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Com sua ampla possibilidade de conexões e periféricos de série, o Computador HP Compaq consegue atender aos projetos mais exigentes do mercado.



# Maintenance & Service Guide

HP Compaq 6000 Pro Business PC

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#### **Maintenance & Service Guide**

HP Compaq 6000 Pro Business PC

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## About This Book

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- ⚠ **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.
  - 📄 **NOTE:** Text set off in this manner provides important supplemental information.
-



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# 1 Product Features

## Microtower Chassis

### Standard Configuration Features

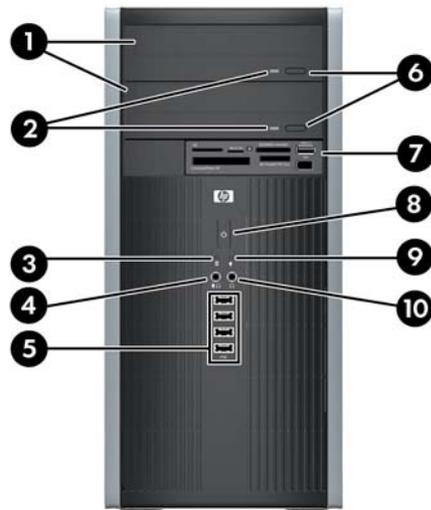
The HP Compaq Microtower features may vary depending on the model. For a complete listing of the hardware and software installed in the computer, run the diagnostic utility (included on some computer models only). Instructions for using the utility are provided in the *Troubleshooting Guide*.

**Figure 1-1** Microtower Configuration



## Front Panel Components

Drive configuration may vary by model.



**Table 1-1 Front Panel Components**

1	5.25-inch Optical Drives <sup>1</sup>	6	Optical Drive Eject Buttons
2	Optical Drive Activity Lights	7	3.5-inch Media Card Reader (optional) <sup>2</sup>
3	Hard Drive Activity Light	8	Dual-State Power Button
4	Microphone/Headphone Connector	9	Power On Light
5	USB (Universal Serial Bus) 2.0 Ports	10	Headphone Connector

**NOTE:** When a device is plugged into the Microphone/Headphone Connector, a dialog box will pop up asking if you want to use the connector for a microphone line Line-In device or a headphone. You can reconfigure the connector at any time by double-clicking the Realtek HD Audio Manager icon in the Windows taskbar.

**NOTE:** The Power On Light is normally green when the power is on. If it is flashing red, there is a problem with the computer and it is displaying a diagnostic code. Refer to the *Troubleshooting Guide* to interpret the code.

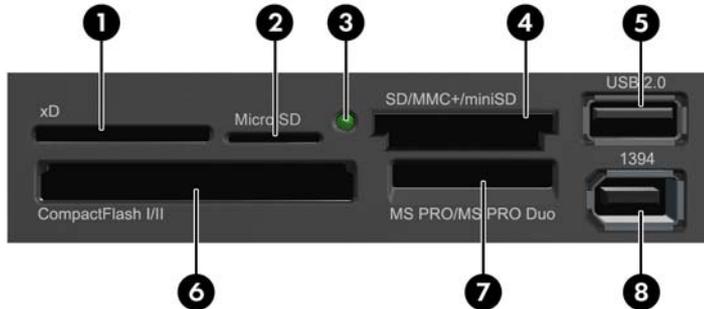
<sup>1</sup> Some models have bezel blanks covering one or both of the 5.25-inch drive bays.

<sup>2</sup> Some models have a bezel blank covering the 3.5-inch drive bay.

## Media Card Reader Components

The media card reader is an optional device available on some models only. Refer to the following illustration and table to identify the media card reader components.

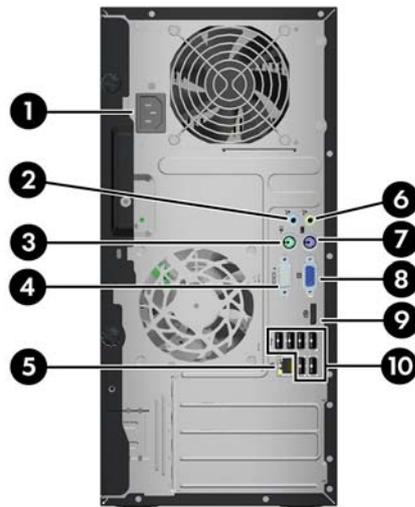
**Figure 1-2** Media Card Reader Components



**Table 1-2** Media Card Reader Components

No.	Slot	Media
1	<b>xD</b>	<ul style="list-style-type: none"> <li>xD-Picture Card (xD)</li> </ul>
2	<b>MicroSD</b>	<ul style="list-style-type: none"> <li>MicroSD (T-Flash)</li> <li>MicroSDHC</li> </ul>
3	<b>Media Card Reader Activity Light</b>	
4	<b>SD/MMC+/miniSD</b>	<ul style="list-style-type: none"> <li>Secure Digital (SD)</li> <li>Secure Digital High Capacity (SDHC)</li> <li>MiniSD</li> <li>MiniSDHC</li> <li>MultiMediaCard (MMC)</li> <li>Reduced Size MultiMediaCard (RS MMC)</li> <li>MultiMediaCard 4.0 (MMC Plus)</li> <li>Reduced Size MultiMediaCard 4.0 (MMC Mobile)</li> <li>MMC Micro (adapter required)</li> </ul>
5	<b>USB</b>	<ul style="list-style-type: none"> <li>USB (Universal Serial Bus) Port</li> </ul>
6	<b>CompactFlash I/II</b>	<ul style="list-style-type: none"> <li>CompactFlash Card Type 1</li> <li>CompactFlash Card Type 2</li> <li>MicroDrive</li> </ul>
7	<b>MS PRO/MS PRO DUO</b>	<ul style="list-style-type: none"> <li>Memory Stick (MS)</li> <li>MagicGate Memory Stick (MG)</li> <li>MagicGate Memory Stick Duo</li> <li>Memory Stick Select</li> <li>Memory Stick Duo (MS Duo)</li> <li>Memory Stick PRO (MS PRO)</li> <li>Memory Stick PRO Duo (MS PRO Duo)</li> <li>Memory Stick PRO-HG Duo</li> <li>Memory Stick Micro (M2) (adapter required)</li> </ul>
8	<b>1394</b>	<ul style="list-style-type: none"> <li>1394 Port (available on select models only)</li> </ul>

## Rear Panel Components



**Table 1-3 Rear Panel Components**

1	Power Cord Connector	6	 Line-Out Connector for powered audio devices (green)
2	 Line-In Audio Connector (blue)	7	 PS/2 Keyboard Connector (purple)
3	 PS/2 Mouse Connector (green)	8	 VGA Monitor Connector
4	 Serial Connector	9	 DisplayPort Monitor Connector
5	 RJ-45 Network Connector	10	 Universal Serial Bus (USB)

**NOTE:** Arrangement and number of connectors may vary by model.

An optional second serial port and an optional parallel port are available from HP.

When a device is plugged into the blue Line-In Audio Connector, a dialog box will pop up asking if you want to use the connector for a line-in device or a microphone. You can reconfigure the connector at any time by double-clicking the Realtek HD Audio Manager icon in the Windows taskbar.

The monitor connectors on the system board are inactive when a graphics card is installed in the computer.

If a graphics card is installed into the PCI or PCI Express x1 slot, the connectors on the graphics card and the system board may be used at the same time. Some settings may need to be changed in Computer Setup to use both connectors. For information about setting the boot VGA controller, refer to the *Computer Setup (F10) Utility Guide*.

## Serial Number Location

Each computer has a unique serial number and product ID number that are located on the top cover of the computer. Keep these numbers available for use when contacting customer service for assistance.

**Figure 1-3** Serial Number and Product ID Location



# Small Form Factor

## Standard Configuration Features

The HP Compaq Small Form Factor features may vary depending on the model. For a complete listing of the hardware and software installed in the computer, run the diagnostic utility (included on some computer models only). Instructions for using the utility are provided in the *Troubleshooting Guide*.

 **NOTE:** The Small Form Factor computer can also be used in a tower orientation. For more information, see [Using the Small Form Factor Computer in a Tower Orientation on page 174](#) in this guide.

**Figure 1-4** Small Form Factor Configuration



# Front Panel Components

Drive configuration may vary by model.

Figure 1-5 Front Panel Components

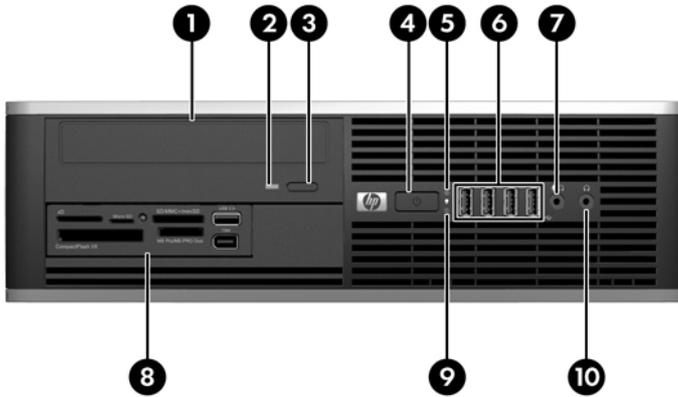


Table 1-4 Front Panel Components

1	5.25-inch Optical Drive <sup>1</sup>	6	USB (Universal Serial Bus) Ports
2	Optical Drive Activity Light	7	Microphone/Headphone Connector
3	Optical Drive Eject Button	8	3.5-inch Media Card Reader (optional) <sup>2</sup>
4	Dual-State Power Button	9	Hard Drive Activity Light
5	Power On Light	10	Headphone Connector

**NOTE:** When a device is plugged into the Microphone/Headphone Connector, a dialog box will pop up asking if you want to use the connector for a microphone line Line-In device or a headphone. You can reconfigure the connector at any time by double-clicking the Realtek HD Audio Manager icon in the Windows taskbar.

**NOTE:** The Power On Light is normally green when the power is on. If it is flashing red, there is a problem with the computer and it is displaying a diagnostic code. Refer to the *Troubleshooting Guide* to interpret the code.

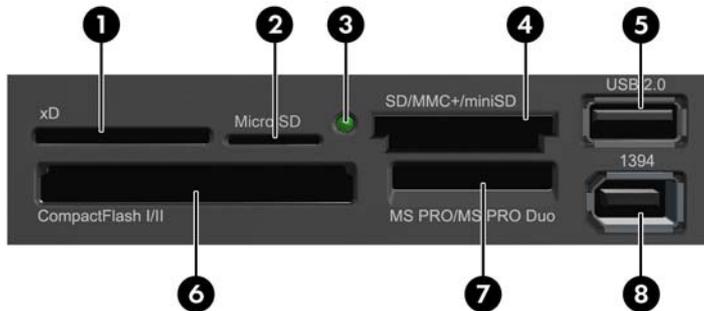
<sup>1</sup> Some models are configured with a 5.25-inch bezel blank covering this bay.

<sup>2</sup> Some models are configured with a 3.5-inch bezel blank covering this bay.

## Media Card Reader Components

The media card reader is an optional device available on some models only. Refer to the following illustration and table to identify the media card reader components.

**Figure 1-6** Media Card Reader Components



**Table 1-5** Media Card Reader Components

No.	Slot	Media
1	<b>xD</b>	<ul style="list-style-type: none"> <li>xD-Picture Card (xD)</li> </ul>
2	<b>MicroSD</b>	<ul style="list-style-type: none"> <li>MicroSD (T-Flash)</li> <li>MicroSDHC</li> </ul>
3	<b>Media Card Reader Activity Light</b>	
4	<b>SD/MMC+/miniSD</b>	<ul style="list-style-type: none"> <li>Secure Digital (SD)</li> <li>Secure Digital High Capacity (SDHC)</li> <li>MiniSD</li> <li>MiniSDHC</li> <li>MultiMediaCard (MMC)</li> <li>Reduced Size MultiMediaCard (RS MMC)</li> <li>MultiMediaCard 4.0 (MMC Plus)</li> <li>Reduced Size MultiMediaCard 4.0 (MMC Mobile)</li> <li>MMC Micro (adapter required)</li> </ul>
5	<b>USB</b>	<ul style="list-style-type: none"> <li>USB (Universal Serial Bus) Port</li> </ul>
6	<b>CompactFlash I/II</b>	<ul style="list-style-type: none"> <li>CompactFlash Card Type 1</li> <li>CompactFlash Card Type 2</li> <li>MicroDrive</li> </ul>
7	<b>MS PRO/MS PRO DUO</b>	<ul style="list-style-type: none"> <li>Memory Stick (MS)</li> <li>MagicGate Memory Stick (MG)</li> <li>MagicGate Memory Duo</li> <li>Memory Stick Select</li> <li>Memory Stick Duo (MS Duo)</li> <li>Memory Stick PRO (MS PRO)</li> <li>Memory Stick PRO Duo (MS PRO Duo)</li> <li>Memory Stick PRO-HG Duo</li> <li>Memory Stick Micro (M2) (adapter required)</li> </ul>
8	<b>1394</b>	<ul style="list-style-type: none"> <li>1394 Port (available on select models only)</li> </ul>

# Rear Panel Components

Figure 1-7 Rear Panel Components

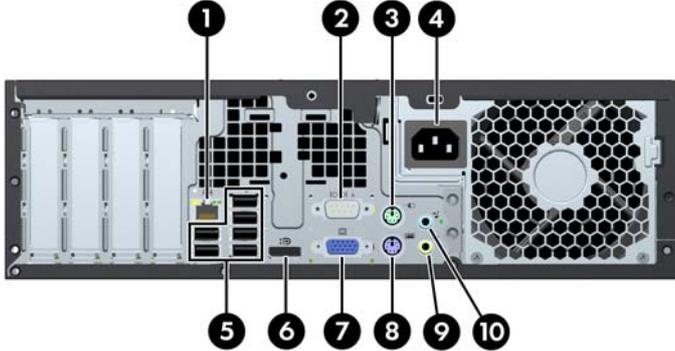


Table 1-6 Rear Panel Components

1	RJ-45 Network Connector	6	DisplayPort Monitor Connector
2	IO/IOA Serial Connector	7	VGA Monitor Connector
3	PS/2 Mouse Connector (green)	8	PS/2 Keyboard Connector (purple)
4	Power Cord Connector	9	Line-Out Connector for powered audio devices (green)
5	Universal Serial Bus (USB)	10	Line-In Audio Connector (blue)

**NOTE:** Arrangement and number of connectors may vary by model.

An optional second serial port and an optional parallel port are available from HP.

When a device is plugged into the blue Line-In Audio Connector, a dialog box will pop up asking if you want to use the connector for a line-in device or a microphone. You can reconfigure the connector at any time by double-clicking the Realtek HD Audio Manager icon in the Windows taskbar.

The monitor connectors on the system board are inactive when a graphics card is installed in the computer.

If a graphics card is installed into the PCI or PCI Express x1 slot, the connectors on the graphics card and the system board may be used at the same time. Some settings may need to be changed in Computer Setup to use both connectors. For information about setting the boot VGA controller, refer to the *Computer Setup (F10) Utility Guide*.

## Serial Number Location

Each computer has a unique serial number and product ID number in the location shown below. Keep these numbers available for use when contacting customer service for assistance.

**Figure 1-8** Serial Number and Product ID Location



---

## 2 Installing and Customizing the Software

If your computer was not shipped with a Microsoft operating system, some portions of this documentation do not apply. Additional information is available in online help after you install the operating system.

 **NOTE:** If the computer was shipped with Windows Vista or Windows 7 loaded, you will be prompted to register the computer with HP Total Care before installing the operating system. You will see a brief movie followed by an online registration form. Fill out the form, click the **Begin** button, and follow the instructions on the screen.

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

 **NOTE:** Be sure there is a 10.2-cm (4-inch) clearance at the back of the unit and above the monitor to permit the required airflow.

---

### Installing the Operating System

The first time you turn on the computer, the operating system is installed automatically. This process takes about 5 to 10 minutes, depending on which operating system is being installed. Carefully read and follow the instructions on the screen to complete the installation.

 **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 may damage the software that runs the computer or prevent its proper installation.

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

---

If your computer was not shipped with a Microsoft operating system, some portions of this documentation do not apply. Additional information is available in online help after you install the operating system.

## Downloading Microsoft Windows Updates

1. To set up your Internet connection, click **Start** > **Internet Explorer** and follow the instructions on the screen.
2. Once an Internet connection has been established, click the **Start** button.
3. Select the **All Programs** menu.
4. Click on the **Windows Update** link.

In Windows Vista and Windows 7, the **Windows Update** screen appears. Click **view available updates** and make sure all critical updates are selected. Click the **Install** button and follow the instructions on the screen.

In Windows XP, you will be directed to the **Microsoft Windows Update Web site**. If you see one or more pop-up windows that ask you to install a program from <http://www.microsoft.com>, click **Yes** to install the program. Follow the instructions on the Microsoft Web site to scan for updates and install critical updates and service packs.

It is recommended that you install all of the critical updates and service packs.

5. After the updates have been installed, Windows will prompt you to reboot the machine. Be sure to save any files or documents that you may have open before rebooting. Then select **Yes** to reboot the machine.

## Installing or Upgrading Device Drivers (Windows systems)

When installing optional hardware devices after the operating system installation is complete, you must also install the drivers for each of 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 <http://www.hp.com/support>. Select your country and language, select **Download drivers and software (and firmware)**, enter the model number of the computer, and press **Enter**.

## Accessing Disk Image (ISO) Files

There are disk image files (ISO files) included on your PC that contain the installation software for additional software. These CD image files are located in the folder `C:\SWSetup\ISOs`. Each .iso file can be burned to CD media to create an installation CD. It is recommended that these disks be created and the software installed in order to get the most from your PC. The software and image file names are:

- Corel WinDVD SD and BD – installation software for WinDVD – used to play DVD movies
- HP Insight Diagnostics OR Vision Diagnostics – software to perform diagnostic activities on your PC

## Protecting the Software

To protect the software from loss or damage, keep a backup copy of all system software, applications, and related files stored on the hard drive. Refer to the operating system or backup utility documentation for instructions on making backup copies of your data files.

---

## 3 Computer Setup (F10) Utility

### Computer Setup (F10) Utilities

Use Computer Setup (F10) Utility to do the following:

- 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, 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 the Computer Setup (F10) Utility and the settings described in this section.
- 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 removable media boot ability.
- 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 USB flash media device or other storage media emulating a 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 drive).

## Using Computer Setup (F10) Utilities

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

1. Turn on or restart the computer.
2. As soon as the computer is turned on, press **F10** when the monitor light turns green to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.
 

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 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** when the monitor light turns green to access the utility.

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3. Select your language from the list and press **Enter**.
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 or previously saved default settings (some models), select **Apply Defaults and Exit**. This option will restore the original factory system defaults.

△ **CAUTION:** Do NOT turn the computer power OFF while the BIOS is saving the Computer Setup (F10) changes because the CMOS could become corrupted. It is safe to turn off the computer only after exiting the F10 Setup screen.

**Table 3-1 Computer Setup (F10) Utility**

Heading	Table
File	<a href="#">Table 3-2 Computer Setup—File on page 16</a>
Storage	<a href="#">Table 3-3 Computer Setup—Storage on page 17</a>
Security	<a href="#">Table 3-4 Computer Setup—Security on page 19</a>
Power	<a href="#">Table 3-5 Computer Setup—Power on page 23</a>
Advanced	<a href="#">Table 3-6 Computer Setup—Advanced (for advanced users) on page 24</a>

## Computer Setup—File

 **NOTE:** Support for specific Computer Setup options may vary depending on the hardware configuration.

**Table 3-2 Computer Setup—File**

Option	Description
<b>System Information</b>	Lists: <ul style="list-style-type: none"><li>• Product name</li><li>• SKU number (some models)</li><li>• Processor type/speed/stepping</li><li>• Cache size (L1/L2)</li><li>• Installed memory size/speed, number of channels (single or dual) (if applicable)</li><li>• Integrated MAC address for embedded, enabled NIC (if applicable)</li><li>• System BIOS (includes family name and version)</li><li>• Chassis serial number</li><li>• Asset tracking number</li><li>• ME firmware version</li><li>• Management mode</li></ul>
<b>About</b>	Displays copyright notice.
<b>Set Time and Date</b>	Allows you to set system time and date.
<b>Flash System ROM</b>	Allows you to update the system ROM with a BIOS image file located on a USB flash media device or CD-ROM.
<b>Replicated Setup</b>	<b>Save to Removable Media</b> Saves system configuration, including CMOS, to a USB flash media device or a diskette-like device (a storage device set to emulate a diskette drive). <b>Restore from Removable Media</b> Restores system configuration from a USB flash media device or a diskette-like device.
<b>Default Setup</b>	<b>Save Current Settings as Default</b> Saves the current system configuration settings as the default. <b>Restore Factory Settings as Default</b> Restores the factory system configuration settings as the default.
<b>Apply Defaults and Exit</b>	Applies the currently selected default settings and clears any established passwords.
<b>Ignore Changes and Exit</b>	Exits Computer Setup without applying or saving any changes.
<b>Save Changes and Exit</b>	Saves changes to system configuration or default settings and exits Computer Setup.

# Computer Setup—Storage

 **NOTE:** Support for specific Computer Setup options may vary depending on the hardware configuration.

**Table 3-3 Computer Setup—Storage**

Option	Description
<b>Device Configuration</b>	<p>Lists all installed BIOS-controlled storage devices.</p> <p>When a device is selected, detailed information and options are displayed. The following options may be presented:</p> <p><b>Drive Emulation</b></p> <p>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.)</p> <p><b>Emulation Type</b></p> <p>ATAPI Zip drive:</p> <ul style="list-style-type: none"><li>• None (treated as Other).</li><li>• Diskette (treated as diskette drive).</li></ul> <p>CD-ROM: No emulation options available.</p> <p>ATAPI LS-120:</p> <ul style="list-style-type: none"><li>• None (treated as Other).</li><li>• Diskette (treated as diskette drive).</li></ul> <p>Hard Disk:</p> <ul style="list-style-type: none"><li>• None (prevents BIOS data accesses and disables it as a boot device).</li><li>• Hard Disk (treated as hard disk).</li></ul> <p><b>Translation Mode</b> (<i>ATA disks only</i>)</p> <p>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 Off.</p> <p><b>CAUTION:</b> 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.</p> <p><b>Translation Parameters</b> (<i>ATA disks only</i>)</p> <p><b>NOTE:</b> This feature appears only when User translation mode is selected.</p> <p>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.</p> <p><b>SATA Default Values</b></p> <p>Allows you to specify the default values for the Translation Mode for ATA devices.</p>

**Table 3-3 Computer Setup—Storage (continued)**

Option	Description
<b>Storage Options</b>	<p><b>Removable Media Boot</b></p> <p>Enables/disables ability to boot the system from removable media.</p> <p><b>eSATA Port</b></p> <p>Allows you to enable eSATA support. This causes one of the SATA connectors to become eSATA capable.</p> <p><b>Max eSATA Speed</b></p> <p>Allows you to choose 1.5 Gbps or 3.0 Gbps as the maximum eSATA speed. By default, the speed is limited to 1.5 Gbps for maximum reliability.</p> <p><b>CAUTION:</b> Consult your eSATA drive and cable manufacturer before enabling 3.0 Gbps speed. Some drive and cable combinations may not run reliably at 3.0 Gbps.</p> <p><b>SATA Emulation</b></p> <p>Allows you to choose how the SATA controller and devices are accessed by the operating system. There are two supported options: IDE and AHCI.</p> <p>IDE - This is the most backwards-compatible setting of these options. Operating systems usually do not require additional driver support in IDE mode.</p> <p>AHCI (default option) - Allows operating systems with AHCI device drivers loaded to take advantage of more advanced features of the SATA controller.</p> <p><b>NOTE:</b> The AHCI device driver must be installed prior to attempting to boot from an AHCI volume. If you attempt to boot from an AHCI volume without the required device driver installed, the system will crash (blue screen).</p> <p>For more information on AHCI, go to <a href="http://www.hp.com/support">http://www.hp.com/support</a>. Select your country and language, select <b>See support and troubleshooting information</b>, enter the model number of the computer, and press <b>Enter</b>. In the <b>Resources</b> category, click <b>Manuals (guides, supplements, addendums, etc)</b>. Under <b>Quick jump to manuals by category</b>, click <b>White papers</b>.</p>
<b>DPS Self-Test</b>	<p>Allows you to execute self-tests on ATA hard drives capable of performing the Drive Protection System (DPS) self-tests.</p> <p><b>NOTE:</b> This selection will only appear when at least one drive capable of performing the DPS self-tests is attached to the system.</p>
<b>Boot Order</b>	<p>Allows you to:</p> <ul style="list-style-type: none"><li>Specify the order in which attached devices (such as a USB flash media device, 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.</li><li>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).</li></ul> <p><b>NOTE:</b> MS-DOS drive lettering assignments may not apply after a non-MS-DOS operating system has started.</p> <p><b>Shortcut to Temporarily Override Boot Order</b></p> <p>To boot <b>one time</b> from a device other than the default device specified in Boot Order, restart the computer and press <b>F9</b> 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 <b>Enter</b>. The computer then boots from the selected non-default device for this one time.</p>

## Computer Setup—Security

 **NOTE:** Support for specific Computer Setup options may vary depending on the hardware configuration.

**Table 3-4 Computer Setup—Security**

Option	Description
<b>Setup Password</b>	<p>Allows you to set and enable a setup (administrator) password.</p> <p><b>NOTE:</b> 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.</p> <p>See the <i>Desktop Management Guide</i> for more information.</p>
<b>Power-On Password</b>	<p>Allows you to set and enable a power-on password. The power-on password prompt appears after a power cycle. If the user does not enter the correct power-on password, the unit will not boot.</p> <p><b>NOTE:</b> This password does not appear on warm boots, such as <b>Ctrl+Alt+Delete</b> or <b>Restart from Windows</b>, unless enabled in <b>Password Options</b> (see below).</p> <p>See the <i>Desktop Management Guide</i> for more information.</p>
<b>Password Options</b>  (This selection appears only if a power-on password or setup password is set.)	<p>Allows you to:</p> <ul style="list-style-type: none"><li>• Lock legacy resources (appears if a setup password is set)</li><li>• Enable/disable network server mode (appears if a power-on password is set)</li><li>• Specify whether the password is required for warm boot (<b>Ctrl+Alt+Delete</b>) (appears if a power-on password is set)</li><li>• Enable/Disable Setup Browse Mode (appears if a setup password is set) (allows viewing, but not changing, the F10 Setup Options without entering setup password)</li><li>• Enable/disable Stringent Password (appears if a power-on password is set), which when enabled bypasses the onboard password jumper to disable the power-on password.</li></ul> <p>See the <i>Desktop Management Guide</i> for more information.</p>
<b>Device Security</b>	<p>Allows you to set Device Available/Device Hidden for:</p> <ul style="list-style-type: none"><li>• Serial ports</li><li>• Parallel port</li><li>• System audio</li><li>• Network controllers (some models)</li><li>• Embedded security device (some models)</li><li>• SATA0</li><li>• SATA1</li><li>• SATA2</li><li>• SATA3</li></ul>

**Table 3-4 Computer Setup—Security (continued)**

Option	Description
<b>USB Security</b>	<p>Allows you to set Device Available/Device Hidden for:</p> <ul style="list-style-type: none"><li>• Front USB Ports<ul style="list-style-type: none"><li>◦ USB Port 1</li><li>◦ USB Port 2</li><li>◦ USB Port 3</li><li>◦ USB Port 4</li><li>◦ USB Port 5</li><li>◦ USB Port 6</li></ul></li><li>• Rear USB Ports<ul style="list-style-type: none"><li>◦ USB Port 7</li><li>◦ USB Port 8</li><li>◦ USB Port 9</li><li>◦ USB Port 10</li><li>◦ USB Port 11</li><li>◦ USB Port 12</li></ul></li></ul>
<b>Slot Security</b>	<p>Allows you to disable PCIe and PCI slots along with cards plugged into them.</p>
<b>Network Service Boot</b>	<p>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 be either a PCI expansion card or embedded on the system board.)</p>
<b>System IDs</b>	<p>Allows you to set:</p> <ul style="list-style-type: none"><li>• Asset tag (18-byte identifier), a property identification number assigned by the company to the computer.</li><li>• Ownership tag (80-byte identifier) displayed during POST.</li><li>• 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.)</li><li>• Keyboard locale setting (for example, English or German) for System ID entry.</li></ul>
<b>DriveLock Security</b>	<p>Allows you to assign or modify a master or user password for 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.</p> <p><b>NOTE:</b> This selection will only appear when at least one drive that supports the DriveLock feature is attached to the system. You may need to power-cycle the system and re-enter F10 Setup in order to manage DriveLock passwords.</p> <p>See the <i>Desktop Management Guide</i> for more information.</p>

**Table 3-4 Computer Setup—Security (continued)**

Option	Description
<b>System Security</b> (some models: these options are hardware dependent)	Data Execution Prevention (some models) (enable/disable) - Helps prevent operating system security breaches.
	PAVP (Some models) (disabled/min) - PAVP enables the Protected Audio Video Path in the Chipset. This may allow viewing of some protected high definition content that would otherwise be prohibited from playback.
	Virtualization Technology (some models) (enable/disable) - Controls the virtualization features of the processor. Changing this setting requires turning the computer off and then back on.
	Virtualization Technology Directed I/O (some models) (enable/disable) - Controls virtualization DMA remapping features of the chipset. Changing this setting requires turning the computer off and then back on.
	Trusted Execution Technology (some models) (enable/disable) - Controls the underlying processor and chipset features needed to support a virtual appliance. Changing this setting requires turning the computer off and then back on. To enable this feature you must enable the following features: <ul style="list-style-type: none"><li>• Embedded Security Device Support</li><li>• Virtualization Technology</li><li>• Virtualization Technology Directed I/O</li></ul>
	Embedded Security Device Support (some models) (enable/disable) - Permits activation and deactivation of the Embedded Security Device. Changing this setting requires turning the computer off and then back on.
	<b>NOTE:</b> To configure the Embedded Security Device, a Setup password must be set. <ul style="list-style-type: none"><li>• Reset to Factory Settings (some models) (Do not reset/Reset) - Resetting to factory defaults will erase all security keys. Changing this setting requires turning the computer off and then back on.</li></ul>
	<b>CAUTION:</b> The embedded security device is a critical component of many security schemes. Erasing the security keys will prevent access to data protected by the Embedded Security Device. Choosing Reset to Factory Settings may result in significant data loss.
	<ul style="list-style-type: none"><li>• Power-on authentication support (some models) (enable/disable) - Controls the power-on password authentication scheme that utilizes the Embedded Security Device. Changing this setting requires turning the computer off and then back on.</li><li>• Reset authentication credentials (some models) (Do not reset/Reset) - Selecting Reset disables the power-on authentication support and clears the authentication information from the Embedded Security Device. Changing this setting requires turning the computer off and then back on.</li></ul>
	OS management of Embedded Security Device (some models) (enable/disable) - This option allows the user to limit operating system control of the Embedded Security Device. Changing this setting requires turning the computer off and then back on. This option allows the user to limit OS control of the Embedded Security Device. <ul style="list-style-type: none"><li>• Reset of Embedded Security Device through OS (some models) (enable/disable) - This option allows the user to limit the operating system ability to request a Reset to Factory Settings of the Embedded Security Device. Changing this setting requires turning the computer off and then back on.</li></ul>

**NOTE:** To enable this option, a Setup password must be set.

**Table 3-4 Computer Setup—Security (continued)**

Option	Description
<b>Master Boot Record Security</b>	<p>Allows you to disable/enable Master Boot Record Security.</p> <ul style="list-style-type: none"><li>• Save Master Boot Record – This option will appear if Master Boot Record Security is enabled. It allows you to save a copy of the Master Boot Record into non-volatile storage.</li><li>• Restore Master Boot Record – This option will appear on the next boot once the Master Boot Record has been saved. It allows you to restore the saved copy back to the hard drive's Master Boot Record.</li></ul>
<b>Setup Security Level</b>	<p>Provides a method to allow end-users limited access to change specified setup options, without having to know the Setup Password.</p> <p>This feature allows the administrator the flexibility to protect changes to essential setup options, while allowing the user to view system settings and configure nonessential options. The administrator specifies access rights to individual setup options on a case-by-case basis via the Setup Security Level menu. By default, all setup options are assigned Setup Password, indicating the user must enter the correct Setup Password during POST to make changes to any of the options. The administrator may set individual items to None, indicating the user can make changes to the specified options when setup has been accessed with invalid passwords. The choice, None, is replaced by Power-On Password if a Power-On Password is enabled.</p> <p><b>NOTE:</b> Setup Browse Mode must be set to Enable in order for the user to enter Setup without knowing the setup password.</p>

## Computer Setup—Power

 **NOTE:** Support for specific Computer Setup options may vary depending on the hardware configuration.

**Table 3-5 Computer Setup—Power**

Option	Description
<b>OS Power Management</b>	<ul style="list-style-type: none"><li>• 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.</li><li>• Idle Power Savings—Extended/Normal. Allows certain operating systems to decrease the processors power consumption when the processor is idle.</li><li>• 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.</li><li>• ACPI S3 PS2 Mouse Wakeup—Enables or disables waking from S3 due to PS2 mouse activity.</li><li>• USB Wake on Device Insertion (some models)—Allows system to wake from Standby on USB device insertion.</li><li>• Unique Sleep State Blink Rates—Enable/Disable. This feature is designed to provide a visual indication of what sleep state the system is in. Each sleep state has a unique blink pattern.<ul style="list-style-type: none"><li>◦ S0 = Solid green LED.</li><li>◦ S3 = 3 blinks at 1Hz (50% duty cycle) followed by a pause of 2 seconds (green LED) — repeated cycles of 3 blinks and a pause.</li><li>◦ S4 = 4 blinks at 1Hz (50% duty cycle) followed by a pause of 2 seconds (green LED) — repeated cycles of 4 blinks and a pause.</li><li>◦ S5 = LED is off.</li></ul></li></ul> <p><b>NOTE:</b> If this feature is disabled, S4 and S5 both have the LED off. S1 (no longer supported) and S3 use 1 blink per second.</p>
<b>Hardware Power Management</b>	SATA power management enables or disables SATA bus and/or device power management.
<b>Thermal</b>	Fan idle mode—This bar graph controls the minimum permitted fan speed. <p><b>NOTE:</b> This setting only changes the minimum fan speed. The fans are still automatically controlled.</p>

## Computer Setup—Advanced

 **NOTE:** Support for specific Computer Setup options may vary depending on the hardware configuration.

**Table 3-6 Computer Setup—Advanced (for advanced users)**

Option	Description
<b>Power-On Options</b>	Allows you to set: <ul style="list-style-type: none"><li>• POST mode (QuickBoot, Clear Memory, FullBoot, or FullBoot Every x Days).<ul style="list-style-type: none"><li>◦ QuickBoot = Do not clear memory or perform a memory test.</li><li>◦ FullBoot = Memory test (count) on cold boot. Clears memory on all boots.</li></ul></li></ul>

**Table 3-6 Computer Setup—Advanced (for advanced users) (continued)**

Option	Description
	<ul style="list-style-type: none"><li>◦ Clear Memory = No memory count on cold boot. Clears memory on all boots.</li><li>◦ FullBoot Every x Days = Memory count on 1st cold boot on or after the xth day. No more memory counts until 1st cold boot on or after x days. Clears memory on all boots.</li><li>• POST messages (enable/disable).</li><li>• <b>F9</b> prompt (hidden/displayed). Enabling this feature will display the text <b>F9 = Boot Menu</b> during POST. Disabling this feature prevents the text from being displayed. However, pressing <b>F9</b> will still access the Shortcut Boot [Order] Menu screen. See <b>Storage &gt; Boot Order</b> for more information.</li><li>• <b>F10</b> prompt (hidden/displayed). Enabling this feature will display the text <b>F10 = Setup</b> during POST. Disabling this feature prevents the text from being displayed. However, pressing <b>F10</b> will still access the Setup screen.</li><li>• <b>F11</b> prompt (hidden/displayed). Setting this feature to displayed will display the text <b>F11 = Recovery</b> during POST. Hiding the feature prevents the text from being displayed. However, pressing <b>F11</b> will still attempt to boot to the recovery partition. See Factory Recovery Boot Support for more information.</li><li>• <b>F12</b> prompt (hidden/displayed). Enabling this feature will display the text <b>F12 = Network</b> during POST. Disabling this feature prevents the text from being displayed. However, pressing <b>F12</b> will still force the system to attempt booting from the network.</li><li>• Factory Recovery Boot Support (enable/disable). Enabling this feature will cause an additional prompt, <b>F11 = Recovery</b>, to be displayed during POST on systems with a recovery partition on the boot hard drive. Pressing <b>F11</b> causes the system to boot to the recovery partition. The <b>F11 = Recovery</b> prompt can be hidden with the <b>F11</b> prompt (hidden/displayed) option (see above).</li><li>• Option ROM prompt (enable/disable). Enabling this feature will cause the system to display a message before loading option ROMs. (This feature is supported on some models only.)</li><li>• WOL After Power Loss (enable/disable). Enabling this option will cause the system to power-up momentarily after a power loss in order to enable the Wake On LAN (WOL) feature.</li><li>• Remote wakeup boot source (remote server/local hard drive).</li><li>• After Power Loss (off/on/previous state): Setting this option to:<ul style="list-style-type: none"><li>◦ Off—causes the computer to remain powered off when power is restored.</li><li>◦ On—causes the computer to power on automatically as soon as power is restored.</li><li>◦ Previous state—causes the computer to power on automatically as soon as power is restored, if it was on when power was lost.</li></ul></li></ul> <p><b>NOTE:</b> If you turn off power to the computer using the switch on a power strip, you will not be able to use the suspend/sleep feature or the Remote Management features.</p> <ul style="list-style-type: none"><li>• POST Delay (None, 5, 10 15, or 20 seconds). 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 select <b>F10</b> to enter Computer (F10) Setup.</li><li>• Limit CPUID Maximum Value to 3. Restricts the number of CPUID functions reported by the microprocessor. Enable this feature if booting to Windows NT.</li><li>• Bypass <b>F1</b> Prompt. This feature allows the system to boot without pressing <b>F1</b> at the prompt when the configuration changes.</li></ul>
<b>Execute Memory Test</b> (some models)	Restarts the computer and executes the POST memory test.

**Table 3-6 Computer Setup—Advanced (for advanced users) (continued)**

Option	Description
<b>BIOS Power-On</b>	Allows you to set the computer to turn on automatically at a time you specify.
<b>Onboard Devices</b>	Allows you to set resources for or disable onboard system devices (serial port or parallel port).
<b>PCI Devices</b>	<ul style="list-style-type: none"><li>• Lists currently installed PCI devices and their IRQ settings.</li><li>• Allows you to reconfigure IRQ settings for these devices or to disable them entirely. These settings have no effect under an ACPI-based operating system.</li></ul>
<b>PCI VGA Configuration</b>	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.  <b>NOTE:</b> In order to see this entry, you must enable Integrated Video ( <b>Advanced &gt; Device Options</b> ) and Save Changes and Exit.
<b>Bus Options</b>	On some models, allows you to enable or disable: <ul style="list-style-type: none"><li>• PCI SERR# Generation.</li><li>• 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.</li></ul>
<b>Device Options</b>	Allows you to set: <ul style="list-style-type: none"><li>• Printer mode (Bi-Directional, EPP + ECP, Output Only).</li><li>• <b>Num Lock</b> state at power-on (off/on).</li><li>• S5 Wake on LAN (enable/disable).<ul style="list-style-type: none"><li>◦ To disable Wake on LAN during the off state (S5), use the arrow (left and right) keys to select the <b>Advanced &gt; Device Options</b> menu and set the <b>S5 Wake on LAN</b> feature to <b>Disable</b>. 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.</li><li>◦ If a network connection is not required, completely disable the network controller (NIC) by using the arrow (left and right) keys to select the <b>Security &gt; Device Security</b> menu. Set the <b>Network Controller</b> option to <b>Device Hidden</b>. This prevents the network controller</li></ul></li></ul>

**Table 3-6 Computer Setup—Advanced (for advanced users) (continued)**

Option	Description
	<p>from being used by the operating system and reduces the power used by the computer in S5.</p> <ul style="list-style-type: none"><li>• Processor cache (enable/disable).</li><li>• Integrated Video (enable/disable). Allows you to use integrated video and PCI or PCIe x1 Up Solution video at the same time.</li></ul> <p><b>NOTE:</b> After Integrated Video is enabled and changes saved, a new menu item appears under <b>Advanced</b> to allow you to select the primary VGA controller video device.</p> <p>Inserting a PCI Express x16 video card automatically disables Integrated Video. When a PCI Express x16 video card is installed, Integrated Video cannot be enabled.</p> <ul style="list-style-type: none"><li>• Multi-Processor (enable/disable). This option may be used to disable multi-processor support under the OS.</li><li>• Internal speaker (some models) (does not affect external speakers).</li><li>• 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.</li></ul>
Management Devices	<p>The Management Devices menu will only be displayed in the Advanced menu when the BIOS detects multiple management options.</p> <p>This option is for installed NIC cards that support ASF or DASH. Use the Management Devices menu to select if the BIOS management operations will be through the embedded solution or one of the installed NIC cards.</p>
<b>Management Operations</b>	<p>Allows you to set:</p> <ul style="list-style-type: none"><li>• MEBx Setup Prompt (enable/disable). Enabling this feature displays the <b>CTRL+P</b> prompt during POST. Disabling this feature prevents the prompt from being displayed. However, pressing <b>Ctrl+P</b> still accesses the utility used to configure manageability settings.</li></ul> <p>The <b>CTRL+P</b> function activates the MEBx Setup menu. If the Setup Password is configured, the user will be prompted to correctly enter it before being allowed to enter the MEBx Setup. If the password is entered incorrectly three times, the MEBx Setup will not be activated.</p> <ul style="list-style-type: none"><li>• SOL Character Echo (enable/disable). Some remote consoles print remotely-entered characters which can cause the characters to appear twice (once when entered remotely and once when echoed back from local client video). This option allows the administrator to have the SOL terminal emulator suppress echoing remotely-entered characters to the local video display.</li><li>• SOL Terminal Emulation Mode (enable/disable). Selects between VT100 and ANSI SOL terminal emulation. SOL terminal emulation mode is only activated during remote AMT redirection operations. The emulation options allow administrators to select which mode works best with their console.</li><li>• SOL Keyboard (enable/disable). Disable or enable client keyboard during SOL sessions. Some remote remediation may involve having the local client boot a remote image provided by an administrator. This option determines if the BIOS will keep the local keyboard enabled or disabled for possible local client interaction. If the local keyboard is disabled, all keyboard input is only accepted from the remote source.</li></ul>

## Recovering the Configuration Settings

This method of recovery requires that you first perform the **Save to Removable Media** command with the Computer Setup (F10) Utility before **Restore** is needed. (See [Save to Removable Media on page 16](#) in the Computer Setup—File table.)

 **NOTE:** It is recommended that you save any modified computer configuration settings to a USB flash media device or a diskette-like device (a storage device set to emulate a diskette drive) and save the device for possible future use.

