

# Dell™ PowerEdge™ R900 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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September 2007

P/N XK946

Rev. A00

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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.



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

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

## Accessing System Features During Startup

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

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

Keystroke	Description
<F2>	Enters the System Setup program. See "Using the System Setup Program" on page 41.
<F10>	Opens the utility partition, allowing you to run the system diagnostics. See " <b>Running the System Diagnostics</b> " on page 149.
<F11>	Enters the boot menu.
<F12>	Enters the PXE boot.
<Ctrl><c>	Enters the SAS Configuration Utility. See your <i>SAS adapter User's Guide</i> for more information.
<Ctrl><e>	Enters the Baseboard Management Controller (BMC) Management Utility, which allows access to the system event log (SEL). See the <i>BMC User's Guide</i> for more information on setup and use of BMC.

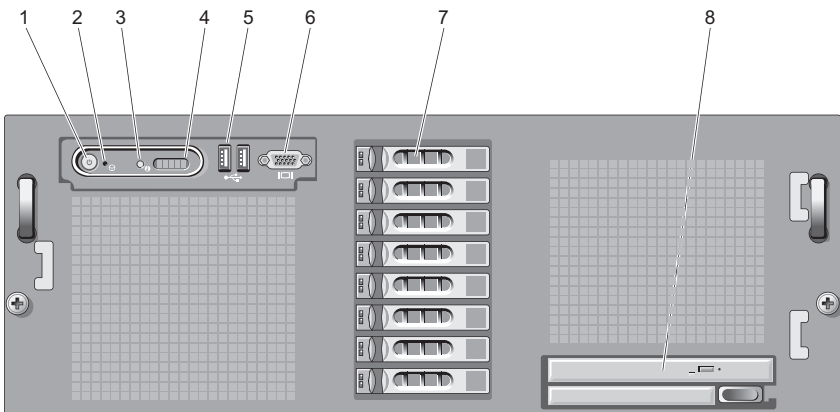
**Table 1-1. Keystrokes for Accessing System Functions**

Keystroke	Description
<Ctrl> <r>	Enters the RAID configuration utility, which allows you to configure an optional RAID card. For more information, see the documentation for your RAID card.
<Ctrl> <s>	Option is displayed only if you have PXE support enabled through the System Setup Program (see "Using the System Setup Program" on page 41). This keystroke allows you to configure NIC settings for PXE boot. For more information, see the documentation for your integrated NIC.
<Ctrl> <d>	If you have the optional Dell Remote Assistant Card (DRAC), this keystroke allows access to selected DRAC configuration settings. See the <i>DRAC User's Guide</i> for more information on setup and use of DRAC.

## Front Panel Features and Indicators

Figure 1-1 shows the controls, indicators, connectors, and drives on the system's front panel.

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



1 Power button/indicator.

The power-on indicator lights when the system power is on.

The power button controls the DC power supply output to the system.

**NOTE:** If you turn off the system using the power button and the system is running an ACPI-compliant operating system, the system performs a graceful shutdown before the power is turned off. If the system is not running an ACPI-compliant operating system, the power is turned off immediately after the power button is pressed.

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.

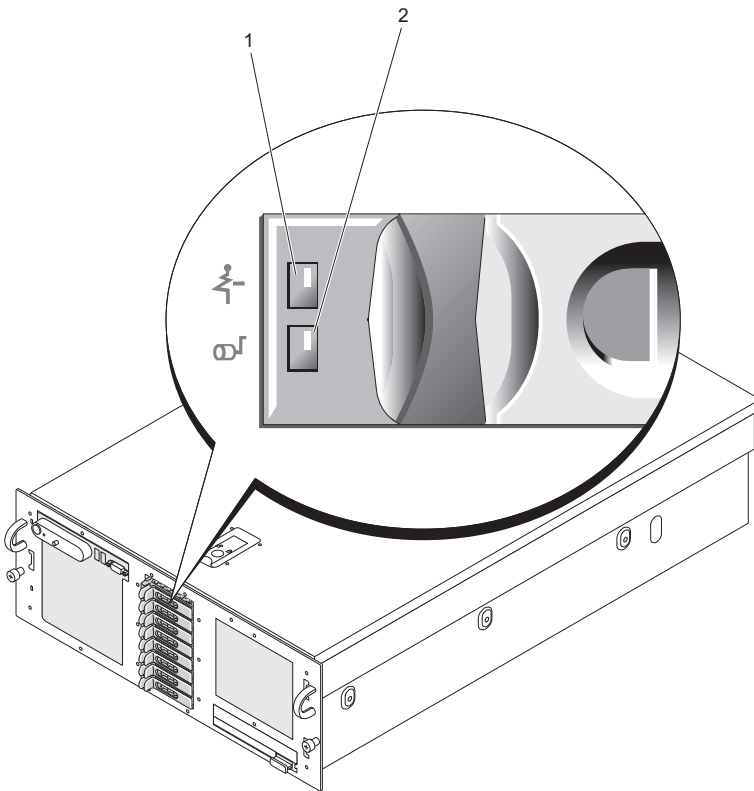
The identification buttons on the front and back panels can be used to locate a particular system within a rack. When one of these buttons is pushed, the LCD panel on the front and the blue system status indicator on the back blink until one of the buttons is pushed again.

- |   |                     |  |
|---|---------------------|--|
| 4 | LCD panel.          | Provides system ID, status information, and system error messages.<br>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.<br>The LCD lights amber when the system needs attention, and the LCD panel displays an error code followed by descriptive text.<br>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 2.0-compliant devices to the system.  |
| 6 | Video connector.    | Connects a monitor to the system.  |
| 7 | Hard drives.        | Eight 2.5-inch hot-plug or five 3.5-inch hot-plug.   |
| 8 | Optical drive.      | One slimline optical drive.  |

### **Hard Drive Indicator Codes**

The hard drive carriers have two indicators—the drive-activity indicator and the drive-status indicator.

**Figure 1-2. Hard Drive Indicators**



1 green and amber drive-status indicator

2 green drive-activity indicator

The Activity LED indicates command activity between the hard disk drives and storage controller.

The Status LED is a bi-color (Green/Amber) LED that indicates the state of a drive in a slot. The color and blink rate of the LED indicates the state of the drive as shown in Table 1-2.



**Table 1-2. Hard Drive Indicators**

<b>Pattern</b>	<b>Green element</b>	<b>Amber element</b>	<b>Drive/slot state</b>
Slot empty	Off	Off	The slot is empty, an unsupported drive is present, the drive has been spun down for removal (Ready for Removal), or a new drive has been inserted, and the state has not been updated by the RAID controller.
Drive online	On	Off	The drive is either online, ready, a hotspare or a foreign drive.
Drive identify (prep for removal)	On ~250mS Off ~250mS	Off	The slot is being identified because of a user request (either a drive identify or a preparing for removal was requested).
Drive rebuilding	On ~400mS Off ~100mS	Off	The drive is being written to, to make a virtual disk redundant.
Drive failed	Off	On ~150mS Off ~150mS	The RAID controller can no longer access or control (read/write to) the drive because it has detected an unrecoverable fault (after it has completed its error handling) on the drive.
Predicted Failure (SMART)	On ~500mS Off ~500mS Off ~1000S	Off ~500mS On ~500mS	Predictive failure event has been reported by the drive.

**Table 1-2. Hard Drive Indicators**

<b>Pattern</b>	<b>Green element</b>	<b>Amber eLement</b>	<b>Drive/slot state</b>
Rebuild Abort	On ~3000mS Off ~9000mS	Off ~6000mS On ~3000mS Off ~3000mS	The drive has been spun down by a user request (Prepare to Remove operation), or had a rebuild operation on it aborted by a user action or due to any reason other than a drive failure.

In RAID configurations, the drive-status indicator lights to indicate the status of the drive.



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

Table 1-2 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.

## Connecting External Devices

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

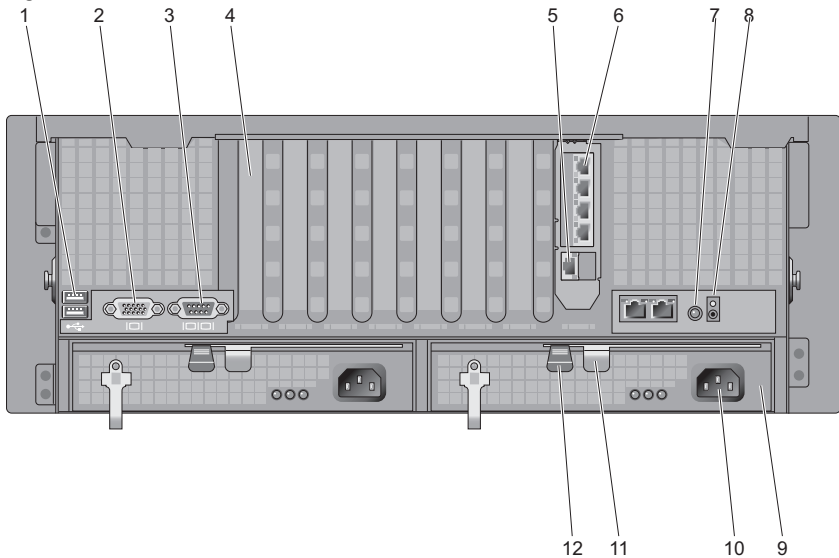
- Most devices must be connected to a specific connector and device drives must be installed before the device operates properly. (Device drivers are normally included with your operating system software or with the device itself.) See the documentation that accompanied the device for specific installation 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 153. For information about enabling, disabling, and configuring I/O ports and connectors, see "Using the System Setup Program" on page 41.

## 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  | USB connectors (2)            | 5  | DRAC network connector       |
| 2  | Video connector               | 6  | Network connectors (4)       |
| 3  | Serial connector              | 7  | System identification button |
| 4  | Expansion card filler bracket | 8  | Intrusion LED                |
| 9  | Power supply                  | 10 | Power connector              |
| 11 | Power supply lever            | 12 | Power supply latch           |

## 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).

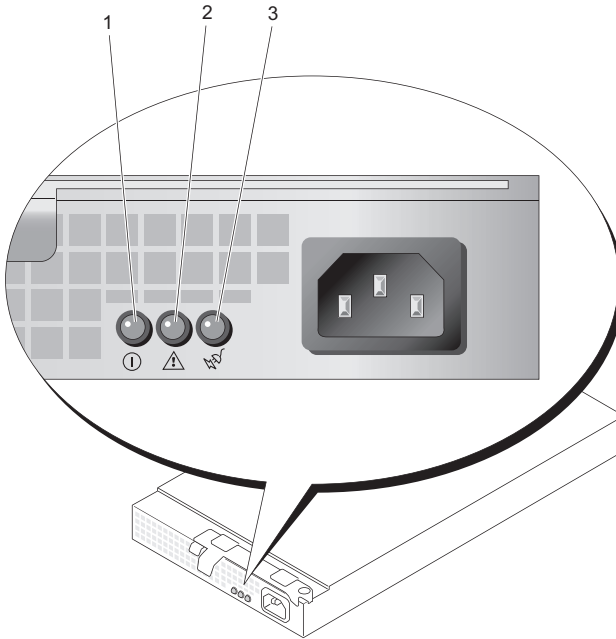
For information about individual connectors, see "Jumpers and Connectors" on page 153. For information about enabling, disabling, and configuring I/O ports and connectors, see "Using the System Setup Program" on page 41.

## Power Indicator Codes

The power button on the front panel controls the power input to 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 1-3 lists the power supply indicator codes.

**Figure 1-4. Redundant Power Supply Indicators**



- 1 power supply status
- 3 AC line status

- 2 power supply fault

**Table 1-3. Redundant Power Supply Indicators**

Indicator	Function
Power supply status	Green indicates that the power supply is operational.
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.

# NIC Indications

Each NIC has two indicators that provides information on network activity and link status. See Figure 1-5. Table 1-4 lists the NIC indications.

**Figure 1-5. NIC Indicators**



1 link indicator (green)

2 activity indicator (amber)

**Table 1-4. NIC Indications**

Indicators Illumination	Meaning
Link and activity indicators are off.	The NIC is not connected to the network.
Link indicator is on.	The NIC is connected to a valid link partner on the network.
Activity indicator is blinking.	Network data is being transmitted.

## LCD Status Messages

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

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



**CAUTION:** 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 165.

**Table 1-5. LCD Status Messages**

Code	Test	Causes	Corrective Actions
N/A	<i>SYSTEM NAME</i>	A 62-character string that can be defined by the user in the System Setup program. The <i>SYSTEM NAME</i> displays under the following conditions: <ul style="list-style-type: none"> <li>• The system is powered on.</li> <li>• The power is off and active POST errors are displayed.</li> </ul>	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 41.
E1000	FAILSAFE, CALL SUPPORT		See "Getting Help" on page 165.
E1114	Temp Ambient	Ambient system temperature is out of acceptable range.	See "Troubleshooting System Cooling" on page 138.
E1116	Temp Memory	Memory has exceeded acceptable temperature and has been disabled to prevent damage to the components.	See "Troubleshooting System Cooling" on page 138.
E12nn xx	PwrGd	Specified voltage regulator has failed.	See "Getting Help" on page 165.

**Table 1-5. LCD Status Messages**

<b>Code</b>	<b>Test</b>	<b>Causes</b>	<b>Corrective Actions</b>
E1210	CMOS Batt	CMOS battery is missing, or the voltage is out of acceptable range.	See "Troubleshooting the System Battery" on page 136.
E1211	ROMB Batt	RAID battery is either missing, bad, or unable to recharge due to thermal issues.	Reseat the RAID battery connector. See "Installing a RAID Battery" on page 84, and "Troubleshooting the System Battery" on page 136.
E1229	CPU # VCORE	Processor # VCORE voltage regulator has failed.	See "Getting Help" on page 165.
E1310	RPM Fan ##	RPM of specified cooling fan is out of acceptable operating range.	See "Troubleshooting System Cooling" on page 138.
E1313	Fan Redundancy	The system is no longer fan-redundant. Another fan failure will put the system at risk of overheating.	Check control panel LCD for additional scrolling messages. See "Troubleshooting System Cooling" on page 138.
E1410	CPU # IERR	Specified microprocessor is reporting an internal error.	See your system's Information Update Tech Sheet located on <a href="http://support.dell.com">support.dell.com</a> for the most current system information. If problem persists, see "Getting Help" on page 165.



**Table 1-5. LCD Status Messages**

<b>Code</b>	<b>Test</b>	<b>Causes</b>	<b>Corrective Actions</b>
E1414	CPU # Thermtrip	Specified microprocessor is out of acceptable temperature range and has halted operation.	See "Troubleshooting System Cooling" on page 138. If the problem persists, ensure that the processor heat sinks are properly installed. See "Troubleshooting Processors" on page 147.  <b>NOTE:</b> 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 Processors" on page 147.
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 <i>Getting Started Guide</i> .

**Table 1-5. LCD Status Messages**

<b>Code</b>	<b>Test</b>	<b>Causes</b>	<b>Corrective Actions</b>
E141F	CPU Protocol	The system BIOS has reported a processor protocol error.	See "Getting Help" on page 165.
E1420	CPU Bus PERR	The system BIOS has reported a processor protocol error.	See "Getting Help" on page 165.
E1421	CPU Init	The system BIOS has reported a processor initialization error.	See "Getting Help" on page 165.
E1422	CPU Machine Chk	The system BIOS has reported a machine check error.	See "Getting Help" on page 165.
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 137.
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 137.
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 137.
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 problem persists, see "Troubleshooting Power Supplies" on page 137.

