HP mt40 Mobile Thin Client

Administrator Reference Guide

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Product notice

This guide describes features that are common to most models. Some features may not be available on your computer.

Safety warning notice

⚠ **WARNING!** To reduce the possibility of heat-related injuries or of overheating the computer, do not place the computer directly on your lap or obstruct the computer air vents. Use the computer only on a hard, flat surface. Do not allow another hard surface, such as an adjoining optional printer, or a soft surface, such as pillows or rugs or clothing, to block airflow. Also, do not allow the AC adapter to come into contact with the skin or a soft surface, such as pillows or rugs or clothing, during operation. The computer and the AC adapter comply with the user-accessible surface temperature limits defined by the International Standard for Safety of Information Technology Equipment (IEC 60950).

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1 Welcome

Finding information

The computer comes with several resources to help you perform various tasks.

Resources	For information about
Getting Started	• Computer features • How to connect to a wireless network • How to maximize battery life • How to protect the computer • How to care for the computer • How to install certain components • How to create a wired and/or wireless network • How to set up the computer • Help to identify computer components • Regulatory and safety information • Battery disposal information • Computer specifications
Help and Support **NOTE:** For U.S. support, go to http://www.hp.com/go/contactHP. For worldwide support, go to http://welcome.hp.com/country/us/en/wwcontact_us.html.	• Operating system information • Software, driver, and BIOS updates • Troubleshooting tools • How to access technical support
Safety & Comfort Guide To access this guide: Go to http://www.hp.com/ergo.	• Proper workstation setup, posture, health, and work habits • Electrical and mechanical safety information
Worldwide Telephone Numbers booklet This booklet is provided with your computer.	HP support telephone numbers

Resources	For information about
HP website For U.S. support, go to http://www.hp.com/go/contactHP. For worldwide support, go to http://welcome.hp.com/country/us/en/wwcontact_us.html.	• Support information • Ordering parts and finding additional help • Accessories available for the device
*Limited Warranty** To access the warranty: Go to http://www.hp.com/go/orderdocuments.	Warranty information

*You can find the expressly provided HP Limited Warranty applicable to your product located with the user guides on your computer and/or on the CD/DVD provided in the box. In some countries/regions, HP may provide a printed HP Limited Warranty in the box. For some countries/regions where the warranty is not provided in printed format, you may request a printed copy from http://www.hp.com/go/orderdocuments or write to:

- **North America**: Hewlett-Packard, MS POD, 11311 Chinden Blvd, Boise, ID 83714, USA
- **Europe, Middle East, Africa**: Hewlett-Packard, POD, Via G. Di Vittorio, 9, 20063, Cernusco s/Naviglio (MI), Italy
- **Asia Pacific**: Hewlett-Packard, POD, P.O. Box 200, Alexandra Post Office, Singapore 911507

When you request a printed copy of your warranty, please include your product number, warranty period (found on your service label), name, and postal address.

IMPORTANT: Do NOT return your HP product to the addresses above. For U.S. support, go to http://www.hp.com/go/contactHP. For worldwide support, go to http://welcome.hp.com/country/us/en/wwcontact_us.html.

2 HP Write Filters

The File-Based Write Filter (FBWF) and the Enhanced Write Filter (EWF) provide two distinct ways to provide a secure environment for your computer by protecting it from unauthorized writes to storage and file systems. FBWF operates at the file level, and EWF operates at the sector level. Only one write filter can be selected and active at one time.

File-Based Write Filter

The File-Based Write Filter (FBWF) provides a secure environment for your computer by protecting it from undesired read and write access to write-sensitive or read-only storage.

FBWF has only two states, enabled or disabled. When FBWF is disabled, all previous changes are lost.

Using the File-Based Write Filter command line utility

Windows® Embedded includes the FBWF command line utility. This utility enables you to issue a set of commands to the FBWF driver, report the status of each protected overlay, and report the format of the overall FBWF configurations.

By including the FBWF configuration interface in your configuration and building it into your image, you enable use of the FBWF command line utility and the corresponding commands.

To use the FBWF command line utility, follow these steps:

1. Select **Start > Run**.
2. Type `CMD` in the Open field to access the system DOS prompt.
3. Click **OK**.
4. Type `fbwfmgr c:` at the prompt.
5. Press enter.

When you enter the `fbwfmgr [boot command]` syntax, use the following commands in the boot command variable of the command line:

- **/disable**

  Disables the write filter on the next restart.

- **/enable**

  Enables the write filter on the next restart.

- **/displayconfig**

  Displays all current configuration information for the write filter including filter state, protected volumes list, cache compression state, overlay cache threshold, cache pre-allocation status, and write through paths.

- **/overlaydetail**

  Displays detail on the current overlay contents for all protected volumes including file and folder contents and memory used.

- **/addexclusion**

  Adds a write through path to the exclusion list.

- **/removeexclusion**

  Removes a write through path from the exclusion list.

- **/setthreshold**

  Sets the overlay threshold value.

Using the File-Based Write Filter configuration interface

In addition to the DOS command-line tool, Windows Embedded includes a FBWF configuration interface. You can access the FBWF interface by using the Windows Control Panel.

To access the FBWF interface, follow these steps:

1. Log on as an administrator.
2. Select **Start > Control Panel**.
3. Select **HP Write Filter Configuration**.

The FBWF interface includes the following buttons:

- **Enable/Disable Write Filter**

  Enable/disable the FBWF so that data written to the protected media is cached or not.

- **Enable/Disable Cache Compression**

  Enable/disable cache compression.

- **Enable/Disable Cache Pre-allocation**

  Enable/disable cache pre-allocation.

- **Set Cache Threshold**

  Set the amount of RAM in MB that the FBWF cache can use.

Using the File-Based Write Filter status utility

The FBWF status utility creates an icon in the notification area of the taskbar that shows the status of the FBWF. You can right-click the icon to display and execute the available options.

The FBWF Status icon displays the following states:

- Red lock: FBWF is disabled.
- Green lock: FBWF is enabled.
- Yellow lock: FBWF state will change on next boot.

If you are logged on as an administrator, you can change the status of FBWF by right-clicking the icon and selecting the desired FBWF state.

NOTE: Because the fbwfmgr.exe utility and the FBWF status service execute separate code, status changes made by fbwfmgr.exe are not automatically reflected by the FBWF status icon.

If you use the command line to modify the FBWF, right-click the icon to refresh the status icon display (click anywhere on the screen to close the context menu). The status icon display is refreshed automatically when you make modifications through the FBWF Control Panel utility. The FBWF utility always reflects the current status.

Enhanced Write Filter

The Enhanced Write Filter (EWF) provides a secure environment for your computer by protecting it from undesired flash memory writes (the operating system and functional software components reside in flash memory). The write filter also extends the life of the computer by preventing excessive flash write activity. Instead of allowing writes directly to the flash memory, it intercepts all flash writes and caches them.

To save changes to system configuration settings, you must disable the write filter cache or perform the `-commit` command during the current boot session. Otherwise, the new settings will be lost when the computer is shut down or restarted. If you do not want to make permanent changes, you can enable the write filter.

The write filter cache contents are not lost when you log off and on again (as the same or different user). You can disable the write filter cache after the new logon and still retain the changes.

After you disable the write filter, all future writes during the current boot session are written to the flash with no further caching until the computer is restarted. You can also enable/disable the write filter by using the command line.

NOTE: Only an account with administrator privileges can enable, disable, or commit the enhanced write filter.

NOTE: Always enable the write filter after you have made all of your permanent changes.

Using the Enhanced Write Filter command line utility

CAUTION: When using the `-commit` command, all of the temporary contents are permanently written to the flash memory.

NOTE: Because the Enhanced Write Filter commands are executed on the next boot, you must restart the computer for the command to take effect.

Windows Embedded includes the EWF command line utility. This utility enables you to issue a set of commands to the EWF driver, report the status of each protected volume overlay, and report the format of the overall EWF configurations.

By including the EWF configuration interface in your configuration and building it into your image, you enable use of the EWF command line utility and the corresponding commands.

To use the EWF command line utility, follow these steps:

1. Select **Start > Run**.
2. Type `CMD` in the Open field to access the system DOS prompt.
3. Click **OK**.
4. Type `ewfmgr c:` at the prompt.
5. Press enter.

When you enter the `ewfmgr [boot command]` syntax, use the following commands in the boot command variable of the command line:

- **-all**

  Displays information about all protected volumes and performs a command, such as disable, enable, and commit, on each volume, if specified.

- **-commit**

  Commits all current level data in the overlay to the protected volume, and resets the current overlay value to 1. You can combine `-commit` with the `-disable` command to commit and then disable.

- **-disable**

  Disables the overlay on the specified protected volume.

- **-enable**

  Enables the EWF so that data written to the protected media is cached in the overlays. The current overlay level becomes 1 as soon as EWF is started, and a new overlay is created at level 1.

- **-commitanddisable**

  Commits data in the overlay upon shutdown and disables EWF after the system reboots.

Using the Enhanced Write Filter configuration interface

In addition to the DOS command-line tool, Windows Embedded includes an EWF configuration interface. You can access the EWF interface by using the Windows Control Panel.

To access the EWF interface, follow these steps:

1. Log on as an administrator.
2. Select **Start > Control Panel**.
3. Select **HP Write Filter Configuration**.

The EWF interface includes the following buttons:

- **Enable/Disable EWF**

  Enables the Enhanced Write Filter so that data written to the protected media is cached in the overlays. Disables the overlay on the specified protected volume.

- **Overlay Configuration**

  Displays the overlay information and is a combination of the information supplied when executing `ewfmgr.exe c: -Description` and `ewfmgr.exe c: -Gauge` from the DOS prompt.

- **Clear Boot Command**

  Clears the boot command from the DOS prompt.

- **Commit Data to Volume**

  Commits all current-level data in the overlay to the protected volume, and resets the current overlay value to 1.

Using the Enhanced Write Filter status utility

The EWF status utility creates an icon in the notification area of the taskbar that shows the status of the filter. You can right-click the icon to display and execute the available options.

The EWF Status icon displays the following states:

- Red lock: EWF is disabled.
- Green lock: EWF is enabled.
- Yellow lock: EWF state will change on next boot.

If you are logged on as an administrator, you can change the status of EWF by right-clicking the icon and selecting the desired EWF state.

NOTE: Because the ewfmgr.exe utility and the EWF status service execute separate code, status changes by ewfmgr.exe are not automatically reflected by the EWF status icon.

If you use the command line to modify the EWF, right-click the icon to refresh the status icon display (click anywhere on the screen to close the context menu). The status icon display is refreshed automatically when you make modifications through the EWF Control Panel utility. The EWF utility always reflects the current status.

3 Configuration

Local drives

The following sections describe the local drives on your computer.

Drive Z

Drive Z (HP RAMDisk) is a virtual drive that is created from the system's physical RAM. The RAMDisk will look and behave like a standard fixed disk drive, but it is created at system startup and destroyed at system shutdown. Therefore, HP recommends that you do not store information or data on this virtual disk drive.

The RAMDisk is volatile memory space set aside for temporary data storage.

The following items are stored on the RAMDisk:

- Browser Web page cache
- Browser history
- Browser cookies
- Browser cache
- Temporary Internet files
- Print spooling
- User/system temporary files

Use the RAMDisk Configuration dialog box to configure the RAMDisk size. If you change the size of the RAMDisk, you will be prompted to restart for the change to take effect. To permanently save the change, disable the write filter cache or issue the `-commit` command during the current boot session before restarting.

Drive C

⚠ **CAUTION:** If the available free space on the flash drive is reduced to below 3 MB, the computer becomes unstable.

A write filter is used by the computer for security and to prevent excessive flash write activity. Changes to the computer configuration are lost when the computer is restarted unless the write filter cache is disabled or a `-commit` command is issued during the current boot session. For additional information, refer to HP Write Filters on page 3.

Saving files

The computer uses an embedded operating system with a fixed amount of flash memory. HP recommends that you save files that you want to retain on a server rather than on your computer. Be careful of application settings that write to the C drive, which resides in flash memory (in particular, many applications by default write cache files to the C drive on the local system). If you must write to a local drive, change the application settings to use the Z drive. To minimize writing to the C drive, update the configuration settings.

Mapping network drives

To keep the mappings after the computer is restarted, follow these steps:

1. Disable the write filter cache during the current boot session or issue the `-commit` command.
2. Click **Reconnect at logon**.

Because a user logon cannot disable the write filter cache, you can retain the mappings created by a user by logging off the user (do not shut down or restart the computer), logging back on as administrator, and then disabling the write filter.

You can also assign the remote home directory by using the Local Users and Groups utility or by other means known to administrators.

Roaming profiles

Write roaming profiles to the C drive. The profiles need to be limited in size and will not be retained when the computer is restarted.

