Service Reference Guide
HP Compaq Business Desktop dc7100 Series
   3rd Edition

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3rd Edition, November 2005
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This document provides information on the removal and replacement of all parts as well as information on troubleshooting, Desktop Management, setup utilities, SATA and PATA drives, safety, routine care, connector pin assignments, POST error messages, and diagnostic indicator lights.

WARNING: Text set off in this manner indicates that failure to follow directions could result in bodily harm or loss of life.

CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

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Installing the Operating System

⚠ **CAUTION:** Do not add optional hardware or third-party devices to your computer until the operating system is successfully installed. Doing so may cause errors and may prevent the operating system from installing properly.

⚠ **CAUTION:** Once the automatic installation has begun, DO NOT TURN OFF THE COMPUTER UNTIL THE PROCESS IS COMPLETE. Turning off the computer during the installation process might damage the software that runs the computer or prevent its proper installation.

The first time the computer is turned on, the operating system is automatically installed. This takes approximately 10 minutes, depending on the system hardware configuration. At the beginning of the installation process, you are prompted to select the appropriate language for the operating system. Read and follow the instructions that appear on the screen to complete the installation. During this process, do not turn off your computer unless you are directed to do so.

✎ If the computer shipped with more than one operating system language on the hard drive, the installation process could take up to 60 minutes.

1.1 Installing or Upgrading Device Drivers

To install hardware devices such as a printer, a display adapter, or network adapter after the operating system installation is completed, the operating system needs access to the appropriate software drivers for the devices.

If prompted for the I386 directory, replace the path specification with **C:\i386**, or use the **Browse** button in the dialog box to locate the i386 folder. This action points the operating system to the appropriate drivers.

Obtain the latest support software, including support software for the operating system from www.hp.com. Click **Support & Drivers**, select **Download drivers and software**, enter the model number of the computer, and press **Enter**.

You can also obtain the latest support software on CDs. The following Web site provides information on how to purchase a support software CD subscription:

http://h18000.www1.hp.com/support/files/desktops/us/purchase.html

✎ If the computer has an optical CD-RW drive, install the appropriate application to be able to write to the drive. To install the application, double-click the Setup Software icon on the desktop or the application launcher and select the **Easy CD Creator** and **Direct CD** option when prompted.

1.2   Transferring Files and Settings

Use the Microsoft Windows XP Files and Settings Transfer Wizard to move files and settings from an old computer to a new one. Click **Start > All Programs > Accessories > System Tools > Files and Settings Transfer Wizard**.

1.3   Backing Up and Restoring Files

1.3.1 Creating a Backup File—Windows XP Professional

1. Click **Start > All Programs > Accessories > System Tools > Backup**.

2. Use the Backup or Restore Wizard to create a backup file or tape.

✎ A backup file can be saved to a hard disk, a floppy disk, CD, USB flash media device, tape drive, or to any other removable or nonremovable media.

1.3.2 Restoring from the Backup File—Windows XP Professional

1. Click **Start > All Programs > Accessories > System Tools > Backup**.

2. Use the Backup or Restore Wizard to restore files from a backup file.

✎ A backup file can be on a hard disk, a floppy disk, CD, USB flash media device, tape drive, or any other removable or nonremovable media.

1.4   Converting to NTFS

Windows XP Professional

To convert a FAT or FAT32 volume to NTFS,

1. Click **Start > All Programs > Accessories > Command Prompt**.

2. Type **convert** *drive_letter***: /fs:ntfs** (where *drive_letter* is the volume to be converted) and press **Enter**.

1.5   HP Software

The Microsoft Windows XP Professional operating system is preinstalled on the computer and will be configured automatically the first time the computer is turned on. The following HP software may also be installed at that time on selected models:

■ Computer Setup Utilities

■ HP Support Software including device drivers

■ Configuration Record

■ Online *Safety & Comfort Guide*

■ Power Management with energy saver features

■ Security Management tools

■ Software Support Management tools

Certain drivers and utilities are available only in selected languages. You can obtain the latest version of these files, in English and selected other languages, in one of three ways:

■ Support Software CD

■ HP Web site at www.hp.com

■ *Restore Plus!* CD, which is supplied with many HP models

✎ Additional HP software may be required in certain situations.

2

Setup Utilities and Diagnostics Features

Setup Utilities (F10) and diagnostic features provide information needed about the computer system when contacting Customer Support. These tools 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.

■ Determine if all of the devices installed on the computer are recognized by the system and functioning properly.

■ Determine information about the operating environment of the computer.

■ Solve system configuration errors detected but not automatically fixed during the Power-On Self-Test (POST).

■ Establish and manage passwords and other security features.

■ Establish and manage energy-saving timeouts.

✎ All features identified in this chapter may not be available on all HP products.

2.1 Power-On Self-Test (POST)

POST is a series of diagnostic tests that runs automatically when the system is turned on. POST checks the following items to ensure that the computer system is functioning properly:

■ Keyboard

■ Memory modules

■ All mass storage devices

■ Processors

■ Controllers

✎ If the Power-On Password is set, a key icon appears on the screen while POST is running. You will need to enter the password before continuing. Refer to Chapter 3, Section 3.1 for information on setting, deleting, or bypassing the password.

If POST finds an error in the system, an audible and/or visual message occurs. For POST error messages and their solutions refer to Appendix C, "POST Error Messages."

2.2 **Computer Setup Utilities**

Use Computer Setup Utilities (F10) to:

■ Change factory default settings.

■ Set the system date and time.

■ Set, view, change, or verify the system configuration, including settings for processor, graphics, memory, audio, storage, communications, and input devices.

■ Modify the boot order of bootable devices such as hard drives, diskette drives, optical drives, or USB flash media devices.

■ Enable Quick Boot, which is faster than Full Boot but does not run all of the diagnostic tests run during a Full Boot. You can set the system to:

❏ always Quick Boot (default);

❏ periodically Full Boot (from every 1 to 30 days); or

❏ always Full Boot.

■ Select Post Messages Enabled or Disabled to change the display status of Power-On Self-Test (POST) messages. Post Messages Disabled suppresses most POST messages, such as memory count, product name, and other non-error text messages. If a POST error occurs, the error is displayed regardless of the mode selected. To manually switch to Post Messages Enabled during POST, press any key (except **F1** through **F12**).

■ Establish an Ownership Tag, the text of which is displayed each time the system is turned on or restarted.

■ Enter the Asset Tag or property identification number assigned by the company to this computer.

■ Enable the power-on password prompt during system restarts (warm boots) as well as during power-on.

■ Establish a setup password that controls access to Computer Setup (F10) Utility and the settings described in this section.

■ To secure integrated I/O functionality, including the serial, USB, or parallel ports, audio, or embedded NIC, so that they cannot be used until they are unsecured.

■ Enable or disable Master Boot Record (MBR) Security.

■ Enable or disable removable media boot ability.

■ Enable or disable legacy diskette write ability (when supported by hardware).

■ Solve system configuration errors detected but not automatically fixed during the Power-On Self-Test (POST).

■ Replicate the system setup by saving system configuration information on diskette and restoring it on one or more computers.

■ Execute self-tests on a specified ATA hard drive (when supported by drive).

■ Enable or disable DriveLock security (when supported by MultiBay drive).

2.2.1 Using Computer Setup (F10) Utilities

Computer Setup can be accessed only by turning on the computer or restarting the system. To access the Computer Setup Utilities menu, complete the following steps:

1. Turn on or restart the computer. If you are in Windows, click **Start >Shut Down >Restart**.

2. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

3. Select your language from the list and press the **Enter** key.

4. A choice of five headings appears in the Computer Setup Utilities menu: File, Storage, Security, Power, and Advanced.

5. Use the arrow (left and right) keys to select the appropriate heading. Use the arrow (up and down) keys to select the option you want, then press **Enter**. To return to the Computer Setup Utilities menu, press **Esc**.

6. To apply and save changes, select **File > Save Changes and Exit**.

   ❏ If you have made changes that you do not want applied, select **Ignore Changes and Exit**.

   ❏ To reset to factory settings, select **Set Defaults and Exit**. This option will restore the original factory system defaults.

⚠ **CAUTION:** Do NOT turn the computer power OFF while the ROM is saving your F10 Computer Setup changes because the CMOS could become corrupted. It is safe to turn off all power to the computer after you exit the F10 Setup screen.

2.2.2 Computer Setup Menu

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Heading	Option	Description
File	System Information	Lists: • Product name • Processor type/speed/stepping • Cache size (L1/L2) • Installed memory size/speed, number of channels (single or dual) (if applicable) • Integrated MAC address for embedded, enabled NIC (if applicable) • System ROM (includes family name and version) • Chassis serial number • Asset tracking number
	About	Displays copyright information.
	Set Time and Date	Allows you to set system time and date.
	Replicated Setup	**Save to Removable Media** Saves system configuration, including CMOS, to a formatted 1.44-MB diskette, a USB flash media device, or a diskette-like device (a storage device set to emulate a diskette drive). **Restore from Removable Media** Restores system configuration from a diskette, a USB flash media device, or a diskette-like device.
	Default Setup	**Save Current Settings as Default** Saves the current system configuration settings as the default. **Restore Factory Settings as Default** Restores the factory system configuration settings as the default.
	Apply Defaults and Exit	Applies the currently selected default settings and clears any established passwords.
	Ignore Changes and Exit	Exits Computer Setup without applying or saving any changes.
	Save Changes and Exit	Saves changes to system configuration or default settings and exits Computer Setup.

✎ Support for specific Computer Setup options may vary depending on the hardware configuration.

Heading	Option	Description
Storage	Device Configuration	Lists all installed BIOS-controlled storage devices.
		When a device is selected, detailed information and options are displayed. The following options may be presented.

Diskette Type

Identifies the highest capacity media type accepted by the diskette drive.

Legacy Diskette Drives

Options are 3.5" 1.44 MB and

5.25" 1.2 MB.

Drive Emulation

Allows you to select a drive emulation type for a certain storage device. (For example, a Zip drive can be made bootable by selecting diskette emulation.)

Drive Type	Emulation Options
ATAPI Zip drive	None (treated as Other)
	Diskette (treated as diskette drive)
ATA Hard disk	None (treated as Other)
	Hard disk (treated as hard drive)
Legacy diskette	No emulation options available
CD-ROM drive	No emulation options available
ATAPI LS-120	None (treated as Other).
	Diskette (treated as diskette drive).

Default Values IDE/SATA

Multisector Transfers *(ATA disks only)*

Specifies how many sectors are transferred per multi-sector PIO operation. Options (subject to device capabilities) are Disabled, 8, and 16.

Transfer Mode *(ATA devices only)*

Specifies the active data transfer mode. Options (subject to device capabilities) are PIO 0, Max PIO, Enhanced DMA, Ultra DMA 0, and Max UDMA.

✎ Support for specific Computer Setup options may vary depending on the hardware configuration.

Heading	Option	Description
Storage *(continued)*	Device Configuration *(continued)*	**Translation Mode** *(ATA disks only)* Lets you select the translation mode to be used for the device. This enables the BIOS to access disks partitioned and formatted on other systems and may be necessary for users of older versions of UNIX (e.g., SCO UNIX version 3.2). Options are Automatic, Bit-Shift, LBA Assisted, User, and None ⚠ **CAUTION:** Ordinarily, the translation mode selected automatically by the BIOS should not be changed. If the selected translation mode is not compatible with the translation mode that was active when the disk was partitioned and formatted, the data on the disk will be inaccessible.
		Translation Parameters (ATA disks only) ✎ This feature appears only when User translation mode is selected. Allows you to specify the parameters (logical cylinders, heads, and sectors per track) used by the BIOS to translate disk I/O requests (from the operating system or an application) into terms the hard drive can accept. Logical cylinders may not exceed 1024. The number of heads may not exceed 256. The number of sectors per track may not exceed 63. These fields are only visible and changeable when the drive translation mode is set to User.
	Storage Options	**Removable Media Boot** Enables/disables ability to boot the system from removable media.
		Legacy Diskette Write Enables/disables ability to write data to legacy diskettes. ✎ After saving changes to Removable Media Write, the computer will restart. Turn the computer off, then on, manually.
		BIOS DMA Data Transfers Allows you to control how BIOS device I/O requests are serviced. When "Enable" is selected, the BIOS will service ATA device read and write requests with DMA data transfers. When "Disable" is selected, the BIOS will service ATA device read and write requests with PIO data transfers.

✎ Support for specific Computer Setup options may vary depending on the hardware configuration.

Heading	Option	Description
Storage *(continued)*	Storage Options *(continued)*	**SATA Emulation** Allows you to choose how the SATA controller and devices are accessed by the operating system. "<u>Separate IDE Controller</u>" is the default option. Up to 4 SATA and 2 PATA devices may be accessed in this mode. The SATA and PATA controllers appear as two separate IDE controllers. Use this option with Microsoft Windows 2000 and Windows XP. • SATA 0 is seen as SATA Primary Device 0 • SATA 1 (if present) is seen as SATA Secondary Device 0 "<u>Combined IDE Controller</u>" is the other option. Up to 2 PATA and 2 SATA devices may be accessed in this mode. The SATA and PATA controllers appear as one combined IDE controller. Use this option with Microsoft Windows 98 and earlier operating systems. • PATA Primary Device 0 replaces SATA 1 • PATA Primary Device 1 replaces SATA 3
		IDE Controller Allows you to enable or disable the primary IDE controller. This feature is supported on select models only.
		Primary SATA Controller Allows you to enable or disable the Primary SATA controller.
		Secondary SATA Controller Allows you to enable or disable the Secondary SATA controller. This feature is supported on select models only.
	DPS Self-Test	Allows you to execute self-tests on ATA hard drives capable of performing the Drive Protection System (DPS) self-tests. ✎ This selection will only appear when at least one drive capable of performing the DPS self-tests is attached to the system.

✎ Support for specific Computer Setup options may vary depending on the hardware configuration.

Heading	Option	Description
Storage *(continued)*	Boot Order	Allows you to: • Specify the order in which attached devices (such as a USB flash media device, diskette drive, hard drive, optical drive, or network interface card) are checked for a bootable operating system image. Each device on the list may be individually excluded from or included for consideration as a bootable operating system source. • Specify the order of attached hard drives. The first hard drive in the order will have priority in the boot sequence and will be recognized as drive C (if any devices are attached). ✎ MS-DOS drive lettering assignments may not apply after a non-MS-DOS operating system has started. **Shortcut to Temporarily Override Boot Order** To boot **one time** from a device other than the default device specified in Boot Order, restart the computer and press **F9** when the monitor light turns green. After POST is completed, a list of bootable devices is displayed. Use the arrow keys to select the preferred bootable device and press **Enter**. The computer then boots from the selected non-default device for this one time.
Security	Setup Password	Allows you to set and enables setup (administrator) password. ✎ If the setup password is set, it is required to change Computer Setup options, flash the ROM, and make changes to certain plug and play settings under Windows. See the *Troubleshooting Guide* on the *Documentation CD* for more information.
	Power-On Password	Allows you to set and enable power-on password. See the *Troubleshooting Guide* for more information.
	Password Options (This selection will appear only if a power-on password is set.)	Allows you to specify whether the password is required for warm boot (**CTRL+ALT+DEL**). See the *Desktop Management Guide* for more information.
	Smart Cover	Allows you to: • Lock/unlock the Cover Lock. • Set the Cover Removal Sensor to Disable/Notify User/Setup Password. ✎ *Notify User* alerts the user that the sensor has detected that the cover has been removed. *Setup Password* requires that the setup password be entered to boot the computer if the sensor detects that the cover has been removed. This feature is supported on select models only. See the *Desktop Management Guide* on the *Documentation CD* for more information.

✎ Support for specific Computer Setup options may vary depending on the hardware configuration.

Heading	Option	Description
Security *(continued)*	Embedded Security	Allows you to: • Enable/disable the Embedded Security device. • Reset the device to Factory Settings. This feature is supported on select models only. See the *Desktop Management Guide* on the *Documentation CD* for more information.
	Device Security	Enables/disables serial ports, parallel port, front USB ports, system audio, network controllers (some models), MultiBay devices (some models), SMBus controller (some models), and SCSI controllers (some models).
	Network Service Boot	Enables/disables the computer's ability to boot from an operating system installed on a network server. (Feature available on NIC models only; the network controller must reside on the PCI bus or be embedded on the system board.)
	System IDs	Allows you to set: • Asset tag (18-byte identifier) and ownership Tag (80-byte identifier displayed during POST). See the *Desktop Management Guide* on the *Documentation CD* for more information. • Chassis serial number or Universal Unique Identifier (UUID) number. The UUID can only be updated if the current chassis serial number is invalid. (These ID numbers are normally set in the factory and are used to uniquely identify the system.) • Keyboard locale setting (for example, English or German) for System ID entry.
	DriveLock Security	Allows you to assign or modify a master or user password for MultiBay hard drives. When this feature is enabled, the user is prompted to provide one of the DriveLock passwords during POST. If neither is successfully entered, the hard drive will remain inaccessible until one of the passwords is successfully provided during a subsequent cold-boot sequence. ✎ This selection will only appear when at least one MultiBay drive that supports the DriveLock feature is attached to the system. See the *Desktop Management Guide* on the *Documentation CD* for more information.
	Data Execution Prevention	Enable/Disable. Data Execution Prevention Mode help prevent OS security breaches. ✎ This selection is in effect only if the processor and operating system being used comprehend and utilize the function.

✎ Support for specific Computer Setup options may vary depending on the hardware configuration.

Heading	Option	Description
Power	OS Power Management	• Runtime Power Management - Enable/Disable. Allows certain operating systems to reduce processor voltage and frequency when the current software load does not require the full capabilities of the processor. • Idle Power Savings - Extended/Normal. Allows certain operating systems to decrease the processors power consumption when the processor is idle. • ACPI S3 Support - Enables or disables ACPI S3 support. • ACPI S3 Hard Disk Reset - Enabling this causes the BIOS to ensure hard disks are ready to accept commands after resuming from S3 before returning control to the operating system. • ACPI S3 PS2 Mouse Wakeup - Enables or disables waking from S3 due to PS2 mouse activity.
	Hardware Power Management	SATA power management enables or disables SATA bus and/or device power management.
	Thermal	Fan idle mode - This bar graph controls the minimum permitted fan speed.

✎ Support for specific Computer Setup options may vary depending on the hardware configuration.

Heading	Option	Description
Advanced* *For advanced users only	Power-On Options	Allows you to set: • POST mode (QuickBoot, FullBoot, or FullBoot every 1-30 days). • POST messages (enable/disable). • **F9** prompt (enable/disable). Enabling this feature will display the text **F9=Boot Menu** during POST. Disabling this feature prevents the text from being displayed but pressing **F9** will still access the Shortcut Boot (Order) Menu screen. See **Storage > Boot Order** for more information. • **F10** prompt (enable/disable). Enabling this feature will display the text **F10=Setup** during POST. Disabling this feature prevents the text from being displayed but pressing **F10** will still access the Setup screen. • **F12** prompt (enable/disable). Enabling this feature will display the text **F12=Network Service Boot** during POST. Disabling this feature prevents the text from being displayed but pressing **F12** will still force the system to attempt booting from the network. • Option ROM* prompt (enable/disable). Enabling this feature will cause the system to display a message before loading options ROMs. (This feature is supported on select models only.) • Remote wakeup boot source (remote server/local hard drive). • After Power Loss (off/on/previous state): After power loss, if you connect your computer to an electric power strip and would like to turn on power to the computer using the switch on the power strip, set this option to **ON**. ✎ If you turn off power to your computer using the switch on a power strip, you will not be able to use the suspend/sleep feature or the Remote Management features. • POST Delay (in seconds) (enable/disable). Enabling this feature will add a user-specified delay to the POST process. This delay is sometimes needed for hard disks on some PCI cards that spin up very slowly; so slowly that they are not ready to boot by the time POST is finished. The POST delay also gives you more time to press **F10** to enter Computer (F10) Setup. • I/O APIC Mode (enable/disable). Enabling this feature will allow Microsoft Windows Operating Systems to run optimally. This feature must be disabled for certain non-Microsoft Operating Systems to work properly.

✎ Support for specific Computer Setup options may vary depending on the hardware configuration.

Heading	Option	Description
Advanced* *(continued)* *For advanced users only	Power-On Options *(continued)*	Allows you to set: (continued) • ACPI/USB Buffers @ Top of Memory (enable/disable). Enabling this feature places USB memory buffers at the top of memory. The advantage is that some amount of memory below 1 MB is freed up for use by option ROMs. The disadvantage is that a popular memory manager, HIMEM.SYS, does not work properly when USB buffers are at top of memory AND the system has 64 MB or less of RAM. • Hyper-threading (enable/disable). • Limit CPUID Maximum Value to 3 - Restricts the number of CPUID functions reported by the microprocessor. Enable this feature if booting to WinNT.
	BIOS Power-On	Allows you to set the computer to turn on automatically at a time you specify.
	Onboard Devices	Allows you to set resources for or disable onboard system devices (diskette controller, serial port, or parallel port).
	PCI Devices	• Lists currently installed PCI devices and their IRQ settings. • Allows you to reconfigure IRQ settings for these devices or to disable them entirely. These settings have no effect under an APIC-based operating system.
	Bus Options*	On some models, allows you to enable or disable: • PCI SERR# Generation. • PCI VGA palette snooping, which sets the VGA palette snooping bit in PCI configuration space; only needed when more than one graphics controller is installed.

✎ Support for specific Computer Setup options may vary depending on the hardware configuration.

Heading	Option	Description
Advanced* *(continued)* *For advanced users only	Device options	Allows you to set: • Printer mode (bi-directional, EPP & ECP, output only). • **Num Lock** state at power-on (off/on). • S5 Wake on LAN (enable/disable). • To disable Wake on LAN during the off state (S5), use the arrow (left and right) keys to select the **Advanced** > **Device Options** menu and set the S5 Wake on Lan feature to "Disable." This obtains the lowest power consumption available on the computer during S5. It does not affect the ability of the computer to Wake on LAN from suspend or hibernation, but will prevent it from waking from S5 via the network. It does not affect operation of the network connection while the computer is on. • If a network connection is not required, completely disable the network controller (NIC) by using the arrow (left and right) keys to select the **Security** > **Device Security** menu. Set the Network Controller option to "Device Hidden." This prevents the network controller from being used by the operating system and reduces the power used by the computer in S5. • Processor cache (enable/disable). • Unique Sleep State Blink Patterns. Allows you to choose an LED blink pattern that uniquely identifies each sleep state. • Integrated Video (enable/disable) Allows you to use integrated video and PCI Up Solution video at the same time (available on select models only). ✎ Inserting a PCI or PCI Express video card automatically disables Integrated Video. When PCI Express video is on, Integrated Video must remain disabled. • Monitor Tracking (enable/disable). Allows ROM to save monitor asset information.
		Allows you to set: • NIC PXE Option ROM Download (enable/disable). The BIOS contains an embedded NIC option ROM to allow the unit to boot through the network to a PXE server. This is typically used to download a corporate image to a hard drive. The NIC option ROM takes up memory space below 1MB commonly referred to as DOS Compatibility Hole (DCH) space. This space is limited. This F10 option will allow users to disable the downloading of this embedded NIC option ROM thus giving more DCH space for additional PCI cards which may need option ROM space. The default will be to have the NIC option ROM enabled.
	PCI VGA Configuration	Displayed only if there are multiple PCI video adapters in the system. Allows you to specify which VGA controller will be the "boot" or primary VGA controller.

✎ Support for specific Computer Setup options may vary depending on the hardware configuration.

2.3 **Diagnostics for Windows**

The Diagnostics for Windows (DFW) utility is a component of HP Client Management Solutions that allows you to view information about the hardware and software configuration of the computer while running Microsoft Windows (Microsoft Windows 2000 and Microsoft Windows XP). It also allows you to perform hardware and software tests on the subsystems of the computer.

When you invoke Diagnostics for Windows, the current configuration of the computer is shown on the Overview screen. There is access from this screen to several categories of information about the computer and the **Test** tab. The information in every screen of the utility can be saved to a file or printed.

✎ To test all subsystems, you must log in as the administrator. If you do not log in as the administrator, you will be unable to test some subsystems. The inability to test a subsystem will be indicated by an error message under the subsystem name in the Test window or by shaded check boxes that cannot be selected.

Use Diagnostics for Windows in to determine if all the devices installed on the computer are recognized by the system and functioning properly. Running tests is optional but recommended after installing or connecting a new device.

Third party devices not supported by HP may not be detected by Diagnostics for Windows. Save, print, or display the information generated by the utility.

2.3.1 Detecting Diagnostics for Windows

Some computers ship with the Diagnostics for Windows preloaded, but not preinstalled.

To determine whether Diagnostics for Windows is installed:

1. Access the location of the Diagnostics icons:

   ❏ In Windows 2000 Professional, select **Start > Settings > Control Panel**.

   ❏ In Windows XP Home or Windows XP Professional, select **Start > Control Panel > Performance and Maintenance**.

2. If icons for Configuration Record and Diagnostics for Windows are present, the Diagnostics for Windows utility is installed. If the icons are not present, the utility is either not preloaded or not installed.

2.3.2 Installing Diagnostics for Windows

If Diagnostics for Windows is not preloaded, you can download the Diagnostics for Windows SoftPaq from the following Web site:

http://www.hp.com/support/files

Once the software has been downloaded onto the hard drive it may be installed by performing these steps:

1. Close all Windows applications.

2. Install the Diagnostics for Windows utility:

   ❏ In Windows XP, select **Start > Software Setup** icon. Select **Diagnostics for Windows > Next** button, then follow the instructions on the screen.

   ❏ In Windows 2000, select the **Setup Software** icon on the **Desktop > Diagnostics for Windows > Next** button, then follow the instructions on the screen.

   ❏ In either Windows XP or Windows 2000, if the **Setup Software/Software Setup** icon is not on the Desktop or in the Start menu, run the Setup program from the **C:\CPQAPPS\DIAGS** directory or select **Start > Run** and type the following in the command line: **C:\CPQAPPS\DIAGS\SETUP**.

3. Click **Next** to install Diagnostics for Windows.

4. After the program has finished installing, you may be prompted to restart the computer, or it may automatically restart. If prompted, click **Finish** to restart the computer or **Cancel** to exit the program. You must restart the computer to complete the installation of Diagnostics for Windows.

✎ If you want to upgrade an existing version of Diagnostics for Windows installed on the computer, visit http://www.hp.com/support/files and click on an applicable product. Locate the desired software and download the latest version. Execute the downloaded file and select **Repair** to update the installed version. This will cause the new version to overwrite the old version.

2.3.3 Using Categories in Diagnostics for Windows

To use categories:

1. Click **Start > HP Information Center > Diagnostics for Windows**. You can also select the **Diagnostics for Windows** icon, located in the Control Panel.

   The screen displays the overview of the computer hardware and software.

   ❏ In Windows 2000 Professional, select **Start > Settings > Control Panel**, then select **Diagnostics for Windows**.

   ❏ In Windows XP Home and Windows XP Professional, select **Start > Control Panel > Performance and Maintenance,** then select **Diagnostics for Windows**.

2. For specific hardware and software information, select a category from the **Categories** pull-down menu or the appropriate icon on the toolbar.

✎ As the cursor moves over the toolbar icons, the corresponding category name is displayed.

3. To display more detailed information in a selected category, click **More** in the **Information Level** box in the lower left corner of the window or click **Level** at the top of the screen and select **More**.

4. Review, print, and/or save this information as desired.

   ❏ To print the information, click **File > 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.

   ❏ To save the information, click **File > Save As**. Select one of the following options: **Detailed Report (All Categories)**, **Summary Report (All Categories)**, or **Current Category**. Click **OK** to save the report you selected.

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

Menu Bar—File, Categories, Navigation, Level, Tab, Help

At the top of the Diagnostics for Windows screen is the Menu Bar consisting of six pull-down menus. Selecting an item will provide the following information on the system:

- File—Save As, Print, Printer Setup, Exit
- Categories
  - ❏ System—System board, ROM, date, and time
  - ❏ Asset Control—Asset tag, system serial number, and processor
  - ❏ Input Devices—Keyboard, mouse, and joystick(s)
  - ❏ Communication—Ports
  - ❏ Storage—Storage drives
  - ❏ Graphics—Graphics
  - ❏ Memory—System board and Windows memory
  - ❏ Multimedia—Optical storage (CD, DVD, and so on) and audio
  - ❏ Windows—Windows
  - ❏ Architecture—PCI Device

❏ Resources—IRQ, I/O, and Memory Map

❏ Health—Status of system temperature and hard drives

❏ Miscellaneous—CMOS, DMI, BIOS, System, Product Name, and Serial Number

■ Navigation—Previous Category (**F5**), Next Category (**F6**)

■ Level—Less (**F7**), More (**F8**) <information on the screen>

■ Tab

❏ Overview—Displays general information about the computer. This window is displayed when first starting the utility. The left side of the window shows hardware information, while the right side shows software information.

❏ Test—Allows you to choose various parts of the system to test. You can also choose the type of test and testing mode.

❏ Status—Displays the status of each test in progress. You can cancel testing by clicking the **Cancel Testing** button.

❏ Log—Displays a log of tests for each device.

❏ Error—Displays any errors that occurred during device testing. The window lists the device being tested, the type and number of errors, and the error code.

■ Help—Contents, How to use Help, About

2.3.4 Running Diagnostic Tests in Diagnostics for Windows

To run diagnostic tests:

1. Click **Start > HP Information Center > Diagnostics for Windows**.

   Alternately, you can access Diagnostics for Windows via the control panel.

   The screen displays the overview of the computer hardware and software. Five tabs are displayed below the row of icons: **Overview**, **Test**, **Status**, **Log**, and **Error**.

2. Click the **Test** tab, or click **Tab** at the top of the screen and select **Test**.

3. Select one of the following options:

   ❏ Quick Test—Runs a quick, general test on each device. Requires no user intervention if Unattended Mode is selected.

   ❏ Complete Test—Runs maximum testing of each device. The user can select Interactive Mode or Unattended Mode.

   ❏ Custom Test—Runs only the tests you select. To select specific devices or tests, find the device in the list, then select the check box beside each test. When selected, a red check mark is displayed in the box. Some tests selected may require user intervention.

✎ To test all subsystems, you must log in as the administrator. If you do not log in as the administrator, you will be unable to test some subsystems. The inability to test a subsystem will be indicated by an error message under the subsystem name in the Test window or by shaded boxes that cannot be checked.

4. Select **Interactive Mode** or **Unattended Mode**. In Interactive Mode, the diagnostic software will prompt you for input during tests that require it. Some tests require interaction and will display errors or halt testing if selected in conjunction with Unattended Mode.

   ❏ Interactive Mode provides maximum control over the testing process. You determine whether the test passed or failed and may be prompted to insert or remove devices.

   ❏ Unattended Mode does not display prompts. If errors are found, they are displayed when testing is complete.

5. Click the **Begin Testing** button at the bottom of the window. Test Status is displayed, showing the progress and result of each test. For more details on the tests run, click the **Log** tab or click **Tab** at the top of the screen and select **Log**.

6. To view a test report, select one of three tabs:

   ❏ **Status**—Summarizes the tests run, passed, and failed during the current testing session.

   ❏ **Log**—Lists tests run on the system, the numbers of times each test has run, the number of errors found on each test, and the total run time of each test.

   ❏ **Error**—Lists all errors found on the computer with their error codes.

7. To save a test report:

   ❏ Select the **Log** tab **Save** button to save a Log tab report.

   ❏ Select the **Error** tab **Save** button to save an Error tab report.

8. To print a test report:

   ❏ If the report is on the Log tab, select **File > Save As**, then print the file from the selected folder.

   ❏ If the report is on the Error tab, select the **Error** tab **Print** button.

9. If errors are found, click the **Error** tab to display more detailed information and recommended actions.

10. Click **Print** or save the error information for future reference.

11. To exit Diagnostics for Windows, click **File > Exit**.

2.4 Configuration Record

The Configuration Record utility is a windows-based information-gathering tool that gathers critical hardware and software information from various computer subsystems. The information includes such things as the ROM, asset tag, processor, physical drives, PCI devices, memory, graphics, operating system version number, operating system parameters, and the operating system startup files to give a complete view of the computer. Configuration Record provides a means for automatically identifying and comparing configuration changes, and has the ability to maintain a configuration history. The information can be saved as a history of multiple sessions.

This utility allows the resolution of problems without taking the computer offline and assists in maximizing the computer availability. The information obtained by the utility is useful in troubleshooting system problems, and streamlines the service process by enabling quick and easy identification of system configurations.

The utility displays it findings in a *Now.log* file. If the original *Base.log* file is present in the *cpqdiags* directory, the *Base.log* file is displayed next to the *Now.log* file in a split window with the differences between the two highlighted in the color red.

2.4.1 Installing Configuration Record

The Configuration Record is part of Diagnostics for Windows and is automatically installed at the same time as Diagnostics for Windows.

2.4.2 Running Configuration Record

To run this program:

1. Click **Start > HP Information Center > Configuration Record**.

   Alternately, you can access Diagnostics for Windows via the control panel.

✎ The Configuration Record utility has two view options: **Show Changed Items Only** and **Show All**. The default view is **Show Changed Items Only**, therefore all the text is displayed in the color red since it shows only the differences. Switching to **Show All** displays the complete, comprehensive view of the system.

2. The default view is **Show Changed Items Only**. To view all the information gathered by Configuration Record, click **View** at the top of the window and select **Show All**, or click the **Show All Items** icon.

3. To save the information in the left or right window, select **File > Save Window File** and then select **Left Window File** or **Right Window File**.

✎ Saving the configuration of the computer periodically allows the user to keep a history of the configuration. This history may be useful to you in the future if the system ever encounters a problem that needs debugging.

4. To exit Configuration Record, click **File**, then click **Exit**.

3

Desktop Management

HP Client Management Solutions provides standards-based solutions for managing and controlling desktops, workstations, and notebook PCs in a networked environment.

The key capabilities and features of desktop management are:

■ Initial configuration and deployment

■ Remote system installation

■ Software updating and management

■ ROM flash

■ Asset tracking and security

■ Fault notification and recovery

✎ Support for specific features described in this guide may vary by model or software version.

3.1   Initial Configuration and Deployment

HP computers come with a preinstalled system software image. After a brief software "unbundling" process, the computer is ready to be used.

A customized software image may be deployed by:

■ Installing additional software applications after unbundling the preinstalled software image.

■ Using software deployment tools, such as Altiris Deployment Solution, to replace the preinstalled software with a customized software image.

■ Using a disk cloning process to copy the contents from one hard drive to another.

The best deployment method depends on your information technology environment and processes. The PC Deployment section of the Solutions and Services Web site (http://whp-sp-orig.extweb.hp.com/country/us/en/solutions.html provides information to help you select the best deployment method.

The *Restore Plus!* CD, ROM-based setup, and ACPI hardware provide further assistance with recovery of system software, configuration management and troubleshooting, and power management.

3.2 Remote System Installation

Remote System Installation allows you to start and set up your system using the software and configuration information located on a network server by initiating the Preboot Execution Environment (PXE). The Remote System Installation feature is usually used as a system setup and configuration tool, and can be used for the following tasks:

■ Formatting a hard drive.

■ Deploying a software image on one or more new PCs.

■ Remotely updating the system BIOS in flash ROM. See Section 3.3.7, "Remote ROM Flash."

■ Configuring the system BIOS settings.

To initiate Remote System Installation, press **F12** when the F12 = Network Service Boot message appears in the lower-right corner of the HP logo screen. Follow the instructions on the screen to continue the process. The default boot order is a BIOS configuration setting that can be changed to always attempt to PXE boot.

HP and Altiris have partnered to provide tools designed to make the task of corporate PC deployment and management easier and less time-consuming, ultimately lowering the total cost of ownership and making HP PCs the most manageable client PCs in the enterprise environment.

3.3 Software Updating and Management

HP provides several tools for managing and updating software on desktops and workstations—HP Client Manager Software, Altiris Client Management Solutions, System Software Manager; Proactive Change Notification; and Subscriber's Choice.

3.3.1 HP Client Manager Software

HP Client Manager Software (HP CMS) assists HP customers in managing the hardware aspects of their client computers with features that include:

■ Detailed views of hardware inventory for asset management

■ PC health check monitoring and diagnostics

■ Proactive notification of changes in the hardware environment

■ Web-accessible reporting of business critical details such as machines with thermal warnings, memory alerts, and more

■ Remote updating of system software such as device drivers and ROM BIOS

■ Remote changing of boot order

For more information on the HP Client Manager, visit http://h18000.www1.hp.com/im/client_mgr.html.

3.3.2 Altiris Client Management Solutions

HP and Altiris have partnered to provide comprehensive, tightly integrated systems management solutions to reduce the cost of owning HP client PCs. HP Client Manager Software is the foundation for additional Altiris Client Management Solutions that address:

- Inventory and Asset Management
  - ❏ SW license compliance
  - ❏ PC tracking and reporting
  - ❏ Lease contract, fixing asset tracking
- Deployment and Migration
  - ❏ Windows XP Professional migration
  - ❏ System deployment
  - ❏ Personality migrations
- Help Desk and Problem Resolution
  - ❏ Managing help desk tickets
  - ❏ Remote troubleshooting
  - ❏ Remote problem resolution
  - ❏ Client disaster recovery
- Software and Operations Management
  - ❏ Ongoing desktop management
  - ❏ HP system SW deployment
  - ❏ Application self-healing

For more information and details on how to download a fully-functional 30-day evaluation version of the Altiris solutions, visit http://h18000.www1.hp.com/im/prodinfo.html#deploy.

On selected desktop and notebook models, an Altiris management agent is included as part of the factory loaded image. This agent enables communication with the Altiris development Solution which can be used to complete new hardware deployment or personality migration to a new OS using easy-to-follow wizards. Altiris solutions provide easy-to-use software distribution capabilities. When used in conjunction with System Software Manager (Section 3.3.3), or HP Client Manager Software, administrators can also update ROM BIOS and device driver software from a central console.

For more information, visit http://h18000.www1.hp.com/im/index.html.

3.3.3 System Software Manager

System Software Manager (SSM) is a utility that lets you update system-level software on multiple systems simultaneously. When executed on a PC client system, SSM detects both hardware and software versions, then updates the appropriate software from a central repository, also known as a file store. Driver versions that are supported by SSM are denoted with a special icon on the driver download Web site and on the Support Software CD. To download the utility or to obtain more information on SSM, visit http://www.hp.com/go/ssm.

3.3.4 Proactive Change Notification (PCN)

The Proactive Change Notification program uses the Subscriber's Choice Web site in order to proactively and automatically:

■ Send you Proactive Change Notification (PCN) e-mails informing you of hardware and software changes to most commercial computers and servers, up to 60 days in advance.

■ Send you e-mail containing Customer Bulletins, Customer Advisories, Customer Notes, Security Bulletins, and Driver alerts for most commercial computers and servers.

You create your own profile to ensure that you only receive the information relevant to a specific IT environment. To learn more about the Proactive Change Notification program and create a custom profile, visit http://h30046.www3.hp.com/subhub.php?jumpid=go/pcn.

3.3.5 Subscriber's Choice

Subscriber's Choice is a client-based service from HP. Based on your profile, HP will supply you with personalized product tips, feature articles, and/or driver and support alerts/notifications. Subscriber's Choice Driver and Support Alerts/Notifications will deliver e-mails notifying you that the information you subscribed to in your profile is available for review and retrieval. To learn more about Subscriber's Choice and create a custom profile, visit http://h30046.www3.hp.com/subhub.php.

3.3.6 ROM Flash

The computer comes with a reprogrammable flash ROM (read only memory). By establishing a setup password in Computer Setup (F10) Utility, you can protect the ROM from being unintentionally updated or overwritten. This is important to ensure the operating integrity of the computer. Should you need or want to upgrade your ROM, you may:

■ Order an upgraded *ROMPaq™* diskette from HP.

■ Download the latest ROMPaq images the HP driver and support page, http://www.hp.com/support/files.

CAUTION: For maximum ROM protection, be sure to establish a setup password. The setup password prevents unauthorized ROM upgrades. System Software Manager allows the system administrator to set the setup password on one or more PCs simultaneously. For more information, visit http://www.hp.com/go/ssm.

3.3.7 Remote ROM Flash

Remote ROM Flash allows the system administrator to safely upgrade the ROM on remote HP computers directly from the centralized network management console. Enabling the system administrator to perform this task remotely, on multiple computers and personal computers, results in a consistent deployment of and greater control over HP PC ROM images over the network. It also results in greater productivity and lower total cost of ownership.

✎ The computer must be powered on, or turned on through Remote Wakeup, to take advantage of Remote ROM Flash.

For more information on Remote ROM Flash, refer to the HP Client Manager Software or System Software Manager at http://h18000.www1.hp.com/im/prodinfo.html.

3.3.8 HPQFlash

The HPQFlash utility is used to locally update or restore the system ROM on individual PCs through a Windows operating system.

For more information on HPQFlash, visit http://www.hp.com/support/files and enter the name of the computer when prompted.

3.3.9 FailSafe Boot Block ROM

The FailSafe Boot Block ROM allows for system recovery in the unlikely event of a ROM flash failure, for example, if a power failure were to occur during a ROM upgrade. The Boot Block is a flash-protected section of the ROM that checks for a valid system ROM flash when power to the system is turned on.

- If the system ROM is valid, the system starts normally.

- If the system ROM fails the validation check, the FailSafe Boot Block ROM provides enough support to start the system from a ROMPaq diskette, which will program the system ROM with a valid image.

✎ Some models also support recovery from a ROMPaq CD. ISO ROMPaq images are included with selected models in the downloadable ROM softpaqs.

When the boot block detects an invalid system ROM, the System Power LED blinks RED 8 times, one every second, followed by a 2-second pause. Also 8 simultaneous beeps will be heard. A Boot Block recovery mode message is displayed on the screen (some models).

To recover the system after it enters Boot Block recovery mode, complete the following steps:

1. If there is a diskette in the diskette drive or a CD in the CD drive, remove the diskette and CD and turn off the power.

2. Insert a ROMPaq diskette into the diskette drive or, if permitted on this computer, a ROMPaq CD into the CD drive.

3. Turn on the computer.

   If no ROMPaq diskette or ROMPaq CD is found, you will be prompted to insert one and restart the computer.

   If a setup password has been established, the Caps Lock light will turn on and you will be prompted to enter the password.

4. Enter the setup password.

   If the system successfully starts from the diskette and successfully reprograms the ROM, then the three keyboard lights will turn on. A rising tone series of beeps also signals successful completion.

5. Remove the diskette or CD and turn the power off.

6. Turn the power on again to restart the computer.

The following table lists the various keyboard light combinations used by the Boot Block ROM (when a PS/2 keyboard is attached to the computer), and explains the meaning and action associated with each combination.

Keyboard Light Combinations Used by Boot Block ROM

Failsafe Boot Block Mode	Keyboard LED Color	Keyboard LED Activity	State/Message
Num Lock	Green	On	ROMPaq diskette or ROMPaq CD not present, is bad, or drive not ready.
Caps Lock	Green	On	Enter password.
Num, Caps, Scroll Lock	Green	Blink on in sequence, one-at-a-time—N, C, SL	Keyboard locked in network mode.
Num, Caps, Scroll Lock	Green	On	Boot Block ROM Flash successful. Turn power off, then on to reboot.
✎ Diagnostic lights do not flash on USB keyboards.			

3.3.10 Replicating the Setup

The following procedures give an administrator the ability to easily copy one setup configuration to other computers of the same model. This allows for faster, more consistent configuration of multiple computers.

✎ Both procedures require a diskette drive or a supported USB flash media device, such as an HP Drive Key.

Copying to Single Computer

⚠ **CAUTION:** A setup configuration is model-specific. File system corruption may result if source and target computers are not the same model. For example, do not copy the setup configuration from a dc7100 Ultra-Slim Desktop to a dx6100 Slim Tower.

1. Select a setup configuration to copy. Turn off the computer. If you are in Windows, click **Start > Shut Down > Shut Down.**

2. If you are using a USB flash media device, insert it now.

3. Turn on the computer.

4. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

5. If you are using a a diskette, insert it now.

6. Click **File > Replicated Setup > Save to Removable Media**. Follow the instructions on the screen to create the configuration diskette or USB flash media device.

7. Turn off the computer to be configured and insert the configuration diskette or USB flash media device.

8. Turn on the computer to be configured.

9. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

10. Click **File > Replicated Setup > Restore from Removable Media**, and follow the instructions on the screen.

11. Restart the computer when the configuration is complete.

Copying to Multiple Computers

△ **CAUTION:** A setup configuration is model-specific. File system corruption may result if source and target computers are not the same model. For example, do not copy the setup configuration from a dc7100 Ultra-Slim Desktop to a dx6100 Slim Tower.

This method takes a little longer to prepare the configuration diskette or USB flash media device, but copying the configuration to target computers is significantly faster.

✎ A bootable diskette is required for this procedure or to create a bootable USB flash media device. If Windows XP is not available to use to create a bootable diskette, use the method for copying to a single computer instead (see).

1. Create a bootable diskette or USB flash media device. See or

△ **CAUTION:** Not all computers can be booted from a USB flash media device. If the default boot order in the Computer Setup (F10) Utility lists the USB device before the hard drive, the computer can be booted from a USB flash media device. Otherwise, a bootable diskette must be used.

2. Select a setup configuration to copy. Turn off the computer. If you are in Windows, click **Start > Shut Down > Shut Down.**

3. If you are using a USB flash media device, insert it now.

4. Turn on the computer.

5. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

6. If you are using a a diskette, insert it now.

7. Click **File > Replicated Setup > Save to Removable Media.** Follow the instructions on the screen to create the configuration diskette or USB flash media device.

8. Download a BIOS utility for replicating setup (repset.exe) and copy it onto the configuration diskette or USB flash media device. To obtain this utility, go to http://welcome.hp.com/support/files and enter the model number of the computer.

9. On the configuration diskette or USB flash media device, create an autoexec.bat file containing the following command:

   repset.exe

10. Turn off the computer to be configured. Insert the configuration diskette or USB flash media device and turn the computer on. The configuration utility will run automatically.

11. Restart the computer when the configuration is complete.

Creating a Bootable Device

Supported USB Flash Media Device

Supported devices, such as an HP Drive Key or a DiskOnKey, have a preinstalled image to simplify the process of making them bootable. If the USB flash media device being used does not have this image, use the procedure later in this section (see "Unsupported USB Flash Media Device" on page 10).

⚠ **CAUTION:** Not all computers can be booted from a USB flash media device. If the default boot order in the Computer Setup (F10) Utility lists the USB device before the hard drive, the computer can be booted from a USB flash media device. Otherwise, a bootable diskette must be used.

To create a bootable USB flash media device, you must have:

■ One of the following systems:
   ❏ HP Compaq Business Desktop dc7100 series
   ❏ HP Compaq Business Desktop dx6100 series
   ❏ HP Compaq Business Desktop d530 Series - Ultra-Slim Desktop, Small Form Factor, or Convertible Minitower
   ❏ Compaq Evo D510 Ultra-slim Desktop
   ❏ Compaq Evo D510 Convertible Minitower/Small Form Factor

   Depending on the individual BIOS, future systems may also support booting to a USB flash media device.

⚠ **CAUTION:** If you are using a computer other than one named above, make sure the default boot order in the Computer Setup (F10) Utility lists the USB device before the hard drive.

■ One of the following storage modules:
   ❏ 16MB HP Drive Key
   ❏ 32MB HP Drive Key
   ❏ 32MB DiskOnKey
   ❏ 64MB HP Drive Key
   ❏ 64MB DiskOnKey
   ❏ 128MB HP Drive Key
   ❏ 128MB DiskOnKey

❏ 256MB HP Drive Key

❏ 256MB DiskOnKey

■ A bootable DOS diskette with the FDISK and SYS programs. If SYS is not available, FORMAT may be used, but all existing files on the USB flash media device will be lost.

1. Turn off the computer.

2. Insert the USB flash media device into one of the computer's USB ports and remove all other USB storage devices except USB diskette drives.

3. Insert a bootable DOS diskette with FDISK.COM and either SYS.COM or FORMAT.COM into a diskette drive and turn on the computer to boot to the DOS diskette.

4. Run FDISK from the A:\ prompt by typing **FDISK** and pressing Enter. If prompted, click **Yes** (**Y**) to enable large disk support.

5. Enter Choice [**5**] to display the drives in the system. The USB flash media device will be the drive that closely matches the size of one of the drives listed. It will usually be the last drive in the list. Note the letter of the drive.

   USB flash media device drive: _____

△ **CAUTION:** If a drive does not match the USB flash media device, do not proceed. Data loss can occur. Check all USB ports for additional storage devices. If any are found, remove them, reboot the computer, and proceed from step 4. If none are found, either the system does not support the USB flash media device or the USB flash media device is defective. DO NOT proceed in attempting to make the USB flash media device bootable.