**Table 1-5. LCD Status Messages**

<b>Code</b>	<b>Test</b>	<b>Causes</b>	<b>Corrective Actions</b>
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 problem persists, see "Troubleshooting Power Supplies" on page 137.
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 137.
E1710	I/O Channel Chk	The system BIOS has reported an I/O channel check.	See "Getting Help" on page 165.
E1711	PCI PERR B## D## F##  PCI PERR Slot #	The system BIOS has reported a PCI parity error on a component that resides in PCI configuration space at bus ##, device ##, function ##.  The system BIOS has reported a PCI parity error on a component that resides in the specified PCI slot.	Remove and reseal the PCI expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 145.  If the problem persists, the riser card or system board is faulty. See "Getting Help" on page 165.
	PCI PERR Slot #	The system BIOS has reported a PCI parity error on a component that resides in the specified PCI slot.	Remove and reseal the PCI expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 145.  If the problem persists, the riser card or system board is faulty. See "Getting Help" on page 165.

**Table 1-5. LCD Status Messages**

<b>Code</b>	<b>Test</b>	<b>Causes</b>	<b>Corrective Actions</b>
E1712	PCI SERR B## D## F##  PCI SERR Slot #	The system BIOS has reported a PCI system error on a component that resides in PCI configuration space at bus ##, device ##, function ##.  The system BIOS has reported a PCI system error on a component that resides in the specified slot.	Remove and reseal the PCI expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 145.  If the problem persists, the riser card or system board is faulty. See "Getting Help" on page 165.
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 165.
E171F	PCIE Fatal Err B## D## F##  PCIE Fatal Err Slot #	The system BIOS has reported a PCIe fatal error on a component that resides in PCI configuration space at bus ##, device ##, function ##.  The system BIOS has reported a PCIe fatal error on a component that resides in the specified slot.	Remove and reseal the PCI expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 145.  If the problem persists, the riser card or system board is faulty. See "Getting Help" on page 165.
E1810	HDD ## Fault	The SAS subsystem has determined that hard drive ## has experienced a fault.	See "Troubleshooting a Hard Drive" on page 142.

**Table 1-5. LCD Status Messages**

<b>Code</b>	<b>Test</b>	<b>Causes</b>	<b>Corrective Actions</b>
E1811	HDD ## Rbld Abrt	The specified hard drive has experienced a rebuild abort.	See "Troubleshooting a Hard Drive" on page 142. If the problem persists, see your RAID documentation.
E1812	HDD ## Removed	The specified hard drive has been removed from the system.	Information only.
E1913	CPU & Firmware Mismatch	The BMC firmware does not support the processor.	Update to the latest BMC firmware. See the <i>BMC User's Guide</i> for more information on setup and use of BMC.
E1A14	SAS Cable A	SAS cable A is missing or bad.	Reseat the cable. If problem persists, replace cable. See "SAS Controller Card" on page 78.
E1A15	SAS Cable B	SAS cable B is missing or bad.	Reseat the cable. If problem persists, replace cable. See "SAS Controller Card" on page 78.
E2010	No Memory	No memory is installed in the system.	Install memory. See "General Memory Module Installation Guidelines" on page 92.
E2011	Mem Config Error	Memory detected, but is not configurable. Error detected during memory configuration.	See "Troubleshooting System Memory" on page 139.
E2012	Unusable Memory	Memory is configured, but not usable. Memory subsystem failure.	See "Troubleshooting System Memory" on page 139.
E2013	Shadow BIOS Fail	The system BIOS failed to copy its flash image into memory.	See "Troubleshooting System Memory" on page 139.

**Table 1-5. LCD Status Messages**

<b>Code</b>	<b>Test</b>	<b>Causes</b>	<b>Corrective Actions</b>
E2014	CMOS Fail	CMOS failure. CMOS RAM not functioning properly.	See "Getting Help" on page 165.
E2015	DMA Controller	DMA controller failure.	See "Getting Help" on page 165.
E2016	Int Controller	Interrupt controller failure.	See "Getting Help" on page 165.
E2017	Timer Fail	Timer refresh failure.	See "Getting Help" on page 165.
E2018	Prog Timer	Programmable interval timer error.	See "Getting Help" on page 165.
E2019	Parity Error	Parity error.	See "Getting Help" on page 165.
E201A	SIO Err	SIO failure.	See "Getting Help" on page 165.
E201B	Kybd Controller	Keyboard controller failure.	See "Getting Help" on page 165.
E201C	SMI Init	System management interrupt (SMI) initialization failure.	See "Getting Help" on page 165.
E201D	Shutdown Test	BIOS shutdown test failure.	See "Getting Help" on page 165.
E201E	POST Mem Test	BIOS POST memory test failure.	See "Troubleshooting System Memory" on page 139. If problem persists, see "Getting Help" on page 165.

**Table 1-5. LCD Status Messages**

<b>Code</b>	<b>Test</b>	<b>Causes</b>	<b>Corrective Actions</b>
E201F	DRAC Config	Dell Remote Assistant Card (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	processor 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 139.
E2022	POST Fail	General failure after video.	Check screen for specific error messages.
E2110	MBE Crd # DIMM ## & ##	One of the DIMMs in the set implicated by "## & ##" has had a memory multi-bit error (MBE). If no memory card is present, the "Crd #" string is left out of the message.	See "Troubleshooting System Memory" on page 139.
E2111	SBE Log Disable Crd # 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. If no memory riser card is present, the "Crd #" string is left out of the message.	See "Troubleshooting System Memory" on page 139.

**Table 1-5. LCD Status Messages**

<b>Code</b>	<b>Test</b>	<b>Causes</b>	<b>Corrective Actions</b>
E2112	Mem Spare Crd # 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. If no memory card is present, the "Crd #" string is left out of the message.	See "Troubleshooting System Memory" on page 139.
E2113	Mem Mirror Crd # DIMM ## & ##	The system BIOS has disabled memory mirroring because it has determined that one half of the mirror has had too many errors. "## & ##" represents the DIMM pair implicated by the BIOS. If no memory card is present, the "Crd #" string is left out of the message.	See "Troubleshooting System Memory" on page 139.
E2118	Fatal NB Mem CRC	One of the connections in the Fully Buffered DIMM (FBDIMM) memory subsystem link on the Northbound side has failed.	See "Troubleshooting System Memory" on page 139.
E2119	Fatal SB Mem CRC	One of the connections in the FBDIMM memory subsystem link on the Southbound side has failed.	See "Troubleshooting System Memory" on page 139.
I1910	Intrusion	System cover has been removed.	Information only.



**Table 1-5. LCD Status Messages**

<b>Code</b>	<b>Test</b>	<b>Causes</b>	<b>Corrective Actions</b>
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.
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 84.

**NOTE:** For the full name of an abbreviation or acronym used in this table, see "Glossary" on page 171.

### Solving Problems Described by LCD Status Messages

The code and text of the status messages on the LCD (see Table 1-5) 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 1-6 lists the system messages that can occur and a brief description of each message.



**NOTE:** If you receive a system message that is not listed in Table 1-6, check the documentation for the application that is running when the message appears or the operating system's documentation for an explanation of the message and recommended action.



**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 1-6. System Messages**

System Message	Corrective Action
Error: Incorrect memory configuration.	This error message will be displayed when any memory error which causes memory loss happens during memory configuration.

**Table 1-6. System Messages**

<b>System Message</b>	<b>Corrective Action</b>
Warning: The current memory configuration is not validated. Change it to the recommended memory configuration or press any key to continue.	This warning message will be displayed when there is no any memory configuration error, but the memory configuration is not recommended by Dell.
Alert! Redundant memory disabled! Memory configuration does not support redundant memory.	Redundant memory was set to enabled in CMOS, but the current configuration does not support redundant memory.
Attempting to update Remote Configuration. Please wait...	Remote Configuration request has been detected and is being processed.
Caution! NVRAM_CLR jumper is installed on system board	NVRAM_CLR jumper is installed. CMOS has been cleared. NVRAM_CLR jumper should be removed.
CPUs with different cache sizes detected	The system does not support running with processors with mismatched cache sizes
Decreasing available Memory	One or more DIMMs improperly seated or faulty
Diskette drive 0 seek failure	Faulty or improperly inserted diskette, incorrect configuration settings in System Setup program, loose diskette/tape drive interface cable, or loose power cable Replace the diskette.
Diskette read failure	Faulty diskette, faulty or improperly connected diskette/tape drive interface cable, or loose power cable
Diskette subsystem reset failed	Faulty diskette/tape drive controller
Drive not ready	Diskette missing from or improperly inserted in diskette drive

**Table 1-6. System Messages**

<b>System Message</b>	<b>Corrective Action</b>
Error: Remote Access Controller initialization failure	Remote Access Controller initialization failure
More than one RAC detected, system halted	More than one RAC detected
Error 8602 - Auxiliary Device Failure Verify that mouse and keyboard are securely attached to correct connectors.	Mouse cable connector loose or improperly connected, defective mouse
Gate A20 failure	Faulty keyboard controller
General failure	Operating system corrupted or not installed properly
Keyboard controller failure	Defective keyboard/mouse controller
Keyboard data line failure	Keyboard cable connector loose or improperly connected, defective keyboard, or defective keyboard/mouse controller
Keyboard stuck key failure	
Keyboard fuse has failed.	Overcurrent detected at Keyboard connector
Manufacturing mode detected	System is in manufacturing mode. Clear CMOS via NVRAM_CLR jumper to take system out of manufacturing mode.

**Table 1-6. System Messages**

<b>System Message</b>	<b>Corrective Action</b>
Memory address line failure at <i>address</i> , read <i>value</i> expecting <i>value</i>	Faulty or improperly seated DIMMs or defective system board
Memory double word logic failure at <i>address</i> , read <i>value</i> expecting <i>value</i>	
Memory odd/even logic failure at <i>address</i> , read <i>value</i> expecting <i>value</i>	
Memory write/read failure at <i>address</i> , read <i>value</i> expecting <i>value</i>	
Memory tests terminated by keystroke	POST memory test terminated by pressing the <spacebar>
No boot device available	Faulty diskette, diskette/tape drive subsystem, hard-disk drive, hard-disk drive subsystem, or no boot disk in drive A
No boot sector on hard-disk drive	Incorrect configuration settings in System Setup program, or no operating system on hard-disk drive
No timer tick interrupt	Defective system board
Not a boot diskette	No operating system on diskette
PCI BIOS failed to installed	PCI device BIOS (Option ROM) checksum failure is detected during shadowing
Plug & Play Configuration error	Plug & Play Configuration error is detected during PCI device scan
Read fault	Faulty diskette, diskette/tape drive subsystem, or hard-disk drive subsystem
Requested sector not found	
Remote Configuration update attempt failed	System was unable to process Remote Configuration request.

**Table 1-6. System Messages**

<b>System Message</b>	<b>Corrective Action</b>
ROM bad checksum = address	Expansion card improperly installed or faulty
Sector not found	Defective sectors on diskette or hard-disk drive
Seek error	Defective sectors on diskette or hard-disk drive
Seek operation failed	Faulty diskette or hard-disk drive
Shutdown failure	Defective system board
Spare bank enabled	DIMM sparing has been enabled
The amount of system memory has changed	DIMMs have been added or removed
Time-of-day clock stopped	Defective battery or faulty chip
Time-of-day not set - please run SETUP program	Incorrect Time or Date settings or defective system battery
Timer chip counter 2 failed	Defective system board
Unexpected interrupt in protected mode	Improperly seated DIMMs or faulty keyboard/mouse controller chip
Unsupported CPU combination	The installed processors cannot be installed at the same time.
Unsupported CPU stepping detected	Invalid processor stepping is detected
Unsupported DIMM detected in the RAID DIMM slot!	DIMM installed in RAID DIMM slot is not supported.
Utility partition not available	Utility partition is not available on the hard disk
Write fault	Faulty diskette or hard-disk drive
Write fault on selected drive	
BIOS Update Attempt Failed	BIOS remote update failed
Warning! No micro code update loaded for processor n	Micro code update failed

**Table 1-6. System Messages**

<b>System Message</b>	<b>Corrective Action</b>
<b>NOTE:</b> For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 171.	

## 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 165, and then follow the instructions in that section for obtaining technical assistance.

## Alert Messages

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





## Using the System Setup Program

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

You can use the System Setup program to:

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

### Entering the System Setup Program

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

<F2> = System Setup

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



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

### Responding to Error Messages

You can enter the System Setup program by responding to certain error messages. If an error message appears while the system is booting, make a note of the message. Before entering the System Setup program, see "System Messages" on page 34 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. Setup Menu Key Use**

Key	Function	Description
<Enter>	Execute Command	<Enter> activates and closes sub-menus, and selects sub-fields for time/date only.
<Esc>	Exit	<Esc> provides a way to back out of any field. When the <Esc> key is pressed while editing any field or selecting features of a menu, the parent menu is re-entered. When <Esc> is pressed in a submenu, the parent menu is re-entered. When <Esc> is pressed in a major menu, the exit confirmation window is displayed and the user is asked whether changes should be saved or discarded.
Up arrow	Select item up	The up arrow is used to select the previous value in a menu item's option list. Press <Enter> to activate the selected item.
Down arrow	Select item down	The down arrow is used to select the next value in a menu item's option list. Press <Enter> to activate the selected item.
Left and right arrows	Select menu	The left and right arrow keys are used to select values for a setup item.
<->	Change value	The minus key scrolls backward through the selected item's values.
<+>	Change value	The plus key scrolls forward through the selected item's values. On 106-key Japanese keyboards, the plus key has a different scan code than the plus key on keyboards from other regions, but it performs the same function.

**Table 2-1. Setup Menu Key Use**

Key	Function	Description
<Alt><b>	Immediate save and reboot	Immediately saves any changed setup items and reboots the server. The user will NOT be prompted for confirmation.
<Alt><d>	Load selected item default	Loads default for the currently selected setup item.
<Alt><f>	Load all defaults	Loads all setup defaults.



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

## System Setup Options

### Main Screen

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

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

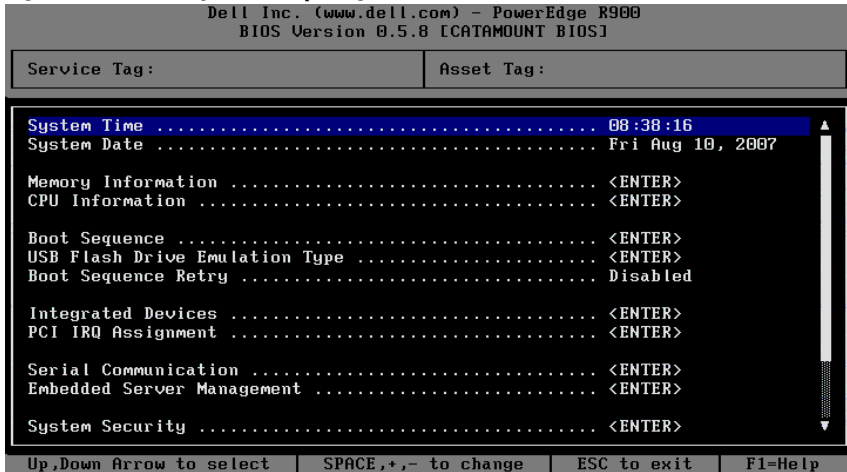



Table 2-2 lists the options and descriptions for the information fields that appear on the main System Setup program screen.