NOTE: For roaming profiles to work and be downloaded, sufficient flash space must be available. You might need to remove software components to free up space for roaming profiles.

4 Applications

Remote Desktop Connection

The Remote Desktop Connection utility allows you to establish connections to a Windows Terminal Server or to access remote applications by using Microsoft Remote Desktop Protocol (RDP).

For additional information on how to use the Microsoft Remote Desktop Connection utility, go to the Microsoft Web site at http://www.microsoft.com.

HP Remote Graphics Software (RGS)

HP RGS is an advanced utility that allows a user to access and share the desktop of a remote computer over a standard network. All applications run natively on the remote computer and take full advantage of the computer and graphics resources of the sending computer.

TeemTalk Terminal Emulation

All computer models include terminal emulation software to support computing on legacy platforms. The software uses the Telnet protocol to communicate with the computing platform. Refer to the terminal emulation documentation (supplied separately) for instructions.

- To access the TeemTalk Connection Wizard and the TeemTalk Emulator, select **Start > All Programs > Hewlett-Packard**.

HP Device Manager

HP Device Manager is a management solution that communicates with a large number of HP Mobile Thin Clients, and provides remote and asset management, reporting, and security. HP Device Manager is based on industry-standard technologies, such as RDMS and SSL encryption.

Citrix XenApp Client

Citrix XenApp Client is an on-demand application delivery solution that offers application compatibility. It enables any Windows® application to be virtualized, centralized, and managed in the datacenter, and then delivered as a service instantly anywhere, and to any device.

For additional information on how to use the Citrix XenApp Client, go to the Citrix Web site at http://www.citrix.com.

HP ThinState Capture

The HP ThinState Capture tool is a wizard-based utility that you can use to capture a Windows Embedded image, which you can then deploy to another HP computer of identical model and hardware.

NOTE: HP ThinState Capture is not a standalone utility and can only be accessed by the administrator from within the computer image.

Save all data on the USB flash drive prior to performing this procedure.

1. Select **Start > Control Panel > HP ThinState Capture**.
2. Click **Next**.
3. Insert a USB flash drive. The USB flash drive letter and size are displayed.

   The USB flash drive must be greater in size than the onboard flash drive. Therefore, if your computer has a 512-MB flash drive, the USB flash drive must be 1 GB.
4. Click **Capture**.
5. Click **Yes**.

   The HP ThinState Capture utility formats and makes the USB flash drive bootable. HP ThinState Capture will now reboot the system.
6. Follow the on-screen instructions.

   You can now use the USB flash drive to deploy the captured image to another HP computer of the identical model and hardware.

HP ThinState Deploy

To perform an HP ThinState deployment, follow these steps:

1. On the computer that will receive the captured image, make sure that **USB boot** is first in the boot order in Computer Setup.
2. Insert the USB flash drive that was created by using HP ThinState Capture, and then restart the computer.
3. Follow the on-screen instructions.

After you remove the USB flash drive and cycle power to the system, the image will unbundle. This process can take 10 to 12 minutes. Do not interrupt or cycle power to the computer during this process.

Microsoft Internet Explorer

The Microsoft Internet Explorer browser is installed locally on the computer. For information about Microsoft Internet Explorer, go to the Microsoft Web site at http://www.microsoft.com.

Windows Media Player

Windows Media Player contains security, performance, and functionality improvements. For more information about improvements to Windows Media Player, go to the Microsoft Web site at http://www.microsoft.com.

VMware View Manager

View Manager, a key component of VMware View, is an enterprise class desktop management solution, which streamlines the management, provisioning, and deployment of virtual desktops. Using View Manager, users are able to securely access virtual desktops hosted on VMware Infrastructure, terminal servers, blade PCs, and remote computers.

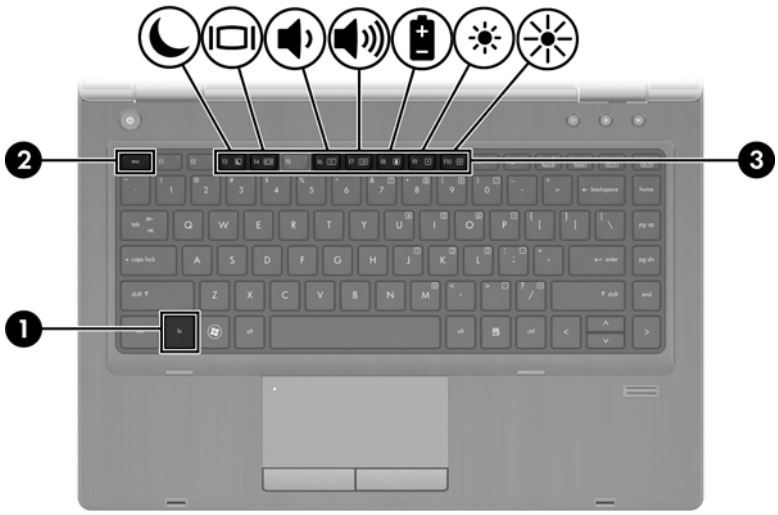
For more information about VMware View Manager, go to the VMware Web site at http://www.vmware.com/.

5 Keyboard and pointing devices

Using the keyboard

Identifying the hotkeys

A hotkey is a combination of the fn key **(1)** and either the esc key **(2)**, or one of the function keys **(3)**.



To use a hotkey:

▲ Briefly press the fn key, and then briefly press the second key of the hotkey combination.

Hotkey combination	Description
fn+esc	Displays system information.
fn+f3	Initiates Sleep, which saves your information in system memory. The display and other system components turn off and power is conserved. To exit Sleep, briefly press the power button. **CAUTION:** To reduce the risk of information loss, save your work before initiating Sleep. The function of the fn+f3 hotkey can be changed. In all Windows operating system windows, references to the *sleep button* apply to the fn+f3 hotkey.

Hotkey combination		Description
	fn+f4	Switches the screen image among display devices connected to the system. For example, if a monitor is connected to the computer, fn+f4 alternates the screen image from computer display to monitor display to simultaneous display on both the computer and the monitor. Most external monitors receive video information from the computer using the external VGA video standard. The fn+f4 hotkey can also alternate images among other devices that are receiving video information from the computer.
	fn+f6	Decreases speaker volume.
	fn+f7	Increases speaker volume.
	fn+f8	Opens the Power Control Panel Applet, which is used to configure power management.
	fn+f9	Decreases the screen brightness level.
	fn+f10	Increases the screen brightness level.

Using pointing devices

To move the pointer, slide your finger across the TouchPad surface in the direction you want the pointer to go. Use the TouchPad buttons like the corresponding buttons on an external mouse.

NOTE: In addition to the pointing devices included with your computer, you can use an external USB mouse (purchased separately) by connecting it to one of the USB ports on the computer.

Setting pointing device preferences

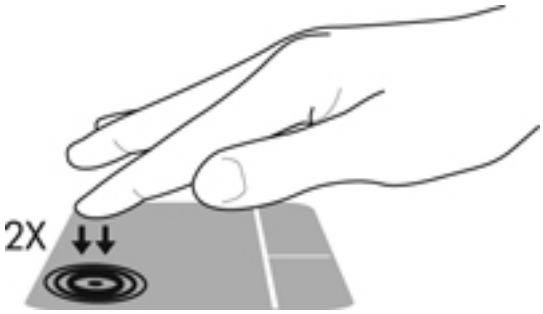
To access Mouse Properties, select **Start > Control Panel > Mouse**.

Using the TouchPad

To move the pointer, slide one finger across the TouchPad in the direction you want the pointer to go. Use the left and right TouchPad buttons like the buttons on an external mouse.

Turn the TouchPad off and on

To turn the TouchPad off and on, quickly double-tap the TouchPad on/off button.

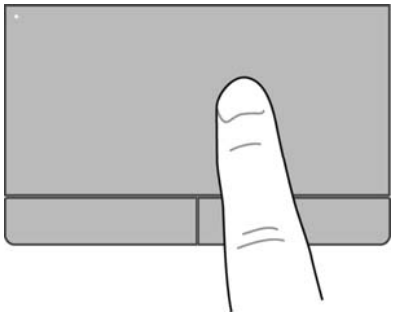


The following table shows and describes the TouchPad display icons.

TouchPad light	Icon	Description
Amber		Indicates that the TouchPad is off.
Off		Indicates that the TouchPad is on.

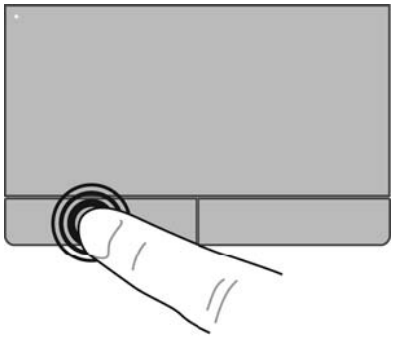
Navigating

To move the pointer, slide one finger across the TouchPad in the direction you want the pointer to go.



Selecting

Use the left and right TouchPad buttons like the corresponding buttons on an external mouse.



6 Power

NOTE: A computer may have a power button or a power switch. The term *power button* is used throughout this guide to refer to both types of power controls.

Shutting down the computer

CAUTION: Unsaved information is lost when the computer shuts down.

The shutdown command closes all open programs, including the operating system, and then turns off the display and computer.

Shut down the computer under any of the following conditions:

- When you need to replace the battery or access components inside the computer
- When you are connecting an external hardware device that does not connect to a Universal Serial Bus (USB) port
- When the computer will be unused and disconnected from external power for an extended period

Although you can shut down the computer with the power button, the recommended procedure is to use the Windows shutdown command:

NOTE: If the computer is in the Sleep state, you must first exit Sleep before shutdown is possible.

1. Save your work and close all open programs.
2. Select **Start > Shut down**.

If the computer is unresponsive and you are unable to use the preceding shutdown procedure, try the following emergency procedures in the sequence provided:

- Press ctrl+alt+delete, and then click the **Power** button on the screen.
- Press and hold the power button on the computer for at least 5 seconds.
- Disconnect the computer from external power.
- On models with a user-replaceable battery, remove the battery.

Setting power options

Using power-saving states

The computer has one power-saving state that is enabled at the factory: Sleep.

When Sleep is initiated, the power lights blink and the screen clears. Your computer is disconnected from the network.

CAUTION: To reduce the risk of possible audio and video degradation, loss of audio or video playback functionality, or loss of information, do not initiate Sleep while reading from or writing to an external media card.

NOTE: You cannot initiate any type of networking connection or perform any computer functions while the computer is in the Sleep state.

Initiating and exiting Sleep

The system is set at the factory to initiate Sleep after a period of inactivity when running on battery power or on external power.

Power settings and timeouts can be changed using Power Options in Windows Control Panel.

With the computer on, you can initiate Sleep in any of the following ways:

- Briefly press the power button.
- Close the display.
- Click **Start**, click the arrow next to the Shut down button, and then click **Sleep**.

To exit Sleep:

- Briefly press the power button.
- If the display is closed, open the display.
- Press a key on the keyboard.
- Tap or swipe the TouchPad.

When the computer exits Sleep, the power lights turn on and your work returns to the screen as it was before you stopped working.

NOTE: If you have set a password to be required on wakeup, you must enter your Windows password before your work will return to the screen.

Using the power meter

The power meter is located in the notification area, at the far right of the taskbar. The power meter allows you to quickly access power settings and view the remaining battery charge.

- To display the percentage of remaining battery charge and the current power plan, move the pointer over the power meter icon.
- To access Power Options, or to change the power plan, click the power meter icon and select an item from the list.

Different power meter icons indicate whether the computer is running on battery or external power. The icon also displays a message if the battery has reached a low or critical battery level.

Using power plans

A power plan is a collection of system settings that manages how the computer uses power. Power plans can help you conserve power or maximize performance.

Viewing the current power plan

Use any of the following methods:

- Click the power meter icon in the notification area, at the far right of the taskbar.
- Log on as an administrator, select **Start**, select **Control Panel**, and then select **Power Options**.

Selecting a different power plan

Use any of the following methods:

- Click the power meter icon in the notification area, and then select a power plan from the list.
- Log on as an administrator, select **Start**, select **Control Panel**, select **Power Options**, and then select an item from the list.

Customizing power plans

1. Click the power meter icon in the notification area, and then click **More power options**.

   – or –

   Log on as an administrator, select **Start**, select **Control Panel**, and then select **Power Options**.
2. Select a power plan, and then click **Change plan settings**.
3. Change the settings as needed.
4. To change additional settings, click **Change advanced power settings** and make your changes.

Setting password protection on wakeup

To set the computer to prompt for a password when the computer exits Sleep, follow these steps:

1. Log on as an administrator, select **Start**, select **Control Panel**, and then select **Power Options**.
2. In the left pane, click **Require a password on wakeup**.
3. Click **Require a password (recommended)**.

