

Dell™ PowerEdge™ 840 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

1	About Your System	9
	Other Information You May Need	9
	Accessing System Features During Startup	10
	Front-Panel Features and Indicators	11
	Back-Panel Features and Indicators	13
	Connecting External Devices	14
	NIC Indicator Codes	14
	Diagnostics Indicator Codes	15
	Hard-Drive Indicator Codes	17
	System Messages	18
	System Beep Codes	26
	Warning Messages	28
	Diagnostics Messages	28
	Alert Messages	28
	Baseboard Management Controller Messages	28
2	Using the System Setup Program	29
	Entering the System Setup Program	29
	Responding to Error Messages	29
	Using the System Setup Program	29
	System Setup Options	30
	Main Screen	30
	CPU Information Screens	33
	Integrated Devices Screen	34
	Console Redirection Screen	35
	System Security Screen	35
	Exit Screen	37

System and Setup Password Features	37
Using the System Password	37
Using the Setup Password	39
3 Installing System Components	41
Recommended Tools	41
Inside the System	42
Opening the System	43
Removing the Bezel	43
Removing the Cover	44
Front-Panel Drive Inserts	44
Removing the Front-Panel Drive Inserts	45
Installing the Front-Panel Drive Inserts	46
Closing the System	47
Replacing the Cover	47
Installing the Bezel	47
Connecting Drives	47
Interface Cables	47
Drive Cable Configurations	47
DC Power Cables	48
Diskette Drive	48
Removing a Diskette Drive	48
Installing a Diskette Drive	48
Optical or Tape Drives	49
Installing an Optical or Tape Drive	50
Hard Drives	53
Hard Drive Installation Guidelines	53
Configuring the Boot Drive	54
Removing a Hard Drive from the Drive Bay	54
Installing a Hard Drive in the Drive Bay	55
Removing a Hard Drive from a Lever-Release Drive Carrier	59
Installing an Hard Drive in the Lever-Release Drive Carrier	60
Hot-Plug SATA Hard Drives Using the SAS Backplane	61
Removing a Hot-Plug SAS or SATA Hard Drive	64

Cooling Shroud	64
Removing the Cooling Shroud	64
Installing the Cooling Shroud	65
Cooling Fans	65
Removing the Front System Fan	66
Installing the Front System Fan	67
Removing the Back System Fan	67
Installing the Back System Fan	68
Power Supply	69
Removing the Power Supply	69
Replacing the Power Supply	70
Expansion Cards	71
Installing an Expansion Card	72
Removing an Expansion Card	73
Replacing the SAS Controller Card Battery	75
Memory	76
General Memory Module Installation Guidelines	76
Installing Memory Modules	76
Removing Memory Modules	78
Microprocessor	78
Removing the Processor	79
Installing a Processor	81
Installing a RAC Card	83
System Battery	83
Replacing the System Battery	83
Front I/O Panel (Service-Only Parts Procedure)	85
Removing the Control Panel Assembly and Chassis-Intrusion Switch	85
Installing the Control Panel Assembly	87
System Board (Service-Only Parts Procedure)	87
Removing the System Board	87
Installing the System Board	89

4	Troubleshooting Your System	91
	Safety First—For You and Your System	91
	Start-Up Routine	91
	Checking the Equipment.	92
	Troubleshooting IRQ Assignment Conflicts.	92
	Troubleshooting the Video Subsystem	92
	Troubleshooting the Keyboard.	93
	Troubleshooting the Mouse.	93
	Troubleshooting Serial I/O Problems	94
	Troubleshooting a Serial I/O Device	94
	Troubleshooting a USB Device	95
	Troubleshooting a NIC	95
	Troubleshooting External Connections	96
	Troubleshooting a Wet System.	96
	Troubleshooting a Damaged System.	97
	Troubleshooting the System Battery.	98
	Troubleshooting Power Supplies	98
	Troubleshooting System Cooling Problems	99
	Troubleshooting a Fan	99
	Troubleshooting System Memory	100
	Troubleshooting a Diskette Drive	101
	Troubleshooting an Optical Drive	102
	Troubleshooting an External SCSI Tape Drive.	103
	Troubleshooting a Hard Drive	104
	Troubleshooting SATA Hard Drives	105
	Troubleshooting a SATA Hard Drive	105
	Troubleshooting a SATA Hard Drive in a RAID Configuration	106
	Troubleshooting a SAS RAID Controller.	107
	Troubleshooting Expansion Cards.	108
	Troubleshooting the Microprocessor	109

5	Running the System Diagnostics	111
	Using Dell PowerEdge Diagnostics	111
	System Diagnostics Features	111
	When to Use the System Diagnostics	112
	Running the System Diagnostics	112
	From the Utility Partition	112
	From Removable Bootable Media	112
	System Diagnostics Testing Options	113
	Using the Custom Test Options	113
	Selecting Devices for Testing	113
	Selecting Diagnostics Options	113
6	Jumpers and Connectors	115
	System Board Jumpers	115
	System Board Connectors	118
	Disabling a Forgotten Password	120
7	Getting Help	121
	Obtaining Assistance	121
	Online Services	121
	AutoTech Service	122
	Automated Order-Status Service	122
	Support Service	122
	Dell Enterprise Training and Certification	123
	Problems With Your Order	123
	Product Information	123
	Returning Items for Warranty Repair or Credit	123
	Before You Call	124
	Contacting Dell	126

Glossary 147

Index 155

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
- Warning messages
- Diagnostics messages
- Beep codes
- 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 *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 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.

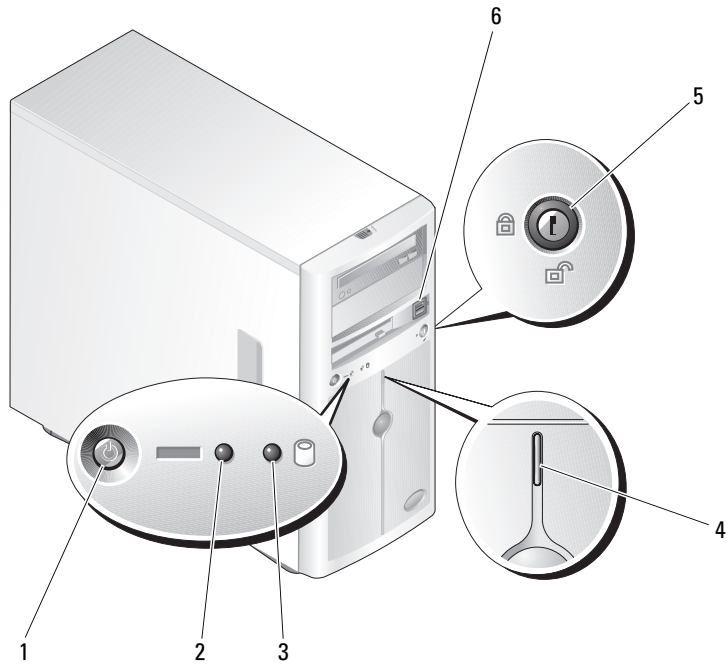
Table 1-1. Keystrokes for Accessing System Features

Keystroke	Description
<F2>	Enters the System Setup program. See "Entering the System Setup Program" on page 29.
<F10>	Opens the utility partition, allowing you to run the system diagnostics. See "Running the System Diagnostics" on page 112.
<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.
<Ctrl+S>	Option is displayed only if you have PXE support enabled through the System Setup Program (see "Integrated Devices Screen" on page 34). 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 <i>User's Guide</i> for more information on setup and use of DRAC.

Front-Panel Features and Indicators





Figure 1-1 shows the controls, indicators, and connectors located on the system's front panel. Table 1-2 provides component descriptions.

Figure 1-1. Front-Panel Features and Indicators



- | | | | | | |
|---|-------------------------|---|--------------------|---|-------------------------------|
| 1 | power button | 2 | power-on indicator | 3 | hard-drive activity indicator |
| 4 | system status indicator | 5 | security lock | 6 | USB connectors (2) |

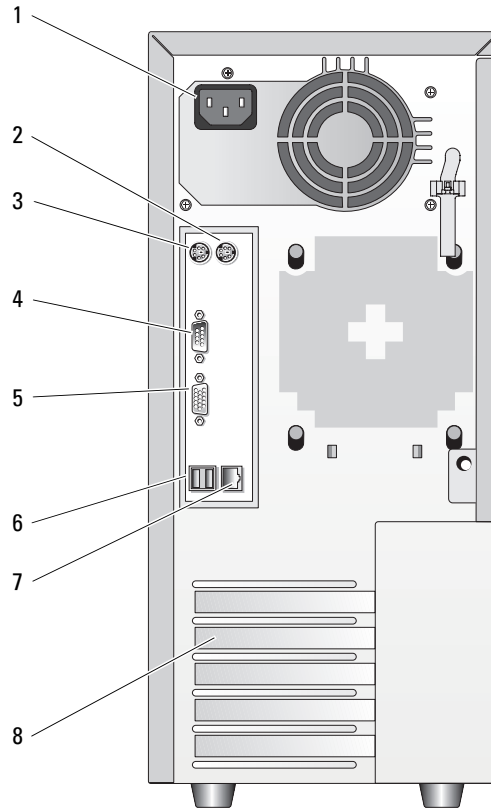
Table 1-2. Front-Panel Components

Item	Component	Icon	Description
1	Power button		<p>The power button turns system power off and on.</p> <p> NOTICE: 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 29 and the operating system's documentation.</p>
2	Power-on indicator		<p>On: System power is on.</p> <p>Blinking: System is on but in standby state, or system is off but still connected to the power source.</p>
3	Hard-drive activity indicator		<p>Flashes when data is being read from or written to the internal SATA hard drives that are connected to the integrated controller.</p>
4	System status indicator		<p>Blue: Normal system operation.</p> <p>Amber: Flashes when the system needs attention due to a problem with power supplies, fans, system temperature, or hot-plug hard drives.</p> <p>NOTE: If the system is connected to AC power and an error has been detected, the amber system status indicator flashes regardless of whether the system has been powered on.</p>
5	Security lock		<p>Controls access to the system's internal components.</p>
6	USB connectors		<p>Connects USB 2.0-compliant devices to the system.</p>

Back-Panel Features and Indicators

Figure 1-2 shows the connectors located on the system's back panel.

Figure 1-2. Back-Panel Features



- | | | | | | |
|---|-----------------------|---|---------------------|---|--------------------|
| 1 | AC power connector | 2 | mouse connector | 3 | keyboard connector |
| 4 | serial connectors (5) | 5 | video connector | 6 | USB connector (2) |
| 7 | NIC connector | 8 | expansion slots (5) | | |

Connecting External Devices

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

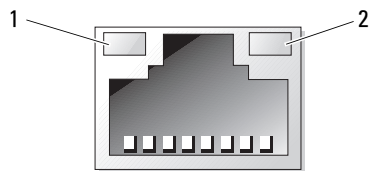
- Most devices must be connected to a specific connector and device drivers must be installed before the device operates properly. (Device drivers are normally included with your operating system software or with the device itself.) See the documentation that accompanied the device for specific installation 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 29 for information about enabling, disabling, and configuring I/O ports and connectors.

NIC Indicator Codes

The 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



1 link indicator

2 activity indicator







Table 1-3. NIC Indicator Codes

Indicator Type	Indicator Code	Description
Activity	Off	When off at the same time that the link indicator is off, the NIC is not connected to the network or the NIC is disabled in the System Setup program. See "Using the System Setup Program" on page 29.
	Blinking yellow	Indicates that network data is being sent or received.
Link	Off	When off at the same time that the activity indicator is off, the NIC is not connected to the network or the NIC is disabled in the System Setup program. See "Using the System Setup Program" on page 29.
	On (green)	Indicates active link.

Diagnostics Indicator Codes

Four diagnostic indicator lights are located behind the bezel on the I/O control panel. To access the lights, see "Opening the System" on page 43. These lights display error codes during system startup. Table 1-4 lists the causes and corrective actions associated with these codes and the power light status before system POST. Table 1-6 lists the causes and possible corrective actions for these codes during POST. A highlighted circle indicates the light is on; a non-highlighted circle indicates the light is off.

Table 1-4. Diagnostic Indicator Codes

Code	Causes	Corrective Action
 A B C D	No power is applied to the system.	See "Troubleshooting Power Supplies" on page 98.
 A B C D	A possible processor failure has occurred.	See "Troubleshooting the Microprocessor" on page 109.
 A B C D	Memory failure.	See "Troubleshooting System Memory" on page 100.
 A B C D	Possible expansion-card failure.	See "Troubleshooting Expansion Cards" on page 108.
 A B C D	Possible video card failure.	See "Troubleshooting Expansion Cards" on page 108.
 A B C D	Diskette or hard-drive failure.	Ensure that the diskette drive and hard drive(s) are properly connected. See "Hard Drives" on page 53 for information on the drive(s) installed in your system.














-  = yellow
-  = green
-  = off

Table 1-4. Diagnostic Indicator Codes (continued)

Code	Causes	Corrective Action
 A B C D	Possible USB failure.	See "Troubleshooting a USB Device" on page 95.
 A B C D	No memory modules detected.	See "Troubleshooting System Memory" on page 100.
 A B C D	System board failure.	See "Getting Help" on page 121."
 A B C D	Memory configuration error.	See "Troubleshooting System Memory" on page 100.
 A B C D	Possible system board resource and/or system board hardware failure.	See "Getting Help" on page 121."
 A B C D	Possible expansion card failure.	See "Troubleshooting Expansion Cards" on page 108.
 A B C D	Other failure.	Ensure that the diskette drive, optical drive, and hard drive(s) are properly connected. See "Troubleshooting Your System" on page 91" for the appropriate drive(s) installed in your system. If the problem persists, see "Getting Help" on page 121."
 A B C D	The system is in a normal operating condition after POST.	Information only.

 = yellow

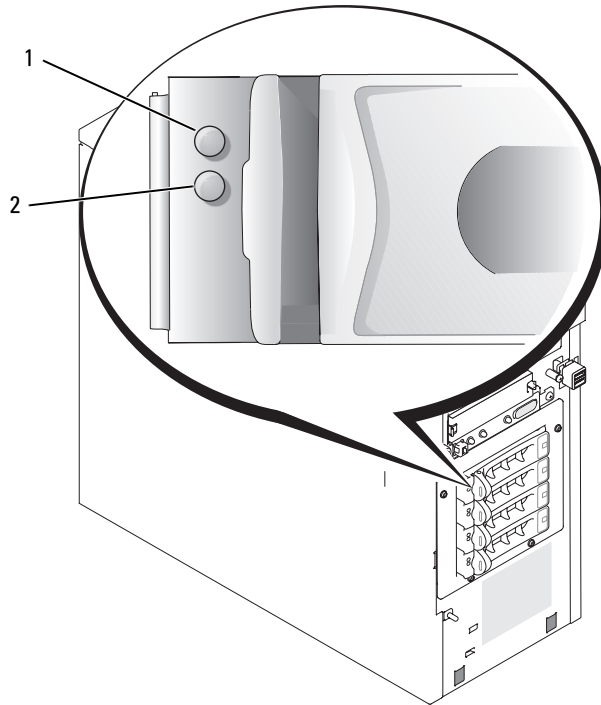
 = green

 = off

Hard-Drive Indicator Codes

If an optional SAS backplane is installed in the system, two indicators on each of the hard-drive carriers provide information on the status of the hard drives. See Figure 1-4 and Table 1-5. The SAS backplane firmware controls the drive power-on/fault indicator.

Figure 1-4. Hard-Drive Indicators



1 drive status indicator

2 drive busy indicator

Table 1-5 lists the drive indicator patterns. Different patterns are displayed as drive events occur in the system. For example, if a hard drive fails, the "drive failed" pattern appears. After the drive is selected for removal, the "drive being prepared for removal" pattern appears, followed by the "drive ready for insertion or removal" pattern. After the replacement drive is installed, the "drive being prepared for operation" pattern appears, followed by the "drive online" pattern.


 **NOTE:** If a RAID controller is not installed, only the "drive online" indicator pattern appears. The drive-activity indicator also blinks when the drive is being accessed.

Table 1-5. Hard-Drive Indicator Patterns

Condition	Indicator Pattern
Identify drive	The green power-on/fault indicator blinks four times per second.
Drive being prepared for removal	The green power-on/fault indicator blinks two times per second.
Drive ready for insertion or removal	Both drive indicators are off.
Drive being prepared for operation	The green power-on/fault indicator is on.
Drive predicted failure	The power-on/fault indicator slowly blinks green, amber, and off.
Drive failed	The amber power-on/fault indicator blinks four times per second.
Drive rebuilding	The green power-on/fault indicator blinks slowly.
Drive online	The green power-on/fault indicator is on.

System Messages

System messages appear on the screen to notify you of a possible problem with the system. Table 1-6 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 1-6, 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.

Table 1-6. System Messages

Message	Causes	Corrective Actions
Amount of available memory limited to 256MB	OS Install Mode is enabled in the System Setup program.	Disable OS Install Mode in the System Setup program. See "Using the System Setup Program" on page 29.

Table 1-6. System Messages (continued)

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	BIOS remote update failed.	Retry update.
Caution! NVRAM_CLR jumper is installed on system board.	NVRAM_CLR jumper is installed.	Remove the NVRAM_CLR jumper. See "System Board Jumpers" on page 115 for the jumper location.
Data error	Faulty diskette, diskette drive, optical drive, hard drive.	Replace the diskette. Ensure that the diskette drive, optical drive, and hard-drive cables are properly connected. See "Troubleshooting a Diskette Drive" on page 101 or "Troubleshooting an Optical Drive" on page 102 for the appropriate drive(s) installed in your system.
Decreasing available memory	Faulty or improperly installed memory modules.	Ensure that all memory modules are properly installed. See ""Troubleshooting System Memory" on page 100.
Diskette drive 0 seek failure	Incorrect configuration settings in System Setup program. Faulty or improperly installed diskette, loose diskette drive or optical drive interface cable, or loose power cable.	Run the System Setup program to correct the settings. See "Using the System Setup Program" on page 29. Replace the diskette. Ensure that the diskette drive and optical drive cables are properly connected. See ""Troubleshooting a Diskette Drive" on page 101" and ""Troubleshooting an Optical Drive" on page 102" in "Troubleshooting Your System."
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 Diskette Drive" on page 101 and "Troubleshooting an Optical Drive" on page 102. If the problem persists, see "Getting Help" on page 121.

Table 1-6. System Messages (continued)

Message	Causes	Corrective Actions
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.	An unmatched pair of memory modules is installed.	Install a matched pair of memory modules, or remove the memory module in socket DIMM1_B. See "General Memory Module Installation Guidelines" on page 76.
Error: Remote Access Card initialization failure.	Faulty or improperly installed RAC.	Ensure that the RAC is properly installed. See "Troubleshooting Expansion Cards" on page 108.
Error 8602: Auxiliary device failure. Verify that the 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 121.
General failure	Operating system corrupted or improperly installed.	Reinstall the operating system.
IDE Primary drive x not found	Improperly connected or missing optical drive or tape backup unit.	Ensure that the drive cables are properly connected. See "Troubleshooting Your System" on page 91 for the appropriate drive installed in your system. If no drive is installed, disable the IDE controller. See "Using the System Setup Program" on page 29.
Invalid memory configuration detected. Potential for data corruption exists!	Unsupported DIMMs are installed in the system, or the memory configuration is incorrect.	Replace or reconfigure the DIMMs. See "Memory" on page 76 for memory configuration guidelines, a list of supported DIMMs, and supported memory configurations.
Keyboard controller failure	Faulty keyboard controller (faulty system board).	See "Getting Help" on page 121.

Table 1-6. System Messages (continued)

Message	Causes	Corrective Actions
Keyboard data line failure Keyboard failure Keyboard stuck key 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 121.
Keyboard fuse has failed.	Keyboard fuse has failed.	Replace the keyboard.
Manufacturing mode detected	System is incorrectly configured.	Install the NVRAM_CLR jumper and reboot the system. See "System Board Jumpers" on page 115 for jumper location.
Memory address line failure at <i>address</i> , read <i>value</i> expecting <i>value</i> Memory double word logic failure at <i>address</i> , read <i>value</i> expecting <i>value</i> Memory odd/even logic failure at <i>address</i> , read <i>value</i> expecting <i>value</i> Memory write/read failure at <i>address</i> , read <i>value</i> expecting <i>value</i>	Faulty or improperly installed memory modules, or faulty system board.	Ensure that all memory modules are properly installed. See "Troubleshooting System Memory" on page 100. If the problem persists, see "Getting Help" on page 121.
Memory tests terminated by keystroke	The spacebar was pressed during POST to terminate the memory test.	Information only.
More than one RAC detected, system halted		Verify that the RAC is installed in the proper PCI expansion slot (SLOT_5). If a RAC is installed in any other slot, remove it.

Table 1-6. System Messages (continued)

Message	Causes	Corrective Actions
No boot device available	Faulty or missing diskette drive, optical drive, or hard drive.	Check the Integrated Devices configuration settings in the System Setup program. See "Using the System Setup Program" on page 29. Ensure that either SATA Controller , Diskette Controller , or IDE Controller is enabled. If the system is booting from a SCSI controller, ensure that the controller is properly connected. If the problem persists, replace the drive. See "Hard Drives" on page 53.
No boot sector on hard-disk drive	An operating system is not on the hard drive.	Check the hard-drive configuration settings in the System Setup program. See "Using the System Setup Program" on page 29.
No timer tick interrupt	Faulty system board.	See "Getting Help" on page 121.
Not a boot diskette	Not a bootable diskette.	Use a bootable diskette.
PCI BIOS failed to install	Loose cables to expansion card(s); faulty or improperly installed expansion card.	Ensure that all appropriate cables are securely connected to the expansion cards. See "Troubleshooting Expansion Cards" on page 108.
PCIe Degraded Link Width Error: Embedded Bus# <i>nn</i> /Dev# <i>nn</i> /Func <i>n</i> Expected Link Width is <i>n</i> Actual Link Width is <i>n</i>	Faulty or improperly installed PCIe card.	Reseat the PCIe cards. See "Expansion Cards" on page 71. If the problem persists, see "Getting Help" on page 121.
PCIe Degraded Link Width Error: Slot <i>n</i> Expected Link Width is <i>n</i> Actual Link Width is <i>n</i>	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 71. If the problem persists, see "Getting Help" on page 121.
PCIe Training Error: Embedded Bus# <i>nn</i> /Dev# <i>nn</i> /Func <i>n</i>	Faulty or improperly installed PCIe card.	Reseat the PCIe cards. See "Expansion Cards" on page 71. If the problem persists, see "Getting Help" on page 121.
PCIe Training Error: Slot <i>n</i>	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 71. If the problem persists, see "Getting Help" on page 121.

