



HP Z200 Small Form Factor Workstation

Maintenance and Service Guide

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About this guide

This guide provides service and maintenance information for the HP Z200 Small Form Factor (SFF) Workstation. It includes these topics:

Guide topics

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[Setting up the operating system on page 16](#)

[Restoring the operating system on page 22](#)

[System management on page 26](#)

[Replacing components on page 59](#)

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[Configuring RAID devices on page 173](#)

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1 Product overview

This chapter presents an overview of the hardware components of the computer. It includes these topics:

Topics

[Product features on page 1](#)

[Computer specifications on page 7](#)

Product features

The following sections describe the computer system board architecture and components, and includes these topics:

Topics

[System board architecture on page 1](#)

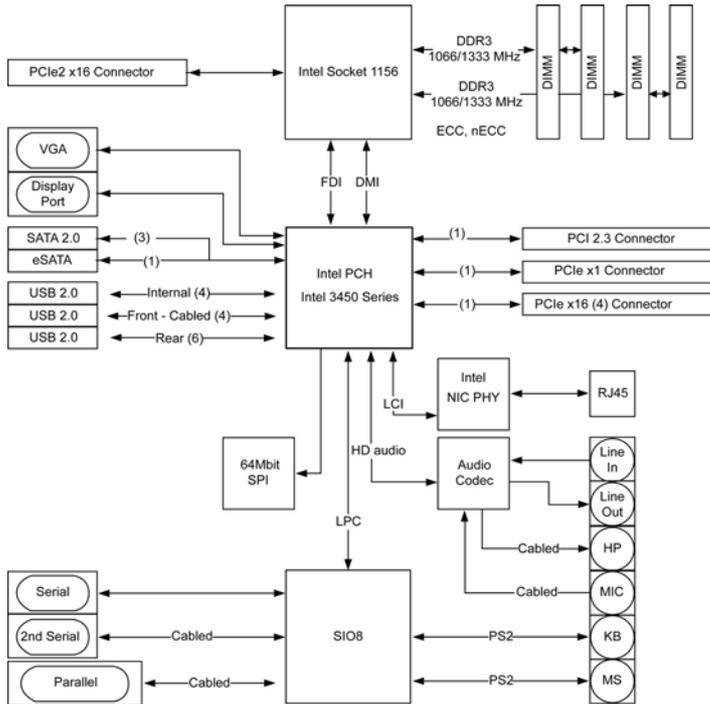
[Computer components on page 4](#)

System board architecture

This section describes the system architecture.

The following figure shows the typical system board block diagram.

Figure 1-1 System board block diagram



NOTE: The x1 and x16 designators describe the mechanical length of the slot. The number in parentheses lists the number of electrical PCIe lanes routed to the expansion slot. For example, x16(4) means that the expansion slot is mechanically a x16 length connector, with four PCIe lanes connected.

Processor technology

This computer uses the Intel® Series 3450 chipset, including support of Quad Core Intel Xeon™ processors and processors of up to 95W. These processors incorporate an integrated 2-channel memory controller, microarchitecture improvements, integrated graphics, and L3 caching to improve performance. In addition, the computer uses Intel DMI interface to connect the processor to the I/O controller.

Memory technology

The computer dual in-line memory modules (DIMMs) are based on DDR3 1333MHz technology. Error checking and correcting (ECC) and non-ECC DIMMs are supported. Two direct-attach memory channels permit low latency access and fast data transfer to improve performance. System memory sizes up to 16GB (using 4GB DIMMs) are supported.

NOTE: To optimize performance, distribute the DIMMs across both memory channels. See [Memory on page 118](#) for more information.

NOTE: Do not intermix non-ECC memory DIMMs with ECC memory DIMMs.

Graphics

The system supports multiple graphics cards as long as the total power usage of all graphics cards is less than 45W, and the total of all I/O power usage is less than 80W.

Expansion card slots

The computer provides multiple graphics and I/O slots: one full PCIe Gen2 x16, one PCIe x16(4); one PCIe x1; and one PCI 32/33. These slots provide extra I/O bandwidth for high speed I/O cards.

 **NOTE:** The total of all graphics cards cannot exceed 45 W, and the total I/O power usage cannot exceed 80W.

Additional features

The computer provides these additional features:

- Ten external and four internal USB 2.0 ports.
- A 240W power supply that is 89% efficient and permits Energy Star Version 5.0 system configurations.
- Supports European Union ERP Lot 6 power limit of less than 1W in off mode.
- HP Quiet Fan Technology permits quiet system operation.
- Parallel and serial headers that can be used with an optional PCI bulkhead connector.

Computer components

This section describes the computer components, including front and rear panel components.

For complete and current information on supported accessories and components for the computer, see <http://partsurfer.hp.com>.

Chassis components

The following image shows the components of a typical computer layout. Drive configurations can vary.

Figure 1-2 Computer components

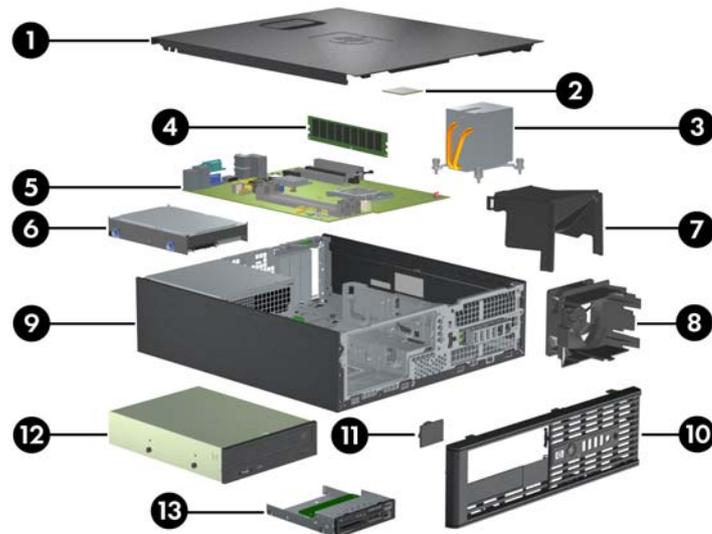


Table 1-1 Computer component descriptions

Item	Description	Item	Description
1	Access panel	8	System fan
2	Processor (CPU)	9	Chassis
3	Heatsink	10	Front bezel
4	PCIe card	11	Speaker
5	System board	12	Optical drive
6	Hard disk drive	13	Optional media reader or second hard disk drive
7	Airflow guide		

Front panel components

The following figure shows the layout of a typical front panel.

Figure 1-3 Front panel

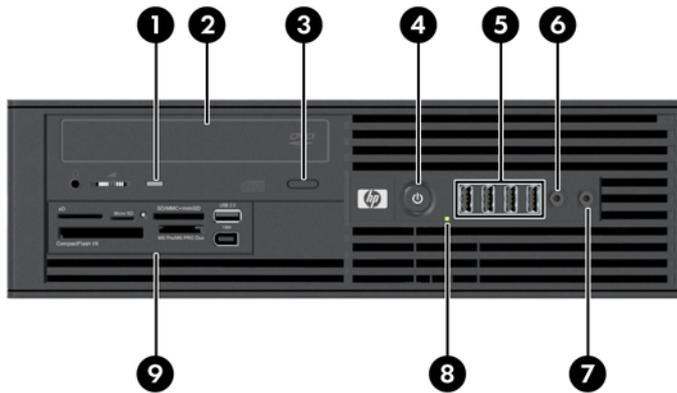


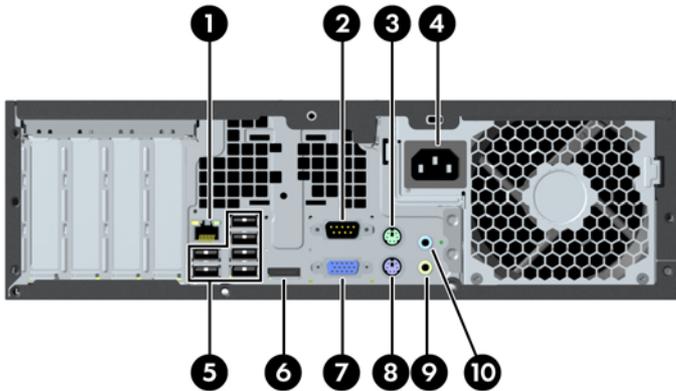
Table 1-2 Front panel connectors

Item	Symbol	Description	Item	Symbol	Description
1		Optical drive activity light	6		Microphone connector
2		Optical drive	7		Headphone connector
3		Optical drive manual eject button	8		Hard drive activity light Optical drive activity light
4		Power button	9		Media card reader (shown) or optional hard disk drive
5		USB 2.0 ports (4)			

Rear panel components

The following figure shows the layout of a typical rear panel.

Figure 1-4 Rear panel



NOTE: The labels for the rear panel connectors use industry-standard icons and colors.

Table 1-3 Rear panel connectors

Item	Symbol	Description	Item	Symbol	Description
1		RJ-45 network connector	6		Display port (DP) ¹
2		Serial port	7		VGA (monitor) ¹
3		PS/2 mouse connector (green)	8		PS/2 keyboard connector (purple)
4		Power cord connector	9		Audio line-out connector (green)
5		USB 2.0 ports (6)	10		Audio line-in connector (blue)

1. The DP and VGA ports are disabled if used with Intel® Xeon quad-core processors.

Computer specifications

This section provides computer chassis, power supply, and environmental specifications.

Physical characteristics

The following table lists the computer physical characteristics.

Weight (Typical configuration)	7.6 kg (16.72 lb.)
Chassis Dimensions	Height: 10.0 cm (3.95 in.)
	Width: 33.8 cm (13.0 in.)
	Depth: 37.9 cm (14.9 in.)

Power supply description

The computer includes a 240W 89% efficient power supply to provide power for the computer. The power supply is compatible with ENERGY STAR Ver. 5 requirements.

Power supply voltages

Table 1-4 Power supply source voltages

Source voltage	Description
+12 V-CPU	Input to onboard regulator that supplies power to CPU
+12 V-MAIN	PCI, PCIe, system fans, storage (optical and hard disk drives), and input to onboard regulators
+12 V-SBY	Input to onboard regulators
V12N	PCI and serial ports

Power supply currents

Table 1-5 Maximum current per rail

Output (240W)	+12V Main	+12Vcpu	-12V	12Vsb
Nominal output voltage	12.1	12.1	-12.0	11.4
Maximum continuous current	14A	12A	0.15A	1.3A
240W combined				

△ **CAUTION:** Do not exceed 240 watts of total continuous output power.

Maximum combined current on +12V(CPU,Main) is 20A.

Power supply specifications

Table 1-6 Power supply specifications

Item	Description
Power supply	240W Wide Ranging, Active PFC and 89% efficient
Operating voltage range	90 – 264 VAC
Rated voltage range	100–240 VAC
Rated line frequency	50–60 Hz
Operating line frequency range	47–63 Hz
Rated input current	4A
Heat dissipation (Configuration and software dependent)	Typical 170 BTU/hr = (42.87 kg-cal/hr) Maximum 1063 BTU/hr = (206.27 kg-cal/hr)
Power supply fan	One fan, 92mm x 25mm, variable speed
FEMP Standby Power compliant @115V (<2W in S5 – Power Off)	Yes
ERP Lot 6 (EuP) compliant @230V (<1w in S5 – Power Off)	Yes
Built-in Self Test LED	No
Surge tolerant full ranging power supply (withstands power surges up to 2000V)	Yes
Power Consumption in sleep mode (as defined by ENERGY STAR) - Suspend to RAM (S3) (Instantly Available PC)	<6 watts

Power consumption and heat dissipation

Power consumption and heat dissipation specifications are available for multiple configurations. To review available specifications, see <http://www.hp.com/go/quickspecs>.

To reach zero power consumption, unplug the computer from the power outlet or use a power strip with an on/off switch. For additional information about power-saving features, see the operating system installation instructions.

This product is in compliance with U.S. Executive Order 13221.

System fans

This computer includes:

- One front system fan
- One power supply fan

In addition, some graphics cards include onboard fans.

Resetting the power supply

If an overload triggers the power supply overload protection, power is immediately disconnected.

To reset the power supply:

1. Disconnect the power cord from the computer.
2. Determine what caused the overload and fix the problem. For troubleshooting information, see [Diagnostics and troubleshooting on page 139](#).
3. Reconnect the power cord and restart the computer.

When you power off the computer through the operating system, power consumption falls below what is considered low power consumption but does not reach zero. This low power consumption feature extends the life of the power supply.

Environmental specifications

The following table lists the environmental specifications of HP Workstations.

Table 1-7 HP Workstation environmental specifications

Temperature	<p>Operating: 5 to 35°C (40 to 95°F)</p> <p>Non-operating: -40 to 60°C (-40 to 140°F)</p> <p>NOTE: Derate by one degree C (1.8 degrees F) for every 305m (1,000 ft.) altitude over 1,524m (5,000 ft.).</p>
Humidity	<p>Operating: 8 to 85% Relative Humidity (RH), non-condensing</p> <p>Non-operating: 8 to 90% Relative Humidity, non-condensing</p>
Altitude	<p>Operating: 0 to 3,048m (10,000 ft.)</p> <p>Non-operating: 0 to 9,144m (30,000 ft.)</p>
Shock	<p>Operating: ½-sine: 40g, 2-3ms</p> <p>Non-operating:</p> <ul style="list-style-type: none"> • ½-sine: 160 cm/s, 2-3ms (~100g) • square: 422 cm/s, 20g <p>NOTE: Values represent individual shock events and do not indicate repetitive shock events.</p>
Vibration	<p>Operating Random: 0.5g (rms), 5-300 Hz</p> <p>Non-Operating: random: 2.0g (rms), 10-500 Hz</p> <p>NOTE: Values do not indicate continuous vibration.</p>

ENERGY STAR Qualification

HP computers marked with the ENERGY STAR logo are compliant with the applicable U.S. Environmental Protection Agency (EPA) ENERGY STAR specifications for computers. The EPA ENERGY STAR logo does not imply endorsement by the EPA. As an ENERGY STAR Partner, Hewlett-Packard Company has determined the products marked with the ENERGY STAR logo are ENERGY STAR qualified per the applicable ENERGY STAR guidelines for energy efficiency. The following logo appears on all ENERGY STAR qualified computers.



The ENERGY STAR Computers Program was created by the EPA to promote energy efficiency and reduce air pollution through more energy-efficient equipment in homes, offices, and factories. One way products achieve this energy efficiency is by reducing power consumption when not being used through the Microsoft Windows Power Management feature.

The Power Management feature enables the computer to enter a low-power (or “sleep”) mode after a period of inactivity. When used with an external monitor that is ENERGY STAR qualified, this feature also supports the similar power management features of the external monitor.

To take advantage of this energy savings:

- The Power Management feature has been preset to suspend the computer to a sleep state after 30 minutes of inactivity.
- The Power Management feature has been preset to suspend the monitor to a sleep state after 15 minutes of inactivity.

Both the computer and monitor can be woken from sleep mode through user interaction with any of the computer input devices (mouse, keyboard, and so on). when configured with Wake On LAN (WOL) enabled, the computer can also be woken by a network signal.

See the EPA ENERGY STAR Power Management Web site for more information about the energy and financial savings potential of the Power Management Feature: <http://www.energystar.gov/powermanagement>.

See the EPA ENERGY STAR Web site for more information about the ENERGY STAR program and its environmental benefits: <http://www.energystar.gov>.

△ **CAUTION:** Using the Energy Save Monitor feature with monitors that are not ENERGY STAR qualified can cause video distortion when an Energy Save timeout occurs.

📝 **NOTE:** ENERGY STAR is not supported on Linux computers.

If it is necessary to restore the operating system, you must also reset the ENERGY STAR settings (if applicable) after the restore.

To verify the factory default power settings for your computer, select **Start>Control Panel**, and then double-click **Power Options**.

ERP compliance mode

This computer provides ERP compliance mode capability.

When enabled, this feature enables the computer to shut down to the lowest possible power state by removing all power to the system board.

When disabled, the computer powers down conventionally.

When the computer is shut down in ERP compliance mode, it must be powered up with the computer power button.

Enabling ERP compliance mode

To enable ERP compliance mode:

1. Press **F10** during start up.
2. Using the arrow keys, select the **Power>Hardware Power Management>ERP Compliance Mode**, and then select **Enable**.
3. Press **F10** to accept the change.
4. Select **File>Save Change and Exit**, and then press **F10** to accept the change.

Disabling ERP compliance mode

To disable the ERP compliance mode:

1. Press **F10** during start up.
2. Select **Power>Hardware Power Management>ERP Compliance Mode**, and then select **Disable**.
3. Press **F10** to accept the change.
4. Select **File>Save Change and Exit**, and then press **F10** to accept the change.

Accessibility

HP is committed to developing products, services, and information that is easier to access for all customers, including customers with disabilities and age-related limitations. HP products with Windows® 7, Windows Vista® Business, and Microsoft® Windows® XP Professional preinstalled are designed for accessibility. These products are tested with industry-leading Assistive Technology products. For more information see <http://www.hp.com/accessibility>.

Hyper-threading

This HP computer supports Hyper-threading.

Hyper-Threading Technology (HTT), is an Intel-proprietary technology used to provide process parallelization . The technology improves processor performance under certain workloads by providing useful work for execution units that would otherwise be idle. A processor with Hyper-Threading enabled is treated by the operating system as two processors instead of one. Hyper-threading relies on support in the operating system as well as the CPU.

SATA Power Management

SATA Power Management enables or disables SATA bus and/or device power management.

Intel Turbo Boost Technology

The HP Z Workstation series supports Intel® Turbo Boost Technology.

This feature enables the CPU to run at a higher than normal rate. When all CPU cores are not necessary for the workload, inactive cores are turned off and power is diverted to the active cores to increase their performance.

Turbo Boost is enabled and disabled in computer BIOS.

HP Cool Tools

An HP computer with Windows XP includes additional software that is not installed when you first start the computer. To access or learn more about these additional preinstalled tools on the computer that can enhance the computer experience:

1. Open the HP Cool Tools folder by selecting **Start>All Programs>HP Cool Tools**.
2. Select the **HP Cool Tools** icon on the desktop.
3. To learn more about these applications, select **HP Cool Tools—Learn More**.
4. To install or launch the applications, select the appropriate application.

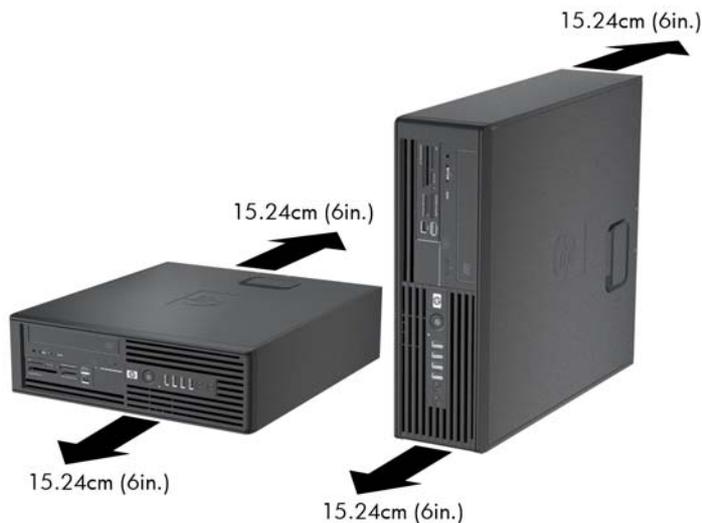
 **NOTE:** A preinstalled Windows 7 or Windows Vista Business operating system does not contain a Cool Tools icon, shortcut or folder but several of the tool programs are included, such as Performance Tuning Framework.

Ensuring proper ventilation

Proper ventilation for the system is important for computer operation. Follow these guidelines to ensure adequate ventilation:

- Operate the computer on a sturdy, level surface.
- Place the computer in an area with adequate ventilation. Provide at least 15.24 CM (6 inches) of clearance at the front and back of the computer as shown in the following figure. (Your computer might look different than the one shown.)

Figure 1-5 Proper computer ventilation

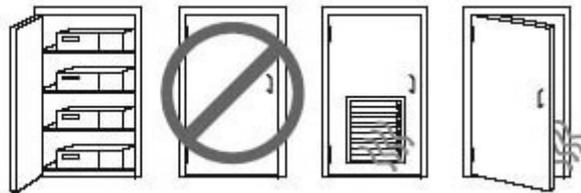


- Ensure that the ambient air temperature surrounding the computer falls within the published limit.

NOTE: The ambient upper limit of 35 C is only good up to 1524 M (5000 FT) elevation. There is a 1 C per 304.8 M (1000 FT) derating above 1524 M (5000 FT). So, at 3,048 M (10,000 FT), the upper ambient air temperature limit is 30 C.

- For cabinet installation, ensure adequate cabinet ventilation and ensure that the ambient temperature within the cabinet does not exceed published limits.
- Never restrict the incoming or outgoing airflow of the computer by blocking any vents or air intakes as shown in the following figure.

Figure 1-6 Proper computer placement



2 Setting up the operating system

This chapter provides setup and update information for the computer operating system. It includes these topics:

Topics

[Setting up the Microsoft operating system on page 17](#)

[Setting up Red Hat Enterprise Linux on page 18](#)

[Setting up Novell SLED on page 19](#)

[Updating the computer on page 19](#)

This chapter also includes information on how to determine that you have the latest BIOS, drivers, and software updates installed on the computer.

-
- △ **CAUTION:** Do not add optional hardware or third-party devices to the HP computer until the operating system is successfully installed. Adding hardware might cause errors and prevent the operating system from installing correctly.
-

Setting up the Microsoft operating system

 **NOTE:** If you ordered a downgrade from Windows Vista or Windows 7 to the Windows XP Professional operating system, your system comes pre-installed with the Windows XP Professional operating system. This configuration comes with recovery media for the Windows Vista or Windows 7 operating system only. Therefore you should create your own recovery media for the Windows XP Professional operating system as soon as you can after you first boot your system

When you first apply power to the computer, the operating system is installed. This process takes approximately 5 to 10 minutes. Carefully follow the instructions on the screen to complete the installation.

 **CAUTION:** After installation has started, do *not* turn off the computer until the process is complete. Turning off the computer during installation can damage the installation and operation of the software.

For complete operating system installation and configuration instructions, see the operating system documentation that was provided with the computer. Additional information is available in the online help tool after you successfully install the operating system.

Installing or upgrading device drivers

To install hardware devices after the operating system is installed, you must install the appropriate device drivers before you install the devices. Follow the installation instructions that came with the device. In addition, for optimum performance, your operating system must have the most recent updates, patches, and software fixes. For additional driver and software update information, refer to [Upgrading device drivers on page 21](#).

Transferring files and settings to your Windows computer

The Microsoft Windows operating system offers data migration tools that helps you choose and transfer files and data from a Windows computer to your Windows 7, Windows Vista, or Windows XP Professional operating system computer.

For instructions on how to use these tools, see the documents at <http://www.microsoft.com>.

Setting up Red Hat Enterprise Linux

HP offers an HP Installer Kit for Linux (HPIKL) to supplement Red Hat box sets and help HP Linux customers customize their system image. The HPIKL contains the HP driver CD and device drivers to successfully setup up the Red Hat Enterprise Linux (RHEL) operating system, The HP Installer Kit for Linux CDs are currently available for download at http://www.hp.com/support/workstation_swdrivers.

Installing with the HP driver CD

To install the HP driver CD, see “Installing with the HP Installer Kit for Linux” in the *HP Workstations for Linux* manual at http://www.hp.com/support/workstation_manuals.

Installing and customizing Red Hat-enabled computers

Linux-enabled computers require the HP Installer Kit and the purchase of a Red Hat Enterprise Linux box set. The Installer kit includes the HP CDs necessary to complete the installation of all versions of the Red Hat Enterprise Linux box set that have been qualified to work on an HP computer.

To use the drivers in the HP Installer kit for Linux other than RHEL, you must manually extract the drivers from the HP Driver CD and install them. HP does not test the installation of these drivers on other Linux distributions nor does HP support this operation.

Verifying hardware compatibility

To see which Linux versions have been qualified to work on HP Workstations visit http://www.hp.com/support/linux_hardware_matrix.

Setting up Novell SLED

To set up the SUSE Linux Enterprise Desktop (SLED) on systems preloaded with the operating system:

1. Boot the computer.
2. Start the Installation Settings and enter the password, network, graphics, time, keyboard settings, and Novell Customer Center Configuration for the computer.

 **NOTE:** During Installation Settings after the first time after booting the system the Novell subscription can be activated from the Novell Customer Center Configuration screen. Visit the full Novell Customer Center documentation at <http://www.novell.com/documentation/ncc/>.

Updating the computer

HP is constantly working on improving your total computer experience. To ensure that the computer leverages the latest enhancements, HP recommends that you install the latest BIOS, driver, and software updates on a regular basis.

Updating the computer after first boot

After successfully booting the computer for the first time, you should follow these guidelines to ensure that the computer is up-to-date:

- Ensure that you have the latest system BIOS loaded. See [Upgrading the BIOS on page 19](#) for instructions.
- Ensure that you have the latest drivers for your system. See [Upgrading device drivers on page 21](#) for instructions.
- Become familiar with your available HP resources.
- Consider a subscription to Driver Alerts at <http://www.hp.com/go/subscriberschoice>.

Upgrading the BIOS

For optimum performance, determine the BIOS revision on the computer, and upgrade it if necessary.

Determining current BIOS

To determine the current BIOS of the computer during system power up:

1. Wait for F10=setup to appear on the lower right corner of the screen.
2. Press **F10** to enter the F10 Setup utility.

The F10 Setup utility displays the computer BIOS version under **File > System Information**.

3. Note the computer BIOS version so that you can compare it with the BIOS versions that appear on the HP website.

Upgrading BIOS

To find and download the latest available BIOS, which includes the latest enhancements:

1. Go to <http://www.hp.com/go/workstationsupport>.
2. Select **Download Drivers and Software** from the left menu column under Tasks.
3. Follow the instructions to locate the latest BIOS available for the computer.
4. If the BIOS on the Web site is the same as the version on your system, no further action is required.
5. If the BIOS on the Web site is a version later than the one on your system, download the appropriate version for the computer. Follow the instructions in the release notes to complete the installation.

Upgrading device drivers

If you install a peripheral device (such as a printer, display adapter, or network adapter), confirm you have the latest device drivers loaded. If you purchased your device through HP, visit the HP Web site to download the latest drivers for your device. These drivers have been tested to ensure the best compatibility between your device and your HP computer.

If you did not purchase your device from HP, HP recommends visiting the HP Web site first to see if your device and its drivers have been tested for HP computer compatibility. If no driver is available, visit the device manufacturer's Web site to download the latest drivers.

To upgrade device drivers:

1. Go to <http://www.hp.com/go/workstationsupport>.
2. Select **Download Drivers and Software** from the left menu column under Tasks.
3. Follow the instructions to find the latest drivers available for the computer.

If a needed driver is not found, see the Web site of the manufacturer of the peripheral device.

3 Restoring the operating system

This chapter describes how to restore the Windows or Linux operating system. It includes these topics:

Topics

[Restore methods on page 22](#)

[Restoring Windows 7 or Windows Vista on page 22](#)

[Restoring Windows XP Professional on page 24](#)

[Restoring Novell SLED on page 25](#)

Restore methods

The Windows 7 or Windows Business Vista operating system can be reinstalled using the HP RestorePlus! process. The Windows XP Professional operating system can be reinstalled using the RestorePlus! process or the HP Backup and Recovery Manager.

- RestorePlus!

The RestorePlus! process reinstalls the Windows operating system and device drivers (for devices included with the system) to a near-factory state. The process does not back up or recover data on the hard drive. Some application software might not be restored using this process and must be installed from the appropriate application CD.

△ **CAUTION:** These methods restore the operating system, but not data. Data must be backed up regularly to avoid loss.

Restoring Windows 7 or Windows Vista

This section describes how to restore Windows 7 or Windows Vista.

Ordering the RestorePlus! media

If you ordered restore media with your computer, the media is included with your computer components.

If you did not order restore media, call HP Support and request a RestorePlus! media kit. For worldwide technical support phone numbers, see <http://www.hp.com/support>.

Restoring the operating system

 **NOTE:** Windows Vista provides a backup and restore application as well. To learn more about this application, see the Microsoft Web site.

△ **CAUTION:** Before you restore the operating system, back up your data.

When you run RestorePlus! from media, the process deletes all information on the primary hard drive, including all partitions.

To restore Windows 7 or Windows Vista:

1. Boot from the RestorePlus! DVD to start the RestorePlus! process. You must start from the RestorePlus! DVD to install device drivers and settings.
2. Follow the prompts to restore your operating system.

Some application software might not be restored using this process. If software is not restored, install it from the appropriate application DVD.

Restoring Windows XP Professional

This section describes how to restore the Windows XP Professional operating system.

 **NOTE:** The computer must have a CD or DVD writer installed to create the media set.

Creating RestorePlus! media

The RestorePlus! kit can be created using the files contained on the hard drive. To create the restore media:

Restoring the operating system

△ **CAUTION:** Before you restore the operating system, back up your data.

When you run RestorePlus! from media, the process deletes all information on the primary hard drive, including all partitions. If you run RestorePlus! from the recovery partition, only the root (C:) partition is affected.

Using RestorePlus!

To restore with RestorePlus!:

1. Boot the computer from the RestorePlus! DVD. You must start from the RestorePlus! DVD for device drivers and settings to be installed.
2. Follow the prompts to restore the operating system.

Some application software might not be restored using this process. If software is not restored, install it from the appropriate application DVD.

Restoring Novell SLED

The SLED restore media is required to restore the Linux operating system.

Creating restore media

THE SUSE Linux Enterprise Desktop preload includes a SUSE ISO icon on the desktop. You can click this icon to go to the `/iso` directory. The `/iso` directory contains all iso images used to preload your computer. To recover or restore the original image, follow the instructions in the readme file in the `/iso` directory to copy the ISO image file onto CDs.

 **NOTE:** Make copies of the ISO recovery images on CD as backup files in case your computer experiences a hard drive failure.

4 System management

This section describes the tools and utilities that provide system management for the computer. It includes these topics:

Topics

[BIOS ROM on page 27](#)

[The Computer Setup \(F10\) Utility on page 27](#)

[Desktop management on page 38](#)

BIOS ROM

The BIOS ROM is a collection of machine language applications stored as firmware in ROM. It includes functions such as Power on Self Test (POST), PCI device initialization, Plug and Play support, power management, and the Computer Setup (F10) Utility. The BIOS ROM is an 8MB Serial Peripheral Interface (SPI) port.

See <http://www.hp.com/go/quickspecs> to review the latest BIOS ROM specifications.

The Computer Setup (F10) Utility

This section contains these topics:

Topics

[Computer Setup \(F10\) functionality on page 27](#)

[Accessing the Computer Setup \(F10\) Utility on page 29](#)

[The Computer Setup \(F10\) Utility menu on page 30](#)

Computer Setup (F10) functionality

The Computer Setup (F10) Utility enables you to:

- Change factory default settings and set or change the computer configuration, which might be necessary when you add or remove hardware.
- Determine if all devices installed on the computer are recognized by the system and functioning.
- Determine information about the operating environment of the computer.
- Solve system configuration errors that are detected but not fixed during the Power-On Self-Test (POST).
- Establish and manage passwords and other security features.
- Establish and manage energy-saving time-outs (not supported on Linux platforms).
- Modify or restore factory default settings.
- Set the computer date and time.
- Set, view, change, or verify the computer configuration, including settings for CPU, graphics, memory, audio, storage, communications, and input devices.
- Modify the boot order of installed mass storage devices such as SATA, optical disk drives, network drives, LS-120 drives, and USB boot devices.
- Configure the boot priority of SATA hard-drive controllers.
- Enable or disable Network Server Mode, which enables the computer to start the operating system when the power-on password is enabled with or without a keyboard or mouse attached. When attached to the computer, the keyboard and mouse remain locked until the power-on password is entered.

- Enable or disable POST Messages to change the display status of POST messages. POST Messages disabled suppresses most POST messages, such as memory count, product name, and other nonerror text messages. If a POST error occurs, the error is displayed regardless of the mode selected. To manually switch to POST Messages Enabled during POST, press any key except F1 through F12.
- Specify an Ownership Tag, which appears when the computer is powered on or restarted.
- Specify the Asset Tag or property identification number assigned by the company to this computer.
- Enable power-on password prompts during system restarts (warm-starts) and power on.
- Hide or show the integrated I/O functionality, including serial, USB, or parallel ports, audio, or embedded NIC. Hidden devices are inaccessible, which increases system security.
- Enable or disable removable media boot ability.
- Enable or disable removable media write ability (if supported by hardware).
- Replicate the computer setup by saving system configuration information on CD or diskette and restoring it on computers.
- Execute self-tests on specified SATA hard disk drives (if supported by the drive).

Accessing the Computer Setup (F10) Utility

To access the Computer Setup (F10) Utility menu:

1. Power on or restart the computer.
2. When the display is active and **F10=Setup** appears in the lower right corner of the screen, press **F10**.

If you do not press **F10** at the appropriate time, try again. Turn the computer off, then on, and press **F10** again to access the utility. You can also press the **Ctrl + Alt + Delete** keys before starting if you miss the opportunity to press **F10**.

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

In the Computer Setup (F10) Utility menu, five headings are displayed: File, Storage, Security, Power, and Advanced.

4. Use the left and right arrow keys to select the appropriate heading, use the up and down arrow keys to select an option, and then press **Enter**.
5. Choose from the following:
 - To apply and save changes, select **File>Save Changes**, and then select **F10=YES**.
 - To remove changes you have made, select **Ignore Changes** and then select **F10=YES**.
 - To reset to factory settings, select **File>Default Setup>Restore Factory Settings as Default**. Press **F10** to accept the changes, and then select **Apply Defaults and Exit**. This restores the original factory system defaults.

△ **CAUTION:** Do not power off the computer while the ROM is saving the Computer Setup (F10) Utility changes, because the Complementary Metal-Oxide Semiconductor (CMOS) could become corrupted. After you exit the F10 Setup screen, you can disconnect power from the computer.

The Computer Setup (F10) Utility menu

The following table describes the functions available in the Computer Setup (F10) utility menu.

 **NOTE:** With new BIOS releases, the following content is subject to change, so the menu might be different than shown.

Table 4-1 Computer Setup (F10) Utility menu descriptions

Heading	Option	Description
File	System Information	Displays the following system characteristics: <ul style="list-style-type: none">• Product Name• QPI Link Speed• Memory Size• Integrated MAC• System BIOS• Boot Block Date• Chassis serial number• Asset Tracking Number• Management Module• Processor Type• Processor Speed• Processor Stepping• Cache Size• DIMMs
	About	Displays copyright information.
	System Temperatures	Displays system temperatures and fan speeds.
	Set Time and Date	Enables you to set system time and date.
	Flash System ROM	Enables you to upgrade the BIOS from a ROM image on diskette, CD, or USB.
	Replicated Setup	Provides these options: <ul style="list-style-type: none">• Save to Removable Media—Saves the computer configuration, including CMOS, in the <i>qsetup.txt</i> file. This file can be saved to a formatted, blank 1.44-MB diskette, or to a USB device.• Restore from Removable Media—Restores the computer configuration from a diskette or a USB device.

