Dell™ PowerEdge™ R805 Systems
Hardware Owner's Manual

Notes, Notices, and Cautions

NOTE: A NOTE indicates important information that helps you make better use of your computer.

NOTICE: A NOTICE indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

CAUTION: A CAUTION indicates a potential for property damage, personal injury, or death.

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About Your System

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

- Front or back panel indicators
- System messages
- Warning messages
- Diagnostics messages
- Alert messages

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

Other Information You May Need

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

- The *Rack Installation Guide* or *Rack Installation Instructions* included with your rack solution describes how to install your system into a rack.
- The *Getting Started Guide* provides an overview of system features, setting up your system, and technical specifications.
- CDs included with your system provide documentation and tools for configuring and managing your system.
- Systems management software documentation describes the features, requirements, installation, and basic operation of the software.
- Operating system documentation describes how to install (if necessary), configure, and use the operating system software.

- Documentation for any components you purchased separately provides information to configure and install these options.
- Updates are sometimes included with the system to describe changes to the system, software, and/or documentation.

    Ø **NOTE:** Always check for updates on **support.dell.com** and read the updates first because they often supersede information in other documents.

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

Accessing System Features During Startup

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

Table 1-1.   Keystrokes for Accessing System Features

Keystroke	Description
\<F2\>	Enters the System Setup program. See "Using the System Setup Program" on page 48.
\<F10\>	Opens the utility partition, allowing you to run the system diagnostics. See "Running the System Diagnostics" on page 161
\<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.

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

Keystroke	Description
<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.
<Ctrl><S>	If you have PXE support enabled through the System Setup Program (see "Integrated Devices Screen" on page 54), 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 behind the optional rack bezel on the system's front panel.

Figure 1-1.   Front-Panel Features and Indicators
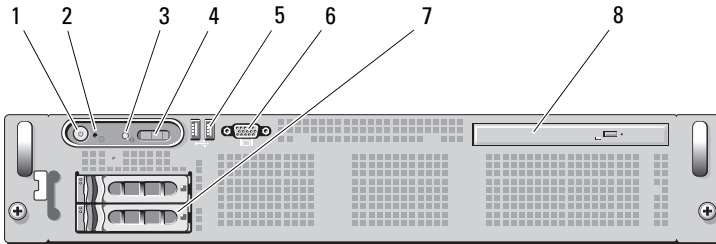
Table 1-2.   Front-Panel LED Indicators, Buttons, and Connectors

Item	Indicator, Button, or Connector	Icon	Description
1	Power-on indicator, power button	⏻	The power-on indicator lights when the system power is on.
			The power button controls the DC power supply output to the system. When the system bezel is installed, the power button is not accessible.
			NOTE: When powering on the system, the video monitor can take from several seconds to over 2 minutes to display an image, depending on the amount of memory installed in the system.
			NOTE: On ACPI-compliant operating systems, turning off the system using the power button causes the system to perform a graceful shutdown before power to the system is turned off.

Table 1-2. Front-Panel LED Indicators, Buttons, and Connectors *(continued)*

Item	Indicator, Button, or Connector	Icon	Description
2	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.
3	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 LED Indicators, Buttons, and Connectors *(continued)*

Item	Indicator, Button, or Connector	Icon	Description
4	LCD panel		Provides system ID, status information, and system error messages.
			The LCD lights during normal system operation. Both the systems 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.
5	USB connectors (2)	•←	Connects USB devices to the system. The ports are USB 2.0-complaint.
6	Video connector	▯◻▯	Connects a monitor to the system.
7	Hard drives (2)		One or two 2.5-inch hot plug
8	Optical drive (optional)		One optional slim-line SATA DVD-ROM drive or DVD-RW drive, or combination CD-RW/DVD drive (when available).
			NOTE: DVD devices are data only.

Hard-Drive Indicator Codes

The hard-drive carriers have two indicators—the drive-activity indicator and the drive-status indicator. See Figure 1-2. In RAID configurations, the drive-status indicator lights to indicate the status of the drive. In non-RAID configurations, only the drive-activity indicator lights; the drive-status indicator is off.

Figure 1-2.   Hard-Drive Indicators
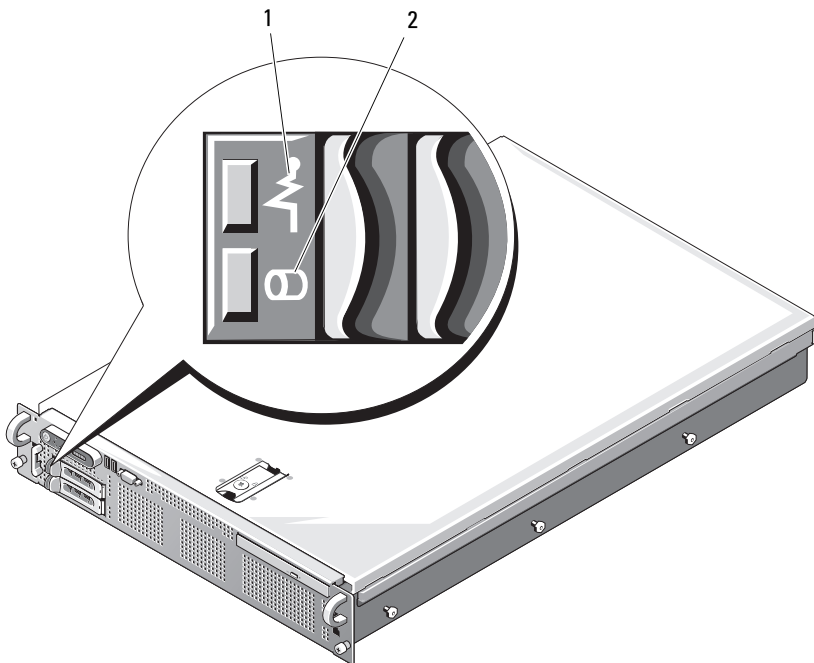
1	drive-status indicator (green and amber)	2	green drive-activity indicator

Table 1-3 lists the drive indicator patterns for RAID hard drives. Different patterns are displayed as drive events occur in the system. For example, if a hard drive fails, the "drive failed" pattern appears. After the drive is selected for removal, the "drive being prepared for removal" pattern appears, followed

by the "drive ready for insertion or removal" pattern. After the replacement drive is installed, the "drive being prepared for operation" pattern appears, followed by the "drive online" pattern.

✍ **NOTE:** For non-RAID configurations, only the drive-activity indicator is active. The drive-status indicator is off.

Table 1-3.   Hard-Drive Indicator Patterns for RAID

Condition	Drive-Status Indicator Pattern
Identify drive/preparing for removal	Blinks green two times per second
Drive ready for insertion or removal	Off
Drive predicted failure	Blinks green, amber, and off.
Drive failed	Blinks amber four times per second.
Drive rebuilding	Blinks green slowly.
Drive online	Steady green.
Rebuild aborted	Blinks green three seconds, amber three seconds, and off six seconds.

Back-Panel Features and Indicators

Figure 1-3 shows the controls, indicators, and connectors located on the system's back panel.

Figure 1-3.   Back-Panel Features and Indicators
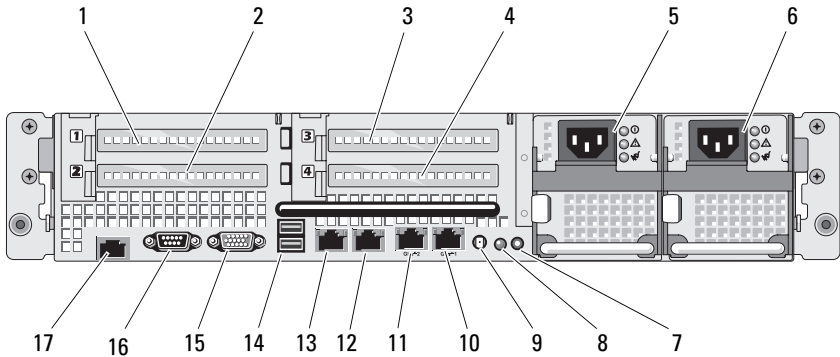
1	PCIe slot 1	2	PCIe slot 2
3	PCIe slot 3	4	PCIe slot 4
5	power supply bay 1 (PS1)	6	power supply bay 2 (PS2)
7	system identification button	8	system status indicator
9	system status indicator connector	10	LOM4 connector (Gb/10Gb)[a]
11	LOM3 connector (Gb/10Gb)[a]	12	LOM2 connector (Gb)
13	LOM1 connector (Gb)	14	2.0-compliant USB connectors (2)
15	video connector	16	serial connector
17	remote access controller (RAC) connector (optional)		

[a.] Upgradeable to 10Gbps when available

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 external devices 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).

For information about individual connectors, see "Jumpers and Connectors" on page 165. For information about enabling, disabling, and configuring I/O ports and connectors, see "Using the System Setup Program" on page 47.

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 1-4). Table 1-4 lists the power supply indicator codes.

Table 1-4.   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 1-4. Redundant Power Supply Indicators
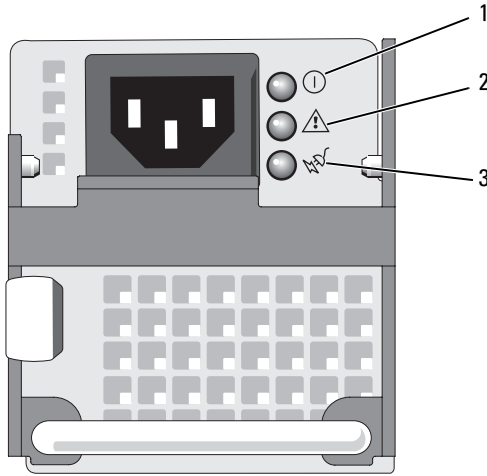
1	power supply status (DC out is operational)	2	power supply fault
3	AC line status (AC in is operational)		

NIC Indicator Codes

Each NIC on the back panel has an indicator that provides information on network activity and link status. See Figure 1-5. Table 1-5 lists the NIC indicator codes.

Figure 1-5. NIC Indicators
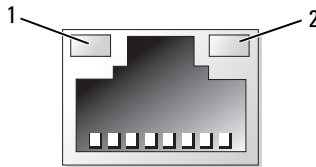
1	link indicator	2	activity indicator

Table 1-5.   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 1-6 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: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

📝 **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 1-6.   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 "Using the System Setup Program" on page 47.
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 149.
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 147.
E1211	ROMB Batt	RAID battery is either missing, bad, or unable to recharge due to thermal issues.	Reseat the RAID battery connector. See "RAID Battery" on page 87, and "Troubleshooting System Cooling Problems" on page 149.
E1214 E1216 E1217	## PwrGd	Specified voltage regulator has failed.	See "Getting Help" on page 175.

Table 1-6.   LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
E1218	PCI Rsr 5V PwrGd	The 5V voltage regulator on the PCI riser has failed.	See "Getting Help" on page 175.
E121A	8V PwrGd	8V voltage regulator has failed.	Recycle power to the system or clear the SEL. If the problem persists, see "Getting Help" on page 175.
E121D	1.2V VM Dual PwrGd	1.2V voltage regulator for the VM dual signal has failed.	Recycle power to the system or clear the SEL. If the problem persists, see "Getting Help" on page 175.
E1226	PCI Rsr 1.5V PwrGd	The 1.5V voltage regulator on the PCI riser has failed.	See "Getting Help" on page 175.
E1227	Linear PwrGd	Linear voltage regulator(s) has failed. Represents status of multiple voltage regulators used in the video and LOM circuitry.	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.
E122D	CPU # VDDIO 1.0V PwrGd	Processor # VDDIO voltage has exceeded the allowable voltage range	See "Getting Help" on page 175.
E122E	CPU # VDDA	Processor # VDDA voltage has exceeded the allowable voltage range	See "Getting Help" on page 175.
E122F	2.5V PwrGd	2.5V voltage regulator has failed.	See "Getting Help" on page 175.
E1231	1.2V HTCORE PwrGd	1.2V HTCORE voltage regulator has failed.	See "Getting Help" on page 175.

Table 1-6. LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
E1232	VDD 12V PS# PwrGd	The specified power supply has failed or has been removed from the bay while the system was on.	If removed, reinsert the power supply into the bay and reconnect to power. For component failures, see "Getting Help" on page 175.
E123B	LOM Mezz PwrGd	Voltage regulator for the LOM daughter card has failed.	Recycle power to the system or clear the SEL. If the problem persists, see "Getting Help" on page 175.
E123C	Planar LOM PwrGd	Voltage regulator for the integrated LOM has failed.	Recycle power to the system or clear the SEL. If the problem persists, 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 149.
E1313	Fan Redundancy	The system is no longer fan-redundant. Another fan failure will put the system at risk of over-heating.	Check control panel LCD for additional scrolling messages. See "Troubleshooting System Cooling Problems" on page 149.

Table 1-6.   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 149. If the problem persists, ensure that the microprocessor heat sinks are properly installed. See "Troubleshooting the Microprocessors" on page 160.
			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 Microprocessors" on page 160.
E141C	CPU Mismatch	Processors are in a configuration unsupported by Dell.	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 1-6. 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.
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 Power Supplies" on page 147.
E1614	PS # Status	No power is available from the specified power supply; specified power supply is improperly installed or faulty.	See "Troubleshooting Power Supplies" on page 147.
E1618	PS # Predictive	Power supply voltage is out of acceptable range; specified power supply is improperly installed or faulty.	See "Troubleshooting Power Supplies" on page 147.
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 Power Supplies" on page 147.
E1620	PS # Input Range	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 Power Supplies" on page 147.

Table 1-6.   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 Power Supplies" on page 147.
E1625	PS AC Current	Power source is out of acceptable range.	Check the AC power source.
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 158.
	PCI PERR Slot #	The system BIOS has reported a PCI parity error on a component that resides in the specified PCIe slot.	Reinstall the expansion-card riser. See "Expansion-Card Risers" on page 99. If the problem persists, the riser card or system board is faulty. See "Getting Help" on page 175.

Table 1-6.   LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
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 158.
	PCI SERR Slot #	The system BIOS has reported a PCI system error on a component that resides in the specified slot.	Reinstall the expansion-card riser. See "Expansion-Card Risers" on page 99.
			If the problem persists, the riser card or system board is faulty. See "Getting Help" on page 175.
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.
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 158.
	PCIE Fatal Err Slot #	The system BIOS has reported a PCIe fatal error on a component that resides in the specified slot.	Reinstall the expansion-card riser. See "Expansion-Card Risers" on page 99.
			If the problem persists, the riser card or system board is faulty. See "Getting Help" on page 175.
E1810	HDD ## Fault	The SAS subsystem has determined that hard drive ## has experienced a fault.	See "Troubleshooting a Hard Drive" on page 155.

Table 1-6.   LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
E1811	HDD ## Rbld Abrt	The specified hard drive has experienced a rebuild abort.	See "Troubleshooting a Hard Drive" on page 155. If the problem persists, see your RAID documentation.
E1812	HDD ## Removed	The specified hard drive has been removed from the system.	Information only.
E1914	DRAC5 Conn2 Cbl	DRAC 5 cable is missing or disconnected.	Reconnect the cable. See "Installing a RAC Card" on page 106.
E1915	IO55 HTSink Missing MCP55 Htsink Missing	Heatsink sensor reports that the chipset IO55 heatsink is missing. Heatsink sensor reports that the chipset MCP heatsink heatsink is missing.	See "Getting Help" on page 175.
E1A12	PCI Rsr Missing	One or all of the PCIe risers is missing, preventing the system from powering on.	Reinstall the missing riser card(s).
E1A14	SAS Cable A	SAS cable A is missing or bad.	Reseat the cable. If the problem persists, replace cable. See "SAS Controller Daughter Card" on page 84.
E1A15	SAS Cable B	SAS cable B is missing or bad.	Reseat the cable. If the problem persists, replace cable. See "SAS Controller Daughter Card" on page 84.
E1A1C	LOM Mezz Missing	LOM daughter card is missing.	Install or reseat the LOM daughter card. If the problem persists, replace the card. See "Getting Help" on page 175.

Table 1-6. LCD Status Messages *(continued)*

Code	Text	Causes	Corrective Actions
E1B01	USB# Overcurrent	Device plugged in the specified USB port caused an overcurrent condition.	Reseat the device cable. If the problem persists, replace or remove the device.
E2010	No Memory	No memory is installed in the system.	Install memory. See "Installing Memory Modules" on page 117.
E2011	Mem Config Err	Memory detected, but is not configurable. Error detected during memory configuration.	See "Troubleshooting System Memory" on page 150.
E2012	Unusable Memory	Memory is configured, but not usable. Memory subsystem failure.	See "Troubleshooting System Memory" on page 150.
E2013	Shadow BIOS Fail	The system BIOS failed to copy its flash image into memory.	See "Troubleshooting System Memory" on page 150.
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 1-6.   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 150. If problem persists, see "Getting Help" on page 175.
E201F	DRAC Config	Dell remote access controller (DRAC) configuration failure.	Check screen for specific error messages. Ensure that DRAC cables and connectors are properly seated. If problem persists, see your DRAC 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 150.
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 150.

Table 1-6. 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 150.
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 pair implicated by the BIOS.	See "Troubleshooting System Memory" on page 150.
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 1-6. 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 "RAID Battery" on page 87.

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.

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.

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

Table 1-7.   System Messages

Message	Causes	Corrective Actions
Alert! Node Interleaving disabled! Memory configuration does not support Node Interleaving.	The memory configuration does not support node interleaving, or the configuration has changed (for example, a failed DIMM) so that node interleaving cannot be supported. The system will run but with reduced functionality.	Ensure that the memory modules are installed in a configuration that supports node interleaving. Check other system messages for additional information for possible causes. For memory configuration information, see "General Memory Module Installation Guidelines" on page 114. If the problem persists, see "Troubleshooting System Memory" on page 150.
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 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 NVRAM_CLR jumper. See Figure 6-1 for jumper location.
CPUs with different cache sizes detected!	Microprocessors with different cache sizes are installed.	Ensure that all microprocessors have the same cache size and that they are properly installed. See "Processors" on page 120.
Decreasing available memory	Faulty or improperly installed memory modules.	See "Troubleshooting System Memory" on page 150.

Table 1-7. System Messages *(continued)*

Message	Causes	Corrective Actions
`Error: Incorrect memory configuration` `CPU n`	The DIMM group for CPU *n* is incorrectly configured and caused the system to halt.	See "General Memory Module Installation Guidelines" on page 114 for memory configuration information. If the problem persists, see "Troubleshooting System Memory" on page 150.
`!!*** Error: Remote Access Controller initialization failure *** RAC virtual USB devices may not be available...`	Remote Access Controller initialization failure	Ensure that the Remote Access Controller is properly installed. See "Installing a RAC Card" on page 106.
`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.
`HyperTransport 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 137 for any faulty components specified in the SEL.
`Invalid NVRAM configuration, Resource Re-allocated`	System detected and corrected a resource conflict.	No action is required.

Table 1-7. System Messages *(continued)*

Message	Causes	Corrective Actions
`Invalid PCIe card found in the Internal_Storage slot!`	The system halted because an invalid PCIe expansion card is installed in the dedicated storage controller slot.	Remove the PCIe expansion card and install either the internal SAS controller in the dedicated slot.
`Keyboard Controller failure`	Faulty keyboard controller; faulty system board	See "Getting Help" on page 175.
`Manufacturing mode detected`	System is in manufacturing mode.	Reboot to take the system out of manufacturing mode.
`Memory address line failure at address, read value expecting value`	Faulty or improperly installed memory modules.	See "Troubleshooting System Memory" on page 150.
`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`		
`Memory tests terminated by keystroke.`	POST memory test terminated by pressing the spacebar.	Information only.

Table 1-7.   System Messages *(continued)*

Message	Causes	Corrective Actions
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 SD Card or Internal USB Key" on page 152 and "Troubleshooting a Hard Drive" on page 155. See "Using the System Setup Program" on page 47 for information on setting the order of boot devices.
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 47. 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."
Optical drive not found	Cable is not properly seated, or drive missing.	See "Troubleshooting an Optical Drive" on page 153.
PCI BIOS failed to install	PCIe device BIOS (Option ROM) checksum failure detected during shadowing. Cables to expansion card(s) loose; faulty or improperly installed expansion card(s).	Reseat the expansion card(s). Ensure that all appropriate cables are securely connected to the expansion card(s). If the problem persists, see "Troubleshooting Expansion Cards" on page 158.

Table 1-7. System Messages (continued)

Message	Causes	Corrective Actions

`PCIe Degraded Link Width Error: Embedded device`
 	
`Expected Link Width is n`
 	
`Actual Link Width is n`
	Faulty system board or riser board.	See "Getting Help" on page 175.

`PCIe Degraded Link Width Error: Integrated device`
 	
`Expected Link Width is n`
 	
`Actual Link Width is n`
	The specified PCIe device is faulty or improperly installed.	For a SAS controller daughter card, reseat the card in the dedicated PCIe connector. See "Installing a SAS Controller Daughter Card" on page 84. If the problem persists, see "Getting Help" on page 175.