Table 1-6. System Messages (continued)

Message	Causes	Corrective Actions
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 108. If the problem persists, see "Getting Help" on page 121.
Primary drive <i>n</i> configuration error Primary drive 1 failure	Faulty hard-disk drive.	Replace the hard-disk drive. See "Troubleshooting SATA Hard Drives" on page 105 or "Troubleshooting a SAS RAID Controller" on page 107 in for the appropriate drive(s) installed in your system.
Read fault Requested sector not found	Faulty diskette, diskette drive, optical drive, or hard drive.	Replace the diskette. Ensure that the diskette, optical, and hard-drive cables are properly connected. See "Troubleshooting a Diskette Drive" on page 101, "Troubleshooting an Optical Drive" on page 102, "Troubleshooting SATA Hard Drives" on page 105," or "Troubleshooting a SAS RAID Controller" on page 107" for the appropriate drive(s) installed in your system.
Remote Configuration update attempt failed	System could not implement Remote Configuration request.	Retry Remote Configuration.
ROM bad checksum = <i>address</i>	Faulty or improperly installed expansion card.	Remove and reseat the expansion cards. See "Troubleshooting Expansion Cards" on page 108.
SATA Port <i>n</i> hard disk drive configuration error SATA Port <i>n</i> hard disk drive failure SATA Port <i>n</i> hard disk drive auto-sensing error	Faulty SATA hard drive.	Replace the hard-disk drive. See "Troubleshooting SATA Hard Drives" on page 105 for the appropriate drive(s) installed in your system.

Table 1-6. System Messages (continued)


Message	Causes	Corrective Actions
SATA Port <i>n</i> hard disk not found	SATA hard drive not connected to port <i>n</i> .	Ensure that the hard-drive cable is properly connected. See "Hard Drives" on page 53. If a drive is not connected to port <i>n</i> , check that the SATA port is disabled in the System Setup program. See "Using the System Setup Program" on page 29.
Sector not found Seek error Seek operation failed	Faulty diskette or hard drive.	Replace the diskette. If the problem persists, see "Troubleshooting SATA Hard Drives" on page 105 or "Troubleshooting a SAS RAID Controller" on page 107 for the appropriate drive installed in your system.
Shutdown failure	Shutdown test failure.	Ensure that all memory modules are properly installed. See "Troubleshooting System Memory" on page 100. If the problem persists, see "Getting Help" on page 121.
The amount of system memory has changed.	Faulty memory module.	See "Troubleshooting System Memory" on page 100. If the problem persists, see "Getting Help" on page 121.
The amount of tested memory is below the minimum system configuration. System halted!	Invalid memory configuration Faulty memory module.	See "General Memory Module Installation Guidelines" on page 76. See "Troubleshooting System Memory" on page 100. If the problem persists, see "Getting Help" on page 121."
Time-of-day clock stopped	Faulty battery; faulty system board.	See "Troubleshooting the System Battery" on page 98. If the problem persists, see "Getting Help" on page 121.

Table 1-6. System Messages (continued)

Message	Causes	Corrective Actions
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" in your <i>User's Guide</i> . If the problem persists, see "Troubleshooting the System Battery" on page 98.
Timer chip counter 2 failed	Faulty system board.	See "Getting Help" on page 121.
Unexpected interrupt in protected mode	Faulty or improperly installed memory modules or faulty system board.	Ensure that all memory modules are properly installed. See "General Memory Module Installation Guidelines" on page 76. If the problem persists, see "Troubleshooting System Memory" on page 100. If the problem persists, see "Getting Help" on page 121.
Utility partition not available	<F10> key was pressed during POST, but no utility partition exists on the boot hard drive.	Create a utility partition on the boot hard drive. See the CDs that came with your system.
Warning! No microcode update loaded for processor <i>n</i>	Unsupported processor.	Update the BIOS firmware using the Dell Support website at support.dell.com .
Write fault Write fault on selected drive	Faulty diskette, diskette drive, optical drive, hard drive.	Replace the diskette. Ensure that the diskette drive, optical drive, and hard-drive cables are properly connected. See "Troubleshooting a Diskette Drive" on page 101, "Troubleshooting an Optical Drive" on page 102, or "Troubleshooting a Hard Drive" on page 104 for the appropriate drive(s) installed in your system.

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 1-7. 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 121.

Table 1-7. System Beep Codes


Code	Cause	Corrective Action
1-1-2	CPU register test failure	See "Troubleshooting the Microprocessor" on page 109.
1-1-3	CMOS write/read failure; faulty system board	Faulty system board. See "Getting Help" on page 121.
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 121.
1-2-2	DMA initialization failure	See "Troubleshooting System Memory" on page 100.
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 1-7. System Beep Codes (continued)

Code	Cause	Corrective Action
3-1-1	Slave DMA-register failure	Faulty system board. See "Getting Help" on page 121.
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 121.
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 108.
4-3-1	Improperly installed or faulty memory modules	See "Troubleshooting System Memory" on page 100.
4-3-2	No memory modules installed in the first memory module connector	Install a memory module in the first memory module connector. See "Memory" on page 76.
4-3-3	Faulty system board	Faulty system board. See "Getting Help" on page 121.
4-3-4	Time-of-day clock stopped	See "Troubleshooting System Memory" on page 100. If the problem persists, see "Getting Help" on page 121.
4-4-1	Super I/O chip failure; faulty system board	Faulty system board. See "Getting Help" on page 121.
4-4-4	Cache test failure; faulty processor	See "Troubleshooting the Microprocessor" on page 109.

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," 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.

Baseboard Management Controller Messages

The Baseboard Management Controller (BMC) enables you to configure, monitor, and recover systems remotely. BMC uses the system's serial port and integrated NIC1 to support fault logging and SNMP alerting.

 **NOTE:** If the integrated network controller is used in an Ether Channel team or link aggregation team, the BMC management traffic will not function properly. For more information about network teaming, see the documentation for the network controller.

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

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 18 for an explanation of the message and suggestions for correcting errors. Also, the system emits a series of beeps during POST if an error is encountered but cannot be reported. For more information, see "System Beep Codes" on page 26 for more information.

 **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

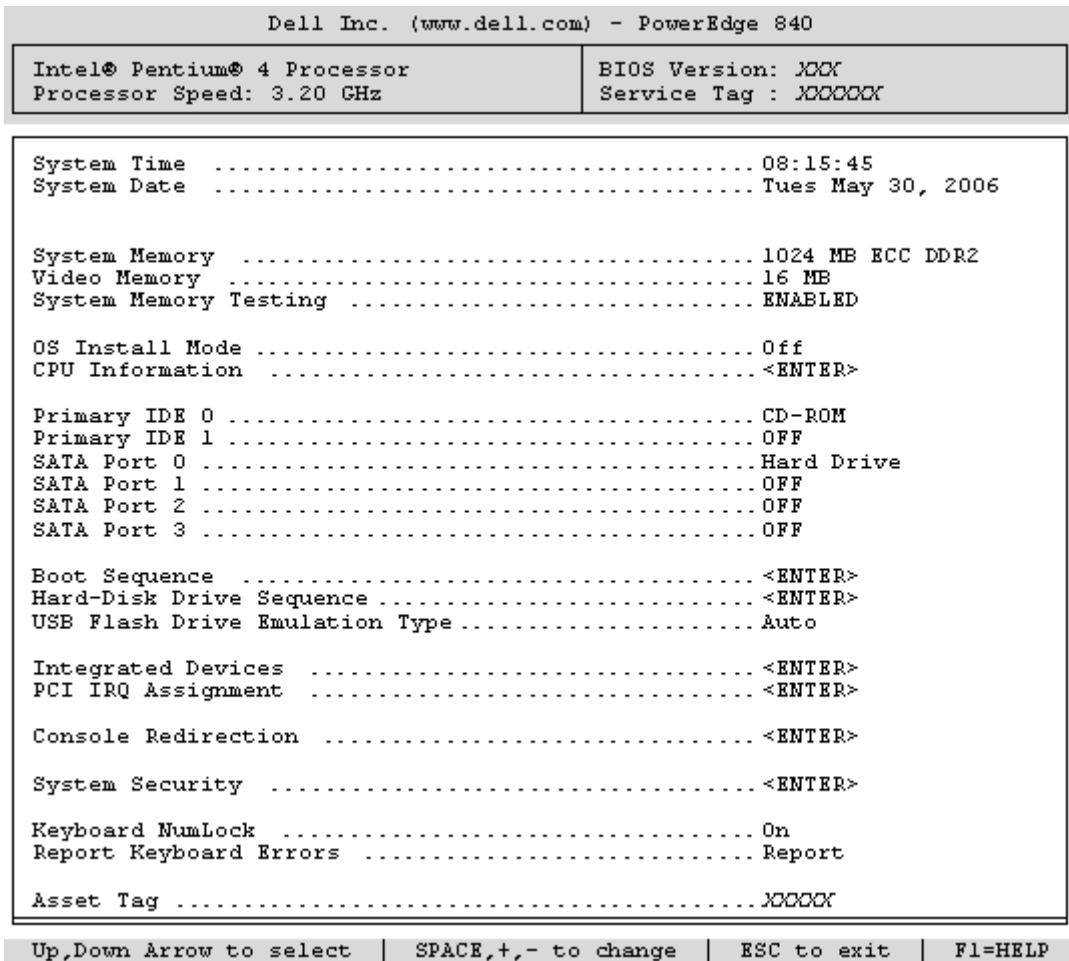


Table 2-2 lists the options and descriptions for the information fields that appear on the main System Setup program screen.



-  **NOTE:** The options for the System Setup program change based on the system configuration.
-  **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.
System Memory	Displays information related to installed system, video, and redundant memory, including size, type, and speed of memory modules, system video memory size, system memory test option, and redundant memory status.
Video Memory	Displays the amount of video memory. This option does not have user-selectable settings.
System Memory Testing	Determines if memory is being tested during POST.
OS Install Mode (Off default)	Determines the maximum amount of memory available to the operating system. On sets the maximum memory to 256 MB. Off makes all of the system memory available to the operating system. Some operating systems cannot install with more than 2 GB of system memory. Enable this option (On) during operating system installation and disable (Off) after installation.
CPU Information	Displays information related to microprocessors (speed, cache size, and so on). Enable or disable Hyper-Threading technology by changing the setting of the Logical Processor option. See Table 2-3.
Primary IDE 0	Enables (Auto) or disables (Off) the IDE device in Drive 0 (optical drive).
Primary IDE 1	Enables (Auto) or disables (Off) the IDE device in Drive 1 (tape backup unit).
SATA Port 0	Enables (Auto) or disables (Off) the SATA hard drive in Port 0.
SATA Port 1	Enables (Auto) or disables (Off) the SATA hard drive in Port 1.
SATA Port 2	Enables (Auto) or disables (Off) the SATA hard drive in Port 2.
SATA Port 3	Enables (Auto) or disables (Off) the SATA hard drive in Port 3.
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. NOTE: System boot is not supported from an external device attached to a SAS or SCSI adapter. See support.dell.com for the latest support information about booting from external devices.
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.
USB Flash Drive Emulation Type (Auto default)	Determines the emulation type for a USB flash drive. Hard disk allows the USB flash drive to act as a hard drive. Floppy allows the USB flash drive to act as a removal diskette drive. Auto automatically chooses an emulation type.
Integrated Devices	See "Integrated Devices Screen" on page 34.

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

Option	Description
PCI IRQ Assignment	Displays a screen to change the IRQ assigned to each of the integrated devices on the PCI bus, and any installed expansion cards that require an IRQ.
Console Redirection	Displays a screen to configure serial communication, external serial connector, fail-safe baud rate, remote terminal type, and redirection after boot.
System Security	Displays a screen to configure the system password and setup password features. See "Using the System Password" on page 37 and "Using the Setup Password" on page 39 for more information.
Keyboard NumLock (On default)	Determines whether your system starts up with the NumLock 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. Select Report for host systems that have keyboards attached. Select Do Not Report 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.
Asset Tag	Displays the customer-programmable asset tag number for the system if an asset tag number has been assigned.

CPU Information Screens

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

Table 2-3. CPU Information Screen

Option	Description
Bus Speed	Displays the bus speed of the processor(s).
Logical Processor (Enabled default)	Displays when the processors support HyperThreading. Enabled permits all logical processors to be used by the operating system. Only the first logical processor of each processor installed in the system is used by the operating system if Disabled is selected.
Virtualization Technology (Disabled default)	Displays when the processor(s) support Virtualization Technology. Enabled permits virtualization software to use Virtualization Technology incorporated in the processor design. This feature can only be used by software that supports Virtualization Technology.
Adjacent Cache Line Prefetch (Enabled default)	Enables or disables optimal use of sequential memory access. Disable this option for applications that require high use of random memory access.
Hardware Prefetcher (Enabled default)	Enables or disables the hardware prefetcher.

Table 2-3. CPU Information Screen (continued)

Option	Description
Demand-Based Power Management (Disabled default)	Enables or disables demand-based power management. When enabled, the CPU Performance State tables will be reported to the operating system; when disabled, the CPU Performance State tables will not be reported to the operating system. If any of the CPUs do not support demand-based power management, the field will become read-only, and automatically set to Disabled .
Processor 1 ID	Displays the family, model number, and details for each processor. A submenu displays: <ul style="list-style-type: none"> – Core Speed – Level 2 Cache – Number of Cores – 64-bit Technology

Integrated Devices Screen

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

Table 2-4. Integrated Devices Screen Options

Option	Description
IDE Controller (Auto default)	Enables the integrated IDE controller. When set to Auto , each channel of the integrated IDE controller is enabled if IDE devices are attached to the channel and the external IDE controller is not detected.
SATA Controller (ATA default)	Allows the integrated SATA controller to be set to Off or ATA Mode . Off disables the SATA subsystem. ATA Mode sets the SATA subsystem to Native IDE mode.
USB Controller (On with BIOS support default)	Enables or disables the system's USB ports. Options are On with BIOS support , On without BIOS support , or Off . Disabling the USB ports makes system resources available for other devices.
Embedded Gb NIC (Enabled with PXE default)	Enables or disables the system's integrated NIC. Options are Enabled with 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.
Diskette Controller	Enables or disables the system's diskette drive controller. When Auto is selected, the system turns off the controller when necessary to accommodate a controller card installed in an expansion slot. You can also configure the drive as Read-Only , or Off . When using the Read-Only setting, the drive cannot be used to write to a disk.

Table 2-4. Integrated Devices Screen Options (continued)

Option	Description
Serial Port (COM1 default)	<p>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.</p> <p>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.</p> <p>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.</p> <p>Off and COM3 are not available options when Console Redirection is set to use Serial Port 1.</p>
Speaker (On default)	Enables or disables the system internal speaker.

Console Redirection Screen

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

Table 2-5. Console Redirection Screen Options

Option	Description
Console Redirection (Off default)	Sets the console redirection feature to Serial Port or Off .
Failsafe Baud Rate (11520 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 2-6 lists the options and descriptions for the information fields that appear on the **System Security** screen.

Table 2-6. 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>NOTE: See "Using the System Password" on page 37 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>NOTE: See "Using the Setup Password" on page 39 for instructions on assigning a setup password and using or changing an existing setup password.</p>
Password Status	<p>Setting the Setup Password option to Enabled 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 Setup Password option and then change the Password Status option to Locked. In this state, you cannot change the system password using the System Password option and cannot be disabled at system start-up by pressing <Ctrl> <Enter>.</p> <p>To <i>unlock</i> the system password, enter the setup password in the Setup Password field and then change the Password Status option to Unlocked. In this state, you can disable the system password at system start-up by pressing <Ctrl> <Enter> and then change the password using the System Password option.</p>
Front-Bezel Chassis Intrusion	<p>Enables or disables the chassis-intrusion detection feature.</p>
Power Button	<p>Turns system's power off and on.</p> <ul style="list-style-type: none">• 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 system is not running an ACPI-compliant operating system, power is turned off immediately after the power button is pressed. <p>The button is enabled in the System Setup program. When disabled, the button can only turn on system power.</p> <p>NOTE: You can still turn on the system by using the power button, even if the Power Button option is set to Disabled.</p>
AC Power Recovery (Last default)	<p>Determines how the system reacts when power is restored to the system. If system is set to Last, the system returns to the last power state. On turns on the system after power is restored. When set to Off, the system remains off after power is restored.</p>


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 39). 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 120.

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 39), 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>.
- 2 Type your password and press <Enter>.

To disable the password security:


- 1 Turn on or reboot your system by pressing <Ctrl><Alt>.
- 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>, 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> 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 39.

Installing System Components

This section describes how to install the following system components:

- Diskette drive
- Optical and tape drives
- Hard drives
- Cooling Shroud
- Cooling Fans
- Power supply
- Expansion cards
- Memory
- SAS controller card
- Microprocessor
- System battery
- Front I/O panel
- System board

Recommended Tools

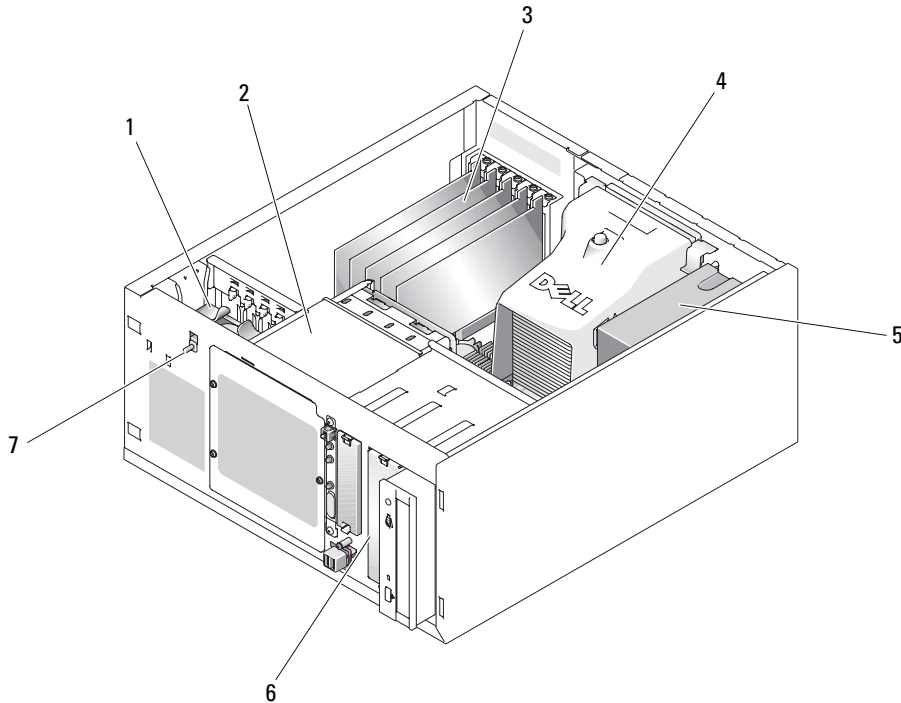
You may need the following items to perform the procedures in this section:

- #2 Phillips screwdriver
- Long #2 Phillips screwdriver (blade at least 6 inches long)
- Small flat-blade driver
- Wrist grounding strap

Inside the System

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

Figure 3-1. Inside the System



- | | | | | | |
|---|--------------------------|---|--------------|---|----------------------------|
| 1 | front fan | 2 | drive cage | 3 | expansion cards (optional) |
| 4 | cooling shroud | 5 | power supply | 6 | 5.25-inch drive bays (2) |
| 7 | chassis-intrusion switch | | | | |

The system board can accommodate a single processor, five expansion cards, and four memory modules. The hard-drive cage provides space for up to four SAS or SATA hard drives. Two 5.25-inch external drive bays in the front of the system can accommodate optical or tape drives; a single 3.25 drive can accommodate an optional diskette drive. A controller expansion card is required to use SAS hard drives. Power is supplied to the system board and internal peripherals through a single, nonredundant power supply.

Opening the System

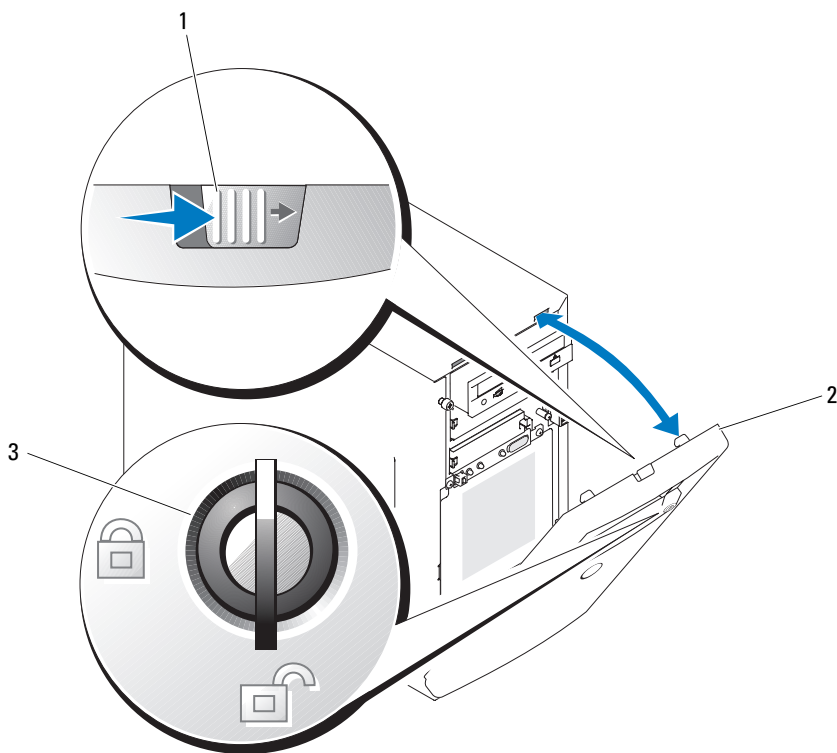
⚠ CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting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

Removing the Bezel

You must remove the bezel to remove the system cover.

- 1 Using the system key, unlock the bezel. See Figure 3-2.
- 2 Slide the bezel latch toward the right side of the system.
- 3 Swing the top of the bezel away from the system, disengage the hooks at the bottom of the bezel, and lift the bezel away from the system.

Figure 3-2. Removing the Bezel



1 bezel latch

2 bezel

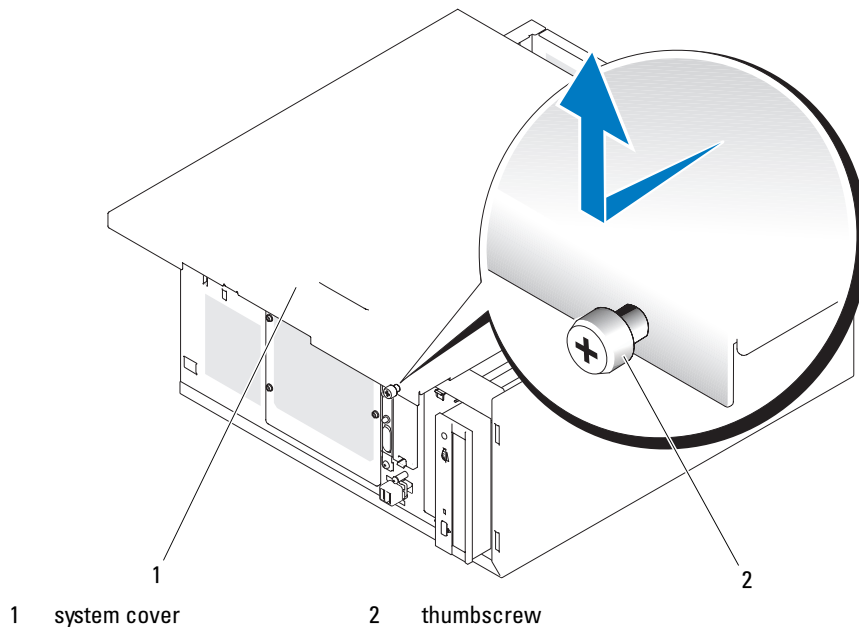
3 keylock

Removing the Cover

⚠ 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 Remove the bezel. See "Removing the Bezel" on page 43.
- 3 Lay the system on its right side.
- 4 Loosen the thumbscrew at the front of the system. See Figure 3-3.
- 5 Slide the cover forward and grasp it at both ends.
- 6 Lift the front edge of the cover 2.5 cm (1 inch), slide the cover toward the top of the system, and then lift the cover away from the system.

