

# Dell™ PowerEdge™ R200 Systems

## Hardware Owner's Manual

# Notes, Notices, and Cautions

-  **NOTE:** A NOTE indicates important information that helps you make better use of your computer.
-  **NOTICE:** A NOTICE indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.
-  **CAUTION:** A CAUTION indicates a potential for property damage, personal injury, or death.

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# Contents

<b>1 About Your System . . . . .</b>	<b>11</b>
<b>Other Information You May Need . . . . .</b>	<b>11</b>
<b>Accessing System Features During Startup . . . . .</b>	<b>12</b>
<b>Front-Panel Features and Indicators . . . . .</b>	<b>13</b>
<b>Back-Panel Features and Indicators . . . . .</b>	<b>17</b>
Connecting External Devices . . . . .	18
<b>NIC Indicator Codes . . . . .</b>	<b>19</b>
<b>System Messages . . . . .</b>	<b>19</b>
<b>Diagnostics Indicator Codes . . . . .</b>	<b>29</b>
<b>System Beep Codes . . . . .</b>	<b>31</b>
<b>Warning Messages . . . . .</b>	<b>34</b>
<b>Diagnostics Messages . . . . .</b>	<b>34</b>
<b>Alert Messages . . . . .</b>	<b>34</b>
<b>2 Using the System Setup Program . . . . .</b>	<b>35</b>
<b>Entering the System Setup Program . . . . .</b>	<b>35</b>
Responding to Error Messages . . . . .	35
Using the System Setup Program . . . . .	36

<b>System Setup Options</b> . . . . .	<b>36</b>
Main Screen . . . . .	36
Memory Information Screen . . . . .	39
CPU Information Screen . . . . .	39
SATA Configuration Screen . . . . .	40
Integrated Devices Screen . . . . .	41
Console Redirection Screen . . . . .	42
System Security Screen . . . . .	43
Exit Screen . . . . .	44
<b>System and Setup Password Features</b> . . . . .	<b>45</b>
Using the System Password . . . . .	45
Using the Setup Password . . . . .	48
<b>Disabling a Forgotten Password</b> . . . . .	<b>49</b>
<b>Baseboard Management Controller Configuration</b> . . . . .	<b>49</b>
Entering the BMC Setup Module . . . . .	50
BMC Setup Module Options . . . . .	50
<b>3 Installing System Components</b> . . . . .	<b>51</b>
<b>    Recommended Tools</b> . . . . .	<b>51</b>
<b>    Inside the System</b> . . . . .	<b>51</b>
<b>    Opening and Closing the System</b> . . . . .	<b>53</b>
Removing the Bezel . . . . .	53
Installing the Bezel . . . . .	54
Opening the System . . . . .	54
Closing the System . . . . .	55

<b>Cooling Shroud</b>	56
Removing the Cooling Shroud	56
Installing the Cooling Shroud	57
<b>System Battery</b>	58
Replacing the System Battery	58
<b>Optical Drive</b>	60
Removing the Optical Drive	60
Installing the Optical Drive	61
<b>Configuring the Boot Drive</b>	62
<b>Hard Drives</b>	62
Removing a Hard Drive	63
Installing a Hard Drive	67
<b>Installing a SAS Controller Card</b>	68
<b>Fan Assembly</b>	68
Removing the Fan Assembly	69
Installing the Fan Assembly	70
<b>Optional PCI Fan Assembly</b>	71
Removing the PCI Fan Assembly	71
Installing the PCI Fan Assembly	72
<b>Power Supply</b>	73
Removing the Power Supply	73
Installing the Power Supply	75
<b>Expansion Cards</b>	75
Installing an Expansion Card	75
Removing an Expansion Card	78

<b>Riser Card</b>	79
Removing the Riser Card	79
Installing the Riser Card	80
<b>System Memory</b>	81
Memory Module Installation Guidelines	81
Installing Memory Modules	82
Removing Memory Modules	84
<b>Processor</b>	85
Replacing the Processor	85
<b>Control Panel Assembly (Service-Only Procedure)</b>	89
Removing the Control Panel Assembly	89
Installing the Control Panel Assembly	90
<b>System Board (Service-Only Procedure)</b>	91
Removing the System Board Assembly	91
Installing the System Board Assembly	94
<b>4 Troubleshooting Your System</b>	97
<b>Safety First—For You and Your System</b>	97
<b>Start-Up Routine</b>	97
<b>Checking the Equipment</b>	98
Troubleshooting IRQ Assignment Conflicts	98
Troubleshooting External Connections	99
Troubleshooting the Video Subsystem	99
Troubleshooting the Keyboard	100
Troubleshooting the Mouse	101
Troubleshooting Basic I/O Functions	101
Troubleshooting a Serial I/O Device	102

Troubleshooting a USB Device . . . . .	102
Troubleshooting a NIC . . . . .	103
<b>Responding to a Systems Management Software Alert Message . . . . .</b>	<b>104</b>
<b>Troubleshooting a Wet System . . . . .</b>	<b>104</b>
<b>Troubleshooting a Damaged System . . . . .</b>	<b>105</b>
<b>Troubleshooting the System Battery . . . . .</b>	<b>106</b>
<b>Troubleshooting the Power Supply . . . . .</b>	<b>106</b>
<b>Troubleshooting System Cooling Problems . . . . .</b>	<b>107</b>
Troubleshooting a Fan . . . . .	108
<b>Troubleshooting System Memory . . . . .</b>	<b>108</b>
<b>Troubleshooting an Optical Drive . . . . .</b>	<b>110</b>
<b>Troubleshooting a Hard Drive . . . . .</b>	<b>111</b>
<b>Troubleshooting Expansion Cards . . . . .</b>	<b>113</b>
<b>Troubleshooting the Microprocessor . . . . .</b>	<b>114</b>
<b>5 Running the System Diagnostics . . . . .</b>	<b>117</b>
<b>Using Dell PowerEdge Diagnostics . . . . .</b>	<b>117</b>
<b>System Diagnostics Features . . . . .</b>	<b>117</b>
<b>When to Use the System Diagnostics . . . . .</b>	<b>118</b>
<b>Running the System Diagnostics . . . . .</b>	<b>118</b>
From the Utility Partition . . . . .	118
From Removable Bootable Media . . . . .	118

<b>System Diagnostics Testing Options</b>	<b>119</b>
<b>Using the Custom Test Options</b>	<b>119</b>
Selecting Devices for Testing	120
Selecting Diagnostics Options	120
Viewing Information and Results	120
<b>6 Jumpers and Connectors</b>	<b>121</b>
<b>System Board Jumpers</b>	<b>121</b>
<b>System Board Connectors</b>	<b>122</b>
<b>Riser Card Connectors</b>	<b>124</b>
<b>Disabling a Forgotten Password</b>	<b>125</b>
<b>7 Getting Help</b>	<b>127</b>
<b>Obtaining Assistance</b>	<b>127</b>
Online Services	128
Automated Order-Status Service	129
Support Service	129
<b>Dell Enterprise Training and Certification</b>	<b>129</b>
<b>Problems With Your Order</b>	<b>129</b>
<b>Product Information</b>	<b>129</b>
<b>Returning Items for Warranty Repair or Credit</b>	<b>130</b>
<b>Before You Call</b>	<b>131</b>
<b>Contacting Dell</b>	<b>133</b>

**Glossary** ..... 165

**Index** ..... 177



# About Your System

This section describes the physical, firmware, and software interface features that provide and ensure the essential functioning of your system. The physical connectors on your system's front and back panels provide convenient connectivity and system expansion capability. The system firmware, applications, and operating systems monitor the system and component status and alert you when a problem arises. System conditions can be reported by any of the following:

- Front or back panel indicators
- System messages
- Diagnostic indicator codes
- Beep codes
- Warning messages
- Diagnostics messages
- Alert messages

This section describes each type of message, lists the possible causes, and provides steps to resolve any problems indicated by a message. The system indicators and features are illustrated in this section.

## Other Information You May Need



**CAUTION: The *Product Information Guide* provides important safety and regulatory information. Warranty information may be included within this document or as a separate document.**

- The *Rack Installation Guide* and *Rack Installation Instructions* included with your rack solution describe how to install your system into a rack.
- The *Getting Started Guide* provides an overview of system features, setting up your system, and technical specifications.
- CDs included with your system provide documentation and tools for configuring and managing your system.

- Systems management software documentation describes the features, requirements, installation, and basic operation of the software.
- Operating system documentation describes how to install (if necessary), configure, and use the operating system software.
- Documentation for any components you purchased separately provides information to configure and install these options.
- Updates are sometimes included with the system to describe changes to the system, software, and/or documentation.



**NOTE:** Always check for updates on [support.dell.com](http://support.dell.com) and read the updates first because they often supersede information in other documents.

- Release notes or readme files may be included to provide last-minute updates to the system or documentation or advanced technical reference material intended for experienced users or technicians.

## Accessing System Features During Startup

Table 1-1 describes keystrokes that may be entered during startup to access system features. If your operating system begins to load before you enter the keystroke, allow the system to finish booting, and then restart your system and try again.

**Table 1-1. Keystrokes for Accessing System Features**

Keystroke	Description
<F2>	Enters the System Setup program. See "Using the System Setup Program" on page 35.
<F10>	Opens the utility partition, allowing you to run the system diagnostics. See "Running the System Diagnostics" on page 118.
<Ctrl+E>	Enters the Baseboard Management Controller (BMC) Management Utility, which allows access to the system event log (SEL). See the <i>BMC User's Guide</i> for more information on setup and use of BMC.
<Ctrl+C>	Enters the SAS Configuration Utility. See your SAS adapter <i>User's Guide</i> for more information.
<Ctrl+R>	Enters the RAID configuration utility, which allows you to configure an optional RAID card. For more information, see the documentation for your RAID card.

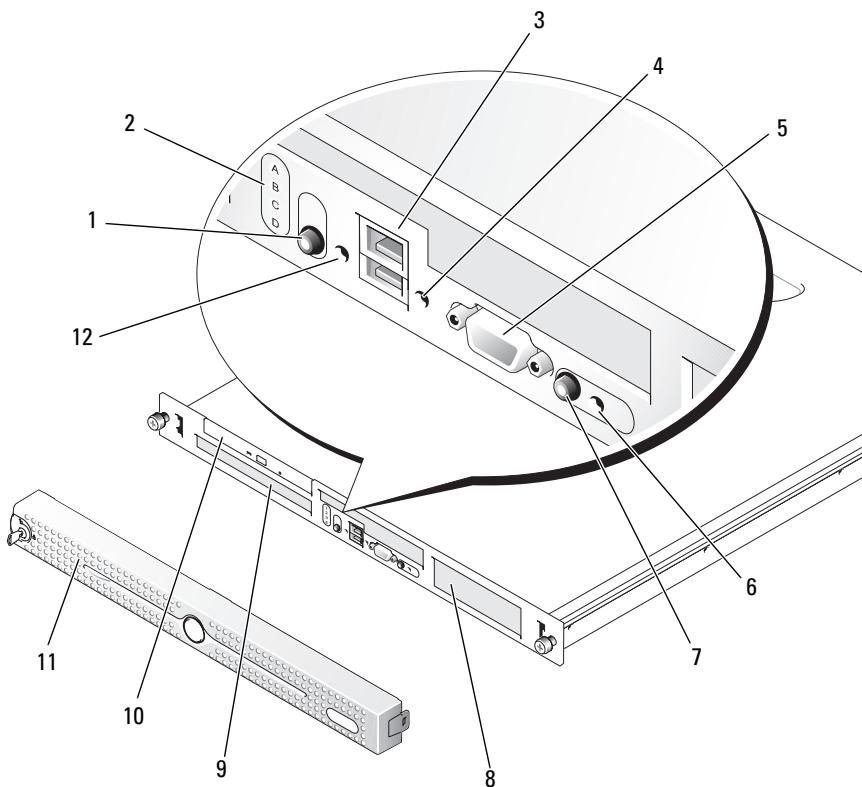
**Table 1-1. Keystrokes for Accessing System Features (*continued*)**

<b>Keystroke</b>	<b>Description</b>
<Ctrl+S>	Option is displayed only if you have PXE support enabled through the System Setup Program (see "SATA Configuration Screen" on page 40 for options and descriptions for the information fields that appear on the SATA Configuration screen). This keystroke allows you to configure NIC settings for PXE boot. For more information, see the documentation for your integrated NIC.
<Ctrl+D>	If you have the optional Dell Remote Access Controller (DRAC), this keystroke allows access to selected DRAC configuration settings. See the DRAC User's Guide for more information on setup and use of DRAC.

## Front-Panel Features and Indicators

Figure 1-1 shows the controls, indicators, connectors, and features on the system front panel behind the optional bezel. (To remove the bezel, press the latch at the left end of the bezel. See "Opening the System" on page 54.) Table 1-2 provides component descriptions.

**Figure 1-1. Front-Panel Features and Indicators**



**Table 1-2. Front-Panel Components**

Item	Component	Icon	Description
1	Power-on indicator, power button		<p>The power button turns system power off and on.</p> <p> <b>NOTICE:</b> If you turn off the system using the power button and the system is running an ACPI-compliant operating system, the system can perform an orderly shutdown before power is turned off. If the power button is pressed for more than 4 seconds, the system power will turn off regardless of the current operating system state. If the system is not running an ACPI-compliant operating system, power is turned off immediately after the power button is pressed.</p> <p>The power button is enabled in the System Setup program. When disabled, the button can only turn the system power on. For more information, see "Using the System Setup Program" on page 35 and the operating system's documentation.</p> <p>The power-on indicator lights or blinks to indicate the status of power to the system.</p> <p>The power-on indicator lights when the system is on. The indicator is off when the system is off and power is disconnected from the system. The indicator blinks when the system is on but in standby state, or when the system is off but is still connected to the power source.</p> <p>To exit from the standby state, briefly press the power button.</p>

**Table 1-2. Front-Panel Components (*continued*)**

<b>Item</b>	<b>Component</b>	<b>Icon</b>	<b>Description</b>
2	Diagnostic indicators (4)		The diagnostic indicators aid in diagnosing and troubleshooting the system. For more information, see "Diagnostics Indicator Codes" on page 29.
3	USB connectors (2)		Connect USB 2.0-compliant devices to the system.
4	Hard-drive activity indicator		The green hard-drive activity indicator flashes when the hard drives are in use.
5	Video connector		Connects a monitor to the system.
6	System status indicator		<p>The blue system status indicator lights up during normal system operation.</p> <p>The amber system status indicator flashes when the system needs attention due to a system problem.</p>
7	System identification button		<p>You can use the system identification buttons on the front and back panels to locate a particular system within a rack. When one of these buttons is pushed, the blue system status indicators on the front and back panels blink until one of the buttons is pushed again.</p> <p>You can also use the systems management software to cause the indicators to flash to identify a particular system.</p>
8	Hard drive 1		Optional 3.5-inch SAS or SATA hard drive.
9	Hard drive 0		A 3.5-inch SAS or SATA hard drive.
10	Optical drive		Optional.
11	Bezel		Optional

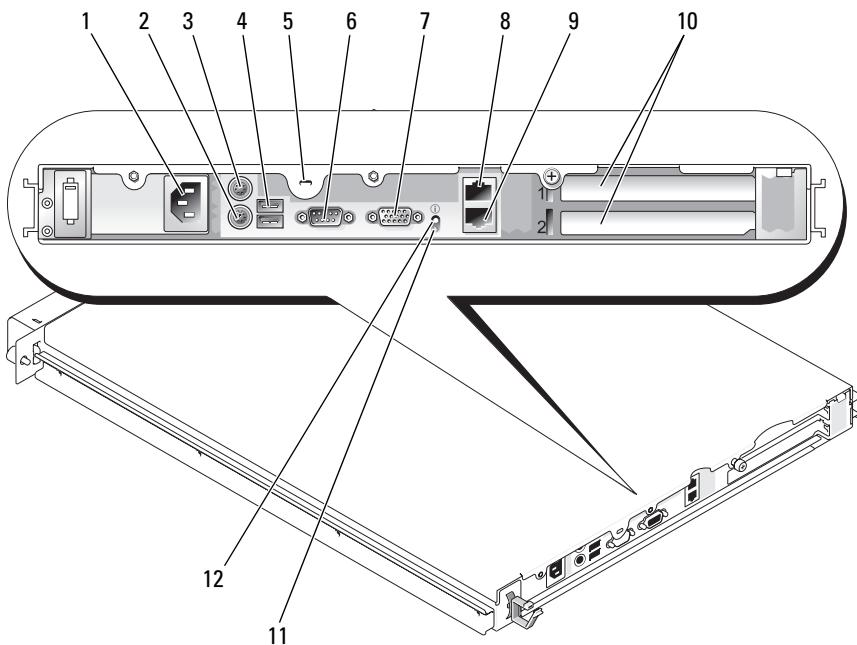
**Table 1-2. Front-Panel Components (*continued*)**

Item	Component	Icon	Description
12	NMI button	⌚	The NMI button is used to troubleshoot software and device driver errors when using certain operating systems. This button can be pressed using the end of a paper clip. Use this button only if directed to do so by qualified support personnel or by the operating system's documentation.

## Back-Panel Features and Indicators

Figure 1-2 shows the controls, indicators, and connectors located on the system's back panel.

**Figure 1-2. Back-Panel Features and Indicators**



- |                          |                            |                                 |
|--------------------------|----------------------------|---------------------------------|
| 1 power supply connector | 2 keyboard connector       | 3 mouse connector               |
| 4 USB connectors (2)     | 5 Kensington lock          | 6 serial connector              |
| 7 video connector        | 8 NIC1 connector           | 9 NIC2 connector                |
| 10 expansion slots (2)   | 11 system status indicator | 12 system identification button |

## Connecting External Devices

When connecting external devices to your system, follow these guidelines:

- Most devices must be connected to a specific connector and device drivers must be installed before the device operates properly. (Device drivers are normally included with your operating system software or with the device itself.) See the documentation that accompanied the device for specific installation and configuration instructions.

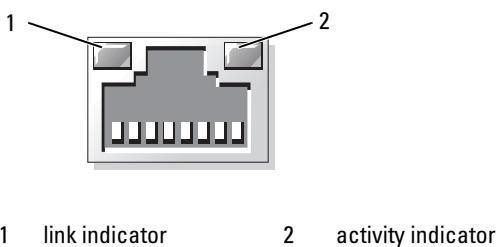
- Always attach an external device while your system and the device are turned off. Next, turn on any external devices before turning on the system (unless the documentation for the device specifies otherwise).

See "Using the System Setup Program" on page 35 for information about enabling, disabling, and configuring I/O ports and connectors.

## NIC Indicator Codes

Each NIC on the back panel has an indicator that provides information on network activity and link status. See Figure 1-3. Table 1-3 lists the NIC indicator codes.

**Figure 1-3. NIC Indicators**



**Table 1-3. NIC Indicator Codes**

Indicator	Indicator Code
Link and activity indicators are off.	The NIC is not connected to the network.
Link indicator is green.	The NIC is connected to a valid link partner on the network.
Activity indicator is blinking yellow.	Network data is being sent or received.

## System Messages

System messages appear on the screen to notify you of a possible problem with the system. Table 1-4 lists the system messages that can occur and the probable cause and corrective action for each message.



**NOTE:** If you receive a system message that is not listed in Table 1-4, check the documentation for the application that is running when the message appears or the operating system's documentation for an explanation of the message and recommended action.



**CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

**Table 1-4. System Messages**

Message	Causes	Corrective Actions
Attempting to update Remote Configuration. Please wait....	Remote Configuration is in progress.	Wait until the process is complete.
BIOS Update Attempt Failed!	Remote BIOS update attempt failed.	Retry the BIOS update. If the problem persists, see "Getting Help" on page 127.
Caution! NVRAM_CLR jumper is installed on system board.	NVRAM_CLR jumper is installed.	Check the System Setup configuration settings. See "Using the System Setup Program" on page 35. Remove the NVRAM_CLR jumper. See Figure 6-1 for jumper locations.
Data error	The diskette drive or hard drive cannot read the data.	For the operating system, run the appropriate utility to check the file structure of the diskette drive or hard drive.  See your operating system documentation for information on running these utilities.

**Table 1-4. System Messages (*continued*)**

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
Decreasing available memory	One or more memory modules might be improperly seated or faulty.	Reinstall the memory modules and, if necessary, replace them. See "System Memory" on page 81.  See "Troubleshooting System Memory" on page 108.
Diskette read failure	Faulty or improperly inserted diskette.	Replace the diskette.
Diskette subsystem reset failed	Faulty diskette drive or optical drive controller.	Ensure that the diskette drive and optical drive cables are properly connected. See "Troubleshooting a USB Device" on page 102 and "Troubleshooting an Optical Drive" on page 110. If the problem persists, see "Getting Help" on page 127.
Drive not ready	Diskette missing or improperly inserted in diskette drive.	Reinsert or replace the diskette.
Error: Incorrect memory configuration.  Ensure memory in slots DIMM1_A and DIMM1_B, DIMM2_A and DIMM2_B match identically in size, speed and rank.	The installed memory modules are not matched pairs.	See "Memory Module Installation Guidelines" on page 81.

**Table 1-4. System Messages (*continued*)**

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
Error: Remote Access Controller initialization failure.	Faulty or improperly installed RAC.	Ensure that the RAC is properly installed. See "Troubleshooting Expansion Cards" on page 113.
Error 8602: Auxiliary device failure. Verify that mouse and keyboard are securely attached to correct connectors.	Loose or improperly connected mouse or keyboard cable; faulty mouse or keyboard.	Replace the mouse. If the problem persists, replace the keyboard.
Gate A20 failure	Faulty keyboard controller (faulty system board).	See "Getting Help" on page 127.
General failure	The operating system is unable to carry out the command.	This message is usually followed by specific information. Take the appropriate action to resolve the problem.
Keyboard controller failure	Faulty keyboard controller (faulty system board).	See "Getting Help" on page 127.
Keyboard data line failure	Loose or improperly connected keyboard cable; faulty keyboard; faulty keyboard controller.	Ensure that the keyboard is properly connected. If the problem persists, replace the keyboard. If the problem persists, see "Getting Help" on page 127.
Keyboard failure		
Keyboard stuck key failure		
Keyboard fuse has failed.	Keyboard fuse has failed. Faulty system board.	Replace the keyboard. If the problem persists, the system board is faulty. See "Getting Help" on page 127.

**Table 1-4. System Messages (*continued*)**

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
Manufacturing mode detected	System is incorrectly configured.	
Memory address line failure at <i>address</i> , read value expecting value	Faulty or improperly installed memory modules, or faulty system board.	Ensure that all memory modules are properly installed. See "Troubleshooting System Memory" on page 108. If the problem persists, see "Getting Help" on page 127.
Memory double word logic failure at <i>address</i> , read value expecting value		
Memory odd/even logic failure at <i>start address</i> to <i>end address</i>		
Memory write/read failure at <i>address</i> , read value expecting value		
Memory tests terminated by keystroke	The spacebar was pressed during POST to terminate the memory test.	Information only.
No boot device available	The system cannot find the diskette or hard drive.	If the diskette drive is your boot device, ensure that a bootable disk is in the drive.  If the hard drive is your boot device, ensure that the hard drive is installed, properly seated, and partitioned as a boot device.  Enter the System Setup program and verify the boot sequence information. See your <i>Hardware Owner's Manual</i> for details.

**Table 1-4. System Messages (*continued*)**

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
No boot sector on hard-disk drive	The system configuration information in the System Setup program might be incorrect.	Enter the System Setup program and verify the system configuration information for the hard drive. See your <i>Hardware Owner's Manual</i> for details.  If the message continues to appear after verifying the information in the System Setup program, the operating system might have been corrupted. Reinstall the operating system. See your operating system documentation for reinstallation information.
No timer tick interrupt	A chip on the system board might be malfunctioning.	Run the system diagnostics. See "Running the System Diagnostics" on page 117.
Not a boot diskette	The operating system is trying to boot from a diskette that does not have a bootable operating system installed on it.	Insert a diskette that has a bootable operating system.
Option ROM Checksum Error	PCI device BIOS (Option ROM) checksum failure is detected during shadowing.	Ensure that all appropriate cables are securely connected to the expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 113.

**Table 1-4. System Messages (*continued*)**

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
PCIe Degraded Link Width Error: Embedded Bus#nn/Dev#nn/Funcn Expected Link Width is n  Actual Link Width is n	Faulty or improperly installed PCIe card.	Reseat the PCIe cards. See "Expansion Cards" on page 75. If the problem persists, see "Getting Help" on page 127.
PCIe Degraded Link Width Error: Slot n Expected Link Width is n  Actual Link Width is n	Faulty or improperly installed PCIe card in the specified slot number.	Reseat the PCIe card in the specified slot number. See "Expansion Cards" on page 75. If the problem persists, see "Getting Help" on page 127.
PCIe Training Error: Embedded Bus#nn/Dev#nn/Funcn	Faulty or improperly installed PCIe card.	Reseat the PCIe cards. See "Expansion Cards" on page 75. If the problem persists, see "Getting Help" on page 127.
PCIe Training Error: Slot n	Faulty or improperly installed PCIe card in the specified slot number.	Reseat the PCIe card in the specified slot number. See "Expansion Cards" on page 75. If the problem persists, see "Getting Help" on page 127.

**Table 1-4. System Messages (*continued*)**

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
Plug & Play Configuration Error	Error encountered in initializing PCI device; faulty system board.	Install the NVRAM_CLR jumper and reboot the system. See Figure 6-1 for jumper location. Check for a BIOS update. If the problem persists, see "Troubleshooting Expansion Cards" on page 113. If the problem persists, see "Getting Help" on page 127.
Read fault Requested sector not found	The operating system cannot read from the diskette or hard drive, the system could not find a particular sector on the disk, or the requested sector is defective.	Replace the diskette. Ensure that the diskette and hard-drive cables are properly connected. See "Troubleshooting a USB Device" on page 102 or "Troubleshooting a Hard Drive" on page 111 for the appropriate drive(s) installed in your system.
Remote Configuration update attempt failed	System could not implement Remote Configuration request.	Retry Remote Configuration.
SATA port 0/1/2 hard disk drive configuration error	Faulty drive. Parameters failure.	Ensure that the hard drive cables are properly connected. See "Troubleshooting a Hard Drive" on page 111.
SATA port 0/1/2 hard disk drive failure	Faulty drive. INT13 call failure from the drive.	Ensure that the hard drive cables are properly connected. See "Troubleshooting a Hard Drive" on page 111.
SATA port 0/1/2 hard disk drive auto-sensing error		

**Table 1-4. System Messages (*continued*)**

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
SATA Port 0/1/2 hard disk not found	SATA Port 0/1/2 set as Auto, no disk installed.	Run the System Setup program to correct the settings. See "Using the System Setup Program" on page 35.
Sector not found	Faulty diskette or hard drive.	See "Troubleshooting a USB Device" on page 102 or "Troubleshooting a Hard Drive" on page 111 for the appropriate drive installed in your system.
Seek error		
Seek operation failed		
Shutdown failure	Shutdown test failure.	Ensure that all memory modules are properly installed. See "Troubleshooting System Memory" on page 108. If the problem persists, see "Getting Help" on page 127.
The amount of system memory has changed.	Faulty memory module.  Information only, if you have changed the memory configuration.	See "Troubleshooting System Memory" on page 108. If the problem persists, see "Getting Help" on page 127.
Time-of-day clock stopped	Faulty battery; faulty system board.	See "Troubleshooting the System Battery" on page 106. If the problem persists, see "Getting Help" on page 127.