To restore the configuration, insert a USB flash media device or other storage media emulating a diskette with the saved configuration and perform the **Restore from Removable Media** command with the Computer Setup (F10) Utility. (See [Restore from Removable Media on page 16](#) in the Computer Setup—File table.)

## Drive Protection System (DPS)

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

When these systems 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.

Running DPS will not affect any programs or data stored on the hard drive. The test resides in the hard drive firmware and can be executed even if the computer will not boot to an operating system. The time required to execute the test depends on the manufacturer and size of the hard drive; in most cases, the test will take approximately two minutes per gigabyte.

Use DPS when you suspect a hard drive problem. If the computer reports a SMART Hard Drive Detect Imminent Failure message, there is no need to run DPS; instead, back up the information on the hard drive and contact a service provider for a replacement hard drive.

## Accessing DPS Through Computer Setup

When the computer does not power on properly you should use Computer Setup to access the DPS program. To access DPS, perform the following steps:

1. Turn on or restart the computer.
2. When the F10 Setup message appears in the lower-right corner of the screen, press the **F10** key.

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

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

3. Select **Storage > DPS Self-Test**.

The screen will display the list of DPS-capable hard drives that are installed on the computer.

 **NOTE:** If no DPS-capable hard drives are installed, the **DPS Self-Test** option will not appear on the screen.

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4. Select the hard drive to be tested and follow the screen prompts to complete the testing process.

When the test has been completed, one of three messages will be displayed:

- Test Succeeded. Completion Code 0.
- Test Aborted. Completion Code 1 or 2.
- Test Failed. Drive Replacement Recommended. Completion Code 3 through 14.

If the test failed, the completion code should be recorded and reported to your service provider for help in diagnosing the computer problem.

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# 4 Computer Diagnostic Features

## Hewlett-Packard Vision Diagnostics

 **NOTE:** HP Vision Diagnostics is included on CD with some computer models only.

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The Hewlett-Packard Vision Field Diagnostics utility allows you to view information about the hardware configuration of the computer and perform hardware diagnostic tests on the subsystems of the computer. The utility simplifies the process of effectively identifying, diagnosing, and isolating hardware issues.

The Survey tab is displayed when you invoke HP Vision Diagnostics. This tab shows the current configuration of the computer. From the Survey tab, there is access to several categories of information about the computer. Other tabs provide additional information, including diagnostic test options and test results. The information in each screen of the utility can be saved as an html file and stored on a diskette or USB flash drive.

Use HP Vision Field Diagnostics 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.

You should run tests, save the test results, and print them so that you have printed reports available before placing a call to the Customer Support Center.

 **NOTE:** Third party devices may not be detected by HP Vision Field Diagnostics.

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## Accessing HP Vision Diagnostics

To access HP Vision Field Diagnostics, you must burn the utility onto a CD or copy it onto a USB flash drive then boot to the CD or USB flash drive. It can also be downloaded from <http://www.hp.com> and either burned to CD or installed to a USB flash drive. See [Downloading the Latest Version of HP Vision Diagnostics on page 34](#) for more information.

 **NOTE:** HP Vision Field Diagnostics is included with some computer models only.

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If you have already downloaded HP Vision Diagnostics to either a CD or USB Flash drive, then begin the following procedure at step 2.

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1. In Windows Explorer, go to **c:\SWSetup\ISOs** and burn the file **Vision Diagnostics.ISO** to a CD or copy it to a USB flash drive.
2. While the computer is on, insert the CD in the Optical Drive or USB flash drive in a USB port on the computer.
3. Shut down the operating system and turn off the computer.
4. Turn on the computer. The system will boot into HP Vision Diagnostics.

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 **NOTE:** If the system does not boot to the CD in the optical drive or to the USB flash drive, you may need to change the boot order in the Computer Setup (F10) utility. Refer to the *Computer Setup (F10) Utility Guide* for more information.

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5. At the boot menu, select either the **HP Vision Diagnostics** utility to test the various hardware components in the computer or the **HP Memory Test** utility to test memory only.

 **NOTE:** The HP Memory Test is a comprehensive memory diagnostic utility that is run as a stand-alone application, outside of HP Vision Diagnostics.

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6. If running **HP Vision Diagnostics**, select the appropriate language and click **Continue**.
7. In the End User License Agreement page, select **Agree** if you agree with the terms. The HP Vision Diagnostics utility launches with the Survey tab displayed.

## Survey Tab

The Survey tab displays important system configuration information.

In the **View level** field, you can select the **Summary** view to see limited configuration data or select the **Advanced** view to see all the data in the selected category. By default, the View Level is set to **Overview** which displays general information about all of the component categories.

In the **Category** field, you can select the following categories of information to display:

**All**—Gives a listing of all categories of information about the computer.

**Architecture**—Provides system BIOS and PCI device information.

**Asset Control**—Shows product name, system serial number, asset tag and universal unique ID information.

**Audio**—Displays information about the audio controllers present in the system, including PCI audio cards.

**Communication**—Shows information about the computer parallel (LPT) and serial (COM) port settings, plus USB and network controller information.

**Graphics**—Shows information about the graphics controller of the computer.

**Input Devices**—Shows information about the keyboard, mouse, and other input devices connected to the computer.

**Memory**—Shows information about all memory in the computer. This includes memory slots on the system board and any memory modules installed.

**Processors**—Shows information about the processor(s) installed in the computer, including clock speeds and cache sizes.

**Storage**—Shows information about storage media connected to the computer. This list includes all hard drives, diskette drives, and optical drives.

**System**—Shows information about the computer model, internal fans, chassis, and BIOS.

## Test Tab

The Test tab allows you to choose various parts of the system to test. You can also choose the type of test and testing mode.

There are three types of tests to choose from:

- **Quick Test**—Provides a predetermined script where a sample of each hardware component is exercised. You may further modify which of the Quick tests are executed by selecting or deselecting individual tests in the hardware component check list.
- **Complete Test**—Provides a predetermined script where each hardware component is fully tested. You may further modify which of the Complete tests are executed by selecting or deselecting individual tests in the hardware component check list.
- **Custom Test**—Provides the most flexibility in controlling the testing of a system. The Custom Test mode allows you to specifically select which devices, tests, and test parameters are run.

By default, the three test modes do not display prompts and require no interaction. If errors are found, they are displayed when testing is complete.

However, for each test type, you may also optionally add interactive tests by clicking the **Include interactive tests** box under **Test mode**. Selecting interactive tests provides the maximum control over the testing process. The diagnostic software will prompt you for input during tests.

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 **NOTE:** Memory can not be tested from within the HP Vision Diagnostics application. To test the memory in your computer, you must exit HP Vision Diagnostics, boot to either the CD or USB flash drive and select **HP Memory Test** from the boot menu.

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To begin testing:

1. Select the Test tab.
2. Select the type of tests you want to run: **Quick**, **Complete**, or **Custom**.
3. Include optional interactive tests by selecting **Include interactive tests**.
4. Choose how you want the test to be executed, either **Number of Loops** or **Total Test Time**. When choosing to run the test over a specified number of loops, enter the number of loops to perform. If you want the diagnostic test for a specified time period, enter the amount of time in minutes.
5. Click the **Start Test** button to start the testing. The Status tab, which allows you to monitor the progress of the tests, is automatically displayed during the testing process. When the tests are complete, the Status tab shows whether the devices passed or failed.
6. If errors are found, go to the Errors tab to display detailed information and recommended actions.

## Status Tab

The Status tab displays the status of the selected tests. The main progress bar displays the percent complete of the current set of tests. While testing is in progress, a **Cancel Testing** button is displayed for use if you want to cancel the test.

The Status tab also shows:

- The devices being tested
- The test status (running, waiting, passed, or failed) of each device being tested
- The overall test progress of all devices being tested
- The test progress for each device being tested
- The elapsed test times for each device being tested

## History Tab

The History tab contains information on past test executions.

The History Log displays all tests that have been executed, the number of times of execution, the number of times failed, the date each test was executed, and the time it took to complete each test. The **Clear History** button will clear the contents of the History Log.

The contents of the History Log may be saved as a HTML file to either floppy or USB flash drive by clicking the **Save** button.

## Errors Tab

The Errors tab displays detailed information about any errors found, as well as any recommended actions.

The Error Log displays the tests for devices that have failed during the diagnostic testing and includes the following columns of information.

- The **Device** section displays the device tested.
- The **Test** section displays the type of test run.
- The **Times Failed** is the number of times the device has failed a test.
- The **Defect Code** provides a numerical code for the failure. The error codes are defined in the Help tab.
- The **Description** section describes the error that the diagnostic test found.
- The **Reason** section describes the likely cause of the error.
- The **Recommended Repair** will give a recommended action that should be performed to resolve the failed hardware.
- The **Warranty ID** is a unique error code associated with the specific error on your computer. When contacting the HP Support Center for assistance with a hardware failure, please be prepared to provide the Warranty ID.

The **Clear Errors** button will clear the contents of the Error Log.

The contents of the Error Log may be saved as a HTML file to either floppy or USB flash drive by clicking the **Save** button.

## Help Tab

The Help tab contains a **Vision Help** section, and a **Test Components** section. This tab includes search and index features. You may also review the HP End User License Agreement (EULA), as well as the HP Vision Field Diagnostic application version information on this tab.

The **Vision Help** section contains information on the major functions of Hewlett-Packard Vision Field Diagnostics.

The **Test Components** section provides a description of each test, as well as the parameters that may be adjusted when running in Custom test mode.

The **Defect codes** section contains information on the numerical error code that may appear in the Errors tab.

The **Memory test tab** section provides information on the **HP Memory Test** application that may be launched from the boot menu.

The **HP Support** section provides information on obtaining technical support from HP.

## Saving and Printing Information in HP Vision Diagnostics

You can save the information displayed in the HP Vision Diagnostics **Survey**, **History** and **Errors** tabs to a diskette or a USB flash drive. You can not save to the hard drive. The system will automatically create an html file that has the same appearance as the information displayed on the screen.

1. Insert a diskette or USB flash drive if running HP Vision Diagnostics from CD.
2. Click **Save** in the bottom on any of the **Survey**, **History** or **Errors** tabs. All three log files will be saved regardless of from which tab the Save button was clicked.
3. Select the drive onto which you will save the log files and click the **Save** button. Three html files will be saved to the inserted diskette or USB flash drive.

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 **NOTE:** Do not remove the diskette or USB flash drive until you see a message indicating that the html files have been written to the media.

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4. Print the desired information from the storage device used to save it.

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 **NOTE:** To exit HP Vision Diagnostics, click the **Exit Diagnostics** button at the bottom of the screen. Be sure to remove the USB flash drive or CD from the optical drive.

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## Downloading the Latest Version of HP Vision Diagnostics

1. Go to <http://www.hp.com>.
2. Click the **Software & Drivers** link.
3. Select **Download drivers and software (and firmware)**.
4. Enter your product name in the text box and press the **Enter** key.
5. Select your specific computer model.
6. Select your OS.
7. Click the **Diagnostic** link.
8. Click the **Hewlett-Packard Vision Field Diagnostics** link.
9. Click the **Download** button.

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 **NOTE:** The download includes instructions on how to create the bootable CD or the bootable USB flash drive.

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## Protecting the Software

To protect software from loss or damage, you should keep a backup copy of all system software, applications, and related files stored on the hard drive. See the operating system or backup utility documentation for instructions on making backup copies of data files.

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# 5 Desktop Management

HP Client Management Solutions provides standards-based solutions for managing and controlling desktops, workstations, and notebook PCs in a networked environment. HP pioneered desktop manageability in 1995 with the introduction of the industry's first fully manageable desktop personal computers. HP is a patent holder of manageability technology. Since then, HP has led an industry-wide effort to develop the standards and infrastructure required to effectively deploy, configure, and manage desktops, workstations, and notebook PCs. HP develops its own management software and works closely with leading management software solution providers in the industry to ensure compatibility between HP Client Management Solutions and these products. HP Client Management Solutions are an important aspect of our broad commitment to providing you with solutions that assist you in lowering the total cost of owning and maintaining the PCs throughout their lifecycle.

The key capabilities and features of desktop management are:

- Initial configuration and deployment
- Remote system installation
- Software updating and management
- ROM flash
- Hardware option configuration
- Asset tracking and security
- Fault notification and recovery

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

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## Initial Configuration and Deployment

The computer comes with a preinstalled system software image. After a brief software “unbundling” process, the computer is ready to use.

You may prefer to replace the preinstalled software image with a customized set of system and application software. There are several methods for deploying a customized software image. They include:

- Installing additional software applications after unbundling the preinstalled software image.
- Using software deployment tools, such as HP Client Automation Standard Edition or HP Client Automation Enterprise Edition (based on Radia technology) 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.

ROM-based setup and ACPI hardware provide further assistance with recovery of system software, configuration management and troubleshooting, and power management.

## HP Client Automation Agent

The management agent used by both HP Client Automation Standard and Enterprise Editions is pre-loaded on the computer. When installed, it enables communication with the HP management console.

To install the HP Client Automation Agent:

1. Click **Start**.
2. Click **All Programs**.
3. Click **HP Manageability**.
4. Click the **HP Management Agent Readme** applicable to the language you desire.
5. Review and follow the instructions contained in the Readme file to install the HP Client Automation Agent.

HP Client Automation Agent is a key infrastructure component for enabling all of the HP Client Automation solutions. To learn about the other infrastructure components necessary for implementing the HP configuration management solutions, please visit <http://h20229.www2.hp.com/solutions/ascm/index.html>.

## HP Client Manager

HP Client Manager (HPCM) is a free solution developed by Symantec for all supported HP business desktop, notebook, workstation and HP Blade PCs. HPCM integrates HP specific tools such as System Software Manager, HP Instant Support Professional Edition, and HP Client Management Interface to enable a centralized model for the managing, tracking, and monitoring of all supported HP hardware.

HP Client Manager 7.0 features a brand new Portal Page which serves as a one-stop-shop where the administrator can accomplish the following management tasks:

- Inventory
- Alerts
- BIOS Management
- Driver Updates
- Perform HP Instant Support Health Scan and Diagnostics
- Perform Embedded Security tasks
- View the overall HP Health Alert Trend over the last 3-6 months
- View the overall compliance of supported computers with HP Instant Support Health Scan and Diagnostics
- View the Summary of HP Computers – a breakdown of the various supported desktops, notebooks, workstations and HP Blade PCs
- View Alerts: Asset, Threshold, Hardware Health

- Reports
- Administrative tasks to update HP specific tools

HPCM can be downloaded from <http://www.symantec.com/business/theme.jsp?themeid=altiris> by clicking on **HP Client Manager** under **Strategic Partner Products**. A free permanent license can also be obtained from the download page.

HPCM “How to” videos are also published on <http://www.symantec.com/connect>. Search for **HP Client Manager 7.0** to view step by step videos for various tasks within HPCM.

## Remote System Installation

Remote System Installation allows you to start and set up the 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 ([Remote ROM Flash on page 45](#))

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 **NOTE:** There are facilities to flash the system BIOS from within the Microsoft Windows operating system.

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- 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 when the computer is booting up. 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.

## Software Updating and Management

HP provides several tools for managing and updating software on desktops, workstations, and notebooks:

- HP Client Management Interface
- HP SoftPaq Download Manager
- HP System Software Manager
- HP ProtectTools Security Manager
- HP Client Automation Starter, Standard, and Enterprise Editions
- HP Client Manager from Symantec
- Altiris Client Management Suite
- HP Client Catalog for Microsoft System Center & SMS Products
- Intel vPro-branded PCs with Active Management Technology
- Verdiem Surveyor

- HP Proactive Change Notification
- HP Subscriber's Choice

## HP Client Management Interface

Regardless of the system management tools your IT department uses, managing both your hardware and software assets is important to keeping your IT costs low and your business agile. The IT administrator can access the HP Client Management Interface by writing simple scripts and integrating those scripts to the management solution of their choice.

With the HP Client Management Interface (HP CMI), new HP business computers seamlessly integrate into your managed IT environment. HP CMI provides an interface that simplifies the integration of HP business computers with popular industry system management tools (including Microsoft Systems Management Server, IBM Tivoli Software, and HP Operations) and custom in-house developed management applications. Using HP CMI, systems management tools and applications can request in-depth client inventory, receive health status information, and manage system BIOS settings by communicating directly with the client computer, reducing the need for agent or connector software to achieve integration.

HP Client Management Interface is based on industry standards that include Microsoft Windows Management Interface (MS WMI), Web-Based Enterprise Management (WBEM), System Management BIOS (SMBIOS), and Advanced Configuration and Power Interface (ACPI). HP CMI is a foundation technology utilized in HP Client Management Solutions. With HP CMI, HP gives you flexibility in choosing how you manage your HP client computers.

HP Client Management Interface used in conjunction with system management software can:

- Request in-depth client inventory information—Capture detailed information about the processors, hard drives, memory, BIOS, drivers, including sensor information (such as fan speed, voltage, and temperature).
- Receive health status information—Subscribe for a wide range of client hardware alerts (such as over-temperature, fan stall, and hardware configuration changes) to be sent to the system management console, application, or to the local client computer. Alerts are sent real-time when triggered by hardware events.
- Manage system BIOS settings—Perform F10 functions including setting and changing the BIOS passwords and computer boot order remotely from your system management console on any or all of your client systems without having to visit each machine.

For more information on HP Client Management Interface, refer to <http://www.hp.com/go/hpcmii/>.

## HP SoftPaq Download Manager

HP SoftPaq Download Manager is a free, easy-to-use interface for locating and downloading software updates for the HP client PC models in your environment. By specifying your models, operating system, and language, you can quickly locate, sort, and select the softpaqs you need. To download HP SoftPaq Download Manager, visit <http://www.hp.com/go/sdm>.

## HP System Software Manager

HP System Software Manager (SSM) is a free utility that automates remote deployment of device drivers and BIOS updates for your networked HP business PCs. When SSM runs, it silently (without user interaction) determines the revision levels of drivers and BIOS installed on each networked client system and compares this inventory against system software SoftPaqs that have been tested and stored in a

central file store. SSM then automatically updates any down-revision system software on the networked PCs to the later levels available in the file store. Since SSM only allows distribution of SoftPaq updates to the correct client system models, administrators can confidently and efficiently use SSM to keep system software updated.

System Software Manager integrates with enterprise software distribution tools such as HP Client Automation solutions, HP Client Manager from Symantec, and Microsoft Systems Management Server (SMS). Using SSM, you can distribute customer-created or third-party updates that have been packaged in the SSM-format.

SSM may be downloaded at no charge by visiting <http://www.hp.com/go/ssm>.

 **NOTE:** SSM does not currently support remote ROM flash on systems that have Windows BitLocker Drive Encryption enabled and are using TPM measurements to protect the BitLocker keys because flashing the BIOS would invalidate the trust signature that BitLocker created for the platform. Disable BitLocker via Group Policy in order to flash the system BIOS.

You can enable BitLocker support without TPM measurements of BIOS to avoid invalidating the BitLocker keys. HP recommends you keep a secure backup of the BitLocker credentials in case of recovery emergencies.

## HP ProtectTools Security Manager

HP ProtectTools security software provides security features that help protect against unauthorized access to the computer, networks, and critical data. Enhanced security functionality is provided by the following software modules, and is accessible through HP ProtectTools Security Manager:

HP ProtectTools Security Manager is the single console through which all other modules are accessed.

- Credential Manager for HP ProtectTools
- Drive Encryption for HP ProtectTools
- Privacy Manager for HP ProtectTools
- File Sanitizer for HP ProtectTools
- Java Card Security for HP ProtectTools
- Embedded Security for HP ProtectTools
- Device Access Manager for HP ProtectTools
- LoJack Pro for HP ProtectTools

HP ProtectTools provides two versions that can be utilized: HP ProtectTools Security Manager and HP ProtectTools Administrative Console. Both Administrator and user versions are available in the **Start > All Programs** menu.

The software modules available for your computer may vary depending on your model. For example, Embedded Security for HP ProtectTools is available only for computers on which the Trusted Platform Module (TPM) embedded security chip is installed.

HP ProtectTools software modules may be preinstalled, preloaded, or available for download from the HP Web site. For select HP Pro Desktops, HP ProtectTools is available as an after market option. Visit <http://www.hp.com/products/security> for more information.

## HP Client Automation Starter and Standard Editions

HP Client Automation is a hardware and software management solution for Windows Vista, Windows XP and HP Thin Client environments that is easy to use and quick to deploy, while providing a strong foundation for future requirements. It is offered in two editions:

- The Starter Edition is a free product for managing HP desktops, notebooks and workstations, providing hardware and software inventory, remote control, HP alert monitoring, HP BIOS and driver updates, integration with HP Protect Tools and add-on support for Intel AMT. The Starter Edition also supports deployment and management of HP Thin Clients.
- The Standard Edition, available for purchase, includes all functionality provided in Starter Edition and adds Windows deployment and migration, patch management capabilities, software distribution and software usage metering.

HP Client Automation Starter and Standard Editions provide a migration path to HP Client Automation Enterprise Edition (based on Radia technology) for automated management of large, heterogeneous and continuously changing IT environments.

For more information about the HP Client Automation solutions, visit <http://www.hp.com/go/client>.

## HP Client Automation Enterprise Edition

HP Client Automation Enterprise Edition is a policy-based solution that enables administrators to inventory, deploy, patch, and continuously manage software and content across heterogeneous client platforms. With the HP Client Automation Enterprise Edition, the IT professional can:

- Automate the entire lifecycle management process from discovery, deployment, and ongoing management through migration and retirement
- Automatically deploy and continuously manage an entire software stack (operating systems, applications, patches, settings, and content) to a desired state
- Manage software on virtually any device, including desktops, workstations, and notebooks, in a heterogeneous or standalone infrastructure
- Manage software on most operating systems

With continuous configuration management, HP customers report dramatic savings in IT costs, accelerated time-to-market for software and content, and increased user productivity and satisfaction.

For more information about the HP Client Automation solutions, visit <http://www.hp.com/go/client>.

## HP Client Manager from Symantec

HP Client Manager from Symantec, developed with Altiris, is available free for all supported HP business desktop, notebook, and workstation models. SSM is integrated into HP Client Manager, and enables central tracking, monitoring, and management of the hardware aspects of HP client systems.

Use HP Client Manager from Symantec to:

- Get valuable hardware information such as CPU, memory, video, and security settings
- Monitor system health to fix problems before they occur
- Automatically acquire and install drivers and BIOS updates without visiting each PC

- Remotely configure BIOS and security settings
- Automate processes to quickly resolve hardware problems

Tight integration with HP Instant Support tools reduces hardware troubleshooting time.

- Diagnostics—remotely run & view reports on HP desktop, notebook, and workstation models
- System Health Scan—check for known hardware issues in your installed base of HP client systems
- Active Chat—connect to HP customer support to resolve issues
- HP Knowledgebase—link to expert information
- Automated SoftPaq collection and delivery process for fast resolution of hardware problems
- Identify, inventory, and initialize systems with HP ProtectTools embedded security chip
- Option for health alerts to display locally on the client system
- Report basic inventory information for non-HP clients
- Setup and configure TPM security chip
- Centrally schedule client backup and recovery
- Add on support for managing Intel AMT

For more information on HP Client Manager from Symantec, visit <http://www.hp.com/go/clientmanager>.

## Altiris Client Management Suite

Altiris Client Management Suite is an easy-to-use solution for full life-cycle software management of desktops, notebooks, and workstations. Client Management Suite includes the following Altiris products:

- Inventory Solution
- Deployment Solution
- Software Delivery Solution
- Patch Management Solution
- Application Metering Solution
- Application Management Solution
- Carbon Copy Solution

For more information on Altiris Client Management Suite, visit <http://www.symantec.com/business/client-management-suite>.

## HP Client Catalog for Microsoft System Center & SMS Products

The HP Client Catalog enables IT professionals using Microsoft products to automate the deployment of HP software updates (Softpaqs) to HP business PCs. The catalog file contains detailed platform information on HP business desktops, notebooks and workstations. It can be used in conjunction with the custom inventory and update features of Microsoft products to provide automated driver and patch updates to managed HP client computers.

Microsoft products supported by the HP Client Catalog include:

- System Center Configuration Manager 2007
- System Center Essentials 2007
- Systems Management Server (SMS) 2003 R2

For more information on HP Client Catalog for SMS, visit [http://h20331.www2.hp.com/Hpsub/cache/486247-0-0-225-121.html?jumpid=reg\\_R1002\\_USEN](http://h20331.www2.hp.com/Hpsub/cache/486247-0-0-225-121.html?jumpid=reg_R1002_USEN).

## Remote Management Technology

Models include either vPro technology or standard technology. Both allow for better discovery, healing, and protection of networked computing assets. Both technologies allow PCs to be managed whether the system is on, off, or the operating system is hung.

The three forms of remote manageability available on business desktops are Alert Standard Format (ASF), Intel Active Management Technology (AMT), and Desktop and mobile Architecture for Systems Hardware (DASH).

Remote management technology features include:

- Network discovery
- Hardware inventory information
- Platform health monitoring
- Power management—power on/off, cycle power
- Remote diagnosis and repair
  - Text console redirection—allows console control of remote PC during its boot phase
  - Media redirection—allows system booting from a remote boot drive, disk, or ISO image (the two variants of this are IDE-Redirect (IDE-R) on AMT platforms and USB Media Redirection)
- Hardware-based isolation and recovery—limit or cut off PC network access, if virus-like activity is detected
- Platform event tracking and auditing
- Integrated web server management portal for remote access and configuration
- Remote management technologies are integrated with HP's management console partners

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 **NOTE:** All features above are not available on all platforms.

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## Configuring the Intel Management Engine

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 **NOTE:** For an overview of Intel vPro technology, visit <http://www.intel.com/vpro>.

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For HP-specific information on Intel vPro technology, see the white papers at <http://www.hp.com/support>. Select your country and language, select **See support and troubleshooting information**, enter the model number of the computer, and press **Enter**. In the **Resources** category, click **Manuals (guides, supplements, addendums, etc.)**. Under **Quick jump to manuals by category**, click **White papers**.

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Available management technologies include the following:

- AMT (includes DASH 1.0)
- ASF
- DASH 1.1 (using a Broadcom NIC)

ASF and AMT may not be configured at the same time, but both are supported.

To configure Intel vPro systems for AMT or ASF:

1. Turn on or restart the computer. If you are in Microsoft Windows, click **Start > Shut Down > Restart**.
2. As soon as the computer is turned on, press the hot key, **Ctrl+P**, before the computer boots to the operating system.

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 **NOTE:** If you do not press **Ctrl+P** at the appropriate time, you must restart the computer and again press **Ctrl+P** before the computer boots to the operating system to access the utility.

---

This hot-key enters the Intel Management Engine BIOS Execution (MEBx) setup utility. This utility allows the user to configure various aspects of the management technology. Some of the configuration options are listed below:

- Main Menu
  - Intel ® ME Configuration
  - Intel ® AMT Configuration
  - Change Intel ® ME Password
  - Exit
- Intel ® ME Platform Configuration
  - Intel ® ME State Control (enable/disable)
  - Intel ® ME Firmware Local Update (enable/disable)
  - Intel ® ME Features Control
  - Intel ® ME Power Control
- Intel ® AMT Configuration
  - Host Name
  - TCP/IP
  - Provision Model (Enterprise, SMB)
  - Setup and Configuration
  - Un-Provision
  - SOL/IDE-R (enable/disable)

- Password Policy
- Secure Firmware Update (enable/disable)
- Set PRTC
- Idle Timeout
- Change Intel® ME Password (HP highly recommends that this password be changed. The default password is **admin**.)

In order to remotely manage AMT systems, the administrator must use a remote console that supports AMT. Enterprise management consoles are available from suppliers such as HP, Altiris and Microsoft SMS. In SMB mode, the client provides a Web browser interface. To access this feature, open a browser from any other system on the network and enter `http://host_name:16992` where `host_name` is the name assigned to the system. Alternatively, the IP address may be used in place of the host name.

To configure systems with a Broadcom DASH capable NIC:

Check for the latest documentation on the <http://www.hp.com> site under **Support & Troubleshooting**, then select your specific model, then select **Manuals**, then **White papers** referring to DASH or the Broadcom NIC.

## Verdiem Surveyor

Verdiem Surveyor is a software solution that helps manage PC energy costs. Surveyor measures and reports how much energy each PC consumes. It also provides control over PC power settings enabling administrators to easily implement energy saving strategies across their networks. An HP SoftPaq containing the Surveyor agent may be downloaded from the HP Support site and installed on supported commercial desktop models. Surveyor licenses for managing PCs may be purchased through your HP representative.

## HP Proactive Change Notification

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-mail 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>.

## 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>.

## Retired Solutions

Two software packages, Altiris Local Recovery, and Dantz Retrospect, will no longer be shipping on HP business desktops, notebooks, or workstations.

## ROM Flash

The computer's BIOS is stored in a programmable flash ROM (read only memory). By establishing a setup password in the 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 the BIOS, you may download the latest BIOS images from 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>.

## Remote ROM Flash

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

- 📋 **NOTE:** SSM does not currently support remote ROM flash on systems that have Windows BitLocker Drive Encryption enabled and are using TPM measurements to protect the BitLocker keys because flashing the BIOS would invalidate the trust signature that BitLocker created for the platform. Disable BitLocker via Group Policy in order to flash the system BIOS.

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://www.hp.com/go/ssm/>.

## HPQFlash

The HPQFlash utility is used to locally update or restore the system BIOS of individual PCs from a Windows operating system.

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

## Boot Block Emergency Recovery Mode

Boot Block Emergency Recovery Mode permits system recovery in the unlikely event of a ROM flash failure. For example, if a power failure were to occur during a BIOS upgrade, the ROM flash would be incomplete. This would render the system BIOS unusable. The Boot Block is a flash-protected section of the ROM that contains code that checks for a valid system BIOS image when the system is turned on.

- If the system BIOS image is valid, the system starts normally.
- If the system BIOS image is not valid, a failsafe Boot Block BIOS provides enough support to search removable media for BIOS image files. If an appropriate BIOS image file is found, it is automatically flashed into the ROM.

When an invalid system BIOS image is detected, the system power LED will blink red 8 times, one blink every second. Simultaneously, the speaker will beep 8 times. If the portion of the system ROM containing the video option ROM image is not corrupt, **Boot Block Emergency Recovery Mode** will be displayed on the screen.

To recover the system after it enters Boot Block Emergency Recovery Mode, complete the following steps:

1. Turn off the power.
2. Insert a CD or USB flash device containing the desired BIOS image file in the root directory.

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 **NOTE:** The media must be formatted using the FAT12, FAT16, or FAT32 file system.

---

3. Turn on the computer.

If no appropriate BIOS image is found, you will be prompted to insert media containing a BIOS image file.

If the system successfully reprograms the ROM, the system will automatically power off.

4. Remove the removable media used to upgrade the BIOS.
5. Turn the power on to restart the computer.

---

 **NOTE:** BitLocker prevents Windows Vista from booting when a CD containing the BIOS image file is in an optical drive. If BitLocker is enabled, remove this CD before attempting to boot to Windows Vista.

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# 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.

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 **NOTE:** Both procedures require a diskette drive or a supported USB flash drive.

**NOTE:** System Software Manager (SSM) can be used to replicate computer setup information from within the Windows operating system. For more information see the SSM User's Guide at <http://www.hp.com/go/ssm>.

---

## 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 dc7xxx PC to a dx7xxx PC.

---

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 **F10** before the computer boots to the operating system to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** before the computer boots to the operating system to access the utility.

---

5. If you are using 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 **F10** before the computer boots to the operating system to 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 dc7xxx PC to a dx7xxx PC.

---

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.

 **NOTE:** 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 [Copying to Single Computer on page 47](#)).

1. Create a bootable diskette or USB flash media device. See [Supported USB Flash Media Device on page 48](#) or [Unsupported USB Flash Media Device on page 50](#).

△ **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 **F10** before the computer boots to the operating system to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** before the computer boots to the operating system to access the utility.

6. If you are using 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/country/us/en/support.html?pageDisplay=drivers> 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 have a preinstalled image to simplify the process of making them bootable. All HP or Compaq and most other USB flash media devices have this preinstalled image. 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 50](#)).

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

- a supported USB flash media device
- 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.)
- a PC that is bootable from a USB flash media device

△ **CAUTION:** Some older PCs may not be bootable 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.

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 messages 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.

---

 **NOTE:** 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 [Copying to Multiple Computers on page 47](#).

## Unsupported USB Flash Media Device

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

- a USB flash media device
- 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.)
- a PC that is bootable from a USB flash media device

△ **CAUTION:** Some older PCs may not be bootable 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.

---

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 **F10** before the computer boots to the operating system to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** before the computer boots to the operating system to access the utility.

---

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 **F10** before the computer boots to the operating system to 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.

---

 **NOTE:** 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 (F10) Utility* 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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Return to [Copying to Multiple Computers on page 47](#).

## 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 standby button. The standby feature does not completely turn off power, but instead causes the computer to enter a low-power standby state. 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 standby button, press the power button to put the system in a very low power state (standby). Press the button again to quickly bring the system out of standby to full power status. 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.

---

## HP Web Site Support

HP engineers rigorously test and debug software developed by HP and third-party suppliers, and develop operating system specific support software, to ensure performance, compatibility, and reliability for HP computers.

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.

## Industry Standards

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

## Asset Tracking and Security

Asset tracking features incorporated into the computer provide key asset tracking data that can be managed using HP Systems Insight Manager, HP Client Manager, HP Configuration Management Solution, HP Client Configuration 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 the environment and to leverage the investment in existing tools.

HP also offers several solutions for controlling access to valuable components and information. HP Embedded Security for ProtectTools, if installed, prevents unauthorized access to data and checks system integrity and authenticates third-party users attempting system access. (For more information, refer to the *HP ProtectTools Security Manager Guide* at <http://www.hp.com/products/security>.) Security features such as HP Embedded Security for ProtectTools, the Smart Cover Sensor and the Smart Cover Lock, available on some 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.

 **NOTE:** HP Embedded Security for ProtectTools, the Smart Cover Sensor, and the Smart Cover Lock are available as options on some systems.

Use the following utilities to manage security settings on the 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 from Symantec, HP Client Automation, or System Software Manager. This software enables the secure, consistent deployment and control of security settings.

The following table and sections refer to managing security features of the computer locally through the Computer Setup (F10) Utilities.

**Table 5-1 Security Features Overview**

Option	Description
<b>Setup Password</b>	<p>Allows you to set and enable setup (administrator) password.</p> <p><b>NOTE:</b> 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.</p>
<b>Power-On Password</b>	<p>Allows you to set and enable power-on password. The power-on password prompt appears after a power cycle. If the user does not enter the correct power-on password, the unit will not boot.</p> <p><b>NOTE:</b> This password does not appear on warm boots, such as <b>Ctrl+Alt+Delete</b> or <b>Restart from Windows</b>, unless enabled in <b>Password Options</b> (see below).</p>
<p><b>Password Options</b></p> <p>(This selection appears only if a power-on password or setup password is set.)</p>	<p>Allows you to:</p> <ul style="list-style-type: none"> <li>• Lock legacy resources (appears if a setup password is set)</li> <li>• Enable/disable network server mode (appears if a power-on password is set)</li> <li>• Specify whether the password is required for warm boot (<b>Ctrl+Alt+Delete</b>) (appears if a power-on password is set)</li> <li>• Enable/Disable Setup Browse Mode (appears if a setup password is set) (allows viewing, but not changing, the F10 Setup Options without entering setup password)</li> <li>• Enable/disable Stringent Password (appears if a power-on password is set), which when enabled bypasses the onboard password jumper to disable the power-on password</li> </ul> <p>See the <i>Desktop Management Guide</i> for more information.</p>
<b>Smart Cover</b> (some models)	<p>Allows you to:</p> <ul style="list-style-type: none"> <li>• Lock/unlock the Cover Lock.</li> <li>• Set the Cover Removal Sensor to Disable/Notify User/Setup Password.</li> </ul> <p><b>NOTE:</b> <i>Notify User</i> alerts the user that the sensor has detected that the cover has been removed. <i>Setup Password</i> requires that the setup password be entered to boot the computer if the sensor detects that the cover has been removed.</p> <p>This feature is supported on some models only.</p>

**Table 5-1 Security Features Overview (continued)**

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<b>Device Security</b>	Allows you to set Device Available/Device Hidden for: <ul style="list-style-type: none"><li>• Serial ports</li><li>• Parallel port</li><li>• Rear USB ports</li><li>• Front USB ports</li><li>• Internal USB ports</li><li>• System audio</li><li>• Network controllers (some models)</li><li>• Legacy diskette</li><li>• Embedded security device (some models)</li><li>• SATA0</li><li>• SATA1 (some models)</li><li>• SATA2 (some models)</li><li>• SATA3 (some models)</li><li>• eSATA (some models)</li></ul>
<b>LoJack for HP ProtectTools</b>	Allows you to remotely monitor, manage, and track your computer.  Once activated, LoJack Pro for HP ProtectTools is configured from the Absolute Software Customer Center. From the Customer Center, the administrator can configure LoJack for HP ProtectTools to monitor or manage the computer. If the system is misplaced or stolen, the Customer Center can assist local authorities to locate and recover the computer. If configured, LoJack Pro can continue to function even if the hard drive is erased or replaced.
<b>Network Service Boot</b>	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 be either a PCI expansion card or embedded on the system board.)
<b>System IDs</b>	Allows you to set: <ul style="list-style-type: none"><li>• Asset tag (18-byte identifier), a property identification number assigned by the company to the computer.</li><li>• Ownership tag (80-byte identifier) displayed during POST.</li><li>• 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.)</li><li>• Keyboard locale setting (for example, English or German) for System ID entry.</li></ul>
<b>DriveLock Security</b>	Allows you to assign or modify a master or user password for 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.  <b>NOTE:</b> This selection will only appear when at least one drive that supports the DriveLock feature is attached to the system.

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**Table 5-1 Security Features Overview (continued)**

<b>Setup Security Level</b>	<p>Provides a method to allow end-users limited access to change specified setup options, without having to know the Setup Password.</p>
	<p>This feature allows the administrator the flexibility to protect changes to essential setup options, while allowing the user to view system settings and configure nonessential options. The administrator specifies access rights to individual setup options on a case-by-case basis via the Setup Security Level menu. By default, all setup options are assigned Setup Password, indicating the user must enter the correct Setup Password during POST to make changes to any of the options. The administrator may set individual items to None, indicating the user can make changes to the specified options when setup has been accessed with invalid passwords. The choice, None, is replaced by Power-On Password if a Power-On Password is enabled.</p>
	<p><b>NOTE:</b> Setup Browse Mode must be set to Enable in order for the user to enter Setup without knowing the setup password.</p>
<b>System Security</b> (some models: these options are hardware dependent)	<p>Data Execution Prevention (some models) (enable/disable) - Helps prevent operating system security breaches.</p>
	<p>Virtualization Technology (some models) (enable/disable) - Controls the virtualization features of the processor. Changing this setting requires turning the computer off and then back on.</p>
	<p>Virtualization Technology Directed I/O (some models) (enable/disable) - Controls virtualization DMA remapping features of the chipset. Changing this setting requires turning the computer off and then back on.</p>
	<p>Trusted Execution Technology (some models) (enable/disable) - Controls the underlying processor and chipset features needed to support a virtual appliance. Changing this setting requires turning the computer off and then back on. To enable this feature you must enable the following features:</p>
	<ul style="list-style-type: none"><li>• Embedded Security Device Support</li><li>• Virtualization Technology</li><li>• Virtualization Technology Directed I/O</li></ul>
	<p>Embedded Security Device Support (some models) (enable/disable) - Permits activation and deactivation of the Embedded Security Device. Changing this setting requires turning the computer off and then back on.</p>
	<p><b>NOTE:</b> To configure the Embedded Security Device, a Setup password must be set.</p>
	<ul style="list-style-type: none"><li>• Reset to Factory Settings (some models) (Do not reset/Reset) - Resetting to factory defaults will erase all security keys. Changing this setting requires turning the computer off and then back on.</li></ul>
	<p><b>CAUTION:</b> The embedded security device is a critical component of many security schemes. Erasing the security keys will prevent access to data protected by the Embedded Security Device. Choosing Reset to Factory Settings may result in significant data loss.</p>
	<ul style="list-style-type: none"><li>• Reset authentication credentials (some models) (Do not reset/Reset) - Selecting Reset disables the power-on authentication support and clears the authentication information from the Embedded Security Device. Changing this setting requires turning the computer off and then back on</li></ul>
	<p>OS management of Embedded Security Device (some models) (enable/disable) - This option allows the user to limit operating system control of the Embedded Security Device. Changing this setting requires turning the computer off and then back on. This option allows the user to limit OS control of the Embedded Security Device.</p>
	<ul style="list-style-type: none"><li>• Reset of Embedded Security Device through OS (some models) (enable/disable) - This option allows the user to limit the operating system ability to request a Reset to Factory Settings of the Embedded Security Device. Changing this setting requires turning the computer off and then back on.</li></ul>
	<p><b>NOTE:</b> To enable this option, a Setup password must be set.</p>
	<p>PAVP (Some models) (disabled/min/max) - PAVP enables the Protected Audio Video Path in the Chipset. This may allow viewing of some protected high definition content that would otherwise be prohibited from playback. Selecting Max will assign 96 Megabytes of system memory exclusively to PAVP.</p>

## 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.

 **NOTE:** System Software Manager (SSM) can be used to create and manage BIOS passwords from within the Windows operating system. For more information see the SSM User's Guide at <http://www.hp.com/go/ssm>.

**NOTE:** HP Client Management Interface (HP CMI) provides access to BIOS setting management including BIOS passwords from within the Windows operating system. For more information see the HP Client Management Interface Technical Whitepaper at <http://www.hp.com/go/hpcmi>.

### Establishing a Setup Password Using Computer Setup

If the system is equipped with an embedded security device, refer to the *HP ProtectTools Security Manager Guide* at <http://www.hp.com>. 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 **F10** before the computer boots to the operating system to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** before the computer boots to the operating system to access the utility.

3. Select **Security**, then select **Setup Password** and follow the instructions on the screen.
4. Before exiting, click **File > Save Changes and Exit**.

### 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 **F10** before the computer boots to the operating system to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** before the computer boots to the operating system to access the utility.

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

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

If you enter the password incorrectly, a broken key icon appears. Try again. After three unsuccessful tries, you must turn off the 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 the *HP ProtectTools Security Manager Guide* at <http://www.hp.com>.

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 **F10** before the computer boots to the operating system to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** before the computer boots to the operating system to access the utility.

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

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

If you enter the password incorrectly, a broken key icon appears. Try again. After three unsuccessful tries, you must turn off the 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 the *HP ProtectTools Security Manager Guide* at <http://www.hp.com>.

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 **F10** before the computer boots to the operating system to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** before the computer boots to the operating system to access the utility.

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`

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

4. Press **Enter**.

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

 **NOTE:** Refer to the [National Keyboard Delimiter Characters on page 58](#) 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 the *HP ProtectTools Security Manager Guide* at <http://www.hp.com>.

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 **F10** before the computer boots to the operating system to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** before the computer boots to the operating system to access the utility.

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**.

 **NOTE:** Refer to [National Keyboard Delimiter Characters on page 58](#) 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 to change or delete the password depend on the keyboard that came with the computer.