 **NOTE:** The options for the System Setup program change based on the system configuration.

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

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

<b>Option</b>	<b>Description</b>
System Time	Set up the system time
System Date	Set up the system date
Memory Information	Set up the memory configuration. See "Memory Information Screen" on page 45.
CPU Information	Set up the processor configuration. See "CPU Information Screen" on page 45.
Boot Sequence	Set up the boot device sequence
USB Flash Drive Emulation Type	Set up Virtual Floppy as Auto / Floppy / Hard disk
Boot Sequence Retry	Enabled / Disabled
Integrated Devices	Set up Integrated Devices. See "Integrated Devices Screen" on page 46.
PCI IRQ Assignment	View IRQ assignments. See "PCI IRQ Screen" on page 47.
Serial Communication	Set up Serial Communication parameters. See "Serial Communication Screen" on page 47.
Embedded Server Management	Set up Embedded Server Management. See "Embedded Server Management Screen" on page 48.
System Security	Set up the system security. See "System Security Screen" on page 48.
Keyboard NumLock	Enabled / Disabled
Report Keyboard Errors	Report / No Report

## Memory Information Screen

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

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

Option	Description
System Memory Size	Displays memory size
System Memory Speed	Displays memory speed
System Memory Testing	Enabled / Disabled
Redundant Memory	Disabled / Spare Mode / Mirror Mode
Snoop Filter	Enabled / Disabled
Low Power Mode	Enabled / Disabled
Memory Population Information	Displays size, speed, and rank
High-Bandwidth Mode	Enabled / Disabled

## CPU Information Screen

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

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

Option	Description
64-bit	Information Only (Yes/No)
Core Speed	Information Only
Bus Speed	Information Only
Virtualization Technology	Enable/Disable virtualization capabilities of the processor(s) <b>NOTE:</b> If Virtualization Technology is set to ENABLED, the system will perform a power cycle (power off then back on) immediately after saving/exiting BIOS Setup.

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

<b>Option</b>	<b>Description</b>
Adjacent Cache Line Prefetch	Enable/Disable system optimization for sequential memory access
Hardware Prefetcher	Enable/Disable the hardware prefetcher
Demand-Based Power Management	Enable/Disable advanced power management for processors (if supported).
Processor x ID	Information Only (Displayed for each physical processor detected)
Processor ID String	Information Only (Displayed for each physical processor detected)
Level 2 Cache	Information Only (Displayed for each physical processor detected)
Number of cores	Information Only (Displayed for each physical processor detected)

### **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**

<b>Option</b>	<b>Description</b>
Integrated RAID Controller	Enabled / Disabled
Optical Drive Controller	Enabled / Disabled
User Accessible USB Ports	All Ports On / Only Back Ports On / All Ports Off
Internal USB Port	Enabled / Disabled
Embedded Gb NIC#	(Displayed for each NIC) Enabled without PXE / Enabled with PXE / Disabled
MAC Address	(Displayed for each NIC) Information Only
Capability Detected	(Displayed for each NIC) Information Only

**Table 2-5. Integrated Devices Screen Options**

Option	Description
I/OAT DMA Engine	Disabled / Enabled

## PCI IRQ Screen

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

**Table 2-6. PCI IRQ Screen Options**

Option	Description
Embedded NIC # (for each NIC)	IRQ #
Integrated Dell Inc RAID Adapter	IRQ #
Embedded USB UHCI Controller # (for each controller)	IRQ #
Embedded USB EHCI Controller	IRQ #
Embedded Video	IRQ #
Embedded IDE	IRQ #
Embedded SATA	IRQ #

## Serial Communication Screen

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

**Table 2-7. Serial Communication Screen Options**

Option	Description
Serial Communication	On without Console Redirection / On with Console Redirection via COM 1 / On with Console Redirection via COM 2 / Off
External Serial Connector	Remote Access Device / COM 1 / COM 2

**Table 2-7. Serial Communication Screen Options**

<b>Option</b>	<b>Description</b>
Failsafe Baud Rate	15200 / 57600 / 19200 / 9600
Remote Terminal Type	VT100/VT220 / ANSI
Redirection After Boot	Enabled / Disabled

### **Embedded Server Management Screen**

Table 2-8 lists the options and descriptions for the information fields that appear on the Embedded Server Management screen.

**Table 2-8. Embedded Server Management Options**

<b>Option</b>	<b>Description</b>
Front-Panel LCD Options	Default / None / User-Defined String
Default / None / User-Defined String	Press <Enter> to input the string

### **System Security Screen**

Table 2-9 lists the options and descriptions for the information fields that appear on the System Security screen.

**Table 2-9. System Security Screen Options**

<b>Option</b>	<b>Description</b>
System Password	Disabled / Enabled
Setup Password	Disabled / Enabled
Password Status	Unlocked / Locked
TPM Security	See "Trusted Platform Module (TPM) Security Screen" on page 49.
Power Button	Enabled / Disabled
NMI Button	Enabled / Disabled
AC Power Recovery	Last /On /Off



## Trusted Platform Module (TPM) Security Screen

Table 2-10 lists the options and descriptions for the information fields that appear on the TPM Security screen.

**Table 2-10. TPM Security Screen Options**

Option	Description
TPM Security	Off (default)/ On with pre-boot measurements/ On without pre-boot measurements
TPM Clear	Yes/No (default)

## Exit Screen

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

- 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 an existing password, you must know the password (see "Changing the System Password" on page 52). 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 162.

## 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 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 then 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. Uppercase letters, lowercase letters, numbers and special ASCII characters  
`~!@#\$\$%^&\*()\_+=[{ }\|;:'",<.>/? are all valid for password use.



**NOTE:** Numbers and symbols typed from the keypad are different from numbers and symbols typed from along the top of the keyboard.

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 53), 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** in BIOS Setup is set to **Locked**, and you turn on or reboot your system, you will only be able to enter your system password without the ability to disable it using <Ctrl> <Enter>. You must enter BIOS Setup and change the **Password Status** item to **Unlocked** to regain this functionality.

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 "Number of Unsuccessful Password Attempts" and then displays "System Halted! Must Power 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.

### Disabling an Existing System Password

There are several methods of disabling the password such that the password can be deleted or changed.

Method 1: Disabling/Deleting the System Password from POST

- 1 If the **Password Status** item in BIOS Setup is set to **Unlocked**, then enter your system password and press <Ctrl><Enter> to disable the password.

Method 2: Disabling/Deleting the System Password from BIOS Setup

- 1 Enter the System Setup program by pressing <F2> during POST.
- 2 When prompted, type the correct system password and press <Enter>.
- 3 In the Setup Program, open the System Security Screen and verify that the **Password Status** is set to **Unlocked**.
- 4 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**.
- 5 Verify the **System Password** is now set to **Not Enabled**.
- 6 Press <ESC> to exit Setup and continue or press <Alt><b> to immediately save and reboot.

### Changing the System Password

- 1 Enter the System Setup program by pressing <F2> during POST.
- 2 When prompted, type the correct system password and press <Enter>.

- 3 In the Setup Program, open the System Security Screen and verify that the **Password Status** is set to **Unlocked**.
- 4 Select **System Password** and press <Enter>. Enter a new password for both "Enter Password" and "Confirm Password."
- 5 Verify the **System Password** is still set to **Enabled**.
- 6 Press <ESC> to exit Setup and continue or press <Alt><b> to immediately save and reboot.

## 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 <Enter> key. The system prompts you to enter and verify the password.



**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. Uppercase letters, lowercase letters, numbers and special ASCII characters `~!@#\$%^&\*()\_-= [{}]|;:”,<.>/? are all valid for password use.



**NOTE:** Numbers and symbols typed from the keypad are different from numbers and symbols typed from along the top of the keyboard.

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.

## Disabling the System 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 53.

## Disabling a Forgotten Password

A jumper on the system board enables the password. See "Disabling a Forgotten Password" on page 162.

## Baseboard Management Controller Configuration

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

- IPMI Over LAN
- NIC Selection
- LAN Parameters
- Advanced LAN Parameters

- Virtual Media Configuration
- LAN User Configuration
- Reset To Default
- System Event Log Menu



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

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

## Entering the BMC Setup Module

- 1 Turn on or restart your system.
- 2 Press <Ctrl><e> when prompted after POST.

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

## BMC Setup Module Options

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





# Installing System Components

This section describes how gain access to the system and to install the following system components:

- Hard drives
- Replacing a hard drive carrier
- Power supplies
- System fans
- Cooling shroud
- SAS controller card
- RAID battery
- Configuring the boot device
- PCI Express add-in cards
- Optical drive
- System memory
- Processors
- System battery
- Activating the NIC TOE
- I/O riser
- DRAC
- SAS backplane (Service-only Procedure)
- Power Interposer Board (Service-only Procedure)
- System board (Service-only Procedure)

## Recommended Tools

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

- Key to the system keylock
- #2 Phillips screwdriver
- Common screwdriver
- Wrist grounding strap
- Conductive foam pad (recommended)

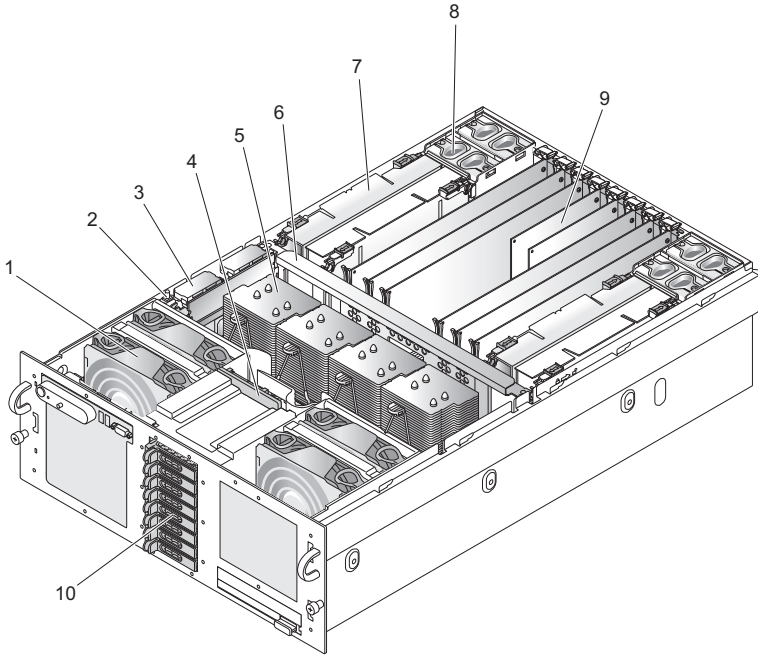
## Inside the System



**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.**

Figure 3-1 shows the interior of the system with the cover removed.

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



- |   |                     |    |                  |
|---|---------------------|----|------------------|
| 1 | Front fan           | 2  | Intrusion switch |
| 3 | RAID controller     | 4  | SAS backplane    |
| 5 | Processor heat sink | 6  | Center brace     |
| 7 | Memory riser        | 8  | Back fan         |
| 9 | PCI Express card    | 10 | Hard drives      |

## Removing and Installing the Top Cover



**CAUTION:** If the system is rack mounted, make sure the rack is anchored securely so it will not tilt forward when the server is extended. A crush hazard exists if the rack tilts forward. This could cause serious injury and/or death.



**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:** For proper cooling and airflow, do not operate the server with the cover removed for more than four minutes. Do not leave the chassis cover open or a system fan removed any longer than necessary; system cooling could be reduced.



**NOTICE:** The server comes with a removable top cover that allows the system fans to be hot-plugged and other system components to be serviced. Except for components described in this chapter, all servicing must be done by a qualified service technician.



**NOTICE:** Provide ElectroStatic Discharge (ESD) protection at all times by wearing an antistatic wrist strap attached to the any unpainted chassis surface (chassis ground) when handling electronic components.

## Removing the Top Cover

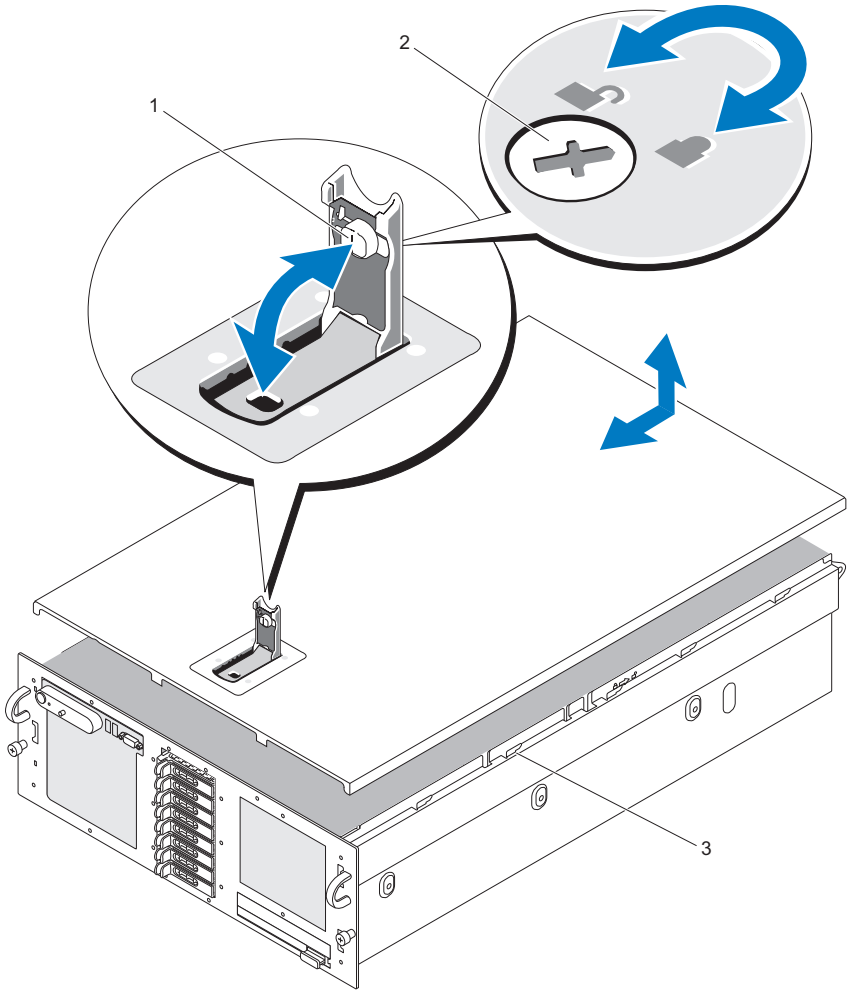
To upgrade or troubleshoot the system, remove the system cover to gain access to internal components.

- 1 Unless you are installing a hot-plug component such as a cooling fan or power supply, remove power from 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 3-2.
- 3 Lift the latch on top of the system. The cover will slide back as you lift the latch. See Figure 3-2.
- 4 Grasp the cover on both sides and carefully lift the cover away from the system.

## Installing the Top Cover

- 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 3-2.
- 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 3-2. Removing the Top 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 five 3.5-inch hard drives, or eight 2.5-inch hard drives. All drives connect to the system board through one of several optional SAS backplanes. See "Power Interposer Connectors" on page 160 for information on these backplane options.

 **NOTE:** Depending on the hard drive configuration you ordered, your hard drive(s) may come with a drive interposer that allows your SATA drive to attach to the SAS connector on the backplane.


## Before You Begin

Hard drives are supplied in special hot-pluggable SATA 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 optional SAS RAID controller card to ensure that the host adapter is configured correctly to support hot-plug drive removal and insertion.


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

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 high-capacity hard drive, allow enough time for the formatting to be completed. Long format times for these drives are normal.

## 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.

The process for removing a drive blank depends on whether your system is configured with 3.5-inch or 2.5-inch hard drives.

