Dell™ PowerEdge™ T300 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.

Contents

1

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 system 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
- LCD status messages
- System messages
- Warning messages
- Diagnostics messages
- Alert messages

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

Other Information You May Need

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

- The *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 at **support.dell.com** and read the updates first because they often supercede 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 41).
<F10>	Opens the utility partition, allowing you to run the system diagnostics (see "Running the System Diagnostics" on page 163.
<F11>	Enters the boot mode selection screen, allowing you to choose a boot device.
<F12>	Starts PXE boot.
<Ctrl+E>	Enters the Baseboard Management Controller (BMC) Management Utility, which allows access to the system event log (SEL) and configuration of the Remote Access Controller (RAC) card. See the *BMC User's Guide* for more information on setup and use of BMC.
<Ctrl+C>	This keystroke enters the SAS Configuration Utility. See your SAS controller *User's Guide* for more information.
<Ctrl+R>	If you have the optional battery-cached SAS RAID controller, this keystroke enters the RAID configuration utility. For more information, see the documentation for your SAS controller card.

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

Keystroke	Description
\<Ctrl+S\>	If you have PXE support enabled through the System Setup Program (see "Integrated Devices Screen" on page 48), this keystroke allows you to configure NIC settings for PXE boot. For more information, see the documentation for your integrated NIC.

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
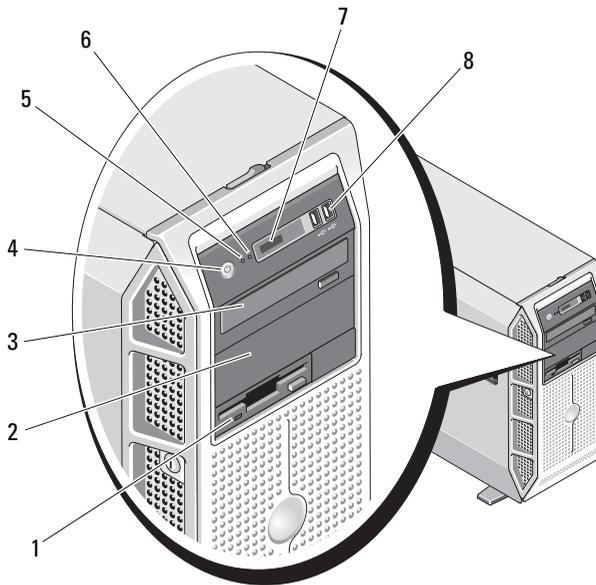
Table 1-2. Front-Panel Components

Item	Component	Icon	Description
1	3.5-inch drive bay		Holds an optional diskette drive.
2	lower 5.25-inch drive bay		Holds an optional optical drive or tape backup unit.
3	upper 5.25-inch drive bay		Holds an optical drive.
4	power button	⏻	The power button controls the DC power supply output to the system. **NOTE:** If you turn off the system using the power button and the system is running an ACPI-compliant operating system, the system performs a graceful shutdown before the power is turned off. If the system is not running an ACPI-compliant operating system, the power is turned off immediately after the power button is pressed.
5	NMI button	⊗	Used to troubleshoot software and device driver errors when using certain operating systems. This button can be pressed using the end of a paper clip. Use this button only if directed to do so by qualified support personnel or by the operating system's documentation.
6	System identification button	🛈	The identification buttons on the front and back panels can be used to locate a particular system within a rack. When one of these buttons is pushed, the LCD panel on the front and the blue system status indicator on the back blink until one of the buttons is pushed again.

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

Item	Component	Icon	Description
7	LCD panel		Provides system ID, status information, and system error messages.
			The LCD lights blue during normal system operation. Both the system management software and the identification buttons located on the front and back of the system can cause the LCD to flash blue to identify a particular system.
			The LCD lights amber when the system needs attention, and the LCD panel displays an error code followed by descriptive text.
			NOTE: If the system is connected to AC power and an error has been detected, the LCD lights amber regardless of whether the system has been powered on.
8	USB connectors (2)		Connects USB 2.0-compliant devices to the system.

Back-Panel Features and Indicators

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

Figure 1-2.   Back-Panel Features and Indicators
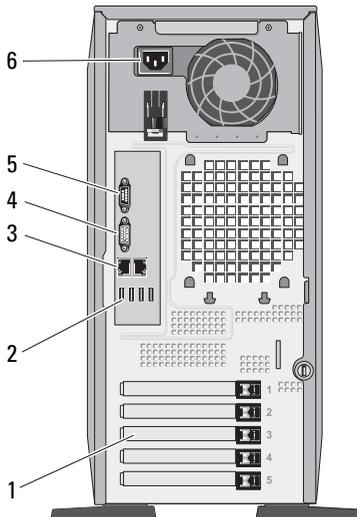
1	expansion card slots (5)	2	USB connectors (4)
3	NIC connectors (2)	4	video connector
5	serial connector	6	power connector(s)

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 41 for information about enabling, disabling, and configuring I/O ports and connectors.

Power Indicator Codes

The power button on the front panel controls the power to the system from the system's power supplies. The power indicator lights green when the system is on.

The indicators on the redundant power supplies show whether power is present or whether a power fault has occurred (see Figure 1-3). Table 1-3 lists the power supply indicator codes.

Table 1-3.   Redundant Power Supply Indicators

Indicator	Function
Power supply status	Green indicates that the power supply is operational and providing DC power to the system.
Power supply fault	Amber indicates a problem with the power supply.
AC line status	Green indicates that a valid AC source is connected to the power supply and is operational.

Figure 1-3.   Redundant Power Supply Indicators
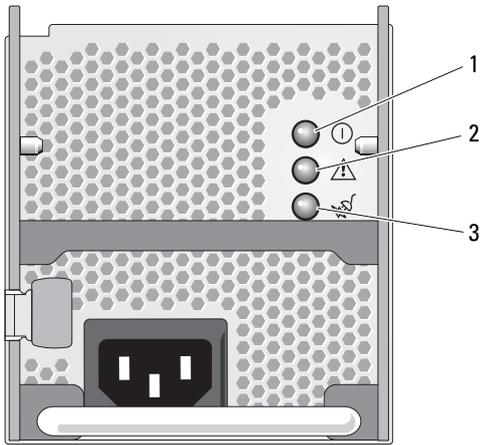
1	power supply status (DC out is operational)	2	power supply fault
3	AC line status (AC in is operational)		

NIC Indicator Codes

Each NIC on the back panel has an indicator that provides information on network activity and link status (see Figure 1-4). For a list of NIC indicator codes, see Table 1-4.

Figure 1-4.   NIC Indicators
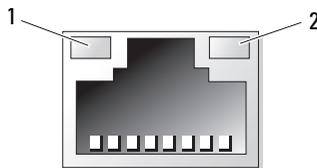
1	link indicator	2	activity indicator

Table 1-4. NIC Indicator Codes

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

LCD Status Messages

The system's control panel LCD provides status messages to signify when the system is operating correctly or when the system needs attention.

The LCD lights blue to indicate a normal operating condition, and lights amber to indicate an error condition. The LCD scrolls a message that includes a status code followed by descriptive text. Table 1-5 lists the LCD status messages that can occur and the probable cause for each message. The LCD messages refer to events recorded in the System Event Log (SEL). For information on the SEL and configuring system management settings, see the systems management software documentation.

⚠️ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

📝 **NOTE:** If your system fails to boot, press the System ID button for at least five seconds until an error code appears on the LCD. Record the code, then see "Getting Help" on page 175.

Table 1-5. LCD Status Messages

Code	Text	Causes	Corrective Actions
N/A	*SYSTEM NAME*	A 62-character string that can be defined by the user in the System Setup program. The *SYSTEM NAME* displays under the following conditions: • The system is powered on. • The power is off and active errors are displayed.	This message is for information only. You can change the system ID and name in the System Setup program (see "Entering the System Setup Program" on page 41).
E1000	FAILSAFE, Call Support	Check the system event log for critical failure events.	See "Getting Help" on page 175.
E1114	Temp Ambient	Ambient system temperature is out of acceptable range.	See "Troubleshooting System Cooling Problems" on page 145.
E1115	Temp Planar	Planar system temperature is out of acceptable range.	See "Troubleshooting System Cooling Problems" on page 145.
E1118	CPU Temp Interface	The BMC is unable to determine the CPU(s) temperature status. Consequently, the BMC increases the CPU fan speed to maximum as a precautionary measure.	Turn off power to the system and restart the system. If the problem persists, see "Getting Help" on page 175.
E1210	CMOS Batt	CMOS battery is missing, or the voltage is out of acceptable range.	See "Troubleshooting the System Battery" on page 143.
E1211	ROMB Batt	RAID battery is either missing, bad, or unable to recharge due to thermal issues.	Reseat the RAID battery connector. If the problem persists, replace the battery.
E12*nn*	## PwrGd	Specified voltage regulator has failed.	See "Getting Help" on page 175.

Table 1-5. LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
E1226	PCI Rsr 1.5V PwrGd	1.5V Riser Card Power Good failure.	See "Getting Help" on page 175.
E1229	CPU # VCORE	Processor # VCORE voltage regulator has failed.	See "Getting Help" on page 175.
E122A	CPU VTT PwrGd	Processor # VTT voltage has exceeded the allowable voltage range	See "Getting Help" on page 175.
E1310	RPM Fan ##	RPM of specified cooling fan is out of acceptable operating range.	See "Troubleshooting System Cooling Problems" on page 145.
E1311	FAN MOD ## RPM	RPM of specified cooling fan module is out of acceptable operating range.	See "Troubleshooting System Cooling Problems" on page 145.
E1313	Fan Redundancy	One or more cooling fans has failed. Cooling fan redundancy has been lost.	See "Troubleshooting System Cooling Problems" on page 145.
E1410	CPU # IERR	Specified microprocessor is reporting an internal error.	See your system's *Information Update* tech sheet located on **support.dell.com** for the most current system information. If the problem persists, see "Getting Help" on page 175.

Table 1-5.   LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
E1414	CPU # Thermtrip	Specified microprocessor is out of acceptable temperature range and has halted operation.	See "Troubleshooting System Cooling Problems" on page 145. If the problem persists, ensure that the microprocessor heat sinks are properly installed (see "Troubleshooting the Microprocessor" on page 161). **NOTE:** The LCD continues to display this message until the system's power cord is disconnected and reconnected to the AC power source, or the SEL is cleared using either Server Assistant or the BMC Management Utility. See the *Dell OpenManage™ Baseboard Management Controller User's Guide* for information about these utilities.
E1418	CPU # Presence	Specified processor is missing or bad, and the system is in an unsupported configuration.	See "Troubleshooting the Microprocessor" on page 161.
E141C	CPU Mismatch	Processors are in an unsupported configuration.	Ensure that your processors match and conform to the type described in the Microprocessor Technical Specifications outlined in your system's *Getting Started Guide*.

Table 1-5. LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
E141F	CPU Protocol	The system BIOS has reported a processor protocol error.	See "Getting Help" on page 175.
E1420	CPU Bus PERR	The system BIOS has reported a processor bus parity error.	See "Getting Help" on page 175.
E1421	CPU Init	The system BIOS has reported a processor initialization error.	See "Getting Help" on page 175.
E1422	CPU Machine Chk	The system BIOS has reported a machine check error.	See "Getting Help" on page 175.
E1610	PS # Missing	No power is available from the specified power supply; specified power supply is improperly installed or faulty.	See "Troubleshooting Redundant Power Supplies" on page 143.
E1614	PS # Status	No power is available from the specified power supply; specified power supply is improperly installed or faulty.	See "Troubleshooting Redundant Power Supplies" on page 143.
E1618	PS # Predictive	Power supply voltage is out of acceptable range; specified power supply is improperly installed or faulty.	See "Troubleshooting Redundant Power Supplies" on page 143.
E161C	PS # Input Lost	Power source for specified power supply is unavailable, or out of acceptable range.	Check the AC power source for the specified power supply. If the problem persists, see "Troubleshooting Redundant Power Supplies" on page 143.

Table 1-5. LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
E1624	PS Redundancy	The power supply subsystem is no longer redundant. If the last supply fails, the system will go down.	See "Troubleshooting Redundant Power Supplies" on page 143.
E1710	I/O Channel Chk	The system BIOS has reported an I/O channel check.	See "Getting Help" on page 175.
E1711	PCI PERR B## D## F##	The system BIOS has reported a PCI parity error on a component that resides in PCI configuration space at bus ##, device ##, function ##.	Remove and reseat the PCIe expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 159. If troubleshooting does not resolve the problem, see "Getting Help" on page 175.
	PCI PERR Slot #	The system BIOS has reported a PCI parity error on a component that resides in the specified PCIe slot.	
E1712	PCI SERR B## D## F##	The system BIOS has reported a PCI system error on a component that resides in PCI configuration space at bus ##, device ##, function ##.	Remove and reseat the PCIe expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 159. If troubleshooting does not resolve the problem, see "Getting Help" on page 175.
	PCI SERR Slot #	The system BIOS has reported a PCI system error on a component that resides in the specified slot.	
E1714	Unknown Err	The system BIOS has determined that there has been an error in the system, but is unable to determine its origin.	See "Getting Help" on page 175.

Table 1-5.   LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
E171F	PCIE Fatal Err B## D## F##	The system BIOS has reported a PCIe fatal error on a component that resides in PCIe configuration space at bus ##, device ##, function ##.	Remove and reseat the PCIe expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 159. If troubleshooting does not resolve the problem, see "Getting Help" on page 175.
	PCIE Fatal Err Slot #	The system BIOS has reported a PCIe fatal error on a component that resides in the specified slot.	
E1810	HDD ## Fault	The SAS subsystem has determined that hard drive ## has experienced a fault.	See "Troubleshooting a Hard Drive" on page 153.
E1811	HDD ## Rbld Abrt	Specified hard drive has ended rebuild before completion.	See "Troubleshooting a Hard Drive" on page 153.
E1812	HDD ## Removed	The specified hard drive has been removed from the system.	Information only.
E1913	CPU & Firmware Mismatch	The BMC firmware does not support the CPU.	Update to the latest BMC firmware. See the *BMC User's Guide* for more information on setup and use of BMC.
E1A14	SAS Cable A	SAS cable A is missing or bad.	Reseat the cable. If the problem persists, replace the cable.
E1A15	SAS Cable B	SAS cable B is missing or bad.	Reseat the cable. If the problem persists, replace the cable.
E1A15	SAS Cable C	SAS cable C is missing or bad.	Reseat the cable. If the problem persists, replace the cable.

Table 1-5.   LCD Status Messages _(continued)_

Code	Text	Causes	Corrective Actions
E1A18	PDB Ctrl Cable	Control cable for the power distribution board (PDB) is missing or bad	Reseat the cable. If the problem persists, replace the cable.
E2010	No Memory	No memory is installed in the system.	Install memory. See "System Memory" on page 111.
E2011	Mem Config Err	Memory detected, but is not configurable. Error detected during memory configuration.	See "Troubleshooting System Memory" on page 146.
E2012	Unusable Memory	Memory is configured, but not usable. Memory subsystem failure.	See "Troubleshooting System Memory" on page 146.
E2013	Shadow BIOS Fail	The system BIOS failed to copy its flash image into memory.	See "Troubleshooting System Memory" on page 146.
E2014	CMOS Fail	CMOS failure. CMOS RAM not functioning properly.	See "Getting Help" on page 175.
E2015	DMA Controller	DMA controller failure.	See "Getting Help" on page 175.
E2016	Int Controller	Interrupt controller failure.	See "Getting Help" on page 175.
E2017	Timer Fail	Timer refresh failure.	See "Getting Help" on page 175.
E2018	Prog Timer	Programmable interval timer error.	See "Getting Help" on page 175.
E2019	Parity Error	Parity error.	See "Getting Help" on page 175.
E201A	SIO Err	SIO failure.	See "Getting Help" on page 175.
E201B	Kybd Controller	Keyboard controller failure.	See "Getting Help" on page 175.

Table 1-5.   LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
E201C	SMI Init	System management interrupt (SMI) initialization failure.	See "Getting Help" on page 175.
E201D	Shutdown Test	BIOS shutdown test failure.	See "Getting Help" on page 175.
E201E	POST Mem Test	BIOS POST memory test failure.	See "Troubleshooting System Memory" on page 146. If the problem persists, see "Getting Help" on page 175.
E201F	DRAC Config	Remote Access Controller (RAC) configuration failure.	Check screen for specific error messages. Ensure that RAC cables and connectors are properly seated. If problem persists, see your RAC documentation.
E2020	CPU Config	CPU configuration failure.	Check screen for specific error messages.
E2021	Memory Population	Incorrect memory configuration. Memory population order incorrect.	Check screen for specific error messages (see "Troubleshooting System Memory" on page 146).
E2022	POST Fail	General failure after video.	Check screen for specific error messages.
E2110	MBE DIMM # & #	One of the DIMMs in the set implicated by "# & #" has had a memory multi-bit error (MBE).	See "Troubleshooting System Memory" on page 146.

Table 1-5.   LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
E2111	SBE Log Disable DIMM #	The system BIOS has disabled memory single-bit error (SBE) logging, and will not resume logging further SBEs until the system is rebooted. "#" represents the DIMM implicated by the BIOS.	See "Troubleshooting System Memory" on page 146.
E2112	Mem Spare DIMM #	The system BIOS has spared the memory because it has determined that the memory had too many errors. "#" represents the DIMM implicated by the BIOS.	See "Troubleshooting System Memory" on page 146.
I1910	Intrusion	System cover has been removed.	Information only.
I1911	>3 ERRs Chk Log	LCD overflow message. A maximum of three error messages can display sequentially on the LCD. The fourth message displays as the standard overflow message.	Check the SEL for details on the events.
I1912	SEL Full	System Event Log is full of events, and is unable to log any more events.	Clear the log by deleting event entries.
I1915	Video Off (LCD lights with a blue or amber background.)	The video has been turned off by the RAC remote user.	Information only.

Table 1-5. LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
I1916	`Video Off in ##` (LCD lights with a blue or amber background.)	The video will be turned off in *xx* seconds by the RAC remote user.	Information only.
W1228	`ROMB Batt < 24hr`	Warns predictively that the RAID battery has less than 24 hours of charge left.	Replace RAID battery (see "Installing a SAS Controller Card" on page 98).

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 177.

Solving Problems Described by LCD Status Messages

The code and text on the LCD can often specify a very precise fault condition that is easily corrected. For example, if the code E1418   CPU_1_Presence appears, you know that a microprocessor is not installed in socket 1.

In contrast, you might be able to determine the problem if multiple related errors occur. For example, if you receive a series of messages indicating multiple voltage faults, you might determine that the problem is a failing power supply.

Removing LCD Status Messages

For faults associated with sensors, such as temperature, voltage, fans, and so on, the LCD message is automatically removed when that sensor returns to a normal state. For example, if temperature for a component goes out of range, the LCD displays the fault; when the temperature returns to the acceptable range, the message is removed from the LCD. For other faults, you must take action to remove the message from the display:

- Clear the SEL — You can perform this task remotely, but you will lose the event history for the system.

- Power cycle — Turn off the system and disconnect it from the electrical outlet; wait approximately ten seconds, reconnect the power cable, and restart the system.

Any of these actions will remove fault messages, and return the status indicators and LCD colors to the normal state. Messages will reappear under the following conditions:

- The sensor returns to a normal state but fails again, resulting in a new SEL entry.
- The system is reset and new error events are detected.
- A failure is recorded from another source that maps to the same display entry.

System Messages

System messages appear on the screen to notify you of a possible problem with the system. Table 1-3 lists the system messages that can occur and the probable cause and corrective action for each message.

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

✎ **NOTE:** If you receive a system message that is not listed in Table 1-3, 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
`Alert! DIMM1_A and DIMM1_B must be populated with a matched set of DIMMs if more than one DIMM is present.  The following memory DIMMs have been disabled:`	If more than one DIMM is present, DIMMs must be installed in matching pairs.	Check other system messages for additional information for possible causes. For memory configuration information, see "Memory Module Installation Guidelines" on page 111. If the problem persists, see "Troubleshooting System Memory" on page 146.
`Alert! Unsupported memory, incomplete sets, or unmatched sets. The following memory is disabled:`	Unsupported DIMMs, mismatched DIMMs, or unmatched DIMMs have been detected. If more than one DIMM is present, DIMMs must be installed in matching pairs.	For memory configuration information, see "Memory Module Installation Guidelines" on page 111. If the problem persists, see "Troubleshooting System Memory" on page 146.
`Attempting to update Remote Configuration. Please wait...`	Remote Configuration request has been detected and is being processed.	Wait until the process is complete.
`BIOS Update Attempt Failed!`	Remote BIOS update attempt failed.	Retry the BIOS update. If the problem persists, see "Getting Help" on page 175.
`Caution! NVRAM_CLR jumper is installed on system board.`	NVRAM_CLR jumper is installed. CMOS has been cleared.	Remove the NVRAM_CLR jumper. See Figure 6-1 for jumper location.
`Decreasing available memory`	Faulty or improperly installed memory modules.	See "Troubleshooting System Memory" on page 146.

Table 1-6. System Messages *(continued)*

Message	Causes	Corrective Actions
`Diskette drive 0 seek failure.`	Faulty or improperly inserted diskette, incorrect configuration settings in the System Setup program, or loose diskette/tape drive interface cable, or loose power cable. Replace the diskette.	See "Troubleshooting a Diskette Drive" on page 149.
`Diskette read failure.`	Faulty diskette, faulty or improperly connected diskette/tape drive interface cable, or loose power cable.	See "Troubleshooting a Diskette Drive" on page 149.
`Diskette subsystem reset failed.`	Faulty diskette/tape drive controller.	See "Troubleshooting a Diskette Drive" on page 149.
`Drive not ready.`	Diskette missing from or improperly inserted in diskette drive.	Insert or replace the diskette.
`Error: Remote Access Controller initialization failure`	The Remote Access Controller failed to initialize.	Ensure that the Remote Access Controller is properly installed (see "Installing a RAC Card" on page 104).
`Error 8602 – Auxiliary Device Failure` `Verify that mouse and keyboard are securely attached to correct connectors.`	The mouse cable connector is loose or improperly connected, or the mouse is defective.	Ensure that the mouse cable is properly connected to the system. If the problem persists, try another mouse.

Table 1-6. System Messages *(continued)*

Message	Causes	Corrective Actions
`Fatal Error caused a system reset:` `Please check the system event log for details`	A fatal system error occurred and caused the system to reboot.	Check the SEL for information that was logged during the error. See the applicable troubleshooting section in "Troubleshooting Your System" on page 133 for any faulty components specified in the SEL.
`Gate A20 failure`	Faulty keyboard controller; faulty system board.	See "Getting Help" on page 175.
`General failure`	The operating system is unable to carry out the command.	This message is usually followed by specific information. Note the information, and take the appropriate action to resolve the problem.
`Keyboard Controller failure`	Faulty keyboard controller; faulty system board	See "Getting Help" on page 175.
`Keyboard data line failure` `Keyboard stuck key failure`	Keyboard cable connector is loose or improperly connected, defective keyboard, or defective keyboard/mouse controller	Check the keyboard connection to the system. If the problem persists, try another keyboard.
`Manufacturing mode detected`	System is in manufacturing mode.	Reboot to take the system out of manufacturing mode.