**Table 1-4. System Messages (*continued*)**

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
Time-of-day not set - please run SETUP program	Incorrect Time or Date settings; faulty system battery.	Check the Time and Date settings. See "Using the System Setup Program" on page 35. If the problem persists, see "Troubleshooting the System Battery" on page 106.
Timer chip counter 2 failed	Faulty system board.	See "Getting Help" on page 127.
Unexpected interrupt in protected mode	Faulty or improperly installed memory modules or faulty system board.	Ensure that all memory modules are properly installed. See "Memory Module Installation Guidelines" on page 81. If the problem persists, see "Troubleshooting System Memory" on page 108. If the problem persists, see "Getting Help" on page 127.
Utility partition not available	Utility partition is not available on the hard disk	Create a utility partition on the boot hard drive. See the CDs that came with your system.
Warning! No micro code update loaded for processor 0	Micro code update failed.	Update the BIOS firmware. See "Getting Help" on page 127.

**Table 1-4. System Messages (*continued*)**

Message	Causes	Corrective Actions
Write fault	Faulty diskette, diskette	Replace the diskette.
Write fault on selected drive	drive, hard drive.	Ensure that the diskette drive and hard-drive cables are properly connected. See "Troubleshooting a USB Device" on page 102 or "Troubleshooting a Hard Drive" on page 111 for the appropriate drive(s) installed in your system.

## Diagnostics Indicator Codes

The four diagnostics indicators on the system front panel display error codes during system startup. Table 1-5 lists the causes and possible corrective actions associated with these codes.

**Table 1-5. Diagnostic Indicator Codes**

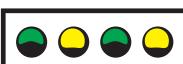
Code	Causes	Corrective Action
 A B C D	Possible processor failure.	See "Troubleshooting the Microprocessor" on page 114.
 A B C D	Memory failure.	See "Troubleshooting System Memory" on page 108.
 A B C D	Possible expansion card failure.	See "Troubleshooting Expansion Cards" on page 113.

 = yellow

 = green

 = off

**Table 1-5. Diagnostic Indicator Codes (*continued*)**

<b>Code</b>	<b>Causes</b>	<b>Corrective Action</b>
 <b>A B C D</b>	Possible video card failure.	See "Troubleshooting Expansion Cards" on page 113.
 <b>A B C D</b>	Diskette drive or hard drive failure.	Ensure that the diskette drive and hard-drive are properly connected. See "Installing a Hard Drive" on page 67 for information on the drives installed in your system.
 <b>A B C D</b>	Possible USB failure.	See "Troubleshooting a USB Device" on page 102.
 <b>A B C D</b>	No memory modules detected.	See "Troubleshooting System Memory" on page 108.
 <b>A B C D</b>	System board failure. See "Getting Help" on page 127.	
 <b>A B C D</b>	Memory configuration error.	See "Troubleshooting System Memory" on page 108.
 <b>A B C D</b>	Possible system board resource and/or system board hardware failure.	See "Troubleshooting IRQ Assignment Conflicts" on page 98. If the problem persists, see "Getting Help" on page 127.

 = yellow

 = green

 = off

**Table 1-5. Diagnostic Indicator Codes (*continued*)**

<b>Code</b>	<b>Causes</b>	<b>Corrective Action</b>
 <b>A B C D</b>	Possible expansion card failure.	See "Troubleshooting Expansion Cards" on page 113.
 <b>A B C D</b>	Other failure.	Ensure that the optical drive and hard drives are properly connected. See "Troubleshooting Your System" on page 97 for the appropriate drive installed in your system.  If the problem persists, see "Getting Help" on page 127.
 <b>A B C D</b>	The system is in a normal operating condition after POST.	Information only.

 = **yellow**  
 = **green**  
 = **off**

## System Beep Codes

If an error that cannot be reported on the screen occurs during POST, the system may emit a series of beeps that identifies the problem.

 **NOTE:** If the system boots without a keyboard, mouse, or monitor attached, the system does not issue beep codes related to those peripherals.

If a beep code is emitted, write down the series of beeps and then look it up in Table 1-6. If you are unable to resolve the problem by looking up the meaning of the beep code, use system diagnostics to identify the possible cause. If you are still unable to resolve the problem, see "Getting Help" on page 127.

**Table 1-6. System Beep Codes**

<b>Code</b>	<b>Cause</b>	<b>Corrective Action</b>
1-1-2	CPU register test failure	See "Troubleshooting the Microprocessor" on page 114.
1-1-3	CMOS write/read failure; faulty system board	Faulty system board. See "Getting Help" on page 127.
1-1-4	BIOS error	Reflash the BIOS.
1-2-1	Programmable interval-timer failure; faulty system board	Faulty system board. See "Getting Help" on page 127.
1-2-2	DMA initialization failure	See "Troubleshooting System Memory" on page 108.
1-2-3	DMA page register write/read failure	
1-3-1	Main-memory refresh verification failure	
1-3-2	No memory installed	
1-3-3	Chip or data line failure in the first 64 KB of main memory	
1-3-4	Odd/even logic failure in the first 64 KB of main memory	
1-4-1	Address line failure in the first 64 KB of main memory	
1-4-2	Parity failure in the first 64 KB of main memory	
1-4-3	Fail-safe timer test failure	
1-4-4	Software NMI port test failure	
2-1-1 through 2-4-4	Bit failure in the first 64 KB of main memory	

**Table 1-6. System Beep Codes (*continued*)**

<b>Code</b>	<b>Cause</b>	<b>Corrective Action</b>
3-1-1	Slave DMA-register failure	Faulty system board. See "Getting Help" on page 127.
3-1-2	Master DMA-register failure	
3-1-3	Master interrupt-mask register failure	
3-1-4	Slave interrupt-mask register failure	
3-2-2	Interrupt vector loading failure	
3-2-4	Keyboard-controller test failure	
3-3-1	CMOS failure	
3-3-2	System configuration check failure	
3-3-3	Keyboard controller not detected	
3-3-4	Video memory test failure	
3-4-1	Screen initialization failure	
3-4-2	Screen-retrace test failure	
3-4-3	Video ROM search failure	
4-2-1	No timer tick	Faulty system board. See "Getting Help" on page 127.
4-2-2	Shutdown test failure	
4-2-3	Gate A20 failure	
4-2-4	Unexpected interrupt in protected mode	See "Troubleshooting Expansion Cards" on page 113.
4-3-1	Improperly installed or faulty memory modules	See "Troubleshooting System Memory" on page 108.
4-3-2	No memory modules installed in the first memory module connector	Install a memory module in the first memory module connector. See "System Memory" on page 81.

**Table 1-6. System Beep Codes (*continued*)**

<b>Code</b>	<b>Cause</b>	<b>Corrective Action</b>
4-3-3	Faulty system board	Faulty system board. See "Getting Help" on page 127.
4-3-4	Time-of-day clock stopped	See "Troubleshooting System Memory" on page 108. If the problem persists, see "Getting Help" on page 127.
4-4-1	Super I/O chip failure; faulty system board	Faulty system board. See "Getting Help" on page 127.
4-4-4	Cache test failure; faulty processor	See "Troubleshooting the Microprocessor" on page 114.

## Warning Messages

A warning message alerts you to a possible problem and prompts you to respond before the system continues a task. For example, before you format a diskette, a message will warn you that you may lose all data on the diskette. Warning messages usually interrupt the task and require you to respond by typing **y** (yes) or **n** (no).

 **NOTE:** Warning messages are generated by either the application or the operating system. For more information, see the documentation that accompanied the operating system or application.

## Diagnostics Messages

When you run system diagnostics, an error message may result. Diagnostic error messages are not covered in this section. Record the message on a copy of the Diagnostics Checklist in "Getting Help" on page 127, and then follow the instructions in that section for obtaining technical assistance.

## Alert Messages

Systems management software generates alert messages for your system. Alert messages include information, status, warning, and failure messages for drive, temperature, fan, and power conditions. For more information, see the systems management software documentation.

# Using the System Setup Program

After you set up your system, run the System Setup program to familiarize yourself with your system configuration and optional settings. Record the information for future reference.

You can use the System Setup program to:

- Change the system configuration stored in NVRAM after you add, change, or remove hardware
- Set or change user-selectable options—for example, the time or date
- Enable or disable integrated devices
- Correct discrepancies between the installed hardware and configuration settings

## Entering the System Setup Program

- 1 Turn on or restart your system.
- 2 Press <F2> immediately after you see the following message:

<F2> = System Setup

If your operating system begins to load before you press <F2>, allow the system to finish booting, and then restart your system and try again.

 **NOTE:** To ensure an orderly system shutdown, see the documentation that accompanied your operating system.

## Responding to Error Messages

You can enter the System Setup program by responding to certain error messages. If an error message appears while the system is booting, make a note of the message. Before entering the System Setup program, see "System Messages" on page 19 for an explanation of the message and suggestions for correcting errors.

 **NOTE:** After installing a memory upgrade, it is normal for your system to send a message the first time you start your system.

## Using the System Setup Program

Table 2-1 lists the keys that you use to view or change information on the System Setup program screens and to exit the program.

**Table 2-1. System Setup Program Navigation Keys**

Keys	Action
Up arrow or <Shift><Tab>	Moves to the previous field.
Down arrow or <Tab>	Moves to the next field.
Spacebar, <+>, <->, left and right arrows	Cycles through the settings in a field. In many fields, you can also type the appropriate value.
<Esc>	Exits the System Setup program and restarts the system if any changes were made.
<F1>	Displays the System Setup program's help file.

 **NOTE:** For most of the options, any changes that you make are recorded but do not take effect until you restart the system.

## System Setup Options

### Main Screen

When you enter the System Setup program, the main System Setup program screen appears (see Figure 2-1).

**Figure 2-1. Main System Setup Program Screen**

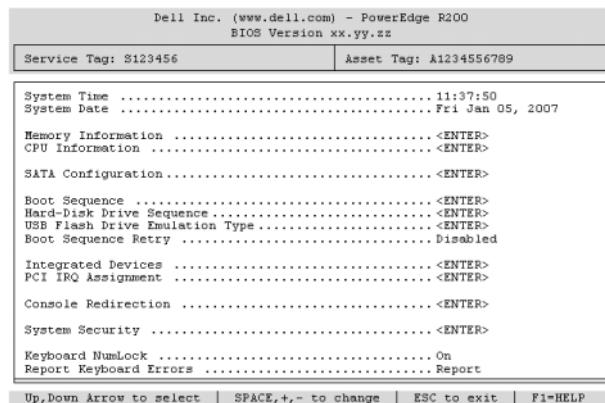


Table 2-2 lists the options and descriptions for the information fields that appear on the main System Setup program screen.

**NOTE:** The System Setup program defaults are listed under their respective options, where applicable.

**Table 2-2. System Setup Program Options**

Option	Description
System Time	Resets the time on the system's internal clock.
System Date	Resets the date on the system's internal calendar.
Memory Information	See "Memory Information Screen" on page 39.
CPU Information	See "CPU Information Screen" on page 39.
SATA Configuration	See "SATA Configuration Screen" on page 40.
Boot Sequence	Determines the order in which the system searches for boot devices during system startup. Available options can include the diskette drive, CD drive, hard drives, and network.
Hard-Disk Drive Sequence	Determines the order in which the system searches the hard drives during system startup. The selections depend on the hard drives installed in your system.

**Table 2-2. System Setup Program Options (*continued*)**

Option	Description
USB Flash Drive Emulation Type (Auto default)	Determines the emulation type for a USB flash drive. <b>Floppy</b> allows the USB flash drive to act as a removable floppy disk, and it will be assigned a drive letter of A: or B:. <b>Hard disk</b> allows the USB flash drive to act as a hard drive. <b>Auto</b> automatically chooses an emulation type.
Boot Sequence Retry (Disabled default)	Enables or disables retrying the boot sequence that was specified in the <b>Boot Sequence</b> option.
Integrated Devices	See "Integrated Devices Screen" on page 41.
PCI IRQ Assignment	Displays a screen to change the <b>IRQ</b> assigned to each of the integrated devices on the PCI bus, and any installed expansion cards that require an <b>IRQ</b> .
Console Redirection	See "Console Redirection Screen" on page 42.
System Security	Displays a screen to configure the system password and setup password features. See "Using the System Password" on page 45 and "Using the Setup Password" on page 48 for more information.
Keyboard NumLock (On default)	Determines whether your system starts up with the <b>NumLock</b> mode activated on 101– or 102-key keyboards (does not apply to 84-key keyboards).
Report Keyboard Errors (Report default)	Enables or disables reporting of keyboard errors during the POST. Enable this option for host systems that have keyboards attached. Select <b>Do Not Report</b> to suppress all error messages relating to the keyboard or keyboard controller during POST. This setting does not affect the operation of the keyboard itself if a keyboard is attached to the system.

## **Memory Information Screen**

Table 2-3 lists the options and descriptions for the information fields that appear on the **Memory Information** screen.

**Table 2-3. Memory Information Screen**

<b>Option</b>	<b>Description</b>
System Memory Size	Displays the amount of main memory in the system.
System Memory Type	Displays the type of memory installed in the system.
System Memory Speed	Displays the clock frequency of the main memory.
Video Memory	Displays the amount of video memory.
System Memory Testing (Enabled default)	When set to <b>Enabled</b> , system memory tests are conducted. When set to <b>Disabled</b> , the memory tests are not performed.

## **CPU Information Screen**

Table 2-4 lists the options and descriptions for the information fields that appear on the **CPU Information** screen.

**Table 2-4. CPU Information Screen**

<b>Option</b>	<b>Description</b>
64-bit	Specifies if the installed processor supports Intel® 64-bit extensions.
Core Speed	Displays the clock speed of the processor.
Bus Speed	Displays the bus speed of the processor.
Logical Processor (Enabled default)	Displays when the processor supports Hyper-Threading technology. <b>Enabled</b> permits all logical processors to be used by the operating system. Only the first logical processor is used by the operating system if <b>Disabled</b> is selected.
Virtualization Technology (Disabled default)	Displays when the processor(s) support Virtualization Technology. <b>Enabled</b> permits virtualization software to use Virtualization Technology incorporated in the processor design. This feature can only be used by software that supports Virtualization Technology.

**Table 2-4. CPU Information Screen (*continued*)**

Option	Description
Adjacent Cache Line Prefetch <b>(Enabled default)</b>	Enables or disables optimal use of sequential memory access. Disable this option for applications that require high use of random memory access.
Hardware Prefetcher <b>(Enabled default)</b>	Enables or disables the hardware prefetcher.
Demand-Based Power Management <b>(Disabled default)</b>	When set to <b>Enabled</b> , the CPU Performance State Tables are reported to the operating system. When set to <b>Disabled</b> , the Performance State Tables are not reported to the operating system. If the processor does not support Demand-Based Power Management, this field is read-only.
Processor 0 ID	Displays the family and model number of the processor.
Processor Name Display	Displays the CPU name of the installed Processor 0.
Level 2 Cache	Displays the amount of cache memory for the processor.
Number of Cores	Displays the number of cores in the processor.

## SATA Configuration Screen

Table 2-5 lists the options and descriptions for the information fields that appear on the **SATA Configuration** screen.

**Table 2-5. SATA Configuration Screen**

Option	Description
Embedded SATA	Enables ( <b>ATA Mode</b> ) or disables ( <b>Off</b> ) all SATA ports.
Port X	Enables ( <b>Auto</b> ) or disables ( <b>Off</b> ) the SATA hard drive in Port X.
Model	Displays the drive model of the selected hard drive.
Drive Type	Displays the drive type of the selected hard drive.
Capacity	Displays the total capacity of the selected hard drive.

## Integrated Devices Screen

Table 2-6 lists the options and descriptions for the information fields that appear on the Integrated Devices screen.

**Table 2-6. Integrated Devices Screen Options**

Option	Description
User Accessible USB Ports <b>(All Ports On default)</b>	Enables or disables the user accessible USB ports. Options are All Ports On, Only Back Ports On, or All Ports Off.
Embedded Gb NIC <b>(Enabled with PXE default)</b>	Enables or disables the system's integrated NIC. Options are Enabled with PXE, Enabled without PXE, and Disabled. PXE support allows the system to boot from the network. Changes take effect after the system reboots.
MAC Address	Displays the MAC address for the integrated 10/100/1000 NIC. This field does not have user-selectable settings.
Secondary Embedded Gb NIC <b>(Enabled without PXE default)</b>	Enables or disables the system's secondary integrated NIC. Options are Enabled without PXE, Enabled with PXE, and Disabled. PXE support allows the system to boot from the network. Changes take effect after the system reboots.
Secondary NIC MAC Address	Displays the MAC address for the secondary integrated 10/100/1000 NIC. This field does not have user-selectable settings.
OS Watchdog Timer <b>(Disabled default)</b>	If the system stops responding, the watchdog timer aids in recovery of the OS. When set to Enabled, the OS is allowed to initialize the timer. When set to Disabled, the timer has no effect on the system.

**Table 2-6. Integrated Devices Screen Options (*continued*)**

Option	Description
Serial Port 1 (COM1 default)	Serial Port options are COM1, COM3, BMC Serial, BMC NIC, COM1/BMC, and Off. If an optional remote access controller (RAC) is installed in the system, RAC is an additional option.  Serial Port shares three usage models. For standard usage, Serial Port attempts to use COM1 first, and then COM3. For BMC usage, serial port 1 uses the COM1 address and communication can be either via the serial port or the integrated shared NIC. RAC control uses only the COM1 address.  The COM1/BMC setting allows you to toggle the system between a COM1 setting and BMC Serial setting. In this mode, press <ESC> to enter the BMC Serial setting and press <ESC><q> to return to the COM1 setting.  Off and COM3 are not available options when Console Redirection is set to use Serial Port 1.
Speaker (On default)	Enables or disables the system internal speaker.

## Console Redirection Screen

Table 2-7 lists the options and descriptions for the information fields that appear on the **Console Redirection** screen.

**Table 2-7. Console Redirection Screen Options**

Option	Description
Console Redirection (Off default)	Sets the console redirection feature to Off or Serial Port 1.
Failsafe Baud Rate (115200 default)	Displays if the failsafe baud rate is used for console redirection.
Remote Terminal Type (VT 100/VT 220 default)	Select either VT 100/VT 220 or ANSI.
Redirection After Boot (Enabled default)	Enables or disables console redirection after your system restarts.

## System Security Screen

Table 2-8 lists the options and descriptions for the information fields that appear on the System Security screen.

**Table 2-8. System Security Screen Options**

Option	Description
System Password	<p>Displays the current status of your system's password security feature and allows you to assign and verify a new system password.</p> <p><b>NOTE:</b> See "Using the System Password" on page 45 for instructions on assigning a system password and using or changing an existing system password.</p>
Setup Password	<p>Restricts access to the System Setup program in the same way that you restrict access to your system using the system password feature.</p> <p><b>NOTE:</b> See "Using the Setup Password" on page 48 for instructions on assigning a setup password and using or changing an existing setup password.</p>
Password Status	<p>Setting the <b>Setup Password</b> option to <b>Enabled</b> prevents the system password from being changed or disabled at system start-up.</p> <p>To <i>lock</i> the system password, assign a setup password in the <b>Setup Password</b> option and then change the <b>Password Status</b> option to <b>Locked</b>. In this state, you cannot change the system password using the <b>System Password</b> option and the system password cannot be disabled at system start-up by pressing &lt;Ctrl&gt;&lt;Enter&gt;.</p> <p>To <i>unlock</i> the system password, enter the setup password in the <b>Setup Password</b> field and then change the <b>Password Status</b> option to <b>Unlocked</b>. In this state, you can disable the system password at system start-up by pressing &lt;Ctrl&gt;&lt;Enter&gt; and then change the password using the <b>System Password</b> option.</p>

**Table 2-8. System Security Screen Options (*continued*)**

Option	Description
Power Button	<p>Turns system's power off and on.</p> <ul style="list-style-type: none"><li>If you turn off the system using the power button and the system is running an ACPI-compliant operating system, the system can perform an orderly shutdown before power is turned off.</li><li>If the system is not running an ACPI-compliant operating system, power is turned off immediately after the power button is pressed.</li></ul> <p>The button is enabled in the System Setup program. When disabled, the button can only turn on system power.</p> <p><b>NOTE:</b> You can still turn on the system by using the power button, even if the Power Button option is set to <b>Disabled</b>.</p>
NMI Button	<p>This field enables/disables the NMI button on the front panel.</p> <p> <b>NOTICE:</b> Use the NMI button only if directed to do so by qualified support personnel or by the operating system's documentation. Pressing this button halts the operating system and displays a diagnostic screen.</p> <p>Sets the NMI feature <b>On</b> or <b>Off</b>.</p>
AC Power Recovery (Last default)	Determines how the system reacts when power is restored to the system. If system is set to <b>Last</b> , the system returns to the last power state. <b>On</b> turns on the system after power is restored. When set to <b>Off</b> , the system remains off after power is restored.

## Exit Screen

After you press <Esc> to exit the System Setup program, the **Exit** screen displays the following options:

- Save Changes and Exit
- Discard Changes and Exit
- Return to Setup

# System and Setup Password Features

- ➡ **NOTICE:** The password features provide a basic level of security for the data on your system. If your data requires more security, use additional forms of protection, such as data encryption programs.
- ➡ **NOTICE:** Anyone can access the data stored on your system if you leave the system running and unattended without having a system password assigned or if you leave your system unlocked so that someone can disable the password by changing a jumper setting.

Your system is shipped to you without the system password feature enabled. If system security is a concern, operate your system only with system password protection.

To change or delete an existing password, you must know the password (see "Deleting or Changing an Existing System Password" on page 47). If you forget your password, you cannot operate your system or change settings in the System Setup program until a trained service technician changes the password jumper setting to disable the passwords, and erases the existing passwords. This procedure is described in "Disabling a Forgotten Password" on page 125.

## Using the System Password

After a system password is assigned, only those who know the password have full use of the system. When the **System Password** option is set to **Enabled**, the system prompts you for the system password after the system starts.

### Assigning a System Password

Before you assign a system password, enter the System Setup program and check the **System Password** option.

When a system password is assigned, the setting shown for the **System Password** option is **Enabled**. If the setting shown for the **Password Status** is **Unlocked**, you can change the system password. If the **Password Status** option is **Locked**, you cannot change the system password. When the system password feature is disabled by a jumper setting, the system password is **Disabled**, and you cannot change or enter a new system password.

When a system password is not assigned and the password jumper on the system board is in the enabled (default) position, the setting shown for the **System Password** option is **Not Enabled** and the **Password Status** field is **Unlocked**. To assign a system password:

- 1 Verify that the **Password Status** option is set to **Unlocked**.
- 2 Highlight the **System Password** option and press <Enter>.
- 3 Type your new system password.

You can use up to 32 characters in your password.

As you press each character key (or the spacebar for a blank space), a placeholder appears in the field.

The password assignment is not case-sensitive. However, certain key combinations are not valid. If you enter one of these combinations, the system beeps. To erase a character when entering your password, press <Backspace> or the left-arrow key.

 **NOTE:** To escape from the field without assigning a system password, press <Enter> to move to another field, or press <Esc> at any time prior to completing step 5.

- 4 Press <Enter>.
  - 5 To confirm your password, type it a second time and press <Enter>.
- The setting shown for the **System Password** changes to **Enabled**. Exit the System Setup program and begin using your system.
- 6 Either reboot your system now for your password protection to take effect or continue working.

 **NOTE:** Password protection does not take effect until you reboot the system.

## Using Your System Password to Secure Your System

 **NOTE:** If you have assigned a setup password (see "Using the Setup Password" on page 48), the system accepts your setup password as an alternate system password.

When the **Password Status** option is set to **Unlocked**, you have the option to leave the password security enabled or to disable the password security.

To leave the password security enabled:

- 1 Turn on or reboot your system by pressing <Ctrl><Alt><Del>.
- 2 Type your password and press <Enter>.

To disable the password security:

- 1 Turn on or reboot your system by pressing <Ctrl><Alt><Del>.
- 2 Type your password and press <Ctrl><Enter>.

When the **Password Status** option is set to **Locked** whenever you turn on your system or reboot your system by pressing <Ctrl><Alt><Del>, type your password and press <Enter> at the prompt.

After you type the correct system password and press <Enter>, your system operates as usual.

If an incorrect system password is entered, the system displays a message and prompts you to re-enter your password. You have three attempts to enter the correct password. After the third unsuccessful attempt, the system displays an error message showing the number of unsuccessful attempts and that the system has halted and will shut down. This message can alert you to an unauthorized person attempting to use your system.

Even after you shut down and restart the system, the error message continues to be displayed until the correct password is entered.



**NOTE:** You can use the **Password Status** option in conjunction with the **System Password** and **Setup Password** options to further protect your system from unauthorized changes.

### **Deleting or Changing an Existing System Password**

- 1 When prompted, press <Ctrl><Enter> to disable the existing system password.  
If you are asked to enter your setup password, contact your network administrator.
- 2 Enter the System Setup program by pressing <F2> during POST.
- 3 Select the **System Security** screen field to verify that the **Password Status** option is set to **Unlocked**.
- 4 When prompted, type the system password.

- 5** Confirm that **Not Enabled** is displayed for the **System Password** option. If **Not Enabled** is displayed for the **System Password** option, the system password has been deleted. If **Enabled** is displayed for the **System Password** option, press the **<Alt><b>** key combination to restart the system, and then repeat steps 2 through 5.

## Using the Setup Password

### Assigning a Setup Password

You can assign (or change) a setup password only when the **Setup Password** option is set to **Not Enabled**. To assign a setup password, highlight the **Setup Password** option and press the **<+>** or **<->** key. The system prompts you to enter and verify the password. If a character is illegal for password use, the system beeps.



**NOTE:** The setup password can be the same as the system password. If the two passwords are different, the setup password can be used as an alternate system password. However, the system password cannot be used in place of the setup password.

You can use up to 32 characters in your password.

As you press each character key (or the spacebar for a blank space), a placeholder appears in the field.

The password assignment is not case-sensitive. However, certain key combinations are not valid. If you enter one of these combinations, the system beeps. To erase a character when entering your password, press **<Backspace>** or the left-arrow key.

After you verify the password, the **Setup Password** setting changes to **Enabled**. The next time you enter the System Setup program, the system prompts you for the setup password.

A change to the **Setup Password** option becomes effective immediately (restarting the system is not required).