   NOTE: If you need to create a user account password or change your current user account password, click **Create or change your user account password**, and then follow the on-screen instructions. If you do not need to create or change a user account password, go to step 4.
4. Click **Save changes**.

Using battery power

WARNING! To reduce potential safety issues, use only the battery provided with the computer, a replacement battery provided by HP, or a compatible battery purchased from HP.

The computer runs on battery power whenever it is not plugged into external AC power. Computer battery life varies, depending on power management settings, running programs, display brightness, external devices connected to the computer, and other factors. Keeping the battery in the computer whenever the computer is plugged into AC power charges the battery and also protects your work in case of a power outage. If the computer contains a charged battery and is running on external AC power, the computer automatically switches to battery power if the AC adapter is disconnected from the computer or an AC power loss occurs.

NOTE: When you disconnect AC power, the display brightness is automatically decreased to save battery life. For information on increasing or decreasing display brightness, see Identifying the hotkeys on page 13.

Displaying the remaining battery charge

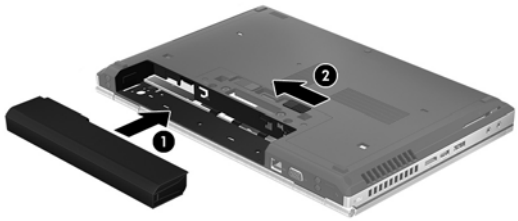
▲ Move the pointer over the power meter icon in the notification area, at the far right of the taskbar.

Inserting or removing the battery

To insert the battery:

1. Turn the computer upside down on a flat surface, with the battery bay toward you.
2. Insert the battery **(1)** into the battery bay until it is seated.

   The battery release latch **(2)** automatically locks the battery into place.



To remove the battery:

CAUTION: Removing a battery that is the sole power source for the computer can cause loss of information. To prevent loss of information, save your work and shut down the computer through Windows before removing the battery.

1. Turn the computer upside down on a flat surface, with the battery bay toward you.
2. Slide the battery release latch **(1)** to release the battery.

3. Remove the battery from the computer **(2)**.

Maximizing battery discharge time

Battery discharge time varies depending on the features you use while on battery power. Maximum discharge time gradually decreases as the battery storage capacity naturally degrades.

Tips for maximizing battery discharge time:

- Lower the brightness on the display.
- Remove the battery from the computer when it is not being used or charged, if the computer contains a user-replaceable battery
- Store the user-replaceable battery in a cool, dry location.
- Select the **HP Optimized** setting in Power Options.

Managing low battery levels

The information in this section describes the alerts and system responses set at the factory. Some low-battery alerts and system responses can be changed using Power Options in Windows Control Panel. Preferences set using Power Options do not affect lights.

Identifying low battery levels

When a battery that is the sole power source for the computer reaches a low or critical battery level, the following behavior occurs:

- The battery light (select models only) indicates a low or critical battery level.

NOTE: For additional information about the battery light, see the *Getting Started* guide.

– or –

- The power meter icon in the notification area shows a low or critical battery notification.

NOTE: For additional information about the power meter, see Using the power meter on page 18.

Resolving a low battery level

Resolving a low battery level when external power is available

▲ Connect one of the following devices:

- AC adapter
- Optional docking or expansion device
- Optional power adapter purchased as an accessory from HP

Resolving a low battery level when no power source is available

- Save your work and shut down the computer.

Conserving battery power

- Select low power-use settings through Power Options in Windows Control Panel.
- Turn off wireless and LAN connections when you are not using them.
- Disconnect unused external devices that are not plugged into an external power source.
- Stop, disable, or remove any external media cards that you are not using.
- Decrease screen brightness.
- Before you leave your work, initiate Sleep, or shut down the computer.

Storing a user-replaceable battery (select models only)

CAUTION: To reduce the risk of damage to a battery, do not expose it to high temperatures for extended periods of time.

If a computer will be unused and unplugged from external power for more than 2 weeks, remove the user-replaceable battery and store it separately.

To prolong the charge of a stored battery, place it in a cool, dry place.

NOTE: A stored battery should be checked every 6 months. If the capacity is less than 50 percent, recharge the battery before returning it to storage.

Calibrate a battery before using it if it has been stored for one month or more.

Disposing of a user-replaceable battery (select models only)

WARNING! To reduce the risk of fire or burns, do not disassemble, crush, or puncture; do not short external contacts; do not dispose of in fire or water.

See the *Regulatory, Safety and Environmental Notices* for proper battery disposal. These notices are located in the printed *Getting Started* guide.

Using external AC power

WARNING! Do not charge the computer battery while you are onboard aircraft.

WARNING! To reduce potential safety issues, use only the AC adapter provided with the computer, a replacement AC adapter provided by HP, or a compatible AC adapter purchased from HP.

NOTE: For information on connecting to AC power, see the *Getting Started* guide.

External AC power is supplied through an approved AC adapter or an optional docking or expansion device.

Connect the computer to external AC power under any of the following conditions:

- When charging or calibrating a battery
- When installing or modifying system software
- When running Disk Defragmenter
- When performing a backup or recovery

When you connect the computer to external AC power, the following events occur:

- The battery begins to charge.
- If the computer is turned on, the power meter icon in the notification area changes appearance.

When you disconnect external AC power, the following events occur:

- The computer switches to battery power.
- The display brightness is automatically decreased to save battery life.

Testing an AC adapter

Test the AC adapter if the computer exhibits any of the following symptoms when it is connected to AC power:

- The computer does not turn on.
- The display does not turn on.
- The power lights are off.

To test the AC adapter:

NOTE: The following instructions apply to computers with user-replaceable batteries.

1. Shut down the computer.
2. Remove the battery from the computer.
3. Connect the AC adapter to the computer, and then plug it into an AC outlet.
4. Turn on the computer.
   - If the power lights turn *on*, the AC adapter is working properly.
   - If the power lights remain *off*, the AC adapter is not functioning and should be replaced.

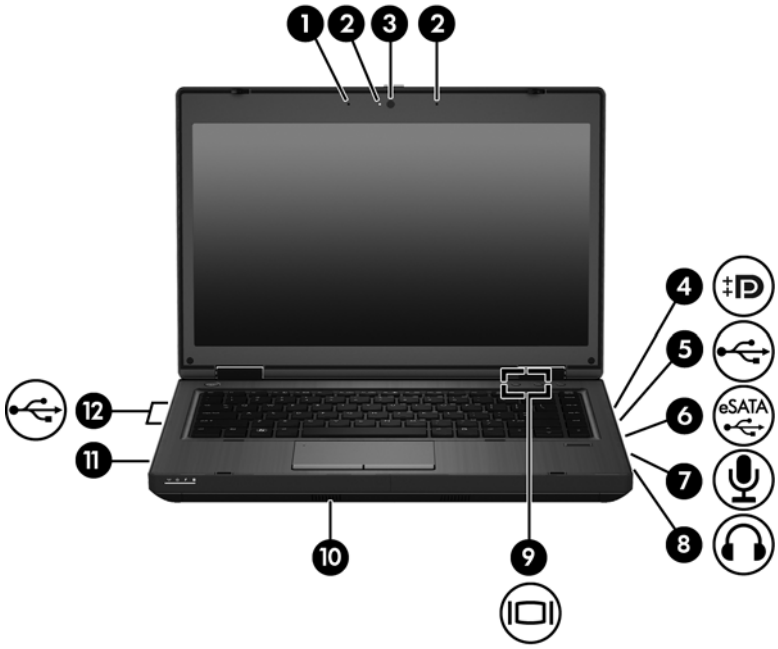
Contact support for information on obtaining a replacement AC power adapter.

7 Multimedia

Using multimedia

Using the audio features

The following illustration and table describe the audio features of the computer.



Component		Description
(1)	Internal microphone(s) (1 without webcam/2 with webcam)	Record sound.
(2)	Webcam light (select models only)	On: The webcam is in use.
(3)	Webcam (select models only)	Records video and captures still photographs.
(4)	DisplayPort	Connects an optional digital display device, such as a high performance monitor or projector.
(5)	USB 2.0 port*	Connects an optional USB device.
(6)	eSATA/USB 2.0 combo port	Connects an optional high-performance eSATA component, such as an eSATA external hard drive, or connects an optional USB device.

Component		Description
(7)	Audio-in (microphone) jack	Connects an optional computer headset microphone, stereo array microphone, or monaural microphone.
(8)	Audio-out (headphone) jack	Connects optional powered stereo speakers, headphones, ear buds, a headset, or television audio. **WARNING!** To reduce the risk of personal injury, adjust the volume before putting on headphones, earbuds, or a headset. For additional safety information, refer to the *Getting Started* guide. **NOTE:** When a device is connected to the jack, the computer speakers are disabled.
(9)	External monitor port	Connects an external VGA monitor or projector. **NOTE:** The external monitor port is located on the rear of the computer.
(10)	Speakers (2)	Produce sound.
(11)	Upgrade bay	The upgrade bay can hold a weight-saver option, a hard drive, or an optical drive that reads an optical disc. **NOTE:** On select models, the optical drive also writes to an optical disc.
(12)	USB 3.0 ports (2)*	Connect optional USB 3.0 devices and provide enhanced USB power performance.
*For information regarding the status of the USB port, contact your network administrator.		

Using the audio-in (microphone) jack

The computer is equipped with a stereo (dual-channel) microphone jack that supports an optional stereo array or monaural microphone. Using sound recording software with external microphones allows for stereo recordings.

When connecting a microphone to the microphone jack, use a microphone with a 3.5-mm plug.

Using the audio-out (headphone) jack

⚠ **WARNING!** To reduce the risk of personal injury, adjust the volume before putting on headphones, earbuds, or a headset. For additional safety information, refer to the *Regulatory, Safety, and Environmental Notices*. These notices are located in the printed *Getting Started Guide*.

⚠ **CAUTION:** To prevent possible damage to an external device, do not plug a single sound channel (monaural) connector into the headphone jack.

In addition to connecting headphones, the headphone jack is used to connect the audio-out function of an audio device such as external powered speakers or a stereo system.

When connecting a device to the headphone jack, use only a 3.5-mm stereo plug.

When a device is connected to the headphone jack, the speakers are disabled.

Adjusting the volume

You can adjust the volume using the following controls:

- Hotkeys:
  - To mute or restore speaker sound, press volume mute button.
  - To decrease speaker sound, press fn+f6. Hold down the hotkey to decrease speaker sound incrementally.
  - To increase speaker sound, press fn+f7. Hold down the hotkey to increase speaker sound incrementally.
- Windows volume control:
  a. Click the **Volume** icon in the notification area, at the far right of the taskbar.
  b. Increase or decrease the volume by moving the slider up or down.
- Program volume control:

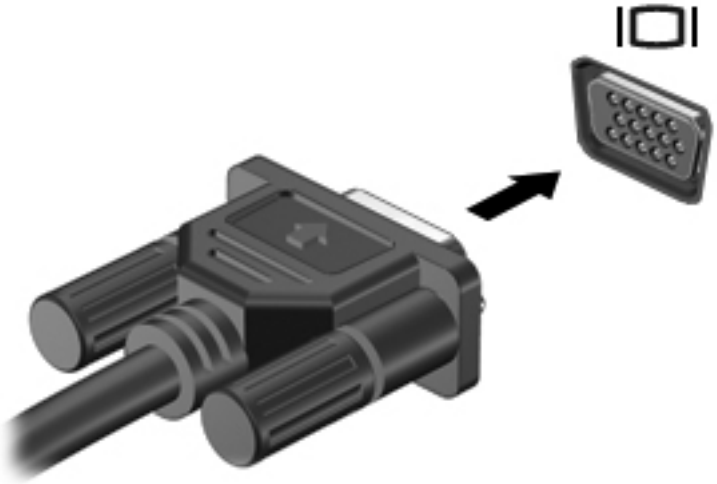
  Volume can also be adjusted within some programs.

Using the video features

Using the external monitor port

The external monitor port connects an external display device, such as an external monitor or a projector, to the computer.

▲ To connect a display device, connect the device cable to the external monitor port.



NOTE: If a properly connected external display device does not display an image, press fn+f4 to transfer the image to the device. Repeatedly pressing fn+f4 alternates the screen image between the computer display, the device, and simultaneous display on both the computer display and the device.

DisplayPort

The DisplayPort connects a digital display device such as a high-performance monitor or projector. The DisplayPort delivers higher performance than the VGA external monitor port and improves digital connectivity.

▲ To connect a digital display device, connect the device cable to the DisplayPort.

NOTE: Press fn+f4 to switch the image between the display devices connected to the computer.