Figure 3-3. Removing the Cover



Front-Panel Drive Inserts

To help keep dust and dirt out of the system, a plastic insert covers each empty external drive bay. Additionally, each empty external drive bay is covered by a metal insert in the chassis to maintain Federal Communications Commission (FCC) certification of the system.

Before you install a 5.25-inch drive in an empty external drive bay, you must first remove both front-panel drive inserts. If you remove a 5.25-inch drive permanently, you must install both inserts.

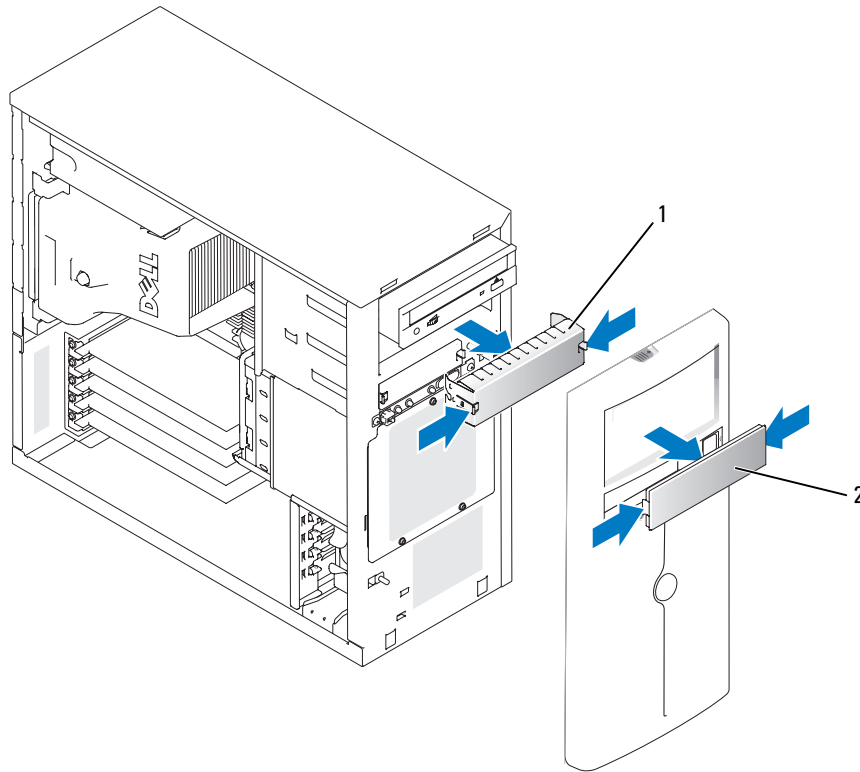
Removing the Front-Panel Drive Inserts



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, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Remove the bezel. See "Removing the Bezel" on page 43.
- 3 Remove the bezel drive insert (see Figure 3-4):
 - a From inside the bezel, press the center of the insert outward with your thumbs to loosen the tabs on the sides of the insert.
 - b Pull the insert out of the bezel.
- 4 Remove the chassis drive insert (see Figure 3-4):
 - a Press both sides of the insert to loosen the tabs on the insert.
 - b Pull the insert out of the chassis.

Figure 3-4. Removing the Front-Panel Drive Inserts



1 chassis drive insert

2 bezel drive insert

Installing the Front-Panel Drive Inserts

⚠ 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: You must install both inserts in an empty 5.25-inch drive bay to maintain Federal Communications Commission (FCC) certification of the system. The inserts also help keep dust and dirt out of the system.

- 1 Install the chassis drive insert by sliding the insert into the chassis until tabs on the side of the insert snap into place. See Figure 3-4.
- 2 Install the bezel drive insert by sliding the insert into the bezel until the tabs on the side of the insert snap into place. See Figure 3-4.
- 3 Install the bezel. See "Installing the Bezel" on page 47.
- 4 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

Closing the System

Replacing the Cover

- 1 Ensure that all cables are connected, and fold cables out of the way.
- 2 Ensure that no tools or loose parts are left inside the system.
- 3 Fit the cover on the side of the system, and slide the cover backward.
- 4 Tighten the cover thumbscrew to secure the cover.

Installing the Bezel

To install the bezel, align the hooks at the bottom of the bezel, swing the top of the bezel toward the system, and press the bezel onto the system until it snaps into place. Using the system key, lock the bezel.

Connecting Drives

Interface Cables

Most interface connectors are keyed for correct insertion. Keying ensures that the pin-1 wire in the cable connects to pin 1 in the connectors on both ends. When you disconnect an interface cable, take care to grasp the cable connector, rather than the cable itself, to avoid stress on the cable.

Drive Cable Configurations

Your system can accommodate many different drive configurations, each with specific cable requirements. Table 3-1 shows the cable requirements for common drive configurations.

Table 3-1. Drive Cable Configuration

Drives	Required Cable	Cable Connections
IDE optical drives, internal IDE and external SCSI tape drives (with optional SCSI HBA card) (See Figure 3-7.)	80-pin IDE 2-drop cable or external SCSI cable	IDE drive and primary IDE connector on system board or external SCSI tape device (with option SCSI HBA card)
Up to four cabled SATA hard drives (non-hot-plug) (See Figure 3-9.)	7-pin SATA hard-drive cable (one cable per drive)	SATA hard drives and SATA port connectors on the system board, or via SAS controller card
Up to four cabled (non-hot-plug) SAS hard-drives (See Figure 3-13.)	32-pin 1- to 4-drop SAS cable	SAS hard drives connected to SAS controller card
Up to four SAS or SATA hard drives connected to the SAS backplane (hot plug) (See Figure 3-12.)	32-pin SAS backplane cable	SAS backplane connected to the SAS controller card

DC Power Cables

Each drive must connect to a DC power cable from the system power supply. These power cables are used for the 3.5-inch diskette drive, 5.25-inch devices, and hard drives.



NOTICE: To avoid electrical damage to internal system components, install a cover connector on any unused connectors on hard-drive power cables.

Diskette Drive

Removing a Diskette 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 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 43.
- 3 Disconnect the power cable and the interface cable from the diskette drive. See Figure 3-5.
- 4 Remove the two screws that secure the diskette drive in the externally accessible drive bay. See Figure 3-5.
- 5 Slide the diskette drive forward out of the drive bay.

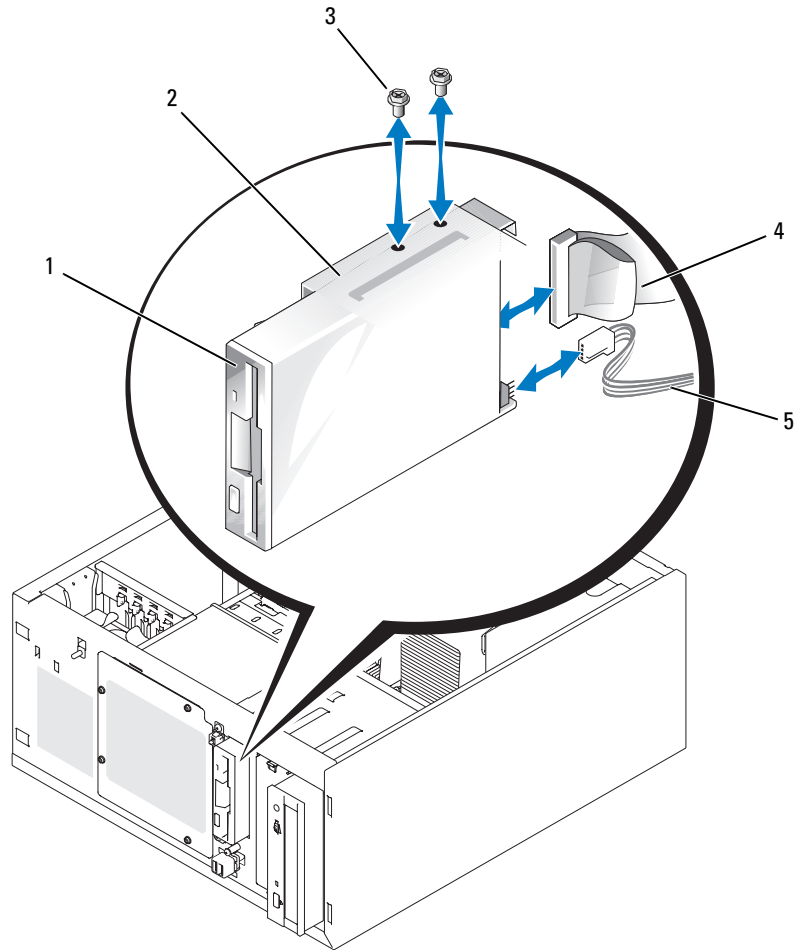
Installing a Diskette Drive



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 Unpack the drive and prepare the drive for installation.
For instructions, see the documentation that accompanied the drive.
- 2 Slide the diskette drive into the externally accessible drive bay.
- 3 Install the two screws that secure the diskette drive in the drive bay. See Figure 3-5.
- 4 Connect the power cable and the interface cable to the diskette drive. See Figure 3-5.
- 5 Close the system. See "Closing the System" on page 47."
- 6 Stand the system upright.
- 7 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

Figure 3-5. Removing or Installing a Diskette Drive



- | | | | | | |
|---|---------------------------|---|---------------------------------|---|------------|
| 1 | diskette (3.5-inch) drive | 2 | externally accessible drive bay | 3 | screws (2) |
| 4 | interface cable | 5 | power cable | | |

Optical or Tape Drives

An optical drive is standard in the first external drive bay. An additional IDE or SCSI tape drive can be installed in the second external drive bay. These drives connect either to the system board or to an optional controller card.

NOTE: Installing an additional optical drive in the second external drive bay is not supported.

Installing an Optical or Tape 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 Unpack the drive (and controller card, if applicable), and prepare the drive for installation.

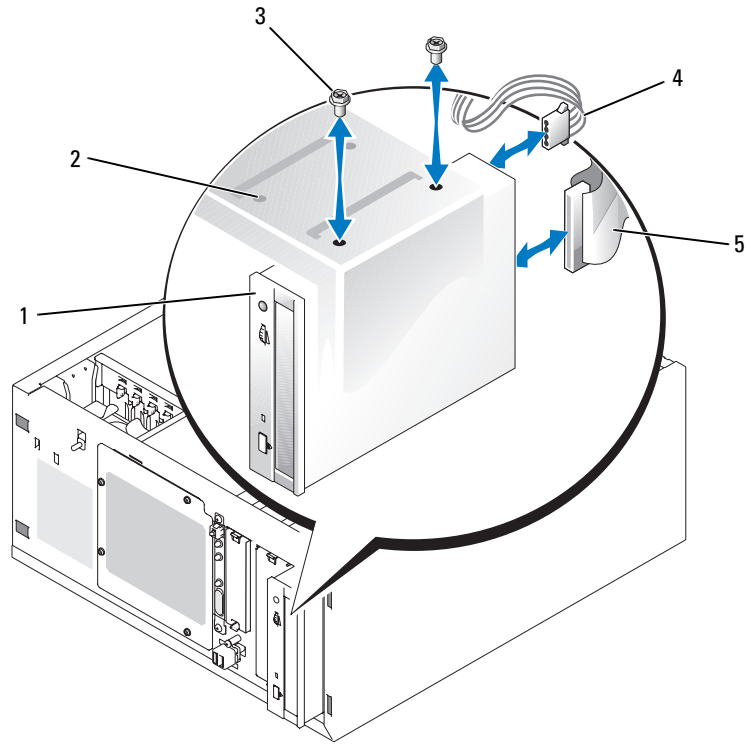
For instructions, see the documentation that accompanied the drive.



NOTE: If you are installing a SCSI tape drive, you must install an Ultra 3 SCSI controller card. The optional SAS controller card does not support a SCSI tape drive.


- 2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 3 Open the system. See "Opening the System" on page 43.
- 4 Remove the front-panel inserts for the empty external drive bay. See "Removing the Front-Panel Drive Inserts" on page 45.
- 5 Slide the drive into the external drive bay.
- 6 Install the screws that secure the drive in the drive bay. See Figure 3-6.

Figure 3-6. Installing or Removing an Optical or Tape Drive



- | | | | | | |
|---|-----------------|---|-----------------|---|------------|
| 1 | 5.25-inch drive | 2 | drive bay | 3 | screws (2) |
| 4 | power cable | 5 | interface cable | | |

- 7 If a controller card was supplied with the drive, install the controller card in expansion slot 3, 4, or 5. See "Installing an Expansion Card" on page 72.
- 8 Connect a power cable to the drive. See Figure 3-6.
- 9 Connect the interface cable to the drive and to the appropriate connector on the system board or controller card (if applicable).

 **NOTE:** See the documentation that is included with the controller card for more information.

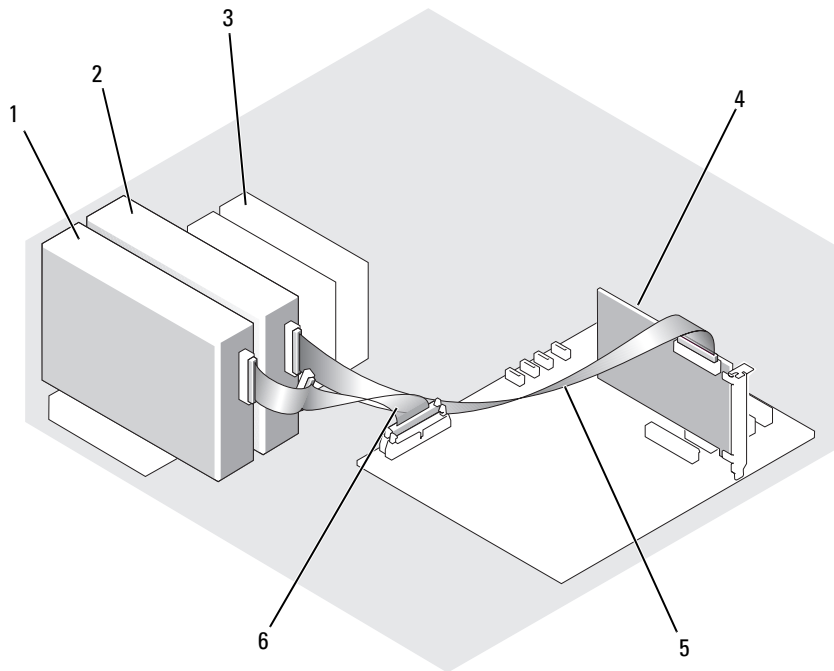
If you are installing an IDE device (such as an optical drive), connect the interface cable to the IDE device and the IDE connector on the system board. See Figure 3-7.

If you are installing a SCSI device in the second drive bay (such as a tape backup device), connect the interface cable to the device and to channel A on the SCSI controller card. See Figure 3-7.

See "System Board Connectors" on page 118 to locate the system board connectors.

NOTE: A SCSI device attached to an optional SCSI controller card and an IDE device attached to the system board can be installed together as shown in Figure 3-7.

Figure 3-7. Connecting a Tape Drive to a SCSI Controller Card



- | | | | | | |
|---|----------------------|---|----------------------|---|-----------------------|
| 1 | IDE device | 2 | optional SCSI device | 3 | hard drives (up to 4) |
| 4 | SCSI controller card | 5 | SCSI cable | 6 | IDE interface cable |

- 10 Ensure that all cables are firmly connected and arranged so that they will not catch on the computer cover or block airflow inside the system.
- 11 Close the system. See "Closing the System" on page 47.
- 12 Stand the system upright.
- 13 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.


14 Test the drive.

If you installed an IDE device, run the IDE devices tests in the system diagnostics to determine whether the device operates properly. See "Running the System Diagnostics" on page 112.

If you installed a SCSI device, run the SCSI controllers test in the system diagnostics. See "Running the System Diagnostics" on page 112.

If you installed a tape drive, see the tape drive software documentation to perform a backup and verification test.

Hard Drives

 **NOTE:** The system's drive configuration must consist of only SATA hard drives or only SAS hard drives. Combining SATA and SAS drives is not supported.

Your system can contain up to four 1-inch-height SATA or SAS hard drives in either a removable fixed hard-drive bay (see Figure 3-8) or a lever-release bay (see Figure 3-11). These drives connect either to the system board, an optional controller card, or an optional SAS backplane.

SAS or SATA drives can be hot-pluggable only if they are attached to an optional SAS backplane. See "Hot-Plug SATA Hard Drives Using the SAS Backplane" on page 61, "Hot-Plug SATA Hard Drives Using the SAS Backplane" on page 61, and "Removing and Installing the Optional SAS Backplane Board" on page 61.

Hard Drive Installation Guidelines

Use the following guidelines when installing hard drives:


- You should only use drives that have been tested and approved by the system manufacturer.
- Do not install a mixture of SATA and SAS hard drives. All hard drives must either be SAS drives or SATA drives.
- You may need to use different programs than those provided with the operating system to partition and format a hard drive. See the hard drive documentation for information on setting up the drive.
- When you format a high-capacity hard drive, allow enough time for the formatting to be completed. Long format times for these drives are normal. For example, a large drive can take over an hour to format.
- Do not turn off or reboot your system while the drive is being formatted. Doing so can cause a drive failure.

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 29). To boot the system from a hard drive or drive array, the drive(s) must be connected to the appropriate controller:

- To boot from a single SATA hard drive, the master drive (drive 0) must be connected to the SATA_0 connector on the system board. To identify system board connectors, see "System Board Connectors" on page 118.
- To boot from a single SAS hard drive, the drive must be connected to a SAS controller card. See the documentation that accompanied the controller card.

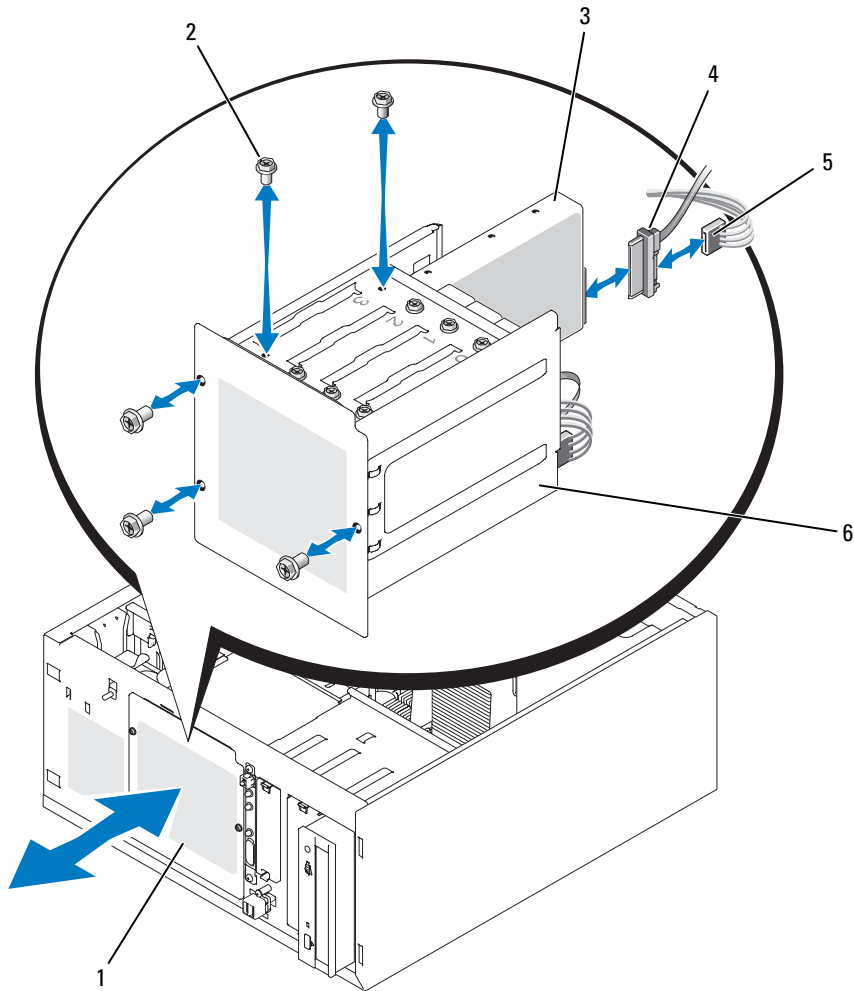
Removing a Hard Drive from the Drive Bay

 **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.**

If you are using the optional SAS backplane, your hard drives may be installed in a lever-release drive bay. See "Removing a Hard Drive from a Lever-Release Drive Carrier" on page 59 for more information.

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 43."
- 3 Disconnect the interface and power cables to the hard drives in the drive bay.
- 4 Remove the hard-drive bay. See Figure 3-8.
 - a Remove the three screws that secure the drive bay to the system.
 - b Slide the hard-drive bay out of the system.
- 5 Remove the drive from the drive bay. See Figure 3-8.
 - a Remove the screws that secure the drive in the hard-drive bay.
 - b Slide the drive out of the drive bay.

Figure 3-8. Installing or Removing a Hard Drive



- | | | | | | |
|---|----------------|---|-----------------------|---|----------------|
| 1 | hard-drive bay | 2 | screws (4 per drive) | 3 | hard drive |
| 4 | drive cable | 5 | power cable connector | 6 | hard drive bay |

Installing a Hard Drive in the Drive Bay

NOTE: Hot-plug capability is supported only when the SAS backplane is installed. For more information, see "Hot-Plug SATA Hard Drives Using the SAS Backplane" on page 61.

- 1 Unpack the drive (and controller card, if applicable), and prepare the drive for installation. For instructions, see the documentation that accompanied the drive.


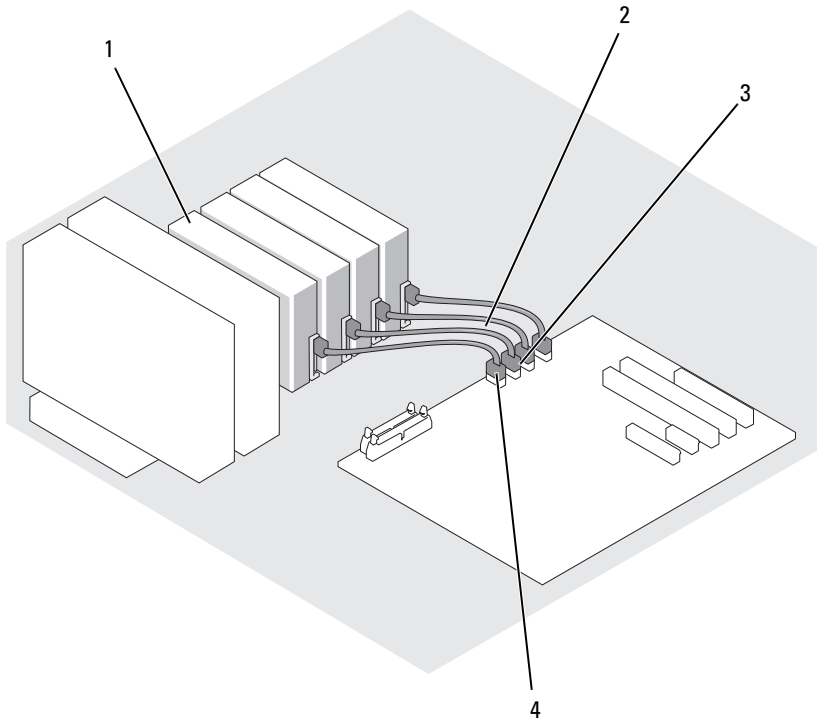
- 2 Install the hard drive in the hard-drive bay:
 - a Slide the drive into the drive bay with the back of the drive toward the back of the drive bay.
 - b Install the screws that secure the drive in the drive bay.
 - 3 Install the hard-drive bay. (See Figure 3-8.):
 - a Slide the drive bay into the system until the drive bay contacts the system.
 - b Install the three screws that secure the drive bay in the system.
-  **NOTICE:** To prevent damage to internal system components, ensure that a connector cap is installed on each available power connector that is not connected to a hard drive.
- 4 Connect a power cable to each hard drive. (See Figure 3-8.)
 - 5 Connect the hard-drive interface cables to each hard drive.
 - *If you are installing a SATA hard drive*, connect the SATA interface cable to the hard drives and to the SATA ports on the system board. (See Figure 3-9.)
 - *If you are installing a SAS drive*, connect the SAS interface cable to the hard drives and to the optional SAS controller card. (See Figure 3-10.)