### Operating With a Setup Password Enabled

If **Setup Password** is set to **Enabled**, you must enter the correct setup password before you can modify most of the System Setup options. When you start the System Setup program, the program prompts you to enter a password.

If you do not enter the correct password in three attempts, the system lets you view, but not modify, the System Setup screens—with the following exception: If **System Password** is not set to **Enabled** and is not locked through the **Password Status** option, you can assign a system password (however, you cannot disable or change an existing system password).

 **NOTE:** You can use the **Password Status** option in conjunction with the **Setup Password** option to protect the system password from unauthorized changes.

### **Deleting or Changing an Existing Setup Password**

- 1 Enter the System Setup program and select the **System Security** option.
- 2 Highlight the **Setup Password** option, press <Enter> to access the setup password window, and press <Enter> twice to clear the existing setup password.  
The setting changes to **Not Enabled**.
- 3 If you want to assign a new setup password, perform the steps in "Assigning a Setup Password" on page 48.

## **Disabling a Forgotten Password**

See "Disabling a Forgotten Password" on page 125.

## **Baseboard Management Controller Configuration**

The Baseboard Management Controller (BMC) enables configuring, monitoring, and recovery of systems remotely. BMC provides the following features:

- Uses the system's serial port and integrated NIC
- Fault logging and SNMP alerting
- Access to system event log and sensor status
- Control of system functions including power on and off
- Support is independent of the system's power or operating state
- Provides text console redirection for system setup, text-based utilities, and operating system consoles

 **NOTE:** To remotely access the BMC through the integrated NIC, you must connect the network connection to integrated NIC1.

For additional information on using BMC, see the documentation for the BMC and systems management applications.

## Entering the BMC Setup Module

- 1** Turn on or restart your system.
- 2** Press <Ctrl-E> when prompted after POST.  
If your operating system begins to load before you press <Ctrl-E>, allow the system to finish booting, and then restart your system and try again.

## BMC Setup Module Options

For information about the BMC Setup Module options and how to configure the emergency management port (EMP), see the *BMC User's Guide*.

# Installing System Components

This section describes how to install the following system components:

- Cooling shroud
- System battery
- Optical drive
- Hard drives
- Fan assembly
- Optional PCI fan
- Power supply
- Expansion cards
- Riser card
- System memory
- Processor
- Control panel
- System board

## Recommended Tools

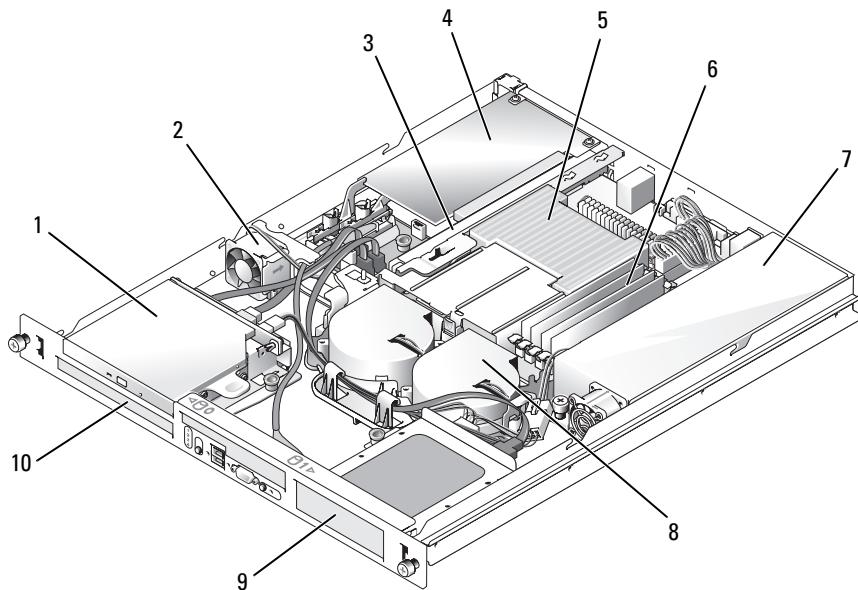
You may need the following items to perform the procedures in this section:

- Key to the system keylock
- Wrist grounding strap
- #2 Phillips screwdriver

## Inside the System

In Figure 3-1, the bezel and system cover are removed to provide an interior view of the system.

**Figure 3-1. Inside the System**



- |    |                               |   |                         |   |                    |
|----|-------------------------------|---|-------------------------|---|--------------------|
| 1  | optical drive (optional)      | 2 | PCI fan (optional)      | 3 | riser card         |
| 4  | PCI expansion card (optional) | 5 | processor and heat sink | 6 | memory modules (4) |
| 7  | power supply                  | 8 | processor fan module    | 9 | hard drive 1       |
| 10 | hard drive 0                  |   |                         |   |                    |

The system board holds the system's control circuitry and other electronic components. The processor and memory are installed directly on the system board. Using a riser card, the system can accommodate two expansion cards. The peripheral bays provide space for up to two hard drives and an optional optical drive. Power is supplied to the system board and drives through one nonredundant power supply.

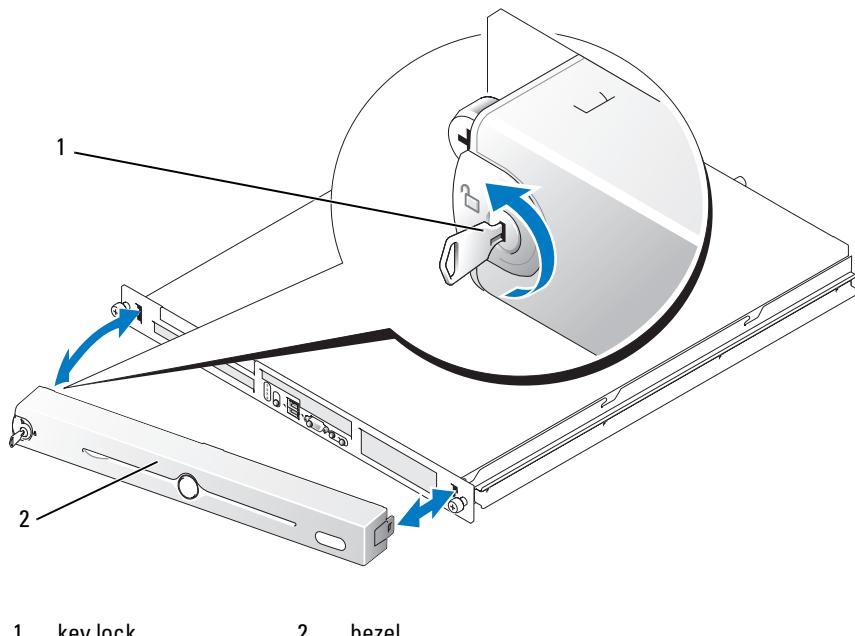
# Opening and Closing the System

The system is enclosed by an optional bezel and cover. To upgrade or troubleshoot the system, remove the bezel and cover.

## Removing the Bezel

- 1 Unlock the bezel. See Figure 3-2.
- 2 Unlatch the left end of the bezel and rotate it away from the front panel.
- 3 Unhook the right end of the bezel and pull the bezel away from the system.

**Figure 3-2. Installing and Removing the Optional Bezel**



## Installing the Bezel

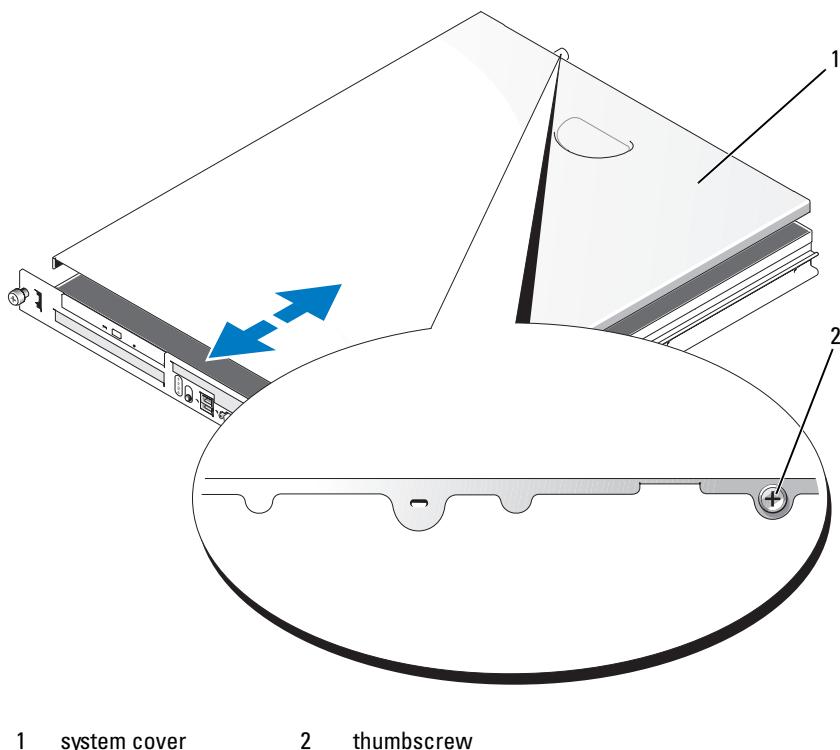
- 1 Hook the right end of the bezel into the bezel slot on the right side of the system front plate
- 2 Rotate the other end of the bezel toward the front panel and press the bezel onto the panel to engage the latch.
- 3 Lock the bezel.

## Opening the System

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Extend the system out of the rack to the locked position. If the system is installed on static rails, remove the system from the rack and place it on a work surface.
- 3 To remove the system cover, loosen the thumbscrew at the back of the system. See Figure 3-3.
- 4 Slide the cover backward about 1.3 cm (0.5 inch), and grasp the cover on both sides.
- 5 Carefully lift the cover away from the system.

**Figure 3-3. Installing and Removing the System Cover**



1 system cover

2 thumbscrew

## Closing the System

- 1 Ensure that you did not leave tools or parts inside the system.
- 2 Place the cover over the sides of the chassis, and slide the cover forward.
- 3 Tighten the thumbscrew at the back of the system to secure the cover. See Figure 3-3.
- 4 Replace the system in the rack, and reconnect the peripheral cables.
- 5 Reconnect the system to the electrical outlet, and turn on the system.

# Cooling Shroud

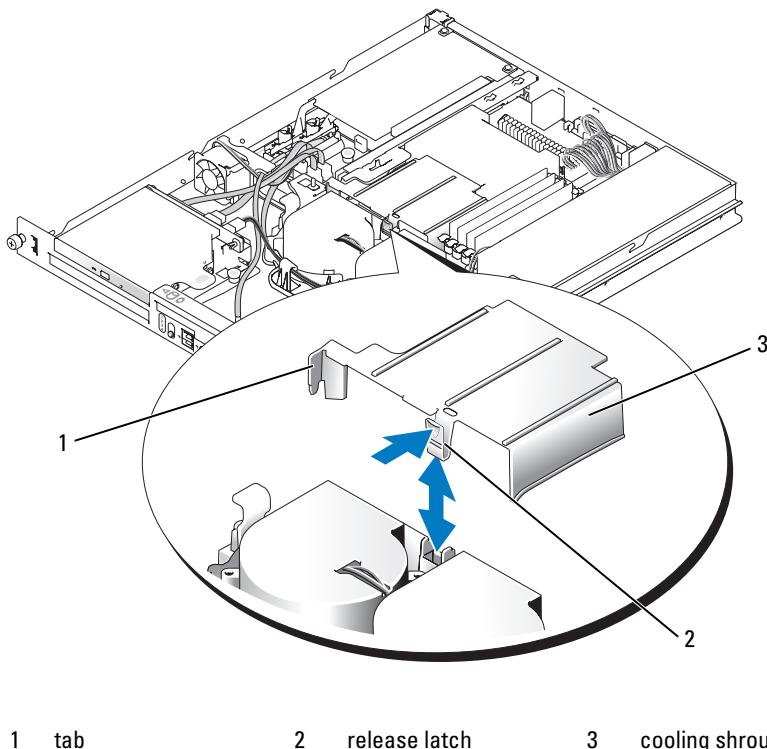
The cooling shroud covers the processor and system battery and provides air flow to these components and the system memory.

## Removing the Cooling Shroud

**!** **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Open the system. See "Opening the System" on page 54.
- 2 While grasping the cooling shroud, press the release latch and lift the shroud away from the fan assembly. See Figure 3-4.
- 3 Remove the cooling shroud.

**Figure 3-4. Installing and Removing the Cooling Shroud**



1 tab

2 release latch

3 cooling shroud

### **Installing the Cooling Shroud**

- 1** Insert the tab on the side of the cooling shroud and the release latch into the fan assembly. See Figure 3-4.
- 2** Push the cooling shroud down until the release latch snaps into place, securing the shroud to the fan assembly.
- 3** Close the system. See "Closing the System" on page 55.

# System Battery

## Replacing the System Battery

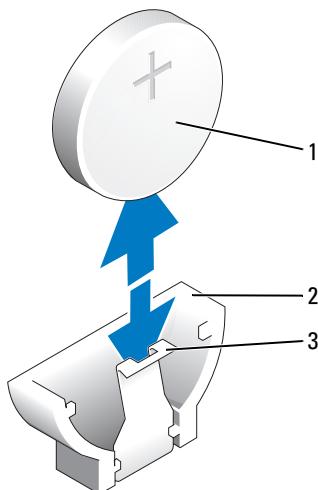
 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Enter the System Setup program and, if possible, make a printed copy of the System Setup screens.  
See "Using the System Setup Program" on page 35.
- 2 Open the system. See "Opening the System" on page 54.
- 3 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 56.
- 4 Remove the riser card. See "Removing the Riser Card" on page 79.
- 5 Locate the battery on the system board. See Figure 6-2 for the battery location.
- 6 Grasp the battery with your fingers and pull it out of the battery socket. See Figure 3-5.
- 7 Push the new battery into the battery socket as shown in Figure 3-5.



**NOTE:** The side of the battery labeled "+" must face toward the open side of the battery socket.

**Figure 3-5. Replacing the Battery**



1 battery

2 battery socket

3 retention tab

- 8 Reinstall the riser card. See "Installing the Riser Card" on page 80.
- 9 Install the cooling shroud. See "Installing the Cooling Shroud" on page 57.
- 10 Close the system. See "Closing the System" on page 55.
- 11 Enter the System Setup program to confirm that the battery operates properly.
- 12 From the main screen, select **System Time** to enter the correct time and date.  
Also, re-enter any system configuration information that is no longer displayed on the System Setup screens, and then exit the System Setup program.
- 13 To test the newly installed battery, see "Troubleshooting the System Battery" on page 106.

# Optical Drive

The optional optical drive is mounted in a bracket using two alignment pins and a spring clip on top of hard drive 0. An interposer card is connected to the back of the drive which allows the drive to be connected to the SATA\_2 connector on the system board.

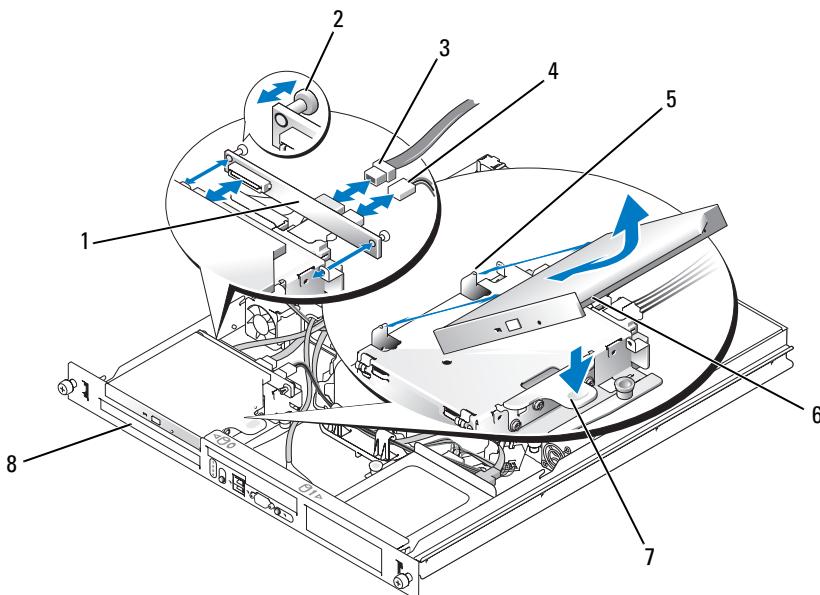
## Removing the Optical Drive



**CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Open the system. See "Opening the System" on page 54.
- 2 Disconnect the power and interface cables from the optical drive's interposer card.
- 3 Pull the two captive fasteners that secure the interposer card to the hard drive 0 carrier. See Figure 3-6.
- 4 Disconnect the interposer card from the optical drive.
- 5 Press the bracket release lever that secures the optical drive to the hard drive 0 carrier. See Figure 3-6.
- 6 Lift and tilt the optical drive up and out of the bracket as shown in Figure 3-6.

**Figure 3-6. Removing and Installing the Optional Optical Drive**



- |   |                       |   |                       |   |                    |
|---|-----------------------|---|-----------------------|---|--------------------|
| 1 | interposer board      | 2 | captive fasteners (2) | 3 | interface cable    |
| 4 | power cable           | 5 | retaining pins (4)    | 6 | mounting holes (4) |
| 7 | bracket release lever | 8 | hard drive 0          |   |                    |

## Installing the Optical Drive

**!** **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Align the optical drive's mounting holes with the retaining pins on the hard drive 0 bracket. See Figure 3-6.
- 2 Rotate the drive downward until it snaps into place.

- 3** Connect the interposer card to the optical drive.  
Push the plungers into the captive fastener barrels until they snap into place.
- 4** Connect the interface and power cables to the optical drive's interposer card.
- 5** Close the system. See "Closing the System" on page 55.

## Configuring the Boot Drive

The drive or device from which the system boots is determined by the boot order specified in the System Setup program. See "Using the System Setup Program" on page 35. To boot the system from a hard drive or drive array, the drive(s) must be connected to the appropriate controller:

- For systems using the integrated hard-drive controller, the master drive (drive 0) must be connected to the SATA\_0 connector on the system board. To identify system board connectors, see Figure 6-2.
- For systems with a SAS controller installed, the hard drive must be connected to the SAS controller card. See the documentation that accompanied the controller card.
- To boot from a SAS RAID array, the drive must be connected to the RAID controller card. See the documentation that accompanied the controller card.

## Hard Drives

Your system contains up to two non-hot-pluggable SATA or SAS hard drives. If your system contains SAS hard drives, they must be connected to a SAS controller card. The cables for hard drive 1 are routed through a cable clamp mounted to the chassis.

## Removing a Hard Drive

The procedures for removing and installing SATA or SAS hard drives are the same.



**CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

- 1 Open the system. See "Opening the System" on page 54.

- 2 If applicable, remove the optical drive.

Remove the optical drive if you are removing hard drive 0. See "Removing the Optical Drive" on page 60.

- 3 Disconnect the power and interface cables from the hard drive.

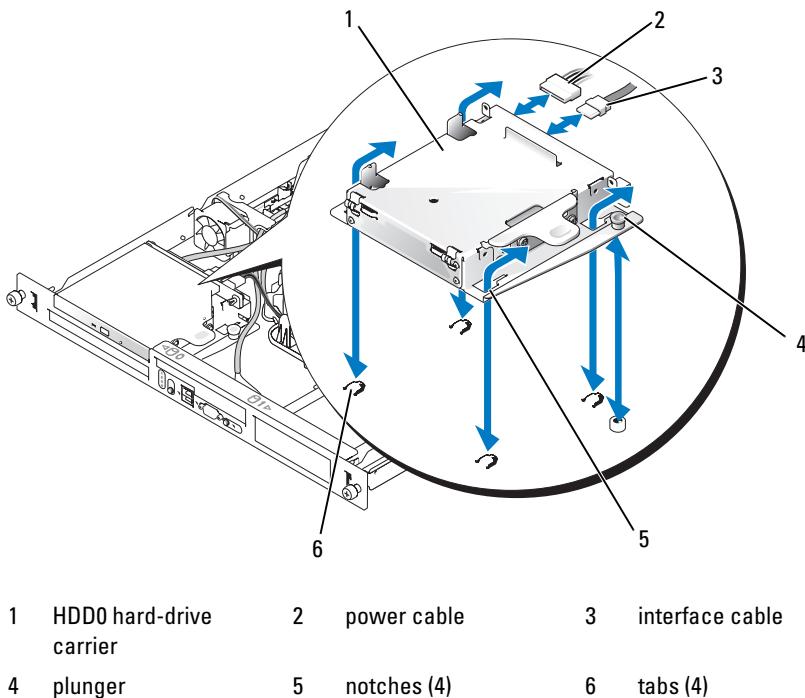
The interface cables for SATA hard drives are connected to the system board. See Figure 6-2 for the location of the system board connectors.

The interface cables for SAS hard drives are connected to a controller card.

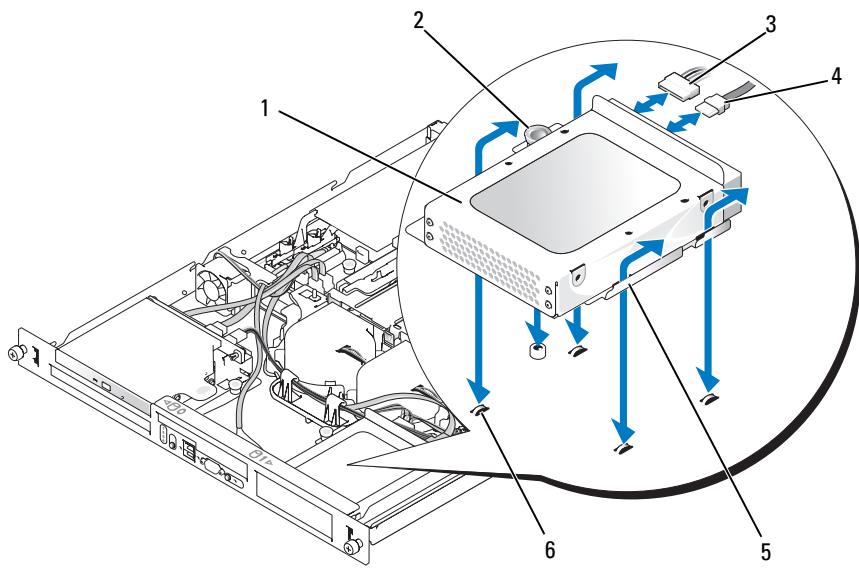
- 4 Pull up on the plunger that secures the hard-drive carrier to the chassis. See Figure 3-7 and Figure 3-8.

- 5 Slide the hard-drive carrier backward and lift the carrier out of the chassis. See Figure 3-7 and Figure 3-8.

**Figure 3-7. Removing the HDD0 Hard-Drive Carrier**

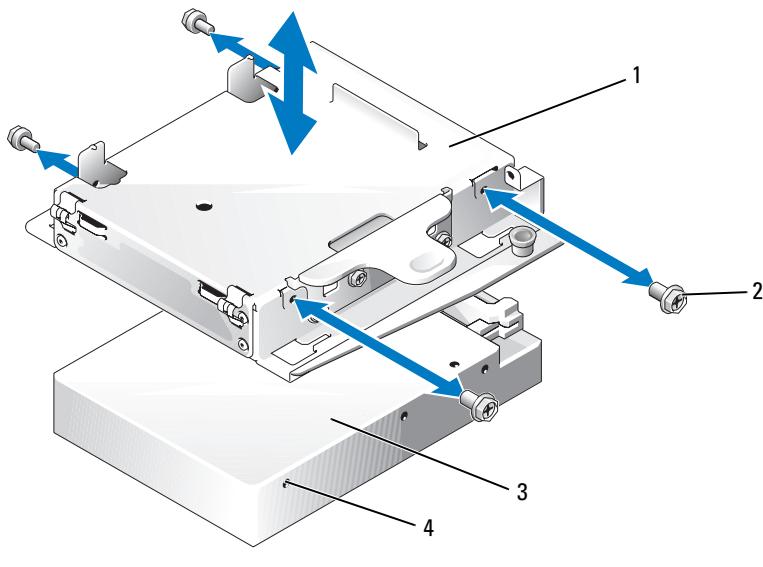


**Figure 3-8. Removing the HDD1 Hard-Drive Carrier**



- |   |                         |   |             |   |             |
|---|-------------------------|---|-------------|---|-------------|
| 1 | HDD1 hard-drive carrier | 2 | plunger     | 3 | power cable |
| 4 | interface cable         | 5 | notches (4) | 6 | tabs (4)    |
- 6** Using a #2 Phillips screwdriver, remove the four screws that secure the hard drive to the carrier and remove the drive from the carrier. See Figure 3-9 and Figure 3-10.

**Figure 3-9. Removing the Hard Drive From the HDD0 Drive Carrier**



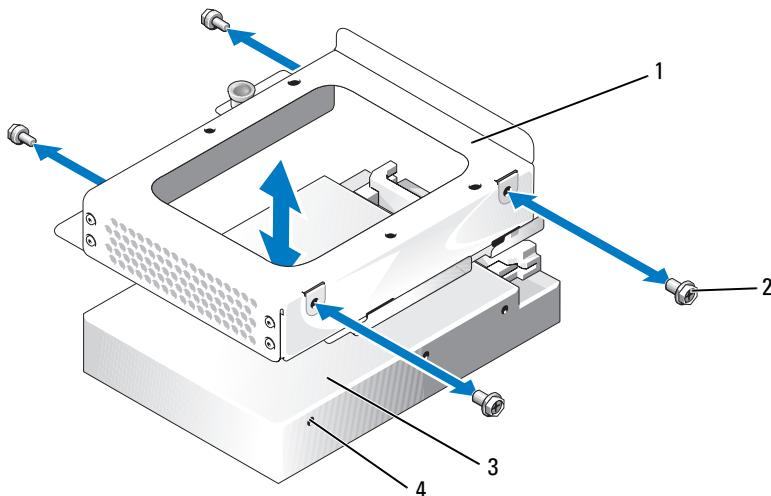
1 HDD0 hard-drive carrier

4 mounting holes (4)

2 screws (4)

3 hard drive

**Figure 3-10. Removing the Hard Drive From the HDD1 Drive Carrier**



- |   |                         |   |            |   |            |
|---|-------------------------|---|------------|---|------------|
| 1 | HDD1 hard-drive carrier | 2 | screws (4) | 3 | hard drive |
| 4 | mounting holes (4)      |   |            |   |            |

## Installing a Hard Drive



**CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Align the hard-drive mounting holes with the holes in the drive carrier.
- 2 Using a #2 Phillips screwdriver, install the four screws that secure the hard drive to the carrier. See Figure 3-10.
- 3 Align the hard-drive carrier so that the tabs on the chassis slide into the notches in the carrier. See Figure 3-7.
- 4 Slide the carrier forward until it stops.
- 5 Press down on the plunger to secure the hard-drive carrier to the chassis. See Figure 3-7 and Figure 3-8.