Table 4-1 Computer Setup (F10) Utility menu descriptions (continued)

Heading	Option	Description
	Default Setup	Provides these options: <ul style="list-style-type: none">• Save Current Settings as Default—Saves the current settings as default settings for the next operation.• Restore Factory Settings as Default—Restores the factory settings as the default settings for the next operation.
	Apply Defaults and Exit	Restores the default settings defined in Default Setup.
	Ignore Changes and Exit	Exits computer setup without applying or saving changes.
	Save Changes and Exit	Saves changes to system configuration and exits the computer setup.
Storage	Device Configuration	<p>Lists installed non-SCSI storage devices (except SATA devices) and provides options for obtaining specific information about each device:</p> <ul style="list-style-type: none">• Hard Disk—Provides information about the hard disk drives in the computer. It is available in IDE Mode only.• CD-ROM—Provides information about the optical disk drives in the computer. (IDE mode only.)• Diskette Type (for legacy diskette drives only)—Identifies the highest capacity media type accepted by the diskette drive. Options are 3.5" (1.44 MB), 5.25" (1.2 MB), and Not Installed.• Default Values—Resets devices to their default configuration (SATA is the default).<ul style="list-style-type: none">◦ Multisector Transfers—Defines the transfer of data per interrupt. Options are 8, 16, and Disable (16 is the default).◦ Transfer Mode—Specifies the active data transfer mode. Options (subject to device capabilities) are Max UDMA, PIO 0, Max PIO, Enhanced DMA, and Ultra DMA0. (Max UDMA is the default).◦ Translation Mode—Enables the BIOS to determine the translation mode used to configure a formatted SATA or USB mass storage device. This prevents you from needing to know how the mass storage device was formatted. Options are Automatic, Bit Shift, LBA Assisted, Use (Cylinders, Heads, Sectors), and Off. Automatic is the default. <p>Ordinarily, you should not change the translation mode selected by the BIOS. If the selected translation mode is not compatible with the translation mode that was active when the drive was partitioned and formatted, the data on the disk is inaccessible.</p>

Table 4-1 Computer Setup (F10) Utility menu descriptions (continued)

Heading	Option	Description
	Storage Options	<p>Provides these options:</p> <ul style="list-style-type: none"> Removable Media Boot—Enables and disables the ability to start the computer from removable media. Legacy Diskette Write—Enables and disables the ability to write data to removable media. SATA Emulation—Sets the SATA emulation mode with the following options: <ul style="list-style-type: none"> RAID + AHCI—both the RAID and AHCI OROMs execute. This emulation mode is the default and offers the best performance and most functionality. IDE —offers standard SATA supports (four ports only). SATA PORT 0-<i>n</i>—enables and disables the SATA ports. Offers these configurations: <ul style="list-style-type: none"> GEN 2/3.0 Gbps (Internal Only/eSATA Only) GEN 1/1.5 Gbps (eSATA Only)
	DPS Self-test	<p>Select a drive—Enables you to select a drive to test. This option is available in SATA IDE emulation mode only.</p> <p>The DPS self-test function directs an IDE hard disk to run an internal self-test and report the results. If the SATA controller is not in IDE emulation mode, the DPS self-test option is not displayed in the setup menu.</p> <p>This selection appears only when at least one drive capable of performing the IDE DPS self-test is attached to the computer. By default, the SATA controller is in RAID+AHCI mode, so this option is not displayed</p>
	Boot Order	<p>Enables you to configure the boot, diskette drive, and hard disk drive orders by physically reordering the menu entries. The following is the default boot order presented in the menu:</p> <ul style="list-style-type: none"> Optical Drive Diskette Drive USB Device Hard Drive Embedded Ethernet controller Embedded Ethernet controller (ASF) Second embedded LAN. (Not available in some configurations.) <p>Press Enter to drag a device to a preferred place. Press F5 to remove the device from consideration as a bootable device.</p> <p>MS-DOS drive lettering assignments might not apply after an operating system other than MS-DOS has started.</p> <p>Boot devices can be disabled in the boot order process. These order changes are stored in the physical ROM when the F10 Setup changes are confirmed with File>Save Changes and Exit.</p> <p>You can temporarily override the boot order. To start one time from a device other than the default device specified in Boot Order, restart the computer and press F9 when the F9=Boot Menu message appears on the screen. After POST completes, a list of bootable devices is displayed. Use the arrow keys to select the preferred bootable device and press Enter. The computer then starts from the selected nondefault device for this one time.</p>

Table 4-1 Computer Setup (F10) Utility menu descriptions (continued)

Heading	Option	Description
Security	Setup Password	Enables you to set and enable a setup password for the administrator. If you create a setup password, you must use it to change computer setup options, to flash the ROM, and to make changes to certain Plug and Play settings under Windows.
	Power-On Password	Enables you to set and enable the power-on password.
	Password Options	This option becomes available when you create a setup and/or power-on password. It provides these options: <ul style="list-style-type: none">• Lock Legacy Resources—Prevents the operating system from changing resources to serial, parallel, or diskette controller.• Network Server Mode—Enables network server mode.• Password Prompt on Warm Boot—Enables a password prompt on a warm boot.• Setup Browse Mode—Enables read-only functionality for password info.
	Smart Cover	Enables you to enable and disable the cover removal sensor, or to notify you if the sensor is activated.
	Device Security	Makes the following devices available or hidden to the computer: <ul style="list-style-type: none">• Serial Port• Front USB Ports• Rear USB Ports• Internal USB Ports• System Audio• IEEE 1394 Controller (Not available on some models.)• Ethernet Controller• Ethernet Controller (ASF) (Not available on some models.)• Legacy Diskette• Embedded Security Device• SATA 0-n <p>For each device, Device Available is the default setting and allows the operating system to access the device. Device Hidden makes the device unavailable; it is disabled by the BIOS and cannot be enabled by the operating system.</p> <p>NOTE: An entry for enabling DriveLock appears in the setup menu if the computer has a DriveLock-compatible hard disk drive.</p>

Table 4-1 Computer Setup (F10) Utility menu descriptions (continued)

Heading	Option	Description
	Embedded Security Device	<p>This option becomes available if Embedded Device is set to Available.</p> <p>Embedded Security Device (Hidden or Available) turns the Trusted Platform Mechanism (TPM) on and off. Device Hidden is the default. If this option is made available, the following options become available:</p> <ul style="list-style-type: none"> Power-On Authentication Support—Enables and disables an authentication feature that requires you to enter a TPM user key password to start the computer. This feature uses the TPM to generate and store the authentication password. Reset Authentication Credential—Resets the authentication functionality and clears authentication credentials. <p>To enable the Embedded Security Device and to access any security features associated with the device, you must enter a setup password.</p> <p>Setting a device to Available enables the operating system to access the device. Hidden makes the device unavailable. It is disabled by the BIOS and cannot be enabled by the operating system.</p>
	Network Service Boot	Enables or disables the ability to boot to the network using the F12 key or the boot order.
	System IDs	<p>Provides these options:</p> <ul style="list-style-type: none"> Asset Tag—A 16-byte string identifying the computer. Ownership Tag—An 80-byte string identifying ownership of the computer. This tag appears on the screen during POST. Universal Unique Identifier (UUID)—Can only be updated if the current chassis serial number is invalid. (These ID numbers are normally set in the factory and are used to uniquely identify the computer.) Keyboard—Enables you to set the keyboard locale for System ID entry.
	System Security	<p>Provides these options:</p> <ul style="list-style-type: none"> Data Execution Prevention—Enables or disables Data Execution Prevention mode in the CPUs. This mode prohibits code from running in pages that were set up as data pages, and prevents attacks such as buffer overflows. Operating system support is required for this feature. Virtualization Technology (VTx)—Enables or disables Intel® Virtualization Technology to increase computer performance. Virtualization Technology for Directed I/O (VT-d2) Enables a virtual machine to gain exclusive control of a hardware device, such as a graphics card. Embedded Security Device—This option becomes available if Embedded Device is set to Available. <p>Embedded Security Device (Hidden or Available) turns the Trusted Platform Mechanism (TPM) on and off. Device Hidden is the default. If this option is made available, the following options become available:</p> <ul style="list-style-type: none"> Power-On Authentication Support—Enables and disables an authentication feature that requires you to enter a TPM user key password to start the computer. This feature uses the TPM to generate and store the authentication password. Reset Authentication Credential—Resets the authentication functionality and clears authentication credentials.

Table 4-1 Computer Setup (F10) Utility menu descriptions (continued)

Heading	Option	Description
		<p>To enable the Embedded Security Device and to access any security features associated with the device, you must enter a setup password.</p> <p>Setting a device to Available enables the operating system to access the device. Hidden makes the device unavailable. It is disabled by the BIOS and cannot be enabled by the operating system.</p> <ul style="list-style-type: none"> • Intel IO Virtualization—Enables or disables Virtualization Technology to increase computer I/O performance. • Embedded Security Device Support—Enables the computer to leverage the trusted platform mechanism device. • OS Management of Embedded Security Device—Enables or disables the ability of the operating system to control the TPM device, including turning it on and off, initializing it, and resetting it. • Reset of Embedded Security Device through OS—Enables or disables the ability of the operating system to reset the TPM.
	Setup Security Level	Enables the administrator to set the security level of each setup feature.
Power	OS Power Management	<p>Enables or disables:</p> <ul style="list-style-type: none"> • Runtime Power Management • MWAITE-AWARE OS • Idle Power Savings • ACPI S3 Hard Disk Reset • ACPI S3 PS/2 Mouse Wakeup • USB Wake on Device Insertion • Unique Sleep State Blink Rates
	Hardware Power Management	<p>Enables or disables:</p> <ul style="list-style-type: none"> • SATA Power Management • Intel Turbo Boost Technology • Enhanced Intel Turbo Boost Technology • ERP Compliance Mode
	Thermal	Enables you to set the rate of the system fan when the CPU is in idle.

Table 4-1 Computer Setup (F10) Utility menu descriptions (continued)

Heading	Option	Description
Advanced ²	Power-On Options	<p>Sets the following:</p> <ul style="list-style-type: none"> • POST Messages—Enables or disables the splash screen during POST. • F9 Prompt (Displayed or Hidden)—Selecting Displayed displays the F9=Boot Menu during POST. Selecting Hidden prevents the text from being displayed. However, pressing F9 still accesses the boot menu. • F10 Prompt (Displayed or Hidden)—Selecting Displayed displays F10=Setup during POST. Selecting Hidden prevents the text from being displayed, but pressing F10 still accesses the Setup screen. • F12 Prompt (Displayed or Hidden)—Selecting Displayed displays F12=Network Service Boot during POST. Selecting Hidden prevents the text from being displayed but pressing F12 still forces the computer to attempt booting from the network. • Option ROM¹ prompt (Enable or Disable)—Enabling this feature causes the computer to display a message before loading options ROMs. • Remote Wakeup Boot Source—Enables you to set the remote wakeup boot source as: <ul style="list-style-type: none"> ◦ Local Hard Drive ◦ Remote Server • After Power Loss (On, Off, Previous State)—Enabling this option directs the previous state to be the default. • POST Delay (in seconds) (5, 10, 15, 20, None)—Adds a specified delay to the POST process. This delay is sometimes needed for hard disk drives on some expansion cards that spin up slowly (so slowly that they are not ready to start by the time POST is finished). The POST delay also gives you time to select F10 to enter the Computer Setup (F10) Utility.
	BIOS Power-On	Enables you to disable or specify a weekday and time for BIOS power-on.
	Processors	<p>Enables/disables these options:</p> <ul style="list-style-type: none"> • Hyper-Threading—Provides processor parallelization such that the operating system treats one processor as two. • Active Cores (1,2, or All Cores)—Selects a single core, or multiple cores per socket. (Not available on some configurations.) • Limit CPUID Maximum Value to 3 (Enable or Disable)—Sets the number of allowable CPU IDs.
	Onboard Devices	Enables you to set resources (IRQ, DMA, I/O Rate) for or disable onboard system devices such as serial port and diskette controller. Operating system parameters generally override Onboard Devices settings.
	PCI VGA Configuration	Configures graphics cards per computer slots. In multi-graphics card configurations, this option designates one card as primary graphics, and the other card as secondary graphics.
	Chipset/Memory	<p>Enable/disable these options:</p> <ul style="list-style-type: none"> • PCI SERR# Generation (Enable or Disable)—Controls PCI SERR# generation for ill-behaved PCI add-in cards (that can generate SERR# spuriously). • PCI VGA Palette Snooping (Enable or Disable)—Controls PCI VGA Palette Snooping for compatibility purposes. • Memory Mode Interleave—Sets interleave mode for dual socket computers.

Table 4-1 Computer Setup (F10) Utility menu descriptions (continued)

Heading	Option	Description
	Device Options	Enables you to set the following device options: <ul style="list-style-type: none">• Num Lock State at Power-On (On or Off)• S5 Wake-on-LAN (Enable or Disable)• Multiprocessor (Activates a single core.)• Unique Sleep State Blink Rates (Enable or Disable)• Internal speaker• Monitor Tracking (Enable or Disable)• NIC PXE Option ROM¹ Download (Enable or Disable)• SATA RAID Option ROM¹ Download (Enable or Disable)

¹ Available on selected models

² These options should be used by advanced users only

Desktop management

This section summarizes capabilities, features, and key components of computer management, including:

Topics

[Initial computer configuration and deployment on page 39](#)

[Installing a remote system on page 39](#)

[Replicating the setup on page 40](#)

[Updating and managing software on page 42](#)

[HP Client Manager Software on page 42](#)

[Altiris Client Management Solutions on page 42](#)

[System Software Manager on page 44](#)

[ROM Flash on page 45](#)

[FailSafe Boot Block ROM on page 46](#)

[Workstation security on page 47](#)

[Fault notification and recovery on page 57](#)

[Dual-state power button on page 58](#)

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

Initial computer configuration and deployment

The computer includes a preinstalled system software image. After a brief software unbundling process, the computer is ready to use.

If you prefer to replace the preinstalled software image with a customized set of system and application software, several methods are available for deploying a customized software image, including:

- Installing additional software applications after unbundling the preinstalled software image
- Using a disk cloning process to copy the contents from one hard disk drive to another

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

Support for specific features described in this guide can vary by model and software version.

The best deployment method depends on the information technology environment and processes.

Installing a remote system

Remote system installation enables starting and setting up the computer using software and configuration information on a network server. This feature is usually used as a system setup and configuration tool and can be used for the following tasks:

- Deploying a software image on new PCs
- Formatting a hard disk drive
- Installing application software or drivers
- Updating the operating system, application software, or drivers

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

Replicating the setup

This section provides information about replicating the computer setup.

Copying a setup configuration to a single computer

-
- △ **CAUTION:** A setup configuration is model-specific. File system corruption can result if source and target computers are not the same model.
-

To copy a setup configuration:

1. Select a setup configuration to copy, and then restart the computer.
2. As soon as the computer powers on, press and hold **F10** until you enter the Computer Setup (F10) Utility. If necessary, press **Enter** to bypass the title screen.

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

If you are using a PS/2 keyboard, you might see a keyboard error message. Disregard it.

3. Select **File>Replicated Setup>Save to Removable Media**. Follow the instructions on the screen to create the configuration diskette or USB media device.
4. Power off the computer you are configuring and insert the configuration diskette into the diskette drive or USB media device.
5. Power on the computer you are configuring.
6. Press and hold the **F10** key until you enter the Computer Setup (F10) Utility. If necessary, press **Enter** to bypass the title screen.
7. Select **File>Replicated Setup>Restore from Removable Media**, and then follow the instructions on the screen.
8. Restart the computer when the configuration is complete.

Copying a setup configuration to multiple computers

- △ **CAUTION:** A setup configuration is model-specific. If source and target computers are not the same model, file system corruption can result. For example, do not copy the setup configuration from an HP xw8600 Workstation to an HP Z200 Workstation.

This method takes longer to prepare the configuration diskette, but copying the configuration to target computers is fast.

A bootable diskette is required for this procedure. If Windows XP is not available to create a bootable diskette, use the method for copying to a single computer instead (see [Copying a setup configuration to a single computer on page 40](#)).

1. Create a bootable diskette or USB media device.
2. Select a setup configuration to copy.
3. If you are using a diskette or USB storage device, insert it now.
4. Restart the computer.
5. As soon as the computer powers on, press and hold **F10** until you enter the Computer Setup (F10) Utility. If necessary, press **Enter** to bypass the title screen.

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

If you are using a PS/2 keyboard, you might see a keyboard error message. Disregard it.

6. Select **File>Replicated Setup>Save to Removable Media**, and follow the instructions on the screen to create the configuration diskette or USB media device.
7. Download a BIOS utility for replicating setup (*repset.exe*), and copy it to the configuration diskette or USB media device. To obtain this utility, see <http://www.hp.com/support/files>.
8. Enter the model number of the computer.
9. On the configuration diskette, create an *autoexec.bat* file containing *repset.exe* and *cpqsetup.txt*.
10. Power off the computer you are configuring, insert the configuration diskette or USB device, and then power on the computer. The configuration utility runs automatically.
11. When the configuration is complete, restart the computer.

Updating and managing software

HP provides several tools for managing and updating software on desktops and computers:

- HP Client Manager Software
- System Software Manager
- Altiris Client Management Solutions

HP Client Manager Software

The HP Client Manager Software offers these services:

- Detailed views of hardware inventory for asset management
- PC health-check monitoring and diagnostics
- Proactive notification of changes in the hardware environment
- Web-accessible reporting of business-critical details such as thermal warnings and memory alerts
- Remote updating of system software such as device drivers and ROM BIOS
- Remote changing of boot order
- Configuration of system BIOS settings

The HP Client Management Solutions (CMS), available for download from <http://www.hp.com/go/easydeploy>, are standards-based solutions for managing and controlling computers in a networked environment.

For more information about the HP Client Manager, see <http://www.hp.com/go/ssm>.

Altiris Client Management Solutions

Altiris and HP have partnered to provide comprehensive, tightly integrated systems management solutions to reduce the cost of owning HP client PCs.

The HP CMS is the foundation for additional Altiris Client Management Solutions that address the following topics.

- Inventory and asset management
- Deployment and migration
- Help desk and problem resolution
- Software and operations management

For more information about the following topics, go to <http://www.hp.com/go/ssm>.

- How HP CMS works
- Which solutions are compatible with the operating system
- How to download a fully functional, 30-day evaluation version of Altiris solutions

HP SoftPaq Download Manager

HP SoftPaq Download Manager is a free, easy-to-use interface for locating and downloading software updates for the HP client PC models in your environment. By specifying your models, operating system, and language, you can quickly locate, sort, and select the softpaqs you need. To download HP SoftPaq Download Manager, visit <http://h20331.www2.hp.com/Hpsub/cache/509658-0-0-225-121.html>.

System Software Manager

System Software Manager (SSM) is a utility available on Windows computers that enables you to update system-level software on multiple systems simultaneously. When executed on a PC client system, SSM detects hardware and software versions and then updates the software from a central repository, known as a *file store*. Driver versions supported by SSM are noted with a special icon on the software, the driver download Web site, and on the Support Software CD.

To download the utility or to obtain more information about SSM, see <http://www.hp.com/go/ssm>.

ROM Flash

HP computers include a programmable flash ROM. By establishing a setup password in the Computer Setup (F10) Utility, you can protect the ROM from being inadvertently updated or overwritten. This function is important to ensure the operating integrity of the computer.

To upgrade the ROM, download the latest SoftPaq images from http://www.hp.com/support/workstation_swdrivers.

For maximum ROM protection, establish a setup password. The setup password prevents unauthorized ROM upgrades. SSM enables you to create the setup password on several computers simultaneously.

Remote ROM Flash

Remote ROM Flash allows system administrators to safely upgrade the ROM on remote HP computers from a centralized network management console, resulting in a consistent deployment of, and greater control over, HP PC ROM images over the network.

To use Remote ROM Flash, the computer must be powered on, or turned on using Remote Wakeup.

For more information about Remote ROM Flash and HPQFlash, see the HP Client Manager Software or System Software Manager sections at <http://www.hp.com/go/ssm>.

HPQFlash

The HPQFlash utility is used to locally update or restore the system ROM on PCs using a Windows operating system. For more information about HPQFlash, see <http://www.hp.com/go/ssm>, and enter the name of the computer.

FailSafe Boot Block ROM

The FailSafe Boot Block ROM enables system recovery in the unlikely event of a ROM flash failure. For example, if a power failure occurs during a ROM upgrade, the Boot Block uses a flash-protected section of the ROM to verify a valid system ROM flash when power is restored to the computer.

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

If the system ROM fails the validation check, the FailSafe Boot Block ROM provides enough support to start the computer from a BIOS image CD created from a SoftPaq. The BIOS image CD programs the system ROM with a valid image.

When Boot Block detects an invalid system ROM, the computer power LED blinks red eight times and the computer beeps eight times; then the computer pauses for two seconds. On some models, a Boot Block recovery mode message appears.

In preparation for system recovery, use the BIOS CD media file in the SoftPaq to create a BIOS image CD.

Recovering the computer from Boot Block Recovery mode

To recover the computer after it enters Boot Block recovery mode:

1. Remove any media such as USB keys or disks in the optical disk drives.
2. Insert a BIOS image CD into the CD drive. You can also use USB media such as an HP DriveKey.
3. Power off, then power on the computer.

If no BIOS image CD or USB media is found, you are prompted to insert one and restart the computer.

If a setup password has been established, the Caps Lock light illuminates and you are prompted for the password.

4. Enter the setup password.

If the computer starts from the CD or USB media and successfully reprograms the ROM, three keyboard lights illuminate. A rising-tone series of beeps also signals successful recovery.

5. Remove the CD or USB media and power off the computer.
6. Restart the computer.

Workstation security

This section provides information about providing system security through asset tracking, password security, hard disk drive locking, and chassis locks.

Asset tracking

Asset tracking features incorporated into the computer provide asset tracking data that can be managed using HP Systems Insight Manager (HP SIM), HP CMS, or other systems-management applications.

Seamless, automatic integration between asset tracking features and these products enables you to choose the management tool that is best suited to the environment and to leverage investments in existing tools.

HP also offers several solutions for controlling access to valuable components and information:

- HP ProtectTools Embedded Security prevents unauthorized access to data, checks system integrity, and authenticates third-party users attempting system access.
- Security features such as ProtectTools and the Side access panel sensor (Smart Cover Sensor) help prevent unauthorized access to the data and to the internal components of the computer.
- By disabling parallel, serial, or USB ports, or by disabling removable-media boot capability, you can protect valuable data assets.
- Memory Change and Side access panel sensor (Smart Cover Sensor) alerts can be forwarded to system management applications to deliver proactive notification of tampering with a computer's internal components.

ProtectTools, the Side access panel sensor (Smart Cover Sensor), and the Side access panel solenoid lock (Hood Lock) are available as options on select systems.

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

- Locally, using the Computer Setup (F10) Utility
- Remotely, using the HP CMS or System SSM, which enables the secure, consistent deployment and control of security settings from a simple command line utility

For more information about the Computer Setup (F10) Utility, see [The Computer Setup \(F10\) Utility menu on page 30](#).

The following table and sections refer to the management of computer security through the Computer Setup (F10) Utility

Table 4-2 Security features overview

Feature	Purpose	How it is established
Removable Media Boot Control	Prevents booting from removable media drives	From the Computer Setup (F10) Utility menu
Serial, Parallel, USB, or Infrared Interface Control	Prevents transfer of data through the integrated serial, parallel, USB, or infrared interface	From the Computer Setup (F10) Utility menu

Table 4-2 Security features overview (continued)

Feature	Purpose	How it is established
Power-On Password	Prevents use of the computer until the password is entered (applies to initial system startup and restarts)	From the Computer Setup (F10) Utility menu
Setup Password	Prevents reconfiguration of the computer (use of the Setup utility) until the password is entered	From the Computer Setup (F10) Utility menu
Network Server Mode	Provides unique security features for computers used as servers	From the Computer Setup (F10) Utility menu

SATA hard disk drive security

HP computers include the HP DriveLock facility for SATA hard disk drives to prevent unauthorized access to data.

⚠ WARNING! Enabling DriveLock can render a SATA hard disk drive permanently inaccessible if the master password is lost or forgotten. No method exists to recover the password or access the data.

DriveLock has been implemented as an extension to Computer Setup (F10) functions. It is only available when hard disk drives that support the ATA security command set are detected. On HP computers, it is not available when the SATA emulation mode is RAID+AHCI or RAID.

DriveLock is for HP customers for whom data security is a paramount concern. For such customers, the cost of a hard disk drive and the loss of the data stored on it is inconsequential when compared to the damage that could result from unauthorized access to its contents.

To balance this level of security with the need to address the issue of a forgotten password, the HP implementation of DriveLock employs a two-password security scheme. One password is intended to be set and used by a system administrator, while the other is typically set and used by the user.

No "back door" can be used to unlock the drive if both passwords are lost. Therefore, DriveLock is most safely used when the data contained on the hard disk drive is replicated on a corporate information system or is regularly backed up.

If both DriveLock passwords are lost, the hard disk drive is rendered unusable. For users who do not fit the previously defined customer profile, this might not be acceptable. For users who fit this profile, it might be a tolerable risk, given the nature of the data stored on the hard disk drive.

DriveLock applications

The most practical use of DriveLock is in a corporate environment. The system administrator would be responsible for configuring the hard disk drive, which involves setting the DriveLock master password and a temporary user password. If you forget the user password or if the equipment is passed on to another employee, the master password can be used to reset the user password and regain access to the hard disk drive.

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

For users with less stringent security requirements, HP does not recommend enabling DriveLock. Users in this category include personal users, or users who do not maintain sensitive data on their hard disk drives as a common practice. For these users, the potential loss of a hard disk drive resulting from forgetting both passwords is much greater than the value of the data DriveLock protects.

Access to Computer Setup (F10) and DriveLock can be restricted through the setup password. By specifying a setup password and not giving it to users, system administrators can restrict users from enabling DriveLock.

Using DriveLock

When hard disk drives that support the ATA security command set are detected, DriveLock appears under the Security menu in the Computer Setup (F10) menu. You are presented with options to set the master password and to enable DriveLock. You must provide a user password to enable DriveLock. Because the initial configuration of DriveLock is typically performed by a system administrator, a master password should be set first.

HP encourages system administrators to set a master password whether they plan to enable DriveLock or not. This gives the administrator the ability to modify DriveLock settings if the drive is locked in the future. After the master password is set, the system administrator can enable DriveLock or leave it disabled.

If a locked hard disk drive is present, POST requires a password to unlock the device. If a power-on password is set and it matches the device's user password, POST does not prompt the user to re-enter the password. Otherwise, the user is prompted to enter a DriveLock password.

For a cold start, use the master or user password. For a warm start, enter the same password used to unlock the drive during the preceding cold start.

Users have two attempts to enter a correct password. During cold start, if neither attempt succeeds, POST continues but the drive remains inaccessible. During a warm-start or restart from Windows, if neither attempt succeeds, POST halts and the user is instructed to cycle power.

Enabling DriveLock

To enable and set the DriveLock user password:

1. Power on or restart the computer.
2. As soon as the computer is powered on, press and hold **F10** until you enter the Computer Setup (F10) Utility. Press **Enter** to bypass the title screen, if necessary.

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

If you are using a PS2 keyboard, you might see a keyboard error message. Disregard it.
3. Select **Security>DriveLock Security**.
4. For each DriveLock-capable drive, select a drive by pressing **F10** to accept.
5. Under Enable/Disable DriveLock options, select **Enable**, and then press **F10** to enable DriveLock for a specific drive.

△ **CAUTION:** Forgetting the DriveLock password renders the drive unusable.

6. Enter a new user password, and then press **F10** to accept. This password may be 1 to 32 characters long.
7. Enter the password again in the Enter New Password Again field. If you forget this password, the drive is rendered permanently disabled.
8. Select **File>Save Changes and Exit**, and then press **F10**. After you press **F10**, the computer performs a cold start before invoking the DriveLock function.

You can also use this process to set the DriveLock master password by selecting **Master** in Step 5.

When the computer starts, you are prompted to enter the DriveLock password for each DriveLock-capable drive for which you have set a password. You have two attempts to enter the password correctly. If the password is not entered correctly, the computer attempts to start anyway. However, the boot process most likely fails because data from a locked drive cannot be accessed.

In a single drive computer, if the drive has DriveLock enabled, the computer might not be able to boot to the operating system, and might try to boot from the network or from another storage device (depending on the boot ordering options). Regardless of the outcome of the start attempts, the drive-locked drive remains inaccessible without the DriveLock password.

In a two-drive computer that has a boot drive and a data drive, you can apply the DriveLock feature to the data drive only. In this case, the computer can always start, but the data drive is accessible only when the DriveLock password is entered.

Cold starts require that you enter DriveLock passwords. However, DriveLock passwords are also required for warm starts. For example, if you boot to DOS and press **Ctrl+Alt+Del**, you must enter the DriveLock password before the computer completes the next start cycle. This warm-start behavior is consistent with the DriveLock feature.

Password security

The power-on password prevents unauthorized use of the computer by requiring entry of a password to access applications or data when the computer is powered on or restarted. The setup password specifically prevents unauthorized access to the Computer Setup (F10) Utility and can also be used as an override to the power-on password. When prompted for the power-on password, entering the setup password instead enables access to the computer.

You can establish a network-wide setup password to enable the system administrator to log in to all network systems to perform maintenance without needing to know the power-on password.

Establishing a setup password using Computer Setup (F10) Utility

Establishing a setup password through the Computer Setup (F10) Utility prevents reconfiguration of the computer (through the use of the Computer Setup (F10) Utility) until the password is entered.

To establish a setup password using the Computer Setup (F10) menu:

1. Power on or restart the computer.
2. As soon as the computer is powered on, press and hold **F10** until you enter the Computer Setup (F10) Utility. Press **Enter** to bypass the title screen, if necessary.

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

If you are using a PS/2 keyboard, you might see a keyboard error message. Disregard it.

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

Establishing a power-on password using computer setup

Establishing a power-on password through the Computer Setup (F10) Utility prevents access to the computer when power is connected, unless you specify the password. When a power-on password is set, the Computer Setup (F10) Utility presents Password Options in the Security menu. The password options include Network Server Mode and Password Prompt on Warm Boot.

When Network Server Mode is disabled, you must enter the password when the computer is powered on, when the key icon appears on the monitor. When Password Prompt on Warm Boot is enabled, you must enter the password. The password must also be entered each time the computer is restarted. When Network Server Mode is enabled, the password prompt is not presented during POST, but an attached PS/2 keyboard remains locked until you enter the power-on password.

To enable Network Server Mode, you must set a power-on password under **Advanced>Password Options**. This option enables the computer to start without requiring the power-on password, but the keyboard and mouse are locked until you enter the password. The keyboard LEDs rotate constantly when the computer is in locked mode.

To establish a power-on password through the Computer (F10) menu:

1. Power on or restart the computer.
2. As soon as the computer is powered on, press and hold **F10** until you enter the Computer Setup (F10) Utility. Press **Enter** to bypass the title screen, if necessary.

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

If you are using a PS/2 keyboard, you might see a keyboard error message. Disregard it.

3. Select **Security>Power-On Password** and then follow the onscreen instructions.
4. Before exiting, select **File>Save Changes and Exit**.

Entering a power-on password

To enter a power-on password:

1. Restart the computer.
2. When the key icon appears on the monitor, enter the current password, and then press **Enter**.

Type carefully. For security reasons, the characters you enter do not appear on the screen.

If you enter the password incorrectly, a broken key icon appears. Try again. After three unsuccessful tries, you will enter the F10 setup screen with read-only permission. (See the Setup Browse Mode option under the Power-On options.)

Entering a setup password

If a setup password has been established on the computer, you will be prompted to enter it each time you run the Computer Setup (F10) Utility.

To enter a setup password:

1. Restart the computer.
2. As soon as the computer is powered on, press and hold **F10** until you enter the Computer Setup (F10) Utility. Press **Enter** to bypass the title screen, if necessary.

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

If you are using a PS/2 keyboard, you might see a keyboard error message. Disregard it.

3. When the key icon appears on the monitor, enter the setup password, and press **Enter**.

Type carefully. For security reasons, the characters you enter do not appear on the screen.

If you enter the password incorrectly, a broken key icon appears. Try again. After three unsuccessful tries, you must restart the computer before you can continue.

Changing a power-on or setup password

To change a power-on or setup password:

1. Restart the computer.
2. To change the power-on password, go to step 4.
3. To change the setup password, as soon as the computer is powered on, press and hold **F10** until you enter the Computer Setup (F10) Utility. Press **Enter** to bypass the title screen, if necessary.

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

If you are using a PS/2 keyboard, you might see a keyboard error message. Disregard it.

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

current password/new password/new password

For information about the alternative delimiter characters, see [National keyboard delimiter characters on page 54](#).

Type carefully. For security reasons, the characters you enter do not appear on the screen.

5. Press **Enter**.

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

The power-on and setup passwords can also be changed using the Security options in the Computer Setup (F10) Utility.

Deleting a power-on or setup password

To delete a power-on or setup password:

1. Power on or restart the computer.
2. Choose from the following:
 - To delete the power-on password, go to step 4.
 - To delete the setup password, as soon as the computer is powered on, press and hold **F10** until you enter the Computer Setup (F10) Utility. Press **Enter** to bypass the title screen, if necessary.

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

Use the appropriate operating system shutdown process.

3. When the key icon appears, enter the current password followed by a slash (/) or alternative delimiter character: *current password/*.

For information about the alternative delimiter characters see [National keyboard delimiter characters on page 54](#).

4. Press **Enter**.

National keyboard delimiter characters

Each keyboard meets country-specific requirements. The syntax and keys you use for changing or deleting passwords depend on the keyboard included with the computer.

Table 4-3 National keyboard delimiter characters

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

* Bosnia-Herzegovina, Croatia, Slovenia, and Yugoslavia

Clearing passwords

If you forget the password, you cannot access the computer.

For instructions about clearing passwords, see **Configuring password security and resetting CMOS**.

Chassis security

Side access panel sensor (Smart Cover Sensor) (optional)

The optional Side access panel sensor is a combination of hardware and software technology that can alert you when the computer side access panel has been removed (if the sensor has been configured in the Computer Setup (F10) Utility).

The three levels of Side access panel sensor protection are shown in the following table:

Table 4-4 Side access panel sensor protection levels

Level	Setting	Description
Level 0	Disabled	Side access panel sensor [*] is disabled (default).
Level 1	Notify User	When the computer restarts, a message appears indicating that the computer side access panel has been removed.
Level 2	Setup Password	When the computer is restarted, a message appears indicating that the computer side access panel has been removed. You must enter the setup password to continue.

^{*} Side access panel sensor settings can be changed using the Computer Setup (F10) Utility.

Setting the side access panel sensor protection level

To set the side access panel sensor protection level:

1. Power on or restart the computer.
2. As soon as the computer is powered on, press and hold the **F10** key until you enter the Computer Setup (F10) Utility. Press **Enter** to bypass the title screen, if necessary.

 **NOTE:** If you do not press the **F10** key at the appropriate time, you must restart the computer, and then press and hold the **F10** key again to access the Computer Setup (F10) Utility.