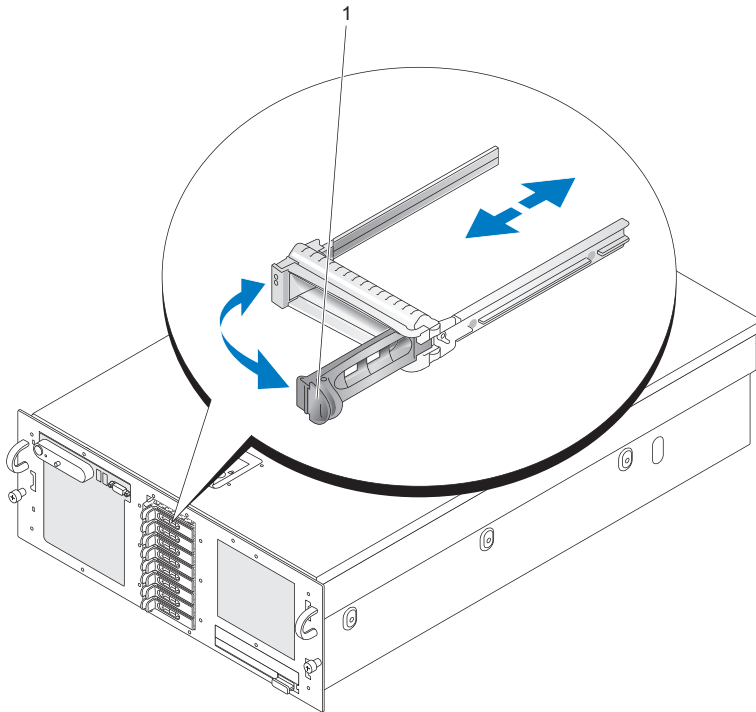
For 3.5-inch hard drive configurations:

- 1 Press the drive blank release in the direction of the arrow.
- 2 Pry the ends of the blank outward until the blank is free.

For 2.5-inch hard drive configurations, remove the blank as you would the 2.5-inch hard drive carrier:

- 1 Open the drive blank release handle to release the blank. See Figure 3-3.
- 2 Slide the drive blank out until it is free of the drive bay.

**Figure 3-3. Removing a Drive Blank**



- 1 Release handle

### **Installing a Drive Blank**

The process for installing a drive blank depends on whether your system is configured with 3.5-inch or 2.5-inch hard drives.

For 3.5-inch hard drive configurations, the drive blank is keyed to ensure correct insertion into the drive bay. To install a 3.5-inch drive blank, insert and rotate in the keyed side of the blank into the drive bay and press evenly on the other end of the blank until it is fully inserted and latched.

For 2.5-inch hard drive configurations, install the hard drive blank as a 2.5-inch hard drive carrier:

- 1 Open the handle on the drive blank.
- 2 Insert the drive blank into the drive bay until the blank is fully seated.
- 3 Close the handle to lock the blank in place.

## Removing a Hot-Plug Hard Drive



**NOTICE:** To maintain proper system cooling, all empty hard drive bays must have drive blanks installed.

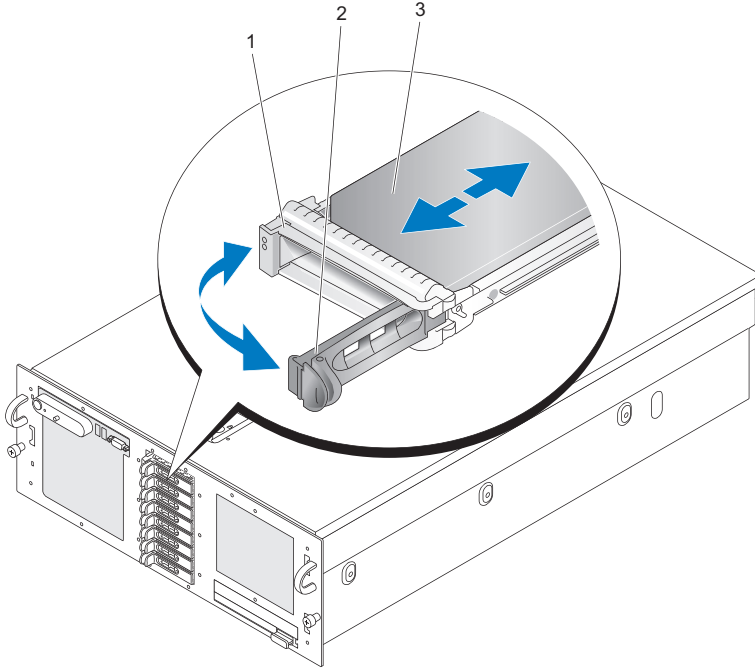
- 1 From the RAID management software, prepare the drive for removal and wait until the hard drive indicators on the drive carrier signal that the drive can be removed safely. See your SAS RAID controller documentation for information about hot-plug drive removal.

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.

- 2 Squeeze the carrier handle to unlatch the carrier from the system.
- 3 Pull the carrier handle away from the system to extract the carrier. See Figure 3-4.



**Figure 3-4. Removing a Hot-Plug Hard Drive**



- 1 activity and fault indicators
- 2 drive carrier release handle
- 3 hard drive

- 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 63".

### 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 If a drive blank is present in the bay, remove it. See "Removing a Drive Blank" on page 62.
- 2 Open the handle on the hard drive carrier.
- 3 Insert the hard drive carrier into the drive bay until the carrier contacts the backplane.
- 4 Close the handle to lock the drive in place.

## Replacing a Hard Drive Carrier

### Removing a Hard Drive From a Hard Drive Carrier

- 1 Remove the four screws from the slide rails on the hard drive carrier.
- 2 Separate the hard drive from the carrier.

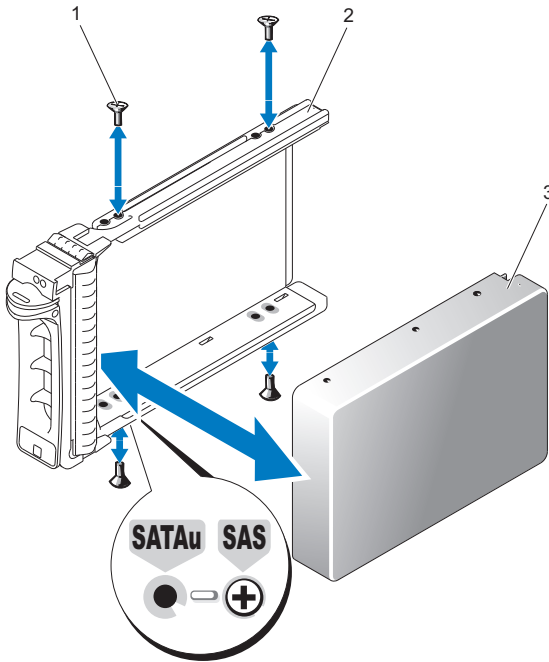
### Installing a SAS Hard Drive Into a SATAu Drive Carrier



**NOTE:** SAS hard drives must be installed only in SATAu drive carriers. The SATAu drive carrier is labeled "SATAu" and also has marks indicating the SAS and SATA mounting screws.

- 1 Insert the SAS hard drive into the hard drive carrier with the connector end of the drive at the back. See Figure 3-5.
- 2 Viewing the assembly as shown in Figure 3-5, align the bottom back screw hole on the hard drive with the hole labeled "SAS" on the hard drive carrier. When aligned correctly, the back of the hard drive will be flush with the back of the hard drive carrier.
- 3 Attach the four screws to secure the hard drive to the hard drive carrier. See Figure 3-5.

**Figure 3-5. Installing a SAS Hard Drive Into a SATAu Drive Carrier**



- 1 Screw (4)
- 3 Hard drive

- 2 Drive carrier

### Installing a SATA Hard Drive Into a SATAu Hard Drive Carrier

**NOTE:** The SATAu drive carrier is labeled "SATAu" and also has marks indicating the SAS and SATA mounting screws.

- 1 Insert the SATA hard drive into the SATAu hard drive carrier with the connector end of the drive at the back. See Figure 3-5.
- 2 Viewing the assembly as shown in Figure 3-5, align the bottom back screw hole on the hard drive with the hole labeled "SATAu" on the hard drive carrier.
- 3 Attach the four screws to secure the hard drive to the hard drive carrier. See Figure 3-5.

# Power Supplies

Two power supplies power your system.



**NOTE:** Your system can operate using only one power supply, but with severely degraded performance.

## Removing a Power Supply



**NOTICE:** The system requires one power supply for the system to operate normally. The system is in the redundant mode when two power supplies are installed and both power supplies are connected to an AC power source. Remove and replace only one power supply at a time in a system that is powered on. Operating the system with only one power supply installed and without a power supply blank installed for extended periods of time can cause the system to overheat.



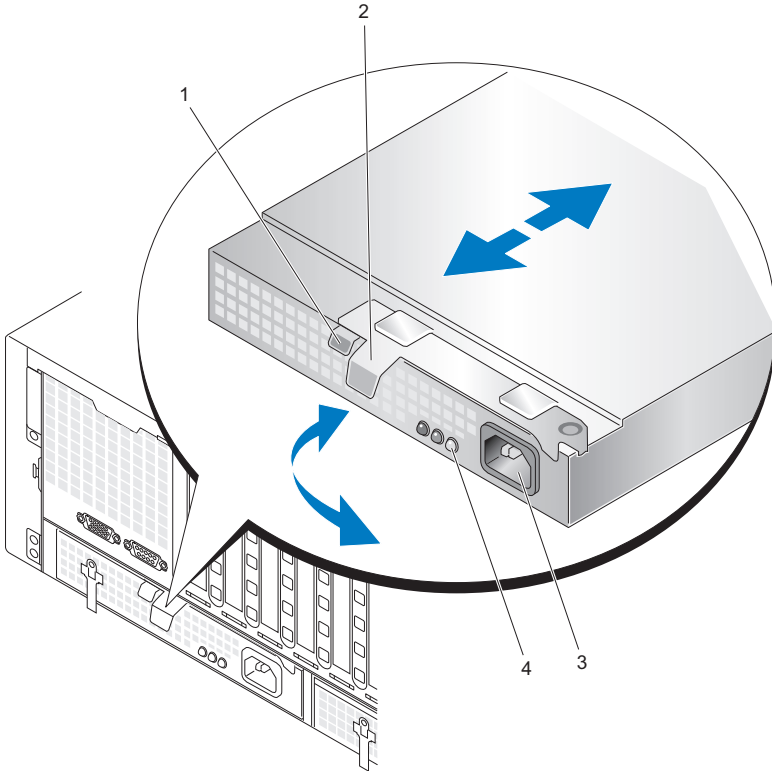
**NOTICE:** If only one power supply is installed, it must be installed in power supply bay (1).



**NOTICE:** If you connect the system to a power source in the range of 120 to 220 VAC, and if two power supplies are installed, the second power supply serves as a redundant, hot-plug power source.

- 1 If your system has a single power supply, remove power from 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.
- 4 Depress the power supply latch and then pull the power supply lever to extract the power supply out of the chassis. See Figure 3-6.
- 5 Pull the power supply straight out to clear the chassis.

**Figure 3-6. Removing a Power Supply**



- |   |                    |   |                                |
|---|--------------------|---|--------------------------------|
| 1 | Power supply latch | 2 | Power supply lever             |
| 3 | Power connector    | 4 | Power supply status indicators |

### **Installing a Power Supply**

- 1 With the power-supply lever in the extended position, slide the new power supply into the chassis. See Figure 3-6.
- 2 Rotate the lever toward the power supply until it is completely flush with the power-supply faceplate and the power supply latch engages. See Figure 3-6.

- 3 Connect the power cable to the power supply, and plug the cable into a 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 3-6.

## System Fans

The system includes eight hot-pluggable cooling fans, four in the front and four in the back.

Four cooling fan are located at the front of the chassis. You can replace each fan.

Two cooling fan housings are located in the back of the chassis. Each housing contains two fans. You can replace each fan and each fan housing.

You can replace a failed cooling fan without turning off the power to the server only if the remaining fans are fully functional.

### Removing a Front 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.

- 1 Open the system. See "Removing the Top Cover" on page 60.
- 2 Locate the fan you are removing.
- 3 Squeeze the fan loop handles to unlatch the fan from the chassis.
- 4 Pull the fan straight up from the fan cage to clear the chassis.

### Installing a Front 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.

- 1 Open the system. See "Removing the Top Cover" on page 60.
- 2 Position the connector on the fan to mate with the connector on the chassis.

- 3 Position the fan between the chassis guides.
- 4 Lower the replacement fan into the chassis until it snaps into place.

### Hot-plugging a Front 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.



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



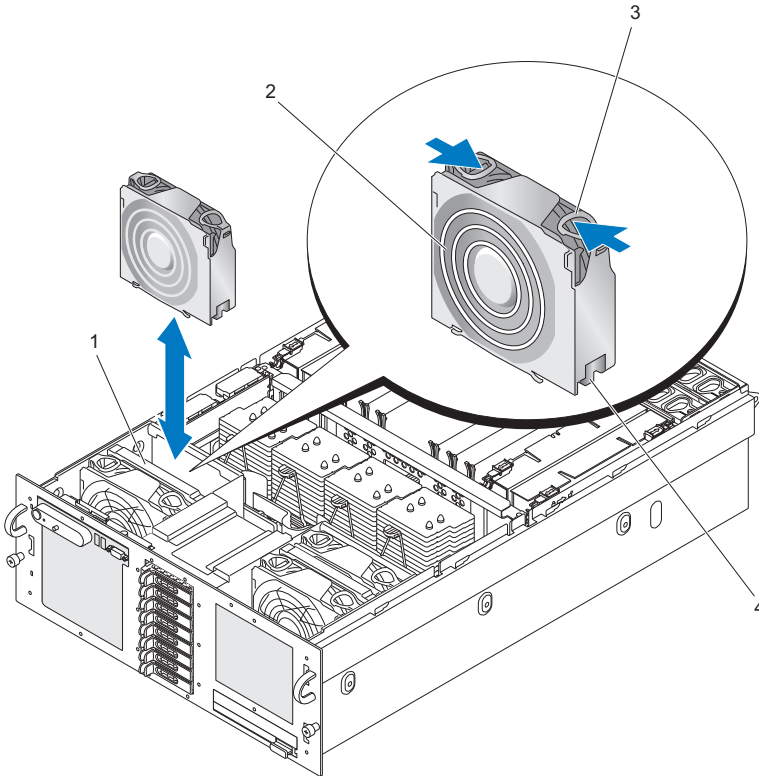
**NOTICE:** For proper cooling and airflow, do not operate the server with the cover removed for more than four minutes. Do not leave the chassis cover open or a system fan removed any longer than necessary; system cooling could be reduced.



**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 "Removing the Top Cover" on page 60.
- 2 Locate the fan you are replacing.
- 3 Squeeze the fan loop handles to unlatch the fan from the chassis.
- 4 Pull the fan straight up from the fan cage to clear the chassis.
- 5 Position the connector on the replacement fan to mate with the connector on the chassis.
- 6 Position the fan between the chassis guides.
- 7 Lower the replacement fan into the chassis until it snaps into place.
- 8 Reinstall the top cover.

**Figure 3-7. Hot-plugging a Front System Fan**



- |   |             |   |               |
|---|-------------|---|---------------|
| 1 | Brace       | 2 | Fan           |
| 3 | Loop handle | 4 | Fan connector |

### Removing a Back 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.**

- 1 Open the system. See "Removing the Top Cover" on page 60.
- 2 Locate the fan you are removing.




- 3 Squeeze the fan loop handles to unlatch the fan from the back system fan housing.
- 4 Pull the fan straight up from the fan cage to clear the back system fan housing.

### Installing a Back 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.


- 1 Open the system. See "Removing the Top Cover" on page 60.
- 2 Position the connector on the fan to mate with the connector on the chassis.
- 3 Position the fan in the fan housing.
- 4 Lower the replacement fan into the back system fan housing until it snaps into place.

### Hot-plugging a Back 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.

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

 **NOTICE:** For proper cooling and airflow, do not operate the server with the cover removed for more than four minutes. Do not leave the chassis cover open or a system fan removed any longer than necessary; system cooling could be reduced.