- 6** Connect the power and interface cables to the new drive:
  - If no SAS controller card is present, attach SATA interface cables to the hard drives and the SATA connectors on the system board. Connect hard drive 0 to the SATA\_0 connector and hard drive 1 to the SATA\_1 connector. See Figure 6-2 for the location of the SATA connectors.
  - If a SAS controller card is present, attach the HDD0 cable from the SAS controller to hard drive 0 and attach the HDD1 cable to hard drive 1. See the controller card documentation for further information.
- 7** Install the CD drive.  
Install the CD drive if you are removing hard drive 0. See "Installing the Optical Drive" on page 61.
- 8** Close the system. See "Closing the System" on page 55.

## Installing a SAS Controller Card

See "Installing an Expansion Card" on page 75 for general instructions about installing the controller card. See the controller card documentation for specific information on installing and configuring the card.

 **NOTICE:** If your SAS controller has an external storage connector, you must install the optional PCI fan assembly in your system to maintain the proper cooling environment. Failure to install the fan assembly could result in the system overheating and shutting down unexpectedly. See "Installing the PCI Fan Assembly" on page 72 for instructions on installing the PCI fan assembly.

## Fan Assembly

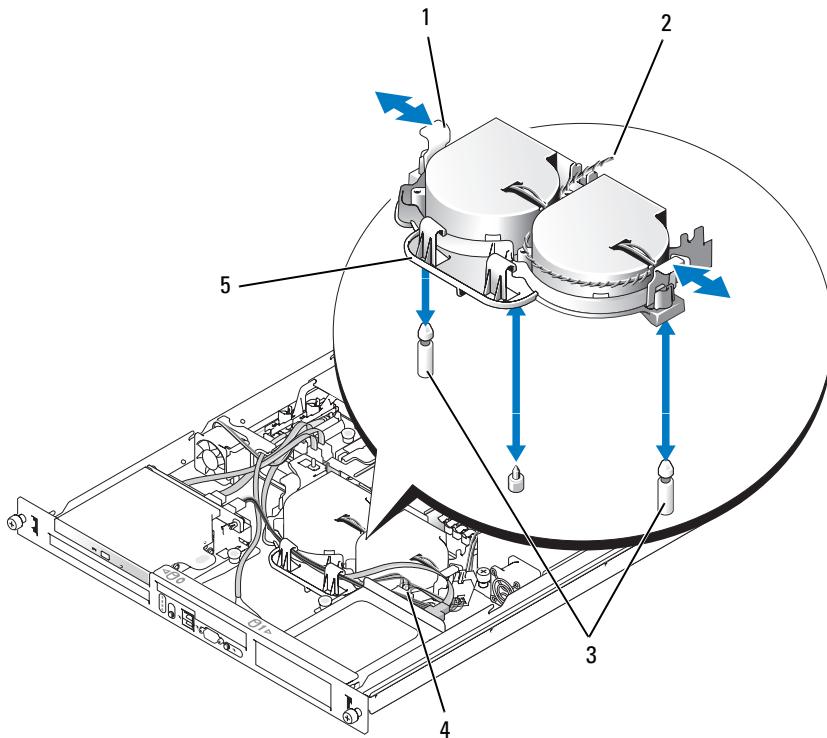
The fan assembly contains two fans and provides cooling for the processor and memory modules.

## Removing the Fan Assembly

**!** **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1** Open the system. See "Opening the System" on page 54.
- 2** Remove the cooling shroud. See "Removing the Cooling Shroud" on page 56.
- 3** Disconnect the fan assembly's power cable from the system board. See Figure 3-11.
- 4** Remove the data cable from hard drive 1 if installed. See Figure 3-11.
- 5** Remove the hard drive 0 power cable if installed.
- 6** Pull the cables out of the fan assembly's cable tray. See Figure 3-11.
- 7** While pressing the two release levers on the fan assembly, lift the fan assembly off of the two securing posts and out of the chassis. See Figure 3-11.

**Figure 3-11. Installing and Removing the Fan Assembly**



- |   |                         |   |             |   |                    |
|---|-------------------------|---|-------------|---|--------------------|
| 1 | release levers (2)      | 2 | power cable | 3 | securing posts (2) |
| 4 | hard drive 1 data cable | 5 | cable tray  |   |                    |

### **Installing the Fan Assembly**

- 1** Align the holes in the fan assembly with the two fan assembly securing posts. See Figure 3-11.
- 2** Lower the fan assembly until the release levers snap onto the securing posts.
- 3** Route the cables in the fan assembly cable tray. See Figure 3-11.
- 4** Reconnect the hard drive 1 data cable to the hard drive. See Figure 3-11.

- 5** Reconnect the fan assembly power cable to the system board.
- 6** Install the cooling shroud. See "Installing the Cooling Shroud" on page 57.
- 7** Close the system. See "Closing the System" on page 55.

## Optional PCI Fan Assembly

The optional PCI fan module provides cooling for the expansion cards.



**NOTICE:** Your system requires the PCI fan assembly if your system has a SAS controller that can be connected to an external storage system. Removing the fan assembly or disabling the fan could result in your system overheating and shutting down unexpectedly.

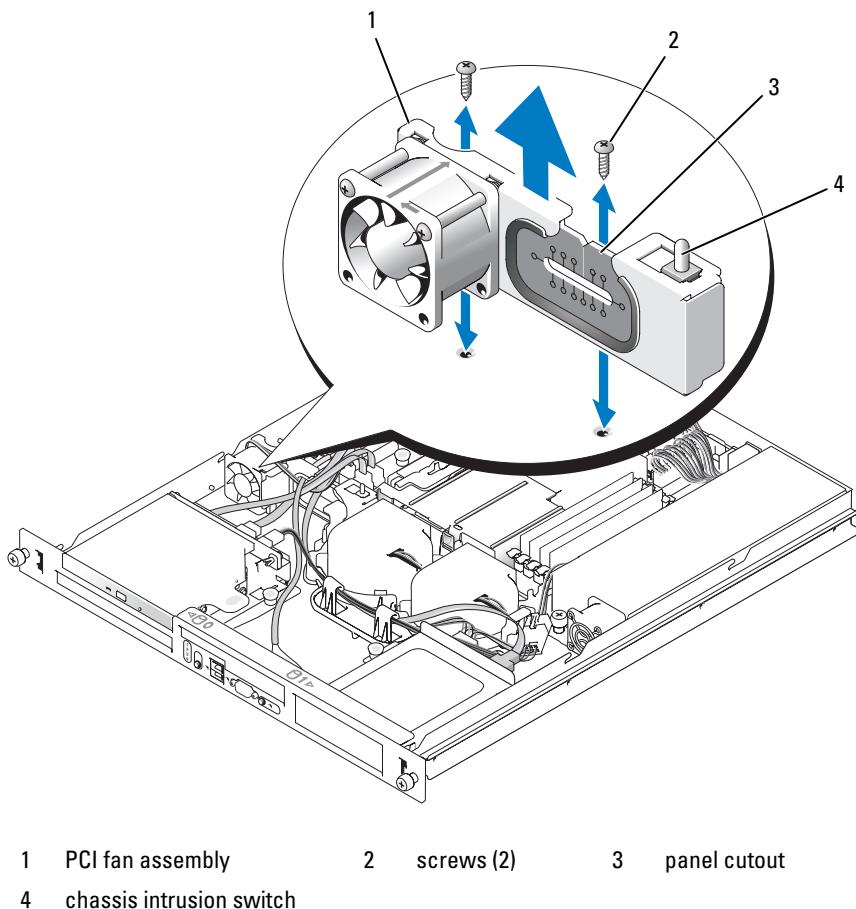
### Removing the PCI Fan Assembly



**CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1** Open the system. See "Opening the System" on page 54.
- 2** Disconnect the following cables from the system board and SAS controller (if present):
  - fan power cable
  - intrusion switch cable
  - hard drive interface cables
  - control panel interface cable
  - optical drive interface cable (if present)
- 3** Pull the interface cables through the panel cutout and fold them out of the way. See Figure 3-12.
- 4** Using a #2 Phillips screwdriver, remove the two screws securing the PCI fan assembly to the chassis. See Figure 3-12.
- 5** Remove the fan assembly from the system.

**Figure 3-12. Installing and Removing the PCI Fan Assembly**



### **Installing the PCI Fan Assembly**

- 1 Align the fan assembly with the screw holes on the chassis and use a #2 Phillips screwdriver to install the two mounting screws. See Figure 3-12.
- 2 Connect the fan's power cable to the PCI FAN connector on the system board. See Figure 6-2 for the location of the connector.

- 3** Connect the intrusion switch cable to the INTRUSION\_SWITCH connector on the system board. See Figure 6-2 for the location of the connector.
- 4** Route all interface connectors through the panel cutout.
- 5** Connect the hard-drive connectors to the SATA connectors on the system board or to the SAS controller, if present. See "Installing a Hard Drive" on page 67.
- 6** Connect the control panel interface cable to the FP\_CONN1 connector on the system board. See Figure 6-2 for the location of the connector.
- 7** Connect the optical drive interface cable to the SATA\_2 connector on the system board. See Figure 6-2 for the location of the connector.
- 8** Close the system. See "Closing the System" on page 55.

## Power Supply

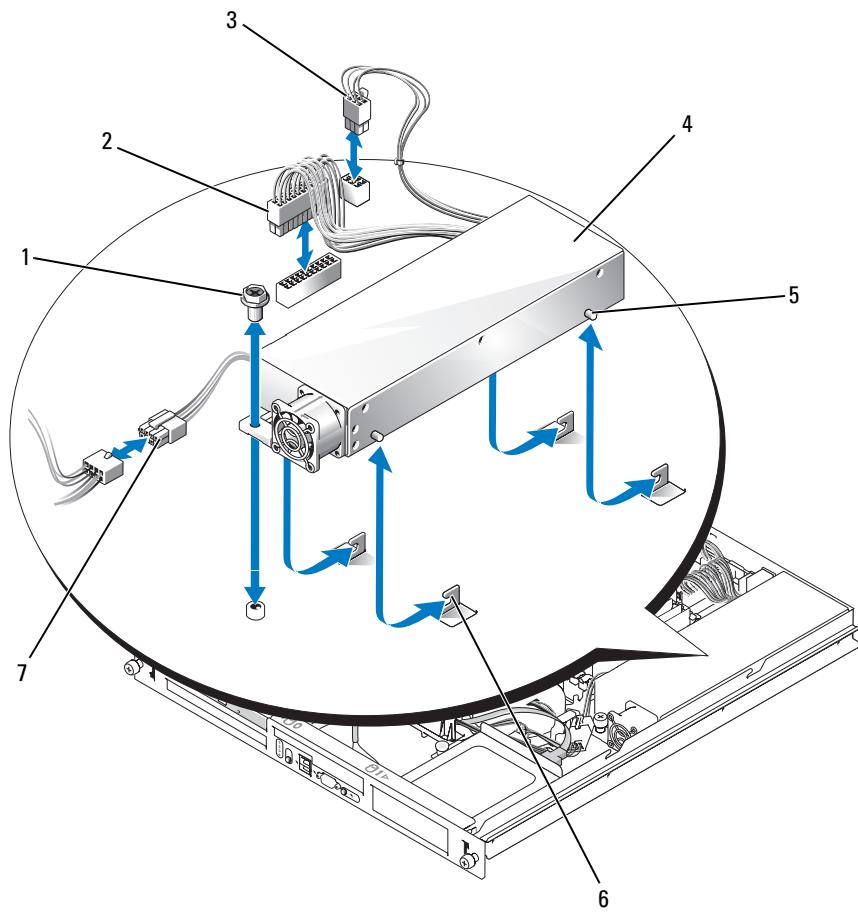
The system supports a single nonredundant power supply.

### Removing the Power Supply

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1** Open the system. See "Opening the System" on page 54.
- 2** Disconnect the following power supply cables:
  - a** P3 from the hard drive cable harness
  - b** P2 from system board connector 12V
  - c** P1 from system board connector PWR\_CONN
- 3** Using a #2 Phillips screwdriver, remove the screw at the front of the power supply that secures the power supply to the chassis. See Figure 3-13.
- 4** Slide the power supply forward and lift straight up to remove the power supply from the chassis.

**Figure 3-13. Installing and Removing the Power Supply**



- |                |                |                         |
|----------------|----------------|-------------------------|
| 1 screw        | 2 P1 connector | 3 P2 connector          |
| 4 power supply | 5 pins (4)     | 6 securing brackets (4) |
| 7 P3 connector |                |                         |

## Installing the Power Supply

- 1 Lower the power supply into the chassis and slide it backward until the four pins on the power supply are engaged into the securing brackets.
- 2 Using a #2 Phillips screwdriver, install the screw at the front of the power supply that secures the power supply to the chassis.
- 3 Connect the following power supply cables:
  - a P3 to the hard drive cable harness
  - b P2 to the system board connector 12V
  - c P1 to the system board connector PWR\_CONN
- 4 Close the system. See "Closing the System" on page 55.

## Expansion Cards

The system is available with an optional PCIe riser card or PCI-X/PCIe riser card. The PCIe riser card contains two PCIe expansion slots with x8-lane connectors—slot 1 has x4-lane capability and slot 2 has x8-lane capability. The PCI-X/PCIe riser card provides one PCI-X expansion slot and one PCIe x8-lane expansion slot. If you are installing a remote access controller card, it must be installed in the upper slot of a PCI-X/PCIe riser card. See "PCIe Riser Card Connectors" on page 124 for the locations of the expansion-card slots on the two types of riser cards.

### Installing an Expansion Card

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Open the system. See "Opening the System" on page 54.
- 2 Remove the expansion-card retainer adjacent to the expansion card slots. See Figure 3-14.
- 3 Slide the expansion-card sliding retainer to the retracted or open position. See Figure 3-15.

- 4 Remove the filler bracket on the slot you will be using.



**NOTE:** Keep this bracket if you need to remove the expansion card. Filler brackets must be installed over empty expansion card slots to maintain Federal Communications Commission (FCC) certification of the system. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

- 5 Insert the expansion card firmly into the expansion-card connector on the riser card until the card is fully seated.



**NOTE:** Ensure that the expansion-card bracket is also inserted into the securing slot on the chassis's back panel.

- 6 Replace the expansion-card retainer. See Figure 3-14.

- 7 Slide the expansion-card sliding retainer to the closed position so that it engages the edge of the expansion card. See Figure 3-15.

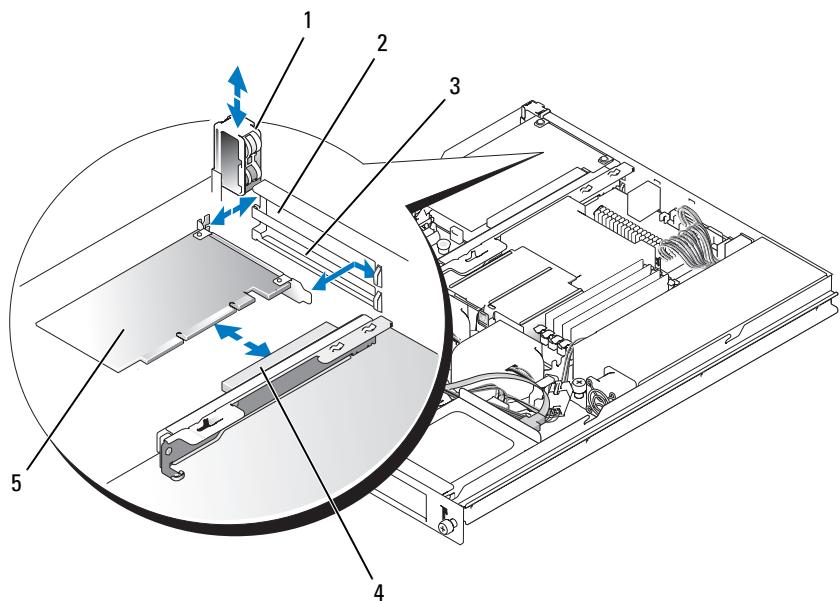
- 8 Connect any internal or external cable(s) to the expansion card.



**NOTE:** You may need to remove the riser card in order to install certain expansion cards with internal connectors. See "Riser Card" on page 79.

- 9 Close the system. See "Closing the System" on page 55.

**Figure 3-14. Installing and Removing Expansion Cards**



1 expansion-card  
retainer

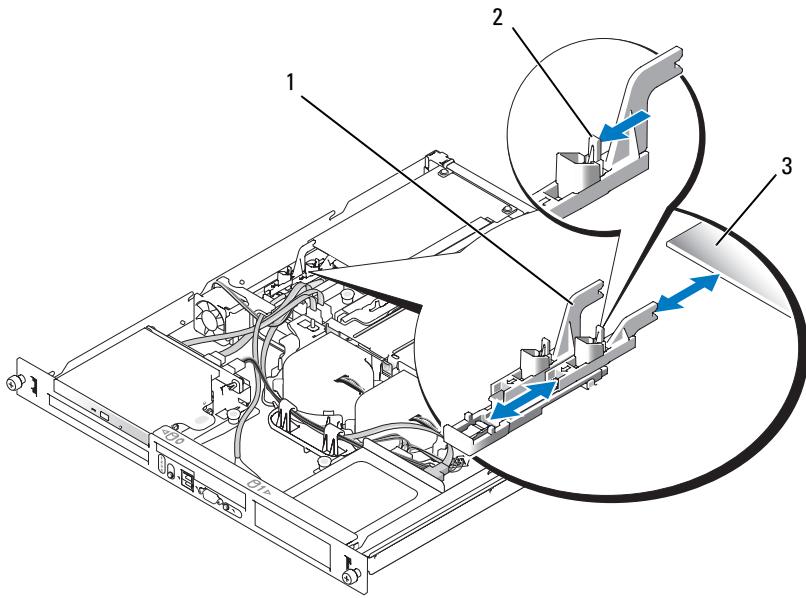
4 expansion-card  
connector (on riser  
card)

2 slot 1

5 expansion card

3 slot 2

**Figure 3-15. Opening and Closing the Expansion-Card Sliding Retainer**



1 expansion-card sliding retainer    2 release tab

3 expansion card

## Removing an Expansion Card

**!** **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Open the system. See "Opening the System" on page 54.
- 2 Disconnect any internal or external cable(s) that are connected to the expansion card.
- 3 Lift the expansion-card retainer adjacent to the PCI slots. See Figure 3-14.
- 4 Slide the expansion-card sliding retainer to the retracted or open position. See Figure 3-15.

- 5** Grip the edges of the expansion card with the fingers of both hands and carefully work the card out of the expansion-card connector.
- 6** If you are permanently removing the card, replace the metal filler bracket over the empty card-slot opening.

 **NOTE:** Filler brackets must be installed over empty expansion-card slots to maintain FCC certification of the system. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.
- 7** Replace the expansion-card retainer.
- 8** Close the system. See "Closing the System" on page 55.

## Riser Card

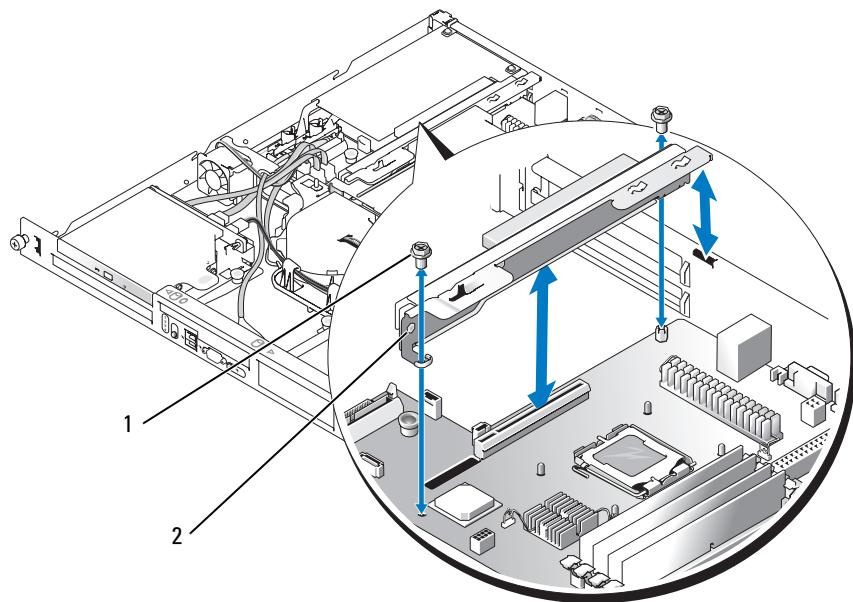
The riser card provides two expansion-card slots. See "Expansion Cards" on page 75 for detailed information on the expansion-card slots.

### Removing the Riser Card

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1** Open the system. See "Opening the System" on page 54.
- 2** Remove any expansion card(s). See "Removing an Expansion Card" on page 78.
- 3** Using a #2 Phillips screwdriver, remove the two screws that secure the riser card to the chassis. See Figure 3-16.
- 4** Lift the riser card straight up and remove the riser card from the system.

**Figure 3-16. Installing and Removing the Riser Card**



1 screws (2)

2 riser card

### Installing the Riser Card

**!** **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Insert the riser card firmly into the riser card connector on the system board until the riser card is fully seated.
- 2 Using a #2 Phillips screwdriver, install the two screws that secure the riser card to the system board.
- 3 Install any expansion card(s). See "Installing an Expansion Card" on page 75.
- 4 Close the system. See "Closing the System" on page 55.

# System Memory

The four memory module sockets are located on the system board adjacent to the power supply and can accommodate 512 MB to 8 GB of unbuffered ECC PC-5300/6400 (DDR2 667 or DDR 800) memory. See Figure 6-2 for the location of the memory module sockets.

You can upgrade the system memory by installing combinations of 512-MB, 1-GB, and 2-GB unbuffered memory modules. If you receive an error message stating that maximum memory has been exceeded, see "System Messages" on page 19 for more information. You can purchase memory upgrade kits from Dell.



**NOTE:** The memory modules must be PC-5300/6400 compliant.

## Memory Module Installation Guidelines

The memory module sockets are arranged in banks (1 and 2) on two channels (A and B).

The memory module banks are identified as follows:

Bank 1: DIMM1\_A and DIMM1\_B

Bank 2: DIMM2\_A and DIMM2\_B

The memory module banks must be installed in identical pairs in configurations that have more than one memory module. For example, if socket DIMM1\_A contains a 512-MB memory module, then the second memory module to be installed must be a 512-MB memory module in socket DIMM1\_B.

Table 3-1 shows examples of different memory configurations, based on the following guidelines:

- The minimum memory configuration is 512 MB.
- If only one memory module is installed, it must be installed in the DIMM1\_A socket.
- A bank must contain identical memory modules.
- Install the memory modules in bank 1 (DIMM1\_x) before installing memory modules in bank 2 (DIMM2\_x).
- Installing three memory modules is not supported.

**Table 3-1. Sample Memory Module Configurations**

Total Memory	DIMM1_A	DIMM2_A	DIMM1_B	DIMM2_B
512 MB	512 MB	None	None	None
1 GB	512 MB	None	512 MB	None
1 GB	1 GB	None	None	None
2 GB	512 MB	512 MB	512 MB	512 MB
2 GB	1 GB	None	1 GB	None
3 GB	1 GB	512 MB	1 GB	512 MB
4 GB	1 GB	1 GB	1 GB	1 GB
4 GB	2 GB	None	2 GB	None
5 GB	2 GB	512 MB	2 GB	512 MB
6 GB	2 GB	1 GB	2 GB	1 GB
8 GB	2 GB	2 GB	2 GB	2 GB

## Installing Memory Modules

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Open the system. See "Opening the System" on page 54.
- 2 Locate the memory module sockets. See Figure 6-2.
- 3 Press the ejectors on the memory module socket down and out, as shown in Figure 3-17, to allow the memory module to be inserted into the socket.
- 4 Align the memory module's edge connector with the alignment keys of the memory module socket, and insert the memory module in the socket.

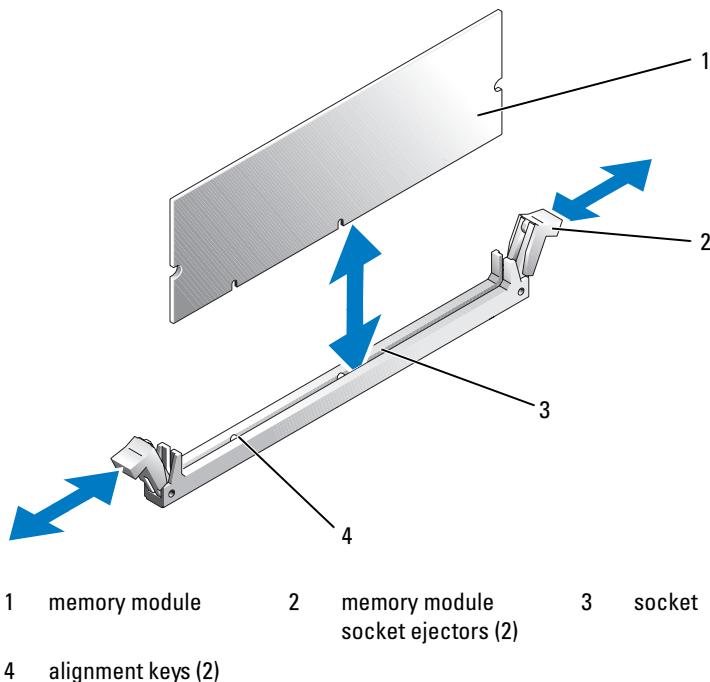
 **NOTE:** The memory module socket has two alignment keys that allow you to install the memory module in the socket in only one way.

- 5 Press down on the memory module with your thumbs while pulling up on the ejectors with your index fingers to lock the memory module into the socket.

When the memory module is properly seated in the socket, the ejectors on the memory module socket align with the ejectors on the other sockets that have memory modules installed.

- 6 Repeat step 2 through step 5 of this procedure to install the remaining memory modules. See Table 3-1 for valid memory configurations.
- 7 Close the system. See "Closing the System" on page 55.
- 8 (Optional) Press <F2> to enter the System Setup program, and check the **System Memory** setting on the main **System Setup** screen.  
The system should have already changed the value to reflect the newly installed memory.
- 9 If the value is incorrect, one or more of the memory modules may not be installed properly. Repeat step 1 through step 8 of this procedure, checking to ensure that the memory modules are firmly seated in their sockets.
- 10 Run the system memory test in the system diagnostics. See "Running the System Diagnostics" on page 117.

**Figure 3-17. Installing and Removing a Memory Module**



## Removing Memory Modules

**!** **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Open the system. See "Opening the System" on page 54.
- 2 Locate the memory module sockets. See Figure 6-2.
- 3 Press down and out on the ejectors on each end of the socket until the memory module pops out of the socket. See Figure 3-17.
- 4 Close the system. See "Closing the System" on page 55.