6. Exit FDISK by pressing the **Esc** key to return to the A:\ prompt.

7. If your bootable DOS diskette contains SYS.COM, go to step 8. Otherwise, go to step 9.

8. At the A:\ prompt, enter **SYS x:** where x represents the drive letter noted above.

△ **CAUTION:** Be sure that you have entered the correct drive letter for the USB flash media device.

   After the system files have been transferred, SYS will return to the A:\ prompt. Go to step 13.

9. Copy any files you want to keep from your USB flash media device to a temporary directory on another drive (for example, the system's internal hard drive).

10. At the A:\ prompt, enter **FORMAT /S X:** where X represents the drive letter noted before.

△ **CAUTION:** Be sure that you have entered the correct drive letter for the USB flash media device.

   FORMAT will display one or more warnings and ask you each time whether you want to proceed. Enter **Y** each time. FORMAT will format the USB flash media device, add the system files, and ask for a Volume Label.

11. Press **Enter** for no label or enter one if desired.

12. Copy any files you saved in step 9 back to your USB flash media device.

13. Remove the diskette and reboot the computer. The computer will boot to the USB flash media device as drive C.

✎ The default boot order varies from computer to computer, and it can be changed in the Computer Setup (F10) Utility.

If you have used a DOS version from Windows 9x, you may see a brief Windows logo screen. If you do not want this screen, add a zero-length file named LOGO.SYS to the root directory of the USB flash media device.

Return to

Unsupported USB Flash Media Device

⚠ **CAUTION:** Not all computers can be booted from a USB flash media device. If the default boot order in the Computer Setup (F10) Utility lists the USB device before the hard drive, the computer can be booted from a USB flash media device. Otherwise, a bootable diskette must be used.

To create a bootable USB flash media device, you must have:

■ One of the following systems:

   ❏ HP Compaq Business Desktop dc7100 series

   ❏ HP Compaq Business Desktop dx6100 series

   ❏ HP Compaq Business Desktop d530 Series—Ultra-Slim Desktop, Small Form Factor, or Convertible Minitower

   ❏ Compaq Evo D510 Ultra-Slim Desktop

   ❏ Compaq Evo D510 Convertible Minitower/Small Form Factor

   Depending on the individual BIOS, future systems may also support booting to a USB flash media device.

⚠ **CAUTION:** If you are using a computer other than one named above, make sure the default boot order in the Computer Setup (F10) Utility lists the USB device before the hard drive.

■ A bootable DOS diskette with the FDISK and SYS programs. If SYS is not available, FORMAT may be used, but all existing files on the USB flash media device will be lost.

1. If there are any PCI cards in the system that have SCSI, ATA RAID or SATA drives attached, turn off the computer and unplug the power cord.

⚠ **CAUTION:** The power cord MUST be unplugged.

2. Open the computer and remove the PCI cards.

3. Insert the USB flash media device into one of the computer's USB ports and remove all other USB storage devices except USB diskette drives. Close the computer cover.

4. Plug in the power cord and turn on the computer.

5. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

6. Go to **Advanced > PCI Devices** to disable both the PATA and SATA controllers. When disabling the SATA controller, note the IRQ to which the controller is assigned. You will need to reassign the IRQ later. Exit setup, confirming the changes.

   SATA IRQ: _____

7. Insert a bootable DOS diskette with FDISK.COM and either SYS.COM or FORMAT.COM into a diskette drive and turn on the computer to boot to the DOS diskette.

8. Run FDISK and delete any existing partitions on the USB flash media device. Create a new partition and mark it active. Exit FDISK by pressing the **Esc** key.

9. If the system did not automatically restart when exiting FDISK, press **Ctrl**+**Alt**+**Del** to reboot to the DOS diskette.

10. At the A:\ prompt, type **FORMAT C: /S** and press **Enter**. Format will format the USB flash media device, add the system files, and ask for a Volume Label.

11. Press **Enter** for no label or enter one if desired.

12. Turn off the computer and unplug the power cord. Open the computer and re-install any PCI cards that were previously removed. Close the computer cover.

13. Plug in the power cord, remove the diskette, and turn on the computer.

14. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

15. Go to **Advanced > PCI Devices** and re-enable the PATA and SATA controllers that were disabled in step 6. Put the SATA controller on its original IRQ.

16. Save the changes and exit. The computer will boot to the USB flash media device as drive C.

✎ The default boot order varies from computer to computer, and it can be changed in the Computer Setup (F10) Utility. Refer to the *Computer Setup Guide* on the *Documentation CD* for instructions.

If you have used a DOS version from Windows 9x, you may see a brief Windows logo screen. If you do not want this screen, add a zero-length file named LOGO.SYS to the root directory of the USB flash media device.

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3.3.11 Dual-State Power Button

With Advanced Configuration and Power Interface (ACPI) enabled, the power button can function either as an on/off switch or as a suspend button. The suspend feature does not completely turn off power, but instead causes the computer to enter a low-power standby. This allows you to power down quickly without closing applications and to return quickly to the same operational state without any data loss.

To change the power button's configuration, complete the following steps:

1. Left click on the **Start Button,** then select **Control Panel > Power Options.**

2. In the **Power Options Properties,** select the **Advanced** tab.

3. In the **Power Button** section, select **Stand by**.

After configuring the power button to function as a suspend button, press the power button to put the system in a very low power state (standby). Press the button again to bring the system out of suspend to full power status quickly. To completely turn off all power to the system, press and hold the power button for four seconds.

⚠ **CAUTION:** Do not use the power button to turn off the computer unless the system is not responding; turning off the power without operating system interaction could cause damage to or loss of data on the hard drive.

3.3.12 World Wide Web Site

When making the transition to new or revised operating systems, it is important to implement the support software designed for that operating system. If you plan to run a version of Microsoft Windows that is different from the version included with the computer, you must install corresponding device drivers and utilities to ensure that all features are supported and functioning properly.

HP has made the task of locating, accessing, evaluating, and installing the latest support software easier. You can download the software from http://www.hp.com/support. The Web site contains the latest device drivers, utilities, and flashable ROM images needed to run the latest Microsoft Windows operating system on the HP computer.

3.3.13 Building Blocks and Partners

HP management solutions integrate with other systems management applications, and are based on industry standards, such as:

- Web-Based Enterprise Management (WBEM)
- Windows Management Interface (WMI)
- Wake on LAN Technology
- ACPI
- SMBIOS
- Pre-boot Execution (PXE) support

3.4 Asset Tracking and Security

Asset tracking features incorporated into the computer provide key asset tracking data that can be managed using HP Insight Manager, HP Client Manager or other system management applications. Seamless, automatic integration between asset tracking features and these products enables you to choose the management tool that is best suited to your environment and to leverage your investment in existing tools.

HP also offers several solutions for controlling access to valuable components and information. ProtectTools Embedded Security, if installed, prevents unauthorized access to data and checks system integrity and authenticates third-party users attempting system access. (Refer to *HP ProtectTools Embedded Security Guide,* on the *Documentation CD* for more information.) Security features such as ProtectTools, the Smart Cover Sensor and the Smart Cover Lock, available on select models, help to prevent unauthorized access to the internal components of the personal computer. By disabling parallel, serial, or USB ports, or by disabling removable media boot capability, you can protect valuable data assets. Memory Change and Smart Cover Sensor alerts can be automatically forwarded to system management applications to deliver proactive notification of tampering with a computer's internal components.

✎ ProtectTools, the Smart Cover Sensor, and the Smart Cover Lock are available as options on select systems.

Use the following utilities to manage security settings on your HP computer:

■ Locally, using the Computer Setup Utilities. See the *Computer Setup (F10) Utility Guide* included with the computer for additional information and instructions on using the Computer Setup Utilities.

■ Remotely, using HP Client Manager Software or System Software Manager. This software enables the secure, consistent deployment and control of security settings from a simple command-line utility.

Computer Setup Utilities (F10) Security Features

Feature	Description
Setup Password	Allows you to set and enable setup (administrator) password.
	✎ If the setup password is set, it is required to change Computer Setup options, flash the ROM, and make changes to certain plug and play settings under Windows.
	See the *Troubleshooting Guide* on the *Documentation CD* for more information.
Power-On Password	Allows you to set and enable power-on password.
	See the *Troubleshooting Guide* on the *Documentation CD* for more information.
Password Options (This selection will appear only if a power-on password is set.)	Allows you to specify whether the password is required for warm boot (**CTRL**+**ALT**+**DEL**).
	See the *Desktop Management Guide* on the *Documentation CD* for more information.
✎ For more information about Computer Setup, see the *Computer Setup (F10) Utility Guide*. Support for security features may vary depending on your specific computer configuration.	

Computer Setup Utilities (F10) Security Features *(Continued)*

Feature	Description
Pre-Boot Authorization	Allows you to enable/disable the Smart Card to be used in place of the Power-On Password.
Smart Cover	Allows you to: • Enable/disable the Cover Lock. • Enable/disable the Cover Removal Sensor. ✎ *Notify User* alerts the user that the sensor has detected that the cover has been removed. *Setup Password* requires that the setup password be entered to boot the computer if the sensor detects that the cover has been removed. This feature is supported on select models only. See the *Desktop Management Guide* on the *Documentation CD* for more information.
Embedded Security	Allows you to: • Enable/disable the Embedded Security device. • Reset the device to Factory Settings. This feature is supported on select models only. See *HP ProtectTools Embedded Security Guide*, on the *Documentation CD* for more information.
Device Security	Enables/disables serial ports, parallel port, front USB ports, system audio, network controllers (some models), MultiBay devices (some models), and SCSI controllers (some models).
Network Service Boot	Enables/disables the computer's ability to boot from an operating system installed on a network server. (Feature available on NIC models only; the network controller must reside on the PCI bus or be embedded on the system board.)
System IDs	Allows you to set: • Asset tag (18-byte identifier) and ownership Tag (80-byte identifier displayed during POST). See the *Desktop Management Guide* on the *Documentation CD* for more information. • Chassis serial number or Universal Unique Identifier (UUID) number. The UUID can only be updated if the current chassis serial number is invalid. (These ID numbers are normally set in the factory and are used to uniquely identify the system.) Keyboard locale setting (for example, English or German) for System ID entry.

✎ For more information about Computer Setup, see the *Computer Setup (F10) Utility Guide*.

Support for security features may vary depending on your specific computer configuration.

Computer Setup Utilities (F10) Security Features *(Continued)*

Feature	Description
DriveLock	Allows you to assign or modify a master or user password for MultiBay hard drives (not supported on SCSI hard drives). When this feature is enabled, the user is prompted to provide one of the DriveLock passwords during POST. If neither is successfully entered, the hard drive will remain inaccessible until one of the passwords is successfully provided during a subsequent cold-boot sequence.
	✎ This selection will only appear when at least one MultiBay drive that supports the DriveLock feature is attached to the system.
	See the *Desktop Management Guide* on the *Documentation CD* for more information.
Master Boot Record Security	Allows you to enable or disable Master Boot Record (MBR) Security.
	When enabled, the BIOS rejects all requests to write to the MBR on the current bootable disk. Each time the computer is powered on or rebooted, the BIOS compares the MBR of the current bootable disk to the previously-saved MBR. If changes are detected, you are given the option of saving the MBR on the current bootable disk, restoring the previously-saved MBR, or disabling MBR Security. You must know the setup password, if one is set.
	✎ Disable MBR Security before intentionally changing the formatting or partitioning of the current bootable disk. Several disk utilities (such as FDISK and FORMAT) attempt to update the MBR.
	If MBR Security is enabled and disk accesses are being serviced by the BIOS, write requests to the MBR are rejected, causing the utilities to report errors.
	If MBR Security is enabled and disk accesses are being serviced by the operating system, any MBR change will be detected by the BIOS during the next reboot, and an MBR Security warning message will be displayed.

✎ For more information about Computer Setup, see the *Computer Setup (F10) Utility Guide*.

Support for security features may vary depending on your specific computer configuration.

Computer Setup Utilities (F10) Security Features *(Continued)*

Feature	Description
Save Master Boot Record	Saves a backup copy of the Master Boot Record of the current bootable disk. Only appears if MBR Security is enabled.
Restore Master Boot Record	Restores the backup Master Boot Record to the current bootable disk. ✎ Only appears if all of the following conditions are true: • MBR Security is enabled. • A backup copy of the MBR has been previously saved. • The current bootable disk is the same disk from which the backup copy of the MBR was saved. ⚠ **CAUTION:** Restoring a previously saved MBR after a disk utility or the operating system has modified the MBR may cause the data on the disk to become inaccessible. Only restore a previously saved MBR if you are confident that the current bootable disk's MBR has been corrupted or infected with a virus.

✎ For more information about Computer Setup, see the *Computer Setup (F10) Utility Guide*.

Support for security features may vary depending on your specific computer configuration.

Mechanical Security Features

Feature	Purpose	How It Is Established
Memory Change Alerts	Detects when memory modules have been added, moved, or removed; notifies user and system administrator.	For information on enabling Memory Change Alerts, refer to the online *Desktop Management Guide* on the Documentation CD.
Cable Lock Provision	Inhibits access to the interior of the computer to prevent unwanted configuration changes or component removal. Can also be used to secure the computer to a fixed object to prevent theft.	Install a cable lock to secure the computer to a fixed object.
Security Loop Provision	Inhibits access to the interior of the computer to prevent unwanted configuration changes or component removal.	Install a lock in the security loop to prevent unwanted configuration changes or component removal.

3.4.1 Password Security

The power-on password prevents unauthorized use of the computer by requiring entry of a password to access applications or data each time the computer is turned on or restarted. The setup password specifically prevents unauthorized access to Computer Setup, and can also be used as an override to the power-on password. That is, when prompted for the power-on password, entering the setup password instead will allow access to the computer.

A network-wide setup password can be established to enable the system administrator to log in to all network systems to perform maintenance without having to know the power-on password, even if one has been established.

3.4.2 Establishing a Setup Password Using Computer Setup

If the system is equipped with an embedded security device, refer to *HP ProtectTools Embedded Security Guide,* on the *Documentation CD*. Establishing a setup password through Computer Setup prevents reconfiguration of the computer (use of the Computer Setup (F10) utility) until the password is entered.

1. Turn on or restart the computer. If you are in Windows, click **Start > Shut Down > Restart.**

2. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

3. Select **Security,** then select **Setup Password** and follow the instructions on the screen.

4. Before exiting, click **File > Save Changes and Exit.**

3.4.3 Establishing a Power-On Password Using Computer Setup

Establishing a power-on password through Computer Setup prevents access to the computer when power is turned on, unless the password is entered. When a power-on password is set, Computer Setup presents Password Options under the Security menu. Password options include Password Prompt on Warm Boot. When Password Prompt on Warm Boot is enabled, the password must also be entered each time the computer is rebooted.

1. Turn on or restart the computer. If you are in Windows, click **Start > Shut Down > Restart.**

2. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

3. Select **Security,** then **Power-On Password** and follow the instructions on the screen.

4. Before exiting, click **File > Save Changes and Exit.**

Entering a Power-On Password

To enter a power-on password, complete the following steps:

1. Turn on or restart the computer. If you are in Windows, click **Start > Shut Down > Restart.**

2. When the key icon appears on the monitor, type your current password, then press **Enter.**

✎ 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 computer, then turn it on again before you can continue.

Entering a Setup Password

If the system is equipped with an embedded security device, refer to *HP ProtectTools Embedded Security Guide,* on the *Documentation CD*.

If a setup password has been established on the computer, you will be prompted to enter it each time you run Computer Setup.

1. Turn on or restart the computer. If you are in Windows, click **Start > Shut Down > Restart.**

2. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

3. When the key icon appears on the monitor, type the setup password, then press **Enter**.

✎ 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 computer, then turn it on again before you can continue.

Changing a Power-On or Setup Password

If the system is equipped with an embedded security device, refer to *HP ProtectTools Embedded Security Guide,* on the *Documentation CD*.

1. Turn on or restart the computer. If you are in Windows, click **Start > Shut Down > Restart the Computer.**

2. To change the Power-On password, go to step 3.

   To change the Setup password, as soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

3. When the key icon appears, type the current password, a slash (/) or alternate delimiter character, the new password, another slash (/) or alternate delimiter character, and the new password again as shown:
current password/new password/new password

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

4. Press **Enter**.

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

✎ Refer to "National Keyboard Delimiter Characters" for information about the alternate delimiter characters. The power-on password and setup password may also be changed using the Security options in Computer Setup.

Deleting a Power-On or Setup Password

If the system is equipped with an embedded security device, refer to *HP ProtectTools Embedded Security Guide,* on the *Documentation CD*.

1. Turn on or restart the computer. If you are in Windows, click **Start > Shut Down > Restart the Computer.**

2. To delete the Power-On password, go to step 3.

   To delete the Setup password, as soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

3. When the key icon appears, type the current password followed by a slash (/) or alternate delimiter character as shown:
current password/

4. Press **Enter**.

✎ Refer to for information about the alternate delimiter characters. The power-on password and setup password may also be changed using the Security options in Computer Setup.

National Keyboard Delimiter Characters

Each keyboard is designed to meet country-specific requirements. The syntax and keys that you use for changing or deleting your password depend on the keyboard that came with your computer.

National Keyboard Delimiter Characters					
Arabic	/	Greek	-	Russian	/
Belgian	=	Hebrew	.	Slovakian	-
BHCSY*	-	Hungarian	-	Spanish	-
Brazilian	/	Italian	-	Swedish/Finnish	/
Chinese	/	Japanese	/	Swiss	-
Czech	-	Korean	/	Taiwanese	/
Danish	-	Latin American	-	Thai	/
French	!	Norwegian	-	Turkish	.
French Canadian	é	Polish	-	U.K. English	/
German	-	Portuguese	-	U.S. English	/

* For Bosnia-Herzegovina, Croatia, Slovenia, and Yugoslavia

Clearing Passwords

If you forget the password, you cannot access the computer. Refer to the *Troubleshooting Guide* on the *Documentation CD* for instructions on clearing passwords.

If the system is equiped with an embedded security device, refer to *HP ProtectTools Embedded Security Guide,* on the *Documentation CD*.

3.4.4 DriveLock

DriveLock is an industry-standard security feature that prevents unauthorized access to the data on specific hard drives. DriveLock has been implemented as an extension to Computer Setup. It is only available on certain systems and only when DriveLock-capable hard drives are detected.

DriveLock is intended for HP customers for whom data security is the paramount concern. For such customers, the cost of the hard drive and the loss of the data stored on it is inconsequential when compared with the damage that could result from unauthorized access to its contents. In order to balance this level of security with the practical need to accommodate a forgotten password, the HP implementation of DriveLock employs a two-password security scheme. One password is intended to be set and used by a system administrator while the other is typically set and used by the end-user. There is no "back-door" that can be used to unlock the drive if both passwords are lost. Therefore, DriveLock is most safely used when the data contained on the hard drive is replicated on a corporate information system or is regularly backed up.

In the event that both DriveLock passwords are lost, the hard drive is rendered unusable. For users who do not fit the previously defined customer profile, this may be an unacceptable risk. For users who do fit the customer profile, it may be a tolerable risk given the nature of the data stored on the hard drive.

Using DriveLock

The DriveLock option appears under the Security menu in Computer Setup. The user is presented with options to set the master password or to enable DriveLock. A user password must be provided in order to enable DriveLock. Since the initial configuration of DriveLock is typically performed by a system administrator, a master password should be set first. HP encourages system administrators to set a master password whether they plan to enable DriveLock or keep it disabled. This will give the administrator the ability to modify DriveLock settings if the drive is locked in the future. Once the master password is set, the system administrator may enable DriveLock or choose to keep it disabled.

If a locked hard drive is present, POST will require a password to unlock the device. If a power-on password is set and it matches the device's user password, POST will not prompt the user to re-enter the password. Otherwise, the user will be prompted to enter a DriveLock password. Either the master or the user password may be used. Users will have two attempts to enter a correct password. If neither attempt succeeds, POST will continue but the drive will remain inaccessible.

DriveLock Applications

The most practical use of the DriveLock security feature is in a corporate environment where a system administrator provides users with multibay hard drives for use in some computers. The system administrator would be responsible for configuring the multibay hard drive which would involve, among other things, setting the DriveLock master password. In the event that the user forgets the user password or the equipment is passed on to another employee, the master password can always be used to reset the user password and regain access to the hard drive.

HP recommends that corporate system administrators who choose to enable DriveLock also establish a corporate policy for setting and maintaining master passwords. This should be done to prevent a situation where an employee intentionally or unintentionally sets both DriveLock passwords before leaving the company. In such a scenario, the hard drive would be rendered unusable and require replacement. Likewise, by not setting a master password, system administrators may find themselves locked out of a hard drive and unable to perform routine checks for unauthorized software, other asset control functions, and support.

For users with less stringent security requirements, HP does not recommend enabling DriveLock. Users in this category include personal users or users who do not maintain sensitive data on their hard drives as a common practice. For these users, the potential loss of a hard drive resulting from forgetting both passwords is much greater than the value of the data DriveLock has been designed to protect. Access to Computer Setup and DriveLock can be restricted through the Setup password. By specifying a Setup password and not giving it to end users, system administrators are able to restrict users from enabling DriveLock.

3.4.5 Smart Cover Sensor

Cover Removal Sensor, available on select models, is a combination of hardware and software technology that can alert you when the computer cover or side panel has been removed. There are three levels of protection, as described in the following table.

Smart Cover Sensor Protection Levels

Level	Setting	Description
Level 0	Disabled	Smart Cover Sensor is disabled (default).
Level 1	Notify User	When the computer is restarted, the screen displays a message indicating that the computer cover or side panel has been removed.
Level 2	Setup Password	When the computer is restarted, the screen displays a message indicating that the computer cover or side panel has been removed. You must enter the setup password to continue.

✎ These settings can be changed using Computer Setup. For more information about Computer Setup, see the *Computer Setup (F10) Utility Guide.*

Setting the Smart Cover Sensor Protection Level

To set the Smart Cover Sensor protection level, complete the following steps:

1. Turn on or restart the computer. If you are in Windows, click **Start > Shut Down > Restart.**

2. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

3. Select **Security > Smart Cover > Cover Removal Sensor,** and select the desired security level.

4. Before exiting, click **File > Save Changes and Exit.**

Smart Cover Lock

The Smart Cover Lock is a software-controllable cover lock featured on select HP computers. This lock prevents unauthorized access to the internal components. Computers ship with the Smart Cover Lock in the unlocked position.

⚠ **CAUTION:** For maximum cover lock security, be sure to establish a setup password. The setup password prevents unauthorized access to the Computer Setup utility.

✎ The Smart Cover Lock is available as an option on select systems.

Locking the Smart Cover Lock

To activate and lock the Smart Cover Lock, complete the following steps:

1. Turn on or restart the computer. If you are in Windows, click **Start > Shut Down > Restart.**

2. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

3. Select **Security > Smart Cover > Cover Lock > Lock** option.

4. Before exiting, click **File > Save Changes and Exit.**

Unlocking the Smart Cover Lock

1. Turn on or restart the computer. If you are in Windows, click **Start > Shut Down > Restart.**

2. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

3. Select **Security > Smart Cover > Cover Lock > Unlock.**

4. Before exiting, click **File > Save Changes and Exit.**

Using the Smart Cover FailSafe Key

If you enable the Smart Cover Lock and cannot enter your password to disable the lock, you will need a Smart Cover FailSafe Key to open the computer cover. You will need the key in any of the following circumstances:

■ Power outage

■ Startup failure

■ PC component failure (such as processor or power supply)

■ Forgotten password

⚠ **CAUTION:** The Smart Cover FailSafe Key is a specialized tool available from HP. Be prepared; order this key before you need one (Tamper-resistant wrench PN 166527-001 or tamper-resistant bits PN 166527-002).

To obtain the FailSafe Key, do any one of the following:

■ Contact an authorized HP reseller or service provider.

■ Call the appropriate number listed in the warranty.

For more information about using the Smart Cover FailSafe Key, consult the *Hardware Reference Guide.*

3.4.6 Master Boot Record Security

The Master Boot Record (MBR) contains information needed to successfully boot from a disk and to access the data stored on the disk. Master Boot Record Security may prevent unintentional or malicious changes to the MBR, such as those caused by some computer viruses or by the incorrect use of certain disk utilities. It also allows you to recover the "last known good" MBR, should changes to the MBR be detected when the system is restarted.

To enable MBR Security, complete the following steps:

1. Turn on or restart the computer. If you are in Windows, click **Start > Shut Down > Restart.**

2. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

3. Select **Security > Master Boot Record Security > Enabled.**

4. Select **Security > Save Master Boot Record.**

5. Before exiting, click **File > Save Changes and Exit.**

When MBR Security is enabled, the BIOS prevents any changes being made to the MBR of the current bootable disk while in MS-DOS or Windows Safe Mode.

✎ Most operating systems control access to the MBR of the current bootable disk; the BIOS cannot prevent changes that may occur while the operating system is running.

Each time the computer is turned on or restarted, the BIOS compares the MBR of the current bootable disk to the previously saved MBR. If changes are detected and if the current bootable disk is the same disk from which the MBR was previously saved, the following message is displayed:

1999—Master Boot Record has changed.

   Press any key to enter Setup to configure MBR Security.

Upon entering Computer Setup, you must

■ Save the MBR of the current bootable disk;

■ Restore the previously saved MBR; or

■ Disable the MBR Security feature.

You must know the setup password, if one exists.

If changes are detected and if the current bootable disk is **not** the same disk from which the MBR was previously saved, the following message is displayed:

2000—Master Boot Record Hard Drive has changed.

   Press any key to enter Setup to configure MBR Security.

Upon entering Computer Setup, you must

■ Save the MBR of the current bootable disk; or

■ Disable the MBR Security feature.

You must know the setup password, if one exists.

In the unlikely event that the previously saved MBR has been corrupted, the following message is displayed:

1998—Master Boot Record has been lost.

Press any key to enter Setup to configure MBR Security.

Upon entering Computer Setup, you must

■   Save the MBR of the current bootable disk; or

■   Disable the MBR Security feature.

You must know the setup password, if one exists.

3.4.7 Before You Partition or Format the Current Bootable Disk

Ensure that MBR Security is disabled before you change partitioning or formatting of the current bootable disk. Some disk utilities, such as FDISK and FORMAT, attempt to update the MBR. If MBR Security is enabled when you change partitioning or formatting of the disk, you may receive error messages from the disk utility or a warning from MBR Security the next time the computer is turned on or restarted. To disable MBR Security, complete the following steps:

1. Turn on or restart the computer. If you are in Windows, click **Start > Shut Down > Restart.**

2. As soon as the computer is turned on, press and hold the **F10** key until you enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

✎ If you do not press the **F10** key at the appropriate time, you must restart the computer and press and hold the **F10** key again to access the utility.

If you are using a PS/2 keyboard, you may see a Keyboard Error message—disregard it.

3. Select **Security > Master Boot Record Security > Disabled.**

4. Before exiting, click **File > Save Changes and Exit.**

3.4.8 Cable Lock Provision

The rear panel of the computer accommodates a cable lock so that the computer can be physically secured to a work area.

For illustrated instructions, please see the Removal and Replacement Chapter for the specific chassis.

3.4.9 Fingerprint Identification Technology

Eliminating the need to enter user passwords, HP Fingerprint Identification Technology tightens network security, simplifies the login process, and reduces the costs associated with managing corporate networks. Affordably priced, it is not just for high-tech, high-security organizations anymore.

✎ Support for Fingerprint Identification Technology varies by model.

For more information, visit http://h18004.www1.hp.com/products/security.

3.5 **Fault Notification and Recovery**

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

If the computer is connected to a network managed by HP Client Manager, the computer sends a fault notice to the network management application. With HP Client Manager Software, you can also remotely schedule diagnostics to automatically run on all managed PCs and create a summary report of failed tests.

3.5.1 **Drive Protection System**

The Drive Protection System (DPS) is a diagnostic tool built into the hard drives installed in select HP computers. DPS is designed to help diagnose problems that might result in unwarranted hard drive replacement.

When HP computers are built, each installed hard drive is tested using DPS, and a permanent record of key information is written onto the drive. Each time DPS is run, test results are written to the hard drive. Your service provider can use this information to help diagnose conditions that caused you to run the DPS software. Refer to the *Troubleshooting Guide* for instructions on using DPS.

3.5.2 **Surge-Tolerant Power Supply**

An integrated surge-tolerant power supply provides greater reliability when the computer 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.

3.5.3 **Thermal Sensor**

The thermal sensor is a hardware and software feature that tracks the internal temperature of the computer. 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.

4

Serial and Parallel ATA Drive Guidelines and Features

✎ Serial ATA = SATA
Parallel ATA = PATA

HP does not support the use of PATA (IDE) hard drives when SATA hard drives are installed on the computer.

4.1   SATA and PATA Device Information

Characteristic	SATA	PATA
Number of pins/conductors in data cable	7/7	40/80
Number of pins in power cable	15	4
Maximum data cable length	39.37 in (100 cm)	18 in (45.7 cm)
Data interface voltage differential	600 mV	5 V
Drive motor voltages	3.3 V, 12 V	5 V, 12 V
Jumpers for configuring drive	N/A	Required
Data transfer rate	150 MB/s	up to 100 MB/s

SATA connectors on the system board are color coded to make identification easier.

SATA Identification	Color
Primary channel, device 0	Dark blue
Primary channel, device 1	Light Blue
Secondary channel, device 0	White
Secondary channel, device 1	Orange

4.2   ATA Cables

4.2.1 SATA Data Cable

The SATA data cable is a thin, 7-pin cable designed to transmit data for only a single drive. As shown in the table, each cable has 3 grounds, and 4 transmit/receive pins.

SATA data cables are susceptible to damage if overflexed. Never crease a SATA data cable and never bend it tighter than a 30 mm (1.18 in) radius.

Pin Number	Usage	Device Plug	Host Plug
P1	Ground	Ground	Ground
P2*	A+	Transmit data	Receive data
P3*	A-	Transmit data	Receive data
P4	Ground	Ground	Ground
P5**	B-	Receive data	Transmit data
P6**	B+	Receive data	Transmit data
P7	Ground	Ground	Ground

*P2 and P3 differential signal pair

**P5 and P6 differential signal pair

4.2.2 SATA Power Cable

Pin	Usage	Notes	Pin	Usage	Notes
P1	V3.3	3.3 V power	P9	V5	5 V power
P2	V3.3	3.3 V power	P10	Ground	
P3	V3.3	3.3 V power	P11	Reserved	
P4	Ground		P12	Ground	
P5	Ground		P13	V 12	12 V power
P6	Ground		P14	V12	12 V power
P7	V5	5 V power	P15	V12	12 V power
P8	V5	5 V power			

4.2.3 PATA Data Cable

Pin	Signal	Pin	Signal	Pin	Signal
1	Reset	15	DD1	29	DMAK
2	Ground	16	DD14	30	Ground
3	DD7	17	DD0	31	INTRQ
4	DD8	18	DD15	32	IOCS16
5	DD6	19	Ground	33	DA1
6	DD9	20	(Key)	34	PDIAG (cable detect)
7	DD5	21	DMARQ	35	DA0
8	DD10	22	Ground	36	DA2
9	DD4	23	DIOW	37	CS1FX
10	DD11	24	Ground	38	CS3FX
11	DD3	25	DIOR	39	DASP
12	DD12	26	Ground	40	Ground
13	DD2	27	IORDY		
14	DD13	28	CSEL		

4.2.4 PATA Power Cable

Pin	Usage
1	+12 V
2	Ground
3	Ground
4	+5 V

4.2.5 PATA Cable Layout

The faces of industry-standard cable connectors are color-coded for easy recognition:

■ System board connector = blue face

■ Device 0 connector = black face

■ Device 1 connector = gray face

The color code of an industry-standard cable is applicable only if the drive's jumper is in the cable-select position.

Single-Drive Cable

System
Board   Device 0

Blue   Black
Face   Face

Two-Drive Cable

System   Device 1   Device 0
Board
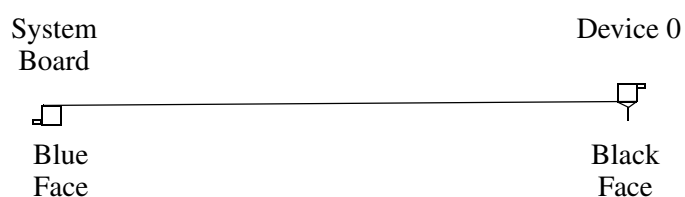
Blue   Gray   Black
Face   Face   Face
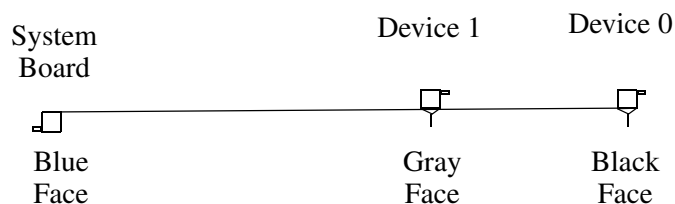
On a two-drive cable, the Drive/Device 0 connector is always the farthest one from the system board connector and the Drive/Device 1 connector is always the closest to the system board connector.

Some cables may be labeled "Drive 0" instead of "Device 0" and "Drive 1" instead of "Device 1".

4.3 PATA Drive Installation Guidelines

Most computer system boards have two or fewer Parallel ATA (PATA) channels with a dedicated connector for each channel. When two channels are present, one is designated as the Primary and the other as the Secondary Channel.

Each of the two channels can have up to two devices attached to it. All drives are connected to a channel using an industry-standard 80-conductor cable.

✎ The industry standard 1.44 MB diskette drive has its own separate channel and is not included as a part of the maximum four drives.

HP does not support the use of PATA (IDE) hard drives when SATA hard drives are installed on the computer.

Each drive attached to a channel must have a drive designation. If a drive is attached to the Device 0 cable position and its cable-select jumper is present, the drive is designated as Device 0. Similarly, if a drive is attached to the Device 1 cable position and its cable-select jumper is present, the drive is designated as Device 1.

For optimal performance of a computer system, all drives need to be attached to the PATA channel(s) in a specified sequence. This sequence is determined by the device class of the drives and by specific attach sequence rules.

4.3.1 PATA Device Classes

In order to determine the best drive attach sequence, ATA/ATAPI drives are segregated into four different classes based upon the bandwidth demands they place on an ATA channel. The most demanding devices are in Class 1 and the least demanding are in Class 4.

Class 1 Hard Drives	Class 2 High Speed Optical Drives	Class 3 Optical Storage Drives	Class 4 Magnetic Storage Drives
ATA-100	DVD	R/W CD-ROM	LS-120
ATA-66	DVD-CD R/W	CD-ROM	Tape
ATA-33			Zip

General Attach Guidelines

■ The lower the device class number, the faster the device and the more bandwidth required.

■ Drives installed in the Device 0 positions on both the primary and secondary channels receive the greatest possible bandwidth.

■ The bootable ATA hard drive should always be installed on the primary channel in the Device 0 position.

4.3.2 PATA Attach Sequence Rules by Class Priority

Drives should be attached in the sequence shown for optimum performance starting at position ❶.
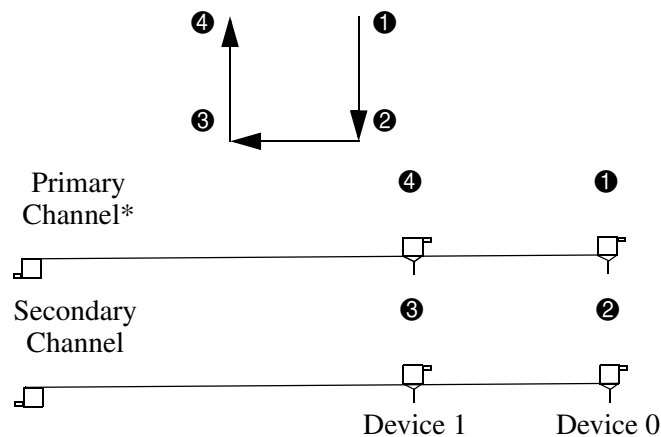
*If there are three or more devices, two or more of which are hard drives, two hard drives should be attached to the primary channel first before following the General Attach Sequence Rule.

The attach sequence rule may also be stated in table format:

General Attach Sequence Rule*	
Sequence	**Description**
1	The lowest class drive—bootable hard drive recommended.
2	If only two drives, the last drive goes here; otherwise the lowest class of the remaining drives.
3	If only three drives, attach the final drive here. If a fourth drive exists, attach the lowest class drive here.
4	If there is a fourth drive, attach the final drive here—the drive with the highest class number of all devices.

*If there are three or more devices, two or more of which are hard drives, two hard drives should be attached to the primary controller first before following the General Attach Sequence Rule.

✎ Cable lengths may restrict drive usage.

The rules allow for:

■ Keeping the hard drive on a separate channel to maximize drive performance until a fourth device is added.

■ Keeping the hard drives and removable media drives on separate channels to maximize compatibility.

■ Keeping the hard drive and the writable optical drive on separate channels to maximize optical drive reliability.

4.3.3 PATA Attach Sequence Worksheet

Use the worksheet below for obtaining optimum system performance when setting up a computer with multiple drives. Use the General Attach Sequence Rule to determine the best drive installation sequence.

Attach Sequence Worksheet				
Device Name	**Device Class**	**Position Number**	**Channel Name**	**Device Number**

Two examples of how to use the worksheet are:

■ Three-device installation

■ Four-device installation

Example 1: Three-Device Installation Sample

A system has three devices: Ultra ATA-100 hard drive, CD-ROM drive, and a DVD drive. Using the Device Class Table in Section 4.3.1, the devices may be identified as:

■ Ultra ATA-100 hard drive = Class 1

■ DVD drive = Class 2

■ CD-ROM drive = Class 3

Attach Sequence Worksheet—Three-Device Installation (Sample)

Device Name	Device Class	Position Number	Channel Name	Device Number
Ultra ATA-100 hard drive	1	❶	Primary	0
DVD drive	2	❷	Secondary	0
CD-ROM drive	3	❸	Secondary	1

✎ Cable lengths may restrict drive usage.
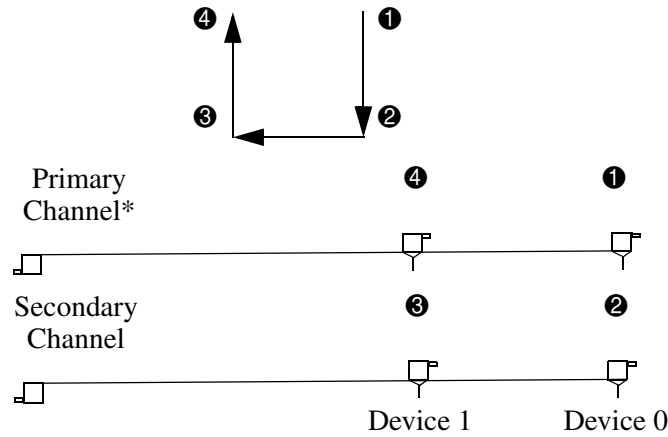
Example 2: Four-Device Installation Sample

A system has four devices: two Ultra ATA-100 hard drives, one DVD-CDR/W drive, and a ZIP-250 drive. Using the Device Class Table in Section 4.3.1, the devices may be reidentified as:

■ Ultra ATA-100 hard drive = Class 1

■ Ultra ATA-100 hard drive = Class 1

■ DVD-CDR/W drive = Class 2

■ ZIP-250 drive = Class 4

Attach Sequence Worksheet—Four-Device Installation (Sample)				
Device Name	**Device Class**	**Position Number**	**Channel Name**	**Device Number**
Ultra ATA-100 hard drive	1	❶	Primary	0
DVD-CDR/W drive	2	❷	Secondary	0
ZIP-250 drive	4	❸	Secondary	1
Ultra ATA-100 hard drive*	1	❹	Primary	1

*If there are three or more devices, two or more of which are hard drives, two hard drives should be attached to the primary channel first before following the General Attach Sequence Rule.
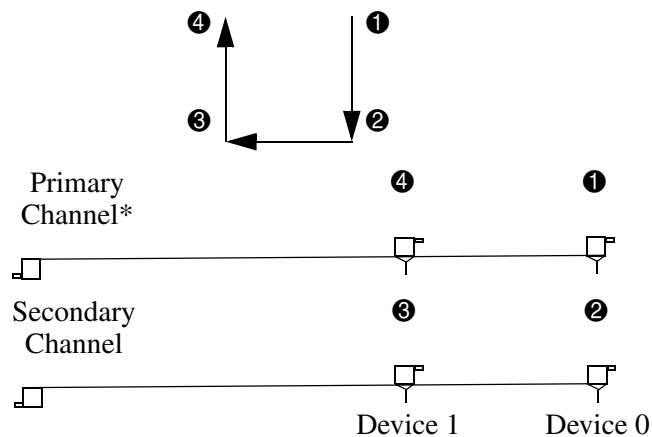
✎ Cable lengths may restrict drive usage.

4.3.4 PATA Additional Drive Application Notes

■ When replacing a hard drive, the replacement should be of the same type (Ultra ATA -33, -66, or -100) as that being removed to retain the same level of performance.

■ When Ultra ATA and SCSI hard drives are mixed in the same system, the Ultra ATA drive will become the boot drive unless the boot order is changed in Computer (F10) Setup.

4.4 ATA SMART Drives

The Self Monitoring Analysis and Recording Technology (SMART) ATA drives for the HP Personal Computers have built-in drive failure prediction that warns the user or network administrator of an impending failure or crash of the hard drive. The SMART drive tracks fault prediction and failure indication parameters such as reallocated sector count, spin retry count, and calibration retry count. If the drive determines that a failure is imminent, it generates a fault alert.

4.5 Drive Capacities

The combination of the file system and the operating system used in the computer determines the maximum usable size of a drive partition. A drive partition is the largest segment of a drive that may be properly accessed by the operating system. A single hard drive may therefore be subdivided into a number of unique drive partitions in order to make use of all of its space.

Because of the differences in the way that drive sizes are calculated, the size reported by the operating system may differ from that marked on the hard drive or listed in the computer specification. Drive size calculations by drive manufacturers are bytes to the base 10 while calculations by Microsoft are bytes to the base 2.

Drive/Partition Capacity Limits				
			Maximum Size	
File System	Controller Type	Operating System	Partition	Drive
FAT 32	ATA	Windows 2000/ XP	32 GB	128 PB
FAT 32	SCSI	Windows 2000/ XP	32 GB	2 TB
NTFS	ATA	Windows NT/2000/XP	2 TB	128 PB
NTFS	SCSI	Windows NT/2000/XP	2 TB	2 TB

4.6 SATA BIOS

Windows 2000 and XP	Windows 9x, NT, and Linux
Enhanced Mode (default BIOS Setting) —Separate IDE controller	Compatibility Mode (non-default BIOS Setting) —Combined IDE controller
• PATA Controller in Legacy Mode - Device 0 is accessible as Device 0 of PATA controller's Primary Channel - Device 1 is accessible as Device 1of PATA controller's Primary Channel • SATA Controller in Native Mode - SATA 0 is accessible as Device 0 of SATA controller's Primary Channel - SATA 1 is accessible as Device 0 of SATA controller's Secondary Channel SATA 2 is accessible as Device 1of SATA controller's Primary Channel - SATA 3 is accessible as Device 1 of SATA controller's Secondary Channel	• PATA Controller in Legacy Mode - Device 0 is accessible as Device 0 of the combined controller's Secondary Channel - Device 1 is accessible as Device 1of the combined controller's Secondary Channel • SATA Controller in Legacy Mode - SATA 0 is accessible as Device 0 of the combined controller's Primary Channel - SATA 1 is inaccessible - SATA 2 is accessible as device 1 of the combined controller's Primary Channel - SATA 3 is inaccessible

4.6.1 Legacy Mode

The Legacy mode is used to access devices attached to the embedded IDE controllers. Each channel requires two fixed I/O address ranges and an IRQ for each.

■ Primary Channel

❏ Command block: 1F0h - 1F7h

❏ Control block: 3F6h

❏ IRQ: 14

■ Secondary Channel

❏ Command block: 170h - 177h

❏ Control block: 376h

❏ IRQ: 15

4.6.2 Native Mode

The native mode is used to access devices attached to add-in cards and is not supported by many legacy operating systems. Addresses are assigned by PCI Plug-n-Play BIOS and the IRQ is shared with multiple controllers. Base Address Registers for the Command and Control Block are found in the PCI Configuration Space.

■ Offset 10h—Primary Command base address

■ Offset 14h—Primary Control base address

■ Offset 18h—Secondary Command base address

■ Offset 1Ch—Secondary Control base address

4.7 Mixed Devices Boot and Drive Letter Ordering

SATA Emulation*	Hard Drive Order	HDD Boot and Drive Letter Ordering
Separate IDE Controller (default). Used with Windows 2000 and XP.	A. Integrated SATA B. Integrated IDE	A1. SATA 0 A2. SATA 2 A3. SATA 1 A4. SATA 3 B1. IDE Device 0 B2. IDE Device 1
Separate IDE Controller. Used with Windows 2000 and XP.	A. Integrated IDE B. Integrated SATA	A1. IDE Device 0 A2. IDE Device 1 B1. SATA 0 B2. SATA 2 B3. SATA 1 B4. SATA 3
Combined with IDE Controller. Used with Windows 9x, NT, and Linux.	A. Integrated SATA B. Integrated IDE	A1. SATA 0 A2. SATA 2 B1. IDE Device 0 B2. IDE Device 1
Combined with IDE Controller. Used with Windows 9x, NT, and Linux.	A. Integrated IDE B. Integrated SATA	A1. IDE Device 0 A2. IDE Device 1 B1. SATA 0 B2. SATA 2
*Refer to section 4.3.2 for PATA attach sequence rules.		

5

Identifying the Chassis, Routine Care, and Disassembly Preparation

This chapter provides general service information for the computer. Adherence to the procedures and precautions described in this chapter is essential for proper service.

△ **CAUTION:** When the computer is plugged into an AC power source voltage is always applied to the system board. You must disconnect the power cord from the power source before opening the computer to prevent system board or component damage.

5.1 Chassis Designations

5.1.1 Convertible Minitower (CMT)

5.1.2 Small Form Factor (SFF)

5.1.3 Ultra-Slim Desktop (USDT)

5.2 Electrostatic Discharge Information

A sudden discharge of static electricity from your finger or other conductor can destroy static-sensitive devices or microcircuitry. Often the spark is neither felt nor heard, but damage occurs. An electronic device exposed to electrostatic discharge (ESD) may not appear to be affected at all and can work perfectly throughout a normal cycle. The device may function normally for a while, but it has been degraded in the internal layers, reducing its life expectancy.

Networks built into many integrated circuits provide some protection, but in many cases, the discharge contains enough power to alter device parameters or melt silicon junctions.

5.2.1 Generating Static

The following table shows that:

■ Different activities generate different amounts of static electricity.

■ Static electricity increases as humidity decreases.

	Relative Humidity		
Event	55%	40%	10%
Walking across carpet	7,500 V	15,000 V	35,000 V
Walking across vinyl floor	3,000 V	5,000 V	12,000 V
Motions of bench worker	400 V	800 V	6,000 V
Removing DIPs* from plastic tube	400 V	700 V	2,000 V
Removing DIPs* from vinyl tray	2,000 V	4,000 V	11,500 V
Removing DIPs* from Styrofoam	3,500 V	5,000 V	14,500 V
Removing bubble pack from PCB	7,000 V	20,000 V	26,500 V
Packing PCBs in foam-lined box	5,000 V	11,000 V	21,000 V

*These are then multi-packaged inside plastic tubes, trays, or Styrofoam.

✎ 700 volts can degrade a product.

5.2.2 Preventing Electrostatic Damage to Equipment

Many electronic components are sensitive to ESD. Circuitry design and structure determine the degree of sensitivity. The following packaging and grounding precautions are necessary to prevent damage to electric components and accessories.

■ To avoid hand contact, transport products in static-safe containers such as tubes, bags, or boxes.

■ Protect all electrostatic parts and assemblies with conductive or approved containers or packaging.

■ Keep electrostatic sensitive parts in their containers until they arrive at static-free stations.

■ Place items on a grounded surface before removing them from their container.

■ Always be properly grounded when touching a sensitive component or assembly.

■ Avoid contact with pins, leads, or circuitry.

■ Place reusable electrostatic-sensitive parts from assemblies in protective packaging or conductive foam.

5.2.3 Personal Grounding Methods and Equipment

Use the following equipment to prevent static electricity damage to equipment:

■ **Wrist straps** are flexible straps with a maximum of one-megohm ± 10% resistance in the ground cords. To provide proper ground, a strap must be worn snug against bare skin. The ground cord must be connected and fit snugly into the banana plug connector on the grounding mat or workstation.

■ **Heel straps/Toe straps/Boot straps** can be used at standing workstations and are compatible with most types of shoes or boots. On conductive floors or dissipative floor mats, use them on both feet with a maximum of one-megohm ± 10% resistance between the operator and ground.