Table 1-6. System Messages *(continued)*

Message	Causes	Corrective Actions

`Memory address line failure at address, read value expecting value`
 	
`Memory double word logic failure at address, read value expecting value`
 	
`Memory odd/even logic failure at address, read value expecting value`
 	
`Memory write/read failure at address, read value expecting value`
	Faulty or improperly installed memory modules.	See "Troubleshooting System Memory" on page 146.

`Memory tests terminated by keystroke`	POST memory test terminated by pressing the spacebar.	Information only.
`No boot device available`	Faulty or missing optical drive subsystem, hard drive, or hard-drive subsystem, or no bootable USB key installed.	Use a bootable USB key, CD, or hard drive. If the problem persists, see "Troubleshooting an Internal USB Memory Key" on page 148 and "Troubleshooting a Hard Drive" on page 153. See "Using the System Setup Program" on page 41 for information on setting the order of boot devices.

Table 1-6. System Messages *(continued)*

Message	Causes	Corrective Actions
`No boot sector on hard drive`	Incorrect configuration settings in System Setup program, or no operating system on hard drive.	Check the hard-drive configuration settings in the System Setup program (see "Using the System Setup Program" on page 41). If necessary, install the operating system on your hard drive (see your operating system documentation).
`No timer tick interrupt`	Faulty system board.	See ""Getting Help" on page 175."
`Not a boot diskette`	No operating system on diskette.	Replace with a bootable diskette.
`PCI BIOS failed to install`	PCIe device BIOS (Option ROM) checksum failure detected during shadowing. A cable to an expansion card is unseated; an expansion card is faulty or improperly installed.	Reseat the expansion card(s) and expansion card cables. If the problem persists, see "Troubleshooting Expansion Cards" on page 159.
`PCIe Fatal Error caused a system reset: Slot n` `Embedded Bus#nn/Dev#nn/Func n` `Please check the system event log for details`	Faulty or improperly installed PCIe card in the specified slot.	Reseat the PCIe card in the specified slot number (see "Installing an Expansion Card" on page 95). If the problem persists, see "Getting Help" on page 175.

Table 1-6. System Messages (continued)

Message	Causes	Corrective Actions
`Plug & Play Configuration Error`	Error encountered in initializing PCIe device; faulty system board.	Install the NVRAM_CLR jumper and reboot the system. See Figure 6-1 for jumper location. If the problem persists, see "Troubleshooting Expansion Cards" on page 159.

`Read fault`
 	
`Requested sector not found`
	The operating system cannot read from the hard drive or USB device, the system could not find a particular sector on the disk, or the requested sector is defective.	Replace the USB medium or device. Ensure that the USB or hard drive cables are properly connected. See "Troubleshooting a USB Device" on page 138, or "Troubleshooting a Hard Drive" on page 153 for the appropriate drive(s) installed in your system.

`Remote configuration update attempt failed`	System unable to process Remote Configuration request.	Retry Remote Configuration.
`ROM bad checksum = address`	Expansion card improperly installed or faulty.	Reseat the expansion card(s) and expansion card cables. If the problem persists, see "Troubleshooting Expansion Cards" on page 159.
`SATA PORT n drive not found`	SATA port x was turned on in setup, but a drive was not found.	See "Troubleshooting a Hard Drive" on page 153 for the appropriate drive(s) installed in your system.

`Sector not found`
 	
`Seek error`
 	
`Seek operation failed`
	Faulty hard drive, USB device, or USB medium.	See "Troubleshooting a USB Device" on page 138 or "Troubleshooting a Hard Drive" on page 153 for the appropriate drive(s) installed in your system.

Table 1-6. System Messages *(continued)*

Message	Causes	Corrective Actions
`Shutdown failure`	Shutdown test failure.	See "Troubleshooting System Memory" on page 146.
`The amount of system memory has changed`	Memory has been added or removed or a memory module may be faulty.	If memory has been added or removed, this message is informative and can be ignored. If memory has not been added or removed, check the SEL to determine if single-bit or multi-bit errors were detected and replace the faulty memory module (see "Troubleshooting System Memory" on page 146).
`Time-of-day clock stopped`	Faulty battery or faulty chip.	See "Troubleshooting the System Battery" on page 143.
`Time-of-day not set - please run SETUP program`	Incorrect time or date settings; faulty system battery.	Check the time and date settings (see "Using the System Setup Program" on page 41). If the problem persists, replace the system battery (see "System Battery" on page 119).
`Timer chip counter 2 failed`	Faulty system board.	See "Getting Help" on page 175.
`TPM configuration operation honored`		Information only. System will now restart.
`TPM failure`	A Trusted Platform Module (TPM) function has failed.	See "Getting Help" on page 175.

Table 1-6. System Messages *(continued)*

Message	Causes	Corrective Actions
TPM operation is pending. Press I to Ignore or M to Modify to allow this change and reset the system. WARNING: Modifying could prevent security.	Configuration change has been requested.	Press **I** to continue system boot. Press **M** to modify the TPM setting and restart.
Unexpected interrupt in protected mode	DIMMs are improperly seated or the keyboard/mouse controller chip has failed.	Reseat the DIMMs. See "Troubleshooting System Memory" on page 146. If the problem persists, see "Getting Help" on page 175.
Unsupported DIMM detected in the RAID DIMM slot!	DIMM installed in RAID DIMM slot is not supported.	See "Troubleshooting System Memory" on page 146. If the problem persists, see "Getting Help" on page 175.
Unsupported RAID key detected.	The RAID key installed in the system is not supported on this system.	Information only.
Utility partition not available	The <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: A fatal error has caused system reset! Please check the system event log!	A fatal system error occurred and caused the system to reboot.	Check the SEL for information that was logged during the error. See the applicable troubleshooting section in "Troubleshooting Your System" on page 133 for any faulty components specified in the SEL.
Warning! No micro code update loaded for processor *n*	A microcode update failed.	Update the BIOS firmware. If the problem persists, see "Getting Help" on page 175.

Table 1-6. System Messages *(continued)*

Message	Causes	Corrective Actions
`Warning! Detected missing RAID hardware for the embedded RAID subsystem.`	RAID key or RAID DIMM missing when system is in RAID mode.	Information only.
`Warning! Detected mode change from SCSI to RAID on channel x of the embedded RAID subsystem.`	The embedded RAID subsystem configuration has changed in System Setup.	See "Using the System Setup Program" on page 42.
`Warning! Detected mode change from RAID to SCSI on channel n of the embedded RAID subsystem.`	The embedded RAID subsystem configuration has changed in System Setup.	See "Using the System Setup Program" on page 42.
`Warning! Embedded RAID firmware is not present.`	The embedded RAID firmware does not respond.	See "Using the System Setup Program" on page 42.
`Warning! Embedded RAID error!`	The embedded RAID firmware responds with an error.	See "Using the System Setup Program" on page 42.
`Warning: The installed memory configuration is not optimal. For more information on valid memory configurations, please see the system documentation on support.dell.com`	Invalid memory configuration. The system will run but at a reduced functionality.	Ensure that the memory modules are installed in a valid configuration (see "Memory Module Installation Guidelines" on page 111). If the problem persists, see "Troubleshooting System Memory" on page 146.

Table 1-6.   System Messages *(continued)*

Message	Causes	Corrective Actions

`Write fault`
 	
`Write fault on`
`selected drive`
	Faulty USB device, USB medium, optical drive assembly, hard drive, or hard-drive subsystem.	See "Troubleshooting a USB Device" on page 138, "Troubleshooting an Internal USB Memory Key" on page 148, or "Troubleshooting a Hard Drive" on page 153.

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 177.

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 hard drive, a message will warn you that you may lose all data on the hard drive. 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

The system diagnostic utilities produce messages from diagnostic tests run on your system. See "Running the System Diagnostics" on page 163 for more information about system diagnostics.

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.

2

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 30 for an explanation of the message and suggestions for correcting errors.

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

Using the System Setup Program

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

Table 2-1. System Setup Program Navigation Keys

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

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

System Setup Options

Main Screen

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

Figure 2-1.   Main System Setup Program Screen

```
        Dell  Inc.  (www.dell.com)    PowerEdge T300
                    BIOS Version: XXX

 Service Tag : XXXXXX                 Asset Tag : XXXXXX


  System Time  ............................ 01:12:45
  System Date ............................. Fri Nov 30, 2007

  Memory Information  ..................... <ENTER>
  CPU Information  ........................ <ENTER>

  SATA Configuration ..................... <ENTER>

  Boot Sequence .......................... <ENTER>
  Hard-Disk Drive Sequence................ <ENTER>
  USB Flash Drive Emulation Type.......... <ENTER>
  Boot Sequence Retry .................... Disabled

  Integrated Devices  .................... <ENTER>
  PCI IRQ Assignment  .................... <ENTER>

  Serial Communication ................... <ENTER>
  Embedded Server Management ............. <ENTER>

  System Security  ....................... <ENTER>

  Keyboard Numlock  .........................On
  Report Keyboard Errors ...................Report
```

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	Sets the time on the system's internal clock.
System Date	Sets the date on the system's internal calendar.
Memory Information	Displays a screen to view memory information and to configure certain memory features (see Table 2-3).
CPU Information	Displays information related to the microprocessor (speed, cache size, and so on) (see Table 2-4).
SATA Configuration	Enables or disables a Serial Advanced Technology Attachment (SATA) device (such as hard drive, CD drive, or DVD drive) (see "SATA Configuration Screen" on page 47).
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. If you have installed a RAC, additional options such as virtual diskette and virtual CD-ROM may be present. **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.
Boot Sequence Retry (**Disabled** default)	Enables or disables the Boot Sequence Retry feature. When set to **Enabled**, the system re-attempts the boot sequence after a 30-second timeout if the previous boot attempt failed.
Integrated Devices	Displays a screen to configure the system's integrated devices.

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.
Serial Communication	Displays a screen to configure serial communication, external serial connector, fail-safe baud rate, remote terminal type, and redirection after boot.
Embedded Server Management	Displays a screen to configure the front-panel LCD options and to set a user-defined LCD string.
System Security	Displays a screen to configure the system password and setup password features (see Table 2-8). For further information, see "Using the System Password" on page 53 and "Using the Setup Password" on page 56.
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.

Memory Information Screen

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

Table 2-3. Memory Information Screen

Option	Description
System Memory Size	Displays the amount of system memory.
System Memory Type	Displays the type of system memory.
System Memory Speed	Displays the system memory speed.
Video Memory	Displays the amount of video memory.

Table 2-3. Memory Information Screen *(continued)*

Option	Description
System Memory Testing	Specifies whether system memory tests are run at system boot. Options are **Enabled** and **Disabled**.

CPU Information Screen

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

Table 2-4. CPU Information Screen

Option	Description
64-bit	Specifies if the installed processor supports 64-bit extensions.
Core Speed	Displays the clock speed of the processor.
Bus Speed	Displays the bus speed of the processor.
Virtualization Technology (**Disabled** default)	**NOTE:** Disable this feature if your system will not be running virtualization software.
	Displays when the processor supports 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 2-4. CPU Information Screen *(continued)*

Option	Description
Demand-Based Power Management (**Enabled** default)	**NOTE:** Check your operating system documentation to verify if the operating system supports this feature.
	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 X ID	Displays the family, model, and stepping of the specified processor.

SATA Configuration Screen

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

Table 2-5. SATA Configuration Screen

Option	Description
Port A (**Auto** default)	Displays the model number, drive type, and size of the device attached to Port A. When set to **Auto** (default), the port is enabled if devices are attached to the port.
Port B (**Off** default)	Displays the model number, drive type, and size of the device attached to Port B. When set to **Auto**, the port is enabled if devices are attached to the port.
Port C (**Off** default)	Displays the model number, drive type, and size of the device attached to Port C. When set to **Auto**, the port is enabled if devices are attached to the port.
Port D (**Off** default)	Displays the model number, drive type, and size of the device attached to Port D. When set to **Auto**, the port is enabled if devices are attached to the port.
Port E (**Off** default)	Displays the model number, drive type, and size of the device attached to Port E. When set to **Auto**, the port is enabled if devices are attached to the port.

Table 2-5. SATA Configuration Screen *(continued)*

Option	Description
Port F (**Off** default)	Displays the model number, drive type, and size of the device attached to Port F. When set to **Auto**, the port is enabled if devices are attached to the port.

Integrated Devices Screen

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

Table 2-6. Integrated Devices Screen Options

Option	Description
Diskette Controller (**Auto** default)	Enables or disables the integrated diskette drive controller.
User Accessible USB Ports (**All Ports On** default)	Enables or disables the system's user accessible USB ports. Options are **All Ports On**, **Only Back Ports On**, and **All Ports Off**.
Internal USB Port (**On** default)	Enables or disables the system's internal USB port.
Embedded Gb NIC*x* (NIC1 default: **Enabled with PXE**; Other NICs: **Enabled**)	Enables or disables the system's integrated NIC. Options are **Enabled**, **Enabled with PXE**, **Enabled with iSCSI Boot**, 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.
OS Watchdog Timer (**Disabled** default)	**NOTE:** This feature is usable only with operating systems that support WDAT implementations of the Advanced Configuration and Power Interface (ACPI) 3.0b specification. Sets a timer that monitors the operating system for activity and aids in recovery if the system stops responding. When this field is set to **Enabled**, the operating system is allowed to initialize the timer. When set to **Disabled**, the timer is not initialized.

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

Option	Description
I/OAT DMA Engine (**Disabled** default)	Enables the I/O Acceleration Technology (I/OAT) option. This feature should be enabled only if the hardware and software support I/OAT. The I/OAT Data Memory Tranfer (DMA) Engine transfers data between memory modules, allowing data to bypass the CPU. I/OAT will be supported on the NICs.
System Interrupt Assignment (Standard)	Controls the interrupt assignment of PCI devices in the system. When set to distributed, the interrupt routing will be swizzled to minimize IRQ sharing.

Serial Communication Screen

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

Table 2-7.   Serial Communication Screen Options

Option	Description
Serial Communication (**On without Console Redirection** default)	Options are **On without Console Redirection**, **On with Console Redirection via COM1**, **On with Console Redirection via COM2**, and **Off**.
External Serial Connector (**COM1** default)	Specifies whether **COM1**, **COM2**, or **Remote Access Device** has access to the external serial connector for serial communications.
Failsafe Baud Rate (**115200** default)	Displays the failsafe baud rate used for console redirection when the baud rate cannot be negotiated automatically with the remote terminal. This rate should not be adjusted.
Remote Terminal Type (**VT 100/VT 220** default)	Select either **VT 100/VT 220** or **ANSI**.
Redirection After Boot (**Enabled** default)	Enables or disables BIOS console redirection after your system boots to the operating system.

System Security Screen

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

NOTE: Systems shipping in China are not equipped with TPM. Disregard any TPM options listed in the System Security Screen.

Table 2-8.   System Security Screen Options

Option	Description
System Password	Displays the current status of your system's password security feature and allows you to assign and verify a new system password. **NOTE:** See "Using the System Password" on page 53 for instructions on assigning a system password and using or changing an existing system password.
Setup Password	Restricts access to the System Setup program in the same way that you restrict access to your system using the system password feature. **NOTE:** See "Using the Setup Password" on page 56 for instructions on assigning a setup password and using or changing an existing setup password.
Password Status	Setting the **Setup Password** option to **Enabled** prevents the system password from being changed or disabled at system start-up. To *lock* 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>. To *unlock* 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.

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

Option	Description
TPM Security (**Off** default)	**NOTE:** The TPM Security feature is not available in China.
	Sets the reporting of the Trusted Platform Module (TPM) in the system.
	NOTE: The TPM can be used by security applications, and it is capable of generating and storing keys and storing passwords and digital certificates. See support.dell.com for additional documentation on TPM technology.
	When set to **Off** (default), presence of the TPM is not reported to the operating system.
	When set to **On with Pre-boot Measurements**, the system reports the TPM to the operating system and stores the pre-boot measurements (compliant with Trusted Computing Group standards) to the TPM during POST.
	When set to **On without Pre-boot Measurements**, the system reports the TPM to the operating system and bypasses pre-boot measurements.
TPM Activation	Changes the operational state of the TPM.
	When set to **Activate**, the TPM is enabled and activated at default settings.
	When set to **Deactivate**, the TPM is disabled and deactivated.
	The **No Change** state initiates no action. The operational state of the TPM remains unchanged (all user settings for the TPM are preserved).
	NOTE: This field is read-only when **TPM Security** is set to **Off**.

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

Option	Description
TPM Clear (**No** default)	⊘ **NOTICE:** Clearing the TPM will cause loss of all encryption keys in the TPM. This option will prevent booting to the operating system and will result in loss of data if the encryption keys cannot be restored. Be sure to back up the TPM keys prior to enabling this option. When set to **Yes**, all the contents of the TPM are cleared. **NOTE:** This field is read-only when **TPM Security** is set to **Off**.
Power Button (**Enabled** default)	Turns system's power off and on. On an ACPI-compliant operating system, the system performs an orderly shutdown before power is turned off. The button is enabled in the System Setup program. When disabled, the button can only turn on system power. **NOTE:** You can still turn on the system by using the power button, even if the **Power Button** option is set to **Disabled**.
NMI Button (**Disabled** default)	⊘ **NOTICE:** Use the NMI button only if directed to do so by qualified support personnel or by the operating system's documentation. Pressing this button halts the operating system and displays a diagnostic screen. Sets the NMI feature **On** or **Off**.
AC Power Recovery (**Last** default)	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.

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 55). 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 173.

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 56), the system accepts your setup password as an alternate system password.

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

To leave the password security enabled:

1 Turn on or reboot your system by pressing <Ctrl><Alt><Del>.

2 Type your password and press <Enter>.

To disable the password security:

1 Turn on or reboot your system by pressing <Ctrl><Alt><Del>.

2 Type your password and press <Ctrl><Enter>.

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

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

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

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

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

Deleting or Changing an Existing System Password

1 When prompted, press <Ctrl><Enter> to disable the existing system password.

If you are asked to enter your setup password, contact your network administrator.

2 Enter the System Setup program by pressing <F2> during POST.

3 Select the **System Security** screen field to verify that the **Password Status** option is set to **Unlocked**.

4 When prompted, type the system password.

5 Confirm that **Not Enabled** is displayed for the **System Password** option.

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

Using the Setup Password

Assigning a Setup Password

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

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

You can use up to 32 characters in your password.

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

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

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

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

Operating With a Setup Password Enabled

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

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

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

Deleting or Changing an Existing Setup Password

1   Enter the System Setup program and select the **System Security** option.

2   Highlight the **Setup Password** option, press <Enter> to access the setup password window, and press <Enter> twice to clear the existing setup password.

    The setting changes to **Not Enabled**.

3   If you want to assign a new setup password, perform the steps in "Assigning a Setup Password" on page 56.

Disabling a Forgotten Password

See "Disabling a Forgotten Password" on page 173.

Baseboard Management Controller Configuration

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

• Uses the system's integrated NIC

• Enables fault logging and SNMP alerting

• Provides access to system event log and sensor status

• Allows control of system functions including power on and off

- Functions independently of the system's power state or the system's operating system
- Provides text console redirection for system setup, text-based utilities, and operating system consoles

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

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

Entering the BMC Setup Module

1 Turn on or restart your system.

2 Press <Ctrl-E> when prompted after POST.

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

BMC Setup Module Options

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

3

Installing System Components

This section describes how to install the following system components:

- Front bezel
- System cover
- EMI fillers
- Processor airflow shroud
- Power supplies and power distribution board
- Hard drives
- Diskette drive
- Optical and tape drives
- Expansion cards
- SAS controller card
- RAID battery
- RAC card
- Internal USB memory key connector
- System fan and expansion card fan
- Memory
- Processor
- System battery
- Chassis intrusion switch
- power supply distribution module
- SAS backplane
- Control panel
- System board

Recommended Tools

The procedures in this section may require one or more of the following tools:

- Small Phillips screwdriver
- Small flat-blade screwdriver
- Wrist grounding strap

Inside the System

Figure 3-1 shows the system cover removed to provide an interior view of the system.

Figure 3-1.   Inside View of the System
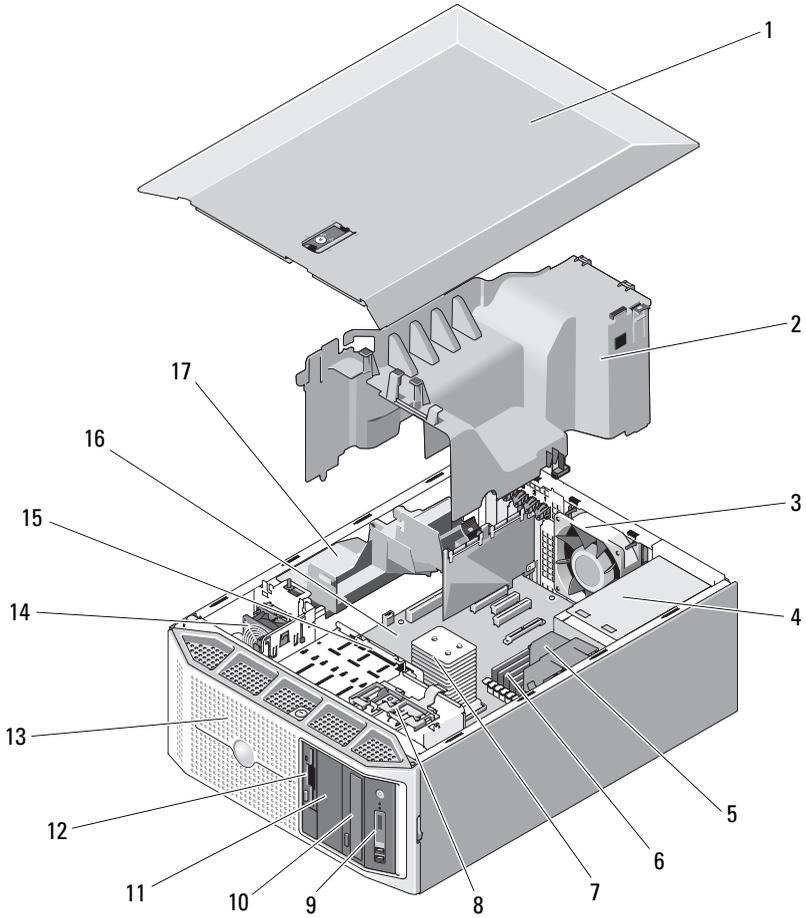
1	system cover	2	processor airflow shroud
3	system fan	4	power supplies
5	power distribution board shroud	6	system memory modules (6)
7	processor and heat sink	8	drive release latch
9	control panel	10	optical drive

11	5.25-inch drive bay	12	diskette drive
13	front bezel	14	expansion card fan
15	3.5-inch hard drive bays (4)	16	system board
17	expansion-card cover		

The system board in your system supports a single processor, five expansion cards, and six memory modules. Internal hard drive bays offer space for four SAS or SATA hard drives, cabled or hot-pluggable.

