq authorized service provider.

Continued

D-6 POST Error Messages

POST Error Messages and Codes *Continued*

Error Code	Probable Source of Problem	Action
1793-Secondary Controller or Disk Failure	An error has been detected with the CD-ROM interface.	Run the Diagnostics utility.
A Critical Error Occurred Prior to this Power-Up	Critical failure (POST) recorded into the wellness log.	None.
A Collectable Memory Error Occurred Prior to this Power-Up	Single-bit ECC during POST.	None.
This Workstation has experienced an NMI (Hardware Error)	As indicated.	None.
Fixed Disk Parameter Table or BIOS Error System Halted	Configuration or hardware failure.	Run the Setup and Diagnostics utilities.
XX000Y ZZ Parity Check 2	Parity RAM failure.	Run the Setup and Diagnostics utilities.
Audible (beep)	Power-on successful.	None.
Invalid Electronic Serial Number	The electronic serial number is corrupt.	Run the Setup and Diagnostics utilities.
(RESUME="F1" KEY)	As indicated to continue.	Press the F1 key.

Appendix E

Installing a New Battery

When your workstation no longer automatically displays the correct date and time, it may mean the battery providing power to the real-time clock needs to be replaced. Battery life is usually about five years. Prior to installing the replacement battery, read the following section.

Running Computer Setup

Computer Setup automatically detects and configures most Compaq components, including Compaq hard drives. If your workstation has a Compaq hard drive you do not need to run Computer Setup prior to installing the replacement battery. However, if your workstation has a third-party hard drive, you **MUST** complete the following steps before installing the replacement battery:

1. Run Computer Setup and record the drive type displayed in the System Configuration Summary.
2. If the drive type number is 65 or 66, record the drive parameters.

Drives with these designators are user-defined types, also called soft-drive types. Whenever the nonvolatile memory (CMOS) has become invalid, such as after the installation of a new battery, drive parameters must be entered manually for these user-defined drives.

After you have completed the battery installation, run Computer Setup and use the drive table parameters recorded earlier to reconfigure the system.

NOTE: Drive parameters must be reentered after battery installation in order to reconfigure the hard drive. The hard drive is inoperable until this is done.

Installation Procedures

The battery that came with the workstation is permanently installed on the system board. If the original battery becomes inoperative, you must install a second battery.



WARNING: The system board contains a lithium battery. The lithium battery may explode if mistreated. The battery is soldered in place and may not be removed. Do not abuse or disassemble. Use only replacement batteries supplied by Compaq.

To install the replacement battery, follow these steps:

1. If the workstation is on, turn it off, then unplug the power cord from the grounded AC electrical outlet.
2. Remove the side access panel and the expansion board assembly.
3. Remove and discard the protective covering on the adhesive on the hook and loop fastener on the back of the battery and attach the battery to the side of the power supply.
4. Plug the battery connector onto pins 1-4 on the system board.

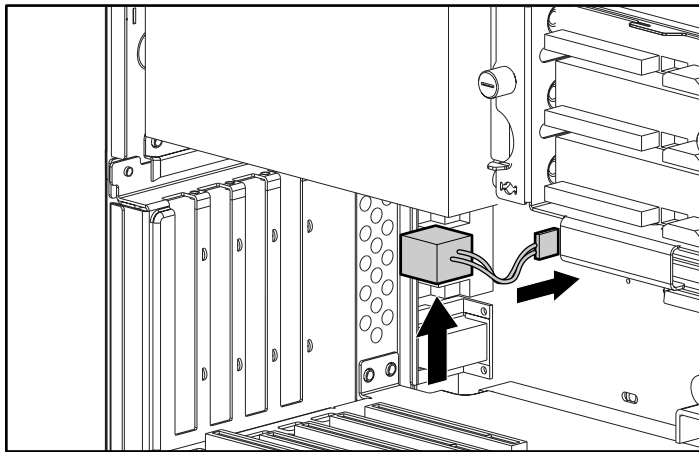


Figure E-1. Attaching the replacement battery

5. Change the jumper from pins 6-7 ❶ to pins 5-6 ❷.

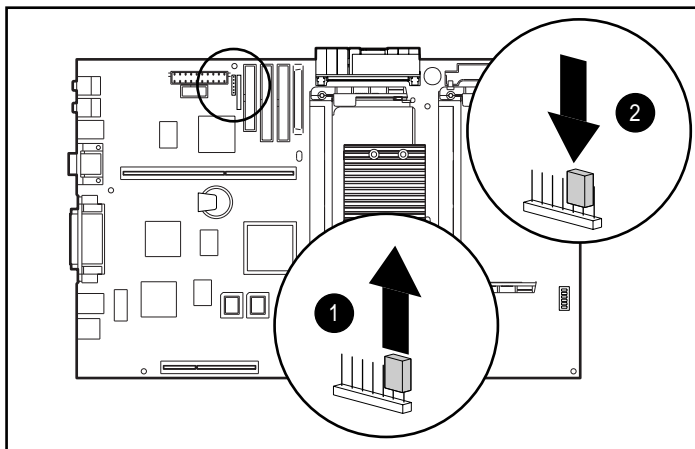


Figure E-2. Changing the jumper from pins 6-7 to pins 5-6

6. Place the pale blue sticker included with the battery kit above the power connector on the back of the workstation.
7. Replace the expansion board assembly and the side access panel.
8. Plug the power cord into a grounded AC outlet.
9. Turn on the workstation.
10. Run Computer Setup to reconfigure the system.
11. If the workstation has a Compaq hard drive, you have now successfully completed the installation.

If the workstation has a third-party hard drive, you must reconfigure the hard drive using the parameters you recorded before you began the installation procedure.

Appendix F

Workstation Specifications

Table F-1
Workstation Specifications

Dimensions (with bezel and without feet)	U.S.	Metric
Height	18.7 in	47.50 cm
Depth	23.2 in	58.90 cm
Width	8.03 in	20.40 cm
Weight	54.75 lb	24.89 kg
Power Supply Input Requirements	Low Range	High Range
Rated Input Voltage	100 to 120 V	200 to 240 V
Rated Input Frequency	50 to 60 Hz	50 to 60 Hz
Input Power (W)	540	540
Input Power (BTU/hr)	1830	1830
Power Supply Output Power		
Rated Steady-State Power	325	325
Maximum Peak Power	325	325
Relative Humidity		
Operating	5% - 95%	5% - 95%
Nonoperating	5% - 95%	5% - 95%
Temperature	U.S.	Metric
Operating	41°F to 95°F	5°C to 35°C
Nonoperating	-40°F to 185°F	-40°C to 85°C

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