 **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 "Removing the Top Cover" on page 60.
- 2 Locate the fan you are replacing.
- 3 Squeeze the fan loop handles to unlatch the fan from the chassis.
- 4 Pull the fan straight up from the fan housing to clear the fan housing.
- 5 Position the connector on the fan to mate with the connector on the chassis.

- 6 Position the fan in the fan housing.
- 7 Lower the replacement fan into the housing until it snaps into place.

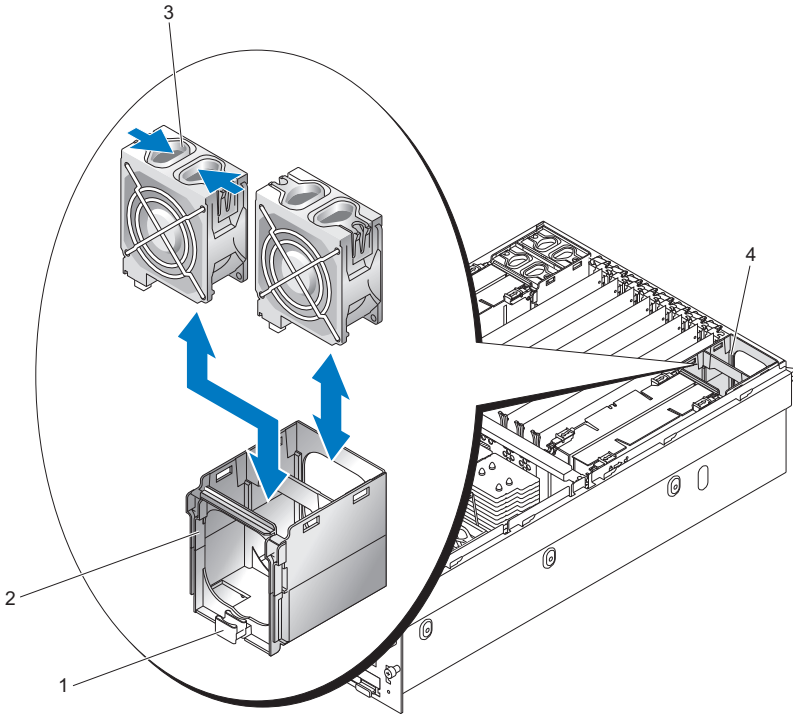
## Removing a Back System Fan Housing



**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 Ensure power is removed.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Remove memory risers. See "Removing a Memory Riser" on page 96.
- 4 Remove applicable back system fans. See "Removing a Back System Fan" on page 72.
- 5 Pull the fan housing latch forward and lift back system fan housing clear of the chassis.

**Figure 3-8. Removing a Back System Fan Housing**



1 Fan housing latch

2 Fan housing

3 Fan loop handle

4 Location of fan housing

### Installing a Back System Fan Housing

**⚠ 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 Ensure power is removed.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Align fan housing guides with frame.

- 4 Lower the replacement fan housing into the chassis until it snaps into place.

## Cooling Shroud

The cooling shroud directs airflow over the processors.

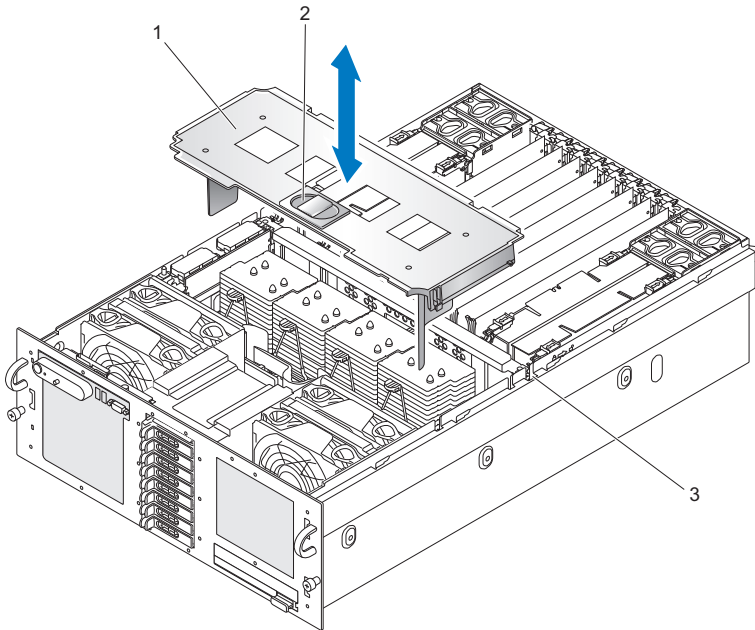


**NOTICE:** Never operate your system with the cooling shroud removed. The system can overheat quickly resulting in a shutdown of the system and the loss of data.

### Removing the Cooling Shroud

- 1 Ensure power is removed.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Grasp the finger holds and lift the cooling shroud straight up. You might have to lift the corners of the shroud up to disengage the shroud guides from the chassis.

**Figure 3-9. Removing the Cooling Shroud**



- 1 Cooling shroud
- 2 Finger holds
- 3 Chassis slot

### **Installing the Cooling Shroud**

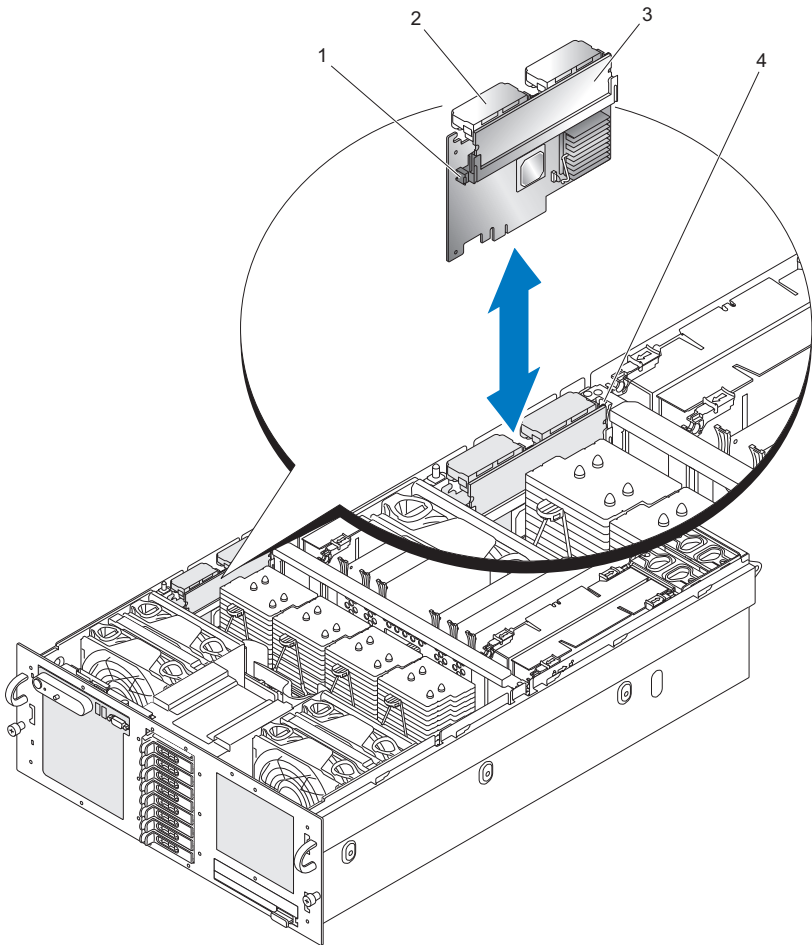
**➡ NOTICE:** When installing the cooling shroud, ensure that the shroud does not damage system cabling.

- 1 Ensure power is removed.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Position the shroud guides above the slots in the chassis.
- 4 Gently press the cooling shroud down into place.

## SAS Controller Card

Your system includes a dedicated slot for a SAS controller card. The SAS controller card provides the SAS storage subsystem for your system's internal hard drives. The optional SAS RAID controller card allows you to set up any internal hard drives in a RAID configuration. Although the cabling for the two types of cards is different (the SAS controller card has only one connector, while the SAS RAID controller card has two), both cards install into the dedicated slot as described below. The SAS RAID controller card is shown in Figure 3-10.

**Figure 3-10. SAS RAID Controller Card**



1 RAID battery connector

2 Controller connector (2)


3 RAID DIMM

4 Card latch

## Removing a SAS Controller Card

 **NOTICE:** See "Protecting Against Electrostatic Discharge" in the safety instructions in your Product Information Guide.

- 1 Ensure power is removed.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 76.
- 4 Disconnect each controller connector by squeezing the connector latches and lifting the connector straight up.

 **NOTICE:** Do not lift on SAS RAID DIMM card attached to the SAS controller card, lift the SAS controller card itself.

- 5 Push the card latch away from the card and lift on the card out of the system.
- 6 Disconnect the RAID battery from the SAS controller card.

## Installing an SAS Controller Card

- 1 Ensure power is removed.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 76.
- 4 Connect the RAID battery to the SAS controller card.
- 5 Position the SAS controller card between the card guides above the SAS controller card connector on the system board.
- 6 Lower the SAS controller card into the chassis until the card is seated on the system board.

 **CAUTION:** Ensure the RAID battery cabling does not touch the processor heat sink.

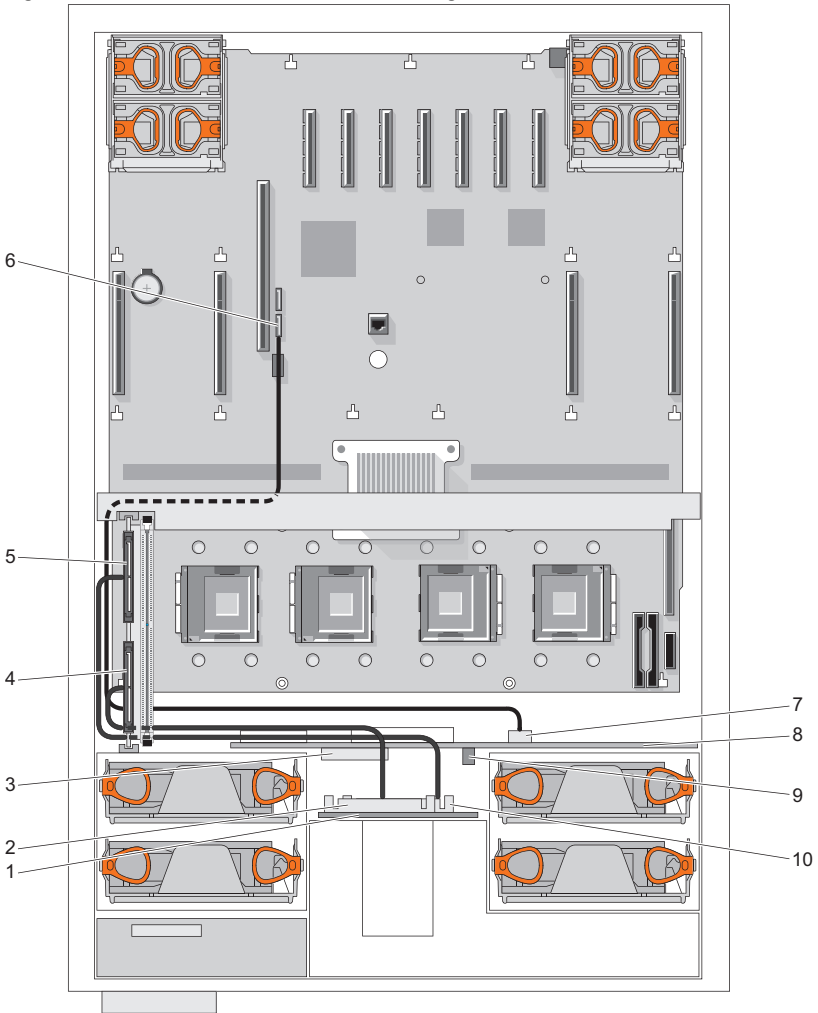
- 7 Connect each controller connector.

## SAS and SAS RAID Controller Card Cabling Guidelines

Ensure that the cabling for the SAS and SAS RAID controller is routed as shown in Figure 3-11 for 2.5-inch systems and in Figure 3-12 for 3.5-inch systems.

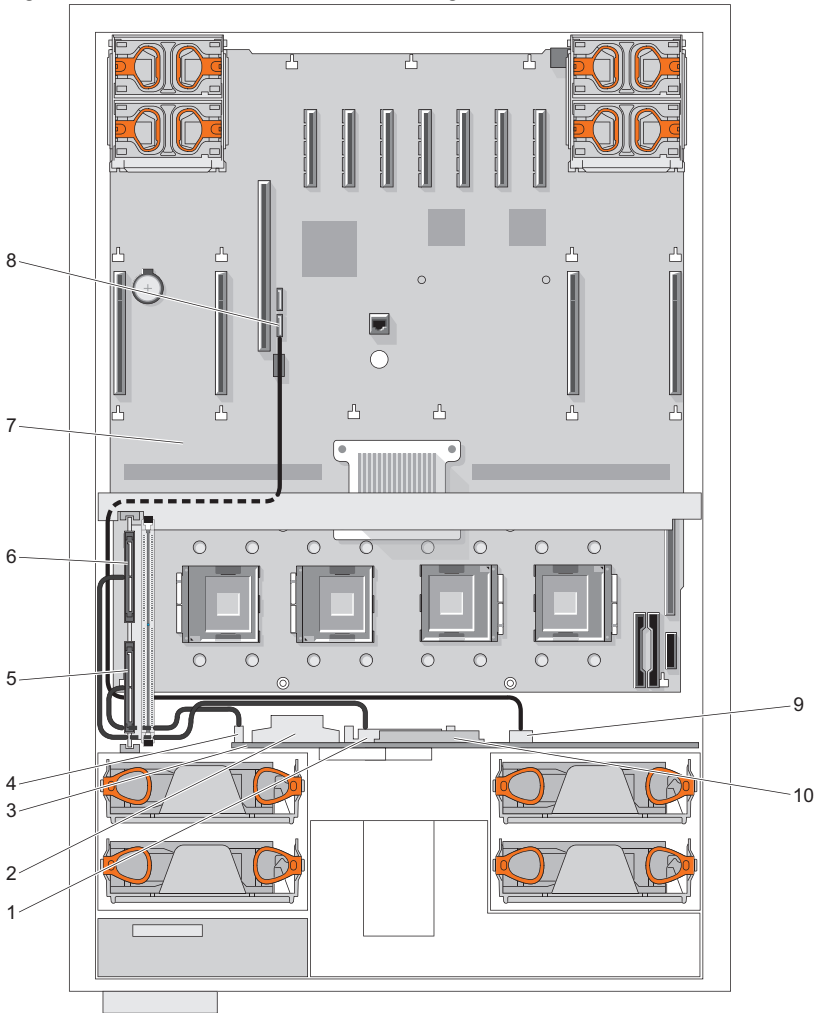


**Figure 3-11. 2.5-Inch SAS / SAS RAID Cabling**



- |   |  |    |                                    |
|---|--|----|------------------------------------|
| 1 | SAS backplane                                | 2  | SAS A connector                    |
| 3 | GND/12V connector                            | 4  | Controller 0 connector             |
| 5 | Controller 1 connector                       | 6  | SATA_A connector (on system board) |
| 7 | SATA_A connector (on Power Interposer Board) | 8  | Power Interposer Board (PIB)       |
| 9 | PIB power connector                          | 10 | SAS B connector                    |

**Figure 3-12. 3.5-Inch SAS / SAS RAID Cabling**



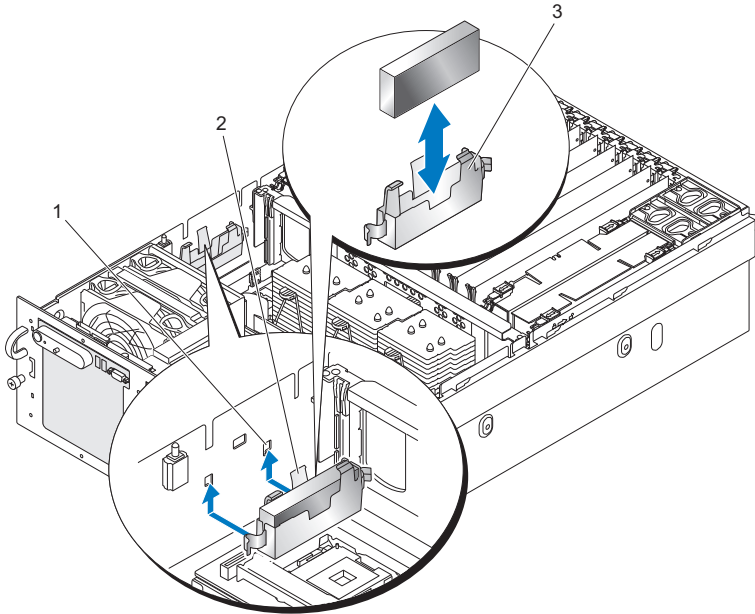
- |   |                                     |    |                                    |
|---|-------------------------------------|----|------------------------------------|
| 1 | SAS A connector                     | 2  | GND/+12V connector                 |
| 3 | SAS backplane                       | 4  | SAS B connector                    |
| 5 | Controller 0 connector              | 6  | Controller 1 connector             |
| 7 | System board                        | 8  | SATA_A connector (on system board) |
| 9 | SATA_A connector (on SAS backplane) | 10 | Control panel connector            |

## RAID Battery

### Installing a RAID Battery

- 1 Insert the RAID battery into the battery carrier. See Figure 3-13.
- 2 Locate the battery carrier slots at the left of the processors.
- 3 Place the controller cabling harnesses between the battery carrier clips and the chassis.
- 4 Insert the battery carrier and RAID battery into the chassis battery carrier slots ensuring that the battery carrier is aligned and fully seated in the slots.
- 5 Connect the battery cable to the SAS controller card.