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

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### National Keyboard Delimiter Characters

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- German - Portuguese

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\* For Bosnia-Herzegovina, Croatia, Montenegro, Serbia, and Slovenia

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## Clearing Passwords

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

If the system is equipped with an embedded security device, refer to the *HP ProtectTools Security Manager Guide* at <http://www.hp.com>.

## DriveLock

DriveLock is an industry-standard security feature that prevents unauthorized access to the data on ATA hard. DriveLock has been implemented as an extension to Computer Setup. It is only available when hard drives that support the ATA Security command set 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

When one or more hard drives that support the ATA Security command set are detected, 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. On a cold boot, either the master or the user password may be used. On a warm boot, enter the same password used to unlock the drive during the preceding cold-boot. Users will have two attempts to enter a correct password. On a cold boot, if neither attempt succeeds, POST will continue but the drive will remain inaccessible. On a warm boot or restart from Windows, if neither attempt succeeds, POST will halt and the user will be instructed to cycle power.

## DriveLock Applications

The most practical use of the DriveLock security feature is in a corporate environment. The system administrator would be responsible for configuring the hard drive which would involve, among other things, setting the DriveLock master password and a temporary user 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.

## Smart Cover Sensor

Cover Removal Sensor, available on some 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.

**Table 5-2 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.

**NOTE:** 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 **F10** before the computer boots to the operating system to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** before the computer boots to the operating system to access the utility.

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 some 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.

📝 **NOTE:** The Smart Cover Lock is available as an option on some 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 **F10** before the computer boots to the operating system to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

📝 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** before the computer boots to the operating system to access the utility.

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 **F10** before the computer boots to the operating system to enter Computer Setup. Press **Enter** to bypass the title screen, if necessary.

📝 **NOTE:** If you do not press **F10** at the appropriate time, you must restart the computer and again press **F10** before the computer boots to the operating system to access the utility.

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 the 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

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△ **CAUTION:** The Smart Cover FailSafe Key is a specialized tool available from HP. Be prepared; order this key before you need one at an authorized reseller or service provider.

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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*.

## Cable Lock Provision

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

For illustrated instructions, please see the *Hardware Reference Guide*.

## 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.

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 **NOTE:** Support for Fingerprint Identification Technology varies by model.

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## 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.

## Drive Protection System

The Drive Protection System (DPS) is a diagnostic tool built into the hard drives installed in some 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. The 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.

## 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.

## Thermal Sensor

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

△ **CAUTION:** A high temperature condition can result in damage to the system or data loss.

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# 6 Serial ATA Drive Guidelines and Features

 **NOTE:** Serial ATA = SATA

HP only supports the use of SATA hard drives on these computers.

## SATA Hard Drives

Serial ATA Hard Drive Characteristics	
Number of pins/conductors in data cable	7/7
Number of pins in power cable	15
Maximum data cable length	39.37 in (100 cm)
Data interface voltage differential	400-700 mV
Drive voltages	3.3 V, 5 V, 12 V
Jumpers for configuring drive	N/A
Data transfer rate	3.0 Gb/s

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

SATA Identification	Color	Port	Attachment Sequence
Primary channel, device 0	Dark blue	SATA 0	1
Primary channel, device 1	Light Blue	SATA 2	4
Secondary channel, device 0	White	SATA 1	2
Secondary channel, device 1	Orange	SATA 3	3

 **NOTE:** If there is an error on the application of the attach rules, a POST error message may be displayed.

# SATA Hard Drive Cables

## SATA Data Cable

Always use an HP approved SATA 3.0 Gb/s cable as it is fully backwards compatible with the SATA 1.5 Gb/s drives.

Current HP desktop products ship with SATA 3.0 Gb/s hard drives.

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.

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.

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

## 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	Ground	
P4	Ground		P12	Ground	
P5	Ground		P13	V12	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			

## 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.

## Hard 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	2 TB
NTFS	ATA	Windows NT/2000/XP	2 TB	2 TB

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# 7 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.
- 

## Chassis Designations

The following subsections illustrate the HP Compaq 6000 Pro Microtower Business PC chassis designs.

### Small Form Factor (SFF)



## Microtower (MT)



## 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.

## Generating Static

The following table shows that:

- Different activities generate different amounts of static electricity.
- Static electricity increases as humidity decreases.

Event	Relative Humidity		
	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.

 **NOTE:** 700 volts can degrade a product.

## 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.

## 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  $\pm$  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  $\pm$  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

## 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.

## 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

# 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. Be sure to unplug the computer before cleaning the air vents.
- 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.
- Keep liquids away from the computer and keyboard.
- Never cover the ventilation slots on the monitor with any type of material.
- Install or enable power management functions of the operating system or other software, including sleep states.

## Routine Care

### 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.

### Cleaning the Computer Case

Follow all safety precautions in [General Cleaning Safety Precautions on page 71](#) 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.

## Cleaning the Keyboard

Follow all safety precautions in [General Cleaning Safety Precautions on page 71](#) before cleaning the keyboard.

To clean the tops of the keys or the keyboard body, follow the procedures described in [Cleaning the Computer Case on page 71](#).

When cleaning debris from under the keys, review all rules in [General Cleaning Safety Precautions on page 71](#) before following these procedures:

- 
- ⚠ **WARNING!** Use safety glasses equipped with side shields before attempting to clean debris from under the keys.
  - ⚠ **CAUTION:** Visible debris underneath or between the keys may be removed by vacuuming or shaking.
  - CAUTION:** 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.
  - CAUTION:** 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.
  - CAUTION:** 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.

## 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 [Cleaning the Computer Case on page 71](#).

## 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 [Cleaning the Computer Case on page 71](#).

## Service Considerations

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

### 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.

### Tools and Software Requirements

To service the computer, you need the following:

- Torx T-15 screwdriver (HP 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 #2 screwdriver
- Diagnostics software
- HP tamper-resistant T-15 wrench (Smart Cover FailSafe Key, PN 166527-001) or HP tamper-resistant bits (Smart Cover FailSafe Key, PN 166527-002)

### 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.

- △ **CAUTION:** Metric screws have a black finish. U.S. screws have a silver finish and are used on hard drives only.

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

## 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.

## Hard Drives

△ **CAUTION:** 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 [Electrostatic Discharge Information on page 68](#)
- 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.

## Lithium Coin Cell Battery

The battery that comes with the computer provides power to the real-time clock and has a minimum 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). Do not attempt to recharge the battery.

📄 **NOTE:** 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, their authorized partners, or their agents.

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## 8 Removal and Replacement Procedures Microtower (MT) 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.

---

 **NOTE:** Not all features listed in this guide are available on all computers.

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### Serial Number Location

Each computer has a unique serial number and product ID number that are located on the top cover of the computer. Keep these numbers available for use when contacting customer service for assistance.

**Figure 8-1** Serial Number and Product ID Location



# Preparation for Disassembly

See [Identifying the Chassis, Routine Care, and Disassembly Preparation on page 67](#) for initial safety procedures.

1. Remove/disengage any security devices that prohibit opening the computer ([External Security Devices on page 118](#)).
2. Close any open software applications.
3. Exit the operating system.
4. Remove any diskette, compact disc, or media card 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.

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.

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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.

---

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

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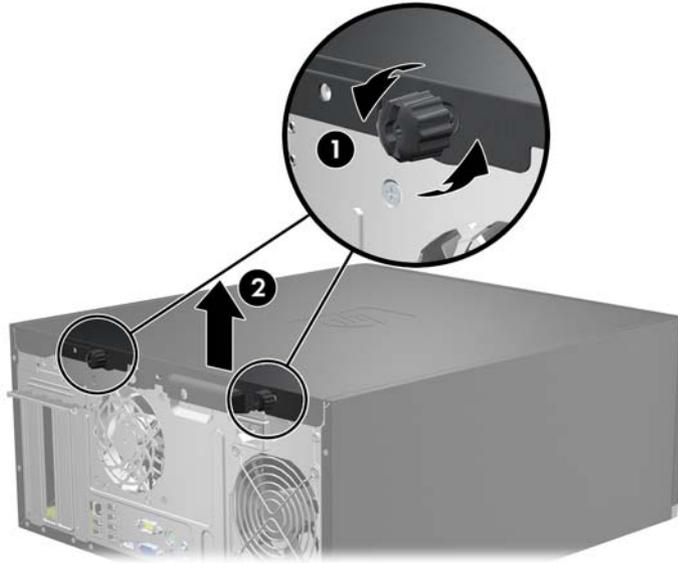
△ **CAUTION:** The screws used in the computer are of different thread sizes and lengths; using the wrong screw in an application may damage the unit.

---

## Access Panel

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
    - △ **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. Loosen the two captive thumbscrews **(1)** that secure the access panel to the computer chassis.
  3. Use the handle located between the thumbscrews to lift the access panel off the unit **(2)**.
- 📝 **NOTE:** You may want to lay the computer on its side to install internal parts. Be sure the side with the access panel is facing up.

**Figure 8-2** Removing the Computer Access Panel

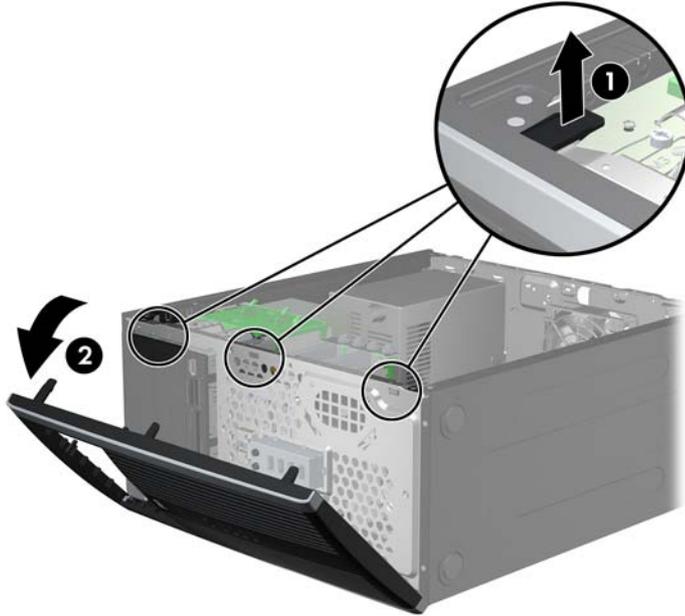


To install the access panel, reverse the removal procedure.

## Front Bezel

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the computer access panel.
3. Lift up the three tabs on the side of the bezel (1), then rotate the bezel off the chassis (2).

**Figure 8-3** Removing the Front Bezel



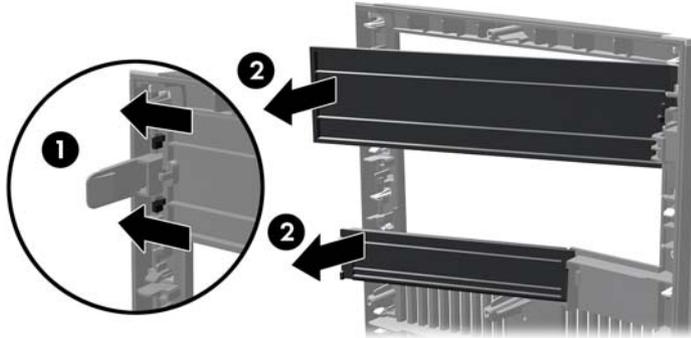
To reinstall the front bezel, reverse the removal procedure.

## Removing Bezel Blanks

On some models, there are bezel blanks covering the 3.5-inch and 5.25-inch external drive bays that need to be removed before installing a drive. To remove a bezel blank:

1. Remove the access panel and front bezel.
2. To remove a bezel blank, push the two retaining tabs that hold the bezel blank in place towards the outer right edge of the bezel (1) and slide the bezel blank back and to the right to remove it (2).

**Figure 8-4** Removing a Bezel Blank



## Cable Management

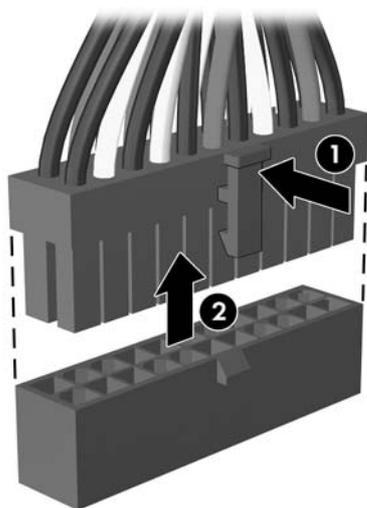
Always follow good cable management practices when working inside the computer.

- Keep cables away from major heat sources like the heat sink.
- 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 them from 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 **(1)**.
2. Grasp the cable end of the connector and pull it straight up **(2)**.

△ **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.



## Cable Connections

System board connectors are color-coded to make it easier to find the proper connection.

Connector Name	Connector Color	Description
PWR, P1	White	Power supply, 6-pin
P2	White	Power supply, 6-pin
PWRCPU, P3	White	Power supply, 4-pin
PS STAT	White	Power supply, 6-pin
SATA PWR1, P160	Black	Optical drive power connector, 4-pin
SATA PWR2, P161	Black	Hard drive power connector, 4-pin
CHFAN, P9	Maroon	Chassis fan
PB/LED, P5	Black	Front power button/LED
CHFAN2, P11	Maroon	2nd chassis fan
FRNT_USB1, P24	Yellow	Front I/O USB
FRNT_USB2, P25	Green	Front I/O USB
FRONT AUD, P23	Blue	Front audio
SPRK, P6	White	Internal speaker
COMB, P52	Black	Serial port
SATA0, P60	Dark blue	1st HDD
SATA1, P61	White	1st ODD or 2nd HDD if no HDD present
SATA2, P62	Light blue	2nd HDD if ODD present
SATA3, P63	Orange	eSATA port or extra ODD/HDD connector
PAR, P126	Black	Parallel port
MEDIA, P150	Black	Media reader

# Memory

The computer comes with double data rate 3 synchronous dynamic random access memory (DDR3-SDRAM) dual inline memory modules (DIMMs).

The memory sockets on the system board can be populated with up to four industry-standard DIMMs. These memory sockets are populated with at least one preinstalled DIMM. To achieve the maximum memory support, you can populate the system board with up to 16-GB of memory configured in a high-performing dual channel mode.

For proper system operation, the DDR3-SDRAM DIMMs must be:

- industry-standard 240-pin
- unbuffered non-ECC PC3-8500 DDR3-1066 MHz-compliant or PC3-10600 DDR3-1333 MHz-compliant

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 **NOTE:** 1333 MHz DIMMS will only run at a speed of 1066 MHz.

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- 1.5 volt DDR3-SDRAM DIMMs

The DDR3-SDRAM DIMMs must also:

- support CAS latency 7 DDR3 1066 MHz (7-7-7 timing) and CAS latency 9 DDR3 1333 MHz (9-9-9 timing)
- contain the mandatory JEDEC SPD information

In addition, the computer supports:

- 512-Mbit, 1-Gbit, and 2-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

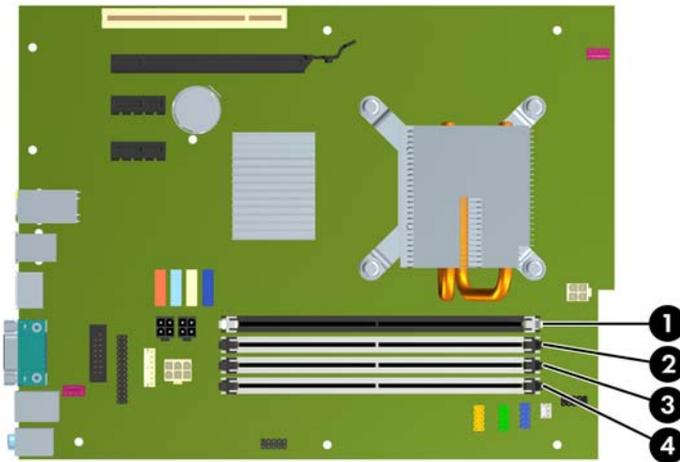
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 **NOTE:** The system will not operate properly if you install unsupported DIMMs.

---

There are four DIMM sockets on the system board, with two sockets per channel. The sockets are labeled DIMM1, DIMM2, DIMM3, and DIMM4. Sockets DIMM1 and DIMM2 operate in memory channel A. Sockets DIMM3 and DIMM4 operate in memory channel B.

**Figure 8-5** DIMM Socket Locations



**Table 8-1** DIMM Socket Locations

Item	Description	Socket Color
1	DIMM1 socket, Channel A (populate first)	Black
2	DIMM2 socket, Channel A (populate third)	White
3	DIMM3 socket, Channel B (populate second)	White
4	DIMM4 socket, Channel B (populate fourth)	White

**NOTE:** A DIMM must occupy the black DIMM1 socket. Otherwise, the system will display a POST error message indicating that a memory module must be installed in the wrong socket.

The system will automatically operate in single channel mode, dual channel mode, or flex mode, depending on how the DIMMs are installed.

- The system will operate in single channel mode if the DIMM sockets are populated in one channel only.
- The system will operate in a higher-performing dual channel 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. The technology and device width can vary between the channels. For example, if Channel A is populated with two 512-MB DIMMs and Channel B is populated with one 1-GB DIMM, the system will operate in dual channel mode.
- The system will operate in flex 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. In flex mode, the channel populated with the least amount of memory describes the total amount of memory assigned to dual channel and the remainder is assigned to single channel. For optimal speed, the channels should be balanced so that the largest amount of memory is spread between the two channels. If one channel will have more memory than the other, the larger amount should be assigned to Channel A. For example, if you are populating the sockets with one 1-GB DIMM, and three 512-MB DIMMs, Channel A should be populated with the 1-GB DIMM and one 512-MB DIMM, and Channel B should be populated with the two 512-MB DIMMs. With this configuration, 2-GB will run as dual channel and 512-MB will run as single channel.
- In any mode, the maximum operational speed is determined by the slowest DIMM in the system.

---

△ **CAUTION:** You must disconnect the power cord and wait approximately 30 seconds for the power to drain before adding or removing memory modules. Regardless of the power-on state, voltage is always supplied to the memory modules as long as the computer is plugged into an active AC outlet. Adding or removing memory modules while voltage is present may cause irreparable damage to the memory modules or system board. If you see an LED light on the system board, voltage is still present.

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

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.

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

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1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the computer access panel ([Access Panel on page 77](#)).

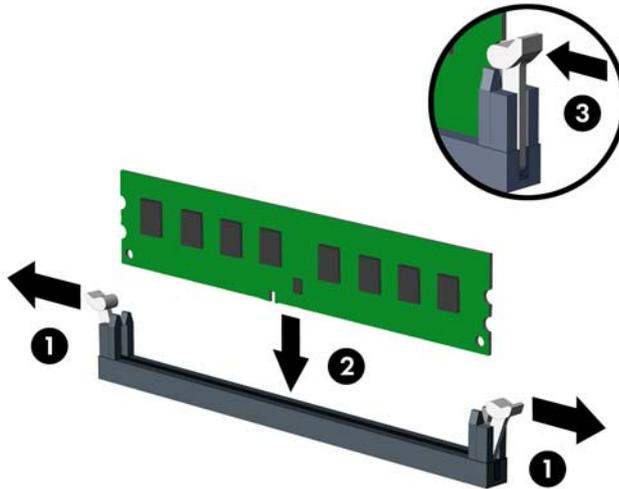
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△ **WARNING!** To reduce risk of personal injury from hot surfaces, allow the internal system components to cool before touching.

---

3. Open both latches of the memory module socket (1), and insert the memory module into the socket (2).

**Figure 8-6** Installing a DIMM



---

 **NOTE:** A memory module can be installed in only one way. Match the notch on the module with the tab on the memory socket.

A DIMM must occupy the XMM4 socket. Always populate XMM4 before XMM2, and XMM3 before XMM1 (populate the black sockets before white sockets in each channel).

A DIMM must occupy the black DIMM1 socket.

Populate the DIMM sockets in the following order: DIMM1, DIMM3, DIMM2, then DIMM4.

For maximum performance, populate the sockets so that the memory capacity is spread as equally as possible between Channel A and Channel B. Refer to [Populating DIMM Sockets on page 127](#) for more information.

4. 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 (3).
5. Repeat steps 3 and 4 for any additional modules that you want to install.

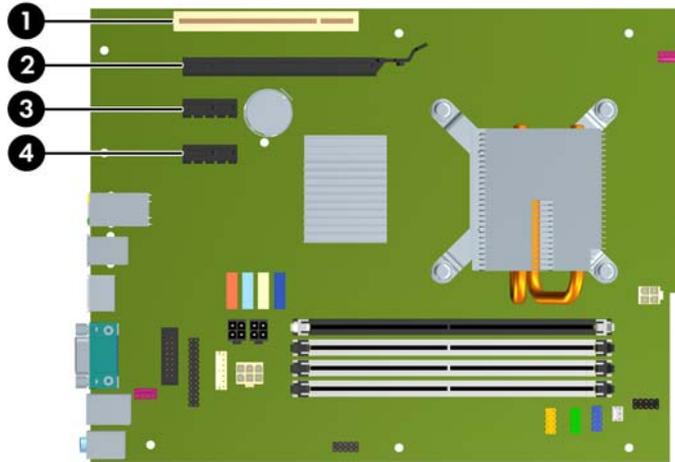
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 **NOTE:** The computer automatically recognizes the additional memory when turned on.

# Expansion Cards

The computer has one PCI expansion slot, two PCI Express x1 expansion slots, and one PCI Express x16 expansion slot.

**Figure 8-7** Expansion Slot Locations



**Table 8-2** Expansion Slot Locations

Item	Description
1	PCI expansion slot
2	PCI Express x16 expansion slot
3	PCI Express x1 expansion slot
4	PCI Express x1 expansion slot

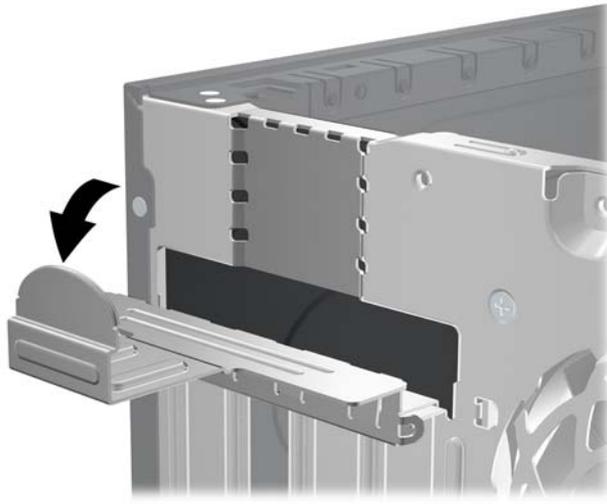
 **NOTE:** You can install a PCI Express x1, x4, x8, or x16 expansion card in the PCI Express x16 expansion slot.

To remove, replace, or add an expansion card:

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the computer access panel ([Access Panel on page 77](#)).
3. Locate the correct vacant expansion socket on the system board and the corresponding expansion slot on the back of the computer chassis.

4. 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 open position.

**Figure 8-8** Opening the Expansion Slot Retainer

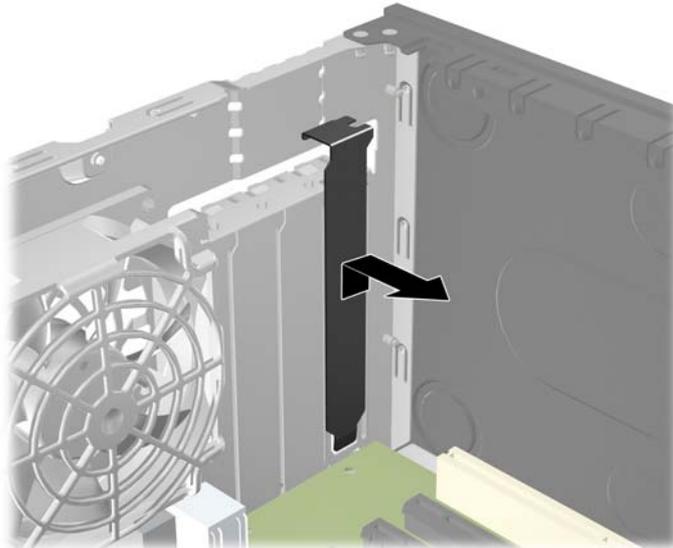


5. Before installing an expansion card, remove the expansion slot cover or the existing expansion card.

 **NOTE:** Before removing an installed expansion card, disconnect any cables that may be attached to the expansion card.

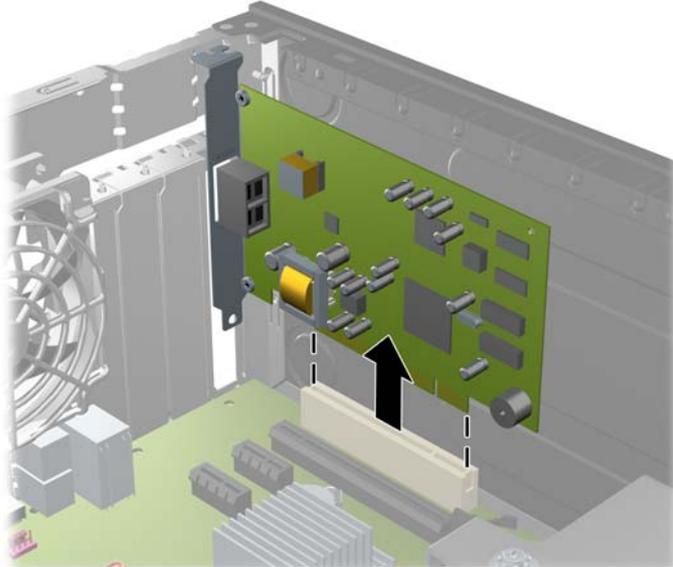
- a. If you are installing an expansion card in a vacant socket, remove the appropriate expansion slot cover on the back of the chassis. Pull the slot cover straight up then away from the inside of the chassis.

**Figure 8-9** Removing an Expansion Slot Cover



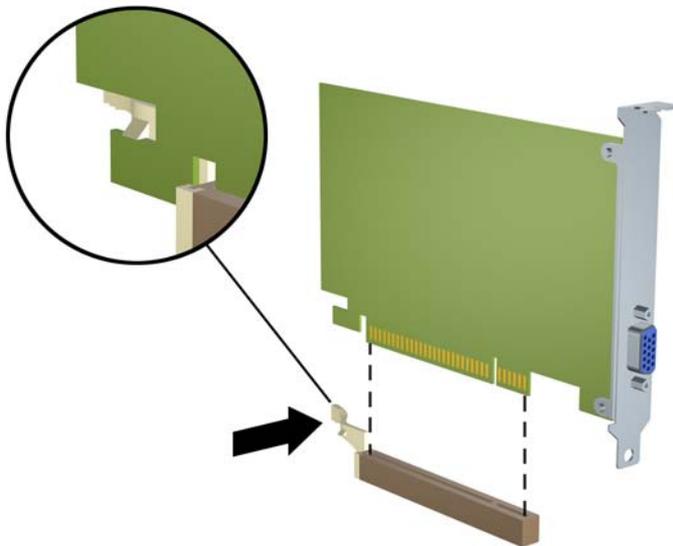
- b.** If you are removing a standard PCI card or PCI Express x1 card, hold the card at each end, and carefully rock it back and forth until the connectors pull free from the socket. Pull the expansion card straight up from the socket then away from the inside of the chassis to release it from the chassis frame. Be sure not to scrape the card against the other components.

**Figure 8-10** Removing a Standard PCI Expansion Card



- c.** If you are removing a PCI Express x16 card, pull the retention arm on the back of the expansion socket away from the card 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 to release it from the chassis frame. Be sure not to scrape the card against the other components.

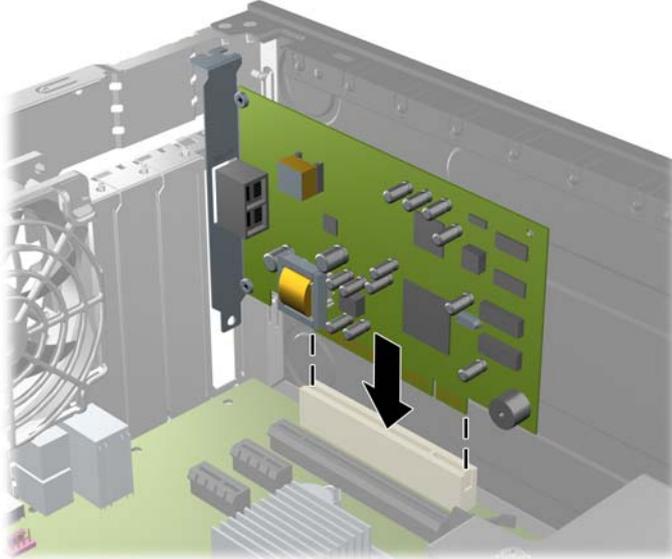
**Figure 8-11** Removing a PCI Express x16 Expansion Card



- 6.** Store the removed card in anti-static packaging.

7. If you are not installing a new expansion card, install an expansion slot cover to close the open slot.
- 
- △ **CAUTION:** After removing an expansion card, you must replace it with a new card or expansion slot cover for proper cooling of internal components during operation.
- 
8. To install a new expansion card, hold the card just above the expansion socket on the system board then move the card toward the rear of the chassis so that the bracket on the card is aligned with the open slot on the rear of the chassis. Press the card straight down into the expansion socket on the system board.

**Figure 8-12** Installing an Expansion Card



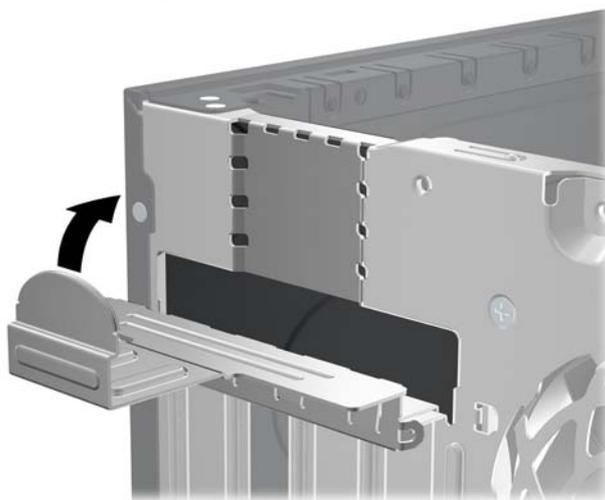
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 **NOTE:** When installing an expansion card, press firmly on the card so that the whole connector seats properly in the expansion card slot.

---

9. Rotate the slot cover retention latch back in place to secure the expansion card.

**Figure 8-13** Closing the Expansion Slot Retainer



10. Connect external cables to the installed card, if needed. Connect internal cables to the system board, if needed.
11. Reconfigure the computer, if necessary. Refer to the *Computer Setup (F10) Utility Guide* for instructions on using Computer Setup.

## Installing and Removing Drives

When installing additional drives, follow these guidelines:

- The primary Serial ATA (SATA) hard drive must be connected to the dark blue primary SATA connector on the system board labeled SATA0.
- Connect a SATA optical drive to the white SATA connector on the system board labeled SATA1.
- Connect devices in order of SATA0, SATA1, SATA2, then SATA3.
- Connect an eSATA adapter cable to the orange SATA3 connector.

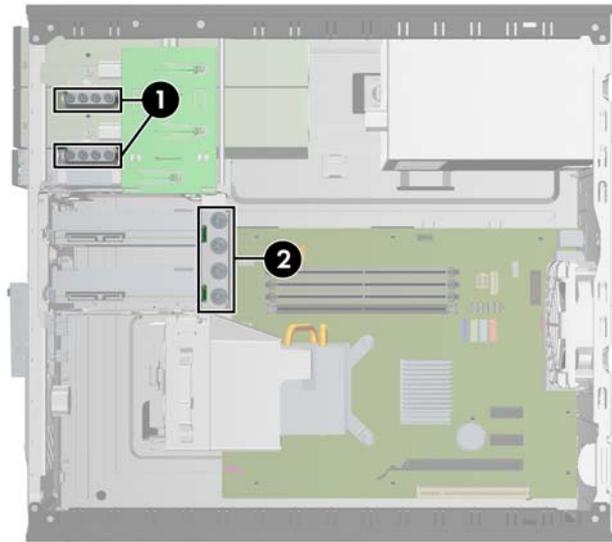


**NOTE:** The eSATA adapter installs into one of the expansion slots on the rear of the computer. You must configure the SATA3 connector to function as eSATA in the Computer Setup utility. Select **Storage > Storage Options > eSATA Port** to reconfigure the SATA3 connector. Refer to the *Computer Setup (F10) Utility Guide* for more information.

- Connect a media card reader USB cable to the USB connector on the system board labeled MEDIA. If the media card reader has a 1394 port, connect the 1394 cable to the 1394 PCI card.
- The system does not support Parallel ATA (PATA) optical drives or PATA hard drives.
- You must install guide screws to ensure the drive will line up correctly in the drive cage and lock in place. HP has provided extra guide screws for the external drive bays (four 6-32 isolation mounting guide screws and eight M3 metric guide screws), installed on the side of the drive bays. The 6-32 isolation mounting screws are required for a secondary hard drive. All other drives (except the primary hard drive) use M3 metric screws. The HP-supplied metric screws are black and the HP-supplied isolation mounting screws are silver and blue. If you are replacing the primary hard

drive, you must remove the four silver and blue 6-32 isolation mounting guide screws from the old hard drive and install them in the new hard drive.

**Figure 8-14** Extra Guide Screw Locations



No.	Guide Screw	Device
1	Black M3 Metric Screws	All Other Drives (except primary hard drive)
2	Silver and Blue 6-32 Isolation Mounting Screws	Secondary Hard Drive

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

If you are inserting or removing a drive, shut down the operating system properly, turn off the computer, and unplug the power cord. Do not remove a 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.

Handle a drive carefully; do not drop it.

Do not use excessive force when inserting a drive.

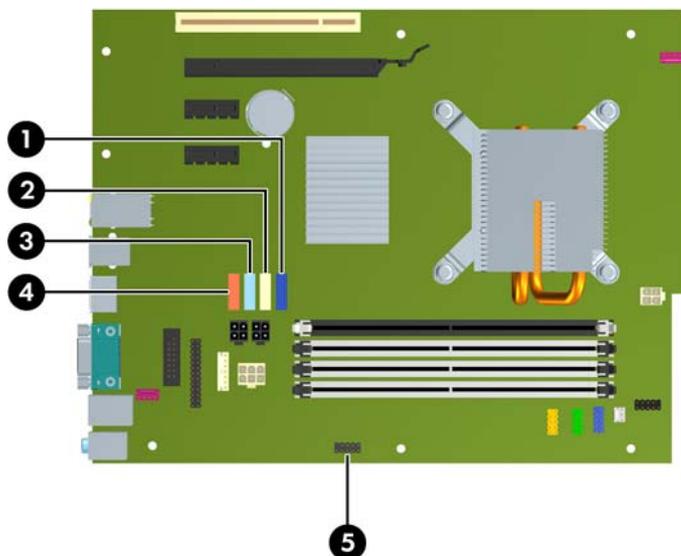
Avoid exposing a hard drive to liquids, temperature extremes, or products that have magnetic fields such as monitors or speakers.

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

## System Board Drive Connections

Refer to the following illustration and table to identify the system board drive connectors.

**Figure 8-15** System Board Drive Connections



**Table 8-3** System Board Drive Connections

No.	System Board Connector	System Board Label	Color
1	SATA0	SATA0	dark blue
2	SATA1	SATA1	white
3	SATA2	SATA2	light blue
4	SATA3	SATA3	orange
5	Media Card Reader	MEDIA	black

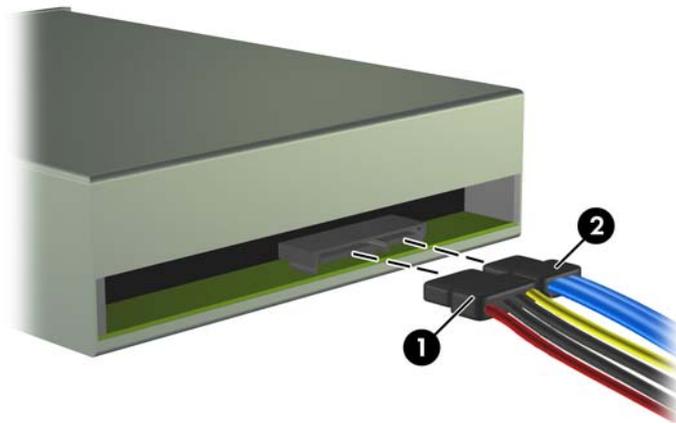
**NOTE:** The orange SATA3 connector can be reconfigured as eSATA in the Computer Setup utility if you are installing an eSATA adapter. Select **Storage > Storage Options > eSATA Port** to reconfigure the SATA3 connector. Refer to the *Computer Setup (F10) Utility Guide* for more information.

## Removing an External 5.25-inch or 3.5-inch Drive

△ **CAUTION:** All removable media should be taken out of a drive before removing the drive from the computer.

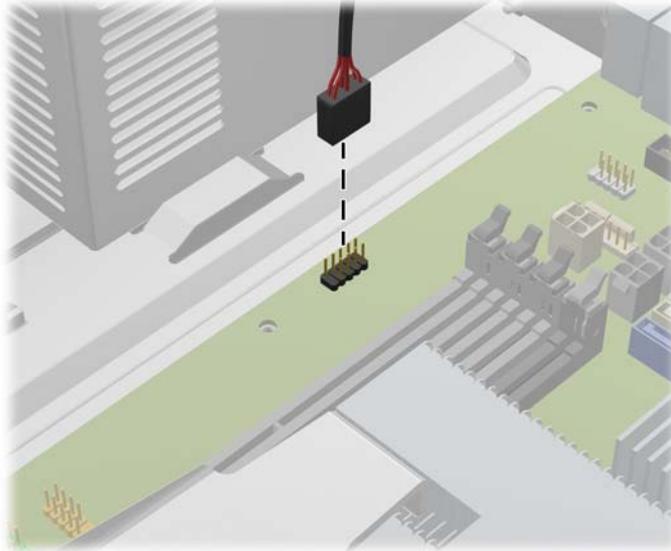
1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Remove the front bezel ([Front Bezel on page 78](#)).
4. Disconnect the drive cables, as indicated in the following illustrations.
  - a. If you are removing a 5.25-inch optical drive, disconnect the power cable (1) and data cable (2) from the back of the drive.

**Figure 8-16** Disconnecting the Optical Drive Cables

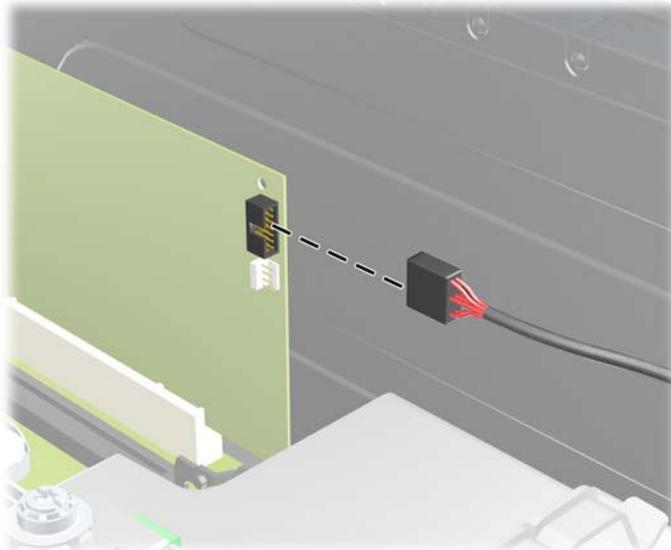


- b. If you are removing a media card reader, disconnect the USB cable from the system board. If the media card reader has a 1394 port, disconnect the 1394 cable from the PCI card.

**Figure 8-17** Disconnecting the Media Card Reader USB Cable

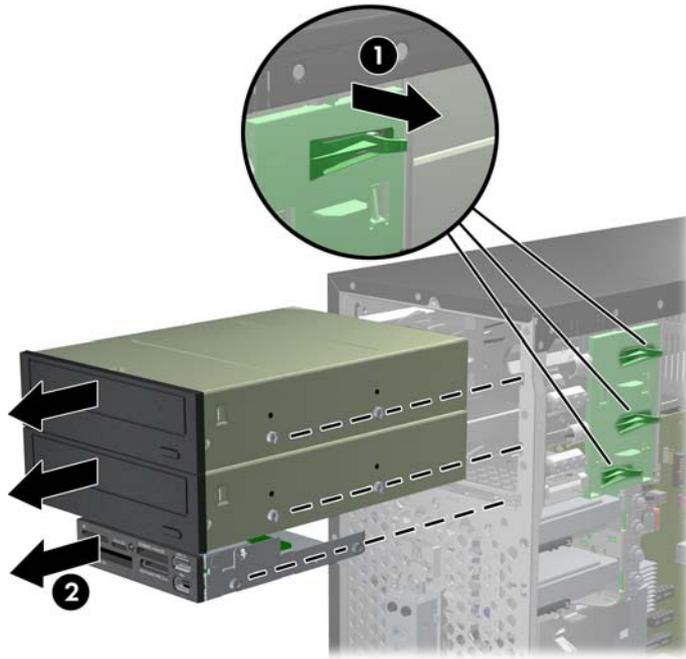


**Figure 8-18** Disconnecting the Media Card Reader 1394 Cable



5. A latch drive bracket with release tabs secures the drives in the drive bay. Lift the release tab on the latch drive bracket (1) for the drive you want to remove, then slide the drive from its drive bay (2).

**Figure 8-19** Removing the External Drives



6. Remove the four guide screws (two on each side) from the old drive. You will need these screws to install a new drive.

## Installing an External 5.25-inch or 3.5-inch Drive

 **NOTE:** The system does not support Parallel ATA (PATA) optical drives.

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Remove the front bezel ([Front Bezel on page 78](#)).
4. Install four M3 metric guide screws in the lower holes on each side of the drive. HP has provided eight extra M3 metric guide screws on the front of the chassis, under the front bezel. The M3 metric guide screws are black. Refer to [Installing and Removing Drives on page 90](#) for an illustration of the extra M3 metric guide screws location.

 **CAUTION:** Use only 5-mm long screws as guide screws. Longer screws can damage the internal components of the drive.

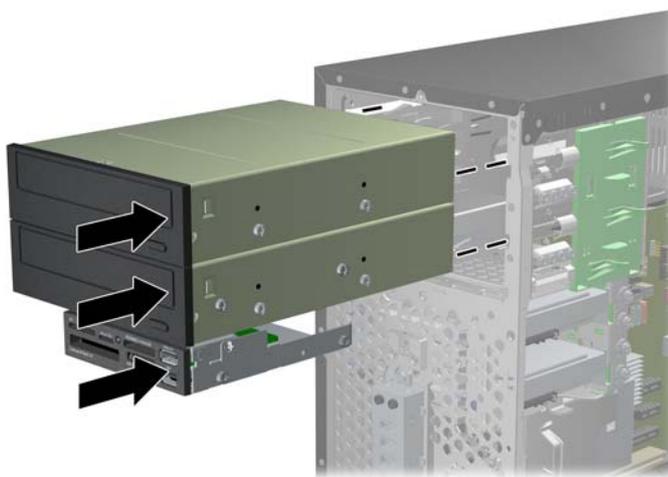
 **NOTE:** When replacing the drive, transfer the four M3 metric guide screws from the old drive to the new one.