If you are using a PS/2 keyboard, you might see a keyboard error message. Disregard it.

3. Select **Security>Smart Cover>Cover Removal Sensor**, and follow the onscreen instructions.
4. Before exiting, select **File>Save Changes and Exit**.

Side access panel solenoid lock

The side access panel solenoid locks the side access panel to the chassis. The solenoid is controlled by a local or remote signal.

To lock the solenoid, set a password for the solenoid lock in the Computer Setup (F10) Utility. To unlock the solenoid, remove the solenoid lock password in the Computer Setup (F10) Utility.

The solenoid lock FailSafe Key—available from HP—is a device for manually disabling the solenoid lock. You will need the FailSafe Key in case of forgotten password, power loss, or computer malfunction.

Cable lock (optional)

To prevent theft, the rear chassis panel of the computer accommodates a keyed cable lock. This cable lock attaches to the chassis and secures it to the work area.

Fault notification and recovery

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

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

Drive Protection System

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

When HP computers are built, each installed hard disk drive is tested using the DPS, and a permanent record of key information is written onto each drive. Every time the DPS is run, test results are written to the hard disk drive. The service provider can use this information to help diagnose conditions that required you to run the DPS software.

ECC fault prediction

When the computer encounters an excessive number of error checking and correcting (ECC) memory errors, it displays a local alert message. This message contains information about the errant DIMM, enabling you to take action before you experience noncorrectable memory errors. ECC DIMMs are standard on this computer.

Thermal sensors

Several thermal sensors in the HP Workstation regulate computer fans to maintain an acceptable, efficient chassis temperature.

Dual-state power button

With ACPI enabled, the power button can function as an on/off switch or as a button. This feature does not completely turn off power, but instead causes the computer to enter a low-power standby state. This enables you to go to standby without closing applications, and to return to the same operational state without any data loss.

Changing the power button configuration

To change the power button configuration:

1. Select **Start**, and then select **Control Panel>Power Options**.
2. In Power Options Properties, select the **Advanced** tab.
3. In the Power Button section, select **Hibernate**.

 **NOTE:** Hibernate must be enabled in the Hibernate tab.

After configuring the power button to function as a button, you can press the power button to put the computer in a very low power state. Press the button again to bring the computer out of this low power state to full power state. To completely turn off power to the computer, press and hold the power button for four seconds.

△ **CAUTION:** Do not use the power button to power off the computer unless the system is not responding; turning off the power without operating system interaction can cause data loss.

5 Replacing components

This chapter presents removal and installation procedures for most internal computer components. It includes these topics:

Topics

[Warnings and cautions on page 60](#)

[Service considerations on page 61](#)

[Customer Self-Repair on page 65](#)

[Removing and installing components on page 66](#)

[Product recycling on page 138](#)

Warnings and cautions

-
- ⚠ **WARNING!**  Any surface or area of the equipment marked with this symbol indicates the presence of a hot surface or hot component. If this surface is contacted, the potential for injury exists. To reduce the risk of injury from a hot component, enable the surface to cool before touching.
-
- ⚠ **WARNING!**  Any surface or area of the equipment marked with this symbol indicates the presence of an electrical shock hazard. To reduce the risk of injury from electrical shock, do not open any enclosed area marked with this symbol.
-
- ⚠ **WARNING!** To reduce the risk of electric shock or damage to your equipment:
- Do not disable the power cord grounding plug. The grounding plug is an important safety feature.
 - Plug the power cord in a grounded (earthed) outlet that is easily accessible at all times.
 - Disconnect power from the equipment by unplugging the power cord from the electrical outlet.
-
- ⚠ **WARNING!** To reduce the risk of serious injury, read the *Safety & Comfort Guide*. It describes proper computer setup, posture, health, and work habits for computer users, and provides important electrical and mechanical safety information. This guide is located at <http://www.hp.com/ergo>.
-
- ⚠ **WARNING!** If a product is shipped in packaging marked with this symbol,  the product must always be lifted by two persons to avoid personal injury due to product weight.
-
- ⚠ **CAUTION:** Static electricity can damage the electronic components of the computer. Before beginning these procedures, be sure you discharge static electricity by briefly touching a grounded metal object.
-
- ⚠ **CAUTION:** Observe the following cautions when removing or replacing a processor:
- Installing a processor incorrectly can damage the system board. Contact an HP authorized reseller or service provider to install the processor. If you plan to install the processor yourself, read all of the instructions carefully before you begin.
 - Failure to follow the computer preparation instructions can result in an improperly installed processor, causing extensive computer damage.
 - Processor socket pins are delicate and bend easily. Use extreme care when placing the processor in the socket.
-
- ⚠ **CAUTION:** To prevent damage to the computer, observe the following Electrostatic Discharge (ESD) precautions while performing the system parts removal and replacement procedures:
- Work on a static-free mat.
 - Wear a static strap to ensure that any accumulated electrostatic charge is discharged from your body to the ground.
 - Create a common ground for the equipment you are working on by connecting the static-free mat, static strap, and peripheral units to that piece of equipment.
-

 **NOTE:** HP accessories are for use in HP Workstation products. They have been extensively tested for reliability and are manufactured to high quality standards.

Service considerations

Review the following service considerations before replacing system components.

Cautions, warnings and safety precautions

Review the cautions, warnings, and safety precautions before accessing the computer components. Also, review the *Safety and Regulatory Guide* that came with the computer for more information.

ESD information

Generating static

The following table shows that different activities generate different amounts of static electricity through electrostatic discharge (ESD). Static electricity increases as humidity decreases.

Event	Relative humidity		
	55%	40%	10%
Walking across carpet	7,500V	15,000V	35,000V
Walking across vinyl floor	3,000V	5,000V	12,000V
Motions of bench worker	400V	800V	6,000V
Removing bubble pack from PCB	7,000V	20,000V	26,500V
Packing PCBs in foam-lined box	5,000V	11,000V	21,000V

CAUTION: Static electricity in the amount of 700 volts might degrade a product.

Preventing ESD equipment damage

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

- Transport products in static-safe containers such as tubes, bags, or boxes, to avoid hand contact.
- Protect electrostatic parts and assemblies with nonconductive or approved containers or packaging.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free stations.
- Place items on a grounded surface before removing them from containers.
- When handling or touching a sensitive component or assembly, ground yourself by touching the chassis.
- Avoid contact with pins, leads, or circuitry.
- Place reusable electrostatic-sensitive parts from assemblies in protective packaging or nonconductive foam.

Personal grounding methods and equipment

Use the following items to help prevent ESD damage:

- **Wrist straps**—These are flexible straps with a maximum of one megohm \pm 10% resistance in the ground cords. To provide a proper ground, wear the strap against bare skin. The ground cord must be connected and fit snugly into the banana plug connector on the grounding mat or computer.
- **Heel straps, toe straps, and boot straps**—These can be used at standing computers and are compatible with most types of shoes or boots. On conductive floors or dissipative floor mats, use them on both feet with a maximum of one megohm \pm 10% resistance between the operator and ground.

The following table shows protection levels available from static shielding materials.

Table 5-1 Static shielding protection levels

Method	Voltage
Antistatic plastic	1,500V
Carbon-loaded plastic	7,500V
Metalized laminate	15,000V

This section provides guidelines to prevent ESD damage to equipment.

Grounding the work area

To prevent static damage in the work area:

- Cover the work surface with approved static-dissipative material. Use a wrist strap connected to the work surface, and properly grounded tools and equipment.
- Use static-dissipative mats, foot straps, or air ionizers to give added protection.
- Handle electrostatic-sensitive components, parts, and assemblies by the case or PCB laminate. Handle them only in static-free work areas.
- Disconnect power and input signals before inserting and removing connectors or test equipment.
- Use fixtures made of static-safe materials when fixtures must directly contact dissipative surfaces.
- Keep work area free of nonconductive materials, such as plastic assembly aids and Styrofoam.
- Use field service tools (such as cutters, screwdrivers, and vacuums) that are conductive.

Recommended ESD prevention materials and equipment

The recommended materials and equipment are:

- Antistatic tape
- Antistatic smocks, aprons, and sleeve protectors
- Conductive bins and other assembly or soldering aids
- Conductive foam
- Conductive tabletop computers with a ground cord of one megohm \pm 10% resistance
- Static-dissipative table or floor mats with a hard-tie to ground
- Field service kits
- Static awareness labels
- Wrist straps and footwear straps providing one megohm \pm 10% resistance
- Material-handling packages
- Conductive plastic bags
- Conductive plastic tubes
- Conductive tote boxes
- Opaque shielding bags
- Transparent metallized shielding bags
- Transparent shielding tubes

Tools and software requirements

The tools necessary for computer component removal and installation are:

- Torx T-15 driver
- Flat blade and cross-tip screwdrivers
- Diagnostics software

Special handling of components

The components included in this section require special handling when servicing the computer.

⚠ **WARNING!** Do not use the front bezel as a handle or lifting point when lifting or moving the computer. Lifting the computer from the front bezel, or lifting it incorrectly, could cause the computer to fall, causing possible injury to you and damage to the computer. To properly and safely lift the computer, lift from the bottom of the computer.

Cables and connectors

Handle cables with care to avoid damage. Apply only the tension required to seat or unseat cables during insertion or removal from the connector. When possible, handle cables by the connector or pull-strap. In all cases, avoid bending or twisting the cables, and be sure that the cables are routed in such a way that they cannot be caught or snagged by parts being removed or replaced.

When servicing the computer, be sure that cables are placed in their proper location during the reassembly process. Improper cable placement can damage the computer.

Hard drives

Hard drives are fragile, precision components. Avoid subjecting them to physical shock and vibration. The following guidelines apply to all drives, including failed drives, replacement drives, and spares.

- Do not remove hard drives from the shipping package for storage. Keep hard drives in their protective packaging until they are mounted in the computer.
- Avoid dropping hard drives from any height.
- If you are inserting or removing a hard drive, power off the computer. Do not remove a hard drive while the computer is powered on or in standby mode.
- Before handling a drive, be sure that you discharge static electricity. While handling a drive, avoid touching the connector. For more information about preventing electrostatic damage, see [ESD information on page 61](#).

To prevent possible ESD damage when the drive is installed, connect the drive power cable before connecting the data cable. This discharges accumulated static electricity through the drive power cable to the computer chassis.

- When inserting a drive, do not use excessive force.
- Avoid exposing a hard drive to liquids, temperature extremes, or products with magnetic fields such as monitors or speakers.

Lithium coin cell battery

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

For instructions on battery removal and replacement, see [Battery on page 131](#).

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

📝 NOTE: Do not dispose of batteries, battery packs, and accumulators with general household waste.

Customer Self-Repair

Customer Self-Repair enables you to obtain replacement parts and install them on the computer. For more information, see <http://www.hp.com/go/selfrepair/>.

Removing and installing components

Topics in this section:

Component locations on page 67	Using the Small Form Factor Computer in a Tower Orientation on page 108	Battery on page 131
Predisassembly procedures on page 69	Front panel I/O device assembly on page 109	CPU heatsink on page 132
Disassembly order on page 70	Speaker on page 113	CPU on page 135
Removing the cable lock (optional) on page 70	Power supply on page 114	System board on page 137
Access panel on page 72	System fan assembly on page 116	
Access panel solenoid lock on page 78	Memory on page 118	
Removing and installing drives on page 78	Expansion card slot identification on page 124	
Cable management on page 106	Removing and installing expansion cards on page 126	

Component locations

The following illustration and table identify computer system board components.

Figure 5-1 System board component locations

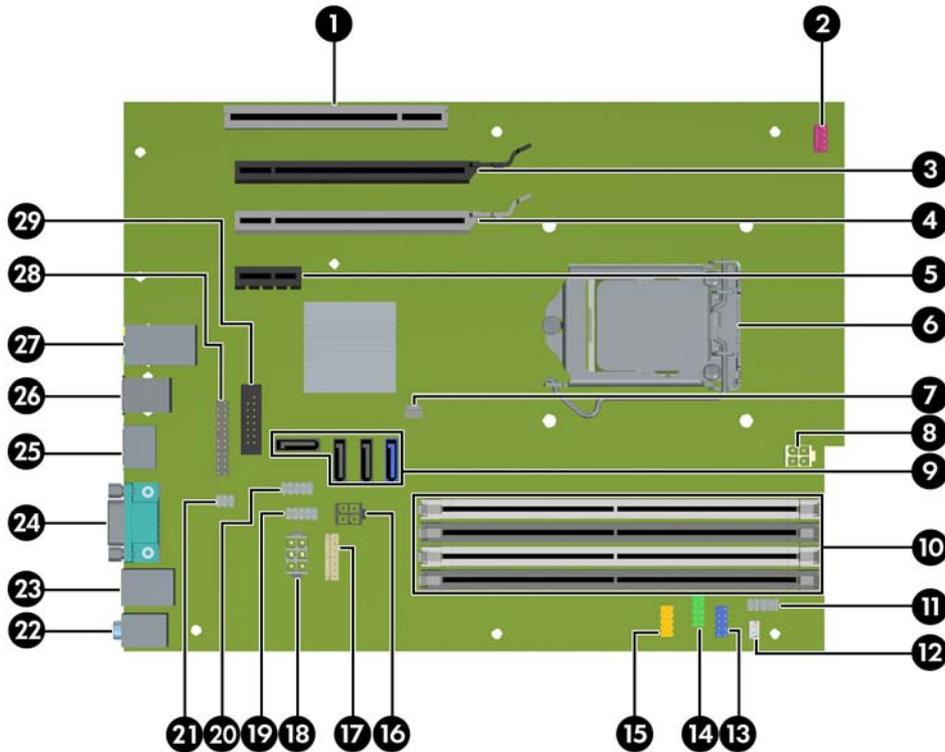


Table 5-2 System board components ID

Item	Component	Item	Component	Item	Component
1	PCI 32/33	11	Front power button/LED	21	Solenoid hood lock
2	Front system fan	12	Speaker	22	Audio
3	PCIe2 x16(16)	13	Front audio	23	Keyboard/mouse
4	PCIe x16(4)	14	Front USB	24	VGA/1st serial
5	PCIe x1	15	Front USB	25	Display port
6	CPU socket	16	SATA power	26	USB
7	Chassis intrusion switch	17	Power COMM	27	Network/USB
8	CPU power	18	Main power	28	Parallel
9	SATA ports (3) and eSATA port (1)	19	Internal USB1	29	2nd serial
10	Memory sockets	20	Internal USB2/DASH		

NOTE: All SATA ports are eSATA compatible, even though only one port is labeled for eSATA on the system board.

NOTE: The DP and VGA ports are disabled if used with Intel Xeon quad-core processors.

For related system architecture information, see [System board architecture on page 1](#).

Predisassembly procedures

- △ **CAUTION:** To avoid personal injury, equipment damage, or data loss, read the sections on *Warnings and cautions* and the *Safety and Regulatory Information* for the computer before servicing components.
-

Perform the following steps before servicing a computer:

1. Locate and clear a suitable work area.
2. Close all open software applications.
3. Remove all USB keys, diskettes, CDs, and DVDs from the computer.
4. Shut down the operating system.
5. Power off the computer and all peripheral devices connected to it.
6. Remove or disengage security devices that prevent you from opening the computer.
7. Disconnect the power cord from the electrical outlet and then from the computer.
8. Disconnect peripheral device cables from the computer.
9. If the computer is on a stand, remove the computer from the stand.
10. Gather the tools.
11. Service the computer.
12. Restore power to the computer when servicing is done.

Disassembly order

For convenience, disassembly procedures should be followed in a particular order. Use the following table to determine the sequence in which to access major computer components.

Table 5-3 computer component installation

To install/ replace...	Remove...	Then remove...	Then remove...	Then remove...	Then remove...
Battery, front bezel, optical drive, hard drive, memory, power supply, hood sensor, or solenoid lock	Chassis lock	Access panel			
Heatsink	Chassis lock	Access panel	Airflow guide		
Processor	Chassis lock	Access panel	Airflow guide	Heatsink	
Expansion card (PCI/PCle)	Chassis lock	Access panel	Expansion card slot cover		
Front panel I/O assembly, power button assembly, system fan, or system speaker	Chassis lock	Access panel	Front bezel		
System board	Chassis lock	Access panel	Airflow guide	Expansion cards or DIMMs	Heatsink

Removing the cable lock (optional)

If a cable lock is installed on the computer, remove it before servicing the computer.

Unlock it and pull it out of the cable lock slot as shown in the following figure.

Figure 5-2 Removing the cable lock



Access panel

Before accessing the internal components of the computer, you must remove the access panel.

This section describes how to remove and install the access panel.

Removing the access panel

⚠ **WARNING!** Power off the computer and disconnect the power cord from the electrical outlet before you remove the computer access panel.

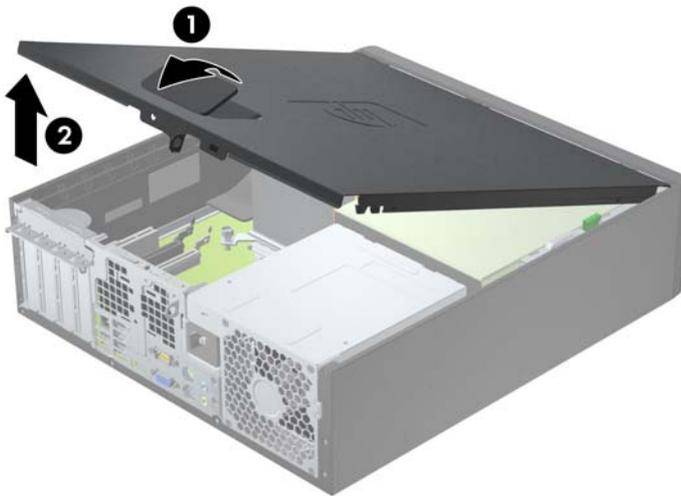
To remove the access panel:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).

⚠ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove locks that are present such as a cable lock.
3. Pull up on the handle (1) and then rotate the panel away from the chassis (2), as shown in the following figure.

Figure 5-3 Removing the access panel



Installing the access panel

To install the access panel:

1. Align the front edge of the access panel with the slot on the front of the chassis.
2. Rotate the back of the panel down onto the chassis, then press firmly until the latch engages.

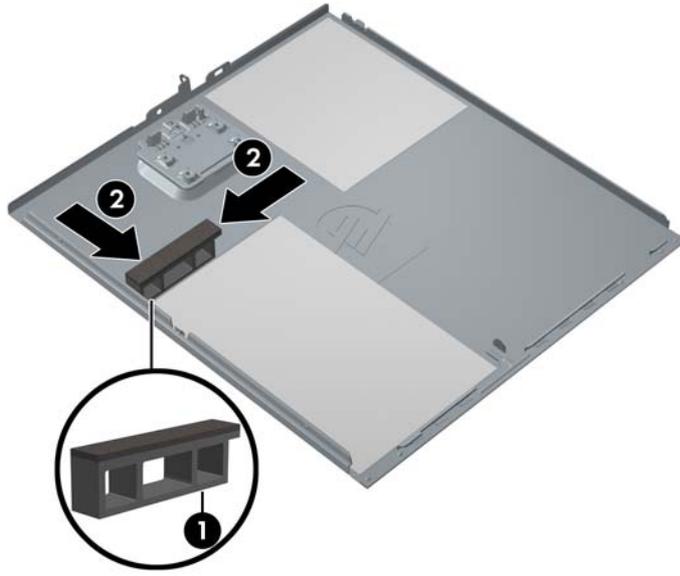
Replacing the card hold-down bracket

The access panel has a hold-down bracket for PCIe cards mounted on the inside. If you have to replace the bracket, follow these steps:

1. Remove the protective strip from the adhesive strip on the bottom of the hold-down (1).

2. Carefully place the hold-down on the inside of the side access panel with the foam padding facing up:
 - Align the hold down with the edge of the hood label and the edge of the side access panel (2).
 - Make sure the overhanging tab on the hold down faces toward the outside edge of the side access panel with a gap of approximately 2 mm between the metal edge and the tab (3).

Figure 5-4 Correct positioning for the card hold-down



Bezel

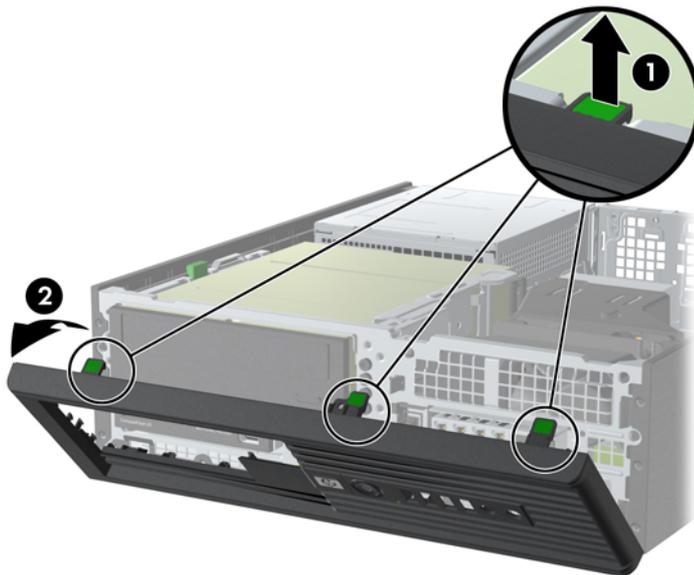
This section describes how to remove and install the front chassis bezel.

Removing the front bezel

To remove the front bezel:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).
△ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. If the security screw is installed (next to the middle front bezel release tab), remove the screw. (See [Front bezel security on page 75](#).)
4. Lift the release tabs (1), and then rotate the front bezel off the chassis (2).

Figure 5-5 Removing the front bezel



Installing the front bezel

To install the front bezel:, align the tabs discussed in the previous section and rotate the bezel until it snaps in place.

1. Align the tabs discussed in the previous section and rotate the bezel until it snaps in place.
2. If you are using the bezel security screw, replace the screw next to the middle front bezel release tab.

Front bezel security

You can lock the front bezel in place by installing a security screw provided by HP. To install the security screw:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).
△ CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the front bezel (see [Removing the access panel on page 72](#)).
4. Remove one of the five silver 6-32 standard screws located on the front of the chassis behind the bezel.

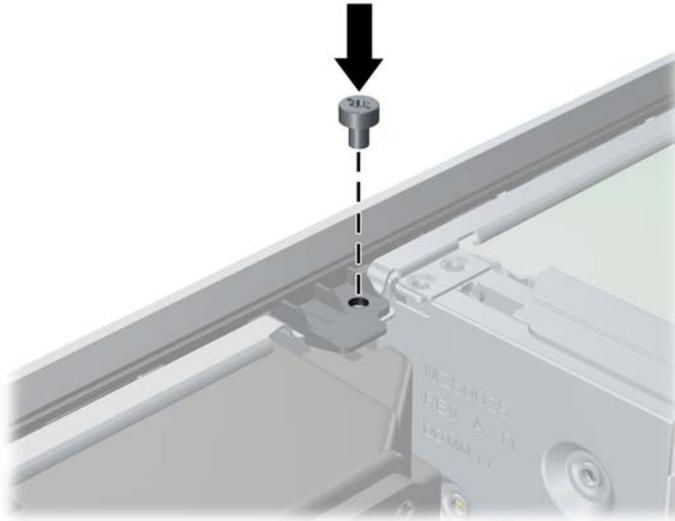
Figure 5-6 Retrieving the Front Bezel Security Screw



5. Replace the front bezel.

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

Figure 5-7 Installing the Front Bezel Security Screw



7. Replace the access panel.
8. Reconnect all connections and equipment listed in the [Predisassembly procedures on page 69](#).

Access panel sensor (optional)

The access panel sensor is a remote solenoid that detects when the access panel is opened. This section describes how to remove and install the sensor.

Removing the access panel sensor

To remove the access panel sensor:

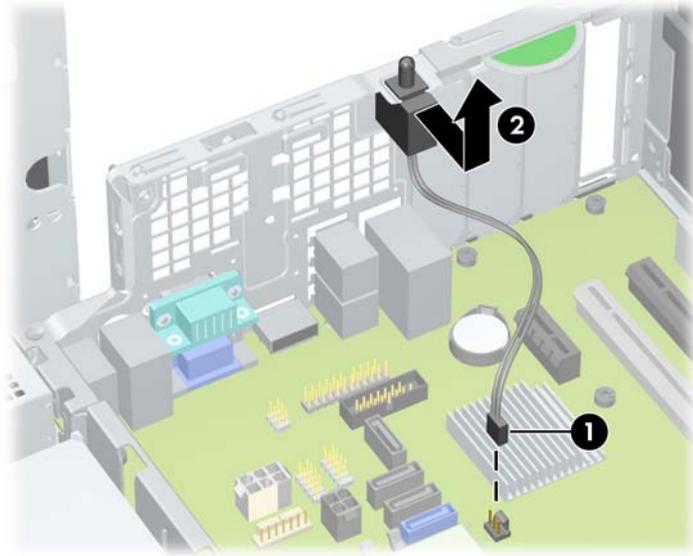
1. Prepare the computer for servicing by following the [Predisassembly procedure on page 69](#).

CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove the access panel (see [Removing the access panel on page 72](#)).

3. Disconnect the sensor cable from the in-line chassis cable as shown below (1).

Figure 5-8 Removing the access panel sensor



4. Slide the sensor back in its slot, push the sensor down, and then remove it from the chassis (2).

Installing the access panel sensor

To replace the access panel sensor, reverse the previous steps.

Access panel solenoid lock

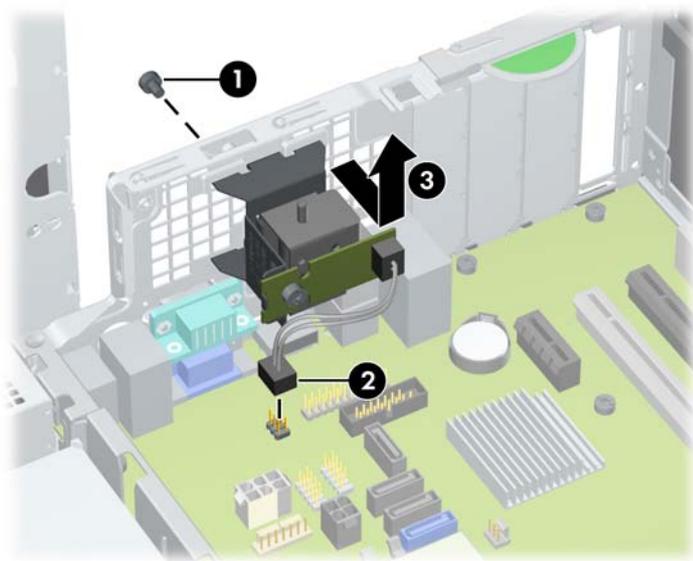
The access panel solenoid lock provides a method to lock the access panel by means of a local or remote signal-controlled solenoid. This section describes how to remove and install the access panel solenoid lock.

Removing the access panel solenoid lock

To remove the access panel solenoid lock:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).
△ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the screw that fastens the solenoid lock to the chassis (1) as shown in the following figure.
4. Disconnect the access panel solenoid lock cable from the system board (2).
5. Pull the solenoid lock assembly inward and then up (3) to remove the assembly from the chassis.

Figure 5-9 Removing the access panel solenoid lock



Installing the access panel solenoid lock

Reverse the above steps to install the access panel solenoid lock. This involves connecting the solenoid lock cable to the system board and fastening the solenoid lock to the chassis.

Removing and installing drives

This section describes how to remove and install the Z200 SFF drives:

- Optical disk drive
- Internal hard disk drive
- Optional hard disk drive or media card reader

 **NOTE:** For information about configuring SATA RAID devices, see [Configuring RAID devices on page 173](#).

Predisassembly for drives

Take these actions before you begin installing or removing a drive:

Follow all general predisassembly procedures

Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).

△ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.

Perform a data backup

△ **CAUTION:** Before removing a hard drive, make sure you back up all information on the drive up to an external storage device. Failure to do so can result in data loss. After replacing the primary hard drive, you must run the *Restore Plus!* CD to load the HP factory-installed files.

Gather required tools

You will need a Torx T-15 screwdriver to remove and install the guide screws on a drive.

Verify drive position and information

To verify the type, size, and capacity of the storage devices installed in the computer, run the Computer Setup (F10) Utility. The following figure illustrates the physical position of the drives.

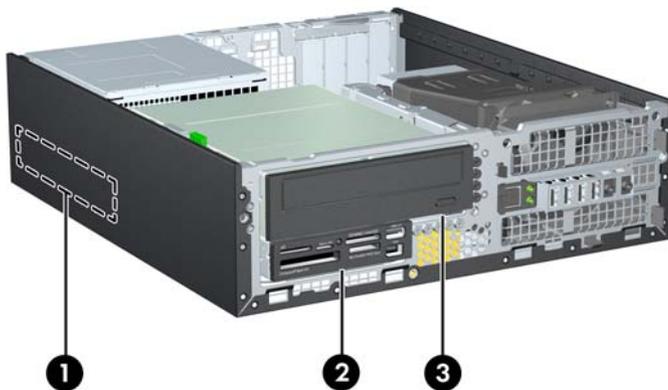


Table 5-4 Drive positions

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

NOTE: The drive configuration on your computer may differ from the drives shown above.

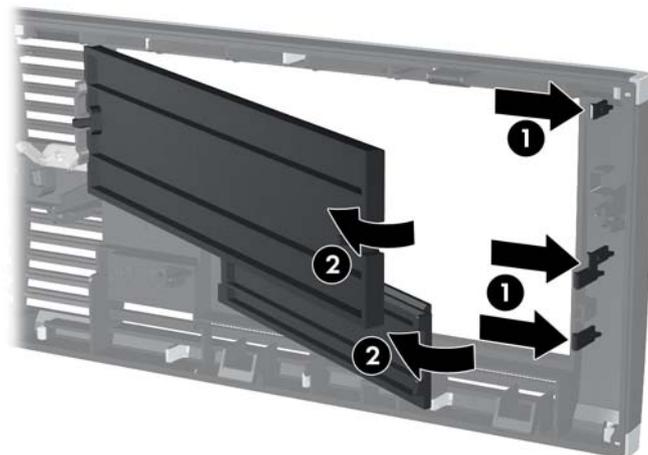
NOTE: You can install a maximum of two hard disk drives in the Z200 SFF.

NOTE: For additional information about configuring SATA RAID devices, see [Configuring RAID devices on page 173](#).

Remove bezel blanks

On some models, you may need to remove the bezel blanks that cover the 3.5-inch and 5.25-inch drive bays before you install a drive. To remove a bezel blank:

1. Remove the access panel (see [Removing the access panel on page 72](#)).
2. Remove the front bezel (see [Removing the access panel on page 72](#)).
3. On the inside of the bezel, push the two retaining tabs that hold the bezel blank in place towards the outer right edge of the bezel (1) and then slide the bezel blank back and to the left to remove it (2).



Locate system board drive connections

Adding a new drive may require that you make new connections from the drive to the system board. Refer to the following illustration and table to identify the system board drive connectors.

Figure 5-10 System board drive connections

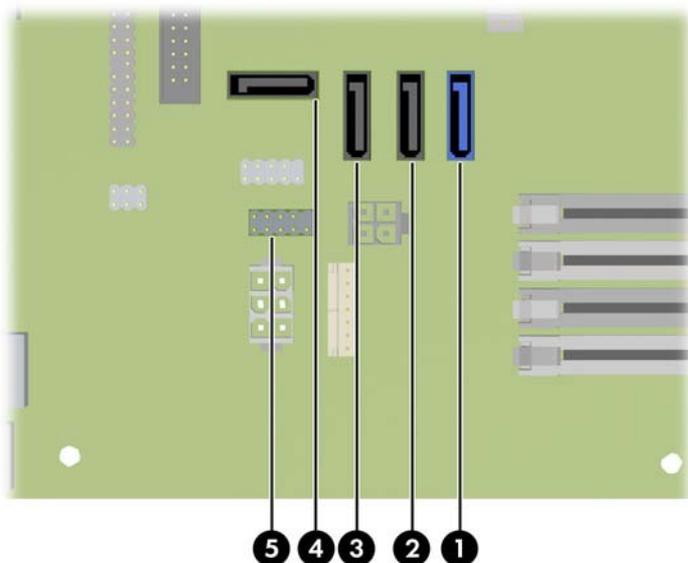


Table 5-5 System Board Drive Connections

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

- The primary Serial ATA (SATA) hard drive must be connected to the dark blue primary SATA connector on the system board labeled SATA0.
- Connect SATA optical drives to the white SATA1 connector.
- Connect devices in order of SATA0, SATA1, then SATA2
- Connect an optional eSATA adapter cable to the black ESATA connector on the system board.
- Connect a media card reader USB cable to the USB connector on the system board labeled MEDIA. If the media card reader has a 1394 port, connect the 1394 cable to the 1394 PCI card.

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

Locating extra guide screws

Each drive requires four guide screws to ensure the drive lines up correctly in the drive cage and locks in place. HP provides extra guide screws for installing new drives.

- The extra screws are mounted in the front of the chassis, under the front bezel (see [Removing the front bezel on page 74](#)).
- There are four black M3 metric screws used to install most drives.

- There are five silver 6-32 standard screws. Four are used for mounting 3.5-inch hard disk drives, and the fifth is used for bezel security (see [Front bezel security on page 75](#)).
- If you are replacing the primary hard drive, you must remove the four silver and blue 6-32 isolation mounting guide screws from the old hard drive and install them in the new hard drive.

Figure 5-11

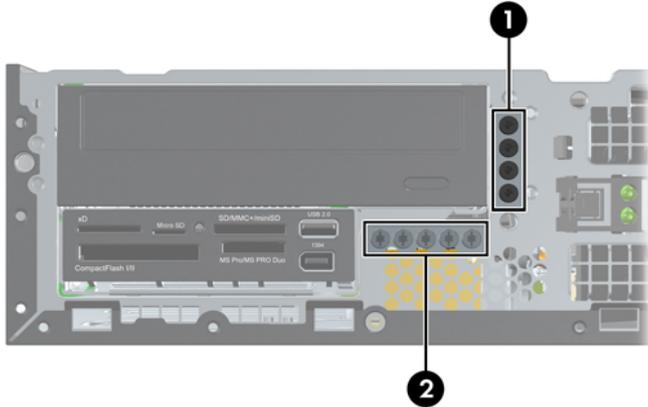


Table 5-6 Extra Guide Screw Locations

No.	Guide screw, color	Device
1	Black M3 Metric Screws	Optical disk drives, SSDs, small form factor hard drives (6.3cm/2.5in), media card reader
2	Silver 6-32 Standard Screws	8.9cm/3.5in hard disk drives, front bezel security

There are at total of five extra silver 6-32 standard screws. Four are used as guide screws for a secondary hard drive. The fifth is used for bezel security.

Carefully handle hard disk drives

△ **CAUTION:** Take proper precautions when handling hard disk drives to prevent loss of work and damage to the computer or drive.

- Always follow the [Predisassembly procedures on page 69](#), which include shutting down the operating system, turning off the power, and unplugging the power cord. Never remove a drive while the computer is on or in standby mode.
- Before handling a drive, ensure that you are discharged of static electricity. While handling a drive, avoid touching the connector.
- Handle a drive carefully; do not drop it.
- Do not use excessive force when inserting a drive.
- Avoid exposing a hard drive to liquids, temperature extremes, or products that have magnetic fields such as monitors or speakers.
- If you must mail a drive, use a bubble-pack mailer or other protective packaging and label the package "Fragile: Handle With Care."