Figure 3-9. Connecting SATA Hard Drives to the Integrated Drive Controller

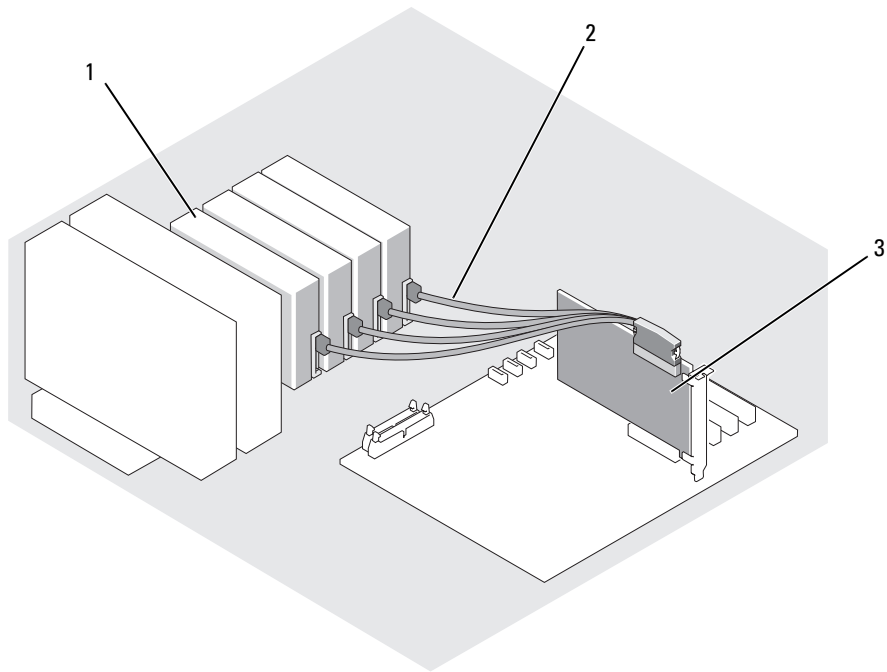


1 SATA hard drive (up to four)
4 SATA_0 connector

2 SATA interface cable

3 SATA_1 connector

Figure 3-10. Connecting SATA Drives to a SAS Controller Card (SAS backplane not installed)




- 1 SATA hard drive (up to four) 2 SATA interface cable) 3 SAS controller card

- 6 Ensure that all cables are firmly connected and arranged so that they will not catch on the computer cover or block airflow inside the system.
- 7 Close the system. See "Closing the System" on page 47.
- 8 Stand the system upright.
- 9 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.
- 10 Partition and logically format the hard drive. See the operating system documentation for more information.
- 11 Install any required device drivers.

- 12** Run the hard drive tests in the system diagnostics to determine whether the drive operates properly. See "Running the System Diagnostics" on page 111.
 - If the drive is connected to a SATA RAID controller card, see the RAID controller card documentation for information on testing the controller.
 - If the drive is connected to a SAS controller card, run the SAS controller tests and the hard-drive tests in the system diagnostics. See "Running the System Diagnostics" on page 111
 - If the hard drive fails the hard-drive tests or does not operate properly, see "Getting Help" on page 121.

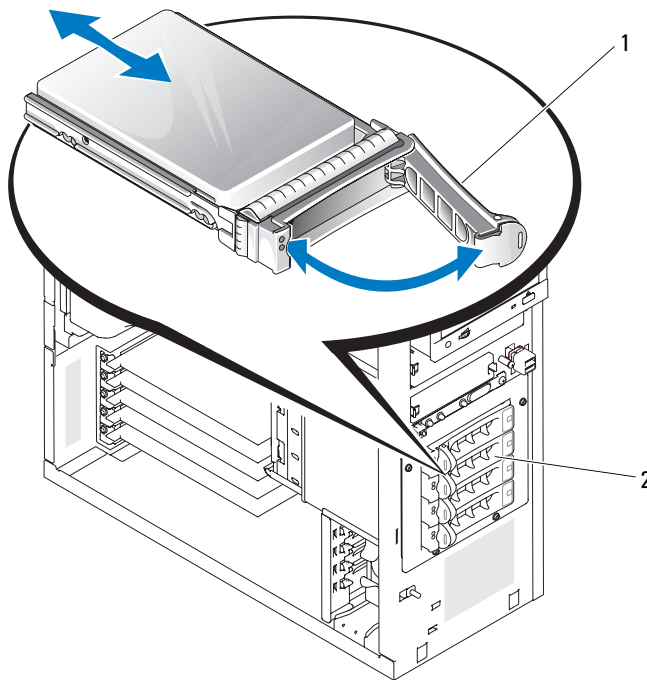
Removing a Hard Drive from a Lever-Release Drive Carrier

 **NOTICE:** To prevent data loss, you must shut down the system before removing a drive carrier, unless a SAS controller is connected to the optional SAS backplane. See "Hot-Plug SATA Hard Drives Using the SAS Backplane" on page 61 for information on hot-plug drive requirements and operation.

The drive bays in a system with an optional SAS backplane board provides space for up to four optional lever-release hard drives. The hard drives plug into the SAS backplane board, which is connected to the controller card (see Figure 3-12). For instructions on installing the optional SAS backplane board, see "Removing and Installing the Optional SAS Backplane Board" on page 61.

- 1** Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2** Remove the bezel. See "Removing the Bezel" on page 43.
- 3** Open the hard-drive carrier handle to release the drive. See Figure 3-11.
- 4** Slide the hard drive out until it is free of the drive bay.

Figure 3-11. Removing or Installing a SCSI Hard-Drive Carrier



- 1 hard-drive carrier handle 2 lever-release drive carrier

Installing an Hard Drive in the Lever-Release Drive Carrier

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Remove the bezel. See "Removing the Bezel" on page 43.
- 3 Open the hard-drive carrier handle. See Figure 3-11.
- ➔ **NOTICE:** Do not insert a hard-drive carrier and attempt to lock its handle next to a partially installed carrier. Doing so can damage the partially installed carrier's shield spring and make it unusable. Ensure that the adjacent drive carrier is fully installed.
- 4 Insert the hard-drive carrier into the drive bay. See Figure 3-11.
- 5 Close the hard-drive carrier handle to lock it in place.
- 6 Install the bezel. See "Installing the Bezel" on page 47.
- 7 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.
- 8 Install any required device drivers.

- 9 Run the SAS controllers tests and the hard-drive tests in the system diagnostics. See "Running the System Diagnostics" on page 112.

If the hard drive fails the hard-drive tests or does not operate properly, see "Getting Help" on page 121.

Hot-Plug SATA Hard Drives Using the SAS Backplane

If you are using the optional SAS backplane, the SATA hard drives you install are hot-pluggable if the backplane is attached directly to the SAS controller card on the system board (see Figure 3-13). For instructions on installing the optional SAS backplane board, see "Removing and Installing the Optional SAS Backplane Board" on page 61.

The SAS backplane supports up to four hot-plug hard drives connected to the optional SAS controller card. The SAS controller card must be connected to channel A on the optional SAS controller card, or port 0 on an optional RAID controller card. For instructions on installing the optional SAS backplane board, see "Removing and Installing the Optional SAS Backplane Board" on page 61.

Removing and Installing the Optional SAS Backplane Board

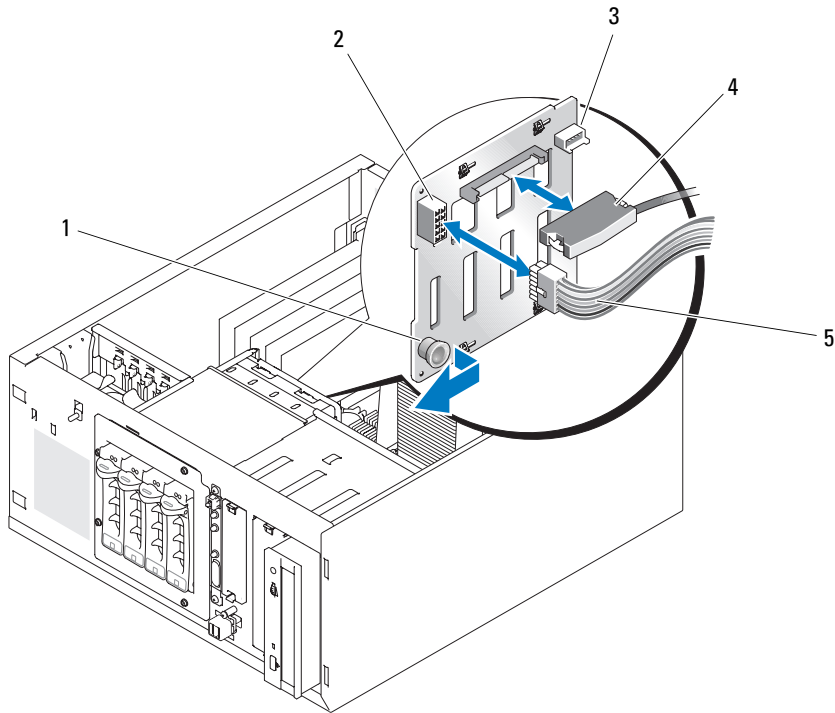
The optional SAS backplane board supports hot-plug SAS or SATA drives (if an optional SAS controller card is installed in the system).



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, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 43.
- 3 Remove all existing hard drives from the hard drive bay. See "Removing a Hard Drive from the Drive Bay" on page 54.
- 4 Install the SAS backplane:
 - a Lower the backplane into the system and align the backplane with the retention hooks on the drive bay, then fit the backplane over the retention hooks.
 - b Slide the backplane board toward the front fan about 12 mm (0.5 inch) until it clicks into place.

Figure 3-12. Installing the SAS Backplane Board



- | | | | | | |
|---|-------------|---|-----------------|---|---------------|
| 1 | release tab | 2 | power connector | 3 | I2C connector |
| 4 | data cable | 5 | power cable | | |

- 5 Connect the power cable connector P3 to the power connector on the SAS backplane. See Figure 3-12.
- 6 Connect the baseboard management controller (BMC) inter-IC (I2C) cable to the SAS backplane. See Figure 3-12.
- 7 Connect the other end of the BMC I2C cable to connector BP_I2C on the system board. See "System Board Connectors" on page 118.
- 8 If not already installed, install the SAS controller card.
See "Installing an Expansion Card" on page 72 for instructions about installing the card.
- 9 Connect the SAS data cable to the SAS controller card, and to the SAS interface connector on the backplane. See Figure 3-13 and Figure 3-12.
- 10 Close the system. See "Closing the System" on page 47.
- 11 Stand the system upright.


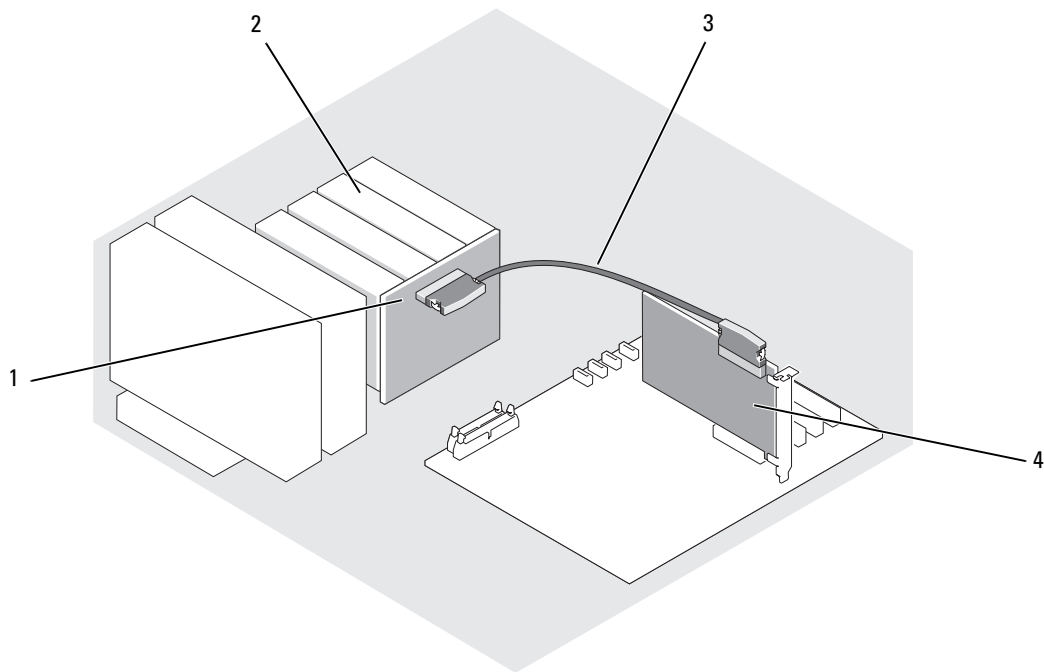

- 12** Install the hard drives into the hard-drive bay. See Figure 3-11.
 - 13** Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.
 - 14** Install any required device drivers.
 - 15** Run the SAS controllers tests and the hard-drive tests in the system diagnostics. See "Running the System Diagnostics" on page 112.
-  Installing SATA and SCSI hard drives in the same system is not supported.

Figure 3-13. SAS Backplane Connected to a SAS Controller Card



- | | | | | | |
|---|---------------------|---|------------------------------|---|---------------------|
| 1 | SAS backplane | 2 | SATA hard drive (up to four) | 3 | SAS interface cable |
| 4 | SAS controller card | | | | |

Removing a Hot-Plug SAS or SATA Hard Drive

 **NOTICE:** Not all operating systems support hot-plug drive installation. See the operating system documentation to confirm that the operating system supports this feature.

- 1 Remove the bezel. See "Removing the Bezel" on page 43."
- 2 Take the hard drive offline and wait until the hard-drive indicator codes on the drive carrier signal that the drive can be removed safely. See Table 1-5 for a list of hard-drive indicator codes.


If the drive has been online, the drive status indicator will blink green two times per second as the drive is powered down. When all indicators are off, the drive is ready for removal.

See your operating system documentation for more information on taking the hard drive offline.

- 3 Remove the drive. See "Removing a Hard Drive from a Lever-Release Drive Carrier" on page 59.

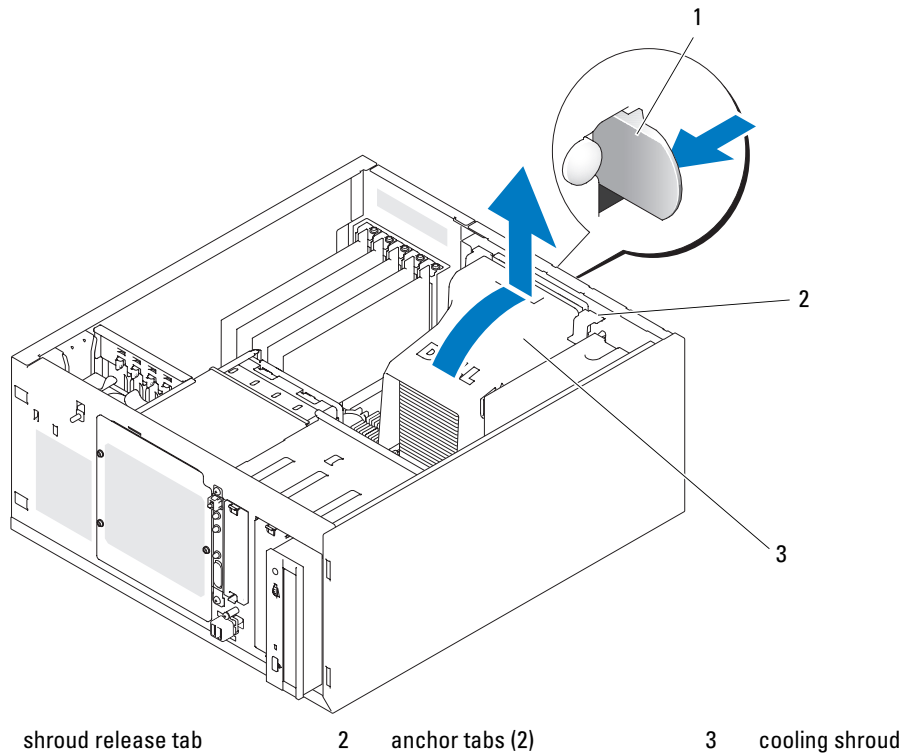
Cooling Shroud

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 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 43.
- 3 Disconnect the power cables and hard-drive interface cable connectors from the SAS backplane (if applicable) or hard drives.
- 4 Press the shroud release tab on the back panel toward the power supply. See Figure 3-14.
- 5 Lift the cooling shroud out of the system. See Figure 3-14.

Figure 3-14. Removing the Cooling Shroud



Installing the Cooling Shroud

- 1 Ensure that no tools or loose parts are left inside the system.
- 2 Align the anchor tabs on the cooling shroud with the notches in the system chassis.
- 3 Reposition the SAS or SATA cables and power cables so they do not obstruct the memory modules and interfere with installing the cooling shroud.
- 4 Gently lower the cooling shroud until the shroud release tab on the back panel snaps into place.
- 5 Reconnect the power cable(s) to the SAS backplane (if applicable) or the hard drive(s).

Cooling Fans

The system includes the following cooling fans:

- Front system fan (only when configured with optional SAS or RAID controller cards)
- Back system fan

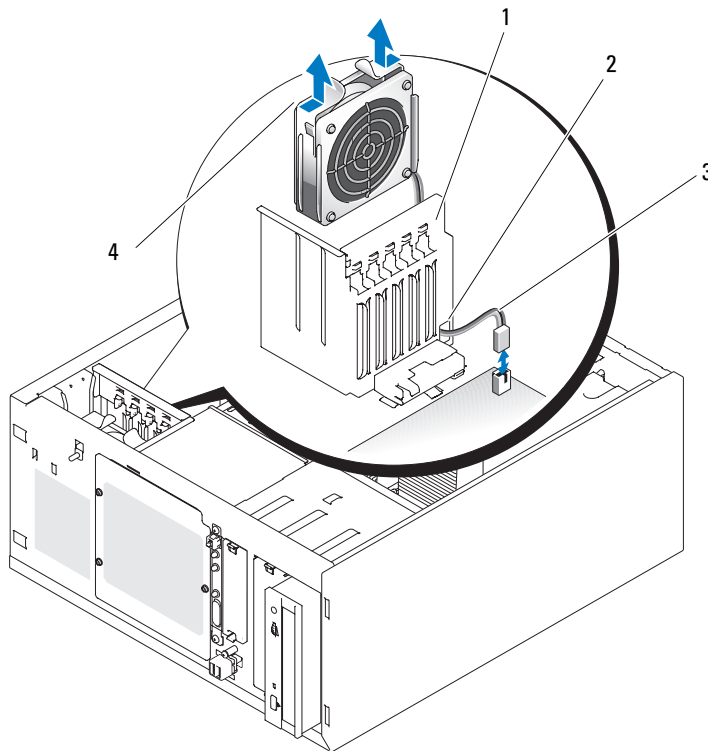
Removing the Front System Fan

⚠ 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.

Figure 3-15 illustrates the front system fan inside the system and the fan cable routing hole in the expansion-card guide bracket.

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 43.
- 3 Disconnect the fan power cable from the FRONT_FAN connector on the system board. See "System Board Connectors" on page 118.


Figure 3-15. Front System Fan Power Cable



- | | | | | | |
|---|------------------------------|---|--------------------|---|-----------------|
| 1 | expansion-card guide bracket | 2 | cable routing hole | 3 | fan power cable |
| 4 | release tabs (2) | | | | |


- 4 Squeeze the two release tabs on the top of the fan assembly and lift the fan assembly away from the system. See Figure 3-15.

Installing the Front System Fan

 **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.**

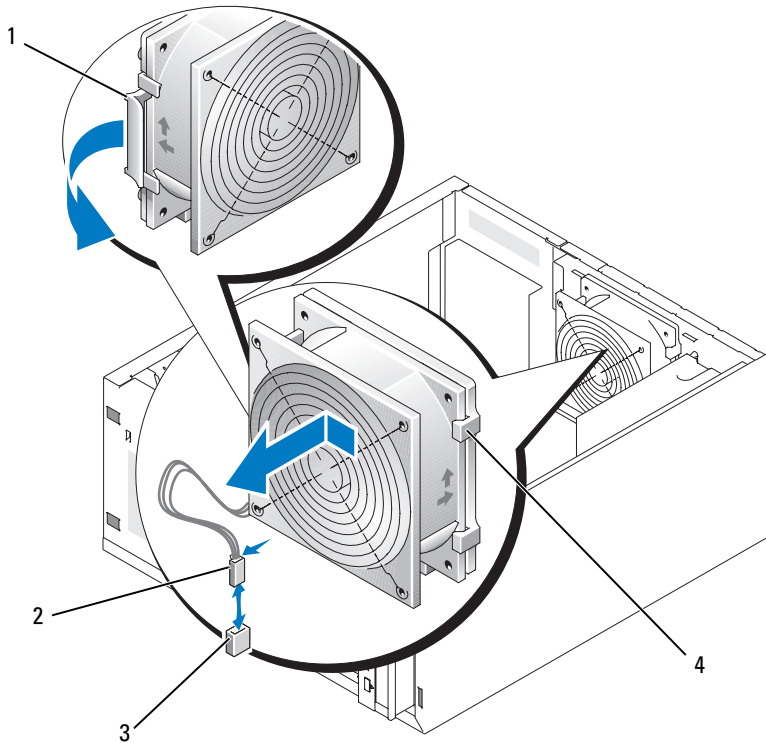
- 1 Insert the fan power cable through the cable routing hole in the expansion-card guide bracket. See Figure 3-15.
- 2 Align the fan assembly with the slots in the chassis and lower the assembly into the chassis. See Figure 3-15.
- 3 Pull the fan cable through the routing hole in the expansion-card guide bracket. See Figure 3-15.
- 4 Connect the fan cable connector to the FRONT_FAN connector on the system board.
- 5 Close the system. See "Connecting Drives" on page 47.
- 6 Stand the system upright.
- 7 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

Removing the Back System Fan

 **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, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 43.
- 3 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 64.
- 4 Disconnect the fan cable from the BACK_FAN connector on the system board. To identify system board connectors, see "System Board Connectors" on page 118.
- 5 Pull the release tab on the fan assembly away from the back panel and slide the fan assembly about 0.63 cm (0.25 inch) toward the expansion-card slots. See Figure 3-16.
- 6 Pull the fan assembly forward and lift the assembly out of the system. See Figure 3-16.