**Figure 8-20** Installing Guide Screws (Optical Drive Shown)



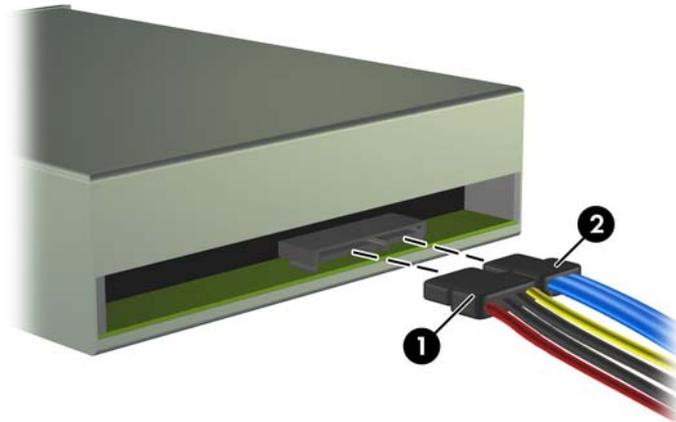
5. Slide the drive into the drive bay, making sure to align the guide screws with the guide slots, until the drive snaps into place.

**Figure 8-21** Sliding the External Drives into the Drive Cage



6. Connect the power and data cables to the drive as indicated in the following illustrations.
  - a. If you are installing an optical drive, connect the power cable (1) and data cable (2) to the back of the drive.

**Figure 8-22** Connecting the Optical Drive Cables



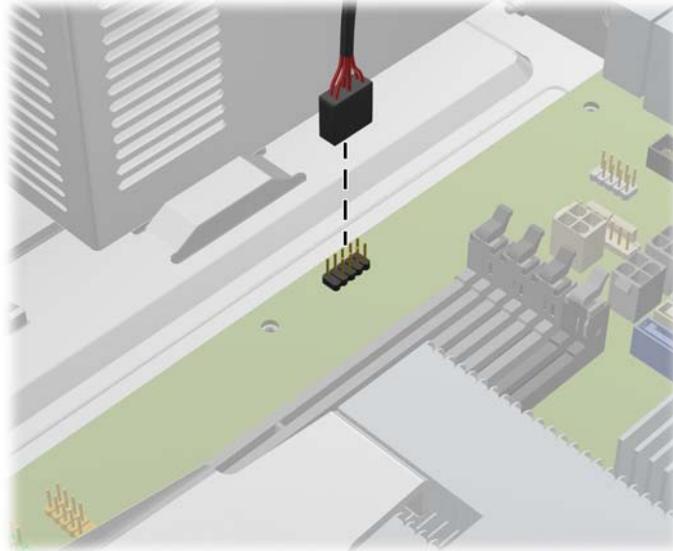
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△ **CAUTION:** Never crease or bend a SATA data cable tighter than a 30 mm (1.18 in) radius. A sharp bend can break the internal wires.

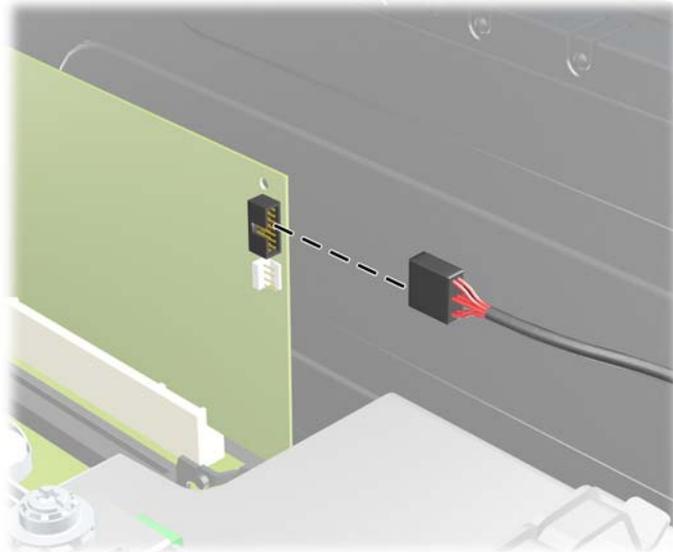
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- b. If you are installing a media card reader, connect the USB cable to the system board. If the media card reader has a 1394 port, connect the 1394 cable to the PCI card.

**Figure 8-23** Connecting the Media Card Reader USB Cable



**Figure 8-24** Connecting the Media Card Reader 1394 Cable



7. If installing a new drive, connect the opposite end of the data cable to the appropriate system board connector.

 **NOTE:** If you are installing a new optical drive, connect the SATA cable to the next available SATA system board connector in the following order: SATA1, SATA2, then SATA3.

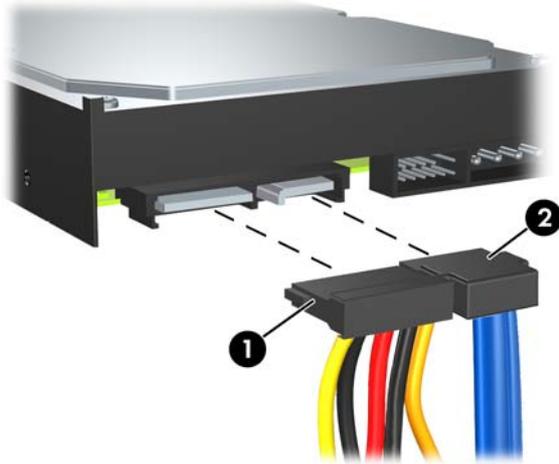
Refer to [System Board Drive Connections on page 92](#) for an illustration of the system board drive connectors.

## Removing an Internal 3.5-inch Hard Drive

 **NOTE:** Before you remove the old hard drive, be sure to back up the data from the old hard drive so that you can transfer the data to the new hard drive.

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Disconnect the power cable (1) and data cable (2) from the back of the hard drive.

**Figure 8-25** Disconnecting the Hard Drive Cables



4. Release the drive by pulling the release tab away from the drive (1) and sliding the drive out of the bay (2).

**Figure 8-26** Removing a Hard Drive



5. Remove the four guide screws (two on each side) from the old drive. You will need these screws to install a new drive.

## Installing an Internal 3.5-inch Hard Drive

 **NOTE:** The system does not support Parallel ATA (PATA) hard drives.

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Install the four guide screws (two on each side) that were removed from the old drive into the new drive. The screws help guide the drive into its proper position in the bay. Extra guide screws are provided on the exterior of the hard drive bays.

**Figure 8-27** Installing Hard Drive Guide Screws

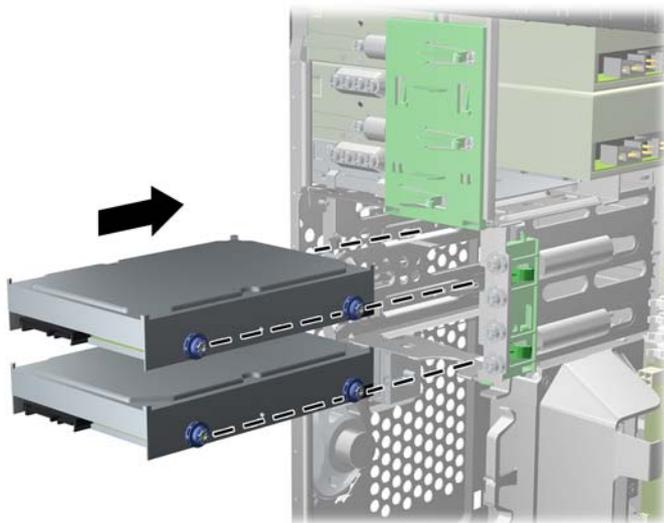


 **NOTE:** The hard drive uses 6-32 isolation mounting guide screws. Four extra guide screws are installed on the exterior of the hard drive bays. The HP-supplied isolation mounting guide screws are silver and blue. Refer to [Installing and Removing Drives on page 90](#) for an illustration of the extra 6-32 isolation mounting guide screws location.

If you are replacing a drive, transfer the guides screws from the old drive to the new one.

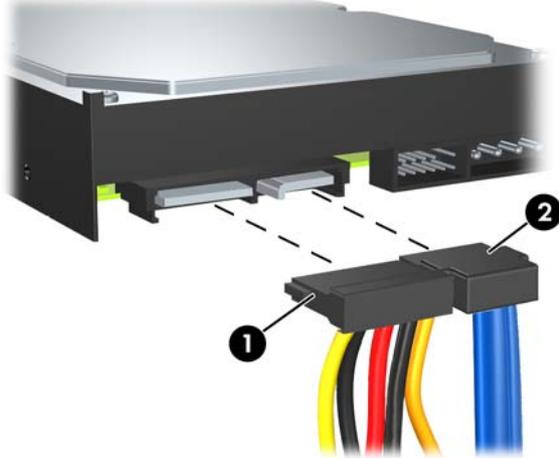
4. Slide the drive into the drive bay, making sure to align the guide screws with the guide slots, until the drive snaps into place. The bottom bay is for the primary hard drive. The upper bay is for an optional secondary hard drive.

**Figure 8-28** Sliding a Hard Drive into the Drive Bay



5. Connect the power cable (1) and data cable (2) to the back of the hard drive.

**Figure 8-29** Connecting the Hard Drive Cables



△ **CAUTION:** Never crease or bend a SATA data cable tighter than a 30 mm (1.18 in) radius. A sharp bend can break the internal wires.

6. If installing a new drive, connect the opposite end of the data cable to the appropriate system board connector.

📄 **NOTE:** If your system has only one SATA hard drive, you must connect the hard drive data cable to the dark blue connector labeled SATA0 to avoid any hard drive performance problems. If you are adding a second hard drive, connect the data cable to the next available (unpopulated) SATA connector on the system board in the following order: SATA0, SATA1, SATA2, SATA3.

7. Route the power and data cables in their cable retainers.

## Removing and Replacing a Removable 3.5-inch SATA Hard Drive

Some models are equipped with a Removable SATA Hard Drive Enclosure in the 5.25-inch external drive bay. The hard drive is housed in a carrier that can be quickly and easily removed from the drive bay. To remove and replace a drive in the carrier:

📄 **NOTE:** Before you remove the old hard drive, be sure to back up the data from the old hard drive so that you can transfer the data to the new hard drive.

1. Unlock the hard drive carrier with the key provided and slide the carrier out of the enclosure.

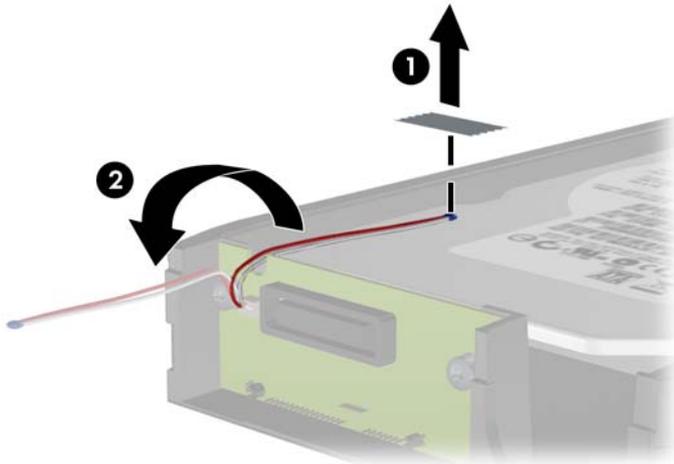
2. Remove the screw from the rear of the carrier (1) and slide the top cover off the carrier (2).

**Figure 8-30** Removing the Carrier Cover



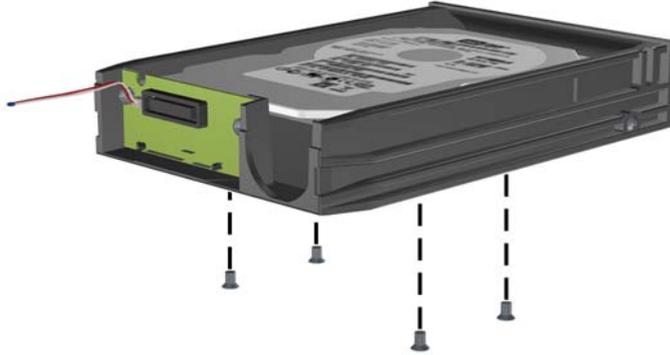
3. Remove the adhesive strip that secures the thermal sensor to the top of the hard drive (1) and move the thermal sensor away from the carrier (2).

**Figure 8-31** Removing the Thermal Sensor



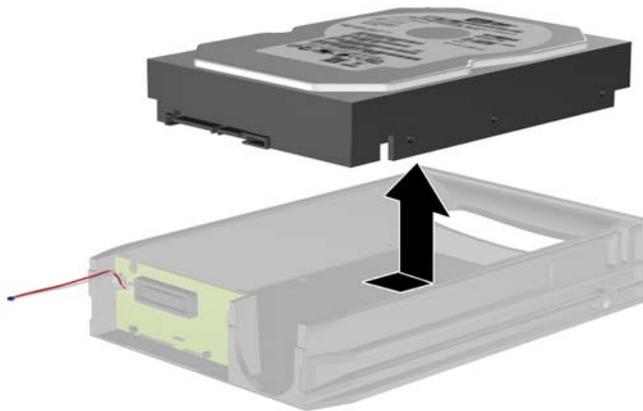
4. Remove the four screws from the bottom of the hard drive carrier.

**Figure 8-32** Removing the Security Screws



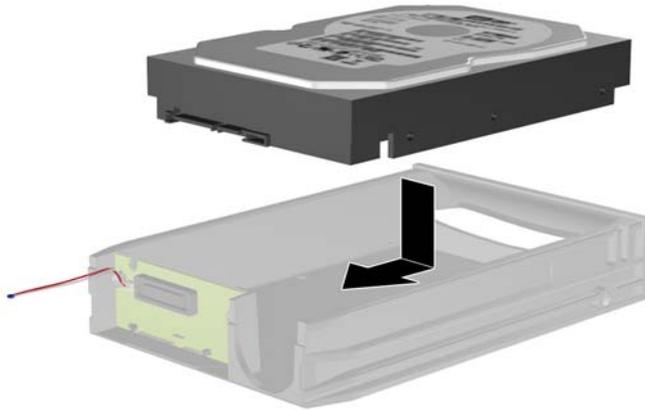
5. Slide the hard drive back to disconnect it from the carrier then lift it up and out of the carrier.

**Figure 8-33** Removing the Hard Drive



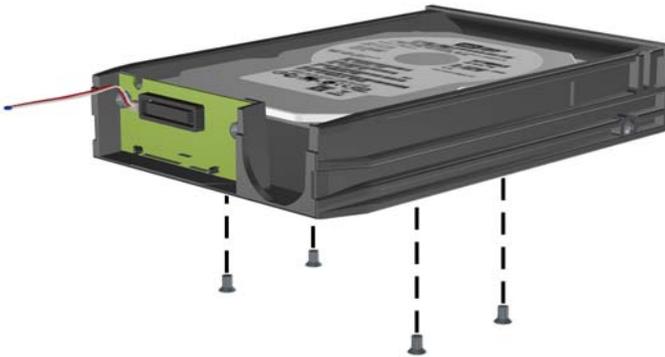
6. Place the new hard drive in the carrier then slide the hard drive back so that it seats in the SATA connector on the carrier's circuit board. Be sure the connector on the hard drive is pressed all the way into the connector on the carrier's circuit board.

**Figure 8-34** Replacing the Hard Drive



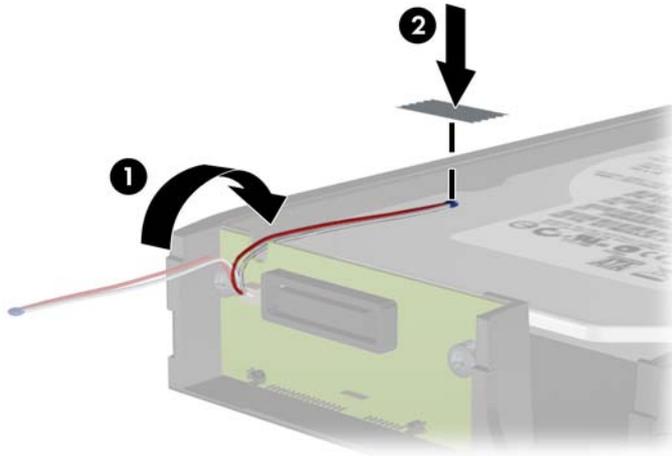
7. Replace the four screws in the bottom of the carrier to hold the drive securely in place.

**Figure 8-35** Replacing the Security Screws



- Place the thermal sensor on top of the hard drive in a position that does not cover the label **(1)** and attach the thermal sensor to the top of the hard drive with the adhesive strip **(2)**.

**Figure 8-36** Replacing the Thermal Sensor



- Slide the cover on the carrier **(1)** and replace the screw on the rear of the carrier to secure the cover in place **(2)**.

**Figure 8-37** Replacing the Carrier Cover

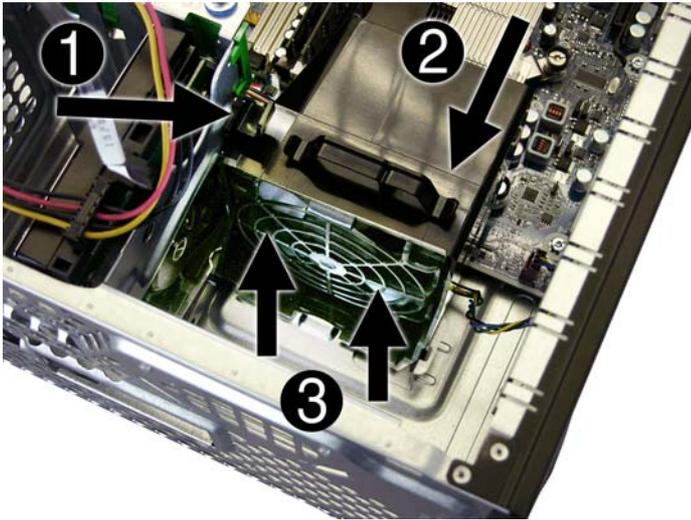


- Slide the hard drive carrier into the enclosure on the computer and lock it with the key provided.

 **NOTE:** The carrier must be locked for power to be supplied to the hard drive.

## Fan/Baffle Assembly

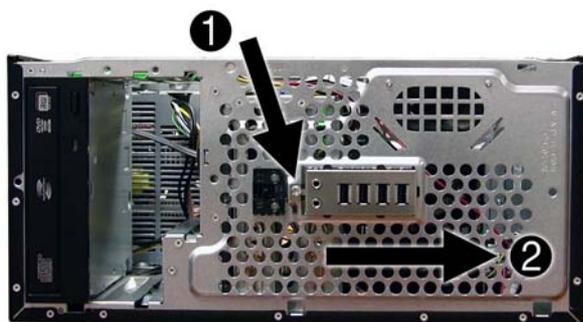
1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Unplug the fan cable from the system board (CHFAN1, P9).
4. Press the lever that secures the assembly to the chassis (1), pivot the assembly forward toward the front of the computer (2), and then lift the assembly straight up and out of the computer (3).



To reinstall the fan/baffle, reverse the removal procedure.

## Front I/O Assembly

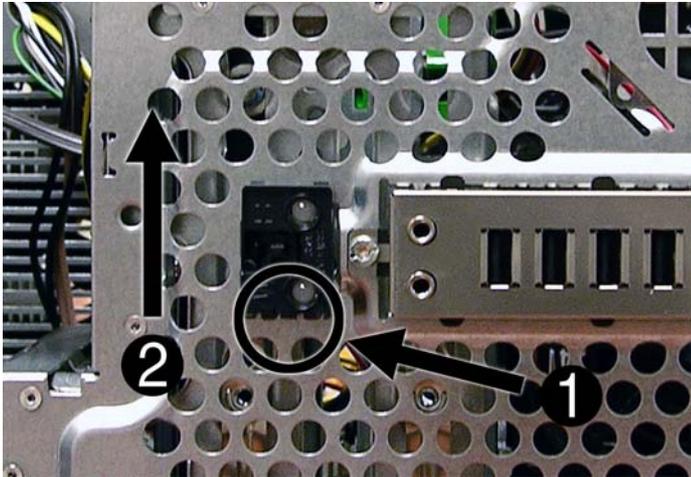
1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the computer access panel ([Access Panel on page 77](#)).
3. Remove the front bezel ([Front Bezel on page 78](#)).
4. Remove the cables from the clip on top of the baffle.
5. Disconnect the three front I/O cables (yellow, green, and blue) from the system board connectors (FRNT\_USB1, FRNT\_USB2, and FRNT\_AUD).
6. Remove the silver T15 screw **(1)** that secures the assembly to the chassis.
7. Rotate the assembly to the right **(2)**, and then lift the assembly away from the computer while threading the wires through the hole in the front of the chassis.



To reinstall the panel, reverse the removal procedure.

## Power Switch/LED Assembly

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Remove the front bezel ([Front Bezel on page 78](#)).
4. Disconnect the cable from the system board (P5, PB/LED).
5. With the computer on its side, press on the bottom of the assembly **(1)** and rotate upward **(2)** to disengage it from the chassis.



6. Pull the assembly away from the chassis while threading the cable through the hole in front of the chassis.

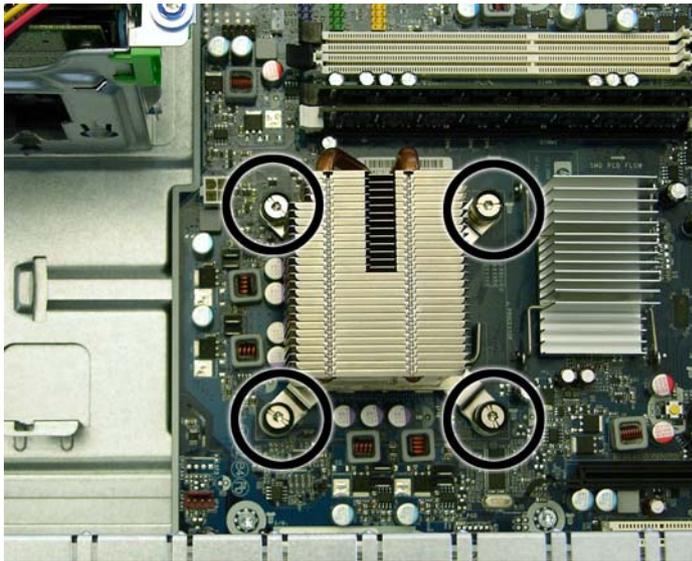
To reinstall the assembly, insert the tabs on the right side of the assembly into the slots in the chassis, and then rotate the left side of the assembly down until it snaps into place.

# Heat sink

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

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the computer access panel ([Access Panel on page 77](#)).
3. Loosen the four silver T15 captive screws that secure the heat sink to the system board.

△ **CAUTION:** Heat sink 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.



4. Remove the heat sink from the processor.

When reinstalling the heat sink, 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.

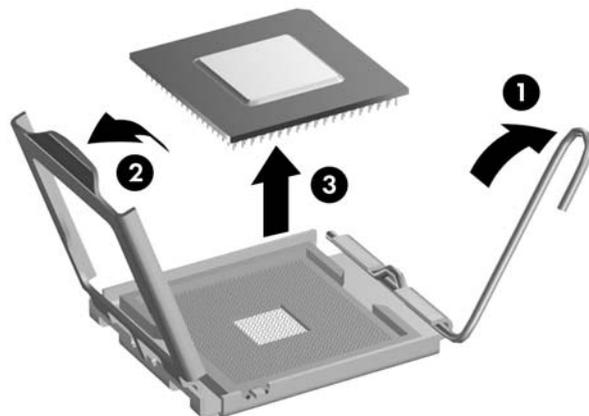
△ **CAUTION:** Heat sink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heat sink on the processor. This is especially important as the pins on the socket are very fragile and any damage to them may require replacing the system board.

## Processor

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Remove the heat sink ([Heat sink on page 109](#)).
4. Rotate the locking lever to its full open position **(1)**.
5. Raise and rotate the microprocessor retainer to its fully open position **(2)**.
6. Carefully lift the processor from the socket **(3)**.

△ **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.

The heat sink 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 heat sink, go to step 3.  
If using a new heat sink, go to step 5.
3. If reusing the existing heat sink, apply the thermal grease provided in the spares kit to the top of the processor.
4. Clean the bottom of the heat sink with the provided alcohol pad and place it atop the processor.

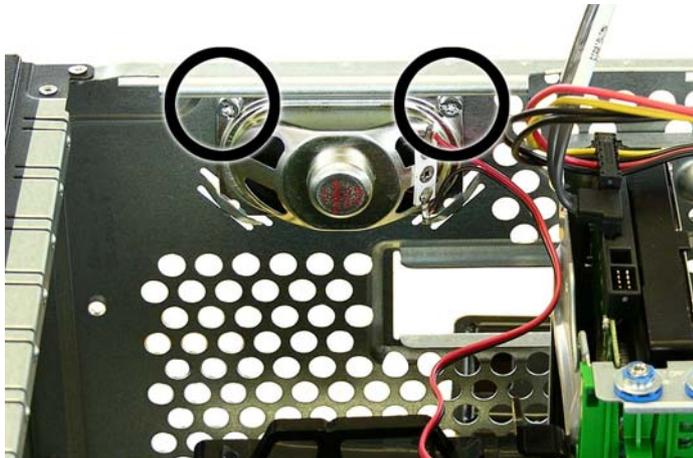
5. If using a new heat sink, remove the protective covering from the bottom of the heat sink and place it in position atop the processor.
6. Secure the heat sink to the system board and system board tray with the four captive screws and attach the heat sink control cable to the system board.

△ **CAUTION:** heat sink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heat sink 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.

📝 **NOTE:** 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 BIOS can be found on the Web at: <http://h18000.www1.hp.com/support/files>.

## Speaker

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Remove the baffle ([Fan/Baffle Assembly on page 106](#)).
4. Disconnect the speaker wire from the system board (SPKR, P6).
5. From the inside of the chassis, remove the two silver T15 screws that secure the speaker to the chassis.
6. Slide the speaker up and lift it out of the chassis.



To replace the speaker, reverse the removal procedures.

When replacing the speaker, be sure to route the cable through the hole in the left side of the processor baffle.

## Rear Chassis Fan

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Disconnect the fan control cable from the system board (CHFAN2).
4. Remove the four silver Phillips screws that secure the fan to the chassis.



5. Lift the fan out of the chassis.

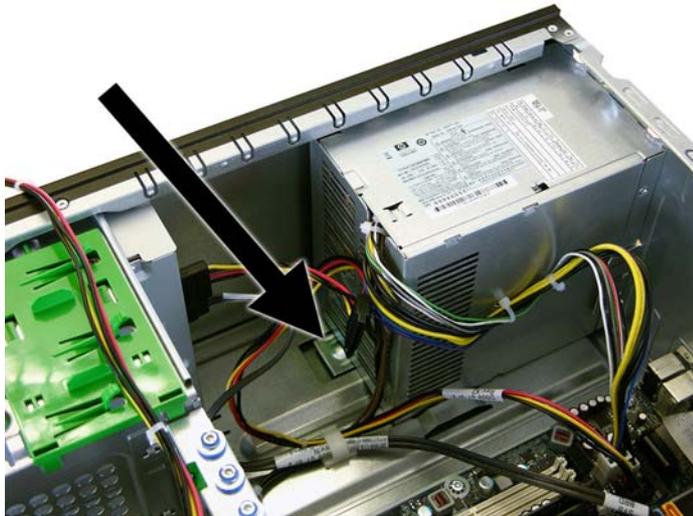
To install the fan assembly, reverse the removal procedure. Be sure to orient the air flow out of the unit.

## Power Supply

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Disconnect all power cables from the drives and from the system board.
4. Remove the four silver T15 screws that connect the power supply to the chassis.



5. Press the tab on the base pan in front of the power supply that holds it in place.

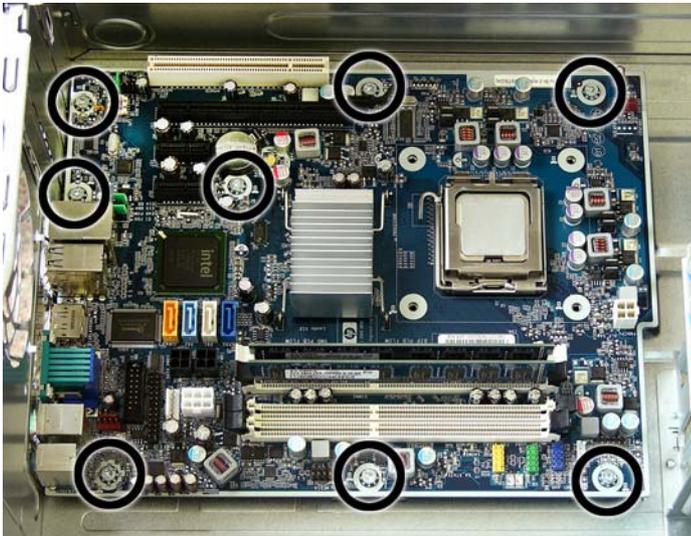


6. Slide the power supply toward the front of the computer, rotate toward the fan so the power supply clears the lip on the top of the chassis, and then lift the power supply out of the chassis.

To install the power supply, reverse the removal procedure.

## System Board

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Remove all expansion boards ([Expansion Cards on page 86](#)).
4. Disconnect all cables connected to the system board, noting their location for reinstallation.
5. Remove the heat sink ([Heat sink on page 109](#)).
6. Remove the eight screws that secure the system board to the chassis.



7. Slide the system board toward the front of the computer to disengage the I/O panel from the rear of the chassis.
8. Lift the system board out of the computer.

When reinstalling the system board, first insert the I/O panel back into the slots in the rear of the chassis, and then align the board with the chassis screw holes.

 **NOTE:** When replacing the system board, you must change the chassis serial number in the BIOS.

# Battery

The battery that comes with the computer provides power to the real-time clock. When replacing the battery, use a battery equivalent to the battery originally installed in the computer. The computer comes with a 3-volt lithium coin cell battery.

- △ **WARNING!** The 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 60°C (140°F).

Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.

Replace the battery only with the HP 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 *Computer Setup (F10) Utility Guide* for information on backing up the CMOS settings.

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.

- 📝 **NOTE:** 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.

HP encourages customers to recycle used electronic hardware, HP original print cartridges, and rechargeable batteries. For more information about recycling programs, go to <http://www.hp.com/recycle>.

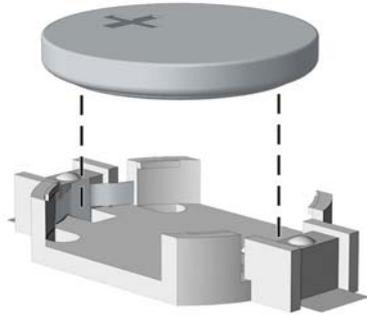
1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the computer access panel ([Access Panel on page 77](#)).

- 📝 **NOTE:** 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:

## Type 1 Battery Holder

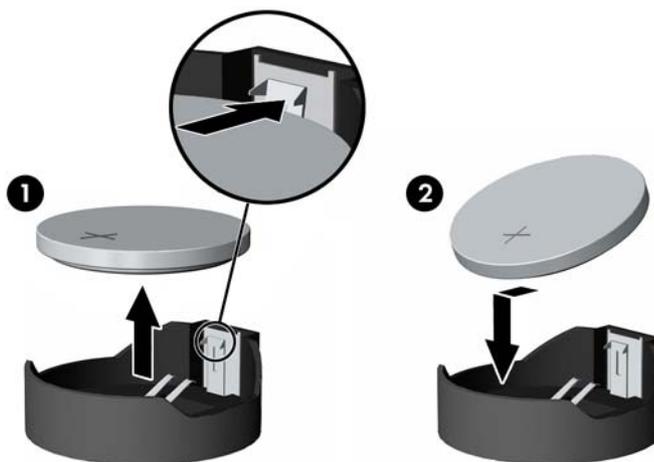
1. Lift the battery out of its holder.



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 access panel.
5. Plug in the computer and turn on power to the computer.
6. Reset the date and time and any special system setups using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

## Type 2 Battery Holder

1. To release the battery from its holder, squeeze the metal clamp **(1)** 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 **(2)**. Push the other edge down until the clamp snaps over the other edge of the battery.

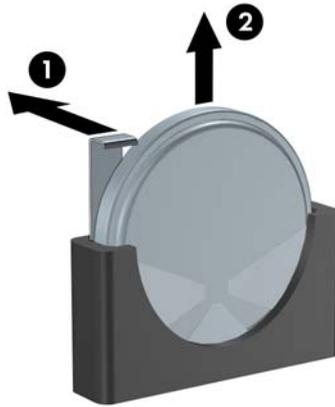


3. Replace the computer access panel.

4. Plug in the computer and turn on power to the computer.
5. Reset the date and time and any special system setups using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

### Type 3 Battery Holder

1. Pull back on the clip (1) that holds the battery in place, then remove the battery (2).
2. Insert the new battery and position the clip back in place.



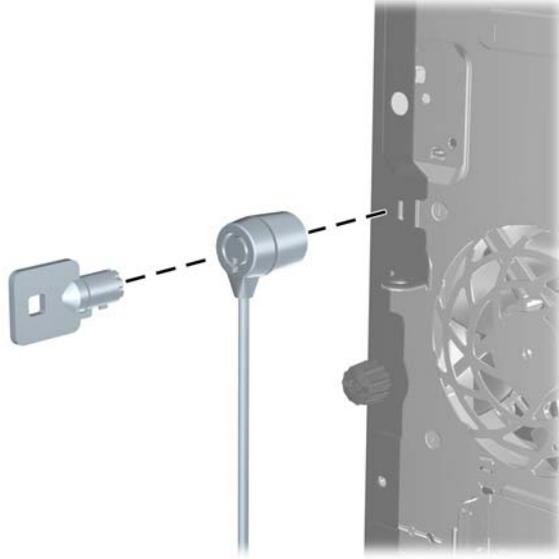
3. Replace the computer access panel.
4. Plug in the computer and turn on power to the computer.
5. Reset the date and time and any special system setups using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

## External Security Devices

The following security devices are used to prevent unauthorized access to the internal components of the computer and/or secure the computer to a fixed object.

### Cable Lock

**Figure 8-38** Installing a Cable Lock



### Padlock

**Figure 8-39** Installing a Padlock



## HP Business PC Security Lock

1. Fasten the security cable by looping it around a stationary object.

**Figure 8-40** Securing the Cable to a Fixed Object



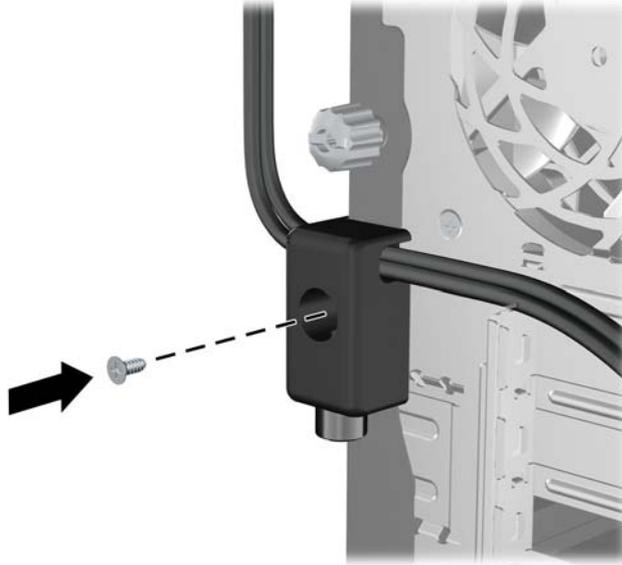
2. Thread the keyboard and mouse cables through the lock.

**Figure 8-41** Threading the Keyboard and Mouse Cables



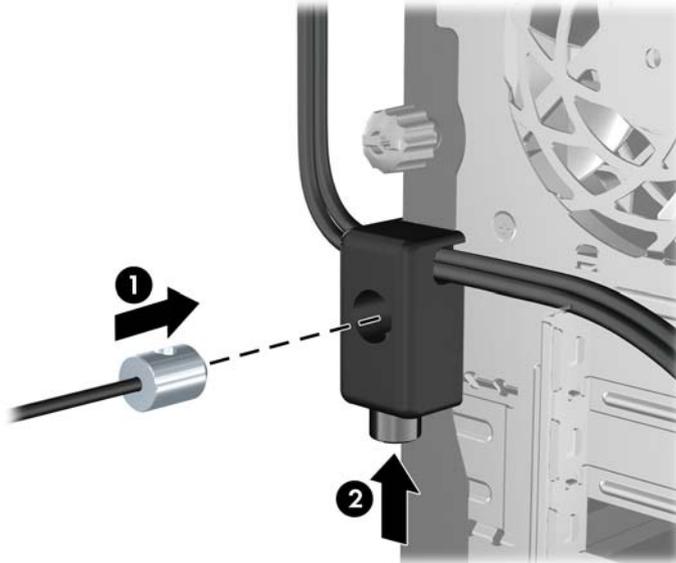
3. Screw the lock to the chassis using the screw provided.

**Figure 8-42** Attaching the Lock to the Chassis



4. Insert the plug end of the security cable into the lock (1) and push the button in (2) to engage the lock. Use the key provided to disengage the lock.

**Figure 8-43** Engaging the Lock



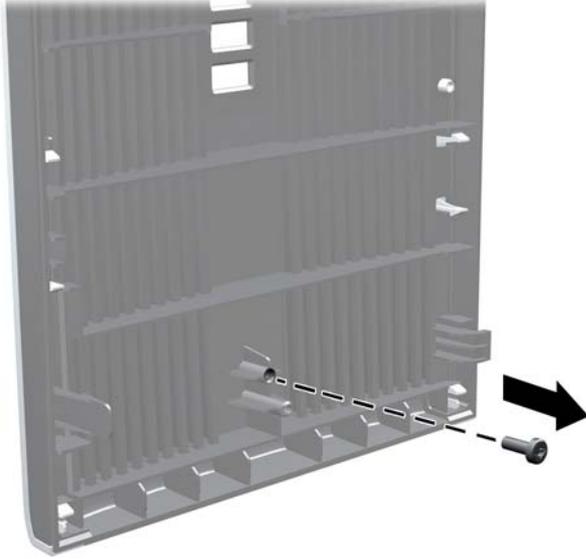
## Front Bezel Security

The front bezel can be locked in place by installing a security screw provided by HP. To install the security screw:

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 76](#)).
2. Remove the access panel ([Access Panel on page 77](#)).
3. Remove the front bezel ([Front Bezel on page 78](#)).

4. Remove the security screw from the inside of the front bezel.

**Figure 8-44** Retrieving the Front Bezel Security Screw



5. Replace the front bezel.
6. Install the screw through the interior of the front of the chassis into the front bezel. The screw hole is located toward the middle of the right edge of the chassis between the hard drive bay and speaker.

**Figure 8-45** Installing the Front Bezel Security Screw



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# 9 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.

---

 **NOTE:** Not all features listed in this guide are available on all computers.

---

## Preparation for Disassembly

See [Identifying the Chassis, Routine Care, and Disassembly Preparation on page 67](#) for initial safety procedures.

1. Remove/disengage any security devices that prohibit opening the computer ([External Security Devices on page 169](#)).
2. Close any open software applications.
3. Exit the operating system.
4. Remove any diskette, compact disc, or media card 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.

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. If the computer is on a stand, remove the computer from the stand.
8. Disconnect all peripheral device cables from the computer.

---

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

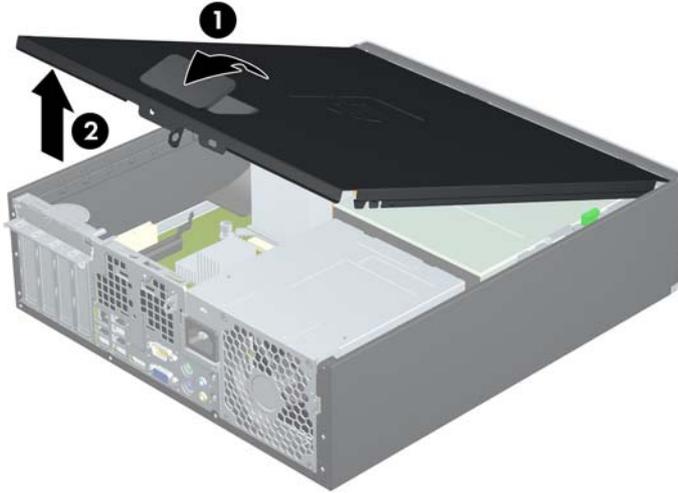
△ **CAUTION:** The screws used in the computer are of different thread sizes and lengths; using the wrong screw in an application may damage the unit.

---

## Access Panel

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Lift up on the access panel handle (1) then lift the access panel off the computer (2).

**Figure 9-1** Removing the Access Panel

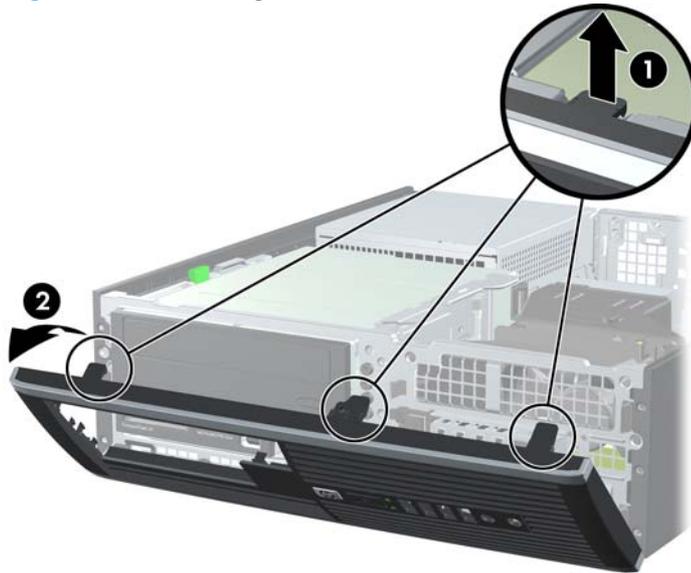


To install the access panel, reverse the removal procedure.

## Front Bezel

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Lift up the three tabs on the side of the bezel (1), then rotate the bezel off the chassis (2).

**Figure 9-2** Removing the Front Bezel



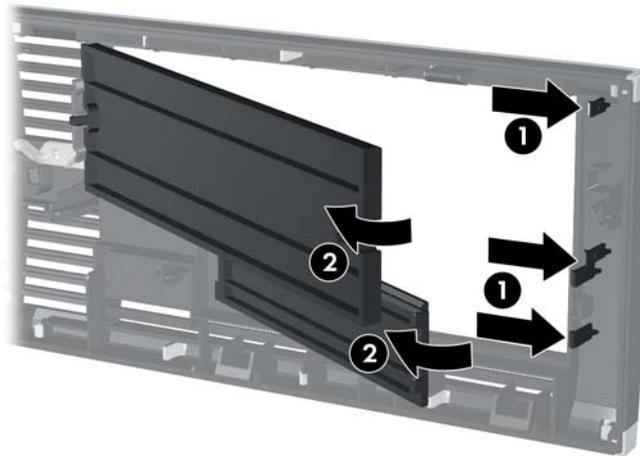
To install the front bezel, reverse the removal procedure.