`PCIe Degraded Link Width Error: Slot n`
 	
`Expected Link Width is n`
 	
`Actual Link Width is n`
	Faulty or improperly installed PCIe card in the specified slot.	Reseat the PCIe card in the specified slot number. See "Expansion Cards" on page 91. If the problem persists, see "Getting Help" on page 175.

`PCIe Training Error: Embedded device`	Faulty system board or riser board.	See "Getting Help" on page 175.
`PCIe Training Error: Integrated device`	The specified PCIe device is faulty or improperly installed.	For a SAS controller daughter card, reseat the card in the dedicated PCIe connector. See "Installing a SAS Controller Daughter Card" on page 84. If the problem persists, see "Getting Help" on page 175.

Table 1-7. System Messages (continued)

Message	Causes	Corrective Actions
`PCIe Training Error: Slot n`	Faulty or improperly installed PCIe card in the specified slot.	Reseat the PCIe card in the specified slot number. See "Expansion Cards" on page 91. If the problem persists, see "Getting Help" on page 175.
`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 158.

`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 143, or "Troubleshooting a Hard Drive" on page 155 for the appropriate drive(s) installed in your system.

`Remote Access Controller cable error or incorrect card in the RAC slot.`	RAC cables not connected, or RAC card installed in wrong expansion slot.	Check that the RAC cables are connected, and that the RAC card is installed in the correct expansion slot. See "Installing a RAC Card" on page 106.
`Remote configuration update attempt failed`	System unable to process Remote Configuration request	Retry Remote Configuration.

Table 1-7.   System Messages *(continued)*

Message	Causes	Corrective Actions
ROM bad checksum = *address*	Expansion card improperly installed or faulty.	Reseat the expansion card(s). Ensure that all appropriate cables are securely connected to the expansion card(s). If the problem persists, see "Troubleshooting Expansion Cards" on page 158.
Sector not found Seek error Seek operation failed	Faulty hard drive, USB device, or. USB medium.	See "Troubleshooting a USB Device" on page 143 or "Troubleshooting a Hard Drive" on page 155 for the appropriate drive(s) installed in your system.
Shutdown failure	Shutdown test failure.	See "Troubleshooting System Memory" on page 150.
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 150.
This system supports only Opteron(TM) 2000 series processors.	Microprocessor(s) is not supported by the system.	Install a supported microprocessor or microprocessor combination. See "Installing a Processor" on page 123.
Time-of-day clock stopped	Faulty battery or faulty chip.	See "Troubleshooting the System Battery" on page 147.

Table 1-7. System Messages (continued)

Message	Causes	Corrective Actions
`Time-of-day not set - please run SETUP program`	Incorrect Time or Date settings; faulty system battery.	Check the Time and Date settings. See "Using the System Setup Program" on page 47. If the problem persists, replace the system battery. See "System Battery" on page 125.
`Timer chip counter 2 failed`	Faulty system board.	See "Getting Help" on page 175.

`Unsupported CPU combination`
 	
`Unsupported CPU stepping detected`
	Microprocessor(s) is not supported by the system.	Install a supported microprocessor or microprocessor combination. See "Processors" on page 120.

`TPM failure`	A Trusted Platform Module (TPM) function has failed.	See "Getting Help" on page 175.
`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: Following faulty DIMMs are disabled:`
 	
`DIMM ` n_1 n_2
 	
`Total memory size is reduced.`
	Faulty or improperly seated memory module(s). DIMMs are disabled in pairs, as indicated by the n_1 and n_2. Check both DIMMs for a possible fault.	See "Troubleshooting System Memory" on page 150.

`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 137 for any faulty components specified in the SEL.

Table 1-7. System Messages *(continued)*

Message	Causes	Corrective Actions
`Warning! No micro code update loaded for processor n`	Micro code update failed.	Update the BIOS firmware. See "Getting Help" on page 175.
`Warning: One or more faulty DIMMs found on CPUn`	Faulty or improperly seated memory module(s) used by CPU*n*.	See "Troubleshooting System Memory" on page 150.
`Warning: The installed memory configuration is not optimal. For more information on valid memory configurations, please see the system documentation on the technical support web site.`	Invalid memory configuration. The system will run but with reduced functionality.	Ensure that the memory modules are installed in a valid configuration. See "General Memory Module Installation Guidelines" on page 114. If the problem persists, see "Troubleshooting System Memory" on page 150.
`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 143, "Troubleshooting an SD Card or Internal USB Key" on page 152, and "Troubleshooting a Hard Drive" on page 155.

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

When you run system diagnostics, an error message may result. Diagnostic error messages are not covered in this section. Record the message on a copy of the Diagnostics Checklist in "Getting Help" on page 175, and then follow the instructions in that section for obtaining technical assistance.

Alert Messages

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

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 35 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 R805
                   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>