NOTE: A controller expansion card is required for SAS hard drives.

The drive bays in the front of your system provide space for an optical drive, an optional tape drive or second optical drive, an optional diskette drive, and up to four hot-pluggable hard drives.

Power is supplied to the system board and internal peripherals through a pair of redundant power supplies or a single non-redundant power supply.

Front Bezel

The front bezel covers the front of the system. In order to remove or install any devices in the front drive bays, the front bezel must first be removed.

NOTE: If you are removing or installing a hot-pluggable hard drive, the system may remain turned on and in the upright position during removal of the front bezel (see "Diskette Drive (Optional)" on page 84). If you are removing or installing any other system component(s), the system should be turned off and placed in the orientation shown in Figure 3-1.

Removing the Front Bezel

1 Using the system key, unlock the front bezel (if locked).

Figure 3-2. Locking and Unlocking the System
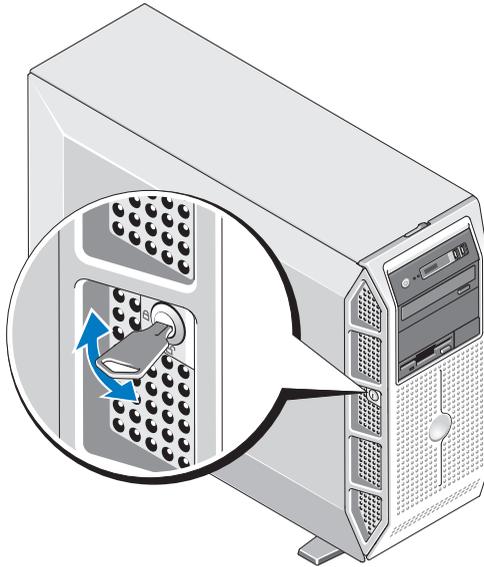
2 Slide the bezel release latch to the right (away from the power button) then rotate the top of the bezel away from the chassis.

3 Lift the bezel up and away from the system, removing the tabs from the bezel tab slots.

Figure 3-3.   Removing and Installing the Front Bezel
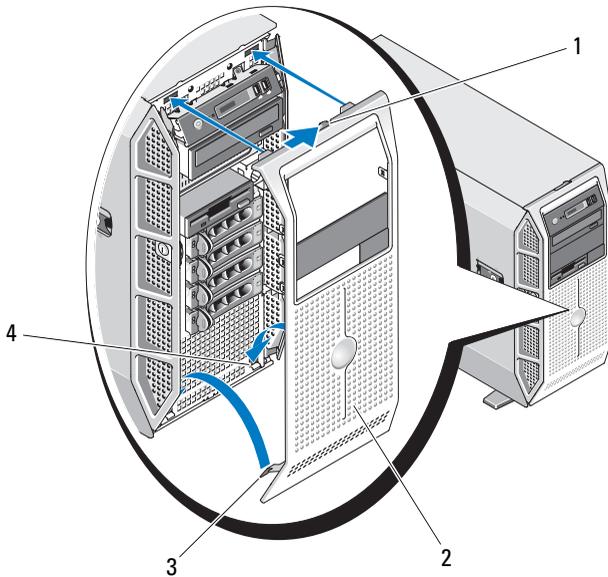
| 1 | lever | 2 | front bezel |
| 3 | tabs (2) | 4 | bezel tab slots (2) |

Installing the Front Bezel

1 Insert the tabs on the front bezel into the bezel tab slots on the system (see Figure 3-3).

2 Rotate the top of the bezel towards the chassis until the bezel locks into place (see Figure 3-3).

3 Using the system key, lock the bezel (see Figure 3-2).

Front Bezel Inserts

Removing a Front Bezel Insert

NOTE: Before installing a drive in one or more of the front drive bays, first remove the corresponding insert(s) on the front bezel.

NOTE: Bezel inserts may contain screws on the inside. You can attach the screws to new drives, as needed.

1   Remove the front bezel (see "Removing the Front Bezel" on page 63).

2   Press inward on one of the insert tabs, then pull the insert away from the bezel from the back of the bezel. See Figure 3-4.

Figure 3-4.   Removing and Installing the Front Bezel Insert
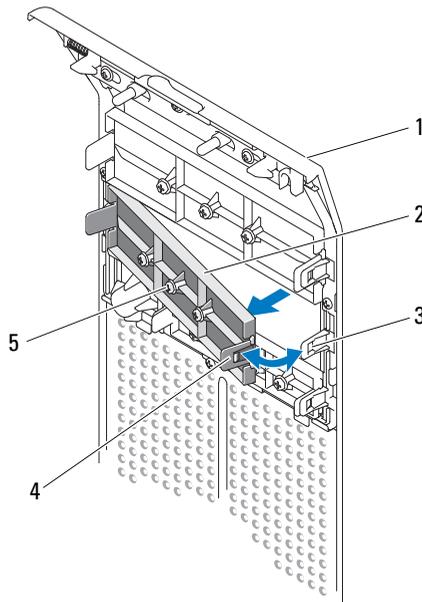
1	front bezel	2	front bezel insert
3	tab notch	4	insert tab
5	screws		

Installing a Front Bezel Insert

📝 **NOTE:** If you remove a drive from one or more of the front drive bays, replace the corresponding insert(s) on the front bezel.

1 From the back of the front bezel, align one of the insert tabs with the corresponding notch on the bezel, then press the insert into the bezel until the opposite tab snaps into place (see Figure 3-4).

2 Replace the front bezel (see "Installing the Front Bezel" on page 64).

System Cover

Removing the System Cover

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Ensure that your work surface is flat and clean to prevent the system cover from being scratched.

2 Turn off the system and all attached peripherals.

3 Disconnect the system from the electrical outlet, then disconnect all peripherals from the system.

4 Press the power button to ground the system board.

5 Rotate the system feet inward into the *closed* position (see Figure 3-5).

6 Lay the system on a flat surface with the system cover facing up (see Figure 3-5).

7 Using a small flat-blade screwdriver, turn the release latch lock on the cover release latch counterclockwise to the unlocked position (see Figure 3-5).

8 Lift the cover release latch, then rotate the latch towards the back of the system to release the cover (see Figure 3-5).

9 Grasp the cover on both sides and carefully lift the cover away from the system.

Figure 3-5. Removing and Installing the System Cover
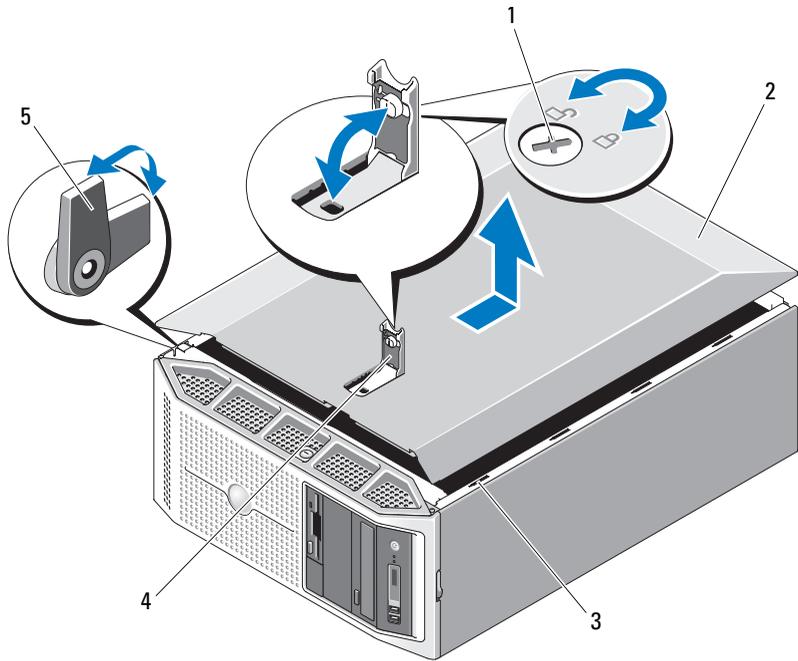
1	cover release latch lock	2	system cover
3	hook slot	4	cover release latch
5	foot (4)		

Installing the System Cover

1   Ensure that all internal cables are connected and folded out of the way.

2   Ensure that no tools or extra parts are left inside the system.

3   Ensure that the cover release latch is in the up (open) position.

4   Align the metal hooks on the cover with the hook slots on the system chassis, then lower the cover until the cover is flush with the system (see Figure 3-5).

5   Rotate the cover release latch towards the front of the system, then press the latch into place to secure the cover.

6 Using a small flat-blade screwdriver, turn the release latch lock on the cover release latch clockwise to the locked position (see Figure 3-5).

7 Rotate the system feet outward into the open position (see Figure 3-5) and return the system to the upright position.

8 Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

9 Turn on the system and attached peripherals.

EMI Fillers

Depending on the configuration of your system, an EMI filler may be installed in one or more of the 5.25-inch optical drive bays or the 3.5-inch diskette drive bay at the front of the system. EMI fillers are essential for airflow efficiency and for electromagnetic interference (EMI) protection.

To install an optical drive or optional diskette drive, the corresponding EMI filler must first be removed.

Removing an EMI Filler

1 Remove the front bezel (see "Removing the Front Bezel" on page 63).

2 Squeeze the tabs on the EMI filler, then pull the EMI filler out of the chassis.

Figure 3-6.   Removing and Installing a Blank Drive EMI Filler
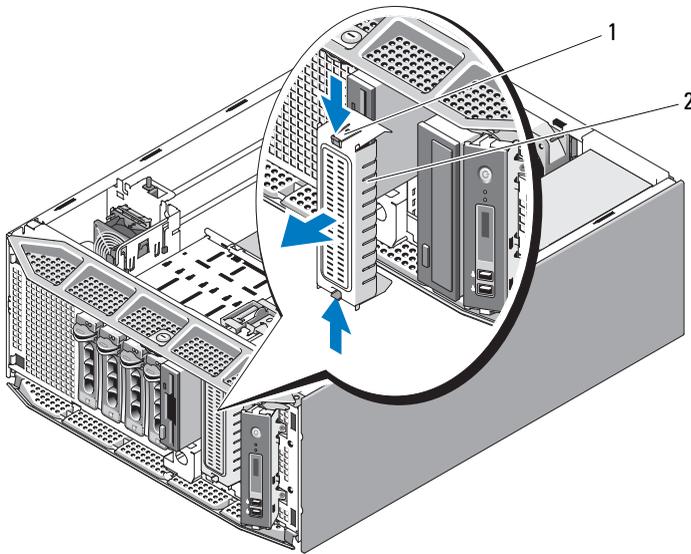
| 1 | tabs (2) | 2 | EMI filler |

Installing an EMI Filler

NOTE: If you remove a drive from one or more of the 5.25-inch optical drive bays or the 3.5-inch diskette drive bay at the front of the system, replace the drive with an EMI filler.

  1 Push the EMI filler into the empty 5.25-inch or 3.5-inch drive bay on the front of the chassis until the filler tabs lock into place (see Figure 3-6).

  2 Replace the front bezel (see "Installing the Front Bezel" on page 64).

Processor Airflow Shroud

The processor airflow shroud directs airflow over the system processor and memory modules.

NOTICE: Never operate your system with the processor airflow shroud removed. Overheating of the system can develop quickly, resulting in shutdown of the system and loss of data.

Removing the Processor Airflow Shroud

⚠️ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Remove the system cover (see "Removing the System Cover" on page 66).

2 Press the release tab on the expansion card cover and pivot the cover open.

   📝 **NOTE:** You can remove the expansion card cover, if desired, and set it aside.

Figure 3-7. Opening and Closing the Expansion Card Cover
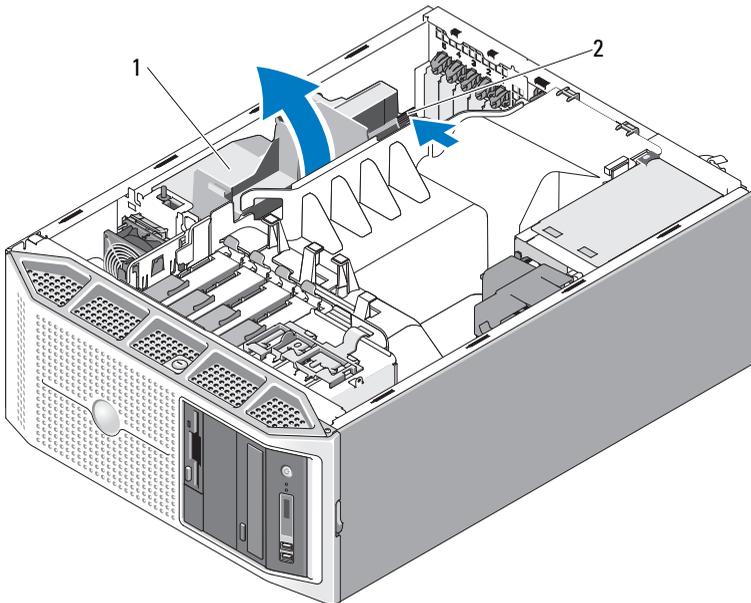
| 1 | expansion card cover | 2 | release tab |

3 Remove the cable(s) from the cable guides and fold the SATA cable(s) away from the processor airflow shroud.

4 If present, remove the cable from the cable guides and fold the SAS cable away from the processor airflow shroud.

5 Press the release tabs on the airflow shroud, then lift the shroud up and out of the chassis.

Figure 3-8. Removing and Installing the Processor Shroud
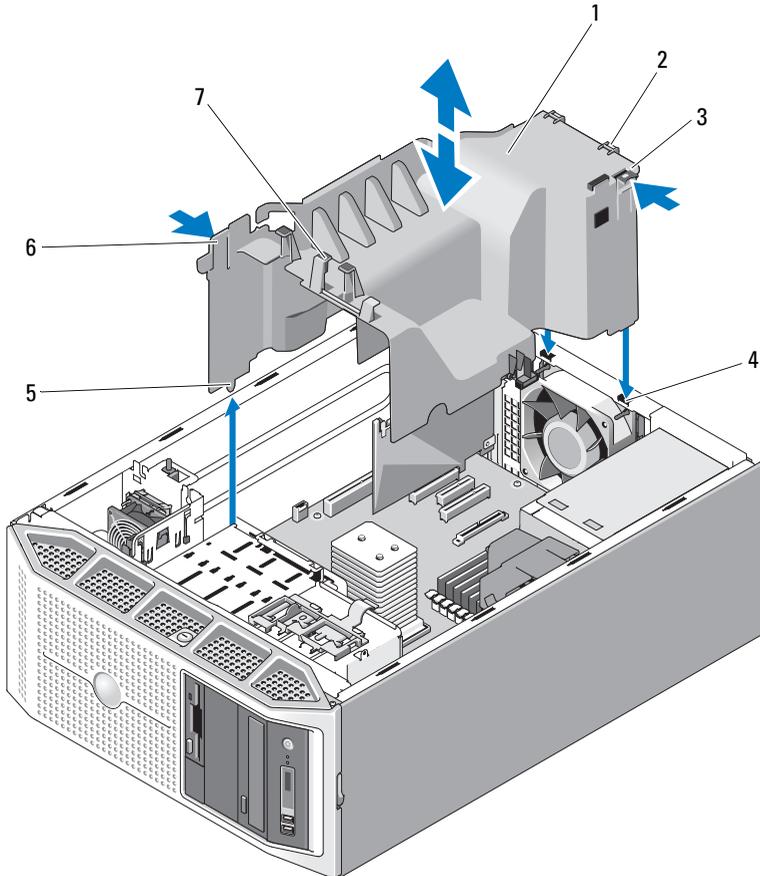
1	processor airflow shroud	2	alignment tabs (2)
3	release tab	4	tab slots (2)

| 5 | alignment guide | 6 | release tab |
| 7 | cable guides (4) | | |

Installing the Processor Airflow Shroud

◑ **NOTICE:** Ensure that all SATA/SAS cables are folded out of the way and that all power cables are properly routed before installing the processor airflow shroud.

1 Align the tabs on the processor airflow shroud with the tab slots on the chassis, then carefully lower the shroud into the chassis until the release tabs lock into place. Ensure that the alignment guide is seated in the corresponding hole in the chassis and that no cables are pinned under the bottom edges of the shroud (see Figure 3-8).

2 Route SATA cable(s) under and through the cable guides on the shroud.

3 Route the SAS cable, if applicable, under and through the cable guides on the shroud.

4 Reinstall the expansion card cover, if removed, and pivot the expansion card cover down until the cover snaps into place (see Figure 3-7).

5 Replace the system cover (see "Installing the System Cover" on page 67).

Redundant and Non-Redundant Power Supplies

Depending on your configuration, your system supports up to two hot-pluggable redundant 528-W power supplies or a single non-redundant 490-W power supply.

In redundant mode, the system distributes the power load across both power supplies to maximize efficiency. The second power supply provides power redundancy; thus, when a power supply is removed with the system powered on, the full power load is carried by the remaining power supply.

For information on removing and installing redundant power supplies, see "Removing a Redundant Power Supply" on page 73 or "Installing a Redundant Power Supply" on page 75. For information on removing and installing a non-redundant power supply, see "Removing a Non-redundant Power Supply" on page 75 or "Installing a Non-Redundant Power Supply" on page 77.

Removing a Redundant Power Supply

⊘ **NOTICE:** The system requires one power supply to operate the system normally. On power-redundant systems, remove and replace only one power supply at a time in a system that is powered on.

⊘ **NOTICE:** If you are replacing a redundant power supply while your system is on, ensure that both the power supply status and the AC line status LEDs are green before removing the power supply (see Figure 1-3). If one or both of the LEDs are not green, see "Troubleshooting Redundant Power Supplies" on page 143.

1   Disconnect the power cable from the electrical outlet.

2   Disconnect the power cable from the power supply and remove the power cable from the cable retention bracket.

3   Press the locking tab in toward the center of the power supply, then lift power supply handle to release the power supply from the chassis.

4   Using the power supply handle, pull the power supply straight out of the chassis.

Figure 3-9.   Removing and Installing a Redundant Power Supply
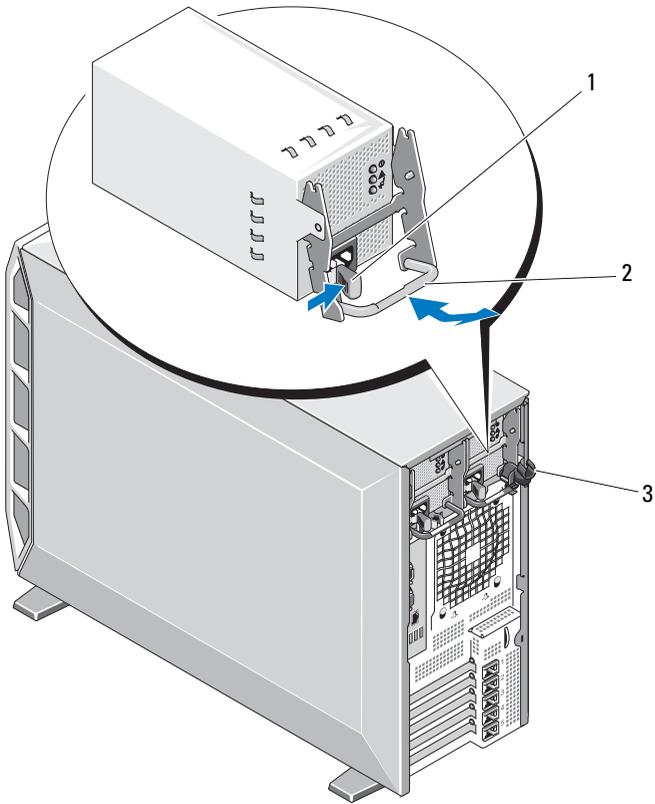
1	locking tab	2	power supply handle
3	cable retention bracket		

Installing a Redundant Power Supply

✍ **NOTE:** When installing a redundant power supply, allow several seconds for the system to recognize the power supply and determine if it is functioning properly.

1 With the power supply handle in the extended position, slide the power supply into the chassis (see Figure 3-9).

2 Press down on the power supply handle until the the locking tab snaps into place (see Figure 3-9).

✍ **NOTE:** You may have to manually press the locking tab into place in order to secure the power supply.

3 Connect the power cable to the power supply.

4 Route the power cable through the cable retention bracket (see Figure 3-9).

5 Connect the power cable to the electrical outlet.

The power supply status indicator turns green if the power supply is functioning properly (see Figure 1-3).

Removing a Non-redundant Power Supply

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2 Remove the system cover (see "Removing the System Cover" on page 66).

3 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

4 Disconnect all power cables from the system board, drives, and SAS backplane (if installed).

Note the routing of the power cables as you disconnect the cables from the system board and drives. You must route these cables properly when you replace them to prevent them from being pinched or crimped.

5 Remove the screw that secures the power supply to the system.

6 Press the power supply release tab and slide the power supply out of the system.

Figure 3-10.   Removing and Installing a Non-redundant Power Supply
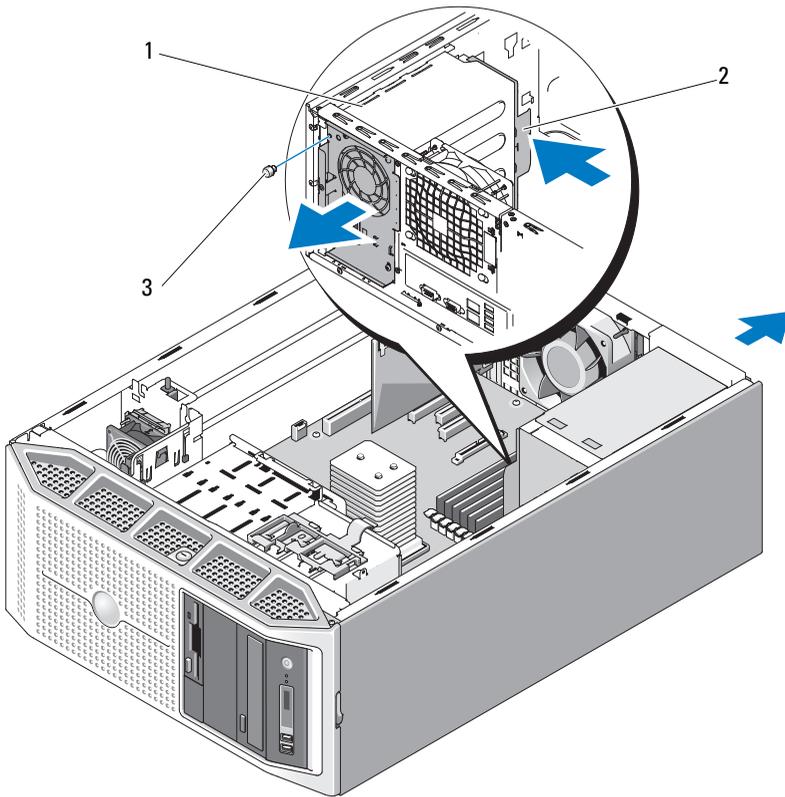
1	non-redundant power supply	2	power supply release tab
3	screw		

Installing a Non-Redundant Power Supply

1 Slide the power supply into the back of the chassis until the power supply release tab snaps into place (see Figure 3-10).