## Bezel Blanks

On some models, there are bezel blanks covering the 3.5-inch and 5.25-inch external drive bays that need to be removed before installing a drive. To remove a bezel blank:

1. Remove the access panel ([Access Panel on page 123](#)).
2. Remove the front bezel ([Front Bezel on page 124](#)).
3. To remove a bezel blank, push the two retaining tabs that hold the bezel blank in place towards the outer right edge of the bezel **(1)** and slide the bezel blank back and to the right to remove it **(2)**.

**Figure 9-3** Removing a Bezel Blank



# Installing Additional Memory

The computer comes with double data rate 3 synchronous dynamic random access memory (DDR3-SDRAM) dual inline memory modules (DIMMs).

## DIMMs

The memory sockets on the system board can be populated with up to four industry-standard DIMMs. These memory sockets are populated with at least one preinstalled DIMM. To achieve the maximum memory support, you can populate the system board with up to 16-GB of memory configured in a high-performing dual channel mode.

## DDR3-SDRAM DIMMs

For proper system operation, the DDR3-SDRAM DIMMs must be:

- industry-standard 240-pin
- unbuffered non-ECC PC3-8500 DDR3-1066 MHz-compliant or PC3-10600 DDR3-1333 MHz-compliant

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 **NOTE:** 1333 MHz DIMMS will only run at a speed of 1066 MHz.

---

- 1.5 volt DDR3-SDRAM DIMMs

The DDR3-SDRAM DIMMs must also:

- support CAS latency 7 DDR3 1066 MHz (7-7-7 timing) and CAS latency 9 DDR3 1333 MHz (9-9-9 timing)
- contain the mandatory JEDEC SPD information

In addition, the computer supports:

- 512-Mbit, 1-Gbit, and 2-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

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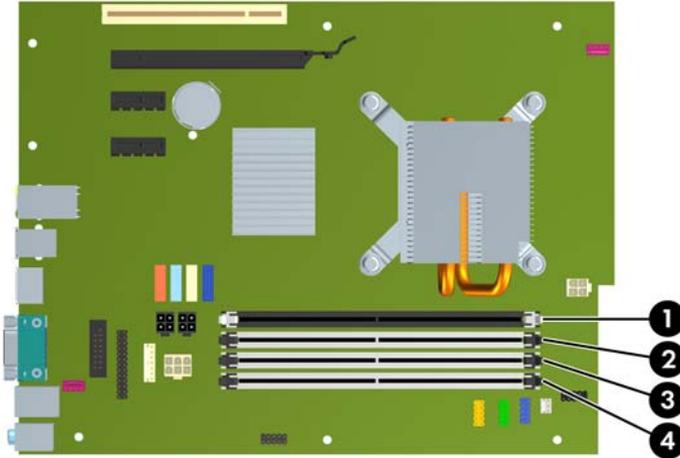
 **NOTE:** The system will not operate properly if you install unsupported DIMMs.

---

## Populating DIMM Sockets

There are four DIMM sockets on the system board, with two sockets per channel. The sockets are labeled DIMM1, DIMM2, DIMM3, and DIMM4. Sockets DIMM1 and DIMM2 operate in memory channel A. Sockets DIMM3 and DIMM4 operate in memory channel B.

**Figure 9-4** DIMM Socket Locations



**Table 9-1** DIMM Socket Locations

Item	Description	Socket Color
1	DIMM1 socket, Channel A (populate first)	Black
2	DIMM2 socket, Channel A (populate third)	White
3	DIMM3 socket, Channel B (populate second)	White
4	DIMM4 socket, Channel B (populate fourth)	White

**NOTE:** A DIMM must occupy the black DIMM1 socket. Otherwise, the system will display a POST error message indicating that a memory module must be installed in the wrong socket.

The system will automatically operate in single channel mode, dual channel mode, or flex mode, depending on how the DIMMs are installed.

- The system will operate in single channel mode if the DIMM sockets are populated in one channel only.
- The system will operate in a higher-performing dual channel 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. The technology and device width can vary between the channels. For example, if Channel A is populated with two 512-MB DIMMs and Channel B is populated with one 1-GB DIMM, the system will operate in dual channel mode.
- The system will operate in flex 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. In flex mode, the channel populated with the least amount of memory describes the total amount of memory assigned to dual channel and the remainder is assigned to single channel. For optimal speed, the channels should be balanced so that the largest amount of memory is spread between the two channels. If one channel will have more memory than the other, the larger amount should be assigned to Channel A. For

example, if you are populating the sockets with one 1-GB DIMM, and three 512-MB DIMMs, Channel A should be populated with the 1-GB DIMM and one 512-MB DIMM, and Channel B should be populated with the two 512-MB DIMMs. With this configuration, 2-GB will run as dual channel and 512-MB will run as single channel.

- In any mode, the maximum operational speed is determined by the slowest DIMM in the system.

## Installing DIMMs

△ **CAUTION:** You must disconnect the power cord and wait approximately 30 seconds for the power to drain before adding or removing memory modules. Regardless of the power-on state, voltage is always supplied to the memory modules as long as the computer is plugged into an active AC outlet. Adding or removing memory modules while voltage is present may cause irreparable damage to the memory modules or system board. If you see an LED light on the system board, voltage is still present.

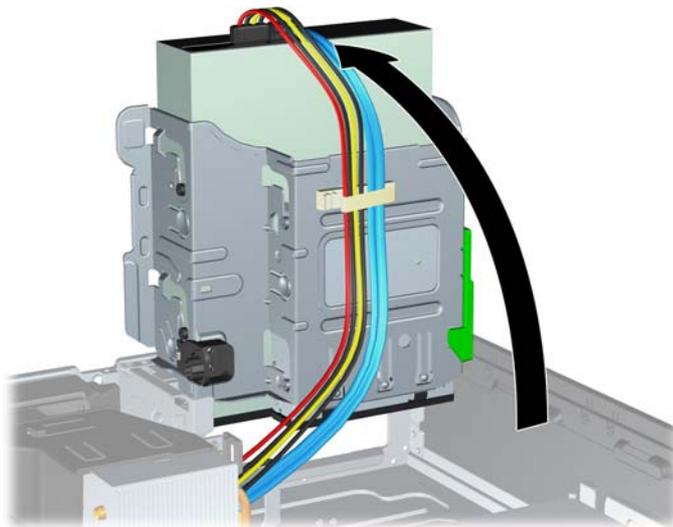
The memory module sockets have gold-plated metal contacts. When upgrading the memory, it is important to use memory modules with gold-plated metal contacts to prevent corrosion and/or oxidation resulting from having incompatible metals in contact with each other.

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.

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

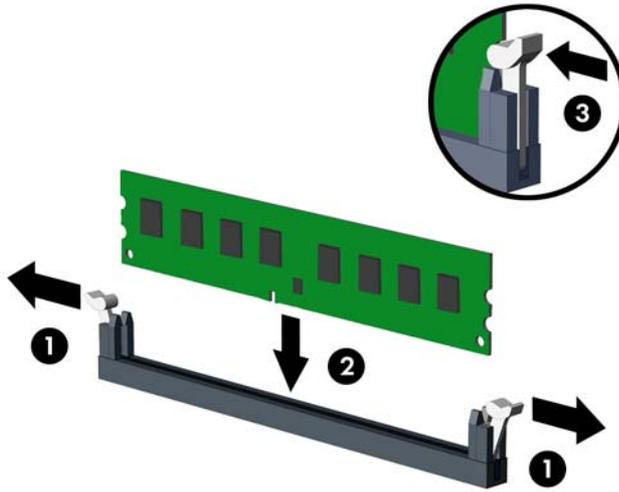
1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Rotate up the external drive bay housing to access the memory module sockets on the system board.

**Figure 9-5** Rotating the Drive Cage Up



4. Open both latches of the memory module socket (1), and insert the memory module into the socket (2).

**Figure 9-6** Installing a DIMM



**NOTE:** A memory module can be installed in only one way. Match the notch on the module with the tab on the memory socket.

A DIMM must occupy the black DIMM1 socket.

Populate the DIMM sockets in the following order: DIMM1, DIMM3, DIMM2, then DIMM4.

For maximum performance, populate the sockets so that the memory capacity is spread as equally as possible between Channel A and Channel B. Refer to [Populating DIMM Sockets on page 127](#) for more information.

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 (3).
6. Repeat steps 5 and 6 to install any additional modules.

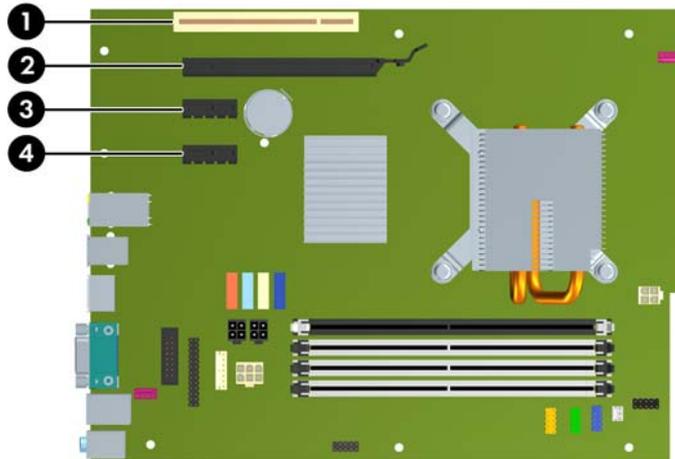
The computer should automatically recognize the additional memory the next time you turn on the computer.

# Expansion Cards

The computer has one PCI expansion slot, two PCI Express x1 expansion slots, and one PCI Express x16 expansion slot.

**NOTE:** The PCI and PCI Express slots support only low profile cards.

**Figure 9-7** Expansion Slot Locations



**Table 9-2** Expansion Slot Locations

Item	Description
1	PCI expansion slot
2	PCI Express x16 expansion slot
3	PCI Express x1 expansion slot
4	PCI Express x1 expansion slot

**NOTE:** You can install a PCI Express x1, x4, x8, or x16 expansion card in the PCI Express x16 slot.

To install an expansion card:

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Locate the correct vacant expansion socket on the system board and the corresponding expansion slot on the back of the computer chassis.

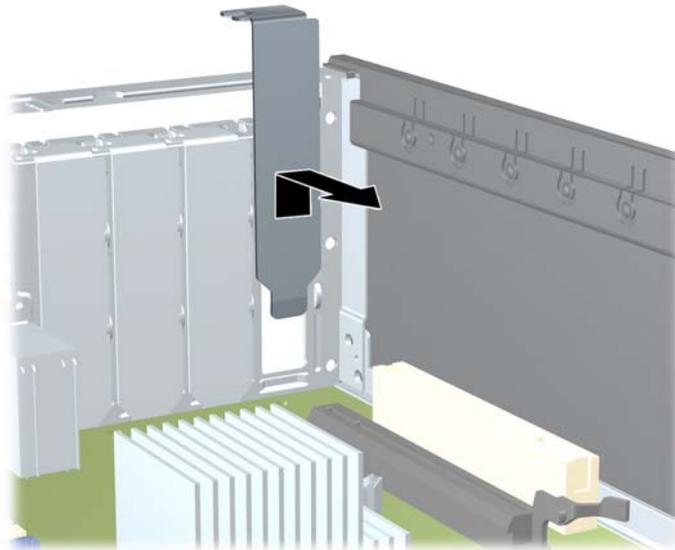
4. Release the slot cover retention latch that secures the PCI slot covers by lifting the green tab on the latch and rotating the latch to the open position.

**Figure 9-8** Opening the Expansion Slot Retainer



5. Before installing an expansion card, remove the expansion slot cover or the existing expansion card.
  - a. 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 then away from the inside of the chassis.

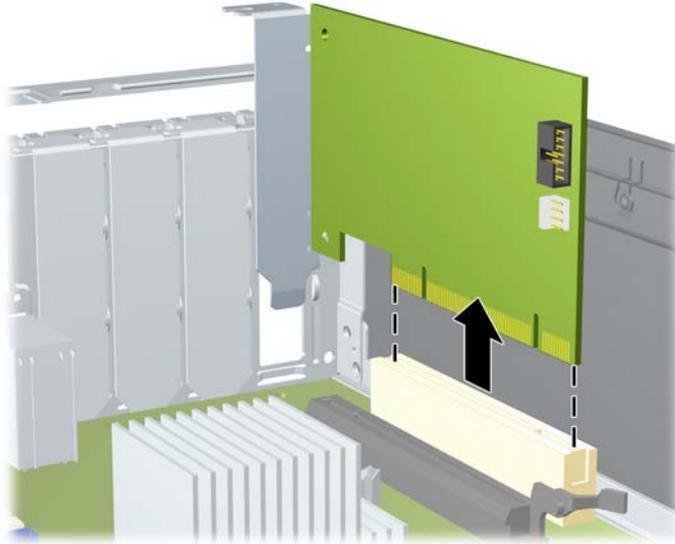
**Figure 9-9** Removing an Expansion Slot Cover



- b. If you are removing a standard PCI card or PCI Express x1 card, hold the card at each end, and carefully rock it 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 to release it from the chassis frame. Be sure not to scrape the card against the other components.

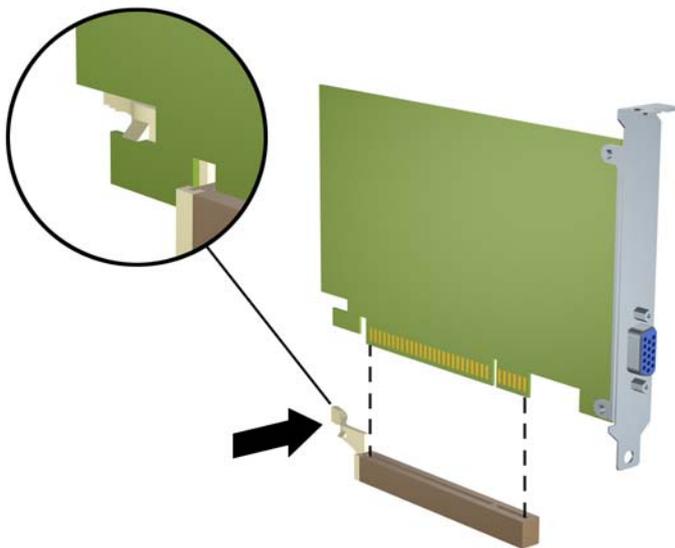
 **NOTE:** Before removing an installed expansion card, disconnect any cables that may be attached to the expansion card.

**Figure 9-10** Removing a Standard PCI Expansion Card



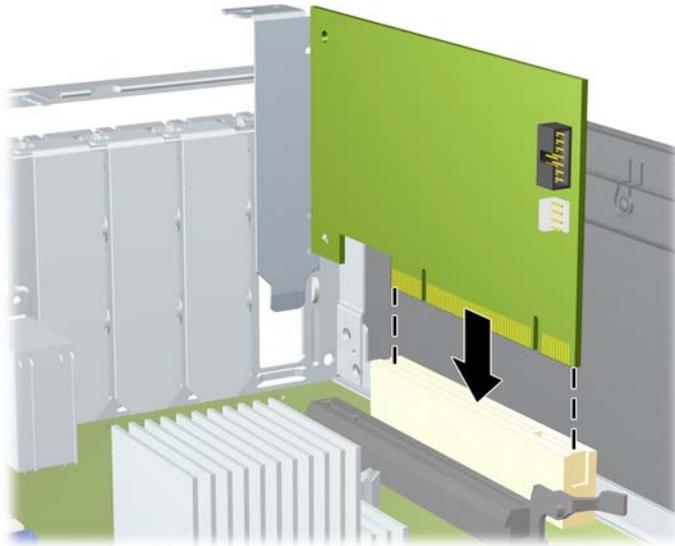
- c. If you are removing a PCI Express x16 card, pull the retention arm on the back of the expansion socket away from the card and carefully rock the card back and forth until the connectors pull free from the socket. Pull the expansion card straight up from the socket then away from the inside of the chassis to release it from the chassis frame. Be sure not to scrape the card against the other components.

**Figure 9-11** Removing a PCI Express x16 Expansion Card



6. Store the removed card in anti-static packaging.
  7. If you are not installing a new expansion card, install an expansion slot cover to close the open slot.
- △ **CAUTION:** After removing an expansion card, you must replace it with a new card or expansion slot cover for proper cooling of internal components during operation.
8. To install a new expansion card, hold the card just above the expansion socket on the system board then move the card toward the rear of the chassis so that the bracket on the card is aligned with the open slot on the rear of the chassis. Press the card straight down into the expansion socket on the system board.

**Figure 9-12** Installing an Expansion Card



- 📝 **NOTE:** When installing an expansion card, press firmly on the card so that the whole connector seats properly in the expansion card slot.

9. Rotate the slot cover retention latch back in place to secure the expansion card.

**Figure 9-13** Closing the Expansion Slot Retainer



10. Connect external cables to the installed card, if needed. Connect internal cables to the system board, if needed.
11. Reconfigure the computer, if necessary. Refer to the *Computer Setup (F10) Utility Guide* for instructions on using Computer Setup.

# Cable Management

The Small Form Factor 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.

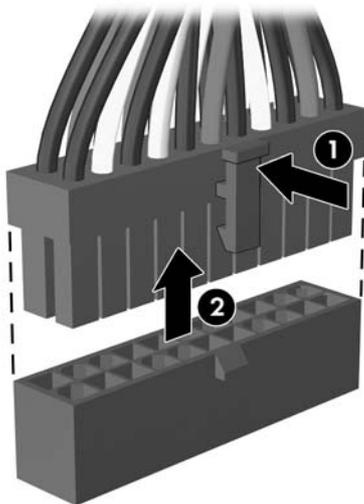
- Keep cables away from major heat sources like the heat sink.
- Do not jam cables on top of expansion cards or memory modules. Printed circuit cards like these are not designed to take excessive pressure on them.
- Keep cables clear of movable or rotating parts like the power supply and drive cage to prevent them from being cut or crimped when the component is lowered into its normal position.
- 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 connector 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 **(1)**.
2. Grasp the cable end of the connector and pull it straight up **(2)**.

△ **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.

**Figure 9-14** Removing a power supply cable from its connector



## Cable Connections

System board connectors are color-coded to make it easier to find the proper connection.

Connector Name	Connector Color	Description
PWR, P1	White	Power supply, 6-pin
P2	White	Power supply, 6-pin
PWRCPU, P3	White	Power supply, 4-pin
PS STAT	White	Power supply, 6-pin
SATA PWR1, P160	Black	Optical drive power connector, 4-pin
SATA PWR2, P161	Black	Hard drive power connector, 4-pin
CHFAN, P9	Maroon	Chassis fan
PB/LED, P5	Black	Front power button/LED
CHFAN2, P11	Maroon	2nd chassis fan
FRNT_USB1, P24	Yellow	Front I/O USB
FRNT_USB2, P25	Green	Front I/O USB
FRONT AUD, P23	Blue	Front audio
SPRK, P6	White	Internal speaker
COMB, P52	Black	Serial port
SATA0, P60	Dark blue	1st HDD
SATA1, P61	White	1st ODD or 2nd HDD if no HDD present
SATA2, P62	Light blue	2nd HDD if ODD present
SATA3, P63	Orange	eSATA port or extra ODD/HDD connector
PAR, P126	Black	Parallel port
MEDIA, P150	Black	Media reader

# Drive Positions

Figure 9-15 Drive Positions

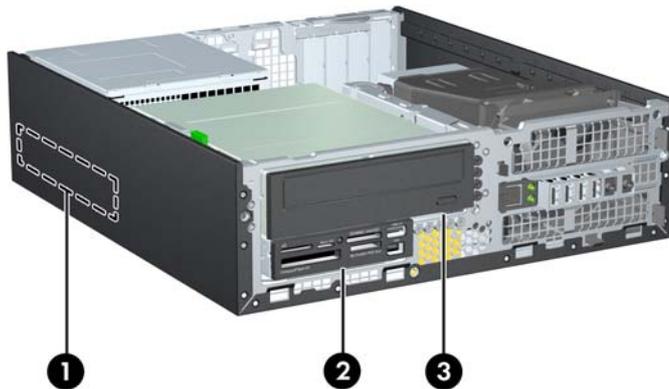


Table 9-3 Drive Positions

1	3.5-inch internal hard drive bay
2	3.5-inch external drive bay for optional drives (media card reader shown)
3	5.25-inch external drive bay for optional drives (optical drive shown)

**NOTE:** The drive configuration on your computer may be different than the drive configuration shown above.

To verify the type, size, and capacity of the storage devices installed in the computer, run Computer Setup. Refer to the *Computer Setup (F10) Utility Guide* for more information.

# Installing and Removing Drives

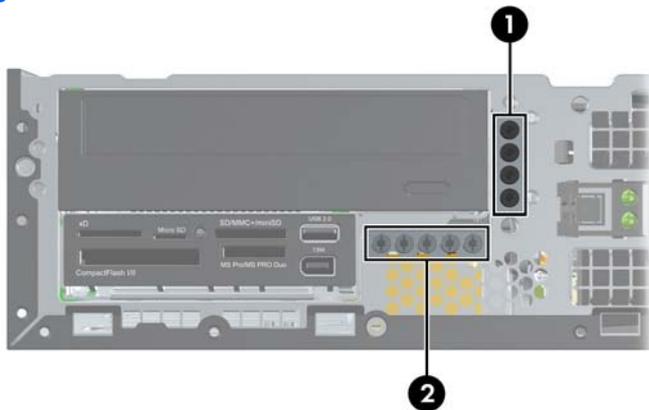
When installing additional drives, follow these guidelines:

- The primary Serial ATA (SATA) hard drive must be connected to the dark blue primary SATA connector on the system board labeled SATA0.
- Connect a SATA optical drive to the white SATA connector on the system board labeled SATA1.
- Connect devices in order of SATA0, SATA1, SATA2, then SATA3
- Connect an eSATA adapter cable to the orange SATA3 connector.

 **NOTE:** The eSATA adapter installs into one of the expansion slots on the rear of the computer. You must configure the SATA3 connector to function as eSATA in the Computer Setup utility. Select **Storage > Storage Options > eSATA Port** to reconfigure the SATA3 connector. Refer to the *Computer Setup (F10) Utility Guide* for more information.

- Connect a media card reader USB cable to the USB connector on the system board labeled MEDIA. If the media card reader has a 1394 port, connect the 1394 cable to the 1394 PCI card.
- The system does not support Parallel ATA (PATA) optical drives or PATA hard drives.
- You must install guide screws to ensure the drive will line up correctly in the drive cage and lock in place. HP has provided extra guide screws for the external drive bays (five 6-32 standard screws and four M3 metric screws), installed in the front of the chassis, under the front bezel. The 6-32 standard screws are required for a secondary hard drive. All other drives (except the primary hard drive) use M3 metric screws. The HP-supplied metric screws are black and the HP-supplied standard screws are silver. If you are replacing the primary hard drive, you must remove the four silver and blue 6-32 isolation mounting guide screws from the old hard drive and install them in the new hard drive.

**Figure 9-16** Extra Guide Screw Locations



No.	Guide Screw	Device
1	Black M3 Metric Screws	All Other Drives (except primary hard drive)
2	Silver 6-32 Standard Screws	Secondary Hard Drive

There are a total of five extra silver 6-32 standard screws. Four are used as guide screws for a secondary hard drive. The fifth is used for bezel security (see [Front Bezel Security on page 120](#) for more information).

---

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

If you are inserting or removing a drive, shut down the operating system properly, turn off the computer, and unplug the power cord. Do not remove a 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.

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.

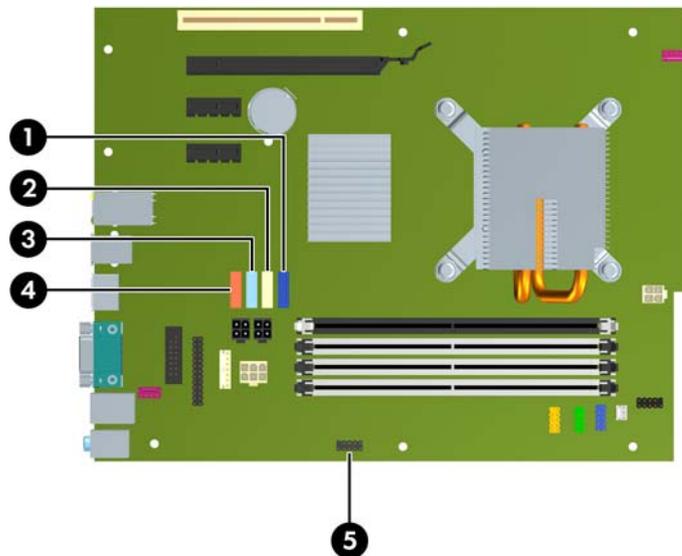
If a drive must be mailed, place the drive in a bubble-pack mailer or other protective packaging and label the package "Fragile: Handle With Care."

---

## System Board Drive Connections

Refer to the following illustration and table to identify the system board drive connectors.

**Figure 9-17** System Board Drive Connections



**Table 9-4** System Board Drive Connections

No.	System Board Connector	System Board Label	Color
1	SATA0	SATA0	dark blue
2	SATA1	SATA1	white
3	SATA2	SATA2	light blue
4	SATA3	SATA3	orange
5	Media Card Reader	MEDIA	black

**NOTE:** The orange SATA3 connector can be reconfigured as eSATA in the Computer Setup utility if you are installing an eSATA adapter. Select **Storage > Storage Options > eSATA Port** to reconfigure the SATA3 connector. Refer to the *Computer Setup (F10) Utility Guide* for more information.

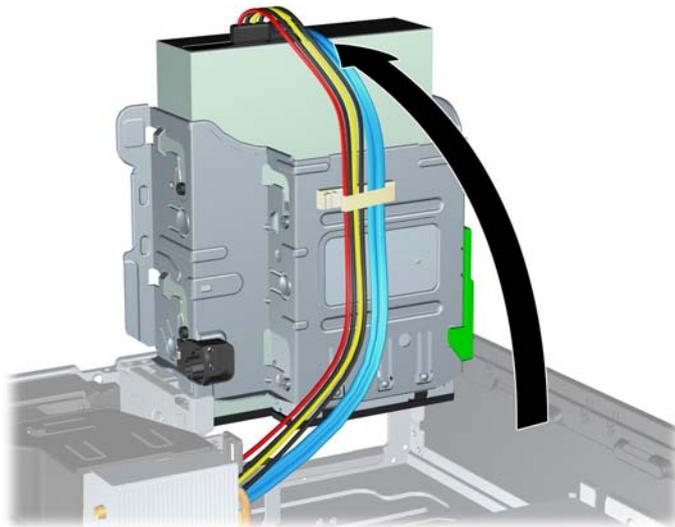
## Removing an External 5.25-inch Drive

- △ **CAUTION:** All removable media should be taken out of a drive before removing the drive from the computer.

To remove a 5.25-inch external drive:

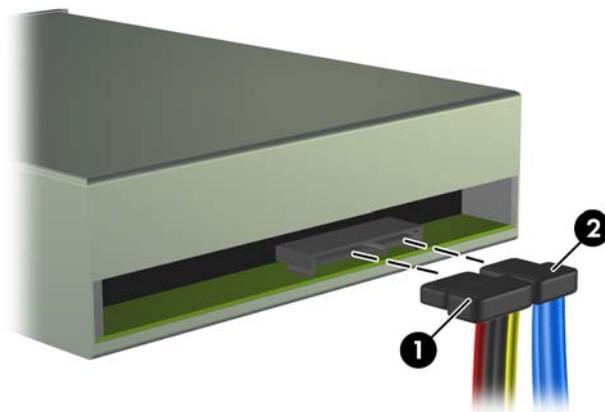
1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Remove the front bezel ([Bezel Blanks on page 125](#)).
4. Rotate the drive cage to its upright position.

**Figure 9-18** Rotating the Drive Cage Up



5. If removing an optical drive, disconnect the power cable (1) and data cable (2) from the rear of the optical drive.

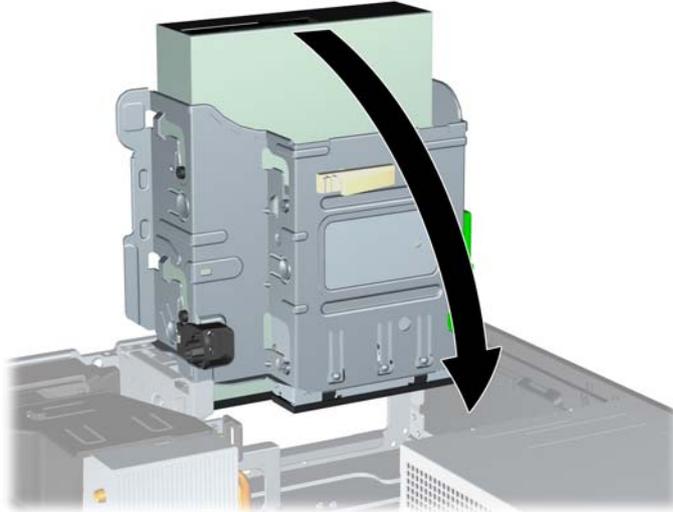
**Figure 9-19** Disconnecting the Power and Data Cables



6. Rotate the drive cage back down to its normal position.

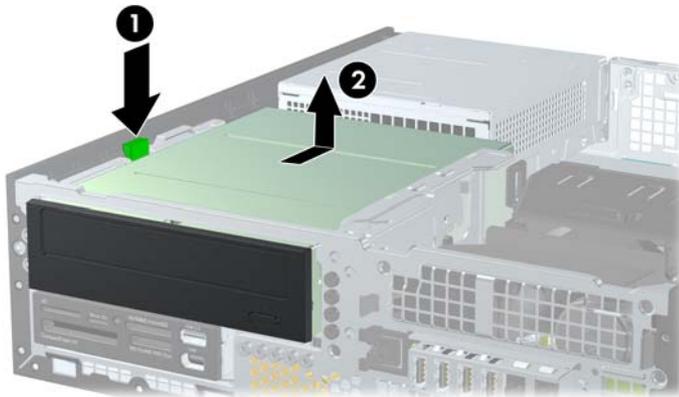
△ **CAUTION:** Be careful not to pinch any cables or wires when rotating the drive cage down.

**Figure 9-20** Rotating the Drive Cage Down



7. Press down on the green drive retainer button located on the left side of the drive to disengage the drive from the drive cage (1). While pressing the drive retainer button, slide the drive back until it stops, then lift it up and out of the drive cage (2).

**Figure 9-21** Removing the 5.25-inch Drive



📖 **NOTE:** To replace the drive, reverse the removal procedure. When replacing a drive, transfer the four guide screws from the old drive to the new one.

## Installing an Optical Drive into the 5.25-inch Drive Bay

To install an optional 5.25-inch optical drive:

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. If you are installing a drive in a bay covered by a bezel blank, remove the front bezel then remove the bezel blank. See [Bezel Blanks on page 125](#) for more information.

4. Install four M3 metric guide screws in the lower holes on each side of the drive. HP has provided four extra M3 metric guide screws on the front of the chassis, under the front bezel. The M3 metric guide screws are black. Refer to [Installing and Removing Drives on page 138](#) for an illustration of the extra M3 metric guide screws location.

△ **CAUTION:** Use only 5-mm long screws as guide screws. Longer screws can damage the internal components of the drive.

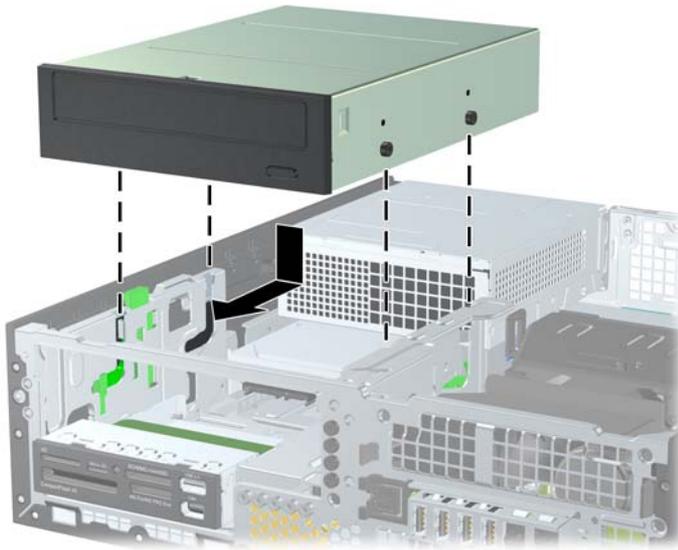
📝 **NOTE:** When replacing the drive, transfer the four M3 metric guide screws from the old drive to the new one.

**Figure 9-22** Installing Guide Screws in the Optical Drive



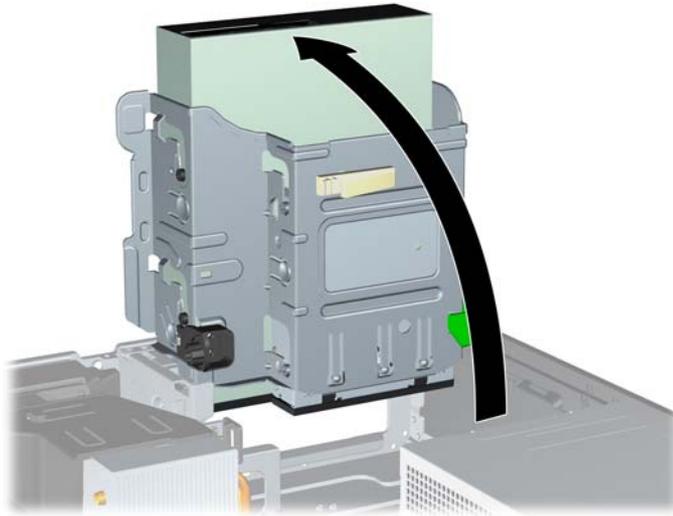
5. Position the guide screws on the drive into the J-slots in the drive bay. Then slide the drive toward the front of the computer until it locks into place.

**Figure 9-23** Installing the Optical Drive



6. Rotate the drive cage to its upright position.

**Figure 9-24** Rotating the Drive Cage Up



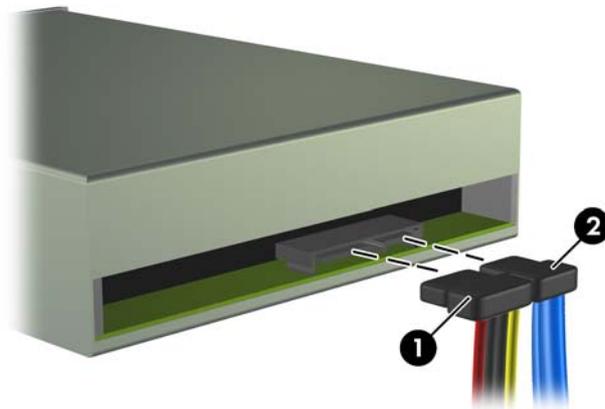
7. Connect the SATA data cable to the white system board connector labeled SATA1.

8. Route the data cable through the cable guides.

△ **CAUTION:** There are two cable guides that keep the data cable from being pinched by the drive cage when raising or lowering it. One is located on the bottom side of the drive cage. The other is located on the chassis frame under the drive cage. Ensure that the data cable is routed through these guides before connecting it to the optical drive.

9. Connect the power cable (1) and data cable (2) to the rear of the optical drive.

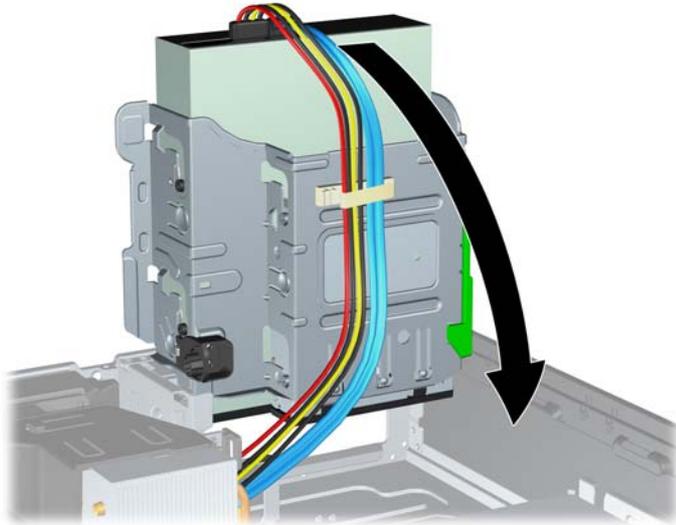
**Figure 9-25** Connecting the Power and Data Cables



10. Rotate the drive cage back down to its normal position.

△ **CAUTION:** Be careful not to pinch any cables or wires when rotating the drive cage down.

**Figure 9-26** Rotating the Drive Cage Down



The system automatically recognizes the drive and reconfigures the computer.

## Removing an External 3.5-inch Drive

△ **CAUTION:** All removable media should be taken out of a drive before removing the drive from the computer.

The 3.5-inch drive is located underneath the 5.25-inch drive. You must remove the external 5.25-inch drive before removing the external 3.5-inch drive.

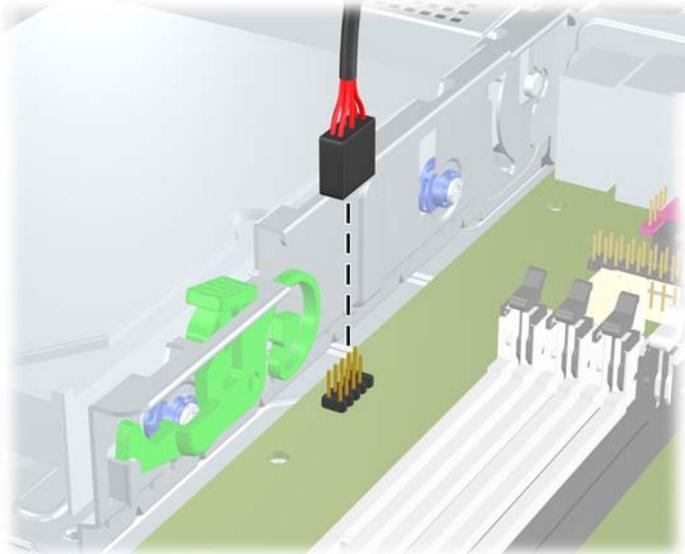
1. Follow the procedure in [Removing an External 5.25-inch Drive on page 141](#) to remove the 5.25-inch drive and access the 3.5-inch drive.

△ **CAUTION:** Ensure that the computer is turned off and that the power cord is disconnected from the electrical outlet before proceeding.

2. Disconnect the drive cables from the rear of the drive, or, if you are removing a media card reader, disconnect the USB and 1394 cables from the system board as indicated in the following illustrations.

 **NOTE:** On some models, the media card reader does not include a 1394 port or cable.

**Figure 9-27** Disconnecting the Media Card Reader USB Cable

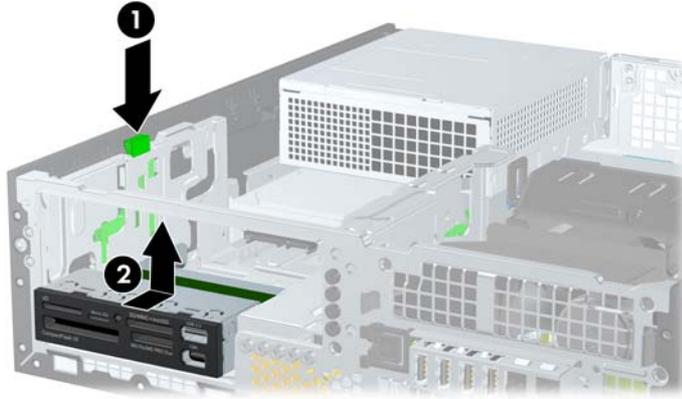


**Figure 9-28** Disconnecting the Media Card Reader 1394 Cable



3. Press down on the green drive retainer button located on the left side of the drive to disengage the drive from the drive cage (1). While pressing the drive retainer button, slide the drive back until it stops, then lift it up and out of the drive cage (2).

**Figure 9-29** Removing a 3.5-inch Drive (Media Card Reader Shown)



 **NOTE:** To replace the 3.5-inch drive, reverse the removal procedure.

When replacing a 3.5-inch drive, transfer the four guide screws from the old drive to the new one.

## Installing a Drive into the 3.5-inch External Drive Bay

The 3.5-inch bay is located underneath the 5.25-inch drive. To install a drive into the 3.5-inch bay:

 **NOTE:** Install guide screws to ensure the drive will line up correctly in the drive cage and lock in place. HP has provided extra guide screws for the external drive bays (four 6-32 standard screws and four M3 metric screws), installed in the front of the chassis, under the front bezel. A secondary hard drive uses 6-32 standard screws. All other drives (except the primary hard drive) use M3 metric screws. The HP-supplied M3 metric screws are black and the HP-supplied 6-32 standard screws are silver. Refer to [Installing and Removing Drives on page 138](#) for illustrations of the guide screw locations.

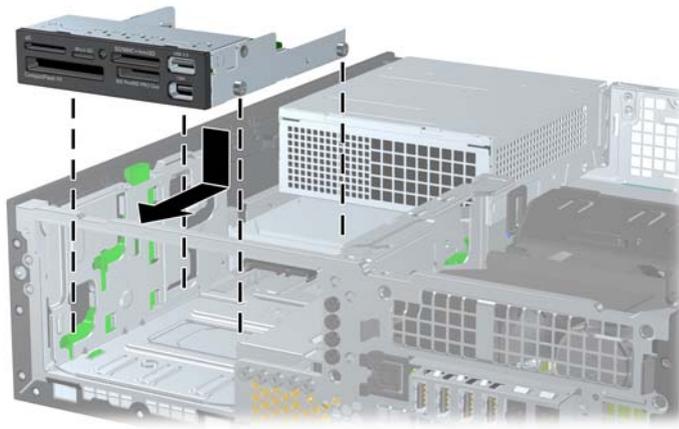
1. Follow the procedure in [Removing an External 5.25-inch Drive on page 141](#) to remove the 5.25-inch drive and access the 3.5-inch drive bay.

 **CAUTION:** Ensure that the computer is turned off and that the power cord is disconnected from the electrical outlet before proceeding.

2. If you are installing a drive in a bay covered by a bezel blank, remove the front bezel then remove the bezel blank. See [Bezel Blanks on page 125](#) for more information.

3. Position the guide screws on the drive into the J-slots in the drive bay. Then slide the drive toward the front of the computer until it locks into place.

**Figure 9-30** Installing a Drive into the 3.5-inch Drive Bay (Media Card Reader Shown)



4. Connect the appropriate drive cables:
  - a. If installing a second hard drive, connect the power and data cables to the rear of the drive and connect the other end of the data cable to the next available (unpopulated) SATA connector on the system board by following the numbered sequence of the connectors.
  - b. If installing a media card reader, connect the USB cable from the media card reader to the USB connector on the system board labeled MEDIA. If the media card reader includes a 1394 port, connect the 1394 cable to the 1394 PCI card.

---

 **NOTE:** Refer to [System Board Drive Connections on page 140](#) for an illustration of the system board drive connectors.