**Figure 3-13. Installing a RAID Battery**




- 1 Mounting hole (2)
- 2 RAID battery latch
- 3 Battery carrier guide

### **Removing a RAID Battery**

- 1 Remove the SAS controller card. See "Removing a SAS Controller Card" on page 80
- 2 Pull the RAID battery carrier latch away from the chassis.
- 3 Lift the RAID battery carrier out of the system.
- 4 Gently pulling back the two guides holding the RAID battery into the battery carrier, remove the RAID battery from the battery carrier.


## 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](http://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 41 for information about the System Setup program.

## PCI Express Add-in Cards

 **NOTICE:** The server must be powered down to install or remove a card from a PCI Express slot.

 **CAUTION:** Expansion slot covers must be installed over all vacant slots to maintain the electromagnetic emission characteristics of the server and to ensure proper system cooling.

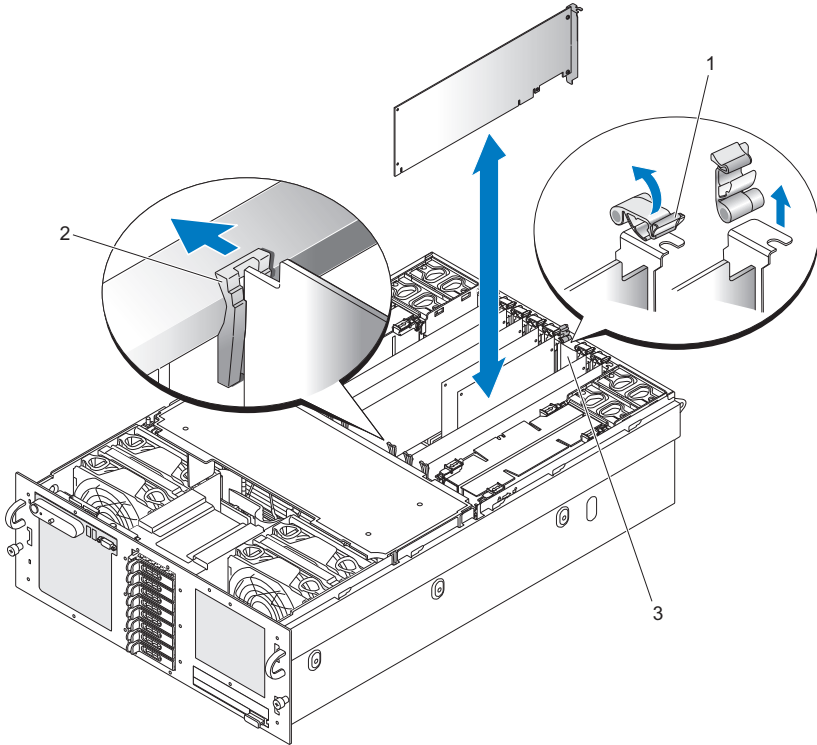
### Installing a PCI Express Card

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

To install a expansion card, perform the following steps:


- 1 Remove power from the system and attached peripherals, and then disconnect the system from the electrical outlet.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Open the plastic expansion-card retainer above the filler bracket of the empty slot. See Figure 3-14.

**Figure 3-14. Installing and Removing PCI Express Cards**



- 1 Expansion card retainer
- 2 Card latch
- 3 Filler bracket

- 4 Remove the filler bracket on the slot that you are using.

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

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



**NOTE:** Ensure that the expansion-card bracket is also inserted into the securing slot at the bottom of the bracket slot.

- 6 Close the expansion-card retainer. See Figure 3-14.
- 7 Connect any internal or external cable(s) to the expansion card.
- 8 Close the system. See "Installing the Top Cover" on page 60.

## Removing a PCI Express Card



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

- 1 Remove power from the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Disconnect any internal or external cable(s) that are connected to the expansion card.
- 4 Open the expansion-card retainer adjacent to the slot. See Figure 3-14.
- 5 Press the card latch away from the expansion card, grasp the card, and carefully lift it from the system-board connector.
- 6 If you are permanently removing the card, replace the metal filler bracket over the empty card-slot opening.
- 7 Close the expansion-card retainer. See Figure 3-14.
- 8 Close the system. See "Installing the Top Cover" on page 60.

## Optical Drive

The system accommodates one optical drive. The device is not hot-pluggable, so the system must be powered down and the power cords removed from the chassis before installing or removing this drive.

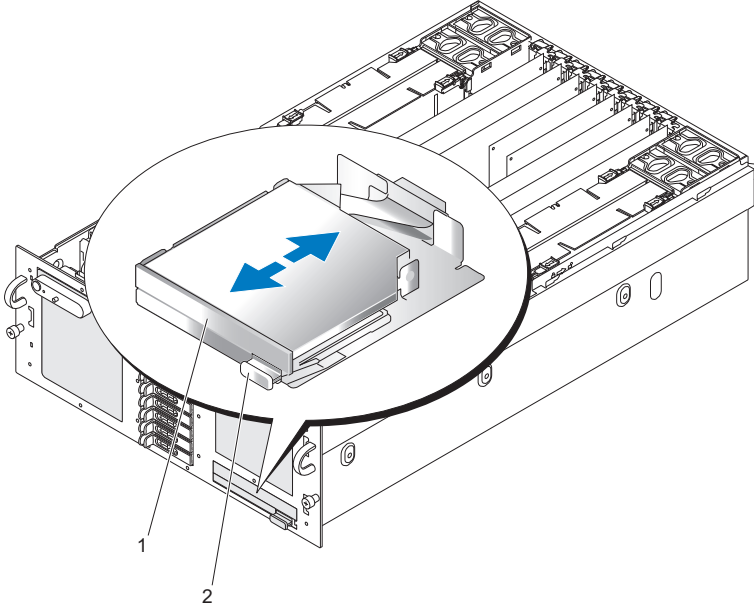
### Removing the Optical Drive

- 1 Remove power from the system and attached peripherals, and then disconnect the system from the electrical outlet.



- 2 Pull the locking handle until the drive releases from the chassis. See Figure 3-15.
- 3 Remove the drive from the chassis.

**Figure 3-15. Removing the Optical Drive**



1 Optical drive

2 Locking handle

### **Installing the Optical Drive**

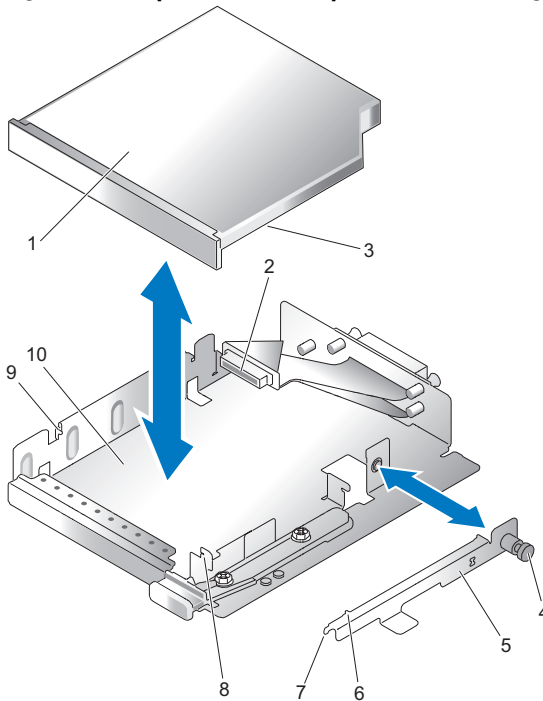
- 1 Insert the drive fully into the chassis until it snaps into place.
- 2 Push the locking handle into the drive to lock the drive into the chassis.

# Replacing an Optical Drive Mounting Tray

## Removing an Optical Drive From an Optical Drive Mounting Tray

- 1 Remove the optical drive from the system. See "Removing the Optical Drive" on page 88.
- 2 Disconnect the ribbon cable from the back of the optical drive. See Figure 3-16.

**Figure 3-16. Optical Drive and Optical Drive Mounting Tray**



- |   |                           |    |                     |
|---|---------------------------|----|---------------------|
| 1 | Optical drive             | 2  | Ribbon cable        |
| 3 | Hole in optical drive     | 4  | Retaining screw     |
| 5 | Retaining bracket         | 6  | Alignment pin       |
| 7 | Retaining bracket tab     | 8  | Mounting tray notch |
| 9 | Alignment pin (left side) | 10 | Mounting tray       |

- 3** Unscrew the optical drive retaining screw.
- 4** Pull the retaining bracket away from the optical drive.
- 5** Remove the optical drive from the optical drive mounting tray.

## Installing an Optical Drive Into an Optical Drive Mounting Tray

- 1 Slide the optical drive onto the left side alignment pins of the optical drive mounting tray.
- 2 Angle the retaining bracket tab into the optical drive mounting tray notch.
- 3 Press the retaining bracket against the optical drive, ensuring the alignment pin engages the optical drive hole.



**NOTE:** The alignment pin on the retaining bracket must engage a hole in the optical drive.

- 4 Screw the optical drive retaining screw into the optical drive mounting tray.
- 5 Connect the ribbon cable to the back of the optical drive.

## System Memory

The system supports x4 or x8, single- or dual-rank fully buffered 667 MT/s (5-5-5 latency) DDR2 DIMMs in 512 MB, 1 GB, 2 GB, or 4 GB packages.

Four memory risers must be installed at all times. The risers connect to the main board through x16 PCI Express connectors.

### General Memory Module Installation Guidelines

AC power must be removed from the system before servicing the memory risers.



**NOTICE:** For proper cooling, each memory riser must be fully populated with DIMMs or blanks or a combination thereof.

Four memory risers with one DIMM per riser must be installed for the server to function.

Supported memory riser configurations are as follows:

- All DIMMs must be FBD using DDR2 DRAMs (FBD Generation 1).
- In all cases, DIMMs must be installed starting with the lowest number slot in a given channel (i.e., install DIMM1 first).
- In non-Mirrored Mode, all DIMMs with the same slot number within a given branch must match (size, technology, etc.). It is not required to match DIMMs between different slot numbers.

- Mirrored mode requires the same DIMM type across and up-and-down channels.
- In Single Channel Mode, a DIMM must be populated in the Branch 0, Channel A, DIMM 1 slot first, then you can populate the Channel A up to all 8 DIMMs.
- For the Dual Channel Mode, the memory capacity upgrade path would be to populate Branch 0 of Channel A and Channel B with the same DIMM number and type, or Branch 1 of Channel C and Channel D with the same DIMM number and type.

## **Non-Optimal Memory Configurations**

System performance can be affected if your memory configuration does not conform to the preceding installation guidelines. Your system may issue an error message during startup stating that your memory configuration is non-optimal.

The server will support a population of DIMMs with different speed ratings. The overall system memory speed will be determined by the slowest DIMM populated.

The server will support population of mixed memory suppliers, provided all other rules above are followed.

## **Memory Sparing Support**

The system supports memory sparing if eight identical memory modules are installed in the system. The memory sparing feature must be enabled in the System Setup program and can be used only if memory mirroring is not enabled.

Memory sparing allocates four ranks of DIMM memory to the spare bank. These four ranks consist of the first rank of memory in DIMM sockets 1 through 4. For single-rank DIMMs, the entire capacity of the four DIMMs is allocated to sparing whereas for dual-rank DIMMs, only half of the four-DIMM capacity is allocated to sparing. Table 3-1 shows how memory sparing splits the available and spared memory in each of the single- and dual-ranked memory module combinations.

## Memory Mirroring Support

The system supports memory mirroring if 16 identical memory modules are installed in the system. Mirroring must be enabled in the System Setup program and can be used only if memory sparing is not enabled. In a mirrored configuration, the total available system memory is one-half of the total installed memory.