Figure 3-16. Removing the Back System Fan



- 1 release tab
- 2 fan cable connector
- 3 BACK_FAN connector
- 4 back system fan

Installing the Back System Fan

⚠ 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 tabs on the fan bracket with the mounting holes in the back panel and slide the fan assembly toward the power supply about 0.63 cm (0.25 inch) until the fan bracket release tab snaps into place. See Figure 3-16.
- 2 Connect the fan cable to the BACK_FAN connector on the system board.
To identify system board connectors, see "System Board Connectors" on page 118.
- 3 Install the cooling shroud. See "Installing the Cooling Shroud" on page 65."
- 4 Close the system. See "Closing the System" on page 47.

- 5 Stand the system upright.
- 6 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

Power Supply

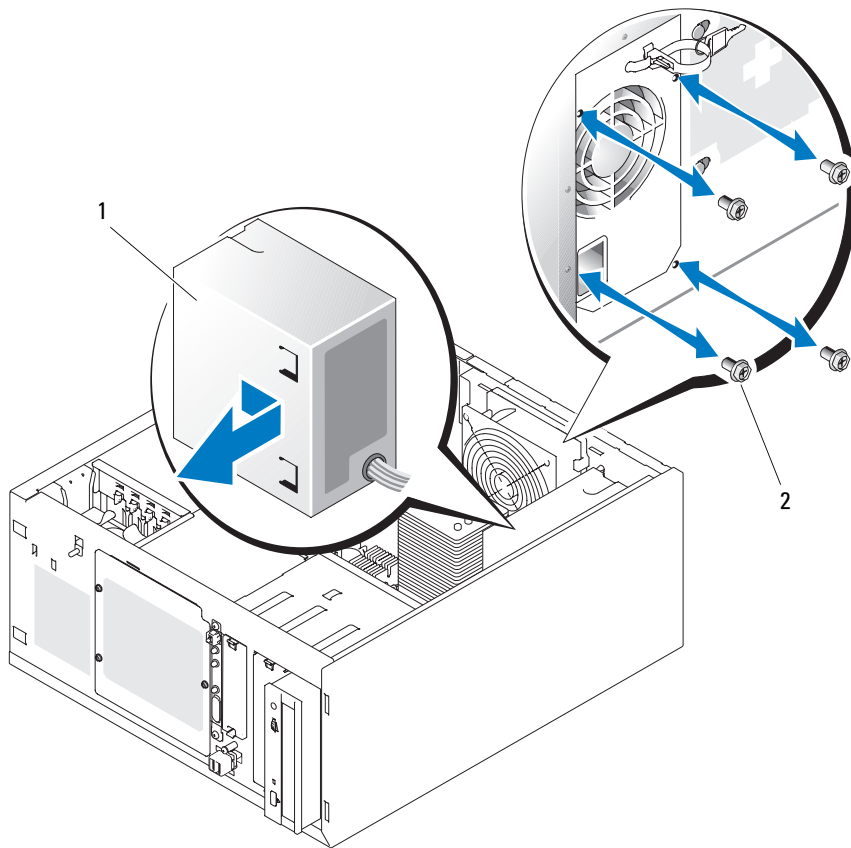
Removing the Power Supply



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 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 43.
- 3 Disconnect the DC power cables from the following components:
 - POWER CONN connector on the backplane board (if applicable)
 - PWR_CONN and 12V connectors on the system board
 - Hard drives
 - Diskette drive (if applicable)
 - Optical drive (if applicable)
 - Tape backup drive (if applicable)
- 4 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 64.
- 5 Remove the four screws securing the power supply to the back panel. See Figure 3-17.

Figure 3-17. Removing the Power Supply



1 power supply

2 screws (4)

- 6 Slide the power supply toward the front of the system, and then lift the power supply up and out of the system.

Replacing the Power Supply

- 1 Lower the power supply into the system and align the mounting holes with the holes on the back panel.
- 2 Install the four screws securing the power supply to the back panel.
- 3 Install the cooling shroud. See "Installing the Cooling Shroud" on page 65.

- 4 Connect the DC power cables to the following components:
 - POWER_CONN connector on the backplane board (if applicable)
 - PWR_CONN and 12V connectors on the system board
 - Hard drives or SAS backplane.
 - Diskette drive (if applicable)
 - Optical drive (if applicable)
 - Tape backup drive (if applicable)
- 5 Close the system. See "Closing the System" on page 47.
- 6 Stand the system upright.
- 7 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

Expansion Cards

Your system supports up to five full-length expansion cards, installed in connectors on a riser card. The expansion slots are configured as follows:

- Slot 1 is a x8 lane-width PCI-Express expansion slot.
- Slot 2 is a x1 lane-width PCI-Express expansion slot.
- Slots 3 and 4 are 3.3-V, 64-bit, 133-MHz PCI-X expansion slots.
- Slot 5 is a 5-V, 32-bit, 33-MHz legacy PCI expansion slot.

Figure 3-18 shows the relative locations of the expansion-card slots.


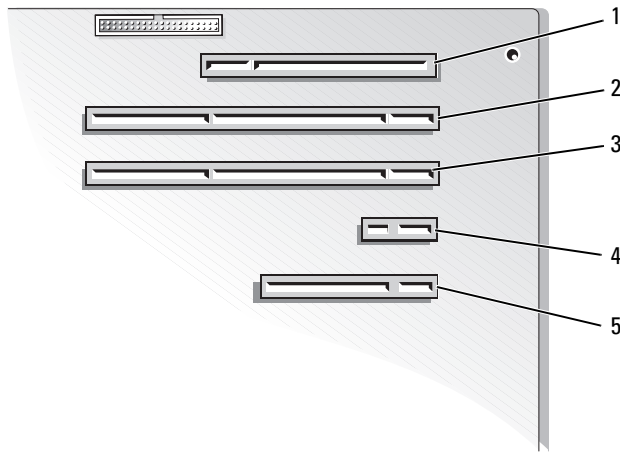
 **NOTICE:** If you install a RAC card, it must be installed in PCI slot SLOT_5.

Figure 3-18. Expansion Slots



- | | | | | | |
|---|------------------------------------|---|--|---|--|
| 1 | SLOT_5 - PCI 32-bit, 33-MHz (5-V) | 2 | SLOT_4 - PCI-X 64-bit, 133-MHz (3.3-V) | 3 | SLOT_3 - PCI-X 64-bit, 133-MHz (3.3-V) |
| 4 | SLOT_2 - x1 lane width PCI-Express | 5 | SLOT_1 - x8 lane width PCI-Express | | |

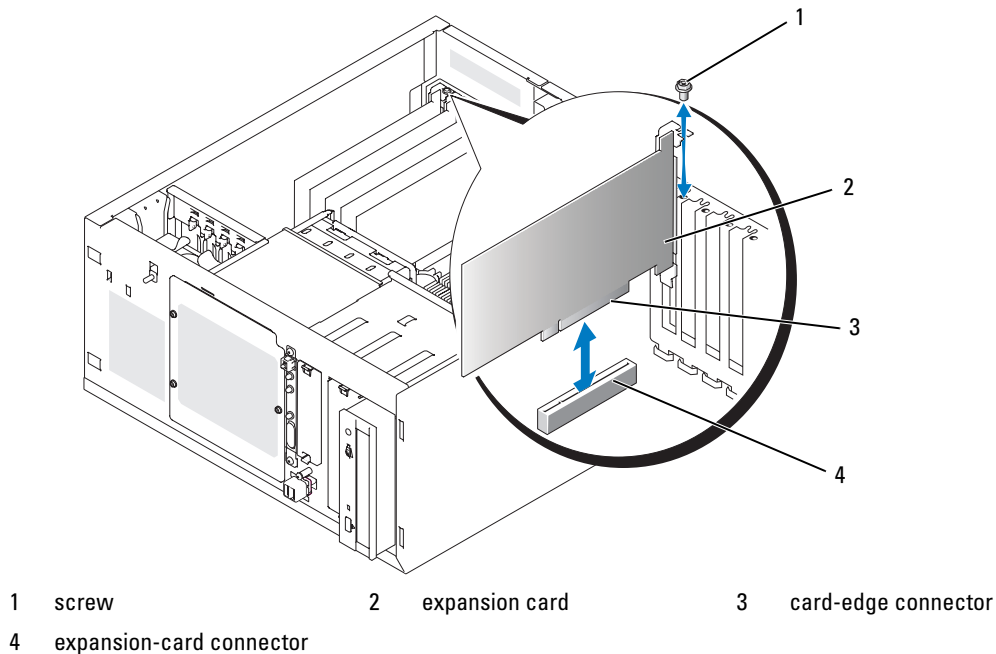
Installing an Expansion Card

⚠ 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 Unpack the expansion card, and prepare it for installation.
For instructions, see the documentation that accompanied the card.
- 2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 3 Open the system. See "Opening the System" on page 43.
- 4 Remove the filler bracket from the expansion slot.
- 5 Install the expansion card. See Figure 3-19.
 - a Position the expansion card so that the card-edge connector aligns with the expansion-card connector on the system board.
 - b Insert the card-edge connector firmly into the expansion-card connector until the card is fully seated.
 - c Install the screw that secures the expansion-card bracket to the back panel.

- 6 Connect any cables that should be attached to the card.
See the documentation that accompanied the card for information about its cable connections.
- 7 Close the system. See "Closing the System" on page 47.
- 8 Stand the system upright.
- 9 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.
- 10 Install any device drivers required for the card as described in the documentation for the card.


Figure 3-19. Removing and Installing an 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.

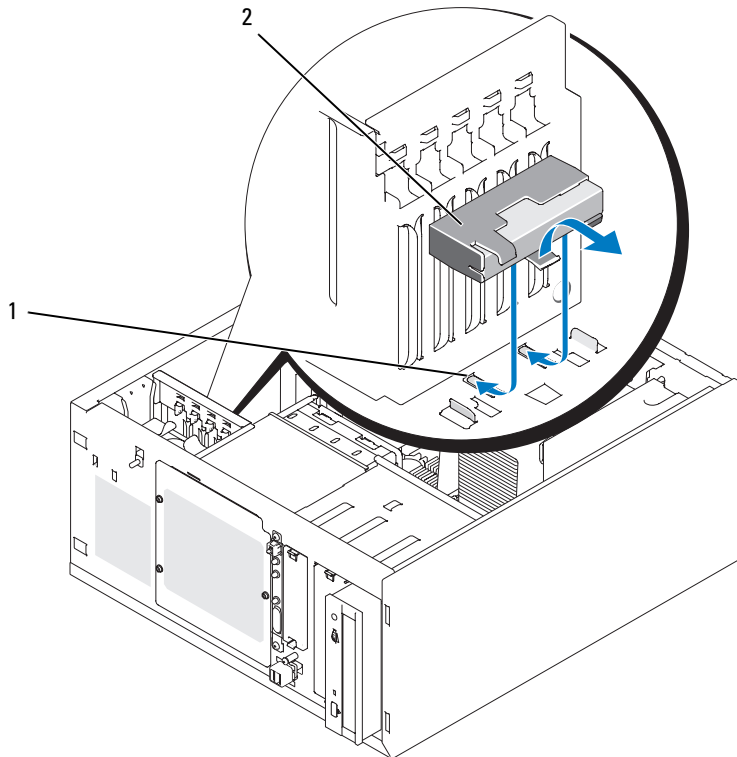
- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 43.
- 3 Disconnect any cables attached to the card.

- 4 Remove the expansion card (see Figure 3-19):
 - a Remove the screw that secures the expansion-card bracket to the back panel.
 - b Grasp the expansion card by its top corners, and carefully remove it from the expansion-card connector.
-  **NOTICE:** You must install a filler bracket over an empty expansion slot to maintain Federal Communications Commission (FCC) certification of the system. The brackets also help keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.
- 5 If you are removing the card permanently, install a metal filler bracket over the empty expansion slot opening and close the expansion-card latch.
- 6 Close the system. See "Closing the System" on page 47.
- 7 Stand the system upright.
- 8 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

Replacing the SAS Controller Card Battery

- 1 Disconnect the battery cable from the SAS controller card.

Figure 3-20. Replacing the SAS Controller Card Battery



1 chassis notches

2 battery/battery holder

- 2 Remove the battery and battery holder from the system chassis. See Figure 3-20.
- 3 Insert the new battery into the battery bay, ensuring that the battery is aligned and fully seated into the slots.
- 4 Connect the battery cable to the SAS controller card.

Memory

You can upgrade your system memory to a maximum of 8 GB by installing combinations of 512-MB, 1-GB, and 2-GB unbuffered ECC DDRII SDRAM 533- or 667-MHz memory modules. The system memory is located on the system board adjacent to the power supply connectors. See "System Board Connectors" on page 118. The memory module sockets are arranged in two banks 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

General Memory Module Installation Guidelines

- If only one memory module is installed, it must be installed in socket DIMM1_A.
- If two or more memory modules are installed, they must be installed in pairs of matched memory size, speed, and technology.

Table 3-2 shows examples of different memory configurations.

Table 3-2. Sample Memory 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

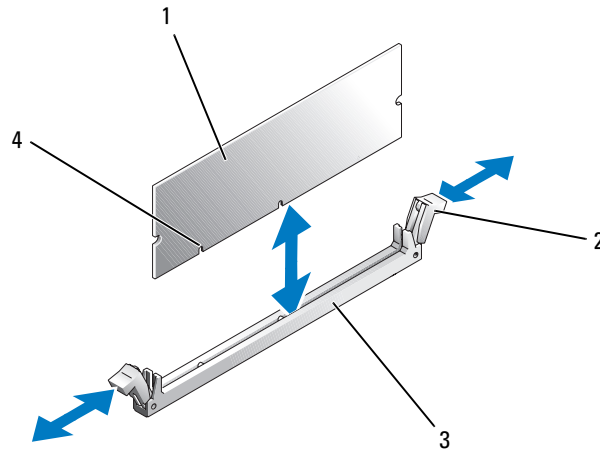


CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

- 2 Open the system. See "Opening the System" on page 43.
- 3 Locate the memory module sockets. See "System Board Connectors" on page 118.
- 4 Press the ejectors on the memory module socket down and out, as shown in Figure 3-21, to allow the memory module to be inserted into the socket.

Figure 3-21. Installing and Removing a Memory Module



- | | | | | | |
|---|--------------------|---|--------------------------------------|---|--------|
| 1 | memory module | 2 | memory module socket
ejectors (2) | 3 | socket |
| 4 | alignment keys (2) | | | | |

- 5 Align the memory module's edge connector with the alignment keys on the memory module socket, and insert the memory module in the socket.

NOTE: The memory module socket has alignment keys that ensure correct insertion of the memory module in the socket.

- 6 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.

- 7 Repeat this procedure to install the remaining memory modules. See Table 3-2 for sample memory configurations.
- 8 Close the system. See "Closing the System" on page 47.
- 9 Stand the system upright.
- 10 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

- 11 (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.
- 12 If the value is incorrect, one or more of the memory modules may not be installed properly. Repeat step 1 through step 11 of this procedure, checking to ensure that the memory modules are firmly seated in their sockets.
- 13 Run the system memory test in the system diagnostics. See "Running the System Diagnostics" on page 112.

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 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 43.
- 3 Locate the memory module sockets. See "System Board Connectors" on page 118.
- 4 Press down and out on the ejectors on each end of the socket until the memory module pops out of the socket. See Figure 3-21.
- 5 Close the system. See "Closing the System" on page 47.
- 6 Stand the system upright.

Microprocessor

You can upgrade the system processor to take advantage of future options in speed and functionality.

A processor upgrade kit contains the following items:

- Processor
- Thermal grease packet and/or a replacement heat sink

If your kit does not include a replacement heat sink, you must reuse the processor heat sink currently in your system.



NOTICE: If your upgrade kit included a thermal grease packet, you must use the thermal grease as instructed to ensure the proper thermal operating condition for the processor. Failure to do so will result in damage to your system.

Removing 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.

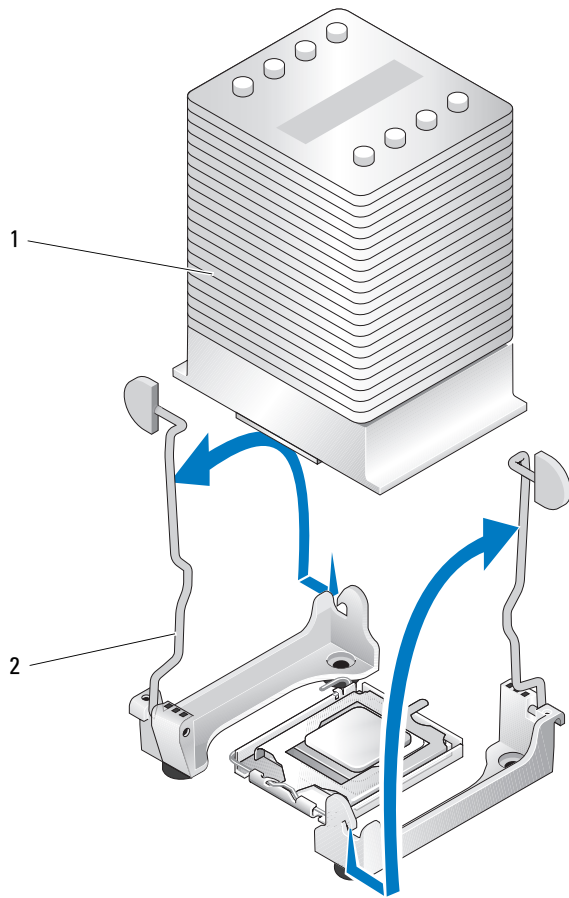
- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 43.
- 3 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 64.



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.

- 4 Remove the heat sink. See Figure 3-22.
 - a Open one securing clip by pressing the end of the clip down and away from the retention module until it clears the securing tab on the retention module, and then lift the clip up.
 - b Repeat step a for the remaining securing clip.
 - c Rotate the heat sink slightly and then lift the heat sink off the processor. Do not pry the processor off the heat sink.
 - d If you are reusing the heat sink with the new processor, clean the contact side of the heat sink and set it aside for use later in the processor installation procedure.

Figure 3-22. Removing the Heat Sink

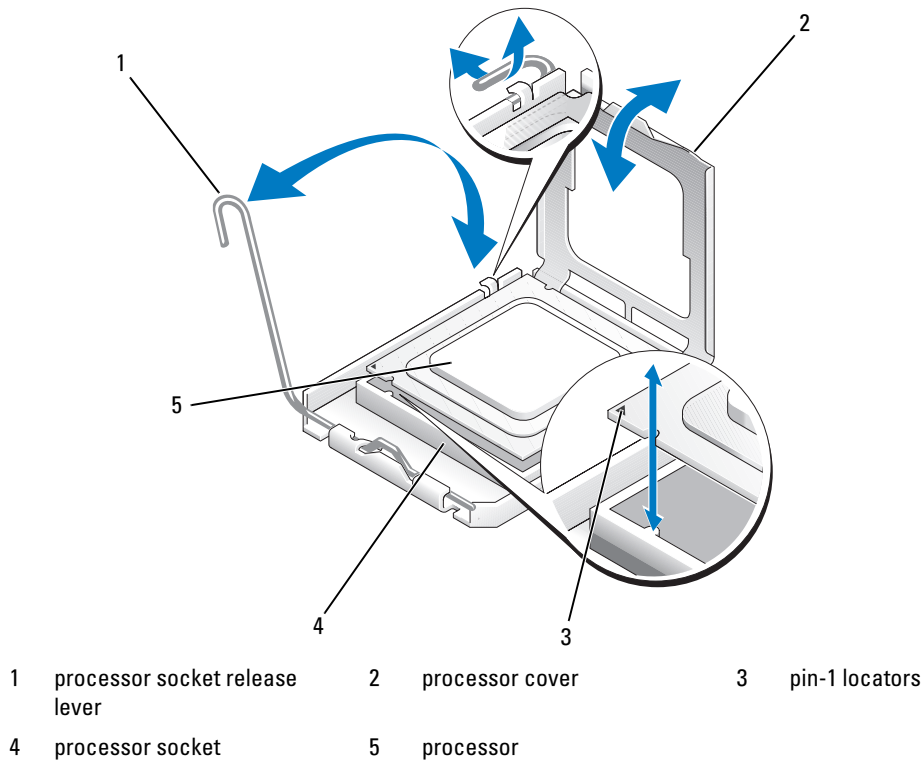


1 heat sink

2 securing clips (2)

- 5 Press down on the processor socket release lever, then pull the release lever upward to the fully open position. See Figure 3-23.
- 6 Open the processor cover. See Figure 3-23.
- 7 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 3-23.

Figure 3-23. Removing/Replacing the Processor



Installing a 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 Unpack the new processor and heat sink, if provided.
- 2 Ensure that the processor socket release lever is in the fully open position.
- 3 Align the pin 1 corners of the processor and socket. See Figure 3-23.

➔ 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.

4 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.

5 Close the processor cover.

6 Rotate the release lever back down until it snaps into place, securing the processor cover.

➔ NOTICE: Do not operate the system without the heat sink installed. The heat sink is required to maintain proper thermal conditions.

7 Prepare the heat sink for installation:

- If you are reusing the heat sink from the previous processor, ensure that the contact side (bottom) of the heat sink is clean, open the thermal grease packet, and apply thermal grease to the bottom of the heat sink.
- If you received a replacement heat sink, remove the protective sheet from the thermal grease layer that is pre-applied to the bottom of the heat sink.

8 Lower the heat sink onto the processor. See Figure 3-22.

9 Secure the heat sink to the retention module.

- a Gently press down on the heat sink and then press one securing clip to secure it.
- b Repeat step a for the remaining securing clip.

10 Ensure that the back fan connector is connected to the BACK_FAN connector on the system board. See "System Board Connectors" on page 118.

11 Install the cooling shroud. See "Installing the Cooling Shroud" on page 65.

12 Close the system. See "Closing the System" on page 47.

13 Stand the system upright.

14 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

15 Enter the System Setup program, and ensure that the processor options match the new system configuration. See "Using the System Setup Program" on page 29.

As the system boots, it detects the presence of the new processor and automatically changes the system configuration information in the System Setup program. A message similar to the following appears:

```
One 2.8 GHz Processor, Processor Bus: 533 MHz, L2 cache 256 KB
```

16 Confirm that the top line of the system data area in the System Setup program correctly identifies the installed processor. See "Using the System Setup Program" on page 29.


17 Exit the System Setup program.

18 Ensure that your system is running the latest BIOS version.

You can download the latest BIOS version from the Dell Support website located at support.dell.com

- 19 Run the system diagnostics to verify that the new processor is operating correctly.
See "Running the System Diagnostics" on page 112 for information on running the diagnostics and troubleshooting any problems that may occur.

Installing a RAC 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 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 43.
- 3 Install the RAC card in PCI expansion slot SLOT_5.
See "Installing an Expansion Card" on page 72 for information on installing the card.
- 4 Connect the cable from the RAC card to connector RAC_CONN on the system board. See "System Board Connectors" on page 118.
- 5 Close the system. See "Closing the System" on page 47.
- 6 Stand the system upright.
- 7 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.
- 8 Enter the System Setup program and verify that the setting for the RAC card has changed to reflect the presence of the card. See "Using the System Setup Program" on page 29.