Static Shielding Protection Levels	
Method	**Voltage**
Antistatic plastic	1,500
Carbon-loaded plastic	7,500
Metallized laminate	15,000

5.2.4 Grounding the Work Area

To prevent static damage at the work area, use the following precautions:

■ Cover the work surface with approved static-dissipative material. Provide a wrist strap connected to the work surface and properly grounded tools and equipment.

■ Use static-dissipative mats, foot straps, or air ionizers to give added protection.

■ Handle electrostatic sensitive components, parts, and assemblies by the case or PCB laminate. Handle them only at static-free work areas.

■ Turn off power and input signals before inserting and removing connectors or test equipment.

■ Use fixtures made of static-safe materials when fixtures must directly contact dissipative surfaces.

■ Keep work area free of nonconductive materials such as ordinary plastic assembly aids and Styrofoam.

■ Use field service tools, such as cutters, screwdrivers, and vacuums, that are conductive.

5.2.5 Recommended Materials and Equipment

Materials and equipment that are recommended for use in preventing static electricity include:

■ Antistatic tape

■ Antistatic smocks, aprons, or sleeve protectors

■ Conductive bins and other assembly or soldering aids

■ Conductive foam

■ Conductive tabletop workstations with ground cord of one-megohm +/- 10% resistance

■ Static-dissipative table or floor mats with hard tie to ground

■ Field service kits

■ Static awareness labels

■ Wrist straps and footwear straps providing one-megohm +/- 10% resistance

■ Material handling packages

■ Conductive plastic bags

■ Conductive plastic tubes

■ Conductive tote boxes

■ Opaque shielding bags

■ Transparent metallized shielding bags

■ Transparent shielding tubes

5.3 Operating Guidelines

To prevent overheating and to help prolong the life of the computer:

■ Keep the computer away from excessive moisture, direct sunlight, and extremes of heat and cold.

■ Operate the computer on a sturdy, level surface. Leave a 10.2-cm (4-inch) clearance on all vented sides of the computer and above the monitor to permit the required airflow.

■ Never restrict the airflow into the computer by blocking any vents or air intakes. Do not place the keyboard, with the keyboard feet down, directly against the front of the desktop unit as this also restricts airflow.

■ Occasionally clean the air vents on all vented sides of the computer. Lint, dust, and other foreign matter can block the vents and limit the airflow.

■ Never operate the computer with the cover or side panel removed.

■ Do not stack computers on top of each other or place computers so near each other that they are subject to each other's re-circulated or preheated air.

■ If the computer is to be operated within a separate enclosure, intake and exhaust ventilation must be provided on the enclosure, and the same operating guidelines listed above will still apply.

■ The computer is designed to operate continuously (24x7), provided that the operating guidelines listed above are met.

■ Install or enable power management functions of the operating system or other software, including sleep states.

5.4 Routine Care

5.4.1 General Cleaning Safety Precautions

1. Never use solvents or flammable solutions to clean the computer.

2. Never immerse any parts in water or cleaning solutions; apply any liquids to a clean cloth and then use the cloth on the component.

3. Always unplug the computer when cleaning with liquids or damp cloths.

4. Always unplug the computer before cleaning the keyboard, mouse, or air vents.

5. Disconnect the keyboard before cleaning it.

6. Wear safety glasses equipped with side shields when cleaning the keyboard.

5.4.2 Cleaning the Computer Case

Follow all safety precautions in Section 5.4.1 before cleaning the computer.

To clean the computer case, follow the procedures described below:

■ To remove light stains or dirt, use plain water with a clean, lint-free cloth or swab.

■ For stronger stains, use a mild dishwashing liquid diluted with water. Rinse well by wiping it with a cloth or swab dampened with clear water.

■ For stubborn stains, use isopropyl (rubbing) alcohol. No rinsing is needed as the alcohol will evaporate quickly and not leave a residue.

■ After cleaning, always wipe the unit with a clean, lint-free cloth.

■ Occasionally clean the air vents on the computer. Lint and other foreign matter can block the vents and limit the airflow.

5.4.3 Cleaning the Keyboard

Follow all safety precautions in Section 5.4.1 before cleaning the keyboard.

To clean the tops of the keys or the keyboard body, follow the procedures described in Section 5.4.2.

When cleaning debris from under the keys, review all rules in Section 5.4.1 before following these procedures:

⚠ **CAUTION:** Use safety glasses equipped with side shields before attempting to clean debris from under the keys.

■ Visible debris underneath or between the keys may be removed by vacuuming or shaking.

■ Canned, pressurized air may be used to clean debris from under the keys. Caution should be used as too much air pressure can dislodge lubricants applied under the wide keys.

■ If you remove a key, use a specially designed key puller to prevent damage to the keys. This tool is available through many electronic supply outlets.

⚠ **CAUTION:** Never remove a wide leveled key (like the space bar) from the keyboard. If these keys are improperly removed or installed, the keyboard may not function properly.

■ Cleaning under a key may be done with a swab moistened with isopropyl alcohol and squeezed out. Be careful not to wipe away lubricants necessary for proper key functions. Use tweezers to remove any fibers or dirt in confined areas. Allow the parts to air dry before reassembly.

5.4.4 Cleaning the Monitor

■ Wipe the monitor screen with a clean cloth moistened with water or with a towelette designed for cleaning monitors. Do not use sprays or aerosols directly on the screen; the liquid may seep into the housing and damage a component. Never use solvents or flammable liquids on the monitor.

■ To clean the monitor body follow the procedures in Section 5.4.2.

5.4.5 Cleaning the Mouse

Before cleaning the mouse, ensure that the power to the computer is turned off.

■ Clean the mouse ball by first removing the retaining plate and the ball from the housing. Pull out any debris from the ball socket and wipe the ball with a clean, dry cloth before reassembly.

■ To clean the mouse body, follow the procedures in Section 5.4.2.

5.5 Service Considerations

Listed below are some of the considerations that you should keep in mind during the disassembly and assembly of the computer.

5.5.1 Power Supply Fan

The power supply fan is a variable-speed fan based on the temperature in the power supply.

⚠ **CAUTION:** The cooling fan is always on when the computer is in the "On" mode. The cooling fan is off when the computer is in "Standby," "Suspend," or "Off" modes.
You must disconnect the power cord from the power source before opening the computer to prevent system board or component damage.

5.5.2 Tools and Software Requirements

To service the computer, you need the following:

- Torx T-15 screwdriver (Compaq screwdriver with bits, PN 161946-001)

- Torx T-15 screwdriver with small diameter shank (for certain front bezel removal)

- Flat-bladed screwdriver (may sometimes be used in place of the Torx screwdriver)

- Phillips #0 screwdriver

- Phillips #2 screwdriver

- Diagnostics software

- Compaq tamper-resistant T-15 wrench (Smart Cover FailSafe Key, PN 166527-001) or Compaq tamper-resistant bits (Smart Cover FailSafe Key, PN 166527-002)

5.5.3 Screws

The screws used in the computer are not interchangeable. They may have standard or metric threads and may be of different lengths. If an incorrect screw is used during the reassembly process, it can damage the unit. HP strongly recommends that all screws removed during disassembly be kept with the part that was removed, then returned to their proper locations.

✎ Metric screws have a black finish.
U.S. screws have a silver finish.

✎ As each subassembly is removed from the computer, it should be placed away from the work area to prevent damage.

5.5.4 Cables and Connectors

Most cables used throughout the unit are flat, flexible cables. These cables must be handled with care to avoid damage. Apply only the tension required to seat or unseat the cables during insertion or removal from the connector. Handle cables by the connector whenever possible. In all cases, avoid bending or twisting the cables, and ensure that the cables are routed in such a way that they cannot be caught or snagged by parts being removed or replaced.

⚠ **CAUTION:** When servicing this computer, ensure that cables are placed in their proper location during the reassembly process. Improper cable placement can damage the computer.

5.5.5 Hard Drives

Handle hard drives as delicate, precision components, avoiding all physical shock and vibration. This applies to failed drives as well as replacement spares.

■ If a drive must be mailed, place the drive in a bubble-pack mailer or other suitable protective packaging and label the package "Fragile: Handle With Care."

■ Do not remove hard drives from the shipping package for storage. Keep hard drives in their protective packaging until they are actually mounted in the CPU.

■ Avoid dropping drives from any height onto any surface.

■ If you are inserting or removing a hard drive, turn off the computer. Do not remove a hard drive while the computer is on or in standby mode.

■ Before handling a drive, ensure that you are discharged of static electricity. While handling a drive, avoid touching the connector. For more information about preventing electrostatic damage, refer to Section 5.2, "Electrostatic Discharge Information."

■ Do not use excessive force when inserting a drive.

■ Avoid exposing a hard drive to liquids, temperature extremes, or products that have magnetic fields such as monitors or speakers.

5.5.6 Lithium Coin Cell Battery

The battery that comes with the computer provides power to the real-time clock and has a lifetime of about three years.

See the appropriate removal and replacement chapter for the chassis you are working on in this guide for instructions on the replacement procedures.

⚠ **WARNING:** This computer contains a lithium battery. There is a risk of fire and chemical burn if the battery is handled improperly. Do not disassemble, crush, puncture, short external contacts, dispose in water or fire, or expose it to temperatures higher than 140°F (60°C).

⚠ **CAUTION:** Batteries, battery packs, and accumulators should not be disposed of together with the general household waste.

6

Removal and Replacement Procedures - Convertible Minitower (CMT) Chassis

Adherence to the procedures and precautions described in this chapter is essential for proper service. After completing all necessary removal and replacement procedures, run the Diagnostics utility to verify that all components operate properly.

✎ Not all features listed in this guide are available on all computers.

6.1 Preparation for Disassembly

See Chapter 5, 'Identifying the Chassis, Routine Care, and Disassembly Preparation' for initial procedures.

1. Remove/disengage any security devices that prohibit opening the computer (Section 6.2, "Unlocking the Smart Cover Lock" and Section 6.4, "External Security Devices").

2. Close any open software applications.

3. Exit the operating system.

4. Remove any diskette, compact disc, or MultiBay device from the computer.

5. Turn off the computer and any peripheral devices that are connected to it.

⚠ **CAUTION:** Turn off the computer before disconnecting any cables.

⚠ **CAUTION:** Regardless of the power-on state, voltage is always present on the system board as long as the system is plugged into an active AC outlet. In some systems the cooling fan is on even when the computer is in the "Standby," or "Suspend" modes. The power cord should always be disconnected before servicing a unit.

6. Disconnect the power cord from the electrical outlet and then from the computer.

7. Disconnect all peripheral device cables from the computer.

8. Lay the computer down on its side to achieve a safe working position.

✎ During disassembly, label each cable as you remove it, noting its position and routing. Keep all screws with the units removed.

⚠ **CAUTION:** The screws used in the computer are of different thread sizes and lengths; using the wrong screw in an application may damage the unit.

6.2 Unlocking the Smart Cover Lock

If you have locked the Smart Cover Lock use Computer Setup to unlock the lock. Refer to the *Desktop Management Guide* on the *Documentation Library* CD for more information about the Smart Cover Lock.

If you cannot access Computer Setup to unlock the cover you will need to remove the locking solenoid by using the Smart Cover FailSafe Key (Spare part number 166527-001 or 166527-002). Once the solenoid has been deactivated or removed the access panel can be removed.

The Smart Cover FailSafe Key will be needed in any of the following circumstances:

■ Power outage

■ Startup failure

■ Processor or power supply failure

■ Lost password

1. Using the Smart Cover FailSafe Key, remove the two tamper-proof screws that secure the Smart Cover Lock to the inside of the chassis.

2. Remove the computer cover.

To reattach the Smart Cover Lock, secure the lock in place with the two tamper-proof screws.

6.3 Hood Sensor

1. Prepare the computer for disassembly (Section 6.1).

2. Remove the access panel (Section 6.5).

3. Disconnect the hood sensor cable from the system board.

4. Slide the hood sensor switch towards the front of the computer ❶ and lower it down through the slot ❷.
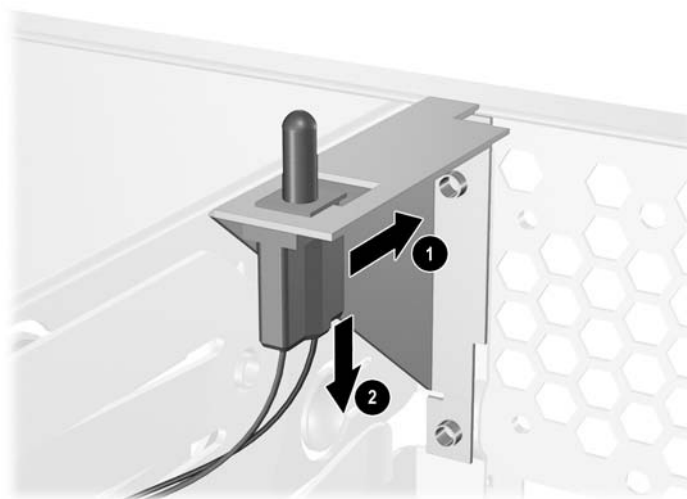
To install the hood sensor, reverse the removal procedure.

6.4 External Security Devices

6.4.1 Cable Lock

The cable lock may be used to secure the computer access panel to the chassis and, at the same time, secure the computer to a fixed object.
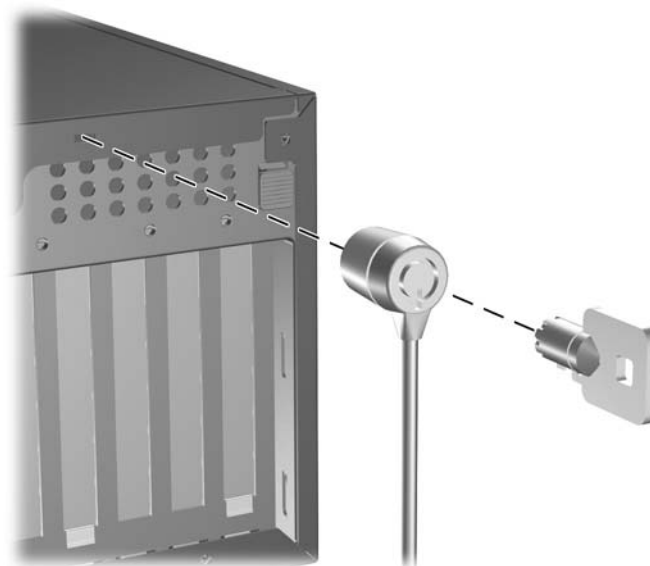
6.4.2 Padlock

A padlock may be used by itself to secure the access panel to the computer chassis. A padlock may also be used with a security cable to secure the computer to a fixed object.

6.5 Computer Access Panel

1. Prepare the computer for disassembly (Section 6.1).

⚠ **CAUTION:** Before removing the computer access panel, ensure that the computer is turned off and that the power cord is disconnected from the electrical outlet.

2. Lift up on the access panel handle ❶, slide the access panel back about 1 inch (2.5 cm), then lift it off the unit ❷.
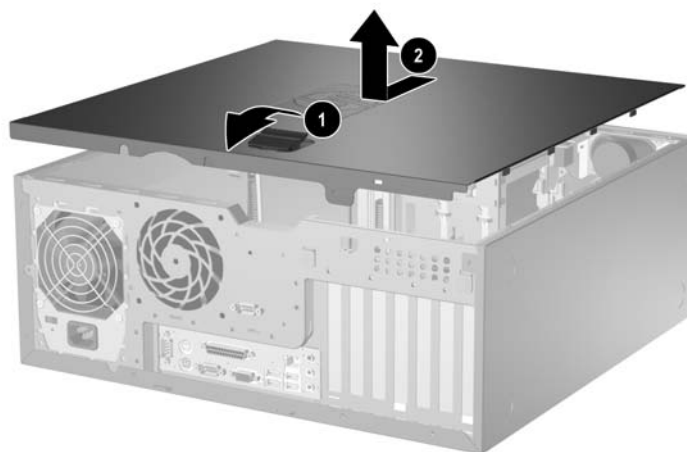
To install the computer cover, reverse the removal procedure.

6.6 Front Bezel

1. Prepare the computer for disassembly (Section 6.1).

2. Remove the computer access panel (Section 6.5).

3. Push up on the two release tabs ❶, then rotate the front bezel away from the chassis to release it ❷.
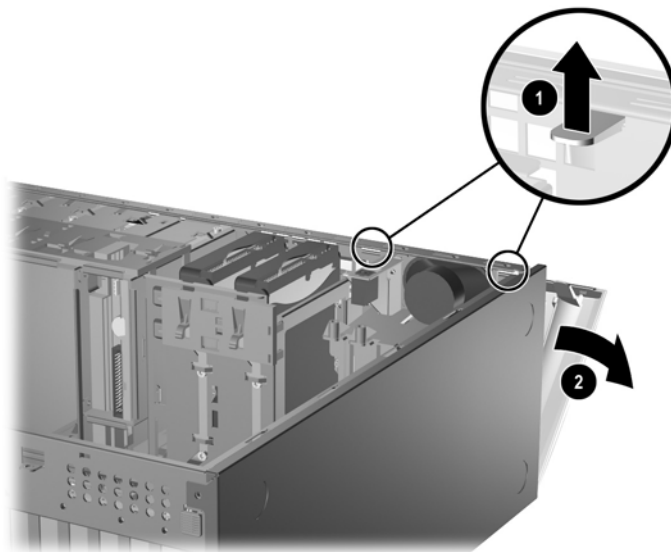
To reinstall the front bezel, reverse the removal procedure

6.7 Front Drive Bezels

1. Prepare the computer for disassembly (Section 6.1).

2. Remove the access panel (Section 6.5).

3. Remove the front bezel (Section 6.6).

6.7.1 5.25" Drive Bezel Blank

Gently pull the subpanel, with the bezel blanks secured in it, away from the front bezel, then remove the desired bezel blank.

⚠ **CAUTION:** Hold the subpanel straight when pulling it away from the front bezel. Pulling the subpanel away at an angle could damage the pins that align it with the front bezel.
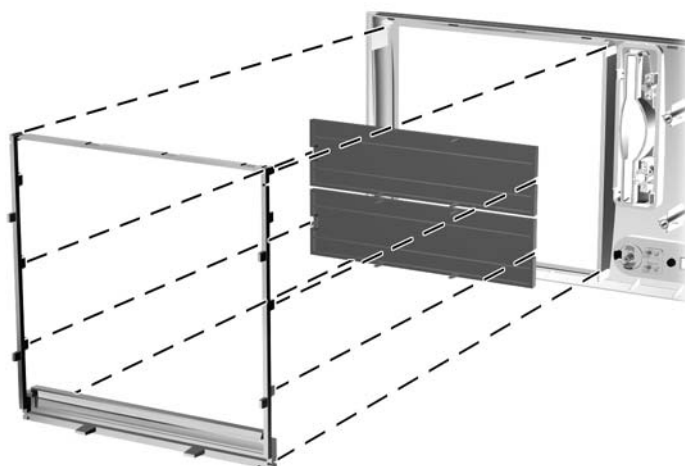
To install a bezel blank, reverse the removal procedure.

✎ When replacing the subpanel, ensure that the aligning pins and any remaining bezel blanks are in their proper orientation. The logo in the subpanel should be located at the bottom of the subpanel when properly oriented.

6.7.2 **Diskette Drive Bezel or Bezel Blank**

Press up on the two small retaining clips ❶ on the bottom of the bezel insert, press down on the two small retaining clips ❷ on the top of the insert, and push the cover out of the front bezel ❸.
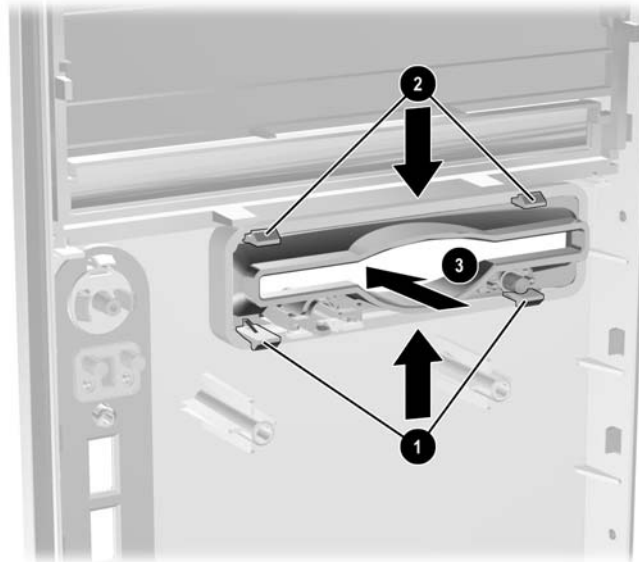
To install a bezel or a bezel blank, reverse the removal procedure.

6.8 Cable Management

Always follow good cable management practices when working inside the computer.

■ Keep cables away from major heat sources like the heatsink.

■ Do not jam cables on top of expansion cards or memory modules.Printed circuit cards like these are not designed to take excessive pressure on them.

■ Keep cables clear of sliding or moveable parts to prevent their being cut or crimped when the parts are moved.

■ When folding a flat ribbon cable, never fold to a sharp crease. Sharp creases may damage the wires.

■ Some flat ribbon cables come prefolded. Never change the folds on these cables.

■ Do not bend any cable sharply. A sharp bend can break the internal wires.

■ Never bend a SATA data cable tighter than a 30 mm (1.18 in) radius.

■ Never crease a SATA data cable.

■ Do not rely on components like the drive cage, power supply, or computer cover to push cables down into the chassis. Always position the cables to lay properly by themselves.

When removing the power supply power cables from the P1 or P3 connectors on the system board, always follow these steps:

1. Squeeze on the top of the retaining latch attached to the cable end of the connector ❶.

2. Grasp the cable end of the connector and pull it straight up ❷.

⚠ **CAUTION:** Always pull the connector - NEVER pull on the cable. Pulling on the cable could damage the cable and result in a failed power supply.

6.9 **Memory**

CAUTION: The memory module sockets have gold metal contacts. When upgrading the memory, it is important to use memory modules with gold metal contacts to prevent corrosion and/or oxidation resulting from having incompatible metals in contact with each other.

CAUTION: Static electricity can damage the electronic components of the computer or optional cards. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object. Refer to Chapter 5 for more information.

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

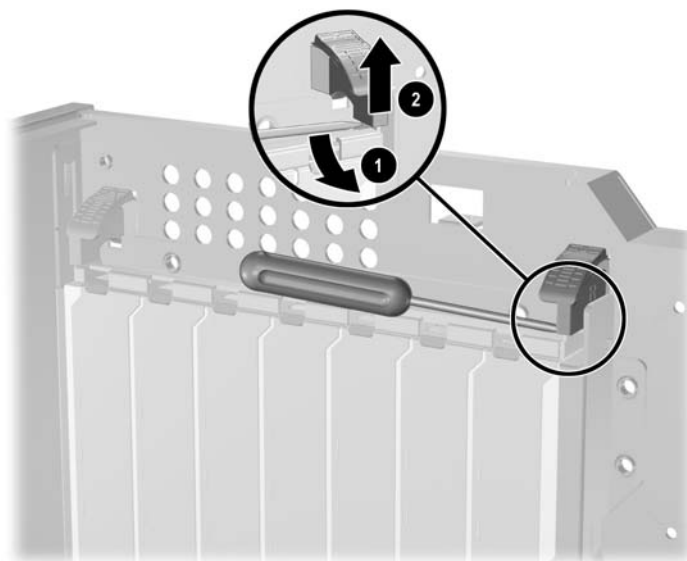1. If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock (Section 6.2).

2. Prepare the computer for disassembly (Section 6.1).

3. Remove the computer access panel (Section 6.5).

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

4. Open both latches of the memory module socket ❶, and insert the memory module into the socket ❷. Begin by installing a module into the socket nearest the preinstalled module, and install the modules following the numerical order of the sockets.
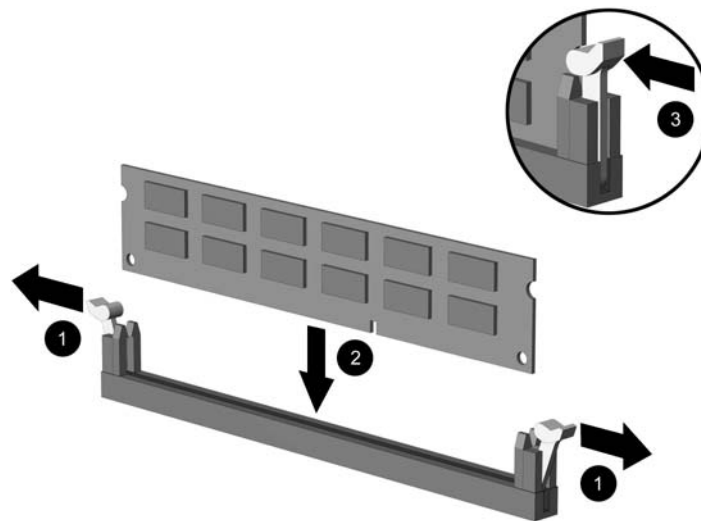
A memory module can be installed in only one way. Match the notch on the module with the tab on the memory socket.

5. Push the module down into the socket, ensuring that the module is fully inserted and properly seated. Make sure the latches are in the closed position ❸.

6. Repeat steps 4 and 5 for any additional modules that you want to install.

✎ The computer automatically recognizes the additional memory when the computer is turned on.

To reassemble the computer, reverse the removal procedure.

✎ If you normally lock the Smart Cover Lock, use Computer Setup to relock the lock and enable the Smart Cover Sensor.

6.10 Expansion Cards

1. If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock (Section 6.2).

2. Prepare the computer for disassembly (Section 6.1).

3. Remove the computer access panel (Section 6.5).

4. Locate the correct vacant expansion socket on the system board and the corresponding expansion slot on the back of the computer chassis.

5. Push down and out on the two green thumb tabs inside the chassis and rotate the expansion card retention latch up.
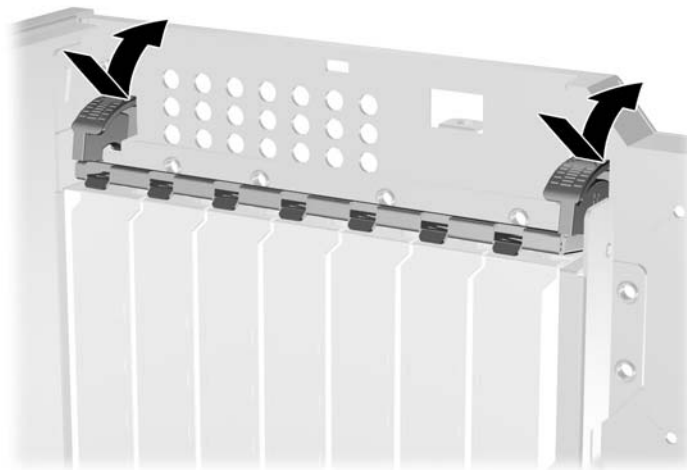
6. If you are installing an expansion card in a vacant socket, remove the appropriate expansion slot cover on the back of the chassis. Pull the slot cover straight up to release it from the chassis frame.
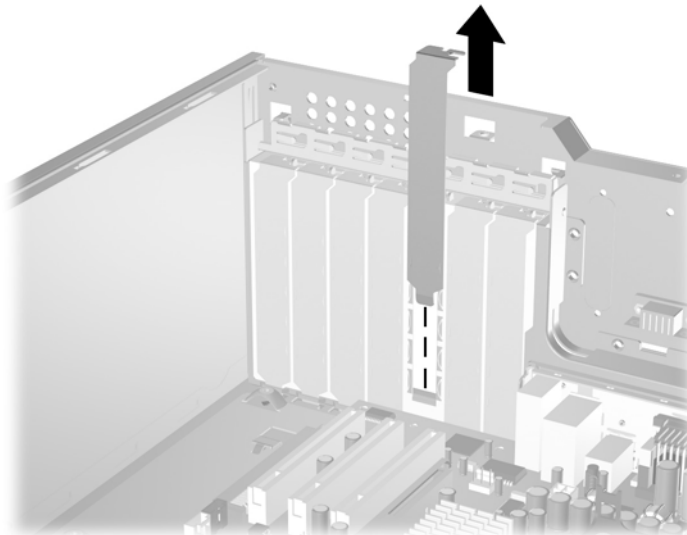
7. If you are removing an expansion card from a standard expansion socket, hold the card at each end and carefully rock it back and forth until the connectors pull free from the socket. Lift the expansion card straight up to release it from the chassis frame. Be sure not to scrape the card against other components.

✎ Before removing an installed expansion card, disconnect any cables that may be attached to the expansion card.
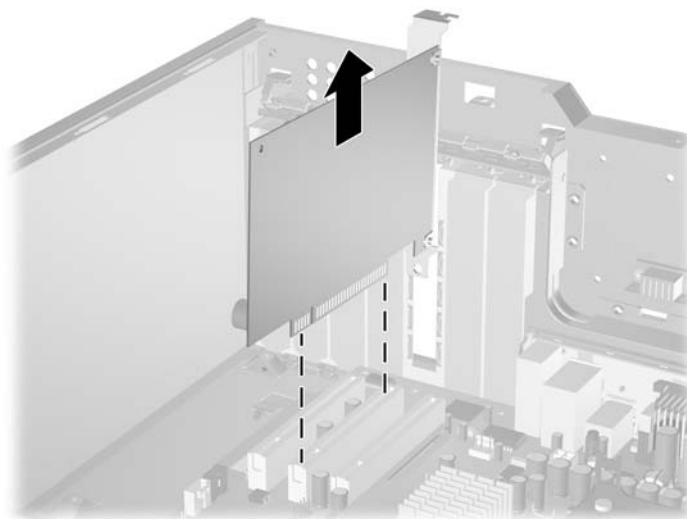
8. If you are removing a PCI Express card from a x16 PCI Express socket with a retention mechanism, pull the retention arm away from the socket then carefully rock the card back and forth until the connectors pull free from the socket. Lift the expansion card straight up then pull it in toward the center of the chassis to release it from the chassis frame. Be sure not to scrape the card against other components.
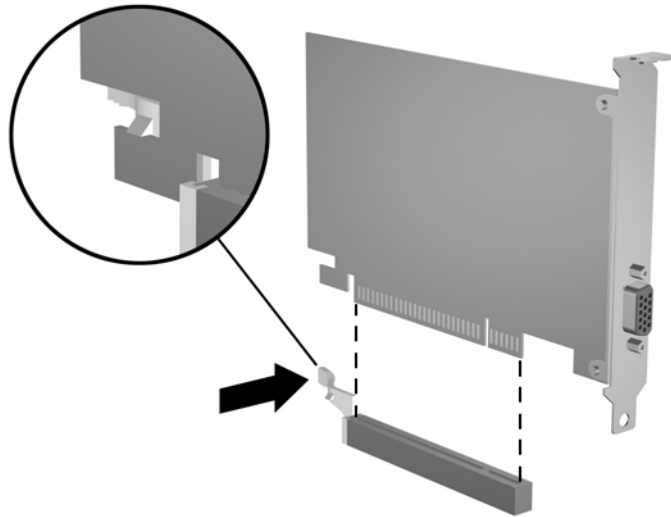
9. Store the removed card in anti-static packaging.

10. If you are not installing a new expansion card, install an expansion slot cover to close the open slot and continue with step 12.

   If you are installing a new expansion card, continue with step 11.

⚠ **CAUTION:** After removing an expansion card, you must replace it with a new card or cover the open slot (for example, with a metal slot cover or a piece of duct tape) for proper cooling of internal components during operation.

11. Slide the bracket on the end of the expansion card down into the slot on the back of the chassis and press the card down firmly into the socket on the system board.
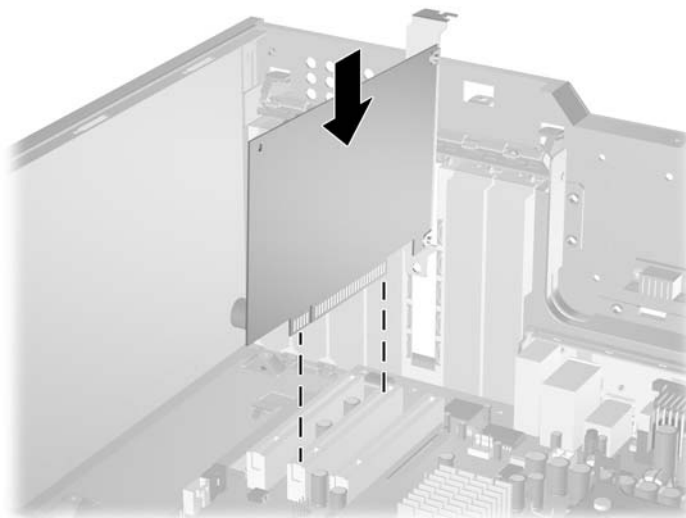
✎ When you install an expansion card, make sure you press firmly on the card so that the whole connector seats properly in the expansion card socket on the system board.

12. Close the expansion slot latch, making sure that it snaps firmly into place.

13. Connect external cables to the installed card and internal cables to the system board as needed.

14. Replace the computer access panel.

15. If you normally lock the Smart Cover Lock, use Computer Setup to relock the lock and enable the Smart Cover Sensor.

16. Reconfigure the computer, if necessary. Refer to the *Computer Setup (F10) Utility Guide* on the *Documentation Library* CD for instructions about using Computer Setup.

6.11 PCI Retainer Latch

If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock (Section 6.2).

1. Prepare the computer for disassembly (Section 6.1).

2. Remove the computer access panel (Section 6.5).

3. Locate the correct vacant expansion socket on the system board and the corresponding expansion slot on the back of the computer chassis.

4. Push down and out on the two green thumb tabs inside the chassis and rotate the expansion card retention latch up.
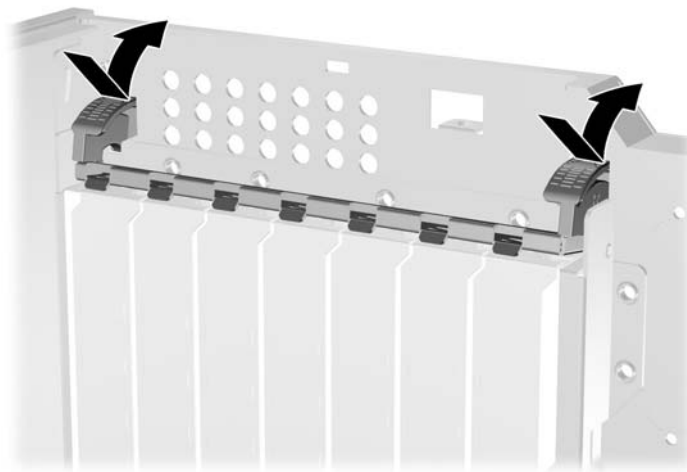
5. Use a thin flat blade screwdriver to pry up on the broken plastic latches ❶ then, complete the removal by pulling the latches off the pivoting bar ❷.

6. Slide the pivoting bar to the right ❶ then, lift the left end ❷ to remove it from the chassis. To replace the bar, slide it into the socket on the right ❶, lower it into position ❸, and slide it to the left ❹ to secure it in place.
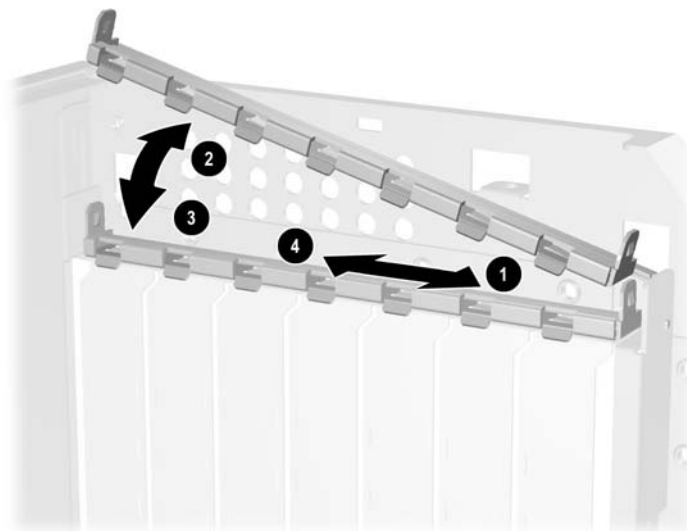
7. With the bar in a slightly rotated position, install the latches through the openings in the back of the chassis and press them firmly in place on the rotating bar.
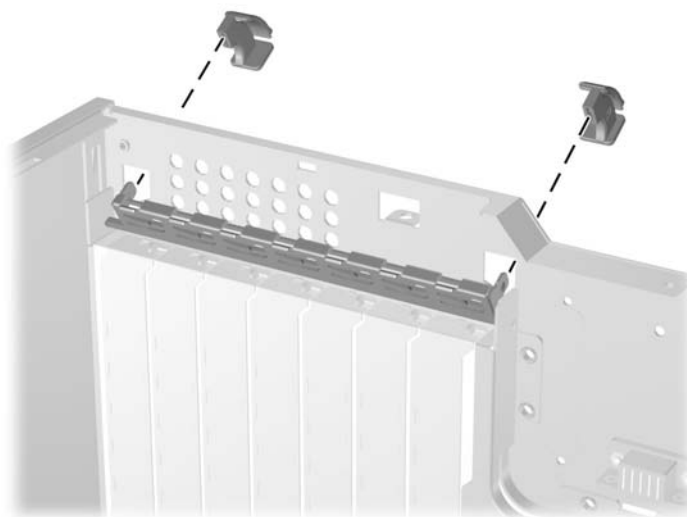
✎ The green latches are marked "R" and "L" for your convenience.

6.12 Expansion Card Guide

If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock (Section 6.2).

1. Prepare the computer for disassembly (Section 6.1).

2. Remove the computer access panel (Section 6.5).

3. Remove any expansion cards that might be in the way (Section 6.10).

4. Compress the retaining tabs that secure the card guide to the chassis and remove the guide from the chassis ❷.
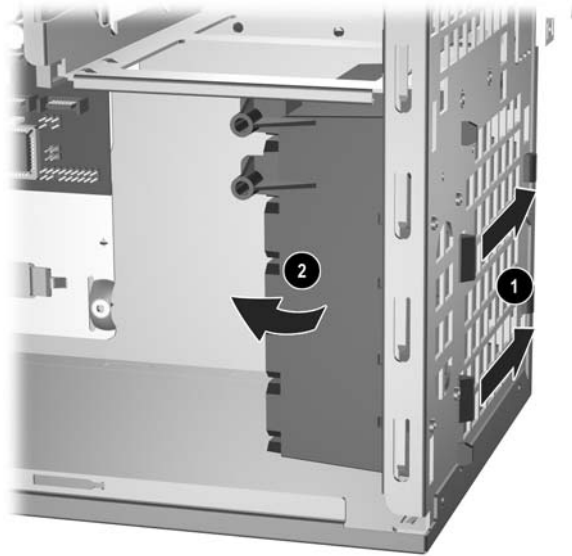
To install the expansion card guide, reverse the removal procedure.

6.13 Drives

The computer supports up to six drives that may be installed in various configurations.

This Section describes the procedure for replacing or upgrading the storage drives. A Torx T-15 screwdriver is needed to remove and install the guide screws on a drive.

⚠ **CAUTION:** Make sure personal files on the hard drive are backed up to an external storage device before removing the hard drive. Failure to do so will result in data loss. After replacing the primary hard drive, you will need to run the *Restore Plus!* CD to load the Compaq factory-installed files.

6.13.1 Drive Positions
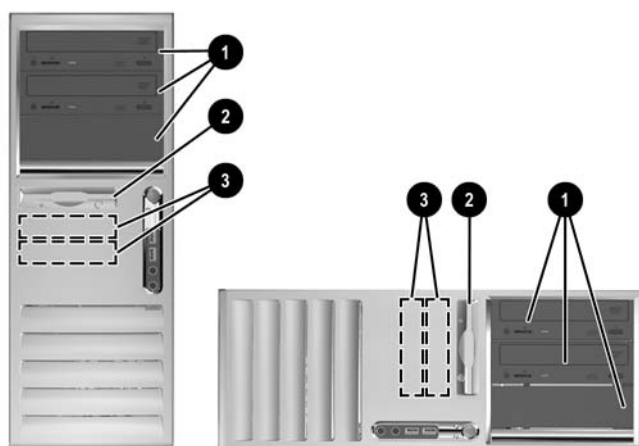
	Drive Positions		
Item	**Description**	**Item**	**Description**
❶	*Three 5.25-inch, half-height bays for optional drive.	❸	Two internal 3.5-inch, one-third height bay for hard drives)
❷	**One standard 3.5-inch, one-third height bay (1.44-MB diskette drive shown)*		

*The bottom 5.25-inch drive bay has a shorter depth than the upper two bays. The bottom bay supports a drive that is no more than 6.7 inches in depth, including the cables that attach to the back of the drive. Do not try to force a larger drive into the bottom bay as it could damage the drive and the system board.

**Depending on the computer configuration, you may have a bezel blank in this position. If you do not have a drive in this slot, you may choose to install a 3.5-inch device (such as a diskette drive, hard drive, or Zip drive).

To verify the type and size of the storage device installed in the computer, run Computer Setup.

6.13.2 Hard Drive

⚠️ **CAUTION:** To prevent loss of work and damage to the computer or drive:

- If you are inserting or removing a hard drive, shut down the operating system properly, then turn off the computer. Do not remove a hard drive while the computer is on or in standby mode.
- Before handling a drive, ensure that you are discharged of static electricity. While handling a drive, avoid touching the connector. For more information about preventing electrostatic damage, refer to Chapter 5 for more information
- Handle a drive carefully; do not drop it.
- Do not use excessive force when inserting a drive.
- Avoid exposing a hard drive to liquids, temperature extremes, or products that have magnetic fields such as monitors or speakers.

1. If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock (Section 6.2).

2. Prepare the computer for disassembly (Section 6.1).

3. Remove the computer access panel (Section 6.5).

4. Remove the front bezel (Section 6.6).

5. Disconnect the power ❶ and data ❷ cables from the back of the drive.
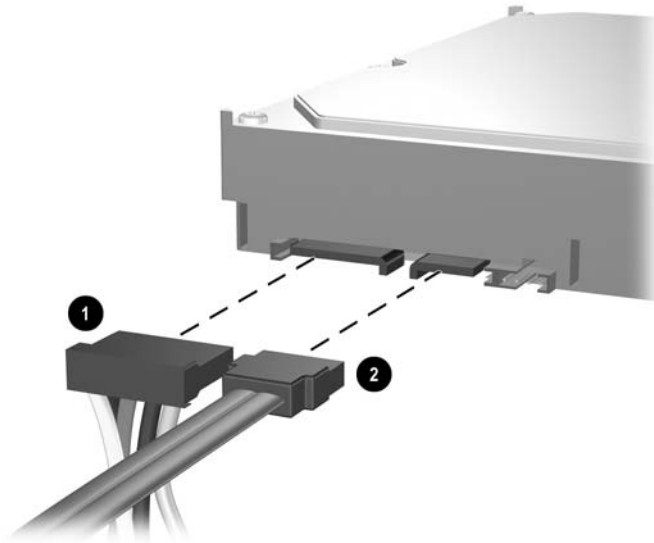
✎ Some hard drives use a right angle connection on the SATA drive data cable ❷.

6. Pull up on the green hard drive drivelock mechanism ❶ for that drive and slide the drive from the drive bay ❷.
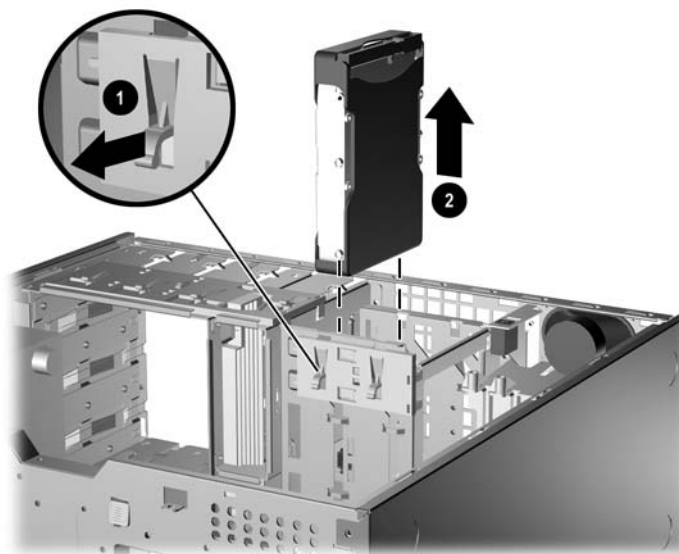
7. Remove the four guide screws (two on each side) from the old drive and install them in the replacement drive.

✎ Extra guide screws are provided on the chassis. Optical drives use M3 metric screws. The HP-supplied metric screws are black. The HP-supplied standard screws are silver.

8. Store the removed drive in anti-static packaging.

9. Install the new drive by sliding it into the appropriate drive bay on the front of the chassis. The drivelock automatically secures the drive in the bay.

6.13.3 Optical Drive

✎ An optical drive is a CD-ROM, CD-R/RW, DVD-ROM, DVD-R/RW, or CD-RW/DVD Combo drive. A removable storage drive is a diskette or Zip drive.

1. If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock (Section 6.2).

2. Prepare the computer for disassembly (Section 6.1).

3. Remove the computer access panel (Section 6.5).

4. Remove the front bezel (Section 6.6).

✎ If you are adding a drive in a bay that was previously empty, you must remove the corresponding bezel blank from the front bezel.

5. Disconnect the audio, power, and data cables on the back of the drive. Install four guide screws in the lower holes on each side of the drive.

⚠ **CAUTION:** When removing cables, pull the tab or connector instead of the cable itself to prevent damaging the cable.

6. If the computer is in the desktop mode, continue with step 7.

   If the computer is in the minitower mode, continue with step 8.

7. In the desktop mode, press down on the yellow drivelock mechanism ❶ and slide the drive from the drive bay ❷.
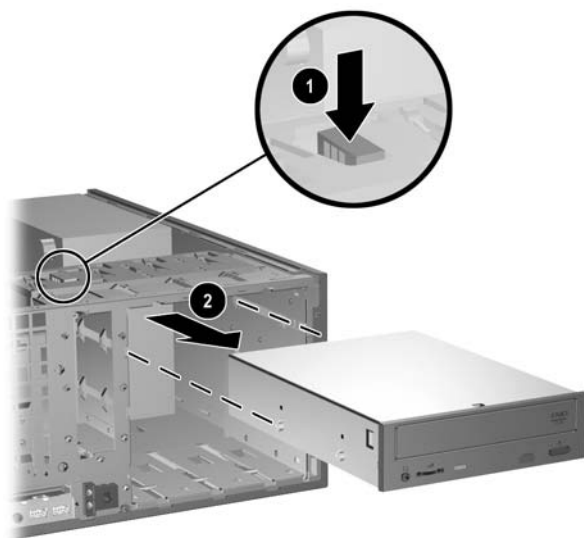
8. In the minitower mode, pull up on the green drivelock mechanism ❶ for that specific drive and slide the drive from the drive bay ❷.
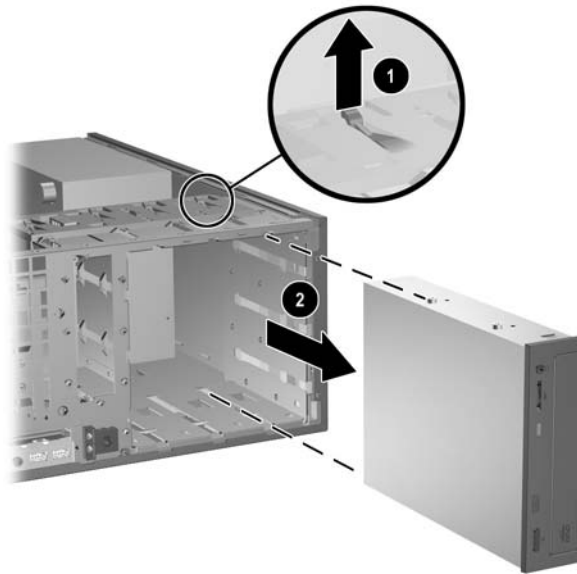
9. Remove the four guide screws (two on each side) from the old drive and install them in the lower set of holes on the optical drive.

✎ Extra guide screws are provided on the chassis on the side of the fourth drive bay. Optical drives use M3 metric screws. The HP-supplied metric screws are black. The HP-supplied standard screws are silver.

10. Install the drive by sliding it into the appropriate drive bay on the front of the chassis. The drivelock automatically secures the drive in the bay.