---

5. Replace the 5.25-inch drive.

## Removing and Replacing the Primary 3.5-inch Internal SATA Hard Drive

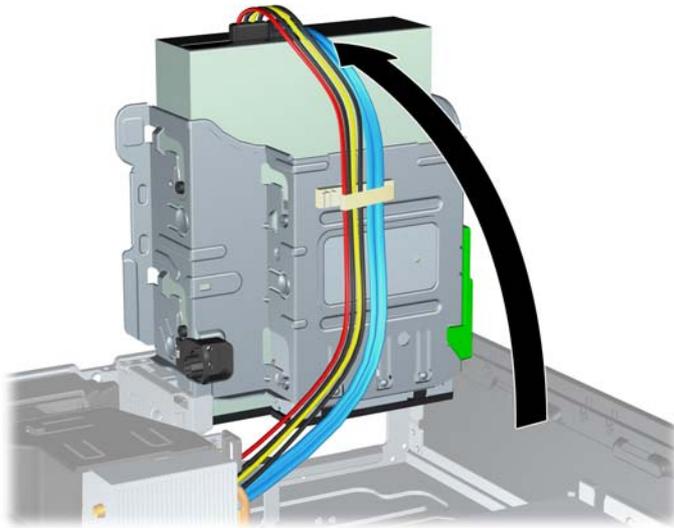
 **NOTE:** The system does not support Parallel ATA (PATA) hard drives.

Before you remove the old hard drive, be sure to back up the data from the old hard drive so that you can transfer the data to the new hard drive.

The preinstalled 3.5-inch hard drive is located under the power supply. To remove and replace the hard drive:

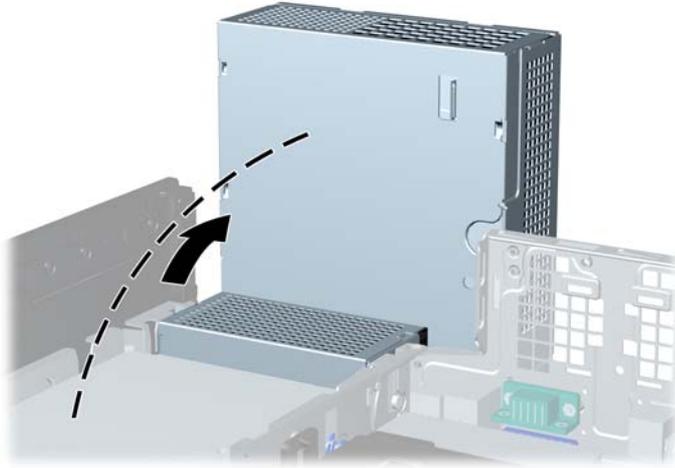
1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Rotate the drive cage for external drives to its upright position.

**Figure 9-31** Rotating the Drive Cage Up



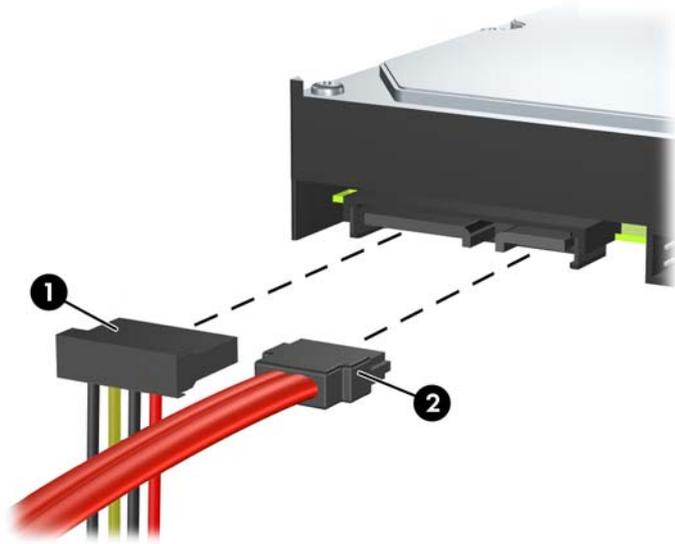
4. Rotate the power supply to its upright position. The hard drive is located beneath the power supply.

**Figure 9-32** Raising the Power Supply



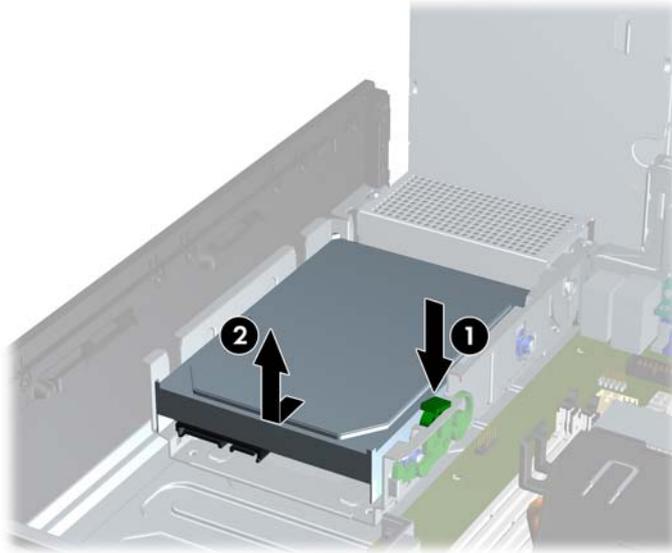
5. Disconnect the power cable (1) and data cable (2) from the back of the hard drive.

**Figure 9-33** Disconnecting the Hard Drive Power Cable and Data Cable



6. Press down on the green release latch next to the hard drive (1). While holding the latch down, slide the drive forward until it stops, then lift the drive up and out of the bay (2).

**Figure 9-34** Removing the Hard Drive



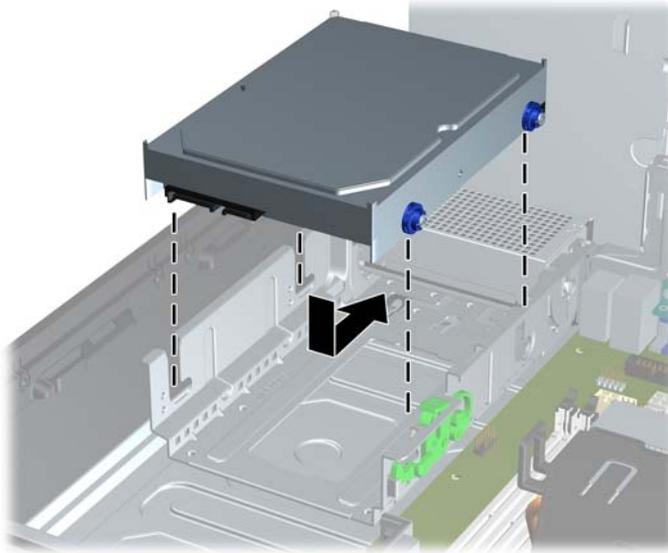
7. To install a hard drive, you must transfer the silver and blue isolation mounting guide screws from the old hard drive to the new hard drive.

**Figure 9-35** Installing Hard Drive Guide Screws



8. Align the guide screws with the slots on the chassis drive cage, press the hard drive down into the bay, then slide it back until it stops and locks in place.

**Figure 9-36** Installing the Hard Drive



9. Connect the power and data cables to the back of the hard drive.

 **NOTE:** When replacing the primary hard drive, be sure to route the SATA and power cables through the cable guide on the bottom of the chassis frame behind the hard drive.

If the system has only one SATA hard drive, the data cable must be connected to the dark blue connector labeled SATA0 on the system board to avoid any hard drive performance problems. If you are adding a second hard drive, connect the other end of the data cable to the next available (unpopulated) SATA connector on the system board in the following order: SATA0, SATA1, SATA2, SATA3.

10. Rotate the drive cage for external drives and the power supply down to their normal positions.

## Removing and Replacing a Removable 3.5-inch SATA Hard Drive

Some models are equipped with a Removable SATA Hard Drive Enclosure in the 5.25-inch external drive bay. The hard drive is housed in a carrier that can be quickly and easily removed from the drive bay. To remove and replace a drive in the carrier:

 **NOTE:** Before you remove the old hard drive, be sure to back up the data from the old hard drive so that you can transfer the data to the new hard drive.

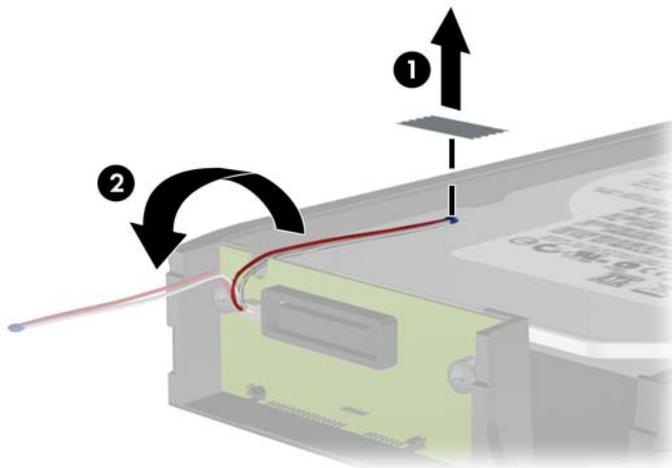
1. Unlock the hard drive carrier with the key provided and slide the carrier out of the enclosure.
2. Remove the screw from the rear of the carrier (1) and slide the top cover off the carrier (2).

**Figure 9-37** Removing the Carrier Cover



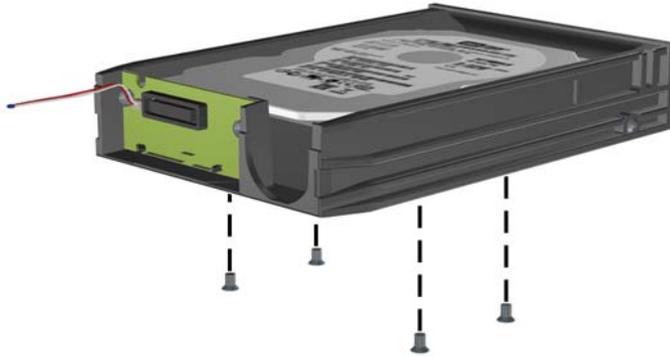
3. Remove the adhesive strip that secures the thermal sensor to the top of the hard drive (1) and move the thermal sensor away from the carrier (2).

**Figure 9-38** Removing the Thermal Sensor



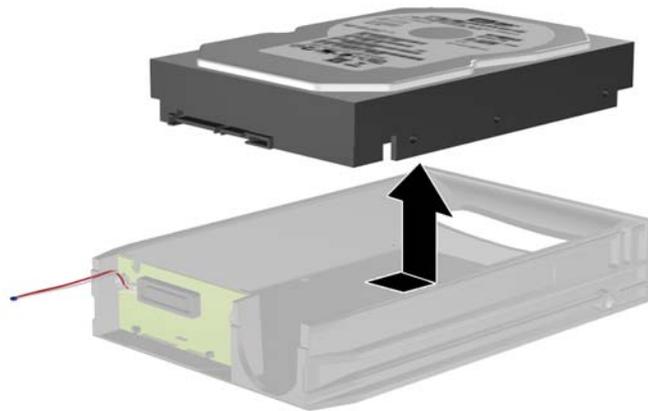
4. Remove the four screws from the bottom of the hard drive carrier.

**Figure 9-39** Removing the Security Screws



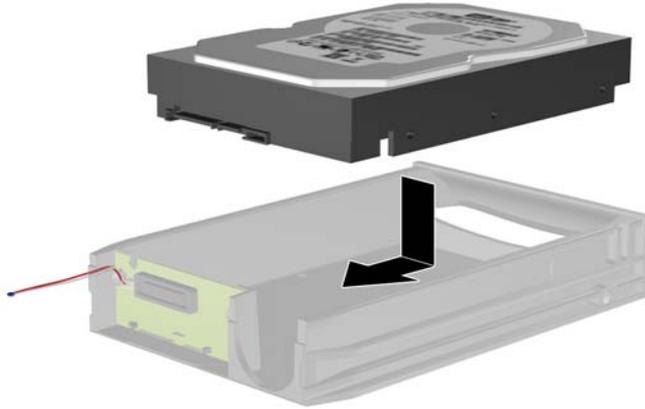
5. Slide the hard drive back to disconnect it from the carrier then lift it up and out of the carrier.

**Figure 9-40** Removing the Hard Drive



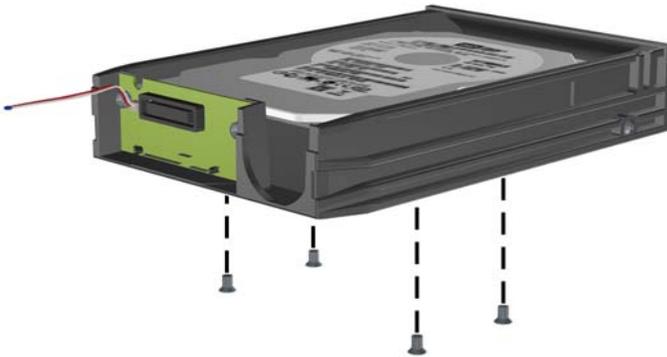
6. Place the new hard drive in the carrier then slide the hard drive back so that it seats in the SATA connector on the carrier's circuit board. Be sure the connector on the hard drive is pressed all the way into the connector on the carrier's circuit board.

**Figure 9-41** Replacing the Hard Drive



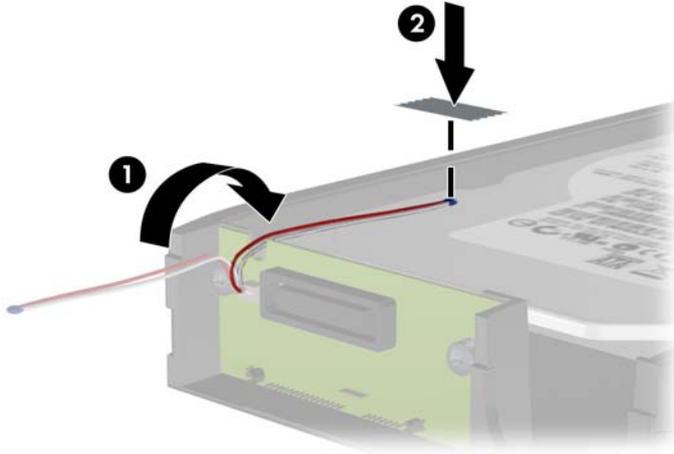
7. Replace the four screws in the bottom of the carrier to hold the drive securely in place.

**Figure 9-42** Replacing the Security Screws



- Place the thermal sensor on top of the hard drive in a position that does not cover the label (1) and attach the thermal sensor to the top of the hard drive with the adhesive strip (2).

**Figure 9-43** Replacing the Thermal Sensor



- Slide the cover on the carrier (1) and replace the screw on the rear of the carrier to secure the cover in place (2).

**Figure 9-44** Replacing the Carrier Cover



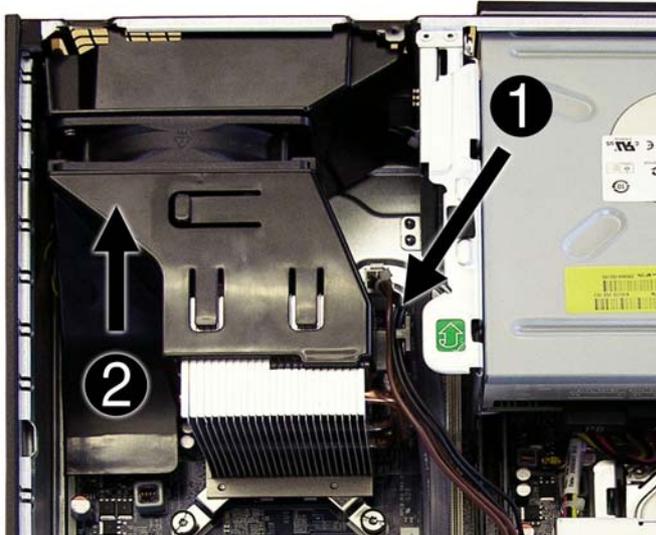
- Slide the hard drive carrier into the enclosure on the computer and lock it with the key provided.

 **NOTE:** The carrier must be locked for power to be supplied to the hard drive.

## Baffle

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Remove the cable from the arm that extends from the side of the baffle (1).
4. Lift the baffle straight up out of the chassis (2).

**Figure 9-45** Removing the baffle

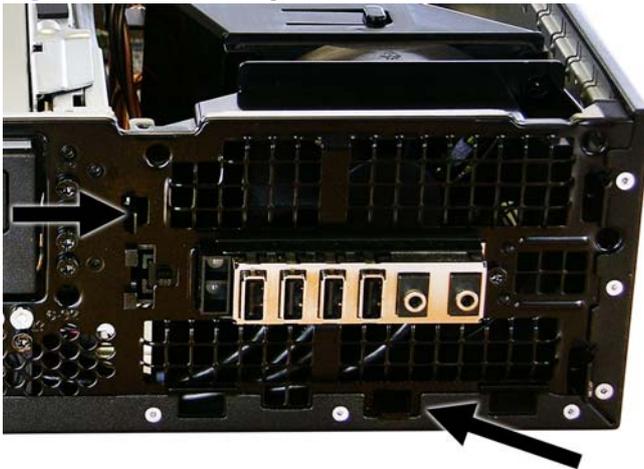


To install the baffle, reverse the removal procedure.

## Front Fan Assembly

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Remove the front bezel ([Front Bezel on page 124](#)).
4. Remove the baffle ([Baffle on page 157](#)).
5. Disconnect the fan cable from the system board (CH FAN1, P9).
6. On the front of the computer, press the left and bottom tabs to disengage the fan assembly from the chassis.

**Figure 9-46** Removing the chassis fan



7. Lift the assembly out of the chassis.

To install the chassis fan, reverse the removal procedure. Be sure to orient the air flow into the unit.

# Front I/O and Power Switch Assembly

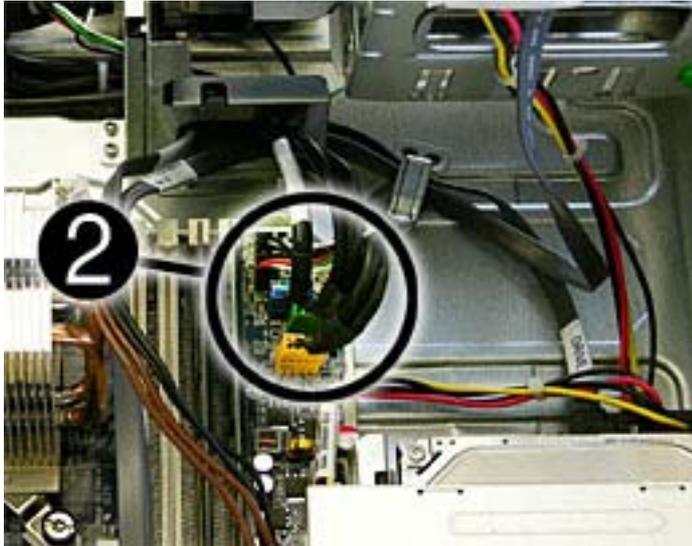
1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Remove the front bezel ([Front Bezel on page 124](#)).
4. Remove the front fan assembly ([Front Fan Assembly on page 158](#)).
5. Remove the black T15 screw **(1)** that secures the assembly to the chassis.

**Figure 9-47** Removing the front I/O device/power switch



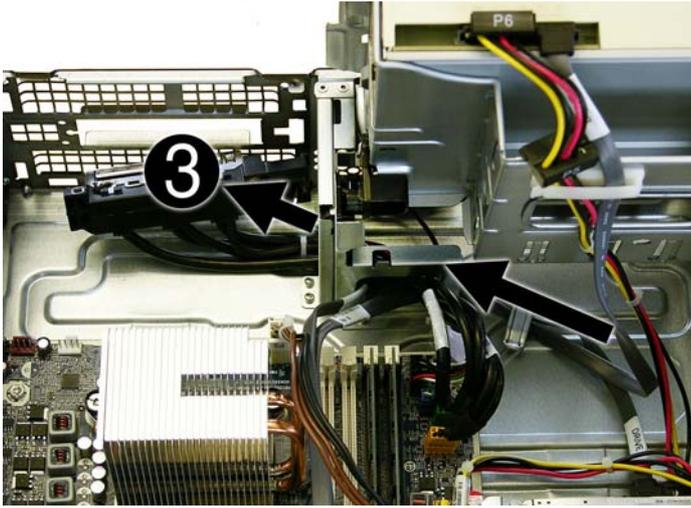
6. Rotate the drive cage to its upright position.
7. Disconnect the cables **(2)** from the system board.

**Figure 9-48** Disconnecting the cables from the system board



8. While holding the body of the assembly, pull the assembly away from the front of the chassis while guiding the cables through the hole in the drive cage (3).

**Figure 9-49** Guiding the wires through the drive cage



9. Remove the assembly from the chassis.

To reinstall the front I/O/power supply assembly, reverse the removal procedure.

## Speaker

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Remove the front bezel ([Front Bezel on page 124](#)).
4. Rotate the drive cage to its upright position.
5. Disconnect the speaker wire from the system board (SPKR, P5).
6. Remove the two black T15 screws that secure the speaker to the chassis.

**Figure 9-50** Removing the speaker

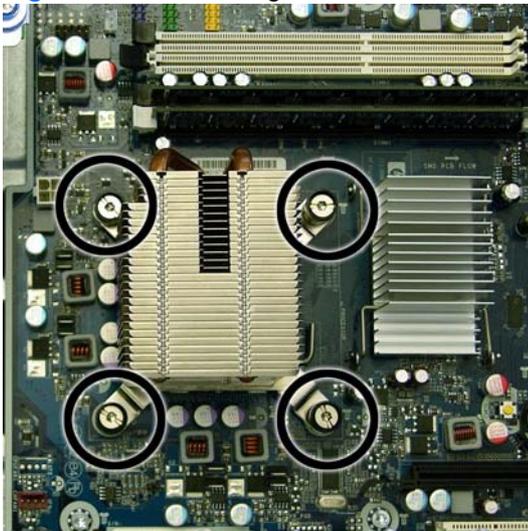


7. Lift the speaker from the inside of the chassis to remove it.
- To install the speaker, reverse the removal procedures.

## Heat sink

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Remove the baffle ([Baffle on page 157](#)).
4. Remove the front fan assembly ([Front Fan Assembly on page 158](#)).
5. Loosen the four captive screws that secure the heat sink to the system board tray.
  - △ **CAUTION:** Heat sink 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 heat sink from atop the processor and set it on its side to keep from contaminating the work area with thermal grease.

**Figure 9-51** Removing the heat sink



When reinstalling the heat sink, 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:** Heat sink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heat sink on the processor to avoid damage that could require replacing the system board.

Failure to install the fan shroud may cause the computer to overheat.

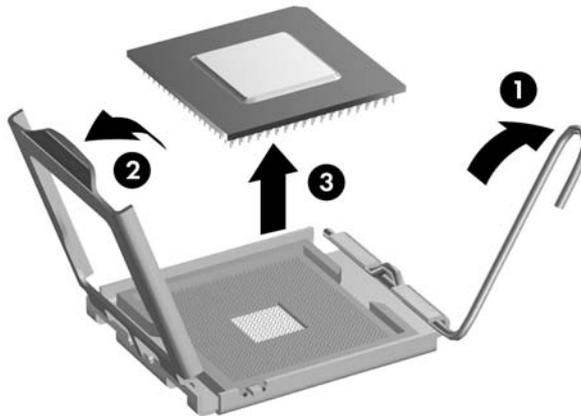
# Processor

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Remove the fan shroud ([Baffle on page 157](#)).
4. Remove the heat sink ([Heat sink on page 162](#)).
5. Rotate the locking lever to its full open position **(1)**.
6. Raise and rotate the microprocessor retainer to its fully open position **(2)**.
7. Carefully lift the processor from the socket **(3)**.

△ **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.

The heat sink must be installed within 24 hours of installing the processor to prevent damage to the processor's solder connections.

**Figure 9-52** Removing the processor



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 heat sink, go to step 3. If using a new heat sink, go to step 6.
3. If reusing the existing heat sink, clean the bottom of the heat sink with the alcohol pad provided in the spares kit.

△ **CAUTION:** Before reinstalling the heat sink you must clean the top of the processor and the bottom of the heat sink with an alcohol pad supplied in the spares kit. After the alcohol has evaporated, apply thermal grease to the top of the processor from the syringe supplied in the spares kit.

4. Apply the thermal grease provided in the spares kit to the top of the processor and install the heat sink atop the processor.
5. Go to step 7.
6. If using a new heat sink, remove the protective covering from the bottom of the heat sink and place it in position atop the processor.
7. Secure the heat sink to the system board and system board tray with the four captive screws and attach the heat sink control cable to the system board.

△ **CAUTION:** Heat sink retaining screws should be tightened in diagonally opposite pairs (as in an X) to evenly seat the heat sink 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.

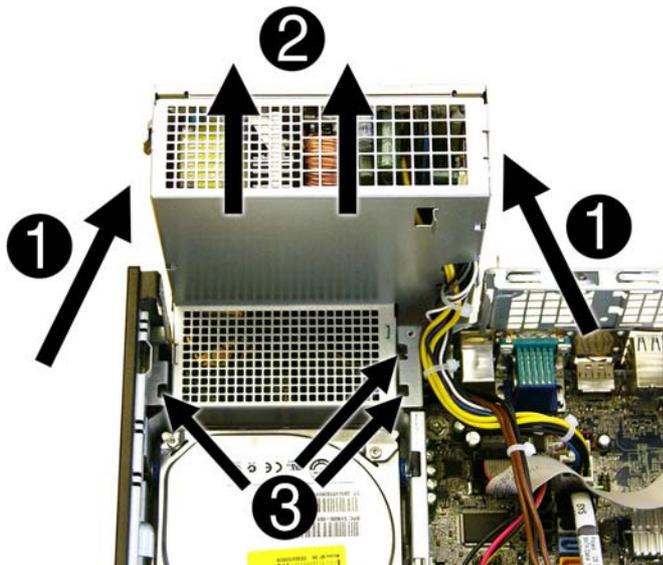
📄 **NOTE:** After installing a new processor onto the system board, always update the system ROM to ensure that the latest version of the BIOS is being used on the computer. The latest system BIOS can be found on the Web at: <http://h18000.www1.hp.com/support/files>.

## 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 ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Rotate the drive cage up and disconnect the power cables from all of the drives.
4. Disconnect the power cables from the system board.
5. Rotate the power supply to its full upright position (1), pull the power supply forward (2) until the posts on the power supply move forward in the power supply bracket (3), and then lift the power supply straight up and out of the chassis.

**Figure 9-53** Removing the power supply



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.

## System Board

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Remove all PCI and PCI Express expansion boards ([Expansion Cards on page 130](#)).
4. Remove the baffle from the chassis ([Baffle on page 157](#)).
5. Remove the fan from the chassis ([Front Fan Assembly on page 158](#)).
6. Rotate the drive cage to its upright position.
7. Rotate the power supply to its full upright position.
8. Disconnect all data and power cables from the system board.
9. If applicable, disconnect the serial port from the system board.
10. Disconnect the balance of the cables from the system board.
11. Remove the heat sink ([Heat sink on page 162](#)).
12. Remove the eight screws that secure the system board to the chassis.

**Figure 9-54** Removing the system board



13. Lift up the front of the system board, and then pull the system board forward, up, and out of the chassis.

To install the system board, reverse the removal procedure.

📝 **NOTE:** When replacing the system board, you must also change the chassis serial number in the BIOS.

**NOTE:** The heat sink should be installed on the system board before the system board is reinstalled in the chassis.

△ **CAUTION:** Before reinstalling the heat sink you must clean the top of the processor and the bottom of the heat sink with an alcohol pad supplied in the spares kit. After the alcohol has evaporated, apply thermal grease to the top of the processor from the syringe supplied in the spares kit.

**CAUTION:** When reconnecting the cables it is important that they be positioned so they do not interfere with the rotation of the drive cage or power supply.

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## Battery

The battery that comes with your 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.

 **NOTE:** 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 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 *Computer Setup (F10) Utility Guide* for information on backing up the CMOS settings.

 **NOTE:** HP encourages customers to recycle used electronic hardware, HP original print cartridges, and rechargeable batteries. For more information about recycling programs, go to <http://www.hp.com/recycle>.

△ **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.

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1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).

2. Remove the access panel ([Access Panel on page 123](#)).

 **NOTE:** It may be necessary to remove an expansion card to gain access to the battery.

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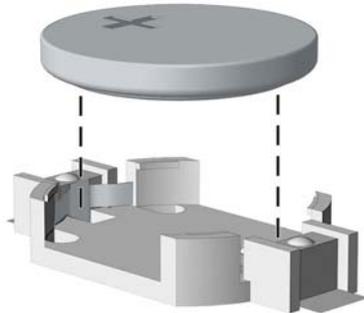
3. Locate the battery and battery holder on the system board.

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

## Type 1 Battery Holder

1. Lift the battery out of its holder.

**Figure 9-55** Removing the battery from a type 1 holder

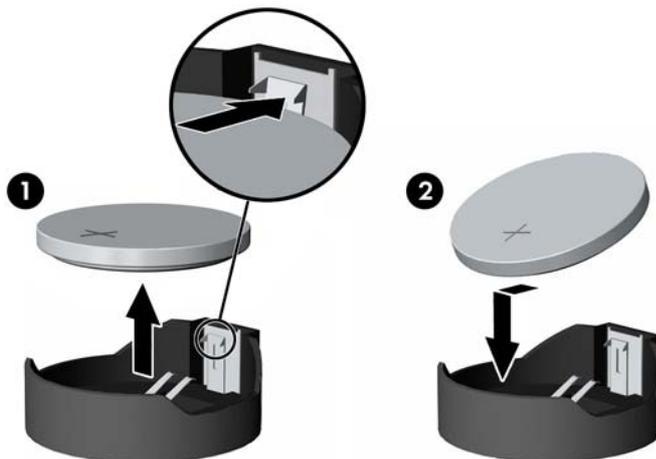


2. Slide the replacement battery into position, positive side up.
3. The battery holder automatically secures the battery in the proper position.
4. Replace the computer access panel.
5. Plug in the computer and turn on power to the computer.
6. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

## 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 (1).
2. To insert the new battery, slide one edge of the replacement battery under the holder's lip with the positive side up (2). Push the other edge down until the clamp snaps over the other edge of the battery.

**Figure 9-56** Removing the battery from a type 2 holder



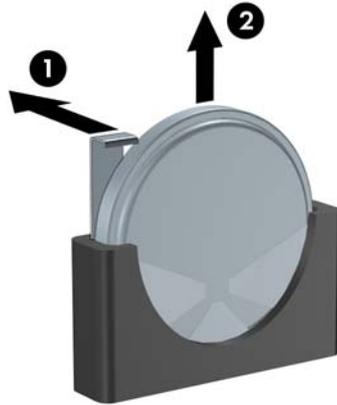
3. Replace the computer access panel.

4. Plug in the computer and turn on power to the computer.
5. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

### Type 3 Battery Holder

1. Pull back on the clip (1) that holds the battery in place, then remove the battery (2).
2. Insert the new battery and position the clip back in place.

**Figure 9-57** Removing the battery from a type 3 holder



3. Replace the computer access panel.
4. Plug in the computer and turn on power to the computer.
5. Reset the date and time, your passwords, and any special system setups, using Computer Setup. Refer to the *Computer Setup (F10) Utility Guide*.

## External Security Devices

The following security devices are used to prevent unauthorized access to the internal components of the computer and/or secure the computer to a fixed object.

 **NOTE:** For information on data security features, refer to the *Computer Setup (F10) Utility Guide*, the *Desktop Management Guide*, and the *HP ProtectTools Security Manager Guide* (some models) at <http://www.hp.com>.

### Installing a Security Lock

The security locks displayed below and on the following pages can be used to secure the computer.

#### Cable Lock

**Figure 9-58** Installing a Cable Lock



## Padlock

**Figure 9-59** Installing a Padlock



## HP Business PC Security Lock

1. Fasten the security cable by looping it around a stationary object.

**Figure 9-60** Securing the Cable to a Fixed Object



2. Thread the keyboard and mouse cables through the lock.

**Figure 9-61** Threading the Keyboard and Mouse Cables



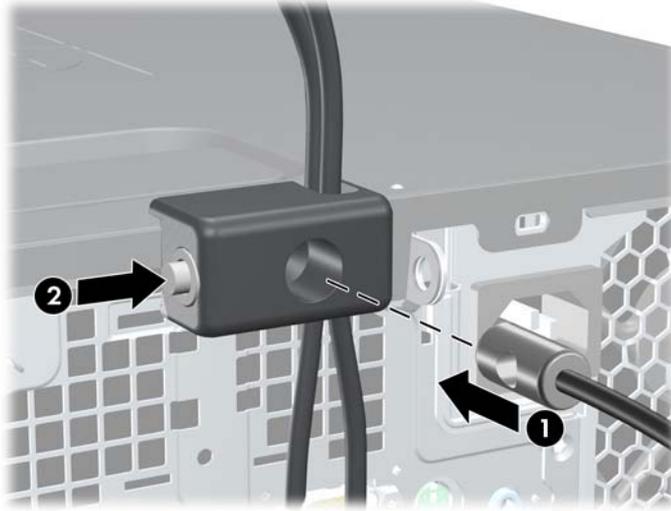
3. Screw the lock to the chassis using the screw provided.

**Figure 9-62** Attaching the Lock to the Chassis



4. Insert the plug end of the security cable into the lock (1) and push the button in (2) to engage the lock. Use the key provided to disengage the lock.

**Figure 9-63** Engaging the Lock

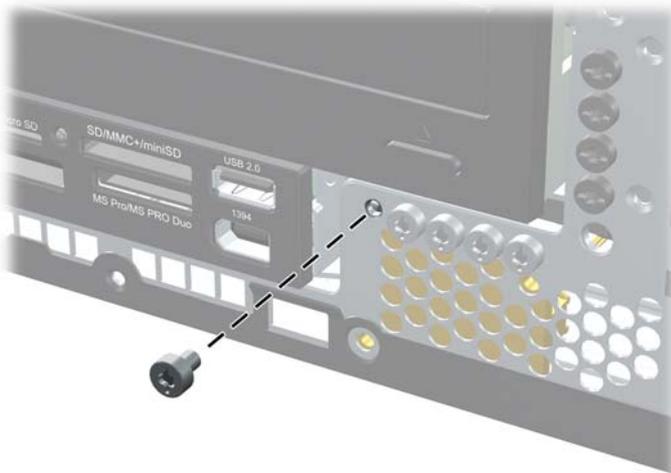


## Front Bezel Security

The front bezel can be locked in place by installing a security screw provided by HP. To install the security screw:

1. Prepare the computer for disassembly ([Preparation for Disassembly on page 122](#)).
2. Remove the access panel ([Access Panel on page 123](#)).
3. Remove the front bezel ([Front Bezel on page 124](#)).
4. Remove one of the five silver 6-32 standard screws located on the front of the chassis behind the bezel.

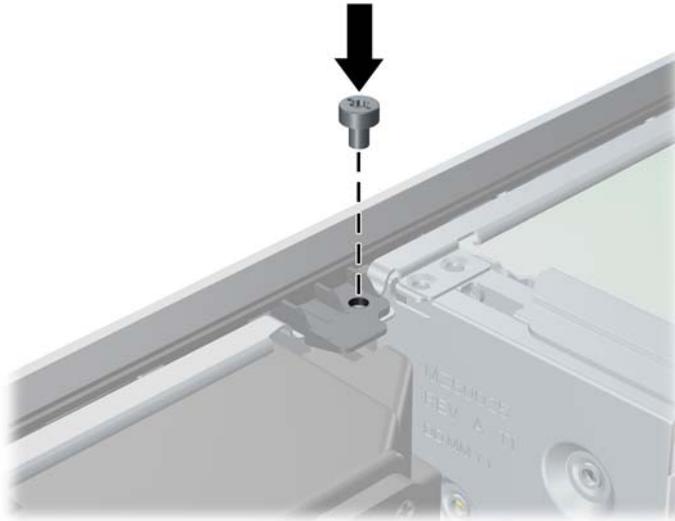
**Figure 9-64** Retrieving the Front Bezel Security Screw



5. Replace the front bezel.

6. Install the security screw next to the middle front bezel release tab to secure the front bezel in place.

**Figure 9-65** Installing the Front Bezel Security Screw



7. Replace the access panel.

# Using the Small Form Factor Computer in a Tower Orientation

The Small Form Factor computer can be used in a tower orientation with an optional tower stand that can be purchased from HP.

1. Remove/disengage any security devices that prohibit opening the computer.
2. Remove all removable media, such as compact discs or USB flash drives, from the computer.
3. Turn off the computer properly through the operating system, then turn off any external devices.
4. Disconnect the power cord from the power outlet and disconnect any external devices.

△ **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. You must disconnect the power cord to avoid damage to the internal components of the computer.

5. Orient the computer so that its right side is facing down and place the computer in the optional stand.

**Figure 9-66** Changing from Desktop to Tower Orientation



📄 **NOTE:** To stabilize the computer in a tower orientation, HP recommends the use of the optional tower stand.

6. Reconnect the power cord and any external devices, then turn on the computer.

📄 **NOTE:** Ensure at least 10.2 centimeters (4 inches) of space on all sides of the computer remains clear and free of obstructions.

# 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.

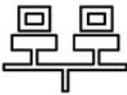
## Keyboard

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

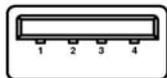
## Ethernet RJ-45

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

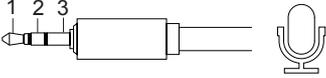
## Serial Interface, Powered and Non-Powered

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)

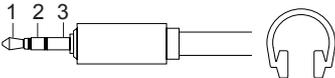
## USB

Connector and Icon	Pin	Signal
 	1	+5 VDC
	2	- Data
	3	+ Data
	4	Ground

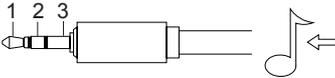
## Microphone

Connector and Icon (1/8" miniphone)	Pin	Signal
	1 (Tip)	Audio_left
	2 (Ring)	Audio_Right
	3 (Shield)	Ground

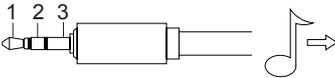
## Headphone

Connector and Icon (1/8" miniphone)	Pin	Signal
	1 (Tip)	Audio_left
	2 (Ring)	Power_Right
	3 (Shield)	Ground

## Line-in Audio

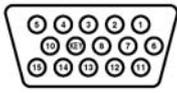
Connector and Icon (1/8" miniphone)	Pin	Signal
	1 (Tip)	Audio_In_Left
	2 (Ring)	Audio_In_Right
	3 (Shield)	Ground

## Line-out Audio

Connector and Icon (1/8" miniphone)	Pin	Signal
	1 (Tip)	Audio_Out_Left
	2 (Ring)	Audio_Out_Right
	3 (Shield)	Ground

# Monitor

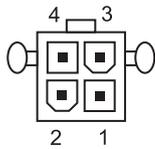
## Connector and Icon



Pin	Signal	Pin	Signal
1	Red Analog	9	+5V (fused)
2	Green Analog	10	Ground
3	Blue Analog	11	Not used
4	Not used	12	DDC Serial Data
5	Ground	13	Horizontal Sync
6	Ground	14	Vertical Sync
7	Ground	15	DDC Serial Clock
8	Ground		

# 4-Pin Power (for CPU)

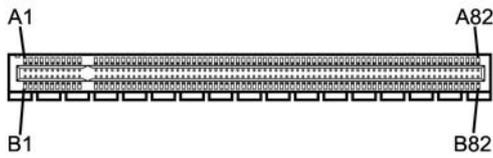
## Connector and Icon



Pin	Signal
1	GND
2	GND
3	+12V CPU
4	-12V CPU

# 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

**NOTE:** x1 PCI Express uses pins 1-18

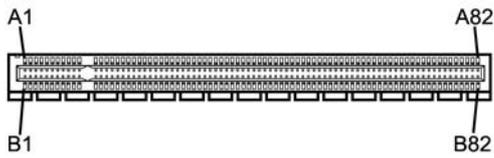
x4 PCI Express uses pins 1-32

x8 PCI Express uses pins 1-49

x16 PCI Express uses pins 1-8

# 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	GND	22	GND
3	RSVD	8	+3.3 V	13	GND	18	PETp1	23	PETp2
4	GND	9	JTAG1	14	PETp0	19	PETn1	24	PETn2
5	SMCLK	10	3.3vAux	15	PETn0	20		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								

Pin B information is on the next page

**NOTE:** x1 PCI Express uses pins 1-18

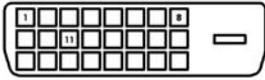
x4 PCI Express uses pins 1-32

x8 PCI Express uses pins 1-49

x16 PCI Express uses pins 1-8

# DVI Connector

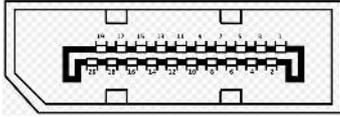
## Connector and Icon



Pin	Signal	Pin	Signal
1	T.M.D.S. Data2-	13	T.M.D.S. Data3+
2	T.M.D.S. Data2+	14	+5V Power
3	T.M.D.S. Data2/4 Shield	15	Ground (for +5V)
4	T.M.D.S. Data4-	16	Hot Pug Detect
5	T.M.D.S. Data4+	17	T.M.D.S. Data0-
6	DDC Clock	18	T.M.D.S. Data0+
7	DDC Data	19	T.M.D.S. Data0/5 Shield
8	No Connect	20	T.M.D.S. Data5-
9	T.M.D.S. Data1-	21	T.M.D.S. Data5+
10	T.M.D.S. Data1+	22	T.M.D.S. Data Shield
11	T.M.D.S. Data1/3 Shield	23	T.M.D.S. Clock+
12	T.M.D.S. Data3-	24	T.M.D.S. Clock-

# DisplayPort Connector

## Connector and Icon



Pin	Signal	Pin	Signal
1	ML_Lane 0 (p)	13	CONFIG1
2	Ground	14	CONFIG2
3	ML_Lane 0 (n)	15	AUX CH (p)
4	ML_Lane 1 (p)	16	Ground
5	Ground	17	AUX CH (n)
6	ML_Lane 1 (n)	18	Hot Plug
7	ML_Lane 2 (p)	19	Return
8	Ground	20	DP_PWR
9	ML_Lane 2 (n)		
10	ML_Lane 3 (p)		
11	Ground		
12	ML_Lane 3 (n)		

---

## B Power Cord Set Requirements

The power supplies on some computers have external power switches. The voltage select switch feature on the computer permits it to operate from any line voltage between 100-120 or 220-240 volts AC. Power supplies on those computers that do not have external power switches are equipped with internal switches that sense the incoming voltage and automatically switch to the proper voltage.

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.

### General Requirements

The requirements listed below are applicable to all countries:

1. The power cord must be approved by an acceptable accredited agency responsible for evaluation in the country where the power cord set will be installed.
2. The power cord set must have a minimum current capacity of 10A (7A Japan only) and a nominal voltage rating of 125 or 250 volts AC, as required by each country's power system.
3. The diameter of the wire must be a minimum of 0.75 mm<sup>2</sup> or 18AWG, and the length of the cord must be between 1.8 m (6 feet) and 3.6 m (12 feet).

The power cord should be routed so that it is not likely to be walked on or pinched by items placed upon it or against it. Particular attention should be paid to the plug, electrical outlet, and the point where the cord exits from the product.

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△ **WARNING!** Do not operate this product with a damaged power cord set. If the power cord set is damaged in any manner, replace it immediately.