NOTE: To remove the device cable, press down on the connector latch to disconnect it from the computer.

8 Wireless

About integrated wireless devices

Wireless technology transfers data across radio waves instead of wires. Your computer may be equipped with a wireless local area network (WLAN) device. This device connects the computer to wireless local area networks (commonly referred to as Wi-Fi networks, wireless LANs, or WLANs) in corporate offices, your home, and public places such as airports, restaurants, coffee shops, hotels, and universities. In a WLAN, each mobile wireless device communicates with a wireless router or a wireless access point.

Using wireless controls

You can control the wireless devices in your computer by using these methods:

- Wireless button
- Operating system controls

Using the wireless button

The computer has a wireless button, one or more wireless devices, and two wireless lights. All of the wireless devices on your computer are enabled at the factory, so the wireless light is on (white) when you turn on the computer.

The wireless light indicates the overall power state of your wireless devices, not the status of individual devices. If the wireless light is white, at least one wireless device is on. If the wireless light is amber, all wireless devices are off.

Because the wireless devices are enabled at the factory, you can use the wireless button to turn on or turn off the wireless devices simultaneously.

Using operating system controls

Some operating systems also offer a way to manage integrated wireless devices and the wireless connection. For more information, refer to the user guide for your operating system.

Using WLAN

With a WLAN device, you can access a wireless local area network, which is composed of other computers and accessories that are linked by a wireless router or a wireless access point.

NOTE: The terms *wireless router* and *wireless access point* are often used interchangeably.

- A large-scale WLAN, such as a corporate or public WLAN, typically uses wireless access points that can accommodate a large number of computers and accessories and can separate critical network functions.
- A home or small office WLAN typically uses a wireless router, which allows several wireless and wired computers to share an Internet connection, a printer, and files without requiring additional pieces of hardware or software.

NOTE: To use the WLAN device in your computer, you must connect to a WLAN infrastructure (provided through a service provider or a public or corporate network).

Computers with WLAN devices support one or more of the following IEEE industry standards:

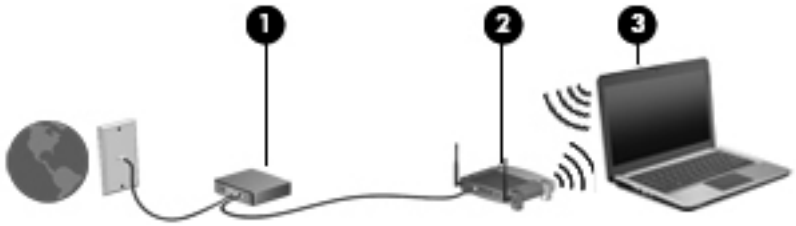
- 802.11a supports data rates of up to 54 Mbps and operates at a frequency of 5 GHz.
- 802.11b, the first popular standard, supports data rates of up to 11 Mbps and operates at a frequency of 2.4 GHz.
- 802.11g supports data rates of up to 54 Mbps and operates at a frequency of 2.4 GHz. An 802.11g WLAN device is backward compatible with 802.11b devices, so they can operate on the same network.
- 802.11n supports data rates of up to 600 Mbps and operates at a frequency of 2.4 and/or 5 GHz. An 802.11n WLAN device is backward compatible with 802.11a, 802.11b, and 802.11g devices, so they can operate on the same network.

Setting up a WLAN

To set up a WLAN and connect to the Internet, you need the following equipment:

- A broadband modem (either DSL or cable) **(1)** and high-speed Internet service purchased from an Internet service provider (ISP)
- A wireless router (purchased separately) **(2)**
- The wireless computer **(3)**

The following illustration shows an example of a wireless network installation that is connected to the Internet.



As your network grows, additional wireless and wired computers can be connected to the network to access the Internet.

For help in setting up your WLAN, refer to the information provided by your router manufacturer or your ISP.

Connecting to a WLAN

To connect to a WLAN, follow these steps:

1. Verify that the WLAN device is turned on. If it is on, the wireless light is white. If the wireless light is amber, press the wireless button.
2. Open Network Connections by selecting **Start > Control Panel > Network and Sharing Center**.

NOTE: You must commit these changes in order for them to be saved. For additional information, refer to HP Write Filters on page 3.

NOTE: The functional range (how far your wireless signals travel) depends on WLAN implementation, router manufacturer, and interference from other electronic devices or structural barriers such as walls and floors.

More information about using a WLAN is available through your ISP and the user guide included with your wireless router and other WLAN equipment.

For a list of public WLANs near you, contact your ISP or search the Web. Web sites that list public WLANs include Cisco Internet Mobile Office Wireless Locations, Hotspotlist, and Geektools. Check with each public WLAN location for cost and connection requirements.

Using wireless security features

When you set up a WLAN or access an existing WLAN, always enable security features to protect your network from unauthorized access. The most common security levels are Wi-Fi Protected Access (WPA)-Personal and Wired Equivalent Privacy (WEP).

When setting up a network, use one or more of the following security measures:

- **Wireless encryption**—Your computer supports three encryption protocols:
  - Wi-Fi Protected Access (WPA)
  - Wi-Fi Protected Access II (WPA2)
  - Wired Equivalent Privacy (WEP)

NOTE: HP recommends that you select WPA2, which is the most advanced of the three encryption protocols. The use of WEP encryption is not recommended, because it can be overcome with little effort.

- Wi-Fi Protected Access (WPA) and Wi-Fi Protected Access II (WPA2) use security standards to encrypt and decrypt data transmitted over the network. Both WPA and WPA2 dynamically generate a new key for every packet, and they also generate a different set of keys for each computer on the network. To accomplish this:
  - WPA uses Advanced Encryption Standard (AES) and Temporal Key Integrity Protocol (TKIP).
  - WPA2 uses Cipher Block Chaining Message Authentication Code Protocol (CCMP), which is a new AES protocol.
- Wired Equivalent Privacy (WEP) encrypts data with a WEP key before it is transmitted. Without the correct key, others will not be able to use the WLAN.

You can also set up the following security measures:

- Change the default network name (SSID) and password.
- Use a firewall.
- Set security on your Web browser.

9 Local area network (LAN)

Connecting to a local area network

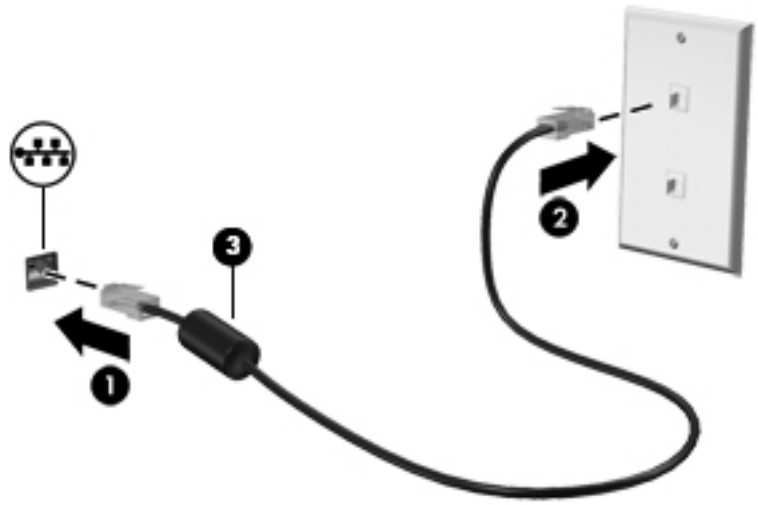
Use a LAN connection if you want to connect the computer directly to a router in your home (instead of working wirelessly), or if you want to connect to an existing network at your office.

Connecting to a LAN requires an 8-pin, RJ-45 (network) cable.

To connect the network cable, follow these steps:

1. Plug the network cable into the network jack **(1)** on the computer.
2. Plug the other end of the network cable into a network wall jack **(2)** or router.

NOTE: If the network cable contains noise suppression circuitry **(3)**, which prevents interference from TV and radio reception, orient the circuitry end of the cable toward the computer.



10 Security

Protecting the computer

NOTE: Security solutions are designed to act as deterrents. These deterrents may not prevent a product from being mishandled or stolen.

Security features provided with your computer can protect the computer and your data from a variety of risks. The way you use your computer will determine which security features you need to use.

The Windows operating system offers certain security features. Additional security features are listed in the following table. Most of these additional security features can be configured in the Computer Setup utility (referred to hereafter as Computer Setup).

NOTE: Computer Setup is a non-Windows utility accessed by pressing f10 when the computer is turned on or restarted. When using Computer Setup, you must use the keys on your computer to navigate and make selections.

To protect against	Use this security feature
Unauthorized use of the computer	Power-on authentication using passwords • Administrator passwords • User passwords
Unauthorized access to Computer Setup (f10)	Setup password in Computer Setup
Unauthorized reset of Computer Setup (f10) passwords	Stringent security feature in Computer Setup
Unauthorized access to data	Microsoft Windows Firewall—An improved Microsoft Windows Firewall (previously known as Internet Connection Firewall, or ICF) that prevents outside requests for data from entering the computer, unless specifically allowed by the user. **NOTE:** For more information on firewall software, refer to the firewall documentation or contact your firewall manufacturer for more information.
Unauthorized access to Computer Setup (f10) settings and other system identification information	Setup password in Computer Setup
Unauthorized removal of the computer	Security cable slot (used with an optional security cable)

Using passwords

Most security features use passwords. Whenever you set a password, write down the password and store it in a secure location away from the computer. Note the following password considerations:

- Setup and power-on passwords are set in Computer Setup and are managed by the system BIOS.
- Windows passwords are set only in the Windows operating system.
- If you forget the setup password that is set in Computer Setup, you will not be able to access the utility.
- If you have the stringent security feature enabled in Computer Setup and you forget the setup password or the power-on password, the computer is inaccessible and can no longer be used.
- If you forget both the power-on password and the setup password that are set in Computer Setup, you cannot turn on the computer.

You can use the same password for a Computer Setup feature and for a Windows security feature. You can also use the same password for more than one Computer Setup feature.

Use the following tips for creating and saving passwords:

- When creating passwords, follow requirements set by the program.
- Write down your passwords and store them in a secure place away from the computer.
- Do not store passwords in a file on the computer.

The following tables list commonly used passwords and describe their functions.

Setting passwords in Windows

Windows passwords	Function
Administrator password	Protects access to a Windows administrator-level account.
User password	Protects access to a Windows user account.

Using administrator and user passwords

You can log on to your computer either automatically or manually.

Automatic logon

The factory setting for the computer is automatic logon.

NOTE: Only the network administrator can change automatic logon properties.

With automatic logon, the Log On to Windows dialog box is bypassed, which brings you directly to the Windows desktop.

To log on as a different user, follow these steps:

▲ Click the arrow next to **Shut down**, and then click **Log off**.

The **Log On to Windows** dialog box opens, allowing you to manually enter the logon information.

Manual logon

If the automatic logon is disabled by the network administrator, log on as follows:

1. In the Log On to Windows dialog box, type your information in the **User Name** and **Password** boxes.

NOTE: For a user, the initial user name and password are both *User*. For an administrator, the initial user name and password are both *Administrator*.

HP strongly recommends the default passwords be changed before deploying into a production environment.

2. Click **OK**.

Note the following considerations:

- To prevent unauthorized access to your information, change your password as soon as possible after setup.
- Passwords are case sensitive, but user names are not.

Administrator logon

To access the administrator logon screen in either automatic or manual logon mode, follow these steps:

1. Press and hold down the left shift key, and then click **Start**.
2. Click **Shut Down**, and then click **Log Off**.

The Administrator logon screen is displayed.

You can use the HP Windows Logon Configuration Manager to permanently modify the default logon user.

Setting passwords in Computer Setup

Computer Setup passwords	Function
Setup password	Protects access to Computer Setup.
Power-on password	Protects access to the computer contents when the computer turns on or restarts.

Using a setup password

The setup password in Computer Setup protects the configuration settings and system identification information in Computer Setup. After this password is set, it must be entered to access Computer Setup and to make changes using Computer Setup.

Note the following characteristics of the setup password:

- It is not interchangeable with a Windows administrator password, although both passwords can be identical.
- It is masked as it is set, entered, changed, or deleted.
- It must be set and entered with the same keys. For example, a setup password set with keyboard number keys will not be recognized if you enter it thereafter with embedded numeric keypad number keys.
- It can include any combination of up to 32 letters and numbers and is not case sensitive.

Managing a setup password

A setup password is set, changed, and deleted in Computer Setup.