⚠ **CAUTION:** Make sure the guide screws line up with the guide slots in the drive cage. The use of unnecessary force when installing any drive into the drive bay may result in damage to the drive.
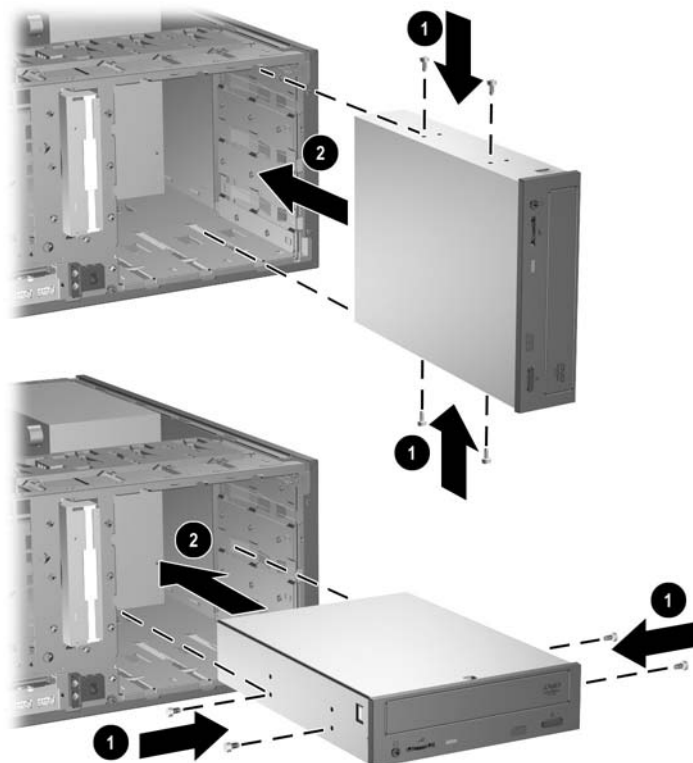
11. When installing an optical drive, the default audio solution is digital audio. No separate audio cable is required for Windows XP applications.

12. Connect the data and power cables on the to the drive.

✎ Refer to Chapter 4, "Serial and Parallel ATA Drive Guidelines and Features" for information on attaching the cabling to get optimum performance.

13. Replace the front bezel (Section 6.6).

14. Replace the computer access panel (Section 6.5)

15. If you normally lock the Smart Cover Lock, use Computer Setup to relock the lock and enable the Smart Cover Sensor (Section 6.2).

6.13.4 Diskette Drive

1. If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock (Section 6.2).

2. Prepare the computer for disassembly (Section 6.1).

3. Remove the computer access panel (Section 6.5).

4. Remove the front bezel (Section 6.6).

5. Pull up on the green hard drive drivelock mechanism ❶ and slide the drive from the bay.
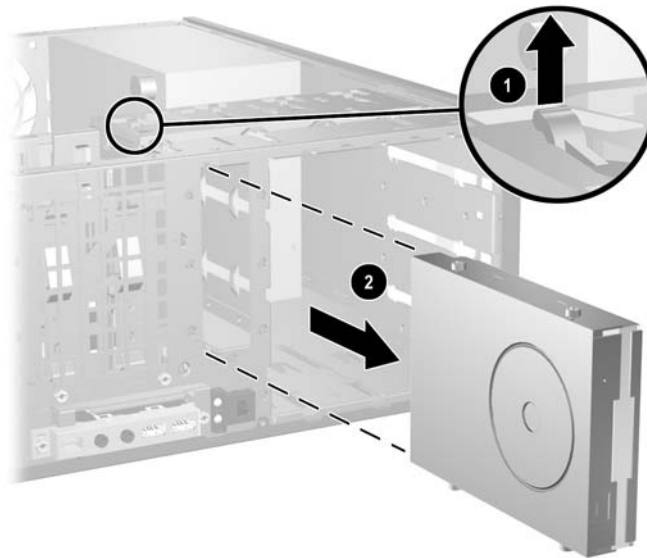
6. Remove the four guide screws (two on each side) from the old drive and install them in the replacement drive. Install four guide screws, two on each side of the drive.

✎ Extra guide screws are provided on the side of the drive bay under the access panel. The diskette drive use M3 metric screws. The HP-supplied metric screws are black. The HP-supplied standard screws are silver.

7. Insert the diskette drive into the bay from the front of the chassis. Push it in until it locks into place.

⚠ **CAUTION:** Make sure the guide screws line up with the guide slots in the drive cage. The use of unnecesary force when installing any drive into the drive bay may result in damage to the drive.

8. Connect the data and power cables to the drive.

9. Replace the front bezel (Section 6.6).

10. Replace the computer access panel (Section 6.5)

11. If you normally lock the Smart Cover Lock, use Computer Setup to relock the lock and enable the Smart Cover Sensor (Section 6.2).

6.14 Front I/O Device

1. Prepare the computer for disassembly (Section 6.1).

2. Remove the computer access panel (Section 6.5).

3. Disconnect the two I/O device cables from the system board: the front USB cable pair and the front audio cable.

4. Remove the two screws that secure the front I/O device to the mounting bracket ❶.

5. Remove the two screws that secure the mounting bracket to the chassis ❷.

6. Lift the mounting bracket off the chassis ❸.
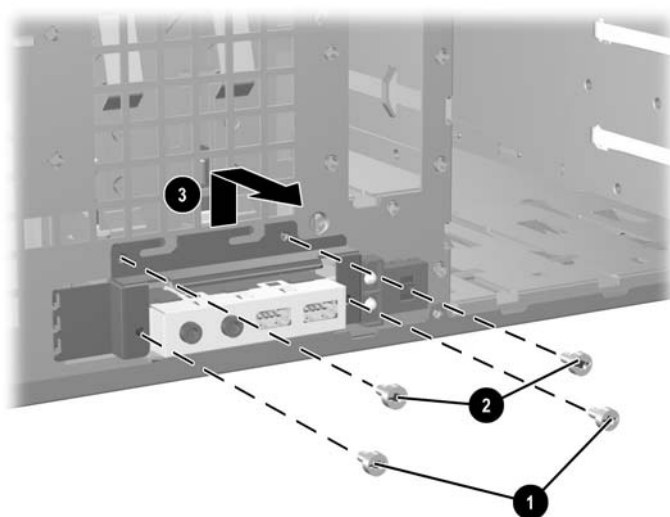
7. Carefully pull the cables from the front of the chassis making sure that they do not snag on the lower drive cage.

To reinstall the I/O device:

1. Thread the cables through the opening and down the space in front of the lower drive cage. This step may be easier if you thread a single cable at a time through the opening.

⚠ **CAUTION:** Be careful when threading the cables in the chassis so the cable ends are not damaged.

2. Position the I/O device and the mounting bracket on the front of the chassis and install the two screws that secure the bracket to the chassis.

3. Install the two screws that secure the I/O device to the mounting bracket.

Complete the reassembly by reinstalling the other parts that had been removed.

6.15 Power Switch Assembly

1. Prepare the computer for disassembly (Section 6.1).

2. Remove the computer access panel (Section 6.5).

3. Disconnect the power switch/LED cable from the system board.

4. Squeeze the switch holder retaining clips together at the front of the chassis ❶ and pull the switch assembly out of the chassis ❷.
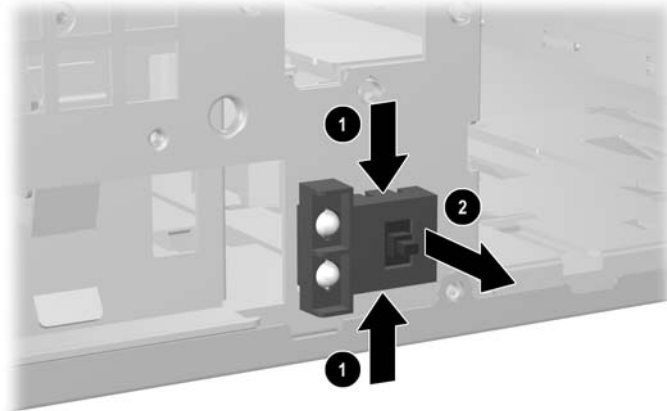
To install the power switch assembly, reverse the removal procedure.

✎ When installing the power switch cable it may be necessary to disconnect a data cabe from one of the drives to make it easier to grab the free end of the cable.

6.16 System Board

1. Prepare the computer for disassembly (Section 6.1).

2. Remove the computer access panel (Section 6.5).

3. Remove all PCI expansion boards (Section 6.10).

4. Remove the x16 PCI Express graphics card (Section 6.10).

5. Disconnect all cables connected to the system board, noting their location for reinstallation.

6. Compress the system board tray handle ❶ to release the latch and slide the system board tray towards the front of the computer ❷ to free it from the back of the chassis.
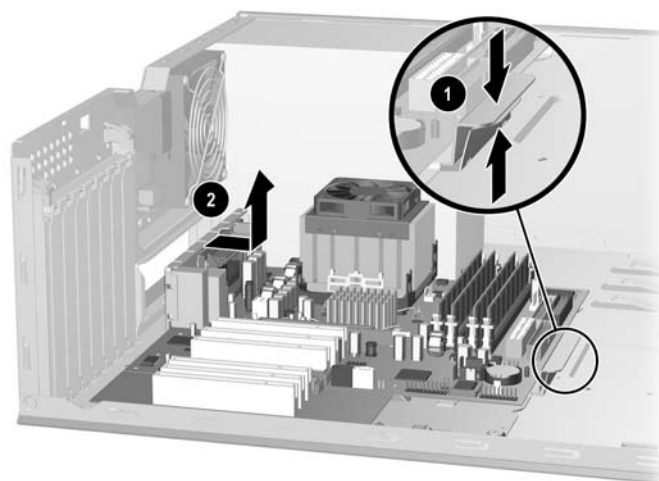
To install the system board with its tray, press down on the board to ensure its latching ❶ and then, push the board into its locked position ❷.
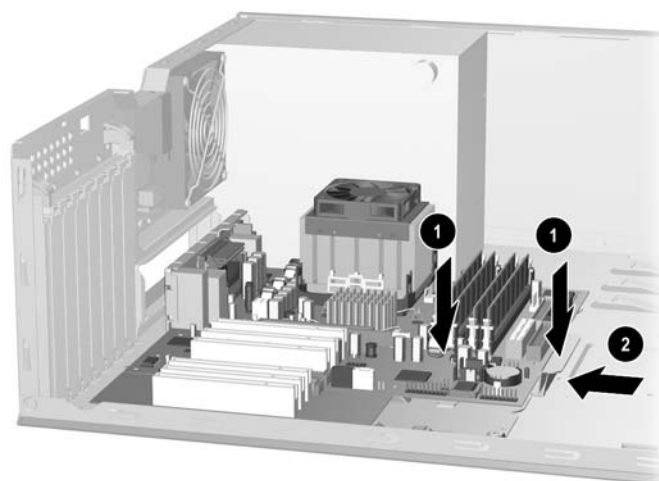
6.17 Battery

The 3-volt lithium coin cell battery that comes with this computer provides power to the real-time clock and has a lifetime of about three years. When replacing the battery, use a battery equivalent to the battery originally installed on the computer.

✎ The lifetime of the lithium battery can be extended by plugging the computer into a live AC wall socket. The lithium battery is only used when the computer is NOT connected to AC power.

⚠ **WARNING:** This computer contains an internal lithium manganese dioxide battery. There is a risk of fire and burns if the battery 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 140°F (60°C)
- Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.
- Replace the battery only with the HP/Compaq spare designated for this product.

⚠ **CAUTION:** Before replacing the battery, it is important to back up the computer CMOS settings. When the battery is removed or replaced, the CMOS settings will be cleared. Refer to the *Troubleshooting Guide* for information on backing up the CMOS settings.

🗑 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 HP/Compaq, their authorized partners, or their agents.

⚠ **CAUTION:** Static electricity can damage the electronic components of the computer or optional equipment. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

1. Prepare the computer for disassembly (Section 6.1).

2. Remove the computer access panel (Section 6.5).

✎ It may be necessary to remove an expansion card to gain access to the battery.

3. Locate the battery and battery holder on the system board.

4. Depending on the type of battery holder on your system board, complete the following instructions to replace the battery:

6.17.1 Type 1 Battery Holder
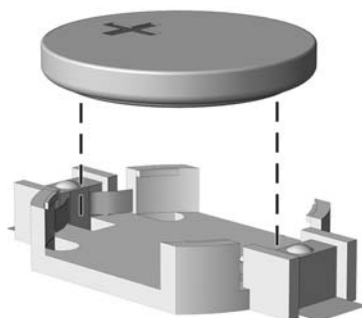
1. Lift the battery out of its holder.

2. Slide the replacement battery into position, positive side up.

3. The battery holder automatically secures the battery in the proper position.

4. Replace the computer cover or access panel.

5. Plug in the computer and turn on power to the computer.

6. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide.*

6.17.2 Type 2 Battery Holder

1. To release the battery from its holder, squeeze the metal clamp ❶ that extends above one edge of the battery. When the battery pops up, lift it out.

2. To insert the new battery, slide one edge of the replacement battery under the holder's lip with the positive side up ❷. Push the other edge down until the clamp snaps over the other edge of the battery.
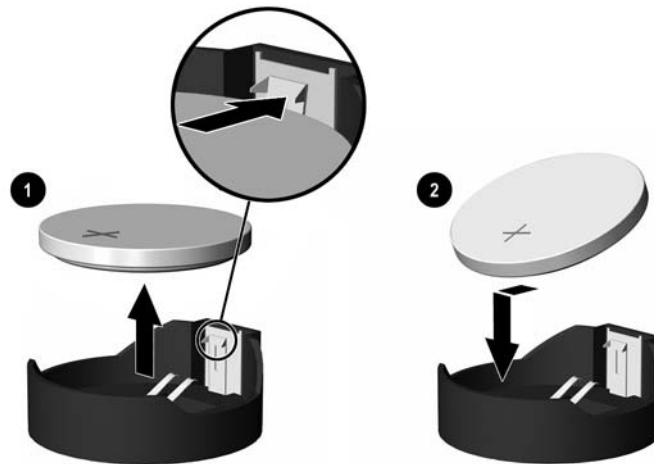
✎ After the battery has been replaced, use the following steps to complete this procedure.

3. Replace the computer access panel.

4. Plug in the computer and turn on power to the computer.

Reset the date and time, your passwords, and any special system setups, using Computer Setup.

6.18 Heatsink

1. Prepare the computer for disassembly (Section 6.1, "Preparation for Disassembly").

2. Remove the computer access panel (Section 6.5).

3. Disconnect the heatsink control cable from the system board.

4. Uncrew the four captive screws ❶ that secure the heatsink to the system board.

⚠ **CAUTION:** Heatsink retaining screws should be removed in diagonally opposite pairs (as in an X) to even the downward forces on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

5. Remove the heatsink ❷ from atop the processor.
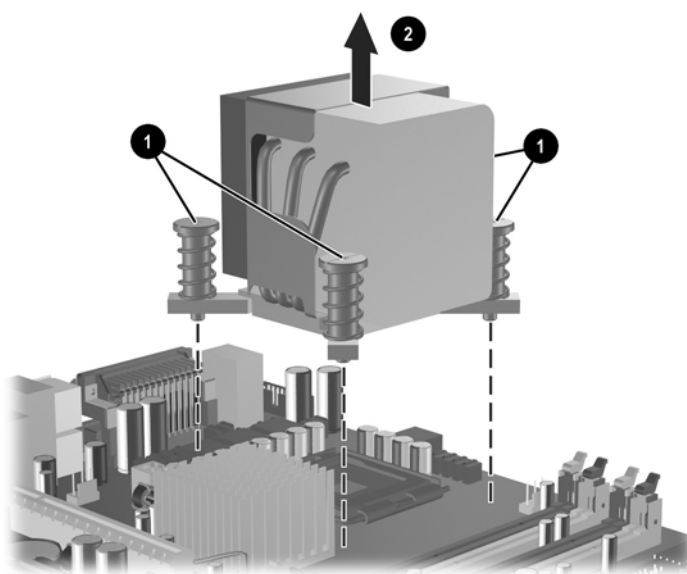
When reinstalling the heatsink, make sure that its bottom has been cleaned with an alcohol wipe and fresh thermal grease has been applied to the top of the processor.

⚠ **CAUTION:** Heatsink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heatsink on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

6.19 **Processor**

1. Prepare the computer for disassembly (Section 6.1, "Preparation for Disassembly").

2. Remove the computer access panel (Section 6.5, "Computer Access Panel").

3. Disconnect the heatsink control cable from the system board and remove the heatsink Section 6.18, "Heatsink".

4. Rotate the locking lever to its full open position ❶.

5. Raise and rotate the microprocessor retainer to its fully open position ❷.

6. Carefully lift the processor from the socket ❸.

⚠ **CAUTION:** Do NOT handle the pins in the processor socket. These pins are very fragile and handling them could cause irreparable damage. Once pins are damaged it may be necessary to replace the system board.

⚠ **CAUTION:** The heatsink must be installed within 24 hours of installing the processor to prevent damage to the processor's solder connections.

To install a new processor:

1. Place the processor in its socket and close the retainer.

2. Secure the locking lever.

If reusing the existing heatsink, go to step 3.

If using a new heatsink, go to step 5.

3. If reusing the existing heatsink, apply the thermal grease provided in the spares kit to the top of the processor.

4. Clean the bottom of the heatsink with the provided alcohol pad and place it atop the processor.

Go to step 5.

5. If using a new heatsink, remove the protective covering from the bottom of the heatsink and place it in position atop the processor.

6. Secure the heatsink to the system board and system board tray with the 4 captive screws and attach the heatsink control cable to the system board.

⚠ **CAUTION:** Heatsink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heatsink on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

✎ After installing a new processor onto the system board, always update the system ROM to ensure that the latest version of the BIOS is being used on the computer. The latest system ROMPaq can be found on the Web at: http:\\h18000.www1.hp.com/support/files.

6.20 Speaker

1. Prepare the computer for disassembly (Section 6.1).

2. Remove the computer access panel (Section 6.5).

3. Disconnect the speaker wire from the system board.

4. Remove the four screws from the inside of the chassis ❶ that secure the speaker to the chassis.

5. Remove the speaker ❷.
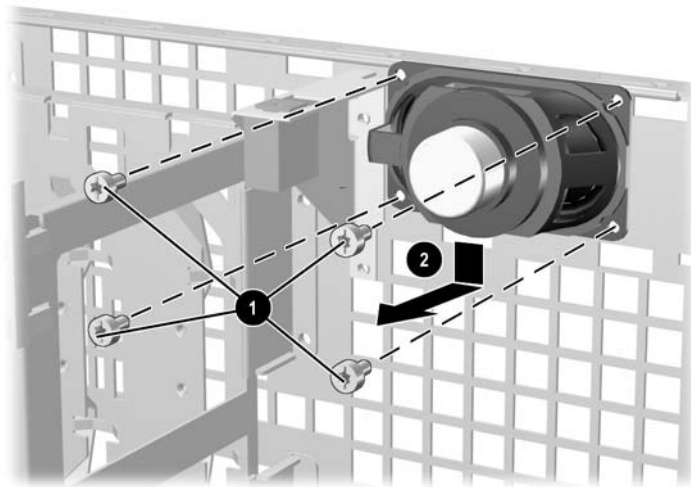
To install the speaker, reverse the removal procedures.

6.21 Chassis Fan

1. Prepare the computer for disassembly (Section 6.1).

2. Remove the computer access panel (Section 6.5).

3. Disconnect the fan control cable from the system board.

4. Remove the four screws that secure the fan assembly to the chassis ❶ and then remove the fan assembly ❷.
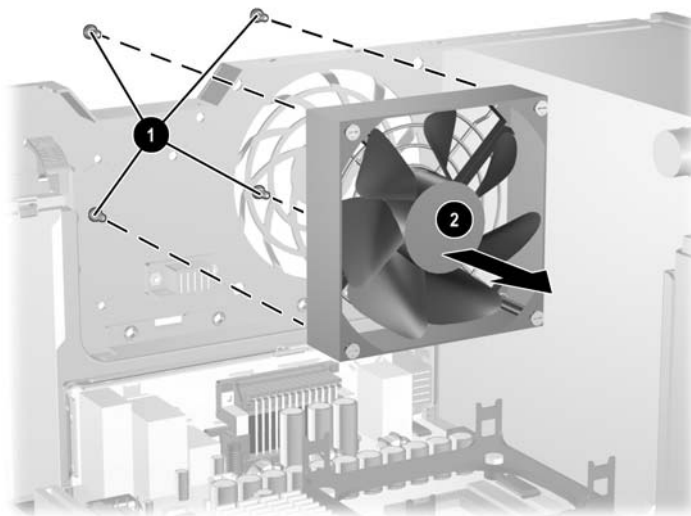
To install the fan assembly, reverse the removal procedure.

6.22 Power Supply

⚠ **WARNING:** Voltage is always present on the system board when the computer is plugged into an active AC outlet. To avoid possible personal injury and damage to the equipment the power cord should be disconnected from the computer and/or the AC outlet before opening the computer.

1. Prepare the computer for disassembly (Section 6.1).

1. Remove the computer access panel (Section 6.5).

2. Disconnect all power cables from the mass storage devices and from the system board.

3. Remove the four screws that connect the power supply to the chassis ❶.

4. Slide the power supply toward the front of the computer, then lift it out of the computer ❷.
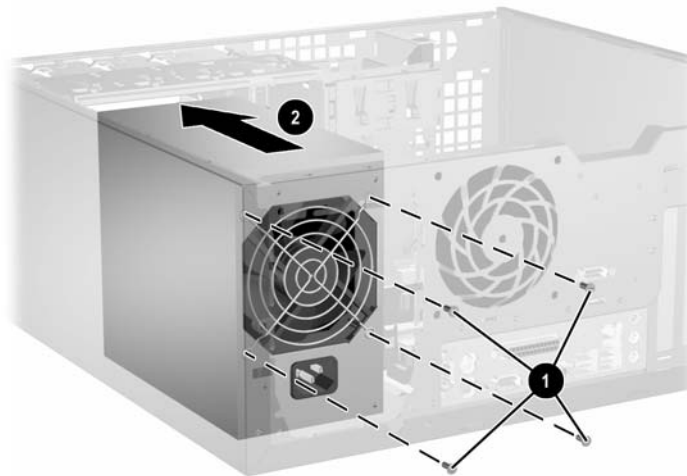
To install the power supply, reverse the removal procedure.

6.23 Changing from Desktop to Minitower

1. If you have locked the Smart Cover Lock, use Computer Setup to unlock it.

2. Prepare the computer for disassembly (Section 6.1).

3. Remove the computer access panel (Section 6.5).

4. Remove the front bezel (Section 6.6).

5. Disconnect all power and data cables from the back of the drives in the 5.25-inch drive bays.

6. To release the drives from the 5.25-inch drive bay, press down on the short yellow drivelock as shown. While pressing the drivelock, pull the drives out of the drive bay.
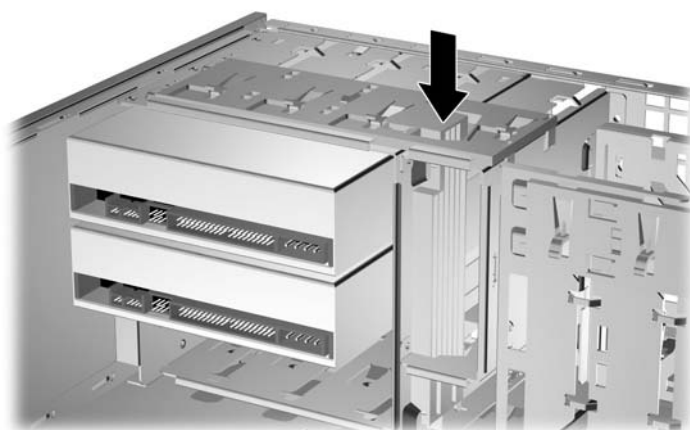
7. Before you reinstall each drive into the chassis, turn it so that it is in the same orientation as the internal 3.5-inch drive. The bottom of the drive should be parallel to the yellow drivelock.

8. Slide the drive into the uppermost available bay until it snaps into place. When the drive is properly inserted, the drivelock will secure it. Repeat this step for each drive.

⚠ **CAUTION:** The bottom 5.25-inch drive bay has a shorter depth than the upper two bays. The bottom bay supports a drive that is no more than 6.7 inches in depth, including the cables that attach to the back of the drive. Do not try to force a larger drive, such as an optical drive or MultiBay drive, into the bottom bay. This could cause damage to the drive and the system board.

The use of unnecessary force when installing any drive into the drive bay may result in damage to the drive.

9. Reconnect all power and data cables to the drives in the 5.25-inch drive bays.

10. Remove the bezel subpanel (Section 6.23).

⚠ **CAUTION:** Hold the subpanel straight when you pull it away from the front bezel. Pulling the subpanel away at an angle could damage the pins that align it within the front bezel.

11. Reposition the bezel blanks within the subpanel in the proper orientation for the desktop configuration.

12. Reposition the subpanel (rotate it 90°) with the logo at the bottom, then snap it back into the bezel.
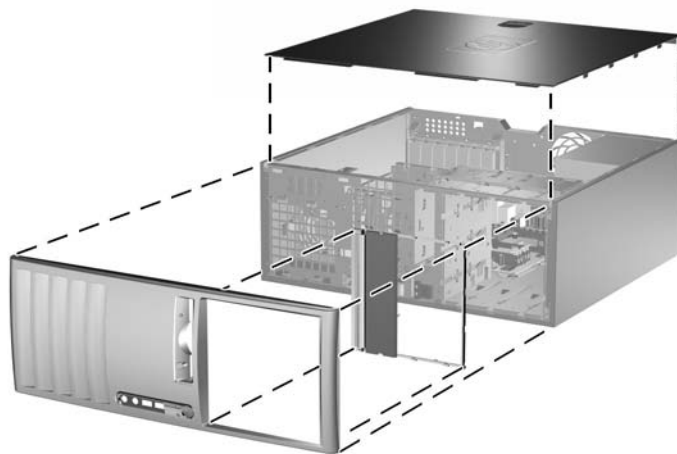
6.24 Changing from Minitower to Desktop

1. If you have locked the Smart Cover Lock, use Computer Setup to unlock it.

2. Prepare the computer for disassembly (Section 6.1).

3. Remove the computer access panel (Section 6.5).

4. Remove the front bezel (Section 6.6).

5. Disconnect all power and data cables from the back of the drives in the 5.25-inch drive bays.

6. To release the drives from the 5.25-inch drive bay, lift the release tab on the green latch drive bracket for the drive. While lifting the release tab, slide the drive from its drive bay. Repeat this step for each 5.25-inch drive.
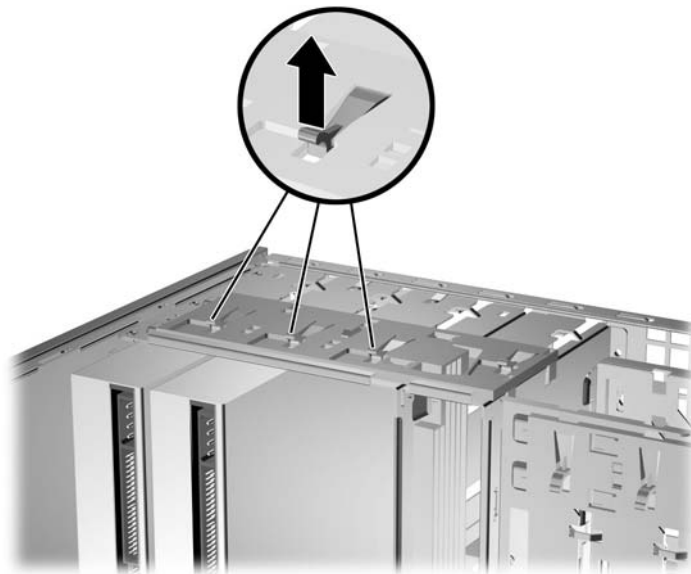
7. Before reinstalling each drive into the chassis, turn the drive so that it is perpendicular to the internal 3.5-inch drive. The drive should be parallel to the green latch drive bracket.

8. Slide the drive into the uppermost available bay until it snaps into place. When the drive is properly inserted, the drivelock will secure it. Repeat this step for each drive.

⚠ **CAUTION:** The bottom 5.25-inch drive bay has a shorter depth than the upper two bays. The bottom bay supports a drive that is no more than 6.7 inches in depth, including the cables that attach to the back of the drive. Do not try to force a larger drive, such as an optical drive or MultiBay drive, into the bottom bay. This could cause damage to the drive and the system board.

The use of unnecessary force when installing any drive into the drive bay may result in damage to the drive.

9. Reconnect all power and data cables to the drives in the 5.25-inch drive bays.

10. Remove the bezel subpanel (Section 6.7).

⚠ **CAUTION:** Hold the subpanel straight when you pull it away from the front bezel. Pulling the subpanel away at an angle could damage the pins that align it within the front bezel.

11. Reposition the bezel blanks within the subpanel in the proper orientation for the desktop configuration.

12. Reposition the subpanel (rotate it 90°) with the logo at the bottom, then snap it back into the bezel.
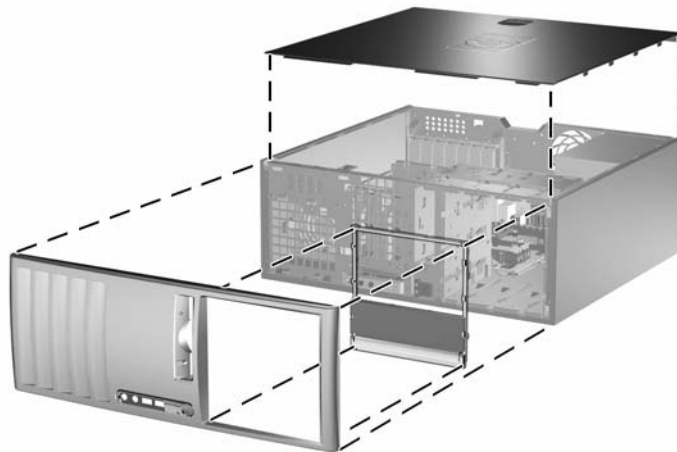
13. Replace the front bezel and computer access panel.

14. Reconnect the external equipment.

15. If you normally lock the Smart Cover Lock, use Computer Setup to relock the lock and enable the Smart Cover Sensor.

7

Removal and Replacement Procedures—
Small Form Factor (SFF) Chassis

Adherence to the procedures and precautions described in this chapter is essential for proper service. After completing all necessary removal and replacement procedures, run the Diagnostics utility to verify that all components operate properly.

✎ Not all features listed in this guide are available on all computers.

7.1 Preparation for Disassembly

See Chapter 5, "Identifying the Chassis, Routine Care, and Disassembly Preparation" for initial safety procedures.

1. Remove/disengage any security devices that prohibit opening the computer (Section 7.2, "Unlocking the Smart Cover Lock," and Section 7.4, "External Security Devices").

2. Close any open software applications.

3. Exit the operating system.

4. Remove any diskette, compact disc, or MultiBay device from the computer.

5. Turn off the computer and any peripheral devices that are connected to it.

⚠ **CAUTION:** Turn off the computer before disconnecting any cables.

⚠ **CAUTION:** Regardless of the power-on state, voltage is always present on the system board as long as the system is plugged into an active AC outlet. In some systems the cooling fan is on even when the computer is in the "Standby," or "Suspend" modes. The power cord should always be disconnected before servicing a unit.

6. Disconnect the power cord from the electrical outlet and then from the computer.

7. Disconnect all peripheral device cables from the computer.

✎ During disassembly, label each cable as you remove it, noting its position and routing. Keep all screws with the units removed.

⚠ **CAUTION:** The screws used in the computer are of different thread sizes and lengths; using the wrong screw in an application may damage the unit.

7.2 Unlocking the Smart Cover Lock

If you have locked the Smart Cover Lock use Computer Setup to unlock the lock. Refer to the *Desktop Management Guide* on the *Documentation Library* CD for more information about the Smart Cover Lock.

If you cannot access Computer Setup to unlock the cover you will need to remove the locking solenoid by using the Smart Cover FailSafe Key (Spare part number 166527-001 or 166527-002). Once the solenoid has been deactivated or removed the access panel can be removed.

The Smart Cover FailSafe Key will be needed in any of the following circumstances:

■ Power outage

■ Startup failure

■ Processor or power supply failure

■ Lost password

1. Using the Smart Cover FailSafe Key, remove the tamper-proof screw that secures the Smart Cover Lock to the inside of the chassis.

2. Remove the computer cover (Section 7.5, "Computer Cover").

To reattach the Smart Cover Lock, position the lock with the tamper-proof screw.
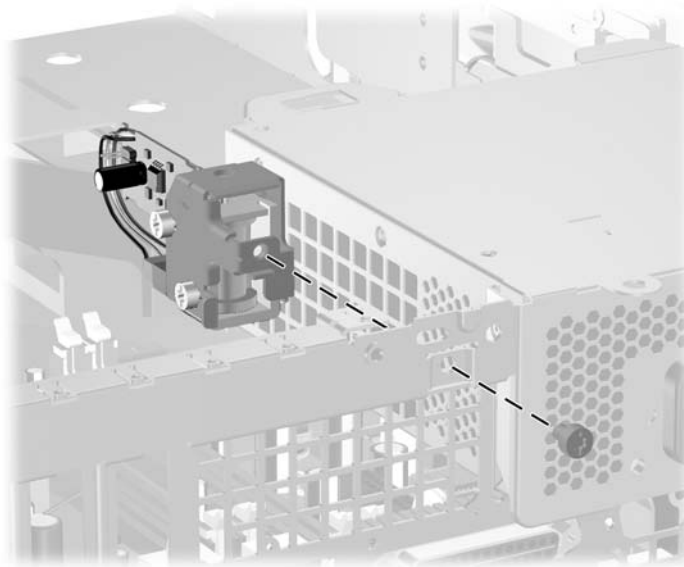
7.3   Hood Sensor

1. Prepare the computer for disassembly.

2. Remove the computer cover.

3. Raise the power supply to its full upright position.

4. Disconnect the hood sensor cable from the system board.

5. Slide the hood sensor switch mounted on the power supply towards the outside of the computer ❶ and lower it through the slot ❷.
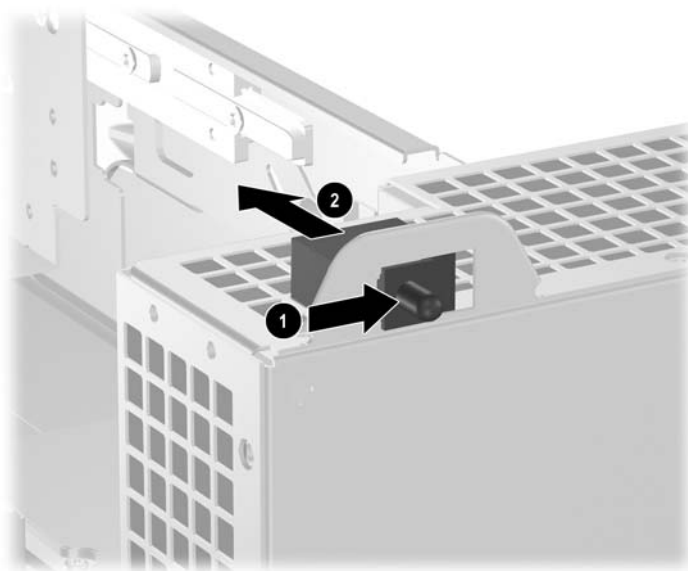
To install the hood sensor, reverse the removal procedure.

7.4 External Security Devices

7.4.1 Security Clip

A special clip is required to secure the computer from intrusion. This clip must be installed before installing the computer cover.
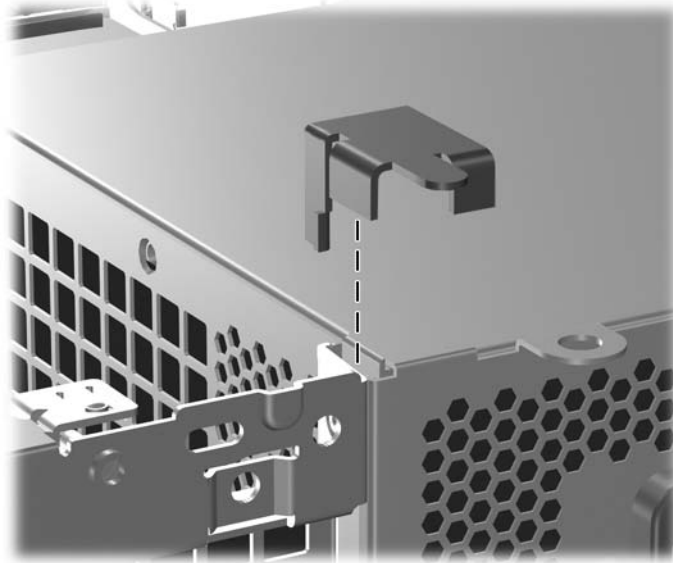
7.4.2 Cable Lock

The cable lock may be used to secure the computer cover to the chassis and, at the same time, secure the computer to a fixed object.

Insert the cable lock in the location shown below.

7.4.3 Padlock

A padlock may be used by itself to secure the computer cover to the computer chassis. A padlock may also be used with a security cable to secure the computer to a fixed object.

7.4.4 Universal Chassis Clamp Lock

Without Security Cable

1. Thread the keyboard and mouse cables through the lock.

2. Screw the lock to the chassis using the screw provided.

3. Insert the plug into the lock ❶ and push the button in ❷ to engage the lock. Use the key provided to disengage the lock.
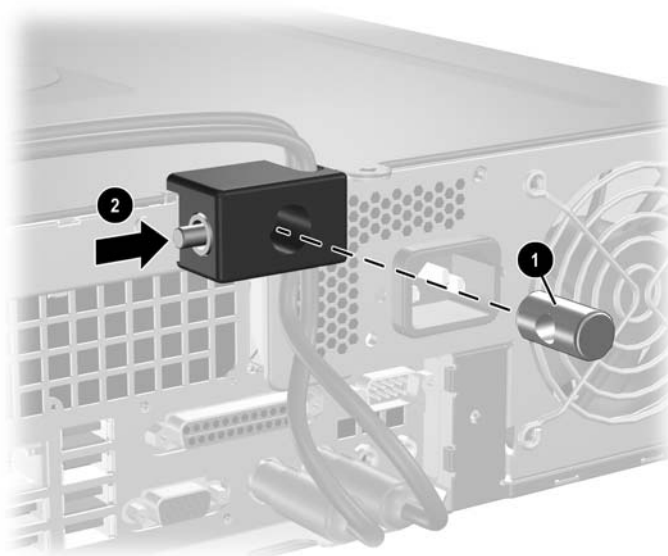
With Security Cable

1. Fasten the cable by looping it around a stationary object.

2. Thread the keyboard and mouse cables through the lock.

3. Screw the lock to the chassis using the screw provided.

4. Insert the plug end of the security cable into the lock ❶ and push the button in ❷ to engage the lock. Use the key provided to disengage the lock.
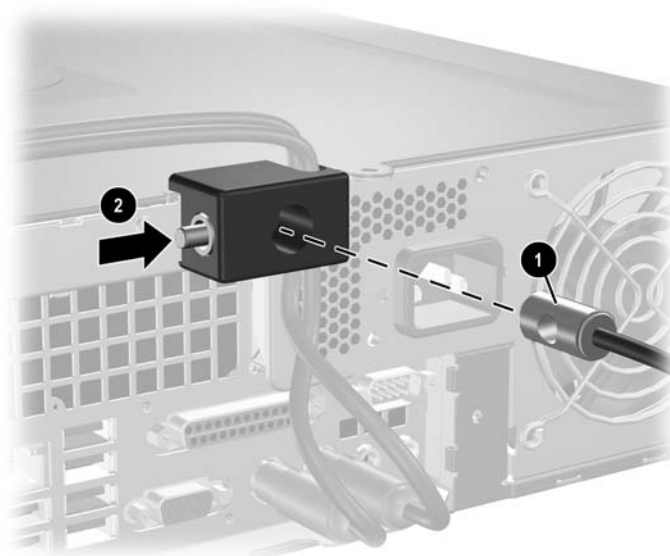
7.5 Computer Cover

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

⚠ **CAUTION:** Before removing the computer cover, ensure that the computer is turned off and that the power cord is disconnected from the electrical outlet.

1. Press the buttons on the left and right sides of the computer ❶.

2. Slide the computer cover towards the front of the computer until it stops ❷ then, lift it up and off the chassis.
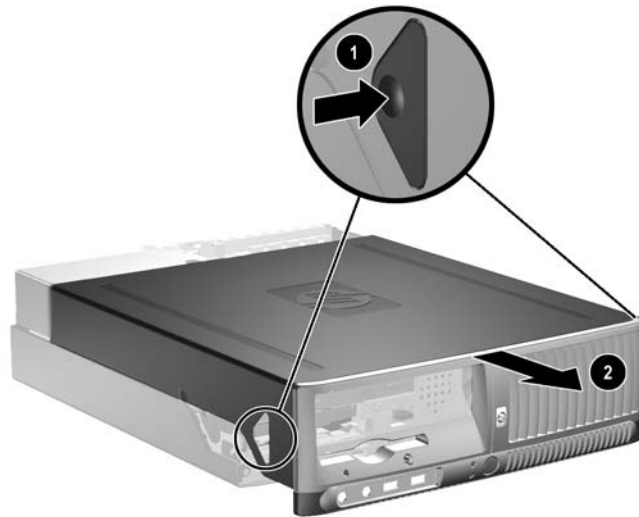
To install the computer cover, reverse the removal procedure.

7.6 Front Drive Bezels

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer cover (Section 7.5, "Computer Cover").

3. Remove the drive bezel by pushing the top tab on the right side of the larger front bezel as shown ❶ and rotating the drive bezel away from the larger front bezel ❷.

✎ The drive bezel will vary depending on the computer configuration.
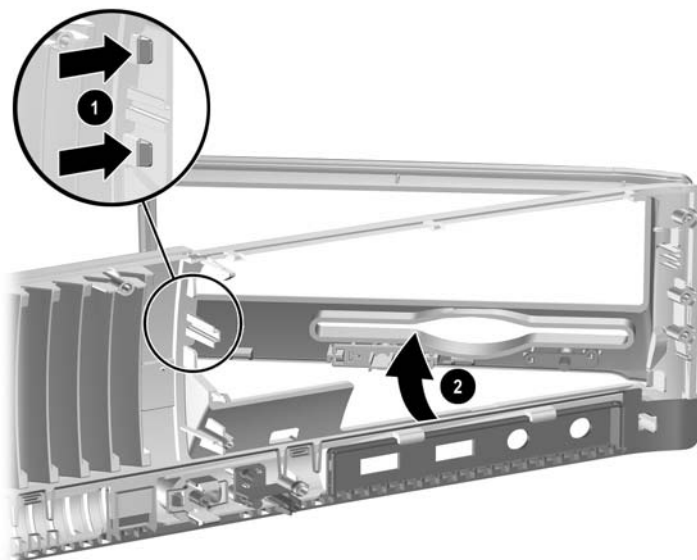
4. Install a bezel or a bezel blank by pushing the bezel into place.

There are three drive bezel inserts that are available.
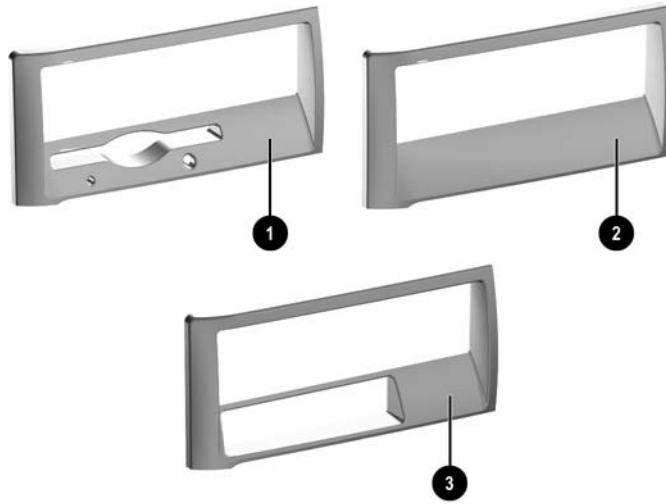
Item	Description
❶	Diskette drive bezel
❷	Hard drive bezel
❸	3.5" drive bezel

7.7   **Cable Management**

The Slim Tower chassis is a very compact computer and proper routing of the internal cables is critical to the operation of the computer. Follow good cable management practices when working inside the computer.

■   Keep cables away from major heat sources like the heatsink.

■   Do not jam cables on top of expansion cards or memory modules.Printed circuit cards like these are not designed to take excessive pressure on them.

■   Keep cables clear of sliding parts like the drive cage to prevent their being cut when the drive cage is being seated.

■   Keep cables clear of rotating parts like the power supply to prevent their being cut or crimped when the power supply is lowered.

■   When folding a flat ribbon cable, never fold to a sharp crease. Sharp creases may damage the wires.

■   Some flat ribbon cables come prefolded. Never change the folds on these cables.

■   Do not bend any cable sharply. A sharp bend can break the internal wires.

■   Never bend a SATA data cable tighter than a 30 mm (1.18 in) radius.

■   Never crease a SATA data cable.

■   Do not rely on components like the drive cage, power supply, or computer cover to push cables down into the chassis. Always position the cables to lay properly by themselves.

When removing the power supply power cables from the P1 or P3 connectors on the system board, always follow these steps:

1. Squeeze on the top of the retaining latch attached to the cable end of the connector ❶.

2. Grasp the cable end of the connector and pull it straight up ❷.

⚠ **CAUTION:** Always pull the connector - NEVER pull on the cable. Pulling on the cable could damage the cable and result in a failed power supply.

7.8 **Memory**

⚠ **CAUTION:** The memory module sockets have gold metal contacts. When upgrading the memory, it is important to use memory modules with gold metal contacts to prevent corrosion and/or oxidation resulting from having incompatible metals in contact with each other.

⚠ **CAUTION:** Static electricity can damage the electronic components of the computer or optional cards. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object. Refer to Chapter 5, "Identifying the Chassis, Routine Care, and Disassembly Preparation," for more information.

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

1. If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock (Section 7.2, "Unlocking the Smart Cover Lock").

2. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

3. Remove the computer cover (Section 7.5, "Computer Cover").

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

4. Open both latches of the memory module socket ❶, and insert the memory module into the socket ❷. Refer to Appendix F for the correct sequence for installing memory modules to get optimal performance.
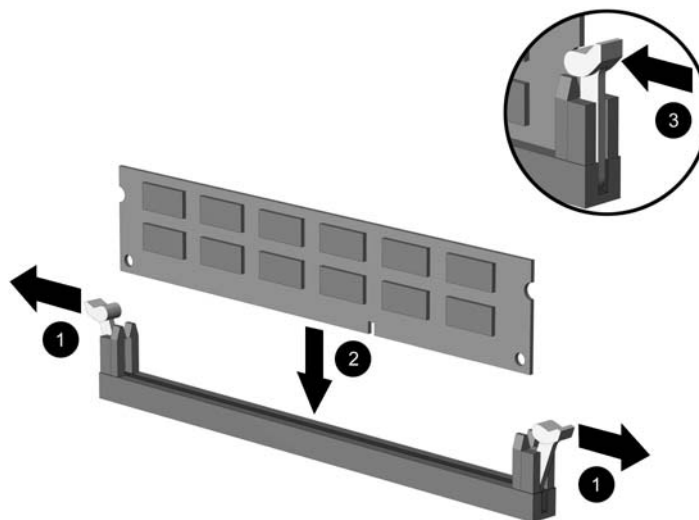
✎ A memory module can be installed in only one way. Match the notch on the module with the tab on the memory socket.

5. Push the module down into the socket, ensuring that the module is fully inserted and properly seated. Make sure the latches are in the closed position ❸.

6. Repeat steps 4 and 5 for any additional modules that you want to install.

✎ The computer automatically recognizes the additional memory when the computer is turned on.

To reassemble the computer, reverse the removal procedure.

✎ If you normally lock the Smart Cover Lock, use Computer Setup to relock the lock and enable the Smart Cover Sensor.

7.9 Vertically Oriented Expansion Card

7.9.1 Expansion Card Retainer

1. If you have locked the Smart Cover Lock, restart the computer and enter Computer Setup to unlock the lock.

2. Turn off the computer properly through the operating system, then turn off any external devices.

3. Disconnect the power cord from the power outlet and disconnect any external devices.

4. Remove the computer from the stand and lay the computer on its side.

5. Remove the computer cover. Refer to Section 7.5, "Computer Cover"

6. Release the slot cover retention latch that secures the PCI slot covers by lifting the green tab on the latch and rotating the latch to the full open position ❶.

7. Remove the single screw that keeps the card retainer in place ❷ and slide the retainer to the left to remove it from the chassis ❸.
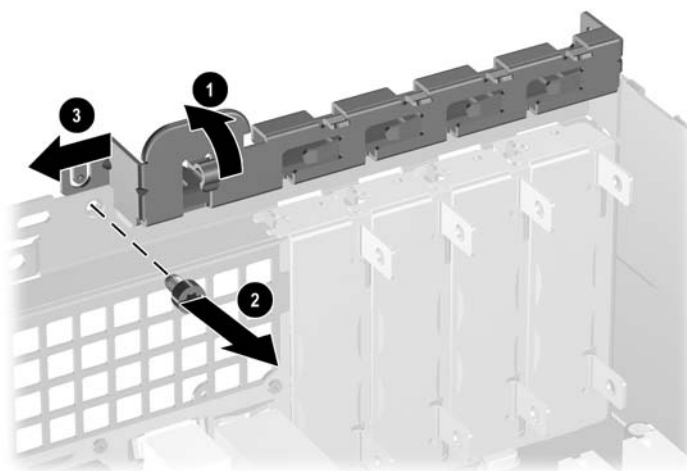
To install the card retainer, reverse the removal procedure.