See the RAC card documentation for information on configuring and using the RAC card.

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 record the option settings on the System Setup screens.
See "Using the System Setup Program" on page 29.
- 2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 3 Open the system. See "Opening the System" on page 43.

- 4 Remove the system battery. See "System Board Connectors" on page 118 for the battery socket location on the system board.
 - a Pull the latch away from the battery. See Figure 3-24.
 - b Lift the battery out of the battery socket.


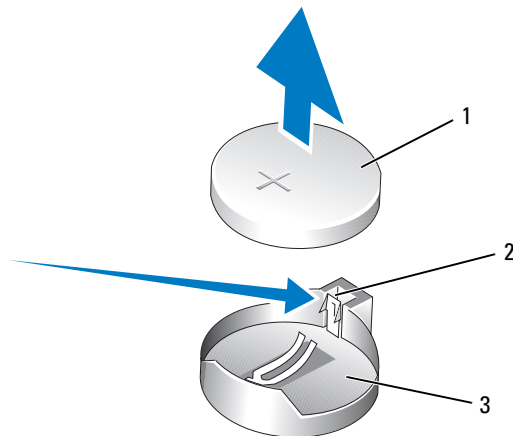
 **NOTICE:** You must install the new system battery with the side labeled "+" facing up. See Figure 3-24.

Figure 3-24. Removing the System Battery



1 system battery

2 latch

3 battery socket

- 5 To install the new system battery, hold the battery with the side labeled "+" facing up, and then press the battery straight down into the battery socket until the latch snaps into place over the edge of the battery. See Figure 3-24.
- 6 Close the system. See "Closing the System" on page 47.
- 7 Stand the system upright.
- 8 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.
- 9 Enter the System Setup program to confirm that the battery operates properly.
- 10 From the main screen, select **System Time** to enter the correct time and date.
- 11 Re-enter any system configuration information that is no longer displayed on the System Setup screens, and then exit the System Setup program.
- 12 To test the newly installed battery, see "Troubleshooting the System Battery" on page 98.

Front I/O Panel (Service-Only Parts Procedure)

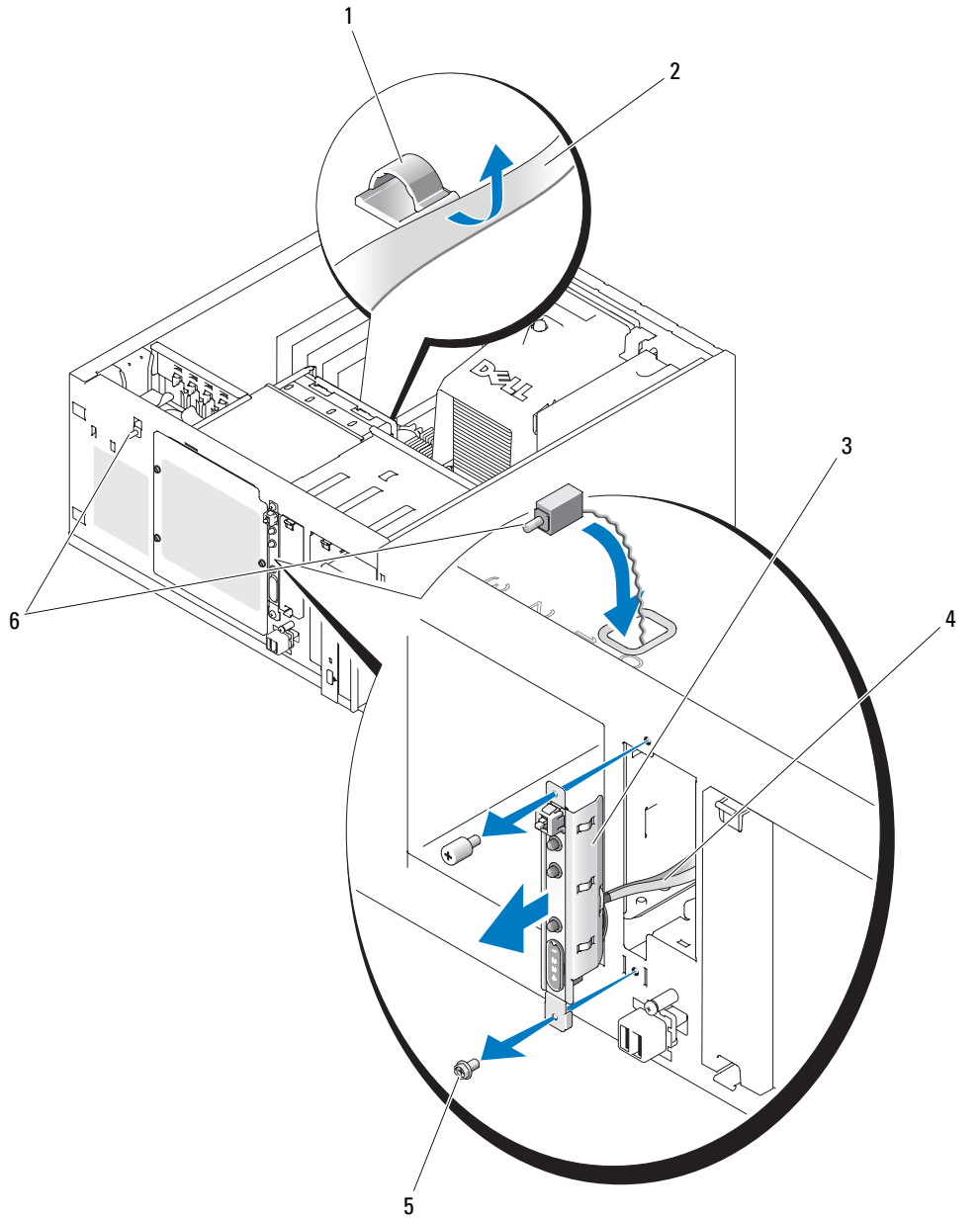
Removing the Control Panel Assembly and Chassis-Intrusion Switch



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 43.
- 3 Disconnect the control panel assembly cable from the FRONT_PANEL connector on the system board and remove the assembly cable from its guide bracket. See Figure 3-25.
- 4 Slide the chassis-intrusion switch upward and lift it out of its slot in the front of the chassis. Then, remove the chassis-intrusion cable from its three holding clips underneath the front lip of the system chassis.
- 5 Using a #2 Phillips screwdriver, remove the two screws that secure the control panel assembly to the chassis. See Figure 3-25.
- 6 Lift the control panel assembly and the attached chassis-intrusion switch away from the system. See Figure 3-25.

Figure 3-25. Removing the Control Panel Assembly




- | | | | | | |
|---|------------------------------|---|---------------------|---|--------------------------|
| 1 | assembly cable guide bracket | 2 | chassis floor | 3 | control panel assembly |
| 4 | control panel assembly cable | 5 | mounting screws (2) | 6 | chassis-intrusion switch |

Installing the Control Panel Assembly

- 1 Insert the control panel assembly cable and chassis-intrusion switch through the front of the system.
- 2 Thread the chassis-intrusion switch upward through the opening above the control panel slot.
- 3 Connect the control panel assembly cable connector to the FRONT_PANEL connector on the system board and insert the cable in its guide bracket.
- 4 Guide the chassis-intrusion switch cable through the three holding clips underneath the front lip of the system chassis.
- 5 Insert the chassis-intrusion switch into its slot in the front of the chassis, then slide the switch down into place.
- 6 Using a #2 Phillips screwdriver, install the screws that secure the control panel assembly to the chassis. See Figure 3-25.
- 7 Close the system. See "Closing the System" on page 47.
- 8 Stand the system upright.
- 9 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

System Board (Service-Only Parts Procedure)

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

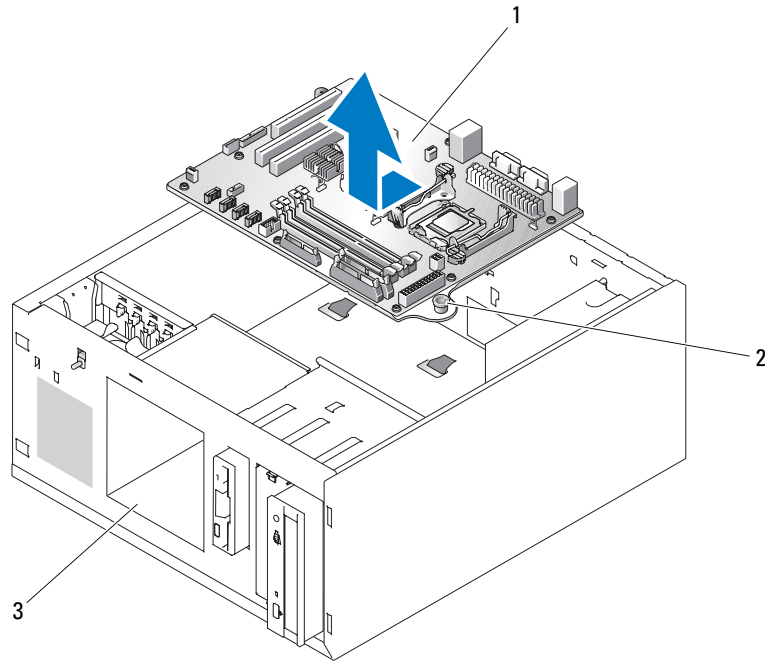
 **CAUTION:** The processor heat sink can get hot during operation. To avoid burns, ensure that the system has sufficient time to cool before removing the system board.

Removing the System Board

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Disconnect the cables to the I/O connectors on the back panel.
- 3 Open the system. See "Opening the System" on page 43.
- 4 Disconnect the two power cables from connectors PWR_CONN and 12V on the system board.
- 5 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 64.
- 6 If the system has cabled SAS drives or SATA drives, note the relative location of the interface cable connections between the system board and the drives, so you can reconnect them in the proper sequence.
- 7 Disconnect the SAS or SATA interface cable(s) connected to the system board or optional hard-drive controller card.

- 8** Disconnect the power cable(s) connected to the hard drives in the drive bay, or to the optional SAS backplane.
- 9** Remove the screws securing the drive bay and remove the bay from the system.
- 10** Disconnect all remaining cables attached to the connectors on the system board:
 - Optical-drive interface cable (PRIMARY_IDE connector)
 - Diskette-drive cable (FDD connector)
 - Control panel cable (FRONT_PANEL connector)
 - Front fan cable (FRONT_FAN connector)
 - Back fan cable (BACK_FAN connector)
 - Any other cables attached to the system board, after recording their locations.
- 11** Remove the back fan. See "Removing the Back System Fan" on page 67 in "Installing System Components."
- 12** Remove all PCI expansion cards from the expansion slots. See "Removing an Expansion Card" on page 73.
- 13** Pull up on the system board plunger and slide the system board toward the front of the chassis about 2.5 cm (1 inch). See Figure 3-26.
- 14** Carefully lift the system board up and out of the chassis. See Figure 3-26.

Figure 3-26. Removing the System Board



- 1 system board 2 plunger 3 drive bay

Installing the System Board

- 1 Unpack the new system board.
- 2 Ensure that the system board jumpers are set the same as on the board that you just removed, and change the settings if necessary. See "System Board Jumpers" on page 115.
- 3 Remove the memory modules from the original system board and transfer them to the new board, being careful to install the memory modules in the same locations.
See "Installing Memory Modules" on page 76.
- 4 Remove the processor from the original system board. See "Removing the Processor" on page 79.
- 5 Reinstall the processor and heat sink on the new system board. See "Installing a Processor" on page 81.
- 6 Making sure that no cables are trapped beneath the system board tray, lower the new system board into the chassis.
- 7 Position the system board in place and gently press down on the board until the plunger locks.
- 8 Install the back fan and connect the fan cable to the BACK_FAN connector on the system board. See "Installing the Back System Fan" on page 68.

- 9** Connect the following cables to the system board. See "System Board Connectors" on page 118.
 - Optical-drive interface cable (PRIMARY_IDE connector)
 - Diskette-drive cable (FDD connector)
 - Control panel cable (FRONT_PANEL connector)
 - Front fan cable (FRONT_FAN connector)
- 10** Install all expansion cards and connect any interface cables to the appropriate components in the system. See "Installing an Expansion Card" on page 72.
- 11** Reinstall the drive bay and secure it with the four Phillips screws. See "Installing a Hard Drive in the Drive Bay" on page 55.
- 12** Reconnect the SAS or SATA interface cable(s) to the system board or optional hard-drive controller card.

Ensure that you reattach the interface cables in their original locations.
- 13** Reconnect the power cables to the hard drives in the drive bay, or to the optional SAS backplane.
- 14** Replace the cooling shroud. See "Installing the Cooling Shroud" on page 65.
- 15** Connect the two power cables to connectors PWR_CONN and 12V on the system board.
- 16** Carefully check for any remaining cables or components that are not installed or are improperly seated in their connectors on the system board.
- 17** Close the system. See "Closing the System" on page 47.
- 18** Stand the system upright.
- 19** Reconnect the cables to the I/O connectors on the system back panel.
- 20** Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

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
A status or error message displayed on the monitor.	See "System Messages" on page 18.
A series of beeps emitted by the system.	See "System Beep Codes" on page 26.
Diagnostic indicator lights indicate a problem.	See "Diagnostics Indicator Codes" on page 15.
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 92.
The keyboard indicators.	See "Troubleshooting the Keyboard" on page 93.
The USB device activity indicator.	See "Troubleshooting a USB Device" on page 95.
The diskette drive activity indicator.	See "Troubleshooting a Diskette Drive" on page 101.
The optical drive activity indicator.	See "Troubleshooting an Optical Drive" on page 102.
The hard-drive activity indicator.	See "Troubleshooting a Hard Drive" on page 104.
An unfamiliar constant scraping or grinding sound when you access a drive.	See "Getting Help" on page 121.

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."

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

IRQ Line	Assignment
IRQ0	System timer
IRQ1	Keyboard controller
IRQ2	Interrupt controller 1 to enable IRQ8 through IRQ15
IRQ3	Available
IRQ4	Serial port 1 (COM1 and COM3)
IRQ5	Remote access controller
IRQ6	Diskette drive controller
IRQ7	Available
IRQ8	Real-time clock
IRQ9	ACPI functions (used for power management)
IRQ10	<i>Available</i>
IRQ11	<i>Available</i>
IRQ12	PS/2 mouse port unless the mouse is disabled through the System Setup program
IRQ13	Math coprocessor
IRQ14	IDE optical drive controller
IRQ15	<i>Available</i>

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 an expansion card with a video output connector.
In this system configuration, the monitor cable should normally be connected to the connector on the expansion card, *not* to the system's integrated video connector.
To verify that the monitor is connected to the correct video connector, turn off the system and wait for 1 minute, then connect the monitor to the other video connector and turn the system on again.
- 3 Run the appropriate online diagnostic test. See "Running the System Diagnostics" on page 111.
If the tests run successfully, the problem is not related to video hardware.
If the tests fail, see "Getting Help" on page 121.

Troubleshooting the Keyboard

Problem

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

Action

- 1 If you are using a USB keyboard, enter the System Setup program and ensure that the USB ports are enabled. See "Using the System Setup Program" on page 29.
- 2 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 121.
- 4 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 111.
If the problem is not resolved, see "Getting Help" on page 121.

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 Server Administrator Diagnostics" in "Running the System Diagnostics."
If the test fails, continue to the next step.

- 2 Examine the mouse and its cable for signs of damage.
If the mouse is not damaged, go to step 4.
If the mouse is damaged, continue to the next step.
- 3 Swap the faulty mouse with a working mouse.
If the problem is resolved, replace the faulty mouse. See "Getting Help" on page 121.
- 4 Enter the System Setup program and ensure that the mouse controller is enabled. See "Using the System Setup Program."
If the problem is not resolved, see "Getting Help" on page 121.

Troubleshooting Serial I/O Problems

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 and configured correctly for your application. See "Using the System Setup Program" on page 29.
- 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 111.
If the tests run successfully but the problem persists, see "Troubleshooting a Serial I/O Device" on page 94.

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 121.
- 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 121.

If the problem persists, see "Getting Help" on page 121.

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."
- 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 the reconnected device.
If the problem is resolved, the USB connector might be defective. See "Getting Help" on page 121"
- 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 121.
- 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 121.
If the problem persists, see "Getting Help" on page 121.

Troubleshooting a NIC

Problem

- NIC cannot communicate with network.

Action

- 1 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" in "Running the System Diagnostics."

- 2 Check the appropriate indicator on the NIC connector. See "NIC Indicator Codes" on page 14.
 - 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."
- 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.

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 1-2 for the back-panel connectors on your system.

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 43.
- 3 Remove all expansion cards installed in the system. See "Installing an Expansion Card" on page 72.
- 4 Let the system dry thoroughly for at least 24 hours.

- 5 Close the system. See "Closing the System" on page 47.
- 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 121.
- 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 72.
- 8 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 111.
If the tests fail, see "Getting Help" on page 121.

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 43.
- 2 Ensure that the following components are properly installed:
 - Expansion cards
 - Power supplies
 - Fans
 - Processors and heat sinks
 - Memory modules
 - Drive-carrier connections to the backplane board, if applicable
- 3 Ensure that all cables are properly connected.
- 4 Close the system. See "Closing the System" on page 47.
- 5 Run the system board tests in the system diagnostics. See "Using Dell PowerEdge Diagnostics" on page 111.
If the tests fail, see "Getting Help" on page 121.

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."
- 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" in "Installing System Components."

If the problem is not resolved by replacing the battery, see "Getting Help" on page 121.



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 Power Supplies

Problem

- System-status indicators are amber.
- Power-supply fault 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 111.
- 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 43.

- 4 Ensure that the power supply is properly installed by removing and reinstalling it. See "Power Supply" on page 69.



NOTE: After installing a power supply, allow several seconds for the system to recognize the power supply and to determine if it is working properly. The power indicator turns green to signify that the power supply is functioning properly.

- 5 If the problem is resolved, close the system. See "Closing the System" on page 47.
If the problem persists, remove the faulty power supply. See "Power Supply" on page 69.
- 6 Install a new power supply. See "Power Supply" on page 69.
If the problem persists, see "Getting Help" on page 121.

Troubleshooting System Cooling Problems

Problem

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

Action

Ensure that none of the following conditions exist:

- System cover, cooling shroud, drive blank, or front or back filler panel is removed.
- Ambient temperature is too high.
- External airflow is obstructed.
- Cables inside the system obstruct airflow.
- An individual cooling fan is removed or has failed. See "Troubleshooting a Fan" on page 99.

Troubleshooting a Fan

Problem

- System-status indicator is amber.
- Systems management software issues a fan-related error message.
- Fan status indicator indicates a problem with the fan.

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 111.
- 2 Open the system. See "Opening the System" on page 43.

 **CAUTION: The cooling fans are hot-pluggable. To maintain proper cooling while the system is on, only replace one fan at a time.**

- 3 Ensure that the faulty fan's power cable is firmly attached to the fan power connector. For a hot-plug fan, remove and reseat the fan. See "Cooling Fans" on page 65.

 **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 "Cooling Fans" on page 65.
If the replacement fan is working properly, close the system. See "Closing the System" on page 47.
If the replacement fan does not operate, see "Getting Help" on page 121.

Troubleshooting System Memory

Problem

- Faulty memory module.
- Faulty system board.
- Front-panel diagnostic lights indicate 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 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 111.
- 2 Turn on the system and attached peripherals.
If an error message does not appear, continue to the next step.
If an error messages appears, go to step 10.
- 3 Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 29.
If the amount of memory installed matches the system memory setting, go to step 10.
- 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 43.
- 6 Reseat the memory modules in their sockets. See "Installing Memory Modules" on page 76.
- 7 Close the system. See "Closing the System" on page 47.
- 8 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.

- 9 Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 29.

If the amount of memory installed does not match the system memory setting, then perform the following steps:

- a Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
- b Open the system. See "Opening the System" on page 43.

 **NOTE:** Several configurations for memory modules exist; see "General Memory Module Installation Guidelines" on page 76.

- c Swap the memory module in socket 1 with another of the same capacity. See "Installing Memory Modules" on page 76.

- d Close the system. See "Closing the System" on page 47.

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

- f As the system boots, observe the monitor screen and the indicators on the keyboard.

- 10 Perform the following steps:

- a Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.

- b Open the system. See "Opening the System" on page 43.

- c Perform step d through step f in step 9 for each memory module installed.

If the problem persists, see "Getting Help" on page 121.

Troubleshooting a Diskette Drive

Problem

- Error message indicates a diskette drive problem.

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 Enter the System Setup program and verify that the diskette drive is configured correctly. See "Using the System Setup Program" on page 29.

- 2 Remove the bezel. See "Removing the Bezel" on page 43.

- 3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 111.

- 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 43.

- 6** Ensure that the diskette drive interface cable is securely connected to the diskette drive and the system board.
- 7** Ensure that a power cable is properly connected to the drive.
- 8** Close the system. See "Closing the System" on page 47.
- 9** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 10** Run the appropriate online diagnostic test to see whether the diskette drive works correctly.
- 11** Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
- 12** Open the system. See "Opening the System" on page 43.
- 13** Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 73.
- 14** Close the system. See "Closing the System" on page 47.
- 15** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 16** Run the appropriate online diagnostic test to see whether the diskette drive works correctly.
If the tests run successfully, an expansion card may be conflicting with the diskette drive logic, or an expansion card may be faulty. Continue to the next step.
If the tests fail, see "Getting Help" on page 121.
- 17** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 18** Open the system. See "Opening the System" on page 43.
- 19** Reinstall one of the expansion cards you removed in step 13. See "Installing an Expansion Card" on page 72.
- 20** Close the system. See "Closing the System" on page 47.
- 21** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 22** Run the appropriate online diagnostic test to see whether the diskette drive works correctly.
- 23** Repeat step 17 through step 22 until all expansion cards are reinstalled or one of the expansion cards causes the tests to fail.
If the problem is not resolved, see "Getting Help" on page 121.

Troubleshooting an Optical Drive

Problem

- System cannot read data from a CD or DVD in an optical drive.
- 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 To ensure that the problem is not media-related, try using a different CD or DVD that you know works properly.
- 2 Enter the System Setup program and ensure that the drive's IDE controller is enabled. See "Using the System Setup Program" on page 29.
- 3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 111.
- 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 43.
- 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 47.
- 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 121.

Troubleshooting an External SCSI Tape Drive

Problem

- Defective tape drive
- Defective tape cartridge
- Missing or corrupted tape-backup software or tape drive device driver
- Defective SCSI controller

Action

- 1 Remove the tape cartridge you were using when the problem occurred, and replace it with a tape cartridge that you know works.
- 2 Ensure that the SCSI device drivers for the tape drive are installed and are configured correctly.
- 3 Verify that the tape drive is configured for a unique SCSI ID number and that the tape drive is terminated or not terminated, based on the interface cable used to connect the drive.
See the documentation for the tape drive for instructions on selecting the SCSI ID number and enabling or disabling termination.
- 4 Run the appropriate online diagnostics tests. See "Using Dell PowerEdge Diagnostics" on page 111.
- 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 43.



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.