To set, change, or delete this password, follow these steps:

1. Open Computer Setup by turning on or restarting the computer, and then pressing f10 while the “F10 = ROM Based Setup” message is displayed in the lower-left corner of the screen.
2. Use the arrow keys to select **Security > Setup password**, and then press enter.
   - To set a setup password, type your password in the **New password** and **Verify new password** fields, and then press f10.
   - To change a setup password, type your current password in the **Old password** field, type a new password in the **New password** and **Verify new password** fields, and then press f10.
   - To delete a setup password, type your current password in the **Old password** field, and then press f10.
3. To save your preferences, use the arrow keys to select **File > Save changes and exit**. Then follow the instructions on the screen.

Your preferences go into effect when the computer restarts.

Entering a setup password

At the **Setup password** prompt, type your setup password (using the same kind of keys you used to set the password), and then press enter. After 3 unsuccessful attempts to enter the setup password, you must restart the computer and try again.

Using a power-on password

The Computer Setup power-on password prevents unauthorized use of the computer. After this password is set, it must be entered each time the computer is turned on.

Note the following characteristics of a power-on password:

- It is masked as it is set, entered, changed, or deleted.
- It must be set and entered with the same keys. For example, a power-on password set with keyboard number keys will not be recognized if you enter it thereafter with embedded numeric keypad number keys.
- It can include any combination of up to 32 letters and numbers and is not case sensitive.

Managing a power-on password

A power-on password is set, changed, and deleted in Computer Setup.

To set, change, or delete this password, follow these steps:

1. Open Computer Setup by turning on or restarting the computer, and then pressing f10 while the “F10 = ROM Based Setup” message is displayed in the lower-left corner of the screen.
2. Use the arrow keys to select **Security > Power-On password**, and then press enter.
   - To set a power-on password, type the password in the **New password** and **Verify new password** fields, and then press f10.
   - To change a power-on password, type the current password in the **Old password** field, type the new password in the **New password** and **Verify new password** fields, and then press f10.
   - To delete a power-on password, type the current password in the **Old password** field, and then press f10.
3. To save your preferences, use the arrow keys to select **File > Save changes and exit**. Then follow the instructions on the screen.

Your preferences go into effect when the computer restarts.

Entering a power-on password

At the **Power-on Password** prompt, type your password (using the same kind of keys you used to set the password), and then press enter. After 3 unsuccessful attempts to enter the password, you must turn off the computer, turn it back on, and then try again.

Requiring a power-on password at restart

In addition to requiring that a power-on password be entered each time the computer is turned on, you can also require that a power-on password be entered each time the computer is restarted.

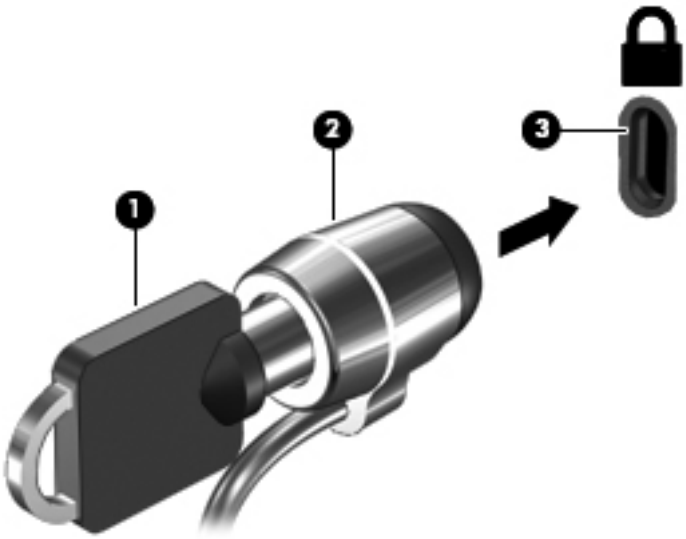
To enable and disable this feature in Computer Setup, follow these steps:

1. Open Computer Setup by turning on or restarting the computer, and then pressing f10 while the “F10 = ROM Based Setup” message is displayed in the lower-left corner of the screen.
2. Use the arrow keys to select **Security > Password options**, and then press enter.
3. Use the arrow keys to select **Enable** or **Disable** in the **Require password on restart** field, and then press f10.
4. To save your preferences, use the arrow keys to select **File > Save changes and exit**. Then follow the instructions on the screen.

Installing a security cable

NOTE: The security cable (purchased separately) is designed to act as a deterrent, but it may not prevent the computer from being mishandled or stolen.

1. Loop the security cable around a secured object.
2. Insert the key **(1)** into the cable lock **(2)**.
3. Insert the cable lock into the security cable slot on the computer **(3)**, and then lock the cable lock with the key.



NOTE: Your computer may look different from the illustration. The location of the security cable slot varies by model.

11 Connecting hardware

Using a USB device

Universal Serial Bus (USB) is a hardware interface that can be used to connect an optional external device, such as a USB keyboard, mouse, drive, printer, scanner, or hub. Devices can be connected to the computer or an optional docking device.

Some USB devices may require additional support software, which is usually included with the device. For more information about device-specific software, refer to the manufacturer's instructions.

The computer has 4 USB ports. A USB hub provides additional USB ports that can be used with the computer.

NOTE: To view the status of the USB ports, go to the USB Storage Options utility. For additional information, refer to Securing USB ports on page 41.

Connecting a USB device

CAUTION: To prevent damage to a USB connector, use minimal force to connect a USB device.

- To connect a USB device to the computer, connect the USB cable for the device to the USB port.

Securing USB ports

The USB Storage Options utility gives the network administrator control over which users can access which USB ports on a local computer. With the USB Storage Options utility, you can perform the following tasks:

- Enable storage devices
- Allow read-only access to devices
- Disable storage devices

Using the USB Storage Options utility

To enable or disable the USB ports, follow these steps:

1. Select **Start > Control Panel > USB Storage Security Options**.
2. Select the permissions for the computer, and then click **OK**.

12 Using Media Card Reader cards

Optional digital cards provide secure data storage and convenient data sharing. These cards are often used with digital media-equipped cameras and PDAs as well as with other computers.

The Media Card Reader supports the following digital card formats:

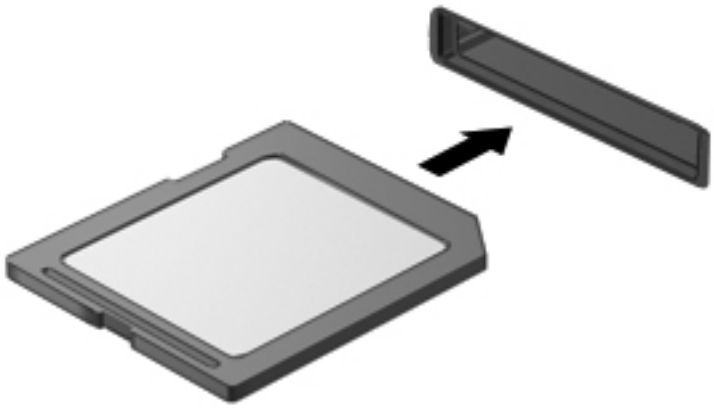
- MultiMediaCard (MMC)
- Secure Digital (SD) Memory Card

Inserting a digital card

CAUTION: To avoid damaging the digital card or the computer, do not insert any type of adapter into the Media Card Reader.

CAUTION: To prevent damage to the digital card connectors, use minimal force to insert a digital card.

1. Hold the digital card label-side up, with the connectors facing the computer.
2. Insert the card into the Media Card Reader, and then push in on the card until it is firmly seated.



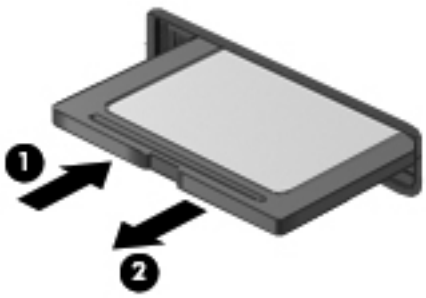
You will hear a sound when the device has been detected, and a menu of available options may be displayed.

Removing a digital card

CAUTION: To prevent loss of data or an unresponsive system, use the following procedure to safely remove the digital card.

To remove a digital card, follow these steps:

1. Save your information and close all programs associated with the digital card.
2. To eject the digital card, press in on the card **(1)**, and then remove it from the slot **(2)**.



NOTE: If the card does not eject, pull the card out of the slot.

13 Using ExpressCards

An ExpressCard is a high-performance PC Card that is inserted into the ExpressCard slot. Your computer supports *ExpressCard/34* cards.

Like standard PC Cards, ExpressCards are designed to conform to the standard specifications of the Personal Computer Memory Card International Association (PCMCIA).

Configuring an ExpressCard

Install only the software required for your device. If you are instructed by the ExpressCard manufacturer to install device drivers:

- Install only the device drivers for your operating system.
- Do not install other software, such as card services, socket services, or enablers, that are supplied by the ExpressCard manufacturer.

Inserting an ExpressCard

CAUTION: To prevent damage to the computer and external media cards, do not insert a PC Card into an ExpressCard slot.

CAUTION: To prevent damage to the connectors:

Use minimal force when inserting an ExpressCard.

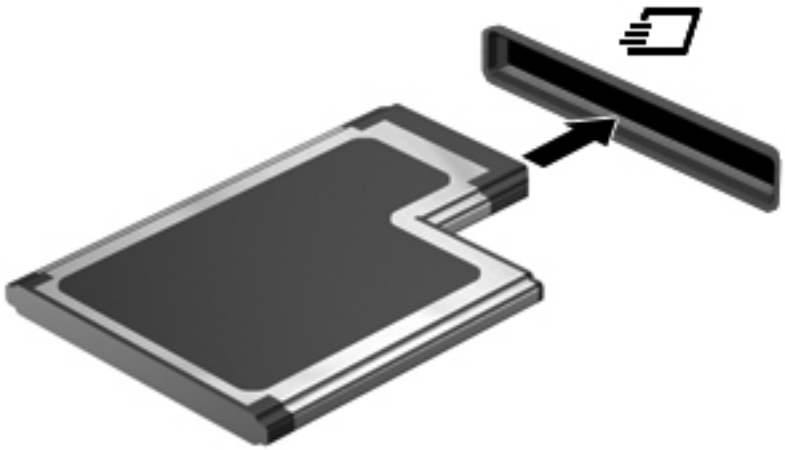
Do not move or transport the computer when an ExpressCard is in use.

The ExpressCard slot may contain a protective insert. To remove the insert, follow these steps:

1. Press in on the insert **(1)** to unlock it.
2. Pull the insert out of the slot **(2)**.

To insert an ExpressCard, follow these steps:

1. Hold the card label-side up, with the connectors facing the computer.
2. Insert the card into the ExpressCard slot, and then push in on the card until it is firmly seated.



You will hear a sound when the device has been detected, and a menu of available options may be displayed.

NOTE: The first time you insert an ExpressCard, a message is displayed in the notification area to let you know the card is recognized by the computer.

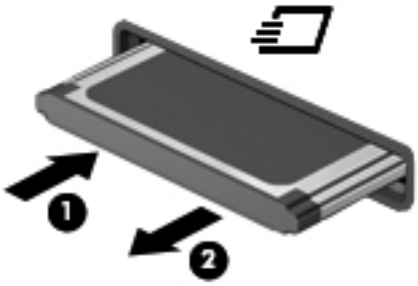
NOTE: An inserted ExpressCard uses power even when idle. To conserve power, stop or remove an ExpressCard when it is not in use.

Removing an ExpressCard

⚠ **CAUTION:** To prevent loss of data or an unresponsive system, use the following procedure to safely remove the ExpressCard.

To remove an ExpressCard, follow these steps:

1. Save your information and close all programs associated with the ExpressCard.
2. Release and remove the ExpressCard:
   a. Gently press in on the ExpressCard **(1)** to unlock it.
   b. Pull the ExpressCard out of the slot **(2)**.



14 Hardware upgrades

Handling drives

⚠ **CAUTION:** Drives are fragile computer components that must be handled with care. Refer to the following cautions before handling drives. Additional cautions are included with the procedures to which they apply.

CAUTION: To reduce the risk of damage to the computer, damage to a drive, or loss of information, observe these precautions:

Before handling a drive, discharge static electricity by touching the unpainted metal surface of the drive.

Do not touch the connector pins on a removable drive or on the computer.

Handle a drive carefully; do not drop a drive or place items on it.

When the battery is the only source of power, be sure that the battery is sufficiently charged before writing to media.

Avoid exposing a drive to temperature or humidity extremes.

Avoid exposing a drive to liquids. Do not spray the drive with cleaning products.

Remove media from a drive before removing the drive from the drive bay, or traveling with, shipping, or storing a drive.

If a drive must be mailed, place the drive in a bubble-pack mailer or other suitable protective packaging and label the package “FRAGILE.”

Avoid exposing a drive to magnetic fields. Security devices with magnetic fields include airport walk-through devices and security wands. The airport security devices that use X-rays to check luggage moving on conveyor belts will not damage a drive.