# Processor

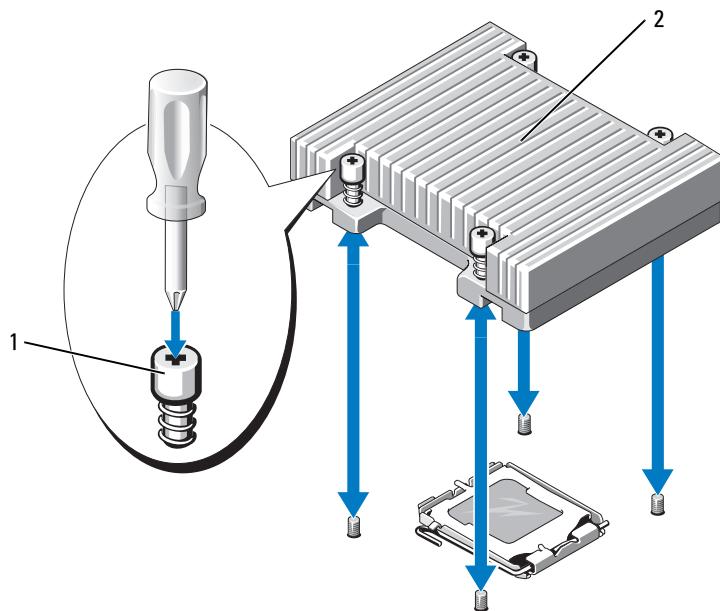
You can upgrade the processor to take advantage of future options in speed and functionality. The processor and its associated internal cache memory are contained in a land grid array (LGA) package that is installed in a ZIF socket on the system board.

## Replacing the Processor

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

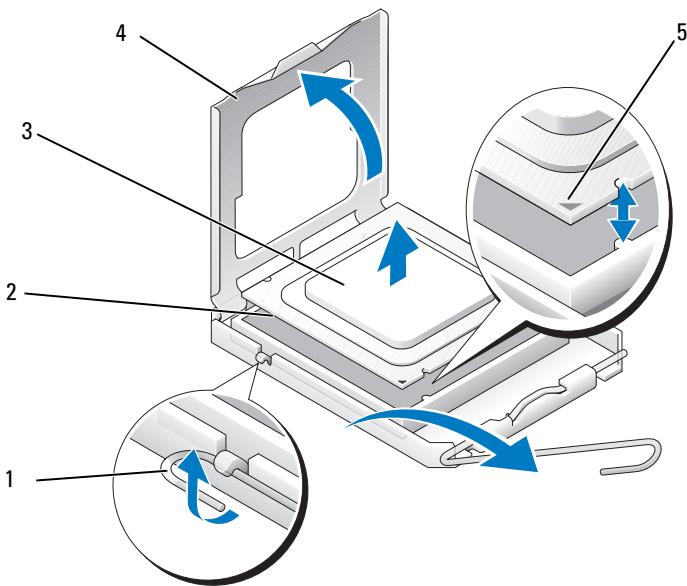
-  **1** Open the system. See "Opening the System" on page 54.
-  **2** **NOTICE:** Never remove the heat sink from a processor unless you intend to remove the processor. The heat sink is necessary to maintain proper thermal conditions.
-  **3** **NOTE:** When you remove the heat sink, the possibility exists that the processor might adhere to the heat sink and be removed from the socket. It is recommended that you remove the heat sink while the processor is still warm.
-  **4** Remove the cooling shroud. See "Removing the Cooling Shroud" on page 56.
-  **5** Using a #2 Phillips screwdriver, loosen the four captive screws that secure the heat sink to the system board. See Figure 3-18.

**Figure 3-18. Installing and Removing the Heat Sink**



- 1 captive screws (4)      2 heat sink
- 4 Wait 30 seconds for the heat sink to loosen from the processor.
  - 5 If the heat sink has not separated from the processor, carefully rotate the heat sink in a clockwise, then counterclockwise, direction until it releases from the processor. Do not pry the heat sink off of the processor.
  - 6 Lift the heat sink off of the processor and set the heat sink aside.
  - 7 Press down on the processor socket release lever, then pull the release lever upward to the fully open position. See Figure 3-19.
  - 8 Open the processor cover. See Figure 3-19.
  - 9 Lift the processor vertically out of the socket. Leave the processor cover and release lever in the open position so that the socket is ready for the new processor. See Figure 3-19.

**Figure 3-19. Installing and Removing the Processor**



- |   |                                |   |                  |   |           |
|---|--------------------------------|---|------------------|---|-----------|
| 1 | processor socket release lever | 2 | processor socket | 3 | processor |
| 4 | processor cover                | 5 | pin-1 locators   |   |           |

- 10 Unpack the new processor.
- 11 Ensure that the processor socket release lever is in the fully open position.
- 12 Align the pin 1 corners of the processor and socket. See Figure 3-19.
- 13 Set the processor lightly in the socket and ensure that the processor is level in the socket. When the processor is positioned correctly, press it gently to seat it in the socket.
- 14 Close the processor cover.

**NOTICE:** You must position the processor correctly in the socket to avoid damaging the processor and the system board when you turn on the system. Be careful not to touch or bend the pins on the socket.

- 15** Rotate the release lever back down until it snaps into place, securing the processor cover.
  - 16** Install the heat sink.
    - a** Using a clean lint-free cloth, remove the existing thermal grease from the heat sink.
-  **NOTE:** Use the heat sink that you removed earlier in this procedure.
- b** Apply thermal grease evenly to the top of the processor.
  - c** Place the heat sink onto the processor. See Figure 3-18.
  - d** Using a #2 Phillips screwdriver, tighten in a diagonal pattern the four captive screws that secure the heat sink to the system board. See Figure 3-18.
- 17** Install the cooling shroud. See "Installing the Cooling Shroud" on page 57.
  - 18** Close the system. See "Closing the System" on page 55.
- As the system boots, it detects the presence of the new processor and automatically changes the system configuration information in the System Setup program.
- 19** Press **<F2>** to enter the System Setup program, and check that the processor information matches the new system configuration.  
See "Using the System Setup Program" on page 35.
  - 20** Run the system diagnostics to verify that the new processor operates correctly.  
See "Running the System Diagnostics" on page 117 for information about running the diagnostics and troubleshooting processor problems.

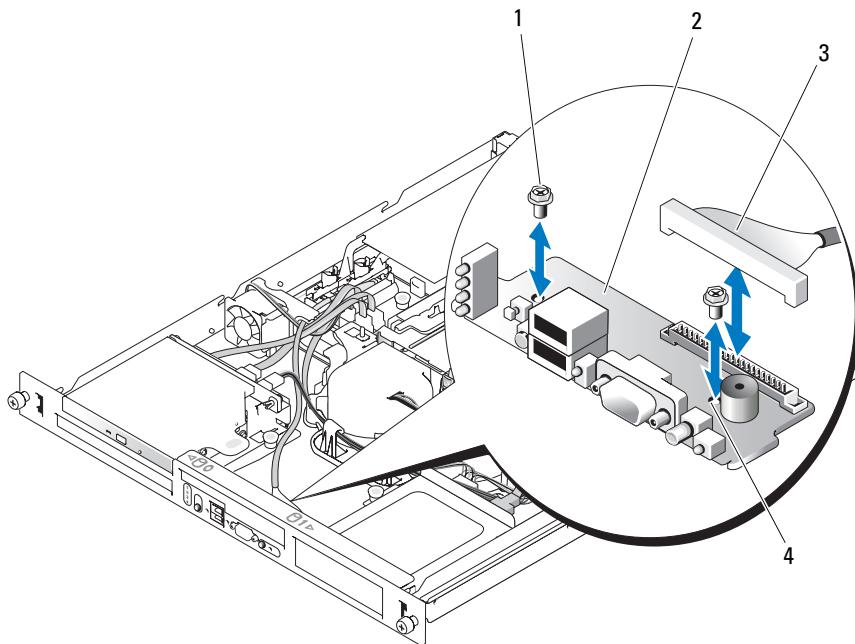
# Control Panel Assembly (Service-Only Procedure)

## Removing the Control Panel Assembly

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Open the system. See "Opening the System" on page 54.
- 2 Disconnect the control panel cables. See Figure 3-20.
- 3 Using a #2 Phillips screwdriver, remove the two screws that secure the control panel assembly to the chassis. See Figure 3-20.
- 4 Carefully lift the back of the control panel assembly to clear the chassis mounting studs, and remove the assembly from the system.

**Figure 3-20. Installing and Removing the Control Panel Assembly**



1 control panel assembly

2 screws (2)

3 cables

4 mounting holes (2)

## Installing the Control Panel Assembly

**!** **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Align the control panel assembly's mounting holes with the chassis mounting holes. See Figure 3-20.
- 2 Using a #2 Phillips screwdriver, install the two screws that secure the control panel assembly to the chassis. See Figure 3-20.

- 3** Connect the control panel cables. See Figure 3-20.
- 4** Close the system. See "Closing the System" on page 55.

## System Board (Service-Only Procedure)

The system board and system board tray are removed and replaced as a single assembly.

### Removing the System Board Assembly

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

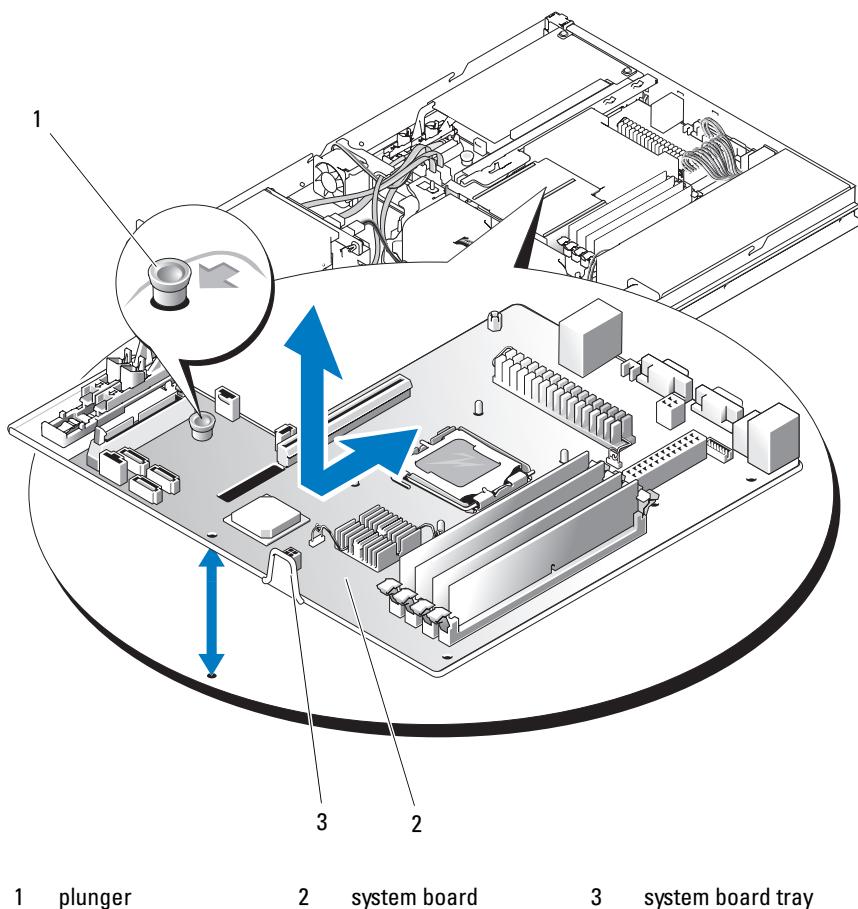
- 1** Open the system. See "Opening the System" on page 54.
- 2** Remove the cooling shroud. See "Removing the Cooling Shroud" on page 56.
- 3** Remove the heat sink and processor. See "Replacing the Processor" on page 85.
- 4** Remove the memory modules. See "Removing Memory Modules" on page 84.

 **NOTE:** As you remove the memory modules, record the memory module socket locations to ensure proper installation.

- 5** If applicable, disconnect the optical drive interface cable from the IDE connector on the system board. See Figure 6-2.
- 6** Disconnect the control-panel interface cable from the FP\_CONN1 connector on the system board. See Figure 6-2.
- 7** Disconnect the hard-drive interface cables:
  - a** If a SAS controller is installed, disconnect the interface cable from the controller card.
  - b** If the system hard drives are connected to the integrated controller, disconnect the interface cables from the SATA\_0 and SATA\_1 connectors on the board. See Figure 6-2.

- 8** Remove all PCI expansion cards installed on the riser card. See "Removing an Expansion Card" on page 78.
- 9** Remove the riser card. See "Removing the Riser Card" on page 79.
- 10** Disconnect the chassis intrusion cable from the INTRUSION\_SWITCH connector on the system board.
- 11** Disconnect the two power cables from the 12V and PWR\_CONN connectors on the system board. See Figure 6-2.
- 12** Pull up on the plunger that secures the system board tray to the chassis floor. See Figure 3-21.
- 13** Using the tab on the system board tray, slide the system board forward (toward the front of the system) and lift the assembly up and out of the chassis. See Figure 3-21.
- 14** Lay the system board tray down on a smooth, nonconductive work surface.

**Figure 3-21. Installing and Removing the System Board**



## Installing the System Board Assembly

**!** **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Unpack the new system board assembly.
  - 2 Align the system board tray so that the tabs on the chassis floor slide into the notches in the system board tray.
  - 3 Slide the system board tray backward until it stops.
  - 4 Press down on the plunger that secures the system board tray to the chassis. See Figure 3-21.
  - 5 Connect the two power cables to the 12V and PWR\_CONN connectors on the system board. See Figure 6-2.
  - 6 Connect the chassis intrusion cable to the INTRUSION\_SWITCH connector on the system board.
  - 7 Install the riser card. See "Installing the Riser Card" on page 80.
  - 8 Using a #2 Phillips screwdriver, tighten the two screws that secure the riser card to the system board.
  - 9 Install any PCI expansion cards that you removed. See "Installing an Expansion Card" on page 75.
  - 10 Connect the hard-drive interface cables:
    - a If you installed a SAS controller, reconnect the interface cable to the controller card.
    - b If your configuration uses the integrated controller, reconnect the hard drive 0 interface cable to the SATA\_0 connector and the hard drive 1 interface cable to the SATA\_1 connector on the system board. See Figure 6-2 for the location of the SATA connectors.
  - 11 Install the processor and heat sink. See "Replacing the Processor" on page 85.
  - 12 Install the memory modules. See "Installing Memory Modules" on page 82.
-  **NOTE:** Install the memory modules as noted in step 3 of the procedure in "Removing the System Board Assembly" on page 91.

- 13** Connect the control-panel interface cable to the FP\_CONN1 connector on the system board. See Figure 6-2 for the location of the FP\_CONN1 connector.
- 14** If applicable, connect the optical drive interface cable to the SATA\_2 connector on the system card. See Figure 6-2 for the location of the SATA\_2 connector.
- 15** Install the cooling shroud. See "Installing the Cooling Shroud" on page 57.
- 16** Close the system. See "Closing the System" on page 55.



# Troubleshooting Your System

## Safety First—For You and Your System

To perform certain procedures in this document, you must remove the system cover and work inside the system. While working inside the system, do not attempt to service the system except as explained in this guide and elsewhere in your system documentation.

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

## Start-Up Routine

Look and listen during the system's start-up routine for the indications described in Table 4-1.

**Table 4-1. Start-Up Routine Indications**

Look/listen for:	Action
An error message displayed on the monitor.	See "System Messages" on page 19.
System status and diagnostic indicators	See "Front-Panel Features and Indicators" on page 13 and "Diagnostics Indicator Codes" on page 29.
Alert messages from the systems management software.	See the systems management software documentation.
The monitor's power indicator.	See "Troubleshooting the Video Subsystem" on page 99.
The keyboard indicators.	See "Troubleshooting the Keyboard" on page 100.

**Table 4-1. Start-Up Routine Indications (*continued*)**

<b>Look/listen for:</b>	<b>Action</b>
The USB diskette drive activity indicator.	See "Troubleshooting a USB Device" on page 102.
The USB CD drive activity indicator.	See "Troubleshooting a USB Device" on page 102.
The optical drive activity indicator.	See "Troubleshooting an Optical Drive" on page 110.
The hard-drive activity indicator.	See "Troubleshooting a Hard Drive" on page 111.
An unfamiliar constant scraping or grinding sound when you access a drive.	See "Getting Help" on page 127.

## Checking the Equipment

This section provides troubleshooting procedures for external devices attached to the system, such as the monitor, keyboard, or mouse. Before you perform any of the procedures, see "Troubleshooting External Connections" on page 99.

### Troubleshooting IRQ Assignment Conflicts

Most PCI devices can share an IRQ with another device, but they cannot use an IRQ simultaneously. To avoid this type of conflict, see the documentation for each PCI device for specific IRQ requirements. Table 4-2 lists the IRQ assignments.

**Table 4-2. IRQ Assignment Defaults**

<b>IRQ Line</b>	<b>Assignment</b>
IRQ0	System timer
IRQ1	Keyboard controller
IRQ2	Interrupt controller 1 to enable IRQ8 through IRQ15
IRQ3	<i>Available</i>
IRQ4	Serial port 1 (COM1 and COM3)
IRQ5	<i>Available</i>

**Table 4-2. IRQ Assignment Defaults (*continued*)**

<b>IRQ Line</b>	<b>Assignment</b>
IRQ6	<i>Available</i>
IRQ7	<i>Available</i>
IRQ8	Real-time clock
IRQ9	ACPI functions (used for power management)
IRQ10	<i>Available</i>
IRQ11	<i>Available</i>
IRQ12	PS/2 mouse port (available if the mouse is disabled through the System Setup program)
IRQ13	Math coprocessor
IRQ14	<i>Available</i>
IRQ15	<i>Available</i>

## Troubleshooting External Connections

Loose or improperly connected cables are the most likely source of problems for the system, monitor, and other peripherals (such as a printer, keyboard, mouse, or other external device). Ensure that all external cables are securely attached to the external connectors on your system. See Figure 1-1 for the front-panel connectors and Figure 1-2 for the back-panel connectors on your system.

## Troubleshooting the Video Subsystem

### ***Problem***

- Monitor is not working properly.
- Video memory is faulty.

#### ***Action***

- 1** Check the system and power connections to the monitor.
- 2** Determine whether the system has monitors attached to both the front and rear video connectors.

The system supports only one monitor attached to either the front or rear video connector. When a monitor is connected to the front panel, and the back-panel video connector is disabled.

If two monitors are attached to the system, disconnect one monitor. If the problem is not resolved, continue to the next step.

- 3** Check the system and power connections to the monitor.
- 4** Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.

If the tests run successfully, the problem is not related to video hardware.

If the tests fail, see "Getting Help" on page 127.

## **Troubleshooting the Keyboard**

#### ***Problem***

- System message indicates a problem with the keyboard.
- Keyboard is not functioning properly.

#### ***Action***

- 1** Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.
- 2** Press each key on the keyboard, and examine the keyboard and its cable for signs of damage.
- 3** Swap the faulty keyboard with a working keyboard.

If the problem is resolved, replace the faulty keyboard. See "Getting Help" on page 127.

If the problem is not resolved, see "Getting Help" on page 127.

## Troubleshooting the Mouse

### ***Problem***

- System message indicates a problem with the mouse.
- Mouse is not functioning properly.

### ***Action***

- 1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.  
If the test fails, continue to the next step.
- 2 Examine the mouse and its cable for signs of damage.
- 3 Swap the faulty mouse with a working mouse.  
If the problem is resolved, replace the faulty mouse. See "Getting Help" on page 127.  
If the problem is not resolved, see "Getting Help" on page 127.

## Troubleshooting Basic I/O Functions

### ***Problem***

- Error message indicates a problem with a serial port.
- Device connected to a serial port is not operating properly.

### ***Action***

- 1 Enter the System Setup program and ensure that the serial port is enabled. See "Using the System Setup Program" on page 35.
- 2 If the problem is confined to a particular application, see the application documentation for specific port configuration requirements that the program may require.
- 3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.  
If the tests run successfully but the problem persists, see "Troubleshooting a Serial I/O Device" on page 102.

## Troubleshooting a Serial I/O Device

### ***Problem***

- Device connected to the serial port is not operating properly.

### ***Action***

**1** Turn off the system and any peripheral devices connected to the serial port.

**2** Swap the serial interface cable with a working cable, and turn on the system and the serial device.

If the problem is resolved, replace the interface cable. See "Getting Help" on page 127.

**3** Turn off the system and the serial device, and swap the device with a comparable device.

**4** Turn on the system and the serial device.

If the problem is resolved, replace the serial device. See "Getting Help" on page 127.

If the problem persists, see "Getting Help" on page 127.

## Troubleshooting a USB Device

### ***Problem***

- System message indicates a problem with a USB device.
- Device connected to a USB port is not operating properly.

### ***Action***

**1** Enter the System Setup program, and ensure that the USB ports are enabled. See "Using the System Setup Program" on page 35.

**2** Turn off the system and any USB devices.

**3** Disconnect the USB devices, and connect the malfunctioning device to the other USB connector.

- 4** Turn on the system and then turn on the reconnected device.  
If the problem is resolved, the USB connector might be defective. See "Getting Help" on page 127.
- 5** If possible, swap the interface cable with a working cable.  
If the problem is resolved, replace the interface cable. See "Getting Help" on page 127.
- 6** Turn off the system and the USB device, and swap the device with a comparable device.
- 7** Turn on the system and the USB device.  
If the problem is resolved, replace the USB device. See "Getting Help" on page 127.  
If the problem persists, see "Getting Help" on page 127.

## Troubleshooting a NIC

### ***Problem***

- NIC cannot communicate with network.

### ***Action***

- 1** Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.
- 2** Check the appropriate indicator on the NIC connector. See "NIC Indicator Codes" on page 19.
  - If the link indicator does not light, check all cable connections.
  - If the activity indicator does not light, the network driver files might be damaged or missing.  
Remove and reinstall the drivers if applicable. See the NIC's documentation.
  - Change the autonegotiation setting, if possible.
  - Use another connector on the switch or hub.If you are using a NIC card instead of an integrated NIC, see the documentation for the NIC card.

- 3** Ensure that the appropriate drivers are installed and the protocols are bound. See the NIC's documentation.
- 4** Enter the System Setup program and confirm that the NICs are enabled. See "Using the System Setup Program" on page 35.
- 5** Ensure that the NICs, hubs, and switches on the network are all set to the same data transmission speed. See the network equipment documentation.
- 6** Ensure that all network cables are of the proper type and do not exceed the maximum length.

## Responding to a Systems Management Software Alert Message

Systems management software monitors critical system voltages and temperatures, fans, and hard drives in the system. Alert messages appear in the Alert Log window. For information about the Alert Log window, see the systems management software documentation.

## Troubleshooting a Wet System

### **Problem**

- Liquid spilled on the system.
- Excessive humidity.

### **Action**

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2** Open the system. See "Opening the System" on page 54.
- 3** Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 78.

- 4** Let the system dry thoroughly for at least 24 hours.
- 5** Close the system. See "Closing the System" on page 55.
- 6** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.  
If the system does not start properly, see "Getting Help" on page 127.
- 7** If the system starts properly, shut down the system and reinstall all of the expansion cards that you removed. See "Installing an Expansion Card" on page 75.
- 8** Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.  
If the tests fail, see "Getting Help" on page 127.

## Troubleshooting a Damaged System

### **Problem**

- System was dropped or damaged.

### **Action**

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1** Open the system. See "Opening the System" on page 54.
- 2** Ensure that the following components are properly installed:
  - Expansion cards
  - Power supplies
  - Fans
- 3** Ensure that all cables are properly connected.
- 4** Close the system. See "Closing the System" on page 55.
- 5** Run the system board tests in the system diagnostics. See "Running the System Diagnostics" on page 117.

If the tests fail, see "Getting Help" on page 127.

# Troubleshooting the System Battery

## **Problem**

- System message indicates a problem with the battery.
- System Setup program loses system configuration information.
- System date and time do not remain current.



**NOTE:** If the system is turned off for long periods of time (for weeks or months), the NVRAM may lose its system configuration information. This situation is caused by a defective battery.

## **Action**

- 1 Re-enter the time and date through the System Setup program. See "Using the System Setup Program" on page 35.
- 2 Turn off the system and disconnect it from the electrical outlet for at least one hour.
- 3 Reconnect the system to the electrical outlet and turn on the system.
- 4 Enter the System Setup program.

If the date and time are not correct in the System Setup program, replace the battery. See "System Battery" on page 58.

If the problem is not resolved by replacing the battery, see "Getting Help" on page 127.



**NOTE:** Some software may cause the system time to speed up or slow down. If the system seems to operate normally except for the time kept in the System Setup program, the problem may be caused by software rather than by a defective battery.

# Troubleshooting the Power Supply

## **Problem**

- System-status indicators are amber.

#### **Action**



**CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 117.
- 2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 3 Open the system. See "Opening the System" on page 54.
- 4 Ensure that the power supply is properly installed by removing and reinstalling it. See "Power Supply" on page 73.  
If the problem persists, remove the faulty power supply. See "Removing the Power Supply" on page 73.
- 5 Install a new power supply. See "Installing the Power Supply" on page 75.  
If the problem persists, see "Getting Help" on page 127.

## **Troubleshooting System Cooling Problems**

#### **Problem**

- Systems management software issues a fan-related error message.

#### **Action**

Ensure that none of the following conditions exist:

- Ambient temperature is too high.
- External airflow is obstructed.
- Cables inside the system obstruct airflow.
- An individual cooling fan has failed. See "Troubleshooting a Fan" on page 108.

## Troubleshooting a Fan

### **Problem**

- System-status indicator is amber.
- Systems management software issues a fan-related error message.

### **Action**

 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Run the appropriate diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.
- 2 Open the system. See "Opening the System" on page 54.
- 3 Ensure that the faulty fan's power cable is firmly attached to the fan power connector. See "Fan Assembly" on page 68.

 **NOTE:** Wait 30 seconds for the system to recognize the fan and determine whether it is working properly.

- 4 If the problem is not resolved, install a new fan. See "Fan Assembly" on page 68.  
If the replacement fan is working properly, close the system. See "Closing the System" on page 55.  
If the replacement fan does not operate, see "Getting Help" on page 127.

## Troubleshooting System Memory

### **Problem**

- Faulty memory module.
- Faulty system board.
- Diagnostic indicator code indicates a problem with system memory.

## Action



**CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 If the system is operational, run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.  
If diagnostics indicates a fault, follow the corrective action(s) provided by the diagnostic program. If the problem is not resolved or if the system is not operational, proceed to step 2.
- 2 Turn off the system and attached peripherals, unplug the system from the power source and press the power button, and reconnect the system to power.
- 3 Turn on the system and attached peripherals and, as the system boots, note the messages on the screen.  
If the amount of system memory detected during POST does not match the amount of memory installed, proceed to the next step.  
If an error message appears, go to step 12.
- 4 Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 35.  
If the amount of memory installed matches the system memory setting, go to step 12.
- 5 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 6 Open the system. See "Opening the System" on page 54.
- 7 Ensure that the memory banks are populated correctly. See "Memory Module Installation Guidelines" on page 81.  
If the memory modules are populated correctly, continue to the next step.
- 8 Reseat the memory modules in their sockets. See "Installing Memory Modules" on page 82.
- 9 Close the system. See "Closing the System" on page 55.