7.9.2 PCI Expansion Card

1. If you have locked the Smart Cover Lock, restart the computer and enter Computer Setup to unlock the lock.

2. Turn off the computer properly through the operating system, then turn off any external devices.

3. Disconnect the power cord from the power outlet and disconnect any external devices.

4. Remove the computer from the stand and lay the computer on its side.

5. Remove the computer cover. Refer to Section 7.5, "Computer Cover".

6. Identify the slot into which you want to insert the expansion card.

7. Release the slot cover retention latch that secures the PCI slot covers by lifting the green tab on the latch and rotating the latch to the full open position ❶.

8. Remove the slot cover by sliding it up and out ❷ of the computer.
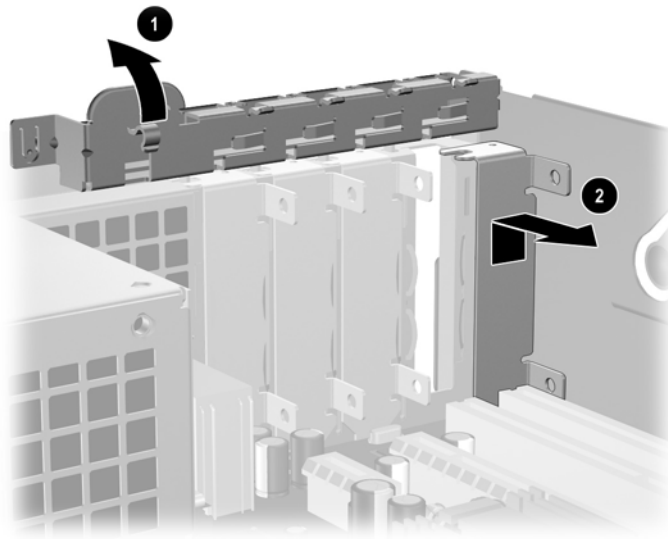
9. Install the expansion card by sliding the card under the slot cover retention latch then pressing the card down into the slot on the system board.

✎ Be sure not to scrape other components in the chassis when installing an expansion card.
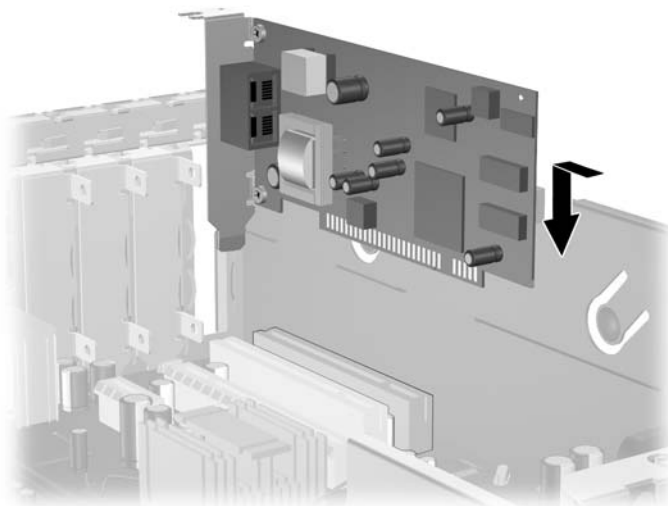
10. Rotate the slot cover retention latch back in place to secure the expansion card.

✎ When you install an expansion card, make sure the metal bracket on the card slides into the slot on the back of the computer then press down firmly on the card so that the whole connector seats properly in the expansion card slot.

⚠ **CAUTION:** All expansion card slots on the rear of the computer must contain either an expansion card or slot cover for proper cooling of internal components during operation.

7.9.3 PCI Express Expansion Card

To remove a PCI Express expansion card:

1. If you have locked the Smart Cover Lock, restart the computer and enter Computer Setup to unlock the lock.

2. Turn off the computer properly through the operating system, then turn off any external devices.

3. Disconnect the power cord from the power outlet and disconnect any external devices.

4. Remove the computer cover. Refer to Section 7.5, "Computer Cover".

5. Release the slot cover retention latch on the back of the computer that secures the PCI slot covers by lifting the green tab on the latch and rotating the latch to the open position.

6. Pull the retention arm on the back of the PCI Express expansion socket away from the card (on x16 card socket only) and carefully rock the card back and forth until the connectors pull free from the socket. Pull the expansion card straight up from the socket then away from the inside of the chassis. Be sure not to scrape the card against the other components.
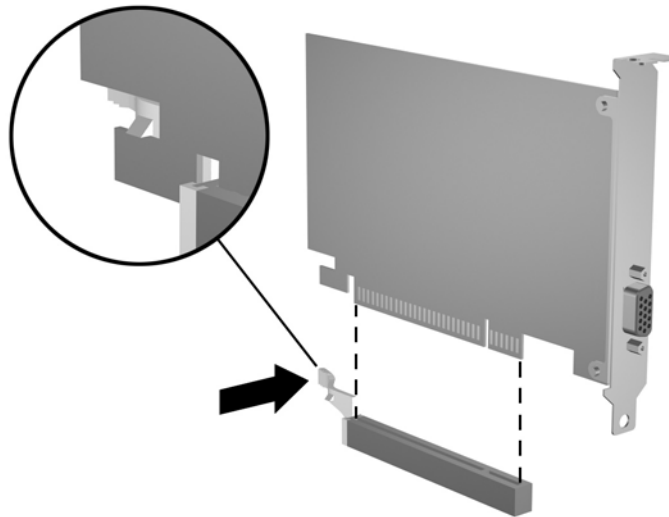
7. If you are not installing a new expansion card, install an expansion slot cover to close the open slot.

8. Rotate the slot cover retention latch back in place to secure the expansion cards and expansion slot.

⚠ **CAUTION:** All expansion card slots on the rear of the computer must contain either an expansion card or slot cover for proper cooling of internal components during operation.

7.10 Horizontally Oriented Expansion Card

This application is only available when the computer has the PCI Riser Card cage installed. Neither a PCI Express x1 or x16 card can be used in this application.

7.10.1 Expansion Card Cage

1. If you have locked the Smart Cover Lock, restart the computer and enter Computer Setup to unlock the lock.

2. Turn off the computer properly through the operating system, then turn off any external devices.

3. Disconnect the power cord from the power outlet and disconnect any external devices.

4. Remove the computer from the stand and lay the computer on its side.

5. Remove the computer cover. Refer to Section 7.5, "Computer Cover".

6. Lift the bail handle on the expansion card cage and pull the cage straight up and out of the computer.
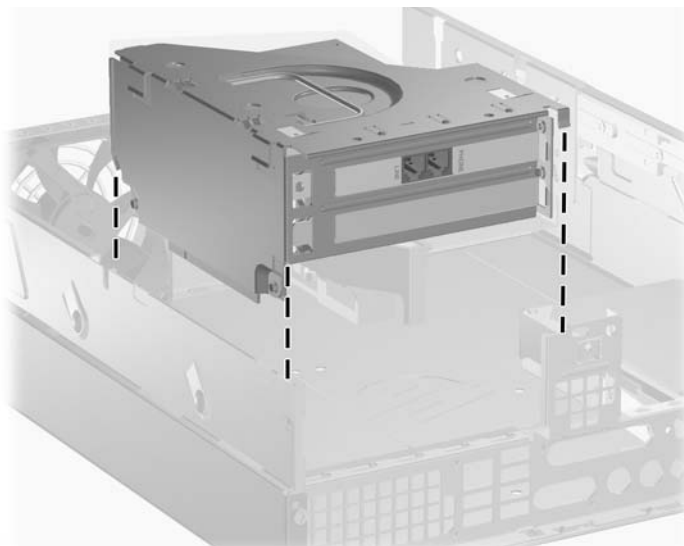
7. Lay the card cage on its top for stability before doing any work on it.

To install the card cage, reverse the installation process.

7.10.2 PCI Expansion Card

1. If you have locked the Smart Cover Lock, restart the computer and enter Computer Setup to unlock the lock.

2. Turn off the computer properly through the operating system, then turn off any external devices.

3. Disconnect the power cord from the power outlet and disconnect any external devices.

4. Remove the computer from the stand and lay the computer on its side.

5. Remove the computer cover. Refer to Section 7.5, "Computer Cover".

6. Remove the expansion card cage Section 7.10, "Horizontally Oriented Expansion Card".

   If you are installing a card for the first time in this computer, go to step 12.

7. If your are replacing an existing card, stand the card cage on its end for better leverage, and remove the card retaining screw ❶.

8. Grasp the card and carefully rock it back and forth until the connectors pull free from the socket. Pull the expansion card straight up from the socket ❷ then away from the inside of the card cage. Be sure not to scrape the card against other components.
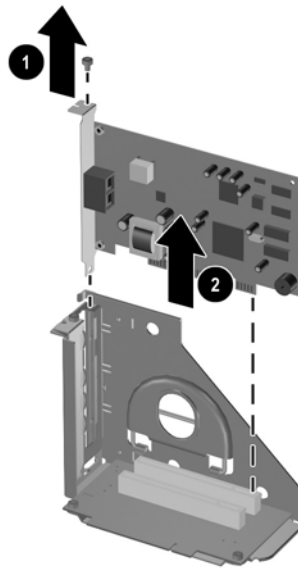
9. Store the removed card in anti-static packaging.

10. Slide the bracket on the end of the expansion card down into the slot on the expansion card cage and press the card down firmly into the socket on the riser card.

11. Reinstall the card retaining screw.

    Go to step 15.

12. If you are installing an expansion card in a vacant slot, remove the slot cover retaining screw and slide the slot cover out of its socket.

13. Slide the bracket on the end of the expansion card down into the slot on the expansion card cage and press the card down firmly into the socket on the riser card.

14. Reinstall the card retaining screw.

15. Reinstall the expansion card cage by aligning the cage with the guide rails on the backwall. Press down firmly on the cage to secure it in place on the backwall. Be sure the riser card in the cage is properly seated in the PCI expansion slot on the system board.
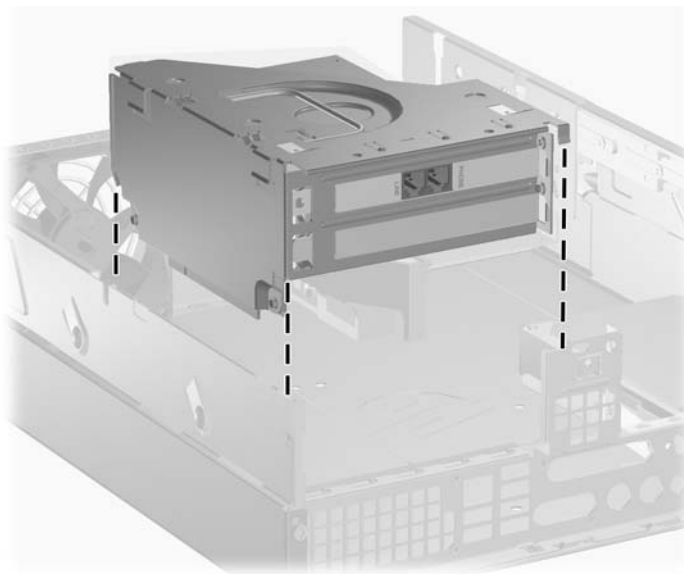
Complete the reassembly of the computer.

7.10.3 Riser Card

1. If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock (Section 7.2, "Unlocking the Smart Cover Lock").

2. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

3. Remove the computer access panel (Section 7.5, "Computer Cover").

4. Remove the expansion card cage (Section 7.10.1, "Expansion Card Cage").

5. Remove the two screws that secure the riser card to the expansion card cage ❶, then remove the card ❷.
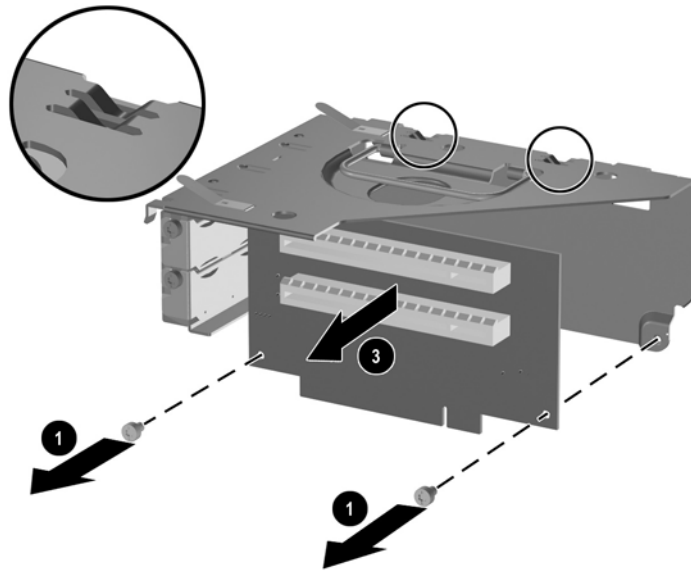
To install the riser card, reverse the removal procedure.

✎ The riser card is not spared separately at the time this document was released.

7.11 Drives

A Torx T-15 screwdriver is needed to remove and install the guide screws on a drive.

⚠ **CAUTION:** Make sure personal files on the hard drive are backed up to an external storage device before removing the hard drive. Failure to do so will result in data loss. After replacing the primary hard drive, you will need to run the *Restore Plus!* CD to load the Compaq factory-installed files.

7.11.1 Drive Positions

Drive Positions			
Item	**Description**	**Item**	**Description**
❶	3.5-inch, internal, standard hard drive bay	❸	3.5-inch drive bay (1.44-MB diskette drive shown)*
❷	5.25-inch drive bay for optional drives		

*A 3.5-inch diskette drive, hard drive, or Zip drive may be installed in this bay but the correct bezel must be installed to ensure proper air flow.

To verify the type and size of the storage device installed in the computer, run Computer Setup.

7.11.2 Optical Drive

⚠ **CAUTION:** All removable media should be taken out of the drives before removing the drive from the computer.

✎ An optical drive is a CD-ROM, CD-R/RW, DVD-ROM, DVD+R/RW, or CD-RW/DVD Combo drive.

1. If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock (Section 7.2, "Unlocking the Smart Cover Lock").

2. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

3. Remove the computer cover (Section 7.5, "Computer Cover").

4. Press down on the green latch located on the front of the chassis next to the drives ❶. This disengages the drive cage.

5. Slide the drive cage forward until it stops ❷.

✎ The unlock icon on the drive tray should align with the arrow on the chassis when the tray is fully extended.
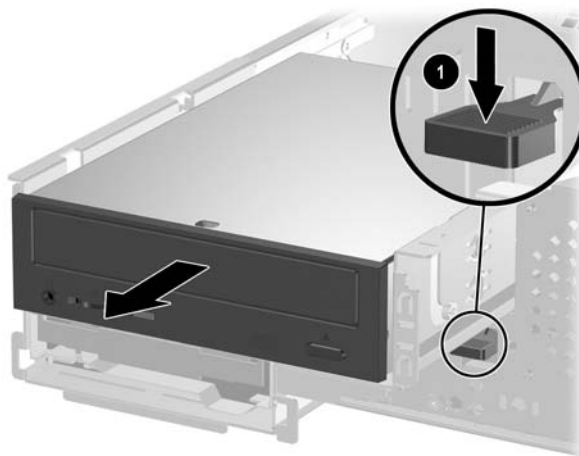
6. Disconnect the power and data cables from the rear of the optical drive.
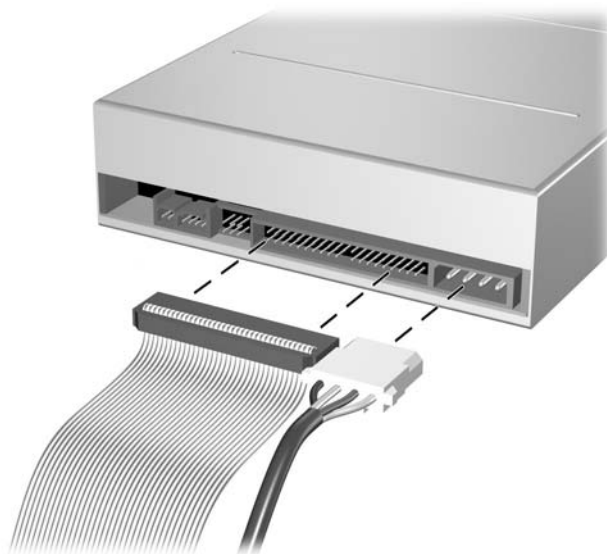
7. Slide the optical drive forward and lift it up and out of the drive cage.

✎ If the drive will not slide out of the cage, the cage is not fully extended. Pull on the cage until the internal drive lock mechanism has been released.
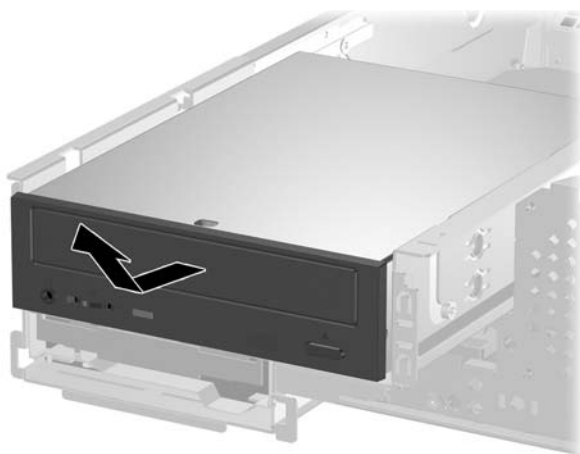
⚠ **CAUTION:** Use only 3/16-inch or 5-mm long screws as guide screws. Longer screws can damage the internal components of the drive.

✎ When replacing the drive, transfer the four screws from the old drive to the new one. The screws take the place of drive rails.

7.11.3 External 3.5-inch Drive

1. If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock. Refer to Section 7.2, "Unlocking the Smart Cover Lock".

2. Prepare the computer for disassembly. Refer to Section 7.1, "Preparation for Disassembly".

3. Remove the computer cover. Refer to Section 7.5, "Computer Cover".

4. Remove the optical drive. Refer to Section 7.11.2, "Optical Drive".

5. Disconnect the signal and power cables from the drive. The other end of the cables should remain connected to the system board.
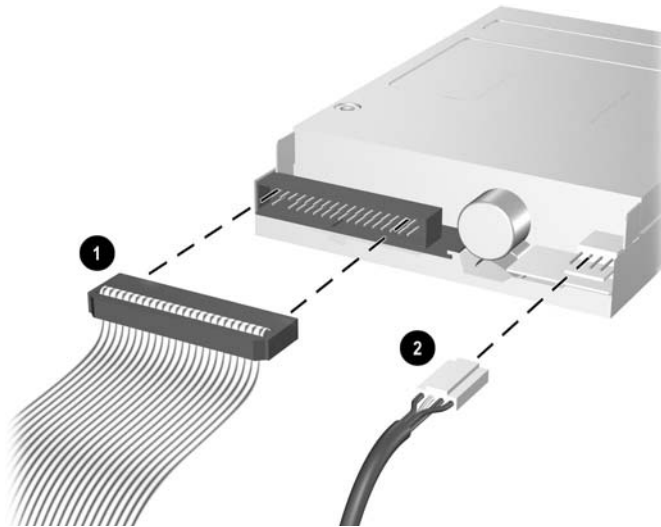
✎ Diskette drive shown.

6. Slide the drive forward and lift it up and out of the drive cage.

To replace the drive, transfer the four screws from the old drive to the new one and reverse the removal procedure.

7.11.4 Primary Hard Drive

1. If you have locked the Smart Cover Lock, use Computer Setup to unlock the lock (Section 7.2, "Unlocking the Smart Cover Lock").

2. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

3. Remove the computer cover (Section 7.5, "Computer Cover").

4. Press down on the green latch located on the front of the chassis next to the optical drive ❶ and slide the drive cage forward ❷ to its fully extended position. This will give you access to the cable connectors on the primary hard drive.
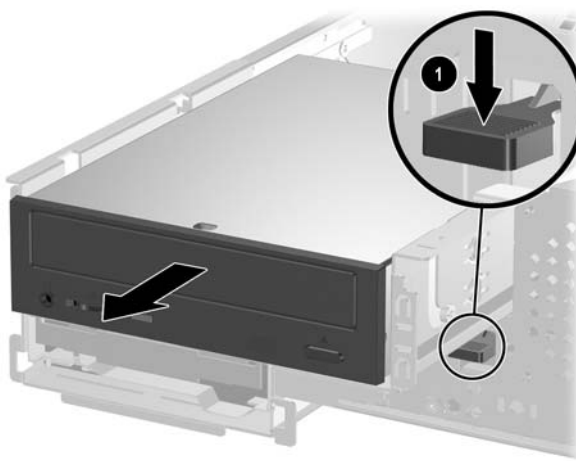
✎ It is not necessary to remove the optical drive.

5. Remove the security clip that secures the backwall to the power supply.
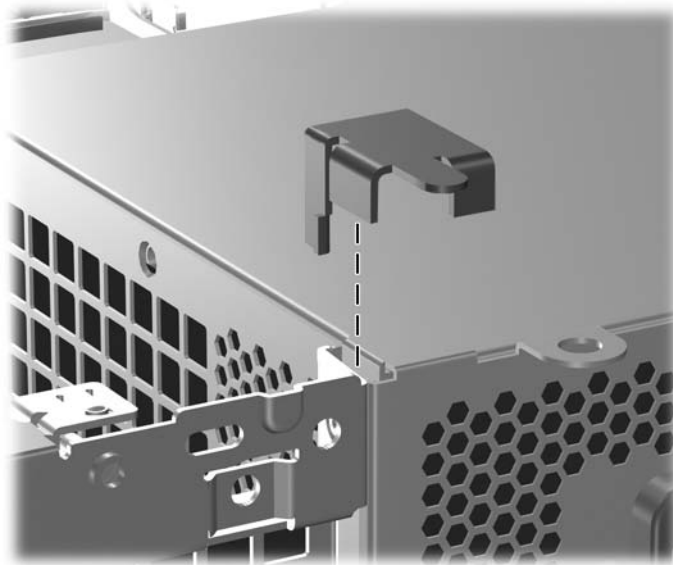
6. Rotate the power supply to its full upright position.
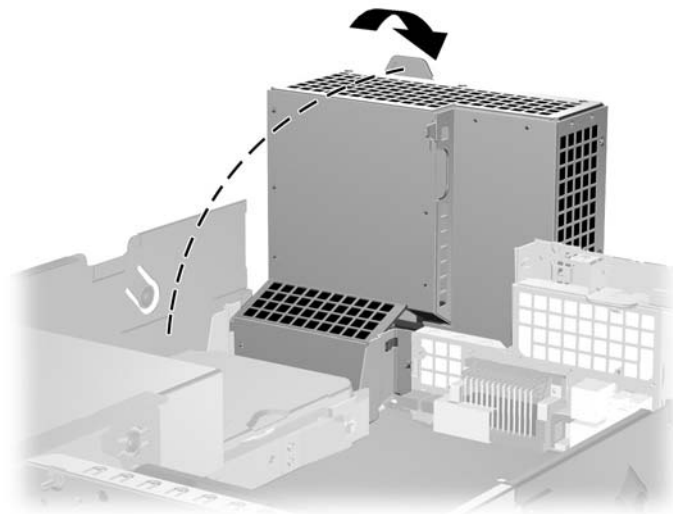
7. Disconnect the power cable ❶ and data cable ❷ from the back of the hard drive.
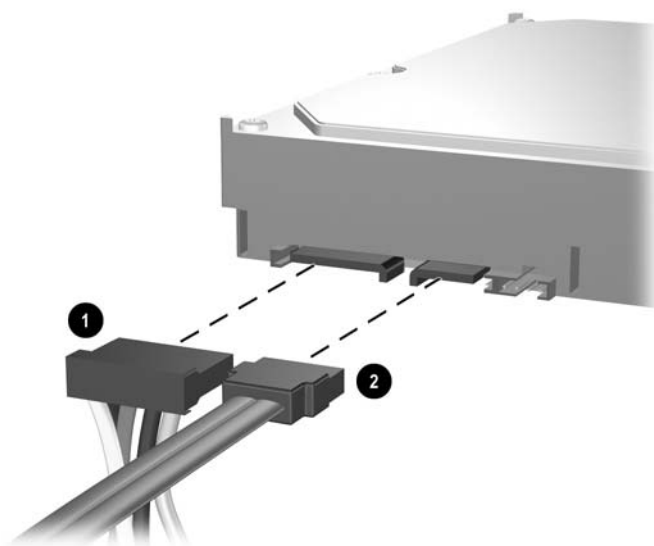
8. Pull the tab that locks the drive in place away from the drive ❶, slide the hard drive toward the front of the computer, then lift it up and out of the bay ❷.
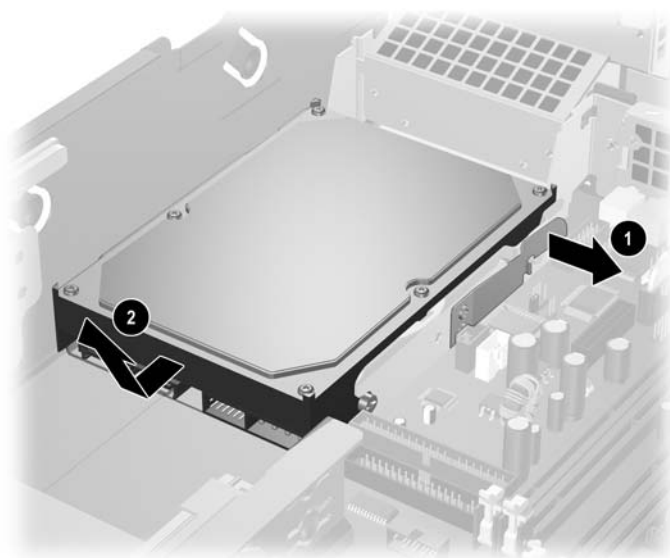
To install a hard drive, reverse the above procedure.

✎ The replacement hard drive kit includes several data cables. Make sure to use the cable that is exactly the same as the factory-installed cable.

✎ If the system has only one SATA hard drive, the data cable must be connected to the **blue** connector labeled P60 SATA 0 first to avoid any hard drive performance problems.

✎ When replacing the hard drive, transfer the four screws from the old drive to the new one. The screws take the place of drive rails. You will need a Torx T-15 screwdriver to remove and re-install the guide screws. HP has provided four extra 6-32 standard guide screws on the front of the chassis, under the computer cover. The 6-32 standard guide screws are silver.

✎ If you replaced the primary hard drive, insert the *Restore Plus!* CD to restore the operating system, software drivers, and any software applications that were preinstalled on the computer. Follow the instructions in the guide included with the *Restore Plus!* CD. When the restore process has completed, reinstall any personal files that you backed up before replacing the hard drive.

7.12 Fan Shroud

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer cover (Section 7.5, "Computer Cover").

3. Lift up on the fan shroud to remove it from the computer.
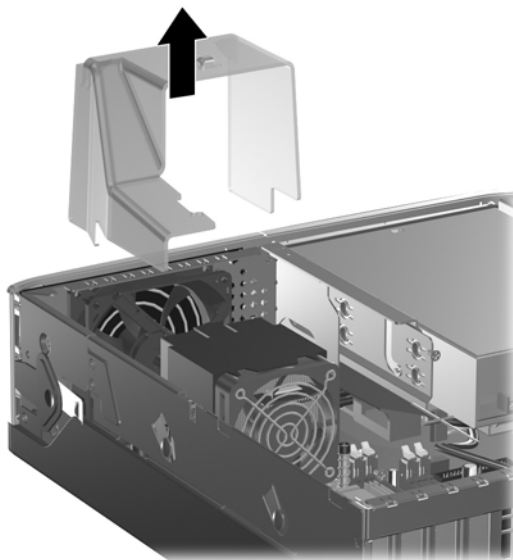
When replacing the shroud, make sure that it does not get caught on the wires from either the fan or the speaker.

7.13 Front I/O Devices

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer cover (Section 7.5, "Computer Cover").

3. Disconnect the two I/O device cables from the system board: the front USB cable pair and the front audio cable.

4. Remove the drives from the drive tray. Refer to Section 7.11, "Drives".

5. Remove the power supply cable that is routed under the drive cage from the side ❶ and front ❷ cable retaining clips.

✎ It may be necessary to flatten the cable in the cable retaining clip areas to make the cable more flexible.

6. Remove the power supply cable that is routed under the green leg of the drive cage ❸.

✎ It may be necessary to flatten the cable to make the cable more flexible.
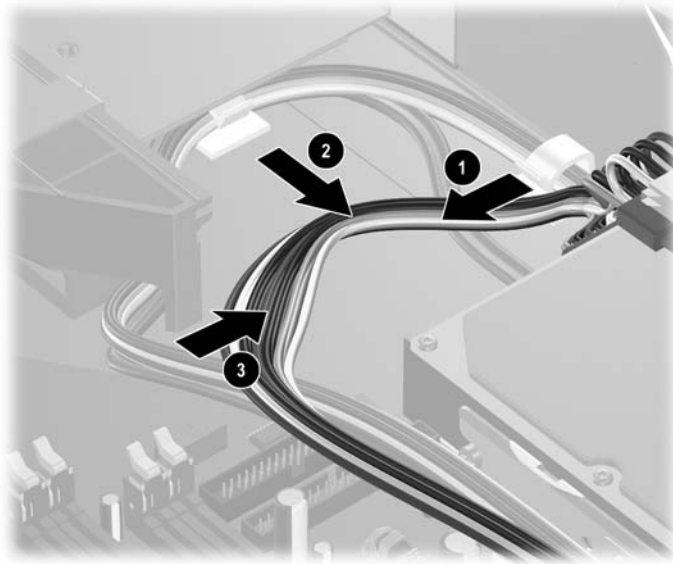
7. Remove the SATA cable from the front and side retaining clips.
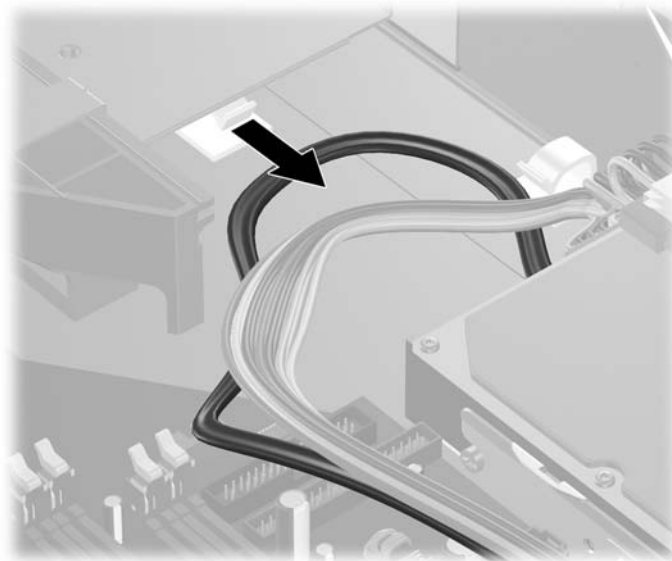
8. Push the empty drive cage back into its locked position.

⚠ **CAUTION:** Make sure the flat ribbon cables are folded down and the SATA and power cables are pushed out of the way to prevent their being damaged when the drive cage is pushed into the locked position.

9. Remove the two screws that secure the front I/O device ❶ then, push the I/O device towards the back of the chassis ❷.

10. Pull the drive cage forward, grasp the I/O device and carefully pull it from under the drive cage ❸. Guide the cable ends through the slots in the drive cage support device to keep them from snagging.
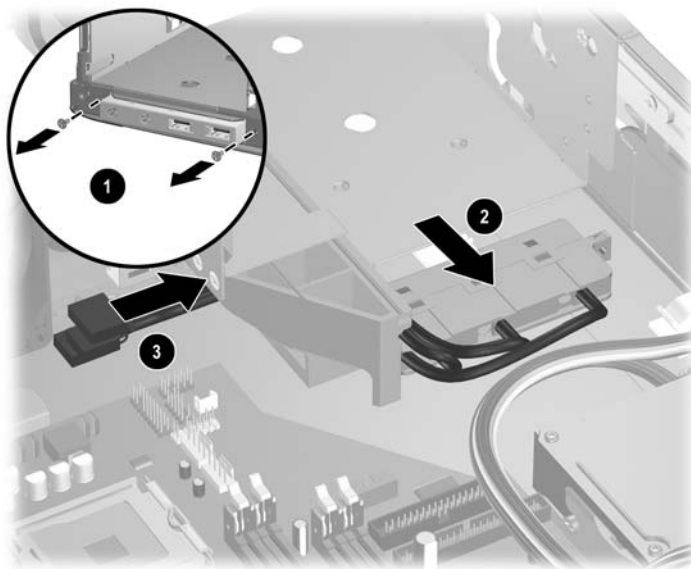
Follow these procedures for reinstalling the front I/O device.

1. Begin with the drive cage in its fully extended position. Guide the I/O device cables under the drive cage and through the legs of the drive cage support ❶. It may be necessary to use a wooden pencil to help in this task.

2. Push the I/O device beneath the drive cage as far as possible ❷ then, push the drive cage into the closed position to access the front of the chassis. Make sure the USB ports in the I/O device are oriented properly on the right side.

3. Install the two retaining screws ❸ while holding the I/O device in position.
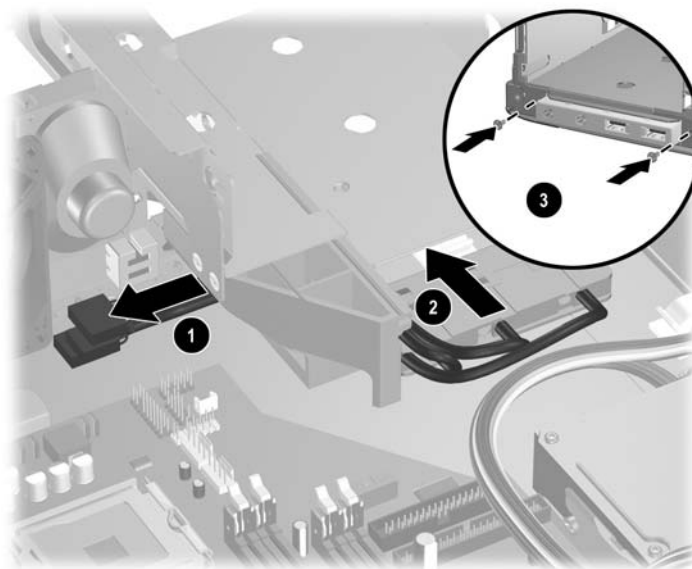
4. Reinstall the balance of the cabling and drives.
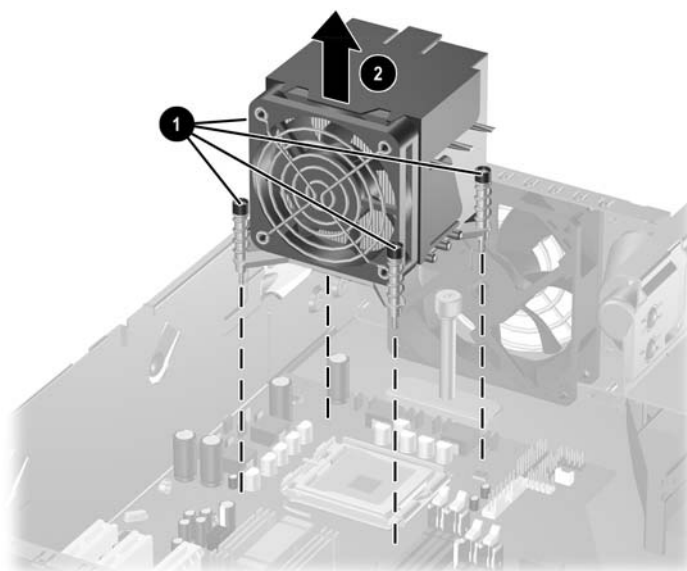
7.14 Power Switch Assembly

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer cover (Section 7.5, "Computer Cover").

3. Disconnect the power switch/LED cable from the system board.

4. Squeeze the switch holder retaining clips together at the front of the chassis ❶ and push the switch assembly out of the chassis ❷. Push the two LEDs out of the chassis ❸.

5. If necessary, the LED holders may also be removed by squeezing the clips and pushing them out of the front of the chassis ❹.
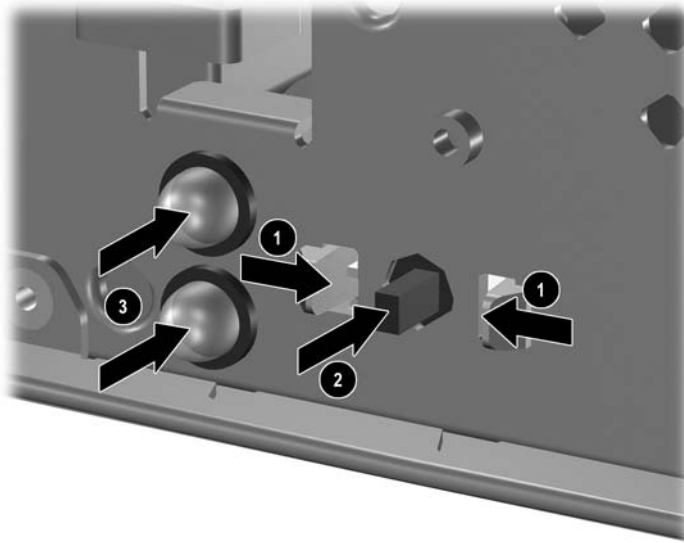
To install the power switch and LEDs, reverse the removal procedure.

7.15 Heatsink

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer cover (Section 7.5, "Computer Cover").

3. Remove the fan shroud. Refer to Section 7.12, "Fan Shroud".

4. Disconnect the fan control cable from the system board.

5. Loosen the four captive screws ❶ that secure the heatsink to the system board tray.

⚠ **CAUTION:** Heatsink retaining screws should be removed in diagonally opposite pairs (as in an X) to even the downward forces on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

6. Lift the heatsink from atop the processor ❷ and set is on its side to keep from contaminating the work area with thermal grease.

When reinstalling the heatsink, make sure that its bottom has been cleaned with an alcohol wipe and fresh thermal grease has been applied to the top of the processor.

⚠ **CAUTION:** Heatsink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heatsink on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

7.16 **Processor**

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer cover (Section 7.5, "Computer Cover").

3. Remove the fan shroud. Section 7.12, "Fan Shroud".

4. Disconnect the heatsink control cable from the system board and remove the heatsink (Section 7.15, "Heatsink").

5. Rotate the locking lever to its full open position ❶.

6. Raise and rotate the microprocessor retainer to its fully open position ❷.

7. Carefully lift the processor from the socket ❸.

⚠ **CAUTION:** Do NOT handle the pins in the processor socket. These pins are very fragile and handling them could cause irreparable damage. Once pins are damaged it may be necessary to replace the system board.

⚠ **CAUTION:** The heatsink must be installed within 24 hours of installing the processor to prevent damage to the processor's solder connections.

To install a new processor:

1. Place the processor in its socket and close the retainer.

2. Secure the locking lever.

If reusing the existing heatsink, go to step 3.

If using a new heatsink, go to step 6.

3. If reusing the existing heatsink, clean the bottom of the heatsink with the alcohol pad provided in the spares kit.

⚠ **CAUTION:** Before reinstalling the heatsink you must clean the top of the processor and the bottom of the heatsink with an alcohol pad supplied in the speaker spares kit. After the alcohol has evaporated, apply thermal grease to the top of the processor from the syringe supplied in the speaker spares kit.

4. Apply the thermal grease provided in the spares kit to the top of the processor and install the heatsink atop the processor.

5. Go to step 7.

6. If using a new heatsink, remove the protective covering from the bottom of the heatsink and place it in position atop the processor.

7. Secure the heatsink to the system board and system board tray with the 4 captive screws and attach the heatsink control cable to the system board.

⚠ **CAUTION:** Heatsink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heatsink on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

✎ After installing a new processor onto the system board, always update the system ROM to ensure that the latest version of the BIOS is being used on the computer. The latest system ROMPaq can be found on the Web at: http:\\h18000.www1.hp.com/support/files.

7.17 Speaker

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer cover (Section 7.5, "Computer Cover").

3. Remove the fan shroud. Section 7.12, "Fan Shroud"

4. Remove the heatsink control cable and the heatsink from the system board (Section 7.15, "Heatsink").

5. Remove any memory modules that might interfere with the screwdriver used for removing the speaker.

6. Disconnect the speaker wire from the system board.

7. Remove the two screws that secure the speaker to the chassis.

8. Remove the speaker from the chassis.
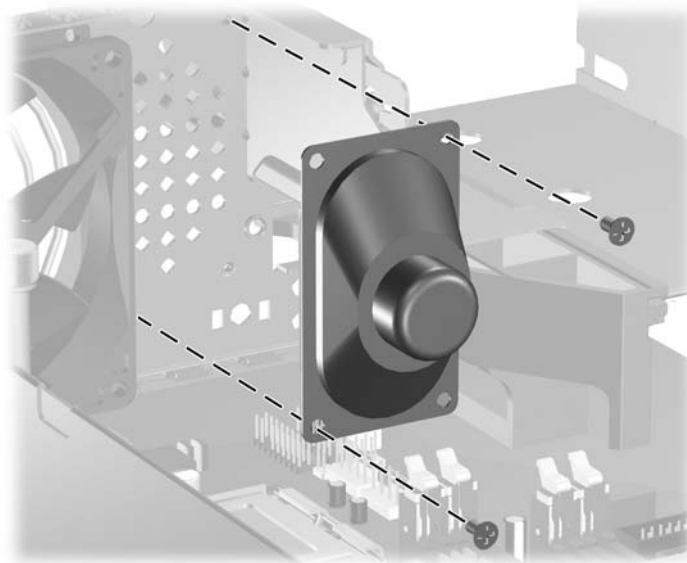
To install the speaker, reverse the removal procedures.

⚠ **CAUTION:** Before reinstalling the heatsink you must clean the top of the processor and the bottom of the heatsink with an alcohol pad supplied in the speaker spares kit. After the alcohol has evaporated, apply thermal grease to the top of the processor from the syringe supplied in the speaker spares kit.
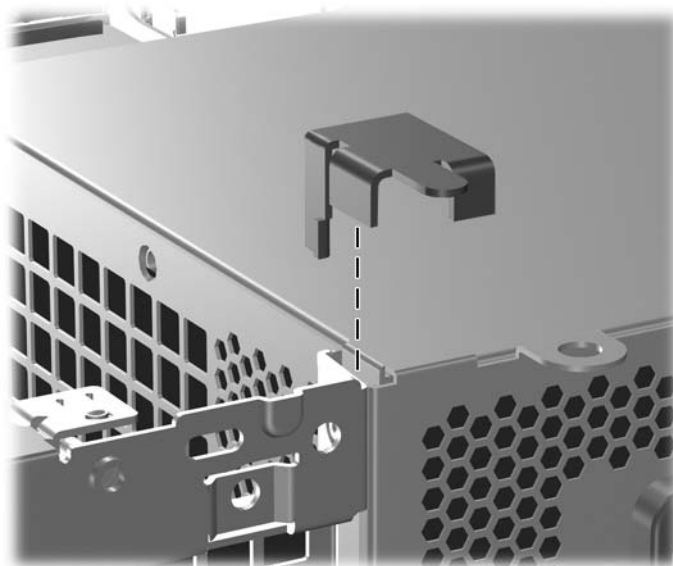
7.18 Power Supply

⚠️ **WARNING:** Voltage is always present on the system board when the computer is plugged into an active AC outlet. To avoid possible personal injury and damage to the equipment the power cord should be disconnected from the computer and/or the AC outlet before opening the computer.
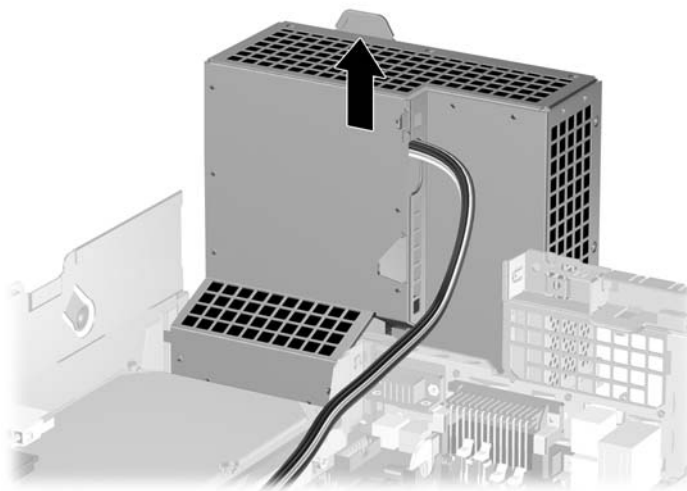
1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer cover (Section 7.5, "Computer Cover").

3. Remove the security clip.

4. Rotate the power supply to its upright position.

5. Pull the drive cage forward and disconnect the power cables from all of the drives.

6. Disconnect the power cables from the system board.

7. Release the power supply cable from the cable retaining clip at the front of the chassis below the drive cage and from the clip on the side of the chassis in front of the hard drive (Section 7.12, "Fan Shroud").

8. Disconnect the hood sensor from the system board and remove the sensor from the power supply if required (Section 7.3, "Hood Sensor").

9. Lift the power supply up and out of the chassis.

To install the power supply, reverse the removal procedure.

⚠ **CAUTION:** When installing the power supply cables, make sure they are properly positioned so they are not cut by the drive cage and are not pinched by the rotating power supply.
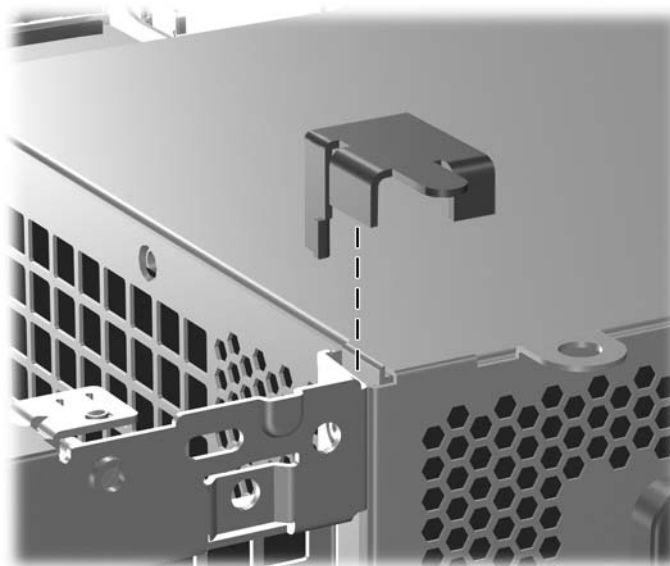
7.19 System Board

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer cover (Section 7.5, "Computer Cover").