Removing or replacing the service door

CAUTION: To prevent information loss or an unresponsive system:

Save your work and shut down the computer before adding or replacing a memory module or hard drive.

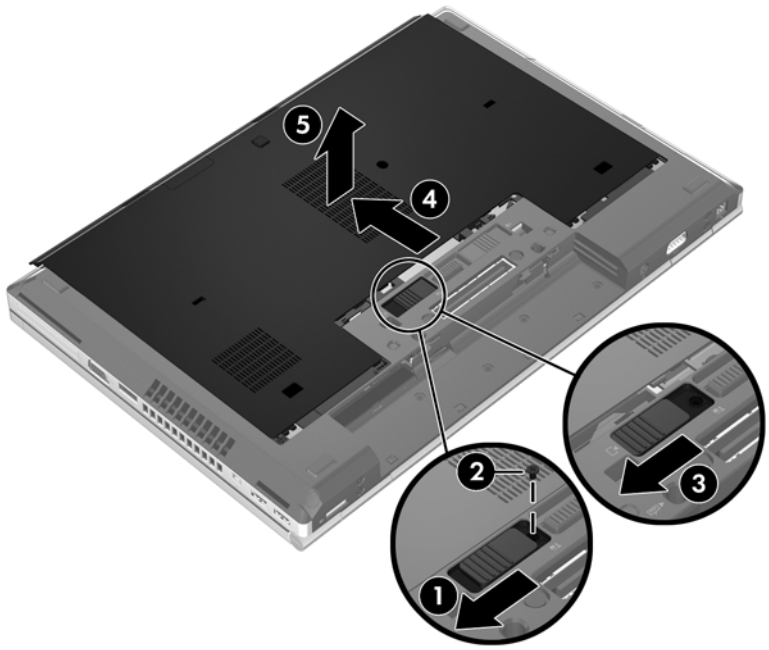
If you are not sure whether the computer is off, turn the computer on by pressing the power button. Then shut down the computer through the operating system.

Removing the service door

Remove the service door to access the memory module slot, hard drive, regulatory label, and other components.

To remove the service door:

1. Remove the battery (see Inserting or removing the battery on page 20).
2. With the battery bay toward you, slide the service door release latch **(1)** to the left, remove the screw (if the optional screw is being used) **(2)**, and then slide the release latch again **(3)** to release the service door.
3. Slide the service door toward the front of the computer **(4)** and lift **(5)** to remove the cover.



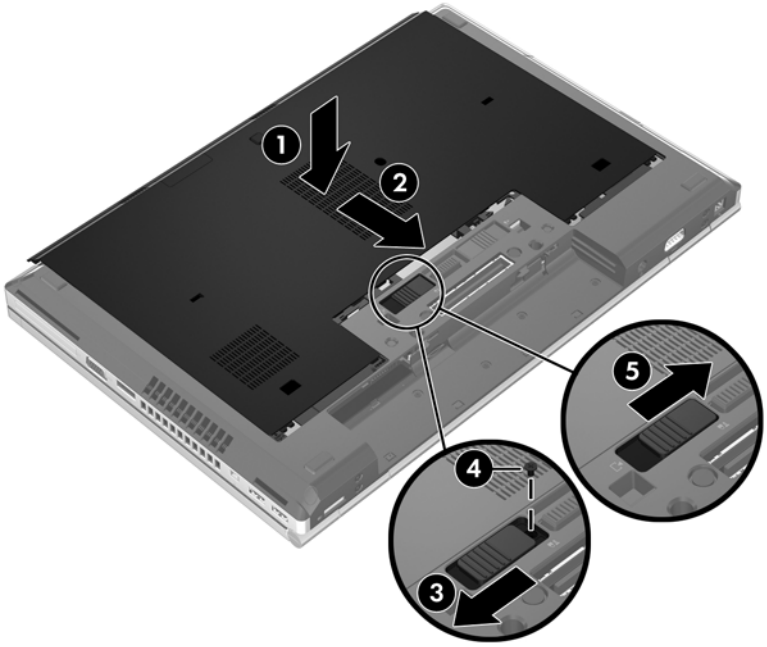
Replacing the service door

Replace the service door after accessing the memory module slot, hard drive, regulatory label, and other components.

To replace the service door:

1. Tilt down the service door to align the front edge of the service door near the front edge of the computer **(1)**.
2. Insert the alignment tabs **(2)** on the rear edge of the service door with the notches on the computer.
3. Slide the service door toward the battery bay until the service door snaps into place.
4. With the battery bay toward you, slide the service door release latch to the left **(3)**, and if you choose to, insert and tighten the optional screw **(4)** to hold the service door in place. Slide the release latch to the right to lock the service door **(5)**.

NOTE: If you want to use the optional screw, it is stored inside the service door.



5. Insert the battery (see Inserting or removing the battery on page 20).

Replacing the hard drive

CAUTION: To prevent information loss or an unresponsive system:

Shut down the computer before removing the hard drive from the hard drive bay. Do not remove the hard drive while the computer is on, in the Sleep state.

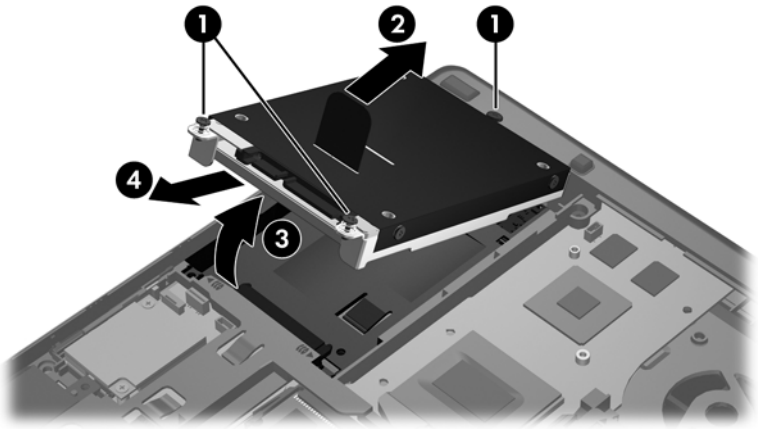
If you are not sure whether the computer is off, turn the computer on by pressing the power button. Then shut down the computer through the operating system.

NOTE: Depending on your computer, you may have a drive that differs from the illustration below. However, the process of replacing the hard drive will be similar.

Removing the hard drive

To remove the hard drive:

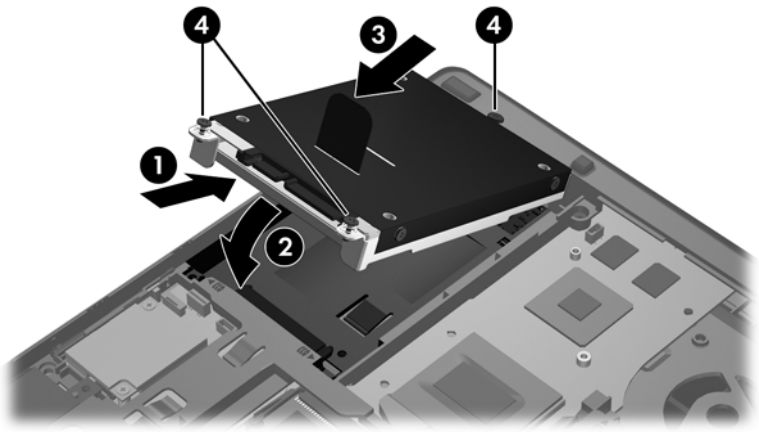
1. Save your work and shut down the computer.
2. Disconnect AC power and external devices connected to the computer.
3. Remove the battery (see Inserting or removing the battery on page 20).
4. Remove the service door (see Removing the service door on page 48).
5. Loosen the 3 hard drive screws **(1)**.
6. Pull the plastic tab on the hard drive **(2)** toward the side of the computer to disengage the hard drive from the connector.
7. Use the plastic tab to lift the connector side of the hard drive up at an angle **(3)** and remove the drive **(4)** from the computer.



Installing a hard drive

To install the hard drive:

1. Insert the hard drive into the hard drive bay at an angle **(1)**, and then lay the hard drive flat in the hard drive bay **(2)**.
2. Pull the plastic tab **(3)** toward the center of the computer to engage the hard drive with the connector.
3. Tighten the hard drive screws **(4)**.



4. Replace the service door (see Replacing the service door on page 49).
5. Insert the battery (see Inserting or removing the battery on page 20).
6. Connect AC power and external devices to the computer.
7. Turn on the computer.

Replacing a drive in the upgrade bay

On select models, the upgrade bay only holds an optical drive.

Replacing an optical drive

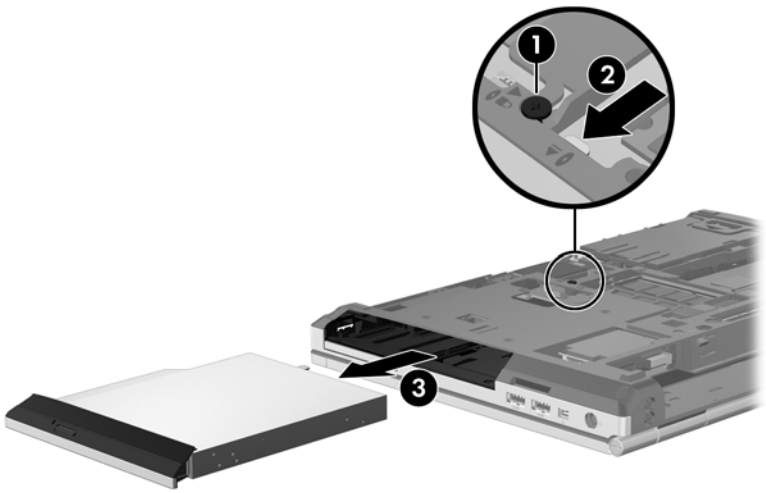
CAUTION: To prevent information loss or an unresponsive system:

Shut down the computer before removing the optical drive from the upgrade bay. Do not remove the optical drive while the computer is on or in the Sleep state.

If you are not sure whether the computer is off, turn the computer on by pressing the power button. Then shut down the computer through the operating system.

To remove an optical drive from the upgrade bay:

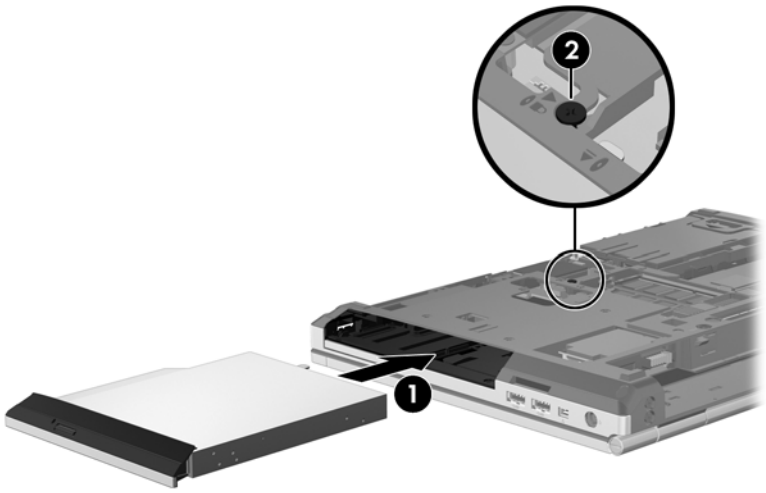
1. Save your work.
2. Shut down the computer and close the display.
3. Disconnect all external hardware devices connected to the computer.
4. Unplug the power cord from the AC outlet.
5. Turn the computer upside down on a flat surface, with the upgrade bay toward you.
6. Remove the battery (see Inserting or removing the battery on page 20).
7. Remove the service door (see Removing the service door on page 48).
8. Loosen the upgrade bay screw **(1)**.
9. Using a flat-bladed screwdriver, gently push the tab to release the optical drive **(2)**.
10. Remove the optical drive from the upgrade bay **(3)**.



To install an optical drive in the upgrade bay:

1. Insert the optical drive into the upgrade bay **(1)**.

2. Tighten the upgrade bay screw **(2)**.



3. Replace the service door (see Replacing the service door on page 49).
4. Insert the battery (see Inserting or removing the battery on page 20).
5. Turn the computer right-side up, and then reconnect AC power and external devices to the computer.
6. Turn on the computer.

Replacing memory modules

The computer has one memory module compartment.

WARNING! To reduce the risk of electric shock and damage to the equipment, unplug the power cord and remove all batteries before installing a memory module.

CAUTION: Electrostatic discharge (ESD) can damage electronic components. Before beginning any procedure, ensure that you are discharged of static electricity by touching a grounded metal object.