2 Replace the screw to secure the power supply to the system (see Figure 3-10).

3 Connect all power cables to the system board, drives, and SAS backplane (if installed).

Ensure that all power cables are routed properly to prevent the cables from becoming pinched or crimped.

4 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

5 Replace the system cover (see "Installing the System Cover" on page 67).

Hard Drives

NOTICE: Combining SATA and SAS hard drives in the same system configuration is not supported.

Depending on your system configuration, your system supports up to four 3.5-inch SATA or SAS hard drives installed internally (see Figure 3-13) or at the front of the system (see Figure 3-11). Hard drives installed in your system are connected to the system board, an optional controller card, or to the SAS backplane (requires a SAS controller card). Only hard drives installed in the hard drive bays at the front of the system can be used as hot-pluggable.

Removing a Hot-Pluggable Hard Drive

1 Remove the front bezel (see "Removing the Front Bezel" on page 63).

2 From the RAID management software, prepare the drive for removal and wait until the hard drive indicators on the front of the drive carrier signal that the drive can be removed safely. See your SAS/RAID controller documentation for information about hot-pluggable hard drive removal.

If the hard drive is online, the green activity/fault indicator flashes as the drive is powered down. When both drive indicators are off, the drive is ready for removal.

3 Squeeze the tabs on the hard drive carrier release handle, then rotate the handle down to release the drive.

4 Slide the hard drive out of the system.

⊖ NOTICE: To maintain proper system cooling and EMI protection, all empty hard drive bays must have a drive carrier or blank installed.

⬚ NOTE: If you are not replacing the hard drive, remove the drive from the drive carrier (see Figure 3-12) and insert the empty carrier back into the drive bay.

Figure 3-11.   Removing and Installing a Hot-Pluggable Hard Drive
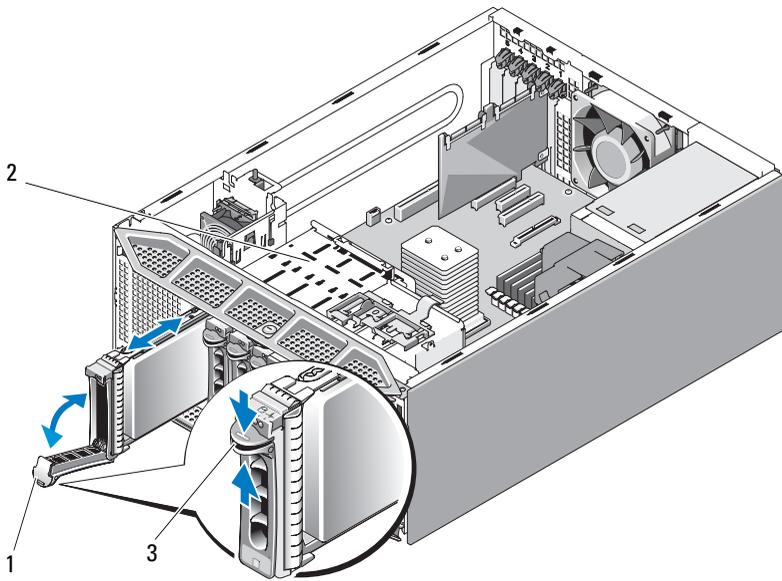
1	hard drive carrier handle	2	hard drive bays (4)
3	tabs		

Installing a Hot-Pluggable Hard Drive

⊖ NOTICE: It is recommended that you use only hard drives that have been tested and approved for use with the SAS/SATA backplane.

⊖ NOTICE: Not all operating systems support hot-pluggable hard drive installation. See the documentation supplied with your operating system for more information.

NOTICE: Combining SATA and SAS hard drives in the same system configuration is not supported.

1. Unpack the hard drive and prepare it for installation.

2. Remove the front bezel (see "Removing the Front Bezel" on page 63).

3. Remove either the existing hard drive, if applicable, or the hard drive carrier (see "Diskette Drive (Optional)" on page 84).

4. Install the hard drive carrier on the hard drive.

   a. Insert the hard drive into the hard-drive carrier with the connector end of the drive at the rear. See Figure 3-12.

   b. Viewing the assembly as shown in Figure 3-12, align the screw holes on the hard drive with the rear set of holes labeled "SAS" on the hard drive carrier.

   When aligned correctly, the rear of the hard drive will be flush with the rear of the hard-drive carrier.

   c. Attach the four screws to secure the hard drive to the hard-drive carrier. See Figure 3-12.

Figure 3-12.   Removing and Installing a Hard Drive Carrier
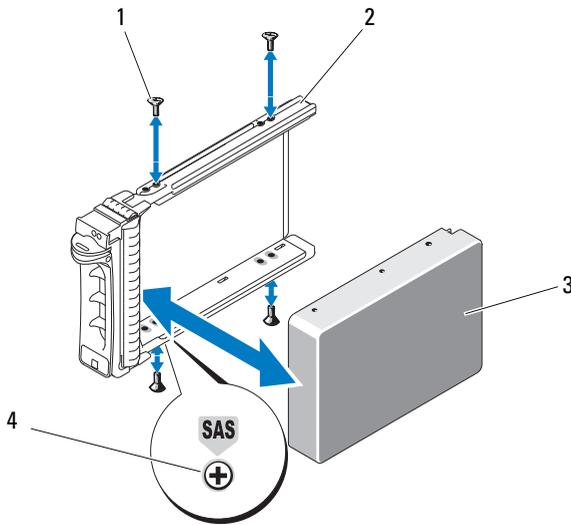
1	screws (4)	2	hard drive carrier
3	hard drive	4	SAS mounting hole

5 With the handle on the hard drive carrier open, slide the hard drive into the drive bay until the carrier contacts the backplane (see Figure 3-11).

6 Push in (towards the system) on the hard drive carrier handle and rotate the handle up until it snaps into place (see Figure 3-11).

7 Replace the front bezel (see "Installing the Front Bezel" on page 64).

Removing a Cabled Hard Drive

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2 Remove the system cover (see "Removing the System Cover" on page 66).

3 Disconnect the data cable and the power cable from the hard drive in the drive bay.

4 Press in on the blue tabs on each side of the hard drive bracket and slide the drive up and out of the bay.

Figure 3-13. Removing and Installing a Cabled Hard Drive

1	hard drive	2	data cable
3	power cable	4	blue tabs (2)

> **NOTE:** If you are not replacing the hard drive, remove the drive from the drive bracket (see Figure 3-14) and insert the empty bracket back into the drive bay.

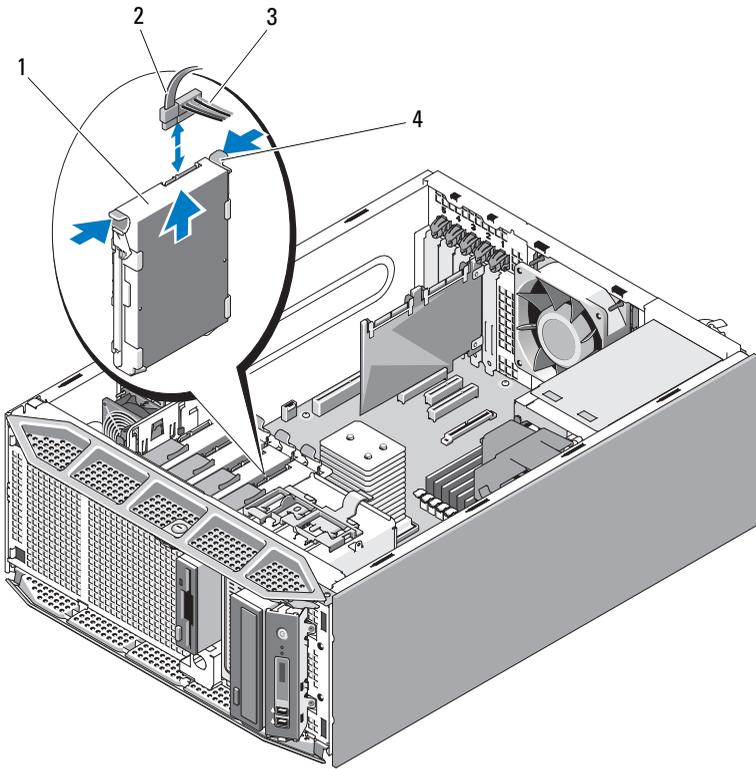**5** Replace the system cover (see "Installing the System Cover" on page 67).

Installing a Cabled Hard Drive

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

⊘ **NOTICE:** Combining SATA and SAS hard drives in the same system configuration is not supported.

1 Unpack the hard drive and prepare it for installation.

2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and from the peripherals.

3 Remove the system cover (see "Removing the System Cover" on page 66).

4 Remove the existing hard drive, if applicable (see "Removing a Cabled Hard Drive" on page 80).

If there is a hard drive bracket in the empty hard drive bay, press in on the blue tabs on each side of the bracket and slide the bracket up and out of the system. (see Figure 3-13).

5 Snap the hard drive bracket onto the hard drive (see Figure 3-14).

If the hard drive you are installing does not have a hard drive bracket, remove the bracket from the old drive. To remove the hard drive, spread the sides of the hard-drive bracket outward and lift the drive from the bracket (see Figure 3-14).

Figure 3-14. Removing a Hard Drive From a Hard Drive Bracket
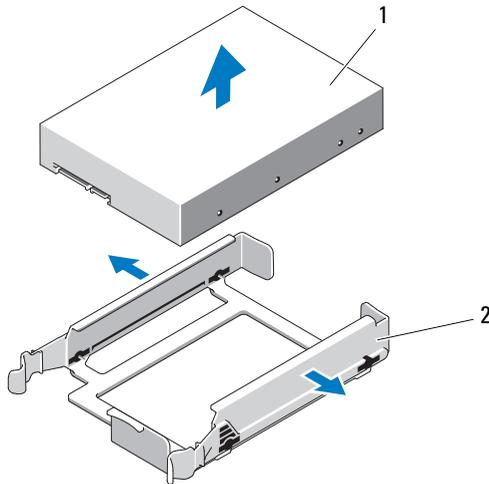
1	hard drive	2	hard drive bracket

6 Slide the hard drive into the drive bay until it snaps into place (see Figure 3-13).

7 Connect the power cable to the hard drive.

8 Connect the data cable to the hard drive:

  • For connection to the integrated SATA controller (SATA hard drives only), connect the SATA data cable to the appropriate SATA connector on the system board (see Figure 6-1).

  • For connection to a SAS or SAS/RAID controller card (SAS or SATA hard drives), connect the data cable to the appropriate connector on the card. For information on installing a SAS controller card, see "Installing a SAS Controller Card" on page 98.

9 Replace the system cover (see "Installing the System Cover" on page 67).

10 Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

11 Turn on the system and attached peripherals.

12 Enter the System Setup program and ensure that the hard drive's controller is enabled (see "Entering the System Setup Program" on page 41).

13 Exit the System Setup program and reboot the system.

See the documentation that came with the hard drive for instructions on installing any software required for drive operation.

NOTICE: To avoid possible hard drive failure, *do not* turn off or reboot your system while the hard drive is being formatted.

Configuring the Boot Device

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.

If booting the system from a hard drive, the drive must be attached to the primary (boot) controller. The 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 41).

Diskette Drive (Optional)

Removing the Diskette Drive

CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

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

2 Remove the front bezel (see "Removing the Front Bezel" on page 63).

3 Remove the system cover (see "Removing the System Cover" on page 66).

4 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

5 Disconnect the power and data cables from the diskette drive.

6 Slide the drive release latch towards the base of the system to release the shoulder screw, then slide the diskette drive out of the drive bay. See .

✎ **NOTE:** If you are permanently removing the diskette drive, replace the 3.5-inch EMI filler (see "Installing an EMI Filler" on page 69) and the 3.5-inch insert on the front bezel (see "Installing a Front Bezel Insert" on page 66).

Figure 3-15.   Removing and Installing a Diskette Drive

1	diskette drive	2	shoulder screw
3	drive release latch		

7 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

8 Replace the system cover (see "Installing the System Cover" on page 67).

9 Replace the front bezel (see "Installing the Front Bezel" on page 64).
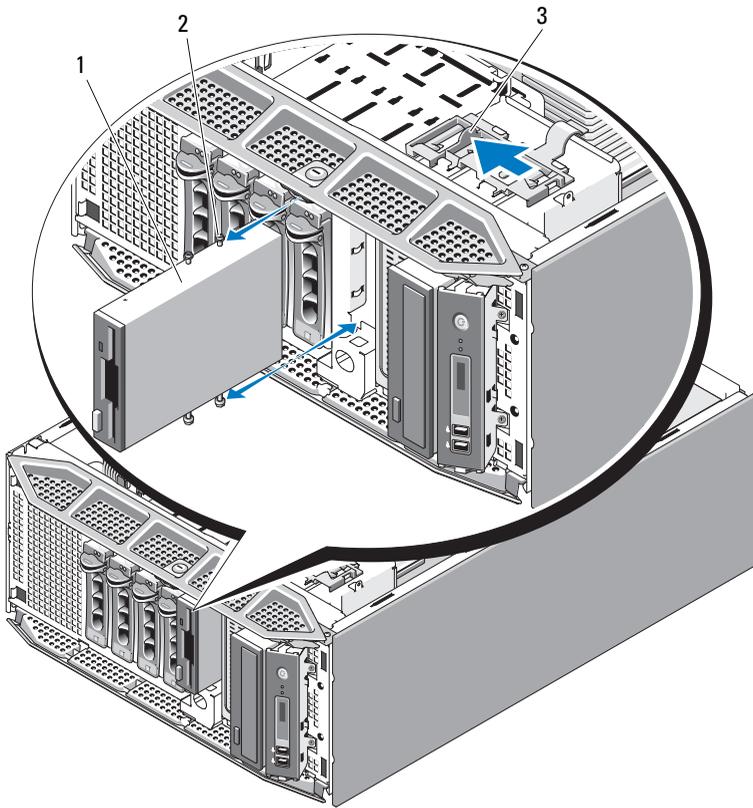
Installing a Diskette Drive

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Unpack the diskette drive, and prepare it for installation.

2 Remove the front bezel (see "Removing the Front Bezel" on page 63).

3 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and from the peripherals.

4 Remove the system cover (see "Removing the System Cover" on page 66).

5 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

6 Remove the existing diskette drive, if applicable (see "Removing the Diskette Drive" on page 84).

> ✍ **NOTE:** If the drive bay is empty, remove the EMI filler (see "Removing an EMI Filler" on page 68).

7 Attach the four shoulder screws to the diskette drive. See Figure 3-16.

> ✍ **NOTE:** If the diskette drive you are installing does not have shoulder screws, remove the four shoulder screws from the old drive or the back of the 3.5-inch insert.

Figure 3-16. Installing Diskette Drive Shoulder Screws
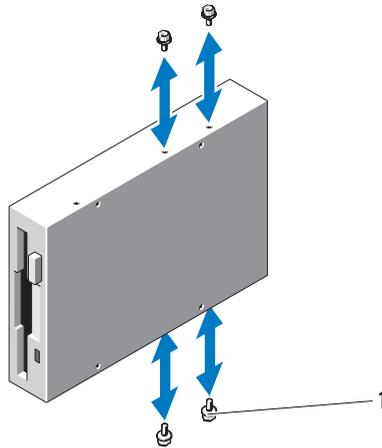
1   shoulder screws (4)

8 From the front of the system, align the shoulder screws with the slot in the chassis, then slide the diskette drive into the drive bay until the shoulder screw snaps into place or you feel the drive securely installed (see Figure 3-15).

9 Connect the power cable to the diskette drive.

10 Connect one end of the data cable to the diskette drive connector on the system board (see Figure 6-1), then connect the other end of the data cable to the diskette drive.

11 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

12 Replace the system cover (see "Installing the System Cover" on page 67).

13 Replace the front bezel (see "Installing the Front Bezel" on page 64).

14 Enter the System Setup program and ensure that the diskette drive's controller is enabled (see "Entering the System Setup Program" on page 41).

Optical and Tape Drives

The 5.25-inch drive bays in the front of your system provide support for an optical drive and either an optional tape drive or second optical drive.

Removing an Optical or Tape Drive

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2 Remove the front bezel (see "Removing the Front Bezel" on page 63).

3 Remove the system cover (see "Removing the System Cover" on page 66).

4 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

5 Disconnect the power and data cables from the back of the drive. See Figure 3-17 for disconnecting SCSI connections and Figure 3-18 for disconnecting SATA connections.

6 Slide the drive release latch towards the base of the system to release the shoulder screw, then slide the drive out of the drive bay.

✍ **NOTE:** If you are permanently removing the drive, replace the 5.25-inch EMI filler (see "Installing an EMI Filler" on page 69) and the 5.25-inch insert on the front bezel (see "Installing a Front Bezel Insert" on page 66).

Figure 3-17. Removing and Installing an Optical or Tape Drive (SCSI Connection)

1	drive release latch	2	shoulder screws
3	optical drive	4	SCSI data cable
5	SCSI power cable			

Figure 3-18. Removing and Installing an Optical Drive (SATA Connection)
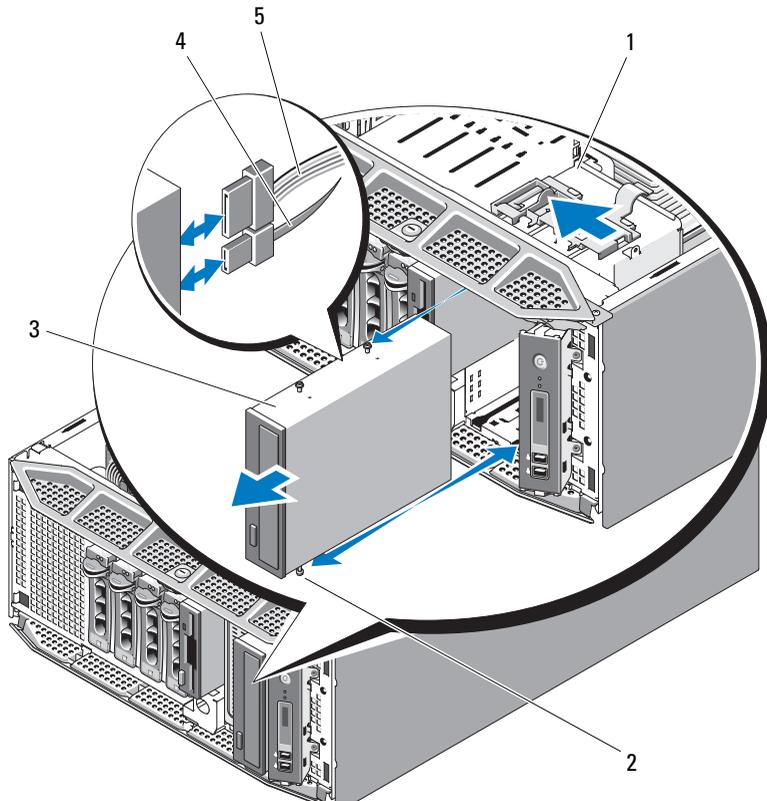
1	drive release latch	2	shoulder screws
3	optical drive	4	SATA data cable
5	SATA power cable			

7 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

8 Replace the system cover (see "Installing the System Cover" on page 67).

9 Replace the front bezel (see "Installing the Front Bezel" on page 64).
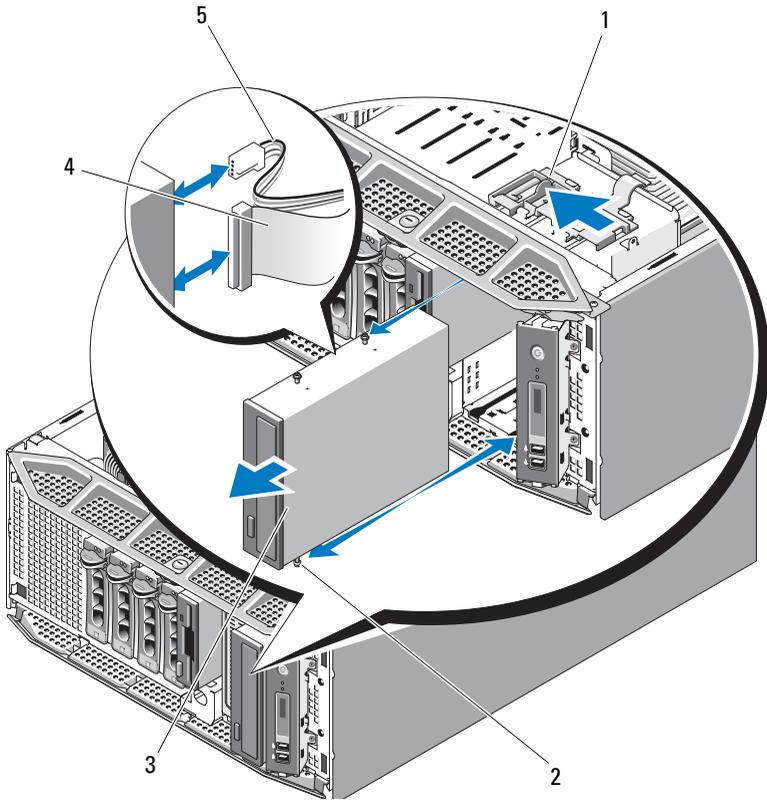
Installing an Optical or Tape Drive

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Unpack the optical or tape drive, and prepare it for installation.

If you are installing a SCSI tape drive, you must have a SCSI controller card installed (see "Installing an Expansion Card" on page 95) and configure the tape drive according to the documentation that came with the tape drive.

2 Remove the front bezel (see "Removing the Front Bezel" on page 63).

3 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and from the peripherals.

4 Remove the system cover (see "Removing the System Cover" on page 66).

5 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

6 Remove the existing drive, if applicable (see "Removing an Optical or Tape Drive" on page 88).

   ✍ **NOTE:** If the drive bay is empty, remove the insert on the front bezel (see "Removing a Front Bezel Insert" on page 65) and the EMI filler from the drive bay (see "Removing an EMI Filler" on page 68).

7 Attach the three shoulder screws to the drive, one screw on the lower front screw hole on the right side and two screws on the lower screw holes on the left side. See Figure 3-19.