**Table 3-1. Valid Memory Configurations**

Number of DIMMS	Branch 0		Branch 1		Available Redundant Memory Modes
	Channel 0 (Riser A)	Channel 1 (Riser B)	Channel 2 (Riser C)	Channel 3 (Riser D)	
1	DIMM A1	(riser only)	(riser only)	(riser only)	None
4	DIMM A1	DIMM B1	DIMM C1	DIMM D1	None
8	DIMM A1	DIMM B1	DIMM C1	DIMM D1	None
	DIMM A2	DIMM B2	DIMM C2	DIMM D2	
12	DIMM A1	DIMM B1	DIMM C1	DIMM D1	None
	DIMM A2	DIMM B2	DIMM C2	DIMM D2	
	DIMM A3	DIMM B3	DIMM C3	DIMM D3	
16	DIMM A1	DIMM B1	DIMM C1	DIMM D1	Spare Mode / Mirror Mode
	DIMM A2	DIMM B2	DIMM C2	DIMM D2	
	DIMM A3	DIMM B3	DIMM C3	DIMM D3	
	DIMM A4	DIMM B4	DIMM C4	DIMM D4	
20	DIMM A1	DIMM B1	DIMM C1	DIMM D1	Spare Mode / Mirror Mode
	DIMM A2	DIMM B2	DIMM C2	DIMM D2	
	DIMM A3	DIMM B3	DIMM C3	DIMM D3	
	DIMM A4	DIMM B4	DIMM C4	DIMM D4	
	DIMM A5	DIMM B5	DIMM C5	DIMM D5	

**Table 3-1. Valid Memory Configurations**

Number of DIMMS	Branch 0		Branch 1		Available Redundant Memory Modes
	Channel 0 (Riser A)	Channel 1 (Riser B)	Channel 2 (Riser C)	Channel 3 (Riser D)	
24	DIMM A1	DIMM B1	DIMM C1	DIMM D1	Spare Mode / Mirror Mode
	DIMM A2	DIMM B2	DIMM C2	DIMM D2	
	DIMM A3	DIMM B3	DIMM C3	DIMM D3	
	DIMM A4	DIMM B4	DIMM C4	DIMM D4	
	DIMM A5	DIMM B5	DIMM C5	DIMM D5	
	DIMM A6	DIMM B6	DIMM C6	DIMM D6	
28	DIMM A1	DIMM B1	DIMM C1	DIMM D1	Spare Mode / Mirror Mode
	DIMM A2	DIMM B2	DIMM C2	DIMM D2	
	DIMM A3	DIMM B3	DIMM C3	DIMM D3	
	DIMM A4	DIMM B4	DIMM C4	DIMM D4	
	DIMM A5	DIMM B5	DIMM C5	DIMM D5	
	DIMM A6	DIMM B6	DIMM C6	DIMM D6	
	DIMM A7	DIMM B7	DIMM C7	DIMM D7	
32	DIMM A1	DIMM B1	DIMM C1	DIMM D1	Spare Mode / Mirror Mode
	DIMM A2	DIMM B2	DIMM C2	DIMM D2	
	DIMM A3	DIMM B3	DIMM C3	DIMM D3	
	DIMM A4	DIMM B4	DIMM C4	DIMM D4	
	DIMM A5	DIMM B5	DIMM C5	DIMM D5	
	DIMM A6	DIMM B6	DIMM C6	DIMM D6	
	DIMM A7	DIMM B7	DIMM C7	DIMM D7	
	DIMM A8	DIMM B8	DIMM C8	DIMM D8	



**NOTE:** The single DIMM configuration is for troubleshooting.

## Removing a Memory Riser

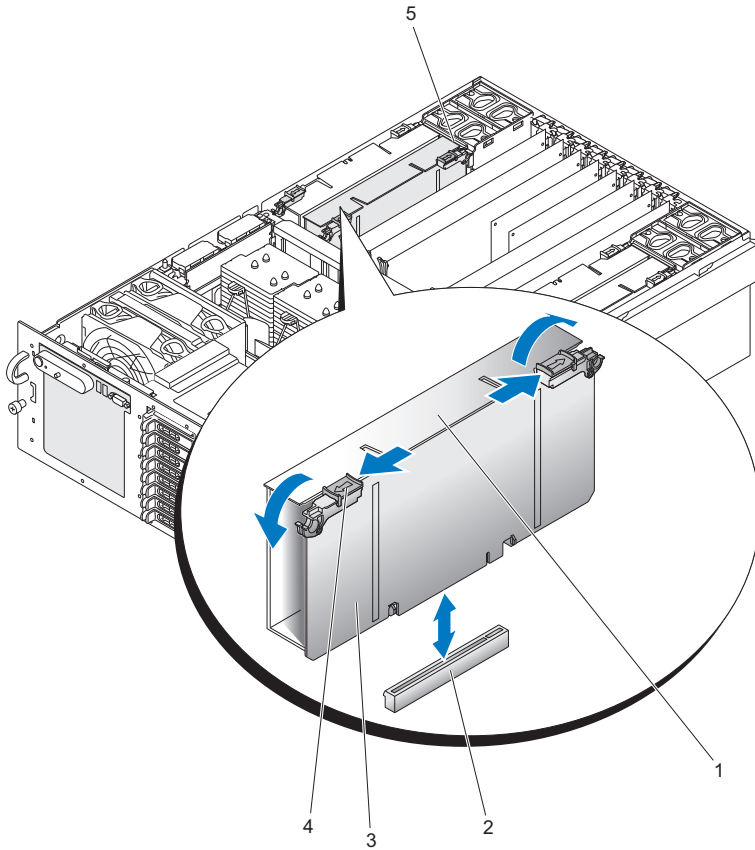


**CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your Product Information Guide for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

- 1 Ensure power is removed.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Push the memory riser latches toward the ends of the memory riser. See Figure 3-17.
- 4 Lift the memory riser latches to raise the memory riser away from the system board.
- 5 Lift the memory riser out of the system.



**Figure 3-17. Removing a Memory Riser**



- |   |                    |   |                        |
|---|--------------------|---|------------------------|
| 1 | Memory riser cover | 2 | System board connector |
| 3 | Memory riser card  | 4 | Memory riser latch     |
| 5 | Back fan housing   |   |                        |

## Installing a Memory Riser



**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 Ensure power is removed.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Ensure the memory riser latches are rotated away from the memory riser.
- 4 Align the memory riser connector with the connector on the system board.
- 5 Lower the memory riser until the memory riser latches engage the chassis (in front) and the back fan housing.
- 6 Press down on the memory riser latches to lever the memory riser onto the system board.

## Memory Population Rules

- Memory must be populated beginning with Memory Riser\_A, slot 1. This is DIMM slot A1. Memory Riser\_A is at the right side of the system.
- To increase memory capacity, additional memory can be added to Memory Riser\_A beginning with slot A2, and followed by slot A3 and then slot A4.
- Additional memory can be added by installing identical pairs of DIMMs in the lowest numbered available slots.
- Identically numbered FBDIMM sockets for both memory risers in a branch must be populated with FBDIMMs identical in terms of timing, technology, and size. For example, DIMM A1 and B1 must be identical, and DIMM C1 and D1 must be identical.
- FBDIMMs installed in different socket positions (numbers) on a memory riser do not need to be identical. For example, DIMMs A1 and B1 can be different from DIMMs A2 and B2.
- If memory mirroring is not required, FBDIMMs installed in the same socket positions (numbers) across the two branches do not need to be identical. For example, DIMMs A1 and B1 can be different from DIMMs C1 and D1.

- If memory mirroring is required, FBDIMMs installed in the same socket positions (numbers) across the two branches must be identical. For example, DIMMs A1 and B1 must be identical to DIMMs C1 and D1.
- Additional memory can be added by installing identical pairs of DIMMs in the lowest numbered available slots.

## Removing the Memory Riser Cover

- 1 Ensure power is removed.
- 2 Remove the top cover. See "Removing the Top Cover" on page 60.
- 3 Remove the memory riser. See "Removing a Memory Riser" on page 96.
- 4 Press down on the memory board cover hooks, straddling the memory board slot connector on the underside of the memory board.
- 5 Pull the cover away from the memory riser.
- 6 Lift the memory riser DIMM cover from the memory riser.



**NOTE:** To install a Memory Riser cover, reverse the removal steps.

## Installing Memory Modules



**CAUTION:** Use extreme care when installing a DIMM. Applying too much pressure can damage the connector. DIMMs are keyed and can be inserted in only one way.



**CAUTION:** Hold DIMMs only by the edges. Do not touch the components or gold edge connectors.



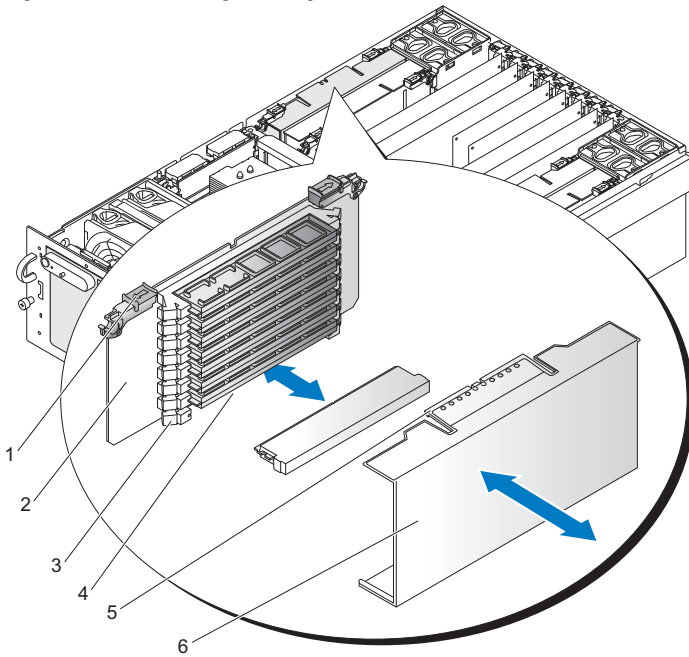
**CAUTION:** Install DIMMs with gold-plated edge connectors only.



**CAUTION:** The maximum DIMM height is 4.445 cm (1.75 inches). Do not install DIMMs that exceed this height.

- 1 Open the plastic levers on each end of the DIMM socket(s). Remove the DIMM from its antistatic container. Hold the DIMM only by the edges. Do not touch the components or gold edge connectors.
- 2 Install DIMMs in the correct order. See "Memory Population Rules" on page 98.
- 3 Position the DIMM above the socket. Align the notch on the bottom edge of the DIMM with the key in the DIMM socket.


**Figure 3-18. Installing Memory Modules**



- |   |                    |   |                    |
|---|--------------------|---|--------------------|
| 1 | Memory riser latch | 2 | Memory riser       |
| 3 | DIMM socket lever  | 4 | DIMM socket        |
| 5 | Memory riser tab   | 6 | Memory riser cover |

- 4 Insert the bottom edge of the DIMM into the socket.
- 5 Push down on the top edge of the DIMM. The levers at each end of the DIMM socket will close. Make sure the levers close securely.
- 6 Lower the memory riser DIMM cover over the DIMM slots.
- 7 Line up the hooks in the memory riser cover with the notches on the bottom edge of the memory riser.
- 8 Lift the memory riser cover over the DIMMs and let the cover latch snap into place.
- 9 Install the memory riser. See "Installing a Memory Riser" on page 98.

## Removing Memory Modules

 **CAUTION: Use extreme care when removing DIMMs. Too much pressure can damage the connector. Apply only enough pressure on the plastic levers to release the DIMM.**

- 1 Remove the Memory Riser Cover. See "Removing the Memory Riser Cover" on page 99.
- 2 Open the plastic levers on each end of the DIMM socket(s). The DIMM will lift from the socket.
- 3 Hold the DIMM only by the edges. Do not touch the DIMM components or the gold edge connectors. Store it in an antistatic bag.
- 4 Line up the hooks in the memory riser cover with the notches on the bottom edge of the memory riser.
- 5 Lift the memory riser cover over the DIMMs and let the cover latch snap into place.
- 6 Install the memory riser. See "Installing a Memory Riser" on page 98.

## Processors


The system requires 1, 2, or four processors—a 3-processor configuration is not supported.

Processors must be installed from right to left, i.e., processor 1, then processor 2, then processors 3 and 4.

Each processor and its associated internal cache memory are contained in a pin grid array (PGA) package that is installed in a ZIF socket on the system board.

Your system comes with processors with the same model, stepping, core frequency, and cache size.

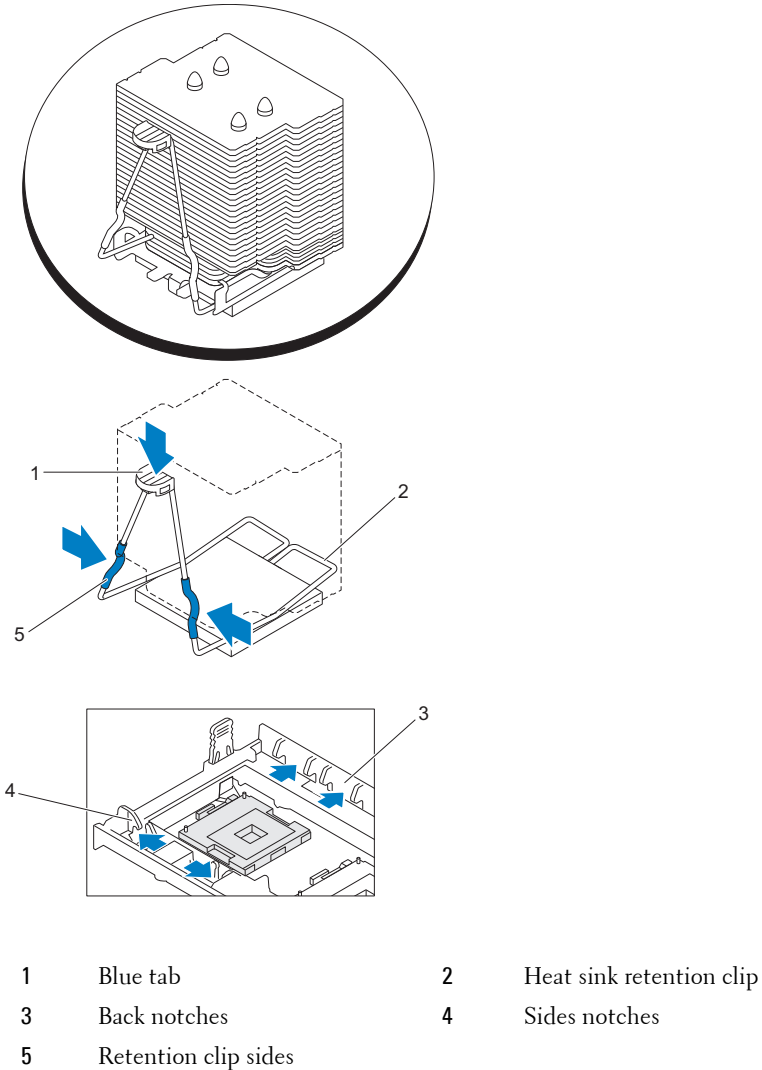
## Removing a Processor Heat Sink

 **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 Remove power from the system and attached peripherals, and disconnect the system from the electrical outlet.

- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 76.
  - ➔ **NOTICE:** When you remove the processor heat sink, the possibility exists that the processor might adhere to the processor heat sink and be removed from the socket. It is recommended that you remove the processor heat sink while the processor is still warm.
  - ➔ **NOTICE:** Never remove the processor heat sink from a processor unless you intend to remove the processor. The processor heat sink is necessary to maintain proper thermal conditions.
- 4 While pressing firmly on the blue tab on the end of the heat-sink retention clip, compress the sides of the retention clip together until the clip disengages from the sides notches of the heat sink bracket, and then slide the retention clip forward to release it from the back notches of the bracket. See Figure 3-19.

**Figure 3-19. Installing and Removing a Processor Heat Sink**



- 5 If the processor heat sink has not separated from the processor, carefully rotate the processor heat sink in a clockwise, then counterclockwise, direction until it releases from the processor. Do not pry the processor heat sink off of the processor.
  - ➔ **NOTICE:** If you are going to reinstall the same processor and processor heat sink, ensure that you do not disturb the thermal grease on either the processor or the processor heat sink.
- 6 Lift the processor heat sink off of the processor and set the processor heat sink upside down so as not to contaminate the thermal grease.

### Installing a Processor Heat Sink



**NOTE:** New processor heat sinks have Thermal Interface Material (TIM) pre-applied. If installing a new processor heat sink, ignore step 1 and step 2 below.

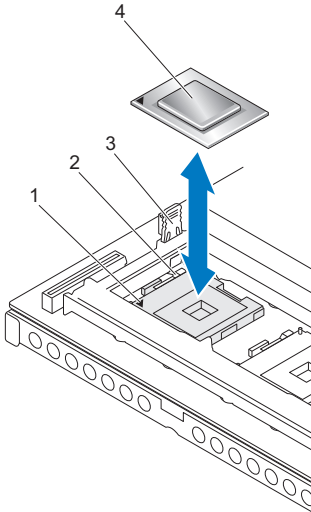
- 1 Using a clean lint-free cloth, remove the existing thermal grease from the processor heat sink.
- 2 Apply thermal grease evenly to the top of the processor while taking care not to use excessive amounts of grease, which could leak out the sides and cause damage to the processor when the heat sink is secured.
- 3 Place the processor heat sink onto the processor. See Figure 3-20.
- 4 Squeeze the sides of the heat-sink retention clip together and press down on the blue tab. When the lower corners of the clip fit into the slots in the socket, release the sides of the clip to lock the processor heat sink in place. See Figure 3-19.

### Removing a Processor


- 1 Remove the processor heat sink. See "Removing a Processor Heat Sink" on page 101.
- 2 Pull the socket-release lever straight up until the processor is released from the socket. See Figure 3-20.