Removing an optical drive

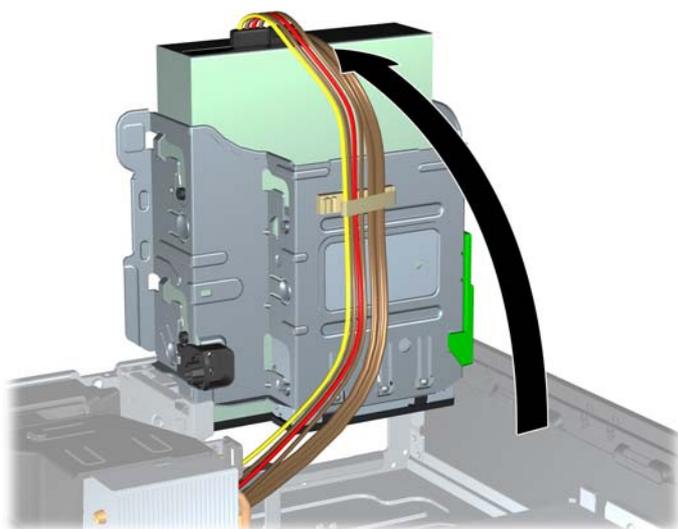
To remove an optical drive from the drive cage:

1. Follow the procedures listed in the [Predisassembly for drives on page 79](#) section.

△ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.

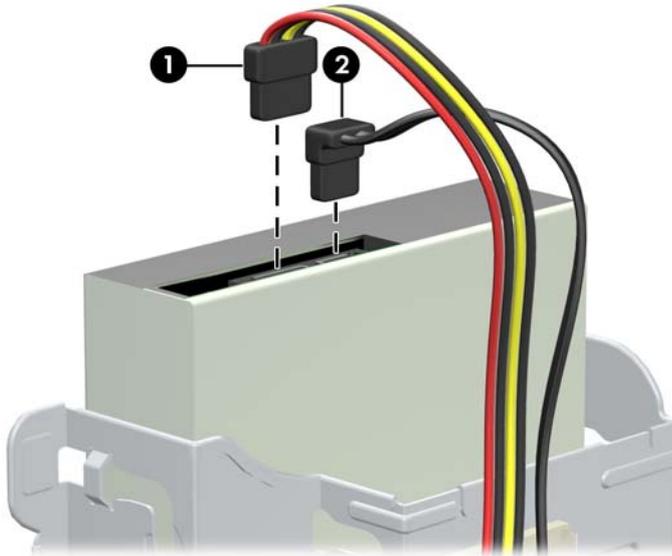
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the front bezel (see [Removing the front bezel on page 74](#)).
4. Rotate the drive cage to its upright position.

Figure 5-12 Rotating the Drive Cage Up



5. Disconnect the power cable (1) and data cable (2) from the rear of the optical drive.

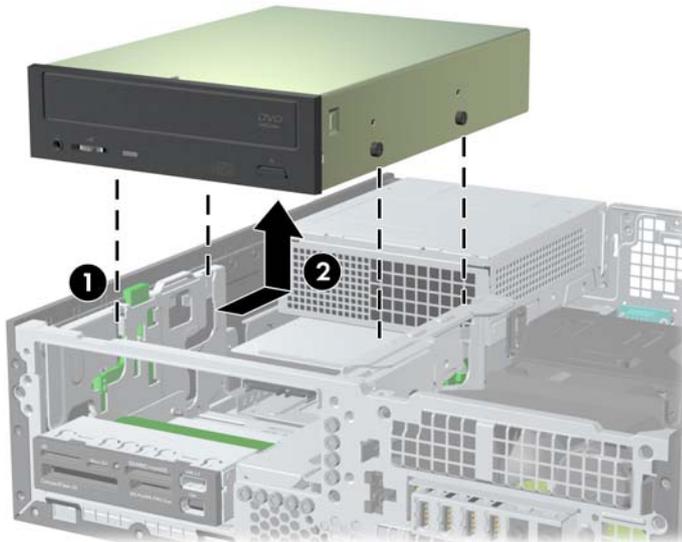
Figure 5-13 Disconnecting the power and data cables



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

CAUTION: Be careful not to pinch any cables or wires when rotating the drive cage down.
7. Press down on the green drive retainer button located on the left side of the drive to disengage the drive from the drive cage (1). While pressing the drive retainer button, slide the drive back until it stops, then lift it up and out of the drive cage (2).

Figure 5-14 Removing the optical drive



8. If you are replacing the drive, transfer the four guide screws from the old drive to the new one.

Installing an optical drive

To install or re-install an optical drive:

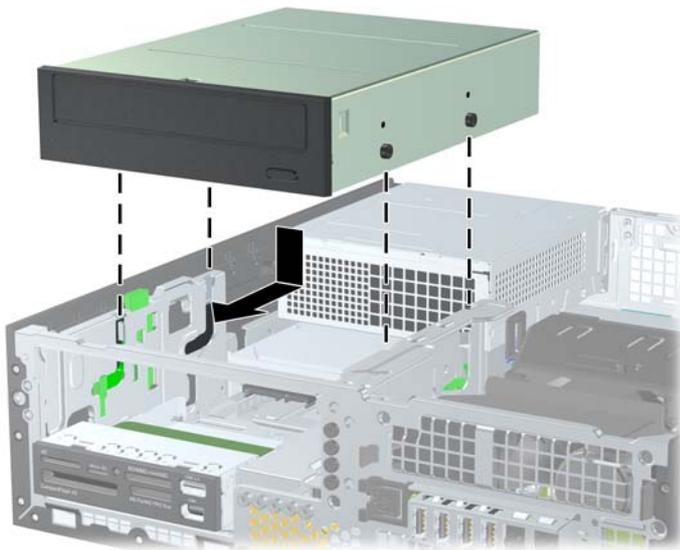
1. Follow the procedures listed in the [Predisassembly for drives on page 79](#) section.
 - △ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the front bezel (see [Removing the front bezel on page 74](#)).
4. If necessary remove the bezel blank. (See [Remove bezel blanks on page 80](#)).
5. Install four M3 metric guide screws in the lower holes on each side of the drive. Either re-use the screws used by your previous optical drive or use the extra HP—provided guide screws mounted on the front of the chassis. (See [Locating extra guide screws on page 81](#).)
 - △ **CAUTION:** Use only 5-mm long screws as guide screws. Longer screws can damage the internal components of the drive.

Figure 5-15 Installing Guide Screws in the Optical Drive



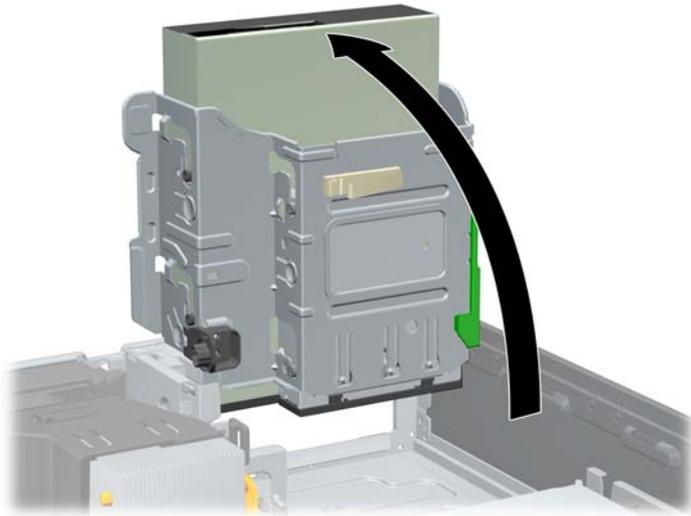
6. Position the guide screws on the drive into the J-slots in the drive bay. Then slide the drive toward the front of the computer until it locks into place.

Figure 5-16 Installing the Optical Drive



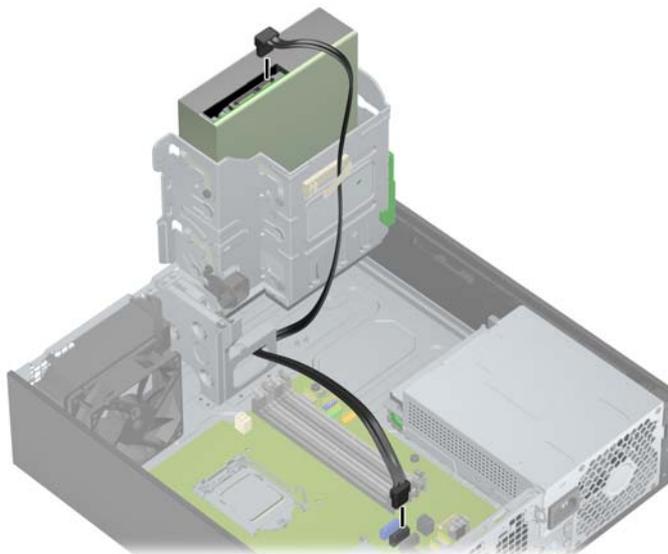
7. Rotate the drive cage to its upright position.

Figure 5-17 Rotating the Drive Cage Up



8. If a cable is not already present and connected:
 - a. Connect the SATA data cable to the system board connector labeled SATA1.
 - b. Route the data cable through the cable guides. There are two cable guides that keep the data cable from being pinched by the drive cage when raising or lowering it. One is located on the bottom side of the drive cage. The other is part of the chassis frame under the drive cage. Ensure that the data cable is routed through these guides before connecting it to the optical drive.

Figure 5-18 Routing the drive cable

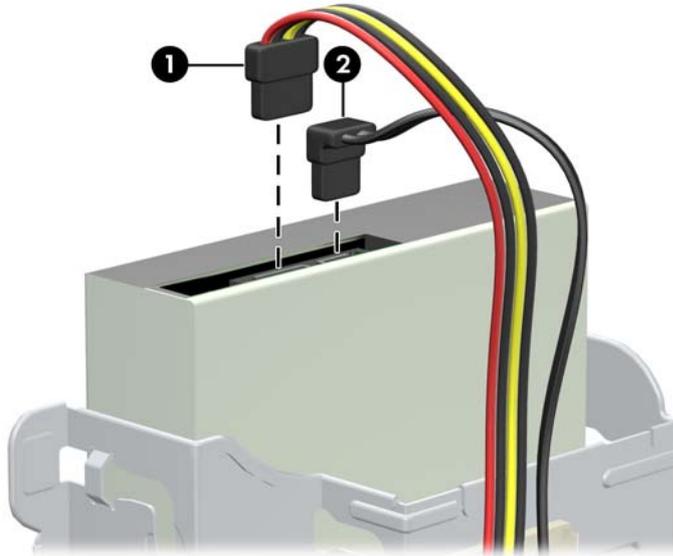


9. If necessary, route the data cable through the cable guides. There are two cable guides that keep the data cable from being pinched by the drive cage when raising or lowering it. One is located on the bottom side of the drive cage. The other is located on the chassis frame under the drive

cage. Ensure that the data cable is routed through these guides before connecting it to the optical drive.

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

Figure 5-19 Connecting the power and data cables



11. Carefully rotate the drive cage back down to its normal position.

△ **CAUTION:** Be careful not to pinch any cables or wires when rotating the drive cage down. See [Cable management on page 106](#).

12. Replace the front bezel (see [Installing the front bezel on page 74](#)).
13. Replace the access panel (see [Installing the access panel on page 72](#)).
14. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69](#).

Removing a hard disk or media card from the drive cage

The 3.3 cm (3.5 in) drive is located underneath the 13.3 cm (5.25 in) optical drive. A media card can also be installed at this location. If an optical drive is present, you must remove it before removing the hard drive.

To remove a hard drive or media card from the drive cage:

1. Follow the procedures listed in the [Predisassembly for drives on page 79](#) section.

△ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the front bezel (see [Removing the front bezel on page 74](#)).
4. Remove the optical disk drive if it is present. (See [Removing an optical drive on page 83](#).)

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

Figure 5-20 Disconnecting the 1394 cable

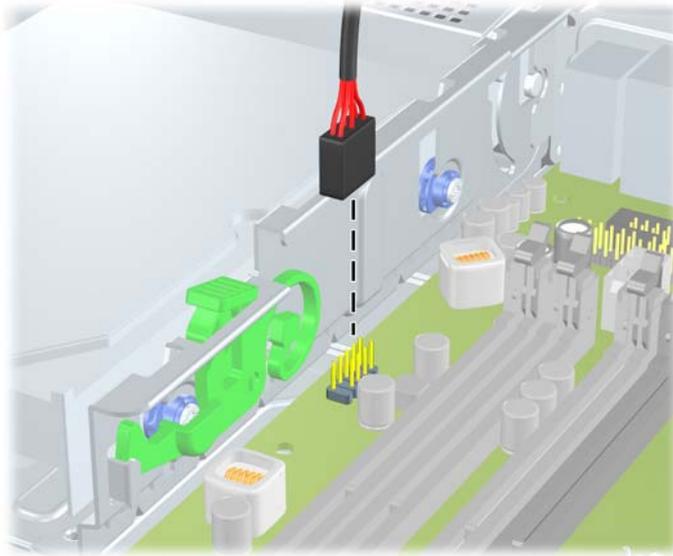


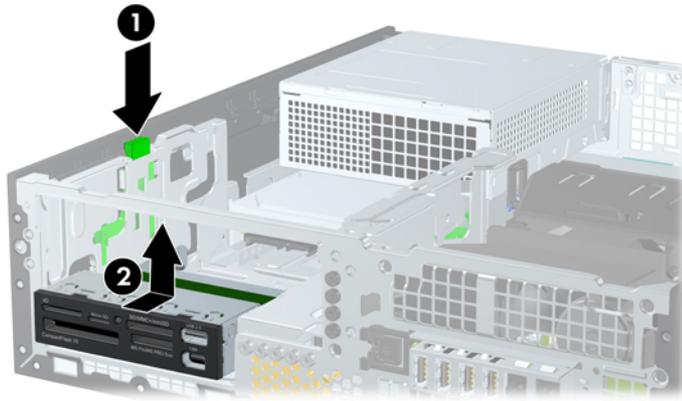
Figure 5-21 Disconnecting the Media Card Reader 1394 Cable



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

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

Figure 5-22 Removing a drive from the drive cage (media card reader shown)



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

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

8. If you are replacing the drive, transfer the four guide screws from the old drive to the new one.
9. Replace the optical drive. (See [Installing an optical drive on page 85.](#))
10. Replace the front bezel (see [Installing the front bezel on page 74.](#))
11. Replace the access panel (see [Installing the access panel on page 72.](#))
12. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69.](#)

Installing a hard drive or media card reader into the drive cage

You can install a 3.3 cm (3.5 in) hard drive underneath the 13.3 cm (5.25 in) optical drive. A media card reader can also be installed at this location. If an optical drive is present, you must remove it to install the hard drive.

To install a hard drive or media card in the drive cage:

1. Follow the procedures listed in the [Predisassembly for drives on page 79](#) section.

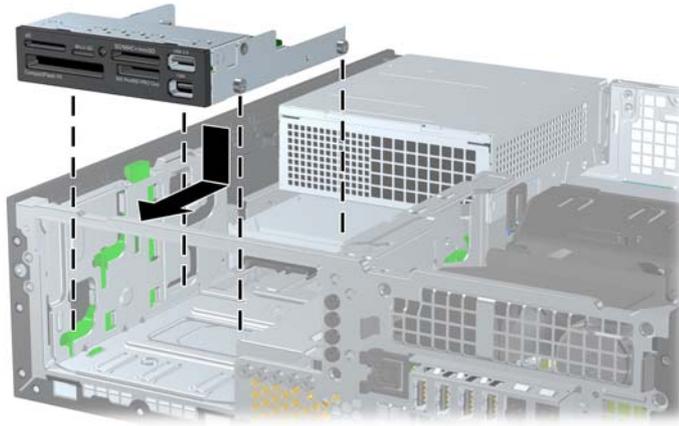
△ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove the access panel (see [Removing the access panel on page 72.](#))
3. Remove the front bezel (see [Removing the front bezel on page 74.](#))
4. Remove the optical disk drive if it is present. (See [Removing an optical drive on page 83.](#))

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

 **TIP:** Angle the drive toward one side of the chassis to line up the guide screws with the slots.

Figure 5-23 Installing a drive into the drive cage (media card reader shown)



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

 **NOTE:** See [Locate system board drive connections on page 80](#) for an illustration of the system board drive connectors.

7. Replace the optical drive. (See [Installing an optical drive on page 85](#).)
8. Replace the front bezel (see [Installing the front bezel on page 74](#)).
9. Replace the access panel (see [Installing the access panel on page 72](#)).
10. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69](#).

Removing a DX115 Dataport hard drive

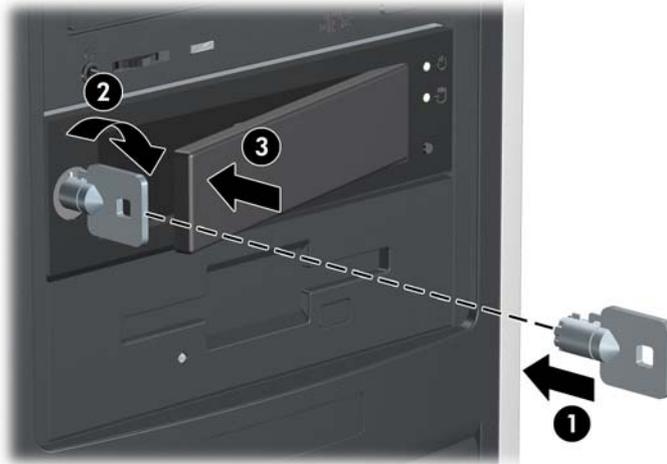
To remove a DX115 Dataport hard drive:

1. If a drive case is installed in the carrier, remove it:

△ **CAUTION:** Insert or remove the carrier (with a disk drive) only when the workstation is shut down. Other procedures may result in system hangs, data loss, or even drive damage. The component supplier's user guide describes a procedure for inserting or removing the carrier (with drive) while the workstation is booted and then powering the drive via the power switch on the enclosure. However, Microsoft Windows XP and Windows Vista do not support this action.

- a. Insert the key (1) and turn it clockwise (2).

Figure 5-24 Unlocking the carrier



- b. Press on the left side of the door to open it (3).
- c. Remove the drive carrier.
- d. If shipping the unit, lock the carrier by inserting the key and turning it counterclockwise (3).

△ **CAUTION:** Always lock the drive before shipping or moving the computer. Failure to do so might result in damage to your removable hard drive system.

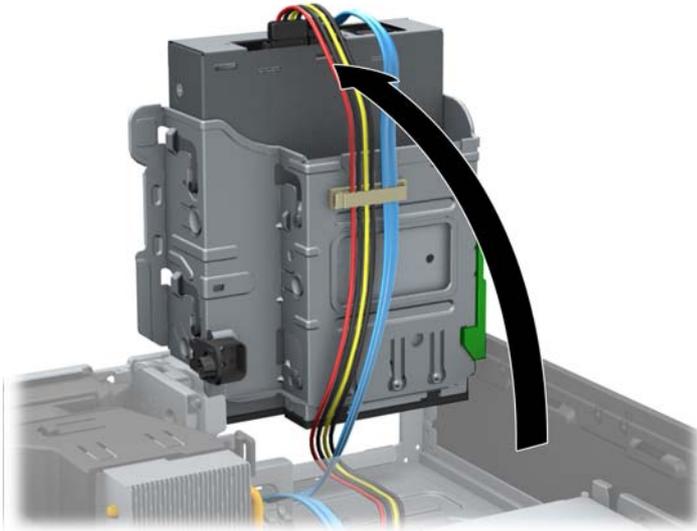
2. Follow the procedures listed in the [Predisassembly for drives on page 79](#) section.

△ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.

📄 **NOTE:** For better clarity, the figures in this section do not show the front bezel. However, you do not need to remove the front bezel to remove the DX115 unit.

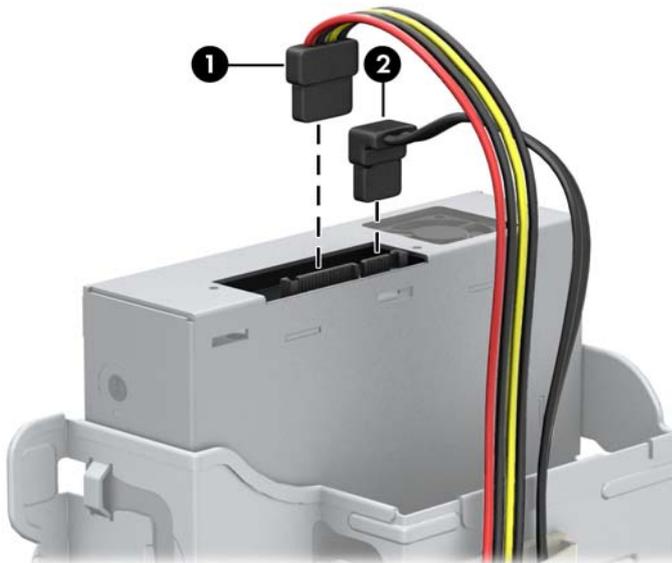
3. Rotate the drive cage to its upright position.

Figure 5-25 Rotating the drive cage up



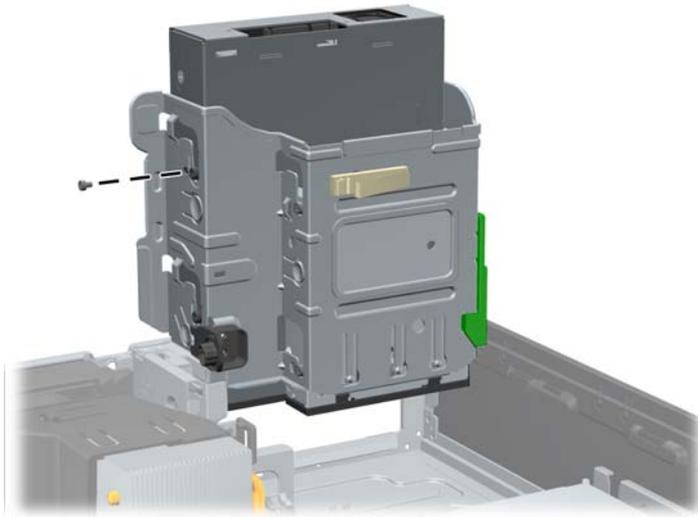
4. Disconnect the power cable (1) and data cable (2) from the rear of the DX115 case.

Figure 5-26 Disconnecting the power and data cables



5. If necessary, remove the shipping screw from the side of the drive cage.

Figure 5-27 Removing the shipping screw

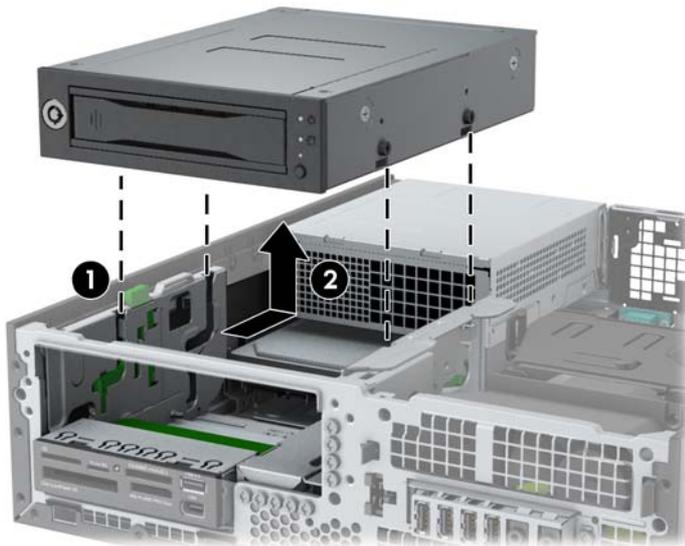


6. Carefully rotate the drive cage back down to its normal position.

△ **CAUTION:** Check clearances on the cables when you rotate the drive cage. The cage may pinch the cables and damage them if they are not routed correctly.

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

Figure 5-28 Removing the DX115 unit



8. If you are replacing the DX115 unit, remove and retain the four M3 x 5mm screws (black) from the lower four mounting holes of the DX115 case, and then transfer the screws to the new unit. (You can also store the screws in the chassis. See [Locating extra guide screws on page 81](#) for screw locations.)

Figure 5-29 Removing the guide screws



9. If it is necessary to remove the a hard disk drive from the carrier:
 - a. Remove the locking screws from the sides of the carrier.

Figure 5-30 Removing the locking screws



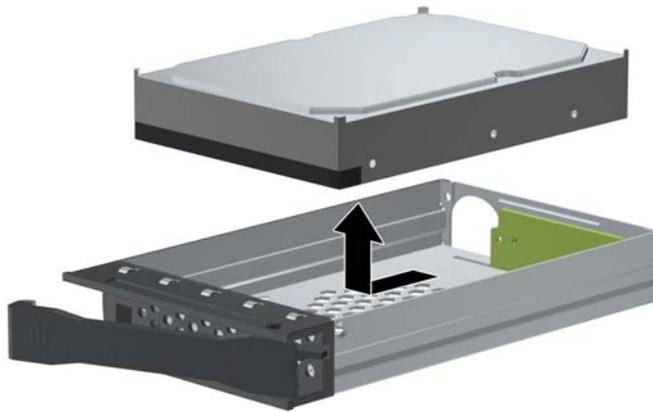
- b. Remove the carrier cover by raising the front end of the cover (1) and pulling it away from the slot in the rear of the carrier (2).

Figure 5-31 Removing the cover



- c. Remove the drive by sliding it toward the front of the carrier until it disengages from the carrier adapter and then lifting the drive out of the carrier.

Figure 5-32 Removing the drive



- d. To replace the hard drive, see [Installing a DX115 Dataport hard drive on page 95](#).
10. Replace the access panel (see [Installing the access panel on page 72](#)).
11. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69](#).

Installing a DX115 Dataport hard drive

The optical disk drive bay can also accommodate a DX115 Dataport removable hard drive.

 **NOTE:** The CRU Dataport DX115 does not fit in all optical drive bays. It is longer than most optical drives. Choose the optical bay for the CRU Dataport DX115 which best fits your computer configuration.

To install a DX115 unit:

1. Follow the procedures listed in the [Predisassembly for drives on page 79](#) section.
 - △ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.
 -  **NOTE:** For better clarity, the figures in this section do not show the front bezel. However, you do not need to remove the front bezel to install the DX115 unit.
2. If you are replacing an existing optical disk drive, remove it. See [Removing an optical drive on page 83](#).

3. If you are installing a new DX115 unit, remove and discard the counter-sunk shipping screw on the side of the DX115 case.

Figure 5-33 Removing the shipping screw



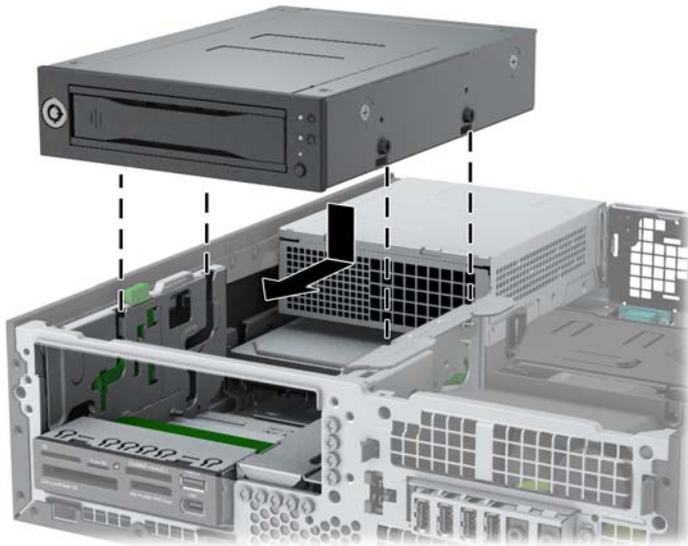
4. Install four (supplied) M3 x 5mm screws (black) in the lower four mounting holes of the DX115 case. (See [Locating extra guide screws on page 81](#) for screw locations.)

Figure 5-34 Installing the guide screws



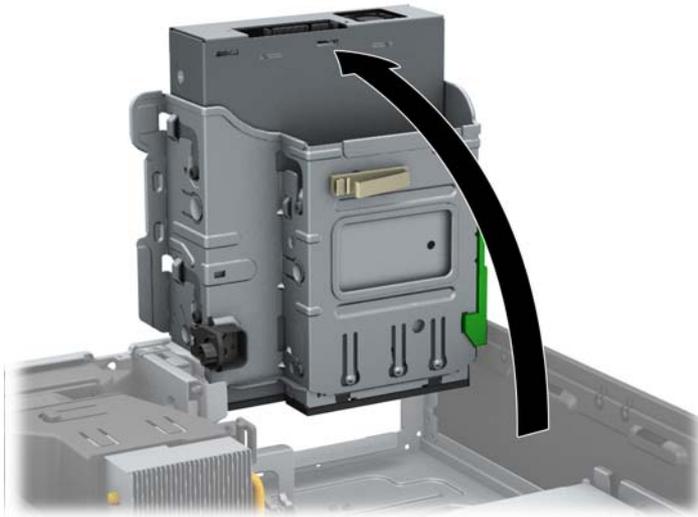
5. Position the guide screws on the drive into the J-slots in the drive bay. Then slide the drive toward the front of the computer until it locks into place.

Figure 5-35 Installing the DX115 unit



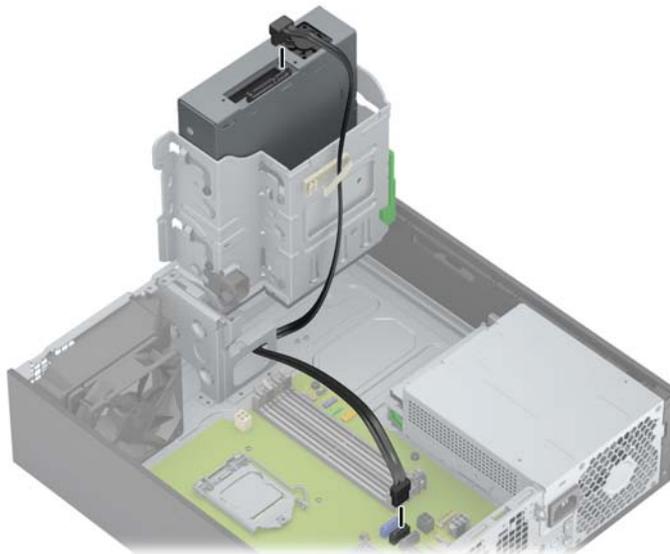
6. Rotate the drive cage to its upright position.

Figure 5-36 Rotating the drive cage up



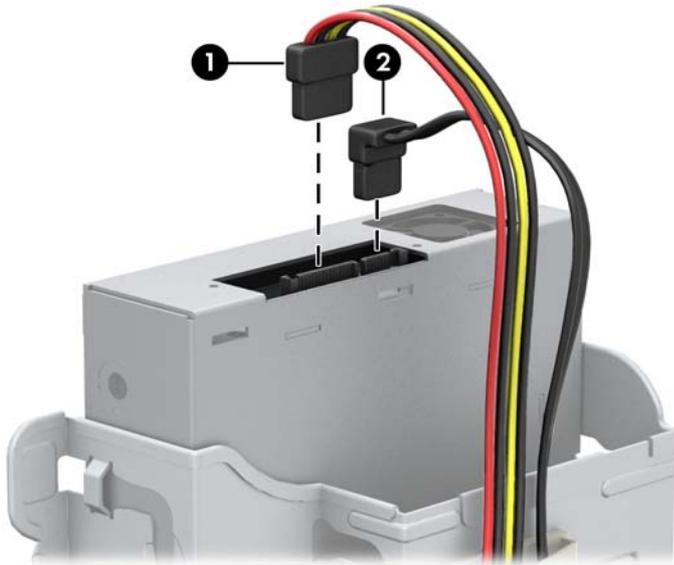
7. If the cables are not already routed and attached to the system board:
 - a. Connect the SATA data cable to the system board connector labeled SATA1. (Refer to the hood label on the inside of the access panel for connector locations.)
 - b. Route the data cable through the cable guides to keep the data cable from being pinched by the drive cage when raising or lowering it. One guide is located on the bottom side of the drive cage (1). The other is part of the chassis frame under the drive cage (2). Routed the data cable through these guides before connecting it to the optical drive.

Figure 5-37 Routing the drive cable



8. Connect the power cable (1) and data cable (2) to the rear of the DX115 case.

Figure 5-38 Connecting the power and data cables



9. Carefully rotate the drive cage back down to its normal position.

△ **CAUTION:** Check clearances on the cables when you rotate the drive cage. The cage may pinch the cables and damage them if they are not routed correctly.

10. If necessary, install a hard disk drive in the carrier:
 - a. Remove the locking screws from the sides of the carrier.

Figure 5-39 Removing the locking screws



- b. Remove the carrier cover by raising the front end of the cover (1) and pulling it away from the slot in the rear of the carrier (2).

Figure 5-40 Removing the carrier cover



- c. Orient the drive so that the data and power connectors face the rear of the carrier.
- d. Place the drive into the front end of the carrier.
- e. Slide the drive all the way to the rear end of the carrier so that the power and data connectors mate with the carrier adapter.

Figure 5-41 Installing the drive



- f. Replace the cover by aligning the tab on the rear of the cover with the slot on the rear of the carrier (1) and then rotating the front of the cover onto the carrier (2).

Figure 5-42 Replacing the carrier cover



- g. Replace the locking screws in the sides of the carrier.

Figure 5-43 Replacing the locking screws

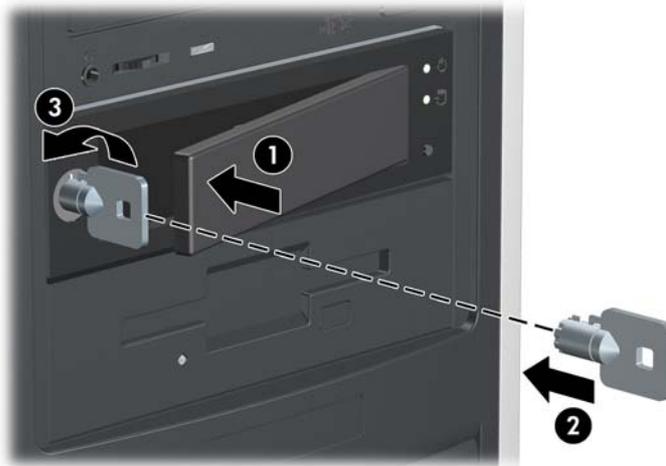


- 11.** Install the carrier in the drive case:

△ **CAUTION:** Insert or remove the carrier (with a disk drive) only when the workstation is shut down. Other procedures may result in system hangs, data loss, or even drive damage. The component supplier's user guide describes a procedure for inserting or removing the carrier (with drive) while the workstation is booted and then powering the drive via the power switch on the enclosure. However, Microsoft Windows XP and Windows Vista do not support this action.

- a. Insert the key (1) and turn it clockwise (2).