   ✍ **NOTE:** If the optical or tape drive you are installing does not have shoulder screws, remove the three shoulder screws from the old drive or the back of the 5.25-inch front bezel insert.

Figure 3-19. Installing Optical or Tape Drive Shoulder Screws
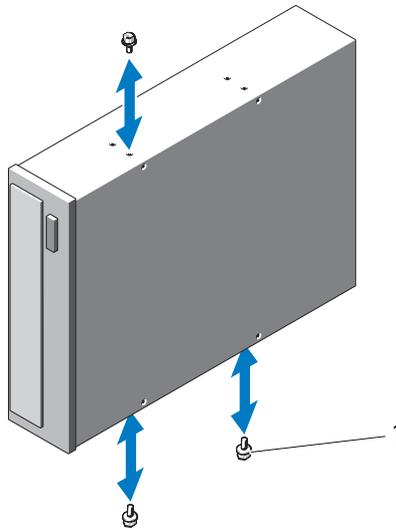
1   screws (3)

8   From the front of the system, align the shoulder screws with the slot in the chassis, then slide the drive into the drive bay until the shoulder screw snaps into place or you feel the drive securely installed (see Figure 3-18).

9   Attach the SCSI power cable (see Figure 3-17) or SATA power cable (see Figure 3-18) to the drive.

10 Attach the data cable:

   •   If you are installing a SATA optical drive (see Figure 3-18), connect the cable from the SATA connector on the drive to the appropriate SATA connector on the system board (see "System Board Connectors" on page 167).

   •   If you are installing a SCSI tape drive, connect the SCSI interface cable (see Figure 3-17) in the drive kit from the SCSI controller card to the drive.

11 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

12 Replace the system cover (see "Installing the System Cover" on page 67).

**13** Replace the front bezel (see "Installing the Front Bezel" on page 64).

14 Enter the System Setup program and ensure that the drive's controller is enabled (see "Entering the System Setup Program" on page 41).

Expansion Cards

The system board can accommodate up to five expansion cards (see Figure 6-1):

- One 3.3-V, full-length PCI-X (slot 5)
- One 3.3-V, full-length PCIe x4 (slot 2)
- One 3.3-V, full-length PCIe x4 with x8 connector (slot 1)
- Two 3.3-V, full-length PCIe x8 (slots 3 and 4)

NOTE: Slot 1 is reserved for an optional RAC card.

NOTE: A SAS controller card may be installed in slot 3 or 4; however, a PERC 6/iR card, if used, must be installed in slot 3.

Removing an Expansion Card

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2 Remove the system cover (see "Removing the System Cover" on page 66).

3 Open the expansion card cover (see Figure 3-7).

NOTE: You can remove the expansion card cover, if desired, and set it aside.

4 Open the expansion card latch adjacent to the slot (see Figure 3-20).

5 Disconnect any cables connected to the card.

6 Grasp the card by its top corners and ease it out of its connector.

NOTE: If you are removing the card permanently, install a filler bracket in the empty card slot.

NOTE: Filler brackets must be installed over empty expansion card slots to maintain Federal Communications Commission (FCC) certification of the system and protect against electromagnetic interference. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

Figure 3-20.   Removing and Installing an Expansion Card

1	expansion card latch	2	expansion card tab
3	expansion card guide slot	4	expansion card connector
5	expansion card		

7 Close the expansion card cover (see Figure 3-7).

8 Replace the system cover (see "Installing the System Cover" on page 67).

9 Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

10 Turn on the system and attached peripherals.
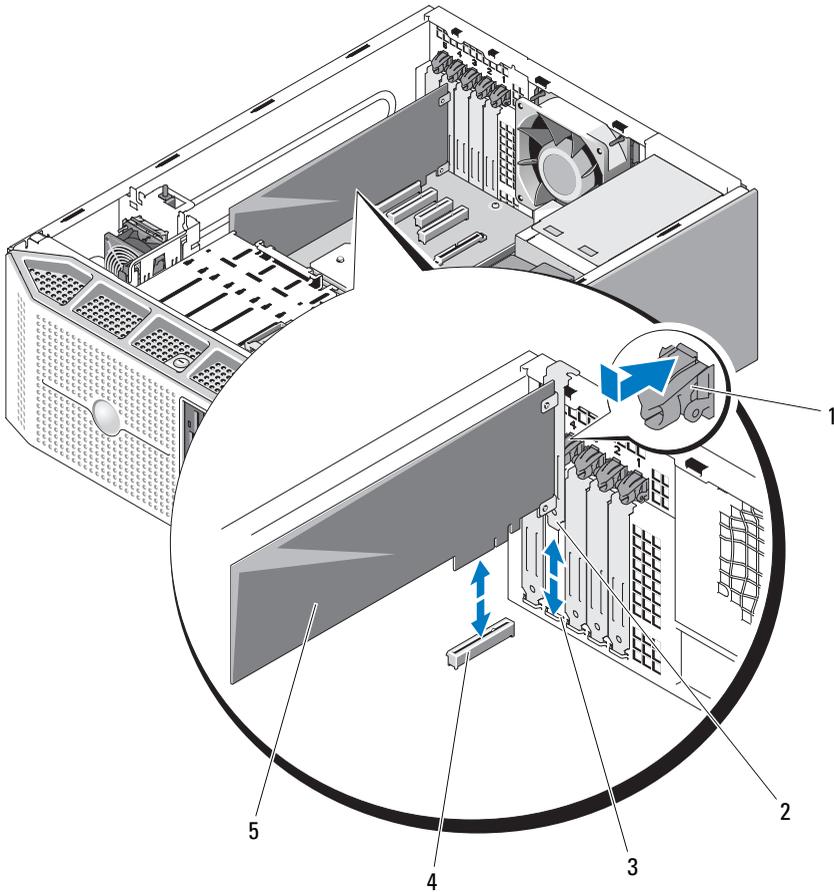
Installing an Expansion Card

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2 Remove the system cover (see "Removing the System Cover" on page 66).

3 Open the expansion card cover (see Figure 3-7).

✍ **NOTE:** You can remove the expansion card cover, if desired, and set it aside.

4 Remove the filler bracket or existing expansion card to create a card-slot opening (see "Removing an Expansion Card" on page 93).

✍ **NOTE:** Keep the filler bracket in case you need to remove the expansion card. Filler brackets must be installed over empty expansion card slots to maintain FCC certification of the system and protect against electromagnetic interference. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

5 Prepare the card for installation.

6 Open the expansion card latch adjacent to the slot (see Figure 3-20).

7   Insert the card into the expansion card connector on the system board and press down firmly (see Figure 3-20). Ensure that the card is fully seated in the guide slot.

8   Close the expansion card latch to secure the card in the system (see Figure 3-20).

NOTICE: Do not route card cables over or behind the cards. Cables routed over the cards can prevent the system cover from closing properly or cause damage to the equipment.

9   Connect any cables that should be attached to the card.

See the documentation for the card for information about the card's cable connections.

10 Close the expansion card cover (see Figure 3-7).

11 Replace the system cover (see "Installing the System Cover" on page 67).

12 Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

13 Turn on the system and attached peripherals.

14 Install any device drivers required for the card.

See the documentation for the card for information about installing the card's device drivers.

SAS Controller Card

Your system provides support for an internal SAS controller card to be used for the SAS storage subsystem for your system's internal or hot-pluggable hard drives. The controller card supports all-SAS or all-SATA hard drive configurations and also enables you to set up the hard drives in a RAID configuration. Supported RAID configurations vary according to the version of the SAS controller card included with your system and both RAID and non-RAID versions of the controller card are available. See the RAID user documentation for information on the available RAID configurations and for instructions on how to set up a RAID configuration.

Removing a SAS Controller Card

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

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

2   Remove the system cover (see "Removing the System Cover" on page 66).

3   Open the expansion card cover (see Figure 3-7).

    🖉 **NOTE:** You can remove the expansion card cover, if desired, and set it aside.

4   Open the expansion card latch adjacent to the slot (see Figure 3-20).

5   Disconnect the SAS cable, LED cable, and RAID battery cable (if applicable) from the SAS controller card.

6   Grasp the card by its top corners and ease it out of its connector (see Figure 3-20).

    🖉 **NOTE:** If you are removing the card permanently, install a filler bracket in the empty card slot.

    🖉 **NOTE:** Filler brackets must be installed over empty expansion card slots to maintain Federal Communications Commission (FCC) certification of the system and protect against electromagnetic interference. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

7   Remove the RAID battery from the battery holder, if applicable (see "Installing and Removing a RAID Battery" on page 101).

8   Close the expansion card cover (see Figure 3-7).

9   Replace the system cover (see "Installing the System Cover" on page 67).

10 Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

11 Turn on the system and attached peripherals.

Installing a SAS Controller Card

⚠️ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

NOTICE: When installing a SAS/RAID controller, do not press on the RAID card DIMM (if one is present) while installing the RAID card into the system board.

NOTICE: The SAS or SAS/RAID controller card must be installed in PCIE_X8_3 or PCIE_x8_4 (see Figure 6-1).

NOTE: If you are installing a replacement SAS/RAID card, do not remove the plastic cover protecting the card until after installation of the card is complete.

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

2   Remove the system cover (see "Removing the System Cover" on page 66).

3   Open the expansion card cover (see Figure 3-7).

   NOTE: You can remove the expansion card cover, if desired, and set it aside.

4   Remove the filler bracket or existing expansion card to create a card-slot opening (see "Removing an Expansion Card" on page 93).

   NOTE: Keep the filler bracket in case you need to remove the expansion card. Filler brackets must be installed over empty expansion card slots to maintain FCC certification of the system and protect against electromagnetic interference. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

5   Prepare the card for installation.

6   Open the expansion card latch adjacent to the slot (see Figure 3-20).

7   Insert the SAS controller card into expansion card slot 3 or slot 4 on the system board (see Figure 6-1) and press down firmly (see Figure 3-20). Ensure that the card is fully seated in the guide slot.

8   Close the expansion card latch to secure the card in the system (see Figure 3-20).

NOTICE: Do not route card cables over or behind the cards. Cables routed over the cards can prevent the system cover from closing properly or cause damage to the equipment.

9 Using the appropriate interface cable, connect the SAS controller card (connector 0) directly to the internal hard drives or to the SAS backplane, if installed.

NOTE: The cable must be connected according to the connector labels on the cable. The cable does not operate if reversed.

10 Connect the SAS cable, LED cable, and RAID battery cable (if applicable) to the SAS controller card.

NOTE: For battery-cached SAS/RAID controllers, install the RAID battery (see "Installing a RAID Battery" on page 102).

11 Close the expansion card cover (see Figure 3-7).

12 Replace the system cover (see "Installing the System Cover" on page 67).

13 Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

14 Turn on the system and attached peripherals.

15 Install any device drivers required for the card.

See the documentation for the card for information about installing the card's device drivers.

RAID Battery

The information in this section applies only to systems with the optional battery-cached SAS/RAID controller card.

Removing a RAID Battery

CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

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

2 Remove the system cover (see "Removing the System Cover" on page 66).

3 Disconnect the cable between the RAID battery and the SAS controller card, then remove the battery cable from the battery cable slot in the chassis.

4 Press outward on the battery carrier release tab, then slide the battery carrier up and out of the system.

5 Press outward on the battery carrier retention tabs and remove the RAID battery from the battery carrier.

Figure 3-21. Installing and Removing a RAID Battery
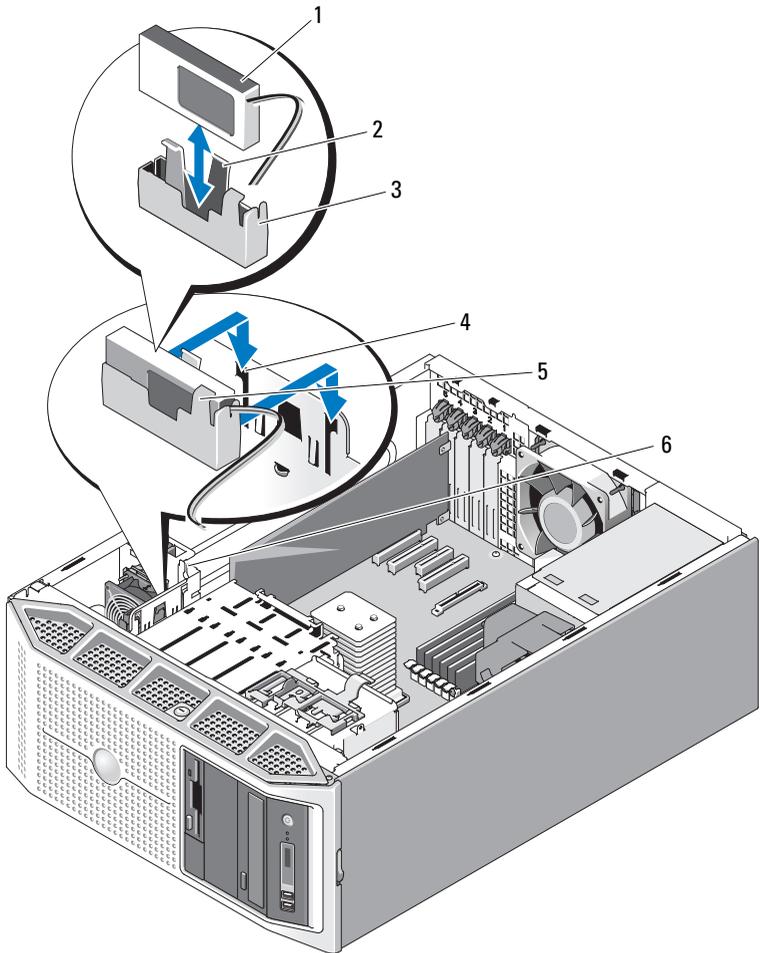
1	RAID battery	2	battery carrier release tab
3	battery carrier	4	battery carrier slots (2)
5	battery carrier retention tabs	6	battery cable slot

Installing a RAID Battery

1   Insert the RAID battery into the battery carrier (see Figure 3-21).

2   Insert the battery carrier and RAID battery into the system's battery carrier slots, ensuring that the battery carrier is aligned and fully seated in the slots.

3   Connect the battery cable to the SAS/RAID controller card. See the documentation for your card for more information.

4   Route the battery cable through the battery cable slot in the chassis (see Figure 3-21).

5   Replace the system cover (see "Installing the System Cover" on page 67).

Remote Access Controller Card (RAC)

The optional Remote Access Controller card provides a set of advanced features for managing the system remotely.

Removing the RAC Card

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2   Remove the system cover (see "Removing the System Cover" on page 66).

3   Open the expansion card cover (see Figure 3-7).

📝 **NOTE:** You can remove the expansion card cover, if desired, and set it aside.

4   Open the expansion card latch adjacent to the slot (see Figure 3-20).

◐ **NOTICE:** When detaching the RAC cables from the system board, squeeze the metal ends of the cable connectors and gently work the connector out of the socket. Do not pull on the cable to unseat the connector. Doing so can damage the cable.

5   Disconnect the ribbon cable to the RAC card.

NOTE: If you are removing the card permanently, disconnect and remove the ribbon cable from the system board.

Figure 3-22.   Removing and Installing a RAC Card
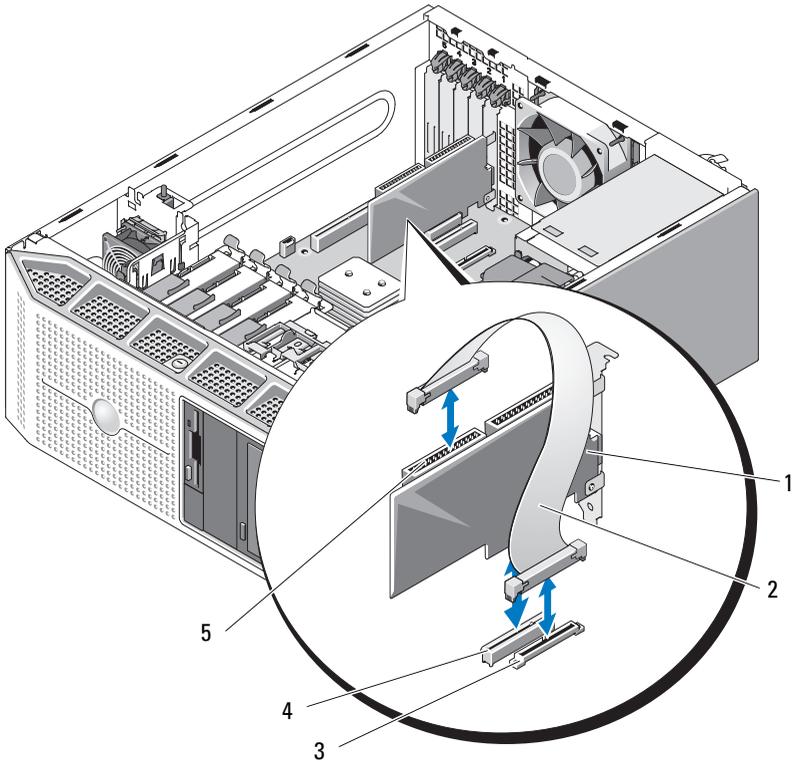
1	RAC card	2	RAC card cable
3	RAC_CONN connector	4	RAC card slot (slot 1)
5	RAC card cable connectors (2, but only connector 2 is used)		

6 Grasp the card by its top corners and ease it out of its connector (see Figure 3-20).

> ✎ **NOTE:** If you are removing the card permanently, install a filler bracket in the empty card slot.

> ✎ **NOTE:** Filler brackets must be installed over empty expansion card slots to maintain Federal Communications Commission (FCC) certification of the system and protect against electromagnetic interference. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

7 Close the expansion card cover (see Figure 3-7).

8 Replace the system cover (see "Installing the System Cover" on page 67).

9 Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

10 Turn on the system and attached peripherals.

Installing a RAC Card

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2 Remove the system cover (see "Removing the System Cover" on page 66).

3 Open the expansion card cover (see Figure 3-7).

> ✎ **NOTE:** You can remove the expansion card cover, if desired, and set it aside.

4 Remove the filler bracket or existing expansion card from slot 1 to create a card-slot opening (see "Removing an Expansion Card" on page 93).

> ✎ **NOTE:** Keep the filler bracket in case you need to remove the expansion card. Filler brackets must be installed over empty expansion card slots to maintain FCC certification of the system and protect against electromagnetic interference. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

5 Prepare the card for installation.

6 Open the expansion card latch adjacent to the slot (see Figure 3-20).

7   Insert the RAC card into expansion card slot 1 on the system board (see Figure 6-1) and press down firmly (see Figure 3-20). Ensure that the card is fully seated in the guide slot.

8   Close the expansion card latch to secure the card in the system (see Figure 3-20).

 NOTICE: When attaching the cable to the system board, ensure that you do not damage the surrounding system board components.

9   Connect the ribbon cable to the RAC_CONN connector on the system board and then to connector 2 on the RAC card (see Figure 3-22).

10 Close the expansion card cover (see Figure 3-7).

11 Replace the system cover (see "Installing the System Cover" on page 67).

12 Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

13 Turn on the system and attached peripherals.

14 Install any device drivers required for the card.

Internal USB Memory Key Connector

The system provides an internal USB connector located on the system board for use with an optional USB flash memory key. The USB memory key can be used as a boot device, security key, or mass storage device. To use the internal USB connector, the **Internal USB Port** option must be enabled in the **Integrated Devices** screen of the System Setup program.

To boot from the USB memory key, you must configure the USB memory key with a boot image and then specify the USB memory key in the boot sequence in the System Setup program (see "System Setup Options" on page 43). For information on creating a bootable file on the USB memory key, see the user documentation that accompanied the USB memory key.

Installing the Optional Internal USB Memory Key

 CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

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

   2 Remove the system cover (see "Removing the System Cover" on page 66).

   3 Open the expansion card cover (see Figure 3-7).

   4 Locate the USB connector on the system board (see Figure 6-1).

   5 Insert the USB memory key into the USB connector onto the board (see Figure 3-23).

   6 Close the expansion card cover (see Figure 3-7).

   7 Replace the system cover (see "Installing the System Cover" on page 67).

   8 Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

   9 Turn on the system and attached peripherals.

   10 Enter the System Setup program and verify that the USB key has been detected by the system (see "Using the System Setup Program" on page 41).

Figure 3-23. Installing an Internal USB Key
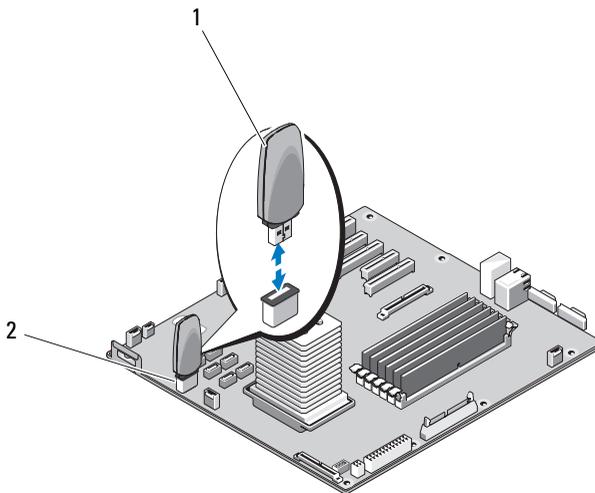
| 1 | USB memory key | 2 | internal USB connector |

Cooling Fans

The system contains two cooling fans, an expansion card fan for the expansion cards, and a system fan for the processor and memory modules.

Removing the Expansion Card Fan

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2. Remove the system cover (see "Removing the System Cover" on page 66).

3. Open the expansion card cover (see Figure 3-7).

4. If present, remove the RAID battery and battery carrier (see "Removing a RAID Battery" on page 99).

5. Disconnect the fan's power cable from the system board (see Figure 6-1), and remove the cable from the adjacent slot on the chassis.