 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

 Up,Down Arrow to select | SPACE,+,- to change | ESC to exit |  F1=HELP
```
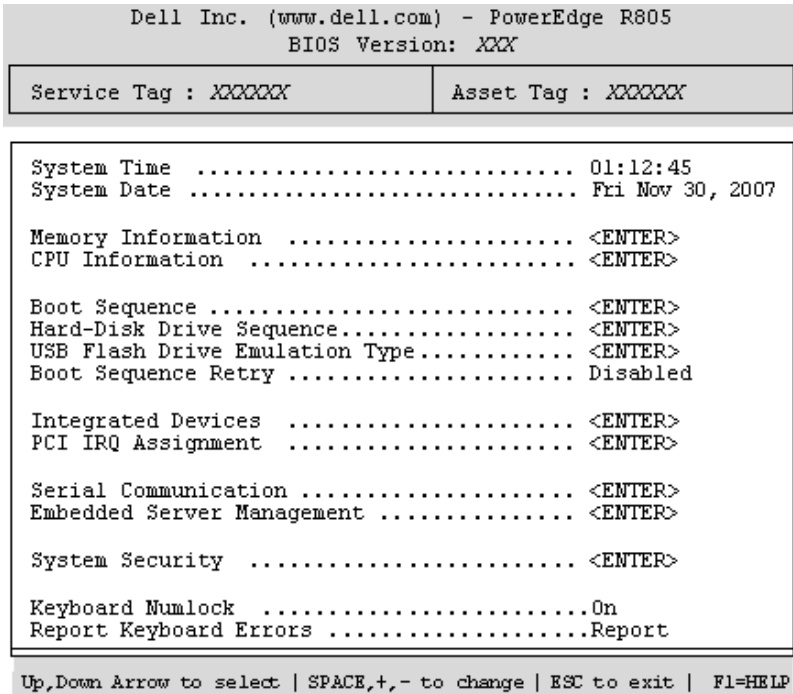
Table 2-2 lists the options and descriptions for the information fields that appear on the main System Setup program screen.

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.

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

Option	Description
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 microprocessors (speed, cache size, and so on). See Table 2-4.
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 floppy 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.
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.

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

Option	Description
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 2-7. For further information, see "Using the System Password" on page 59 and "Using the Setup Password" on page 62.
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.
System Memory Testing	Specifies whether system memory tests are run at system boot. Options are **Enabled** and **Disabled**.

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

Option	Description
Redundant Memory (**Disabled** default)	Enables or disables the redundant memory feature. When set to **Spare Mode**, the first rank of memory on each DIMM is reserved for memory sparing. See "Memory Sparing Support" on page 116. Redundant memory feature is disabled if the Node Interleaving field is enabled.
Node Interleaving	If this field is enabled, memory interleaving is supported if a symmetric memory configuration is installed. If this field is set to disabled (the default), the system can support Non-Uniform Memory architecture (NUMA) (asymmetric) memory configurations. **NOTE:** The Node Interleaving field must be set to Disabled when using the redundant memory feature.
Memory Optimizer Technology (**Enabled** default)	Sets the behavior of the two DRAM controllers for memory optimization. When set to **Enabled**, the two controllers run in parallel 64-bit mode for improved memory performance (running single-bit ECC).When set to **Disabled**, the controllers are joined in 128-bit mode running multi-bit Advanced ECC.
Low Power Mode (**Disabled** default)	Enables or disables the low power mode of the memory. When set to **Disabled**, the memory runs at full speed. When set to **Enabled**, the memory runs at a reduced speed to conserve energy.

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 processors support 64-bit extensions.
Core Speed	Displays the clock speed of the processors.
Bus Speed	Displays the bus speed of the processors.

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

Option	Description
Virtualization Technology (**Enabled** default)	**NOTE:** Disable this feature if your system will not be running virtualization software.
	Displays when the processors support Virtualization Technology. Enabled permits virtualization software to use Virtualization Technology incorporated in the processor design. This feature can only be used by software that supports Virtualization Technology.
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.

Enabling AMD PowerNow!™ Technology

AMD PowerNow! technology controls your system's processor performance automatically, dynamically adjusting the operating frequency and voltage according to the task at hand. When an application does not require full performance, significant amounts of power can be saved. Performance is designed to still be responsive, with maximum processor performance being delivered when required, and automatic power savings when possible.

NOTE: AMD PowerNow! support is dependent on the operating system and version used on your system. Disable AMD PowerNow! if your operating system does not fully support this feature. See your operating system user guide for more information.

To disable the AMD PowerNow! feature, run the System Setup Program and disable the **Demand-Based Power Management** option on the **CPU Information** screen.

Additionally, for Microsoft® Windows® operating systems, you will need to install the AMD PowerNow!™ driver to enable this feature. The driver is available on the Dell OpenManage™ *Service and Diagnostic CD* provided with your system, and at **support.dell.com**.

Integrated Devices Screen

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

Table 2-5. Integrated Devices Screen Options

Option	Description
Integrated SAS/RAID Controller (**Enabled** default)	Enables or disables the integrated SAS controller.
Optical Drive Controller (**On** default)	Enables or disables the integrated optical 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.
SD Card Port	Enables or disables the system's internal SD card port.
Embedded Gb NICx (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.
Capability Detected	Displays the NIC features provided by the LOM NIC hardware key installed in the TOE_KEY socket on the system board. **NOTE:** Some LOM features may require the installation of an additional driver.

Table 2-5. Integrated Devices Screen Options *(continued)*

Option	Description
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.

Serial Communication Screen

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

Table 2-6. 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 2-7 lists the options and descriptions for the information fields that appear on the **System Security** screen.

Table 2-7. 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 59 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 62 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 2-7. System Security Screen Options (continued)

Option	Description
TPM Security (**Off** default)	Sets the reporting of the Trusted Platform Module (TPM) in the system.
	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.
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.

Table 2-7.   System Security Screen Options *(continued)*

Option	Description
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 61). 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 174.

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 62), 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 62.

Disabling a Forgotten Password

See "Disabling a Forgotten Password" on page 174.

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
- Hard drives and hard-drive carriers
- Power supplies
- Internal SD card
- System fans
- SAS controller daughter card
- RAID battery
- Internal USB memory key
- Expansion cards
- Cooling shrouds
- Fan brackets
- Expansion-card risers
- RAC card
- LOM daughter card
- Optical drive
- System memory
- Processors
- System battery
- Sideplane board
- SAS/SATA backplane board
- Control panel assembly
- System board

Recommended Tools

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

- Key to the system keylock
- #1 and #2 Phillips screwdrivers
- T-10 Torx driver
- Wrist grounding strap

Inside the System

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

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

Figure 3-1.   Inside the System
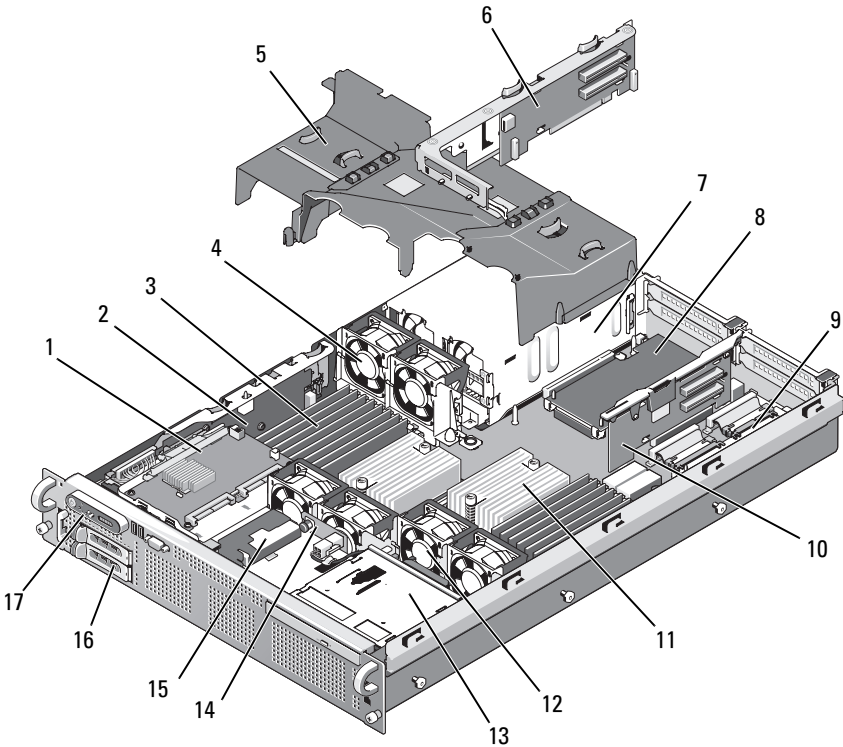
1	SAS controller daughter card	2	sideplane
3	memory modules (up to 16)	4	hot-pluggable power supply cooling fans (2)
5	cooling shrouds (3)	6	riser 2 (PCIe slots 3 and 4)
7	power supplies (1 or 2)	8	LOM daughter card
9	RAC daughter card	10	riser 1 (PCIe slots 1 and 2)
11	heatsinks/microprocessors (2)	12	hot-pluggable processor fans (4)
13	slimline optical drive (optional)	14	SAS/SATA backplane
15	RAID battery (optional battery-cached SAS RAID controller only)	16	SAS or SATA hard drives (1 or 2)
17	control panel		

The system board holds the system's control circuitry and other electronic components. Several hardware options, such as the microprocessors and memory, are installed directly on the system board. Each expansion-card riser accommodates one full-length and one half-length PCIe expansion card. The system provides space for an optional optical drive. The optical drive connects to the SATA controller on the system board. For more information, see "Optical Drive" on page 109.

The hard-drive bays provide space for up to two 2.5-inch SAS or two 2.5-inch SATA hard drives. The hard drives connect to a SAS controller card through the SAS/SATA backplane board. For more information, see "Hard Drives" on page 72 and "SAS Controller Daughter Card" on page 84.

During an installation or troubleshooting procedure, you may be required to change a jumper setting. For more information, see "System Board Jumpers" on page 165.

Front Bezel

A lock on the bezel restricts access to the power button, optical drive, and hard drive(s). A control panel LCD located on the front panel and accessible through the front bezel displays the system's status. See Figure 3-2.

Figure 3-2. Control Panel LCD With Bezel Installed
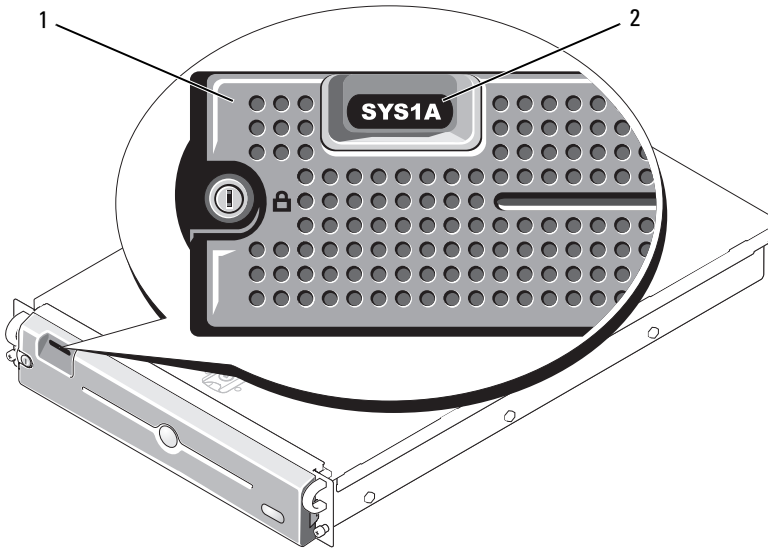
| 1 | bezel | 2 | control panel LCD |

Removing the Front Bezel

1 Using the system key, unlock the bezel.

2 Press the tab at the left end of the bezel.

3 Rotate the left end of the bezel away from the system to release the right end of the bezel.

4 Pull the bezel away from the system. See Figure 3-3.

Figure 3-3.   Removing the Front Bezel
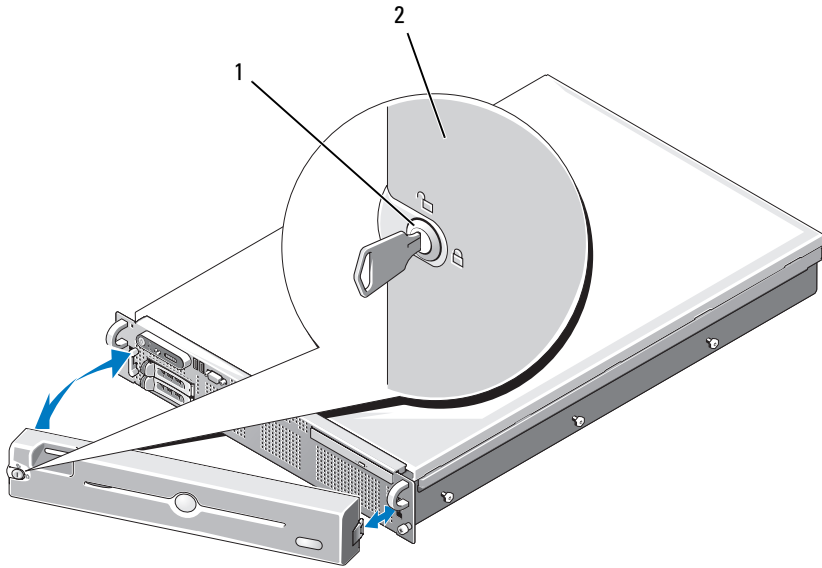
| 1 | bezel lock | 2 | bezel |

Replacing the Front Bezel

To replace the front bezel, perform the above steps in reverse.

Opening and Closing the System

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

Opening the System

To upgrade or troubleshoot the system, remove the system cover to gain access to internal components.

1 Unless you are installing a hot-plug component such as a cooling fan or power supply, turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.

2 To remove the system cover, turn the latch release lock counter-clockwise to the unlocked position. See Figure 3-4.

3 Lift up on the latch on top of the system. See Figure 3-4.

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

Closing the System

1 Lift up the latch on the cover.

2 Place the cover on top of the system and offset the cover slightly back so that it clears the chassis J hooks and lays flush on the system chassis. See Figure 3-4.

3 Push down the latch to lever the cover into the closed position.

4 Rotate the latch release lock in a clockwise direction to secure the cover.

Figure 3-4.   Removing the Cover
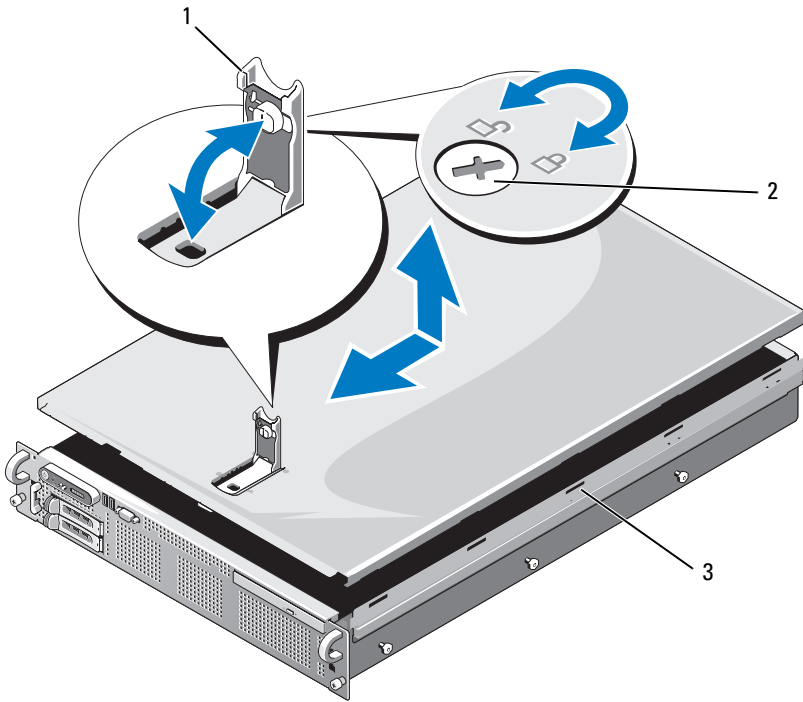
1	latch	2	latch release lock
3	alignment J hooks		

Hard Drives

This subsection describes how to install and configure SAS or SATA hard drives in the system's internal hard-drive bays. Your system features up to two 2.5-inch SAS or SATA hard drives. All drives connect to the system board through the SAS/SATA backplane board. See Figure 6-3. Hard drives are supplied in special hot-pluggable drive carriers that fit in the hard-drive bays.

NOTICE: Before attempting to remove or install a drive while the system is running, see the documentation for the SAS controller daughter card to ensure that the host adapter is configured correctly to support hot-plug drive removal and insertion.

NOTE: All installed drives must be either SAS or SATA. Mixed drive configurations are not supported.

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

You may need to use different programs than those provided with the operating system to partition and format SAS or SATA hard drives.

NOTICE: Do not turn off or reboot your system while the drive is being formatted. Doing so can cause a drive failure.

When you format a hard drive, allow enough time for the formatting to be completed. Be aware that high-capacity hard drives can take a number of hours to format.

Removing a Drive Blank

NOTICE: To maintain proper system cooling, all empty hard-drive bays must have drive blanks installed. If you remove a hard-drive carrier from the system and do not reinstall it, you must replace the carrier with a drive blank.

Remove the drive blank as you would the 2.5-inch hard drive carrier:

1   Remove the front bezel, if attached. See "Removing the Front Bezel" on page 69.

2   Open the drive blank release handle to release the blank. See Figure 3-5.

3   Slide the drive blank out until it is free of the drive bay.

Installing a Drive Blank

Install the hard drive blank as you would a 2.5-inch hard drive carrier:

1   Remove the front bezel, if attached. See "Removing the Front Bezel" on page 69.

2   Open the handle on the drive blank.

3   Insert the drive blank into the drive bay until the blank is fully seated.

4   Close the handle to lock the blank in place.

5   Replace the front bezel, if it was removed in step 1.

Removing a Hot-Plug Hard Drive

1 Remove the front bezel, if attached. See "Removing the Front Bezel" on page 69.

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

If the drive has been online, the green activity/fault indicator will flash as the drive is powered down. When both drive indicators are off, the drive is ready for removal.

3 Open the drive carrier release handle to release the drive. See Figure 3-5.

4 Slide the hard drive out until it is free of the drive bay.

5 If you do not replace the hard drive, insert a drive blank in the vacated drive bay. See "Installing a Drive Blank" on page 73.

NOTICE: To maintain proper system cooling, all empty hard-drive bays must have drive blanks installed.
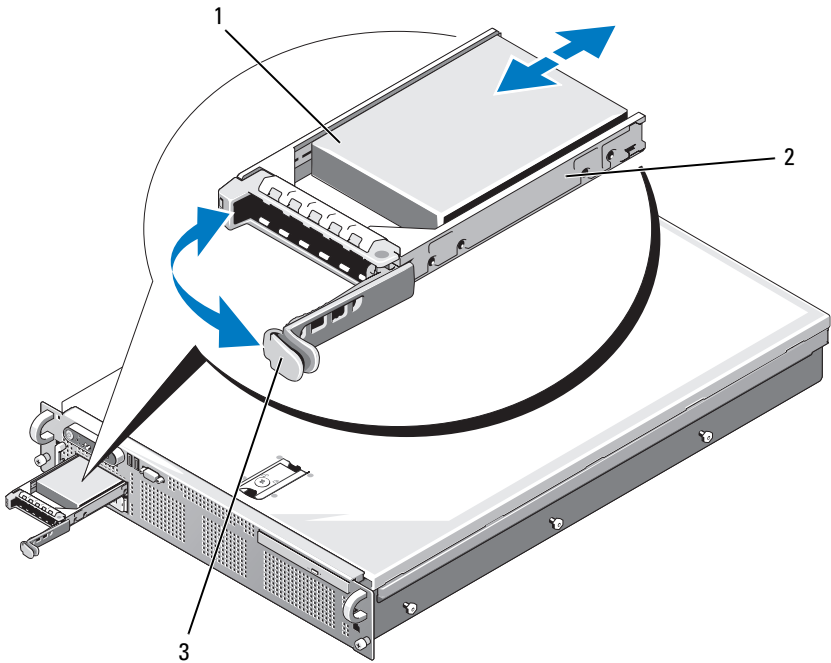
Installing a Hot-Plug Hard Drive

NOTICE: When installing a hard drive, ensure that the adjacent drives are fully installed. Inserting a hard-drive carrier and attempting to lock its handle next to a partially installed carrier can damage the partially installed carrier's shield spring and make it unusable.

NOTICE: Not all operating systems support hot-plug drive installation. See the documentation supplied with your operating system.

1 Remove the front bezel, if attached. See "Removing the Front Bezel" on page 69.

2 If a drive blank is present in the bay, remove it. See "Removing a Drive Blank" on page 73.

Figure 3-5.   Installing a Hot-Plug Hard Drive

1	hard drive	2	drive carrier
3	drive carrier release handle		

3   Install the hot-plug hard drive.

    a   Open the handle on the hard-drive carrier.

    b   Insert the hard-drive carrier into the drive bay until the carrier contacts the backplane.

    c   Close the handle to lock the drive in place.

4   Replace the front bezel, if it was removed in step 1.

Replacing a Hard-Drive Carrier

Two versions of hard-drive carriers are used with your system. The version for SATA hard drives has a single set of (four) mounting holes on the side rails. The second version, called a SAS/SATAu hard-drive carrier, has an extra four mounting holes to enable either a "SAS" and "SATAu" mounting position. When using the SAS/SATAu hard-drive carrier, observe these rules with regard to your system:

- Use only SAS hard drives with SAS/SATAu drive carriers.
- Use only the "SAS" mounting position on the carrier. (The SATAu position is reserved.)

Figure 3-6 illustrates a SAS hard drive being installed in a SAS/SATAu hard-drive carrier.

Removing a Hard Drive From a Hard-Drive Carrier

Remove the four screws from the slide rails on the hard-drive carrier and separate the hard drive from the carrier.

Installing a Hard Drive Into a Drive Carrier

1 Insert the hard drive into the hard-drive carrier with the connector end of the drive at the rear. See Figure 3-6.

2 Viewing the assembly as shown in Figure 3-6, align the screw holes on the hard drive with the rear set of holes 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.

3 Attach the four screws to secure the hard drive to the hard-drive carrier. See Figure 3-6.

Figure 3-6. Installing a SAS Hard Drive Into a SAS/SATAu Drive Carrier
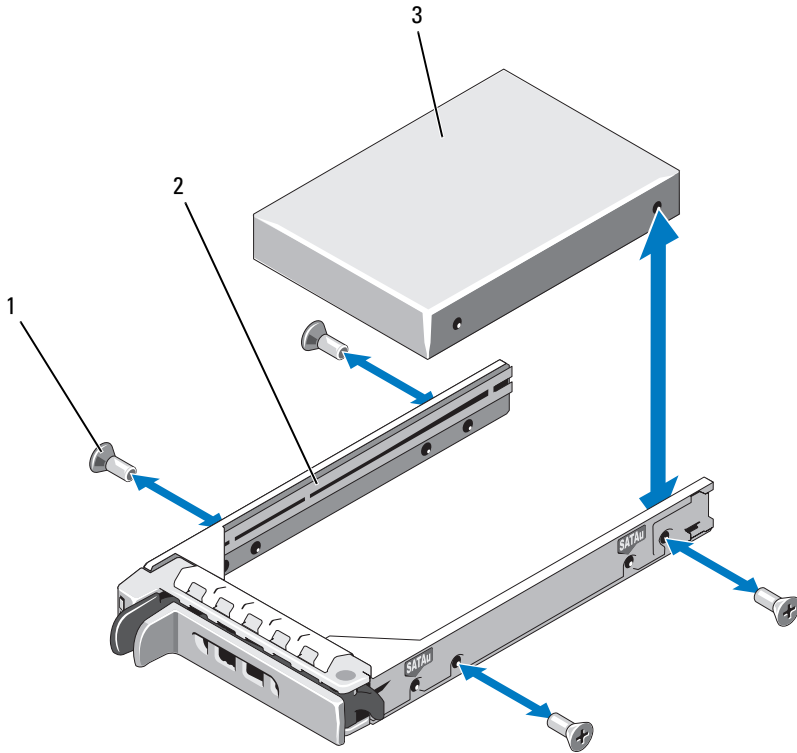
1	screws (4)	2	drive carrier
3	hard drive		

Power Supplies

Your system supports one or two power supplies rated at an output of 700 W. If only one power supply is installed, it must be installed in the left power supply bay (PS1). If two power supplies are installed, the second power supply provides hot-pluggable power redundancy. In redundant mode, the system distributes the power load across both power supplies to maximize efficiency. When a power supply is removed with the system powered on, the full power load is picked up by the remaining power supply.