7 Ensure that the SCSI controller card is firmly seated in its connector. See "Installing an Expansion Card" on page 72.

8 Ensure that the tape drive's data and power cables are properly connected to the tape drive and SCSI controller card.

9 Close the system. See "Closing the System" on page 47.

10 Reconnect the system to its electrical outlet and turn on the system, including attached peripherals.

11 If the problem is not resolved, see the documentation for the tape drive for additional troubleshooting instructions.

12 Reinstall the tape backup software as instructed in the tape backup software documentation.

13 If you cannot resolve the problem, see "Getting Help" on page 121 for information on obtaining technical assistance.

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 111. Depending on the results of the diagnostics test, proceed as needed through the following steps.

2 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.

- 2 Enter the System Setup program and verify that the system is configured correctly. See "Using the System Setup Program."
- 3 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 4 Open the system. See "Opening the System" on page 43.
- 5 Ensure that the hard-drive interface cable is properly connected between the drive and the system board.
To identify system board connectors, see "System Board Connectors" on page 118.
- 6 If the hard drive is the boot drive, ensure that the drive is configured and connected properly. See "Configuring the Boot Drive" on page 54."
- 7 Ensure that the power cable is properly connected to the drive.
- 8 Close the system. See "Closing the System" on page 47.
- 9 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 10 If the problem persists, continue to the next step.
- 11 Format and partition the hard drive. See the operating system documentation.
- 12 If possible, restore the files to the drive.
If the problem persists, see "Getting Help" on page 121.

Troubleshooting a SATA Hard Drive in a RAID Configuration

Problem

- Device driver error
- Damaged or improperly connected hard-drive cables

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 diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 111.
- 2 Ensure that the required device drivers are installed and are configured correctly. See the RAID controller's documentation.
- 3 Restart your system and enter the RAID configuration utility (Ctrl+R) to verify that the controller is configured properly. See the RAID controller documentation.
- 4 If the problem persists, continue to the next step.

- 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 43.
- 7 If the hard drive is the boot drive, ensure that the drive is configured and connected properly. See "Configuring the Boot Drive" on page 54.
- 8 Ensure that the hard-drive interface cable is properly connected to the drive and to the controller card. See the documentation that accompanied the controller card.
- 9 Ensure that the power cable is properly connected to the drive.
- 10 Close the system. See "Closing the System" on page 47.
- 11 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals. If the problem persists, continue to the next step.
- 12 Format and partition the hard drive. See the operating system documentation.
- 13 If possible, restore the files to the drive. If the problem persists, see "Getting Help" on page 121.

Troubleshooting a SAS RAID Controller



NOTE: When troubleshooting a SAS RAID controller, also see the documentation for your operating system and the controller.

Problem

- Error message indicates a problem with the SAS RAID controller.
- SAS RAID controller 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 111.
- 2 Enter the System Setup program and ensure that the SAS RAID controller is enabled and drivers are loaded. See "Using the System Setup Program" on page 29.
- 3 Restart the system and press the applicable key sequence to enter the configuration utility program:
 - <Ctrl><C> for a SAS controller
 - <Ctrl><R> for a SAS RAID controller

See the controller's documentation for information about configuration settings.

- 4 Check the configuration settings, make any necessary corrections, and restart the system.
If the problem is not resolved, continue to the next step.
- 5 Remove the bezel. See "Removing the Bezel" on page 43.
- 6 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
- 7 Open the system. See "Opening the System" on page 43.
- 8 Ensure that the controller card is firmly seated into the system board connector.
- 9 If you have a SAS RAID controller, ensure that the following RAID components are properly installed and connected:
 - Memory module
 - Battery
- 10 Verify that the cable connections between the SAS backplane(s) and the SAS controller are correct. See "Removing a Hot-Plug SAS or SATA Hard Drive" on page 64.
- 11 Ensure that the cables are firmly connected to the SAS controller, the SAS backplane board and, if applicable, the 1x2 expansion backplane.
- 12 Close the system. See "Closing the System" on page 47.
- 13 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals. If the problem persists, see "Getting Help" on page 121.

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 111.
- 2 Open or remove the bezel. See "Removing the Bezel" on page 43.
- 3 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 4 Open the system. See "Opening the System" on page 43.

- 5 Ensure that each expansion card is firmly seated in its connector. See "Installing an Expansion Card" on page 72.
- 6 Close the system. See "Closing the System" on page 47.
- 7 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
If the problem persists, go to the next step.
- 8 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 9 Open the system. See "Opening the System" on page 43.
- 10 Remove all expansion cards installed in the system. See "Removing an Expansion Card" in "Installing System Components."
- 11 Close the system. See "Closing the System" on page 47.
- 12 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 13 Run the appropriate online diagnostic test.
If the tests fail, see "Getting Help" on page 121.
- 14 For each expansion card you removed in step 10, 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 43.
 - c Reinstall one of the expansion cards.
 - d Close the system. See "Closing the System" on page 47.
 - e Run the appropriate diagnostic test.
If the tests fail, see "Getting Help" on page 121.

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 If possible, run the appropriate online diagnostics test.
- 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 43.

- 4** Ensure that the processor and heat sink are properly installed. See "Installing a Processor" on page 81.
- 5** Close the system. See "Closing the System" on page 47.
- 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 121.

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 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.

 **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.

- 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.
- 3 Run the diagnostic utility and follow the on-screen instructions to create the diagnostic partition on the bootable 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 29 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 121.

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.

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



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

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



NOTE: To access the jumpers, remove the memory cooling shroud by lifting the release latch and sliding the shroud toward the front of the system. See Figure 3-14.

Figure 6-1. System Board Jumpers

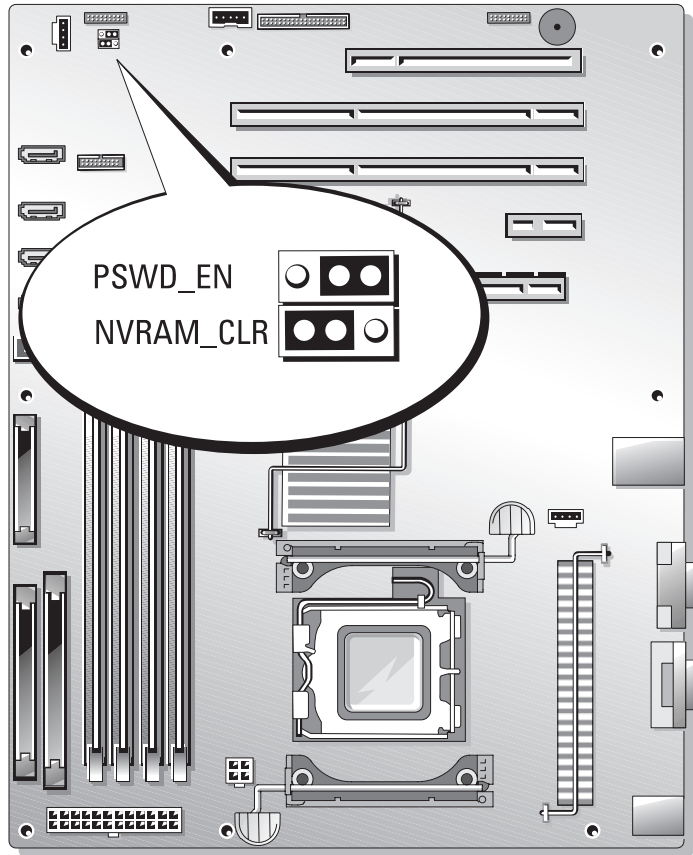








Table 6-1. System Board Jumper Settings

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

 jumpered  unjumpered

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

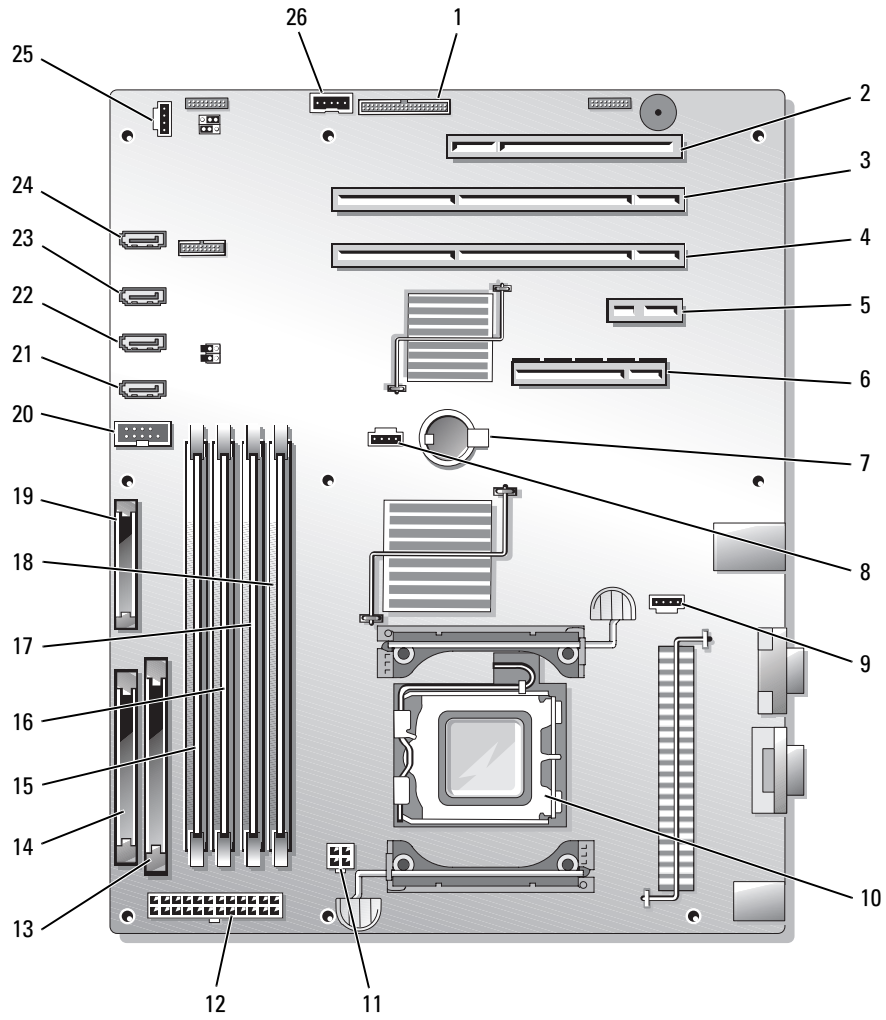


Table 6-2. System Board Connectors

Item	Connector	Description
1	RAC_CONN	Connector for the remote access controller (RAC)
2	SLOT_5	PCI 32-bit, 33-MHz (5-V) expansion slot connector
3	SLOT_4	PCI-X 64-bit, 133-MHz (3.3-V) expansion slot connector
4	SLOT_3	PCI-X 64-bit, 133-MHz (3.3-V) expansion slot connector
5	SLOT_2	PCI-Express (x1) expansion slot connector
6	SLOT_1	PCI-Express (x8) expansion slot connector
7	BATTERY	Connector for the 3.0-V coin battery
8	HD	Hard drive LED activity connector
9	BACK_FAN	Fan power connector
10	CPU	Processor connector
11	12V	Power connector
12	PWR_CONN	Power connector
13	IDE	IDE optical device connector
14	FDD	Diskette drive connector
15	DIMM2_B	Memory module connector
16	DIMM1_B	Memory module connector
17	DIMM2_A	Memory module connector
18	DIMM2_A	Memory module connector
19	FRONT_PANEL	Control panel connector
20	USB	USB 2.0-compliant connector
21	SATA_0	SATA connector
22	SATA_1	SATA connector
23	SATA_2	SATA connector
24	SATA_3	SATA connector
25	FRONT_FAN	Fan power connector
26	BP_I2C	Connector for the baseboard management controller (BMC) inter-IC (I2C) cable for the optional SCSI backplane

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 29. 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 the System" on page 43.
- 3 Remove the memory cooling shroud by lifting the release latch and sliding the shroud toward the front of the system. See **Figure 3-14**.
- 4 Remove the password jumper plug.
See **Figure 6-1** to locate the password jumper on the system board.
- 5 Replace the memory cooling shroud.
- 6 Close the system. See "Closing the System" on page 47.
- 7 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.

- 8 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 9 Open the system.
- 10 Remove the memory cooling shroud.
- 11 Reinstall the password jumper plug in its original position to enable the password protection feature.
- 12 Reinstall the memory cooling shroud.
- 13 Close the system, reconnect the system to the electrical outlet, and turn on the system.
- 14 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 29.

Getting Help

Obtaining Assistance

- 1 Complete the procedures in "Troubleshooting Your System" on page 91.
- 2 Run the system diagnostics and record any information provided.
- 3 Make a copy of the Diagnostics Checklist (see "Diagnostics Checklist" on page 125), and fill it out.
- 4 Use Dell's extensive suite of online services available at Dell Support at support.dell.com for help with installation and troubleshooting procedures.

For more information, see "Online Services" on page 121.

- 5 If the preceding steps have not resolved the problem, call Dell for technical assistance.

NOTE: Call technical support from a phone near or at the system so that technical support 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 technical support service, see "Support Service" on page 122 and "Before You Call" on page 124.

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 access Dell Support at support.dell.com. Select your region on the **WELCOME TO DELL SUPPORT** page, and fill in the requested details to access help tools and information.

You can contact Dell electronically using the following addresses:

- World Wide Web
www.dell.com/
www.dell.com/ap/ (Asian/Pacific countries only)
www.dell.com/jp/ (Japan only)
www.euro.dell.com (Europe only)

www.dell.com/la (Latin American countries)

www.dell.ca (Canada only)

- Anonymous file transfer protocol (FTP)

ftp.dell.com/

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

- Electronic Support Service

support@us.dell.com

apsupport@dell.com (Asian/Pacific countries only)

support.jp.dell.com (Japan only)

support.euro.dell.com (Europe only)

- Electronic Quote Service

apmarketing@dell.com (Asian/Pacific countries only)

sales_canada@dell.com (Canada only)

AutoTech Service

Dell's automated support service—AutoTech—provides recorded answers to the questions most frequently asked by Dell customers about their portable and desktop computer systems.

When you call AutoTech, use your touch-tone telephone to select the subjects that correspond to your questions.

The AutoTech service is available 24 hours a day, 7 days a week. You can also access this service through the support service. See the contact information for your region.

Automated Order-Status Service

To check on the status of any Dell™ products that you have ordered, you can go to 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. See the contact information for your region.

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 124 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 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 available when you call. See the contact information for your region.

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. For the telephone number to call to speak to a sales specialist, see the contact information for your region.

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, see the contact information for your region.

- 2 Include a copy of the invoice and a letter describing the reason for the return.
- 3 Include a copy of any diagnostic information, including the Diagnostics Checklist (see "Diagnostics Checklist" on page 125), indicating the tests you have run and any error messages reported by the system diagnostics.
- 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 our 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 125). If possible, turn on your system before you call Dell for technical 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 system itself. Ensure that the system documentation is available.



CAUTION: Before servicing any components inside your computer, see your *Product Information Guide* for important safety information.

Diagnostics Checklist

Name:

Date:

Address:

Phone number:

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

Express Service Code:

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

Operating system and version:

Peripherals:

Expansion cards:

Are you connected to a network? Yes No

Network, version, and network card:

Programs and versions:

See your operating system documentation to determine the contents of the system's start-up files. If possible, 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

To contact Dell electronically, you can access the following websites:

- www.dell.com
- support.dell.com (support)

For specific web addresses for your country, find the appropriate country section in the table below.



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



NOTE: In certain countries, support specific to Dell™ XPS™ computers is available at a separate telephone number listed for participating countries. If you do not see a telephone number listed that is specific for XPS computers, you may contact Dell through the support number listed and your call will be routed appropriately.

When you need to contact Dell, use the electronic addresses, telephone numbers, and codes provided in the following table. If you need assistance in determining which codes to use, contact a local or an international operator.



NOTE: The contact information provided 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	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Anguilla	Website: www.dell.com.ai E-mail: la-techsupport@dell.com Technical Support	toll-free: 800-335-0031
Antigua and Barbuda	Website: www.dell.com.ag E-mail: la-techsupport@dell.com Technical Support	1-800-805-5924
Aomen	Technical Support (Dell™ Dimension™, Dell Inspiron™, Dell OptiPlex™, Dell Latitude™, and Dell Precision™) Technical Support (servers and storage)	0800-105 0800-105

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Argentina (Buenos Aires) International Access Code: 00 Country Code: 54 City Code: 11	Website: www.dell.com.ar E-mail: la-techsupport@dell.com E-mail for desktop and portable computers: la-techsupport@dell.com E-mail for servers and EMC® storage products: la_enterprise@dell.com	Customer Care toll-free: 0-800-444-0730 Technical Support toll-free: 800-222-0154 Technical Support Services toll-free: 0-800-444-0724 Sales 0-810-444-3355
Aruba	Website: www.dell.com.aw E-mail: la-techsupport@dell.com Technical Support	toll-free: 800-1578
Australia (Sydney) International Access Code: 0011 Country Code: 61 City Code: 2	Website: support.ap.dell.com E-mail: support.ap.dell.com/contactus General Support	13DELL-133355
Austria International Access Code: 900	Website: support.euro.dell.com E-mail: tech_support_central_europe@dell.com	
	Home/Small Business Sales	0820 240 530 00
	Home/Small Business Fax	0820 240 530 49
	Home/Small Business Customer Care	0820 240 530 14
	Preferred Accounts/Corporate Customer Care	0820 240 530 16
	Support for XPS	0820 240 530 81
	Home/Small Business Support for all other Dell computers	0820 240 530 17
	Preferred Accounts/Corporate Support	0820 240 530 17
	Switchboard	0820 240 530 00
Bahamas	Website: www.dell.com.bs E-mail: la-techsupport@dell.com Technical Support	toll-free: 1-866-874-3038

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Barbados	Website: www.dell.com/bb E-mail: la-techsupport@dell.com Technical Support	1-800-534-3142
Belgium (Brussels) International Access Code: 00 Country Code: 32 City Code: 2	Website: support.euro.dell.com Tech Support for XPS Tech Support for all other Dell computers Tech Support Fax Customer Care Corporate Sales Fax Switchboard	02 481 92 96 02 481 92 88 02 481 92 95 02 713 15 65 02 481 91 00 02 481 92 99 02 481 91 00
Bermuda	Website: www.dell.com/bm E-mail: la-techsupport@dell.com Technical Support	toll-free: 1-877-890-0754
Bolivia	Website: www.dell.com/bo E-mail: la-techsupport@dell.com General Support	toll-free: 800-10-0238
Brazil International Access Code: 00 Country Code: 55 City Code: 51	Website: www.dell.com/br E-mail: BR-TechSupport@dell.com Customer Care and Tech Support Technical Support Fax Customer Care Fax Sales	0800 90 3355 51 2104 5470 51 2104 5480 0800 722 3498
British Virgin Islands	General Support	toll-free: 1-866-278-6820
Brunei Country Code: 673	Technical Support (Penang, Malaysia) Customer Care (Penang, Malaysia) Transaction Sales (Penang, Malaysia)	604 633 4966 604 633 4888 604 633 4955

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Canada (North York, Ontario)	Online Order Status: www.dell.ca/ostatus	
International Access Code: 011	AutoTech (automated Hardware and Warranty Support)	toll-free: 1-800-247-9362
	Customer Service (Home Sales/Small Business)	toll-free: 1-800-847-4096
	Customer Service (med./large business, government)	toll-free: 1-800-326-9463
	Customer Service (printers, projectors, televisions, handhelds, digital jukebox, and wireless)	toll-free: 1-800-847-4096
	Hardware Warranty Support (Home Sales/Small Business)	toll-free: 1-800-906-3355
	Hardware Warranty Support (med./large bus., government)	toll-free: 1-800-387-5757
	Hardware Warranty Support (printers, projectors, televisions, handhelds, digital jukebox, and wireless)	1-877-335-5767
	Sales (Home Sales/Small Business)	toll-free: 1-800-387-5752
	Sales (med./large bus., government)	toll-free: 1-800-387-5755
	Spare Parts Sales & Extended Service Sales	1 866 440 3355
Cayman Islands	E-mail: la-techsupport@dell.com	
	Technical Support	toll-free: 1-877-261-0242
Chile (Santiago)	Website: www.dell.com/cl	
Country Code: 56	E-mail: la-techsupport@dell.com	
City Code: 2	Sales and Customer Support	toll-free: 1230-020-4823
	Technical Support (CTC)	toll-free: 800730222
	Technical Support (ENTEL)	toll-free: 1230-020-3762

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
China (Xiamen) Country Code: 86 City Code: 592	Technical Support website: support.dell.com.cn Technical Support E-mail: cn_support@dell.com Customer Care E-mail: customer_cn@dell.com Technical Support Fax Technical Support (Dimension and Inspiron) Technical Support (OptiPlex, Latitude, and Dell Precision) Technical Support (servers and storage) Technical Support (projectors, PDAs, switches, routers, and so on) Technical Support (printers) Customer Care Customer Care Fax Home and Small Business Preferred Accounts Division Large Corporate Accounts GCP Large Corporate Accounts Key Accounts Large Corporate Accounts North Large Corporate Accounts North Government and Education Large Corporate Accounts East Large Corporate Accounts East Government and Education Large Corporate Accounts Queue Team Large Corporate Accounts South Large Corporate Accounts West Large Corporate Accounts Spare Parts	592 818 1350 toll-free: 800 858 2969 toll-free: 800 858 0950 toll-free: 800 858 0960 toll-free: 800 858 2920 toll-free: 800 858 2311 toll-free: 800 858 2060 592 818 1308 toll-free: 800 858 2222 toll-free: 800 858 2557 toll-free: 800 858 2055 toll-free: 800 858 2628 toll-free: 800 858 2999 toll-free: 800 858 2955 toll-free: 800 858 2020 toll-free: 800 858 2669 toll-free: 800 858 2572 toll-free: 800 858 2355 toll-free: 800 858 2811 toll-free: 800 858 2621
Colombia	Website: www.dell.com/cl E-mail: la-techsupport@dell.com Technical Support	toll-free: 1-800-915-5704

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Costa Rica	Website: www.dell.com/cr E-mail: la-techsupport@dell.com Technical Support	toll-free: 800-012-0232
Czech Republic (Prague) International Access Code: 00 Country Code: 420	Website: support.euro.dell.com E-mail: czech_dell@dell.com Technical Support Customer Care Fax Technical Fax Switchboard	22537 2727 22537 2707 22537 2714 22537 2728 22537 2711
Denmark (Copenhagen) International Access Code: 00 Country Code: 45	Website: support.euro.dell.com Technical Support for XPS Technical Support for all other Dell computers Customer Care (Relational) Home/Small Business Customer Care Switchboard (Relational) Switchboard Fax (Relational) Switchboard (Home/Small Business) Switchboard Fax (Home/Small Business)	7010 0074 7023 0182 7023 0184 3287 5505 3287 1200 3287 1201 3287 5000 3287 5001
Dominica	Website: www.dell.com/dm E-mail: la-techsupport@dell.com General Support	toll-free: 1-866-278-6821
Dominican Republic	Website: www.dell.com/do E-mail: la-techsupport@dell.com Technical Support	toll-free: 1-888-156-1834 or toll-free: 1-888-156-1584
Ecuador	Website: www.dell.com/ec E-mail: la-techsupport@dell.com General Support (calling from Quito) General Support (calling from Guayaquil)	toll-free: 999-119-877-655-3355 toll-free: 1800-999-119-877-655-3355