- 10** Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.
  - 11** Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 35. If the amount of memory installed still does not match the system memory setting, proceed to the next step.
  - 12** Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
  - 13** Open the system. See "Opening the System" on page 54.
-  **NOTE:** Several configurations for the memory modules exist; see "Memory Module Installation Guidelines" on page 81.
- 14** If a diagnostic test or error message indicates a specific memory module as faulty, swap or replace the module. Otherwise, swap the memory module in socket 1 with a module of the same type and capacity that is known to be good. See "Installing Memory Modules" on page 82.
  - 15** Close the system. See "Closing the System" on page 55.
  - 16** Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.
  - 17** As the system boots, observe any error message that appears and the diagnostic indicators on the front of the system.
  - 18** If the memory problem is still indicated, repeat step 12 through step 17 for each memory module installed until the faulty memory module is replaced.
- If the problem persists after all memory modules have been checked, see "Getting Help" on page 127.

## Troubleshooting an Optical Drive

### **Problem**

- System cannot read data from a CD or DVD.
- Optical drive indicator does not blink during boot.

#### Action



**CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Try using a different CD or DVD in the optical drive.
- 2 Enter the System Setup program and ensure that the drive's SATA controller is enabled. See "Using the System Setup Program" on page 35.
- 3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.
- 4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 5 Open the system. See "Opening the System" on page 54.
- 6 Ensure that the interface cable is securely connected to the optical drive and to the controller.
- 7 Ensure that a power cable is properly connected to the drive.
- 8 Close the system. See "Closing the System" on page 55.
- 9 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

If the problem is not resolved, see "Getting Help" on page 127.

## Troubleshooting a Hard Drive

#### Problem

- Device driver error.
- One or more hard drives not recognized by the system.

#### Action



**CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.



**NOTICE:** This troubleshooting procedure can destroy data stored on the hard drive. Before you proceed, back up all files on the hard drive.

- 1 Run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 117.

Depending on the results of the diagnostics test, proceed as needed through the following steps.
- 2 If you are experiencing problems with multiple hard drives, skip to step 5. For a problem with a single hard drive, continue to the next step.
- 3 If your system has a SAS RAID controller, perform the following steps.
  - a Restart the system and press <Ctrl><R> to enter the host adapter configuration utility program.

See the documentation supplied with the host adapter for information about the configuration utility.
  - b Ensure that the hard drive has been configured correctly for the RAID.
  - c Exit the configuration utility and allow the system to boot to the operating system.
- 4 Ensure that the required device drivers for your SAS controller card or SAS RAID controller are installed and are configured correctly. See the operating system documentation for more information.
- 5 Check the System Setup program to verify that the SAS controller is enabled and the hard drives connected to the controller are detected.
- 6 Check the cable connections inside the system:
  - a Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
  - b Open the system. See "Opening the System" on page 54.
  - c Verify that the cable connections between the hard drive(s) and the drive controller are correct, whether the connections are to the SATA connectors on the system board, a SAS expansion card, or a SAS RAID controller.
  - d Verify that the SAS or SATA cables are securely seated in their connectors.
  - e Close the system. See "Closing the System" on page 55.

- f Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

If the problem persists, see "Getting Help" on page 127.

## Troubleshooting Expansion Cards



**NOTE:** When troubleshooting an expansion card, see the documentation for your operating system and the expansion card.

### **Problem**

- Error message indicates a problem with an expansion card.
- Expansion card performs incorrectly or not at all.

### **Action**



**CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.
- 2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 3 Open the system. See "Opening the System" on page 54.
- 4 Ensure that each expansion card is firmly seated in its connector. See "Installing an Expansion Card" on page 75.
- 5 Close the system. See "Closing the System" on page 55.
- 6 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.  
If the problem persists, go to the next step.
- 7 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 8 Open the system. See "Opening the System" on page 54.

- 9** Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 78.
- 10** Close the system. See "Closing the System" on page 55.
- 11** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 12** Run the appropriate online diagnostic test.  
If the tests fail, see "Getting Help" on page 127.
- 13** For each expansion card you removed in step 9, perform the following steps:
  - a** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
  - b** Open the system. See "Opening the System" on page 54.
  - c** Reinstall one of the expansion cards.
  - d** Close the system. See "Closing the System" on page 55.
  - e** Run the appropriate diagnostic test.  
If the tests fail, see "Getting Help" on page 127.

## Troubleshooting the Microprocessor

### **Problem**

- Error message indicates a microprocessor problem.
- A heat sink is not installed for the processor.

### **Action**

**!** **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1** Run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 117.
- 2** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

- 3** Open the system. See "Opening the System" on page 54.
  - 4** Ensure that the processor and heat sink are properly installed. See "Replacing the Processor" on page 85.
  - 5** Close the system. See "Closing the System" on page 55.
  - 6** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- If the problem persists, see "Getting Help" on page 127.



# Running the System Diagnostics

If you experience a problem with your system, run the diagnostics before calling for technical assistance. The purpose of the diagnostics is to test your system's hardware without requiring additional equipment or risking data loss. If you are unable to fix the problem yourself, service and support personnel can use diagnostics test results to help you solve the problem.

## Using Dell PowerEdge Diagnostics

To assess a system problem, first use the online Dell® PowerEdge® Diagnostics. Dell PowerEdge Diagnostics is a suite of diagnostic programs, or test modules, that include diagnostic tests on chassis and storage components such as hard drives, physical memory, communications and printer ports, NICs, CMOS, and more. If you are unable to identify the problem using the PowerEdge Diagnostics, then use the system diagnostics.

The files required to run PowerEdge Diagnostics for systems running supported Microsoft® Windows® and Linux operating systems are available at [support.dell.com](http://support.dell.com) and on the CDs that came with your system. For information about using diagnostics, see the *Dell PowerEdge Diagnostics User's Guide*.

## System Diagnostics Features

The system diagnostics provides a series of menus and options for particular device groups or devices. The system diagnostics menus and options allow you to:

- Run tests individually or collectively.
- Control the sequence of tests.
- Repeat tests.
- Display, print, or save test results.
- Temporarily suspend testing if an error is detected or terminate testing when a user-defined error limit is reached.
- View help messages that briefly describe each test and its parameters.

- View status messages that inform you if tests are completed successfully.
- View error messages that inform you of problems encountered during testing.

## When to Use the System Diagnostics

If a major component or device in the system does not operate properly, component failure may be indicated. As long as the microprocessor and the system's input/output devices (monitor, keyboard, and diskette drive) are functioning, you can use the system diagnostics to help identify the problem.

## Running the System Diagnostics

The system diagnostics can be run either from the utility partition on your hard drive or from removable bootable media. You can create this media using the CDs that came with your system or from the diagnostic utility that you can download from [support.dell.com](http://support.dell.com).

 **NOTICE:** Use the system diagnostics to test only your system. Using this program with other systems may cause invalid results or error messages. In addition, use only the program that came with your system (or an updated version of that program).

### From the Utility Partition

- 1 As the system boots, press <F10> during POST.
- 2 From the utility partition main menu under **Run System Utilities**, select **Run System Diagnostics**.

### From Removable Bootable Media

You can create a bootable diagnostic partition on a recordable CD, a USB flash drive, or on diskettes using the CDs that came with your system, or the diagnostic utility that you can download from [support.dell.com](http://support.dell.com).

- 1 Insert a recordable CD, USB flash drive, or writable diskette into your system.
- 2 Run the self-extracting diagnostic utility package from the diagnostic CD that came with your system or the file you downloaded from [support.dell.com](http://support.dell.com).

- 3** Run the diagnostic utility and follow the on-screen instructions to create the diagnostic partition on the removable media.
- 4** Restart the system, enter the System Setup program, and set the removable media type as the default boot device.  
See "Using the System Setup Program" on page 35 for instructions.
- 5** Ensure that the removable bootable media is inserted or attached to the system and reboot the system.  
If the system fails to boot, see "Getting Help" on page 127.

When you start the system diagnostics, a message is displayed indicating that the diagnostics are initializing. Then the **Diagnostics** menu appears. This menu allows you to run all or specific diagnostics tests, or to exit the system diagnostics.



**NOTE:** Before you read the rest of this section, start the system diagnostics so that you can see the utility on your screen.

## System Diagnostics Testing Options

Click the testing option in the **Main Menu** window. Table 5-1 provides a brief explanation of testing options.

**Table 5-1. System Diagnostics Testing Options**

Testing Option	Function
Express Test	Performs a quick check of the system. This option runs device tests that do not require user interaction. Use this option to quickly identify the source of your problem.
Extended Test	Performs a more thorough check of the system. This test can take an hour or longer.
Custom Test	Tests a particular device.
Information	Displays test results.

## Using the Custom Test Options

When you select **Custom Test** in the **Main Menu** window, the **Customize** window appears and allows you to select the device(s) to be tested, select specific options for testing, and view the test results.

## Selecting Devices for Testing

The left side of the **Customize** window lists devices that can be tested. Devices are grouped by device type or by module, depending on the option you select. Click the (+) next to a device or module to view its components. Click (+) on any component to view the tests that are available. Clicking a device, rather than its components, selects all of the components of the device for testing.

## Selecting Diagnostics Options

Use the **Diagnostics Options** area to select how you want to test a device. You can set the following options:

- **Non-Interactive Tests Only** — When checked, runs only tests that require no user intervention.
- **Quick Tests Only** — When checked, runs only the quick tests on the device. Extended tests will not run when you select this option.
- **Show Ending Timestamp** — When checked, time stamps the test log.
- **Test Iterations** — Selects the number of times the test is run.
- **Log output file pathname** — When checked, enables you to specify where the test log file is saved.

## Viewing Information and Results

The tabs in the **Customize** window provide information about the test and the test results. The following tabs are available:

- **Results** — Displays the test that ran and the result.
- **Errors** — Displays any errors that occurred during the test.
- **Help** — Displays information about the currently selected device, component, or test.
- **Configuration** — Displays basic configuration information about the currently selected device.
- **Parameters** — If applicable, displays parameters that you can set for the test.

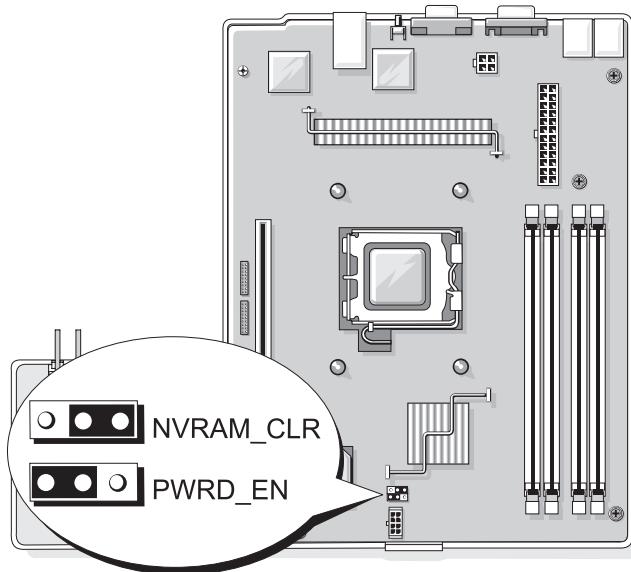
# Jumpers and Connectors

This section provides specific information about the system jumpers and describes the connectors on the various boards in the system.

## System Board Jumpers

Figure 6-1 shows the location of the configuration jumpers on the system board. Table 6-1 lists the jumper settings.

**Figure 6-1. System Board Jumpers**



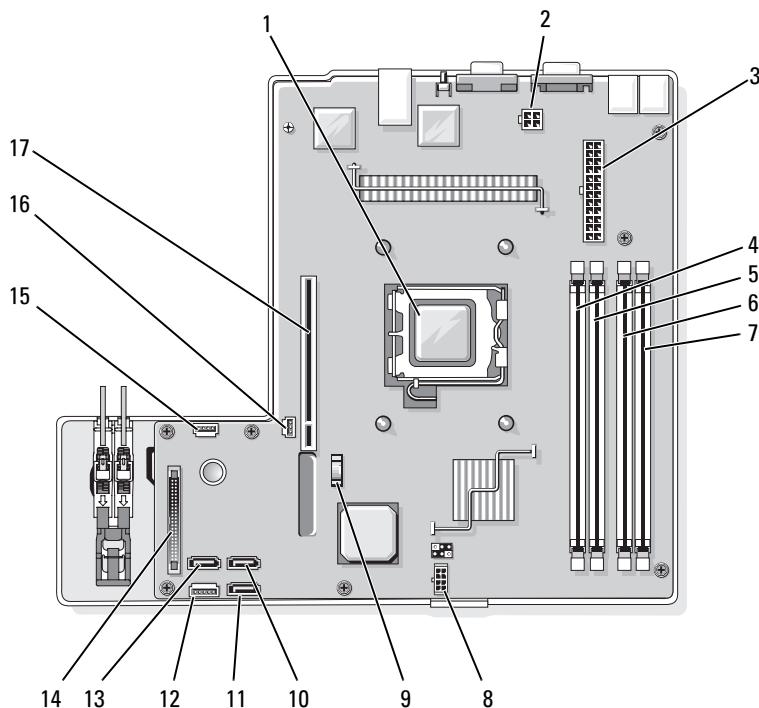
**Table 6-1. System Board Jumper Settings**

Jumper	Setting	Description
NVRAM_CLR		(default) The configuration settings in NVRAM are retained at system boot.
		The configuration settings in NVRAM are cleared at next system boot.
PWRD_EN		(default) The password feature is enabled.
		The password feature is disabled.

## System Board Connectors

See Figure 6-2 and Table 6-2 for the location and description of the system board connectors.

**Figure 6-2. System Board Connectors**



**Table 6-2. System Board Connectors**

Item	Connector	Description
1	CPU	Processor socket
2	12V	power supply connector
3	PWR_CONN	power supply connector
4	DIMM1_A	Memory module
5	DIMM2_A	Memory module
6	DIMM1_B	Memory module
7	DIMM2_B	Memory module
8	FAN	Power connector for the fans

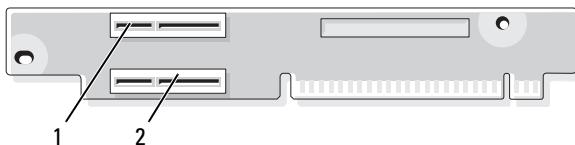
**Table 6-2. System Board Connectors (*continued*)**

Item	Connector	Description
9	BATTERY	Connector for the 3.0 V coin battery
10	SATA_1	Connector for the SATA 1 hard drive
11	SATA_0	Connector for the SATA 0 hard drive
12	PCI FAN	Connector for the PCI fan
13	SATA_2	Connector for the interposer card connected to the optical device
14	FP_CONN1	Control panel interface connector
15	HD_ACT_CARD	Hard drive activity connector (expansion controller)
16	INTRUSION_SWITCH	Connector for the chassis intrusion switch
17	RISER_CONN1	Riser card interface connector

## Riser Card Connectors

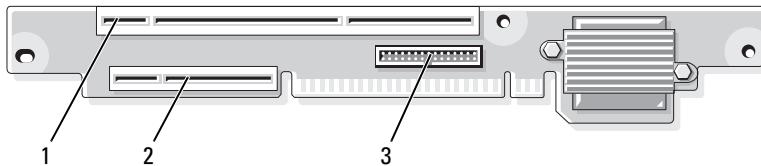
The system is available with either a PCIe riser card or a PCI-X/PCIe riser card. See Figure 6-3 and Figure 6-4 for the location and description of the expansion-card slots on the two riser cards.

**Figure 6-3. PCIe Riser Card Connectors**



1 slot 1, PCIe x4-lane (x8-lane connector)      2 slot 2, PCIe x8-lane

**Figure 6-4. PCI-X/PCIe Riser Card Connectors**



- 1 slot 1, PCI-X 64-bit 133 MHz (3.3 V)    2 slot 2, PCIe x8-lane    3 system management

## Disabling a Forgotten Password

The system's software security features include a system password and a setup password, which are discussed in detail in "Using the System Setup Program" on page 35. The password jumper enables these password features or disables them and clears any password(s) currently in use.

**⚠ CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening and Closing the System" on page 53.
- 3 Remove the password jumper plug.  
See Figure 6-1 to locate the password jumper on the system board.
- 4 Close the system. See "Closing the System" on page 55.
- 5 Reconnect the system to the electrical outlet, and turn on the system.  
The existing passwords are not disabled (erased) until the system boots with the password jumper plug removed. However, before you assign a new system and/or setup password, you must install the jumper plug.

**NOTE:** If you assign a new system and/or setup password with the jumper plug still removed, the system disables the new password(s) the next time it boots.

- 6** Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 7** Open the system.
- 8** Install the password jumper plug.

See Figure 6-1 to locate the password jumper on the system board.

- 9** Close the system, reconnect the system to the electrical outlet, and turn on the system.
- 10** Assign a new system and/or setup password.

To assign a new password using the System Setup program, see "Using the System Setup Program" on page 35.

# Getting Help

## Obtaining Assistance

If you experience a problem with your computer, you can complete the following steps to diagnose and troubleshoot the problem:

- 1 See "Troubleshooting Your System" on page 97 for information and procedures that pertain to the problem your computer is experiencing.
- 2 See "Running the System Diagnostics" on page 117 for procedures on how to run Dell Diagnostics.
- 3 Fill out the "Diagnostics Checklist" on page 132.
- 4 Use Dell's extensive suite of online services available at Dell Support ([support.dell.com](http://support.dell.com)) for help with installation and troubleshooting procedures. See "Online Services" on page 128 for a more extensive list of Dell Support online.
- 5 If the preceding steps have not resolved the problem, see "Contacting Dell" on page 133.



**NOTE:** Call Dell Support from a telephone near or at the computer so that the support staff can assist you with any necessary procedures.



**NOTE:** Dell's Express Service Code system may not be available in all countries.

When prompted by Dell's automated telephone system, enter your Express Service Code to route the call directly to the proper support personnel. If you do not have an Express Service Code, open the **Dell Accessories** folder, double-click the **Express Service Code** icon, and follow the directions.

For instructions on using the Dell Support, see "Support Service" on page 129.



**NOTE:** Some of the following services are not always available in all locations outside the continental U.S. Call your local Dell representative for information on availability.

## **Online Services**

You can learn about Dell products and services on the following websites:

[www.dell.com](http://www.dell.com)

[www.dell.com/ap](http://www.dell.com/ap) (Asian/Pacific countries only)

[www.dell.com/jp](http://www.dell.com/jp) (Japan only)

[www.euro.dell.com](http://www.euro.dell.com) (Europe only)

[www.dell.com/la](http://www.dell.com/la) (Latin American and Caribbean countries)

[www.dell.ca](http://www.dell.ca) (Canada only)

You can access Dell Support through the following websites and e-mail addresses:

- Dell Support websites

[support.dell.com](http://support.dell.com)

[support.jp.dell.com](http://support.jp.dell.com) (Japan only)

[support.euro.dell.com](http://support.euro.dell.com) (Europe only)

- Dell Support e-mail addresses

[mobile\\_support@us.dell.com](mailto:mobile_support@us.dell.com)

[support@us.dell.com](mailto:support@us.dell.com)

[la-techsupport@dell.com](mailto:la-techsupport@dell.com) (Latin America and Caribbean countries only)

[apsupport@dell.com](mailto:apsupport@dell.com) (Asian/Pacific countries only)

- Dell Marketing and Sales e-mail addresses

[apmarketing@dell.com](mailto:apmarketing@dell.com) (Asian/Pacific countries only)

[sales\\_canada@dell.com](mailto:sales_canada@dell.com) (Canada only)

- Anonymous file transfer protocol (FTP)

[ftp.dell.com](http://ftp.dell.com)

Log in as user: **anonymous**, and use your e-mail address as your password.

## **Automated Order-Status Service**

To check on the status of any Dell products that you have ordered, you can go to [support.dell.com](http://support.dell.com), or you can call the automated order-status service. A recording prompts you for the information needed to locate and report on your order. For the telephone number to call for your region, see "Contacting Dell" on page 133.

## **Support Service**

Dell's support service is available 24 hours a day, 7 days a week, to answer your questions about Dell hardware. Our support staff use computer-based diagnostics to provide fast, accurate answers.

To contact Dell's support service, see "Before You Call" on page 131 and then see the contact information for your region.

## **Dell Enterprise Training and Certification**

Dell Enterprise Training and Certification is available; see [www.dell.com/training](http://www.dell.com/training) for more information. This service may not be offered in all locations.

## **Problems With Your Order**

If you have a problem with your order, such as missing parts, wrong parts, or incorrect billing, contact Dell for customer assistance. Have your invoice or packing slip handy when you call. For the telephone number to call for your region, see "Contacting Dell" on page 133.

## **Product Information**

If you need information about additional products available from Dell, or if you would like to place an order, visit the Dell website at [www.dell.com](http://www.dell.com). For the telephone number to call for your region or to speak to a sales specialist, see "Contacting Dell" on page 133.

## **Returning Items for Warranty Repair or Credit**

Prepare all items being returned, whether for repair or credit, as follows:

- 1** Call Dell to obtain a Return Material Authorization Number, and write it clearly and prominently on the outside of the box.  
For the telephone number to call for your region, see "Contacting Dell" on page 133.
- 2** Include a copy of the invoice and a letter describing the reason for the return.
- 3** Include a copy of the Diagnostics Checklist (see "Diagnostics Checklist" on page 132), indicating the tests that you have run and any error messages reported by the Dell Diagnostics (see "Running the System Diagnostics" on page 117).
- 4** Include any accessories that belong with the item(s) being returned (such as power cables, media such as CDs and diskettes, and guides) if the return is for credit.
- 5** Pack the equipment to be returned in the original (or equivalent) packing materials.

You are responsible for paying shipping expenses. You are also responsible for insuring any product returned, and you assume the risk of loss during shipment to Dell. Collect On Delivery (C.O.D.) packages are not accepted.

Returns that are missing any of the preceding requirements will be refused at Dell's receiving dock and returned to you.

## Before You Call



**NOTE:** Have your Express Service Code ready when you call. The code helps Dell's automated-support telephone system direct your call more efficiently.

Remember to fill out the Diagnostics Checklist (see "Diagnostics Checklist" on page 132). If possible, turn on your computer before you call Dell for assistance and call from a telephone at or near the computer. You may be asked to type some commands at the keyboard, relay detailed information during operations, or try other troubleshooting steps possible only at the computer itself. Ensure that the computer documentation is available.



**CAUTION:** Before working inside your computer, follow the safety instructions in your *Product Information Guide*.

## **Diagnostics Checklist**

Name:

Date:

Address:

Phone number:

Service Tag (bar code on the back or bottom of the computer):

Express Service Code:

Return Material Authorization Number (if provided by Dell support technician):

Operating system and version:

Devices:

Expansion cards:

Are you connected to a network? Yes No

Network, version, and network adapter:

Programs and versions:

See your operating system documentation to determine the contents of the system's start-up files. If the computer is connected to a printer, print each file. Otherwise, record the contents of each file before calling Dell.

Error message, beep code, or diagnostic code:

Description of problem and troubleshooting procedures you performed:

# Contacting Dell

For customers in the United States, call 800-WWW-DELL (800-999-3355).



**NOTE:** If you do not have an active Internet connection, you can find contact information on your purchase invoice, packing slip, bill, or Dell product catalog.

Dell provides several online and telephone-based support and service options. Availability varies by country and product, and some services may not be available in your area. To contact Dell for sales, technical support, or customer service issues:

- 1 Visit [support.dell.com](http://support.dell.com).
- 2 Verify your country or region in the **Choose A Country/Region** drop-down menu at the bottom of the page.
- 3 Click **Contact Us** on the left side of the page.
- 4 Select the appropriate service or support link based on your need.
- 5 Choose the method of contacting Dell that is convenient for you. Depending on your region, the methods include either by phone, online chat, or e-mail.

The following table provides a listing of the support e-mail addresses and phone numbers and codes by country. If you need assistance in determining which codes to use, contact a local or an international operator.



**NOTE:** Toll-free numbers are for use within the country for which they are listed.



**NOTE:** The contact information provided in the following table was deemed correct at the time that this document went to print and is subject to change.