NOTICE: To ensure proper system cooling, the power supply blank must be installed on the unoccupied power supply bay in a non-redundant configuration. See "Installing the Power Supply Blank" on page 80.
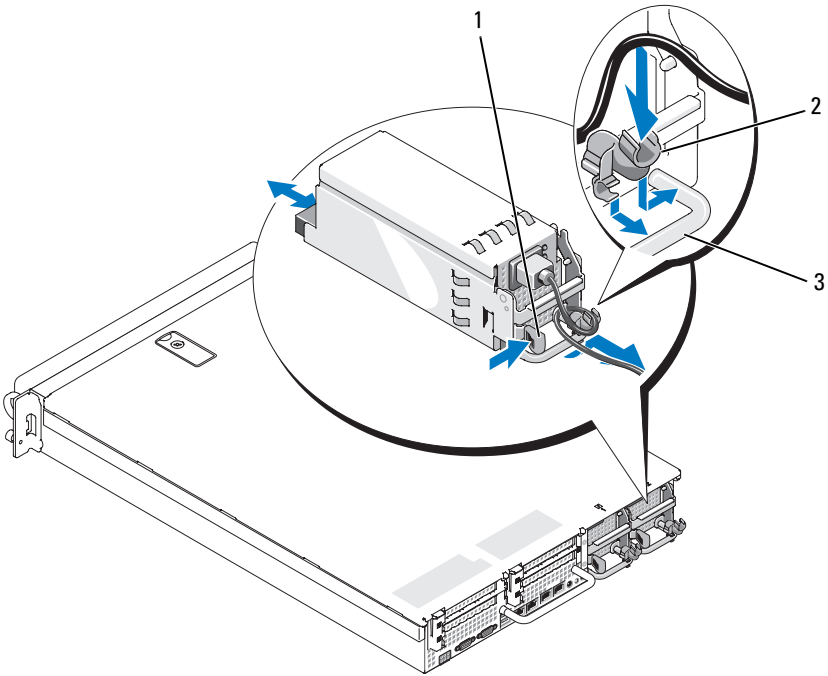
Removing a Power Supply

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.

NOTE: On your rack system, you may have to unlatch and lift the optional cable management arm if it interferes with power supply removal. For information about the cable management arm, see the system's *Rack Installation Guide*.

1 If your system has a single power supply, turn off the system and all attached peripherals. For a redundant system, you can leave the system running and proceed to the next step.

2 Disconnect the power cable from the power source.

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

4 Release the locking tab on the left side of the power supply by pressing in toward the right, and rotate the power-supply handle up until the power supply is released from the chassis. See Figure 3-7.

5 Pull the power supply straight out to clear the chassis.

Figure 3-7.   Removing and Installing a Power Supply

1	locking tab	2	cable retention bracket
3	power-supply handle		

Replacing a Power Supply

1 With the power-supply handle in the extended position, slide the new power supply into the chassis. See Figure 3-7.

2 Rotate the handle down until it is completely flush with the power-supply faceplate and the orange snap engages. See Figure 3-7.

3 Connect the power cable to the power supply.

   a Route the power cable into the cable retention bracket from the power supply side of the bracket (see Figure 3-7).

   b Loop the cable from the cable retention bracket up to the power plug at the back of the power supply, and connect the cable.

c Plug the other end of the cable into a power distribution unit (PDU) or power outlet.

✎ **NOTE:** After installing a new power supply, allow several seconds for the system to recognize the power supply and determine whether it is working properly. The power supply status indicator will turn green to signify that the power supply is functioning properly. See Figure 1-4.

Removing the Power Supply Blank

If you are installing a second power supply, remove the power supply blank in the bay by pulling outward on the blank handle, rotate the blank slightly to clear the bay, and remove from the chassis.

➲ **NOTICE:** To ensure proper system cooling, the power supply blank must be installed in the second power supply bay in a non-redundant configuration. Remove the power supply blank only if you are installing a second power supply.

Installing the Power Supply Blank

✎ **NOTE:** Install the power supply blank only in the second power supply bay.

To install the power supply blank, insert the tab on the right edge of the blank into the slot in the power supply bay wall. Rotate the blank into the power supply bay.

Internal SD Card

The system provides a slot on top of the expansion-card riser 1 for an internal SD card.

✎ **NOTE:** To use an SD card with your system, ensure that the SD card port is enabled in the System Setup program. See "Using the System Setup Program" on page 47.
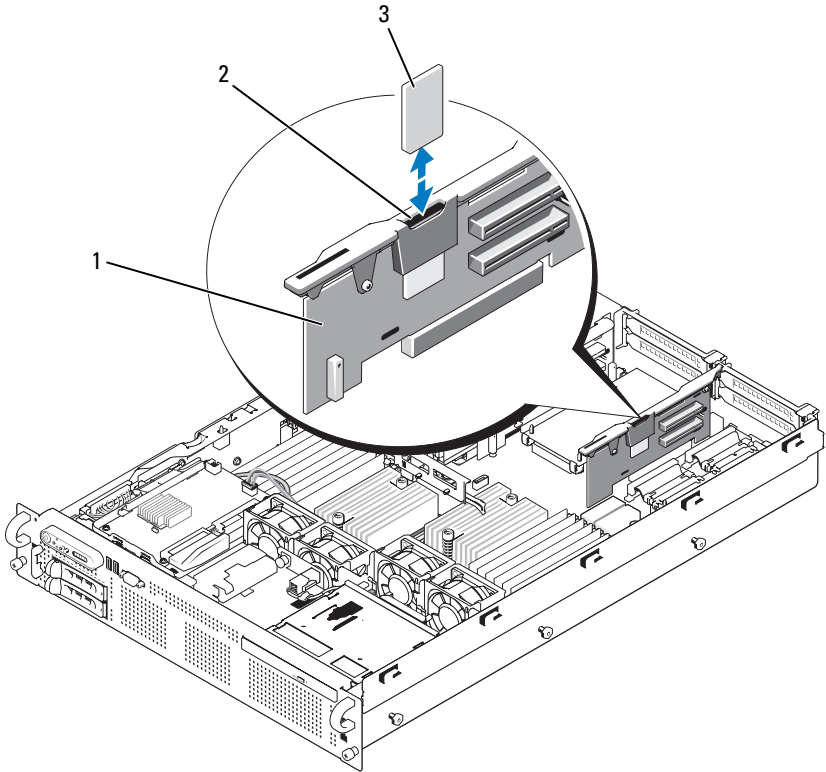
Removing the SD Card

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

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

2 Open the system. See "Opening the System" on page 71.

3 Locate the SD card at the top of riser 1, push down on the card to release it, and pull the card from the card slot. See Figure 3-8.

4 Close the system. See "Closing the System" on page 71.

Figure 3-8. Removing or Installing an Internal SD Card

1	riser 1	2	SD card slot (SD connector)
3	SD card		

Installing the SD Card

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

2 Open the system. See "Opening the System" on page 71.

3 Locate the SD card slot at the top of riser 1 and insert the contact-pin end of the card into the slot with the label on the card facing outward from the riser. See Figure 3-8.

📝 **NOTE:** The slot is keyed to ensure correct insertion of the card.

4 Press down on the card to lock it into the slot.

5 Close the system. See "Closing the System" on page 71.

System Fans

The system includes six hot-pluggable fans to provide cooling to the system's interior components. Fans 1 through 4, located behind the optical drive and SAS backplane, provide airflow over the processors and the "B" memory modules. Fans 5 and 6, located near the power supply bays, draw air over the "A" memory modules and into the power supplies. See Figure 3-9.

Removing a System Fan

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

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

1 Open the system. See "Opening the System" on page 71.

⚠️ **CAUTION: Use caution when handling the fan until the fan blades stop spinning.**

2 Raise the fan handle and pull the fan straight up from the fan bracket to clear the chassis. See Figure 3-9.

Figure 3-9. Removing and Installing a Cooling Fan
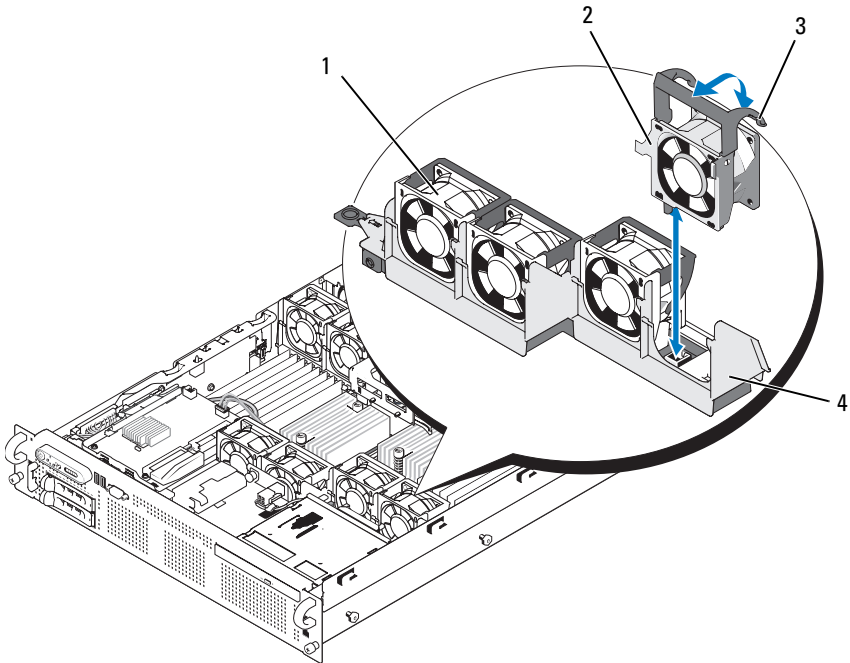
1	fan 1	2	fan 4
3	fan release handle	4	fan bracket

Replacing a Cooling Fan

 1 Ensure that the fan handle is upright and lower the fan into its fan bracket until the fan is fully seated. Then lower the fan handle until it snaps into place. See Figure 3-9.

 2 Close the system. See "Closing the System" on page 71.

SAS Controller Daughter Card

Your system includes a dedicated slot on the sideplane for an internal SAS controller daughter card that provides the SAS storage subsystem for your system's internal hard drives. The controller supports either all-SAS or all-SATA hard drive configurations and also enables you to set up the hard drives in RAID configurations as supported by the version of the SAS controller included with your system.
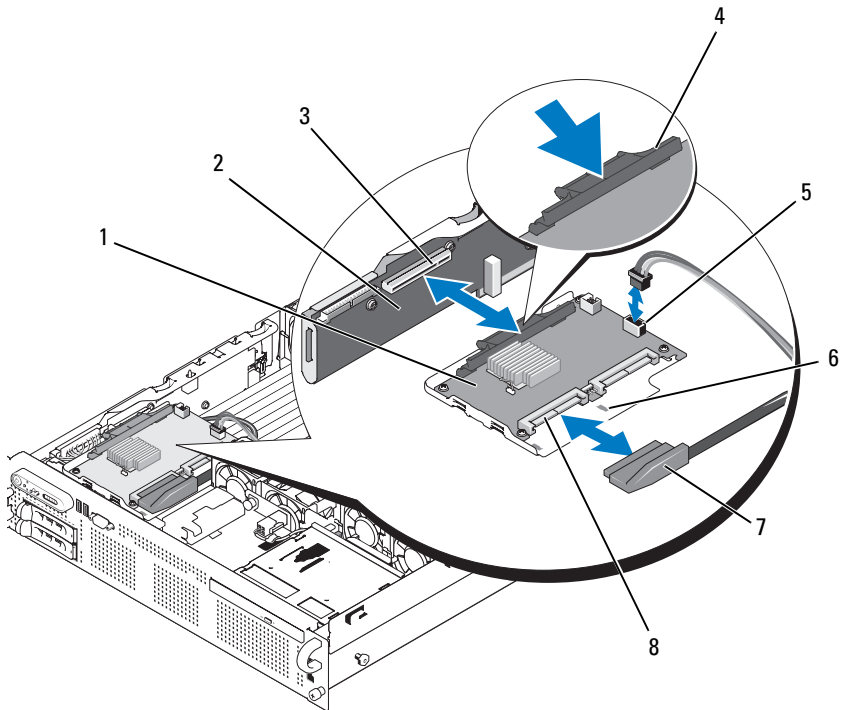
Installing a SAS Controller Daughter Card

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

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

2   Open the system. See "Opening the System" on page 71.

3   Place the SAS daughter card tray on the SAS card bay on top of the hard drive bay and align the card connector with the slot on the sideplane board. See Figure 3-10.

4   With the hooks on the SAS card bay inserted into the cutouts on the SAS daughter card tray, push the card edge connector into the card slot on the sideplane board until the card is fully seated. See Figure 3-10.

Figure 3-10. Installing a SAS Controller Daughter Card

1	SAS controller daughter card	2	sideplane
3	SAS controller daughter card socket	4	release tab
5	RAID battery connector (battery-cached SAS RAID controller only)	6	cutout
7	SAS cable (1)	8	SAS connector(s) (1 or 2) (only SAS 0 used)

5 Attach one end of the interface cable to connector 0 on the SAS controller and the other end to the backplane SAS connector. See Figure 3-11.

![note icon] **NOTE:** Be sure to connect the cable according to the connector labels on the cable. The cable is not operational if reversed.

Figure 3-11. SAS Controller Daughter Card Cabling
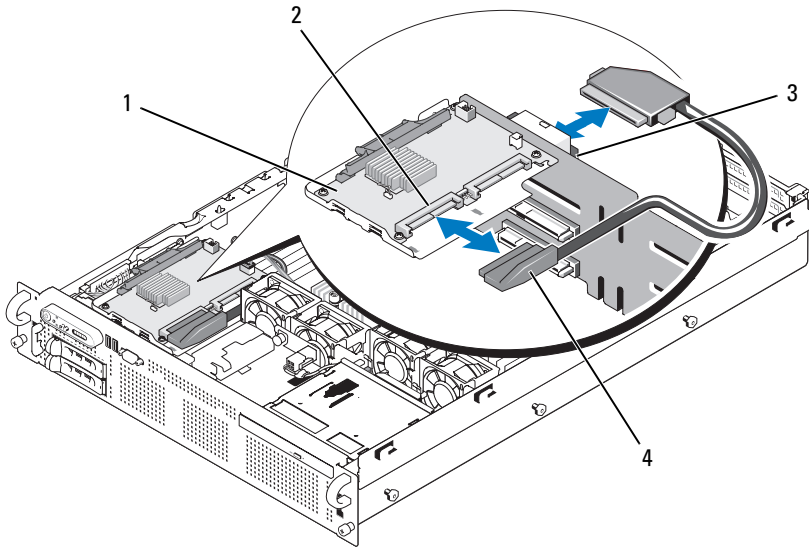
1	SAS controller daughter card	2	SAS 0 connector
3	SAS_A connector (below BKPLN connector)	4	SAS cable (1)

6 For battery-cached SAS RAID controllers, install the RAID battery. See "Installing a RAID Battery" on page 87.

Removing a SAS Controller Daughter Card

1 Disconnect the SAS cable from the SAS controller daughter card.

2 Press down on the blue release tab and push the SAS controller daughter card out of the sideplane connector. See Figure 3-10.

3 Remove the card tray from the chassis hooks and lift the card from the system.

4 If applicable, remove the RAID battery from the battery holder.

RAID Battery

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

Installing a RAID Battery

1 Insert the RAID battery into the battery carrier. See Figure 3-12.

2 Locate the battery bay to the right of the SAS daughter card on top of the hard drive bays.

3 Insert the battery carrier and RAID battery into the system's battery carrier slots and connect the battery cable to the storage daughter card, ensuring that the battery carrier is aligned and fully seated in the slots.

Removing a RAID Battery

1 Disconnect the cable between the RAID battery and the SAS controller daughter card. See Figure 3-12.

2 Press down and to the left on the battery carrier to disengage the carrier from the chassis battery carrier slots.

3 Pull back gently on the two guides holding the RAID battery in the battery carrier and draw out the RAID battery from the battery carrier.

Figure 3-12.   Installing a RAID Battery
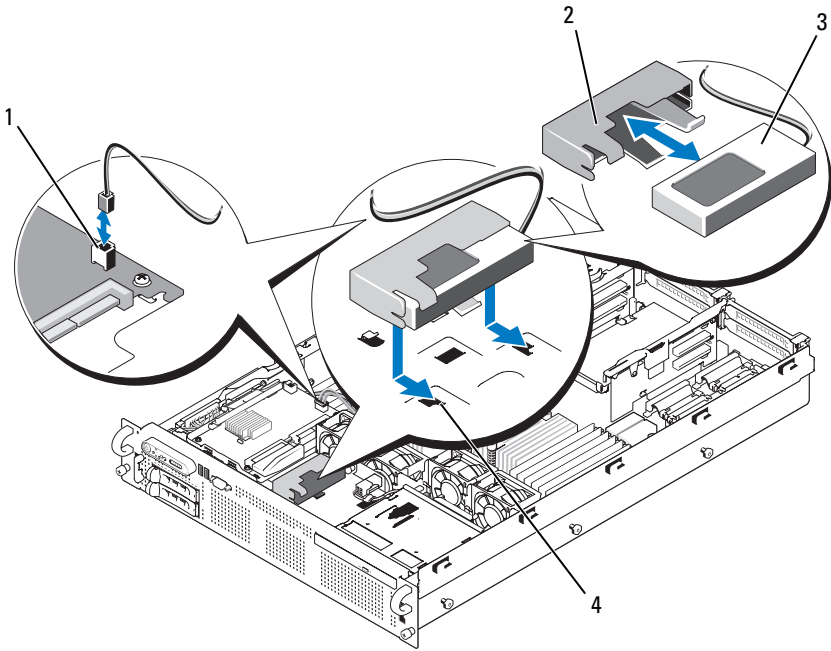
1	RAID battery connector (RAID_BATT)	2	battery carrier
3	RAID battery	4	chassis battery carrier slot (2)

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 you plan to boot the system from a hard drive, the drive must be attached to the primary (or boot) controller. The device that the system boots from is determined by the boot order specified in the System Setup program.

The System Setup program provides options that the system uses to scan for installed boot devices. See "Using the System Setup Program" on page 47 for information about the System Setup program.

Internal USB Memory Key Connector

The system provides an internal USB connector located on the expansion-card riser 2 board for use with a USB flash memory key (see Figure 6-4). 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 48. 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: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

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

2 Open the system. See "Opening the System" on page 71.

3 Locate the USB connector on expansion-card riser 2 (see Figure 6-4).

   If you have full-length expansion card in slot 3, you may have to remove the card to install the USB key. See "Removing an Expansion Card" on page 92.

4 Insert the USB memory key into the USB connector onto the board. See Figure 3-13.

5 If applicable, install the expansion card in slot 3. See "Installing an Expansion Card" on page 91.

6 Close the system. See "Closing the System" on page 71.

7 Reconnect the system to power and restart the system.

8 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 47.

Figure 3-13.   Installing an Internal USB Key
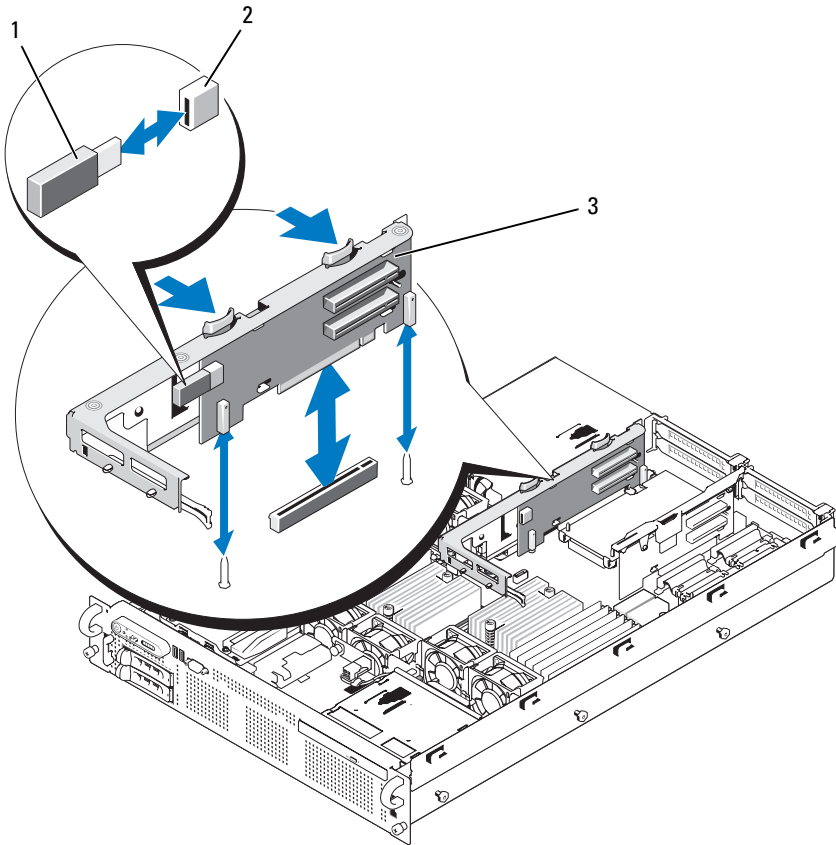
1	USB memory key	2	internal USB connector
3	expansion-card riser 2		

Expansion Cards

The system supports up to four PCI Express (PCIe) expansion cards.

- Expansion-card riser 1 provides two slots:
  - Slot 1 is a full-length PCIe x8-lane expansion slot.
  - Slot 2 is a half-length PCIe x4-lane expansion slot.
- Expansion-card riser 2 provides two slots:
  - Slot 3 is a full-length PCIe x8-lane expansion slot.
  - Slot 4 is a half-length PCIe x8-lane expansion slot.

The expansion card slots are on separate buses. To identify expansion slots, see "Expansion-Card Riser-Board Components and PCIe Buses" on page 172.

Expansion Card Installation Guidelines

Observe the following notes and guidelines regarding the expansion-card slots:

- The expansion-card slots are not hot-pluggable.
- Although slot 2 is physically a PCIe x8 connector, it functions only as a PCIe x4 lane slot.
- Slots 1 and 3 support full-length expansion cards; slots 2 and 4 support half-length expansion cards.
- The system supports up to two RAID expansion cards to manage external storage.

Installing an Expansion Card

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

📝 **NOTE:** The procedure for installing expansion cards into risers 1 and 2 is the same except that slot 3 on riser 2 has a card guide for installing a full-length expansion card. The full-length expansion card installation is illustrated in Figure 3-14.

 1 Unpack the expansion card and prepare it for installation.

   For instructions, see the documentation accompanying the card.

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

3 Open the system. See "Opening the System" on page 71.

4 Open the expansion-card guide latch and remove the filler bracket at the back of the system. See Figure 3-14.

5 Install the expansion card:

   a If the expansion card is full length, align its front edge with the front card guide. See Figure 3-14.

   b Position the expansion card so that the card-edge connector aligns with the expansion-card connector on the expansion-card riser board.

   c Insert the card-edge connector firmly into the PCIe card connector until the card is fully seated.

   d When the card is seated in the connector, close the expansion-card latch. See Figure 3-14.

6 Connect any expansion-card cables for the new card.

   See the documentation that came with the card for information about its cable connections.

7 Close the system. See "Closing the System" on page 71.

Removing an Expansion Card

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

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

2 Open the system. See "Opening the System" on page 71.

3 Disconnect any cables connected to the expansion card.

Figure 3-14.   Removing or Installing an Expansion Card
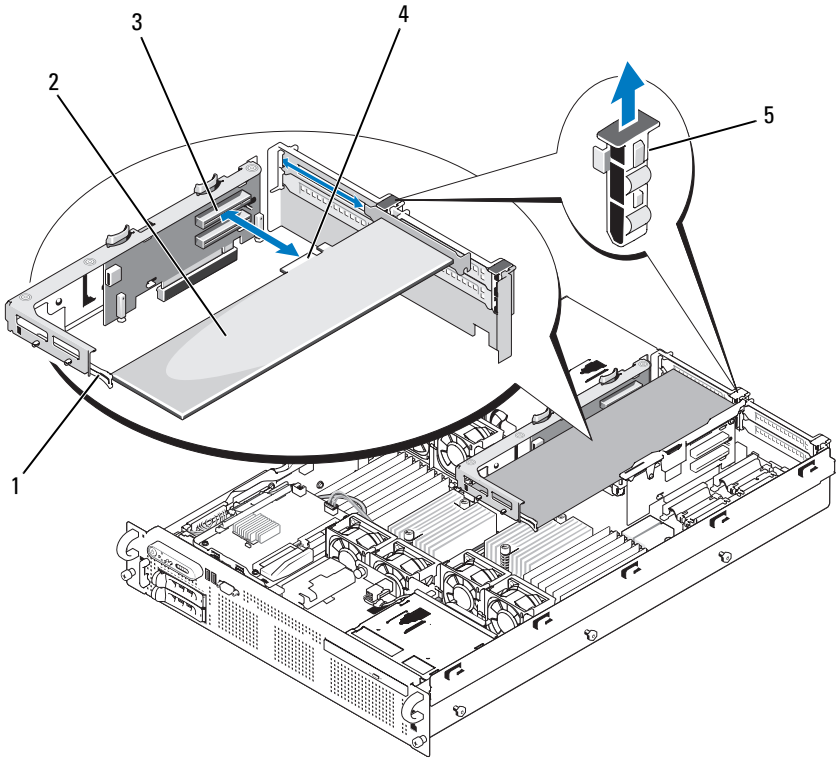
1	front card guide	2	expansion card
3	expansion-card connector	4	card-edge connector
5	expansion-card guide latch		

4 Remove the expansion card:

    a Open the expansion-card latch at the back of the system chassis. See Figure 3-14.

    b Grasp the expansion card by its top corners, and carefully pull the card from the expansion-card connector.

5 If you are removing the card permanently, install a metal filler bracket over the empty expansion slot opening and close the expansion-card latch.

> ◢ **NOTE:** You must install a filler bracket over an empty expansion slot to maintain Federal Communications Commission (FCC) certification of the system. The brackets also aid in proper cooling and airflow inside the system.

6 Close the system. See "Closing the System" on page 71.

Cooling Shrouds

The system provides three cooling shrouds that direct airflow from the cooling fans over the system processors (processor cooling shroud) and memory modules (memory module cooling shrouds "A" and "B").

> ⚠ **CAUTION: The DIMMs are hot to the touch for some time after the system has been powered down. Allow the DIMMs to cool before handling them.**

> ◉ **NOTICE:** Never operate your system with the memory cooling shroud removed. Overheating of the system can develop quickly resulting in a shutdown of the system and the loss of data.

Removing the Memory Module Cooling Shrouds

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

2 Open the system. See "Opening the System" on page 71.

3 Squeeze the blue release latches located on top of the memory module cooling shroud and lift the shroud out of the system. See Figure 3-15.

4 Repeat the previous step for the other memory module cooling shroud.

Figure 3-15.   Removing and Installing the Cooling Shrouds
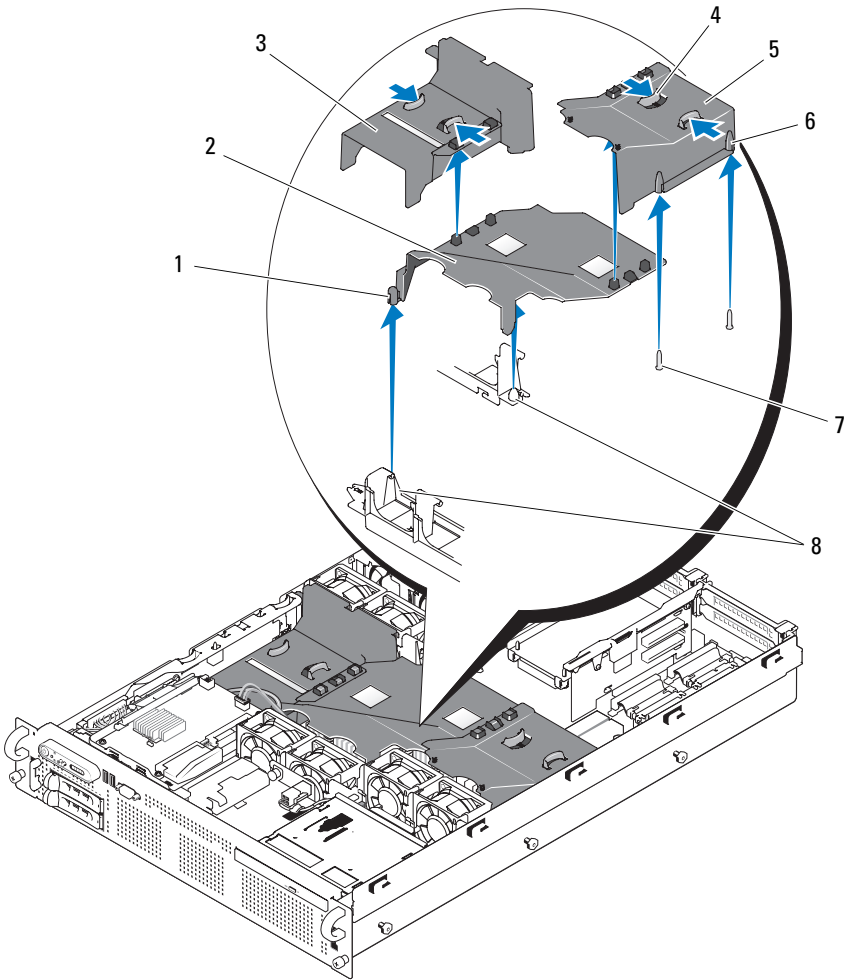
1	pin collar (2)	2	processor cooling shroud
3	memory module cooling shroud ("A")	4	release tabs
5	memory module cooling shroud ("B")	6	pin collar (2)
7	mounting pins (6)	8	mounting pins on fan brackets (2)

Removing the Processor Cooling Shroud

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

2 Open the system. See "Opening the System" on page 71.

3 Detach and remove the two memory module cooling shrouds on each side of the processor cooling shroud.

4 Remove the expansion cards from expansion-card riser 2. See "Removing an Expansion Card" on page 92.

5 Remove expansion-card riser 2. See "Removing Expansion-Card Riser 2" on page 101

6 Lift the shroud upward and out of the system. See Figure 3-15.

Installing the Processor Cooling Shroud

1 Align the pin collars at the bottom of the processor cooling shroud with the pins located on the two fan brackets. See Figure 3-15.

2 Lower the processor cooling shroud straight down onto the pins.

3 Reinstall expansion-card riser 2. See "Replacing Expansion-Card Riser 2" on page 101.

4 Reinstall the expansion cards into the riser 2 board. See "Installing an Expansion Card" on page 91.

Installing the Memory Module Cooling Shrouds

1 Align the pin collars at the bottom of the right ("B") memory module cooling shroud with the pins located on the right side of the "B" memory module slots. See Figure 3-15.

2 Lower the shroud straight down onto the pins and press down lightly to latch the shroud to the processor cooling shroud.