3. Remove all PCI and PCI Express expansion boards (Section 7.9, "Vertically Oriented Expansion Card").

4. Remove the fan shroud from the chassis (Section 7.11, "Drives").

5. Slide the drive tray forward and disconnect the drive and power cables from the system board.
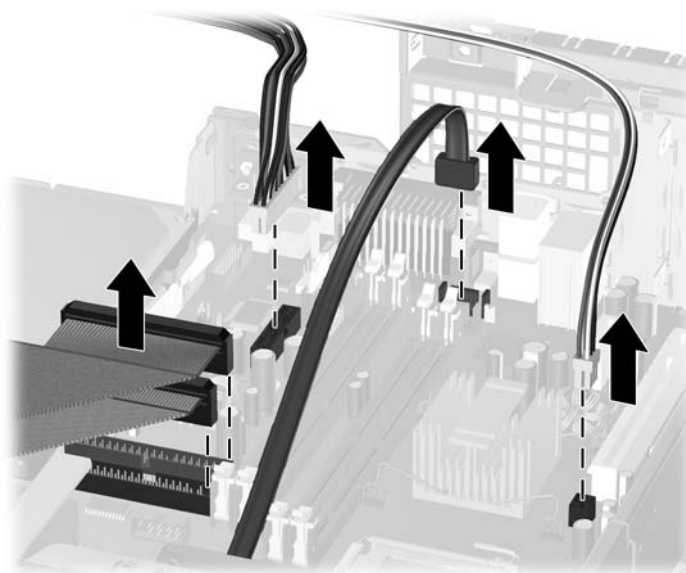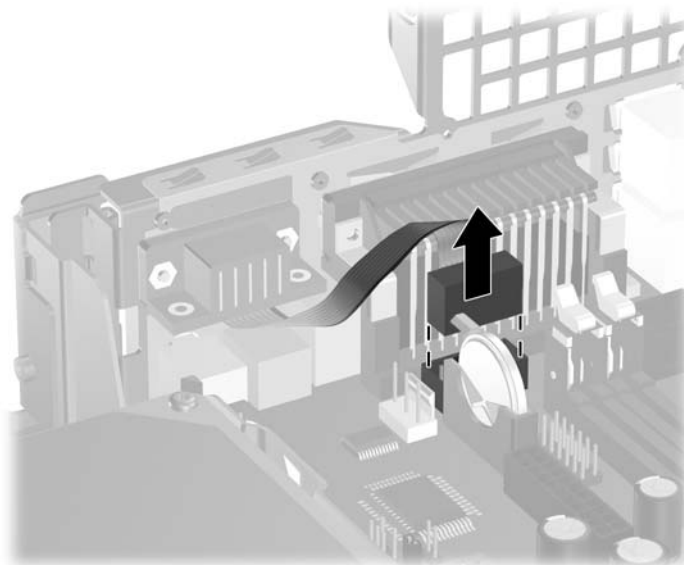

6. Remove the security clip.

7. Rotate the power supply to its upright position.
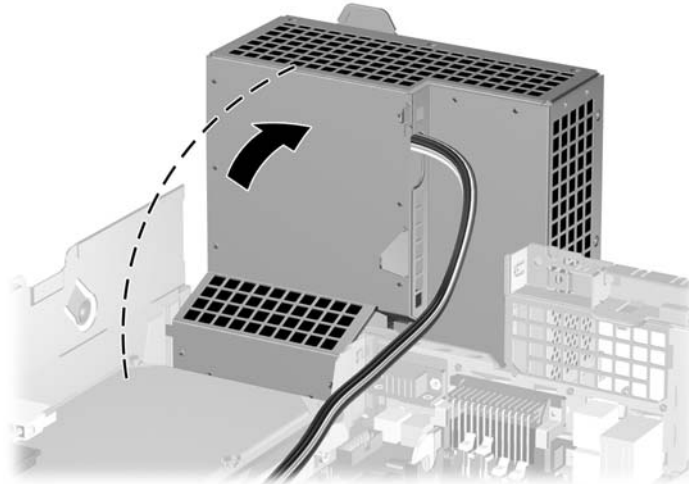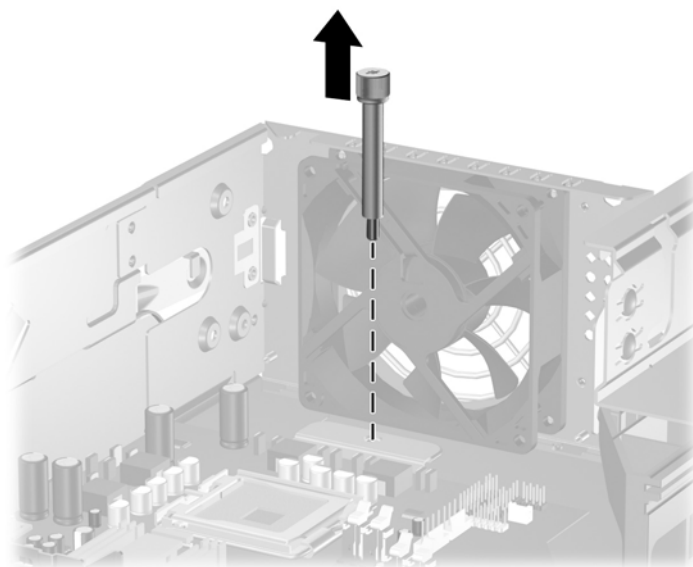
8. Disconnect the serial port from the system board

9. Disconnect the balance of the cables from the system board. .

10. Remove the long mounting screw that secures the system board tray to the chassis.
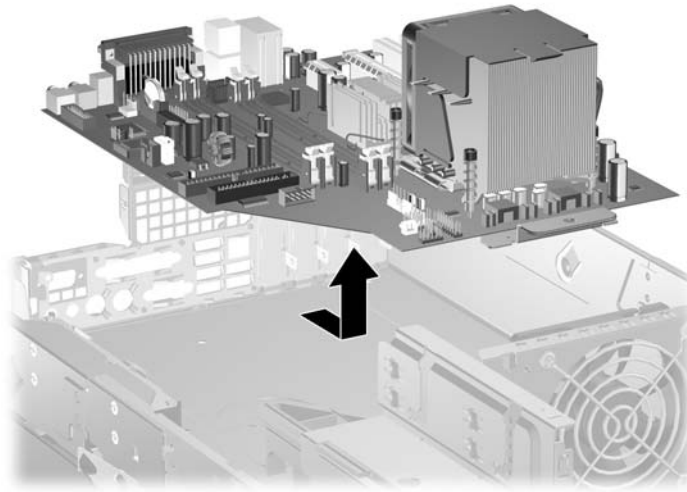
✎ The heatsink has been removed from the drawing below for clarity. The heatsink should not be removed until the system board has been removed from the chassis.

11. Slide the system board tray assembly towards the front of the chassis, about 1/4 inch and lift the system board up and out of the chassis.

12. Remove the heatsink from the system board and the system board tray (Section 7.15, "Heatsink").

✎ When reinstalling the system board it is important to secure the system board and tray to the chassis with the long retaining screw before performing any subsequent steps. Locking the board in place makes the installation of the heatsink easier and prevents damage.

⚠ **CAUTION:** When reconnecting the cables it is important that they be positioned so they do not interfere with the sliding of the drive cage the rotation of the power supply

Complete the installation of the system board by reconnecting all cables.

✎ The heatsink should be installed on the system board before the system board is reinstalled in the chassis.

✎ **CAUTION:** Before reinstalling the heatsink you must clean the top of the processor and the bottom of the heatsink with an alcohol pad supplied in the speaker spares kit. After the alcohol has evaporated, apply thermal grease to the top of the processor from the syringe supplied in the speaker spares kit.

7.20 Chassis Fan

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer cover (Section 7.5, "Computer Cover").

3. Remove the fan shroud (Section 7.12, "Fan Shroud").

4. Disconnect the chassis fan cable from the system board.

5. Remove the four screws that secure the fan and fan guard to the chassis then, remove the fan from the chassis.

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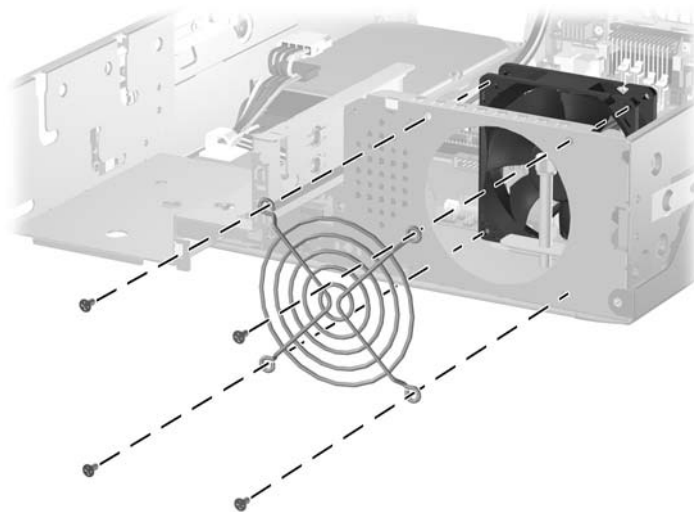
To install the chassis fan, reverse the removal procedure.

7.21 Backwall

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer cover (Section 7.5, "Computer Cover").

3. Remove all PCI and PCI Express expansion boards (Section 7.9, "Vertically Oriented Expansion Card").

4. Press down on the green latch located on the front of the chassis next to the drives ❶. This disengages the drive cage.

5. Slide the drive cage forward until it stops ❷.

✎ It is not necessary to remove any drives from the drive cage. The drive cage is moved only to gain working room.
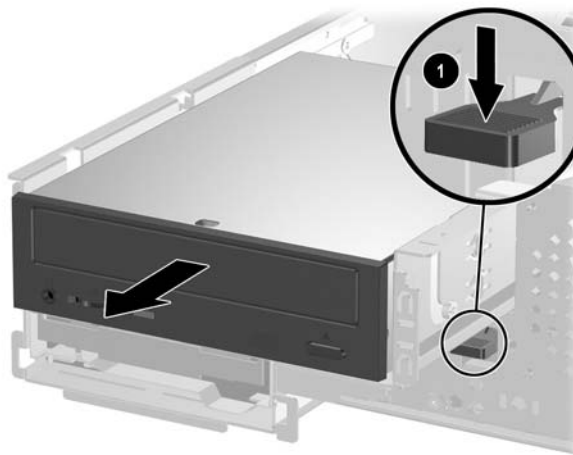
6. Remove the power supply from the chassis (Section 7.18, "Power Supply").

7. Disconnect all data and power cables from the system board except the cable to the heatsink.

8. Disconnect the "Serial A" cable ❶ from the system board, remove the two screws ❷ that secure the serial connector to the backwall, then remove the serial connector ❸ from the backwall.
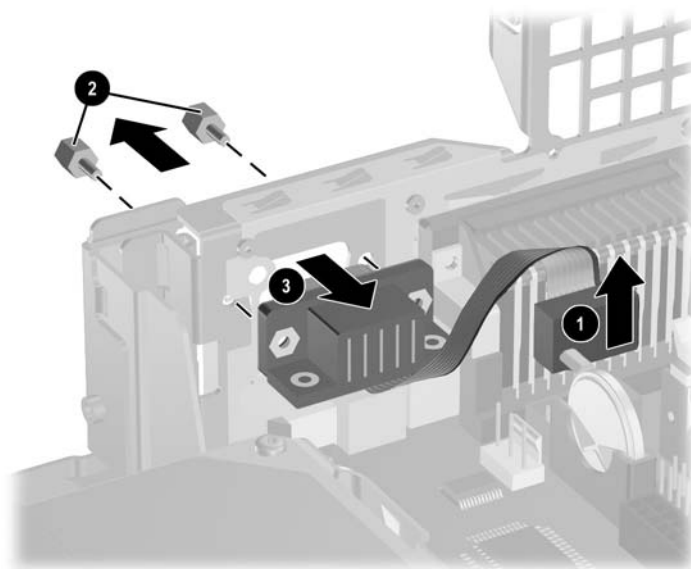
9. Remove the fan shroud from the fan (Section 7.12, "Fan Shroud")

10. Remove the long mounting screw that secures the system board tray to the chassis.
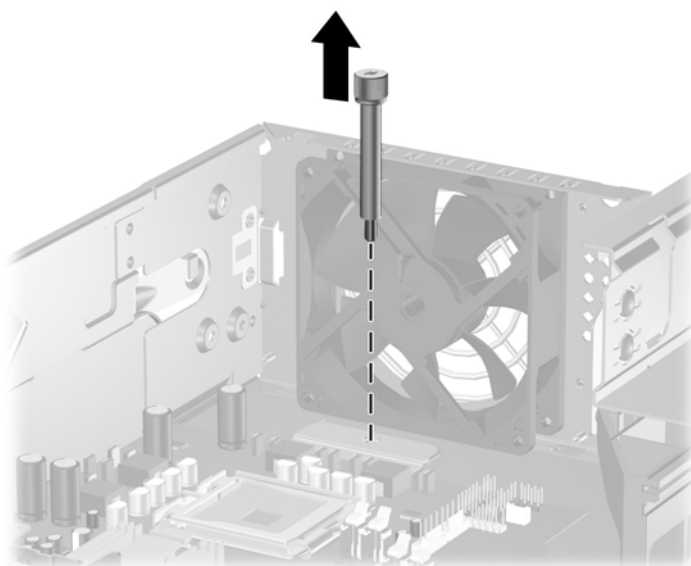
✎ The heatsink has been removed from the drawing for clarity. Do not remove the heatsink for this operation.

11. Slide the system board tray assembly towards the front of the chassis, about 7 mm (1/4-inch) and lift the system board up and out of the computer.
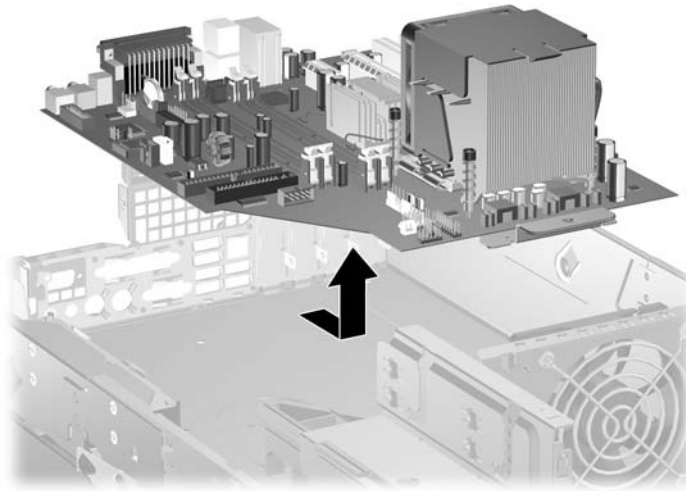
12. Remove the three screws ❶ that secure the backwall assembly to the chassis, then slide the backwall assembly ❷ a few millimeters/inches toward the space vacated by the power supply and lift out.
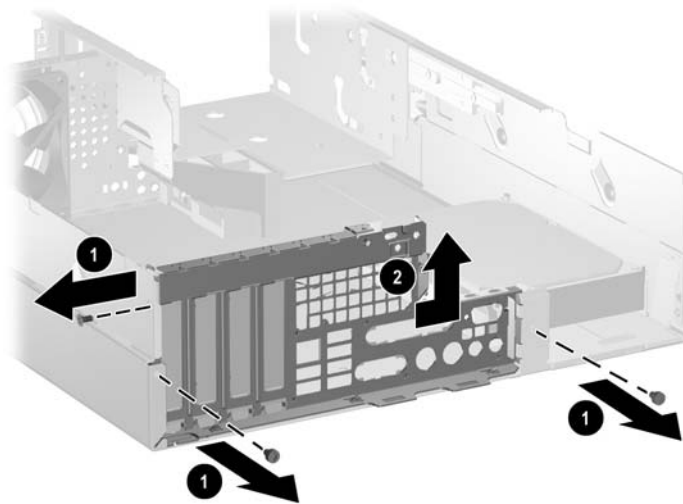
13. Slide the new backwall ❶ onto the rear chassis. Secure it with the three screws ❷ removed from the old backwall.
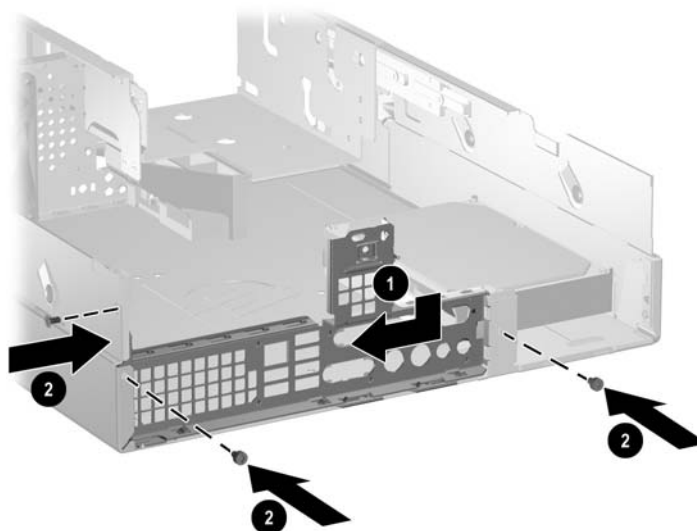
14. Install the serial connector ❶ into the new backwall using the two screws ❷ that were removed from the serial connector in a previous step. Reconnect the "Serial A" cable ❸ to the system board.
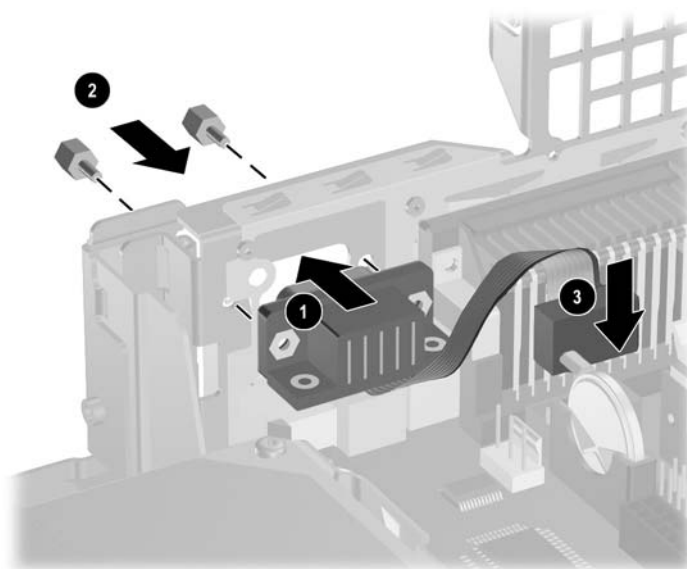
15. Install the system board tray assembly. Be sure the keyhole slot on the system board sits properly over the locking pins. When the system board is in position, replace the long screw to secure the system board to the chassis.

16. Reconnect all power and data cables to the system board. Be sure to use proper cable handling and placement precautions.

17. Install the power supply. Rotate it to its normal operating position. Be sure to use proper cable handling and placement precautions.

18. If ready, install the PCI expansion card in the available slot in the new PCI riser card cage assembly. Consult the guide that comes with your computer model to install a PCI expansion card.

19. Install the new PCI riser card cage assembly on the new backwall by aligning the cage with the guide rails on the backwall. Press down firmly on the cage to secure it in place on the backwall. Be sure the riser card in the cage is properly seated in the PCI expansion slot on the system board.
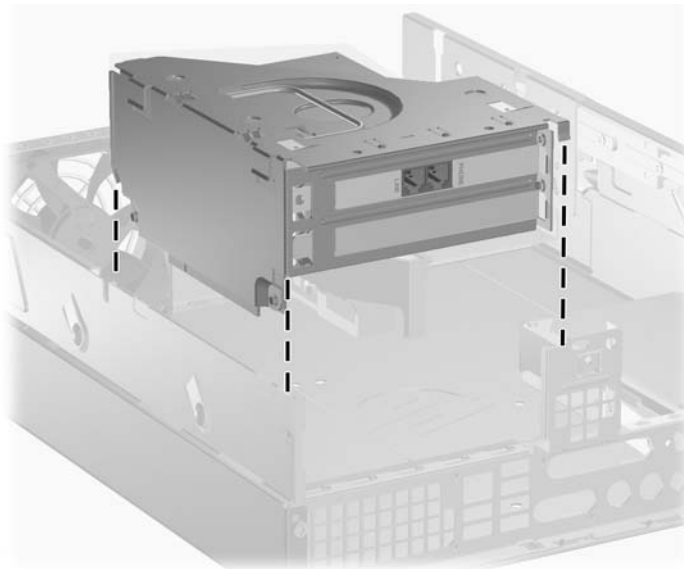
20. Slide the drive cage back into its operating position and lock it in place. Be sure to use proper cable handling and placement precautions.

⚠ **CAUTION:** Cables are very sensitive. Overbending, creasing, or pinching can damage cables.

21. Replace the fan shroud on top of the fan.
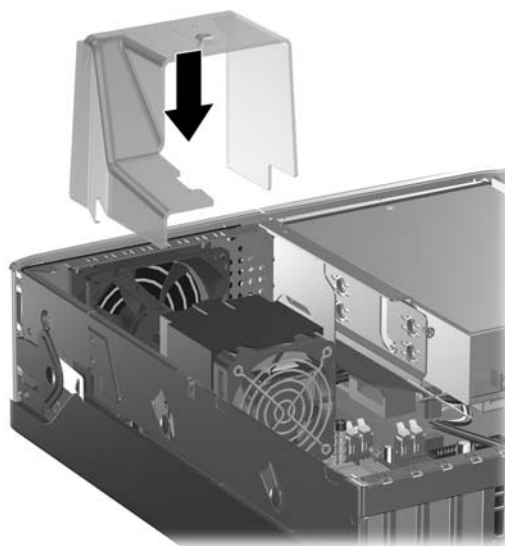
22. Replace the computer access panel.

23. Connect the power cord to the computer and electrical outlet.

24. Connect any peripheral equipment to the computer.

7.22 Battery

The battery that comes with this computer provides power to the real-time clock and has a lifetime of about three years. When replacing the battery, use a battery equivalent to the battery originally installed on the computer. The computer comes with a 3-volt lithium coin cell battery.

✎ The lifetime of the lithium battery can be extended by plugging the computer into a live AC wall socket. The lithium battery is only used when the computer is NOT connected to AC power.

⚠ **WARNING:** This computer contains an internal lithium manganese dioxide battery. There is a risk of fire and burns if the battery 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 140°F (60°C)

■ Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.

■ Replace the battery only with the HP/Compaq spare designated for this product.

⚠ **CAUTION:** Before replacing the battery, it is important to back up the computer CMOS settings. When the battery is removed or replaced, the CMOS settings will be cleared. Refer to the *Troubleshooting Guide* for information on backing up the CMOS settings.

🗑 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 HP/Compaq, their authorized partners, or their agents.

⚠ **CAUTION:** Static electricity can damage the electronic components of the computer or optional equipment. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

1. Prepare the computer for disassembly (Section 7.1, "Preparation for Disassembly").

2. Remove the computer access panel (Section 7.5, "Computer Cover").

✎ It may be necessary to remove an expansion card to gain access to the battery.

3. Locate the battery and battery holder on the system board.

4. Carefully pull the cable bundle out of the way to access the battery.

5. Depending on the type of battery holder on your system board, complete the following instructions to replace the battery:

7.22.1 Type 1 Battery Holder
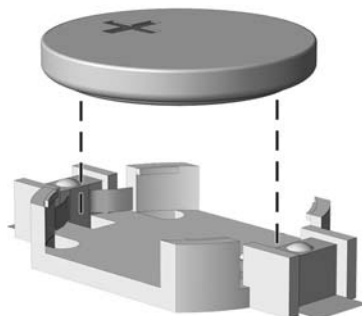
1. Lift the battery out of its holder.

2. Slide the replacement battery into position, positive side up.
3. The battery holder automatically secures the battery in the proper position.
4. Replace the computer cover or access panel.
5. Plug in the computer and turn on power to the computer.
6. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

7.22.2 Type 2 Battery Holder

1. To release the battery from its holder, squeeze the metal clamp that extends above one edge of the battery. When the battery pops up, lift it out ❶.

2. To insert the new battery, slide one edge of the replacement battery under the holder's lip with the positive side up ❷. Push the other edge down until the clamp snaps over the other edge of the battery.
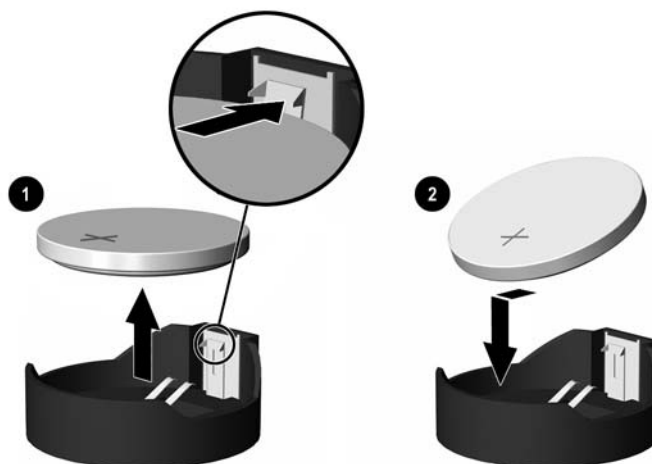
✎ After the battery has been replaced, use the following steps to complete this procedure.

3. Replace the computer cover or access panel.

4. Plug in the computer and turn on power to the computer.

Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide.*

7.22.3 Type 3 Battery Holder

1. Pull back on the clip ❶ that holds the battery in place, then remove the battery ❷.

2. Insert the new battery and position the clip back in place.

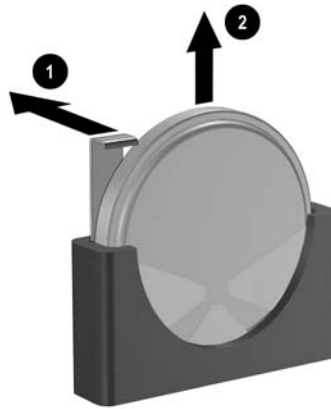✎ After the battery has been replaced, use the following steps to complete this procedure.

3. Replace the computer cover or access panel.

4. Plug in the computer and turn on power to the computer.

Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide.*

8

Removal and Replacement Procedures – Ultra-Slim Desktop (USDT) Chassis

Adherence to the procedures and precautions described in this chapter is essential for proper service. After completing all necessary removal and replacement procedures, run the Diagnostics utility to verify that all components operate properly.

✎ Not all features listed in this guide are available on all computers.

8.1   Preparation for Disassembly

See Chapter 5, "Identifying the Chassis, Routine Care, and Disassembly Preparation" for initial procedures.

1. Remove/disengage any security devices that prohibit opening the computer (Section 8.2).

2. Close any open software applications.

3. Exit the operating system.

4. Remove any diskette, compact disc, or MultiBay device from the computer.

5. Turn off the computer and any peripheral devices that are connected to it.

⚠ **CAUTION:** Turn off the computer before disconnecting any cables.

⚠ **CAUTION:** Regardless of the power-on state, voltage is always present on the system board as long as the system is plugged into an active AC outlet. In some systems the cooling fan is on even when the computer is in the "Standby," or "Suspend" modes. The power cord should always be disconnected before servicing a unit.

6. Disconnect the power cord from the electrical outlet and then from the computer.

7. Disconnect all peripheral device cables from the computer.

✎ During disassembly, label each cable as you remove it, noting its position and routing. Keep all screws with the units removed.

⚠ **CAUTION:** The screws used in the computer are of different thread sizes and lengths; using the wrong screw in an application may damage the unit.

8. If the PC is mounted in the accessory mounting stand, remove it and lay the computer down on its rubber feet.

8.2   External Security Devices

8.2.1 Installing a Cable Lock

The cable lock may be used to secure the computer access panel to the chassis and, at the same time, secure the computer to a fixed object.

8.2.2 Installing a Padlock

A padlock may be used by itself to secure the access panel to the computer chassis. A padlock may also be used with a security cable to secure the computer to a fixed object.

8.3 Computer Access Panel

1. Prepare the computer for disassembly (Section 8.1).

⚠ **CAUTION:** Before removing the computer access panel, ensure that the computer is turned off and that the power cord is disconnected from the electrical outlet.

2. Lay the computer down so the rubber feet rest on a solid surface.

3. Loosen the captive thumbscrew ❶ that secures the access panel to the computer chassis.

4. Slide the top access panel back about 1.3 cm, (1/2 inch), then lift it off the unit ❷.

To install the access panel, reverse the removal procedure.

8.4 **MultiBay Device**

⚠ **CAUTION:** The MultiBay device must be removed from the chassis before the front panel assembly is removed. Failure to remove the MultiBay device will result in severe damage to the computer.

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the access panel (Section 8.3).

3. Unlock the MultiBay device by pushing down on the green locking lever on top of the MultiBay drive cage ❶ an then pushing it to the right ❷.
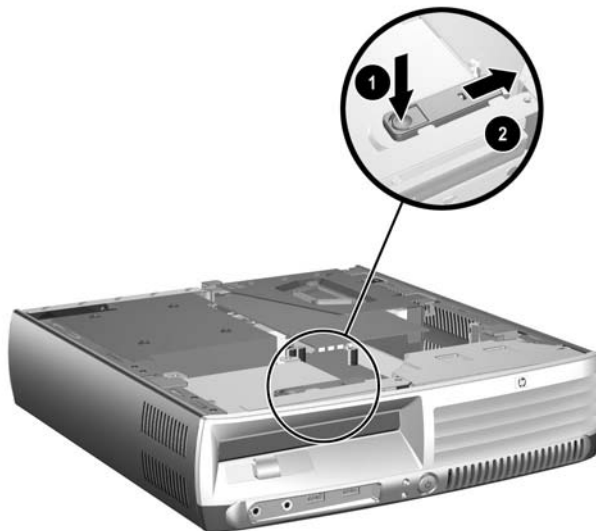
4. Eject the MultiBay device by sliding the front-mounted eject lever to the left ❶ then, pull the device out of the device bay ❷.
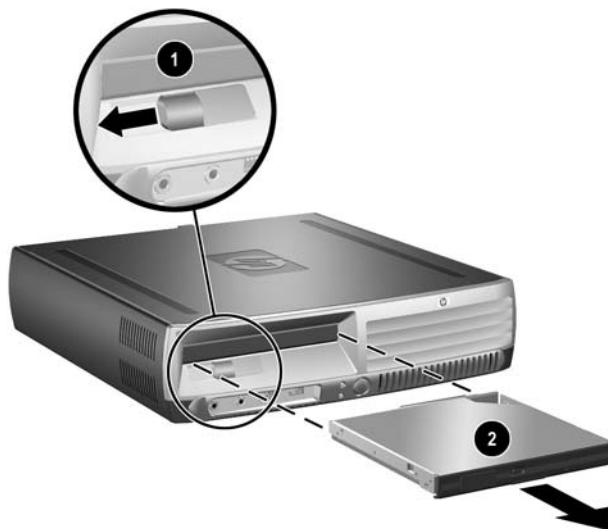
To install the MultiBay device, reverse the removal procedures.

Lock the device in place if desired.

8.5   **MultiBay Riser Card**

⚠ **CAUTION:** The MultiBay riser card must be removed before removing the front panel assembly. Failure to do so will damage the MultiBay riser card and the front panel assembly.

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the access panel (Section 8.3).

3. Remove any MultiBay device in the drive cage (Section 8.4).

4. Grasp the green handle on top of the riser card assembly and lift it straight up.
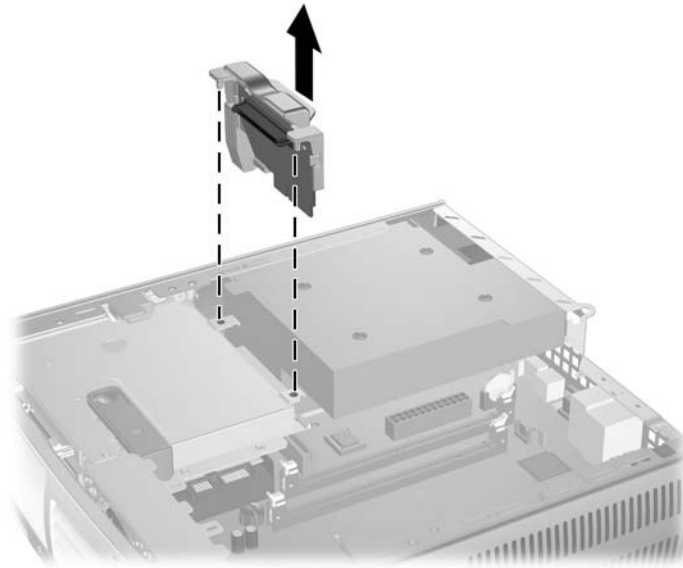
✎ The MultiBay riser card assembly serves a number of purposes: it provides data and power to an installed MultiBay device: it locks the front panel assembly in the chassis; and it secures the power supply in the chassis and prevents its front-to-back movement.

To reinstall the riser card, reverse the removal procedures.

8.6   Front Panel Assembly

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove any MultiBay device from the drive cage (Section 8.4).

4. Remove the MultiBay riser card (Section 8.5).

5. Lift up on the two green locking levers release tabs on the right side of the bezel ❶. This will unlatch the front panel assembly and push it about 1.3 cm (1/2 inch) out of the chassis.

6. Disconnect the fan cable from the system board ❷ and remove the panel assembly ❸ by pulling it straight out of the chassis.
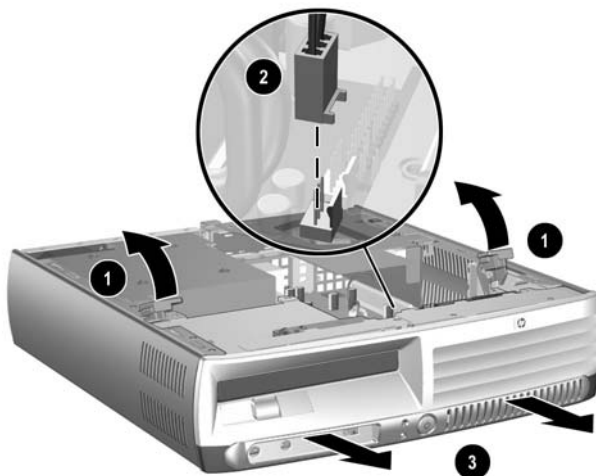
To reinstall the front panel assembly, reverse the removal procedure.

8.7 Front Bezel

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove any MultiBay device in the drive cage (Section 8.4).

4. Remove the MultiBay riser card (Section 8.5).

5. Remove the front panel assembly (Section 8.6).

6. Use a #0 Phillips screwdriver to remove the four screws that secure the front bezel to the front panel assembly ❶.

7. Raise the plastic locking device ❷ located just below the MultiBay drive cage and pull the front bezel away from the assembly. It may be necessary to release the catch ❸ that keeps the top of the bezel in place.

To reinstall the front bezel, reverse the removal procedures.

✎ When installing the front bezel, make sure that the MultiBay eject lever is positioned nearest the center of the bezel to ensure it will properly activate the eject mechanism.

8.8 Chassis Fan

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove any MultiBay device in the drive cage (Section 8.4).
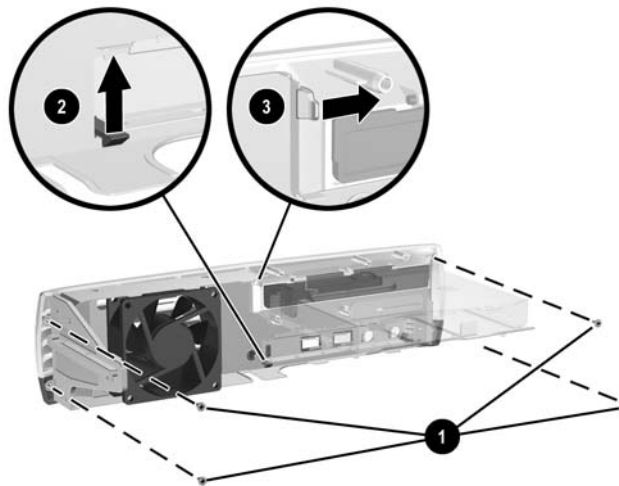
4. Remove the MultiBay riser card (Section 8.5).

5. Remove the front panel assembly (Section 8.6)

6. Remove the front bezel (Section 8.7).

7. Pull the four push pins that secure the fan to the front panel assembly out of the plastic grommets ❶ then, lift the fan off the grommets ❷.
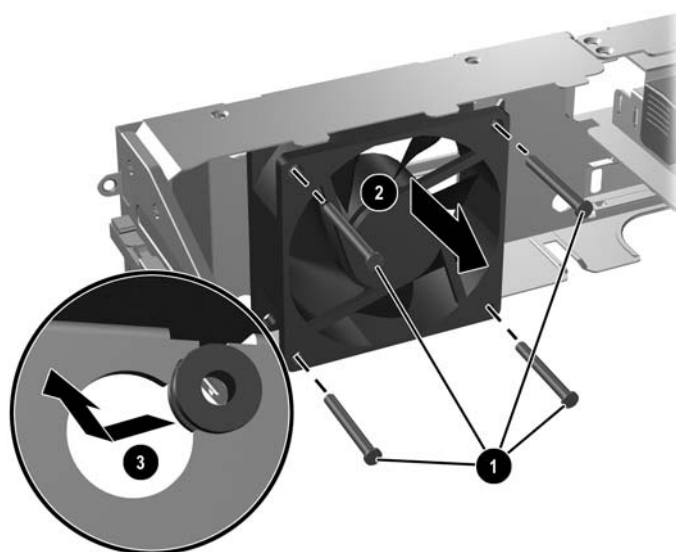
8. To remove the grommets, slide them towards the outside corners of the fan cutout ❸.

To install the fan assembly, reverse the removal procedures, making sure that the fan cable is located near the top of the assembly nearest the center of the front panel assembly.

✎ When installing the four push pins it is necessary to squeeze the pins into the grommets with your fingers acting as a pincer. The back of the grommet must be immovable for the pin to seat properly.

8.9 Cable Management

Always follow good cable management practices when working inside the computer.

■ Keep cables away from major heat sources like the heatsink.

■ Do not jam cables on top of expansion cards or memory modules.Printed circuit cards like these are not designed to take excessive pressure on them.

■ Keep cables clear of sliding or moveable parts to prevent their being cut or crimped when the parts are moved.

■ Do not bend any cable sharply. A sharp bend can break the internal wires.

■ Never bend a SATA data cable tighter than a 30 mm (1.18 in) radius.

■ Never crease a SATA data cable.

Do not rely on components like the drive cage, power supply, or computer cover to push cables down into the chassis. Always position the cables to lay properly by themselves.

When removing the power supply power cables from the P1 or P3 connectors on the system board, always follow these steps:

1. Squeeze on the top of the retaining latch attached to the cable end of the connector ❶.

2. Grasp the cable end of the connector and pull it straight up ❷.

✎ **CAUTION:** Always pull the connector - NEVER pull on the cable. Pulling on the cable could damage the cable and result in a failed power supply.

8.10 Memory

> ⚠ **CAUTION:** The memory module sockets have gold metal contacts. When upgrading the memory, it is important to use memory modules with gold metal contacts to prevent corrosion and/or oxidation resulting from having incompatible metals in contact with each other.

> ⚠ **CAUTION:** Static electricity can damage the electronic components of the computer or optional cards. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object. Refer to Chapter 5 for more information.

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

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

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

3. Remove any MultiBay device in the drive cage (Section 8.4).

4. Remove the MultiBay riser card (Section 8.5).

5. Remove the front panel assembly (Section 8.6).

6. Open both latches of the memory module socket ❶, and insert the memory module into the socket ❷. If you are replacing a memory module, place it in the socket vacated by its predecessor.
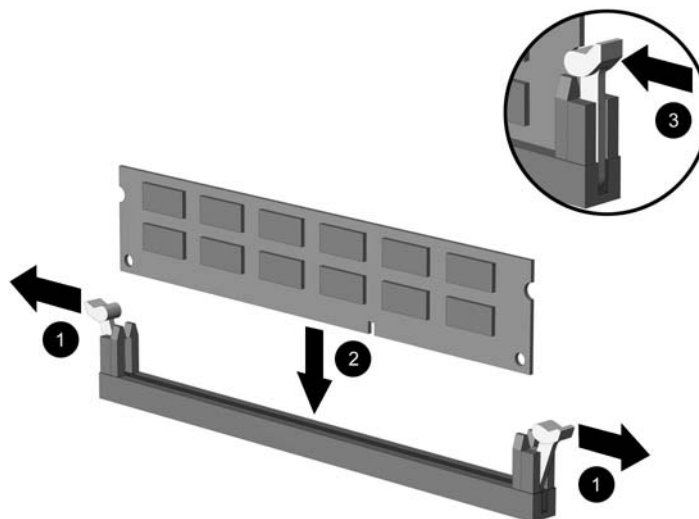
Push the module down into the socket, ensuring that the module is fully inserted and properly seated. Make sure the latches are in the closed position ❸.

✎ A memory module can be installed in only one way. Match the notch on the module with the tab on the memory socket.

7. Repeat step 6 for any additional modules that you want to install.

✎ The computer automatically recognizes the additional memory when the computer is turned on.

To reassemble the computer, reverse the removal procedure.

8.11 Expansion Card Cage

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Lift the green bail handle on the expansion card cage and lift straight up.
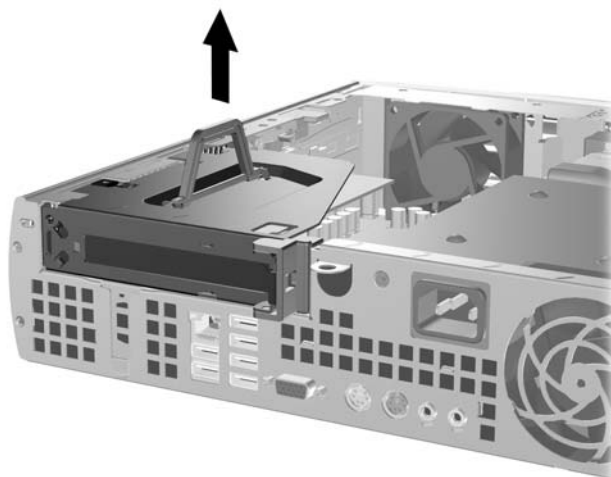
To install the cage, align the cage in the guides on the chassis and press it firmly into place.

8.12 Expansion Card

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove the expansion card cage (Section 8.11).

4. Open the latch ❶ by squeezing the retainer fingers together and rotate the latch out of the way ❷.

5. Lay the card cage on its edge and hold it firmly in place. Grasp the card and carefully rock it back and forth until the connectors pull free from the card cage. Pull the expansion card straight out ❸ to remove it from the chassis. Be sure not to scrape the card against the cage.

   Store the removed card in anti-static packaging.

   .
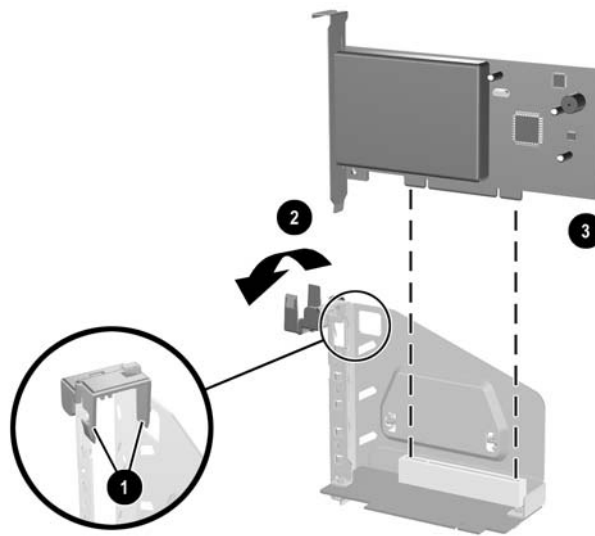
6. If you are not installing a new expansion card, install an expansion slot cover to close the open slot and continue with step 8.

   If you are installing a new expansion card, continue with step 7.

⚠ **CAUTION:** After removing an expansion card, you must replace it with a new card or cover the open slot (for example, with a metal slot cover or a piece of cardboard taped in place) for proper cooling of internal components during operation.

7. Slide the bracket on the end of the expansion card down into the slot and press the card firmly into the socket.

✎ When you install an expansion card, make sure you press firmly on the card so that the whole connector seats properly in the expansion card socket on the riser board.

8. Close the latch firmly to secure the card in place.

9. Install the expansion card cage into the computer.

10. Reconfigure the computer, if necessary. Refer to the *Computer Setup (F10) Utility Guide* on the *Documentation Library* CD for instructions about using Computer Setup.

8.13 Hood Sensor

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove the expansion card cage (Section 8.11).

4. Disconnect the cable from the system board ❶ and then slide the hood sensor out of the slot in the chassis ❷.
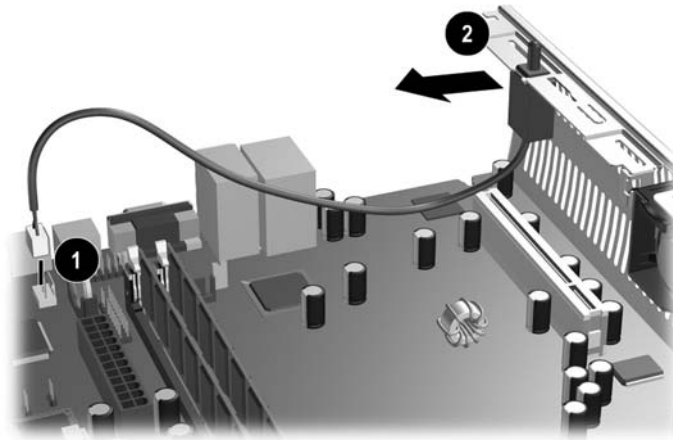
To install the hood sensor, reverse the removal procedures.

8.14 Expansion Card Retaining Latch

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove the expansion card cage (Section 8.11).

4. Open the latch ❶ by squeezing the retainer fingers together then, rotate the latch out of the way ❷.

5. Use a thin, flat-blade screwdriver to pry ❸ the damaged locking lever off the expansion card cage.

6. Remove the locking lever.
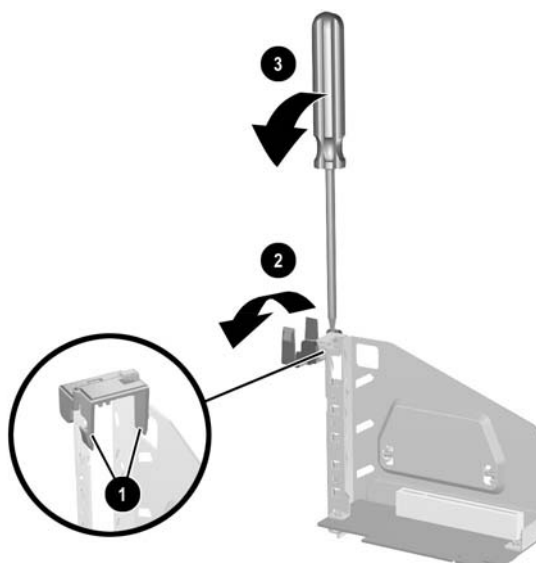
To install the replacement locking lever, spread the pivot pin area and push it onto the ear of the expansion card cage so the pins snap into their receptacles.

Complete the assembly by locking the expansion card in place and reinstalling the expansion card cage.

8.15 **Hard Drive**

A Torx T-15 screwdriver is needed to remove and install the guide screws on a hard drive.

> **CAUTION:** Make sure personal files on the hard drive are backed up to an external storage device before removing the hard drive. Failure to do so will result in data loss. After replacing the primary hard drive, you will need to run the *Restore Plus!* CD to load the Compaq factory-installed files.

> **CAUTION:** To prevent loss of work and damage to the computer or drive:
> - If you are inserting or removing a hard drive, shut down the operating system properly, then turn off the computer. Do not remove a hard drive while the computer is on or in standby mode.
> - Before handling a drive, ensure that you are discharged of static electricity. While handling a drive, avoid touching the connector. For more information about preventing electrostatic damage, refer to Chapter 5 for more information
> - Handle a drive carefully; do not drop it.
> - Do not use excessive force when inserting a drive.
> - Avoid exposing a hard drive to liquids, temperature extremes, or products that have magnetic fields such as monitors or speakers.

1. Prepare the computer for disassembly (Section 8.1).
2. Remove the computer access panel (Section 8.3).

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

3. Remove any MultiBay device in the drive cage (Section 8.4).
4. Remove the MultiBay riser card (Section 8.5).
5. Remove the front panel assembly (Section 8.6).
6. Disconnect the power and data cables from the hard drive.

   Follow proper cable management techniques when handling all cables. Refer to Section 8.9.

7. Pull the drive release lever away from the hard drive ❶, then lift the cable-end of the drive ❷ up and pull it towards the center of the chassis ❸ to remove it from the drive cage.
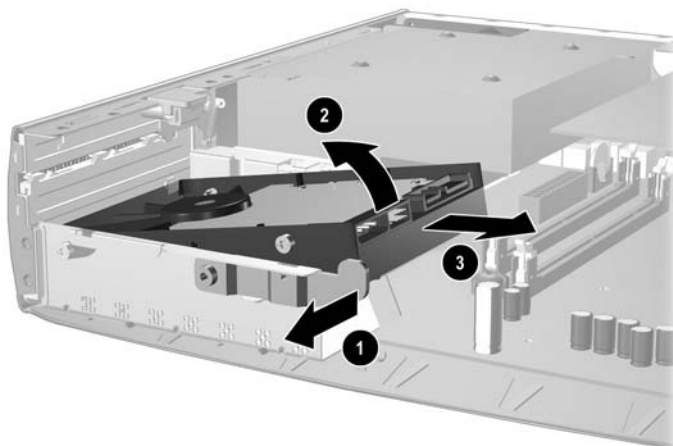
8. Remove the four guide screws (two on each side) from the old drive. You will need these screws to install a new drive.

9. Store the removed drive in anti-static packaging.

To install a drive, reverse the removal procedure.

8.16 Front I/O Device

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove any MultiBay device in the drive cage (Section 8.4).

4. Remove the MultiBay riser card (Section 8.5).

5. Remove the front panel assembly (Section 8.6).

6. Remove the hard drive (Section 8.15).

7. Remove the two screws that hold the front I/O device in place ❶.

8. Disconnect the audio cable from the back of the IO device ❷ and pull that cable through the tunnel opening in the chassis ❸.