Figure 5-44 Locking the carrier



- b. Press the handle to open the door (3).
- c. Insert the drive carrier.
- d. Lock the carrier by inserting the key and turning it counterclockwise (3).

△ **CAUTION:** Always lock the drive before shipping or moving the computer. Failure to do so might result in damage to your removable hard drive system.

12. Replace the access panel (see [Installing the access panel on page 72](#)).
13. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69](#).

Removing and replacing the primary hard drive

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

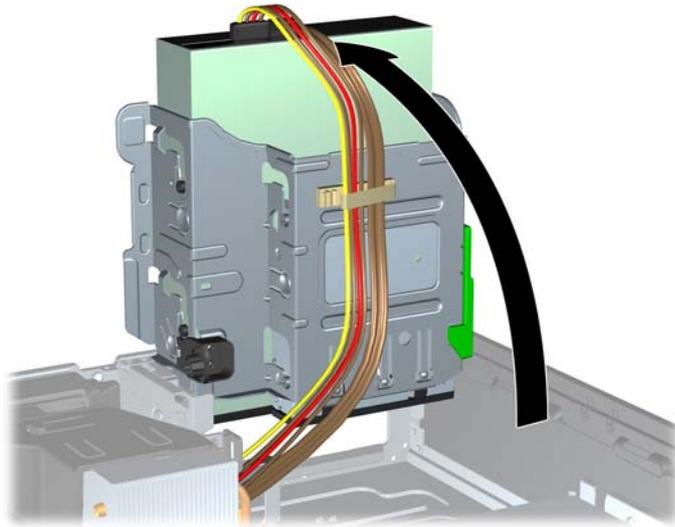
1. Follow the procedures listed in the [Predisassembly for drives on page 79](#) section.

△ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the front bezel (see [Removing the front bezel on page 74](#)).

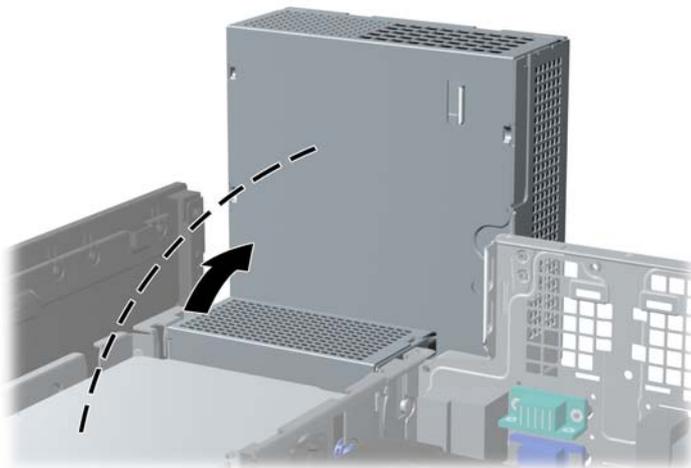
4. Rotate the drive cage to its upright position.

Figure 5-45 Rotating the Drive Cage Up



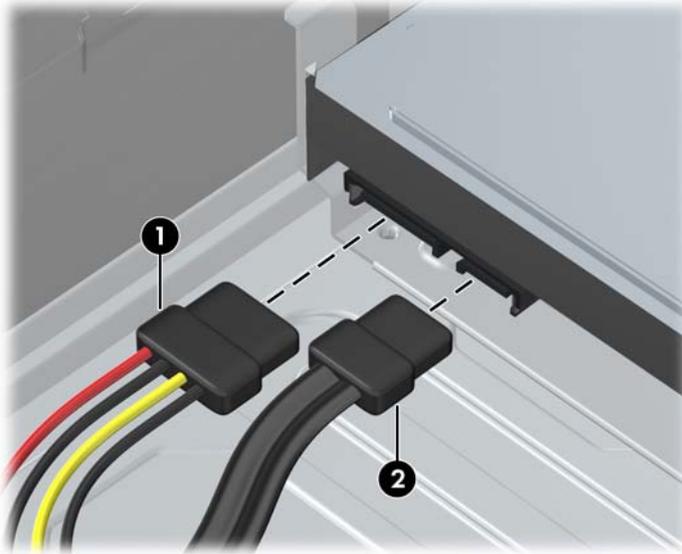
5. Rotate the power supply to its upright position. The hard drive is located beneath the power supply.

Figure 5-46 Rotating the power supply up



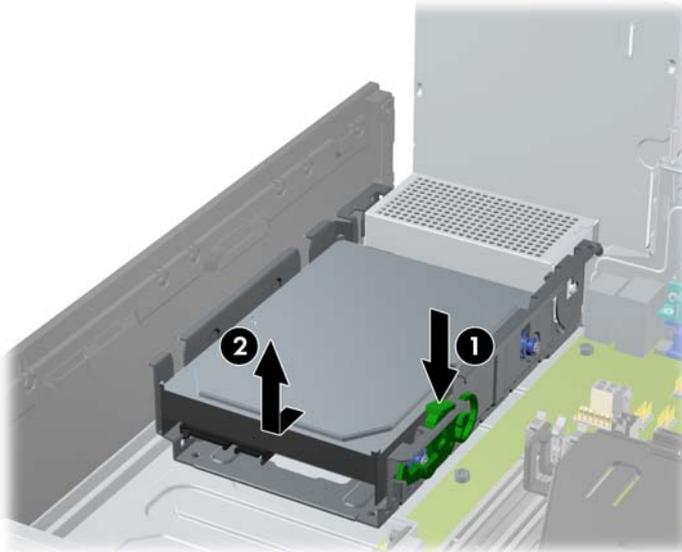
6. Disconnect the power cable (1) and data cable (2) from the hard drive.

Figure 5-47 Removing the optical drive



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

Figure 5-48 Removing the primary hard drive



8. To install a new hard drive, the silver and blue isolation mounting guide screws from the old hard drive to the new hard drive.

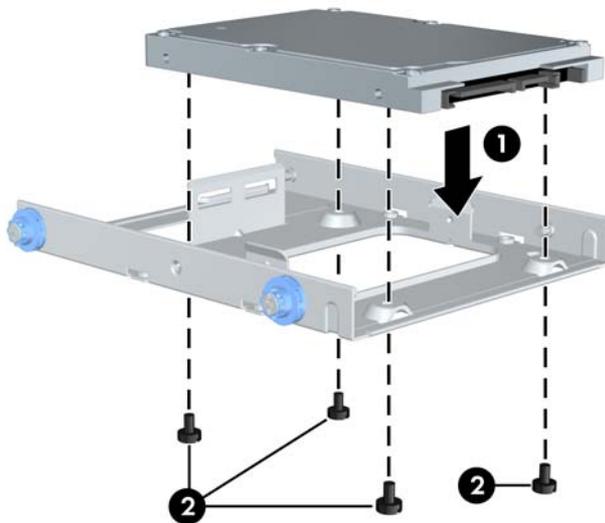
Figure 5-49 Installing the hard drive guide screws



You can also install a small form factor (6.4 cm/2.5 in.) hard drive in the primary drive bay:

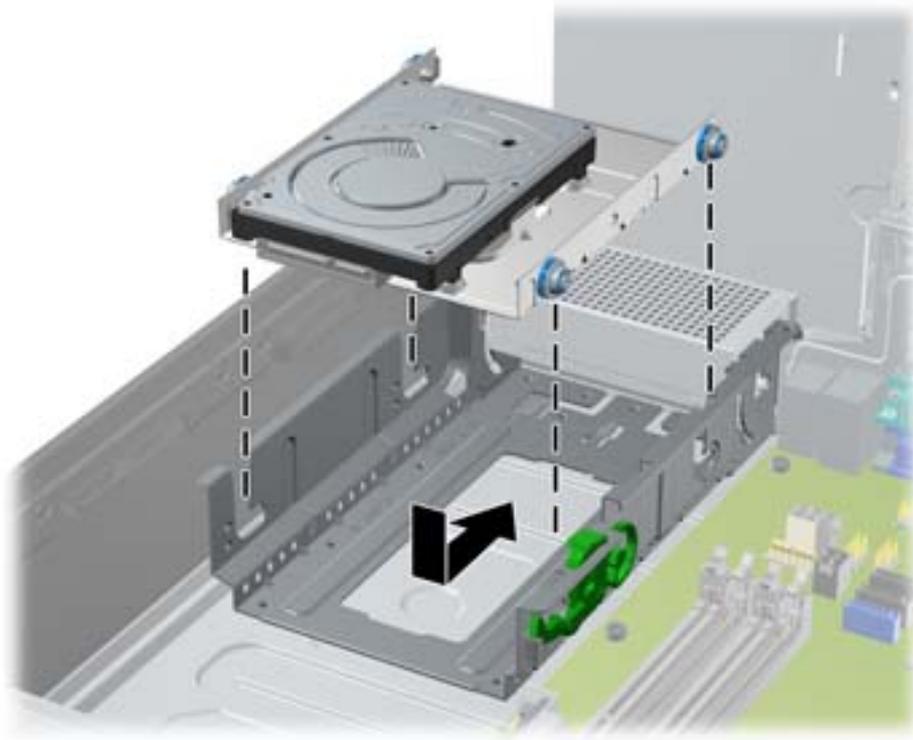
- a. Transfer the silver and blue isolation mounting guide screws from the old hard drive to the drive carrier (1).
- b. Use the black M3 screws from the front of the chassis to mount the small form factor drive to the carrier (2). (See [Locating extra guide screws on page 81](#) for screw location.)

Figure 5-50 Attaching the drive to the carrier



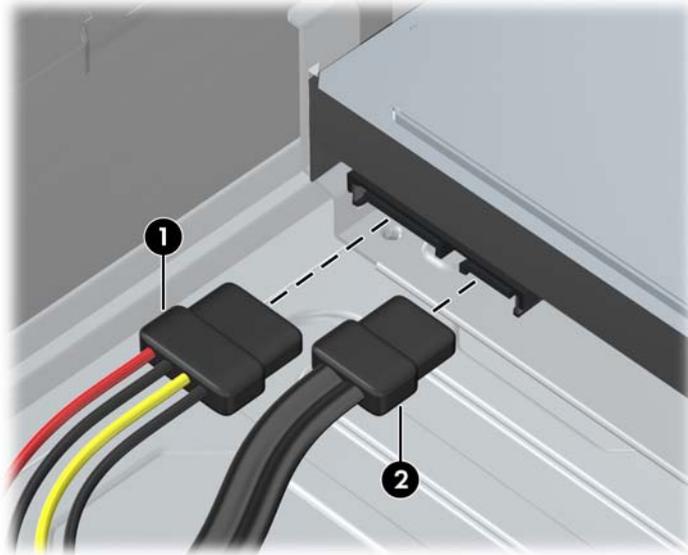
9. Align the guide screws with the slots on the chassis drive cage, press the hard drive down into the bay, then slide it back until it stops and locks in place.

Figure 5-51 Installing the hard drive (drive carrier shown)



10. Connect the drive cables:
 - a. Connect the power cable (1) and data cable (2) to the hard drive.

Figure 5-52 Removing the optical drive



- b. Route the SATA and power cables through the cable guide on the bottom of the chassis frame behind the hard drive. (See [Cable management on page 106.](#))
 - c. If the system has only one SATA hard drive, the data cable must be connected to the dark blue connector labeled SATA0 on the system board to avoid any hard drive performance problems. (See [Locate system board drive connections on page 80.](#))
11. Rotate the drive cage and the power supply down to their normal positions.
12. Replace the front bezel (see [Installing the front bezel on page 74.](#)).
13. Replace the access panel (see [Installing the access panel on page 72.](#)).
14. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69.](#)

Cable management

The Z200 Small Form Factor chassis is a very compact computer and proper routing of the internal cables is critical to the operation of the computer. Follow good cable management practices when working inside the computer

- Keep cables away from direct contact with major heat sources like the heat sink. (The air flow guide has a cable guide that lets you route cables safely around the heatsink.)
- Do not jam cables on top of expansion cards or DIMMs. Circuit cards and DIMMs are not designed to take excessive pressure.
- Keep cables clear of movable or rotating parts like the power supply and drive cage to prevent them from being cut or crimped when the component is lowered into its normal position
- When folding a flat ribbon cable, never fold to a sharp crease. Sharp creases may damage the wires.

- Some flat ribbon cables come prefolded. Never change the folds on these cables.
- Do not bend any cable sharply. A sharp bend can break the internal wires.
- Never bend a SATA data cable tighter than a 30 mm (1.18 in) radius.
- Never crease a SATA data cable.
- Do not rely on components like the drive cage, power supply, or computer cover to push cables down into the chassis. Always position the cables to lay properly by themselves or in the cable guides and chassis areas designed for cable routing.

When removing the power supply power cables from the connector on the system board, always follow these steps:

1. Squeeze on the top of the retaining latch attached to the cable end of the connector.
2. Grasp the cable end of the connector and pull it straight up.

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

Power connections

For help with identifying power cables, see the following figure and table. Ensure that all cables are routed or tied so they cannot interfere with the processor heatsink fans.

Figure 5-53 Power connector identification for a typical configuration

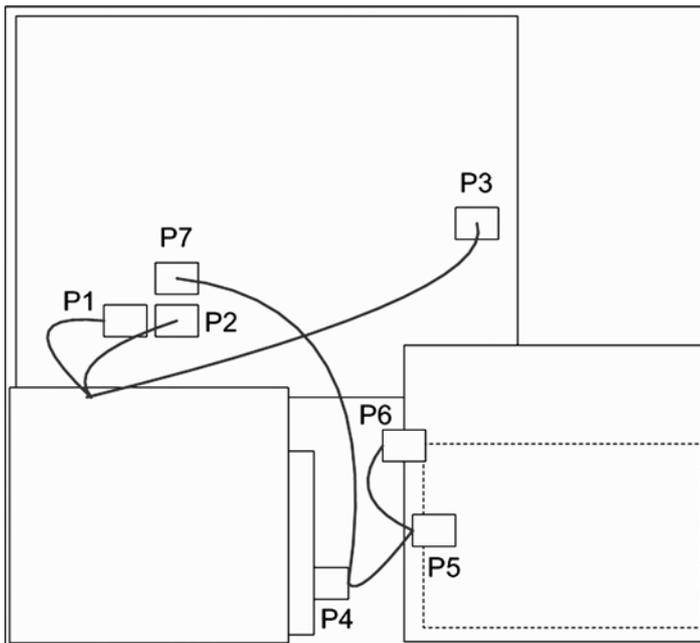


Table 5-7 Power connector description

Item	Description	Item	Description
P1	Main power	P5	4-pin connector for legacy devices
P2	PWRCMD—Power command	P6	(P9) Optical disk drive

Table 5-7 Power connector description (continued)

Item	Description	Item	Description
P3	CPU power	P7	SATA PWR1 (P160 on system board) for optical disk or hard disk drives
P4	Hard disk drive		

Using the Small Form Factor Computer in a Tower Orientation

The Small Form Factor computer can be used in a tower orientation. The HP logo plate on the front bezel is adjustable for either desktop or tower orientation.

1. Follow the procedures listed in the [Predisassembly procedures on page 69](#) section.
 - △ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.
2. Orient the computer so that its right side (as seen from the front) is facing down and place the computer in the optional stand.
 - 📝 **NOTE:** To stabilize the computer in a tower orientation, HP recommends the use of the optional tower stand.

Figure 5-54 Changing from desktop to tower orientation



3. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69](#).
 - 📝 **NOTE:** Ensure at least 10.2 cm (4 in) of space on all sides of the computer remains clear and free of obstructions.

Front panel I/O device assembly

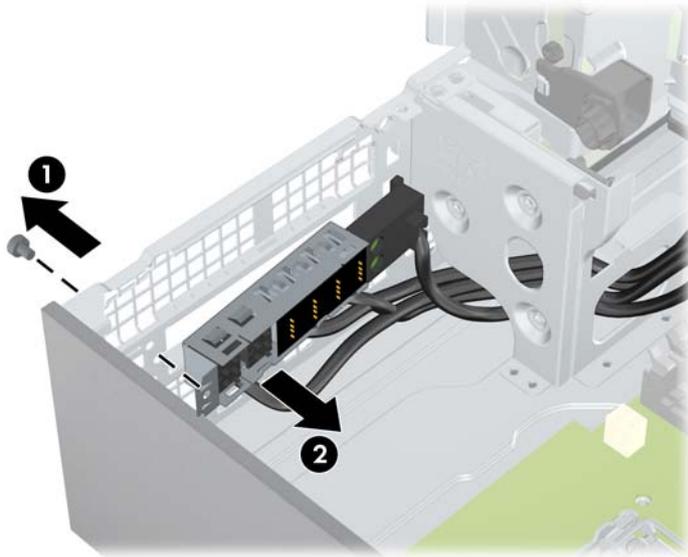
This section describes how to remove and install a front panel I/O device assembly.

Removing the front panel I/O device assembly

To remove the front panel I/O device assembly:

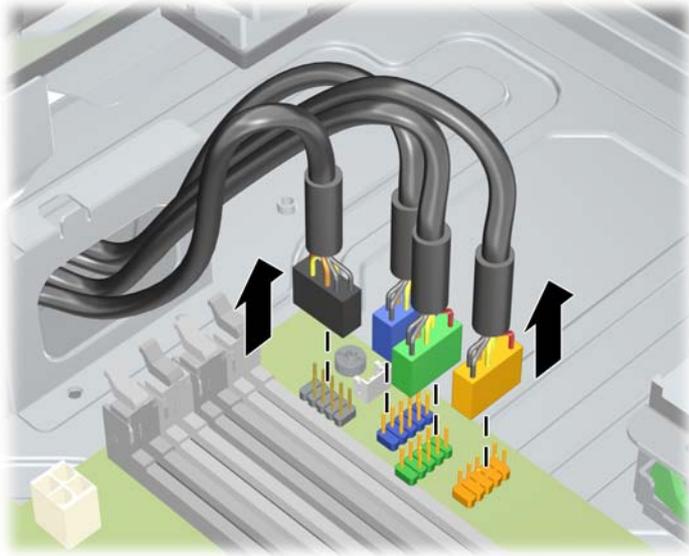
1. Disconnect power from the computer (see [Predisassembly procedures on page 69](#)).
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the front bezel (see [Removing the front bezel on page 74](#)).
4. Remove the screws that attach the I/O device assembly to the chassis, as shown in the following figure (1).
5. Swing the assembly into the chassis to release it from the front panel, as shown in the following figure (2).

Figure 5-55 Disconnecting the front panel I/O device assembly



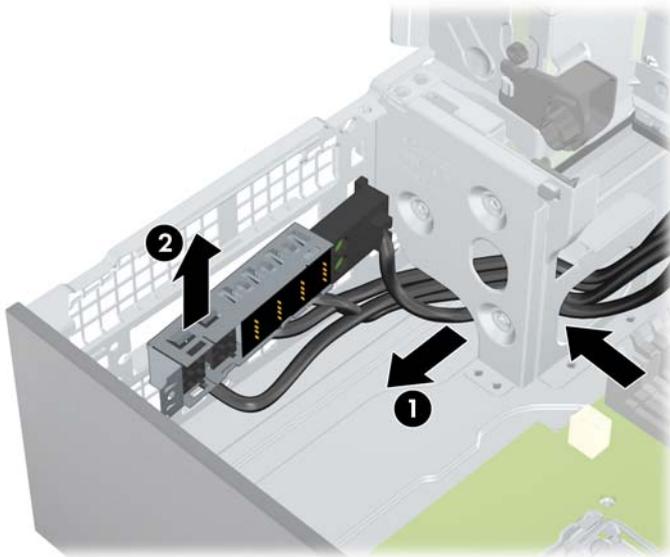
6. Disconnect the front panel I/O device assembly cables from the system board as shown below.

Figure 5-56 Disconnecting the front panel I/O cables



7. Carefully guide the cables through the chassis openings (1), as shown in the following figure.

Figure 5-57 Removing the front panel I/O device assembly



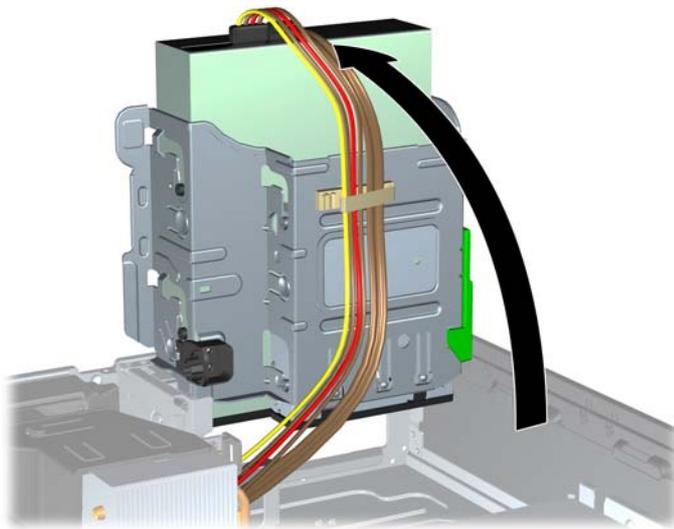
8. Carefully lift the front panel I/O device assembly and cables from the chassis (2).

Installing the front panel I/O device assembly

To install the front panel I/O device assembly:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).
△ CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the front bezel (see [Removing the front bezel on page 74](#)).
4. Rotate the drive cage to its upright position.

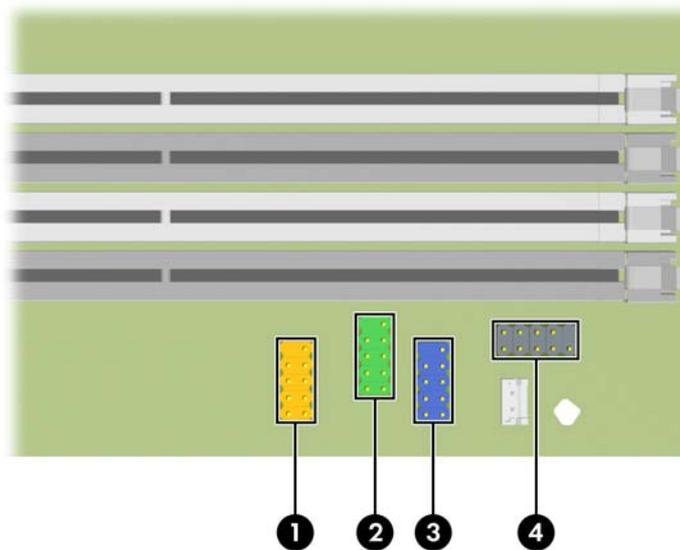
Figure 5-58 Rotating the Drive Cage Up



5. Carefully guide the front panel I/O device assembly cables through the chassis openings from which they were removed.
6. Place the front panel I/O device assembly in the chassis, and then install the fastening screw.

7. Connect the front panel USB (1 and 2), front audio (3), and front power/LED (4) cables to the system board as shown in the following diagram.

Figure 5-59 Connecting the front panel I/O device cables



8. Rotate the drive cage down to its normal position.
9. Replace the front bezel (see [Installing the front bezel on page 74](#)).
10. Replace the access panel (see [Installing the access panel on page 72](#)).
11. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69](#).

Speaker

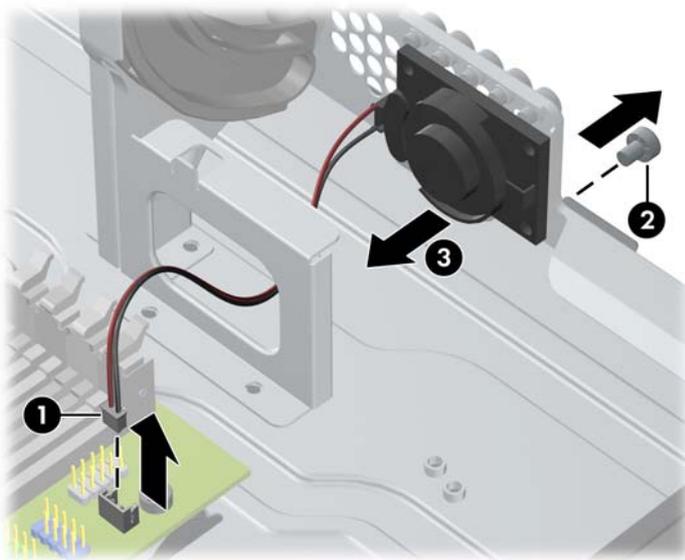
This section describes how to remove and install the speaker.

Removing the speaker

To remove the speaker:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).
△ CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the front bezel (see [Removing the front bezel on page 74](#)).
4. Disconnect the speaker cable from the system board (1) as shown in the figure below.
5. Remove the two screws as shown (2).
6. Slide the speaker away from the chassis and remove it from the chassis (3).

Figure 5-60 Removing the computer speaker



Installing the speaker

To install the speaker, reverse the previous steps.

Power supply

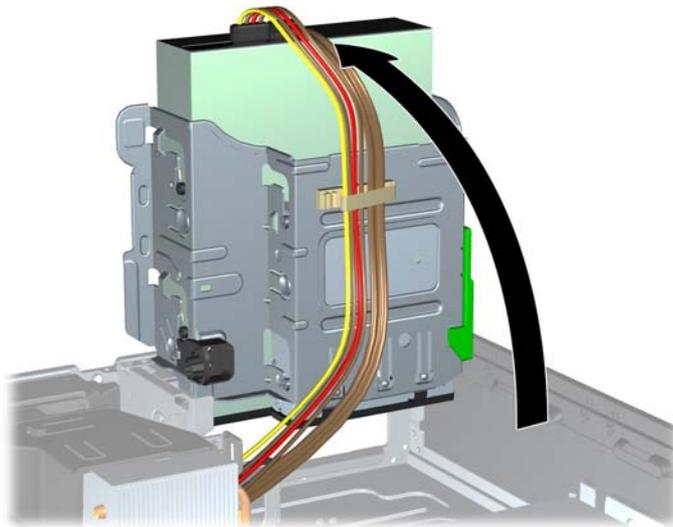
This section describes how to remove and install a power supply.

Removing the power supply

To remove the power supply:

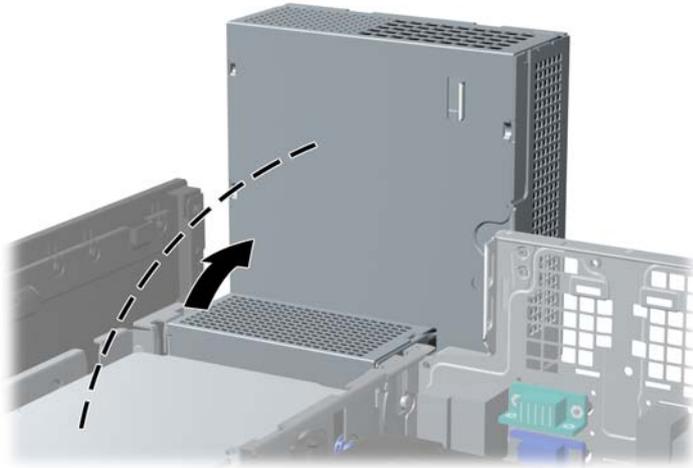
1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).
△ CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Disconnect all of the power supply cables from the system board and all peripheral devices, including hard drives, optical drives, and others as needed. (See [Power connections on page 107](#).)
4. Rotate the drive cage to its upright position.

Figure 5-61 Rotating the drive cage up



5. Slide the power supply toward the chassis and then up to remove it from the chassis.

Figure 5-62 Removing power supply



Installing the power supply

To install the power supply, reverse the previous steps.

System fan assembly

This section describes how to remove and install the system fan assembly.

Removing the system fan assembly

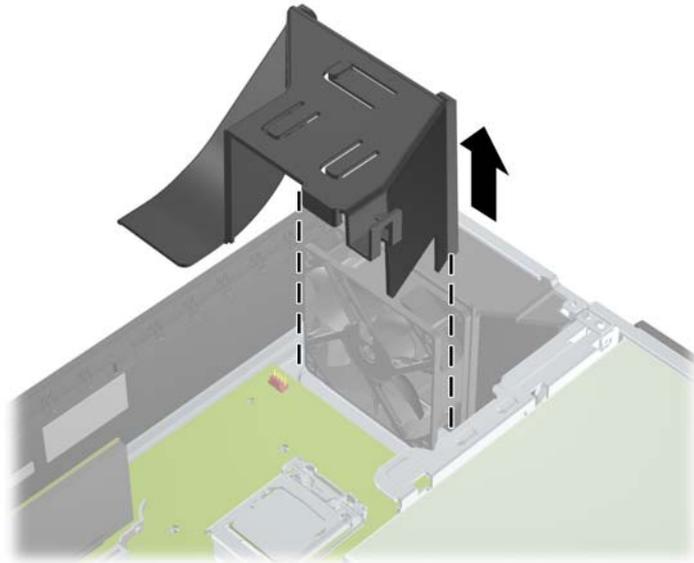
To remove the system fan assembly:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).

△ CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.

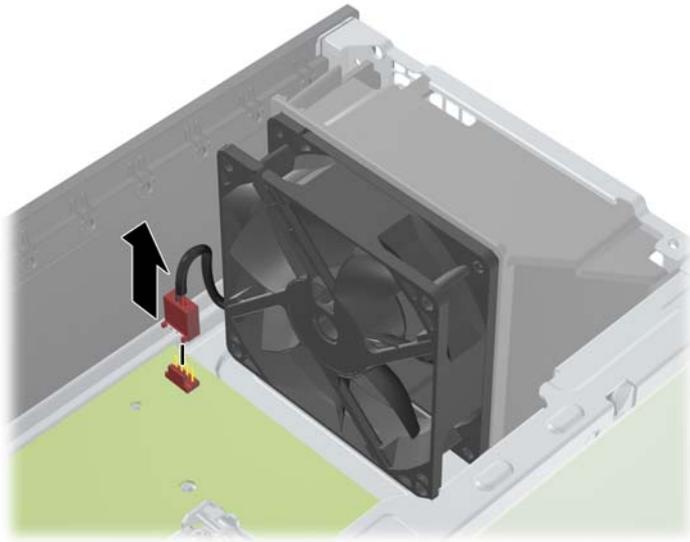
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the front bezel (see [Removing the front bezel on page 74](#)).
4. Remove the cables from the support arm on the airflow guide
5. Remove the airflow guide by pulling it straight up and out of the chassis, as shown in the following figure. (The processor heatsink is not shown.)

Figure 5-63 Removing the airflow guide



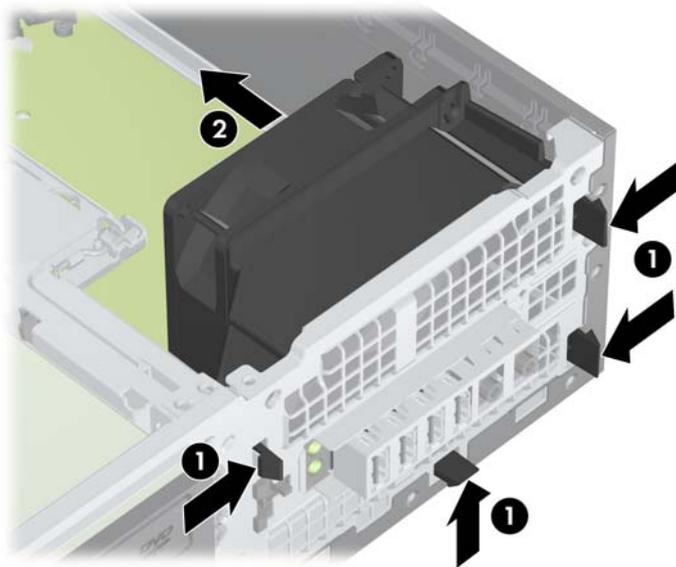
6. Disconnect the system fan assembly cable from the system board as shown in the following figure.

Figure 5-64 Disconnecting fan wires



7. Remove the fan assembly by pushing in on the four release tabs on the front of the chassis (1), and then sliding the fan assembly into the chassis until you can lift it out.

Figure 5-65 Removing the fan assembly



Installing the system fan assembly

To install the system fan assembly, reverse the removal steps.

Memory

This section presents memory module (DIMM) configuration information and removal/installation procedures.

Supported DIMM configurations

The computer supports these DIMM configurations:

- Four DIMM slots
- Memory configuration from 1 GB to 16GB
- No support for mirroring
- No support for DIMM sparing
- Error checking and correcting (ECC) and non-ECC DIMMs are supported.

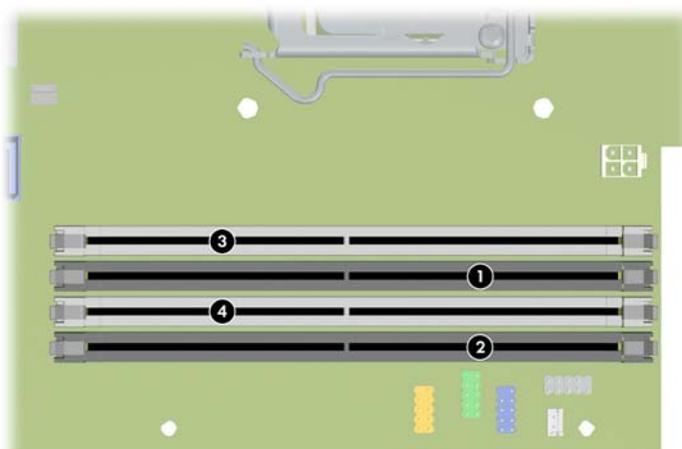
DIMM installation guidelines

- Install only HP-approved DDR3 DIMMs
- △ **CAUTION:** HP ships only DIMMs that are electrically and thermally compatible with this computer. Because third-party DIMMs might not be electrically or thermally compatible, they are not supported by HP.
- For ECC DIMMs, use only industry-standard ECC unbuffered DIMMs. See <http://www.hp.com/go/quickspecs> to find which DIMMs are compatible with the computer.
- Do not intermix non-ECC memory DIMMs with ECC memory DIMMs.

DIMM installation order

The numbers in the following figure show the correct installation order for DIMMs.

Figure 5-66 DIMM load order



BIOS errors and warnings

The BIOS generates warnings/errors on invalid memory configurations:

- If the BIOS can find a valid memory configuration by disabling plugged-in memory, it does so and reports a warning during POST. the computer can still be started. The warning will indicate the location of the failed DIMM on the system board or memory riser.
- If there is no way for the BIOS to obtain a valid memory configuration by disabling plugged-in memory, the BIOS halts with a diagnostics code for memory error (five beeps and blinks).

Removing a DIMM

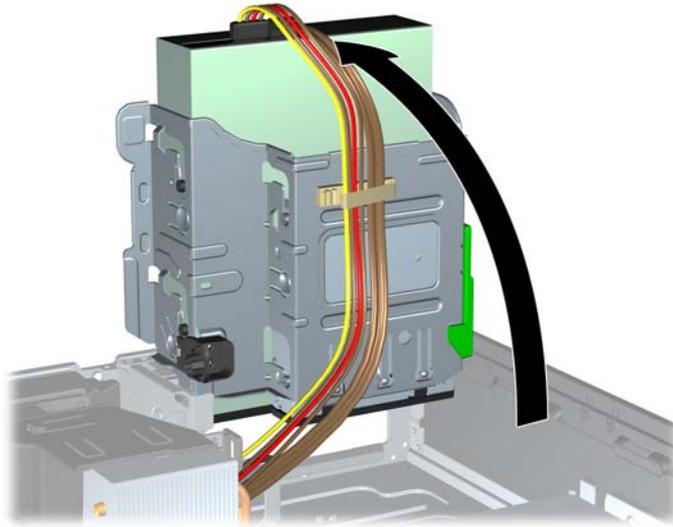
To remove a DIMM:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).

△ CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.

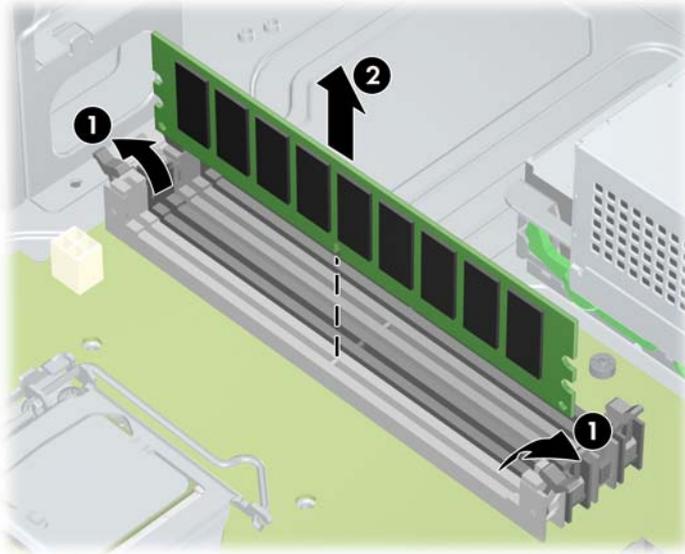
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Rotate the drive cage to its upright position.

Figure 5-67 Rotating the drive cage up



4. Push gently outward on the DIMM socket levers (1) as shown in the following figure.

Figure 5-68 Removing a DIMM



5. Lift the DIMM straight up (2) and out of the socket, then store the DIMM in an antistatic bag.

Installing a DIMM

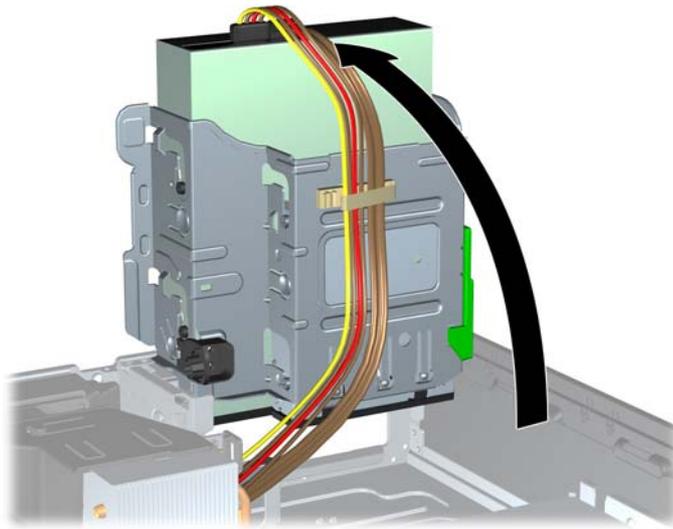
To install the DIMM:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).

△ CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Rotate the drive cage to its upright position.

Figure 5-69 Rotating the drive cage up

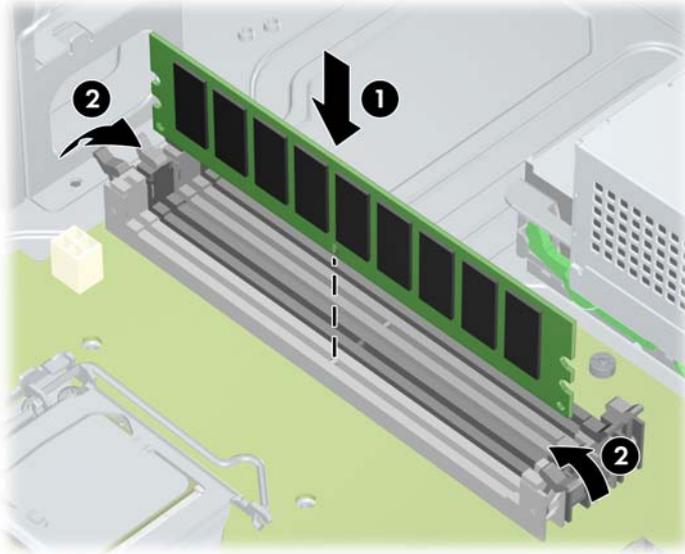


4. Push gently outward on the DIMM socket levers.

5. Align the DIMM connector key with the DIMM socket key, and then seat the DIMM firmly in the socket (1).

△ **CAUTION:** DIMMs and their sockets are keyed for proper installation. To prevent socket or DIMM damage, align these guides properly when installing DIMMs.

Figure 5-70 Opening DIMM socket levers



6. Secure the socket levers (2).
7. Rotate the drive cage and the power supply down to their normal positions.
8. Replace the front bezel (see [Installing the front bezel on page 74](#)).
9. Replace the access panel (see [Installing the access panel on page 72](#)).
10. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69](#).

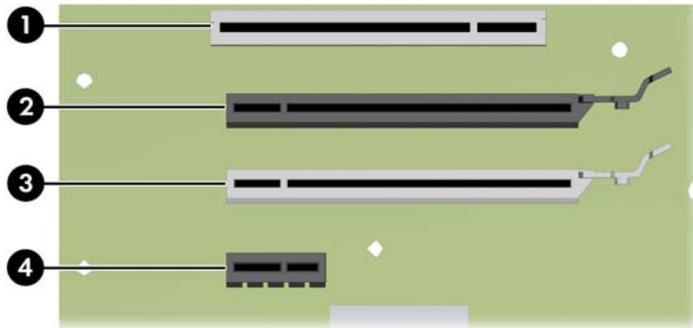
Expansion card slot identification

This section identifies and describes computer expansion card slots, and presents card configuration information.

Slot identification and description

The following figure identifies computer expansion card slots.

Figure 5-71 Identifying expansion card slots



The following table describes the computer PCIe card slots.

Table 5-8 PCI slots

Slot	Type	Slot power (maximum)
1	PCI 32b/33MHZ	• 45W for all graphics cards
2	PCIe2 - x16	• 80W for all I/O devices
3	PCIe - x16(4)	
4	PCIe1 - x1	

NOTE: The x1, x4, and x16 designators describe the mechanical length of the slot. The number in parentheses lists the number of electrical PCIe lanes routed to the expansion slot. For example, x16(4) means that the expansion slot is mechanically a x16 length connector, with four PCIe lanes connected.

Card configuration restrictions for power supplies

CAUTION: To prevent damage, the overall power consumption of the computer (including I/O cards, CPU, and memory) must not exceed the maximum rating of the computer power supply. For power supply information, see [Power supply specifications on page 9](#).

Choosing an expansion card slot

Whenever possible, use the following tips to help you select the proper slot for an expansion card:

- Use the black PCIe x16 I/O slot for the primary graphics card; if you do not use this slot for the graphics card, only cards certified as After Market Options are supported.
- Insert a second graphics card in the white PCIe x16 slot.
- Install a card in a slot that most closely matches its interface technology:
 - Install a PCIe Gen1 x16 or a PCIe Gen1 x8 card in the PCIe Gen2 x16 slot.
 - Install a PCIe Gen1 x4 card in the PCIe Gen1 x4 slot.
 - Install a PCIe Gen1 x1 card in the PCIe Gen1 x1 slot.
 - Install a PCI card in one of the PCI slots.
 - Whenever possible, install a PCIe x1 card in an x1 slot.
- Leave as much space as possible between cards.
- For best operational efficiency, select a slot that:
 - Electrically matches the number of PCIe card lanes (e.g., x1 in a x1 slot).
 - Has more lanes electrically.
 - Has fewer lanes, but is closer to your needs. For example, place an x16 card in an x4 slot, and an x4 card in an x1 slot.
- An x1 connector supports an x1 card only. Although, an x1 card can be inserted into any slot, this may waste the potential for future card placement.
- To prevent electromagnetic interference, avoid installing a card with external cable connections next to a graphics card.

Removing and installing expansion cards

PCIe I/O slots can support other PCIe cards with less bus bandwidth than what is physically defined for the slot.

Expansion card slot description

 **NOTE:** The x1, x4, and x16 designators describe the mechanical length of the slot. The number in parentheses lists the number of electrical PCIe lanes routed to the expansion slot. For example, x16(4) means that the expansion slot is mechanically a x16 length connector, with four PCIe lanes connected.

Use the following table to determine PCIe card compatibility.

Table 5-9 Computer PCIe compatibility matrix

Slot	Mechanical compatibility	Electrical compatibility	Color
1	PCI 32-bit/33MHz	PCI only	White
2	x16 connector	(x1, x4, x8, x16)	Black
3	x16 connector	(x1, x4)	White
4	x1 connector	(x1)	Black

Removing an expansion card

To remove an expansion card:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).

△ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove any cables connected to the expansion card.

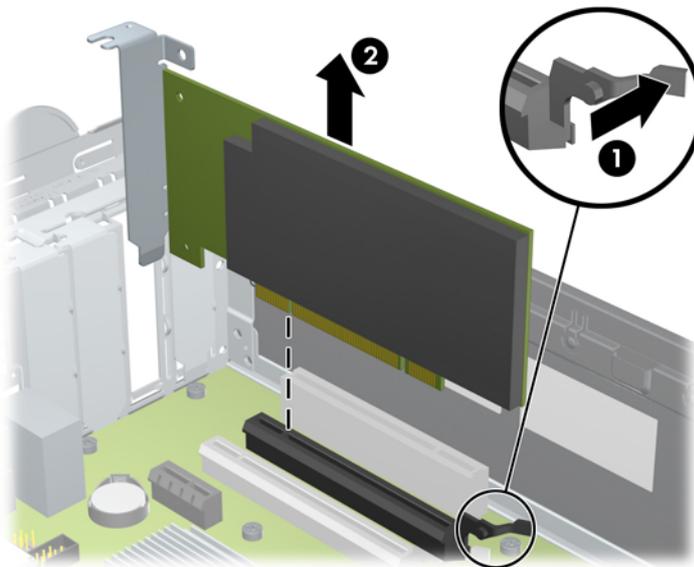
4. Push down on the expansion card retention clamp levers on the inside of the chassis to open the retention clamp (1) as shown below.

Figure 5-72 Releasing the retention clamp



5. If the card slot has a latch, release the latch (1), and then carefully lift the card from the chassis (2).

Figure 5-73 Removing the expansion card



6. Install an expansion slot cover if you do not intend to replace the card.
7. Close the expansion card retention clamp. If the expansion card retention clamp does not close, ensure that all cards are properly seated, and then try again.
8. Replace the access panel (see [Installing the access panel on page 72](#)).
9. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69](#).

Installing an expansion card

Visit <http://www.hp.com/go/quickspecs> to learn which graphics cards are supported in the computer, how much memory each graphics card includes, and graphics card power requirements.

To install an expansion card:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).

CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Push the expansion card retention clamp levers down on the outside of the chassis to release the retention clamp, as shown in the figure below.

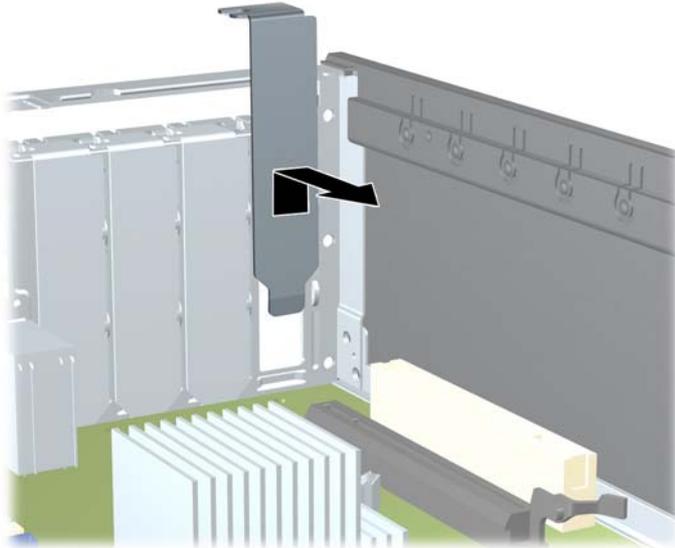
Figure 5-74 Releasing the retention clamp



4. Remove the expansion card slot cover by pulling it up, out of the chassis.

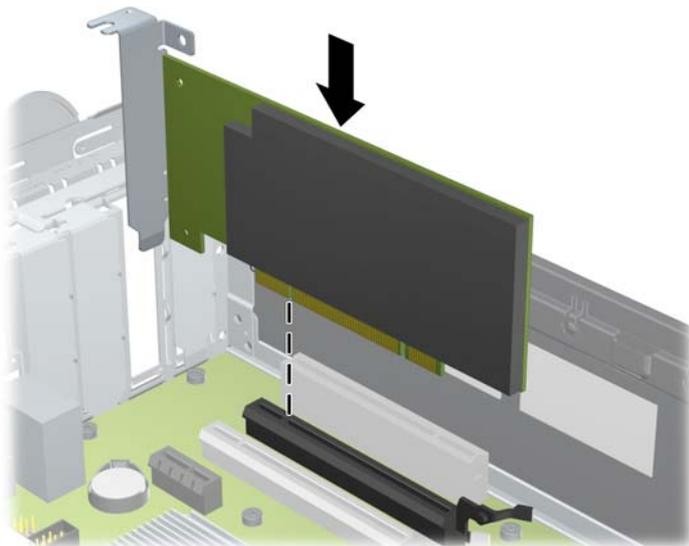
 **TIP:** Grasp the slot cover between two fingers—one from the inside of the chassis, and one from the outside.

Figure 5-75 Removing the slot cover



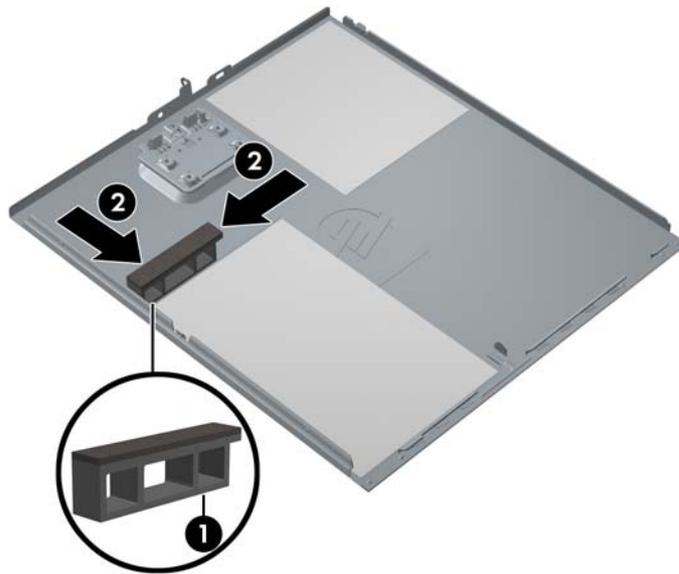
5. Angle the expansion card to insert it into the expansion card guide.
6. Align the PCIe card keyway with the slot key, and then firmly seat the card in the slot as shown next.

Figure 5-76 Inserting the expansion card



7. Close the expansion card retention clamp by rotating it downward.
 - If the PCI retention clamp does not close, ensure that all cards are properly seated, and then try again.
 - If required by the card, connect the auxiliary power cable to the card (not illustrated).
8. Install the card hold-down if it is provided with your card and if the side access panel does not already have one:
 - a. Remove the protective strip from the adhesive strip on the bottom of the hold-down (1).
 - b. Carefully place the hold-down on the inside of the side access panel:
 - Align the hold down with the edge of the hood label and the edge of the side access panel (2).
 - Make sure the overhanging tab on the hold down faces toward the center of the side access panel with the foam padding facing up.

Figure 5-77 Installing the card hold-down



9. Replace the access panel (see [Installing the access panel on page 72](#)).
10. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69](#).

Battery

This section describes how to remove and install the battery.

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

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

△ **CAUTION:** Before removing the battery, back up the CMOS settings in case they are lost when the battery is removed. To back up the CMOS settings, select the **Save to Diskette** option in the Computer Setup (F10) Utility.

📄 **NOTE:** Do not dispose of batteries, battery packs, and accumulators with general household waste.

Removing the battery

To remove the battery:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).

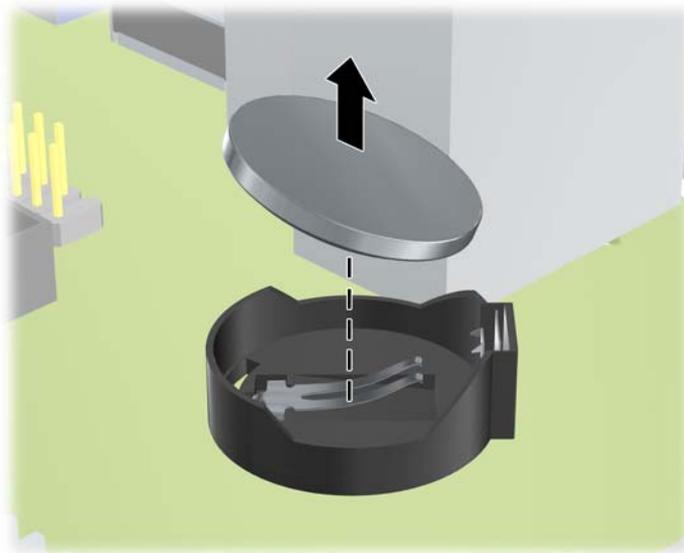
△ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove the access panel (see [Removing the access panel on page 72](#)).

3. On the system board, press the release tab of the battery holder.

4. Lift the battery straight up and out of the holder as shown in the following figure.

Figure 5-78 Removing the battery



Installing the battery

To install the battery:

1. Confirm the polarity (positive or negative) of the battery to position it correctly in the battery holder.
2. Angle the battery and place the battery edge under the plastic housing tab and press gently until it snaps into place.

CPU heatsink

This section describes how to remove and install a CPU heatsink.

Removing the CPU heatsink

To remove a heatsink:

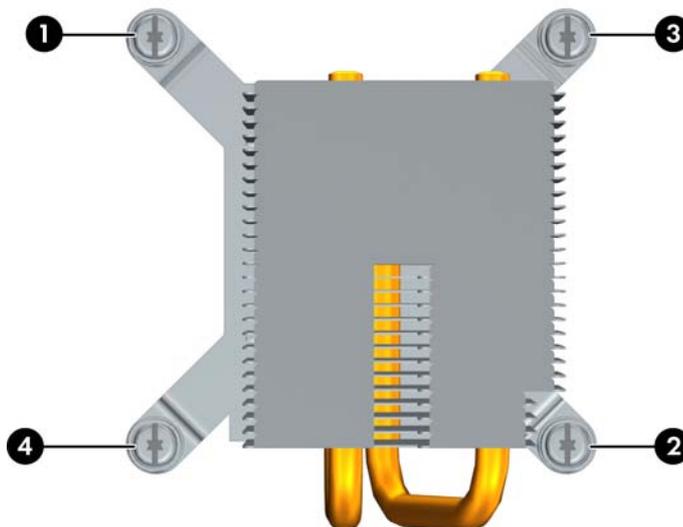
1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).

CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the airflow guide.
4. Slowly and evenly loosen one pair of diagonally opposite screws (1) from the CPU until the screw shanks disengage from the system board, and then loosen the remaining pair (2) as shown below.

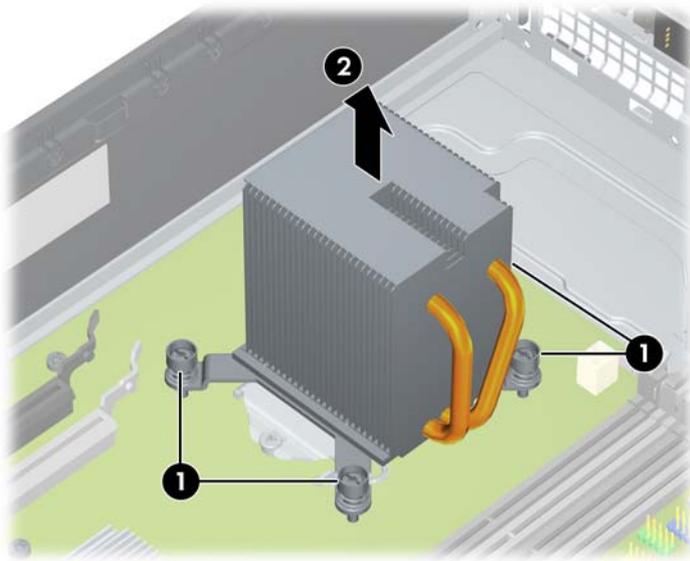
CAUTION: Do *not* fully loosen one screw, and then move on to the next. Instead, loosen all screws a little at a time, ensuring that the CPU remains level.

Figure 5-79 Loosening heatsink screws in sequence



5. Disconnect the heatsink screws from the system board (1) as shown in the following figure.

Figure 5-80 Disconnecting the heatsink screws



6. Before lifting the heatsink, gently twist the heatsink to break the thermal compound between the CPU and the heatsink.
7. Lift the CPU heatsink out of the chassis (2).
8. Use alcohol and a soft cloth to clean the thermal interface residue from the CPU and the heatsink. Let the alcohol on the CPU and CPU heatsink dry completely.

Installing the CPU heatsink

To install a heatsink:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).

CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the airflow guide.
4. Perform one of the following tasks:
 - If you are reusing the original heatsink, clean the old thermal compound from the bottom of the heatsink, then apply a new layer of thermal compound to the center of the CPU top surface.
 - If you are using a new CPU heatsink, remove the thermal compound protective liner from the bottom of the new heatsink. (New heatsinks already have thermal compound on the heatsink surface.)
5. Align the heatsink's four mounting screws with the mounting holes in the chassis.
6. Carefully place the heatsink on the CPU.

7. Tighten each heatsink screw a little at a time to ensure that the CPU stays level. Do *not* fully tighten one screw and then move on to the next.
 8. Tighten each set of diagonally opposed screws a little at a time to 6 in.-lbs. of torque.
-
- △ **CAUTION:** Do not overtighten the heatsink screws. Overtightening can strip the threads in the chassis.
-
9. Replace the airflow guide.
 10. Replace the access panel (see [Installing the access panel on page 72](#)).
 11. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69](#).

CPU

This section describes how to remove and install a CPU.

Removing a CPU

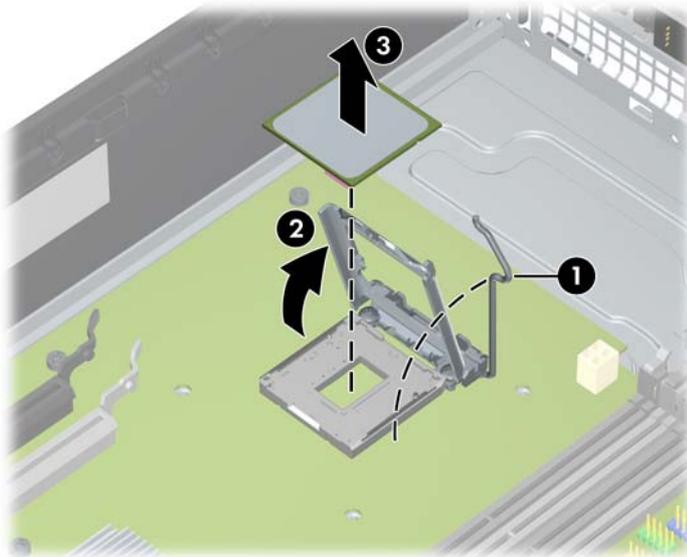
To remove a CPU:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).

△ CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.

2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the CPU heatsink (see [Removing the CPU heatsink on page 132](#)).
4. Raise the CPU socket lever (1) and open the cover (2) as shown in the following figure (fan assembly not shown).

Figure 5-81 Removing a CPU



-
- △ CAUTION:** Do not touch the CPU socket contacts or the gold pads underneath the CPU. Use extreme care and handle the CPU only by the edges.
-
5. Pull the CPU straight out of the socket (3), and store the CPU in a static free container in a safe place where it cannot be damaged

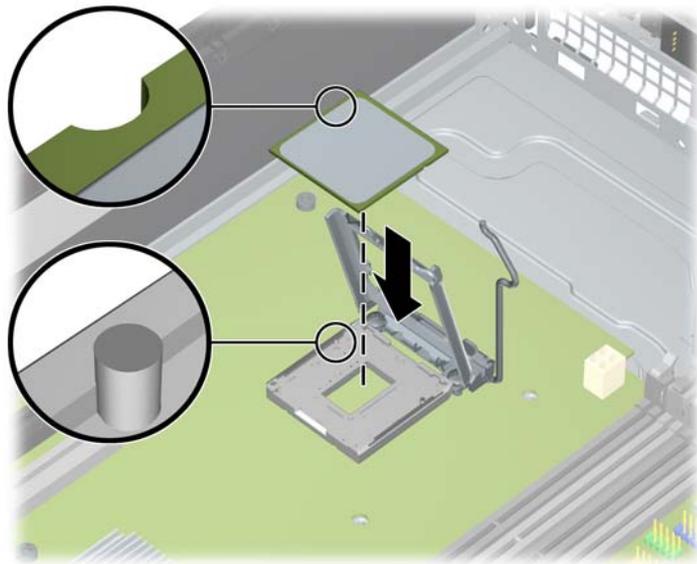
Installing a CPU

 **NOTE:** HP recommends that you do not swap processors (CPUs) from one system board to another.

To install a CPU:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).
 - △ **CAUTION:** Failure to follow the predisassembly procedures can result in equipment damage or data loss.
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Remove the airflow guide.
4. If necessary, remove the CPU heatsink (see [Removing the CPU heatsink on page 132](#)).
5. Using extreme care, fully raise the CPU socket lever and cover.
 - △ **CAUTION:** The CPU socket contacts are delicate. To avoid bending the contacts, use extreme care when installing the CPU in the socket.
6. Align the notches in the CPU base with the tabs on the socket as shown in the figure below.
Seat the CPU into the socket. Ensure that the underside of the CPU is level with the top of the CPU socket.

Figure 5-82 Seating the CPU



7. Close the CPU cover plate by lightly pressing down on the CPU cover plate while closing the socket lever.
8. Replace the CPU heatsink (see [Installing the CPU heatsink on page 133](#)),
9. Replace the access panel (see [Installing the access panel on page 72](#)).
10. Restore all connections and equipment that you removed during the [Predisassembly procedures on page 69](#).

System board

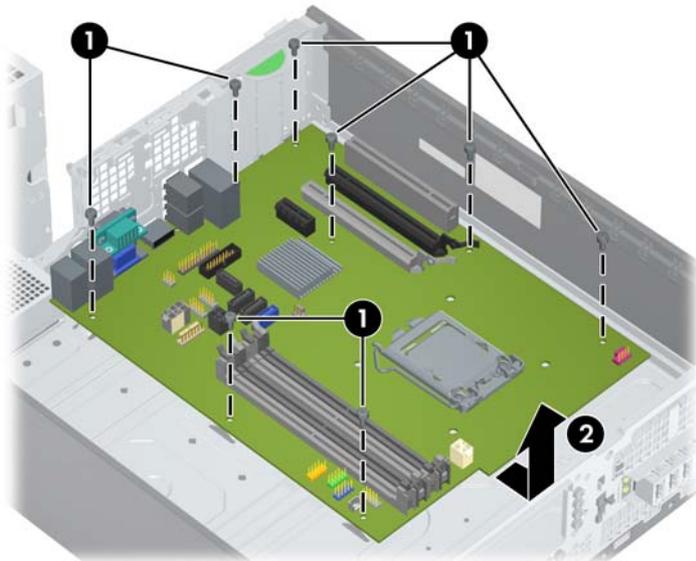
This section describes replacing the system board.

Removing the system board

To remove the system board:

1. Prepare the computer for servicing by following the [Predisassembly procedures on page 69](#).
CAUTION: Failure to follow the predisassembly procedures can result in equipment damage or data loss.
2. Remove the access panel (see [Removing the access panel on page 72](#)).
3. Rotate the drive cage upward (see [Removing an optical drive on page 83](#)).
4. Rotate the power supply upward (see [Power supply on page 114](#)).
5. Remove expansion boards and graphics cards (see [Removing an expansion card on page 126](#)).
6. Remove the CPU heatsink (see [Removing the CPU heatsink on page 132](#)).
7. Disconnect all cabling from the system board.
TIP: Make a note of the cable connections before disconnecting them from the system board. For more information, refer to [Cable management on page 106](#).
8. Remove the mounting screws (1) as shown in the following figure.

Figure 5-83 Removing the system board



9. Lift the system board slightly, and pull the board away from the rear of the chassis.
10. Lift the system board upward out of the chassis (2).

Installing the system board

To install the system board, reverse the steps for removing the board.:

Product recycling

HP encourages customers to recycle used electronic hardware, HP original print cartridges, and rechargeable batteries.

For information about recycling HP components or products, see <http://www.hp.com/go/recycle>.

6 Diagnostics and troubleshooting

This chapter describes the tools available for diagnosing and troubleshooting system issues, and includes these topics:

Topics

[Calling technical support on page 140](#)

[Locating ID labels on page 140](#)

[Locating warranty information on page 141](#)

[Diagnosis guidelines on page 142](#)

[Troubleshooting checklist on page 144](#)

{Xref Error! Target does not exist.}

[Troubleshooting scenarios and solutions on page 144](#)

[Self-troubleshooting with HP Vision Diagnostics on page 153](#)

[Diagnostic codes and errors on page 163](#)

Calling technical support

At times you might encounter an issue that requires technical support. When you call technical support:

- Have the computer readily accessible.
- Write down the computer serial numbers, product numbers, model names, and model numbers and have them in front of you.
- Note any applicable error messages.
- Note any add-on options.
- Note the operating system.
- Note any third-party hardware or software.
- Note the details of any blinking LEDs on the front of the computer.
- Note the applications you were using when you encountered the problem.

 **NOTE:** When calling in for service or support, you might be asked for the Product Number (example: PS988AV) of the computer. If the computer has a Product Number, it is generally located next to the 10- or 12-digit Serial Number of the computer.

NOTE: On most models, the serial number and product number labels can be found on the top panel or side of the computer and at the rear of the computer.

For a listing of all worldwide technical support phone numbers, visit <http://www.hp.com/support>, select your region, and click **Contact HP** in the upper-left corner.

Locating ID labels

To assist in troubleshooting, product, serial, and authentication numbers are available on each computer.

Typically each HP Workstation has two unique serial number labels (1) and a Certificate of Authentication (COA) label (2) as shown in the figure below.

Figure 6-1 Workstation label locations



In general, the serial number labels can be found on the top panel or on the side of the computer and at the rear of the computer (your computer may look different). Keep this number available when contacting customer service for assistance.

A product number is generally located next to the serial number.

The COA is used for Windows-preinstalled systems only, and is generally located on the top panel or side of the computer near the serial number label. On some computers it is located on the bottom of the computer.

Locating warranty information

To locate base warranty information, see <http://www.hp.com/support/warranty-lookuptool>.

To locate an existing Care Pack, see <http://www.hp.com/go/lookuptool>.

To extend a standard product warranty, visit <http://www.hp.com/hps/carepack>. HP Care Pack Services offer upgraded service levels to extend and expand a standard product warranty.

Diagnosis guidelines

If you encounter a problem with the computer, monitor, or software, the following sections provide a list of general suggestions that help you isolate and focus on the problem before taking further action.

Diagnosis at startup

- Verify that the computer and monitor are plugged into a working electrical outlet.
- Remove all diskettes, CDs, or USB drive keys from your system before turning it on.
- Verify that the computer is turned on and the green power light is on.
- If you have installed an operating system other than the factory-installed operating system, check to be sure that it is supported on your system by visiting <http://www.hp.com/go/quickspecs>.
- Verify that the monitor is turned on and the green monitor light is on. Note that not all monitors are equipped with LED lights to indicate their functionality.
- Turn up the brightness and contrast controls of the monitor if the monitor is dim.
- If the computer has multiple video sources and only a single monitor, the monitor must be connected to the primary display adapter. During startup, the other monitor connectors are disabled; if the monitor is connected to one of these ports, it will not function after Power-on Self Test (POST). You can select the default source in Computer Setup (F10).

Diagnosis during operation

- Look for blinking LEDs on the front of the computer. The blinking lights are error codes that will help you diagnose the problem. Refer to the [Diagnostic LED and audible \(beep\) codes on page 163](#) section of this document for information on interpreting diagnostic lights and audible codes.
- Press and hold any key. If the system beeps, then your keyboard is operating correctly.
- Check all cables for loose or incorrect connections.
- Wake the computer by pressing any key on the keyboard or the power button. If the system remains in suspend mode, shut down the system by pressing and holding the power button for at least four seconds, then press the power button again to restart the system. If the system does not shut down, unplug the power cord, wait a few seconds, then plug it in again. If it does not restart, press the power button to start the computer.
- Reconfigure the computer after installing a non-plug and play expansion board or other option.
- Be sure that all required device drivers have been installed. For example, if you have connected a printer, you must install a printer driver.
- If you are working on a network, plug another computer with a different cable into the network connection. There might be a problem with the network plug or cable.
- If you recently added new hardware, remove the hardware and verify if the computer functions properly.
- If you recently installed new software, uninstall the software and verify if the computer functions properly.
- If the screen is blank, plug the monitor into a different video port on the computer if one is available. Alternatively, replace the monitor with a monitor that you know is working properly.
- Upgrade the BIOS. A new release of the BIOS might have been released that supports new features or fixes your problem.

Troubleshooting checklist

Before running diagnostic utilities, use the following checklist to find possible solutions for computer or software problems.

- Is the computer and monitor connected to a working electrical outlet?
- Is the computer powered on?
- Is the blue power light illuminated?
- Is the monitor on?
- Is the monitor power LED illuminated?
- If the monitor is dim, adjust the monitor brightness and contrast controls.
- Press and hold any key. If the system beeps, the keyboard is operating correctly.
- Check cables for loose or improper connections.
- After installing a non-plug and play (PnP) expansion board or other option (such as a diskette drive), reconfigure the computer.
- Are all necessary device drivers installed?
- Have all printer drivers been installed for each application?
- Have you removed diskettes, optical disks, and USB drive keys from the drives before powering on the computer?
- Are you running the latest version of BIOS, drivers, and software?

Troubleshooting scenarios and solutions

This section presents an extensive overview of various troubleshooting scenarios and possible solutions for a Windows-based computer.

 **NOTE:** For Linux troubleshooting information, refer to the *HP Workstations for Linux User Manual* at http://www.hp.com/support/linux_user_manual.

Solving minor problems

Table 6-1 Minor problems

Problem	Cause	Possible Solution
Workstation appears frozen and does not shut down when the power button is pressed.	Software control of the power switch is not functional.	<ol style="list-style-type: none">1. Press and hold the power button for at least four seconds until the computer shuts down.2. Disconnect the electrical plug from the outlet.3. Restart the computer.
Workstation seems to be frozen.	Program in use has stopped responding to commands.	<ol style="list-style-type: none">1. If possible, use the Windows Task Manager to isolate and terminate the offending process.2. Attempt the normal Windows shutdown procedure.3. Restart the computer using the power button.