3 Lower the left ("A") memory module shroud over the "A" memory modules and press down lightly to latch the shroud to the processor cooling shroud.

4 Close the system. See "Closing the System" on page 71.

5 Reconnect the system to the electrical outlet and turn on the system and attached peripherals.
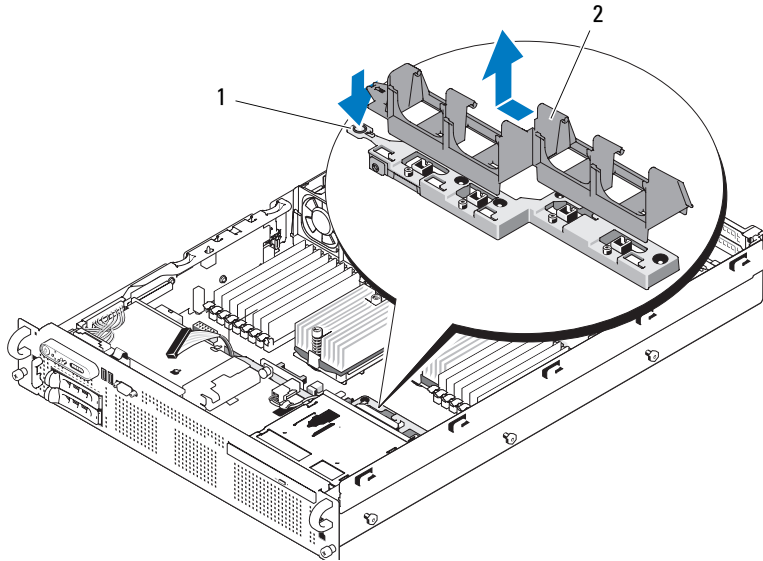
Fan Brackets

Removing the Fan Brackets

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

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

2 Open the system. See "Opening the System" on page 71.

3 Remove the fans from the fan bracket. See "Removing a System Fan" on page 82.

4 Remove the expansion cards from riser 2. See "Removing an Expansion Card" on page 92.

5 Remove the expansion-card riser 2. See "Removing Expansion-Card Riser 2" on page 101.

6 Remove all three cooling shrouds. See "Cooling Shrouds" on page 94.

7 *For the processor fan bracket only:* Remove the SAS controller daughter card. See "Removing a SAS Controller Daughter Card" on page 86.

8 Remove the fan bracket from the system:

    a Press and hold down on the release latch on the left side of the fan bracket. See Figure 3-16.

    b Slide the fan bracket toward the release latch to disengage from the system board tray. See Figure 3-16.

    c Lift the bracket out of the system.

Figure 3-16.   Removing and Installing the Processor Fan Bracket

| 1 | release latch | 2 | fan bracket |

Replacing the Fan Bracket

1   Lower the fan bracket down onto the bracket base so that the tabs and hooks under the bracket fit correctly into the bracket base. See Figure 3-16.

2   With the bracket properly engaged, slide the bracket to lock it in place.

3   Replace the fans in the fan bracket. See "Replacing a Cooling Fan" on page 83.

4   Reinstall the cooling shrouds. See "Cooling Shrouds" on page 94.

5   Reinstall the expansion-card riser 2. See "Replacing Expansion-Card Riser 2" on page 101.

6   Reinstall the expansion cards from riser 2. See "Installing an Expansion Card" on page 91.

7   If applicable, reinstall the SAS controller daughter card. See "Installing a SAS Controller Daughter Card" on page 84.

8   Close the system. See "Closing the System" on page 71.

Expansion-Card Risers

Removing Expansion-Card Riser 1

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

📝 **NOTE:** You must remove all expansion cards from the expansion-card riser before removing the riser from the system.

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

2   Open the system. See "Opening the System" on page 71.

3   Disconnect all cables connected to the expansion card.

4   Remove all expansion cards from the expansion-card riser. See "Removing an Expansion Card" on page 92.

5   Press the tab at the bottom of the riser to release the board from the card slot and lift expansion-card riser 1 off of the mounting pins and out of the system. See Figure 3-17.

Replacing Expansion-Card Riser 1

Aligning the two pin collars over the mounting pins on the system board, gently lower the center riser board until the board connector is firmly seated into the system board socket. See Figure 3-17.

Figure 3-17.   Removing and Replacing Expansion-Card Riser 1
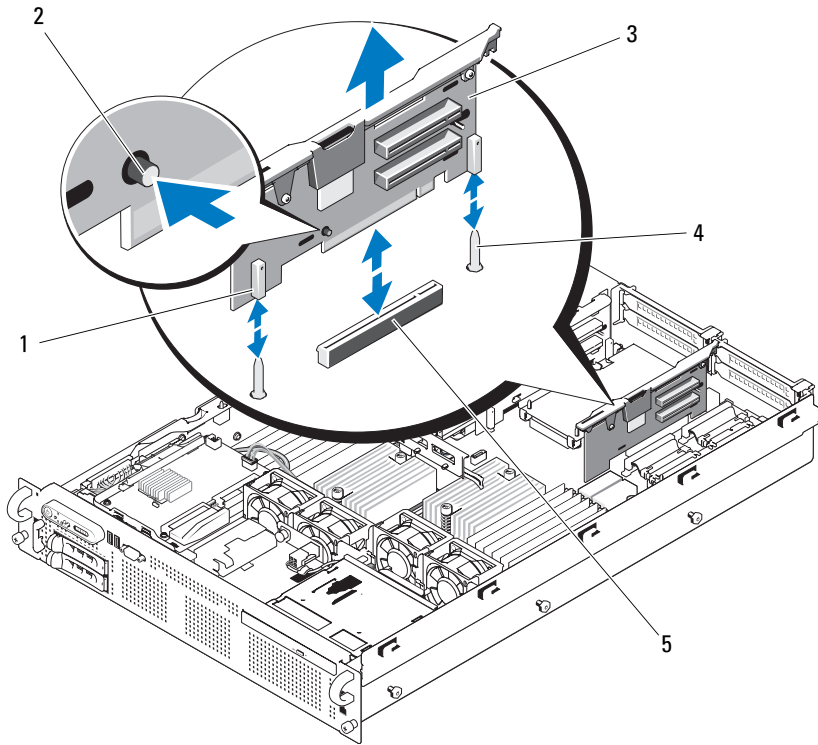
1	pin collars (2)	2	release tab
3	expansion-card riser 1	4	mounting pins (2)
5	system board socket		

Removing Expansion-Card Riser 2

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**
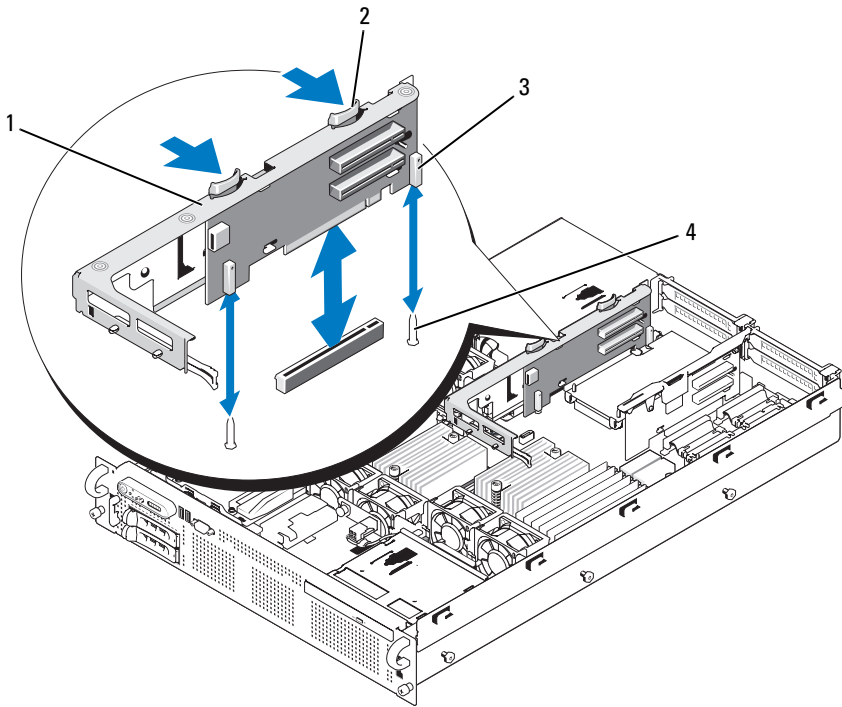
📖 **NOTE:** You must remove all expansion cards from the expansion-card riser before removing the riser from the system.

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

2 Open the system. See "Opening the System" on page 71.

3 Disconnect all cables connected to the expansion card.

4 Remove any expansion cards from the expansion-card riser. See "Removing an Expansion Card" on page 92.

5 Press the two blue release latches on expansion-card riser 2 and lift the riser straight up to clear the chassis. See Figure 3-18.

Replacing Expansion-Card Riser 2

1 Align the guides on each end of expansion-card riser 2 with the mounting pins on the system board, and lower the riser into the system until the latches on the riser the engage. See Figure 3-18.

2 Reinstall any expansion cards.

3 Reconnect all expansion-card cables.

4 Close the system. See "Closing the System" on page 71.

Figure 3-18. Removing and Replacing Expansion-Card Riser 2

1	expansion-card riser 2	2	release latches (2)
3	pin collars (2)	4	mounting pins (2)

Removing the Riser 2 Board From the Expansion-Card Bracket

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

2 Open the system. See "Opening the System" on page 71.

3 Remove any expansion cards from the expansion-card riser 2. See "Removing an Expansion Card" on page 92.

4 Remove expansion-card riser 2. See "Removing Expansion-Card Riser 2" on page 101.

Figure 3-19. Removing and Replacing the Riser 2 Board
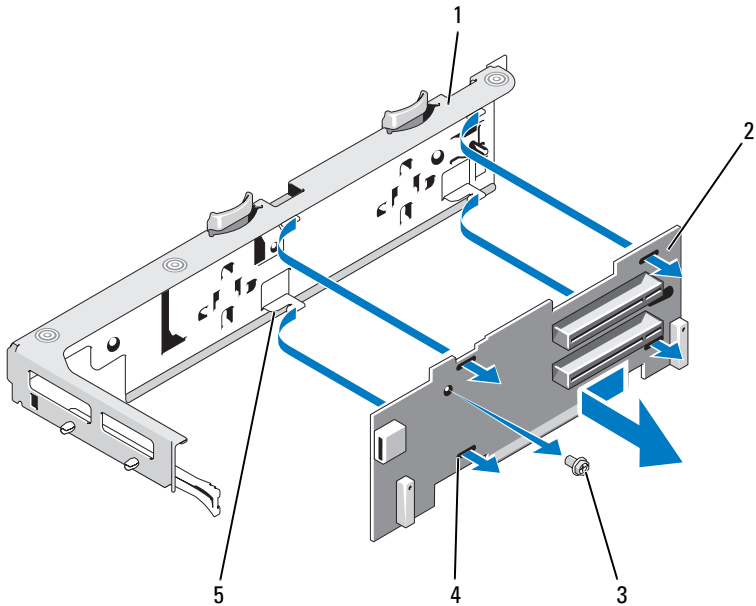
1	expansion-card bracket	2	riser 2 board
3	Phillips screw	4	tab slot (4)
5	tab hook (4)		

5 Remove the expansion-card riser board:

   a Using a Phillips screwdriver, remove the securing screw from the assembly. See Figure 3-19.

   b Slide the riser board off of the four securing tab hooks.

   c Lift the riser board from the bracket.

Replacing the Riser 2 Board on the Expansion-Card Bracket

1 Place the riser board in the expansion-card bracket so that the four tab hooks are fully inserted through the tab slots on the riser board. See Figure 3-19.

2 Slide the riser board into the tab hooks.

3 Using a Phillips screwdriver, secure the board with the Phillips screw.

4 Reinstall expansion-card riser 2. See "Replacing Expansion-Card Riser 2" on page 101.

5 Install all expansion cards in the expansion-card slots. See "Installing an Expansion Card" on page 91.

6 Close the system. See "Closing the System" on page 71.

RAC Card

The optional Remote Access Controller (RAC) provides a set of advanced features for managing the server remotely.

Removing the RAC Card

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

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

2 Open the system. See "Opening the System" on page 71.

3 Remove all expansion cards from expansion-card riser 1. See "Removing an Expansion Card" on page 92.

4 Remove expansion-card riser 1. See "Removing Expansion-Card Riser 1" on page 99.

5 Disconnect the two short ribbon cables to the RAC card. See Figure 3-20.

Figure 3-20.   Removing and Installing a RAC Card
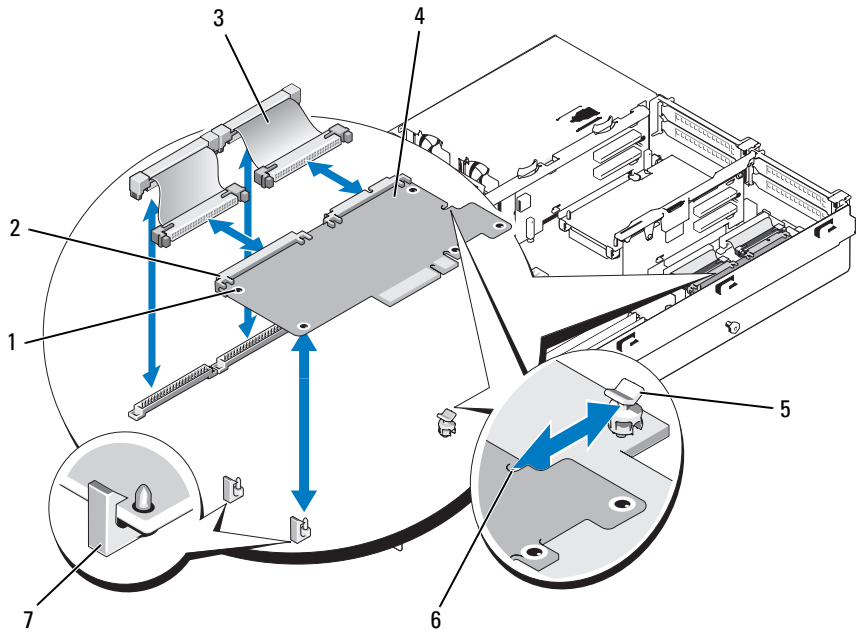
1	standoff holes (2)	2	RAC-card connectors (2)
3	RAC-card cables (2)	4	RAC card
5	support standoff	6	cutout
7	retention standoffs (2)		

6 Pull back slightly on one of the blue retention standoff tabs and gently work the edge of RAC card off of the standoff. Repeat for the other retention standoff.

7 Angle the free end of the RAC card up and pull the card away from the support standoff.

8 If you are not replacing the RAC card, disconnect and remove the ribbon cables from the system board and insert the plastic filler plug in the system back panel.

⊘ **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.

9 Reinstall expansion-card riser 1. See "Replacing Expansion-Card Riser 1" on page 99.

10 Reinstall all expansion cards in expansion-card riser 1. See "Installing an Expansion Card" on page 91.

11 Close the system. See "Closing the System" on page 71.

Installing a RAC Card

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

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

2 Open the system. See "Opening the System" on page 71.

3 Remove all expansion cards from expansion-card riser 1. See "Removing an Expansion Card" on page 92.

4 Remove expansion-card riser 1. See "Removing Expansion-Card Riser 1" on page 99.

5 If you are installing a RAC card for the first time, remove the plastic filler plug from the system back panel. See Figure 3-20.

6 Angle the RAC card so that its NIC connector inserts through the back-panel RAC card opening, and then straighten the card.

7 Position the back edge of the card so that the cutout on the edge of the card inserts into the support standoff. See Figure 3-20.

8 Align the front edge of the RAC card with the two front plastic retention standoffs and press down the side of the card until it is fully seated on the standoffs. See Figure 3-20.

When the front of the card is fully seated, the plastic standoff snaps over the edge of the card.

9 Connect the two short ribbon cables to the RAC card and the system board. See Figure 6-2 for the connector locations

◯ **NOTICE:** Be careful when attaching cables to the system board that you do not damage the surrounding system board components.

　a Connect one cable to connector 1 on the RAC card and to RAC_CONN1 on the system board.

　b Connect the second cable to connector 2 on the RAC card and to RAC_CONN2 on the system board.

10 Reinstall expansion-card riser 1. See "Replacing Expansion-Card Riser 1" on page 99.

11 Reinstall all expansion cards in expansion-card riser 1. See "Installing an Expansion Card" on page 91.

12 Close the system. See "Closing the System" on page 71.

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

LOM Daughter Card

The LAN-on-motherboard (LOM) NIC daughter card provides two additional NIC LOMs. The two daughter card LOMs are upgradeable to 10Gbps data rate capability, when available.

Removing the LOM Daughter Card

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

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

2 Open the system. See "Opening the System" on page 71.

Figure 3-21. Installing and Removing a LOM Daughter Card
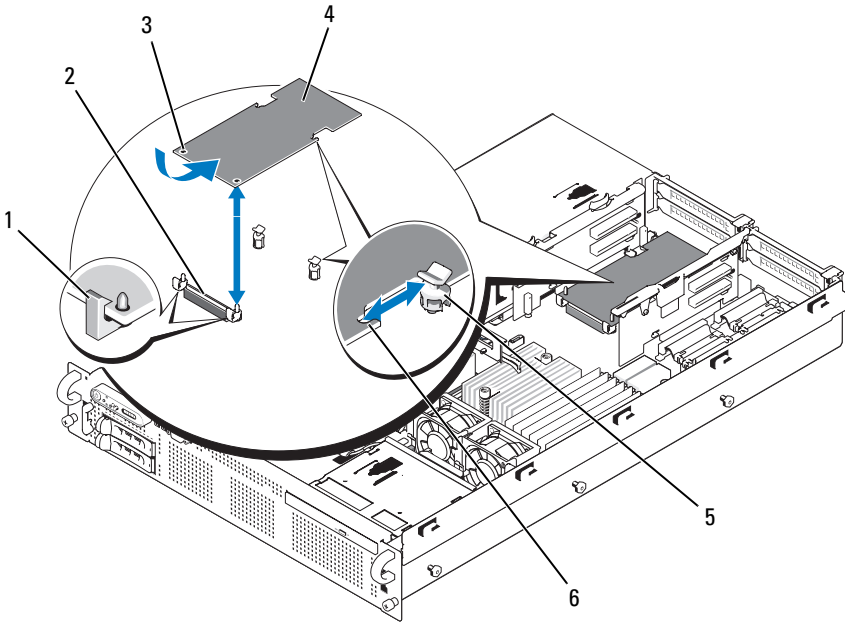
1	retention standoff (2)	2	LOM daughter card connector
3	retention standoff holes (2)	4	LOM daughter card
5	support standoff	6	cutout

3 Remove all expansion cards from expansion-card riser 2. See "Removing an Expansion Card" on page 92.

4 Pull back slightly on the two blue retention standoff tabs at the front edge of the card and gently work the edge of LOM card off of the standoffs.

As the card releases from the standoffs, the connector under the LOM card disengages from the system board.

5 Slide the card back to release the back edge of the card from the two support standoffs and lift the card out of the system.

Replacing the LOM Daughter Card

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

1 Angle the LOM card so that its NIC connectors are positioned toward the back-panel LOM card opening.

2 Straighten the card so that the cutouts on the side edges of the card insert into the two support standoffs. See Figure 3-21.

3 Slide the card back slightly and align the front edge of the LOM card with the two front plastic retention standoffs adjacent to the LOM system board connector, and press down the side of the card until it is fully seated. See Figure 3-20.

   When the front of the card is fully seated, the plastic standoff snaps over the edge of the card.

4 Reinstall all expansion cards in expansion-card riser 2. See "Installing an Expansion Card" on page 91.

5 Close the system. See "Closing the System" on page 71.

Optical Drive

An optional slimline DVD or CD-RW/DVD-RW optical drive is mounted on a tray that slides in the front panel and connects to the controller on the system board.

📝 **NOTE:** DVD devices are data only.

Removing the Optical Drive from the System

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

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

2 Open the system. See "Opening the System" on page 71.

3 Disconnect the optical drive cable from the back of the optical drive tray.

4 To remove the optical drive, pull up on the blue release tab at the back of the optical drive tray and push the tray out of the system. See Figure 3-24.

Installing the Optical Drive

1 Align the optical drive tray with its opening in the front panel. See Figure 3-22.

2 Slide in the drive tray until the tray snaps into place.

3 Connect the optical drive cable to the back of the drive tray.

4 If not already done, connect the power and interface cables from the optical drive to the SAS/SATA backplane and system board connectors.

   a Connect the power cable to the CD_PWR connector on the backplane board. See Figure 6-3 for the location of the connector and Figure 3-22 for the routing of the cable.

   b Route the interface cable along the inside right chassis side panel, inserting the cable under each of the cable routing tabs. See Figure 3-23.

   c Connect the cable to the SATA_A connector on the system board. See Figure 6-2 for the location of the connector.

5 Close the system. See "Closing the System" on page 71.

6 Replace the bezel. See "Replacing the Front Bezel" on page 70.

7 Reconnect your system and peripherals to their electrical outlets, and turn on the system.

Figure 3-22. Removing and Installing the Optical Drive Tray
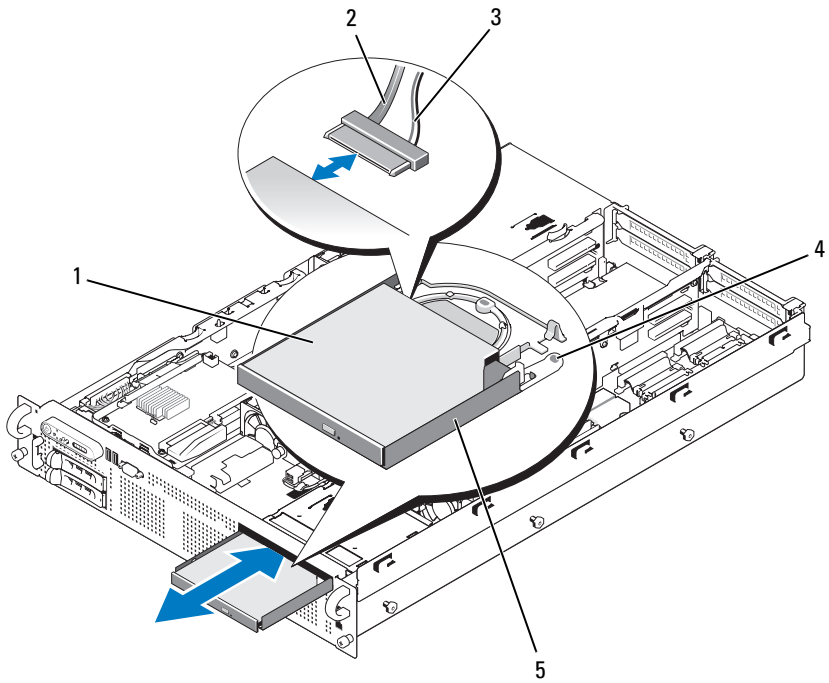
1	optical drive	2	optical-drive interface cable
3	power cable	4	optical-drive release tab
5	optical-drive tray		

Figure 3-23. Cabling the Optical Drive
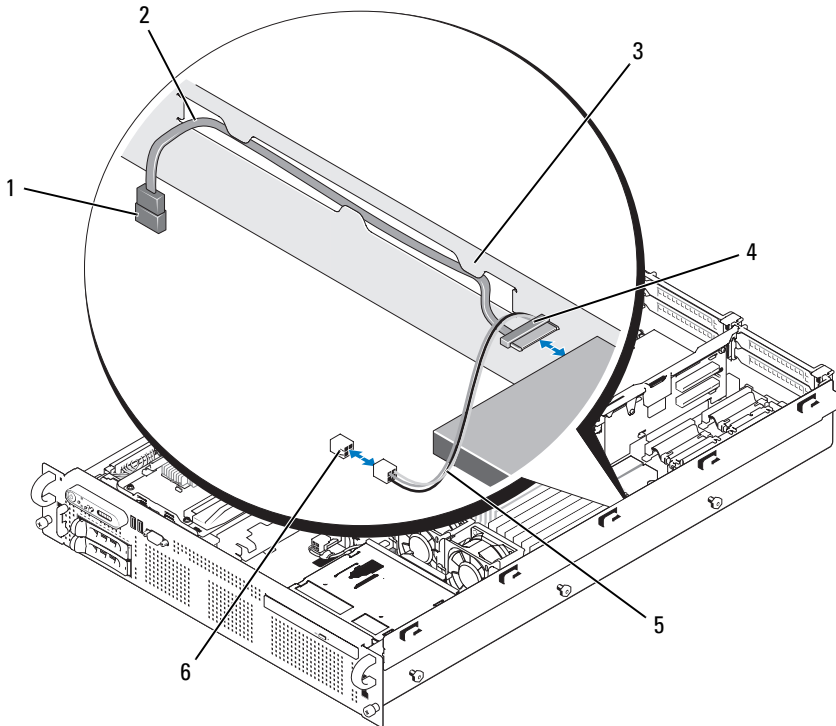
1	SATA connector (SATA_A) on system board	2	SATA interface cable
3	routing tabs in chassis side wall	4	optical-drive SATA connector
5	optical drive power cable	6	CD_PWR connector on backplane

Removing the Optical Drive From the Optical Drive Tray

Pull outward on the tab at the back of the carrier on the left side and simultaneously pull up on the left side of the optical drive to separate the drive from the tray. See Figure 3-24.

Figure 3-24. Removing and Installing the Optical Drive in the Optical Drive Carrier
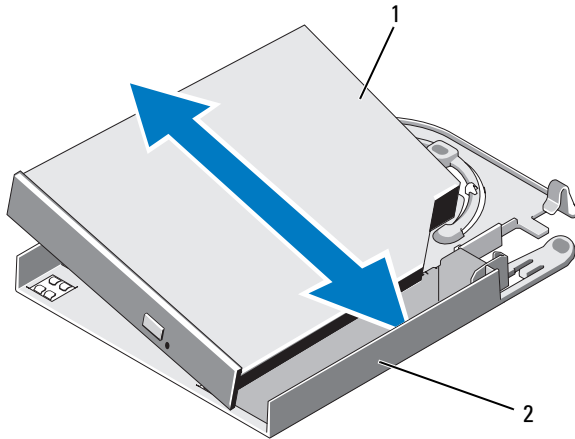
1	optical drive	2	optical drive carrier

Installing an Optical Drive Into the Optical Drive Tray

1 With the optical drive at a slight angle to the drive tray, lower the right side of the optical drive down onto the right side of the drive tray. See Figure 3-24.

2 Lower the left side of the optical drive and press the drive down into the tray until it snaps into place.

System Memory

You can upgrade your system memory to a maximum of 128 GB by installing 667-MHz registered parity DDR2 memory modules (DIMMs) in sets of 512-MB, 1-GB, 2-GB, 4-GB, or 8-GB single- or dual-ranked modules (quad-ranked modules are not supported). The memory sockets are located on the system board under the memory module cooling shrouds and are split into two separate groups of eight sockets each. Each eight-socket group is adjacent to its respective processor.

Your system hardware supports Non-Uniform Memory Architecture (NUMA). Each processor has its own memory controller and local memory for reduced access times, but it can also access memory from another processor. This architecture improves system performance if an operating system is installed that supports this feature.

NOTICE: To enable NUMA, run the System Setup program and disable the Node Interleaving option. See "Using the System Setup Program" on page 47.

General Memory Module Installation Guidelines

To ensure optimal performance of your system, observe the following guidelines when configuring your system memory.

- Memory must be installed in configurations of four, eight, or sixteen DIMMs. The minimum configuration is four 512-MB DIMMs.
- DIMMs must be installed in matched sets of identical speed, technology, and size in the following sockets:
  - A1, A2, B1, and B2 — four identical DIMMs in this set
  - A3, A4, B3, and B4 — four identical DIMMs in this set
  - A5 through A8 and B5 through B8 — eight identical DIMMs in this set
- Minimum configurations (four DIMMs) must occupy sockets A1, A2, B1, and B2.
- A matched DIMM set can be mixed with another matched DIMM set of the next smaller size. For example, a DIMM set containing 2-GB DIMMs can be mixed with another DIMM set containing 1-GB DIMMs, but not a set containing 512-MB DIMMs. The larger capacity DIMMs must occupy the lower-numbered DIMM sockets.

Table 3-1 shows the available memory configurations following these guidelines.

Table 3-1.   Memory Configurations

Total Memory	DIMM Sets (Size Per Socket)		
	DIMM Set A1, A2, B1, B2	DIMM Set A3, A4, B3, B4	DIMM Set A5, A6, A7, A8, B5, B6, B7, B8
2 GB	512 MB		
4 GB	512 MB	512 MB	
8 GB	512 MB	512 MB	512 MB
4 GB	1 GB		
6 GB	1 GB	512 MB	
8 GB	1 GB	1 GB	
12 GB	1 GB	1 GB	512 MB
16 GB	1 GB	1 GB	1 GB
8 GB	2 GB		
12 GB	2 GB	1 GB	