9. Disconnect the I/O cables from the system board.
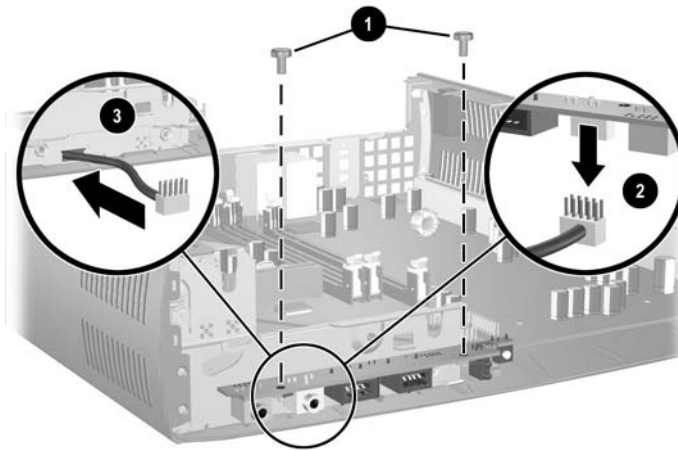
To install the front I/O device, follow this sequence:

1. Thread the audio cable through the tunnel in the chassis and attach it to the front I/O board.

2. Attach the front USB cable and the power switch/LED cable to the front I/O board.

3. Attach the front I/O board to the chassis with two screws.

4. Plug the cables into the system board.

✎ All cables are color coded to match their connectors on the front I/O board and are keyed to prevent improper connections.

8.17 Heatsink Assembly

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove any MultiBay device in the drive cage (Section 8.4).

4. Remove the MultiBay riser card (Section 8.5).

5. Remove the front panel assembly (Section 8.6).

6. Disconnect the thermal sensor and heatsink fan cables ❶ from the system board.

7. Unscrew the four screws that secure the heatsink to the system board ❷ then, lift the heatsink from the system board ❸.

> ⚠ **CAUTION:** Heatsink retaining screws should be removed in diagonally opposite pairs (as in an X) to even the downward forces on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

8. Lay the heatsink on its top in a safe area to prevent the thermal grease from contaminating the work surface.
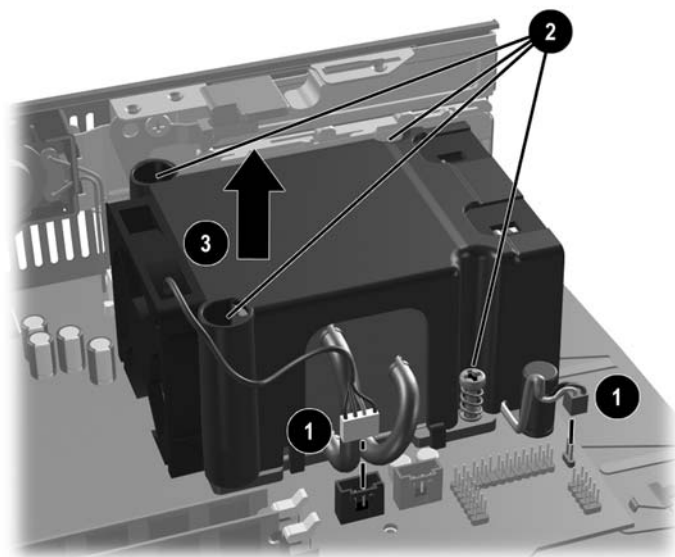
8.17.1 Heatsink Fan with Shroud

1. Turn the heatsink assembly upside down and set it on a flat surface.

2. Spread the four snaps that are hooked around the base of the heatsink ❶ and lift the heatsink from the shroud ❷.

To install a new shroud, reverse the removal procedure.

When reinstalling the heatsink in the computer, make sure that the top of the processor and the bottom of the heatsink have been cleaned with an alcohol wipe and fresh thermal grease has been applied to the top of the processor.

⚠ **CAUTION:** Heatsink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heatsink on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.
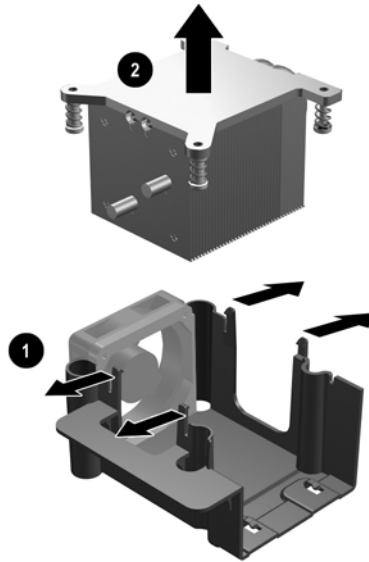
8.18 Processor

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove any MultiBay device in the drive cage (Section 8.4).

4. Remove the MultiBay riser card (Section 8.5).

5. Remove the front panel assembly (Section 8.6).

6. Remove the heatsink (Section 8.17).

7. Rotate the processor locking lever to its full open position ❶.

8. Raise and rotate the microprocessor retainer to its fully open position ❷.

9. Carefully lift the processor from the socket ❸.

⚠ **CAUTION:** Do NOT handle the pins in the processor socket. These pins are very fragile and handling them could cause irreparable damage. Once pins are damaged it may be necessary to replace the system board.

⚠ **CAUTION:** The heatsink must be installed within 24 hours of installing the processor to prevent damage to the processor's solder connections.

To install a new processor:

1. Place the processor in its socket and close the retainer.

2. Secure the locking lever.

If reusing the existing heatsink, go to step 3.

If using a new heatsink, go to step 5.

3. If reusing the existing heatsink clean bottom of the heatsink and apply the thermal grease provided in the spares kit to the top of the processor.

4. Clean the bottom of the heatsink with the provided alcohol pad and place it atop the processor.

Go to step 6.

5. If using a new heatsink, remove the protective covering from the bottom of the heatsink and place it in position atop the processor.

6. Secure the heatsink to the system board and system board tray with the 4 captive screws and attach the heatsink control cable to the system board.

⚠ **CAUTION:** Heatsink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heatsink on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

✎ After installing a new processor onto the system board, always update the system ROM to ensure that the latest version of the BIOS is being used on the computer. The latest system ROMPaq can be found on the Web at: http:\\h18000.www1.hp.com/support/files.

8.19 Power Supply

⚠ **WARNING:** Voltage is always present on the system board when the computer is plugged into an active AC outlet. To avoid possible personal injury and damage to the equipment the power cord should be disconnected from the computer and/or the AC outlet before opening the computer.

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove any MultiBay device in the drive cage (Section 8.4).

4. Remove the MultiBay riser card (Section 8.5).

5. Remove the front panel assembly (Section 8.6).

6. Disconnect the power supply cable from the hard drive and the 6-pin power supply cable on the system board alongside the heatsink.

7. Slide the power supply towards the front of the chassis ❶ about 1.3 cm (1/2 inch) then slide it towards the center of the chassis and rotate it up ❷ to access the main cable connection beneath it.

8. Disconnect the power cable from thesystem board ❸.

✎ There are slots on the chassis that match with clips on the bottom of the power supply for positive retention.

9. Remove the power supply from the chassis.
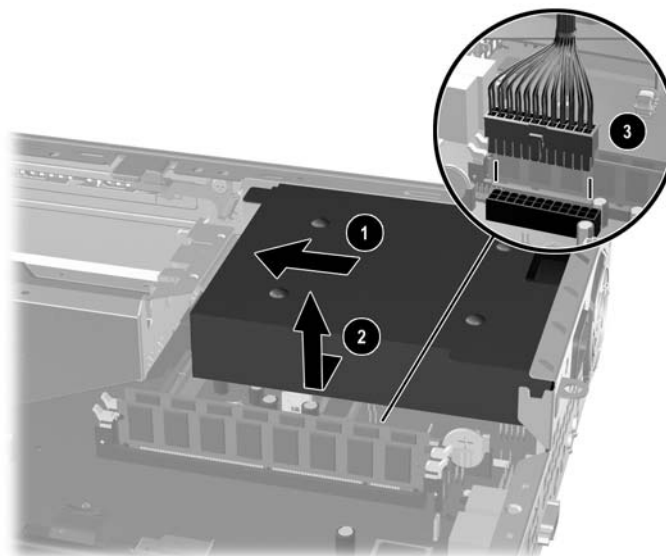
To install the power supply, reverse the removal procedure. Make sure the power supply engages the clips on the chassis when sliding it into place.

✎ When installing the power supply make sure the cables are routed properly and do not interfere with the access panel installation.

8.20 Battery

The battery that comes with this computer provides power to the real-time clock and has a lifetime of about three years. When replacing the battery, use a battery equivalent to the battery originally installed on the computer. The computer comes with a 3-volt lithium coin cell battery.

✎ The lifetime of the lithium battery can be extended by plugging the computer into a live AC wall socket. The lithium battery is only used when the computer is NOT connected to AC power.

⚠ **WARNING:** This computer contains an internal lithium manganese dioxide battery. There is a risk of fire and burns if the battery 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 140°F (60°C)
- Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.
- Replace the battery only with the HP/Compaq spare designated for this product.

⚠ **CAUTION:** Before replacing the battery, it is important to back up the computer CMOS settings. When the battery is removed or replaced, the CMOS settings will be cleared. Refer to the *Troubleshooting Guide* for information on backing up the CMOS settings.

🗑 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 HP/Compaq, their authorized partners, or their agents.

⚠ **CAUTION:** Static electricity can damage the electronic components of the computer or optional equipment. Before beginning these procedures, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove any MultiBay device in the drive cage (Section 8.4).

4. Remove the MultiBay riser card (Section 8.5).

5. Raise the power supply to access the battery but do not either disconnect the cables or remove the assembly from the chassis (Section 8.19).

6. Depending on the type of battery holder on the system board, complete the following instructions to replace the battery:

8.20.1 Type 1 Battery Holder
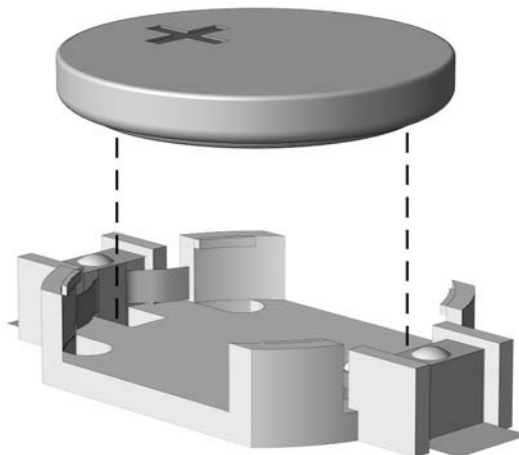
1. Lift the battery out of its holder.

2. Slide the replacement battery into position, positive side up.

3. The battery holder automatically secures the battery in the proper position.

4. Replace the computer cover or access panel.

5. Plug in the computer and turn on power to the computer.

6. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup Guide.*

8.20.2 Type 2 Battery Holder

1. To release the battery from its holder, squeeze the metal clamp ❶ that extends above one edge of the battery. When the battery pops up, lift it out.

2. To insert the new battery, slide one edge of the replacement battery under the holder's lip with the positive side up ❷. Push the other edge down until the clamp snaps over the other edge of the battery.
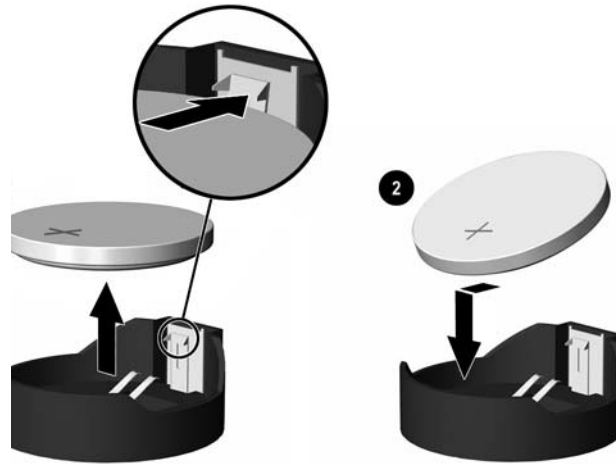
After the battery has been replaced, reverse the disassembly procedure

3. Plug in the computer and turn on power to the computer.

Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup Guide.*

8.20.3 Type 3 Battery

1. Pull back on the clip ❶ that holds the battery in place, then remove the battery ❷.

2. Insert the new battery and position the clip back in place.
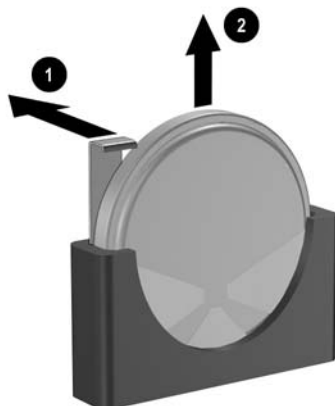
CHeck R&R
process

✎ After the battery has been replaced, use the following steps to complete this procedure.

3. Replace the computer access panel.

4. Plug in the computer and turn on power to the computer.

Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide.*

8.21 Speaker

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove the expansion card cage (Section 8.11).

4. Disconnect the speaker cable from the system board.

5. Grasp the bottom of the speaker while at the same time pressing down on the tab on its top then, slide the speaker towards the center of the chassis to release it.
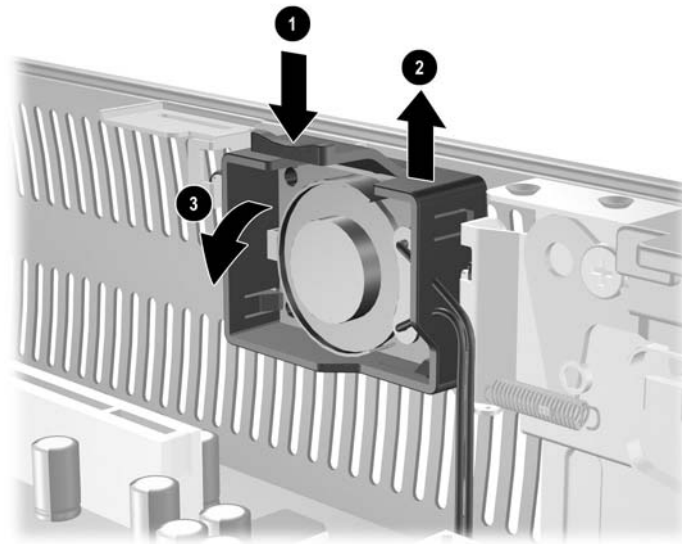
To install the speaker, reverse the removal procedure.

8.22 System Board

1. Prepare the computer for disassembly (Section 8.1).

2. Remove the computer access panel (Section 8.3).

3. Remove any MultiBay device in the drive cage (Section 8.4).

4. Remove the MultiBay riser card (Section 8.5).

5. Remove the front panel assembly (Section 8.6).

6. Remove the memory modules (Section 8.10).

7. Remove the heatsink (Section 8.17).

8. Remove the power supply (Section 8.19).

9. Disconnect all cables connected to the system board, noting their location for reinstallation.

10. Remove the thumbscrew that secures the system board to the chassis ❶.

11. Slide the system board towards the front of the chassis ❷, making sure that all keyhole retainers are clear before lifting the system board from the chassis.

⚠ **CAUTION:** Be very careful when removing or replacing the system board to prevent damaging it.
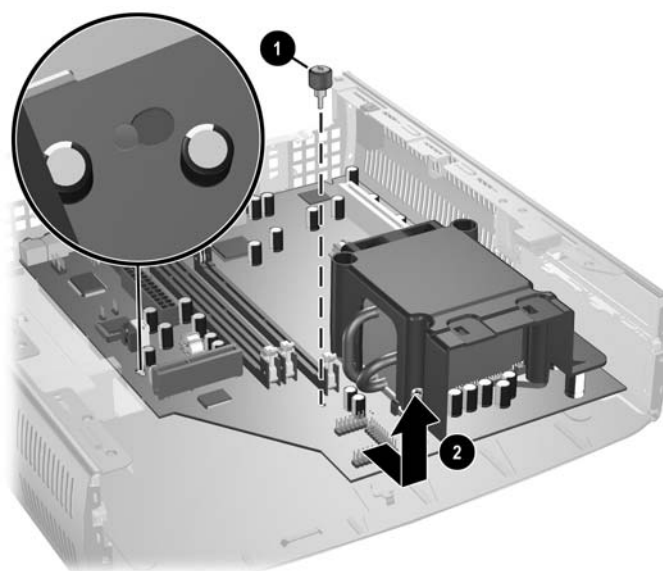
To install the system board, reverse the removal procedure.

✎ When installing the system board make sure that the board is pressed firmly against the floor of the chassis to allow the keys to lock into the keyhole slots on the system board.

A

Connector Pin Assignments

This appendix contains the pin assignments for many computer and workstation connectors. Some of these connectors may not be used on the product being serviced.

Keyboard

Connector and Icon		Pin	Signal
		1	Data
		2	Unused
		3	Ground
		4	+5 VDC
		5	Clock
		6	Unused
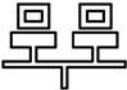
Mouse

Connector and Icon		Pin	Signal
		1	Data
		2	Unused
		3	Ground
		4	+5 VDC
		5	Clock
		6	Unused

Ethernet BNC

Connector and Icon		Pin	Signal
		1 (Center)	Data
		2 (Shield)	Ground

Ethernet RJ-45

Connector and Icon		Pin	Signal
		1	(+) Transmit Data
		2	(-) Transmit Data
		3	(+) Receive Data
		4	Unused
		5	Unused
		6	(-) Receive Data
		7	Unused
		8	Unused

Ethernet AUI

Connector and Icon
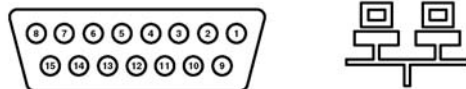
Pin	Signal	Pin	Signal
1	Ground	9	Positive AUI Differential Receive
2	Negative AUI Differential Collision	10	+12V
3	Positive AUI Differential Collision	11	Ground
4	Negative AUI Differential Transmit	12	Ground
5	Positive AUI Differential Transmit	13	Unused
6	Ground	14	Unused
7	Ground	15	Unused
8	Negative AUI Differential Receive	16	Unused

Parallel Interface

Connector and Icon
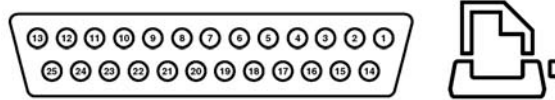
Pin	Signal	Pin	Signal	Pin	Signal
1	Strobe	7	Data Bit 5	13	Select
2	Data Bit 0	8	Data Bit 6	14	Auto Linefeed
3	Data Bit 1	9	Data Bit 7	15	Error
4	Data Bit 2	10	Acknowledge	16	Initialize Printer
5	Data Bit 3	11	Busy	17	Select IN
6	Data Bit 4	12	Paper End	18-25	Signal Ground

Serial Interface, Powered and Non-Powered

Connector and Icon	Pin	Signal
	1	Carrier Detect (12V if powered)
	2	Receive Data
	3	Transmit Data
	4	Data Terminal Ready
	5	Signal Ground
	6	Data Set Ready
	7	Request to Send
	8	Clear to Send
	9	Ring Indicator (5V if powered)

USB

Connector and Icon	Pin	Signal
	1	+5 VDC
	2	- Data
	3	+ Data
	4	Ground
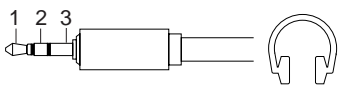
Microphone
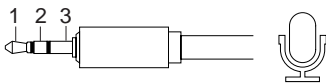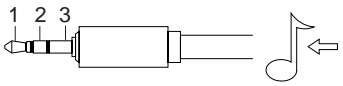
Connector and Icon (1/8" miniphone)	Pin	Signal
	1 (Tip)	Audio
	2 (Ring)	Power
	3 (Shield)	Ground
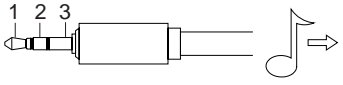
Headphone

Connector and Icon (1/8" miniphone)	Pin	Signal
	1 (Tip)	Audio_Left
	2 (Ring)	Audio_Right
	3 (Shield)	Ground

Line-In Audio

Connector and Icon (1/8" miniphone)	Pin	Signal
	1 (Tip)	Audio_In_Left
	2 (Ring)	Audio_In_Right
	3 (Shield)	Ground

Line-Out Audio

Connector and Icon (1/8" miniphone)	Pin	Signal
	1 (Tip)	Audio_Out_Left
	2 (Ring)	Audio_Out_Right
	3 (Shield)	Ground

SCSI Low Voltage Differential/Single Ended (LVD/SE)

Connector and Icon

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1-16	Ground	40	-D0	49-50	Ground	60	-MSG
17-18	TERMPWR	41	-D1	51-52	TERMPW	61	-SEL
19	Reserved	42	-D1	53	Reserved	62	-C/D
20-34	Ground	43	-D3	54	Ground	63	-REQ
35	-D12	44	-D4	55	-ATN	64	-I/O
36	-D13	45	-D5	56	Ground	65	-D
37	-D14	46	-D6	57	-BSY	66	-D
38	-D15	47	-D7	58	-ACK	67	-D
39	-DP1	48	-DP0	59	-RST	68	-D

Ultra SCSI

Connector and Icon
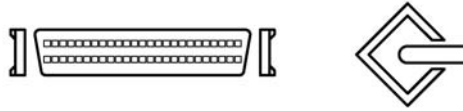
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1-11	Ground	29	DB3	37	Reserved	45	RST #
12	Reserved	30	DB4	38	TERMPWR	46	MSG #
13	Open	31	DB5	39	Reserved	47	SEL #
14	Reserved	32	DB6	40	Ground	48	C/D
15-25	Ground	33	DB7	41	ATN #	49	REQ #
26	DB0	34	DBP	42	Ground	50	Input/Output
27	DB1	35	Ground	43	BSY #		
28	DB2	36	Ground	44	ACK #		

External Infrared Transceiver

Connector and Icon

Pin	Signal	Pin	Signal	Pin	Signal
1	Transmit	4	5V	7	Not Used
2	Receive	5	Mode	8	Not Used
3	Ground	6	Not Used		

Monitor

Connector and Icon

Pin	Signal	Pin	Signal	Pin	Signal
1	Red Analog	6	Ground	11	Not used
2	Green Analog	7	Ground	12	DDC Serial Data
3	Blue Analog	8	Ground	13	Horizontal Sync
4	Not used	9	+5V (fused)	14	Vertical Sync
5	Ground	10	Ground	15	DDC Serial Clock

ATA/ATAPI (IDE) Standard Drive Cable

Connector

Pin	Signal	Pin	Signal	Pin	Signal
1	Reset	15	DD1	29	DMAK
2	Ground	16	DD14	30	Ground
3	DD7	17	DD0	31	INTRQ
4	DD8	18	DD15	32	IOCS16
5	DD6	19	Ground	33	DA1
6	DD9	20	(Key)	34	PDIAG (cable detect)
7	DD5	21	DMARQ	35	DA0
8	DD10	22	Ground	36	DA2
9	DD4	23	DIOW	37	CS1FX
10	DD11	24	Ground	38	CS3FX
11	DD3	25	DIOR	39	DASP
12	DD12	26	Ground	40	Ground
13	DD2	27	IORDY		
14	DD13	28	CSEL		

MultiBay CD-ROM Adapter

Connector
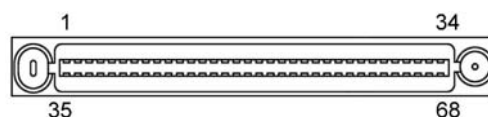
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	RESDRV_	18	D15	35	A0	52	FP05
2	GROUND	19	GROUND	36	A2	53	FP06
3	D07	20	(key)	37	CS1FX	54	FP07
4	D08	21	DRQ	38	CS3FX	55	FP08
5	D06	22	GROUND	39	DASP	56	FP09
6	D09	23	IOW	40	GROUND	57	FP10
7	D05	24	GROUND	41	+5VMLOG	58	FP11
8	D10	25	IOR	42	-5VMOT	59	FP12
9	D04	26	GROUND	43	GROUND	60	FP13
10	D11	27	IOCHDRY	44	AUDIO_L	61	FP14
11	D03	28	CABLE SELECT	45	A_GROUND_R	62	FP15
12	D12	29	DAK	46	A_GROUND_I	63	FP16
13	D02	30	GROUND	47	audio_r	64	FP17
14	D13	31	IRQ	48	FP01	65	FP18
15	D01	32	IO16	49	FP02	66	FP19
16	D14	33	A1	50	FP03	67	FP20
17	D00	34	PDIAG	51	FP04	68	FP21

24-Pin Power

Connector

```
24                    □                 13
┌─────────────────────────────────────────┐
│ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ │
│ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ │
└─────────────────────────────────────────┘
12                                        1
```
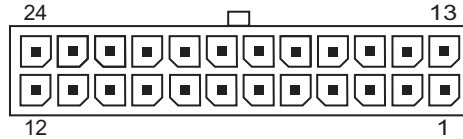
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+3.3 V	7	GND	13	+3.3 V	19	GND
2	+3.3 V	8	POK	14	-12 V	20	open
3	GND	9	+5 Vaux	15	GND	21	+5 V
4	+5 V	10	+12 V	16	PSON	22	+5 V
5	GND	11	+12 V	17	GND	23	+5 V
6	+5 V	12	+3.3 V	18	GND	24	GND
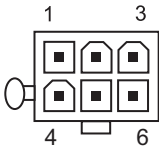
24-Pin MicroFit Power

Connector

```
24                    □                 13
┌─────────────────────────────────────────┐
│ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ │
│ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ │
└─────────────────────────────────────────┘
12                                        1
```
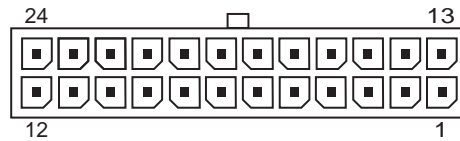
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+5 Vaux	7	PWRGD	13	+12 V	19	GND
2	GND	8	+3.3 V	14	+5 V Sense	20	+3.3 Sense
3	+5 V	9	+3.3 V	15	GND	21	+3.3 V
4	+5 V	10	Tach	16	+5 V	22	+3.3 V
5	PS_ON	11	GND	17	+5 V	23	GND
6	GND	12	Fan-CMD	18	+3.3 V	24	-12 V

4-Pin Power (for CPU)
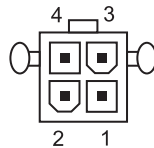
Connector and Icon	Pin	Signal
	1	GND
	2	GND
	3	+12 V CPU
	4	-12 V CPU

6-Pin Power

Connector and Icon	Pin	Signal
	1	GND
	2	GND
	3	GND
	4	12 V CPU
	5	12 V CPU
	6	+12 V

SATA Data and Power

Drive Connector
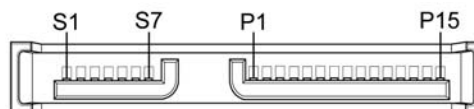
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
S1	Ground	S2	A+	S3	A-	S4	Ground
S5	B-	S6	B+	S7	Ground		
P1	V 3.3	P2	V 3.3	P3	V 3.3	P4	Ground
P5	Ground	P6	Ground	P7	V 5	P8	V 5
P9	V 5	P10	Ground	P11	Reserved	P12	Ground
P13	V 12	P14	V 12	P15	V 12		

*S = Data, P = Power

PCI Express

x1, x4, x8, and x16 PCI Express Connector

Pin A

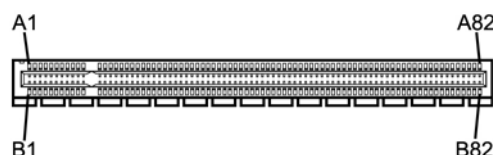| Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	PRSNT1#	6	JTAG3	11	PERST#	16	PERp0	21	PERp1
2	+12V	7	JTAG4	12	GND	17	PERn0	22	PERn1
3	+12V	8	JTAG5	13	REFCLK+	18	GND	23	GND
4	GND	9	+3.3v	14	REFCLK-	19	RSVD	24	GND
5	JTAG2	10	+3.3v	15	GND	20	GND	25	PERp2
26	PERn(2)	31	GND	36	PERn4	41	GND	46	GND
27	GND	32	RSVD	37	GND	42	GND	47	PERp7
28	GND	33	RSVD	38	GND	43	PERp6	48	PERn7
29	PERp3	34	GND	39	PERp5	44	PERn6	49	GND
30	PERn3	35	PERp4	40	PERn5	45	GND	50	RSVD
51	GND	56	PERp9	61	PERn10	66	GND	71	GND
52	PERp8	57	PERn9	62	GND	67	GND	72	PERp13
53	PERn8	58	GND	63	GND	68	PERp12	73	PERn13
54	GND	59	GND	64	PERp11	69	PERn12	74	GND
55	GND	60	PERp10	65	PERn11	70	GND	75	GND
76	PERp14	81	PERn15						
77	PERn14	82	GND						
78	GND								
79	GND								
80	PERp15								

Pin B information is on the next page

Notes:
x1 PCI Express uses pins 1-18
x4 PCI Express uses pins 1-32
x8 PCI Express uses pins 1-49
x16 PCI Express uses pins 1-82

PCI Express

x1, x4, x8, and x16 PCI Express Connector

Pin B

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+12V	6	SMDAT	11	WAKE#	16	GND	21	GND
2	+12V	7	GND	12	RSVD	17	PRSNT2#	22	GND
3	RSVD	8	+3.3v	13	GND	18	GND	23	PETp2
4	GND	9	JTAG1	14	PETp0	19	PETp1	24	PETn2
5	SMCLK	10	3.3vAux	15	PETn0	20	PETn1	25	GND
26	GND	31	PRSNT2#	36	GND	41	PETp6	46	PETn7
27	PETp3	32	GND	37	PETp5	42	PRTn6	47	GND
28	PETn3	33	PETp4	38	PETn5	43	GND	48	PRSNT2#
29	GND	34	PETn4	39	GND	44	GND	49	GND
30	RSVD	35	GND	40	GND	45	PETp7	50	PETp8
51	PETn8	56	GND	61	GND	66	PETp12	71	PETn13
52	GND	57	GND	62	PETp11	67	PETn12	72	GND
53	GND	58	PETp10	63	PETn11	68	GND	73	GND
54	PETp9	59	PETn10	64	GND	69	GND	74	PETp14
55	PETn9	60	GND	65	GND	70	PETp13	75	PETn14
76	GND	81	PRSNT2#						
77	GND	82	RSVD						
78	PETp15								
79	PETn15								
80	GND								

Notes:

x1 PCI Express uses pins 1-18

x4 PCI Express uses pins 1-32

x8 PCI Express uses pins 1-49

x16 PCI Express uses pins 1-82

B

Power Cord Set Requirements

The voltage select switch feature on the computer permits it to operate from any line voltage between 100-120 or 220-240 volts AC.

The power cord set received with the computer meets the requirements for use in the country where you purchased the equipment.

Power cord sets for use in other countries must meet the requirements of the country where you use the computer. For more information on power cord set requirements, contact your authorized HP dealer, reseller, or service provider.

General Requirements

The requirements listed below are applicable to all countries:

1. The length of the power cord set must be at least 1.8 m (6.00 feet) and a maximum of 3.0 m (9.75 feet).

2. All power cord sets must be approved by an acceptable accredited agency responsible for evaluation in the country where the power cord set will be used.

3. The power cord set must have a minimum current capacity of 10A and a nominal voltage rating of 125 or 250 volts AC, as required by each country's power system.

4. The appliance coupler must meet the mechanical configuration of an EN 60 320/IEC 320 Standard Sheet C13 connector, for mating with appliance inlet on the Switch Box.

Country-Specific Requirements

Additional requirements specific to a country are shown in parentheses and explained below.

Country	Accrediting Agency	Country	Accrediting Agency
Australia (1)	EANSW	Italy (1)	IMQ
Austria (1)	OVE	Japan (3)	METI
Belgium (1)	CEBC	Norway (1)	NEMKO
Canada (2)	CSA	Sweden (1)	SEMKO
Denmark (1)	DEMKO	Switzerland (1)	SEV
Finland (1)	SETI	United Kingdom (1)	BSI
France (1)	UTE	United States (2)	UL
Germany (1)	VDE		

1. The flexible cord must be <HAR> Type HO5VV-F, 3-conductor, 1.0 mm^2 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. The flexible cord must be Type SJT or equivalent, No. 18 AWG, 3-conductor. The wall plug must be a two-pole grounding type with a NEMA 5-15P (15A, 125V) or NEMA 6-15P (15A 250V) configuration.

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 mm^2 conductor size. Wall plug must be a two-pole grounding type with a Japanese Industrial Standard C8303 (7A, 125V) configuration.

C

POST Error Messages

POST Error Messages

An error message results if the Power-On Self-Test (POST) encounters a problem. This test runs when the system is turned on, checking assemblies within the computer and reporting any errors found.

Not all computers use all of the codes listed.

POST Error Messages

Screen Message	Probable Cause	Recommended Action
101-Option ROM Checksum Error	System ROM or expansion board option ROM checksum.	Verify the correct ROM. Flash the ROM if needed. If an expansion card was recently added, remove it and see if the problem remains. Clear CMOS. If the message disappears, there may be a problem with the expansion card. Replace the system board.
110-Out of Memory Space for Option ROMs	Recently added PCI expansion card contains an option ROM too large to download during POST.	If a PCI expansion card was recently added, remove it to see if the problem remains. In Computer Setup, disable the NIC PXE Option ROM Download to prevent PXE option ROM for the internal NIC from being downloaded during POST to free more memory for an expansion card's option ROM. Internal PXE option ROM is used for booting from the NIC to a PXE server. Enable the ACPI/USB Buffers @ Top of Memory setting in Computer Setup.
162-System Options Not Set	Configuration incorrect. RTC (real-time clock) battery may need to be replaced.	Run Computer Setup (F10 Setup) and check configuration of **Onboard Devices**. Set the date and time under **Control Panel** or in F10 Setup depending on the operating system. If the problem persists, replace the RTC battery.

POST Error Messages

Screen Message	Probable Cause	Recommended Action
163-Time & Date Not Set	Invalid time or date in configuration memory. RTC (real-time clock) battery may need to be replaced.	Set the date and time under **Control Panel** or in F10 Setup depending on the operating system. If the problem persists, replace the RTC battery.
	CMOS jumper may not be properly installed.	Check for proper placement of the CMOS jumper, if applicable.
164-Memory Size Error	Memory amount has changed since the last boot (memory added or removed).	Press the **F1** key to save the memory changes.
	Memory configuration is incorrect.	Run Computer Setup (F10 Setup). Make sure memory module(s) (if any) are installed properly. If third party memory has been added, test using HP-only memory. Verify proper memory module type.
201-Memory Error	RAM failure.	Run Computer Setup (F10 Setup) or Windows utilities. Ensure memory and continuity modules are installed correctly. Verify proper memory module type. Remove and replace memory module(s) one at a time to isolate faulty module. Replace the faulty memory module(s). If error persists after replacing memory modules, replace the system board.
213-Incompatible memory Module in memory Socket(s) X,X, X	A memory module in memory socket identified in the error message is missing critical SPD information, or is incompatible with the chipset.	Verify proper memory module type. Try another memory socket. Replace memory with a module conforming to the SPD standard.
214-DIMM Configuration Warning	Populated DIMM configuration is not optimized.	Rearrange the DIMMS so that each channel has the same amount of memory.
219-ECC Memory Module Detected ECC Modules not supported on this platform	Recently added memory module(s) support ECC memory error correction.	If additional memory was recently added, remove it to see if the problem remains. Check product documentation for memory support information.

POST Error Messages

Screen Message	Probable Cause	Recommended Action
301-Keyboard Error	Keyboard failure.	Reconnect keyboard with computer turned off.
		Check connector for bent or missing pins.
		Ensure that none of the keys are depressed.
		Replace keyboard.
303-Keyboard Controller Error	I/O board keyboard controller.	Reconnect keyboard with computer turned off.
		Replace the system board.
304-Keyboard or System Unit Error	Keyboard failure.	Reconnect the keyboard with computer turned off.
		Ensure that none of the keys are depressed.
		Replace keyboard.
		Replace system board.
501-Display Adapter Failure	Graphics display controller.	Reseat the graphics card (if applicable).
		Clear CMOS.
		Verify that the monitor is attached and turned on.
		Replace the graphics controller (if applicable).
510-Splash Screen image corrupted	Splash Screen image has errors.	Install latest version of ROMPaq to restore image.
511-CPU, CPUA, or CPUB Fan not detected	Fan is not connected or may have malfunctioned.	Reseat fan cable.
		Reseat the fan.
		Replace the fan.
512-Chassis, rear chassis, or front chassis fan not detected	Fan is not connected, may have malfunctioned.	Reseat chassis, rear chassis, or front chassis fan cable.
		Reseat chassis, rear chassis, or front chassis fan.
		Replace chassis, rear chassis, or front chassis fan.
514-CPU or Chassis Fan not detected.	CPU fan is not connected or may have malfunctioned.	Reseat CPU or chassis fan.
		Reseat fan cable.
		Replace CPU or chassis fan.
601-Diskette Controller Error	Diskette controller circuitry or floppy drive circuitry incorrect.	Run Computer Setup (F10 Setup).
		Check and/or replace cables.
		Clear CMOS.
		Replace diskette drive.
		Replace the system board.

POST Error Messages

Screen Message	Probable Cause	Recommended Action
605-Diskette Drive Type Error	Mismatch in drive type.	Run Computer Setup (F10 Setup). Disconnect any other diskette controller devices (tape drives). Clear CMOS.
912-Computer Cover Has Been Removed Since Last System Start Up		No action required.
917-Front Audio not Detected	Front audio harness has been detached or unseated from the system board.	Reconnect or replace front audio harness.
919-Front Panel, MultiPort, and/or MultiBay Risers not Detected.	Riser card has been removed or has not been reinstalled properly in the system.	Unplug computer and install/reinstall riser cord.
921-Device in PCI Express slot failed to initialize.	There is an incompatibility/problem with this device and the system or PCI Express Link could not be retrained to an X1.	Try rebooting the system. If the error reoccurs, the device may not work with this system.

✎ This error message applies to the PCI Express Graphics slot using Intel 9X1 Express chipsets. This slot supports x1 and x16 (PCI Express Link Width cards) only. If a x4 or x8 card is used, system BIOS will attempt to retrain to a x1. If this fails, the 921 error message will be displayed.

Screen Message	Probable Cause	Recommended Action
1720-SMART Hard Drive Detect Imminent Failure	Hard drive is about to fail. (Some hard drives have a firmware patch that will fix an erroneous error message.)	Determine if hard drive is giving correct error message. Run the Drive Protection System test if applicable. Apply firmware patch if applicable. (see www.hp.com/support) Back up contents and replace hard drive.
1785-MultiBay incorrectly installed	(for MultiBay option on non-USDT systems) Multibay option ribbon cables not seated or improperly attached. or MultiBay device not properly seated. or MultiBay diskette present.	Ensure the MultiBay option is attached as device 0 on the IDE cable. Ensure no other device is attached to the same IDE cable. Ensure both ends of the IDE and MultiBay ribbon cables are properly seated. Ensure the MultiBay device is fully inserted. Ensure a MultiBay diskette is not present (MultiBay diskette drives are not supported by the MultiBay option).

POST Error Messages

Screen Message	Probable Cause	Recommended Action
1785-MultiBay incorrectly installed (continued)	*(for integrated MultiBay/ USDT systems)* MultiBay device not properly seated. or MultiBay riser not properly seated.	Ensure the MultiBay device is fully inserted. Ensure the MultiBay riser is properly seated.
1794-Inaccessible devices attached to SATA 1 and/or SATA 3	A device is attached to SATA 1 and/or SATA 3. Devices attached to these connectors will be inaccessible while "SATA Emulation" is set to "Combined IDE Controller" in Computer Setup.	If using Windows 2000 or Windows XP, change "SATA Emulation" to "Separate IDE Controller" in Computer Setup. If not using Windows 2000 or Windows XP, relocate the affected devices to SATA 0 or SATA 2 (if available). Remove the affected devices from SATA 1 and SATA 3.
1796-SATA Cabling Error	One or more SATA devices are improperly attached. For optimal performance, the SATA 0 and SATA 1 connectors must be used before SATA 2 and SATA 3.	Ensure SATA connectors are used in ascending order. For one device, use SATA 0. For two devices, use SATA 0 and SATA 1. For three devices, use SATA 0, SATA1, and SATA 2.
1801-Microcode Patch Error	Processor not supported by ROM BIOS.	Upgrade BIOS to proper version. Change the processor.
1998-Master Boot Record has been lost.	The previously saved copy of the MBR has been corrupted.	Run Computer Setup and save the MBR of the current bootable disk.
1999-Master Boot Record has been changed.	The current MBR does not match the previously saved copy of the MBR.	Use extreme caution, The MBR may have been updated due to normal disk maintenance activities (disk manager, fdisk, or format). ⚠ Replacing the previously saved MBR in such situations can cause data loss. If certain that the MBR change is unintentional and undesired (e.g. due to a virus), run Computer Setup and restore the previously saved MBR copy. Otherwise, run Computer Setup and either disable MBR security or save the MBR of the current bootable disk.

POST Error Messages

Screen Message	Probable Cause	Recommended Action
2000-Master Boot Record Hard Drive has Changed.	The current bootable hard drive is not the same as the one that was present when MBR security was enabled.	Run Computer Setup and either disable MBR security or save the MBR of the current bootable disk.
Invalid Electronic Serial Number.	Electronic serial number has become corrupted.	Run Computer Setup. If Setup already has data in the field or will not allow the serial number to be entered, download from http://www.hp.com and run SP5572.EXE (SNZERO.EXE). Run Computer Setup and try to enter serial number under Security, System ID, then save changes.
Network Server Mode Active and No Keyboard Attached	Keyboard failure while Network Server Mode enabled.	Reconnect keyboard with computer turned off. Check connector for bent or missing pins. Ensure that none of the keys are depressed. Replace keyboard.
Parity Check 2.	Parity RAM failure.	Run Computer Setup and Diagnostic utilities.

POST Diagnostic Front Panel LEDs and Audible Codes

This section covers the front panel LED codes as well as the audible codes that may occur before or during POST that do not necessarily have an error code or text message associated with them.

If you see flashing LEDs on a PS/2 keyboard, look for flashing LEDs on the front panel of the computer and refer to the following table to determine the front panel LED codes.

Recommended actions in the following table are listed in the order in which they should be performed.

Beeps will occur only for 5 iterations and then stop. LEDs will continue to blink until corrective action is taken.

POST Diagnostic Front Panel LEDs and Audible Codes

Activity	Beeps	Possible Cause	Recommended Action
Green Power LED On.	None	Computer on.	None
Green Power LED flashes every two seconds.	None	Computer in Suspend to RAM mode (select models only) or normal Suspend mode.	None required. Press any key or move the mouse to wake the computer.
Red Power LED flashes two times, once every second, followed by a two second pause. Beeps stop after the fifth iteration but the LED continues to flash until the issue has been resolved.	2	Processor thermal protection activated: A fan may be blocked or not turning. OR The heatsink/fan assembly is not properly attached to the processor.	Ensure that the computer air vents are not blocked and the processor cooling fan is running. Open hood, press power button, and see if the processor fan spins. If the processor fan is not spinning, make sure the fan's cable is plugged onto the system board header. Ensure the fan is fully/properly seated or installed. If fan is plugged in and seated properly, but is not spinning, then replace processor fan. Reseat processor heatsink and verify that the fan assembly is properly attached. Contact an authorized reseller or service provider.

Activity	Beeps	Possible Cause	Recommended Action
Red Power LED flashes three times, once every second, followed by a two second pause. Beeps stop after the fifth iteration but the LED continues to flash until the issue has been resolved.	3	Processor not installed (not an indicator of bad processor).	Check to see that the processor is present. Reseat the processor.
Red Power LED flashes four times, once every second, followed by a two second pause. Beeps stop after the fifth iteration but the LED continues to flash until the issue has been resolved.	4	Power failure (power supply is overloaded).	Open the hood and ensure the power supply cable is seated into the connector on the system board. Check if a device is causing the problem by removing ALL attached devices (such as hard, diskette, or optical drives, and expansion cards). Power on the system. If the system enters the POST, then power off and replace one device at a time and repeat this procedure until failure occurs. Replace the device that is causing the failure. Continue adding devices one at a time to ensure all devices are functioning properly. Replace the power supply. Replace the system board.
Red Power LED flashes five times, once every second, followed by a two second pause. Beeps stop after the fifth iteration but the LED continues to flash until the issue has been resolved.	5	Pre-video memory error.	Reseat DIMMs. Power on the system. Replace DIMMs one at a time to isolate the faulty module. Replace third-party memory with HP memory. Replace the system board.

Activity	Beeps	Possible Cause	Recommended Action
Red Power LED flashes six times, once every second, followed by a two second pause. Beeps stop after the fifth iteration but the LED continues to flash until the issue has been resolved.	6	Pre-video graphics error.	For systems with a graphics card: Reseat the graphics card. Power on the system. Replace the graphics card. Replace the system board. For systems with integrated graphics, replace the system board.
Red Power LED flashes seven times, once every second, followed by a two second pause. Beeps stop after the fifth iteration but the LED continues to flash until the issue has been resolved.	7	System board failure (ROM detected failure prior to video).	Replace the system board.
Red Power LED flashes eight times, once every second, followed by a two second pause. Beeps stop after the fifth iteration but the LED continues to flash until the issue has been resolved.	8	Invalid ROM based on bad checksum.	Reflash the ROM using a ROMPaq diskette. See the "ROM Flash" section of the *Desktop Management Guide* on the *Documentation CD*. Replace the system board.

Activity	Beeps	Possible Cause	Recommended Action
Red Power LED flashes nine times, once every second, followed by a two second pause.	9	System powers on but is unable to boot.	Check that the voltage selector, located on the rear of the power supply (some models), is set to the appropriate voltage. Proper voltage setting depends on your region. Replace the system board. Replace the processor.
Red Power LED flashes ten times, once every second, followed by a two second pause.	10	Bad option card.	Check each graphics card by removing the card (one at a time if multiple cards), then power on the system to see if fault goes away. Once a bad card is identified, remove and replace the bad option card. Replace the system board.
System does not power on and LEDs are not flashing.	None	System unable to power on.	Press and hold the power button for less than 4 seconds. If the hard drive LED turns green, then: Check that the voltage selector, located on the rear of the power supply, is set to the appropriate voltage. Proper voltage setting depends on your region. Remove the expansion cards one at a time until the 3V_aux light on the system board turns on. Replace the system board. OR Press and hold the power button for less than 4 seconds. If the hard drive LED does not turn on green then: Check that the unit is plugged into a working AC outlet. Open hood and check that the power button harness is properly connected to the system board. Check that both power supply cables are properly connected to the system board. Check to see if the 3V_aux light on the system board is turned on. If it is turned on, then replace the power button harness. If the 3V_aux light on the system board is not turned on, then replace the power supply. Replace the system board.

D

Troubleshooting Without Diagnostics

Preliminary Checklist

This section describes some simple, preliminary tests and guidelines for troubleshooting the computer without using the diagnostics.

■ Are the computer and monitor connected to a working electrical outlet?

■ Is the voltage select switch is set to the appropriate voltage for your region (115V or 230V)?

■ Is the computer turned on?

■ Is the green power light illuminated?

■ Is the monitor turned on?

■ Is the green monitor light illuminated?

■ Turn up the monitor brightness and contrast controls if the monitor is dim.

■ If the system has multiple video sources (embedded or PCI adapters) installed (embedded video on select models only) and a single monitor, the monitor must be plugged into the monitor connector on the source selected as the primary VGA adapter. During boot, the other monitor connectors are disabled and if the monitor is connected into these ports, the monitor will not function. You can select which source will be the default VGA source in Computer (F10) Setup.

■ Press and hold any key. If the system beeps, then the keyboard is operating correctly.

■ Check all cables for loose or incorrect connections.

■ Reconfigure the computer after installing a non–Plug and Play expansion board or other option, such as a diskette drive.

■ Are all of the necessary device drivers installed?

■ Have all printer drivers been installed for each application?

■ Remove all bootable media (diskette, CD, or USB device) from the system before turning on the system.

■ Are all switches set correctly?

■ Is the NIC Remote Wakeup cable (featured on some models) connected between the NIC and the riser/system board?

Solving Minor Problems

Solving Minor Problems

Problem	Cause	Possible Solution
Computer appears locked up and will not turn off when the power button is pressed.	Software control of the power switch is not functional.	1. Press and hold the power button for at least four seconds until the computer turns off. 2. Disconnect electrical plug from outlet.
Computer will not respond to USB keyboard or mouse.	Computer is in **standby** mode.	Press the power button to resume from **standby** mode.
	System has locked up.	Restart computer.
⚠ **CAUTION:** When attempting to resume from **standby** mode, do not hold down the power button for more than four seconds. Otherwise, the computer will shut down and you will lose any unsaved data.		
Computer date and time display is incorrect.	RTC (real-time clock) battery may need to be replaced.	1. Reset the date and time under **Control Panel**. 2. Replace the RTC battery.
Computer appears to pause periodically.	Network driver is loaded and no network connection is established.	Establish a network connection, or use Computer Setup or Microsoft Windows Device Manager to disable the network controller.
Cursor will not move using the arrow keys on the keypad.	The **Num Lock** key may be on.	Press the **Num Lock** key. The **Num Lock** key can be disabled (or enabled) in Computer Setup.
Cannot remove computer cover or access panel.	Smart Cover Lock, featured on some computers, is locked.	1. Unlock the Smart Cover Lock using Computer Setup. 2. Use the Smart Cover FailSafe Key in case of forgotten password, power loss, or computer malfunction.
Poor performance is experienced.	Processor is hot.	1. Ensure airflow to the computer is not blocked. 2. Ensure the fans are connected and working properly (some fans only operate when needed). 3. Ensure the processor heatsink is installed properly.
	Hard drive is full.	Transfer data from the hard drive to create more space on the hard drive.
	Low on memory.	Add more memory.
	Hard drive fragmented.	Defragment hard drive.