Table 6-1 Minor problems (continued)

Problem	Cause	Possible Solution
Workstation date and time display is incorrect.	Real-time clock (RTC) battery might need replacement.	<ol style="list-style-type: none">1. Reset the date and time in the Control Panel.2. Replace the RTC battery.
Workstation appears to pause periodically.	Network driver is loaded and no network connection is established.	Establish a network connection, or use the Computer Setup (F10) Utility or the Microsoft Windows Device Manager to disable the network controller.
Cursor does not move using the arrow keys on the keypad.	The Num Lock key might be on.	Press Num Lock . The Num Lock key can be disabled or enabled in the Computer Setup (F10) Utility.
Poor performance is experienced.	Processor is hot.	<ol style="list-style-type: none">1. Verify that airflow to the computer is not blocked.2. Verify that chassis fans are connected and working properly. Some fans operate only when needed.3. Verify that the processor heatsink is installed properly.
	Hard drive is full.	Transfer data from the hard drive to create more space on the hard drive.

Table 6-1 Minor problems (continued)

Problem	Cause	Possible Solution
Workstation powered off automatically and the Power LED flashes red 2 times (once every second), followed by a 2-second pause, and then two simultaneous beeps sounded.	Processor thermal protection is activated. A fan might be blocked or not turning. OR The processor heatsink is not properly attached to the processor.	<ol style="list-style-type: none">1. Verify that the computer air vents are not blocked.2. Open the access panel and press the computer power button.3. Verify that the system fan is running.4. Verify that the processor heatsink fan spins. If the fan is not spinning, verify that the heatsink fan cable is plugged into the system board connector and that the heatsink is properly seated.5. Replace the processor heatsink.
System does not power on, and the LEDs on the front of the computer are not flashing.	System cannot power on.	Press and hold the power button for less than four seconds. If the hard drive LED turns green, then perform the following steps. OR <ol style="list-style-type: none">1. To find a faulty device, remove all devices one at a time:<ol style="list-style-type: none">a. Disconnect AC power to the computer.b. Remove a device.c. Reconnect AC power and power on the computer.2. Repeat this process until the faulty device is identified. Remove the graphics card last. Replace the faulty device.3. If no faulty device is found, replace the system board. <ol style="list-style-type: none">1. Press and hold the power button for <i>less than</i> four seconds. If the hard drive LED does not illuminate, then perform the following tasks:<ol style="list-style-type: none">a. Verify that the computer is plugged into a working AC outlet.b. Verify that the power button harness is connected to the inline front panel I/O device assembly connector.2. Verify that the power supply cables are connected to the system board.

Solving diskette problems

Table 6-2 Diskette problems

Problem	Cause	Solution
Diskette drive light stays on.	Diskette is damaged.	<ol style="list-style-type: none"> 1. Right-click Start, select Explore, and then select a drive. 2. Select File>Properties>Tools. 3. Under Error-checking, select Check Now.
	Diskette is incorrectly inserted.	Remove and reinsert diskette.
	Files on the diskette are damaged.	Verify the program diskettes.
	Drive cable is not properly connected.	Reconnect the power cable and verify that all four pins are connected.
Drive not found.	Cable is loose.	Reseat the diskette drive data and power cables.
	Removable drive is not seated properly.	Reseat the drive.
Diskette drive cannot write to a diskette.	Diskette is not formatted.	Format the diskette.
	Diskette is write-protected.	Use another diskette or remove the write protection.
	Writing to the wrong drive.	Verify the drive letter in the path statement.
	There is not enough space on the diskette.	Use another diskette.
	Diskette write-control is enabled.	Use the Computer Setup (F10) Utility to verify the storage security feature disabled settings.
	Diskette is damaged.	Replace the damaged disk.
Cannot format diskette.	Invalid media reported.	<p>When formatting a disk in MS-DOS, you might need to specify diskette capacity.</p> <p>For example, to format a 1.44-MB diskette, enter the following command at the MS-DOS prompt: FORMAT A: /F:1440</p>
A problem has occurred with a disk transaction.	The directory structure is bad, or there is a problem with a file.	<ol style="list-style-type: none"> 1. Right-click Start, select Explore, and then select a drive. 2. Select File>Properties>Tools. 3. Under Error-checking, select Check Now.
Diskette drive cannot read a diskette.	Diskette is not formatted.	Format the diskette.
	You are using the wrong diskette type for the drive type.	Verify the type of drive that you are using and use the correct diskette type.
	You are reading the wrong drive.	Verify the drive letter in the path statement.
	Diskette is damaged.	Replace the diskette with a new one.

Table 6-2 Diskette problems (continued)

Problem	Cause	Solution
Invalid system disk is displayed.	A diskette that does not contain the system files needed to start the computer has been inserted into the drive.	When drive activity stops, remove the diskette and press the Spacebar. The computer attempts to boot from the next device in the boot order.
	Diskette error has occurred.	Restart the computer by pressing the power button.
Cannot boot to diskette	Diskette is not bootable.	Replace with a bootable diskette.
	Diskette boot has been disabled in Computer Setup.	Run the Computer Setup (F10) Utility and enable diskette boot in Storage>Boot Order .
	Removable media boot has been disabled in Computer Setup.	Run the Computer Setup (F10) Utility and enable Removable Media Boot in Storage>Storage Options .
	Diskette MBR validation is enabled.	Run the Computer Setup (F10) Utility and disable Diskette MBR Validation in Storage>Storage Options .

Solving hard drive problems

Table 6-3 Hard drive problems

Problem	Cause	Solution
Hard drive error occurs.	Hard disk has bad sectors or has failed.	Locate and block the usage of bad sectors. If necessary, reformat the hard disk.
		If the drive is detected by the BIOS, run DPS Self-test.
Disk transaction problem.	The directory structure is bad, or there is a problem with a file.	<ol style="list-style-type: none"> 1. Right-click Start, select Explore, and select a drive. 2. Select File>Properties>Tools. 3. Under Error-checking, select Check Now.

Table 6-3 Hard drive problems (continued)

Problem	Cause	Solution
Drive not found (identified).	Improper cable connection	On computers with discreet data and power cables, ensure that the data and power cables are securely connected to the hard drive. (See the <i>Hard drive</i> section of this guide for connection details.)
	Improperly seated hard drive	On systems with blind-mate drive connections, check for connector damage on the drive and in the chassis. Reseat the hard drive and its carrier in the chassis to ensure a proper connection. (See the <i>Hard drive</i> section of this guide for connection details.)
	The system might not have automatically recognized a newly installed device.	<ol style="list-style-type: none"> 1. Run the Computer Setup (F10) Utility. 2. If the system does not recognize the new device, verify that the device is listed in the Computer Setup (F10) Utility. If it is listed, the probable cause is a driver problem. If it is not listed, the probable cause is a hardware problem. 3. If this drive is newly installed, enter Setup and try adding a POST delay under Advanced>Power-On.
	Drive responds slowly immediately after power-up.	Run the Computer Setup (F10) utility, and increase the POST Delay in Advanced>Power-On Options.
Nonsystem disk or NTLDR missing message.	System is trying to start from a nonbootable diskette.	Remove the diskette from the drive.
	System is trying to start from a damaged hard drive.	<ol style="list-style-type: none"> 1. Insert a bootable diskette into the drive and restart the computer. 2. If the hard drive is still inaccessible and MBR Security is enabled, try restoring the previously saved MBR image by entering Setup and selecting Security>Restore Master Boot Record.
	System files missing or not properly installed.	<ol style="list-style-type: none"> 1. Insert a bootable system diskette and restart. 2. Verify that the hard drive is partitioned and formatted. 3. Install the system files for the appropriate operating system, if necessary.
	Hard drive boot disabled in Computer Setup.	Run the Computer Setup (F10) Utility and enable the hard drive entry in the Storage>Boot Order list.
Workstation will not start.	Hard drive is damaged.	Replace the hard drive.

Solving display problems

Table 6-4 Display problems

Problem	Cause	Solution
Blank screen (no video).	The cable connections are not correct.	Verify the cable connections from the monitor to the computer and to a working electrical outlet.
	The monitor is off.	Turn the monitor on (LED is on). You might need to refer to the monitor manual for an explanation of LED signals.
	Screen blanking utility installed or energy saver features enabled.	Press a key or the mouse button and, if set, enter your password.
	System ROM is bad; system is running in FailSafe Boot Block mode (indicated by 8 beeps).	Reflash the ROM using a SoftPaq.
	Fixed-sync monitor does not sync at the resolution specified.	Verify that the monitor can accept the same horizontal scan rate as the resolution specified.
	Computer is in Hibernate mode.	Press the power button to resume from Hibernate mode.
	Workstation monitor settings are not compatible with the monitor.	<ol style="list-style-type: none"> 1. When you see Press F8 in the bottom-right corner of the screen, restart the computer and press F8 during startup. 2. Using the keyboard arrow keys, select Enable VGA Mode and then press Enter. 3. For Windows, double-click the Display icon in the Control Panel and then select the Settings tab. 4. Use the sliding control to reset the resolution.
The display works properly during the POST but goes blank when the operating system starts.	The display settings in the operating system are incompatible with your graphics card and monitor.	<ol style="list-style-type: none"> 1. For Windows, restart your computer in VGA mode. 2. After the operating system starts, change the display settings to match those supported by your graphics card and monitor. 3. Refer to your operating system and graphics card documentation for information about changing display settings.
Power LED flashes red 6 times (once every second), followed by a 2-second pause, and then the computer beeps 6 times.	Prevideo graphics error.	<p>For systems with a graphics card:</p> <ol style="list-style-type: none"> 1. Reseat the graphics card. 2. If the card requires external power, make sure the power cable is properly connected. 3. Replace the graphics card. 4. Replace the system board.
Monitor does not function when used with Energy Saver features.	Monitor without Energy Saver capabilities is being used with Energy Saver features enabled.	Disable the monitor Energy Saver feature.

Table 6-4 Display problems (continued)

Problem	Cause	Solution
Dim characters	The brightness and contrast controls are not set properly.	Adjust the monitor brightness and contrast controls.
	Cables are not properly connected.	Verify that the graphics cable is connected to the graphics card and the monitor.
Blurry video or requested resolution cannot be set.	If the graphics controller was upgraded, the correct video drivers might not be loaded.	Install the video drivers included in the upgrade kit, or download and install the latest drivers for your graphics card from http://welcome.hp.com/country/us/en/support.html .
	Monitor cannot display requested resolution.	Change the requested resolution.
The picture is broken up, rolls, jitters, or flashes.	The monitor connections might be faulty, or the monitor might be incorrectly adjusted.	<ol style="list-style-type: none"> 1. Be sure the monitor cable is securely connected to the computer. 2. In a multiple CRT monitor system, ensure that the monitors' electromagnetic fields are not interfering with each other. Move them apart if necessary. 3. Move fluorescent lights or fans that are too close to the CRT monitor.
	Monitor must be degaussed.	Degauss the monitor.
Vibrating or rattling noise coming from inside a CRT monitor when powered on.	Monitor degaussing coil has been activated.	None. It is normal for the degaussing coil to be activated when the monitor is powered on.
Clicking noise coming from inside a CRT monitor.	Electronic relays have been activated inside the monitor.	None. It is normal for some monitors to make a clicking noise when turned on and off, when going in and out of Standby mode, and when changing resolutions.
High pitched noise coming from inside a flat-panel monitor.	Brightness and contrast settings are too high.	Lower brightness and contrast settings.
Fuzzy focus; streaking, ghosting, or shadowing effects; horizontal scrolling lines; faint vertical bars; or unable to center the picture on the screen (flat-panel monitors using an analog VGA input connection only.)	Flat-panel monitor's internal digital conversion circuits might be unable to correctly interpret the output synchronization of the graphics card.	<ol style="list-style-type: none"> 1. Select the monitor's Auto-Adjustment option in the monitor's onscreen display menu. 2. Manually synchronize the Clock and Clock Phase onscreen display functions. 3. Download SoftPaq SP22333 to assist with the synchronization).
Some typed symbols do not appear correctly.	The font you are using does not support that symbol.	<p>Use the Character Map to locate and select the appropriate symbol.</p> <p>Select Start>All Programs> Accessories>System Tools>Character Map. You can copy the symbol from the Character Map into a document.</p>

Solving audio problems

Table 6-5 Audio problems

Problem	Cause	Solution
Sound does not come out of the speaker or headphones.	Software volume control is turned down.	Double-click the Speaker icon on the taskbar and use the volume slider to adjust the volume.
	The external speakers are not turned on.	Turn on the external speakers.
	External speakers plugged into the wrong audio jack.	See your sound card documentation for proper speaker connection.
	Digital CD audio is not enabled.	Enable digital CD audio: <ol style="list-style-type: none"> 1. From the Control Panel, select System. 2. On the Hardware tab, select the Device Manager button. 3. Right-click the CD/DVD device and select Properties. 4. On the Properties tab, select Enable digital CD audio for this CD-ROM device.
Headphones or devices connected to the line-out connector have muted the internal speaker.		Turn on and use headphones or external speakers, if connected, or disconnect headphones or external speakers.
	Volume is muted.	<ol style="list-style-type: none"> 1. From the Control Panel, select Sound, Speech and Audio Devices, and then select Sounds and Audio Devices. 2. Deselect the Mute checkbox.
Noise or no sound comes out of the speakers or headphones.	Computer is in Standby mode.	Press the power button to resume from Standby mode.
		<ol style="list-style-type: none"> 1. If you are using digital speakers that have a stereo jack and you want the system to autoswitch to digital, use a stereo-to-mono adapter to engage the auto sense feature, or use multimedia device properties to switch the audio signal from analog to digital. 2. If the headphones have a mono jack, use the multimedia device properties to switch the system to analog out. <p>NOTE: If you set digital as the Output Mode, the internal speaker and external analog speakers no longer output audio until you switch back to an auto sense or analog mode.</p> <p>If you set analog as the Output Mode, external digital speakers do not function until you change the output mode back to an auto-sense or digital mode.</p>

Table 6-5 Audio problems (continued)

Problem	Cause	Solution
Sound occurs intermittently.	Processor resources are being used by other open applications.	Shut down all open processor-intensive applications.
Workstation appears to be locked up while recording audio.	The hard disk might be full.	<ol style="list-style-type: none"> 1. Before recording, be sure there is enough free space on the hard disk. 2. Try recording the audio file in a compressed format.

Solving printer problems

Table 6-6 Printer problems

Problem	Cause	Solution
Printer does not print.	Printer is not turned on and online.	Turn the printer on and be sure it is online.
	The correct printer driver for the application is not installed.	<ol style="list-style-type: none"> 1. Install the correct printer driver for the application. 2. Try printing using the MS-DOS command: DIR C:\> [printer port] Replace <i>printer port</i> with the address of the printer used. If the printer works, reload the printer driver.
	If you are on a network, you might not have made a connection to the printer.	Make the proper network connection to the printer.
	Printer might have failed.	Run printer self-test.
Printer does not turn on.	The cables might not be connected properly.	

Self-troubleshooting with HP Vision Diagnostics

Hewlett-Packard Vision Diagnostics is a diagnostic tool that can be used by the end user or technical support personnel to view information about the hardware configuration of the computer and perform hardware troubleshooting on HP Desktop and Workstation systems. This diagnostic tool should be used to help determine hardware failures. Accessible by either CD or USB key, these diagnostics run outside the operating system and so make it easy to isolate potential issues that may be operating system related versus hardware.

HP Vision Diagnostics benefits are:

- Capture complete system configuration information that can be shared as an HTML file, including:
 - System serial number
 - System product number
 - System BIOS revision

- Memory size and configuration
- Processor information
- Storage device information and configuration
- Graphics / audio / communications information and configuration
- And more...
- Comprehensive list of diagnostic test available with new added features:
 - Highly configurable testing options: quick / complete / custom / interactive / non-interactive
 - Specific failing memory DIMM identification
 - Tests video card memory
 - Launches DST Smart tests for both SATA and SAS drives
 - Many other tests and diagnostics
- Diagnostic Failure Code Output – A unique warranty code is generated for each failure which can be used to validate diagnostic use for a specific system
- Easy to use - uses similar user interface as previous field diagnostics, HP Insight Diagnostics
- True End2End diagnostics – same diagnostics modules used in factory
- Easy to obtain
 - Download from Web
 - USB key bootable or CD bootable
 - Included with restore media

It is expected that these Vision diagnostics will be run on supported products when attempting to troubleshoot system issues.

Overview

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

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

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

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

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

Downloading and accessing HP Vision Diagnostics

Follow these steps to download the HP Vision Diagnostics utility from the HP Web site to a DVD or USB, and then use it to perform diagnostics on the computer:

1. Go to <http://www.hp.com>.
2. Select the **Support & Drivers** link.
3. Select the **Download driver and software** radio button.
4. Enter your product number in the text box, and then press **Enter**.
5. Select your operating system.
6. Select the **Diagnostic** link.
7. Locate **HP Vision Diagnostics** and select **Download**.
8. After the `.iso` file is downloaded, use CD-ROM burning software to copy the `.iso` file to an optical medium or USB flash drive.
9. When the CD or USB flash drive has the utility installed, insert the CD or USB flash drive into the computer (while it is on).
10. Shut down the operating system and turn off the computer.
11. Turn on the computer. The system will boot into HP Vision Diagnostics.

 **NOTE:** If the system does not boot to the CD in the optical drive or to the USB flash drive, you may need to change the boot order. You may use the Computer Setup (F10) utility to change the boot order, or you may press F9 to select the appropriate boot device.

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

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

If the computer is booted from a CD, a separate boot CD will be required to use the memory diagnostic. Hence, HP recommends that a USB key be used to boot the diagnostic utilities. It is faster than using a CD, and it accommodates both Memory and Vision diagnostics.

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

Accessing HP Vision Diagnostics on the computer

The following procedures describe how to access the HP Vision Diagnostics utilities that are included in the computer software.

Creating and using a bootable USB key

This section describes how to use a USB key to access the HP Vision Diagnostics.

 **NOTE:** Using a USB key is the most convenient method to access the HP Vision Diagnostics.

1. In the C:\VisionDiagnostics\ directory, double-click on VisionDiagUSB.exe. A setup menu appears.
2. Follow the setup prompts to create a bootable ISO image of the diagnostic utilities on a USB key.
3. Turn off the computer and restart it with the USB key installed. The computer will boot to the USB key and initiate the HP Vision Diagnostics utility.
4. Follow the HP Vision Diagnostic prompts to troubleshoot the computer.

Creating and using a bootable DVD

This section describes how to use a DVD to access the HP Vision Diagnostics.

1. In the C:\VisionDiagnostics\ directory, double-click on the VisionDiagISO.exe file. A setup menu appears.
2. Follow the setup prompts to create a bootable ISO image of the diagnostic utilities on a DVD.
3. Enable the computer to boot from DVD.
4. Turn off the computer and restart it with the DVD installed in the optical drive. The computer will boot to the DVD and initiate the HP Vision Diagnostics utility.
5. Follow the HP Vision Diagnostic prompts to troubleshoot the computer.

Using the HP Memory Test utility

This section describes how to access the HP Memory Test utility.

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

If the computer is booted from a CD, a separate boot CD will be required to use the memory diagnostic. Hence, HP recommends that a USB key be used to boot the diagnostic utilities. It is faster than using a CD, and it accommodates both Memory and Vision diagnostics.

1. In the C:\VisionDiagnostics\ directory, double-click on the MemoryDiagISO.exe file. A setup menu appears.
2. Follow the setup prompts to create a bootable ISO image of the memory diagnostic utility on a DVD.
3. Turn off the computer and restart it with the DVD installed in the optical drive. The computer will boot to the DVD and initiate the memory diagnostic utility.
4. Follow the diagnostic prompts to troubleshoot computer memory.

User interface

The HP Vision Diagnostics application provides six major functions, accessible through Tabs. These functions are:

- **Survey** — Your current system hardware information.
- **Test** — List all diagnostics available for your system. Tests are started there.
- **Status** — This screen shows progress and status of currently running diagnostics.
- **History** — All past diagnostics runs and status are listed there.
- **Errors** — All past diagnostics failures are listed there.
- **Help** — User help about HP Vision Diagnostics.

There are also some common operations that are part of the utility. They include:

- **Exit Diagnostics** button — This button will close HP Vision Diagnostic application and reboot your system. Any running test will be aborted.
- **Reload** button — If available, this button will rescan your system hardware and reload the diagnostics without the need to restart your entire system.
- **Save** button — If available, save your system survey, test history or error data as an HTML file to a floppy disk or a USB key drive.

Survey tab

The Survey tab shows your system hardware information, organized into eleven Categories (for example "Processors") and device instances (for example "Processor 1").

The amount of information displayed can be controlled by selecting a combination of View Level and Category.

The **View Levels** include:

- **Overview** — shows high level summary of the system hardware. This is the default view level.
- **Summary** — gives limited configuration data for each specific Category.
- **Advanced** — offers more technical and low-level data for the computer-savvy user.

The **Categories Levels** include:

- **All** — Shows all Categories.
- **Architecture** — Shows system architecture information such as high level PCI devices, low level SMBIOS, CMOS and PCI configuration space data.
- **Audio** — Shows all embedded and add-on audio devices.
- **Asset Control** — Shows asset control related information such as product name, serial number, asset tag, and universal unique ID information.
- **Communication** — Shows communication devices such as serial, parallel, USB, network, Firewire, modem, and Bluetooth ports and devices.
- **Graphics** — Shows all embedded and add-on video cards.

- **Input Devices** — Shows user input devices such as all connected mice and keyboards.
- **Memory** — Shows system memory information.
- **Miscellaneous** — List any devices or data that doesn't belong to any other Category.
- **Processors** - Shows system processors.
- **Storage** — Shows mass storage devices such as floppy drives, optical drives, SATA, SAS hard disk drives and controllers, as well as any RAID arrays.
- **System** — Shows information about system board devices such as fans and cables.

Test tab

The Test tab lists all available diagnostics. The lists have been tailored according to your system configuration. Individual test may be selected or unselected. The following Test Modes exist:

- **Quick** — This test selection was picked to perform quickly while covering your entire hardware. Test parameters cannot be modified.
- **Complete** — This test selection offers all available tests and may take a long time to complete. Test parameters cannot be modified.
- **Custom** — Like Complete this test selection offers all available tests. The test parameters may be modified to fit specific needs. For advanced users only!

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

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

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

The **Duration of Test** options control the duration of the test sequence. The following options are available:

- **Number of loops** — A test selection will run once by default. Enter a positive number to make a test selection run many times.
- **Total test time (hours:minutes)** — Alternatively, the test selection can be set to run for a specified amount of time. This does not guarantee that all tests will run if the entered time is less than the necessary time to run all the tests
- **Stop at first error**— Check this option to stop test execution as soon as one error is encountered.

The following **Test Controls** exist:

- **Select All, Unselect All** button — This button toggles to select or unselect all the tests from the test selection tree.
- **Expand, Collapse** button — This button toggles to expand or collapse the test selection tree.
- **Start Test** button — Click this button to start executing all selected tests. HP Vision Diagnostics will automatically switch to the Status tab in order to keep track of the test execution and status.

 **WARNING!** Once started, do not reboot or power off your computer until all the tests have been completed.

To begin testing:

1. Select the Test tab.
2. Select the type of tests you want to run: **Quick**, **Complete**, or **Custom**.
3. Include optional interactive tests by selecting **Include interactive tests**.

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

Status tab

The Status tab shows the overall progress and status of the test scenario as well as the progress and status of each test. The color coded status are black, blue, green, red, and orange.

The Status tab colors are:

- **Waiting** (black) — when no test is running
- **Running** (blue) — when at least one test is currently running
- **Passed** (green) — when all tests have run successfully, meaning that no hardware error or defect was detected
- **Failed** (red) — when the tests have detected at least one error with your system
- **Canceled** (orange) — when the test scenario has been explicitly canceled, in which case no pass or fail conclusion can be drawn

The available data is:

- **Current Loop** — Shows the current execution loop out of total number of loops specified in the Test panel.
- **Test Time** — Shows the total time elapsed since the beginning of the test execution.
- **Test Complete** — Shows the number of tests successfully completed out of the total number of test to execute.
- **Cancel** button — Push the Cancel button to immediately terminate all currently running tests.

History tab

The History tab shows the history of the past test executions.

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

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

Errors tab

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

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

- The Device section displays the device tested.
- The Test section displays the type of test run.
- The Times Failed is the number of times the device has failed a test.
- The Defect Code provides a numerical code for the failure. The error codes are defined in the Help tab.
- The Description section describes the error that the diagnostic test found.

- The Reason section describes the likely cause of the error.
- The Recommended Repair will give a recommended action that should be performed to resolve the failed hardware.
- The Warranty ID is a unique error code associated with the specific error on your computer. When contacting the HP Support Center for assistance with a hardware failure, please be prepared to provide the Warranty ID.
- The Clear Errors button will clear the contents of the Error Log.

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

Help tab

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

The various sections located here are:

- The Vision Help section contains information on the major functions of HP Vision Diagnostics.
- The Test components section provides a description of each test, as well as the parameters that may be adjusted when running in Custom test mode.
- The Defect codes section contains information on the numerical error code that may appear in the Errors tab.
- The Memory test tab section provides information on the HP Memory Test application that may be launched from the boot menu.
- The HP Support section provides information on obtaining technical support from HP.

Saving and printing information in HP Vision Diagnostics

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

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

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

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

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

Diagnostic codes and errors

This section presents information about diagnostic LED codes, LED color definitions, and POST error messages to help you troubleshoot problems.

Diagnostic LED and audible (beep) codes

This section describes the front panel LED error and operation codes as well as the audible codes that might occur before or during the POST.

Table 6-7 Diagnostic lights and audible codes

Activity	Possible cause	Recommended action
Blue Power LED* on. No beeps.	Computer on.	
Blue Power LED* blinks every two seconds.* No beeps.	Computer in Sleep mode (S3-Suspend to RAM). Select models only.	
Blue Power LED* is off.* No beeps.	Computer in Hibernate mode (S4-Suspend to disk) or system is off (S5).	
Blue Power LED* blinks three times*, once per second.* No beeps.	Computer in Sleep mode (S3-Suspend to RAM). Select models only.	N/A
Blue Power LED* blinks four times*, once per second.* No beeps.	Computer in Hibernate mode (S4-Suspend to disk).	

*User-selectable. See [The Computer Setup \(F10\) Utility menu on page 30](#) for details.

Table 6-7 Diagnostic lights and audible codes (continued)

Activity	Possible cause	Recommended action
<p>For the following LED activity and beeps, the beeps are heard through the chassis speaker. Blinks and beeps repeat for 5 cycles, after which, only the blinks continue to repeat.</p>		
<p>Red Power LED blinks two times, once every second, followed by a two-second pause. Two beeps.</p>	<p>CPU thermal protection activated by either of the following methods:</p> <ul style="list-style-type: none"> • A fan might be blocked or not turning. • The heatsink and fan assembly is not properly attached to the CPU. 	<p>CAUTION: Internal components might be powered even when the computer is off. To prevent damage, disconnect the computer power cord before you remove a component.</p> <ol style="list-style-type: none"> 1. Ensure that the computer air vents are not blocked and the cooling fan is running. 2. Open the access panel, press power button, and verify that the CPU fan is spinning. If the CPU fan is not spinning, make sure the fan cable is plugged into the computer board header. Ensure the fan is fully and properly seated or installed. 3. If fan is plugged in and seated properly, but is not spinning, the problem might be in the CPU fan. Contact HP for assistance. 4. Verify that the fan assembly is properly attached. If problems persist, there might be a problem with the CPU heatsink. Contact HP for assistance.
<p>Red Power LED blinks three times, once every second, followed by a two-second pause. Three beeps.</p>	<p>CPU not installed (not an indicator of bad CPU).</p>	<ol style="list-style-type: none"> 1. Verify that the CPU is present. 2. Reseat the CPU.
<p>Red Power LED blinks four times, once every second, followed by a two-second pause. Four beeps.</p>	<p>Power failure (power supply is overloaded)</p>	<p>CAUTION: Internal components might be powered even when the computer is off. To prevent damage, disconnect the computer power cord before you remove a component.</p> <ol style="list-style-type: none"> 1. Open the access panel and ensure that all power connections (24-pin Main, 4-pin CPU) are secure on the system board. 2. Check if a device is causing the problem by removing all attached devices (such as hard, diskette, or optical disk drives, and expansion cards.) Power on the computer. If the system enters the POST, power off and replace one device at a time; repeat this procedure until failure occurs. Replace the device that is causing the failure. Continue adding devices one at a time to ensure all devices are functioning properly.
<p>Red Power LED blinks five times, once every second, followed by a two-second pause. Five beeps.</p>	<p>Pre-video memory error</p>	<p>CAUTION: Internal components might be powered even when the computer is off. To prevent damage, disconnect the computer power cord before you remove a component.</p> <ol style="list-style-type: none"> 1. Reseat DIMMs. 2. Replace DIMMs one at a time to isolate faulty module. 3. Replace third-party memory with HP memory. 4. The problem might be on the system board. Contact HP for assistance.

Table 6-7 Diagnostic lights and audible codes (continued)

Activity	Possible cause	Recommended action
Red Power LED blinks six times, once every second, followed by a two-second pause. Six beeps.	Pre-video graphics error.	<p>CAUTION: Internal components might be powered even when the computer is off. To prevent damage, disconnect the computer power cord before you remove a component.</p> <ol style="list-style-type: none"> 1. Reseat the graphics card. 2. Verify the graphics auxiliary power cable is connected (if applicable). 3. The problem might be on the graphics card. Contact HP for assistance.
Red Power LED blinks seven times, once every second, followed by a two-second pause. Seven beeps.	System board failure (ROM detected failure prior to video).	<ol style="list-style-type: none"> 1. Clear CMOS. <p>NOTE: Refer to the <i>Maintenance and Service Guide</i> for the computer model for detailed information on clearing CMOS.</p> 2. The problem might be on the system board. Contact HP for assistance.
Red Power LED blinks eight times, once every second, followed by a two-second pause. Eight beeps.	Invalid ROM based on bad checksum.	<p>CAUTION: Internal components might be powered even when the computer is off. To prevent damage, disconnect the computer power cord before you remove a component.</p> <ol style="list-style-type: none"> 1. Clear CMOS. <p>NOTE: Refer to the <i>Maintenance and Service Guide</i> for the computer model for detailed information on clearing CMOS.</p> 2. Upgrade the ROM using SoftPaq, either from the hard disk drive, CD, diskette, or USB removable device (for example, HP Drive Key). See the ROM Flash section of the <i>Maintenance and Service Guide</i> at http://www.hp.com/support/workstation_manuals. SoftPaq is a self-extracting executable, which contains instructions for its use, that enables you to upgrade the ROM. To download the Softpaq executable, visit http://www.hp.com/go/workstationsupport. 3. The problem might be on the system board. Contact HP for assistance.
Red Power LED blinks nine times, once every second, followed by a two-second pause. Nine beeps.	System powers on but does not start.	<ol style="list-style-type: none"> 1. The problem might be on the system board. Contact HP for assistance. 2. The problem might be in the CPU. Contact HP for assistance.

Table 6-7 Diagnostic lights and audible codes (continued)

Activity	Possible cause	Recommended action
System does not power-on and LEDs are not blinking. No beeps.	System unable to power on.	<p>CAUTION: Internal components might be powered even when the computer is off. To prevent damage, disconnect the computer power cord before you remove a component.</p> <p>To resolve the problem, choose one of the following options:</p> <p>Press and hold the power button for less than 4 seconds. If the hard disk drive LED turns green, then:</p> <ol style="list-style-type: none">1. Remove the expansion cards one at a time and try holding the power button again for less than 4 seconds.2. The problem might be on the system board. Contact HP for assistance. <p>Press and hold the power button for less than 4 seconds. If the hard disk drive LED does not turn on green then:</p> <ol style="list-style-type: none">1. Check that unit is plugged into a working AC outlet.2. Open the access panel and check that the power button harness is properly connected to the system board.3. Check that all power supply cables are properly connected to the system board.

* The BIOS option you select controls the blue LED function during these suspend modes.

LED color definitions

The following table describes what each LED light on the computer front panel signifies.

Table 6-8 LED color definitions

LED state	LED color	System status
Solid	Blue	System is on.
Flashing	Blue	System is in Standby.
Solid or flashing	Red	System has experienced an error. (See POST error messages on page 167.)
None	No light	System is in Hibernate, or is off.

POST error messages

The Power-On Self Test (POST) is a series of diagnostic tests that runs automatically when the computer is powered on.

Audible and visual messages occur before the operating system starts if the POST encounters a problem. POST checks the following items to ensure that the computer system is functioning properly:

- Keyboard
- DIMMs
- Diskette drives
- All mass storage devices
- CPUs
- Controllers
- Fans
- Temperature sensors
- Cables (front/rear panels, audio, and USB ports)

The table shown next describes the POST error messages.

Table 6-9 POST error messages

Screen message	Probable cause	Recommended action
101—Option ROM Checksum Error	System ROM checksum.	Verify that you have the latest ROM: <ol style="list-style-type: none">1. Flash the ROM, if needed.2. If an expansion card was recently added, remove it to find out if the problem remains.3. Clear CMOS. If the message disappears, there might be a problem with the expansion card.4. Replace the system board.
102—System Board Failure	DMA, timers, and so forth, might be set improperly or might be defective.	<ol style="list-style-type: none">1. Clear the CMOS.2. Remove the expansion boards.3. Replace the system board.
110—Out of memory space for option ROMs	Option ROM for a device could not run because of memory constraints.	Run the Computer Setup (F10) Utility to disable unneeded option ROMs, and to enable ACP1/USB Buffers at Top of Memory.
162—Systems Options Error		
163—Time and Date Not Set	<ul style="list-style-type: none">• Invalid time or date in configuration memory.• RTC battery might need replacement.• CMOS jumper might not be properly installed.	<ol style="list-style-type: none">1. Set the date and time from the Control Panel or in the Computer Setup (F10) Utility (depending on the operating system).2. If the problem persists, replace the RTC battery.

Table 6-9 POST error messages (continued)

Screen message	Probable cause	Recommended action
164—Memory Size Error	Memory configuration is incorrect.	<ol style="list-style-type: none">1. Run the Computer Setup (F10) Utility or the Windows utilities.2. Verify that the memory modules are installed properly.3. If third-party memory has been added, test the memory configuration using HP memory.4. Verify the memory module type.
201—Memory Error	RAM failure.	<ol style="list-style-type: none">1. Run the Computer Setup (F10) utility or the Windows utilities.2. Be sure that memory modules are installed correctly.3. Verify the memory module type.4. Remove and replace memory modules one at a time to isolate faulty modules.5. Replace faulty memory modules.6. If the error persists after replacing memory modules, replace the system board.
202—Memory Type Mismatch	Memory modules do not match.	Replace the memory modules with matched sets.
203—Memory module failed self-test and failing rank was disabled	Defective memory module.	Replace the memory module.
204—Memory module failed and user rank was disabled	Improper module load.	Reseat the memory module correctly.
205—Memory high temperature detected	Insufficient memory module cooling.	Verify that a memory module cooling fan is installed and operating.
206—Memory setup invalid	Memory configured incorrectly.	Reconfigure the memory modules in the proper slots.
207—Incompatible DIMMs detected	DIMMs are installed that do not fulfill system requirements.	<ol style="list-style-type: none">1. Verify that the memory module type matches computer requirements.2. Insert the DIMM in the proper memory socket.3. Replace the DIMM if the problem persists.
208—Mismatched DIMMs detected	Installed DIMMs are improperly matched.	Verify that matching DIMMs are installed.
209—Memory warning condition detected	Incorrect memory module type in use.	Verify that the memory modules are compatible with computer requirements.
212—Failed Processor 0	Processor has failed to initialize.	<ol style="list-style-type: none">1. Reseat the processor in its socket.2. If the processor does not respond, replace it.3. Replace the system board.