Country (City) International Access Code Country Code City Code	Service Type	Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address
Anguilla	Online Support  E-mail Address  Technical Support, Customer Service, Sales	<a href="http://support.dell.com/ai">support.dell.com/ai</a>  <a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>  toll free: 800-335-0031

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
Antigua and Barbuda	Online Support  Technical Support, Customer Service, Sales	www.dell.com/ag la-techsupport@dell.com  1-800-805-5924
Aomen Country Code: 853	Technical Support  Customer Service (Xiamen, China)  Transaction Sales (Xiamen, China)	toll-free: 0800-105  34 160 910  29 693 115
Argentina (Buenos Aires) International Access Code: 00 Country Code: 54 City Code: 11	Online Support  E-mail for Desktops and Portables  E-mail for Servers and EMC® Storage Products  Customer Service  Technical Support  Sales	www.dell.com/ar la-techsupport@dell.com  la_enterprise@dell.com  toll-free: 0-800-666-0789  toll-free: 0-800-222-0154  or toll-free: 0-800-444-0724  toll-free: 0-800-666-0789
Aruba	Online Support  Technical Support  Customer Service and Sales	www.dell.com/aw la-techsupport@dell.com  toll-free: 800-1727  toll-free: 800-1729
Australia (Sydney) International Access Code: 0011 Country Code: 61 City Code: 2	Online Support  Technical Support	support.ap.dell.com support.ap.dell.com/contactus

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>
<b>International Access Code Country Code</b>		<b>Web and E-mail Address</b>
<b>City Code</b>		
	Technical Support for XPS computers only	toll-free: 1300 790 877
	Home and Home Office	toll-free: 1300-655-533
	Medium and Large Business	toll-free: 1800-633-559
	Small Business, Education, Local Government	toll-free: 1800-060-889
	Customer Service	
	Home and Home Office	toll-free: 1800-812-393 (option 3)
	Medium and Large Business, Education, Local Government	toll-free: 1300-303-270 (option 3)
	24-Hour Automated Order Status Service	toll-free: 1300-662-196
<b>Austria (Vienna)</b>	<b>NOTE:</b> The phone numbers in this section should be called from within Austria only.	
International Access Code: 900		
Country Code: 43		
City Code: 1		
	Online Support	
		support.euro.dell.com
		tech_support_central_europe@dell.com
	Technical Support for XPS computers only	08 20 24 05 30 81
	Large Business Support	08 20 24 05 30 55
	Technical Support at Home	08 20 24 05 30 92
	Home/Small Business Sales	08 20 24 05 30 00
	Home/Small Business Fax	08 20 24 05 30 49

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>	<b>Web and E-mail Address</b>
	Home/Small Business Customer Service	08 20 24 05 30 14	
	Home/Small Business Support	08 20 24 05 30 17	
	Preferred Accounts/Corporate Customer Service	08 20 24 05 30 16	
	Preferred Accounts/Corporate Support	08 20 24 05 30 17	
	Switchboard	08 20 24 05 30 00	
<b>Bahamas</b>	Online Support		<a href="http://www.dell.com/bs">www.dell.com/bs</a> <a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>
	Technical Support	toll-free: 1-866-874-3038	
	Customer Service and Sales	toll-free: 1-866-296-9683	
<b>Barbados</b>	Online Support		<a href="http://www.dell.com/bb">www.dell.com/bb</a> <a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>
	Technical Support	1-800-534-3349	
	Customer Service and Sales	1-800-534-3142	
<b>Belgium (Brussels)</b>	Online Support		<a href="mailto:support.euro.dell.com">support.euro.dell.com</a>
International Access Code: 00	Technical Support for XPS computers only	02 481 92 96	
Country Code: 32	General Support	02 481 92 88	
City Code: 2	General Support Fax	02 481 92 95	
	Customer Service	02 713 15 65	
	Corporate Sales	02 481 91 00	
	Fax	02 481 92 99	
	Switchboard	02 481 91 00	

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
Belize	Online Support	www.dell.com/bz la-techsupport@dell.com
	Technical Support, Customer Service, Sales	811-866-686-9880 or (512) 723-0010
Bermuda	Online Support	www.dell.com/bm la-techsupport@dell.com
	Technical Support	1-877-890-0754
	Customer Service and Sales	1-877-890-0751
Bolivia	Online Support	www.dell.com/bo la-techsupport@dell.com
	Technical Support, Customer Service, Sales	toll-free: 800-10-0238 or EEUU (512) 723-0010
Brazil	Online Support	www.dell.com/br
International Access Code: 00		BR_TechSupport@dell.com
Country Code: 55	Technical Support	0800 970 3355
City Code: 51	Technical Support Fax	51 2104 5470
	Customer Service Fax	51 2104 5480
	Sales	0800 970 3390
British Virgin Islands	Online Support	www.dell.com/vg la-techsupport@dell.com
	Technical Support, Customer Service, Sales	toll-free: 1-866-278-6820 or (512) 723-0010

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>
		<b>Web and E-mail Address</b>
Brunei Country Code: 673	Technical Support (Penang, Malaysia)	604 633 4966
	Customer Service (Penang, Malaysia)	604 633 3101 or toll-free: 801 1012
	24-Hour Automated Order Status Service	toll-free: 801 1044
	Transaction Sales (Penang, Malaysia)	604 633 3101 or toll-free: 801 1012

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>
<b>International Access Code Country Code</b>		<b>Web and E-mail Address</b>
<b>City Code</b>		
Canada (North York, Ontario)  International Access Code: 011	Online Order Status	www.dell.ca/ostatus
	Online Support	support.ca.dell.com
	AutoTech (automated Hardware and Warranty Support)	toll-free: 1-800-247-9362
	Customer Service	
	Home/Home Office	toll-free: 1-800-847-4096
	Small Business	toll-free: 1-800-906-3355
	Medium/Large Business, Government, Education	toll-free: 1-800-387-5757
	Hardware Warranty Phone Support	
	XPS Computers Only	toll-free: 1-866-398-8977
	Computers for Home/Home Office	toll-free: 1-800-847-4096
	Computers for Small/Medium/Large Business, Government	toll-free: 1-800-387-5757
	Printers, Projectors, Televisions, Handheld, Digital Jukebox, and Wireless	1-877-335-5767
	Sales	
	Home and Home Office Sales	toll-free: 1-800-999-3355
	Small Business	toll-free: 1-800-387-5752
	Medium/Large Business, Government	toll-free: 1-800-387-5755
	Spare Parts and Extended Service	1 866 440 3355

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
Cayman Islands	Online Support	www.dell.com/ky la-techsupport@dell.com
	Technical Support	1-877-261-0242
	Customer Service and Sales	1-877-262-5415
Chile (Santiago) Country Code: 56 City Code: 2	Online Support	www.dell.com/cl la-techsupport@dell.com
	Technical Support	toll-free: 800-20-20-44 (CTC) or 123-00-20-37-62 (ENTEL)
	Sales and Customer Support	toll-free: 800-20-20-44 (CTC) or 123-00-20-34-77 (ENTEL)
China (Xiamen) Country Code: 86 City Code: 592	Online Support	support.dell.com.cn
	Technical Support E-mail	support.dell.com.cn/email
	Customer Service E-mail	customer_cn@dell.com
	Technical Support Fax	592 818 1350
	Technical Support – XPS computers only	toll-free: 800 858 0540
	Technical Support – Dell™ Dimension™ and Dell Inspiron™	toll-free: 800 858 2969
	Technical Support – Dell OptiPlex™, Dell Latitude™, and Dell Precision™	toll-free: 800 858 0950
	Technical Support – Dell PowerEdge™ and Dell PowerVault™	toll-free: 800 858 0960

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>	<b>Web and E-mail Address</b>
	Technical Support – Projectors, PDAs, Switches, Routers, etc.	toll-free: 800 858 2920	
	Technical Support – Printers	toll-free: 800 858 2311	
	Customer Service	toll-free: 800 858 2060	
	Customer Service Fax	592 818 1308	
	Home and Small Business	toll-free: 800 858 2222	
	Preferred Accounts Division	toll-free: 800 858 2557	
	Large Corporate Accounts GCP	toll-free: 800 858 2055	
	Large Corporate Accounts Key Accounts	toll-free: 800 858 2628	
	Large Corporate Accounts North	toll-free: 800 858 2999	
	Large Corporate Accounts North Government and Education	toll-free: 800 858 2955	
	Large Corporate Accounts East	toll-free: 800 858 2020	
	Large Corporate Accounts East Government and Education	toll-free: 800 858 2669	
	Large Corporate Accounts Queue Team	toll-free: 800 858 2572	
	Large Corporate Accounts South	toll-free: 800 858 2355	
	Large Corporate Accounts West	toll-free: 800 858 2811	
	Large Corporate Accounts Spare Parts	toll-free: 800 858 2621	

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
Colombia	Online Support	www.dell.com/co la-techsupport@dell.com
	Technical Support	01-800-915-5704
	Customer Service and Sales	01-800-915-4755
	Spare Parts, Software, Peripherals and Warranty Sales	toll free: 01-800-915-6158
Costa Rica	Ink and Toner Sales	toll free: 01-800-915-5676
	Online Support	www.dell.com/cr la-techsupport@dell.com
	Technical Support	0800-012-0232
	Customer Service and Sales	0800-012-0231
Czech Republic (Prague)  International Access Code: 00  Country Code: 420	Online Support	support.euro.dell.com czech_dell@dell.com
	Technical Support	22537 2727
	Customer Service	22537 2707
	Fax	22537 2714
	Technical Fax	22537 2728
	Switchboard	22537 2711

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>
<b>International Access Code Country Code</b>		<b>Web and E-mail Address</b>
<b>City Code</b>		
Denmark (Copenhagen) International Access Code: 00 Country Code: 45	Online Support	support.euro.dell.com
	Technical Support for XPS computers only	7010 0074
	Technical Support	7023 0182
	Customer Service – Relational	7023 0184
	Home/Small Business	3287 5505
	Customer Service	
	Switchboard – Relational	3287 1200
	Switchboard Fax – Relational	3287 1201
	Switchboard – Home/Small Business	3287 5000
	Switchboard Fax – Home/Small Business	3287 5001
Dominica	Online Support	www.dell.com/dm la-techsupport@dell.com
	Technical Support, Customer Service, Sales	toll-free: 1-866-278-6821 or (512) 723-0010
Dominican Republic	Online Support	www.dell.com/do la-techsupport@dell.com
	Technical Support	1-800-156-1834
	Customer Service and Sales	1-800-156-1588

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
Ecuador  (calling from Quito and Guayaquil only)	Online Support	www.dell.com/ec  la-techsupport@dell.com
	Technical Support, Customer Service, Sales (calling from Quito)	toll-free: 999-119-877-655- 3355 or EEUU (512) 723-0020
	Technical Support, Customer Service, Sales (calling from Guayaquil)	toll-free: 1-800-999-119-877- 655-3355
El Salvador	Online Support	www.dell.com/sv  la-techsupport@dell.com
	Technical Support	toll free: 800-6100 (ANTEL) or 800-6170 (Telefonica)
	Customer Service and Sales	toll free: 800-6100 (ANTEL) or 800-6132 (Telefonica)
Finland (Helsinki)  International Access Code: <b>990</b>  Country Code: <b>358</b>  City Code: <b>9</b>	Online Support	support.euro.dell.com  fi_support@dell.com
	Technical Support	0207 533 555
	Customer Service	0207 533 538
	Switchboard	0207 533 533
	Fax	0207 533 530
	Sales under 500 employees	0207 533 540
	Sales over 500 employees	0207 533 533
France (Paris)  (Montpellier)  International Access Code: <b>00</b>  Country Code: <b>33</b>  City Codes: (1) (4)	Online Support	support.euro.dell.com
	Technical Support for XPS computers only	0825 387 129

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>	<b>Web and E-mail Address</b>
<b>International Access Code Country Code</b>			
<b>City Code</b>			
	Home and Small Business		
	Technical Support	0825 387 270	
	Customer Service	0825 823 833	
	Switchboard	0825 004 700	
	Switchboard (calls from outside of France)	04 99 75 40 00	
	Sales	0825 004 700	
	Fax	0825 004 701	
	Fax (calls from outside of France)	04 99 75 40 01	
	Corporate		
	Technical Support	0825 004 719	
	Customer Service	0825 338 339	
	Switchboard	01 55 94 71 00	
	Sales	01 55 94 71 00	
	Fax	01 55 94 71 01	
<b>Germany (Frankfurt)</b>	Online Support		
International Access Code: 00			support.euro.dell.com
Country Code: 49			tech_support_central_europe@dell.com
City Code: 69			
	Technical Support for XPS computers only	069 9792 7222	
	Technical Support	069 9792-7200	
	Technical Support at Home	069 9792-7230	
	Home/Small Business Customer Service	0180-5-224400	
	Global Segment Customer Service	069 9792-7320	

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
	Preferred Accounts Customer Service	069 9792-7320
	Large Accounts Customer Service	069 9792-7320
	Public Accounts Customer Service	069 9792-7320
	Switchboard	069 9792-7000
Greece International Access Code: 00 Country Code: 30	Online Support Technical Support Gold Service Technical Support Switchboard Gold Service Switchboard Sales Fax	support.euro.dell.com 00800-44 14 95 18 2108129811 2108129810 2108129811 2108129800 2108129812
Grenada	Online Support Technical Support, Customer Service, Sales	www.dell.com/gd la-techsupport@dell.com toll-free: 1-866-540-3355
Guatemala	Online Support Technical Support, Customer Service, Sales	www.dell.com/gt la-techsupport@dell.com 1-800-999-0136
Guyana	Online Support Technical Support, Customer Service, Sales	la-techsupport@dell.com toll-free: 1-877-440-6511
Haiti	Online Support Technical Support, Customer Service, Sales	www.dell.com/ht la-techsupport@dell.com toll free: 183-866-686-9849 or (512) 723-0010

<b>Country (City)</b> <b>International Access</b> <b>Code Country Code</b> <b>City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b> <b>Web and E-mail Address</b>
Honduras	Online Support  Technical Support, Customer Service, Sales	www.dell.com/hn la-techsupport@dell.com  toll free: 800-0123-866-686- 9848 or EEUU (512) 723-0020
<b>Hong Kong</b>  International Access Code: 001  Country Code: 852	Online Support  Technical Support – XPS computers only  Technical Support – Dimension and Inspiron  Technical Support – OptiPlex, Latitude, and Dell Precision  Technical Support – Servers and Storage  Technical Support – Projectors, PDAs, Switches, Routers, etc.  Customer Service  Large Corporate Accounts  Global Customer Programs  Medium Business Division  Home and Small Business Division	support.ap.dell.com support.ap.dell.com/contactus  00852-3416 6923 00852-2969 3188 00852-2969 3191 00852-2969 3196 00852-3416 0906 00852-3416 0910 00852-3416 0907 00852-3416 0908 00852-3416 0912 00852-2969 3105

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>	<b>Web and E-mail Address</b>
India	Online Support		support.ap.dell.com
	Portable and Desktop Support		
	Portables, Desktop, and Peripherals E-mail		<a href="http://support.ap.dell.com/ap/en/emaile Dell">support.ap.dell.com/ap/en/emaile Dell</a>
	Portable Support E-mail		<a href="mailto:india_support_notebook@dell.com">india_support_notebook@dell.com</a>
	Phone Numbers	080-25068032 or 080-25068034 or your city STD code + 60003355 or toll-free: 1-800-425-9046	
	Server Support		
	E-mail		<a href="mailto:india_support_server@dell.com">india_support_server@dell.com</a>
	Phone Numbers	080-25068032 or 080-25068034 or your city STD code + 60003355 or toll-free: 1-800-425-8045	
	Gold Support Only		
	E-mail		<a href="mailto:eec_ap@dell.com">eec_ap@dell.com</a>
	Phone Numbers	080-25068033 or your city STD code + 60003355 or toll-free: 1-800-425-9045	
	XPS Support Only		
	E-mail		<a href="mailto:Indihaps_AP@dell.com">Indihaps_AP@dell.com</a>
	Phone Numbers	080-25068066 or toll-free: 1-800-425-2066	
	Customer Service		
	Home and Small Business		<a href="mailto:India_care_HSB@dell.com">India_care_HSB@dell.com</a> toll-free: 1800-4254051

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>
<b>International Access Code Country Code</b>		<b>Web and E-mail Address</b>
<b>City Code</b>		
	Large Corporate Accounts	India_care_REL@dell.com toll-free: 1800-4252067
	Sales	
	Large Corporate Accounts	1600 33 8044
	Home and Small Business	1600 33 8046

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
Ireland (Cherrywood)	Online Support	
International Access Code: 00		support.euro.dell.com dell_direct_support@dell.com
Country Code: 353	Technical Support	
City Code: 1	XPS computers only	1850 200 722
	Business computers	1850 543 543
	Home computers	1850 543 543
	At Home Support	1850 200 889
	Sales	
	Home	1850 333 200
	Small Business	1850 664 656
	Medium Business	1850 200 646
	Large Business	1850 200 646
	Sales E-mail	Dell_IRL_Outlet@dell.com
	Customer Service	
	Home and Small Business	01 204 4014
	Business (greater than 200 employees)	1850 200 982
	General	
	Fax/Sales Fax	01 204 0103
	Switchboard	01 204 4444
	U.K. Customer Service (dial within U.K. only)	0870 906 0010
	Corporate Customer Service (dial within U.K. only)	0870 907 4499
	U.K. Sales (dial within U.K. only)	0870 907 4000

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>	<b>Web and E-mail Address</b>
<b>International Access Code Country Code City Code</b>			
<b>Italy (Milan)</b>	Online Support		support.euro.dell.com
International Access Code: 00	Home and Small Business		
Country Code: 39	Technical Support	02 577 826 90	
City Code: 02	Customer Service	02 696 821 14	
	Fax	02 696 821 13	
	Switchboard	02 696 821 12	
	Corporate		
	Technical Support	02 577 826 90	
	Customer Service	02 577 825 55	
	Fax	02 575 035 30	
	Switchboard	02 577 821	
<b>Jamaica</b> (dial from within Jamaica only)	Online Support		www.dell.com/jm la-techsupport@dell.com
	Technical Support	toll free: 1-800-975-1646	
	Customer Service and Sales	toll free: 1-800-404-9205	
<b>Japan (Kawasaki)</b>	Online Support		support.jp.dell.com
International Access Code: 001			
Country Code: 81	Technical Support – XPS computers only	toll-free: 0120-937-786	
City Code: 44	Technical Support outside of Japan – XPS computers only	81-44-520-1235	
	Technical Support – Dimension and Inspiron	toll-free: 0120-198-226	

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
	Technical Support outside of Japan – Dimension, and Inspiron	81-44-520-1435
	Technical Support – Dell Precision, OptiPlex, and Latitude	toll-free: 0120-198-433
	Technical Support outside of Japan – Dell Precision, OptiPlex, and Latitude	81-44-556-3894
	Technical Support – Dell PowerApp, Dell PowerEdge, Dell PowerConnect™, and Dell PowerVault	toll-free: 0120-198-498
	Technical Support outside of Japan – PowerApp, PowerEdge, PowerConnect, and PowerVault	81-44-556-4162
	Technical Support – Projectors, PDAs, Printers, Routers	toll-free: 0120-981-690
	Technical Support outside of Japan – Projectors, PDAs, Printers, Routers	81-44-556-3468
	Faxbox Service	044-556-3490
	24-Hour Automated Order Status Service	044-556-3801
	Customer Care	044-556-4240
	Business Sales Division – up to 400 employees	044-556-3344

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>
<b>International Access Code Country Code</b>		<b>Web and E-mail Address</b>
<b>City Code</b>		
	Preferred Accounts Division Sales – over 400 employees	044-556-3433
	Public Sales – government agencies, educational institutions, and medical institutions	044-556-5963
	Global Segment Japan	044-556-3469
	Individual User	044-556-1657
	Individual User Online Sales	044-556-2203
	Individual User Real Site Sales	044-556-4649
	Switchboard	044-556-4300
<b>Korea (Seoul)</b>	Online Support	support.ap.dell.com
International Access Code: 001	Technical Support for XPS computers only	toll-free: 080-999-0283
Country Code: 82	Technical Support	toll-free: 080-200-3800
City Code: 2	Customer Service	toll-free: 080-999-0270
	Technical Support – Dimension, PDA, Electronics, and Accessories	toll-free: 080-200-3801
	Sales	toll-free: 080-200-3600
	Fax	2194-6202
	Switchboard	2194-6000

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
Latin America	Customer Technical Support (Austin, Texas, U.S.A.)	512 728-4093
	Customer Service (Austin, Texas, U.S.A.)	512 728-3619
	Fax (Technical Support and Customer Service) (Austin, Texas, U.S.A.)	512 728-3883
	Sales (Austin, Texas, U.S.A.)	512 728-4397
	Sales Fax (Austin, Texas, U.S.A.)	512 728-4600 or 512 728-3772
Luxembourg  International Access Code: 00  Country Code: 352	Online Support	support.euro.dell.com
	Support	342 08 08 075
	Home/Small Business Sales	+32 (0)2 713 15 96
	Corporate Sales	26 25 77 81
	Customer Service	+32 (0)2 481 91 19
	Fax	26 25 77 82
Malaysia (Penang)  International Access Code: 00  Country Code: 60  City Code: 4	Online Support	support.ap.dell.com
	Technical Support – XPS computers only	toll-free: 1 800 885 784
	Technical Support – Dell Precision, OptiPlex, and Latitude	toll-free: 1 800 880 193
	Technical Support – Dimension, Inspiron, and Electronics and Accessories	toll-free: 1 800 881 306

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>
<b>International Access Code Country Code City Code</b>		<b>Web and E-mail Address</b>
	Technical Support – PowerApp, PowerEdge, PowerConnect, and PowerVault	toll-free: 1800 881 386
	Customer Service	toll-free: 1800 881 306 (option 4)
	24-Hour Automated Order Status Service	1 800 88 4432
	Transaction Sales	toll-free: 1 800 888 202
	Corporate Sales	toll-free: 1 800 888 213
<b>Mexico</b>	Online Support	<a href="http://www.dell.com/mx">www.dell.com/mx</a>
International Access Code: 00		<a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>
Country Code: 52	Technical Support	001-866-563-4425
	Sales	50-81-8800 or 001-800-725-3355
	Customer Service	001-877-384-8979 or 001-877-269-3383
	Spare Parts, Software, Peripherals and Warranty Sales	001-866-390-4629
	Ink and Toner Sales	toll free 001-866-851-1754
	Main	50-81-8800 or 001-800-111-3355 or 001-866-851-1754
<b>Montserrat</b>	Online Support	<a href="mailto:support.dell.com.ag">support.dell.com.ag</a> <a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>
	Technical Support, Customer Service, Sales	toll-free: 1-866-278-6822

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
Netherlands Antilles	Online Support	www.dell.com/an la-techsupport@dell.com
	Technical Support, Customer Service, Sales	toll free: 001-866-379-1022
Netherlands (Amsterdam)	Online Support	support.euro.dell.com
International Access Code: 00	Technical Support for XPS computers only	020 674 45 94
Country Code: 31	Technical Support	020 674 45 00
City Code: 20	Technical Support Fax	020 674 47 66
	Home/Small Business Customer Service	020 674 42 00
	Relational Customer Service	020 674 4325
	Home/Small Business Sales	020 674 55 00
	Relational Sales	020 674 50 00
	Home/Small Business Sales Fax	020 674 47 75
	Relational Sales Fax	020 674 47 50
	Switchboard	020 674 50 00
	Switchboard Fax	020 674 47 50

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>
<b>International Access Code Country Code</b>		<b>Web and E-mail Address</b>
<b>City Code</b>		
New Zealand	Online Support	
International Access Code: 00		support.ap.dell.com support.ap.dell.com/contactus
Country Code: 64		
	Technical Support	toll-free: 0800-441-567
	Home and Home Office	toll-free: 0800-446-255
	Business, Education, and Government	toll-free: 0800-444-617
	PowerEdge and PowerVault	toll-free: 0800-443-563
	Technical Support for XPS computers only	toll-free: 0800-335-540
	Customer Service	
	Home and Small Business	toll-free: 0800-289-3355 (option 3)
	Business, Education, and Government	toll-free: 0800-941-128 (option 3)
	24-Hour Automated Order Status Service	toll-free: 0800-449-602
	Sales	toll-free: 0800 441 567
	Home and Home Office	toll-free: 0800-289-3355
	Small Business	toll-free: 0800-941-121
	Business, Education, and Government	toll-free: 0800-941-128
Nicaragua	Online Support	www.dell.com/ni la-techsupport@dell.com
	Technical Support	toll free: 001-800-220-1378
	Customer Service and Sales	toll free: 001-800-220-1377

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
Norway (Lysaker)	Online Support	support.euro.dell.com
International Access Code: 00	Technical Support for XPS computers only	815 35 043
Country Code: 47	Technical Support	671 16882
	Relational Customer Service	671 17575
	Home/Small Business Customer Service	23162298
	Switchboard	671 16800
	Fax Switchboard	671 16865
Panama	Online Support	<a href="http://www.dell.com/pa">www.dell.com/pa</a> <a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>
	Technical Support	toll free: 001-800-507-1385 (C&W) or 001-866-633-4097 (Clarocom)
	Customer Service, Sales	toll free: 001-800-507-1264 (C&W) or 001-866-422-7964 (Clarocom and Movistar) or 001-800-507-1786 (TC)
Paraguay (Asuncion only)	Online Support	<a href="http://www.dell.com/py">www.dell.com/py</a> <a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>
	Technical Support, Customer Service, Sales	dial 008-11-800, then have the operator dial 866-686-9848 or EEUU (512) 723-0020

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>
<b>International Access Code Country Code</b>		<b>Web and E-mail Address</b>
Peru	Online Support	<a href="http://www.dell.com/pe">www.dell.com/pe</a> <a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>
	Technical Support	0800-50-869
	Customer Service and Sales	0800-50-669
Poland (Warsaw)	Online Support	<a href="http://support.euro.dell.com">support.euro.dell.com</a>
International Access Code: 011		<a href="mailto:pl_support_tech@dell.com">pl_support_tech@dell.com</a>
Country Code: 48	Customer Service Phone	57 95 700
City Code: 22	Customer Service	57 95 999
	Sales	57 95 999
	Customer Service Fax	57 95 806
	Reception Desk Fax	57 95 998
	Switchboard	57 95 999
Portugal	Online Support	<a href="http://support.euro.dell.com">support.euro.dell.com</a>
International Access Code: 00	Technical Support	707200149
Country Code: 351	Customer Service	800 300 413
	Sales	800 300 410 or 800 300 411 or 800 300 412 or 21 422 07 10
	Fax	21 424 01 12
Puerto Rico	Online Support	<a href="http://www.dell.com/pr">www.dell.com/pr</a> <a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>
	Technical Support	toll-free: 1-866-390-4695
	Spare Parts, Software, Peripherals and Warranty Sales	toll-free: 1-866-390-4691
	Ink and Toner Sales	toll-free: 1-866-851-1760
	Customer Service and Sales	1-877-537-3355

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers Web and E-mail Address</b>
St. Kitts and Nevis	Online Support	<a href="http://www.dell.com/kn">www.dell.com/kn</a> <a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>
	Technical Support	toll-free: 1-877-441-4734
	Customer Service and Sales	toll-free: 1-866-540-3355
St. Lucia	Online Support	<a href="http://www.dell.com/lc">www.dell.com/lc</a> <a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>
	Technical Support	toll-free: 1-866-464-4352
	Customer Service and Sales	toll-free: 1-866-540-3355
St. Vincent and the Grenadines	Online Support	<a href="http://www.dell.com/vc">www.dell.com/vc</a> <a href="mailto:la-techsupport@dell.com">la-techsupport@dell.com</a>
	Technical Support	toll-free: 1-866-464-4353
	Customer Service and Sales	toll-free: 1-866-540-3355
Singapore (Singapore) International Access Code: 005 Country Code: 65	<b>NOTE:</b> The phone numbers in this section should be called from within Singapore or Malaysia only.	
	Online Support	<a href="mailto:support.ap.dell.com">support.ap.dell.com</a>
	Technical Support	
	XPS computers only	toll-free: 1 800 394 7464
	Dimension, Inspiron, and Electronics and Accessories	toll-free: 1 800 394 7430
	OptiPlex, Latitude, and Dell Precision	toll-free: 1 800 394 7488
	PowerApp, PowerEdge, PowerConnect, and PowerVault	toll-free: 1 800 394 7478

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>
<b>International Access Code</b>		<b>Web and E-mail Address</b>
<b>Code Country Code</b>		
<b>City Code</b>		
Slovakia (Prague)  International Access Code: 00  Country Code: 421	Customer Service  24-Hour Automated Order Status Service  Sales  Transaction Sales  Corporate Sales	toll-free: 1 800 394 7430 (option 4)  toll-free: 1 800 394 7476  toll-free: 1 800 394 7412  toll-free: 1 800 394 7419
South Africa  (Johannesburg)  International Access Code: 09/091  Country Code: 27  City Code: 11	Online Support  Technical Support  Enterprise GOLD  Business Support  Customer Service  Fax  Tech Fax  Switchboard (Sales)	support.euro.dell.com  czech_dell@dell.com  02 5750 8303  02 5750 8308  02 5750 8301  420 22537 2707  02 5441 8328  02 5441 8328  02 5441 7585
Southeast Asian and Pacific Countries	Online Support  Gold Queue  Technical Support  Customer Service  Sales  Fax  Switchboard	support.euro.dell.com  dell_za_support@dell.com  011 709 7713  011 709 7710  011 709 7707  011 709 7700  011 706 0495  011 709 7700
	Technical Support, Customer Service, and Sales (Penang, Malaysia)	604 633 4810

<b>Country (City) International Access Code Country Code City Code</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>	<b>Web and E-mail Address</b>
Spain (Madrid)	Online Support		support.euro.dell.com
International Access Code: 00	Home and Small Business		
Country Code: 34	Technical Support	902 100 130	
City Code: 91	Customer Service	902 118 540	
	Sales	902 118 541	
	Switchboard	902 118 541	
	Fax	902 118 539	
	Corporate		
	Technical Support	902 100 130	
	Customer Service	902 115 236	
	Switchboard	91 722 92 00	
	Fax	91 722 95 83	
Suriname	Online Support		www.dell.com/sr la-techsupport@dell.com
	Technical Support, Customer Service, Sales	toll-free: 156-866-686-9850 or (512) 723-0010	
Sweden (Upplands Vasby)	Online Support		support.euro.dell.com
International Access Code: 00	Technical Support for XPS computers only	77 134 03 40	
Country Code: 46	Technical Support	08 590 05 199	
City Code: 8	Relational Customer Service	08 590 05 642	
	Home/Small Business Customer Service	08 587 70 527	
	Employee Purchase Program (EPP) Support	020 140 14 44	
	Technical Support Fax	08 590 05 594	
	Sales	08 587 705 81	

<b>Country (City)</b>	<b>Service Type</b>	<b>Area Codes, Local Numbers, and Toll-Free Numbers</b>	<b>Web and E-mail Address</b>
<b>International Access</b>			
<b>Code Country Code</b>			
<b>City Code</b>			
Switzerland (Geneva)	Online Support		
International Access			support.euro.dell.com
Code: 00			Tech_support_central_Europe@dell.com
Country Code: 41	Technical Support for XPS computers only	0848 338 857	
City Code: 22	Technical Support – Home and Small Business	0844 811 411	
	Technical Support at Home	0848 338 860	
	Technical Support – Corporate	0844 822 844	
	Customer Service – Home and Small Business	0848 802 202	



# Glossary

This section defines or identifies technical terms, abbreviations, and acronyms used in your system documents.