16 GB	2 GB	2 GB	
24 GB	2 GB	2 GB	1 GB
32 GB	2 GB	2 GB	2 GB
16 GB	4 GB		
24 GB	4 GB	2 GB	
32 GB	4 GB	4 GB	
48 GB	4 GB	4 GB	2 GB
64 GB	4 GB	4 GB	4 GB
32 GB	8 GB		
48 GB	8 GB	4 GB	
64 GB	8 GB	8 GB	
96 GB	8 GB	8 GB	4 GB
128 GB	8 GB	8 GB	8 GB

Memory Sparing Support

Memory sparing is supported in systems that have one of the fully populated memory configurations shown in Table 3-1. The memory sparing feature must be enabled in the **Memory Information** screen of the System Setup program. See "Using the System Setup Program" on page 47.

📝 **NOTE:** The Memory sparing and node interleaving features cannot be used at the same time. To use memory sparing, you must disable the **Node Interleaving** option in the System Setup program.

Memory sparing is applied independently to the two groups of DIMMs on opposite sides of the processor sockets. To support memory sparing, all DIMM sockets within a DIMM group must be populated.

When enabled, memory sparing allocates and reserves ranks of memory from the installed DIMMs to act as spare memory in the event of a memory channel failure. A memory channel uses paired DIMMs; for memory sparing to work, DIMMs must be paired as spares also.

Memory sparing allocates only the first rank of memory of a DIMM. For a single-rank DIMM, the entire capacity of the DIMM must be allocated for sparing along with the adjacent single-rank DIMM to spare a memory channel. For dual-rank DIMMs, two DIMMs are also required for sparing, but as only the first rank of each DIMM is allocated, only half of a dual-rank DIMM's capacity is allocated for sparing. The second ranks on both DIMMs are available memory.

Memory sparing calculates the appropriate DIMMs to spare by searching the DIMM sockets, starting with the higher-numbered socket pair (specifically, sockets 3 and 4 or sockets 7 and 8), for an amount of memory large enough to spare one of the available channels of memory. If the DIMMs in these sockets are sufficient to spare a channel of the available memory, the first rank of each of those two DIMMs are spared. If the amount of memory is not large enough to spare an available memory channel, the system spares the DIMM ranks in the lower-numbered sockets. Table 3-2 shows how memory sparing works in various memory configurations.

Table 3-2.   Memory Sparing Configurations

DIMMs				Available Memory	Spared Memory
A1, A2, B1, B2	A3, A4, B3, B4	A5, A6, B5, B6	A7, A8, B7, B8		
512 MB	512 MB	512 MB	512 MB	6 GB	2 GB
1 GB	1 GB	1 GB	1 GB	12 GB	4 GB
2 GB	2 GB	2 GB	2 GB	28 GB	4 GB
4 GB	4 GB	4 GB	4 GB	56 GB	8 GB
8 GB	8 GB	8 GB	8 GB	112 GB	16 GB

	Indicates a spared single-rank DIMM (512-MB or 1-GB). The entire capacity of this DIMM is reserved for sparing.
	Indicates a spared dual-rank DIMM (2-GB and higher). One-half of this DIMM's capacity is reserved for sparing.

Installing Memory Modules

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

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

  2 Open the system. See "Opening the System" on page 71.

  3 Remove the memory cooling shroud. See "Removing the Memory Module Cooling Shrouds" on page 94.

⊙ **NOTICE:** Never remove the memory cooling shroud without first powering down the system. Overheating of the system can develop quickly resulting in a shutdown of the system and the loss of data.

  4 Locate the memory module sockets on the system board. See Figure 6-2.

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

  5 Press the ejectors on the memory module socket down and out, as shown in Figure 3-25, to allow the memory module to be inserted into the socket.

6 Align the memory module's edge connector with the alignment key on the memory module socket, and insert the memory module in the socket.
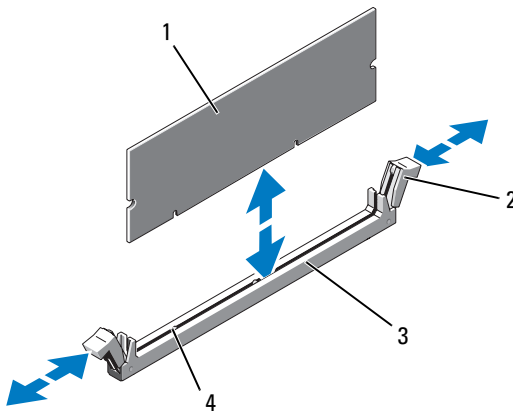
> ✍ **NOTE:** The memory module socket has two alignment keys that allows you to install the memory module in the socket in only one way.

Figure 3-25. Installing and Removing a Memory Module

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

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

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

8 Repeat step 3 through step 7 of this procedure to install the remaining memory modules.

9 Replace the memory cooling shroud. See "Installing the Processor Cooling Shroud" on page 96.

> ⊘ **NOTICE:** Never operate your system with the memory cooling shroud removed. Overheating of the system can develop quickly resulting in a shutdown of the system and the loss of data.

10 Close the system. See "Opening the System" on page 71.

11 (Optional) Enter the System Setup program, and check the **System Memory** setting on the main **System Setup** screen. See "Entering the System Setup Program" on page 47.

The system should have already changed the value to reflect the newly installed memory.

12 If the value is incorrect, one or more of the memory modules may not be installed properly. Repeat step 2 through step 11 of this procedure, checking to ensure that the memory modules are firmly seated in their sockets.

13 Run the system memory test in the system diagnostics. See "Running the System Diagnostics" on page 162.

Removing Memory Modules

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

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

2 Open the system. See "Opening the System" on page 71.

3 Remove the memory cooling shroud. See "Removing the Memory Module Cooling Shrouds" on page 94.

◑ **NOTICE:** Never remove the memory cooling shroud without first powering down the system. Overheating of the system can develop quickly resulting in a shutdown of the system and the loss of data.

4 Locate the memory module sockets on the system board. See Figure 6-2.

⚠ **CAUTION: The 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.**

5 Press down and out on the ejectors on each end of the socket until the memory module pops out of the socket. See Figure 3-25.

6 Replace the memory cooling shroud. See "Installing the Processor Cooling Shroud" on page 96.

NOTICE: Never operate your system with the memory cooling shroud removed. Overheating of the system can develop quickly resulting in a shutdown of the system and the loss of data.

7 Close the system. See "Closing the System" on page 71.

Integrated NIC TOE

The TCP/IP Offload Engine (TOE) functionality of the system's integrated NIC is activated by the LOM NIC hardware key installed in the TOE_KEY socket on the system board (see Figure 6-2.) See the user documentation that came with this system for information on how to set up and configure the TOE feature.

Processors

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

Removing a Processor

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

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

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

3 Open the system. See "Opening the System" on page 71.

4 Remove the memory module cooling shrouds. See "Removing the Memory Module Cooling Shrouds" on page 94.

5 Remove the expansion cards from expansion-card riser 2. See "Removing an Expansion Card" on page 92.

6 Remove expansion-card riser 2. See "Removing Expansion-Card Riser 2" on page 101.

7 Remove the processor cooling shroud. See "Removing the Processor Cooling Shroud" on page 96.

⊘ **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.

8 Using a #2 Phillips screwdriver, loosen one of the two heat-sink retention screws. See Figure 3-26.

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

10 Loosen the other heat-sink retention screw.

11 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.

12 Position your thumb firmly over the socket-release lever and release the lever from the locked position. Rotate the lever 90 degrees upward until the processor is released from the socket. See Figure 3-27.

Figure 3-26. Installing and Removing the Heat Sink
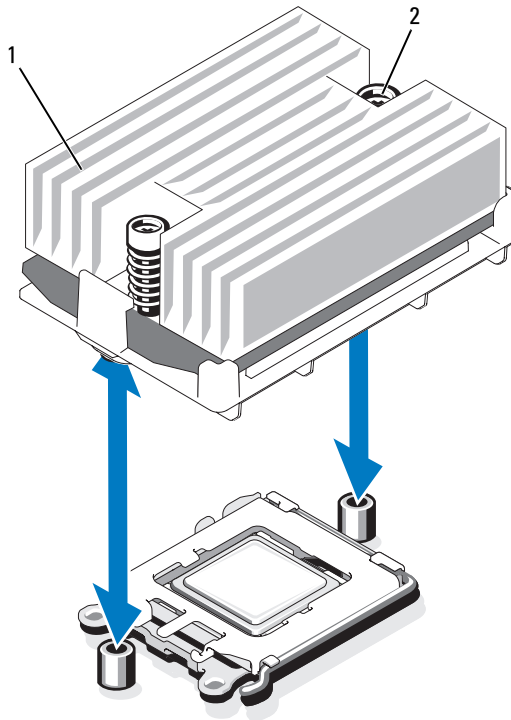
	1	heat sink		2	heat-sink retention screws (2)

13 Rotate the processor shield upward and out of the way.

14 Lift the processor out of the socket and leave the release lever up so that the socket is ready for the new processor.

⊃ 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.

Figure 3-27.   Installing and Removing a Processor
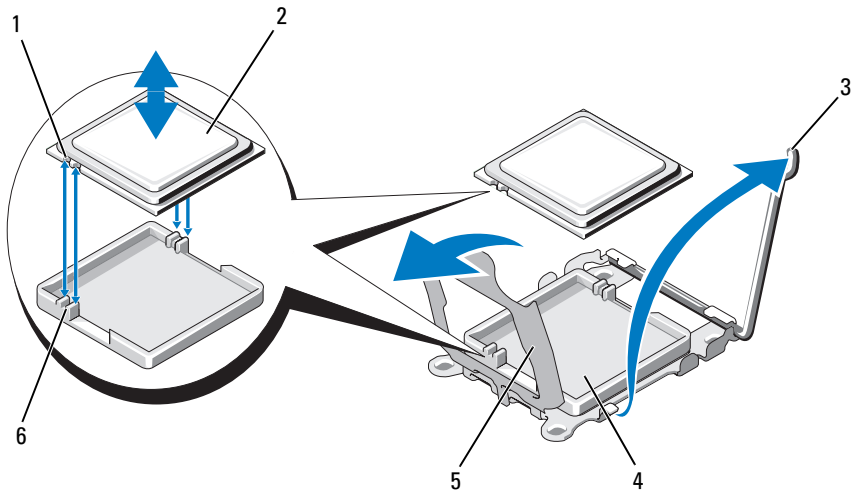
1	notch in processor (2)	2	processor
3	socket-release lever	4	ZIF socket
5	processor shield	6	socket key (2)

Installing a Processor

1 Unpack the new processor.

2 Align the processor with the socket keys on the ZIF socket. See Figure 3-27.

3 Install the processor in the socket.

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.

a If the release lever on the processor socket is not positioned all the way up, move it to that position.

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

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

    c   Close the processor shield. See Figure 3-27.

    d   When the processor is fully seated in the socket, rotate the socket release lever back down until it snaps into place, securing the processor. See Figure 3-27.

4   Install the heat sink.

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

    b   Open the grease packet included with your processor kit and apply thermal grease evenly to the top of the new processor.

    c   Place the heat sink on the processor. See Figure 3-26.

    d   Using a #2 Phillips screwdriver, tighten the heat-sink retention screws. See Figure 3-26.

5   Replace the processor cooling shroud. See "Installing the Processor Cooling Shroud" on page 96.

6   Reinstall expansion-card riser 2. See "Replacing Expansion-Card Riser 2" on page 101.

7   Reinstall the expansion cards into the riser 2 board. See "Installing an Expansion Card" on page 91.

8   Replace the memory module cooling shrouds. See "Installing the Memory Module Cooling Shrouds" on page 96.

9   Close the system. See "Closing the System" on page 71.

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

10   Press <F2> to enter the System Setup program, and check that the processor information matches the new system configuration. See "Entering the System Setup Program" on page 47.

11   Run the system diagnostics to verify that the new processor operates correctly.

See "Running the System Diagnostics" on page 162 for information about running the diagnostics.

System Battery

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

Replacing the System Battery

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

⚠️ **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, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 71.

Figure 3-28. Replacing the System Battery
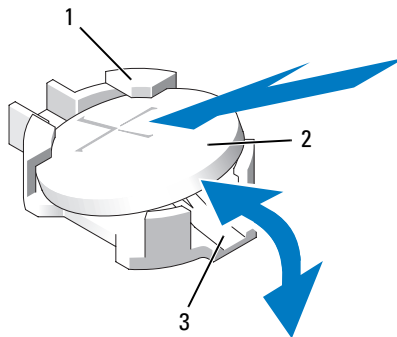
1	positive side of battery connector	2	system battery
3	negative side of battery connector		

3 Locate the battery socket. See "System Board Connectors" on page 167.

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   Remove the system battery.

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

    b   While supporting the battery connector, press the battery toward the positive side of the connector and pry it up out of the securing tabs at the negative side of the connector.

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

5   Install the new system battery.

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

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

    c   Press the battery straight down into the connector until it snaps into place.

6   Close the system. See "Closing the System" on page 71.

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

8   Enter the System Setup program to confirm that the battery is operating properly. See "Entering the System Setup Program" on page 47.

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

10   Exit the System Setup program.

11   To test the newly installed battery, turn off the system and disconnect it from the electrical outlet for at least an hour.

12   After an hour, reconnect the system to its electrical outlet and turn it on.

13 Enter the System Setup program and if the time and date are still incorrect, see "Getting Help" on page 175 for instructions on obtaining technical assistance.

Sideplane Board

Removing the Sideplane Board

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

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

2 Open the system. See "Opening the System" on page 71.

3 Remove the SAS controller daughter card. See "Removing a SAS Controller Daughter Card" on page 86.

4 Remove any cables from the sideplane board.

🚫 **NOTICE:** When detaching the control panel cable from the sideplane 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 Pressing inward on the sideplane release tabs, lift the sideplane up and away from the system. See Figure 3-29

Installing the Sideplane Board

1 Insert the sideplane board into sideplane slots along the left wall of the chassis and lower the sideplane board so that the pin collars connect with the two pins on the system board. Press the sideplane down until sideplane connector is fully seated into the system board connector. See Figure 3-29.

2 Reattach the control panel cable to the sideplane board.

3 Replace the storage controller daughter card. See "Installing a SAS Controller Daughter Card" on page 84.

4 Close the system. See "Closing the System" on page 71.

Figure 3-29. Sideplane Removal and Installation
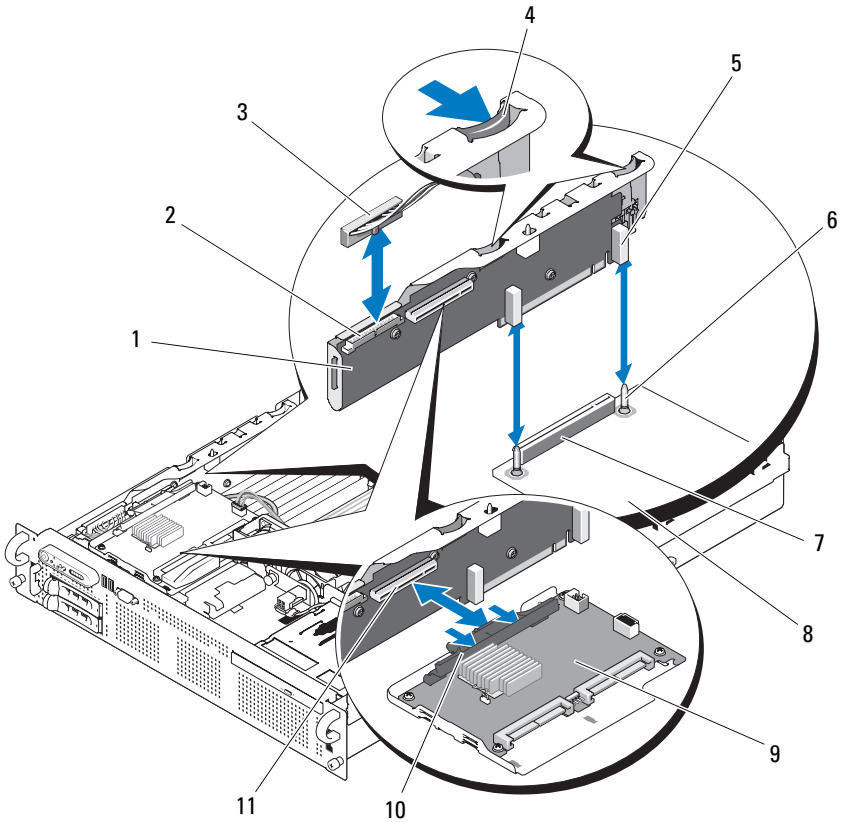
| 1	sideplane	2	control panel connector
3	control panel cable	4	sideplane release tab (2)
5	pin collar (2)	6	chassis pin (2)
7	sideplane connector	8	system board
9	SAS controller daughter card	10	SAS controller daughter card release handle
11	SAS controller daughter card socket		

SAS/SATA Backplane Board

Removing the SAS/SATA Backplane Board

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

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

2   Open the system. See "Opening the System" on page 71.

3   If present, disconnect the optical drive power cable from the SAS/SATA backplane board. See "Removing the Optical Drive from the System" on page 109.

4   Open the drive-carrier release handle on each hard drive and partially extend the drive(s) out of their drive bays. See "Removing a Hot-Plug Hard Drive" on page 74.

5   Remove the storage controller daughter card. See "Removing a SAS Controller Daughter Card" on page 86.

6   Disconnect the SAS cable from the backplane connector.

7   Disconnect the power cable from the backplane connector.

8   Disconnect the optical drive power cable from the backplane connector.

9   Remove the sideplane board. See "Removing the Sideplane Board" on page 127.

10   Remove the SAS/SATA backplane board:

    a   Pull the backplane board release pin. See Figure 3-30.

    b   While pulling the release pin, tilt the backplane board toward the back of the system.

    c   Lift the backplane board from its securing tabs and remove the backplane board from the chassis.

Figure 3-30. SAS/SATA Backplane Board Removal
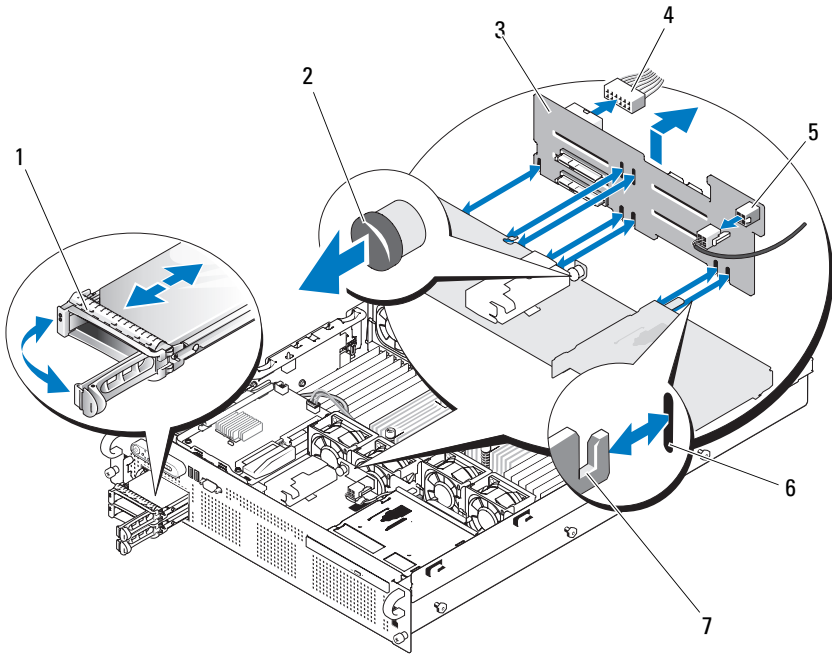
1	drive carrier	2	SAS backplane board release pin
3	SAS/SATA backplane board	4	power cable from system board
5	optical drive power connector	6	securing slots (7)
7	securing tabs (7)		

Installing the SAS/SATA Backplane Board

1 Position the SAS/SATA backplane board so that the securing tabs on the chassis are fully inserted into the securing slots on the backplane board. See Figure 3-30.

2 Pull and hold the release pin, and then tilt the backplane board toward the front of the system until it stops, then release the release pin and ensure that it snaps into place.

3 Reinstall the sideplane board. See "Installing the Sideplane Board" on page 127.

4 Reconnect the power cable to the backplane board.

5 If applicable, reconnect the optical drive power cable to the backplane board. See "Installing the Optical Drive" on page 110.

6 Reinstall the SAS controller daughter card. See "Installing a SAS Controller Daughter Card" on page 84.

7 Reattach the SAS controller daughter card cable.

8 Reinstall the hard drives. See "Installing a Hot-Plug Hard Drive" on page 74.

> **NOTE:** Reinstall the hard drives in the same drive bays from which they were removed.

9 Close the system. See "Closing the System" on page 71.

Control Panel Assembly (Service-only Procedure)

> **NOTE:** The control panel assembly consists of two separate modules—the display module and the control panel circuit board. Use the following instructions to remove and install either module.