CAUTION: To prevent information loss or an unresponsive system:

Shut down the computer before replacing memory modules. Do not remove a memory module while the computer is on or in the Sleep state.

If you are not sure whether the computer is off, turn the computer on by pressing the power button. Then shut down the computer through the operating system.

NOTE: The primary memory is located in the bottom memory slot and the expansion memory is located in the top memory slot.

To replace a memory module:

1. Save your work and shut down the computer.
2. Disconnect AC power and external devices connected to the computer.
3. Remove the battery (see Inserting or removing the battery on page 20).

4. Remove the service door (see Removing the service door on page 48).

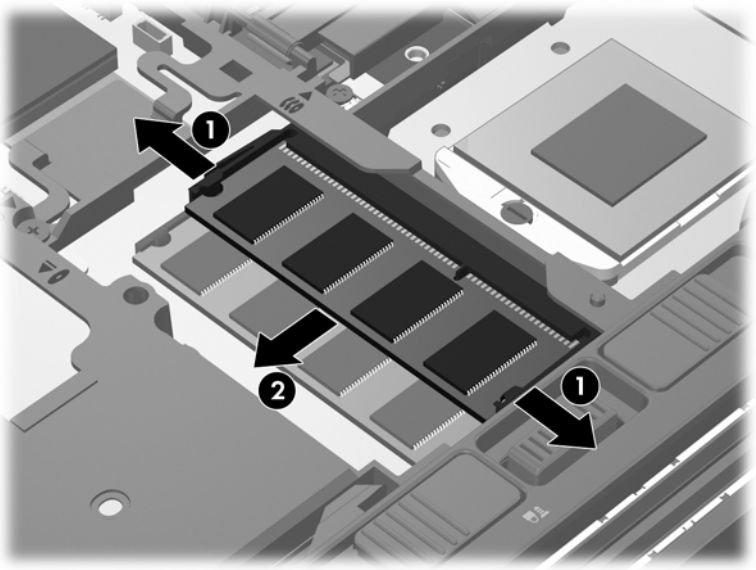
5. If you are replacing a memory module, remove the existing memory module:

   a. Pull away the retention clips **(1)** on each side of the memory module.

      The memory module tilts up.

   b. Grasp the edge of the memory module **(2)**, and then gently pull the memory module out of the memory module slot.

   CAUTION: To prevent damage to the memory module, hold the memory module by the edges only. Do not touch the components on the memory module.



   To protect a memory module after removal, place it in an electrostatic-safe container.

6. Insert a new memory module:

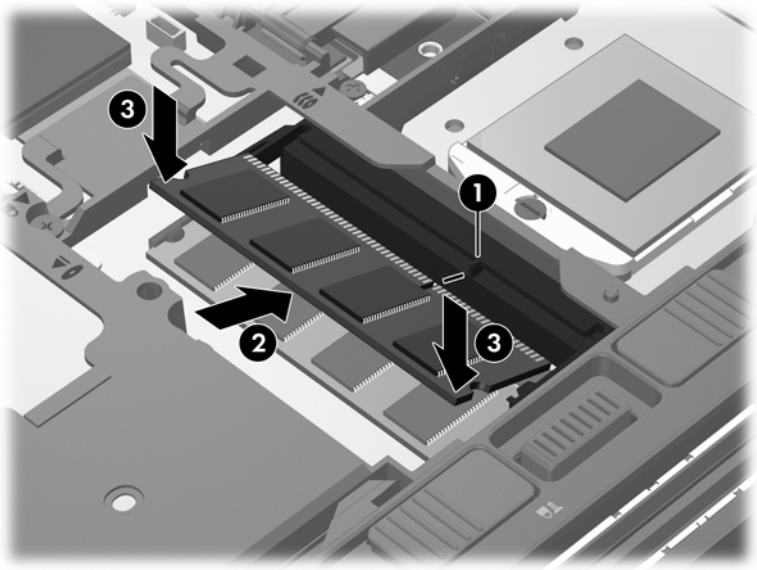
CAUTION: To prevent damage to the memory module, hold the memory module by the edges only. Do not touch the components on the memory module.

   a. Align the notched edge **(1)** of the memory module with the tab in the memory module slot.

   b. With the memory module at a 45-degree angle from the surface of the memory module compartment, press the module **(2)** into the memory module slot until it is seated.

c. Gently press the memory module **(3)** down, applying pressure to both the left and right edges of the memory module, until the retention clips snap into place.

⚠ **CAUTION:** To prevent damage to the memory module, be sure that you do not bend the memory module.



7. Replace the service door (see Replacing the service door on page 49).
8. Insert the battery (see Inserting or removing the battery on page 20).
9. Connect AC power and external devices to the computer.
10. Turn on the computer.

Using optical drives (select models only)

An optical drive, such as a DVD-ROM drive, supports optical discs (CDs and DVDs). These discs store or transport information and play music and movies. DVDs have a higher storage capacity than CDs.

⚠ **CAUTION:** To prevent possible audio and video degradation, or loss of audio or video playback functionality, do not initiate Sleep while reading from a CD or DVD.

If Sleep is initiated during playback of a disc, you may experience the following behaviors:

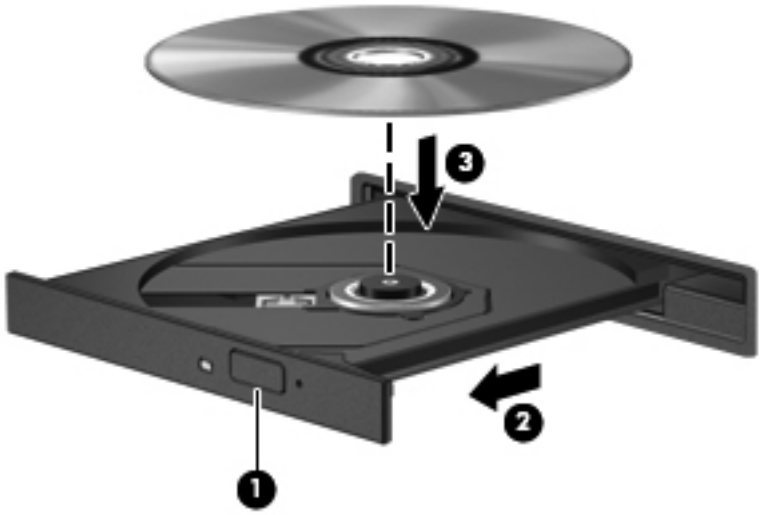
- Your playback may be interrupted.
- You may see a warning message asking if you want to continue. If this message is displayed, click **No**.
- You may need to restart the CD or DVD to resume audio and video playback.

Inserting an optical disc (CD or DVD)

1. Turn on the computer.
2. Press the release button **(1)** on the drive bezel to release the disc tray.
3. Pull out the tray **(2)**.
4. Hold the disc by the edges to avoid touching the flat surfaces and position the disc label-side up over the tray spindle.

NOTE: If the tray is not fully accessible, tilt the disc carefully to position it over the spindle.

5. Gently press the disc **(3)** down onto the tray spindle until the disc snaps into place.



6. Close the disc tray.

NOTE: After you insert a disc, a short pause is normal before playback begins.

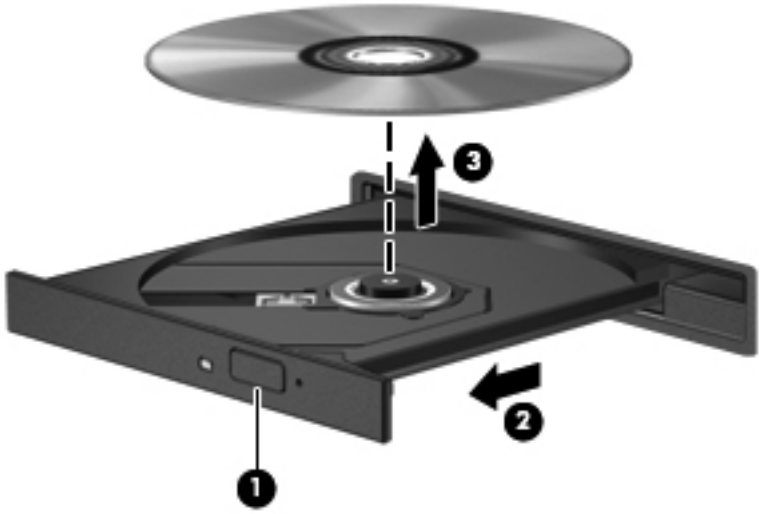
Removing an optical disc (CD or DVD)

There are 2 ways to remove a disc, depending on whether the disc tray opens normally or not.

When the disc tray opens

1. Press the release button **(1)** on the drive bezel to release the disc tray, and then gently pull out the tray **(2)** until it stops.
2. Remove the disc **(3)** from the tray by gently pressing down on the spindle while lifting the outer edges of the disc. Hold the disc by the edges and avoid touching the flat surfaces.

NOTE: If the tray is not fully accessible, tilt the disc carefully as you remove it.

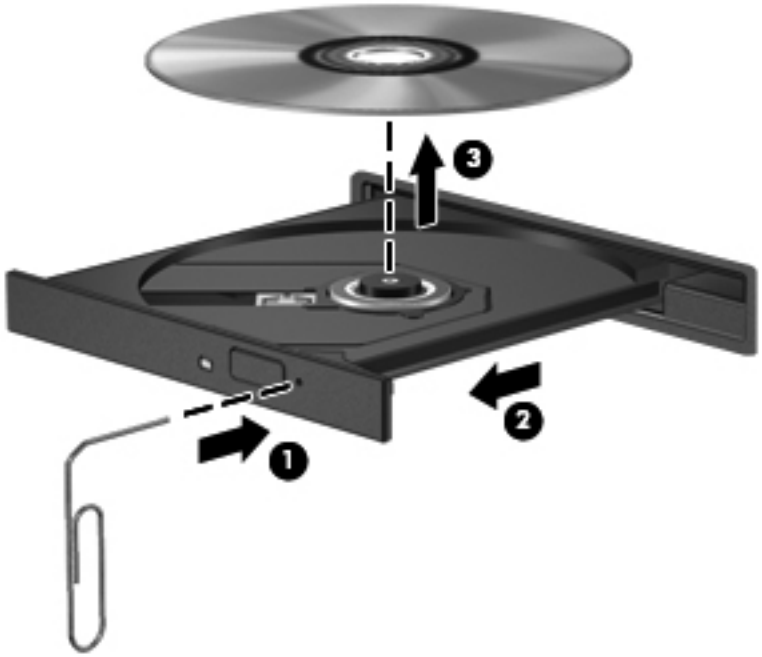


3. Close the disc tray and place the disc in a protective case.

When the disc tray does not open

1. Insert the end of a paper clip **(1)** into the release access in the front bezel of the drive.
2. Press in gently on the paper clip until the tray is released, and then pull out the tray **(2)** until it stops.
3. Remove the disc **(3)** from the tray by gently pressing down on the spindle while lifting the outer edges of the disc. Hold the disc by the edges and avoid touching the flat surfaces.

NOTE: If the tray is not fully accessible, tilt the disc carefully as you remove it.



4. Close the disc tray and place the disc in a protective case.

Using external drives

Removable external drives expand your options for storing and accessing information. A USB drive can be added by connecting the drive to a USB port on the computer.

USB drives include the following types:

- Hard drive module (a hard drive with an adapter attached)
- DVD-ROM Drive
- DVD/CD-RW Combo Drive

Using optional external devices

NOTE: For more information about required software and drivers, or to learn which computer port to use, refer to the manufacturer's instructions.

To connect an external device to the computer, follow these steps:

CAUTION: To reduce the risk of damage to the equipment when connecting a powered device, be sure that the device is turned off and the AC power cord is unplugged.

1. Connect the device to the computer.
2. If you are connecting a powered device, plug the device power cord into a grounded AC outlet.
3. Turn on the device.

To disconnect an unpowered external device from the computer, follow these steps:

1. Turn off the device.
2. Disconnect it from the computer.

To disconnect a powered external device from the computer, follow these steps:

1. Turn off the device.
2. Disconnect it from the computer.
3. Unplug the AC power cord from the external device.

15 Computer Setup (BIOS) and Advanced System Diagnostics

Using Computer Setup

Computer Setup, or Basic Input/Output System (BIOS), controls communication between all the input and output devices on the system (such as disk drives, display, keyboard, mouse, and printer). Computer Setup includes settings for the types of devices installed, the startup sequence of the computer, and the amount of system and extended memory.

NOTE: Use extreme care when making changes in Computer Setup. Errors can prevent the computer from operating properly.

Starting Computer Setup

NOTE: An external keyboard or mouse connected to a USB port can be used with Computer Setup only if USB legacy support is enabled.

To start Computer Setup, follow these steps:

1. Turn on or restart the computer, and then press esc while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.
2. Press f10 to enter Computer Setup.