6. Press the fan release tab and slide the fan up and out of the system.

Figure 3-24. Removing and Installing the Expansion Card Fan
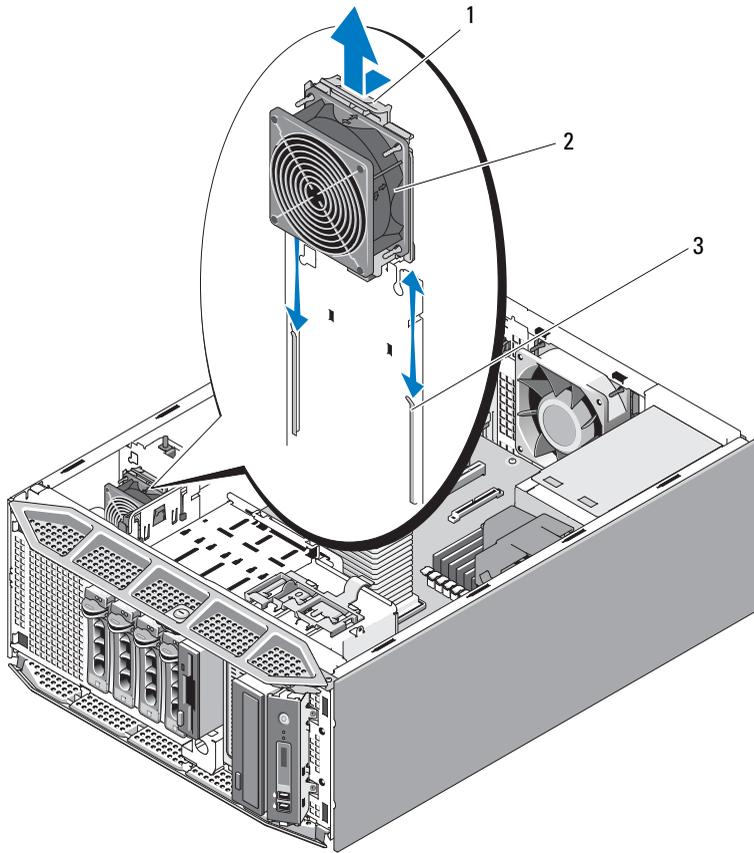
1	fan release tab	2	expansion card fan
3	securing slots		

Installing the Expansion Card Fan

1 Hold the fan with the fan cable on the top side, and align the edges of the fan with the securing slots on the chassis.

2 Slide the fan down into the securing slots until the fan release tab locks into place (see Figure 3-24).

3 Route the fan power cable through the adjacent slot in the chassis, and connect the cable to the FAN1 connector on the system board (see Figure 6-1).

4 Replace the RAID battery and battery carrier, if applicable (see "Installing a RAID Battery" on page 102).

5 Close the expansion card cover (see Figure 3-7).

6 Replace the system cover (see "Installing the System Cover" on page 67).

Removing the System Fan

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2 Remove the system cover (see "Removing the System Cover" on page 66).

3 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

4 Disconnect the fan's power cable from the system board (see Figure 6-1).

5 Press and hold the fan release tab, then slide the fan towards the bottom of the chassis and out of the securing slots.

Figure 3-25.   Removing and Installing the System Fan
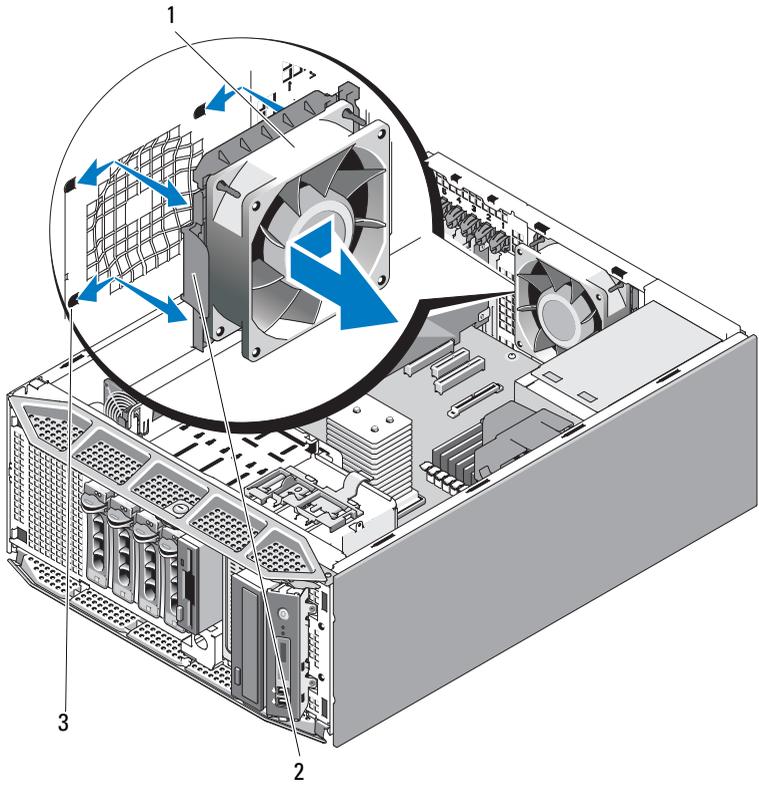
1	system fan	2	fan release tab
3	securing slots		

Installing the System Fan

1   Hold the replacement fan with the fan cable on the left side (opposite the power supply), and align the edges of the fan with the securing slots.

2   Slide the fan into the securing slots until the fan release tab locks into place (see Figure 3-25).

3   Connect the cable to the FAN2 connector on the system board (see Figure 6-1).

4 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

5 Replace the system cover (see "Installing the System Cover" on page 67).

System Memory

The six memory module sockets are located on the system board adjacent to the power supply and can accommodate 512 MB to 24 GB of registered PC2-4200/5300, 533/667-MHz, DDR2 memory with ECC. See Figure 6-1 for the location of the memory module sockets.

You can upgrade the system memory by installing combinations of 512-MB, 1-GB, 2-GB, and 4-GB memory modules. You can purchase memory upgrade kits from Dell.

✎ **NOTE:** Memory modules must be PC2-4200/5300 compliant for your system.

Memory Module Installation Guidelines

The memory module sockets are arranged in three banks (1, 2, and 3) 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

Bank 3: DIMM3_A and DIMM3_B

Memory modules must be installed in memory module banks in identical pairs for configurations with more than one memory module. For example, if socket DIMM1_A contains a 512-MB memory module, then the second memory module to be installed must be a 512-MB memory module in socket DIMM1_B.

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

- The minimum memory configuration is 512 MB.
- If only one memory module is installed, it must be installed in the DIMM1_A socket.
- A memory module bank must contain identical memory modules.

- Install memory modules in bank 1 (DIMM1_x) before installing memory modules in bank 2 (DIMM2_x), and install memory modules in bank 2 before installing memory modules in bank 3 (DIMM3_x).
- Configurations of three or five memory modules are not supported.

Table 3-1.   Sample Memory Module Configurations

Total Memory	DIMM1_A	DIMM1_B	DIMM2_A	DIMM2_B	DIMM3_A	DIMM3_B
512 MB	512 MB					
1 GB	512 MB	512 MB				
1 GB	1 GB					
2 GB	512 MB	512 MB	512 MB	512 MB		
2 GB	1 GB	1 GB				
3 GB	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB
4 GB	1 GB	1 GB	1 GB	1 GB		
4 GB	2 GB	2 GB				
6 GB	1 GB	1 GB	1 GB	1 GB	1 GB	1 GB
8 GB	2 GB	2 GB	2 GB	2 GB		
12 GB	2 GB	2 GB	2 GB	2 GB	2 GB	2 GB
24 GB	4 GB	4 GB	4 GB	4 GB	4 GB	4 GB

Removing Memory Modules

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2   Remove the system cover (see "Removing the System Cover" on page 66).

3   Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

⚠ **CAUTION: Memory Module DIMMs are hot to the touch for some time after the system has been powered down. Allow the DIMMs to cool before handling them. Handle the DIMMs by the card edges, and avoid touching the DIMM components.**

   4 Press down and out on the ejectors on each end of the socket until the memory module pops out of the socket.

Figure 3-26.   Installing and Removing a Memory Module
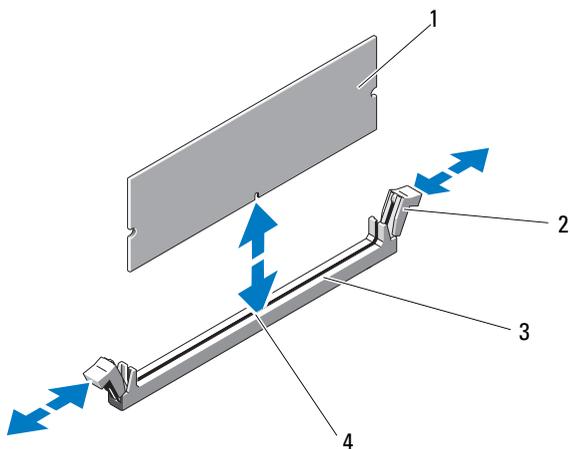
1	memory module	2	memory module socket ejectors (2)
3	memory module socket	4	alignment key

⊙ **NOTICE:** Never operate your system with the processor airflow shroud removed. Overheating of the system can develop quickly resulting in shutdown of the system and loss of data.

   5 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

   6 Replace the system cover (see "Installing the System Cover" on page 67).

Installing Memory Modules

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and**

support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

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

2 Remove the system cover (see "Removing the System Cover" on page 66).

3 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

4 Press the ejectors on the memory module connector down and out (see Figure 3-26) to allow the memory module to be inserted into the connector.

5 Align the memory module's edge connector with the alignment key on the memory module connector, and insert the memory module into the connector (see Figure 3-26).

NOTICE: To avoid damage to the memory module, press the module straight down into the connector while applying equal force to each end of the module.

6 Press down on the memory module with your thumbs until the module is firmly seated in the connector (see Figure 3-26).

When the memory module is properly seated, the ejectors on the memory module connector snap into the cutouts at each end of the memory module.

NOTICE: Never operate your system with the processor airflow shroud removed. Overheating of the system can develop quickly, resulting in shutdown of the system and loss of data.

7 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

8 Replace the system cover (see "Installing the System Cover" on page 67).

9 Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

10 Turn on the system and attached peripherals.

11 Enter the System Setup program, and verify that the value for **System Memory** reflects the newly installed memory (see "Entering the System Setup Program" on page 41).

> **NOTE:** If the value for System Memory is incorrect, one or more of the memory modules may not be installed properly. Reseat the memory modules in their connectors and check the value again. If the problem persists, run the system memory test in the system diagnostics (see "Running the System Diagnostics" on page 163).

Processor

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

Removing the Processor

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Prior to upgrading your system, download the latest system BIOS version on **support.dell.com**.

2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and from the peripherals.

3 Remove the system cover (see "Removing the System Cover" on page 66).

4 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

> **NOTICE:** When you remove the heat sink, the possibility exists that the processor may adhere to the heat sink and be removed from the socket. It is recommended that you remove the heat sink while the processor is still warm.

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.

5   Press down on the ends of the heat sink release levers and pull them outward to release them from the release lever retainers. Swing the levers up to release the heat sink.

Figure 3-27.   Installing and Removing the Heat Sink
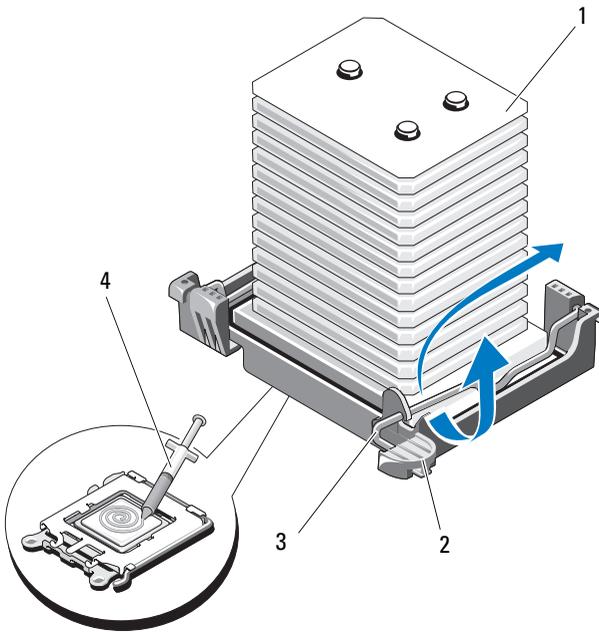
1	heatsink	2	release lever retainers (2)
3	release levers (2)	4	thermal grease

6   Wait 30 seconds for the heat sink to loosen from the processor.

NOTICE: Lay the heat sink on its side to avoid contaminating the thermal adhesive on the bottom of the heat sink.

7   Gently lift the heat sink off of the processor and set the heat sink aside.

NOTICE: The processor is held in its socket under strong pressure. Be aware that the release lever can spring up suddenly if not firmly grasped.

8 Position your thumb firmly over the socket release lever and release the lever from the locked position. Rotate the lever up, then open the processor cover.

Figure 3-28.   Installing and Removing a Processor
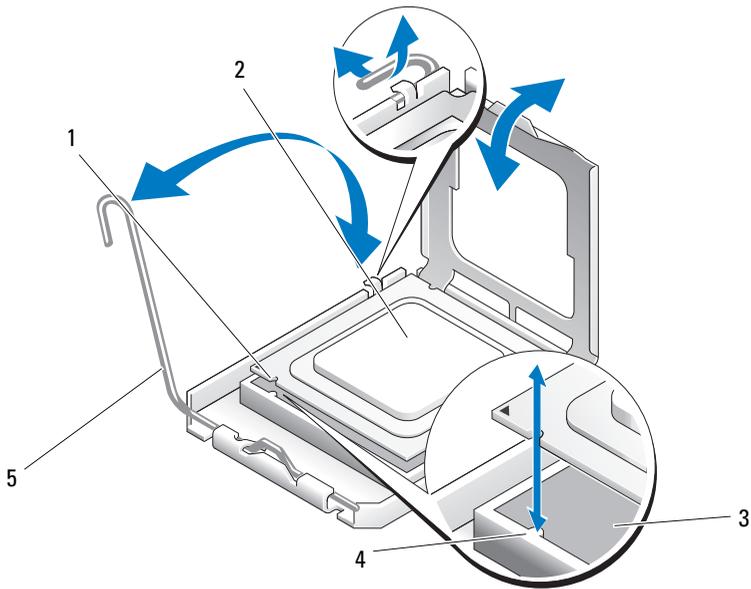
1	notch in processor (2)	2	processor
3	ZIF socket	4	socket key (2)
5	socket release lever			

⊂⊃ **NOTICE:** Be careful not to bend any of the pins on the ZIF socket when removing the processor. Bending the pins can permanently damage the system board.

9 Gently, lift the processor out of the socket. Leave the release lever up so that the socket is ready for processor to be replaced.

Installing the Processor

1   Unpack the new processor.

2   Ensure that the release lever on the processor socket is fully extended, or in the *up* position (see Figure 3-28).

3   Align the processor with the socket keys on the ZIF socket (see Figure 3-28).

⊘ **NOTICE:** Positioning the processor incorrectly can permanently damage the system board or the processor when you turn it on. When placing the processor in the socket, be careful not to bend the pins in the socket. Avoid touching the socket pins or the pads on the processor when handling the processor or the system board.

⊘ **NOTICE:** Do not use force to seat the processor. When the processor is positioned correctly, it engages easily into the socket.

4   With the processor and the socket keys aligned, set the processor lightly in the socket.

5   When the processor is fully seated in the socket, close the processor cover (see Figure 3-28).

6   Rotate the socket release lever back down until it snaps into place, securing the processor (see Figure 3-28).

7   Install the heat sink.

> ✎ **NOTE:** If you did not receive a replacement heat sink, re-use the heat sink that you removed from the old processor.

   a   If you receive a heat sink and pre-applied thermal grease with your processor kit, remove the protective sheet from the thermal grease layer on top of the heat sink.

   If you did not receive a replacement heat sink with your processor kit, do the following:

   •   Using a clean lint-free cloth, remove the thermal grease from the heat sink removed from the old processor.

   •   Open the grease packet included with your processor kit and apply thermal grease evenly to the top of the new processor (see Figure 3-27).

b Place the heat sink on the processor (see Figure 3-27).

c Lower the heat-sink retainers over the edges of the heatsink. One at a time, press the tabs on the retainers down and inward until they lock into place, securing the heatsink.

8 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

9 Replace the system cover (see "Installing the System Cover" on page 67).

10 Place the system upright on a flat, stable surface.

11 Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

12 Turn on the system and attached peripherals.

As the system boots, the system detects the new processor and automatically changes the system configuration information in the System Setup program.

13 Enter the System Setup program, and check that the processor information matches the new system configuration (see "Entering the System Setup Program" on page 41).

14 Run the system diagnostics to verify that the processor operates correctly.

NOTE: You can test the processor, if desired, by running the system diagnostics (see "Running the System Diagnostics" on page 163).

System Battery

The system battery is a 3.0-volt (V), coin-cell battery.

Removing the System Battery

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

⚠ **CAUTION: There is a danger of a new battery exploding if it is incorrectly installed. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions. See your *System Information Guide* for additional information.**

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

2   Remove the system cover (see "Removing the System Cover" on page 66).

3   Open the expansion card cover (see Figure 3-7).

⊘ **NOTICE:** If you pry the battery out of its socket with a blunt object, be careful not to touch the system board with the object. Ensure that the object is inserted between the battery and the socket before you attempt to pry out the battery. Otherwise, you may damage the system board by prying off the socket or by breaking circuit traces on the system board.

⊘ **NOTICE:** To avoid damage to the battery connector, you must firmly support the connector while installing or removing a battery.

4   Support the battery connector by pressing down firmly on the positive side of the connector, then press the battery towards the positive side of the connector and pry it up out of the securing tabs at the negative side of the connector (see Figure 3-29).

Figure 3-29.   Replacing the System Battery
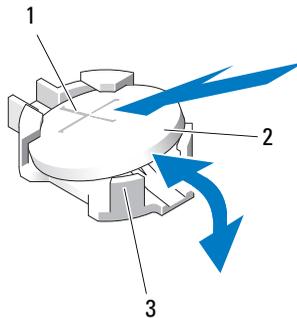
1	positive side of battery connector	2	system battery
3	negative side of battery connector		

Installing the System Battery

NOTICE: To avoid damage to the battery connector, you must firmly support the connector while installing or removing a battery.

1   Support the battery connector by pressing down firmly on the positive side of the connector.

2   Hold the battery with the "+" facing up, and slide it under the securing tabs at the positive side of the connector.

3   Press the battery straight down into the connector until it snaps into place (see Figure 3-29).

4   Close the expansion card cover (see Figure 3-7).

5   Replace the system cover (see "Installing the System Cover" on page 67).

6   Place the system upright on a flat, stable surface.

7   Rotate the system feet outward into the *open* position (see Figure 3-5).

8   Reattach any peripherals you disconnected, then connect the system to the electrical outlet.

9   Turn on the system and attached peripherals.

10 Enter the System Setup program to confirm that the battery is operating properly (see "Entering the System Setup Program" on page 41).

11 Enter the correct time and date in the System Setup program's **Time** and **Date** fields.

12 Exit the System Setup program.

NOTE: To test the newly installed battery, turn off the system and disconnect it from the electrical outlet for at least an hour, then reconnect the system to its electrical outlet and turn it on.

Chassis Intrusion Switch

Removing the Chassis Intrusion Switch

CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and

support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

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

2   Remove the system cover (see "Removing the System Cover" on page 66).

3   Open the expansion card cover (see Figure 3-7).

4   Disconnect the chassis intrusion switch cable from the INTRUSION connector on the system board (see Figure 3-30).

5   Slide the chassis intrusion switch out of the securing bracket notch, then remove the switch and its attached cable from the system.

Figure 3-30.   Removing and Installing the Chassis Intrusion Switch
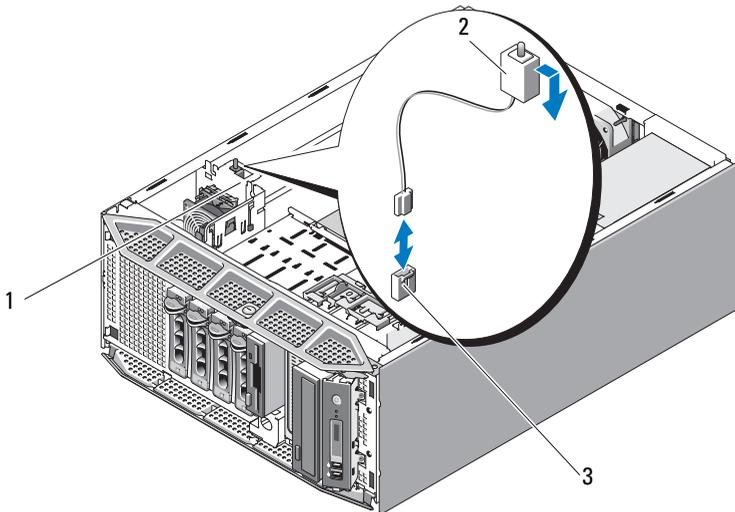
1	securing bracket notch	2	chassis intrusion switch
3	INTRUSION connector on system board		

Installing the Chassis Intrusion Switch

1 Align the chassis intrusion switch with the securing bracket notch (see Figure 3-30).

2 Slide the switch into the securing bracket notch (see Figure 3-30).

3 Connect the switch cable to the INTRUSION connector on the system board (see Figure 6-1).

4 Close the expansion card cover (see Figure 3-7).

5 Replace the system cover (see "Installing the System Cover" on page 67).

Power Supply Distribution Module

If your system has redundant power supplies, it will have a power supply distribution module inside the system.

Removing the Power Supply Distribution Module

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

2 Remove the redundant power supplies (see "Removing a Redundant Power Supply" on page 73).

3 Remove the system cover (see "Removing the System Cover" on page 66).

4 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

5 Disconnect all power supply distribution module power cables from the system board. See Figure 3-31.

6 Pull and hold the blue release pin, slide the module up to free the securing tabs from the slots, and lift the board out of the chassis (see Figure 3-31).

Figure 3-31.   Removing and Installing the Power Supply Distribution Module
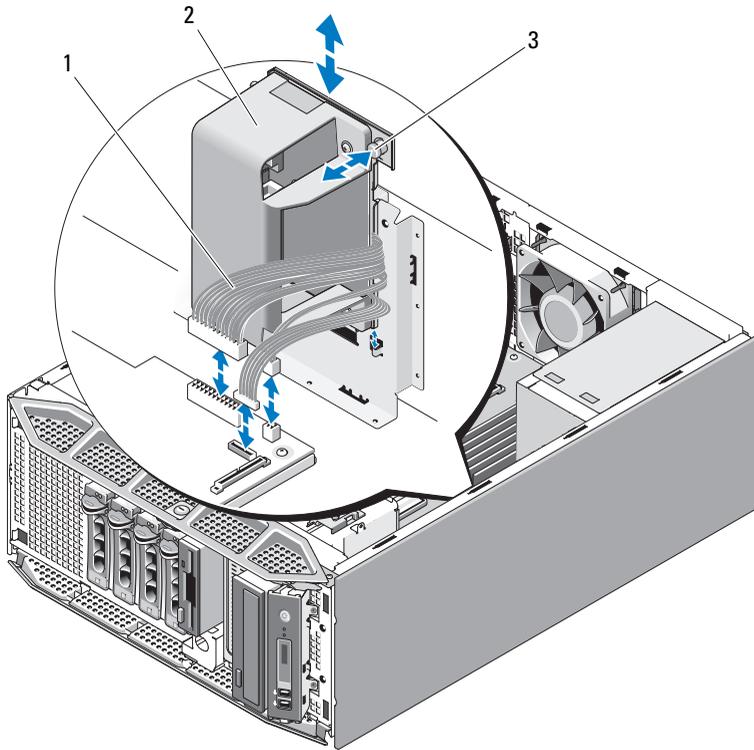
1	power cables	2	power supply distribution module
3	release tab		

Installing the Power Supply Distribution Module

1 Position the power supply distribution module so that the securing tabs are fully inserted into the securing slots on the chassis wall (see Figure 3-31).