Removing the Control Panel Assembly

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

1 If applicable, remove the bezel. See "Removing the Front Bezel" on page 69.

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

3 Open the system. See "Opening the System" on page 71.

4 Disconnect the control panel cable at back of the control panel board. See Figure 3-31.

> ⊘ **NOTICE:** Do not pull on the cable to unseat the connector. Doing so can damage the cable.

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

b Gently work the connector out of the socket.

Figure 3-31.   Control Panel Removal
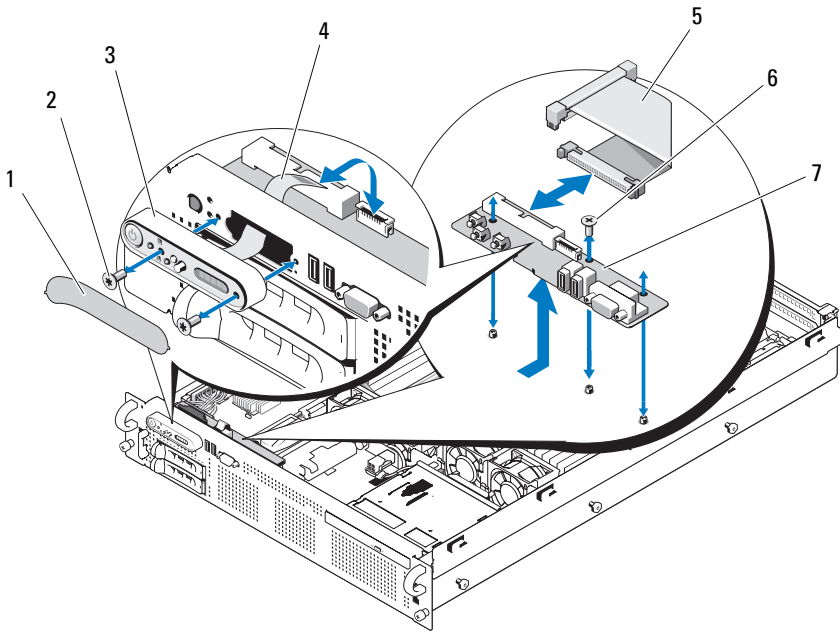
1	display module label	2	display module securing screws (2)
3	display module	4	display module cable
5	control panel cable	6	control-panel circuit board securing screws (3)
7	control panel circuit board		

5 Disconnect the display module cable from the control panel board. See Figure 3-31.

6 Remove the three screws that secure the control panel board to the system chassis and remove the board. See Figure 3-31.

7 Remove the display module:

   a Insert the end of paper clip into the hole on the right side of the display module and gently pry off the label.

   b Using a T10 Torx driver, remove the two screws that secure the display module to the system chassis.

   c Remove the display module from the chassis cutout.

Installing the Control Panel Assembly

1 Insert the display module into the chassis cutout and secure with the two Torx screws.

2 Affix the display module label to the display module.

3 Install the control panel board in the system chassis and secure with the three Phillips screws. See Figure 3-31.

4 Connect the display module cable to the control panel board. See Figure 3-31.

5 Connect the control panel cable to the control panel board. See Figure 3-31.

6 Close the system. See "Closing the System" on page 71.

7 Reconnect the system to the power source and turn on the system and attached peripherals.

8 If applicable, install the bezel.

System Board (Service-only Procedure)

Removing the System Board

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

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

2 Open the system. See "Opening the System" on page 71.

3 If applicable, remove any expansion cards. See "Removing an Expansion Card" on page 92.

4 Remove the power supplies. See "Removing a Power Supply" on page 78.

5 Remove the expansion-card risers. See "Expansion-Card Risers" on page 99.

6 Remove the cooling shrouds. See "Removing the Memory Module Cooling Shrouds" on page 94.

7 Remove the cooling fans. See "Removing a System Fan" on page 82.

8 Remove the fan brackets. See "Removing the Fan Brackets" on page 97.

9 Remove the LOM daughter card. See "Removing the LOM Daughter Card" on page 107.

**10** If applicable, remove the RAC card. See "Removing the RAC Card" on page 104.

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

11 Remove the memory modules. See "Removing Memory Modules" on page 119.

✎ **NOTE:** While removing the memory modules, record the memory module socket locations to ensure proper installation.

12 Remove the heatsinks and microprocessors. See "Removing a Processor" on page 120.

✎ **NOTE:** If the board is to be returned for repair, remove the protective ZIF socket shields from the new system board and install them over the processor sockets on the removed system board to prevent damage to the pins during shipping.

13 Remove the LOM NIC hardware key, if present. See Figure 6-2 for the location of the TOE_KEY socket.

14 Remove the SAS controller card. See "Removing a SAS Controller Daughter Card" on page 86.

15 Remove the sideplane. See "Removing the Sideplane Board" on page 127.

16 Remove the system board:

    a Pull the system-board tray riser release pin. See Figure 3-32.

    b While pulling the release pin, slide the system-board tray toward the front of the chassis.

    c Lift up the system-board tray and remove it from the chassis.

Figure 3-32. System Board Removal
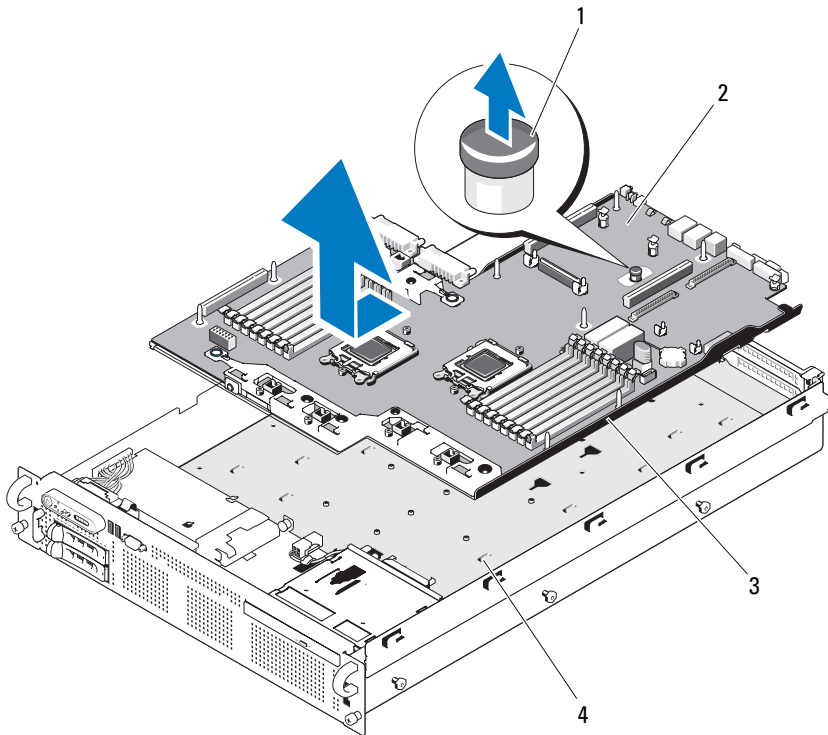
1	system-board tray riser release pin	2	system board
3	system-board tray	4	system-board securing tabs

Installing the System Board

1   Lower the system-board tray until the tray sits flat on the bottom of the chassis.

2   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. See Figure 3-32.

3   Slide the system-board tray toward the back of the chassis until it locks into position.

4   Replace the sideplane. See "Installing the Sideplane Board" on page 127

5   Replace the SAS controller daughter card. See "Installing a SAS Controller Daughter Card" on page 84.

6   Reinstall the LOM NIC hardware key, if applicable. See Figure 6-2 for the TOE_KEY socket location.

7   Replace the heatsinks and microprocessors. See "Installing a Processor" on page 123.

8   Replace the memory modules. See "Installing Memory Modules" on page 117.

9   If applicable, replace the RAC card. See "Installing a RAC Card" on page 106.

10 Replace the fan bracket. See "Replacing the Fan Bracket" on page 98.

11 Replace the fans. See "Replacing a Cooling Fan" on page 83.

12 Replace the cooling shroud. See "Installing the Processor Cooling Shroud" on page 96.

13 Replace the expansion-card risers. See "Expansion-Card Risers" on page 99.

14 Replace the power supplies. See "Replacing a Power Supply" on page 79.

15 If applicable, replace any expansion cards. See "Installing an Expansion Card" on page 91.

16 Close the system. See "Closing the System" on page 71.

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

Start-Up Routine

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

Table 4-1.   Start-Up Routine Indications

Look/listen for:	Action
A status or error message displayed on the front-panel LCD.	See "LCD Status Messages" on page 22.
An error message displayed on the monitor.	See "System Messages" on page 35.
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 139.
The keyboard indicators.	See "Troubleshooting the Keyboard" on page 140.
The USB diskette drive activity indicator.	See "Troubleshooting a USB Device" on page 143.

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

Look/listen for:	Action
The USB CD drive activity indicator.	See "Troubleshooting a USB Device" on page 143.
The CD drive activity indicator.	See "Troubleshooting an SD Card or Internal USB Key" on page 152.
The hard-drive activity indicator.	See "Troubleshooting a Hard Drive" on page 155.
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 139.

Troubleshooting IRQ Assignment Conflicts

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

Table 4-2. IRQ Assignment Defaults

IRQ Line	Assignment
IRQ0	System timer
IRQ1	Keyboard controller
IRQ2	Interrupt controller 1 to enable IRQ8 through IRQ15
IRQ3	Serial port 2 (COM2 and COM4)
IRQ4	Serial port 1 (COM1 and COM3)
IRQ5	Remote access controller
IRQ6	Reserved

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

IRQ Line	Assignment
IRQ7	Reserved
IRQ8	Real-time clock
IRQ9	ACPI functions (used for power management)
IRQ10	*Available*
IRQ11	*Available*
IRQ12	Reserved
IRQ13	Math coprocessor
IRQ14	IDE CD drive controller
IRQ15	*Available*

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 14 and "Back-Panel Features and Indicators" on page 19 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 Swap the monitor with another working monitor to see if this resolves the problem.

3 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.

4 Determine whether the system has monitors attached to both the front and rear video connectors.

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

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

5 If possible, run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 161.

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

Problem

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

Action

1 Enter the System Setup program and ensure that the USB ports are enabled. See "Using the System Setup Program" on page 47.

2 Examine the keyboard and its cable for signs of damage.

3 Swap the faulty keyboard with a working keyboard.

If the problem is resolved, replace the faulty keyboard.

4 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 161.

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

Troubleshooting the Mouse

Problem

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

Action

1 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 161.

If the test fails, continue to the next step.

2 Examine the mouse and its cable for signs of damage.

If the mouse is not damaged, go to step 4.

If the mouse is damaged, continue to the next step.

3 Swap the faulty mouse with a working mouse.

If the problem is resolved, replace the faulty mouse.

4 Enter the System Setup program and ensure that the USB port is enabled. See "Using the System Setup Program" on page 47.

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

Troubleshooting Basic I/O Functions

Problem

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

Action

1 Enter the System Setup program and ensure that the serial port is enabled, and the serial port/COM ports are configured appropriately for any applications you are using. See "Using the System Setup Program" on page 47.

2 If the problem is confined to a particular application, see the application documentation for specific port configuration requirements that the program may require.

3 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 161.

   If the tests run successfully but the problem persists, see "Troubleshooting a Serial I/O Device" on page 142.

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.

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.

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

Troubleshooting a USB Device

Problem

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

Action

1 Enter the System Setup program, and ensure that the USB ports are enabled. See "Using the System Setup Program" on page 47.

2 Turn off the system and any USB devices.

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

4 Turn on the system and the reconnected device.

   If the problem is resolved, the USB connector might be defective. See "Getting Help" on page 175.

5 If possible, swap the interface cable with a working cable.

   If the problem is resolved, replace the interface cable.

6 Turn off the system and the USB device, and swap the device with a comparable device.

7 Turn on the system and the USB device.

   If the problem is resolved, replace the USB device.

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

Troubleshooting a NIC

Problem

- NIC cannot communicate with network.

Action

1 Run the appropriate online diagnostic test. See "Running the System Diagnostics" on page 162.

2 Check the appropriate indicator on the NIC connector. See "NIC Indicator Codes" on page 21.

- If the link indicator does not light, check all cable connections.

- If the activity indicator does not light, the network driver files might be damaged or missing.

  Remove and reinstall the drivers if applicable. See the NIC's documentation.

- Change the autonegotiation setting, if possible.

- Use another connector on the switch or hub.

If you are using a NIC card instead of an integrated NIC, see the documentation for the NIC card.

3 Ensure that the appropriate drivers are installed and the protocols are bound. See the NIC's documentation.

4 Enter the System Setup program and confirm that the NICs are enabled. See "Using the System Setup Program" on page 47.

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. See Network Cable Requirements in your *Getting Started Guide*.

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

Troubleshooting a Wet System

Problem

- Liquid spilled on the system.
- Excessive humidity.

Action

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

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

2 Open the system. See "Opening and Closing the System" on page 70.

3 Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 92.

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

5 Close the system. See "Opening and Closing the System" on page 70.

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 91.

8 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 161.

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

Troubleshooting a Damaged System

Problem

- System was dropped or damaged.

Action

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

1. Open the system. See "Opening and Closing the System" on page 70.

2. Ensure that the following components are properly installed:

   - Expansion cards and risers
   - Power supplies
   - Fans
   - Processors and heat sinks
   - Memory modules
   - Drive-carrier connections to the SAS/SATA backplane board, if applicable

3. Ensure that all cables are properly connected.

4. Close the system. See "Opening and Closing the System" on page 70.

5. Run the system board tests in the system diagnostics. See "Running the System Diagnostics" on page 162.

   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 "Using the System Setup Program" on page 47.

2 Turn off the system and disconnect it from the electrical outlet for at least one hour.

3 Reconnect the system to the electrical outlet and turn on the system.

4 Enter the System Setup program.

   If the date and time are not correct in the System Setup program, replace the battery. See "System Battery" on page 125.

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

1 Run the appropriate online diagnostics test. See "Using Server Administrator Diagnostics" on page 161.

2 Locate the faulty power supply.

The power supply's fault indicator is lit. See "Power Indicator Codes" on page 20.

🗲 **NOTICE:** You can hot-plug the 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 for extended periods of time with only one power supply installed, without a power supply blank installed, can cause the system to overheat.

Remove the faulty power supply. See "Removing a Power Supply" on page 78.

3 Ensure that the power supply is properly installed by removing and reinstalling it. See "Replacing a Power Supply" on page 79.

📝 **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 20.

4 Check the indicators to see if the problem is resolved. If not, remove the faulty power supply. See "Removing a Power Supply" on page 78.

5 Install a new power supply. See "Replacing a Power Supply" on page 79.

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:

- Ambient temperature is too high.

- External airflow is obstructed.

- Cables inside the system obstruct airflow.

- An individual cooling fan has failed. See "Troubleshooting a Fan" on page 149.

Troubleshooting a Fan

Problem

- System-status indicator is amber.

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

- Front panel LCD indicates a problem with the fan.

Action

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

1 Run the appropriate diagnostic test. See "Using Server Administrator Diagnostics" on page 161.

2 Open the system. See "Opening and Closing the System" on page 70.

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

3 Locate the faulty fan indicated by the LCD display or diagnostic software. For the identification number of each fan, see Figure 3-9.

4 Ensure that the faulty fan is fully seated in the fan bracket and attached to the power connector. See "System Fans" on page 82.

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

5 If the problem is not resolved, install a new fan. See "System Fans" on page 82.

If the replacement fan is working properly, close the system. See "Opening and Closing the System" on page 70.

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

1 If the system is operational, run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 161.

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 message appears indicating a fault with a specific memory module, go to step 12.

If you receive any other system message that indicates a nonspecific memory problem, continue to the next step.

4 Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 47. Make any changes to the memory settings, if needed.

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, proceed to step 12.

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