Solving Minor Problems *(Continued)*

Problem	Cause	Possible Solution
Poor performance is experienced. (continued)	Program previously accessed did not release reserved memory back to the system	Restart the computer.
	Virus resident of the hard drive.	Run virus protection program.
	Too many applications running.	Close unnecessary applications. Add more memory.
	Cause unknown.	Restart the computer.
Computer powered off automatically and the Power LED flashes Red two times, once every second, followed by a two second pause, and the computer beeps two times. Beeps continue for five iterations after which the LED flashes will continue until the problem is resolved.	Processor thermal protection activated: A fan may be blocked or not turning. OR The heatsink is not properly attached to the processor.	1. Ensure computer air vents are not blocked and the cooling fan is running. 2. Open hood, press power button, and see if the processor fan spins. If not spinning, make sure the fan's cable is plugged onto the system board header. Ensure the fan is fully/properly seated or installed. 3. Replace the processor fan. 4. Reseat processor heatsink and verify that the fan assembly is properly attached.

Solving Minor Problems *(Continued)*

Problem	Cause	Possible Solution
System does not power on and the LEDs on the front of the computer are not flashing.	System unable to power on.	Press and hold the power button for less than 4 seconds. If the hard drive LED turns green, then:

Press and hold the power button for less than 4 seconds. If the hard drive LED turns green, then:

1. Check that the voltage selector is set to the appropriate voltage.

2. Remove the expansion cards one at a time until the 5 V_aux light on the system board turns on.

3. Replace the system board.

OR

Press and hold the power button for less than 4 seconds. If the hard drive LED does not turn on green then:

1. Check that the unit is plugged into a working AC outlet.

2. Open hood and check that the power button harness is properly connected to the system board.

3. Check that both power supply cables are properly connected to the system board.

4. If the 5 V_aux light on the system board is on, then replace the power button harness.

5. If the 5 V_aux light on the system board is off, then replace the power supply.

6. Replace the system board.

Solving Power Supply Problems

Solving Power Supply Problems

Problem	Cause	Solution
Power supply shuts down intermittently.	Voltage selector switch on rear of computer chassis not switched to correct line voltage.	Select the proper AC voltage.
	Power supply fault.	Replace the power supply.
Computer powered off automatically and the Power LED flashes Red two times, once every second, followed by a two second pause, and the computer beeps two times. Beeps continue for five iterations after which the LED flashes will continue until the problem is resolved.	Processor thermal protection activated: A fan may be blocked or not turning. OR The heatsink/fan assembly is not properly attached to the processor.	1. Ensure that the computer air vents are not blocked and the cooling fan is running. 2. Open hood, press the power button, and see if the processor fan spins. If the processor fan is not spinning, make sure the fan's cable is plugged onto the system board header. Ensure the fan is fully/properly seated or installed. 3. Replace the processor fan. 4. Reseat processor heatsink and verify that the fan assembly is properly attached.
Power LED flashes Red, four times, once every second, followed by a two second pause, and the computer beeps four times. Beeps continue for five iterations after which the LED flashes will continue until the problem is resolved.	Power failure (power supply is overloaded).	1. Check that the voltage selector, is set to the appropriate voltage. 2. Open the hood and ensure the 4-wire power supply cable is seated into the connector on the system board. 3. Check if a device is causing the problem by removing ALL attached devices). Power on the system. If the system enters the POST, then power off and replace one device at a time and repeat this procedure until failure occurs. Replace the device causing the failure. Continue adding devices one at a time to ensure all devices are functioning properly. 4. Replace the power supply. 5. Replace the system board.

Solving Diskette Problems

Solving Diskette Problems

Problem	Cause	Solution
Diskette drive light stays on.	Diskette is damaged.	In Microsoft Windows XP, right-click **Start**, click **Explore**, and select a drive. Select **File > Properties > Tools**. Under **Error-checking**, click **Check Now**.
	Diskette is incorrectly inserted.	Remove diskette and reinsert.
	Drive button is not pushed in.	Push in drive button.
	Files on diskette are damaged.	Check the program diskettes.
	Drive cable is not properly connected.	Reconnect power cable. Ensure that all four pins are connected.
Drive not found.	Cable is loose.	Reseat diskette drive data and power cables.
	Removable drive is not seated properly.	Reseat the drive.
	You attempted to hot plug a removable hard drive that has DriveLock security enabled. (This feature supported on select models only.)	Shut down the computer. Insert the drive into the MultiBay, if it is not already inserted. Turn on the computer.
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 the path statement.
	Not enough space is left on the diskette.	Use another diskette.
	Diskette write control is enabled.	Use Computer Setup to check the storage security feature disabled settings.
	Diskette is damaged.	Replace the damaged disk.
Cannot format diskette.	Invalid media reported.	When formatting a disk in MS-DOS, you may need to specify diskette capacity. For example, to format a 1.44-MB diskette, type the following command at the MS-DOS prompt: **FORMAT A: /F:1440**

Solving Diskette Problems *(Continued)*

Problem	Cause	Solution
Cannot format diskette. (continued)	Diskette is write-protected.	Use another diskette or remove the write protection.
	Diskette write control is enabled.	Use Computer Setup to check the storage security feature disabled settings.
A problem has occurred with a disk transaction.	The directory structure is bad, or there is a problem with a file.	In Windows XP, right-click **Start**, click **Explore**, and select a drive. **Select File > Properties > Tools**. Under **Error-checking**, click **Check Now**.
Diskette 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 that you are using and use the correct diskette type.
	You are reading the wrong drive.	Check the drive letter in the path statement.
	Diskette is damaged.	Replace the diskette with a new one.
"Invalid system disk" message is displayed.	A diskette that does not contain the system files needed to start the computer has been inserted in the drive.	When drive activity stops, remove the diskette and press the **Spacebar**. The computer should start up.
	Diskette error has occurred.	Restart the computer by pressing the power button.
Cannot Boot to Diskette.	Diskette is not bootable.	Replace with a bootable diskette.
	Diskette boot has been disabled in Computer Setup.	Run Computer Setup and enable diskette boot in **Storage > Boot Order**.
		Run Computer Setup and enable Removable Media Boot in **Storage > Storage Options > Removable Media Boot**.
		✎ Both steps should be used as the **Removable Media Boot** function overrides the **Boot Order** enable command.
	Removable media boot has been disabled in Computer Setup.	Run Computer Setup and enable Removable Media Boot in **Storage > Storage Options> Removable Media Boot**.
	Network server mode is enabled in Computer Setup.	Run Computer Setup and disable **Network Server Mode** in **Security > Password Options**.

Solving Hard Drive Problems

Solving Hard Drive Problems

Problem	Cause	Solution
Hard drive error occurs.	Hard disk has bad sectors or has failed.	Use a utility to locate and block usage of bad sectors. If necessary, reformat the hard disk. In Windows XP, right-click **Start**, click **Explore**, and select a drive. Select **File > Properties > Tools**. Under **Error-checking**, click **Check Now**.
Disk transaction problem.	Either the directory structure is bad or there is a problem with a file.	In Windows XP, right-click **Start**, click **Explore**, and select a drive. Select **File > Properties > Tools**. Under **Error-checking**, click **Check Now**.
Drive not found (identified).	Loose cable.	Check cable connections.
	The system may not have automatically recognized a newly installed device.	1. Run Computer Setup. 2. If the system still does not recognize the new device, check to see if the device is listed within Computer Setup. If it is listed, the probable cause is a driver problem. If it is not listed, the probable cause is a hardware problem. 3. If this is a newly installed drive, enter Setup and try adding a POST delay under **Advanced > Power-On**.
	Drive jumper settings may be incorrect.	If the drive is a secondary drive that has just been installed on the same cable as the primary drive, verify that the jumpers for both drives are set correctly.
	Drive's IDE (ATA) controller is disabled in Computer Setup.	Run Computer Setup and enable the Primary and Secondary IDE (ATA) controllers in **Storage > Storage Options**.
	Drive responds slowly immediately after power-up.	Run Computer Setup and increase the POST Delay in **Advanced > Power-On Options**.
Nonsystem disk/NTLDR missing message.	System is trying to start from a non bootable diskette or USB device.	Remove the media from the drive.

Solving Hard Drive Problems *(Continued)*

Problem	Cause	Solution
Nonsystem disk/NTLDR missing message. (continued)	System is trying to start from a damaged hard drive.	1. Insert a bootable diskette into the diskette drive and restart the computer.
		2. Check hard drive format using fdisk: If NTFS formatting, use a third party reader to evaluate the drive. If FAT32 formatting, the hard drive cannot be accessed. Replace the MBR image.
		3. If the hard drive is still inaccessible and MBR Security is enabled, try restoring the previously saved MBR image by entering Setup and selecting **Security > Restore Master Boot Record**.
	System files missing or not properly installed.	1. Insert a bootable system diskette and restart.
		2. Check hard drive format using fdisk: If NTFS formatting, use a third party reader to evaluate the drive. If FAT32 formatting, the hard drive cannot be accessed. Replace the MBR image.
		3. Install system files for the appropriate operating system if necessary.
	Hard drive boot disabled in Computer Setup.	Run Computer Setup and enable the hard drive entry in the **Storage > Boot Order** list.
	Bootable hard drive is not attached as first in a multi-hard drive configuration.	If attempting to boot from an IDE hard drive, ensure it is attached as Primary Device 0. If attempting to boot from a SATA hard drive, ensure it is attached to SATA 0.
	Bootable hard drive's controller is not listed first in the Boot Order.	Enter Computer Setup and select **Storage > Boot Order** and ensure the bootable hard drive's controller is listed immediately under the **Hard Drive** entry.

Solving Hard Drive Problems *(Continued)*

Problem	Cause	Solution
Parallel ATA (PATA) hard drive does not perform optimally.	Using the wrong cable for the drive type.	Reinstall the second Ultra ATA hard drive using an 80-conductor cable (standard on select models.)
	Both slow and fast UATA devices are on the same data cable.	Connect slower UATA devices to a separate data cable connected to the secondary IDE (ATA) controller.
Computer will not start.	Hard drive is damaged.	Observe the beeps and LED lights on the front of the computer. See Appendix C "POST Error Messages".
Computer seems to be locked up.	Program in use has stopped responding to commands.	1. Attempt the normal Windows "Shut Down" procedure. 2. Press the power button for four or more seconds to turn off the power. 3. Restart the computer using the power button.

Solving MultiBay Problems

Solving MultiBay Problems

Problem	Cause	Solution
Drive not found.	You attempted to hot plug a removable hard drive that has DriveLock security enabled. (This feature supported on select models only.)	Shut down Windows and turn off the computer. Insert the drive into the MultiBay, if it is not already inserted. Turn on the computer.
	MultiBay is hidden in Computer Setup.	Enter Computer Setup and set MultiBay to **Device Available** in **Security > Device Security**.

Solving Display Problems

Problem	Cause	Solution
Blank screen (no video).	The cable connections are not correct.	Check the cable connections from the monitor to the computer and to the electrical outlet.
	Screen blanking utility installed or energy saver features enabled.	Press any key or click the mouse button and, if set, type your password.
	System ROM is bad; system is running in FailSafe Boot Block mode (indicated by eight red blinks from the power LED and eight simultaneous beeps).	1. Reflash the ROM using a ROMPaq diskette. 2. Replace the system board.
	Fixed-sync monitor will not sync at the resolution chosen.	Ensure that the monitor can accept the same horizontal scan rate as the resolution chosen.
	Computer is in **standby** mode.	Press the power button to resume from **standby** mode.

⚠ **CAUTION:** When attempting to resume from **standby** mode, do not hold down the power button for more than four seconds. Otherwise, the computer will shut down and you will lose any unsaved data.

Problem	Cause	Solution
	Monitor cable plugged into the wrong connector.	If the computer system has both an integrated graphics connector and a graphics expansion card connector, plug the monitor cable into the expansion card connector.
	Monitor settings in the computer are not compatible with the monitor.	1. Restart the computer and press **F8** during startup when you see "Press F8" in the bottom right corner of the screen. 2. Using the keyboard arrow keys, select **Enable VGA Mode** and press **Enter**. 3. In Windows Control Panel, double-click the **Display** icon and select the **Settings** tab. 4. Use the sliding control to reset the resolution.

Problem	Cause	Solution
Blank screen and the power LED flashes Red five times, once every second, followed by a two second pause, and the computer beeps five times. Beeps continue for five iterations after which the LED flashes will continue until the problem is resolved.	Pre-video memory error.	1. Reseat DIMMs. Power on the system. 2. Replace DIMMs one at a time to isolate the faulty module. 3. Replace third-party memory with HP memory. 4. Replace the system board.
Power LED flashes Red six times, once every second, followed by a two second pause, and the computer beeps six times. Beeps continue for five iterations after which the LED flashes will continue until the problem is resolved.	Pre-video graphics error.	For systems with a graphics card: 1. Reseat the graphics card. 2. Replace the graphics card. 3. Replace the system board. For systems with integrated graphics, replace the system board.
Blank screen and the power LED flashes Red eight times, once every second, followed by a two second pause, and the computer beeps eight times. Beeps continue for five iterations after which the LED flashes will continue until the problem is resolved.	Invalid ROM based on checksum.	1. Reflash the ROM using a ROMPaq diskette. 2. Replace the system board.
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.
Dim characters.	The brightness and contrast controls are not set properly.	Adjust the monitor brightness and contrast controls.
	Cables are not properly connected.	Check that the graphics cable is securely connected to the graphics card and the monitor.
Blurry video or requested resolution cannot be set.	If the graphics controller was upgraded, the correct video drivers may not be loaded.	Install the video drivers included in the upgrade kit.

Problem	Cause	Solution
	Monitor is not capable of displaying requested resolution.	Change requested resolution.
	Graphics card is bad.	Replace the graphics card.
The picture is broken up, rolls, jitters, or flashes.	The monitor connections may be incomplete or the monitor may be incorrectly adjusted.	1. Be sure the monitor cable is securely connected to the computer. 2. In a two-monitor system or if another monitor is in close proximity, be sure the monitors are not interfering with each other's electromagnetic field by moving them apart. 3. Fluorescent lights or fans may be too close to the monitor.
	Monitor needs to be degaussed.	Degauss the monitor.
Vibrating or rattling noise coming from inside a CRT monitor when powered on.	Monitor degaussing coil has been activated.	None. It is normal for the degaussing coil to be activated when the monitor is powered on.
Clicking noise coming from inside a CRT monitor.	Electronic relays have been activated inside the monitor.	None. It is normal for some monitors to make a clicking noise when turned on and off, when going in and out of standby mode, and when changing resolutions.
High pitched noise coming from inside a flat panel monitor.	Brightness and/or contrast settings are too high.	Lower brightness and/or contrast settings.
Fuzzy focus; streaking, ghosting, or shadowing effects; horizontal scrolling lines; faint vertical bars; or unable to center the picture on the screen. (flat panel monitors using an analog VGA input connection only)	Flat panel monitor's internal digital conversion circuits may be unable to correctly interpret the output synchronization of the graphics card.	1. Select the monitor's Auto-Adjustment option in the monitor's on-screen display menu. 2. Manually synchronize the Clock and Clock Phase on-screen display functions. Download SoftPaq SP20930 or SP22333, depending on the monitor, to assist with the synchronization.
	Graphics card is not seated properly or is bad.	1. Reseat the graphics card. 2. Replace the graphics card.

Problem	Cause	Solution
Certain typed symbols do not appear correct.	The font you are using does not support that particular symbol.	Use the Character Map to locate the and select the appropriate symbol. Click **Start > All Programs > Accessories > System Tools > Character Map**. You can copy the symbol from the Character Map into a document.

Solving Audio Problems

Solving Audio Problems

Problem	Cause	Solution
Sound does not come out of the speaker or headphones.	Software volume control is turned down.	Double-click the **Speaker** icon on the taskbar and use the volume slider to adjust the volume.
	The external speakers are not turned on.	Turn on the external speakers.
	Audio is hidden in Computer Setup.	Enable the audio in Computer Setup: **Security > Device Security >Audio**.
	External speakers plugged into the wrong audio jack.	See the sound card documentation for proper speaker connection.
	Audio cable not connected.	Connect audio cable between CD or DVD-ROM drive and the system board.
	Digital CD audio is not enabled.	Enable digital CD audio: 1. From the **Control Panel**, select **System**. 2. On the **Hardware** tab, click the **Device Manager** button. 3. Right-click on the CD/DVD device and select **Properties**. 4. On the **Properties** tab, make sure "**Enable digital CD audio for this CD-ROM device**" is checked.
	Headphones or devices connected to the line-out connector mute the internal speaker.	Turn on and use headphones or external speakers, if connected, or disconnect headphones or external speakers.
	Volume is muted.	1. From the **Control Panel** program, click **Sound, Speech and Audio Devices**, then click **Sounds and Audio Devices**. 2. Click the **Mute** check box to remove the check mark from the box.
	Computer is in **standby** mode.	Press the power button to resume from **standby** mode.

Solving Audio Problems *(Continued)*

Problem	Cause	Solution
⚠ **CAUTION:** When attempting to resume from **standby** mode, do not hold down the power button for more than four seconds. Otherwise, the computer will shut down and any unsaved data will be lost.		
Noise or no sound comes out of the speakers or headphones.		1. If using digital speakers that have a stereo jack and want the system to auto-switch to digital, use a stereo-to-mono adapter to properly engage the auto-sense feature or use the multimedia device properties to manually switch the audio signal from analog to digital.
		2. If the headphones have a mono jack, use the multimedia device properties to switch the system to analog out.
✎ If you set digital as the **Output Mode**, the internal speaker and external analog speakers will no longer output audio until you switch back to an auto-sense or analog mode. If you set analog as the **Output Mode**, external digital speakers will not function until you change the output mode back to an auto-sense or digital mode.		
Sound cuts in and out.	Processor resources are being used by other open applications.	Shut down all open processor-intensive applications.
Computer appears to be locked up while recording audio.	The hard disk may be full.	1. Before recording, make sure there is enough free space on the hard disk.
		2. Try recording the audio file in a compressed format.

Solving Printer Problems

Solving Printer Problems

Problem	Cause	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 driver for the application are not installed.	1. Install the correct printer driver for the application. 2. Try printing using the MS-DOS command: **DIR C:\ > [printer port]** where **[printer port]** is the address of the printer being used. If the printer works, reload the printer driver.
	If you are on a network, you may not have made the connection to the printer.	Make the proper network connections to the printer.
	Printer may have failed.	Run printer self-test.
Printer will not turn on.	The cables may not be connected properly.	Reconnect all cables.
Printer prints garbled information.	The correct printer driver is not installed.	Install the correct printer driver for the application.
	The cables may not be connected properly.	Reconnect all cables.
	Printer memory may be overloaded.	Reset the printer by turning it off for one minute, then turn it back on.
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.

Solving Keyboard and Mouse Problems

Solving Keyboard and Mouse Problems

Problem	Cause	Solution
Keyboard commands and typing are not recognized by the computer.	Keyboard connector is not properly connected.	1. Turn off the computer. 2. Reconnect the keyboard to the back of the computer and restart the computer.
	Program in use has stopped responding to commands.	Shut down the computer using the mouse and then restart the computer.
	Keyboard needs repairs.	Replace the keyboard.
	Computer is in **standby** mode.	Press the power button to resume from **standby** mode.
	Input is coming from a nearby wireless keyboard.	1. Ensure that the keyboard batteries are fresh. 2. Place the receiver over 30 cm (12 in) from a telephone, power supply, transformer, computer, other electrical device, or power cords or cables. 3. The receiver should not be placed on or inside of a metal surface.

△ **CAUTION:** When attempting to resume from **standby** mode, do not hold down the power button for more than four seconds. Otherwise, the computer will shut down and any unsaved data will be lost.

Problem	Cause	Solution
Cursor will not move using the arrow keys on the keypad.	The **Num Lock** key may be on.	Press the **Num Lock** key. The Num Lock light should not be on if you want to use the arrow keys. The **Num Lock** key can be disabled (or enabled) in Computer Setup.
Mouse does not respond to movement or is too slow.	Mouse connector is not properly plugged into the back of the computer.	1. Shut down the computer using the keyboard. 2. Plug the mouse connector into the back of the computer (or the keyboard) and restart the computer.
	Program in use has stopped responding to commands.	Shut down the computer using the keyboard and then restart the computer.
	Mouse may need cleaning.	Remove the roller ball cover on the mouse and clean it.
	Mouse needs repairs.	Replace the mouse.

Solving Keyboard and Mouse Problems

Problem	Cause	Solution
Mouse does not respond to movement or is too slow. (continued)	Computer is in **standby** mode.	Press the power button to resume from **standby** mode.
	Input is coming from a nearby wireless mouse.	1. Ensure that the mouse batteries are fresh. 2. Place the receiver over 30 cm (12 in) from a telephone, power supply, transformer, computer, other electrical device, or power cords or cables. 3. The receiver should not be placed on or inside of a metal surface.

⚠ **CAUTION:** When attempting to resume from **standby** mode, do not hold down the power button for more than four seconds. Otherwise, the computer will shut down and you will lose any unsaved data.

Problem	Cause	Solution
Mouse will only move vertically or horizontally, or movement is jerky.	Mouse roller ball is dirty.	Remove roller ball cover from the bottom of the mouse and clean it.

Solving Hardware Installation Problems

You may need to reconfigure the computer when you add or remove hardware, such as an additional diskette drive. If you install a plug and play device, Windows 2000 and Windows XP automatically recognize the device and configure the computer. If you install a non–plug and play device, you must reconfigure the computer after completing installation of the new hardware. In Windows 2000, select the **Add New Hardware** icon in the **Control Panel** (for Windows XP, use the **Add Hardware Wizard**) and follow the instructions that appear on the screen.

Solving Hardware Installation Problems

Problem	Cause	Solution
A new device is not recognized as part of the system.	Device is not seated or connected properly.	Ensure that the device is properly and securely connected and that pins in the connector are not bent down.
	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 down.
	Power switch of new external device is not turned on.	Turn off the computer, turn on the external device, then turn on the computer to integrate the device with the computer system.
	When the system advised you of changes to the configuration, you did not accept them.	Reboot the computer and follow the instructions for accepting the changes.
	A plug and play board may not automatically configure when added if the default configuration conflicts with other devices.	Use Windows 2000 or Windows XP Device Manager to deselect the automatic settings for the board and choose a basic configuration that does not cause a resource conflict. You can also use Computer Setup to reconfigure or disable devices to resolve the resource conflict.
Computer will not start.	Wrong memory modules were used in the upgrade or memory modules were installed in the wrong location.	1. Review the documentation that came with the system to determine if you are using the correct memory modules and to verify the proper installation. 2. Observe the beeps and LED lights on the front of the computer. See Appendix C "POST Error Messages" to determine possible causes.

Solving Hardware Installation Problems *(Continued)*

Problem	Cause	Solution
Power LED flashes Red five times, once every second, followed by a two second pause, and the computer beeps five times. Beeps continue for five iterations after which the LED flashes will continue until the problem is resolved.	Memory is installed incorrectly or is bad.	1. Reseat DIMMs. 2. Replace DIMMs one at a time to isolate the faulty module. 3. Replace third-party memory with HP memory. 4. Replace the system board.
Power LED flashes Red six times, once every second, followed by a two second pause, and the computer beeps six times. Beeps continue for five iterations after which the LED flashes will continue until the problem is resolved.	Video card is not seated properly or is bad, or system board is bad.	For systems with a graphics card: 1. Reseat the graphics card. Power on the system. 2. Replace the graphics card. 3. Replace the system board. For systems with integrated graphics, replace the system board.
Power LED flashes Red ten times, once every second, followed by a two second pause, and the computer beeps ten times. Beeps continue for five iterations after which the LED flashes will continue until the problem is resolved	Bad option card.	1. Check each option card by removing the cards one at time (if multiple cards), then power on the system to see if fault goes away. 2. Once bad card is identified, remove and replace bad option card. 3. Replace the system board.

Solving Network Problems

These guidelines do not discuss the process of debugging the network cabling.

Solving Network Problems

Problem	Cause	Solution
Wake-on-LAN feature is not functioning.	Wake-on-LAN is not enabled.	Use the Network control application to enable Wake-on-LAN.
Network driver does not detect network controller.	Network controller is disabled.	Run Computer Setup and enable network controller.
		Enable the network controller in the operating system via the Device Manager.
	Incorrect network driver.	Check the network controller documentation for the correct driver or obtain the latest driver from the manufacturer's Web site.
Network status link light does not turn on or it never flashes. ✎ The network status light should flash when there is network activity.	No active network is detected.	Check cabling and network equipment for proper connection.
	Network controller is not set up properly.	Use the Network control application to verify that the device is working properly.
	Network driver is not properly loaded.	Reinstall network drivers.
	System cannot autosense the network.	Disable auto-sensing capabilities and force the system into the correct operating mode.
Diagnostics reports a failure.	The cable is not securely connected.	Ensure that both ends of the data cable are securely connected.
	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.
	Network controller interrupt is shared with an expansion board.	Under the Computer Setup **Advanced** menu, change the resource settings for the board.
	The network controller is defective.	Replace the NIC.

Solving Network Problems *(Continued)*

Problem	Cause	Solution
Diagnostics passes, but the computer does not communicate with the network.	Network drivers are not loaded, or driver parameters do not match current configuration.	1. Make sure the network drivers are loaded and that the driver parameters match the configuration of the network controller. 2. Make sure the correct network client and protocol is installed.
Diagnostics passes, but the computer does not communicate with the network. (continued)	The network controller is not configured for this computer.	Select the **Network** icon in the **Control Panel** and configure the network controller.
Network controller stopped working when an expansion board was added to the computer.	Network controller interrupt is shared with an expansion board.	Under the Computer Setup **Advanced** menu, change the resource settings for the board.
	The network controller requires drivers.	Verify that the drivers were not accidentally deleted when the drivers for a new expansion board were installed.
	The expansion board installed is a network card (NIC) and conflicts with the embedded NIC.	Under the Computer Setup **Advanced** menu, change the resource settings for the board.
Network controller stops working without apparent cause.	The files containing the network drivers are corrupted.	Reinstall the network drivers, using the *Restore Plus!* CD.
	The cable is not securely connected.	Ensure that both ends of the cable are securely attached to the correct devices.
	The network controller is defective.	Replace the NIC.
New network card will not boot.	New network card may be defective or may not meet industry-standard specifications.	Install a working, industry-standard NIC, or change the boot sequence to boot from another source.
Cannot connect to network server when attempting Remote System Installation.	The network controller is not configured properly.	Verify Network Connectivity, that a DHCP Server is present, and that the Remote System Installation Server contains the NIC drivers for your NIC.
System setup utility reports unprogrammed EEPROM.	Unprogrammed EEPROM.	Flash the ROM.

Solving Memory Problems

⚠ **CAUTION:** For those systems that support ECC memory, HP does not support mixing ECC and non-ECC memory. Otherwise, the system will not boot the operating system.

Solving Memory Problems

Problem	Cause	Solution
System will not boot or does not function properly after installing additional memory modules.	Memory module is not the correct type or speed or the new memory module is not seated properly.	Replace module with the correct industry-standard device for the computer.
		On some models, ECC and non-ECC memory modules cannot be mixed.
Out of memory error.	Memory configuration may not be set up correctly.	Use the Device Manager to check memory configuration.
	You have run out of memory to run the application.	Check the application documentation to determine the memory 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 that proper modules are used.
	Integrated graphics may use system memory.	No action required.
Insufficient memory error during operation.	Too many Terminate and Stay Resident programs (TSRs) are installed.	Delete any TSRs that you do not need.
	You have run out of memory for the application.	Check the memory requirements for the application or add more memory to the computer.
Power LED flashes Red five times, once every second, followed by a two second pause, and the computer beeps five times. Beeps continue for five iterations after which the LED flashes will continue until the problem is resolved.	Memory is installed incorrectly or is bad.	1. Reseat DIMMs. 2. Replace DIMMs one at a time to isolate the faulty module. 3. Replace third-party memory with HP memory. 4. Replace the system board.

Solving Processor Problems

Solving Processor Problems

Problem	Cause	Solution
Poor performance is experienced.	Processor is hot.	1. Make sure the airflow to the computer is not blocked. 2. Make sure the fans are connected and working properly (some fans only operate when needed). 3. Make sure the processor heatsink is installed properly.
Power LED flashes Red three times, once every second, followed by a two second pause, and the computer beeps three times. Beeps continue for five iterations after which the LED flashes will continue until the problem is resolved.	Processor is not seated properly or not installed.	1. Check to see that the processor is present. 2. Reseat the processor.

Solving CD-ROM and DVD Problems

Solving CD-ROM and DVD Problems

Problem	Cause	Solution
System will not boot from CD-ROM or DVD drive.	Removable Media Boot is not enabled through the Computer Setup utility.	Run the Computer Setup utility and enable booting to removable media and verify boot order settings.
	Non-bootable CD in drive.	Try a bootable CD in the drive.
	Network Server Mode is enabled in Computer Setup.	Run Computer Setup and disable Network Server Mode in **Security > Password Options**.
	Boot order not correct.	Run Computer Setup and change boot sequence in **Storage > Boot Order**.
CD-ROM or DVD devices are not detected or driver is not loaded.	Drive is not connected properly or not properly configured.	1. Reconnect power and data cables to the drive. 2. Install correct device driver.
Movie will not play in the DVD drive.	Movie may be regionalized for a different country.	See the documentation that came with the DVD drive.
	Decoder software is not installed.	Install decoder software.
	Damaged media.	Replace media.
	Movie rating locked out by parental lock.	Use DVD software to remove parental lock.
	Media installed upside down.	Reinstall media.
Cannot eject compact disc (tray-load unit).	Disc not properly seated in the drive.	1. Turn off the computer and insert a thin metal rod into the emergency eject hole and push firmly. 2. Slowly pull the tray out from the drive until the tray is fully extended, then remove the disc.
CD-ROM, CD-RW, DVD-ROM, or DVD-R/RW drive cannot read a disc or takes too long to start.	Media has been inserted upside down.	Re-insert the Media with the label facing up.
	The DVD-ROM drive takes longer to start because it has to determine the type of media played, such as audio or video.	Wait at least 30 seconds to let the DVD-ROM drive determine the type of media being played. If the disc still does not start, read the other solutions listed for this topic.

Solving CD-ROM and DVD Problems *(Continued)*

Problem	Cause	Solution
	CD or DVD disc is dirty.	Clean CD or DVD with a CD cleaning kit.
	Windows does not detect the CD-ROM or DVD-ROM drive.	1. Use Device Manager to remove or uninstall the device in question. 2. Restart the computer and let Windows detect the device.
Recording audio CDs is difficult or impossible.	Wrong or poor quality media type.	1. Try using a slower recording speed. 2. Verify that you are using the correct media for the drive. 3. Try a different brand of media. Quality varies widely between manufacturers.

Solving Drive Key Problems

Solving Drive Key Problems

Problem	Cause	Solution
Drive key is not seen as a drive letter in Windows XP.	The drive letter after the last physical drive is not available.	Change the default drive letter for the Drive key in Windows XP.
The computer boots to DOS after making a bootable Drive key.	Drive key is bootable.	Install the Drive key after the operating system boots.

Solving Front Panel Component Problems

Solving Front Panel Component Problems

Problem	Cause	Solution
A USB device, headphone, or microphone is not recognized by the workstation.	It is not properly connected.	1. Turn off the computer. 2. Reconnect the device to the front of the workstation and restart the computer.
	The device does not have power.	If the USB device requires AC power, be sure one end is connected to the device and one end is connected to a live outlet.

Solving Front Panel Component Problems

Problem	Cause	Solution
A USB device, headphone, or microphone is not recognized by the workstation. (continued)	The correct device driver is not installed.	1. Install the correct driver for the device. 2. You might need to reboot the computer.
	The cable from the device to the computer does not work.	1. If possible, replace the cable. 2. Restart the workstation.
	The device is not working.	1. Replace the device. 2. Restart the computer.

Solving Internet Access Problems

Solving Internet Access Problems

Problem	Cause	Solution
Unable to connect to the Internet.	Internet Service Provider (ISP) account is not set up properly.	Verify Internet settings or contact the ISP for assistance.
	Modem is not set up properly.	Reconnect the modem. Verify the connections are correct using the quick setup documentation.
Unable to connect to the Internet. (continued)	Web browser is not set up properly.	Verify that the Web browser is installed and set up to work with your ISP.
	Cable/ DSL modem is not plugged in.	Plug in cable/DSL modem. You should see a "power" LED light on the front of the cable/DSL modem.
	Cable/DSL service is not available or has been interrupted due to bad weather.	Try connecting to the Internet at a later time or contact your ISP. (If the cable/DSL service is connected, the "cable" LED light on the front of the cable/DSL modem will be on.)
	The CAT5 10/100 cable is disconnected.	Connect the CAT5 10/100 cable between the cable modem and the computers's RJ-45 connector. (If the connection is good, the "PC" LED light on the front of the cable/DSL modem will be on.)
	IP address is not configured properly.	Contact the ISP for the correct IP address.

Solving Internet Access Problems *(Continued)*

Problem	Cause	Solution
	Cookies are corrupted.	*Windows XP* 1. Select **Start > Control Panel**. 2. Double-click **Internet Options**. 3. On the **General** tab, click the **Delete Cookies** button.
Cannot automatically launch Internet programs.	You must log on to the ISP before some programs will start.	Log on to the ISP and launch the desired program.
Internet takes too long to download Web sites.	Modem is not set up properly.s	Verify that the correct modem speed and COM port are selected. *For Windows XP* 1. Select **Start > Control Panel**. Continue with step #2 2. Double-click **System**. 3. Click the **Hardware** tab. 4. In the Device Manager area, click the **Device Manager** button. 5. Double-click **Ports (COM & LPT)**. 6. Right-click the COM port your modem uses, then click **Properties**. 7. Under **Device status**, verify that the modem is working properly. 8. Under **Device usage**, verify the modem is enabled. 9. If there are further problems, click the **Troubleshoot** button and follow the on-screen instructions.

POST Diagnostic Front Panel LEDs and Audible Codes

This section covers the front panel LED codes as well as the audible codes that may occur before or during POST that do not necessarily have an error code or text message associated with them.

✎ If you see flashing LEDs on a PS/2 keyboard look for flashing LEDs on the front panel of the computer and refer to the following table to determine the front panel LED codes.

✎ Recommended actions in the following table are listed in the order in which they should be performed.

Diagnostic Front Panel LEDs and Audible Codes

Activity	Beeps	Possible Cause	Recommended Action
Green Power LED On.	None	Computer on.	None
Green Power LED flashes every two seconds.	None	Computer in Suspend to RAM mode (select models only) or normal Suspend mode.	None required. Press any key or move the mouse to wake the computer.
Red Power LED flashes two times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is resolved.	2	Processor thermal protection activated: A fan may be blocked or not turning. OR The heatsink/fan assembly is not properly attached to the processor.	1. Ensure that the computer air vents are not blocked and the processor cooling fan is running. 2. Open hood, press power button, and see if the processor fan spins. If the processor fan is not spinning, make sure the fan's cable is plugged onto the system board header. Ensure the fan is fully/properly seated or installed. 3. If fan is plugged in and seated properly, but is not spinning, then replace processor fan. 4. Reseat processor heatsink and verify that the fan assembly is properly attached. 5. Contact an authorized reseller or service provider.

Diagnostic Front Panel LEDs and Audible Codes *(Continued)*

Activity	Beeps	Possible Cause	Recommended Action
Red Power LED flashes three times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is resolved.	3	Processor not installed (not an indicator of bad processor).	1. Check to see that the processor is present. 2. Reseat the processor.
Red Power LED flashes four times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is resolved.	4	Power failure (power supply is overloaded).	1. Open the hood and ensure the 4-wire power supply cable is seated into the connector on the system board. 2. Check if a device is causing the problem by removing ALL attached devices (such as hard, diskette, or optical drives, and expansion cards). Power on the system. If the system enters the POST, then power off and replace one device at a time and repeat this procedure until failure occurs. Replace the device that is causing the failure. Continue adding devices one at a time to ensure all devices are functioning properly. 3. Replace the power supply. 4. Replace the system board.
Red Power LED flashes five times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is resolved.	5	Pre-video memory error.	1. Reseat DIMMs. Power on the system. 2. Replace DIMMs one at a time to isolate the faulty module. 3. Replace third-party memory with HP memory. 4. Replace the system board.
Red Power LED flashes six times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is resolved.	6	Pre-video graphics error.	For systems with a graphics card: 1. Reseat the graphics card. Power on the system. 2. Replace the graphics card. 3. Replace the system board. For systems with integrated graphics, replace the system board.

Diagnostic Front Panel LEDs and Audible Codes *(Continued)*

Activity	Beeps	Possible Cause	Recommended Action
Red Power LED flashes seven times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is resolved.	7	System board failure (ROM detected failure prior to video).	Replace the system board.
Red Power LED flashes eight times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is resolved.	8	Invalid ROM based on bad checksum.	1. Reflash the ROM using a ROMPaq diskette. See the "ROM Flash" section of the *Desktop Management Guide* on the *Documentation CD.* 2. Replace the system board.
Red Power LED flashes nine times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is resolved.	9	System powers on but is unable to boot.	1. Check that the voltage selector, located on the rear of the power supply (some models), is set to the appropriate voltage. Proper voltage setting depends on your region. 2. Replace the system board. 3. Replace the processor.
Red Power LED flashes ten times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is resolved.	10	Bad option card.	1. Check each option card (PCI or PCI Express) by removing the card (one at a time if multiple cards), then power on the system to see if fault goes away. 2. Once a bad card is identified, remove and replace the bad option card. 3. Replace the system board.

Diagnostic Front Panel LEDs and Audible Codes *(Continued)*

Activity	Beeps	Possible Cause	Recommended Action
System does not power on and LEDs are not flashing.	None	System unable to power on.	Press and hold the power button for less than 4 seconds. If the hard drive LED turns green, then:

Press and hold the power button for less than 4 seconds. If the hard drive LED turns green, then:

1. Check that the voltage selector, located on the rear of the power supply, is set to the appropriate voltage. Proper voltage setting depends on your region.

2. Remove the expansion cards one at a time until the LED light on the system board turns on.

3. Replace the system board.

OR

Press and hold the power button for less than 4 seconds. If the hard drive LED does not turn on green then:

1. Check that the unit is plugged into a working AC outlet.

2. Open hood and check that the power button harness is properly connected to the system board.

3. Check that both power supply cables are properly connected to the system board.

4. Check to see if the LED light on the system board is turned on. If it is turned on, then replace the power button harness.

5. If the LED light on the system board is not turned on, then replace the power supply.

6. Replace the system board.

E

System Board and Riser Card Reference Designators

These reference designators are used on most, but not all, HP system and riser boards.

Designator	Component
BAT	Battery socket/Battery
CR1	LED - 5V_Aux(on)/PS_ON(off)
CR2	Health-LED
CR3	UID LED
CR4	Power LED
CR35	Hard drive activity LED
E14	Boot block header/jumper
E15	Boot block recovery header
E25	CPLD programming header
E49/JP49	Clear Password header/jumper
E50	Clear CMOS header
J7	RJ45 jack
J9	Stacked RJ45/Dual USB
J10	Quad stacked USB
J11	First IEEE 1394 connector
J12	Second IEEE 1394 connector
J20 - 29	PCI slots
J30	PCI extender slot (male)
J31 - J35	PCI Express slots
J37	Primary SCSI connector
J38	Secondary SCSI connector
J39	Stacked parallel/SCSI connector
J40	AGP slot
J41	x16 PCI Express slot for graphics
J50	First parallel port
J51	Second parallel port
J52	Double-stacked parallel port, Top = Port B, Bottom = Port A
J53	Parallel port over single Serial Port
J54	Parallel port over Serial Port and Video Port
J55	Parallel port over dual VGA ports
J65	DVI connector
J66	Keyboard connector, PS/2(Closest to power supply)
J67	Mouse connector, PS/2
J68	Double-stacked mouse/keyboard connector, PS/2 Top = Mouse, Bottom = Keyboard

Designator	Component *(Continued)*
J69	Video connector, VGA
J70	Primary single USB connector
J71	Secondary single USB port
J72	Microphone jack
J73	Line-in jack
J74	Line-out jack
J75	Headphone jack
J76	Volume control
J77	Double-stacked headphone, Top = microphone, Bottom = headphone
J78	Double-stacked line-in, Top = line-in, Bottom = line-out
J80	Stacked serial/audio connector
J81	Primary double-stack USB, Top = Port 2, Bottom = Port 1
J82	Secondary double-stack USB, Top = Port 4, Bottom = Port 3
J83	Triple-stacked audio jack (line in, line out/headphone, microphone)
J101	Security board connector for daughter card
J9020-J9029	PCI slots on riser card
J9030-J9034	PCI express slots on riser card
JP49/E49	Clear password header/jumper
L1	USB front port choke (1st)
L2	USB rear port choke (1st)
L3	USB rear port choke (2nd)
L4	USB rear port choke (3rd)
L5	USB front port choke (2nd)
P1	P/S connector (20 or 24 pin)
P2	Second P/S connector (as required)
P3	Processor 12V header
P4	Secondary Processor 12V header
P5	Main Power/HDD LED connector
P6	Speaker connector
P7	Analog audio connector (from CD-ROM)
P8	Primary chassis fan connector
P9	Secondary chassis fan connector
P10	Diskette drive connector
P11	Auxiliary Audio connector
P12	Alert on LAN NIC connector
P13	VRM module footprint
P15	AUI connector
P16	Fan command/fan sink header (may be 2 or 4 pin)
P20	Primary IDE connector
P21	Secondary IDE/MultiBay connector
P22	Header for NEWCARD
P23	Header for front panel audio
P24	Header for front panel USB
P25	Internal USB connector 1
P26	Internal USB connector 2

Designator	Component *(Continued)*
P27	MultiBay header
P29	SCSI LED connector
P30	PCI extender slot (female)
P40	Blade PC graphics connector (outboard)
P41	Blade PC graphics connector (inboard)
P52	Serial port header
P53	First serial port
P54	Flying serial port
P55	Double stack serial port, Top = Serial B, Bottom = Serial A
P58	Riser edge connector (male-mates with J30)
P60	Primary Serial ATA (SATA) connector
P61	Second Serial ATA (SATA) connector
P62	Third Serial ATA (SATA) connector
P63	Fourth Serial ATA (SATA) connector
P64	VSFF expansion connector
P65	Graphics option connector
P70	Primary (CPU) fan header for fansink
P71	Secondary CPU fan header for fansink
P101	Security board connector, system board
P106	Secondary speaker header
P124	Hood lock header
P125	Hood sensor header
P126	Flying parallel port header
P216	White box chassis fan header
SW2	Security hood switch on riser card
SW50	Clear CMOS switch/push button
U2	Single chip solution (combined north bridge/south bridge)
U3	North bridge
U4	South bridge
U5	Super I/O
U6	Clock chip
U7	64 bit Bridge
U10	LOM1
U11	LOM1 EEPROM
U12	LOM1 PHY
U13	Audio Codec
U14	Audio amplifier
U16	LOM2
U17	LOM2 EEPROM
U18	LOM2 PHY
U20	Fan controller
U29	TMDS controller
U30	Parallel port diode array
U31	First serial port transceiver
U32	Second serial port transceiver

Designator	Component *(Continued)*
U46	VRM controller
U50	USB front port power switch
U51	First USB rear port power switch
U52	Second USB rear port power switch
U53	Third USB rear port power switch
XBT	Battery retainer
XMM1	Memory slot. DIMM1 or RIMM1 populated and tested
XMM2 - XMM5	Following memory slots
XU1	Primary processor socket
XU2	Secondary processor socket
XU15/U15	ROM socket (XU15)
Y1	Primary (TH) system clock crystal
Y2	Secondary (SMT) system clock crystal
Y3	Primary NIC clock crystal
Y4	Secondary NIC clock crystal
Y5/H5	RTC clock crystal/tie-down

F

Memory

Intel-Based Systems

Computers equipped with Intel-based processors come with double data rate synchronous dynamic random access memory (DDR-SDRAM) dual inline memory modules (DIMMs).

The memory sockets on the system board can be populated with up to three or four industry-standard DIMMs depending on the model. These memory module slots are populated with at least one preinstalled memory module. To achieve the maximum memory support, you can populate the system board with up to 4GB of memory configured in a high-performing dual channel mode.

For proper system operation, if the computer supports DDR-SDRAM DIMMs, the DIMMs must be industry-standard 184-pin, unbuffered PC2700 333 MHz- or PC3200 400 MHz-compliant, 2.5 volt DDR-SDRAM DIMMs. The DDR-SDRAM DIMMs must also:

■ support CAS latency 2.5 or 3 (CL = 2.5 OR CL=3)

■ contain the mandatory JEDEC SPD information

In addition, the computer supports:

■ 256Mbit, 512Mbit, AND 1 gBIT non-ECC memory technologies

■ single-sided and double-sided DIMMS

■ DIMMs constructed with x8 and x16 DDR devices; DIMMs constructed with x4 SDRAM are not supported

The following processor bus frequencies are required for the system to run at the supported memory frequencies.

Memory Frequency	Required Processor Bus Frequency
333 MHz	533 MHz or 800 MHz
400 MHz	800 MHz

If a memory frequency is paired with an unsupported processor bus frequency, the system will run at the highest supported memory speed. For example, if a 400 MHz DIMM is paired with a 533 MHz processor bus, the system will run at 400 MHz, the highest supported memory speed.

✎ The system will not start if you install unsupported DIMMs.

DIMM Sockets

There are four DIMM sockets on the system board, with two sockets per channel. The sockets are labeled XMM1, XMM2, XMM3, and XMM4. Sockets XMM1 and XMM2 operate in memory channel A. Sockets XMM3 and XMM4 operate in memory channel B.

The system board shown may differ from the one in your product.
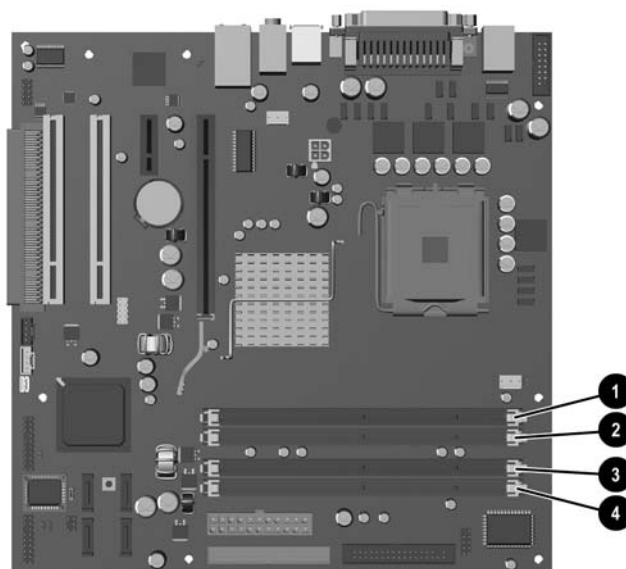
Item	Description	Socket Color
❶	DIMM socket XMM1, Channel A	Black
❷	DIMM socket XMM2, Channel A	Blue
❸	DIMM socket XMM3, Channel B	Black
❹	DIMM socket XMM4, Channel B	Blue

The system will automatically operate in single channel mode, dual channel Asymmetric mode, or a a higher-performing dual channel Interleaved mode, depending on how the DIMMs are installed.

To identify the operating mode, run Computer Setup and select the System Information menu item. The operating memory mode will appear in the line showing the system total memory.

■ The system will operate in single channel mode if the DIMM sockets are populated in one channel only.

■ The system will operate in dual channel Asymmetric mode if the total memory capacity of the DIMMs in Channel A is not equal to the total memory capacity of the DIMMs in Channel B.

■ The system will operate in a higher-performing dual channel Interleaved mode if the total memory capacity of the DIMMs in Channel A is equal to the total memory capacity of the DIMMs in Channel B. However, the technology and device width can vary between the channels, For example, if Channel A is populated with two 256 MB DIMMS and Channel B is populated with one 512 MB DIMM, the system will operate in Interleaved mode.

■ In any mode, the maximum operational speed is determined by the slowest DIMM in the system. For example, if the system is populated with a DIMM that is 333 MHz and a second DIMM that is 400 MHz, the system will run at the slower of the two speeds.

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