2 Slide the power supply distribution module down until the blue release pin locks into place, securing the board.

3 Connect all power cables to the connectors on the system board.

4 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

5 Replace the system cover (see "Installing the System Cover" on page 67).

6 Replace the power supplies (see "Installing a Redundant Power Supply" on page 75).

SAS Backplane

If your system has front-loading hot-pluggable hard drives, the system contains a SAS backplane board to which the hard drives connect.
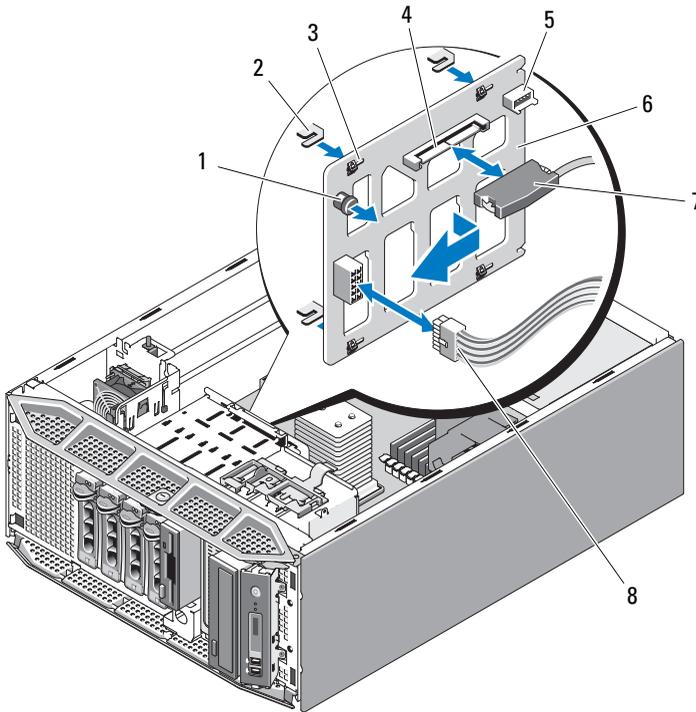
Removing the SAS Backplane

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2 Remove the front-drive bezel (see "Removing the Front Bezel" on page 63).

3 Remove the system cover (see "Removing the System Cover" on page 66).

4 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

5 Open the drive-carrier release handle on each hard drive and partially extend the drive(s) out of their drive bays (see "Diskette Drive (Optional)" on page 84).

6 Disconnect the following cables from the backplane (see Figure 3-32):

- SAS cable
- Power cable
- Backplane cable

7 Remove the SAS backplane:

a Pull the blue backplane release pin (see Figure 3-32).

b While pulling the release pin, slide the backplane towards the top of the system.

c Pull the backplane board until the securing slots are free from the securing tabs, and lift the board from the chassis.

Figure 3-32.   Removing and Installing the SAS Backplane

1	backplane release pin	2	securing tabs (4)
3	securing slots (4)	4	SAS connector
5	backplane connector	6	SAS backplane
7	SAS cable connector	8	power cable

Installing the SAS Backplane

1 Position the SAS backplane so that the securing tabs on the chassis are fully inserted into the securing slots on the backplane (see Figure 3-32).

2 Slide the backplane to the right until the release pin snaps into place.

3 Reconnect the following cables to the backplane (see Figure 3-32):

   • SAS cable

   • Power cable

   • Backplane cable

4 Reseat the hot-plug hard drives in the system (see "Installing a Hot-Pluggable Hard Drive" on page 78).

   ![NOTE icon] **NOTE:** Reinstall the hard drives in the same drive bays from which they were removed.

5 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

6 Replace the system cover (see "Installing the System Cover" on page 67).

Control Panel

Removing the Control Panel

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2 Remove the system cover (see "Removing the System Cover" on page 66).

3 Remove the front-drive bezel (see "Removing the Front Bezel" on page 63).

4 Disconnect the control panel cable at back of the control panel (see Figure 3-33).

   a Squeeze the metal tabs on the ends of the cable connector.

   b Gently work the connector out of the socket.

Figure 3-33. Removing and Installing the Control Panel
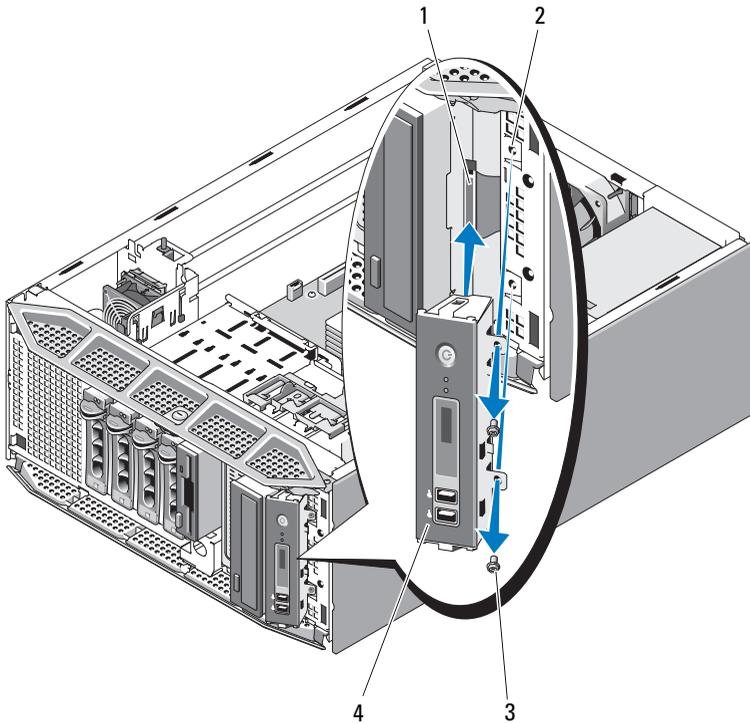
1	control panel cable	2	screw holes (2)
3	screws (2)	4	control panel

5 Remove the two screws that secure the control panel to the system and remove the panel (see Figure 3-33).

Installing the Control Panel

1 Insert the control panel into the system as shown in Figure 3-33.

2 Install the two screws to secure the control panel to the system (see Figure 3-33).

3 Connect the control panel cable to the back of the control panel (see Figure 3-33).

4 Replace the system cover (see "Installing the System Cover" on page 67).

System Board

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

◐ **NOTICE:** If you are using the Trusted Platform Module (TPM) with an encryption application, you may be prompted to create a recovery key during system or application setup. Be sure to create and safely store this recovery key. If you ever need to replace the system board, you must supply the recovery key when you restart your system or application before you can access the encrypted data on your hard drive(s).

Removing the System Board

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

2 Remove the system cover (see "Removing the System Cover" on page 66).

3 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

4 Disconnect all cables from the system board.

5 Remove all expansion cards and any attached cables (see "Removing an Expansion Card" on page 93).

6 Remove the RAC card, if applicable (see "Removing the RAC Card" on page 102).

7 Remove the SAS controller card, if applicable (see "RAID Battery" on page 99).

8 Remove the internal USB memory key, if applicable (see Figure 6-1).

9 Remove all memory modules (see "Removing Memory Modules" on page 112).

> **NOTE:** Record the memory module socket locations to ensure proper reinstallation of the memory modules.

> ⚠ **CAUTION: The processor and heat sink can become extremely hot. Allow sufficient time for the processor and heat sink to cool before handling.**

> ⊘ **NOTICE:** To prevent damaging the processor, do not pry the heat sink off of the processor.

10 Remove the processor (see "Removing the Processor" on page 115).

11 Remove the SAS backplane, if applicable (see "Removing the SAS Backplane" on page 125).

12 Carefully route any loose cables away from the edges of the system board.

13 Pull up on the system board release pin, then slide the system board assembly toward the front of the system.

14 Lift the system board out of the system.

Figure 3-34. Removing and Installing the System Board
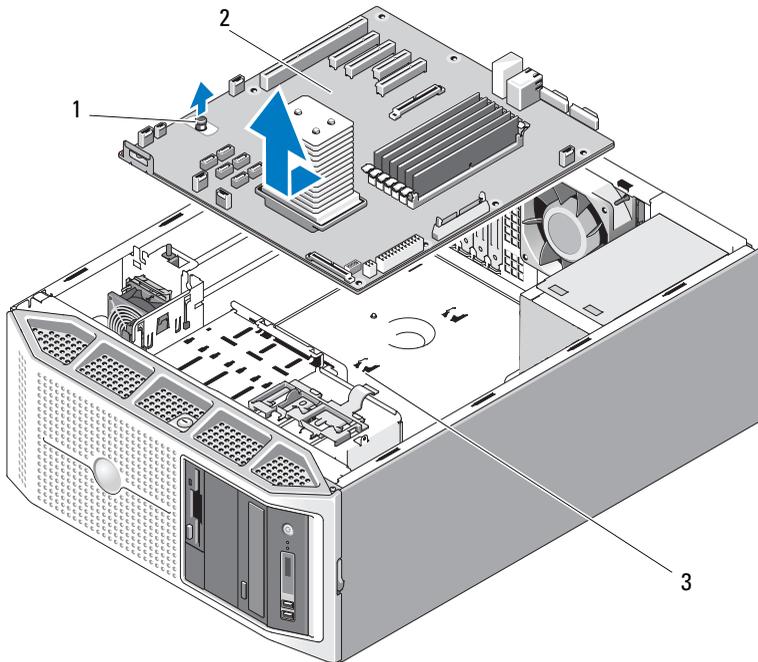
1	system board release pin	2	system board
3	system board securing slots		

Installing the System Board

1 Align the back connectors on the system board with the cutouts in the back of the chassis, and ensure the system board tray is square with the chassis so that the securing tabs on the chassis fully insert into system board securing slots.

2 Slide the system board towards the back of the system until the blue release pin locks into place (see Figure 3-34).

3 Replace the SAS backplane, if applicable (see "Installing the SAS Backplane" on page 127).

4 Replace the processor (see "Installing the Processor" on page 118).

5 Replace the memory modules in the same sockets from which they were removed (see "Installing Memory Modules" on page 113).

6 Replace the internal USB memory key, if applicable (see "Installing the Optional Internal USB Memory Key" on page 105).

7 Replace the SAS controller card, if applicable (see "Installing a SAS Controller Card" on page 98).

8 Replace the RAC card, if applicable (see "Installing a RAC Card" on page 104).

9 Replace all expansion cards that you removed and any attached cables (see "Installing an Expansion Card" on page 95).

10 Replace any cables that you removed from the system board.

11 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

12 Replace the system cover (see "Installing the System Cover" on page 67).

4

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: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

Start-Up Routine

Look and listen during the system's start-up routine for the indications described in the table below.

Table 4-1.   Start-Up Routine Indications

Look/listen for:	Action
A status or error message displayed on the front-panel LCD.	See "LCD Status Messages" on page 19.
An error message displayed on the monitor.	See "System Messages" on page 30.
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 134.
The keyboard indicators.	See "Troubleshooting the Keyboard or Mouse" on page 135.

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

Look/listen for:	Action
The USB diskette drive activity indicator.	See "Troubleshooting a Diskette Drive" on page 149.
The USB CD drive activity indicator.	See "Troubleshooting an Optical Drive" on page 151.
The hard-drive activity indicator.	See "Troubleshooting a Hard Drive" on page 153.
An unfamiliar constant scraping or grinding sound when you access a drive.	See "Getting Help" on page 175.

Checking the Equipment

This section provides troubleshooting procedures for external devices attached to the system, such as the monitor, keyboard, or mouse. Before you perform any of the procedures, see "Troubleshooting External Connections" on page 134.

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 "Front-Panel Features and Indicators" on page 13 and "Back-Panel Features and Indicators" on page 16 for the front- and back-panel connectors on your system.

Troubleshooting the Video Subsystem

Problem

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

Action

1 Check the system and power connections to the monitor.

2 Determine whether the system has 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 "Using Dell PowerEdge Diagnostics" on page 163).

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

If the tests fail, see "Getting Help" on page 175.

Troubleshooting the Keyboard or Mouse

Problem

- System message indicates a problem with the keyboard and/or mouse

- Keyboard and/or mouse is not functioning or is functioning improperly.

Action

1 Disconnect the keyboard and mouse cables from the system for 10 seconds and then reconnect them.

If the problem is not resolved, proceed to the next step.

2 Try connecting the keyboard/mouse to the USB ports on the opposite side of the system. For example, if your are using the front USB ports, try connecting to the rear USB ports.

If the problem is not resolved, proceed to the next step.

If the problem is resolved, restart the system, enter the System Setup program, and check if the nonfunctioning USB ports are enabled. See "Getting Help" on page 175 if the ports are enabled but not functioning.

3 Swap the faulty keyboard or mouse with a working keyboard or mouse.

If the problem is resolved, replace the faulty keyboard or mouse.

4 If other USB devices are connected to the system ports adjacent to those used by the keyboard and mouse, power down the devices and disconnect them from the system.

An overcurrent event on another USB device can cause both the keyboard and mouse to stop functioning.

If the mouse and keyboard do not immediately return to operation after disconnecting the other USB devices, restart your system. If the problem persists, proceed to the next step.

If the mouse and keyboard operations are restored, reconnect the disconnected USB devices and power them on one at a time. Note if any device causes the same problem and replace any faulty device(s).

5 If you have remote access to your system, use a remote host to access the system's System Setup program and enable the USB ports. If remote access is not available, proceed to the next step.

If enabling the USB ports does not resolve the problem, see "Getting Help" on page 175.

6 If you do not have remote access to your system, use the following procedure to set the NVRAM_CLR jumper inside your system and restore the BIOS to its default settings.

⚠️ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

   a Turn off the system and attached peripherals and unplug the system from the power source.

   b Open the system. See "Removing the System Cover" on page 66.

   c Locate the NVRAM_CLR jumper on your system board (see Figure 6-1) and set the jumper to the enabled position.

   d Close the system. See "Installing the System Cover" on page 67.

e Reconnect the system and peripherals to power and restart.

If the mouse and keyboard are operational, proceed to the next step.

If the mouse and keyboard are still not operational, see "Getting Help" on page 175.

f Repeat step a and step b.

g Set the NVRAM_CLR jumper to the disabled position.

h Close the system.

i Reconnect the system to power and restart the system and attached peripherals.

j Enter the System Setup program and reenter any custom BIOS settings that were reset. Be sure to leave all USB ports enabled.

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 "Entering the System Setup Program" on page 41).

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 "Running the System Diagnostics" on page 163).

If the tests run successfully but the problem persists, see "Troubleshooting a USB Device" on page 138.

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 175).

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 175).

   If the problem persists, see "Getting Help" on page 175.

Troubleshooting a USB Device

Problem

- System message indicates a problem with a USB device.
- One or more USB devices are not operating properly.

Action

1 If a single USB device is experiencing a problem, perform the following procedure. For problems with multiple USB devices, skip to step 2.

   a Turn off the USB device, disconnect the USB cable from the system briefly, and reconnect the cable.

   b Restart the system, enter the System Setup program, and ensure that all USB ports are enabled. See "Using the System Setup Program" on page 41.

c Turn off the USB device and swap the interface cable with a working cable. Turn on the device.

If the problem is resolved, replace the interface cable.

d Turn off the USB device, connect it to another USB connector on the system, and turn on the USB device.

If the USB device functions, the USB connector on the system is likely defective. Otherwise, the USB device is faulty and needs to be replaced. See "Getting Help" on page 175.

2 Power down all USB peripheral devices and disconnect all USB devices from the system except the USB mouse and keyboard.

3 Restart the system and reconnect the USB devices.

If the problem is resolved, the problem was likely caused by an overcurrent event on one of the USB devices. If the problem persists, attempt to isolate the faulty device by trying different USB configurations.

If the problem is not resolved, proceed to the next step.

4 Reset the system BIOS to the default settings by setting the NVRAM _CLR jumper inside your system . Use the following procedure.

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

a Turn off the system and attached peripherals and unplug the system from the power source.

b Open the system. See "Removing the System Cover" on page 66.

c Locate the NVRAM_CLR jumper on your system board (see Figure 6-1) and set the jumper to the enabled position.

d Close the system. See "Installing the System Cover" on page 67.

e Reconnect the system and peripherals to power and restart.

If all USB devices are operational, proceed to the next step.

If the USB devices are still not functioning, see "Getting Help" on page 175.

f Repeat step a and step b.

g Set the NVRAM_CLR jumper to the disabled position.

h Close the system.

i Reconnect the system and peripherals to power and restart.

j Enter the System Setup program and reenter any custom BIOS settings that were reset. Be sure to leave all USB ports enabled. See "Using the System Setup Program" on page 41.

Troubleshooting a NIC

Problem

- NIC cannot communicate with network.

Action

1 Run the appropriate online diagnostic test (see "Running the System Diagnostics" on page 164).

2 Check the appropriate indicator on the NIC connector (see "NIC Indicator Codes" on page 18).

- 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 "Entering the System Setup Program" on page 41).

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.

If the problem persists, see "Getting Help" on page 175.

Troubleshooting a Wet System

Problem

- Liquid spilled on the system.
- Excessive humidity.

Action

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2 Open the system (see "System Cover" on page 66).

3 Remove all expansion cards installed in the system (see "Removing an Expansion Card" on page 93).

4 Let the system dry thoroughly for at least 24 hours.

5 Close the system (see "Installing the System Cover" on page 67).

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 175.

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 95).

8 Run the appropriate online diagnostic test (see "Using Dell PowerEdge Diagnostics" on page 163).

If the tests fail, see "Getting Help" on page 175.

Troubleshooting a Damaged System

Problem

- System was dropped or damaged.

Action

⚠️ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Open the system (see "System Cover" on page 66).

2 Ensure that the following components are properly installed:

- Expansion cards
- Power supplies
- Fans
- Processor and heat sink
- Memory modules
- Drive-carrier connections to the SAS/SATA backplane, if applicable

3 Ensure that all cables are properly connected.

4 Close the system (see "Installing the System Cover" on page 67).

5 Run the system board tests in the system diagnostics (see "Running the System Diagnostics" on page 163).

If the tests fail, see "Getting Help" on page 175.

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 "Entering the System Setup Program" on page 41).

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 (see "Entering the System Setup Program" on page 41).

   If the date and time are not correct in the System Setup program, replace the battery (see "System Battery" on page 119).

   If the problem is not resolved by replacing the battery, see "Getting Help" on page 175.

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 Redundant Power Supplies

Problem

- System-status indicators are amber.
- Power-supply fault indicators are amber.
- Front-panel status LCD indicates a problem with the power supplies.

Action

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

 1 Run the appropriate online diagnostics test (see "Running the System Diagnostics" on page 163).

 2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

 3 Locate the faulty power supply.

    The power supply's fault indicator is lit (see "Power Indicator Codes" on page 17).

◉ **NOTICE:** You can hot-plug the redundant power supplies. One power supply must be installed for the system to operate. The system is in the redundant mode when two power supplies are installed. Remove and install only one power supply at a time in a system that is powered on. Operating the system with only one power supply installed for extended periods of time can cause the system to overheat.

 4 Ensure that the power supply is properly installed by removing and reinstalling it (see "Installing a Redundant Power Supply" on page 75).

    📖 **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 (see "Power Indicator Codes" on page 17).

 5 If the problem persists, remove the faulty power supply (see "Removing a Redundant Power Supply" on page 73).

 6 Install a new power supply (see "Installing a Redundant Power Supply" on page 75).

    If the problem persists, see "Getting Help" on page 175.

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, drive blanks, or shrouds are 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 145).

Troubleshooting a Fan

Problem

- Systems management software issues a fan-related error message.
- Front panel LCD indicates a problem with the fan.

Action

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Run the appropriate diagnostic test (see "Using Dell PowerEdge Diagnostics" on page 163).

2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.

3 Open the system (see "System Cover" on page 66).

4 Locate the faulty fan indicated by the LCD display or diagnostic software. For the identification number of each fan, see "Cooling Fans" on page 107.

5 Ensure that the faulty fan's power cable is firmly attached to the fan power connector (see "Cooling Fans" on page 107).

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

7 If the problem is not resolved, install a new fan (see "Cooling Fans" on page 107).

If the replacement fan is working properly, close the system (see "Installing the System Cover" on page 67).

If the replacement fan does not operate, see "Getting Help" on page 175.

Troubleshooting System Memory

Problem

- Faulty memory module.
- Faulty system board.
- Front-panel status LCD indicates a problem with system memory.

Action

⚠️ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 If the system is operational, run the appropriate online diagnostic test (see "Using Dell PowerEdge Diagnostics" on page 163).

If diagnostics indicates a fault, follow the corrective actions provided by the diagnostic program. If the problem is not resolved or if the system is not operational, continue to the next step.

2 Turn off the system and attached peripherals, unplug the system from the power source and press the power button, and then reconnect the system to power.

3 Turn on the system and attached peripherals and, as the system boots, note the messages on the screen.

If an error messages appears indicating a fault with a specific memory module, go to step 12.

If any other system message appears that indicates a nonspecific memory problem, continue to the next step.

4   Enter the System Setup program and check the system memory setting (see "Entering the System Setup Program" on page 41).

If the installed memory does not match the amount of memory shown in the System Setup program, proceed to the next step.

If the memory settings and installed memory indicate no problems, go to step 12.

5   Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

6   Open the system (see "System Cover" on page 66).

7   Ensure that the memory banks are populated correctly (see "Memory Module Installation Guidelines" on page 111).

If the memory modules are populated correctly, continue to the next step.

8   Reseat the memory modules in their sockets (see "Installing Memory Modules" on page 113).

9   Close the system (see "Installing the System Cover" on page 67).

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

11 Enter the System Setup program and check the system memory setting (see "Entering the System Setup Program" on page 41).

If the amount of memory installed still does not match the system memory setting, proceed to the next step.

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

13 Open the system (see "System Cover" on page 66).

14 If a diagnostic test or error message indicates a specific memory module as faulty, swap or replace the module. Otherwise, swap the memory module in the first DIMM socket with a module of the same type and capacity that is known to be good (see "Installing Memory Modules" on page 113).

15 Close the system (see "Installing the System Cover" on page 67).

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

17 As the system boots, observe any error message that appears and the diagnostic indicators on the front of the system.

18 If the memory problem is still indicated, repeat step 12 through step 17 for each memory module installed.

If the problem persists, see "Getting Help" on page 175.

Troubleshooting an Internal USB Memory Key

Problem

- System cannot read data from a USB memory key.

Action

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Enter the System Setup program and ensure that the USB key port is enabled (see "Entering the System Setup Program" on page 41).