6 Open the system. See "Opening the System" on page 71.

7 Check the memory banks and ensure that they are populated correctly. See "General Memory Module Installation Guidelines" on page 114. Make any necessary changes.

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 117.

9 Close the system. See "Closing the System" on page 71.

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

11 Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 47.

If the amount of memory installed still does not match the system memory setting, then proceed to the next step.

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

13 Open the system. See "Opening the System" on page 71.

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 117.

15 Close the system. See "Closing the System" on page 71.

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 after all memory modules have been checked, see "Getting Help" on page 175.

Troubleshooting an SD Card or Internal USB Key

Problem

- System cannot read data from an SD card or USB key.

Action

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

1 Enter the System Setup program and ensure that the SD card or USB key port is enabled. See "Using the System Setup Program" on page 47.

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

3 Open the system. See "Opening and Closing the System" on page 70.

4 Reseat the SD card or USB key.

5 Close the system. See "Opening and Closing the System" on page 70.

6 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.

7 Repeat step 2 and step 3.

8 Insert a different SD card or USB key that you know works properly.

9 Close the system. See "Opening and Closing the System" on page 70.

10 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 an Optical Drive

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

Action

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

1 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 "Using the System Setup Program" on page 47.

3 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 161.

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

5 Open the system. See "Opening and Closing the System" on page 70.

6 Ensure that the interface cable is securely connected to the optical drive and to the system board.

7 Ensure that a power cable is properly connected to the drive.

8 Close the system. See "Opening and Closing the System" on page 70.

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 an External Tape Drive

Problem

- Defective tape drive
- Defective tape cartridge
- Missing or corrupted tape-backup software or tape drive device driver
- Defective tape drive 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 or SAS device drivers for the tape drive are installed and are configured correctly. See your tape drive documentation for more information about device drivers.

3 Reinstall the tape-backup software as instructed in the tape-backup software documentation.

4 Ensure that the tape drive's interface cable is fully connected to the tape drive and the external port on the SCSI or SAS controller card.

5 For SCSI tape drives, 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 Server Administrator Diagnostics" on page 161.

7 Open or remove the bezel. See "Front Bezel" on page 68.

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

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

9   Open the system. See "Opening and Closing the System" on page 70.

10 Reseat the SAS or SCSI controller card in the expansion card slot.

11 Close the system. See "Opening and Closing the System" on page 70.

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

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

14 If you cannot resolve the problem, see "Getting Help" on page 175 for information on obtaining technical assistance.

Troubleshooting a Hard Drive

Problem

• Device driver error.

• One or more hard drives not recognized by the system.

Action

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

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

1   Run the appropriate online diagnostics test. See "Using Server Administrator Diagnostics" on page 161.

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

2   Remove the bezel. See "Removing the Front Bezel" on page 69.

3 If you are experiencing problems with multiple hard drives, skip to step 8. 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 the optional battery-cached SAS RAID controller daughter card, 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 daughter card are installed and are configured correctly. See the operating system documentation for more information.

NOTICE: Skip the following step if your hard drives are in a RAID configuration.

7 For non-RAID configurations only, 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-Plug Hard Drive" on page 74.

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.

8 Check the cable connections inside the system:

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

   b Open the system. See "Opening the System" on page 71.

   c Verify that the cable connections between SAS/SATA backplane(s) and the SAS daughter card are correct. See "Installing a SAS Controller Daughter Card" on page 84.

d Verify that the SAS cables are securely seated in their connectors.

e Verify that the power connectors on the SAS/SATA backplane(s) are securely seated in their connectors.

f Close the system. See "Closing the System" on page 71.

g 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 Controller Daughter Card

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

Problem

- Error message indicates a problem with the SAS controller daughter card.
- SAS controller daughter card performs incorrectly or not at all.

Action

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

1 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 161.

2 Enter the System Setup program and ensure that the SAS controller daughter card is enabled. See "Using the System Setup Program" on page 47.

3 Restart the system and press one of the following applicable key sequences to enter the configuration utility program:

- <Ctrl><C> for a SAS controller
- <Ctrl><R> for the optional battery-cached SAS RAID controller

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

4 Check the configuration settings, make any necessary corrections, and restart the system.

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

5 Remove the bezel. See "Removing the Front Bezel" on page 69.

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

7 Open the system. See "Opening and Closing the System" on page 70.

8 Ensure that the controller card is firmly seated in its connector. See "SAS Controller Daughter Card" on page 84.

9 If present, ensure that the RAID battery is properly installed and connected.

10 Verify that the cable connections between the SAS/SATA backplane(s) and the SAS controller daughter card are correct. See "Installing a SAS Controller Daughter Card" on page 84.

11 Ensure that the cables are firmly connected to the SAS controller daughter card and the SAS/SATA backplane board.

12 Close the system. See "Opening and Closing the System" on page 70.

13 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals. If the problem persists, see "Getting Help" on page 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: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Run the appropriate online diagnostic test. See "Using the System Setup Program" on page 47.

2 Open or remove the bezel. See "Front Bezel" on page 68.

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

4 Open the system. See "Opening and Closing the System" on page 70.

5 Ensure that each expansion card is firmly seated in its connector. See "Installing an Expansion Card" on page 91.

6 Close the system. See "Opening and Closing the System" on page 70.

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

   If the problem persists, go to the next step.

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

9 Open the system. See "Opening and Closing the System" on page 70.

10 Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 92.

11 Close the system. See "Opening and Closing the System" on page 70.

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

13 Run the appropriate online diagnostic test.

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

14 For each expansion card you removed in step 10, perform the following steps:

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

b Open the system. See "Opening and Closing the System" on page 70.

c Reinstall one of the expansion cards.

d Close the system. See "Opening and Closing the System" on page 70.

e Run the appropriate diagnostic test.

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

Troubleshooting the Microprocessors

Problem

- Error message indicates a processor problem.
- Front-panel status LCD indicates a problem with the processors or system board.
- A heat sink is not installed for each processor.

Action

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

1 Run the appropriate online diagnostics test. See "Using Server Administrator Diagnostics" on page 161.

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

3 Open the system. See "Opening and Closing the System" on page 70.

4 Inspect each processor and heat sink and ensure that they are properly installed.

If you need to make adjustments, see "Installing a Processor" on page 123.

5 Close the system. See "Opening and Closing the System" on page 70.

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

7 Run the appropriate online diagnostic test.

If the tests fail or the problem persists, 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 Server Administrator Diagnostics

To assess a system problem, first use the online Server Administrator diagnostics. If you are unable to identify the problem, then use the system diagnostics.

To access the online diagnostics, log into the Server Administrator home page, and then click the **Diagnostics** tab. For information about using diagnostics, see the online help. For additional information, see the *Server Administrator 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.

Table 5-1. System Diagnostics Testing Options *(continued)*

Testing Option	Function
Custom Test	Tests a particular device.
Information	Displays test results.

Using the Custom Test Options

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

Selecting Devices for Testing

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

Selecting Diagnostics Options

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

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

Viewing Information and Results

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

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

6

Jumpers and Connectors

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

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

System Board Jumpers

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

✎ **NOTE:** To access the jumpers, you must remove the expansion cards from expansion-card riser 1. See "Removing an Expansion Card" on page 92.

Figure 6-1. System Board Jumpers

Table 6-1. System Board Jumper Settings

Jumper	Setting	Description
NVRAM_CLR	(default)	The configuration settings are retained at system boot.
		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.)

Table 6-1.   System Board Jumper Settings

Jumper	Setting		Description
PWRD_EN	▣	(default)	The password feature is enabled.
	▣		The password feature is disabled.

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

System Board Connectors

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

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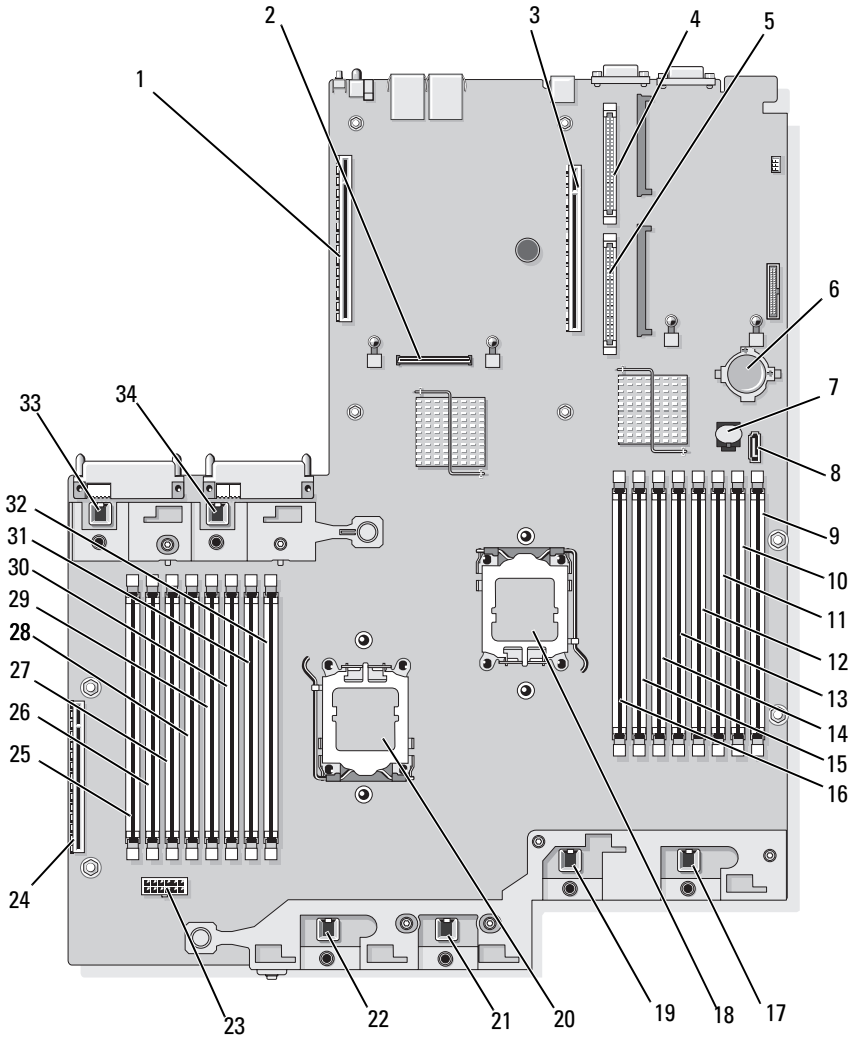
Table 6-2. System Board Connectors

	Connector	Description
1	RISER2	expansion-card riser 2 connector
2	MEZ_CONN	LOM daughter card
3	RISER1	Left riser board connector
4	RAC_CONN2	Remote Access Control (RAC) card 2
5	RAC_CONN1	Remote Access Control (RAC) card 1
6	BATTERY	System battery
7	TOE_KEY	TCP/IP Offload Engine Key
8	SATA_A	SATA A connector
9	B1	First memory module slot (processor 2)
10	B2	Second memory module slot (processor 2)
11	B3	Third memory module slot (processor 2)
12	B4	Fourth memory module slot (processor 2)
13	B5	Fifth memory module slot (processor 2)
14	B6	Sixth memory module slot (processor 2)
15	B7	Seventh memory module slot (processor 2)
16	B8	Eighth memory module slot (processor 2)
17	FAN4	System cooling fan
18	CPU2	Microprocessor 2
19	FAN3	System cooling fan
20	CPU1	Microprocessor 1
21	FAN2	System cooling fan
22	FAN1	System cooling fan
23	BACKPLANE	Backplane power connector
24	SIDEPLANE	Sideplane connector
25	A1	First memory module slot (processor 1)
26	A2	Second memory module slot (processor 1)

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

	Connector	Description
27	A3	Third memory module slot (processor 1)
28	A4	Fourth memory module slot (processor 1)
29	A5	Fifth memory module slot (processor 1)
30	A6	Sixth memory module slot (processor 1)
31	A7	Seventh memory module slot (processor 1)
32	A8	Eighth memory module slot (processor 1)
33	FAN5	System cooling fan
34	FAN6	System cooling fan

SAS/SATA Backplane Board Connectors

Figure 6-3 shows the location of the connectors on the SAS/SATA backplane board.

Figure 6-3.   SAS/SATA Backplane Board Components

front
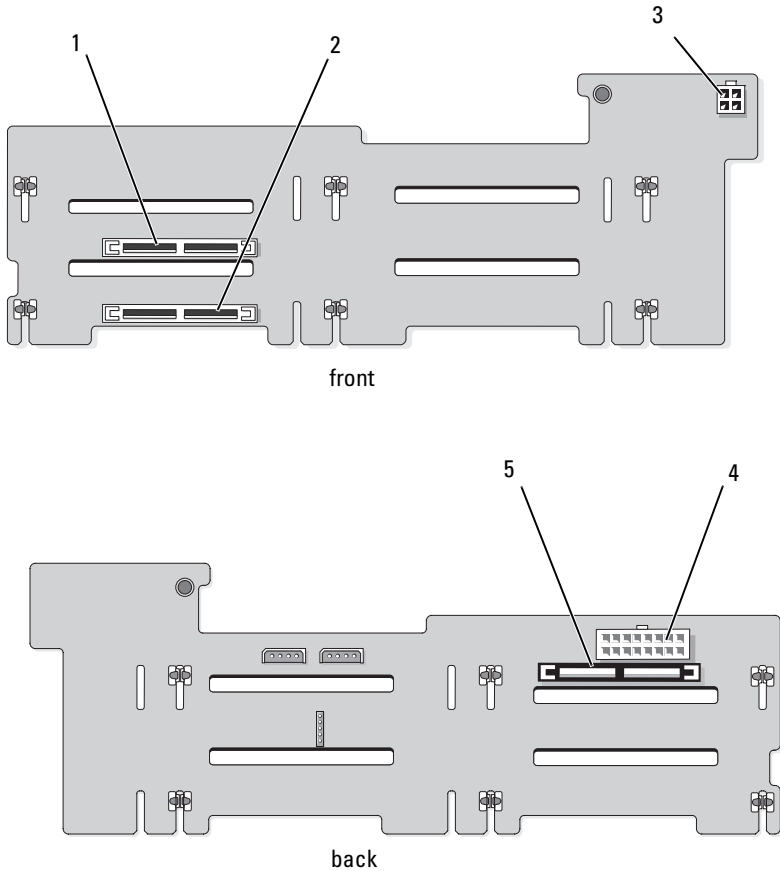
back

1	drive 0 connector	2	drive 1 connector
3	optical drive power (CD_PWR)	4	backplane power (BKPLN)
5	SAS connector (SAS)		

Sideplane Board Connectors

See Figure 6-4 for the location and description of connectors on the sideplane board.

Figure 6-4. Sideplane Board Connectors
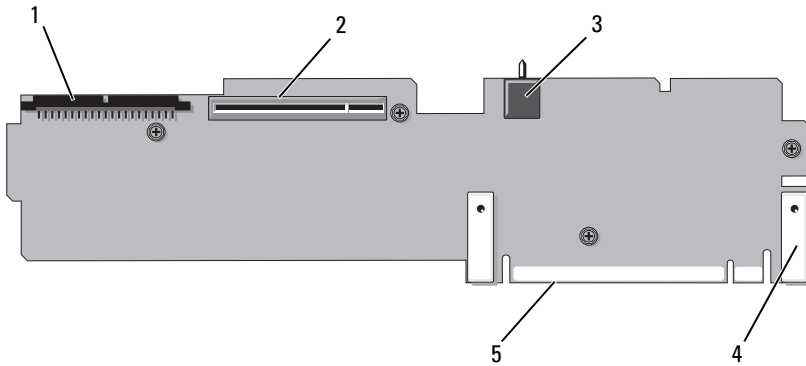
1	control panel (CTR_PNL)	2	SAS controller daughter card (INT_STORAGE)
3	chassis intrusion switch (INTRUSION)	4	pin collars (2)
5	system board connector		

Expansion-Card Riser-Board Components and PCIe Buses

Figure 6-5 and Figure 6-6 show the components on the PCIe expansion-card riser boards, including the expansion-card slots and buses.

Figure 6-5. PCIe Expansion-Card Center Riser 1 Components
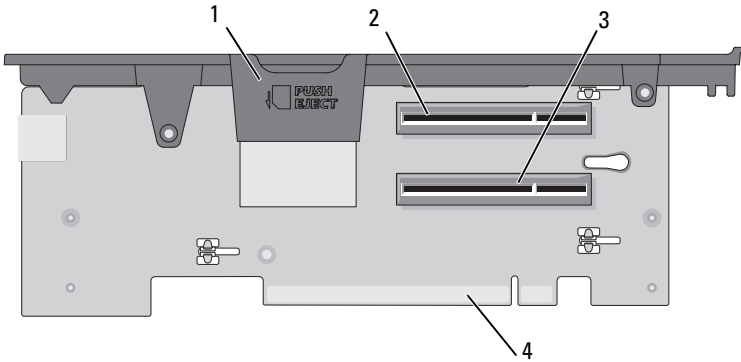
1	internal SD card slot	2	slot 1 PCIe - x8 lane width (full-length)
3	slot 2 PCIe - x8 lane width (half-length)	4	system board connector

Figure 6-6. PCIe Expansion-Card Riser 2 Components
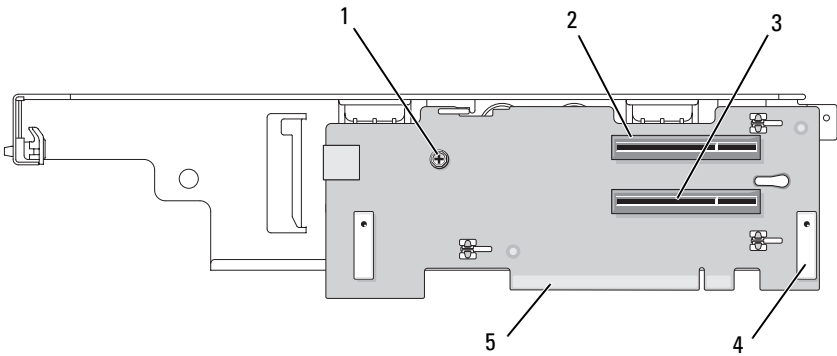
1	Phillips screw	2	slot 3 PCIe x8 lane width (full-length)
3	slot 4 PCIe x8 lane width (half-length)	4	pin collars (2)
5	system board connector		

Disabling a Forgotten Password

The system's software security features include a system password and a setup password, which are discussed in detail in "Using the System Setup Program" on page 47. The password jumper enables these password features or disables them and clears any password(s) currently in use.

⊘ **NOTICE:** See "Protecting Against Electrostatic Discharge" in the safety instructions in your *Product Information Guide*.

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

2   Open the system. See "Opening and Closing the System" on page 70.

3   Remove the jumper plug from the password jumper.

    See Figure 6-1 to locate the password jumper (labeled "PWRD_EN") on the system board.

4   Close the system.

5   Reconnect your system and peripherals to their electrical outlets, 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 "Opening and Closing the System" on page 70.

8   Install the jumper plug on the password jumper.

9   Lower the memory module shroud.

10 Close the system.

11 Reconnect your system and peripherals to their electrical outlets, and turn on the system.

12 Assign a new system and/or setup password.

    To assign a new password using the System Setup program, see "Assigning a System Password" on page 59.

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.

    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*n* — 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.

LGA—Land grid array. A type of processor socket. Unlike the PGA, the LGA interface has no pins on the chip; instead, the chip has pads that contact pins on the system board.

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

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.

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.

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