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### Japanese Power Cord Requirements

For use in Japan, use only the power cord received with this product.

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△ **CAUTION:** Do not use the power cord received with this product on any other products.

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## 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 Type HO5VV-F, 3-conductor, 0.75mm<sup>2</sup> 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 SVT 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, 0.75 mm<sup>2</sup> conductor size. Wall plug must be a two-pole grounding type with a Japanese Industrial Standard C8303 (7A, 125V) configuration.

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## C POST Error Messages

This appendix lists the error codes, error messages, and the various indicator light and audible sequences that you may encounter during Power-On Self-Test (POST) or computer restart, the probable source of the problem, and steps you can take to resolve the error condition.

POST Message Disabled suppresses most system messages during POST, such as memory count and non-error text messages. If a POST error occurs, the screen will display the error message. To manually switch to the POST Messages Enabled mode during POST, press any key (except **F10** or **F12**). The default mode is POST Message Disabled.

The speed at which the computer loads the operating system and the extent to which it is tested are determined by the POST mode selection.

Quick Boot is a fast startup process that does not run all of the system level tests, such as the memory test. Full Boot runs all of the ROM-based system tests and takes longer to complete.

Full Boot may also be enabled to run every 1 to 30 days on a regularly scheduled basis. To establish the schedule, reconfigure the computer to the Full Boot Every x Days mode, using Computer Setup.

---

 **NOTE:** For more information on Computer Setup, see the *Computer Setup (F10) Utility Guide*.

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# POST Numeric Codes and Text Messages

This section covers those POST errors that have numeric codes associated with them. The section also includes some text messages that may be encountered during POST.

 **NOTE:** The computer will beep once after a POST text message is displayed on the screen.

**Table C-1 Numeric Codes and Text Messages**

Control panel message	Description	Recommended action
101-Option ROM Checksum Error	System ROM or expansion board option ROM checksum.	<ol style="list-style-type: none"> <li>1. Verify the correct ROM.</li> <li>2. Flash the ROM if needed.</li> <li>3. If an expansion board was recently added, remove it to see if the problem remains.</li> <li>4. Clear CMOS. (See Appendix B, <a href="#">Password Security and Resetting CMOS on page 233.</a>)</li> <li>5. If the message disappears, there may be a problem with the expansion card.</li> <li>6. Replace the system board.</li> </ol>
103-System Board Failure	DMA or timers.	<ol style="list-style-type: none"> <li>1. Clear CMOS. (See Appendix B, <a href="#">Password Security and Resetting CMOS on page 233.</a>)</li> <li>2. Remove expansion boards.</li> <li>3. Replace the system board.</li> </ol>
110-Out of Memory Space for Option ROMs	Recently added PCI expansion card contains an option ROM too large to download during POST.	<ol style="list-style-type: none"> <li>1. If a PCI expansion card was recently added, remove it to see if the problem remains.</li> <li>2. In Computer Setup, set <b>Advanced &gt; Device Options &gt; NIC PXE Option ROM Download</b> to <b>DISABLE</b> 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.</li> </ol>
162-System Options Not Set	<p>Configuration incorrect.</p> <p>RTC (real-time clock) battery may need to be replaced.</p>	<p>Run Computer Setup and check the configuration in <b>Advanced &gt; Onboard Devices</b>.</p> <p>Reset the date and time under <b>Control Panel</b>. If the problem persists, replace the RTC battery. See the <i>Hardware Reference Guide</i> for instructions on installing a new battery, or contact an authorized dealer or reseller for RTC battery replacement.</p>

**Table C-1 Numeric Codes and Text Messages (continued)**

Control panel message	Description	Recommended action
163-Time & Date Not Set	Invalid time or date in configuration memory. RTC (real-time clock) battery may need to be replaced.	Reset the date and time under <b>Control Panel</b> (Computer Setup can also be used). If the problem persists, replace the RTC battery. See the <i>Hardware Reference Guide</i> for instructions on installing a new battery, or contact an authorized dealer or reseller for RTC battery replacement.
163-Time & Date Not Set	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 <b>F1</b> key to save the memory changes.
164-Memory Size Error	Memory configuration incorrect.	<ol style="list-style-type: none"><li>1. Run Computer Setup or Windows utilities.</li><li>2. Make sure the memory module(s) are installed properly.</li><li>3. If third-party memory has been added, test using HP-only memory.</li><li>4. Verify proper memory module type.</li></ol>
201-Memory Error	RAM failure.	<ol style="list-style-type: none"><li>1. Ensure memory modules are correctly installed.</li><li>2. Verify proper memory module type.</li><li>3. Remove and replace the identified faulty memory module(s).</li><li>4. If the error persists after replacing memory modules, replace the system board.</li></ol>
213-Incompatible Memory Module in Memory Socket(s) X, X, ...	A memory module in memory socket identified in the error message is missing critical SPD information, or is incompatible with the chipset.	<ol style="list-style-type: none"><li>1. Verify proper memory module type.</li><li>2. Try another memory socket.</li><li>3. Replace DIMM with a module conforming to the SPD standard.</li></ol>
214-DIMM Configuration Warning	Populated DIMM Configuration is not optimized.	Rearrange the DIMMs so that each channel has the same amount of memory.
215-DIMM Configuration Error	Populated DIMM configuration is not optimized.	Remove power from the system and reinstall memory modules. On AMD systems, populate modules starting with slot XMM4, then XMM3, followed by slots XMM2 and XMM1. On Intel systems, populate modules starting with slot DIMM1, then DIMM3, followed by slots DIMM2 and DIMM4.
219-ECC Memory Module Detected ECC Modules not supported on this Platform	Recently added memory module(s) support ECC memory error correction.	<ol style="list-style-type: none"><li>1. If additional memory was recently added, remove it to see if the problem remains.</li><li>2. Check product documentation for memory support information.</li></ol>

**Table C-1 Numeric Codes and Text Messages (continued)**

Control panel message	Description	Recommended action
301-Keyboard Error	Keyboard failure.	<ol style="list-style-type: none"><li>1. Reconnect keyboard with computer turned off.</li><li>2. Check connector for bent or missing pins.</li><li>3. Ensure that none of the keys are depressed.</li><li>4. Replace keyboard.</li></ol>
303-Keyboard Controller Error	I/O board keyboard controller.	<ol style="list-style-type: none"><li>1. Reconnect keyboard with computer turned off.</li><li>2. Replace the system board.</li></ol>
304-Keyboard or System Unit Error	Keyboard failure.	<ol style="list-style-type: none"><li>1. Reconnect the keyboard with computer turned off.</li><li>2. Ensure that none of the keys are depressed.</li><li>3. Replace the keyboard.</li><li>4. Replace the system board.</li></ol>
501-Display Adapter Failure	Graphics display controller.	<ol style="list-style-type: none"><li>1. Reseat the graphics card (if applicable).</li><li>2. Clear CMOS. (See Appendix B, <a href="#">Password Security and Resetting CMOS on page 233.</a>)</li><li>3. Verify monitor is attached and turned on.</li><li>4. Replace the graphics card (if possible).</li></ol>
510-Flash Screen Image Corrupted	Flash Screen image has errors.	Reflash the system ROM with the latest BIOS image.
511-CPU Fan not detected	CPU fan is not connected or may have malfunctioned.	<ol style="list-style-type: none"><li>1. Reseat CPU fan.</li><li>2. Reseat fan cable.</li><li>3. Replace CPU fan.</li></ol>
512-Rear Chassis Fan not detected	Rear chassis fan is not connected or may have malfunctioned.	<ol style="list-style-type: none"><li>1. Reseat rear chassis fan.</li><li>2. Reseat fan cable.</li><li>3. Replace rear chassis fan.</li></ol>
513-Front Chassis Fan not detected	Front chassis fan is not connected or may have malfunctioned.	<ol style="list-style-type: none"><li>1. Reseat front chassis fan.</li><li>2. Reseat fan cable.</li><li>3. Replace front chassis fan.</li></ol>
515-Power Supply Fan not detected	Power supply fan is not connected or may have malfunctioned.	<ol style="list-style-type: none"><li>1. Reseat power supply fan.</li><li>2. Reseat fan cable.</li><li>3. Replace power supply fan.</li></ol>

**Table C-1 Numeric Codes and Text Messages (continued)**

Control panel message	Description	Recommended action
605-Diskette Drive Type Error	Mismatch in drive type.	<ol style="list-style-type: none"> <li>1. Disconnect any other diskette controller devices (tape drives).</li> <li>2. Clear CMOS. (See Appendix B, <a href="#">Password Security and Resetting CMOS on page 233.</a>)</li> </ol>
660-Display cache is detected unreliable	Integrated graphics controller display cache is not working properly and will be disabled.	Replace system board if minimal graphics degrading is an issue.
912-Computer Cover Has Been Removed Since Last System Startup	Computer cover was removed since last system startup.	No action required.
917-Front Audio Not Connected	Front audio harness has been detached or unseated from motherboard.	Reconnect or replace front audio harness.
921-Front USB 1 Not Connected	Front USB harness has been detached or unseated from motherboard.	Reconnect or replace front USB harness.
922-Front USB 1 Not Connected	Front USB harness has been detached or unseated from motherboard.	Reconnect or replace front USB harness.
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
1151-Serial Port A Address Conflict Detected	Both external and internal serial ports are assigned to COM1.	<ol style="list-style-type: none"> <li>1. Remove any serial port expansion cards.</li> <li>2. Clear CMOS. (See Appendix B, <a href="#">Password Security and Resetting CMOS on page 233.</a>)</li> <li>3. Reconfigure card resources and/or run Computer Setup or Windows utilities.</li> </ol>
1152-Serial Port B Address Conflict Detected	Both external and internal serial ports are assigned to COM2.	<ol style="list-style-type: none"> <li>1. Remove any serial port expansion cards.</li> <li>2. Clear CMOS. (See Appendix B, <a href="#">Password Security and Resetting CMOS on page 233.</a>)</li> <li>3. Reconfigure card resources and/or run Computer Setup or Windows utilities.</li> </ol>
1155-Serial Port Address Conflict Detected	Both external and internal serial ports are assigned to same IRQ.	<ol style="list-style-type: none"> <li>1. Remove any serial port expansion cards.</li> <li>2. Clear CMOS. (See Appendix B, <a href="#">Password Security and Resetting CMOS on page 233.</a>)</li> <li>3. Reconfigure card resources and/or run Computer Setup or Windows utilities.</li> </ol>

**Table C-1 Numeric Codes and Text Messages (continued)**

Control panel message	Description	Recommended action
1720-SMART Hard Drive Detects Imminent Failure	Hard drive is about to fail. (Some hard drives have a hard drive firmware patch that will fix an erroneous error message.)	<ol style="list-style-type: none"> <li>1. Determine if hard drive is giving correct error message. Enter Computer Setup and run the Drive Protection System test under <b>Storage &gt; DPS Self-test</b>.</li> <li>2. Apply hard drive firmware patch if applicable. (Available at <a href="http://www.hp.com/support">http://www.hp.com/support</a>.)</li> <li>3. Back up contents and replace hard drive.</li> </ol>
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, SATA 1, and SATA 2.
1797-SATA Drivelock is not supported in RAID mode.	Drivelock is enabled on one or more SATA hard drives, and they cannot be accessed while the system is configured for RAID mode.	Either remove the Drivelocked SATA device or disable the Drivelock feature. To disable the Drivelock feature, enter Computer Setup, change <b>Storage &gt; Storage Options &gt; SATA Emulation</b> to <b>IDE</b> , and select <b>File &gt; Save Changes and Exit</b> . Reenter Computer Setup and select <b>Security &gt; Drivelock Security</b> . For each listed Drivelock-capable SATA device, ensure Drivelock is <b>Disabled</b> . Lastly, change <b>Storage &gt; Storage Options &gt; SATA Emulation</b> back to <b>RAID</b> and select <b>File &gt; Save Changes and Exit</b> .
1801-Microcode Patch Error	Processor is not supported by ROM BIOS.	<ol style="list-style-type: none"> <li>1. Upgrade BIOS to proper version.</li> <li>2. Change the processor.</li> </ol>
2200-PMM Allocation Error during MEBx Download	Memory error during POST execution of the Management Engine (ME) BIOS Extensions option ROM.	<ol style="list-style-type: none"> <li>1. Reboot the computer.</li> <li>2. Unplug the power cord, re-seat the memory modules, and reboot the computer.</li> <li>3. If the memory configuration was recently changed, unplug the computer, restore the original memory configuration, and reboot the computer.</li> <li>4. If the error persists, replace the system board.</li> </ol>
2201-MEBx Module did not checksum correctly	Memory error during POST execution of the Management Engine (ME) BIOS Extensions option ROM.	<ol style="list-style-type: none"> <li>1. Reboot the computer.</li> <li>2. Unplug the power cord, re-seat the memory modules, and reboot the computer.</li> <li>3. If the memory configuration was recently changed, unplug the power cord, restore the original memory configuration, and reboot the computer.</li> <li>4. If the error persists, replace the system board.</li> </ol>

**Table C-1 Numeric Codes and Text Messages (continued)**

Control panel message	Description	Recommended action
2202-PMM Deallocation Error during MEBx cleanup	Memory error during POST execution of the Management Engine (ME) BIOS Extensions option ROM.	<ol style="list-style-type: none"><li>1. Reboot the computer.</li><li>2. Unplug the power cord, re-seat the memory modules, and reboot the computer.</li><li>3. If the memory configuration was recently changed, unplug the power cord, restore the original memory configuration, and reboot the computer.</li><li>4. If the error persists, replace the system board.</li></ol>
2203-Setup error during MEBx execution	MEBx selection or exit resulted in a setup failure.	<ol style="list-style-type: none"><li>1. Reboot the computer.</li><li>2. Unplug the power cord, re-seat the memory modules, and reboot the computer.</li><li>3. If the memory configuration was recently changed, unplug the power cord, restore the original memory configuration, and reboot the computer.</li><li>4. If the error persists, replace the system board.</li></ol>
2204-Inventory error during MEBx execution	BIOS information passed to the MEBx resulted in a failure.	<ol style="list-style-type: none"><li>1. Reboot the computer.</li><li>2. If the error persists, update to the latest BIOS version.</li><li>3. If the error still persists, replace the system board.</li></ol>
2205-Interface error during MEBx execution	MEBx operation experienced a hardware error during communication with ME.	<ol style="list-style-type: none"><li>1. Reboot the computer.</li><li>2. If the error persists, update to the latest BIOS version.</li><li>3. If the error still persists, replace the system board.</li></ol>
2211-Memory not configured correctly for proper MEBx execution.	DIMM1 is not installed.	Make sure there is a memory module in the black DIMM1 socket and that it is properly seated.
Invalid Electronic Serial Number	Electronic serial number is missing.	Enter the correct serial number in Computer Setup.
Memory Parity Error	Parity RAM failure.  Third-party graphics card may be causing a problem.	Run Computer Setup and Diagnostic utilities.  Remove third-party graphics card to see if the problem goes away.

**Table C-1 Numeric Codes and Text Messages (continued)**

Control panel message	Description	Recommended action
Network Server Mode Active and No Keyboard Attached	Keyboard failure while Network Server Mode enabled.	<ol style="list-style-type: none"> <li>1. Reconnect keyboard with computer turned off.</li> <li>2. Check connector for bent or missing pins.</li> <li>3. Ensure that none of the keys are depressed.</li> <li>4. Replace keyboard.</li> </ol>
Parity Check 2	<p>Parity RAM failure.</p> <p>Third-party graphics card may be causing a problem.</p>	<p>Run Computer Setup and Diagnostic utilities.</p> <p>Remove third-party graphics card to see if the problem goes away.</p>

## Interpreting 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.

**⚠ WARNING!** When the computer is plugged into an AC power source, voltage is always applied to the system board. To reduce the risk of personal injury from electrical shock and/or hot surfaces, be sure to disconnect the power cord from the wall outlet and allow the internal system components to cool before touching.

**📖 NOTE:** 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.

Not all diagnostic lights and audible codes are available on all models.

**Table C-2 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 (some 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 solved.	2	<p>Processor thermal protection activated:</p> <p>A fan may be blocked or not turning.</p> <p>OR</p> <p>The heat sink/fan assembly is not properly attached to the processor.</p>	<ol style="list-style-type: none"> <li>1. Ensure that the computer air vents are not blocked and the processor cooling fan is running.</li> <li>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.</li> <li>3. If fan is plugged in, but is not spinning, then replace heat sink/fan assembly.</li> <li>4. Contact an authorized reseller or service provider.</li> </ol>

**Table C-2 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 solved.	3	Processor not installed (not an indicator of bad processor).	<ol style="list-style-type: none"><li>1. Check to see that the processor is present.</li><li>2. Reseat the processor.</li></ol>
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 solved.	4	Power failure (power supply is overloaded).	<ol style="list-style-type: none"><li>1. Open the hood and ensure the 4 or 6-wire power supply cable is seated into the connector on the system board.</li><li>2. Check if a device is causing the problem by removing ALL attached devices (such as hard 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.</li><li>3. Replace the power supply.</li><li>4. Replace the system board.</li></ol>
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 solved.	5	Pre-video memory error.	<p><b>CAUTION:</b> To avoid damage to the DIMMs or the system board, you must unplug the computer power cord before attempting to reseat, install, or remove a DIMM module.</p> <ol style="list-style-type: none"><li>1. Reseat DIMMs.</li><li>2. Replace DIMMs one at a time to isolate the faulty module.</li><li>3. Replace third-party memory with HP memory.</li><li>4. Replace the system board.</li></ol>
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 solved.	6	Pre-video graphics error.	<p>For systems with a graphics card:</p> <ol style="list-style-type: none"><li>1. Reseat the graphics card.</li><li>2. Replace the graphics card.</li><li>3. Replace the system board.</li></ol> <p>For systems with integrated graphics, replace the system board.</p>
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 solved.	7	System board failure (ROM detected failure prior to video).	Replace the system board.

**Table C-2 Diagnostic Front Panel LEDs and Audible Codes (continued)**

Activity	Beeps	Possible Cause	Recommended Action
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 solved.	8	Invalid ROM based on bad checksum.	<ol style="list-style-type: none"><li>1. Reflash the system ROM with the latest BIOS image. See the "Boot Block Emergency Recovery Mode" section of the <i>Desktop Management Guide</i> for more information.</li><li>2. Replace the system board.</li></ol>
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 solved.	9	System powers on but is unable to boot.	<ol style="list-style-type: none"><li>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.</li><li>2. Unplug the AC power cord from the computer, wait 30 seconds, then plug the power cord back in to the computer.</li><li>3. Replace the system board.</li><li>4. Replace the processor.</li></ol>
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 solved.	10	Bad option card.	<ol style="list-style-type: none"><li>1. Check each option card by removing the card (one at a time if multiple cards), then power on the system to see if fault goes away.</li><li>2. Once a bad card is identified, remove and replace the bad option card.</li><li>3. Replace the system board.</li></ol>

**Table C-2 Diagnostic Front Panel LEDs and Audible Codes (continued)**

Activity	Beeps	Possible Cause	Recommended Action
Red Power LED flashes eleven times, once every second, followed by a two second pause. Beeps stop after fifth iteration but LEDs continue until problem is solved.	11	The current processor does not support a feature previously enabled on this system.	<ol style="list-style-type: none"><li>1. Install a TXT capable processor.</li><li>2. Disable TXT in the Computer Setup (F10) utility.</li><li>3. Reinstall the original processor.</li></ol>
System does not power on and LEDs are not flashing.	None	System unable to power on.	<p>Press and hold the power button for less than 4 seconds. If the hard drive LED turns green, the power button is working correctly. Try the following:</p> <ol style="list-style-type: none"><li>1. Check that the voltage selector (some models), located on the rear of the power supply, is set to the appropriate voltage. Proper voltage setting depends on your region.</li><li>2. Replace the system board.</li></ol> <p>OR</p> <p>Press and hold the power button for less than 4 seconds. If the hard drive LED does not turn on green then:</p> <ol style="list-style-type: none"><li>1. Check that the unit is plugged into a working AC outlet.</li><li>2. Open hood and check that the power button harness is properly connected to the system board.</li><li>3. Check that both power supply cables are properly connected to the system board.</li><li>4. Check to see if the 5V_aux light on the system board is turned on. If it is turned on, then replace the power button harness. If the problem persists, replace the system board.</li><li>5. If the 5V_aux light on the system board is not turned on, remove the expansion cards one at a time until the 5V_aux light on the system board turns on. If the problem persists, replace the power supply.</li></ol>

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# D Troubleshooting Without Diagnostics

This chapter provides information on how to identify and correct minor problems, such as hard drive, optical drive, graphics, audio, memory, and software problems. If you encounter problems with the computer, refer to the tables in this chapter for probable causes and recommended solutions.

 **NOTE:** For information on specific error messages that may appear on the screen during Power-On Self-Test (POST) at startup, refer to Appendix A, [POST Error Messages on page 185](#).

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## Safety and Comfort

 **WARNING!** Misuse of the computer or failure to establish a safe and comfortable work environment may result in discomfort or serious injury. Refer to the *Safety & Comfort Guide* at <http://www.hp.com/ergo> for more information on choosing a workspace and creating a safe and comfortable work environment. For more information, refer to the *Safety & Regulatory Information* guide.

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## Before You Call for Technical Support

If you are having problems with the computer, try the appropriate solutions below to try to isolate the exact problem before calling for technical support.

- Run the HP diagnostic tool.
- Run the hard drive self-test in Computer Setup. Refer to the *Computer Setup (F10) Utility Guide* for more information.
- Check the Power LED on the front of the computer to see if it is flashing red. The flashing lights are error codes that will help you diagnose the problem. Refer to Appendix A, [POST Error Messages on page 185](#) for more information.
- If the screen is blank, plug the monitor into a different video port on the computer if one is available. Or, replace the monitor with a monitor that you know is functioning properly.
- If you are working on a network, plug another computer with a different cable into the network connection. There may be a problem with the network plug or cable.
- If you recently added new hardware, remove the hardware and see if the computer functions properly.
- If you recently installed new software, uninstall the software and see if the computer functions properly.
- Boot the computer to the Safe Mode to see if it will boot without all of the drivers loaded. When booting the operating system, use “Last Known Configuration.”

- Refer to the comprehensive online technical support at <http://www.hp.com/support>.
- Refer to [Helpful Hints on page 197](#) in this guide.

To assist you in resolving problems online, HP Instant Support Professional Edition provides you with self-solve diagnostics. If you need to contact HP support, use HP Instant Support Professional Edition's online chat feature. Access HP Instant Support Professional Edition at: <http://www.hp.com/go/ispe>.

Access the Business Support Center (BSC) at <http://www.hp.com/go/bizsupport> for the latest online support information, software and drivers, proactive notification, and worldwide community of peers and HP experts.

If it becomes necessary to call for technical assistance, be prepared to do the following to ensure that your service call is handled properly:

- Be in front of your computer when you call.
- Write down the computer serial number, product ID number, and monitor serial number before calling.
- Spend time troubleshooting the problem with the service technician.
- Remove any hardware that was recently added to your system.
- Remove any software that was recently installed.

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 **NOTE:** For sales information and warranty upgrades (Care Packs), call your local authorized service provider or dealer.

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## Helpful Hints

If you encounter problems with the computer, monitor, or software, see the following list of general suggestions before taking further action:

- Check that the computer and monitor are plugged into a working electrical outlet.
- Check that the computer is turned on and the green power light is on.
- Check that the monitor is turned on and the green monitor light is on.
- Check the Power LED on the front of the computer to see if it is flashing red. The flashing lights are error codes that will help you diagnose the problem. Refer to Appendix A, [POST Error Messages on page 185](#) for more information.
- Turn up the brightness and contrast controls of the monitor if the monitor is dim.
- Press and hold any key. If the system beeps, then the keyboard should be operating correctly.
- Check all cable connections for loose connections or incorrect connections.
- Wake the computer by pressing any key on the keyboard or pressing the power button. If the system remains in suspend mode, shut down the computer by pressing and holding the power button for at least four seconds then press the power button again to restart the computer. If the system will not shut down, unplug the power cord, wait a few seconds, then plug it in again. The computer will restart if it is set to automatic start after power loss in Computer Setup as soon as power is restored. If it does not restart, press the power button to start the computer.

- Reconfigure the computer after installing a non-plug and play expansion board or other option. See [Solving Hardware Installation Problems on page 217](#) for instructions.
  - Be sure that all the needed device drivers have been installed. For example, if you are using a printer, you need a driver for that model printer.
  - Remove all bootable media (CD or USB device) from the system before turning it on.
  - If you have installed an operating system other than the factory-installed operating system, check to be sure that it is supported on the system.
  - If the system has multiple video sources (embedded, PCI, or PCI-Express adapters) installed (embedded video on some 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 Setup.
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- △ **CAUTION:** When the computer is plugged into an AC power source, there is always voltage 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.
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# Solving General Problems

You may be able to easily resolve the general problems described in this section. If a problem persists and you are unable to resolve it yourself or if you feel uncomfortable about performing the operation, contact an authorized dealer or reseller.

- ⚠ **WARNING!** When the computer is plugged into an AC power source, voltage is always applied to the system board. To reduce the risk of personal injury from electrical shock and/or hot surfaces, be sure to disconnect the power cord from the wall outlet and allow the internal system components to cool before touching.

**Table D-1 Solving General Problems**

<b>Computer appears locked up and will not turn off when the power button is pressed.</b>	
<b>Cause</b>	<b>Solution</b>
Software control of the power switch is not functional.	<ol style="list-style-type: none"><li>1. Press and hold the power button for at least four seconds until the computer turns off.</li><li>2. Disconnect the power cord from the electrical outlet.</li></ol>

<b>Computer will not respond to USB keyboard or mouse.</b>	
<b>Cause</b>	<b>Solution</b>
Computer is in <b>standby</b> mode.	To resume from <b>standby</b> mode, press the power button or press any key.  <b>CAUTION:</b> When attempting to resume from <b>standby</b> 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.
System has locked up.	Restart computer.

<b>Computer date and time display is incorrect.</b>	
<b>Cause</b>	<b>Solution</b>
RTC (real-time clock) battery may need to be replaced.  <b>NOTE:</b> Connecting the computer to a live AC outlet prolongs the life of the RTC battery.	First, reset the date and time under <b>Control Panel</b> (Computer Setup can also be used to update the RTC date and time). If the problem persists, replace the RTC battery. See the <i>Hardware Reference Guide</i> for instructions on installing a new battery, or contact an authorized dealer or reseller for RTC battery replacement.

<b>Cursor will not move using the <b>arrow</b> keys on the keypad.</b>	
<b>Cause</b>	<b>Solution</b>
The <b>Num Lock</b> key may be on.	Press the <b>Num Lock</b> key. The Num Lock light should not be on if you want to use the <b>arrow</b> keys. The <b>Num Lock</b> key can be disabled (or enabled) in Computer Setup.

**Table D-1 Solving General Problems (continued)****There is no sound or sound volume is too low.**

Cause	Solution
System volume may be set low or muted.	<ol style="list-style-type: none"> <li>1. Check the F10 BIOS settings to make sure the internal system speaker is not muted (this setting does not affect the external speakers).</li> <li>2. Make sure the external speakers are properly connected and powered on and that the speakers' volume control is set correctly.</li> <li>3. Use the system volume control available in the operating system to make sure the speakers are not muted or to increase the volume.</li> </ol>
The audio device may be connected to the wrong jack on the rear of the computer.	Ensure that the device is connected to the correct jack on the rear of the computer.

**Cannot remove computer cover or access panel.**

Cause	Solution
Smart Cover Lock, featured on some computers, is locked.	<p>Unlock the Smart Cover Lock using Computer Setup.</p> <p>The Smart Cover FailSafe Key, a device for manually disabling the Smart Cover Lock, is available from HP. You will need the FailSafe Key in case of forgotten password, power loss, or computer malfunction. Order PN 166527-001 for the wrench-style key or PN 166527-002 for the screwdriver bit key.</p>

**Poor performance is experienced.**

Cause	Solution
Processor is hot.	<ol style="list-style-type: none"> <li>1. Make sure airflow to the computer is not blocked. Leave a 10.2-cm (4-inch) clearance on all vented sides of the computer and above the monitor to permit the required airflow.</li> <li>2. Make sure fans are connected and working properly (some fans only operate when needed).</li> <li>3. Make sure the processor heat sink is installed properly.</li> </ol>
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.
Program previously accessed did not release reserved memory back to the system.	Restart the computer.
Virus resident on the hard drive.	Run virus protection program.

**Table D-1 Solving General Problems (continued)**

**Poor performance is experienced.**

Cause	Solution
Too many applications running.	<ol style="list-style-type: none"><li>1. Close unnecessary applications to free up memory.</li><li>2. Add more memory. Some applications run in the background and can be closed by right-clicking on their corresponding icons in the task tray. To prevent these applications from launching at startup, go to <b>Start &gt; Run</b> (Windows XP) or <b>Start &gt; Accessories &gt; Run</b> (Windows Vista) and type <code>msconfig</code>. On the <b>Startup</b> tab of the System Configuration Utility, clear applications that you do not want to launch automatically.</li></ol>
Some software applications, especially games, are stressful on the graphics subsystem	<ol style="list-style-type: none"><li>1. Lower the display resolution for the current application or consult the documentation that came with the application for suggestions on how to improve performance by adjusting parameters in the application.</li><li>2. Add more memory.</li><li>3. Upgrade the graphics solution.</li></ol>
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 stop after fifth iteration but LEDs continue flashing).**

Cause	Solution
Processor thermal protection activated: A fan may be blocked or not turning. OR The heat sink is not properly attached to the processor.	<ol style="list-style-type: none"><li>1. Ensure that the computer air vents are not blocked and the processor cooling fan is running.</li><li>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.</li><li>3. If fan is plugged in, but is not spinning, then replace the heat sink/fan assembly.</li><li>4. Contact an authorized reseller or service provider.</li></ol>

**Table D-1 Solving General Problems (continued)**

**System does not power on and the LEDs on the front of the computer are not flashing.**

Cause	Solution
System unable to power on.	<p data-bbox="855 277 1441 327">Press and hold the power button for less than 4 seconds. If the hard drive LED turns green, then:</p> <ol data-bbox="855 352 1398 457" style="list-style-type: none"><li data-bbox="855 352 1398 403">1. Remove the expansion cards one at a time until the 5V_aux light on the system board turns on.</li><li data-bbox="855 428 1161 457">2. Replace the system board.</li></ol> <p data-bbox="855 478 890 504">OR</p> <p data-bbox="855 529 1441 579">Press and hold the power button for less than 4 seconds. If the hard drive LED does not turn on green then:</p> <ol data-bbox="855 604 1441 1014" style="list-style-type: none"><li data-bbox="855 604 1430 634">1. Check that the unit is plugged into a working AC outlet.</li><li data-bbox="855 659 1430 709">2. Open hood and check that the power button harness is properly connected to the system board.</li><li data-bbox="855 735 1378 785">3. Check that both power supply cables are properly connected to the system board.</li><li data-bbox="855 810 1441 894">4. Check to see if the 5V_aux light on the system board is turned on. If it is turned on, then replace the power button harness.</li><li data-bbox="855 919 1441 970">5. If the 5V_aux light on the system board is off, then replace the power supply.</li><li data-bbox="855 995 1161 1024">6. Replace the system board.</li></ol>

# Solving Power Problems

Common causes and solutions for power problems are listed in the following table.

**Table D-2 Solving Power Problems**

**Power supply shuts down intermittently.**

Cause	Solution
Power supply will not turn on because of internal power supply fault.	Contact an authorized service provider to 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 stop after fifth iteration but LEDs continue flashing.)**

Cause	Solution
Processor thermal protection activated: A fan may be blocked or not turning. OR The heat sink is not properly attached to the processor.	<ol style="list-style-type: none"><li>1. Ensure that the computer air vents are not blocked and the processor cooling fan is running.</li><li>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.</li><li>3. If fan is plugged in, but is not spinning, then replace the heat sink/fan assembly.</li><li>4. Contact an authorized reseller or service provider.</li></ol>

**Power LED flashes Red four times, once every second, followed by a two second pause, and the computer beeps four times. (Beeps stop after fifth iteration but LEDs continue flashing.)**

Cause	Solution
Power failure (power supply is overloaded).	<ol style="list-style-type: none"><li>1. Open the hood and ensure the 4- or 6-wire power supply cable is seated into the connector on the system board.</li><li>2. Check if a device is causing the problem by removing ALL attached devices (such as hard 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.</li><li>3. Replace the power supply.</li><li>4. Replace the system board.</li></ol>

# Solving Hard Drive Problems

**Table D-3 Solving Hard Drive Problems**

**Hard drive error occurs.**

Cause	Solution
Hard disk has bad sectors or has failed.	<ol style="list-style-type: none"><li>1. In Microsoft Windows XP, right-click <b>Start</b>, click <b>Explore</b>, and select a drive. Select <b>File &gt; Properties &gt; Tools</b>. Under <b>Error-checking</b>, click <b>Check Now</b>.  In Microsoft Windows Vista, right-click <b>Start</b>, click <b>Explore</b>, and right-click on a drive. Select <b>Properties</b> then select the <b>Tools</b> tab. Under <b>Error-checking</b> click <b>Check Now</b>.</li><li>2. Use a utility to locate and block usage of bad sectors. If necessary, reformat the hard disk.</li></ol>

**Disk transaction problem.**

Cause	Solution
Either the directory structure is bad or there is a problem with a file.	<p>In Microsoft Windows XP, right-click <b>Start</b>, click <b>Explore</b>, and select a drive. Select <b>File &gt; Properties &gt; Tools</b>. Under <b>Error-checking</b>, click <b>Check Now</b>.</p> <p>In Microsoft Windows Vista, right-click <b>Start</b>, click <b>Explore</b>, and right-click on a drive. Select <b>Properties</b> then select the <b>Tools</b> tab. Under <b>Error-checking</b> click <b>Check Now</b>.</p>

**Drive not found (identified).**

Cause	Solution
Cable could be loose.	Check cable connections.
The system may not have automatically recognized a newly installed device.	<p>See reconfiguration directions in the <a href="#">Solving Hardware Installation Problems on page 217</a>. 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.</p> <p>If this is a newly installed drive, run the Computer Setup utility and try adding a POST delay under <b>Advanced &gt; Power-On Options</b>.</p>
The device is attached to a SATA port that has been hidden in Computer Setup.	Run the Computer Setup utility and ensure <b>Device Available</b> is selected for the device's SATA port in <b>Security &gt; Device Security</b> .
Drive responds slowly after initial power up.	Run Computer Setup and increase the POST Delay in <b>Advanced &gt; Power-On Options</b> .

**Table D-3 Solving Hard Drive Problems (continued)**

<b>Nonsystem disk/NTLDR missing message.</b>	
<b>Cause</b>	<b>Solution</b>
The system is trying to start from a media device that is not bootable.	Remove the media device from the drive.
The system is trying to start from the hard drive but the hard drive may have been damaged.	<ol style="list-style-type: none"> <li>1. Insert a bootable media device into the drive and restart the computer.</li> <li>2. Check the 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.</li> </ol>
System files missing or not properly installed.	<ol style="list-style-type: none"> <li>1. Insert a bootable media device into the drive and restart the computer.</li> <li>2. Check the hard drive format using Fdisk: If NFTFS formatting, use a third party reader to evaluate the drive. If FAT32 formatting, the hard drive cannot be accessed.</li> <li>3. Install system files for the appropriate operating system.</li> </ol>
Hard drive boot has been disabled in Computer Setup.	Run the Computer Setup utility and enable the hard drive entry in the <b>Storage &gt; Boot Order</b> list.
Bootable hard drive is not attached as first in a multi-hard drive configuration.	If attempting to boot from a hard drive, ensure it is attached to the system board connector labeled SATA 0.
Bootable hard drive's controller is not listed first in the Boot Order.	Run the Computer Setup utility and select <b>Storage &gt; Boot Order</b> and ensure the bootable hard drive's controller is listed immediately under the <b>Hard Drive</b> entry.
<b>Computer will not boot from hard drive.</b>	
<b>Cause</b>	<b>Solution</b>
The device is attached to a SATA port that has been hidden in Computer Setup.	Run the Computer Setup utility and ensure <b>Device Available</b> is selected for the device's SATA port in <b>Security &gt; Device Security</b> .
Boot order is not correct.	Run the Computer Setup utility and change boot sequence in <b>Storage &gt; Boot Order</b> .
Hard Drive's "Emulation Type" is set to "None."	Run the Computer Setup utility and change the "Emulation Type" to "Hard Disk" in the device's details under <b>Storage &gt; Device Configuration</b> .
Hard drive is damaged.	<p>Observe if the front panel Power LED is blinking RED and if any beeps are heard. See Appendix A, <a href="#">POST Error Messages on page 185</a> to determine possible causes for the blinking red and beep codes.</p> <p>See the Worldwide Limited Warranty for terms and conditions.</p>

**Table D-3 Solving Hard Drive Problems (continued)**

**Computer seems to be locked up.**

<b>Cause</b>	<b>Solution</b>
Program in use has stopped responding to commands.	Attempt the normal Windows "Shut Down" procedure. If this fails, press the power button for four or more seconds to turn off the power. To restart the computer, press the power button again.

**The removable hard drive has no power to the hard drive enclosure.**

<b>Cause</b>	<b>Solution</b>
The lock on the enclosure is not turned to the "ON" position.	Insert the key and turn the lock clockwise 90 degrees. The green LED on the front of the enclosure should be on.
Power cable from the computer power supply to the enclosure frame is not properly connected.	Check the power supply to make sure it is properly connected to the rear of the enclosure frame.

**The removable hard drive is not recognized by the computer.**

<b>Cause</b>	<b>Solution</b>
The removable hard drive carrier is not fully seated in the enclosure frame or the hard drive is not fully seated in the carrier.	Push the carrier into the enclosure frame so that the connector on the rear of the frame is properly seated. If this does not solve the problem, turn off the computer, remove the carrier, and check to see if the connector on the hard drive is properly seated in the carrier.

**The removable hard drive enclosure is beeping and the green LED is flashing.**

<b>Cause</b>	<b>Solution</b>
Fan failure alarm on the removable hard drive enclosure has been activated.	Shut down the computer and contact HP for a replacement enclosure.

# Solving Media Card Reader Problems

**Table D-4 Solving Media Card Reader Problems**

**Media card will not work in a digital camera after formatting it in Microsoft Windows XP or Microsoft Windows Vista.**

Cause	Solution
By default, Windows XP and Windows Vista will format any media card with a capacity greater than 32MB with the FAT32 format. Most digital cameras use the FAT (FAT16 & FAT12) format and can not operate with a FAT32 formatted card.	Either format the media card in the digital camera or select FAT file system to format the media card in a computer with Windows XP or Windows Vista.

**A write-protected or locked error occurs when attempting to write to the media card.**

Cause	Solution
Media card is locked. Locking the media card is a safety feature that prevents writing to and deleting from an SD/Memory Stick/PRO card.	If using an SD card, make sure that the lock tab located on the right of the SD card is not in the locked position. If using a Memory Stick/PRO card, make sure that the lock tab located on the bottom of the Memory Stick/PRO card is not in the locked position.

**Can not write to the media card.**

Cause	Solution
The media card is a read-only memory (ROM) card.	Check the manufacturer's documentation included with your card to see if it writable. Refer to the previous section for a list of compatible cards.
Media card is locked. Locking the media card is a safety feature that prevents writing to and deleting from an SD/Memory Stick/PRO card.	If using an SD card, make sure that the lock tab located on the right of the SD card is not in the locked position. If using a Memory Stick/PRO card, make sure that the lock tab located on the bottom of the Memory Stick/PRO card is not in the locked position.

**Unable to access data on the media card after inserting it into a slot.**

Cause	Solution
The media card is not inserted properly, is inserted in the wrong slot, or is not supported.	Ensure that the card is inserted properly with the gold contact on the correct side. The green LED will light if inserted properly.

**Do not know how to remove a media card correctly.**

Cause	Solution
The computer's software is used to safely eject the card.	Open <b>My Computer</b> (Windows XP) or <b>Computer</b> (Windows Vista), right-click on the corresponding drive icon, and select <b>Eject</b> . Then pull the card out of the slot.  <b>NOTE:</b> Never remove the card when the green LED is flashing

**Table D-4 Solving Media Card Reader Problems (continued)**

**After installing the media card reader and booting to Windows, the reader and the inserted cards are not recognized by the computer.**

Cause	Solution
The operating system needs time to recognize the device if the reader was just installed into the computer and you are turning the PC on for the first time.	Wait a few seconds so that the operating system can recognize the reader and the available ports, and then recognize whatever media is inserted in the reader.

**After inserting a media card in the reader, the computer attempts to boot from the media card.**

Cause	Solution
The inserted media card has boot capability.	If you do not want to boot from the media card, remove it during boot or do not select the option to boot from the inserted media card during the boot process.

## Solving Display Problems

If you encounter display problems, see the documentation that came with the monitor and to the common causes and solutions listed in the following table.

**Table D-5 Solving Display Problems**

**Blank screen (no video).**

Cause	Solution
Monitor is not turned on and the monitor light is not on.	Turn on the monitor and check that the monitor light is on.
Bad monitor.	Try a different monitor.
The cable connections are not correct.	Check the cable connection from the monitor to the computer and to the electrical outlet.
You may have a screen blanking utility installed or energy saver features are enabled.	Press any key or click the mouse button and, if set, type your password.
System ROM is corrupted; system is running in Boot Block Emergency Recovery Mode (indicated by eight beeps).	Reflash the system ROM with the latest BIOS image. See the "Boot Block Emergency Recovery Mode" section of the <i>Desktop Management Guide</i> for more information
You are using a fixed-sync monitor and it will not sync at the resolution chosen.	Be sure that the monitor can accept the same horizontal scan rate as the resolution chosen.
Computer is in <b>standby</b> mode.	Press the power button to resume from <b>standby</b> mode.  <b>CAUTION:</b> When attempting to resume from <b>standby</b> 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.
Monitor cable is plugged into the wrong connector.	If the computer system has both an integrated graphics connector and an add-in graphics card connector, plug the monitor cable into the graphics card connector on the back of the computer.