2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

3 Open the system (see "System Cover" on page 66).

4 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

5 Reseat the USB key.

6 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

7 Close the system (see "Installing the System Cover" on page 67).

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

If the problem is not resolved, proceed to the next step.

9 Repeat step 2, step 3, and step 4.

10 Insert a different USB key that you know works properly.

11 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

12 Close the system (see "Installing the System Cover" on page 67).

13 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 175.

Troubleshooting a Diskette Drive

Problem
- Error message indicates a diskette drive problem.

Action

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Enter the System Setup program and verify that the diskette drive is configured correctly (see "Entering the System Setup Program" on page 41).

2 Run the appropriate online diagnostic test (see "Using Dell PowerEdge Diagnostics" on page 163).

3 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

4 Open the system (see "System Cover" on page 66).

5 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

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 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

9 Close the system (see "Installing the System Cover" on page 67).

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

11 Run the appropriate online diagnostic test to see whether the diskette drive works correctly.

If the problem persists, continue with the following steps.

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

13 Open the system (see "System Cover" on page 66).

14 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

15 Remove all expansion cards installed in the system (see "Removing an Expansion Card" on page 93).

16 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

17 Close the system (see "Installing the System Cover" on page 67).

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

19 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 175.

20 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.

21 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

22 Open the system (see "System Cover" on page 66).

23 Reinstall one of the expansion cards you removed in step 15 (see "Installing an Expansion Card" on page 95).

24 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

25 Close the system (see "Installing the System Cover" on page 67).

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

27 Run the appropriate online diagnostic test to see whether the diskette drive works correctly.

28 Repeat step 20 through step 27 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 175.

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: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Try using a different CD or DVD that you know works properly.

2 Enter the System Setup program and ensure that the optical drive controller is enabled (see "Entering the System Setup Program" on page 41).

3 Run the appropriate online diagnostic test (see "Using Dell PowerEdge Diagnostics" on page 163).

4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

5 Open the system (see "System Cover" on page 66).

6 Ensure that the interface cable is securely connected to the optical drive and to the controller.

7 Ensure that the power cable is properly connected to the drive.

8 Close the system (see "Installing the System Cover" on page 67).

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 175.

Troubleshooting a 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 (see "Installing an Optical or Tape Drive" on page 91).

3 Reinstall the tape-backup software as instructed in the tape-backup software documentation.

4 Ensure that the tape drive's interface/DC power cable is connected to the tape drive and SCSI controller card.

5 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.

6   Run the appropriate online diagnostics tests (see "Using Dell PowerEdge Diagnostics" on page 163).

7   Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

8   Open the system (see "System Cover" on page 66).

9   Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

10 Ensure that the SCSI controller card is firmly seated in its connector (see "Installing an Expansion Card" on page 95).

11 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

12 Close the system (see "Installing the System Cover" on page 67).

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

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

15 If you cannot resolve the problem, see "Getting Help" on page 175 for information on obtaining technical assistance.

Troubleshooting a Hard Drive

If your system has hot-pluggable hard drives in a front-loading hard drive bay (when available), see "Troubleshooting a Hot-pluggable Hard Drive" on page 155.

Problem

- Device driver error.

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

Action

⚠️ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

🔜 **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 163).

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

2 If you are experiencing problems with multiple hard drives, skip to step 6. For a problem with a single hard drive, continue to the next step.

3 If your system has a SAS RAID controller, perform the following steps.

   a Restart the system and press <Ctrl><R> to enter the host adapter configuration utility program.

   See the documentation supplied with the host adapter for information about the configuration utility.

   b Ensure that the hard drive has been configured correctly for the RAID.

   c Exit the configuration utility and allow the system to boot to the operating system.

4 Ensure that the required device drivers for your SAS controller card or SAS RAID controller are installed and are configured correctly. See the operating system documentation for more information.

5 Verify that the controller is enabled and the drives appear in the System Setup program (see "Entering the System Setup Program" on page 41).

6 Check the cable connections inside the system:

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

   b Open the system (see "System Cover" on page 66).

c Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

d Verify that the cable connections between the hard drive(s) and the drive controller are correct, whether the connections are to the SATA connectors on the system board, a SAS expansion card, or a SAS RAID controller (see "Hard Drives" on page 77).

e Verify that the SAS or SATA cables are securely seated in their connectors.

f Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

g Close the system (see "Installing the System Cover" on page 67).

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

If the problem persists, see "Getting Help" on page 175.

Troubleshooting a Hot-pluggable Hard Drive

Problem

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

Action

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

◯ **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 163).

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

2 Remove the front bezel (see "Removing the Front Bezel" on page 63).

3 If you are experiencing problems with multiple hard drives, skip to step 9. For a problem with a single hard drive, continue to the next step.

4 Turn off your system, reseat the hard drive, and restart the system.

5 If your system has a SAS RAID controller, perform the following steps.

   a Restart the system and press <Ctrl><R> to enter the host adapter configuration utility program.

     See the documentation supplied with the host adapter for information about the configuration utility.

   b Ensure that the hard drive has been configured correctly for the RAID.

   c Exit the configuration utility and allow the system to boot to the operating system.

6 Ensure that the required device drivers for your controller are installed and are configured correctly. See the operating system documentation for more information.

7 Verify that the controller is enabled and the drives appear in the System Setup program (see "Entering the System Setup Program" on page 41).

NOTICE: Do not perform the following step if you have a SAS RAID controller.

8 If you have a non-RAID SAS controller, remove the hard drive and swap its drive bay location with another hard drive that is functioning properly.

If the problem is resolved, reinstall the hard drive in the original bay (see "Installing a Hot-Pluggable Hard Drive" on page 78).

If the hard drive functions properly in the original bay, the drive carrier could have intermittent problems. Replace the hard drive carrier (see "Getting Help" on page 175).

If the hard drive functioned properly in another bay but does not function in the original bay, the SAS/SATA backplane has a defective connector (see "Getting Help" on page 175).

9 Check the cable connections inside the system:

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

   b Open the system (see "System Cover" on page 66).

c Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

d Verify that the cable connections between the SAS/SATA backplane and the SAS controller are correct (see "Installing the SAS Backplane" on page 127).

e Verify that the SAS cables are securely seated in their connectors.

f Verify that the power cable on the SAS/SATA backplane is securely seated in the connector.

g Install the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

h Close the system (see "Installing the System Cover" on page 67).

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

If the problem persists, see "Getting Help" on page 175.

Troubleshooting a SAS or SAS RAID Controller

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

Problem

• Error message indicates a problem with the SAS or SAS RAID controller.

• SAS or SAS RAID controller performs incorrectly or not at all.

Action

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Run the appropriate online diagnostic test (see "Using Dell PowerEdge Diagnostics" on page 163).

2 Enter the System Setup program and ensure that the SAS or SAS RAID controller is enabled (see "Entering the System Setup Program" on page 41).

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

6 Open the system (see "System Cover" on page 66).

7 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

8 Ensure that the controller card is firmly seated into the system board connector (see "Installing an Expansion Card" on page 95).

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 hard drives and the SAS controller are correct (see "Hard Drives" on page 77).

Ensure that the cables are firmly connected to the SAS controller and the hard drives.

11 If your system has hot-pluggable hard drives in a front-loading drive bay (when available), verify that the cable connections between the SAS/SATA backplane and the SAS controller are correct (see "Installing the SAS Backplane" on page 127).

12 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

13 Close the system (see "Installing the System Cover" on page 67).

14 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals. If the problem persists, see "Getting Help" on page 175.

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: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 Run the appropriate online diagnostic test for the expansion card which is exhibiting issues (see "Using Dell PowerEdge Diagnostics" on page 163). Follow any recommended actions provided by the diagnostics. If the problem persists, go to the next step.

2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

3 Open the system (see "System Cover" on page 66).

4 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

5 Ensure that each expansion card is firmly seated in its connector (see "Installing an Expansion Card" on page 95).

6 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

7 Close the system (see "Installing the System Cover" on page 67).

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

If the problem persists, go to the next step.

9 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

10 Open the system (see "System Cover" on page 66).

11 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

12 Remove all expansion cards in the system (see "Removing an Expansion Card" on page 93).

✎ **NOTE:** If your operating system is running off a disk controller card (such as a SAS controller card), do not remove it.

13 Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

14 Close the system (see "Installing the System Cover" on page 67).

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

16 Run the appropriate online diagnostic test.

If the tests fail, see "Getting Help" on page 175.

17 For each expansion card you removed in step 12, perform the following steps:

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

    b Open the system (see "System Cover" on page 66).

    c Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

    d Reinstall one of the expansion cards.

    e Replace the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

f Close the system (see "Installing the System Cover" on page 67).

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

h Run the appropriate online diagnostic test.

If the tests fail, repeat step 17 for each expansion card until you are able to single out the faulty expansion card.

If the tests fail for all expansion cards, see "Getting Help" on page 175.

Troubleshooting the Microprocessor

Problem

- Error message indicates a processor problem.
- Front-panel status LCD indicates a problem with the processor or system board.
- A heat sink is not installed for the processor.

Action

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

1 If possible, run the appropriate online diagnostics test (see "Using Dell PowerEdge Diagnostics" on page 163).

2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

3 Open the system (see "System Cover" on page 66).

4 Remove the processor airflow shroud (see "Removing the Processor Airflow Shroud" on page 70).

5 Ensure that the processor and heat sink is properly installed (see "Installing the Processor" on page 118).

6 Install the processor airflow shroud (see "Installing the Processor Airflow Shroud" on page 72).

7 Close the system (see "Installing the System Cover" on page 67).

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

9 If possible, run the appropriate online diagnostic test (see "Running the System Diagnostics" on page 163).

   If the tests fail or the problem persists, replace the processor (see "Getting Help" on page 175).

10 If you have replaced the processor and the problem persists, the system board is faulty (see "Getting Help" on page 175).

5

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 is run from the utility partition on your hard drive.

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).

1   As the system boots, press <F10> during POST.

2   From the utility partition main menu, select **Run System Diagnostics**, or select **Run Memory Diagnostics** if you are troubleshooting memory.

When you start the system diagnostics, a message is displayed stating that the diagnostics are initializing. Next, the **Diagnostics** menu appears. The 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.

NOTE: After you select all the devices and components that you want to test, highlight **All Devices** and then click **Run Tests**.

Selecting Diagnostics Options

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

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

Viewing Information and Results

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

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

6

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 Connectors

⚠️ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

Figure 6-1.   System Board Connectors
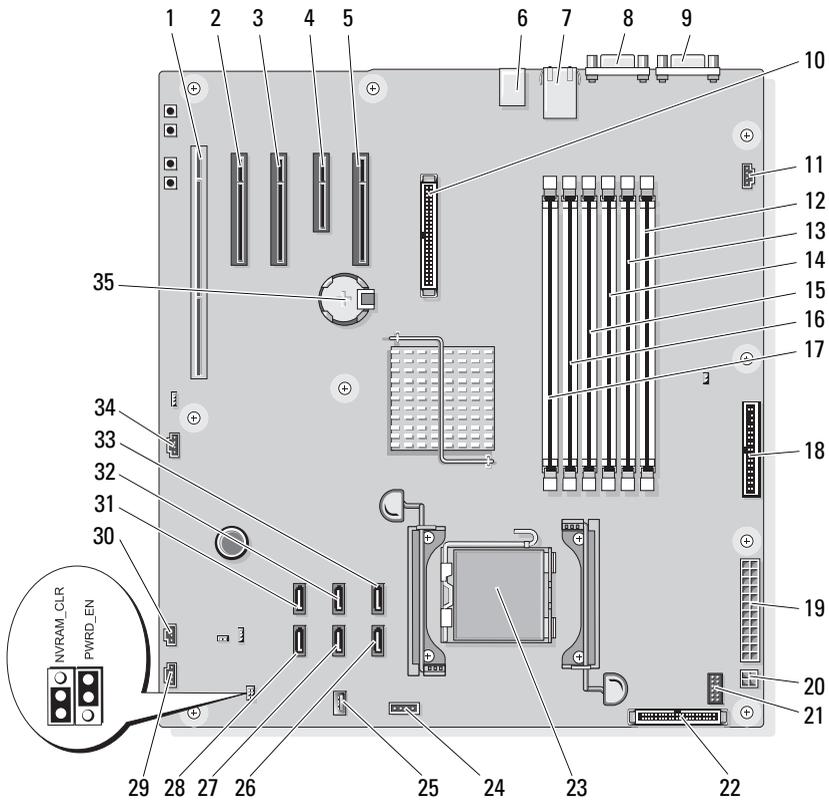
Table 6-1.   System Board Connectors

Item	Connector	Description
1	PCIX_5	PCI-X connector (slot 5)
2	PCIE_X8_4	PCIe x8 connector (slot 4)
3	PCIE_X8_3	PCIe x8 connector (slot 3)
4	PCIE_X4_2	PCIe x4 connector (slot 2)
5	PCIE_X4_1 DRAC SLOT	PCIe x8 connector (slot 1) (reserved for RAC card)

Table 6-1. System Board Connectors *(continued)*

Item	Connector	Description
6	J3	USB connectors (USB1, USB2, USB3, and USB4)
7	J4	NIC connectors (LOM1_UP and LOM2_DOWN)
8	VGA	Video connector
9	COM	Serial connector
10	RAC_CONN	Remote Access Controller (RAC)
11	FAN2	Rear system fan connector
12	DIMM1_A	Memory module connector (slot 1)
13	DIMM1_B	Memory module connector (slot 2)
14	DIMM2_A	Memory module connector (slot 3)
15	DIMM2_B	Memory module connector (slot 4)
16	DIMM3_A	Memory module connector (slot 5)
17	DIMM3_B	Memory module connector (slot 6)
18	FLOPPY	Diskette drive connector
19	PWR_CONN	Main power connector
20	12V	Power connector
21	PSU_12C	Power distribution board connector
22	CTRL_PNL	Control panel connector
23	CPU	Microprocessor connector
24	BP_12C	Backplane connector
25	USB_CONN	Internal USB connector
26	SATA_B	SATA drive connector
27	SATA_D	SATA drive connector
28	SATA_F	SATA drive connector
29	FAN1	Front system fan connector
30	INTRUSION	Chassis intrusion switch connector

Table 6-1. System Board Connectors *(continued)*

Item	Connector	Description
31	SATA_E	SATA drive connector
32	SATA_C	SATA drive connector
33	SATA_A	SATA drive connector
34	HDD_LED	SAS hard drive activity LED connector
35	BATTERY	System battery

Jumper Settings
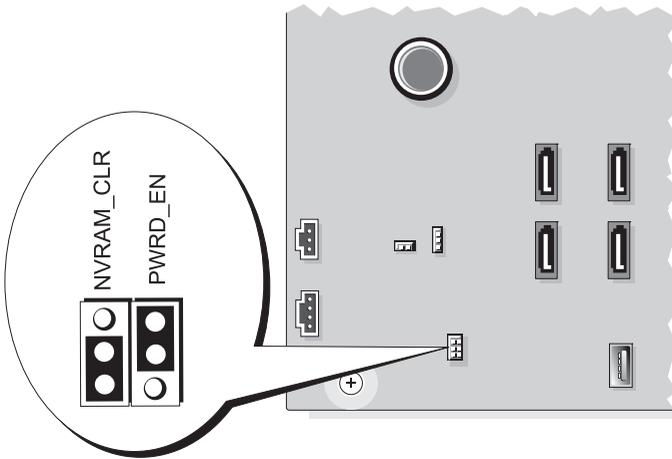
Table 6-2.   System Board Jumper Settings

Jumper	Setting	Description
NVRAM_CLR	Pins 3-5 (default)	The configuration settings in NVRAM are retained at next system boot.
	Pins 1-3	The configuration settings are cleared at the next system boot. (If the configuration settings become corrupted to the point where the system will not boot, install the jumper and boot the system. Remove the jumper before restoring the configuration information.)
PWRD_EN	Pins 2-4 (default)	The password feature is enabled.
	Pins 4-6	The password feature is disabled.

SAS Backplane Board Connectors

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

The SAS backplane is present in systems that have a front-loading hot-plug hard drive bay (when available). Figure 6-2 shows the locations of the SAS backplane connectors.

Figure 6-2. SAS Backplane Connectors

front
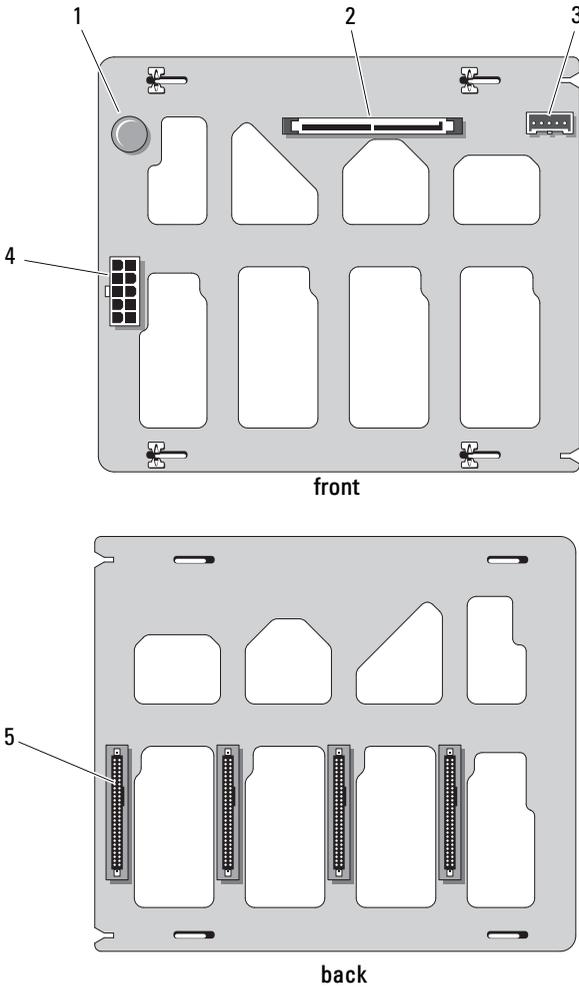
back

1	release pin	2	SAS/SATA connector
3	backplane connector	4	power connector
5	SAS/SATA drive connectors (4)		

Disabling a Forgotten Password

The password jumper on the system board enables the system password features or disables them and clears any password(s) currently in use.

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.**

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

2 Open the system (see "System Cover" on page 66).

3 Move the PWRD_EN jumper to the disabled position.

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

4 Close the system (see "Installing the System Cover" on page 67).

5 Reconnect the system to the electrical outlet, and turn on the system.

   The existing passwords are not disabled (erased) until the system boots with the password jumper plug removed. However, before you assign a new system and/or setup password, you must install the jumper plug.

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

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

7 Open the system (see "System Cover" on page 66).

8 Move the PWRD_EN jumper from the disabled position to the enabled position.

9 Close the system, reconnect the system to the electrical outlet, and turn on the system.

10 Assign a new system and/or setup password.

   To assign a new password using the System Setup program, see "Using the System Password" on page 53.

7

Getting Help

Contacting Dell

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

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

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

1. Visit **support.dell.com**.
2. Verify your country or region in the **Choose A Country/Region** drop-down menu at the bottom of the page.
3. Click **Contact Us** on the left side of the page.
4. Select the appropriate service or support link based on your need.
5. Choose the method of contacting Dell that is convenient for you.

Glossary

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

A — Ampere(s).

AC — Alternating current.

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

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

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

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

ASCII — American Standard Code for Information Interchange.

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

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

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

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

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

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

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

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

BMC — Baseboard management controller.

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

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

BTU — British thermal unit.

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

C — Celsius.

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

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

cm — Centimeter(s).

cmos — Complementary metal-oxide semiconductor.

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

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

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

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

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

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

CPU — Central processing unit. See *processor*.

DC — Direct current.

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

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

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

diagnostics — A comprehensive set of tests for your system.

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

DIN — *Deutsche Industrie Norm*.

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

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

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

DNS — Domain Name System. A method of translating Internet domain names, such as **www.dell.com**, into IP addresses, such as 143.166.83.200.

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

DVD — Digital versatile disc.

ECC — Error checking and correction.

EEPROM — Electronically erasable programmable read-only memory.

EMC — Electromagnetic compatibility.

EMI — Electromagnetic interference.

ERA — Embedded remote access. ERA allows you to perform remote, or "out-of-band," server management on your network server using a Remote Access Controller.

ESD — Electrostatic discharge.

ESM — Embedded server management.

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

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

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

F — Fahrenheit.

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

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

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

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

ft — Feet.

FTP — File transfer protocol.

g — Gram(s).

G — Gravities.

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

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

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

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

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

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

headless system — A system or device that functions without having a keyboard, mouse, or monitor attached. Normally, headless systems are managed over a network using an Internet browser.

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

Hz — Hertz.

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

ID — Identification.

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

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

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

IP — Internet Protocol.

IPX — Internet package exchange.

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

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

K — Kilo-; 1000.

Kb — Kilobit(s); 1024 bits.

KB — Kilobyte(s); 1024 bytes.

Kbps — Kilobit(s) per second.

KBps — Kilobyte(s) per second.

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

kg — Kilogram(s); 1000 grams.

kHz — Kilohertz.

KMM — Keyboard/monitor/mouse.

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

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

lb — Pound(s).

LCD — Liquid crystal display.

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

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

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

LVD — Low voltage differential.

m — Meter(s).

mA — Milliampere(s).

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

mAh — Milliampere-hour(s).

Mb — Megabit(s); 1,048,576 bits.

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

Mbps — Megabits per second.

MBps — Megabytes per second.

MBR — Master boot record.

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

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

memory — An area in your system that stores basic system data. A system can contain several different forms of memory, such as integrated memory (ROM and RAM) and add-in memory modules (DIMMs).

MHz — Megahertz.

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

mm — Millimeter(s).

ms — Millisecond(s).

MS-DOS® — Microsoft Disk Operating System.

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

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

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

ns — Nanosecond(s).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

PS/2 — Personal System/2.

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

RAC — Remote Access Controller.

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

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

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

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

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

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

ROMB — RAID on motherboard.

rpm — Revolutions per minute.

RTC — Real-time clock.

SAS — Serial-attached SCSI.

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

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

SDRAM — Synchronous dynamic random-access memory.

sec — Second(s).

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

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

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

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

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

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

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

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

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

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

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

system diskette — See *bootable diskette*.

system memory — See *RAM*.

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

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

TCP/IP — Transmission Control Protocol/Internet Protocol.

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

TOE — TCP/IP offload engine.

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

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

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

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

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

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

V — Volt(s).

VAC — Volt(s) alternating current.

VDC — Volt(s) direct current.

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

video adapter — The logical circuitry that provides (in combination with the monitor) your system's video capabilities. A video adapter may be integrated into the system board or may be an expansion card that plugs into an expansion slot.

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

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

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

W — Watt(s).

WH — Watt-hour(s).

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

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

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

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

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

ZIF — Zero insertion force.

Index

Numerics

A

B

C

V

W