Navigating and selecting in Computer Setup

To navigate and select in Computer Setup, follow these steps:

1. Turn on or restart the computer, and then press esc while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.
   - To select a menu or a menu item, use the tab key and the keyboard arrow keys and then press enter, or use a pointing device to click the item.
   - To scroll up and down, click the up arrow or the down arrow in the upper-right corner of the screen, or use the up arrow key or the down arrow key.
   - To close open dialog boxes and return to the main Computer Setup screen, press esc, and then follow the on-screen instructions.

   NOTE: You can use either a pointing device (TouchPad, pointing stick, or USB mouse) or the keyboard to navigate and make selections in Computer Setup.
2. Press f10 to enter Computer Setup.

To exit Computer Setup menus, choose one of the following methods:

- To exit Computer Setup menus without saving your changes:

  Click the **Exit** icon in the lower-left corner of the screen, and then follow the on-screen instructions.

  – or –

  Use the tab key and the arrow keys to select **File > Ignore Changes and Exit**, and then press enter.

- To save your changes and exit Computer Setup menus:

  Click the **Save** icon in the lower-left corner of the screen, and then follow the on-screen instructions.

  – or –

  Use the tab key and the arrow keys to select **File > Save Changes and Exit**, and then press enter.

Your changes go into effect when the computer restarts.

Restoring factory settings in Computer Setup

NOTE: Restoring defaults will not change the hard drive mode.

To return all settings in Computer Setup to the values that were set at the factory, follow these steps:

1. Turn on or restart the computer, and then press esc while the “Press the ESC key for Startup Menu” message is displayed at the bottom of the screen.
2. Press f10 to enter Computer Setup.
3. Use a pointing device or the arrow keys to select **File > Restore Defaults**.
4. Follow the on-screen instructions.
5. To save your changes and exit, click the **Save** icon in the lower-left corner of the screen, and then follow the on-screen instructions.

   – or –

   Use the arrow keys to select **File > Save Changes and Exit**, and then press enter.

Your changes go into effect when the computer restarts.

NOTE: Your password settings and security settings are not changed when you restore the factory settings.

Updating the BIOS

The next sections describe different ways of updating the BIOS.

Downloading *SoftPaqs* to update the BIOS

Most BIOS updates on the HP website are packaged in compressed files called *SoftPaqs*.

To install BIOS updates from the HP website, follow the steps below:

1. Download the *SoftPaq* from the HP website.
2. Click **Run**, and then follow the on-screen instructions to update the BIOS.

NOTE: Some download packages contain a file named Readme.txt, which contains information regarding installing and troubleshooting the file.

BIOS Setup Menu

The tables in this section provide an overview of the BIOS Setup menu options.

Main menu

Select	To do this
System information	• View and change the system time and date. • View identification information about your computer. • View specification information about the processor, memory size, and system BIOS.

Security menu

Select	To do this
Administrator password	Control access to Setup Utility.
Power-on password	Control access to your computer.
TPM Status	Disable and enable (select models only).
TPM Operation	Select no operation and TPM status (select models only).

Diagnostics menu

Select	To do this
Primary Hard Disk Self Test	Run a quick or comprehensive self-test on the hard drive.
Memory Test	Run a diagnostic test on the system memory.

Using Advanced System Diagnostics

Advanced System Diagnostics allows you to run diagnostic tests to determine if the computer hardware is functioning properly. The following diagnostic tests are available in Advanced System Diagnostics:

- Start-up test—This test analyzes the main computer components that are required to start the computer.
- Run-in test—This test repeats the start-up test and checks for intermittent problems that the start-up test does not detect.
- System Tune-Up—This group of additional tests checks your computer to make sure that the main components are functioning correctly. System Tune-Up runs longer and more comprehensive tests on memory modules, hard drive SMART attributes, the hard drive surface, the battery (and battery calibration), video memory, and the WLAN module status.
- Hard disk test—This test analyzes the physical condition of the hard drive, and then checks all data in every sector of the hard drive. If the test detects a damaged sector, it attempts to move the data to a good sector.
- Memory test—This test analyzes the physical condition of the memory modules. If it reports an error, replace the memory modules immediately.
- Battery test—This test analyzes the condition of the battery and calibrates the battery if necessary. If the battery fails the test, contact support to report the issue and purchase a replacement battery.

You can view system information and error logs in the Advanced System Diagnostics window.

To start Advanced System Diagnostics:

1. Turn on or restart the computer. While the “Press the ESC key for Startup Menu” message is displayed in the lower-left corner of the screen, press esc. When the Startup Menu is displayed, press f2.
2. Click the diagnostic test you want to run, and then follow the on-screen instructions.

NOTE: If you need to stop a diagnostics test while it is running, press esc.

16 Routine care

Cleaning your computer

Cleaning products

Use the following products to safely clean and disinfect your computer:

- Dimethyl benzyl ammonium chloride 0.3 percent maximum concentration (For example: germicidal disposable wipes. These wipes come in a variety of brand names.)
- Alcohol-free glass cleaning fluid
- Water with mild soap solution
- Dry microfiber cleaning cloth or a chamois (static-free cloth without oil)
- Static-free cloth wipes

CAUTION: Avoid the following cleaning products:

Strong solvents, such as alcohol, acetone, ammonium chloride, methylene chloride, and hydrocarbons, which can permanently damage the surface of the computer.

Fibrous materials, such as paper towels, which can scratch the computer. Over time, dirt particles and cleaning agents can get trapped in the scratches.

Cleaning procedures

Follow the procedures in this section to safely clean your computer.

WARNING! To prevent electric shock or damage to components, do not attempt to clean your computer while it is turned on:

Turn off the computer.

Disconnect external power.

Disconnect all powered external devices.

CAUTION: Do not spray cleaning agents or liquids directly on any computer surface. Liquids dripped on the surface can permanently damage internal components.

Cleaning the display

Gently wipe the display using a soft, lint-free cloth moistened with an *alcohol-free* glass cleaner. Be sure that the display is dry before closing the display.

Cleaning the sides and cover

To clean and disinfect the sides and cover, use a soft microfiber cloth or chamois moistened with one of the cleaning solutions listed previously or use an acceptable germicidal disposable wipe.

NOTE: When cleaning the cover of the computer, use a circular motion to aid in removing dirt and debris.

Cleaning the TouchPad and keyboard

WARNING! To reduce the risk of electric shock or damage to internal components, do not use a vacuum cleaner attachment to clean the keyboard. A vacuum cleaner can deposit household debris on the keyboard surface.

CAUTION: When cleaning the TouchPad and keyboard, do not let liquids drip between the keys. This can permanently damage internal components.

- To clean and disinfect the TouchPad and keyboard, use a soft microfiber cloth or chamois moistened with one of the cleaning solutions listed previously or use an acceptable germicidal disposable wipe.
- To prevent keys from sticking and to remove dust, lint, and particles from the keyboard, use a can of compressed air with a straw extension.

Traveling with the computer

For best results, follow these traveling and shipping tips:

- Prepare the computer for traveling or shipping:
  - Back up your information.
  - Remove all discs and all external media cards, such as digital cards.

    CAUTION: To reduce the risk of damage to the computer, damage to a drive, or loss of information, remove the media from a drive before removing the drive from a drive bay and before shipping, storing, or traveling with a drive.
  - Turn off and then disconnect all external devices.
  - Shut down the computer.
- Take along a backup of your information. Keep the backup separate on the computer.
- When traveling by air, carry the computer as hand luggage; do not check it in with the rest of your bags.

  CAUTION: Avoid exposing a drive to magnetic fields. Security devices with magnetic fields include airport walk-through devices and security wands. Airport conveyer belts and similar security devices that check carry-on baggage use X-rays instead of magnetism and do not damage drives.
- In-flight computer use is at the discretion of the airline. If you plan to use the computer during a flight, check with the airline in advance.
- If the computer will be unused and disconnected from external power for more than 2 weeks, remove the battery and store it separately.

- If you are shipping the computer or a drive, use suitable protective packaging and label the package “FRAGILE.”
- If the computer has a wireless device or an HP Mobile Broadband Module installed, such as an 802.11b/g device, a Global System for Mobile Communications (GSM) device, or a General Packet Radio Service (GPRS) device, the use of these devices may be restricted in some environments. Such restrictions may apply onboard aircraft, in hospitals, near explosives, and in hazardous locations. If you are uncertain of the policy that applies to the use of a particular device, ask for authorization to use it before you turn it on.
- If you are traveling internationally, follow these suggestions:
  - Check the computer-related customs regulations for each country or region on your itinerary.
  - Check the power cord and adapter requirements for each location in which you plan to use the computer. Voltage, frequency, and plug configurations vary.

    ⚠ **WARNING!** To reduce the risk of electric shock, fire, or damage to the equipment, do not attempt to power the computer with a voltage converter kit sold for appliances.

17 Troubleshooting

Quick troubleshooting

The computer is unable to start up

When the computer is turned on, the power light turns on. If the computer and the power light do not turn on when you press the power button, adequate power may not be available to the computer.

The following suggestions may help you determine why the computer will not start up:

- If the computer is plugged into an AC outlet, be sure that the AC outlet is providing adequate power by plugging another electrical device into the outlet.
- If the computer is running on battery power or is plugged into an external power source other than an AC outlet, plug the computer into an AC outlet using the AC adapter. Be sure that the power cord and AC adapter connections are secure.

NOTE: Use only the AC adapter provided with this computer or one approved for this computer.

- If the computer is running on battery power, try the following procedures in the sequence provided, until startup occurs:
  - If the battery light on the front of the computer is blinking amber, the battery has reached a low battery level, which may not allow the computer to start up. Plug the computer into an AC outlet using the AC adapter, start the computer, and allow the battery to charge.
  - Remove the battery and plug the computer into an AC outlet using the AC adapter. If you can turn the computer on, the battery may need to be replaced.

The computer screen is blank

If the computer screen is blank but you have not turned off the computer, one or more of these settings may be the cause:

- The computer may be in the Sleep state.

  To exit Sleep, briefly press the power button.

  Sleep is an energy-saving feature that turns off the display. Sleep can be initiated by the system while the computer is on but not in use, or when the computer has reached a low battery level.

To change these and other power settings:

1. Click **Start**, and then click **Control Panel**.
2. Click **Power Options**.

- The computer may not be set to display the image on the computer screen.

  To transfer the image to the computer screen, press fn+f4.

  On most models, when an optional external display device, such as a monitor, is connected to the computer, the image can be displayed on the computer screen or the external display, or on both devices simultaneously. When you press fn+f4 repeatedly, the image alternates among the computer display, one or more external display devices, and simultaneous display on all devices.

The computer is on but is not responding

If the computer is on but is not responding to software or keyboard commands, turn off the computer by using the standard shutdown procedure:

1. Save your work and close all programs.
2. Click **Start**, and then click **Shut down**.

If you are unable to turn off the computer with these steps, try the following emergency shutdown procedures, in the sequence provided, until shutdown occurs:

⚠ **CAUTION:** Emergency shutdown procedures result in the loss of unsaved information.

- Press and hold the power button for at least 5 seconds.
- Disconnect the computer from external power and remove the battery.

The computer is unusually warm

It is normal for the computer to feel warm to the touch while it is in use. But if the computer feels *unusually* warm, it may be overheating because a vent is blocked.

If you suspect that the computer is overheating, allow the computer to cool to room temperature. Then be sure to keep all vents free from obstructions while you are using the computer.

WARNING! To reduce the possibility of heat-related injuries or of overheating the computer, do not place the computer directly on your lap or obstruct the computer air vents. Use the computer only on a hard, flat surface. Do not allow another hard surface, such as an adjoining optional printer, or a soft surface, such as pillows or rugs or clothing, to block airflow. Also, do not allow the AC adapter to contact the skin or a soft surface, such as pillows or rugs or clothing, during operation. The computer and the AC adapter comply with the user-accessible surface temperature limits defined by the International Standard for Safety of Information Technology Equipment (IEC 60950).

The wireless network connection is not working

If a wireless network connection is not working as expected, follow these suggestions:

NOTE: If you cannot connect to a corporate network, contact the network administrator.

- Be sure that the wireless device is turned on and the wireless light on the computer is amber. If the light is off, press the wireless button to turn on the wireless device.
- Be sure that the computer display is open and the antennas are free from obstructions.
- Be sure that the cable or DSL modem and its power cord are properly connected and that the lights are on.
- Be sure that the wireless router or access point is turned on and properly connected to its power adapter and the cable or DSL modem, and that the lights are on.
- Disconnect and then reconnect all cables, and turn the power off and then back on.

Some external devices are not working

The ExpressCard slot or the USB ports may be disabled. Contact your network administrator for additional information.

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