Table 6-9 POST error messages (continued)

Screen message	Probable cause	Recommended action
213—Incompatible Memory Modules	A memory module in the memory socket identified in the error message is missing critical SPD information, or is incompatible with the chipset.	<ol style="list-style-type: none"> 1. Verify the memory module type. 2. Insert the DIMM in another memory socket. 3. Replace the module with a DIMM conforming to the SPD standard.
214—DIMM Configuration Warning	DIMMs are not installed correctly (not paired correctly).	See the service label on the computer access panel for the correct memory configurations, and reseal the DIMMs accordingly.
215—DIMM Configuration Error		
216—Memory Size Exceeds Maximum Supported	The amount of memory installed exceeds that supported by the hardware.	<ol style="list-style-type: none"> 1. Verify how much memory the computer supports. 2. Remove the excess memory.
301—Keyboard Error	Keyboard failure.	<ol style="list-style-type: none"> 1. Reconnect the keyboard with the computer powered off. 2. Check the connector for bent or missing pins. 3. Be sure that none of the keys are pressed. 4. Replace the keyboard.
303—Keyboard Controller Error	I/O board keyboard controller is defective or is not set properly.	<ol style="list-style-type: none"> 1. Reconnect the keyboard with the computer powered off. 2. Connect a keyboard directly to the computer (instead of through a switch box). 3. Replace the system board.
304—Keyboard or System Unit Error	Keyboard failure.	<ol style="list-style-type: none"> 1. Reconnect the keyboard with the computer powered off. 2. Connect a keyboard directly to the computer (instead of through a switch box). 3. Be sure that none of the keys are pressed. 4. Replace keyboard. 5. Replace system board.
510—Splash Screen image corrupted	Splash Screen image has errors.	Update system BIOS.
511—CPU Fan not detected	Fan is not connected or is defective.	<ol style="list-style-type: none"> 1. Reseat the fan cable. 2. Reseat the fan. 3. Replace the fan.
512—Chassis fan not detected	Fan missing, disconnected, or defective.	<ol style="list-style-type: none"> 1. Reseat the fan cable. 2. Reseat the fan. 3. Replace the fan.

Table 6-9 POST error messages (continued)

Screen message	Probable cause	Recommended action
513—Front Chassis fan not detected	Front fan missing, disconnected, or defective.	<ol style="list-style-type: none"> 1. Reseat the fan cable. 2. Reseat the fan. 3. Replace the fan.
514—Memory fan not detected	Memory fan missing, disconnected, or defective.	<ol style="list-style-type: none"> 1. Reseat the fan cable. 2. Reseat the fan. 3. Replace the fan.
515—CPU Overtemp occurred	Insufficient processor cooling or processor defect.	<ol style="list-style-type: none"> 1. If necessary, add a heatsink to the processor and ensure proper operation. 2. Replace the processor.
516—Chipset fan not detected	Chipset fan missing, disconnected, or defective.	<ol style="list-style-type: none"> 1. Reseat the fan cable. 2. Reseat the fan. 3. Replace the fan.
517—Low power CPU heatsink(s) detected for high power CPUs	Inadequate heatsink is installed.	Replace the low power heatsink with a high power heatsink.
518—Power supply wattage insufficient for hardware configuration	Computer configuration requires more power than the power supply can provide.	<ol style="list-style-type: none"> 1. Reduce the computer power consumption. 2. Replace the power supply with a high output power supply.
601—Diskette Controller Error	Diskette controller circuitry or diskette drive circuitry incorrect.	<ol style="list-style-type: none"> 1. Run the Computer Setup (F10) utility. 2. Verify cabling and replace defective cables if necessary. 3. Clear CMOS. 4. Replace the diskette drive. 5. Replace the system board.
605—Diskette Drive Type Error	Mismatch in drive type.	<ol style="list-style-type: none"> 1. Run the Computer Setup (F10) Utility. 2. Disconnect any other diskette controller devices (tape drives). 3. Clear the CMOS.
610—External Storage Device Failure	External storage device is not detected, is improperly connected, or is defective.	<ol style="list-style-type: none"> 1. Verify that the external device is present and connected properly. 2. Replace the external device.
611—Primary Floppy Port Address Assignment Conflict	The flexible disk drive is configured at a previously assigned address.	Select a new address for the flexible disk drive.
912—Computer Cover Has Been Removed Since Last System Start Up	N/A	No action required.

Table 6-9 POST error messages (continued)

Screen message	Probable cause	Recommended action
914—Hood Lock Coil is not Connected	Mechanism is missing or is not connected.	<ol style="list-style-type: none"> 1. Reconnect or replace the missing mechanism. 2. Reseat or replace the missing mechanism cable.
916—Power Button Not Connected	Power button cable is disconnected from the system board.	Reconnect the cable and restart.
917—Front Audio Not Connected	Front Audio mechanism is missing or is not connected.	<ol style="list-style-type: none"> 1. Replace or reconnect the missing front audio mechanism to the system board. 2. Reseat or replace the missing mechanism cable.
918—Front USB Not Connected	Front USB mechanism is missing or is not connected.	<ol style="list-style-type: none"> 1. Replace or reconnect the missing Front USB mechanism to the system board. 2. Reseat or replace the missing mechanism cable.
919—Multi-Bay Riser Not Connected	Multi-Bay riser mechanism is missing or is not connected.	<ol style="list-style-type: none"> 1. Replace or reconnect the missing Multi-Bay mechanism to the system board. 2. Reseat or replace the missing mechanism cable.
920—Fatal error on QPI link X	Fatal error detected on QPI link x, where x is 0 or 1. This type of error is identified on the line following the error message.	Potential system board problem; contact HP Support.
921—Fatal error on QPI Protocol link X	Fatal error detected in QPI link x protocol, where x is 0 or 1. This type of error is identified on the line following the error message.	Potential system board problem; contact HP Support.
922—Fatal error on PCIe slot X	Fatal error occurred in the designated slot.	Move the card to a different slot. If the problem persists, replace the card.
923—Fatal error on ESI port 0	A fatal error occurred on ESI port 0.	Verify that the ESI port device is connected and working properly.
924—Fatal error on IOH core X	Fatal error detected on IOH core x, where x is 0 or 1. This type of error is identified on the line following.	Potential system board problem; contact HP Support.
925—Fatal error on IOH miscellaneous	Fatal miscellaneous error detected on IOH core x, where x is 0 or 1.	Potential system board problem; contact HP Support.
926—Fatal error on IOH Vtd	Fatal error detected in the Intel Virtualization Technology.	Potential system board problem; contact HP Support.
927—Fatal error on DIMM in slot CPU X DIMM Y	Fatal multibit ECC error detected on the DIMM in the slot labeled DIMM x (where x is 1 - 4), as labeled on the system board.	Replace the DIMM in the identified slot.
928—Fatal machine check detected on CPU X		Contact HP support.

Table 6-9 POST error messages (continued)

Screen message	Probable cause	Recommended action
1720—SMART Hard Drive Detects Imminent Failure	Hard drive is about to fail. (Some hard disk drives have a firmware patch that fixes erroneous error messages.)	<ol style="list-style-type: none"> 1. Determine if the hard disk drive is giving a correct error message. 2. Run the Drive Protection System test (if applicable). 3. Apply firmware patch (if applicable). See http://www.hp.com/support. 4. Back up contents and replace the hard disk drive.
1783—Fixed Disk 0/1 locked	Hard disk drive failure.	Diagnose the hard disk drive, and replace it if necessary.
1796—SATA Cabling Error	Missing or improperly attached cable.	Verify that a cable is attached. Reattach the cable.
1797—SATA Drivelock is not supported in RAID mode	SATA Drivelock is not supported in RAID mode.	Disable RAID mode, or disable SATA drivelock..
1801—Microcode Update Error	Unknown or unsupported processor stepping.	The microcode update failed. Check the processor stepping to ensure it is a supported stepping. If it is contact, HP Support.
1802—Processor Not Supported	The system board does not support the processor.	Replace the processor with a compatible one.
1803—Processor feature set is insufficient for current system settings	Processor feature set is insufficient for current system settings. The BIOS settings do not match the support provided by the processor	Change the BIOS settings or upgrade the processor.
1804—A processor feature and the memory configuration are incompatible	A processor feature is incompatible with the memory configuration.	Restore the previous memory configuration.
ERROR: Invalid 1394 GUID (Invalid electronic serial number)	No electronic serial number is stored with the system.	To assign a serial number , select Security>System IDs in the Computer Setup (F10) Utility.
ERROR: Invalid electronic serial number (no number)	No electronic serial number is stored with the system	To assign a serial number , select Security>System IDs in the Computer Setup (F10) Utility.
ERROR: An unsupported processor is installed. System halted	Unsupported processor detected.	Replace the processor.
ERROR: A processor requiring too much power is installed. System halted	Unsupported processor detected.	Replace the processor.
Invalid electronic serial number	Incorrect serial number registered in the system.	To assign a serial number , select Security>System IDs in the Computer Setup (F10) Utility.
Network Server Mode Active and No Keyboard Attached	Keyboard not detected.	Verify that a functioning keyboard is attached to the computer.
Processor initialization fails	Processor defective.	Replace the processor.

7 Configuring RAID devices

This chapter describes how to configure SATA RAID devices on all Z series computers and includes these topics:

Topics

[Maximum hard drive configurations on page 173](#)

[Configuring SATA RAID devices on page 174](#)

For additional information about configuring RAIDs, see http://www.hp.com/support/RAID_FAQs. For information about preparing the computer for RAID configuration, see http://www.hp.com/support/workstation_manuals.

Maximum hard drive configurations

This section lists the maximum number of hard drives supported on HP computers for RAID configurations.

 **NOTE:** This section applies to internal computer configurations that do not use add-in cards and JBODs.

 **TIP:** Use the table values to determine computer-specific maximum number of hard drives as discussed the sections below.

Table 7-1 Maximum hard drives

Workstation	SATA hard drive	SATA SFF* hard drive
Z800	5	6
Z600	3	4
Z400	4	4
Z200	3	0
Z200 SFF	2	2

* Small form factor hard drive

Configuring SATA RAID devices

This section describes how to use the Intel® Rapid Storage Manager option ROM Configuration utility to set up and manage SATA RAID volumes.

The following SATA RAID configurations are supported on this computer:

- Up to the computer-specific maximum number of internal SATA hard disk drives and eSATA drives (if you use an optional eSATA bulkhead cable)
- Intel Rapid Storage Manager (IRSM) for Windows

If only a single HDD is attached, the Intel Rapid Storage Manager option ROM does not execute. Associated messages are not displayed.

The Intel SATA AHCI BIOS executes when you select **RAID+AHCI** for the SATA emulation mode. This BIOS is only used to support serial-attached optical drives.

This section does not apply to configuring SATA RAID in the Linux environment. For Linux SATA RAID, refer to the Software RAID in Linux Workstations section in the *HP Workstations for Linux User Guide* at http://www.hp.com/support/linux_user_manual.

Attaching SATA HDDs

Attach the required minimum number of SATA hard drives for the desired RAID level:

- RAID 0: two or more hard drives
- RAID 1: only two hard drives
- RAID 5: three or more hard drives (for computers that support three or more hard drives)

Configuring system BIOS

Configure the system BIOS to enable embedded SATA RAID functionality.

1. To enter the system BIOS setup, press **F10**.
2. Use the arrow keys to highlight the desired language, and then press **Enter**.
3. Use the arrows to highlight **Storage>Storage Options**, and then press **Enter**.
4. Use the up or down arrow key to highlight **SATA Emulation**.
5. Use the left or right arrow key to select **RAID+AHCI**.
6. To accept the new setting, press **F10**.
7. Use the arrows to highlight **Advanced>Power-On Options**, and then press **Enter**.
8. Use the up or down arrow key to highlight **POST Messages**.
9. Use the left or right arrow key to select **Enable**.
10. To accept the new setting, press **F10**.
11. Use the arrow keys to highlight **Advanced>Device Options**, and then press **Enter**.
12. Use the up or down arrow key to highlight **SATA RAID Option ROM Download**, and then press **Enter**.
13. Use the left or right arrow key to select **Enable**.
14. To accept the new setting, press **F10**.
15. Use the arrows to highlight **File>Save Changes and Exit**, and then press **Enter**.
16. Press **F10** when prompted.

Creating RAID volumes

To create RAID volumes, use the Intel Rapid Storage Manager option ROM Configuration utility.

1. To enter the Intel Rapid Storage Manager option ROM Configuration utility, press **Ctrl+I** when prompted.
2. If required, refer the computer *Maintenance and Service Guide* to make available enough physical drives to create the RAID volume.
3. Use the up or down arrow key to highlight **1. Create RAID Volume**, and then press **Enter**.
4. Type the desired RAID volume name in the Name: field, and then press **Tab**.
5. Use the up or down arrow key to select the RAID level in the RAID Level: field, and then press **Tab**.
6. If three or more hard drives are installed (for workstations that support three or more hard drives):
 - a. Press **Enter** to display the Select dialog.
 - b. Use the up and down arrow keys and Space to mark individual physical as members of the volume.
 - c. Press **Enter** to exit the Select dialog and return to the Create Volume Menu dialog.
7. If appropriate, use the up or down arrow key to select the Strip Size in the Strip Size: field, and then press **Tab**.
8. Enter the desired volume size in the Capacity: field, and then press **Tab**.
9. Press **Enter** to initiate volume creation.
10. When prompted, press **Y** to acknowledge the warning message and create the volume.
11. Use the up or down arrow key to highlight **5. Exit**, and then press **Enter**.
12. Press **Y** when prompted to confirm the exit.

8 Configuring password security and resetting CMOS

This chapter describes how to configure password security and to reset CMOS, and includes these topics:

- [Preparing to configure passwords on page 177](#)
- [Resetting the password jumper on page 178](#)
- [Clearing and Resetting the CMOS on page 178](#)

Preparing to configure passwords

The Computer Setup (F10) Utility enables you to create setup and power-on passwords.

There are three possibilities for setting passwords:

- Define a setup password only
- Define a power-on password only
- Define both

When defining a setup password only, you cannot enter the setup utility without the password.

No password is needed to boot from power-on.

When defining a power-on password only, the power-on password is needed to enter F10 Setup or to boot from power-on.

When defining both, the setup password is needed to enter F10 setup and can be used to boot from power-on.

The power-on password cannot be used to enter the F10 Setup Utility, but it can be used to boot from power-on.

One of the passwords will be required to boot from power on.

After you create both passwords, you can use the setup password in place of the power-on password as an override to log into the computer (a useful feature for a network administrator).

 **NOTE:** You can only clear the passwords with the password jumper. Clearing CMOS does not clear the passwords.

 **CAUTION:** Before pressing the Clear CMOS button, back up your computer CMOS settings.

Pressing the Clear CMOS button resets CMOS values to factory defaults and erases customized information, including asset numbers and special settings.

To back up the CMOS settings, run the Computer Setup (F10) Utility and select **Save to Diskette** from the File menu.

Resetting the password jumper

Use the following procedure to disable the power-on or setup password features and clear the power-on and setup passwords.

-
- ⚠ **WARNING!** To reduce the risk of personal injury from electrical shock and hot surfaces, be sure to disconnect the power cord from the wall outlet and allow the internal system components to cool before touching.
-
- ⚠ **CAUTION:** When the computer is plugged in, the power supply has voltage applied to the system board, even when the computer is turned off. Failure to disconnect the power cord can result in damage to the system.
-
- ⚠ **CAUTION:** Static electricity can damage the electronic components of the computer or optional equipment. Before beginning these procedures, be sure that you are discharged of static electricity by briefly touching a grounded metal object.
1. Shut down the operating system, power off the computer and external devices, and disconnect the computer power cord and external devices from power outlets.
 2. Disconnect the keyboard, monitor, and other external devices that are connected to the computer.
 3. Remove the access panel.
 4. Locate the password header and jumper.
The password header is E49. The password jumper is green so it can be easily identified.
 5. Verify that the AC power cord is disconnected from the power outlet.
 6. Remove the jumper from pins 1 and 2.
 7. Replace the access panel.
 8. Reconnect the external equipment.
 9. Reconnect AC power to the computer.
 10. Power on the computer.
 11. Wait for the workstation to display the HP splash screen.
 12. Repeat steps 1 through 5.
 13. Replace the jumper from pins 1 and 2.
 14. Repeat steps 7 through 10.
 15. Wait for the workstation to boot to the F10 (Setup) Utility.
 16. Use the F10 (Setup) Utility to create new passwords.

Clearing and Resetting the CMOS

This section describes the steps necessary to successfully clear and reset the CMOS. The CMOS of the computer stores password information and information about the computer configuration.

Using the CMOS Button

To clear CMOS using the Clear CMOS button, use the following procedure:

△ **WARNING!** To reduce the risk of personal injury from electrical shock and hot surfaces, disconnect the power cord from the wall outlet and allow the internal system components to cool before touching.

△ **CAUTION:** When the computer is plugged in, the power supply has voltage applied to the system board, even when the computer is powered off. Failure to disconnect the power cord can result in damage to the system.

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

1. Shut down the operating system, power off the computer and any external devices, and then disconnect the computer power cord and external devices from power outlets.
2. Disconnect the keyboard, monitor, and other external devices that are connected to the computer.
3. Remove the access panel.

△ **CAUTION:** Before pressing the Clear CMOS button, back up your computer CMOS settings.

Pressing the Clear CMOS button resets CMOS values to factory defaults and erases customized information, including asset numbers and special settings.

To back up the CMOS settings, run the Computer Setup (F10) Utility and select **Save to Diskette** from the File menu.

4. Locate, press, and hold the CMOS button for five seconds.

 **NOTE:** Verify that the AC power cord is disconnected from the power outlet.

The CMOS button does not clear CMOS if the power cord is connected.

For assistance locating the CMOS button and other system board components, see the system board layout in the **Replacing components** section.

5. Replace the access panel.
6. Reconnect external devices.
7. Plug in and power on the computer. The system boots to a F1 prompt and displays a message that the date/time has changed and that system options have changed.
8. Press F1. The system shuts down for three seconds and then powers back on.
9. Use the F10 (Setup) Utility to reset the date and time.

Using the Computer Setup (F10) Utility to Reset CMOS

1. Access the Computer Setup (F10) Utility menu.
2. When the Computer Setup message appears in the lower-right corner of the screen, press **F10**, and then press **Enter** to bypass the title screen, if necessary.

If you do not press **F10** while the message is displayed, the computer must be rebooted to access this utility.

3. From the Computer Setup (F10) Utility menu, select **File>Default Setup**.

This restores the settings that include boot sequence order and other factory settings. However, it does not force hardware rediscovery.

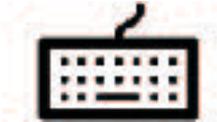
4. Choose **Restore Factory Settings as Default**, and then press **F10** to accept.

5. Select **File->Apply Defaults and Exit**, and then press **F10** to accept.

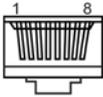
6. Reset the computer passwords and configuration information, such as the system date and time.

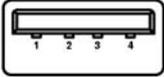
 **NOTE:** This step does not clear the passwords.

A Connector pins

Keyboard	Pin	Signal
 	1	Data
	2	Unused
	3	Ground
	4	+5 VDC
	5	Clock
	6	Unused

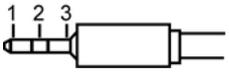
Mouse	Pin	Signal
 	1	Data
	2	Unused
	3	Ground
	4	+5 VDC
	5	Clock
	6	Unused

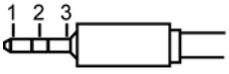
RJ-45 Ethernet	Pin	10/100-MbSignal	1000-Mb signal
 	1	(+) Transmit Data	TX/RX 0 +
	2	(-) Transmit Data	TX/RX 0 -
	3	(+) Receive Data	TX/RX 1 +
	4	Unused	TX/RX 2 +
	5	Unused	RX/RX 2 -
	6	(-) Receive Data	TX/RX 1 -
	7	Unused	TX/RX 3 +
	8	Unused	TX/RX 3 -

USB	Pin	Signal
 	1	+5 VDC
	2	- Data
	3	+ Data
	4	Ground

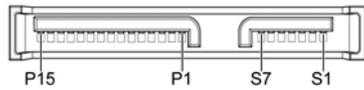
Microphone cable, 6.35 MM (1/8 inch)	Pin	Signal
 	1 (Tip)	Audio
	2 (Ring)	Power
	3 (Shield)	Ground

Headphone cable, 6.35 MM (1/8 inch)	Pin	Signal
 	1 (Tip)	Audio_Left
	2 (Ring)	Audio_Right
	3 (Shield)	Ground

Audio line-in cable, 6.35 MM (1/8 inch)	Pin	Signal
 	1 (Tip)	Audio_In_Left
	2 (Ring)	Audio_In_Right
	3 (Shield)	Ground

Line-out audio cable, 6.35 MM (1/8 inch)	Pin	Signal
 	1 (Tip)	Audio_Out_Left
	2 (Ring)	Audio_Out_Right
	3 (Shield)	Ground

SATA drive

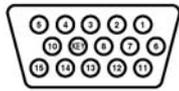


Pin	Signal	Pin	Signal	Pin	Signal
Data Cable		Power Cable		Power Cable	
S1	Ground	P1	3.3V power	P8	5V power
S2*	A+	P2	3.3V power	P9	5V power
S3*	A-	P3	3.3V power	P10	Ground
S4	Ground	P4	Ground	P11	Reserved
S5**	B-	P5	Ground	P12	Ground
S6**	B+	P6	Ground	P13	12V power
S7	Ground	P7	5V power	P14	12V power
				P15	12V power

* S2 and S3 differential signal pair

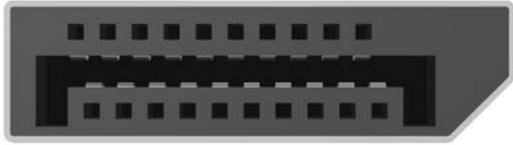
**S5 and S6 differential signal pair

VGA



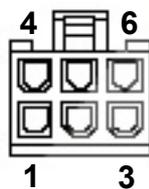
Pin	Signal	Pin	Signal	Pin	Signal
1	Red Analog	6	GND	11	Monitor ID
2	Green Analog	7	GND	12	DDC Serial Data
3	Blue Analog	8	GND	13	Horizontal Sync
4	Monitor ID	9	+5 VDC	14	Vertical Sync
5	GND	10	GND	15	DDC Serial Clock

Display port



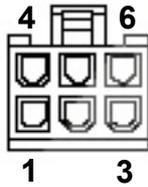
Pin	Signal	Pin	Signal
1	ML_Lane 0(p)	11	GND
2	GND	12	ML_Lane 3(n)
3	ML_Lane 0(n)	13	GND
4	ML_Lane 1(p)	14	GND
5	GND	15	AUX CH(p)
6	ML_Lane 1(n)	16	GND
7	ML_Lane 2(p)	17	AUX CH(n)
8	GND	18	Hot Plug Detect
9	ML_Lane 2(n)	19	DP_PWR Return
10	ML_Lane 3(p)	20	DP_PWR

Main power cable, P1



Pin	Signal	Color
1	GND	Black
2	GND	Black
3	-12V	Dark blue
4	12V-Main	Yellow

Main power cable, P1



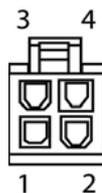
5	12V-Main	Yellow
6	12Vsb	Purple

PWRCMD—Power command, P2



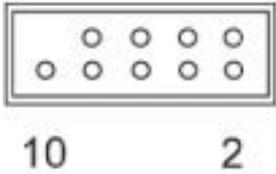
1	PWM	White
2	Tach	White
3	PS_ON	Green
4	PWROK	Gray
5	GND	Black
6	PSU_DETECT	(empty)

CPU power cable, P3



Pin	Color	Signal
1	BLK	GND
2	BLK	GND
3	BRN	12V CPU
4	BRN	12V CPU

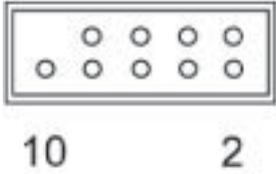
CAUTION: Never connect the PCIe power cable to the system board when power is on. If you do so, the system board can be damaged and the warranty voided. Ensure that you can tell which power cable connects to the PCIe x16 graphics card and which power cable connects to the system board. These two cables have different pin counts and different colors. The PCIe power cable has a 6-pin black connector, and the CPU power cable has an 4-pin white connector. To see a picture of the PCIe cable and where it must be connected, see [Removing and installing expansion cards on page 126](#).

Internal USB 1 2x5		Pin	Signal
	9	1	+5V
		2	+5V
		3	USB6#
		4	USB9#
	10	5	USB6
		6	USB9
		7	GND
		8	GND
		9	(not keyed)
		10	DETECT

CAUTION: Possible equipment damage.

The 2x5 connector can be mated to either a wide 2x5 option cable connector or a narrow 1x5 option cable connector.

To prevent damage to the connectors, always connect a narrow 1x5 option cable connector to pins 1,3,5, and 7 only of the 2x5 connector (pin 9 is not keyed on the connector).

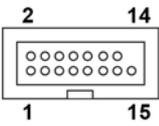
Internal USB 2 2x5		Pin	Signal
	9	1	+5V
		2	+5V
		3	USB7#
		4	USB8#
	10	5	USB7
		6	USB8
		7	GND
		8	GND
		9	(not keyed)
		10	DETECT

CAUTION: Possible equipment damage.

The 2x5 connector can be mated to either a wide 2x5 option cable connector or a narrow 1x5 option cable connector.

To prevent damage to the connectors, always connect a narrow 1x5 option cable connector to pins 1,3,5, and 7 only of the 2x5 connector (pin 9 is not keyed on the connector).

System fan, CHFAN1, P9		Pin	Signal
	1	GND	
	2	+12V	
	3	Tach	
	4	PWM	

Internal serial		Pin	Signal	Pin	Signal
	1	DTR1#	9	+5V	
	2	RXD1	10	+3.3V AUX	
	3	CTS1#	11	RTS1#	
	4	DSR1#	12	COM DETECT	
	5	TXD1	13	DCD21#	
	6	RI#	14	-12V	
	7	Ground	15	+12V	
	8	Ground			

B System board designators

This appendix describes the system board designators for this computer.

Designator	Silk screen	Component/Description
E15	E15	Crisis recovery header/jumper
E49	E49	Clear password header/jumper
J9	J9 RJ/USB	LAN/DUAL USB
J10	J10 QUAD USB	Quad rear USB
J20	J20 PCI	PCI slot (white)
J31	J31	PCIe x1 slot (black)
J41	J41 X16PCIEXP	PCIe x16(16) slot (black)
J42	J42 X4PCIEXP	PCIe x16(4) slot (white)
J53	VGA/COMA	Serial port connector stacked over VGA port
J64	DP	Display port connector
J68	PS2	Mouse connector stacked over keyboard connector
J78	IN/OUT	Audio line in stacked over audio line out
SW50	SW50 CMOS	Clear CMOS switch/push button
P1	PWR	Power supply, 6-pin (white)
P2	PWRCMD	Power command, 6-pin (white)
P3	PWRCPU	Power supply, 4-pin (white)
P5	P5 PB/LED	Front power button/LED (black)
P6	SPRK	Internal speaker (white)
P9	CHFAN1	Front chassis fan
P23	FRONT AUD	Front audio (blue)
P24	FRONT USB	Front I/O USB (yellow)
P25	FRONT USB2	Front I/O USB (green)
P52	COMB	Serial port
P124	HLCK	Hood lock solenoid (black)
P125	HSENSE	Hood sensor
P126	PAR	Flying parallel port (black)
P150	MEDIA	Media card reader

Designator	Silk screen	Component/Description
P151	MEDIA2	Media card reader
P160	SATAPWR1	HDD power (black)
XBT1	XBT1 BAT	Battery holder
XMM1 - XMM4	XMM1 - XMM4 DIMM1 - DIMM4	Memory slots
XU1	XU1	Primary CPU socket

C Routine Care

General cleaning safety precautions

- Never use solvents or flammable solutions to clean the computer.
- Never immerse any component in water or cleaning solutions; apply any liquids to a clean cloth and then use the cloth on the component.
- Always unplug the computer before cleaning the keyboard, mouse, or air vents.
- Always disconnect the keyboard before cleaning it.
- Wear safety glasses equipped with side shields when cleaning the keyboard.

Cleaning the computer case

- Follow the safety precautions presented in the **Service Considerations** section before cleaning the computer.
- To remove light stains or dirt, use plain water with a clean, lint-free cloth or swab.
- For stronger stains, use a mild dish washing liquid diluted with water. Rinse well by wiping it with a cloth or swab dampened with clear water.
- For stubborn stains, use isopropyl (rubbing) alcohol. No rinsing is required because the alcohol evaporates quickly and does not leave a residue.
- After cleaning, always wipe the computer with a clean, lint-free cloth.
- Occasionally, clean the air vents on the computer. Lint and other foreign matter can block the vents and limit the airflow.

Cleaning the keyboard

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

- Follow the safety precautions presented in the **Service Considerations** section before cleaning the computer.
- Visible debris underneath or between the keys can be removed by vacuuming or shaking.
- Canned, pressurized air can be used to clean debris from under the keys. Use caution because too much air pressure can dislodge lubricants applied under the wide keys.
- If you remove a key, use a specially designed key remover to prevent damage to the keys. This tool is available from many electronic supply outlets.

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

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

Cleaning the monitor

- Follow the safety precautions presented in the **Service Considerations** section before cleaning the computer.
- To clean the monitor, wipe the monitor screen with a towelette designed for cleaning monitors or a clean cloth moistened with water.

△ **CAUTION:** Do not use sprays or aerosols directly on the screen—the liquid might seep into the housing and damage a component.

Never use solvents or flammable liquids on the monitor because display or housing damage may result.

Cleaning the mouse

1. Follow the safety precautions presented in the **Service Considerations** section before cleaning the computer.
2. Remove the mouse ball from the housing by removing the retaining plate.
3. Clean the mouse ball.
4. Pull out any debris from the ball socket, and wipe the ball with a clean, dry cloth.
5. Reassemble the mouse.

D Locating HP resources

This section provides information on the following HP resources for your computer:

Topics

[Product information on page 193](#)

- HP Cool Tools
 - Regulatory information
 - Accessories
 - System board
 - Serial number and Certificate of Authenticity labels
 - Linux
-

[Product support on page 194](#)

- Additional information
 - Technical support
 - Business Support Center
 - IT Resource Center
 - HP Service Center
 - HP Business and IT Services
 - Warranty information
-

[Product diagnostics on page 195](#)

- Diagnostics tools
 - Audible beeps and LED code definitions
-

[Product updates on page 196](#)

- Software, BIOS, and driver updates
 - Operating system
-

Product information

Table D-1 Product information

Topic	Location
HP Cool Tools	<p>Most HP Microsoft Windows computers are preloaded with additional software that is not automatically installed during first boot. Additionally, a number of valuable tools on your computer are preinstalled that may enhance system performance. To access or learn more about these applications, choose one of the following options:</p> <p>To learn more about these applications, click HP Cool Tools—Learn More.</p> <p>To install or launch the applications, click the appropriate application icon.</p> <ul style="list-style-type: none">• Click the HP Cool Tools icon on the desktop, or• Open the HP Cool Tools folder by selecting Start > All Programs > HP Cool Tools.
Regulatory information	<p>Refer to the <i>Safety & Regulatory Information</i> guide for product Class information. You can also refer to the label on the computer chassis.</p>
Accessories	<p>For complete and current information on supported accessories and components, see www.hp.com/go/bizsupport.</p>
System board	<p>A diagram of the system board is located on the inside of the side access panel. Also, additional information is located in the <i>Maintenance and Service Guide</i> on the Web at www.hp.com/go/bizsupport under the link for Manuals.</p>
Serial number and Certificate of Authenticity (COA) labels (if applicable)	<p>Serial number labels are on the top panel, or on the side of the unit at the rear, depending on the computer model. The COA label is generally located on the top or side panel near the serial number label. Some computers have this label on the bottom of the unit.</p>
Linux	<p>For information on running Linux on HP computers, see www.hp.com/go/bizsupport and search for “Linux”.</p>

Product support

Table D-2 Product support

Topic	Location
Additional information	<p>For online access to technical support information and tools, see www.hp.com/go/bizsupport.</p> <p>Support resources include Web-based troubleshooting tools, technical knowledge databases, driver and patch downloads, online communities, and proactive notification services.</p> <p>The following communication and diagnostic tools are also available:</p> <p>Refer to the computer <i>Maintenance and Service Guide</i> for more information on how to receive support.</p> <ul style="list-style-type: none">• Instant Chat• Instant Support• Diagnose Problem
Technical support	<p>Before you contact technical support, refer to the computer <i>Maintenance and Service Guide</i> for a listing of information you need to have available.</p> <p>For links to all technical support resources, see http://www.hp.com/go/bizsupport.</p>
Business Support Center (BSC)	<p>For software/driver downloads, warranty information, task-related documents, user manuals, or service manuals, see http://www.hp.com/go/bizsupport.</p>
IT Resource Center (ITRC)	<p>To access a searchable knowledge base for IT professionals, go to http://www.hp.com/go/bizsupport and follow the IT Resource Center link.</p>
HP Business and IT Services.	<p>For business and IT information, see http://www.hp.com/hps/.</p>
HP Hardware Support Services	<p>For hardware service information, see http://www.hp.com/hps/hardware/.</p>
Warranty information	<p>To locate base warranty information, see http://www.hp.com/support/warranty-lookuptool.</p> <p>To locate an existing Care Pack, see http://www.hp.com/go/lookuptool.</p> <p>To extend a standard product warranty, see http://www.hp.com/hps/carepack. HP Care Pack Services offer upgraded service levels to extend and expand a standard product warranty.</p>

Product diagnostics

Table D-3 Product diagnostics

Topic	Location
Diagnostics tools	The HP Vision Diagnostics utility can be downloaded from the HP Web site. To use this utility, refer to the appropriate section of the computer <i>Maintenance and Service Guide</i> .
Audible beep and LED code definitions	Refer to the appropriate section of the computer <i>Maintenance and Service Guide</i> for detailed information about beep and Light Emitting Diode (LED) codes applicable to the computer.

Product updates

Table D-4 Product updates

Topic	Location
Software, BIOS, and driver updates	See http://www.hp.com/go/bizsupport to verify that you have the latest drivers for the computer. To locate the current computer BIOS on your Microsoft Windows computer, select Start>Help and Support>Pick a Task>Use Tools to view...>Tools>My Computer Information>View general system information....
Operating system	For information on operating systems supported on HP computers, see http://www.hp.com/go/wsos .

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