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
El Salvador	Website: www.dell.com/ec E-mail: la-techsupport@dell.com Technical Support (Telephonica)	toll-free: 8006170
Finland (Helsinki) International Access Code: 990 Country Code: 358 City Code: 9	Website: support.euro.dell.com E-mail: fi_support@dell.com Technical Support Customer Care Switchboard Sales under 500 employees Fax Sales over 500 employees Fax	0207 533 555 0207 533 538 0207 533 533 0207 533 540 0207 533 530 0207 533 533 0207 533 530
France (Paris) (Montpellier) International Access Code: 00 Country Code: 33 City Codes: (1) (4)	Website: support.euro.dell.com Home and Small Business Technical Support for XPS Technical Support for all other Dell computers Customer Care Switchboard Switchboard (calls from outside of France) Sales Fax Fax (calls from outside of France) Corporate Technical Support Customer Care Switchboard Sales Fax	0825 387 129 0825 387 270 0825 823 833 0825 004 700 04 99 75 40 00 0825 004 700 0825 004 701 04 99 75 40 01 0825 004 719 0825 338 339 01 55 94 71 00 01 55 94 71 00 01 55 94 71 01

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Germany (Frankfurt) International Access Code: 00 Country Code: 49 City Code: 69	Website: support.euro.dell.com E-mail: tech_support_central_europe@dell.com Technical Support for XPS Technical Support for all other Dell computers Home/Small Business Customer Care Global Segment Customer Care Preferred Accounts Customer Care Large Accounts Customer Care Public Accounts Customer Care Switchboard	069 9792 7222 069 9792-7200 0180-5-224400 069 9792-7320 069 9792-7320 069 9792-7320 069 9792-7320 069 9792-7000
Greece International Access Code: 00 Country Code: 30	Website: support.euro.dell.com Technical Support Gold Service Technical Support Switchboard Gold Service Switchboard Sales Fax	00800-44 14 95 18 00800-44 14 00 83 2108129810 2108129811 2108129800 2108129812
Grenada	E-mail: la-techsupport@dell.com General Support	toll-free: 1-866-540-3355
Guatemala	E-mail: la-techsupport@dell.com General Support	1-800-999-0136
Guyana	E-mail: la-techsupport@dell.com General Support	toll-free: 1-877-270-4609

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Hong Kong	Website: support.ap.dell.com	
International Access Code: 001	Technical Support E-mail: HK_support@Dell.com	
Country Code: 852	Technical Support (Dimension and Inspiron)	00852-2969 3188
	Technical Support (OptiPlex, Latitude, and Dell Precision)	00852-2969 3191
	Technical Support (servers and storage)	00852-2969 3196
	Technical Support (projectors, PDAs, switches, routers, and so on)	00852-3416 0906
	Customer Care	00852-3416 0910
	Large Corporate Accounts	00852-3416 0907
	Global Customer Programs	00852-3416 0908
	Medium Business Division	00852-3416 0912
	Home and Small Business Division	00852-2969 3105
India	E-mail: india_support_desktop@dell.com india_support_notebook@dell.com india_support_Server@dell.com	
	Technical Support	1600338045 and 1600448046
	Sales (Large Corporate Accounts)	1600 33 8044
	Sales (Home and Small Business)	1600 33 8046

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Ireland (Cherrywood) International Access Code: 00 Country Code: 353 City Code: 1	Website: support.euro.dell.com	
	E-mail: dell_direct_support@dell.com	
	Sales	
	Ireland Sales	01 204 4444
	Dell Outlet	1850 200 778
	Online Ordering HelpDesk	1850 200 778
	Customer Care	
	Home User Customer Care	01 204 4014
	Small Business Customer Care	01 204 4014
	Corporate Customer Care	1850 200 982
	Technical Support	
	Technical Support for XPS computers only	1850 200 722
	Technical Support for all other Dell computers	1850 543 543
	General	
	Fax/Sales Fax	01 204 0103
Switchboard	01 204 4444	
U.K. Customer Care (dial within U.K. only)	0870 906 0010	
Corporate Customer Care (dial within U.K. only)	0870 907 4499	
U.K. Sales (dial within U.K. only)	0870 907 4000	
Italy (Milan) International Access Code: 00 Country Code: 39 City Code: 02	Website: support.euro.dell.com	
	Home and Small Business	
	Technical Support	02 577 826 90
	Customer Care	02 696 821 14
	Fax	02 696 821 13
	Switchboard	02 696 821 12
	Corporate	
	Technical Support	02 577 826 90
	Customer Care	02 577 825 55
	Fax	02 575 035 30
	Switchboard	02 577 821

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Jamaica	E-mail: la-techsupport@dell.com Technical Support (dial from within Jamaica only)	toll-free: 1-800-326-6061 or toll-free: 1-800-975-1646
Japan (Kawasaki) International Access Code: 001 Country Code: 81 City Code: 44	Website: support.jp.dell.com Technical Support (servers) Technical Support outside of Japan (servers) Technical Support (Dimension and Inspiron) Technical Support outside of Japan (Dimension and Inspiron) Technical Support (Dell Precision, OptiPlex, and Latitude) Technical Support outside of Japan (Dell Precision, OptiPlex, and Latitude) Technical Support (PDAs, projectors, printers, routers) Technical Support outside of Japan (PDAs, projectors, printers, routers) Faxbox Service 24-Hour Automated Order Status Service Customer Care Business Sales Division (up to 400 employees) Preferred Accounts Division Sales (over 400 employees) Public Sales (government agencies, educational institutions, and medical institutions) Global Segment Japan Individual User Switchboard	toll-free: 0120-198-498 81-44-556-4162 toll-free: 0120-198-226 81-44-520-1435 toll-free: 0120-198-433 81-44-556-3894 toll-free: 0120-981-690 81-44-556-3468 044-556-3490 044-556-3801 044-556-4240 044-556-1465 044-556-3433 044-556-5963 044-556-3469 044-556-1760 044-556-4300

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Korea (Seoul) International Access Code: 001 Country Code: 82 City Code: 2	E-mail: krsupport@dell.com Support Support (Dimension, PDA, Electronics and Accessories) Sales Fax Switchboard	toll-free: 080-200-3800 toll-free: 080-200-3801 toll-free: 080-200-3600 2194-6202 2194-6000
Latin America	Customer Technical Support (Austin, Texas, U.S.A.) Customer Service (Austin, Texas, U.S.A.) Fax (Technical Support and Customer Service) (Austin, Texas, U.S.A.) Sales (Austin, Texas, U.S.A.) SalesFax (Austin, Texas, U.S.A.)	512 728-4093 512 728-3619 512 728-3883 512 728-4397 512 728-4600 or 512 728-3772
Luxembourg International Access Code: 00 Country Code: 352	Website: support.euro.dell.com Support Home/Small Business Sales Corporate Sales Customer Care Fax	342 08 08 075 +32 (0)2 713 15 96 26 25 77 81 +32 (0)2 481 91 19 26 25 77 82
Macao Country Code: 853	Technical Support Customer Service (Xiamen, China) Transaction Sales (Xiamen, China)	toll-free: 0800 105 34 160 910 29 693 115

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Malaysia (Penang)	Website: support.ap.dell.com	
International Access Code: 00	Technical Support (Dell Precision, OptiPlex, and Latitude)	toll-free: 1 800 880 193
Country Code: 60	Technical Support (Dimension, Inspiron, and Electronics and Accessories)	toll-free: 1 800 881 306
City Code: 4	Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault)	toll-free: 1800 881 386
	Customer Care	toll-free: 1800 881 306 (option 6)
	Transaction Sales	toll-free: 1 800 888 202
	Corporate Sales	toll-free: 1 800 888 213
Mexico	E-mail: la-techsupport@dell.com	
International Access Code: 00	Technical Support (TelMex)	toll-free: 1-866-563-4425
Country Code: 52	Sales	50-81-8800 or 01-800-888-3355
	Customer Service	001-877-384-8979 or 001-877-269-3383
	Main	50-81-8800 or 01-800-888-3355
Montserrat	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 1-866-278-6822
Netherlands Antilles	E-mail: la-techsupport@dell.com	
	General Support	001-800-882-1519

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Netherlands (Amsterdam)	Website: support.euro.dell.com	
International Access Code: 00	Technical Support for XPS	020 674 45 94
Country Code: 31	Technical Support for all other Dell computers	020 674 45 00
City Code: 20	Technical Support Fax	020 674 47 66
	Home/Small Business Customer Care	020 674 42 00
	Relational Customer Care	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
New Zealand	Website: support.ap.dell.com	
International Access Code: 00	E-mail: support.ap.dell.com/contactus	
Country Code: 64	General Support	0800 441 567
Nicaragua	E-mail: la-techsupport@dell.com	
	Technical Support	toll-free: 1-800-220-1378
Norway (Lysaker)	Website: support.euro.dell.com	
International Access Code: 00	Technical Support for XPS	815 35 043
Country Code: 47	Technical Support for all other Dell products	671 16882
	Relational Customer Care	671 17575
	Home/Small Business Customer Care	23162298
	Switchboard	671 16800
	Fax Switchboard	671 16865
Panama	E-mail: la-techsupport@dell.com	
	Technical Support	toll-free: 1-800-507-1385
	Technical Support (CLARACOM)	toll-free: 1-866-633-4097
Peru	E-mail: la-techsupport@dell.com	
	Technical Support	toll-free: 0800-50-869

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Poland (Warsaw)	Website: support.euro.dell.com	
International Access Code: 011	E-mail: pl_support_tech@dell.com	
Country Code: 48	Customer Service Phone	57 95 700
City Code: 22	Customer Care	57 95 999
	Sales	57 95 999
	Customer Service Fax	57 95 806
	Reception Desk Fax	57 95 998
	Switchboard	57 95 999
Portugal	Website: support.euro.dell.com	
International Access Code: 00	Technical Support	707200149
Country Code: 351	Customer Care	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	E-mail: la-techsupport@dell.com	
	Technical Support	toll-free: 1-866-390-4695
St. Kitts and Nevis	Website: www.dell.com/kn	
	E-mail: la-techsupport@dell.com	
	Technical Support	toll-free: 1-866-540-3355
St. Lucia	Website: www.dell.com/lc	
	E-mail: la-techsupport@dell.com	
	Technical Support	toll-free: 1-866-464-4352
St. Vincent and the Grenadines	Website: www.dell.com/vc	
	E-mail: la-techsupport@dell.com	
	Technical Support	toll-free: 1-866-464-4353

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Singapore (Singapore) International Access Code: 005 Country Code: 65	NOTE: The phone numbers in this section should be called from within Singapore or Malaysia only. Website: support.ap.dell.com Technical Support (Dimension, Inspiron, and Electronics and Accessories) Technical Support (OptiPlex, Latitude, and Dell Precision) Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault) Customer Care Transaction Sales Corporate Sales	toll-free: 1 800 394 7430 toll-free: 1 800 394 7488 toll-free: 1 800 394 7478 toll-free: 1 800 394 7430 (option 6) toll-free: 1 800 394 7412 toll-free: 1 800 394 7419
Slovakia (Prague) International Access Code: 00 Country Code: 421	Website: support.euro.dell.com E-mail: czech_dell@dell.com Technical Support Customer Care Fax Tech Fax Switchboard (Sales)	02 5441 5727 420 22537 2707 02 5441 8328 02 5441 8328 02 5441 7585
South Africa (Johannesburg) International Access Code: 09/091 Country Code: 27 City Code: 11	Website: support.euro.dell.com E-mail: dell_za_support@dell.com Gold Queue Technical Support Customer Care Sales Fax Switchboard	011 709 7713 011 709 7710 011 709 7707 011 709 7700 011 706 0495 011 709 7700
Southeast Asian and Pacific Countries	Technical Support, Customer Service, and Sales (Penang, Malaysia)	604 633 4810

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Spain (Madrid)	Website: support.euro.dell.com	
International Access Code: 00	Home and Small Business	
Country Code: 34	Technical Support	902 100 130
City Code: 91	Customer Care	902 118 540
	Sales	902 118 541
	Switchboard	902 118 541
	Fax	902 118 539
	Corporate	
	Technical Support	902 100 130
	Customer Care	902 115 236
	Switchboard	91 722 92 00
	Fax	91 722 95 83
Sweden (Upplands Vasby)	Website: support.euro.dell.com	
International Access Code: 00	Technical Support for XPS	0771 340 340
Country Code: 46	Technical Support for all other Dell products	08 590 05 199
City Code: 8	Relational Customer Care	08 590 05 642
	Home/Small Business Customer Care	08 587 70 527
	Employee Purchase Program (EPP) Support	020 140 14 44
	Technical Support Fax	08 590 05 594
	Sales	08 590 05 185
Switzerland (Geneva)	Website: support.euro.dell.com	
International Access Code: 00	E-mail: Tech_support_central_Europe@dell.com	
Country Code: 41	Technical Support for XPS	0848 33 88 57
City Code: 22	Technical Support (Home and Small Business) for all other Dell products	0844 811 411
	Technical Support (Corporate)	0844 822 844
	Customer Care (Home and Small Business)	0848 802 202
	Customer Care (Corporate)	0848 821 721
	Fax	022 799 01 90
	Switchboard	022 799 01 01

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Taiwan	Website: support.ap.dell.com	
International Access Code: 002	E-mail: ap_support@dell.com	
Country Code: 886	Technical Support (OptiPlex, Latitude, Inspiron, Dimension, and Electronics and Accessories)	toll-free: 0080 186 1011
	Technical Support (servers and storage)	toll-free: 0080 160 1256
	Customer Care	toll-free: 0080 160 1250 (option 5)
	Transaction Sales	toll-free: 0080 165 1228
	Corporate Sales	toll-free: 0080 165 1227
Thailand	Website: support.ap.dell.com	
International Access Code: 001	Technical Support (OptiPlex, Latitude, and Dell Precision)	toll-free: 1800 0060 07
Country Code: 66	Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault)	toll-free: 1800 0600 09
	Customer Care	toll-free: 1800 006 007 (option 7)
	Corporate Sales	toll-free: 1800 006 009
	Transaction Sales	toll-free: 1800 006 006
Trinidad/Tobago	Website: www.dell.com/tt	
	E-mail: la-techsupport@dell.com	
	Technical Support	toll-free: 1-888-799-5908
Turks and Caicos Islands	Website: www.dell.com/tc	
	E-mail: la-techsupport@dell.com	
	General Support	toll-free: 1-877-441-4735

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
U.K. (Bracknell) International Access Code: 00 Country Code: 44 City Code: 1344	Website: support.euro.dell.com E-mail: dell_direct_support@dell.com Customer Care website: support.euro.dell.com/uk/en/ECare/form/home.asp	
	Sales	
	Home and Small Business Sales	0870 907 4000
	Corporate/Public Sector Sales	01344 860 456
	Customer Care	
	Home and Small Business Customer Care	0870 906 0010
	Corporate Customer Care	01344 373 185
	Preferred Accounts (500–5000 employees)	0870 906 0010
	Global Accounts Customer Care	01344 373 186
	Central Government Customer Care	01344 373 193
	Local Government & Education Customer Care	01344 373 199
	Health Customer Care	01344 373 194
	Technical Support	
	Technical Support for XPS computers only	0870 366 4180
	Technical Support (Corporate/Preferred Accounts/PAD [1000+ employees])	0870 908 0500
	Technical Support for all other products	0870 353 0800
	General	
	Home and Small Business Fax	0870 907 4006
Uruguay	Website: www.dell.com/uy E-mail: la-techsupport@dell.com Technical Support	toll-free: 413-598-2522

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
U.S.A. (Austin, Texas)	Automated Order-Status Service	toll-free: 1-800-433-9014
International Access Code: 011	AutoTech (portable and desktop computers)	toll-free: 1-800-247-9362
Country Code: 1	Hardware and Warranty Support (Dell TV, Printers, and Projectors) for Relationship customers	toll-free: 1-877-459-7298
	Americas Consumer XPS Support	toll-free: 1-800-232-8544
	Consumer (Home and Home Office) Support for all other Dell products	toll-free: 1-800-624-9896
	Customer Service	toll-free: 1-800-624-9897
	Employee Purchase Program (EPP) Customers	toll-free: 1-800-695-8133
	Financial Services website: www.dellfinancialservices.com	
	Financial Services (lease/loans)	toll-free: 1-877-577-3355
	Financial Services (Dell Preferred Accounts [DPA])	toll-free: 1-800-283-2210
	Business	
	Customer Service and Support	toll-free: 1-800-456-3355
	Employee Purchase Program (EPP) Customers	toll-free: 1-800-695-8133
	Support for printers, projectors, PDAs, and MP3 players	toll-free: 1-877-459-7298
	Public (government, education, and healthcare)	
	Customer Service and Support	toll-free: 1-800-456-3355
	Employee Purchase Program (EPP) Customers	toll-free: 1-800-695-8133
	Dell Sales	toll-free: 1-800-289-3355 or toll-free: 1-800-879-3355
	Dell Outlet Store (Dell refurbished computers)	toll-free: 1-888-798-7561
	Software and Peripherals Sales	toll-free: 1-800-671-3355
	Spare Parts Sales	toll-free: 1-800-357-3355
	Extended Service and Warranty Sales	toll-free: 1-800-247-4618
	Fax	toll-free: 1-800-727-8320
	Dell Services for the Deaf, Hard-of-Hearing, or Speech-Impaired	toll-free: 1-877-DELLTY (1-877-335-5889)

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
U.S. Virgin Islands	E-mail: la-techsupport@dell.com Technical Support	toll-free: 1-877-702-4360
Venezuela	Website: www.dell.com/ve E-mail: la-techsupport@dell.com Technical Support	toll-free: 0800-100-2513

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>. 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.

COMn — 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**, 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>).

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 — A UNIX-like operating system that runs on a variety of hardware systems. Linux is open source software, which 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

Numbers

- 5.25-inch drives
 - installing, 50

A

- alert messages, 28
- asset tag, 33

B

- batteries
 - troubleshooting, 98
- battery
 - removing and replacing, 83
 - troubleshooting the RAID card battery, 107
- beep codes, 26
- bezel
 - installing, 47
- boot drive
 - configuring, 54
- boot sequence, 32

C

- cables
 - drive interface, 47
 - drive power, 48

- CD drive
 - troubleshooting, 102
- CD-ROM drive.
 - See *optical drive*
- checking equipment, 92
- configuring
 - boot drive, 54
- connecting external devices, 14
- connectors
 - system board, 118
- console redirection screen, 35
- contacting Dell, 126
- control panel assembly
 - installing, 87
- cooling fans
 - troubleshooting, 99
- cover
 - installing, 47
- CPU setup options, 33

D

- damaged systems
 - troubleshooting, 97
- Dell
 - contacting, 126
- Dell PowerEdge Diagnostics
 - using, 111

- diagnostics
 - advanced testing options, 113
 - running from the utility partition, 112
 - using Dell PowerEdge Diagnostics, 111
 - when to use, 112
- diagnostics messages, 28
- diskette drive
 - installing, 48
 - removing, 48
 - troubleshooting, 101
- drives
 - interface cables, 47
 - power cables, 48

E

- error messages, 29
- expansion card
 - troubleshooting, 108
- expansion cards, 71
 - installing, 72
 - removing, 73
- external devices
 - connecting, 14

F

- fans
 - back system, 67-68
 - front system, 66-67

fans (*continued*)
installing, 67-68
removing, 66-67

features
back-panel, 13
front-panel, 11

front-panel drive inserts
installing, 46
removing, 45

G
guidelines
hard-drive installation, 53
memory installation, 76

H
hard drive
troubleshooting, 104
hard drives (cabled)
installation guidelines, 53
installing, 55
removing, 54
hard drives (EasyExchange SCSI)
indicator codes, 17
installing non-hot-plug, 60
removing hot-plug, 64
removing non-hot-plug, 59
hard drives (SATA)
troubleshooting, 105
hard-drive activity
indicator, 12

I
indicators
back-panel, 13
EasyExchange SCSI, 17
front-panel, 11
hard-drive activity, 12
NIC, 14
installing, 83
5.25-inch drive, 50
back system fan, 68
bezel, 47
control panel assembly, 87
cover, 47
diskette drive, 48
expansion card, 72
front system fan, 67
front-panel drive inserts, 46
hard drive, 55
hard-drive guidelines, 53
memory, 76
memory guidelines, 76
processor, 79
SCSI backplane, 61
system board, 89

IRQs
avoiding conflicts, 92
configuring, 33
line assignments, 92

J
jumpers
about, 115

K
keyboards
troubleshooting, 93

M
memory
installation guidelines, 76
installing, 76
removing, 78
system, 76
troubleshooting, 100

messages
alert, 28
beep codes, 26
diagnostics, 28
EasyExchange SCSI indicator
codes, 17
error messages, 29
system, 18
warning, 28

microprocessor
troubleshooting, 109
mouse
troubleshooting, 93

N
NICs
indicators, 14
troubleshooting, 95

O
optical drive
installing, 50

- options
 - CPU setup, 33
 - integrated devices, 34
 - system security, 35
 - system setup, 30

P

- password
 - disabling, 120
- password features
 - setup, 37
 - system, 37
- passwords
 - setup, 39
 - system, 37
- phone numbers, 126

POST

- accessing system features, 10

- power supplies
 - troubleshooting, 98

- processor
 - removing, 79
 - upgrades, 78

R

- RAC card, 83

- recommended tools, 41

- removing
 - back system fan, 67
 - diskette drive, 48
 - expansion card, 73
 - front system fan, 66
 - front-panel drive inserts, 45

- removing (*continued*)
 - hard drive, 54
 - memory, 78
 - processor, 79
 - system board, 87

- removing and replacing
 - battery, 83

S

- safety, 91
- SAS controller daughter card
 - troubleshooting, 107
- SAS RAID controller
 - daughter card
 - troubleshooting, 107
- SCSI backplane
 - installing, 61
- securing your system, 38
- serial I/O device
 - troubleshooting, 94
- setup password
 - assigning, 39
 - changing, 40
 - using, 39
- setup password enabled
 - working with, 40
- setup password features, 37
- startup
 - accessing system features, 10
- support
 - contacting Dell, 126
- system
 - closing, 47

- system board
 - connectors, 118
 - installing, 89
 - removing, 87

- system cooling
 - troubleshooting, 99

- system features
 - accessing, 10

- system messages, 18

- system password
 - assigning, 37
 - changing, 39
 - deleting, 39
 - using, 37

- system password features, 37

- system security, 33

- system setup
 - entering, 29
 - options, 30
 - using, 29

- system setup screens
 - console redirection, 35
 - CPU information, 33
 - integrated devices, 34
 - main, 30
 - system security, 35

T

- tape drive
 - troubleshooting, 103

- telephone numbers, 126

- troubleshooting
 - battery, 98
 - CD drive, 102

troubleshooting (*continued*)

- cooling fans, 99
- damaged system, 97
- diskette drive, 101
- expansion card, 108
- external connections, 96
- hard drive, 104
- hard drives (SATA), 105
- keyboard, 93
- memory, 100
- microprocessor, 109
- mouse, 93
- NIC, 95
- power supplies, 98
- SAS RAID controller daughter card, 107
- serial I/O device, 94
- start-up routine, 91
- system cooling, 99
- tape drive, 103
- USB device, 95
- video, 92
- wet system, 96

U

- upgrades
 - processor, 78
- USB device
 - troubleshooting, 95
- using system setup, 29

V

- video
 - troubleshooting, 92

W

- warning messages, 28
- warranty, 9
- wet system
 - troubleshooting, 96