**A** — Ampere(s).

**AC** — Alternating current.

**ACPI** — Advanced Configuration and Power Interface. A standard interface for enabling the operating system to direct configuration and power management.

**ambient temperature** — The temperature of the area or room where the system is located.

**ANSI** — American National Standards Institute. The primary organization for developing technology standards in the U.S.

**application** — Software designed to help you perform a specific task or series of tasks. Applications run from the operating system.

**ASCII** — American Standard Code for Information Interchange.

**asset tag** — An individual code assigned to a system, usually by an administrator, for security or tracking purposes.

**backup** — A copy of a program or data file. As a precaution, back up your system's hard drive on a regular basis. Before making a change to the configuration of your system, back up important start-up files from your operating system.

**backup battery** — A battery that maintains system configuration, date, and time information in a special section of memory when the system is turned off.

**beep code** — A diagnostic message in the form of a pattern of beeps from your system's speaker. For example, one beep, followed by a second beep, and then a burst of three beeps is beep code 1-1-3.

**BIOS** — Basic input/output system. Your system's BIOS contains programs stored on a flash memory chip. The BIOS controls the following:

- Communications between the processor and peripheral devices
- Miscellaneous functions, such as system messages

**bit** — The smallest unit of information interpreted by your system.

**blade** — A module that contains a processor, memory, and a hard drive. The modules are mounted into a chassis that includes power supplies and fans.

**BMC** — Baseboard management controller.

**boot routine** — A program that clears all memory, initializes devices, and loads the operating system when you start your system. Unless the operating system fails to respond, you can reboot (also called *warm boot*) your system by pressing **<Ctrl><Alt><Del>**. Otherwise, you must restart the system by pressing the reset button or by turning the system off and then back on.

**bootable diskette** — A diskette that is used to start your system if the system will not boot from the hard drive.

**BTU** — British thermal unit.

**bus** — An information pathway between the components of a system. Your system contains an expansion bus that allows the processor to communicate with controllers for the peripheral devices connected to the system. Your system also contains an address bus and a data bus for communications between the processor and RAM.

**C** — Celsius.

**cache** — A fast storage area that keeps a copy of data or instructions for quick data retrieval. When a program makes a request to a disk drive for data that is in the cache, the disk-cache utility can retrieve the data from RAM faster than from the disk drive.

**CD** — Compact disc. CD drives use optical technology to read data from CDs.

**cm** — Centimeter(s).

**cmos** — Complementary metal-oxide semiconductor.

**component** — As they relate to DMI, components include operating systems, computer systems, expansion cards, and peripherals that are compatible with DMI. Each component is made up of groups and attributes that are defined as relevant to that component.

**COM** — The device names for the serial ports on your system.

**control panel** — The part of the system that contains indicators and controls, such as the power button and power indicator.

**controller** — A chip that controls the transfer of data between the processor and memory or between the processor and a peripheral.

**conventional memory** — The first 640 KB of RAM. Conventional memory is found in all systems. Unless they are specially designed, MS-DOS® programs are limited to running in conventional memory.

**coprocessor** — A chip that relieves the system's processor of specific processing tasks. A math coprocessor, for example, handles numeric processing.

**CPU** — Central processing unit. See *processor*.

**DC** — Direct current.

**DDR** — Double-data rate. A technology in memory modules that potentially doubles the output.

**device driver** — A program that allows the operating system or some other program to interface correctly with a peripheral. Some device drivers—such as network drivers—must be loaded from the `config.sys` file or as memory-resident programs (usually, from the `autoexec.bat` file). Others must load when you start the program for which they were designed.

**DHCP** — Dynamic Host Configuration Protocol. A method of automatically assigning an IP address to a client system.

**diagnostics** — A comprehensive set of tests for your system.

**DIMM** — Dual in-line memory module. See also *memory module*.

**DIN** — *Deutsche Industrie Norm*.

**directory** — Directories help keep related files organized on a disk in a hierarchical, “inverted tree” structure. Each disk has a “root” directory. Additional directories that branch off the root directory are called *subdirectories*. Subdirectories may contain additional directories branching off them.

**DMA** — Direct memory access. A DMA channel allows certain types of data transfer between RAM and a device to bypass the processor.

**DMI** — Desktop Management Interface. DMI enables the management of your system’s software and hardware by collecting information about the system’s components, such as the operating system, memory, peripherals, expansion cards, and asset tag.

**DNS** — Domain Name System. A method of translating Internet domain names, such as [www.dell.com](http://www.dell.com), into IP addresses, such as 143.166.83.200.

**DRAM** — Dynamic random-access memory. A system’s RAM is usually made up entirely of DRAM chips.

**DVD** — Digital versatile disc.

**ECC** — Error checking and correction.

**EEPROM** — Electronically erasable programmable read-only memory.

**EMC** — Electromagnetic compatibility.

**EMI** — Electromagnetic interference.

**ERA** — Embedded remote access. ERA allows you to perform remote, or “out-of-band,” server management on your network server using a remote access controller.

**ESD** — Electrostatic discharge.

**ESM** — Embedded server management.

**expansion bus** — Your system contains an expansion bus that allows the processor to communicate with controllers for peripherals, such as NICs.

**expansion card** — An add-in card, such as a NIC or SCSI adapter, that plugs into an expansion-card connector on the system board. An expansion card adds some specialized function to the system by providing an interface between the expansion bus and a peripheral.

**expansion-card connector** — A connector on the system board or riser board for plugging in an expansion card.

**F** — Fahrenheit.

**FAT** — File allocation table. The file system structure used by MS-DOS to organize and keep track of file storage. The Microsoft® Windows® operating systems can optionally use a FAT file system structure.

**flash memory** — A type of EEPROM chip that can be reprogrammed from a utility on diskette while still installed in a system; most EEPROM chips can only be rewritten with special programming equipment.

**format** — To prepare a hard drive or diskette for storing files. An unconditional format deletes all data stored on the disk.

**FSB** — Front-side bus. The FSB is the data path and physical interface between the processor and the main memory (RAM).

**ft** — Feet.

**FTP** — File transfer protocol.

**g** — Gram(s).

**G** — Gravities.

**Gb** — Gigabit(s); 1024 megabits or 1,073,741,824 bits.

**GB** — Gigabyte(s); 1024 megabytes or 1,073,741,824 bytes. However, when referring to hard-drive capacity, the term is usually rounded to 1,000,000,000 bytes.

**graphics mode** — A video mode that can be defined as *x* horizontal by *y* vertical pixels by *z* colors.

**group** — As it relates to DMI, a group is a data structure that defines common information, or attributes, about a manageable component.

**guarding** — A type of data redundancy in which a set of physical drives stores data and an additional drive stores parity data. See also *mirroring*, *striping*, and *RAID*.

**h** — Hexadecimal. A base-16 numbering system, often used in programming to identify addresses in the system's RAM and I/O memory addresses for devices. In text, hexadecimal numbers are often followed by *h*.

**headless system** — A system or device that functions without having a keyboard,

mouse, or monitor attached. Normally, headless systems are managed over a network using an Internet browser.

**host adapter** — A host adapter implements communication between the system's bus and the controller for a peripheral device. (Hard-drive controller subsystems include integrated host adapter circuitry.) To add a SCSI expansion bus to your system, you must install or connect the appropriate host adapter.

**Hz** — Hertz.

**I/O** — Input/output. A keyboard is an input device, and a monitor is an output device. In general, I/O activity can be differentiated from computational activity.

**ID** — Identification.

**IDE** — Integrated drive electronics. A standard interface between the system board and storage devices.

**integrated mirroring** — Provides simultaneous physical mirroring of two drives. Integrated mirroring functionality is provided by the system's hardware. See also *mirroring*.

**internal processor cache** — An instruction and data cache built into the processor.

**IP** — Internet Protocol.

**IPX** — Internet package exchange.

**IRQ** — Interrupt request. A signal that data is about to be sent to or received by a peripheral device travels by an IRQ line to the processor. Each peripheral connection must be assigned an IRQ number. Two devices can share the same IRQ assignment, but you cannot operate both devices simultaneously.

**jumper** — Small blocks on a circuit board with two or more pins emerging from them. Plastic plugs containing a wire fit down over the pins. The wire connects the pins and creates a circuit, providing a simple and reversible method of changing the circuitry in a board.

**K** — Kilo-; 1000.

**Kb** — Kilobit(s); 1024 bits.

**KB** — Kilobyte(s); 1024 bytes.

**Kbps** — Kilobit(s) per second.

**KBps** — Kilobyte(s) per second.

**key combination** — A command requiring you to press multiple keys at the same time (for example, <Ctrl><Alt><Del>).

**kg** — Kilogram(s); 1000 grams.

**kHz** — Kilohertz.

**KMM** — Keyboard/monitor/mouse.

**KVM** — Keyboard/video/mouse. KVM refers to a switch that allows selection of the system from which the video is displayed and for which the keyboard and mouse are used.

**LAN** — Local area network. A LAN is usually confined to the same building or a few nearby buildings, with all equipment linked by wiring dedicated specifically to the LAN.

**lb** — Pound(s).

**LCD** — Liquid crystal display.

**LED** — Light-emitting diode. An electronic device that lights up when a current is passed through it.

**Linux** — An open-source operating system, similar to the UNIX® operating system, that runs on a variety of hardware systems. Linux is freely available; however, the full distribution of Linux along with technical support and training are available for a fee from vendors such as Red Hat® Software.

**local bus** — On a system with local-bus expansion capability, certain peripheral devices (such as the video adapter circuitry) can be designed to run much faster than they would with a traditional expansion bus. See also *bus*.

**LVD** — Low voltage differential.

**m** — Meter(s).

**mA** — Milliampere(s).

**MAC address** — Media Access Control address. Your system's unique hardware number on a network.

**mAh** — Milliampere-hour(s).

**Mb** — Megabit(s); 1,048,576 bits.

**MB** — Megabyte(s); 1,048,576 bytes. However, when referring to hard-drive capacity, the term is often rounded to mean 1,000,000 bytes.

**Mbps** — Megabits per second.

**MBps** — Megabytes per second.

**MBR** — Master boot record.

**memory address** — A specific location, usually expressed as a hexadecimal number, in the system's RAM.

**memory module** — A small circuit board containing DRAM chips that connects to the system board.

**memory** — An area in your system that stores basic system data. A system can contain

several different forms of memory, such as integrated memory (ROM and RAM) and add-in memory modules (DIMMs).

**MHz** — Megahertz.

**mirroring** — A type of data redundancy in which a set of physical drives stores data and one or more sets of additional drives stores duplicate copies of the data. Mirroring functionality is provided by software. See also *guarding*, *integrated mirroring*, *striping*, and *RAID*.

**mm** — Millimeter(s).

**ms** — Millisecond(s).

**MS-DOS®** — Microsoft Disk Operating System.

**NAS** — Network Attached Storage. NAS is one of the concepts used for implementing shared storage on a network. NAS systems have their own operating systems, integrated hardware, and software that are optimized to serve specific storage needs.

**NIC** — Network interface controller. A device that is installed or integrated in a system to allow connection to a network.

**NMI** — Nonmaskable interrupt. A device sends an NMI to signal the processor about hardware errors.

**ns** — Nanosecond(s).

**NTFS** — The NT File System option in the Windows 2000 operating system.

**NVRAM** — Nonvolatile random-access memory. Memory that does not lose its contents when you turn off your system. NVRAM is used for maintaining the date, time, and system configuration information.

**parity** — Redundant information that is associated with a block of data.

**partition** — You can divide a hard drive into multiple physical sections called *partitions* with the *fdisk* command. Each partition can contain multiple logical drives. You must format each logical drive with the *format* command.

**PCI** — Peripheral Component Interconnect. A standard for local-bus implementation.

**PDU** — Power distribution unit. A power source with multiple power outlets that provides electrical power to servers and storage systems in a rack.

**peripheral** — An internal or external device, such as a diskette drive or keyboard, connected to a system.

**PGA** — Pin grid array. A type of processor socket that allows you to remove the processor chip.

**pixel** — A single point on a video display. Pixels are arranged in rows and columns to create an image. A video resolution, such as 640 x 480, is expressed as the number of

pixels across by the number of pixels up and down.

**POST** — Power-on self-test. Before the operating system loads when you turn on your system, the POST tests various system components such as RAM and hard drives.

**processor** — The primary computational chip inside the system that controls the interpretation and execution of arithmetic and logic functions. Software written for one processor must usually be revised to run on another processor. **CPU** is a synonym for processor.

**protected mode** — An operating mode that allows operating systems to implement:

- A memory address space of 16 MB to 4 GB
- Multitasking
- Virtual memory, a method for increasing addressable memory by using the hard drive

The Windows 2000 and UNIX 32-bit operating systems run in protected mode. MS-DOS cannot run in protected mode.

**PS/2** — Personal System/2.

**PXE** — Preboot eXecution Environment. A way of booting a system via a LAN (without a hard drive or bootable diskette).

**RAC** — Remote access controller.

**RAID** — Redundant array of independent disks. A method of providing data redundancy. Some common implementations of RAID include RAID 0, RAID 1, RAID 5, RAID 10, and RAID 50. See also *guarding*, *mirroring*, and *striping*.

**RAM** — Random-access memory. The system's primary temporary storage area for program instructions and data. Any information stored in RAM is lost when you turn off your system.

**RAS** — Remote Access Service. This service allows users running the Windows operating system to remotely access a network from their system using a modem.

**readme file** — A text file, usually shipped with software or hardware, that contains information supplementing or updating the product's documentation.

**read-only file** — A read-only file is one that you are prohibited from editing or deleting.

**ROM** — Read-only memory. Your system contains some programs essential to its operation in ROM code. A ROM chip retains its contents even after you turn off your system. Examples of code in ROM include the program that initiates your system's boot routine and the POST.

**ROMB** — RAID on motherboard.

**rpm** — Revolutions per minute.

**RTC** — Real-time clock.

**SAS** — Serial-attached SCSI.

**SATA** — Serial Advanced Technology Attachment. A standard interface between the system board and storage devices.

**SCSI** — Small computer system interface. An I/O bus interface with faster data transmission rates than standard ports.

**SDRAM** — Synchronous dynamic random-access memory.

**sec** — Second(s).

**serial port** — An I/O port used most often to connect a modem to your system. You can usually identify a serial port on your system by its 9-pin connector.

**service tag** — A bar code label on the system used to identify it when you call Dell for technical support.

**simple disk volume** — The volume of free space on a single dynamic, physical disk.

**SMART** — Self-Monitoring Analysis and Reporting Technology. Allows hard drives to report errors and failures to the system BIOS and then display an error message on the screen.

**SMP** — Symmetric multiprocessing. Used to describe a system that has two or more processors connected via a high-bandwidth link and managed by an operating system, where each processor has equal access to I/O devices.

**SNMP** — Simple Network Management Protocol. A standard interface that allows a network manager to remotely monitor and manage workstations.

**spanning** — Spanning, or concatenating, disk volumes combines unallocated space from multiple disks into one logical volume, allowing more efficient use of all the space and all drive letters on a multiple-disk system.

**striping** — Disk striping writes data across three or more disks in an array, but only uses a portion of the space on each disk. The amount of space used by a "stripe" is the same on each disk used. A virtual disk may use several stripes on the same set of disks in an array. See also *guarding*, *mirroring*, and *RAID*.

**SVGA** — Super video graphics array. VGA and SVGA are video standards for video adapters with greater resolution and color display capabilities than previous standards.

**system board** — As the main circuit board, the system board usually contains most of your system's integral components, such as the processor, RAM, controllers for peripherals, and various ROM chips.

**system configuration information** — Data stored in memory that tells a system what hardware is installed and how the system should be configured for operation.

**system diskette** — See *bootable diskette*.

**system memory** — See RAM.

**System Setup program** — A BIOS-based program that allows you to configure your system's hardware and customize the system's operation by setting features such as password protection. Because the System Setup program is stored in NVRAM, any settings remain in effect until you change them again.

**system.ini file** — A start-up file for the Windows operating system. When you start Windows, it consults the **system.ini** file to determine a variety of options for the Windows operating environment. Among other things, the **system.ini** file records which video, mouse, and keyboard drivers are installed for Windows.

**TCP/IP** — Transmission Control Protocol/Internet Protocol.

**termination** — Some devices (such as the last device at each end of a SCSI cable) must be terminated to prevent reflections and spurious signals in the cable. When such devices are connected in a series, you may need to enable or disable the termination on these devices by changing jumper or switch settings on the devices or by changing settings in the configuration software for the devices.

**TOE** — TCP/IP offload engine.

**UNIX** — Universal Internet Exchange. UNIX, the precursor to Linux, is an operating system written in the C programming language.

**uplink port** — A port on a network hub or switch used to connect to other hubs or switches without requiring a crossover cable.

**UPS** — Uninterruptible power supply. A battery-powered unit that automatically supplies power to your system in the event of an electrical failure.

**USB** — Universal Serial Bus. A USB connector provides a single connection point for multiple USB-compliant devices, such as mice and keyboards. USB devices can be connected and disconnected while the system is running.

**utility** — A program used to manage system resources—memory, disk drives, or printers, for example.

**UTP** — Unshielded twisted pair. A type of wiring used to connect systems in a business or home to a telephone line.

**V** — Volt(s).

**VAC** — Volt(s) alternating current.

**VDC** — Volt(s) direct current.

**VGA** — Video graphics array. VGA and SVGA are video standards for video adapters with greater resolution and color display capabilities than previous standards.

**video adapter** — The logical circuitry that provides (in combination with the monitor) your system's video capabilities. A video adapter may be integrated into the system

board or may be an expansion card that plugs into an expansion slot.

**video driver** — A program that allows graphics-mode application programs and operating systems to display at a chosen resolution with the desired number of colors. Video drivers may need to match the video adapter installed in the system.

**video memory** — Most VGA and SVGA video adapters include memory chips in addition to your system's RAM. The amount of video memory installed primarily influences the number of colors that a program can display (with the appropriate video drivers and monitor capabilities).

**video resolution** — Video resolution (800 x 600, for example) is expressed as the number of pixels across by the number of pixels up and down. To display a program at a specific graphics resolution, you must install the appropriate video drivers and your monitor must support the resolution.

**W** — Watt(s).

**WH** — Watt-hour(s).

**win.ini file** — A start-up file for the Windows operating system. When you start Windows, it consults the **win.ini** file to determine a variety of options for the Windows operating environment. The **win.ini** file also usually includes sections that contain optional settings for Windows application programs that are installed on the hard drive.

**Windows 2000** — An integrated and complete Microsoft Windows operating system that does not require MS-DOS and that provides advanced operating system performance, improved ease of use, enhanced workgroup functionality, and simplified file management and browsing.

**Windows Powered** — A Windows operating system designed for use on NAS systems. For NAS systems, the Windows Powered operating system is dedicated to file service for network clients.

**Windows Server 2003** — A set of Microsoft software technologies that enable software integration through the use of XML Web services. XML Web services are small reusable applications written in XML that allow data to be communicated between otherwise unconnected sources.

**XML** — Extensible Markup Language. XML is a way to create common information formats and to share both the format and the data on the World Wide Web, intranets, and elsewhere.

**ZIF** — Zero insertion force.



# **Index**

## **A**

alert messages, 34  
assigning passwords, 45

## **B**

Baseboard Management Controller (BMC), 49  
battery  
    removing or replacing, 58  
    replacing, 58  
    troubleshooting, 106  
beep codes, 31  
bezel  
    installing, 54  
    removing, 53

connectors  
    riser card, 124  
    system board, 122  
Console Redirection screen, 42  
contacting Dell, 133  
control panel  
    installing, 90  
    removing, 89  
cooling fan  
    troubleshooting, 108  
cooling shroud  
    installing, 57  
    removing, 56  
cover  
    closing, 55  
    opening, 54  
CPU Information screen, 39

## **C**

CD drive  
    installing, 61  
    removing, 60  
    troubleshooting, 110  
checking equipment, 98  
configuring the boot drive, 62  
connecting external devices, 18

## **D**

damaged systems  
    troubleshooting, 105  
Dell  
    contacting, 133  
Dell PowerEdge Diagnostics  
    using, 117

**d**  
diagnostics  
  advanced testing options, 119  
  running from the utility  
    partition, 118  
  using Dell PowerEdge  
    Diagnostics, 117  
  when to use, 118  
  
diagnostics indicator codes, 29  
  
drives  
  CD, 60  
  optical, 60

**f**  
features  
  back-panel, 17  
  front-panel, 13  
  
**H**  
hard drives  
  configuring the boot drive, 62  
  installing, 67  
  removing, 63  
  troubleshooting, 111

**E**  
error messages, 35  
  
expansion cards  
  installing, 75  
  removing, 78  
  troubleshooting, 113  
  
external devices  
  connecting, 18

**I**  
indicators  
  back-panel, 17  
  front-panel, 13  
  NIC, 19  
  
installing  
  bezel, 54  
  CD drive, 61  
  control panel, 90  
  cooling shroud, 57  
  expansion cards, 75  
  hard drives, 67  
  memory modules, 82  
  optical drive, 61  
  PCI fan assembly, 72  
  power supply, 75  
  processor fan assembly, 70  
  riser card, 80  
  system board, 94  
  
Integrated Devices screen, 41

**F**  
fan assembly (PCI)  
  installing, 72  
  removing, 71  
  troubleshooting, 108  
  
fan assembly (processor)  
  installing, 70  
  removing, 69  
  troubleshooting, 108

## **I**

### **IRQs**

- avoiding conflicts, 98
- line assignments, 98

## **J**

- ### **jumpers**
- system board, 121

## **K**

- ### **keyboard**
- troubleshooting, 100

## **M**

- ### **memory**
- installation guidelines, 81
  - installing, 82
  - removing, 84
  - troubleshooting, 108
- ### **messages**
- alert, 34
  - beep codes, 31
  - diagnostics indicator codes, 29
  - error messages, 35
  - system, 19
  - systems management, 104
  - warning, 34
- ### **mouse**
- troubleshooting, 101

## **N**

- ### **navigation keys**
- system setup program, 36
- ### **NICs**
- indicators, 19
  - troubleshooting, 103
- ### **NMI button**
- 17

## **O**

- ### **optical drive**
- installing, 61
  - removing, 60

## **P**

- ### **password**
- disabling, 125
- ### **PCI fan assembly**
- installing, 72
  - removing, 71
  - troubleshooting, 108
- ### **phone numbers**
- 133
- ### **POST**
- accessing system features, 12
- ### **power supply**
- installing, 75
  - removing, 73
  - troubleshooting, 106

processor  
replacing, 85  
troubleshooting, 114  
processor fan assembly  
troubleshooting, 108

## R

RAID controller card. *See* expansion cards.  
recommended tools, 51  
removing  
bezel, 53  
CD drive, 60  
control panel, 89  
cooling shroud, 56  
expansion cards, 78  
hard drives, 63  
memory modules, 84  
optical drive, 60  
PCI fan assembly, 71  
power supply, 73  
processor fan assembly, 69  
riser card, 79  
system board, 91  
replacing  
processor, 85  
system battery, 58  
riser card  
connectors, 124  
installing, 80  
removing, 79

**S**  
safety, 97  
SAS controller card. *See* expansion cards.  
SAS hard drives. *See* hard drives.  
SATA hard drives. *See* hard drives.  
securing your system, 46  
serial I/O device  
troubleshooting, 102  
setup password  
assigning, 48  
changing, 49  
features, 45  
working with, 48  
startup  
accessing system features, 12  
support  
contacting Dell, 133  
system battery  
replacing, 58  
troubleshooting, 106  
system board  
connectors, 122  
installing, 94  
jumpers, 121  
removing, 91  
system cooling  
troubleshooting, 107  
system features  
accessing, 12

system identification button, 16  
system messages, 19  
system password  
    assigning, 45  
    changing, 47  
    deleting, 47  
    features, 45  
System Security screen, 43  
system setup program  
    Console Redirection screen, 42  
    CPU Information screen, 39  
    entering, 35  
    Integrated Devices screen, 41  
main screen, 36  
navigation keys, 36  
System Security screen, 43  
system status indicator, 16

## T

telephone numbers, 133  
troubleshooting  
    basic I/O, 101  
    battery, 106  
    CD drive, 110  
    cooling fan, 108  
    damaged system, 105  
    expansion cards, 113  
    external connections, 99  
    hard drives, 111

troubleshooting (*continued*)  
    keyboard, 100  
    memory, 108  
    mouse, 101  
    NIC, 103  
    power supply, 106  
    processor, 114  
    serial I/O device, 102  
    start-up routine, 97  
    system cooling, 107  
    USB device, 102  
    video, 99  
    wet system, 104

## U

USB device  
    troubleshooting, 102

## V

video  
    troubleshooting, 99

## W

warning messages, 34  
warranty, 11  
wet system  
    troubleshooting, 104