**Table D-5 Solving Display Problems (continued)**

<b>Blank screen (no video).</b>	
<b>Cause</b>	<b>Solution</b>
Monitor settings in the computer are not compatible with the monitor.	<ol style="list-style-type: none"> <li>In Windows XP Control Panel, double-click the <b>Display</b> icon and select the <b>Settings</b> tab.  In Windows Vista Control Panel, under <b>Appearance and Personalization</b>, select <b>Adjust screen resolution</b>.</li> <li>Use the sliding control to reset the resolution.</li> </ol>
Monitor is configured to use an input that is not active.	Use the monitor's on-screen menu controls to select the input that is being driven by the system. Refer to the monitor's user documentation for more information on the on-screen controls and settings.
<b>Cannot enable integrated graphics after installing a PCI Express graphics card.</b>	
<b>Cause</b>	<b>Solution</b>
On systems with Intel integrated graphics, the integrated graphics cannot be enabled after installing a PCI Express x16.	The integrated graphics can be enabled in Computer Setup if a PCI or PCI Express x1 graphics card is installed, but it cannot be enabled if there is a graphics card in the PCI Express x16 slot.
On systems with AMD integrated graphics, the integrated graphics can be enabled in Computer Setup only if an AMD PCI Express x16 graphics card is installed.	On systems with AMD integrated graphics, install an AMD PCI Express x16 graphics card and enable the integrated graphics in Computer Setup.
<b>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 stop after fifth iteration but LEDs continue flashing.)</b>	
<b>Cause</b>	<b>Solution</b>
Pre-video memory error.	<ol style="list-style-type: none"> <li>Reseat DIMMs. Power on the system.</li> <li>Replace DIMMs one at a time to isolate the faulty module.</li> <li>Replace third-party memory with HP memory.</li> <li>Replace the system board.</li> </ol>
<b>Blank screen and the power LED flashes Red six times, once every second, followed by a two second pause, and the computer beeps six times. (Beeps stop after fifth iteration but LEDs continue flashing.)</b>	
<b>Cause</b>	<b>Solution</b>
Pre-video graphics error.	<p>For systems with a graphics card:</p> <ol style="list-style-type: none"> <li>Reseat the graphics card. Power on the system.</li> <li>Replace the graphics card.</li> <li>Replace the system board.</li> </ol> <p>For systems with integrated graphics, replace the system board.</p>

**Table D-5 Solving Display Problems (continued)**

**Blank screen and the power LED flashes Red seven times, once every second, followed by a two second pause, and the computer beeps seven times. (Beeps stop after fifth iteration but LEDs continue flashing.)**

Cause	Solution
System board failure (ROM detected failure prior to video).	Replace the system board.

**Monitor does not function properly when used with energy saver features.**

Cause	Solution
Monitor without energy saver capabilities is being used with energy saver features enabled.	Disable monitor energy saver feature.

**Dim characters.**

Cause	Solution
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.**

Cause	Solution
If the graphics controller was upgraded, the correct graphics drivers may not be loaded.	Install the video drivers included in the upgrade kit.
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.**

Cause	Solution
The monitor connections may be incomplete or the monitor may be incorrectly adjusted.	<ol style="list-style-type: none"><li>1. Be sure the monitor cable is securely connected to the computer.</li><li>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.</li><li>3. Fluorescent lights or fans may be too close to the monitor.</li></ol>
Monitor needs to be degaussed.	Degauss the monitor. Refer to the documentation that came with the monitor for instructions.

**Table D-5 Solving Display Problems (continued)**

**Image is not centered.**

<b>Cause</b>	<b>Solution</b>
Position may need adjustment.	Press the monitor's Menu button to access the OSD menu. Select <b>ImageControl/ Horizontal Position</b> or <b>Vertical Position</b> to adjust the horizontal or vertical position of the image.

**"No Connection, Check Signal Cable" displays on screen.**

<b>Cause</b>	<b>Solution</b>
Monitor video cable is disconnected.	Connect the video cable between the monitor and computer.  <b>CAUTION:</b> Ensure that the computer power is off while connecting the video cable.

**"Out of Range" displays on screen.**

<b>Cause</b>	<b>Solution</b>
Video resolution and refresh rate are set higher than what the monitor supports.	Restart the computer and enter Safe Mode. Change the settings to a supported setting then restart the computer so that the new settings take effect.

**Vibrating or rattling noise coming from inside a CRT monitor when powered on.**

<b>Cause</b>	<b>Solution</b>
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.**

<b>Cause</b>	<b>Solution</b>
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.**

<b>Cause</b>	<b>Solution</b>
Brightness and/or contrast settings are too high.	Lower brightness and/or contrast settings.

**Table D-5 Solving Display Problems (continued)**

**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).**

Cause	Solution
Flat panel monitor's internal digital conversion circuits may be unable to correctly interpret the output synchronization of the graphics card.	<ol style="list-style-type: none"><li>1. Select the monitor's Auto-Adjustment option in the monitor's on-screen display menu.</li><li>2. Manually synchronize the Clock and Clock Phase on-screen display functions. To download a SoftPaq that will assist you with the synchronization, go to the following Web site, select the appropriate monitor, and download either SP32347 or SP32202: <a href="http://www.hp.com/support">http://www.hp.com/support</a></li></ol>
Graphics card is not seated properly or is bad.	<ol style="list-style-type: none"><li>1. Reseat the graphics card.</li><li>2. Replace the graphics card.</li></ol>

**Certain typed symbols do not appear correct.**

Cause	Solution
The font you are using does not support that particular symbol.	Use the Character Map to locate and select the appropriate symbol. Click <b>Start &gt; All Programs &gt; Accessories &gt; System Tools &gt; Character Map</b> . You can copy the symbol from the Character Map into a document.

## Solving Audio Problems

If the computer has audio features and you encounter audio problems, see the common causes and solutions listed in the following table.

**Table D-6 Solving Audio Problems**

**Sound cuts in and out.**

Cause	Solution
Processor resources are being used by other open applications.	Shut down all open processor-intensive applications.
Direct sound latency, common in many media player applications.	In Windows XP only: <ol style="list-style-type: none"><li>1. From the <b>Control Panel</b>, select <b>Sounds and Audio Devices</b>.</li><li>2. On the <b>Audio</b> tab, select a device from the <b>Sound Playback</b> list.</li><li>3. Click the <b>Advanced</b> button and select the <b>Performance</b> tab.</li><li>4. Set the <b>Hardware acceleration</b> slider to <b>None</b> and the <b>Sample rate conversion quality</b> slider to <b>Good</b> and retest the audio.</li><li>5. Set the <b>Hardware acceleration</b> slider to <b>Full</b> and the <b>Sample rate conversion quality</b> slider to <b>Best</b> and retest the audio.</li></ol>

**Table D-6 Solving Audio Problems (continued)****Sound does not come out of the speaker or headphones.**

<b>Cause</b>	<b>Solution</b>
Software volume control is turned down or muted.	Double-click the <b>Speaker</b> icon on the taskbar, then make sure that <b>Mute</b> is not selected and use the volume slider to adjust the volume.
Audio is hidden in Computer Setup.	Enable the audio in Computer Setup: <b>Security &gt; Device Security &gt; System Audio</b> .
The external speakers are not turned on.	Turn on the external speakers.
The audio device may be connected to the wrong jack.	Ensure that the device is connected to the correct jack on the computer. The speakers should be plugged into the rear line-out jack and the headphones should be plugged into the front headphone jack.
External speakers plugged into the wrong audio jack on a recently installed sound card.	See the sound card documentation for proper speaker connection.
Digital CD audio is not enabled.	Enable digital CD audio. In the Device Manager, right-click on the CD/DVD device and select <b>Properties</b> . Make sure <b>Enable digital CD audio for this CD-ROM device</b> 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.
Computer is in <b>standby</b> mode.	Press the power button to resume from <b>standby</b> mode.  <b>CAUTION:</b> When attempting to resume from <b>standby</b> 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.
Internal speaker is disabled in Computer Setup.	Enable the internal speaker in Computer Setup. Select <b>Advanced &gt; Device Options &gt; Internal Speaker</b> .
One or more audio solutions are installed in the system.	Ensure that your application is set to use the correct audio device.

**Sound from headphones is not clear or muffled.**

<b>Cause</b>	<b>Solution</b>
Headphones are plugged into the rear audio output connector. The rear audio output connector is for powered audio devices and is not designed for headphone use.	Plug the headphones into the headphone connector on the front of the computer.

**Computer appears to be locked up while recording audio.**

<b>Cause</b>	<b>Solution</b>
The hard disk may be full.	Before recording, make sure there is enough free space on the hard disk. You can also try recording the audio file in a compressed format.

**Table D-6 Solving Audio Problems (continued)**

**Line-in jack is not functioning properly.**

<b>Cause</b>	<b>Solution</b>
Jack has been reconfigured in the audio driver or application software.	In the audio driver or application software, reconfigure the jack or set the jack to its default value.

**Headphone/Microphone jack on the front of the computer is not functioning properly.**

<b>Cause</b>	<b>Solution</b>
Jack has been reconfigured in the audio driver or application software.	In the audio driver or application software, reconfigure the jack or set the jack to its default value.

# Solving Printer Problems

If you encounter printer problems, see the documentation that came with the printer and to the common causes and solutions listed in the following table.

**Table D-7 Solving Printer Problems**

**Printer will not print.**

Cause	Solution
Printer is not turned on and online.	Turn the printer on and make sure it is online.
The correct printer drivers for the application are not installed.	<ol style="list-style-type: none"><li>1. Install the correct printer driver for the application.</li><li>2. Try printing using the MS-DOS command: <pre>DIR C:\ &gt; [printer port]</pre>where [printer port] is the address of the printer being used. If the printer works, reload the printer driver.</li></ol>
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.**

Cause	Solution
The cables may not be connected properly.	Reconnect all cables and check the power cord and electrical outlet.

**Printer prints garbled information.**

Cause	Solution
The correct printer driver for the application 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.**

Cause	Solution
The printer may be out of paper.	Check the paper tray and refill it if it is empty. Select online.

# Solving Keyboard and Mouse Problems

If you encounter keyboard or mouse problems, see the documentation that came with the equipment and to the common causes and solutions listed in the following table.

**Table D-8 Solving Keyboard Problems**

**Keyboard commands and typing are not recognized by the computer.**

Cause	Solution
Keyboard connector is not properly connected.	<ol style="list-style-type: none"><li>1. On the Windows XP Desktop, click <b>Start &gt; Shut Down</b>.  On the Windows Vista Desktop, click <b>Start</b>, click the arrow on the lower right corner of the Start menu, then select <b>Shut Down</b>.</li><li>2. After the shutdown is complete, reconnect the keyboard to the back of the computer and restart the computer.</li></ol>
Program in use has stopped responding to commands.	Shut down your computer using the mouse and then restart the computer.
Keyboard needs repairs.	See the Worldwide Limited Warranty for terms and conditions.
Computer is in <b>standby</b> mode.	Press the power button to resume from <b>standby</b> mode.  <b>CAUTION:</b> When attempting to resume from <b>standby</b> 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.

**Cursor will not move using the [arrow](#) keys on the keypad.**

Cause	Solution
The <a href="#">Num Lock</a> key may be on.	Press the <a href="#">Num Lock</a> key. The Num Lock light should not be on if you want to use the <a href="#">arrow</a> keys. The <a href="#">Num Lock</a> key can be disabled (or enabled) in Computer Setup.

**Table D-9 Solving Mouse Problems**

**Mouse does not respond to movement or is too slow.**

Cause	Solution
Mouse connector is not properly plugged into the back of the computer.	Shut down the computer using the keyboard. <ol style="list-style-type: none"><li>1. Press the <a href="#">Ctrl</a> and <a href="#">Esc</a> keys at the same time (or press the <a href="#">Windows logo</a> key) to display the <b>Start</b> menu.</li><li>2. Use the <a href="#">arrow</a> keys to select <b>Shut Down</b> and then press the <a href="#">Enter</a> key.</li><li>3. After the shutdown is complete, plug the mouse connector into the back of the computer (or the keyboard) and restart.</li></ol>
Program in use has stopped responding to commands.	Shut down the computer using the keyboard then restart the computer.

**Table D-9 Solving Mouse Problems (continued)**

**Mouse does not respond to movement or is too slow.**

Cause	Solution
Mouse may need cleaning.	Remove the roller ball cover on the mouse and clean the internal components.
Mouse may need repair.	See the Worldwide Limited Warranty for terms and conditions.
Computer is in <b>standby</b> mode.	Press the power button to resume from <b>standby</b> mode.  <b>CAUTION:</b> When attempting to resume from <b>standby</b> 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.

**Mouse will only move vertically, horizontally, or movement is jerky.**

Cause	Solution
Mouse roller ball or the rotating encoder shafts that make contact with the ball are dirty.	Remove roller ball cover from the bottom of the mouse and clean the internal components with a mouse cleaning kit available from most computer stores.

## Solving Hardware Installation Problems

You may need to reconfigure the computer when you add or remove hardware, such as an additional drive or expansion card. If you install a plug and play device, Windows automatically recognizes the device and configures 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, use the **Add Hardware Wizard** and follow the instructions that appear on the screen.

- ⚠ **WARNING!** When the computer is plugged into an AC power source, voltage is always applied to the system board. To reduce the risk of personal injury from electrical shock and/or hot surfaces, be sure to disconnect the power cord from the wall outlet and allow the internal system components to cool before touching.

**Table D-10 Solving Hardware Installation Problems**

**A new device is not recognized as part of the system.**

Cause	Solution
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.

**Table D-10 Solving Hardware Installation Problems (continued)**

**A new device is not recognized as part of the system.**

Cause	Solution
A plug and play board may not automatically configure when added if the default configuration conflicts with other devices.	Use Windows 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.
USB ports on the computer are disabled in Computer Setup.	Enter Computer Setup (F10) and enable the USB ports.

**Computer will not start.**

Cause	Solution
Wrong memory modules were used in the upgrade or memory modules were installed in the wrong location.	<ol style="list-style-type: none"><li>1. Review the <i>Hardware Reference Guide</i> for your system to determine if you are using the correct memory modules and to verify the proper installation.</li><li>2. Observe the beeps and LED lights on the front of the computer. Beeps and flashing LEDs are codes for specific problems.</li><li>3. If you still cannot resolve the issue, contact Customer Support.</li></ol>

**Power LED flashes Red five times, once every second, followed by a two second pause, and the computer beeps five times. (Beeps stop after fifth iteration but LEDs continue flashing.)**

Cause	Solution
Memory is installed incorrectly or is bad.	<p><b>CAUTION:</b> To avoid damage to the DIMMs or the system board, you must unplug the computer power cord before attempting to reseat, install, or remove a DIMM module.</p> <ol style="list-style-type: none"><li>1. Reseat DIMMs. Power on the system.</li><li>2. Replace DIMMs one at a time to isolate the faulty module. <p><b>NOTE:</b> Refer to the <i>Hardware Reference Guide</i> for your system for proper DIMM installation instructions.</p></li><li>3. Replace third-party memory with HP memory.</li><li>4. Replace the system board.</li></ol>

**Table D-10 Solving Hardware Installation Problems (continued)**

**Power LED flashes Red six times, once every second, followed by a two second pause, and the computer beeps six times. (Beeps stop after fifth iteration but LEDs continue flashing.)**

Cause	Solution
Graphics card is not seated properly or is bad, or system board is bad.	For systems with a graphics card: <ol style="list-style-type: none"><li>1. Reseat the graphics card. Power on the system.</li><li>2. Replace the graphics card.</li><li>3. Replace the system board.</li></ol> 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 stop after fifth iteration but LEDs continue flashing.)**

Cause	Solution
Bad option card.	<ol style="list-style-type: none"><li>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.</li><li>2. Once bad card is identified, remove and replace bad option card.</li><li>3. Replace the system board.</li></ol>

# Solving Network Problems

Some common causes and solutions for network problems are listed in the following table. These guidelines do not discuss the process of debugging the network cabling.

**Table D-11 Solving Network Problems**

**Wake-on-LAN feature is not functioning.**

Cause	Solution
Wake-on-LAN is not enabled.	<p>To enable Wake-on-LAN in Windows XP:</p> <ol style="list-style-type: none"><li>1. Select <b>Start &gt; Control Panel</b>.</li><li>2. Double-click <b>Network Connections</b>.</li><li>3. Double-click <b>Local Area Connection</b>.</li><li>4. Click <b>Properties</b>.</li><li>5. Click <b>Configure</b>.</li><li>6. Click the <b>Power Management</b> tab, then select the check box to <b>Allow this device to bring the computer out of standby</b>.</li></ol> <p>To enable Wake-on-LAN in Windows Vista:</p> <ol style="list-style-type: none"><li>1. Select <b>Start &gt; Control Panel</b>.</li><li>2. Under <b>Network and Internet</b>, select <b>View network status and tasks</b>.</li><li>3. In the <b>Tasks</b> list, select <b>Manage network connections</b>.</li><li>4. Double-click <b>Local Area Connection</b>.</li><li>5. Click the <b>Properties</b> button.</li><li>6. Click the <b>Configure</b> button.</li><li>7. Click the <b>Power Management</b> tab, then select the check box to <b>Allow this device to wake the computer</b>.</li></ol>

**Network driver does not detect network controller.**

Cause	Solution
Network controller is disabled.	<ol style="list-style-type: none"><li>1. Run Computer Setup and enable network controller.</li><li>2. Enable the network controller in the operating system via Device Manager.</li></ol>
Incorrect network driver.	Check the network controller documentation for the correct driver or obtain the latest driver from the manufacturer's Web site.

**Table D-11 Solving Network Problems (continued)**

**Network status link light never flashes.**

**NOTE:** The network status light is supposed to flash when there is network activity.

Cause	Solution
No active network is detected.	Check cabling and network equipment for proper connection.
Network controller is not set up properly.	Check for the device status within Windows, such as Device Manager for driver load and the Network Connections applet within Windows for link status.
Network controller is disabled.	<ol style="list-style-type: none"><li>1. Run Computer Setup and enable network controller.</li><li>2. Enable the network controller in the operating system via Device Manager.</li></ol>
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.**

Cause	Solution
The cable is not securely connected.	Ensure that the cable is securely attached to the network connector and that the other end of the cable is securely attached to the correct device.
The cable is attached to the incorrect connector.	Ensure that the cable is attached to the correct connector.
There is a problem with the cable or a device at the other end of the cable.	Ensure that the cable and device at the other end are operating correctly.
Network controller interrupt is shared with an expansion board.	Under the Computer Setup <b>Advanced</b> menu, change the resource settings for the board.
The network controller is defective.	Contact an authorized service provider.

**Diagnostics passes, but the computer does not communicate with the network.**

Cause	Solution
Network drivers are not loaded, or driver parameters do not match current configuration.	Make sure the network drivers are loaded and that the driver parameters match the configuration of the network controller.  Make sure the correct network client and protocol is installed.
The network controller is not configured for this computer.	Select the <b>Network</b> icon in the <b>Control Panel</b> and configure the network controller.

**Network controller stopped working when an expansion board was added to the computer.**

Cause	Solution
Network controller interrupt is shared with an expansion board.	Under the Computer Setup <b>Advanced</b> menu, change the resource settings for the board.

**Table D-11 Solving Network Problems (continued)**

**Network controller stopped working when an expansion board was added to the computer.**

<b>Cause</b>	<b>Solution</b>
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 <b>Advanced</b> menu, change the resource settings for the board.

**Network controller stops working without apparent cause.**

<b>Cause</b>	<b>Solution</b>
The files containing the network drivers are corrupted.	Reinstall the network drivers.
The cable is not securely connected.	Ensure that the cable is securely attached to the network connector and that the other end of the cable is securely attached to the correct device.
The network controller is defective.	Contact an authorized service provider.

**New network card will not boot.**

<b>Cause</b>	<b>Solution</b>
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.**

<b>Cause</b>	<b>Solution</b>
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.**

<b>Cause</b>	<b>Solution</b>
Unprogrammed EEPROM.	Contact an authorized service provider.

# Solving Memory Problems

If you encounter memory problems, some common causes and solutions are listed in the following table.

- △ **CAUTION:** Power may still be supplied to the DIMMs when the computer is turned off (depending on the Management Engine (ME) settings on some models). To avoid damage to the DIMMs or the system board, you must unplug the computer power cord before attempting to reseat, install, or remove a DIMM module.

For those systems that support ECC memory, HP does not support mixing ECC and non-ECC memory. Otherwise, the computer will not boot the operating system.

-  **NOTE:** On some models, the memory count will be affected by configurations with the Management Engine (ME) enabled. The ME uses 8MB of system memory in single channel mode or 16MB of memory in dual-channel mode to download, decompress, and execute the ME firmware for Out-of-Band (OOB), third-party data storage, and other management functions.

**Table D-12 Solving Memory Problems**

<b>System will not boot or does not function properly after installing additional memory modules.</b>	
<b>Cause</b>	<b>Solution</b>
On Intel systems, A memory module is not installed in the DIMM1 socket.	Ensure that a memory module is installed in the black DIMM1 socket on the system board. This socket must be populated with a memory module. Populate DIMM sockets in the following order for Intel systems: DIMM1, DIMM3, DIMM2, DIMM4.
On AMD systems, a memory module is not installed in the system board memory socket.	The sockets must be populated with at least one memory module. Install memory modules in the following order: XMM4, XMM3, XMM2, XMM1.
Memory module is not the correct type or speed grade for the system 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.
<b>Out of memory error.</b>	
<b>Cause</b>	<b>Solution</b>
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.
<b>Memory count during POST is wrong.</b>	
<b>Cause</b>	<b>Solution</b>
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.

**Table D-12 Solving Memory Problems (continued)**

**Insufficient memory error during operation.**

Cause	Solution
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 stop after fifth iteration but LEDs continue flashing.)**

Cause	Solution
Memory is installed incorrectly or is bad.	<ol style="list-style-type: none"><li>1. Reseat DIMMs. Power on the system.</li><li>2. Replace DIMMs one at a time to isolate the faulty module.</li><li>3. Replace third-party memory with HP memory.</li><li>4. Replace the system board.</li></ol>

## Solving Processor Problems

If you encounter processor problems, common causes and solutions are listed in the following table.

**Table D-13 Solving Processor Problems**

**Poor performance is experienced.**

Cause	Solution
Processor is hot.	<ol style="list-style-type: none"><li>1. Make sure the airflow to the computer is not blocked.</li><li>2. Make sure the fans are connected and working properly (some fans only operate when needed).</li><li>3. Make sure the processor heat sink is installed properly.</li></ol>

**Power LED flashes Red three times, once every second, followed by a two second pause.**

Cause	Solution
Processor is not seated properly or not installed.	<ol style="list-style-type: none"><li>1. Check to see that the processor is present.</li><li>2. Reseat the processor.</li></ol>

Power LED flashes Red eleven times, once every second, followed by a two second pause.

Cause	Solution
The current processor does not support a feature previously enabled on this system.	<ol style="list-style-type: none"><li>1. Install a TXT capable processor.</li><li>2. Disable TXT in the Computer Setup (F10) utility.</li><li>3. Reinstall the original processor.</li></ol>

## Solving CD-ROM and DVD Problems

If you encounter CD-ROM or DVD problems, see the common causes and solutions listed in the following table or to the documentation that came with the optional device.

**Table D-14 Solving CD-ROM and DVD Problems**

**System will not boot from CD-ROM or DVD drive.**

Cause	Solution
The device is attached to a SATA port that has been hidden in the Computer Setup utility.	Run the Computer Setup utility and ensure <b>Device Available</b> is selected for the device's SATA port in <b>Security &gt; Device Security</b> .
Removable Media Boot is disabled in the Computer Setup utility.	Run the Computer Setup utility and enable booting to removable media in <b>Storage &gt; Storage Options</b> . Ensure CD-ROM is enabled in <b>Storage &gt; Boot Order</b> .
Network Server Mode is enabled in Computer Setup.	Run the Computer Setup utility and disable Network Server Mode in <b>Security &gt; Password Options</b> .
Non-bootable CD in drive.	Try a bootable CD in the drive.
Boot order not correct.	Run the Computer Setup utility and change boot sequence in <b>Storage &gt; Boot Order</b> .

**Drive not found (identified).**

Cause	Solution
Cable could be loose.	Check cable connections.
The system may not have automatically recognized a newly installed device.	See reconfiguration directions in the <a href="#">Solving Hardware Installation Problems on page 217</a> . 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.  If this is a newly installed drive, run the Computer Setup utility and try adding a POST delay under <b>Advanced &gt; Power-On Options</b> .
The device is attached to a SATA port that has been hidden in Computer Setup.	Run the Computer Setup utility and ensure <b>Device Available</b> is selected for the device's SATA port in <b>Security &gt; Device Security</b> .
Drive responds slowly immediately after power-up.	Run Computer Setup and increase the POST Delay in <b>Advanced &gt; Power-On Options</b> .

**Table D-14 Solving CD-ROM and DVD Problems (continued)****CD-ROM or DVD devices are not detected or driver is not loaded.**

Cause	Solution
Drive is not connected properly or not properly configured.	See the documentation that came with the optional device.

**Movie will not play in the DVD drive.**

Cause	Solution
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).**

Cause	Solution
Disc not properly seated in the drive.	Turn off the computer and insert a thin metal rod into the emergency eject hole and push firmly. 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.**

Cause	Solution
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.
CD or DVD disc is dirty.	Clean CD or DVD with a CD cleaning kit, available from most computer stores.
Windows does not detect the CD-ROM or DVD-ROM drive.	<ol style="list-style-type: none"> <li>1. Use Device Manager to remove or uninstall the device.</li> <li>2. Restart the computer and let Windows detect the CD or DVD driver.</li> </ol>

**Recording or copying CDs is difficult or impossible.**

Cause	Solution
Wrong or poor quality media type.	<ol style="list-style-type: none"> <li>1. Try using a slower speed when recording.</li> <li>2. Verify that you are using the correct media for the drive.</li> <li>3. Try a different brand of media. Quality varies widely between manufacturers.</li> </ol>

# Solving USB Flash Drive Problems

If you encounter USB flash drive problems, common causes and solutions are listed in the following table.

**Table D-15 Solving USB Flash Drive Problems**

**USB flash drive is not seen as a drive letter in Windows.**

Cause	Solution
The drive letter after the last physical drive is not available.	Change the default drive letter for the flash drive in Windows.

**USB flash drive not found (identified).**

Cause	Solution
The device is attached to a USB port that has been hidden in Computer Setup.	Run the Computer Setup utility and ensure that "Device Available" is selected for the USB Ports under <b>Security &gt; Device Security</b> .
The device was not properly seated before power-up.	Ensure the device is fully inserted into the USB port before applying power to the system

**System will not boot from USB flash drive.**

Cause	Solution
Boot order is not correct.	Run the Computer Setup utility and change boot sequence in <b>Storage &gt; Boot Order</b> .
Removable Media Boot is disabled in the Computer Setup utility.	Run the Computer Setup utility and enable booting to removable media in <b>Storage &gt; Storage Options</b> . Ensure USB is enabled in <b>Storage &gt; Boot Order</b> .
The image on the device is not bootable.	Follow the procedures described in the "ROM Flash: Replicating the Setup: Creating a Bootable Device: Supported USB Flash Media Device" section of the <i>Service Reference Guide</i> .

**The computer boots to DOS after making a bootable flash drive.**

Cause	Solution
Flash drive is bootable.	Install the flash drive only after the operating system boots.

## Solving Front Panel Component Problems

If you encounter problems with devices connected to the front panel, refer to the common causes and solutions listed in the following table.

**Table D-16 Solving Front Panel Component Problems**

**A USB device, headphone, or microphone is not recognized by the computer.**

Cause	Solution
Device is not properly connected.	<ol style="list-style-type: none"><li>1. Turn off the computer.</li><li>2. Reconnect the device to the front of the computer and restart the computer.</li></ol>
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.
The correct device driver is not installed.	<ol style="list-style-type: none"><li>1. Install the correct driver for the device.</li><li>2. You might need to reboot the computer.</li></ol>
The cable from the device to the computer does not work.	<ol style="list-style-type: none"><li>1. If possible, replace the cable.</li><li>2. Restart the computer.</li></ol>
The device is not working.	<ol style="list-style-type: none"><li>1. Replace the device.</li><li>2. Restart the computer.</li></ol>
USB ports on the computer are disabled in Computer Setup.	Enter Computer Setup (F10) and enable the USB ports.

## Solving Internet Access Problems

If you encounter Internet access problems, consult your Internet Service Provider (ISP) or refer to the common causes and solutions listed in the following table.

**Table D-17 Solving Internet Access Problems**

**Unable to connect to the Internet.**

Cause	Solution
Internet Service Provider (ISP) account is not set up properly.	Verify Internet settings or contact your ISP for assistance.
Modem is not set up properly.	Reconnect the modem. Verify the connections are correct using the quick setup documentation.
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 UTP cable is disconnected.	Connect the CAT5 UTP cable between the cable modem and the computer's RJ-45 connector. (If the connection is good, the "PC" LED light on the front of the cable/DSL modem will be on.)

**Table D-17 Solving Internet Access Problems (continued)**

**Unable to connect to the Internet.**

<b>Cause</b>	<b>Solution</b>
IP address is not configured properly.	Contact your ISP for the correct IP address.
Cookies are corrupted. (A “cookie” is a small piece of information that a Web server can store temporarily with the Web browser. This is useful for having the browser remember some specific information that the Web server can later retrieve.)	<p><b>Windows Vista</b></p> <ol style="list-style-type: none"><li>1. Select <b>Start &gt; Control Panel</b>.</li><li>2. Click <b>Network and Internet</b>.</li><li>3. Click <b>Internet Options</b>.</li><li>4. In the <b>Browsing history</b> section on the <b>General</b> tab, click the <b>Delete</b> button.</li><li>5. Click the <b>Delete cookies</b> button.</li></ol> <p><b>Windows XP</b></p> <ol style="list-style-type: none"><li>1. Select <b>Start &gt; Control Panel</b>.</li><li>2. Double-click <b>Internet Options</b>.</li><li>3. On the <b>General</b> tab, click the <b>Delete Cookies</b> button.</li></ol>

**Cannot automatically launch Internet programs.**

<b>Cause</b>	<b>Solution</b>
You must log on to your ISP before some programs will start.	Log on to your ISP and launch the desired program.

**Table D-17 Solving Internet Access Problems (continued)**

**Internet takes too long to download Web sites.**

Cause	Solution
Modem is not set up properly.	<p data-bbox="855 275 1385 327">Verify that the modem is connected and communicating properly.</p> <p data-bbox="855 352 986 378"><b>Windows XP</b></p> <ol data-bbox="855 403 1437 861" style="list-style-type: none"><li>1. Select <b>Start &gt; Control Panel</b>.</li><li>2. Double-click <b>System</b>.</li><li>3. Click the <b>Hardware</b> tab.</li><li>4. In the <b>Device Manager</b> area, click the <b>Device Manager</b> button.</li><li>5. Double-click <b>Modems</b>.</li><li>6. Double-click <b>Agere Systems PCI-SV92PP Soft Modem</b>.</li><li>7. On the <b>General</b> tab, click <b>Diagnostics</b>.</li><li>8. Click <b>Query Modem</b>. A "Success" response indicates the modem is connected and working properly.</li></ol> <p data-bbox="855 886 1007 911"><b>Windows Vista</b></p> <ol data-bbox="855 936 1437 1365" style="list-style-type: none"><li>1. Select <b>Start &gt; Control Panel</b>.</li><li>2. Click on <b>System and Maintenance</b>.</li><li>3. Click on <b>System</b>.</li><li>4. In the <b>Tasks</b> list, select <b>Device Manager</b>.</li><li>5. Double-click <b>Modems</b>.</li><li>6. Double-click <b>Agere Systems PCI-SV92PP Soft Modem</b>.</li><li>7. On the <b>General</b> tab, click <b>Diagnostics</b>.</li><li>8. Click <b>Query Modem</b>. A "Success" response indicates the modem is connected and working properly.</li></ol>

# Solving Software Problems

Most software problems occur as a result of the following:

- The application was not installed or configured correctly.
- There is insufficient memory available to run the application.
- There is a conflict between applications.
- Be sure that all the needed device drivers have been installed.
- If you have installed an operating system other than the factory-installed operating system, check to be sure it is supported on the system.

If you encounter software problems, see the applicable solutions listed in the following table.

**Table D-18 Solving Software Problems**

Cause	Solution
<b>Computer will not continue and no HP logo screen has appeared.</b>	
POST error has occurred.	Observe the beeps and LED lights on the front of the computer. See Appendix A, <a href="#">POST Error Messages on page 185</a> to determine possible causes.  See the Restore Kit or the Worldwide Limited Warranty for terms and conditions.
<b>Computer will not continue after HP logo screen has appeared.</b>	
System files may be damaged.	Press the <b>F11</b> key at startup to boot into the recovery partition and run a factory restore.  <b>CAUTION:</b> Restoring the system will erase all data on the hard drive. Be sure to back up all data files before running the restore process.
<b>“Illegal Operation has Occurred” error message is displayed.</b>	
Software being used is not Microsoft-certified for your version of Windows.	Verify that the software is certified by Microsoft for your version of Windows (see program packaging for this information).
Configuration files are corrupt.	If possible, save all data, close all programs, and restart the computer.

## Contacting Customer Support

For help and service, contact an authorized reseller or dealer. To locate a reseller or dealer near you, visit <http://www.hp.com>.

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 **NOTE:** If you take the computer to an authorized reseller, dealer, or service provider for service, remember to provide the setup and power-on passwords if they are set.

Refer to the number listed in the warranty or in the *Support Telephone Numbers* guide for technical assistance.

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# E Password Security and Resetting CMOS

This computer supports security password features, which can be established through the Computer Setup Utilities menu.

This computer supports two security password features that are established through the Computer Setup Utilities menu: setup password and power-on password. When you establish only a setup password, any user can access all the information on the computer except Computer Setup. When you establish only a power-on password, the power-on password is required to access Computer Setup and any other information on the computer. When you establish both passwords, only the setup password will give you access to Computer Setup.

When both passwords are set, the setup password can also be used in place of the power-on password as an override to log in to the computer. This is a useful feature for a network administrator.

If you forget the password for the computer, you can clear that password so you can gain access to the information on the computer by resetting the password jumper.

---

△ **CAUTION:** Pushing the CMOS button will reset CMOS values to factory defaults. It is important to back up the computer CMOS settings before resetting them in case they are needed later. Back up is easily done through Computer Setup. See the *Computer Setup (F10) Utility Guide* for information on backing up the CMOS settings.

---

# Resetting the Password Jumper

To disable the power-on or setup password features, or to clear the power-on or setup passwords, complete the following steps:

1. Shut down the operating system properly, then turn off the computer and any external devices, and disconnect the power cord from the power outlet.
2. With the power cord disconnected, press the power button again to drain the system of any residual power.

---

⚠ **WARNING!** To reduce the risk of personal injury from electrical shock and/or hot surfaces, be sure to disconnect the power cord from the wall outlet, and allow the internal system components to cool before touching.

⚠ **CAUTION:** When the computer is plugged in, the power supply always has voltage applied to the system board even when the unit is turned off. Failure to disconnect the power cord can result in damage to the system.

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. See the *Safety & Regulatory Information* guide for more information.

---

3. Remove the computer cover or access panel.
4. Locate the header and jumper.

📄 **NOTE:** The password jumper is green so that it can be easily identified. For assistance locating the password jumper and other system board components, see the Illustrated Parts & Service Map (IPSM) for that particular system. The IPSM can be downloaded from <http://www.hp.com/support>.

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5. Remove the jumper from pins 1 and 2. Place the jumper on either pin 1 or 2, but not both, so that it does not get lost.
6. Replace the computer cover or access panel.
7. Reconnect the external equipment.
8. Plug in the computer and turn on power. Allow the operating system to start. This clears the current passwords and disables the password features.
9. To establish new passwords, repeat steps 1 through 4, replace the password jumper on pins 1 and 2, then repeat steps 6 through 8. Establish the new passwords in Computer Setup. Refer to the *Computer Setup (F10) Utility Guide* for Computer Setup instructions.

# Clearing and Resetting the CMOS

The computer's configuration memory (CMOS) stores information about the computer's configuration.

The CMOS button resets CMOS but does not clear the power-on and setup passwords.

Clearing CMOS will clear the Active Management Technology (AMT) settings in the Management Engine BIOS Extension (MEBx), including the password. The password will default to "admin" and will need to be reset. The AMT settings will also need to be reset. To access the MEBx, press **Ctrl+P** during POST.

1. Turn off the computer and any external devices, and disconnect the power cord from the power outlet.
2. Disconnect the keyboard, monitor, and any other external equipment connected to the computer.

---

⚠ **WARNING!** To reduce the risk of personal injury from electrical shock and/or hot surfaces, be sure to disconnect the power cord from the wall outlet, and allow the internal system components to cool before touching.

⚠ **CAUTION:** When the computer is plugged in, the power supply always has voltage applied to the system board even when the unit is turned off. Failure to disconnect the power cord can result in damage to the system.

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. See the *Safety & Regulatory Information* guide for more information.

---

3. Remove the computer cover or access panel.

---

⚠ **CAUTION:** Pushing the CMOS button will reset CMOS values to factory defaults. It is important to back up the computer CMOS settings before resetting them in case they are needed later. Back up is easily done through Computer Setup. See the *Computer Setup (F10) Utility Guide* for information on backing up the CMOS settings.

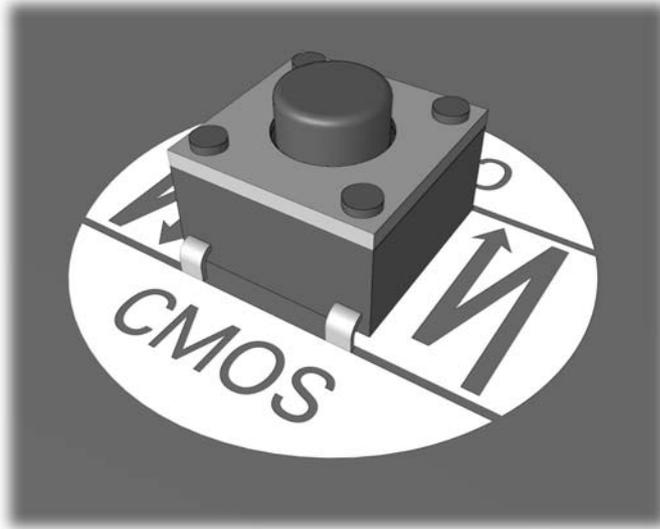
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4. Locate, press, and hold the CMOS button in for five seconds.

 **NOTE:** Make sure you have disconnected the AC power cord from the wall outlet. The CMOS button will not clear CMOS if the power cord is connected.

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**Figure E-1** CMOS button



 **NOTE:** For assistance locating the CMOS button and other system board components, see the Illustrated Parts & Service Map (IPSM) for that particular system.

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5. Replace the computer cover or access panel.
6. Reconnect the external devices.
7. Plug in the computer and turn on power.

 **NOTE:** You will receive POST error messages after clearing CMOS and rebooting advising you that configuration changes have occurred. Use Computer Setup to reset any special system setups along with the date and time.

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For instructions on Computer Setup, see the *Computer Setup (F10) Utility Guide*.

# F Specifications

This chapter provides specifications for the microtower and small form factor chassis.

## Microtower Chassis

**Table F-1 Specifications**

<b>Desktop Dimensions</b>		
Height	14.85 in	37.72 cm
Width	6.95 in	17.65 cm
Depth	16.85 in	42.80 cm
<b>Approximate Weight</b>		
	23.5 lb	10.66 kg
<b>Temperature Range</b>		
Operating	50° to 95°F	10° to 35°C
Nonoperating	-22° to 140°F	-30° to 60°C
<b>Relative Humidity (noncondensing)</b>		
Operating	10-90%	10-90%
Nonoperating (38.7°C max wet bulb)	5-95%	5-95%
<b>Maximum Altitude (unpressurized)</b>		
Operating	10,000 ft	3048 m
Nonoperating	30,000 ft	9144 m
<b>NOTE:</b> Operating temperature is derated 1.0° C per 300 m (1000 ft) to 3000 m (10,000 ft) above sea level; no direct sustained sunlight. Maximum rate of change is 10° C/Hr. The upper limit may be limited by the type and number of options installed.		
<b>Heat Dissipation</b>		
Max STD PS	1410 BTU/hr	356 kg-cal/hr
Typical STD PS idle	TBD BTU/hr	TBD kg-cal/hr
Max EPA 87/89/85% @ 20/50/100% load PS	1255 BTU/hr	316 kg-cal/hr
Typical EPA 87/89/85% @ 20/50/100% load PS idle	TBD BTU/hr	TBD kg-cal/hr

**Table F-1 Specifications (continued)**

<b>Power Supply</b>	<b>115V</b>	<b>230V</b>
Operating Voltage Range (STD PS)	90-264 VAC	90-264 VAC
Operating Voltage Range (EPA 87/89/85% @ 20/50/100% load PS)	90-264 VAC	90-264 VAC
Rated Voltage Range (STD PS)	100-240 VAC	100-240 VAC
Rated Voltage Range (EPA 87/89/85% @ 20/50/100% load PS)	100-240 VAC	100-240 VAC
Rated Line Frequency	50-60 Hz	50-60 Hz
<b>Power Output</b>	<b>320W</b>	<b>320W</b>
<b>Rated Input Current (maximum)<sup>1</sup></b>		
STD PS	5.5A @ 115 VAC	2.75A @ 230 VAC
EPA 87/89/85% @ 20/50/100% load PS	5.5A @ 115 VAC	2.75A @ 230 VAC

<sup>1</sup> This system utilizes an active power factor corrected power supply. This allows the system to pass the CE mark requirements for use in the countries of the European Union. The active power factor corrected power supply also has the added benefit of not requiring an input voltage range select switch.

# Small Form Factor Chassis

**Table F-2 Specifications**

<b>Desktop Dimensions</b> (in the desktop position)		
Height	3.95 in	10.0 cm
Width	13.3 in	33.8 cm
Depth	14.9 in	37.8 cm
<b>Approximate Weight</b>		
	19 lb	8.6 kg
<b>Weight Supported</b> (maximum distributed load in desktop position)		
	77 lb	35 kg
<b>Temperature Range</b>		
Operating	50° to 95°F	10° to 35°C
Nonoperating	-22° to 140°F	-30° to 60°C
<p><b>NOTE:</b> Operating temperature is derated 1.0° C per 300 m (1000 ft) to 3000 m (10,000 ft) above sea level; no direct sustained sunlight. Maximum rate of change is 10° C/Hr. The upper limit may be limited by the type and number of options installed.</p>		
<b>Relative Humidity (noncondensing)</b>		
Operating	10-90%	10-90%
Nonoperating (38.7°C max wet bulb)	5-95%	5-95%
<b>Maximum Altitude (unpressurized)</b>		
Operating	10,000 ft	3048 m
Nonoperating	30,000 ft	9144 m
<b>Heat Dissipation</b>		
Max STD PS	1063 BTU/hr	268 kg-cal/hr
Typical STD PS idle	TBD BTU/hr	TBD kg-cal/hr
Max EPA 87/89/85% @ 20/50/100% load PS	941 BTU/hr	237 kg-cal/hr
Typical EPA 87/89/85% @ 20/50/100% load PS idle	TBD BTU/hr	TBD kg-cal/hr
<b>Power Supply</b>		
	<b>115V</b>	<b>230V</b>
Operating Voltage Range (STD PS)	90-264 VAC	90-264 VAC
Operating Voltage Range (EPA 87/89/85% @ 20/50/100% load PS)	90-264 VAC	90-264 VAC
Rated Voltage Range (STD PS)	100-240 VAC	100-240 VAC
Rated Voltage Range (EPA 87/89/85% @ 20/50/100% load PS)	100-240 VAC	100-240 VAC
Rated Line Frequency	50-60 Hz	50-60 Hz
<b>Power Output</b>		
	240W	240W

**Table F-2 Specifications (continued)**

---

<b>Rated Input Current (maximum)<sup>1</sup></b>		
STD PS	4A @ 100 VAC	2A @ 230 VAC
EPA 87/89/85% @ 20/50/100% load PS	4A @ 100 VAC	2A @ 230 VAC

---

<sup>1</sup> This system utilizes an active power factor corrected power supply. This allows the system to pass the CE mark requirements for use in the countries of the European Union. The active power factor corrected power supply also has the added benefit of not requiring an input voltage range select switch.

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