**Figure 3-20. Removing and Installing a Processor**




- |   |                  |   |                      |
|---|------------------|---|----------------------|
| 1 | Pin 1 mark       | 2 | Socket release lever |
| 3 | Blue plastic tab | 4 | Processor            |

 **NOTE:** If you are removing processor 1 or processor 4, pull upward on the blue plastic tab next to the socket to open the socket-release lever.

- 3 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 when removing the processor. Bending the pins can permanently damage the processor.

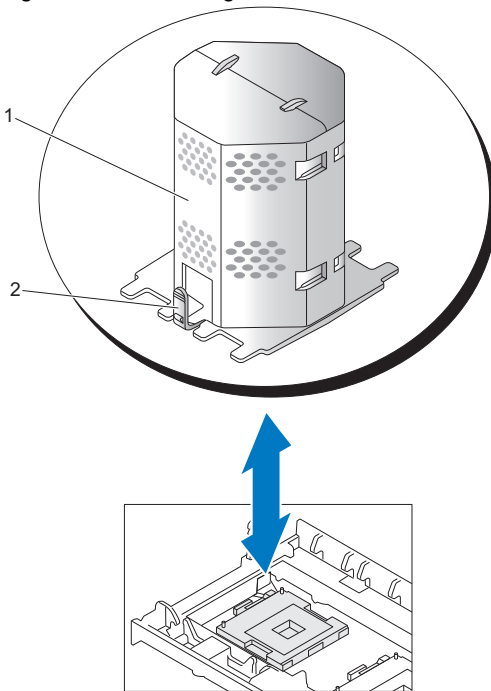
### Installing a Processor

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

- 1 Remove power from the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Removing the Top Cover" on page 60.

- 3** Remove the cooling shroud. See "Removing the Cooling Shroud" on page 76.
- 4** Unpack the new processor.  
If any of the pins on the processor appear bent, see "Getting Help" on page 165.
- 5** If you are adding an additional processor, remove the processor filler blank from the socket by pressing inward on the two tabs on the filler blank and lifting the filler blank out of the system. See Figure 3-21.

**Figure 3-21. Removing a Processor Filler Blank**



**1** Processor filler blank

**2** Tab

- 6** Align the pin-1 corner of the new processor with the pin-1 corner of the ZIF socket. See Figure 3-20.

- ➔ **NOTICE:** Identifying the pin-1 corners is critical to positioning the processor correctly. Pin-1 corners of processors 3 and 4 are opposite orientation of pin-1 corners of processors 1 and 2.

Identify the pin-1 corner of the processor by locating the tiny gold triangle on one corner of the processor. Place this corner in the same corner of the ZIF socket identified by a corresponding triangle.

- 7 Install the processor in the socket.

- ➔ **NOTICE:** Positioning the processor incorrectly can permanently damage the processor and the system when you turn it on. When placing the processor in the socket, be sure that all of the pins on the processor enter the corresponding holes. Be careful not to bend the pins.

- a If the release lever on the processor socket is not positioned all the way up, move it to that position.
- b With the pin-1 corners of the processor and socket aligned, set the processor lightly in the socket, making sure all pins are matched with the correct holes in the socket.

Because the system uses a ZIF processor socket, do not use force, which could bend the pins if the processor is misaligned.

When the processor is positioned correctly, it drops down into the socket with minimal pressure.

- c When the processor is fully seated in the socket, rotate the socket release lever back down until it snaps into place, securing the processor.
- 8 Install the processor heat sink. See "Installing a Processor Heat Sink" on page 104.
  - 9 Reinstall the cooling shroud. See "Installing the Cooling Shroud" on page 77.
  - 10 Close the system. See "Installing the Top Cover" on page 60
  - 11 Connect the system to the electrical outlet, and then turn on the system and attached peripherals.


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


- 12 Press <F2> to enter the System Setup program, and check that the processor information matches the new system configuration. See "System Setup Options" on page 43.
- 13 Run the system diagnostics to verify that the new processor operates correctly.  
See "Running the System Diagnostics" on page 149 for information about running the diagnostics and troubleshooting processor problems.



## System Battery

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

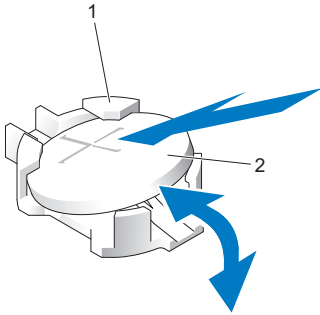
### Replacing the System Battery

 **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 Remove power from the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Remove memory risers 3 and 4 from the system.
- 4 Locate the battery socket. See "System Board Connectors" on page 154.
  -  **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.
- 5 Lift the battery from the system board.

**Figure 3-22. Replacing the System Battery**



1 Battery connector

2 System battery

- 6 Place the new battery with the "+" facing up into the battery connector and gently press down on the battery until it snaps into place.
- 7 Install the memory risers on the left side of the system. See "Installing a Memory Riser" on page 98
- 8 Install the top cover. See "Installing the Top Cover" on page 60.
- 9 Reconnect the system to its electrical outlet and turn the system and any attached peripherals on.
- 10 Enter the System Setup program to confirm that the battery is operating properly. See "Entering the System Setup Program" on page 41.
- 11 Enter the correct time and date in the System Setup program's **Time** and **Date** fields.
- 12 Exit the System Setup program.
- 13 To test the newly installed battery, remove power from the system and disconnect it from the electrical outlet for at least an hour.
- 14 After an hour, reconnect the system to its electrical outlet and turn it on.
- 15 Enter the System Setup program and if the time and date are still incorrect, see "Getting Help" on page 165 for instructions on obtaining technical assistance.

# Activating the NIC TOE

To add TCP/IP Offload Engine (TOE) functionality to the system, install the TOE NIC hardware key in the TOE\_KEY socket on the system board. See "System Board Jumpers and Connectors" on page 153.

## I/O Riser

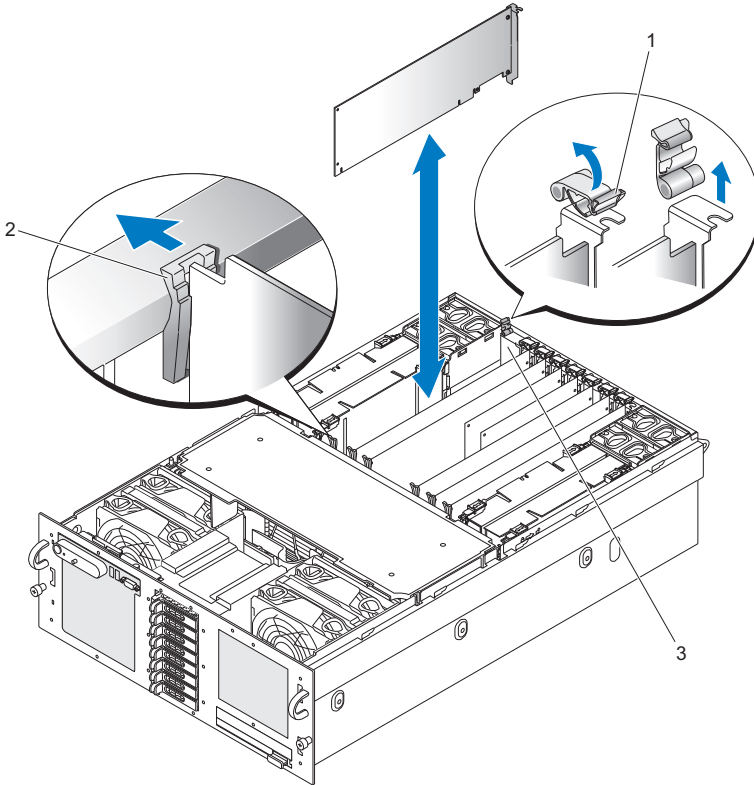
### Removing the I/O Riser



**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 Open the system. See "Removing the Top Cover" on page 60.
- 2 Rotate the retention latch at the back of the card slot into the up position.
- 3 Push the card latch away from the card and lift on the card out of the system.

**Figure 3-23. Removing I/O Riser**



- |   |                 |   |            |
|---|-----------------|---|------------|
| 1 | Retention latch | 2 | Card latch |
| 3 | I/O Riser       |   |            |

### **Installing the I/O Riser**

- 1** Align the I/O riser card with its corresponding card connector on the system board, the card latch (at the front), and the expansion slot (at the back).
- 2** Slide the card down until it seats in its connector.
- 3** Rotate the retention latch at the back of the card slot into the down position.

# Installing a DRAC

The Dell Remote Assistant Card (DRAC) attaches to the I/O riser.

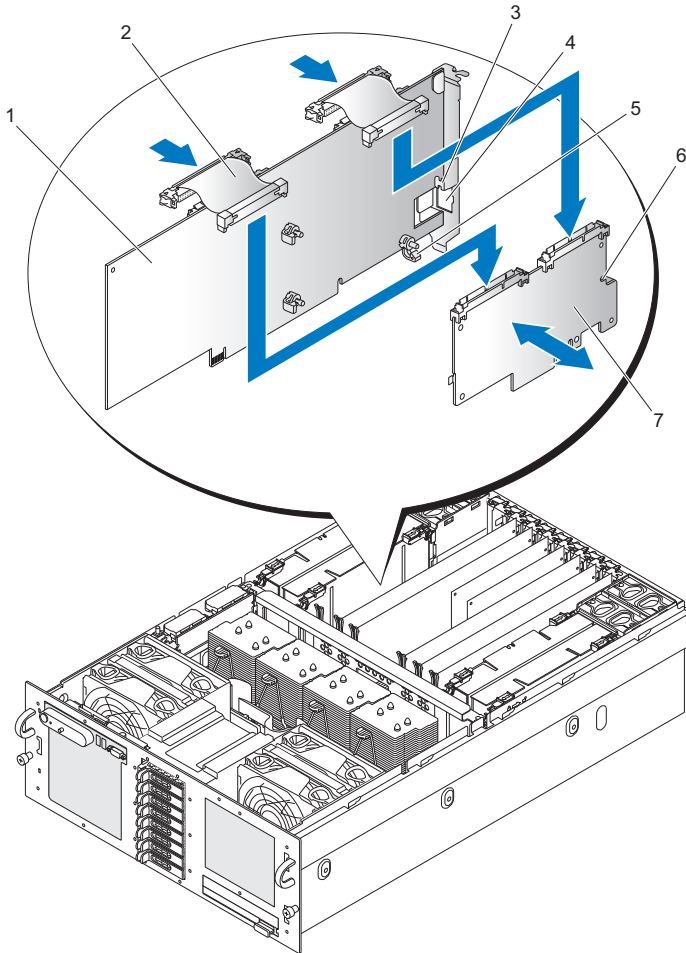


**CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your Product Information Guide for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**



- 1 Open the system. See "Removing the Top Cover" on page 60.
- 2 Remove the I/O riser. See "Removing the I/O Riser" on page 110.
- 3 Align the DRAC network connector with the DRAC mounting hole and align the notch in the DRAC with the metal tab of the I/O riser. See Figure 3-24.



**Figure 3-24. Installing a DRAC**



- |   |                     |   |                    |
|---|---------------------|---|--------------------|
| 1 | I/O Riser           | 2 | Ribbon cable       |
| 3 | I/O Riser metal tab | 4 | DRAC mounting hole |
| 5 | DRAC mounting post  | 6 | DRAC notch         |
| 7 | DRAC                |   |                    |

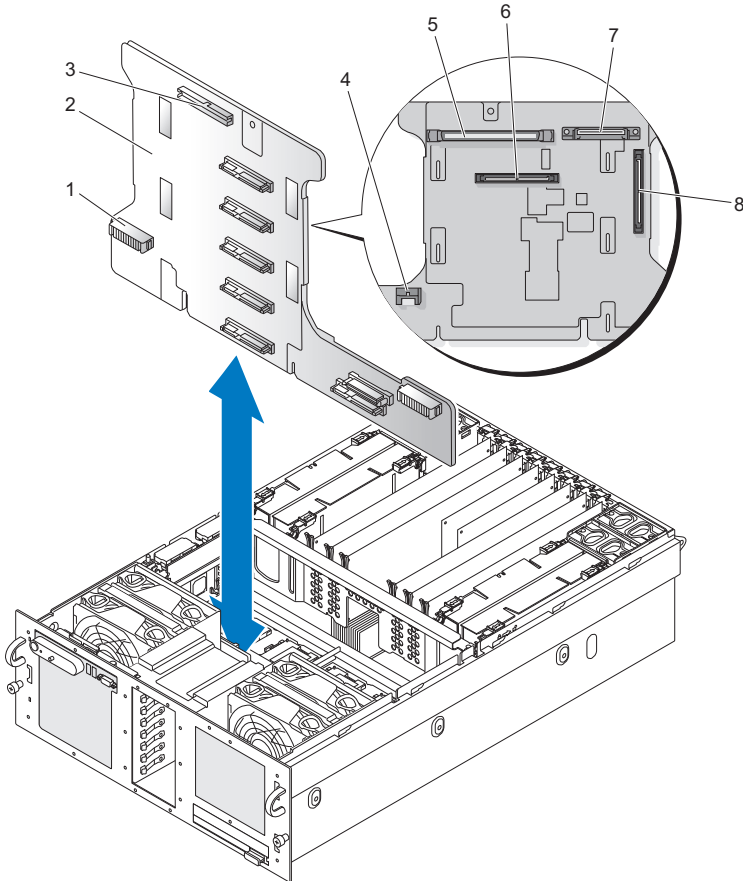
- 4 Slide the DRAC onto the metal tab of the I/O riser.
- 5 Align the DRAC with the three DRAC mounting posts on the I/O riser.  
 **CAUTION:** To prevent damage to components on the I/O riser, support the I/O riser at each of the plastic clips.
- 6 Press the DRAC onto the I/O riser until three DRAC mounting posts snap into place.
- 7 Attach the two ribbon cables from the I/O riser to the DRAC.  
 **NOTE:** The ribbon cables can only be installed one way and they are labeled for correct placement on the DRAC and the system board.
- 8 Install the I/O riser. See "Installing the I/O Riser" on page 111.

## SAS Backplane (Service-only Procedure)

### Removing the SAS Backplane (3.5" Hard Drives)

- 1 Remove the system board. See "Removing the System Board" on page 122.
- 2 Remove the optical drive. See "Removing the Optical Drive" on page 88.
- 3 Remove the hard drives. See "Hard Drives" on page 62.
- 4 Disconnect the control panel connector from the back of the SAS backplane. See Figure 3-25.

**Figure 3-25. Removing the SAS Backplane (3.5-inch Hard Drives)**



- |   |                                 |   |                  |
|---|---------------------------------|---|------------------|
| 1 | Fan connector                   | 2 | SAS backplane    |
| 3 | Control panel connector (front) | 4 | SATA A connector |
| 5 | Control panel connector (back)  | 6 | SAS A connector  |
| 7 | GND/+12V connector              | 8 | SAS B connector  |

- 5** Disconnect the control panel connector from the front of the SAS backplane. See Figure 3-25.

- 6 Disconnect the GND/+12V connector from the SAS backplane. See Figure 3-25.
- 7 Disconnect the SAS A connector from the SAS backplane. See Figure 3-25.
- 8 Disconnect the SATA\_A connector from the SAS backplane. See Figure 3-25.
- 9 Pull the blue plunger on the SAS backplane forward and then lift the SAS backplane up to disengage it from the fan connectors.
- 10 Pull the SAS backplane away from the forward bulkhead of the chassis.

### Installing the SAS Backplane (3.5-inch Hard Drives)



**NOTE:** Installation of the SAS backplane requires that the system board must not be installed in the system.

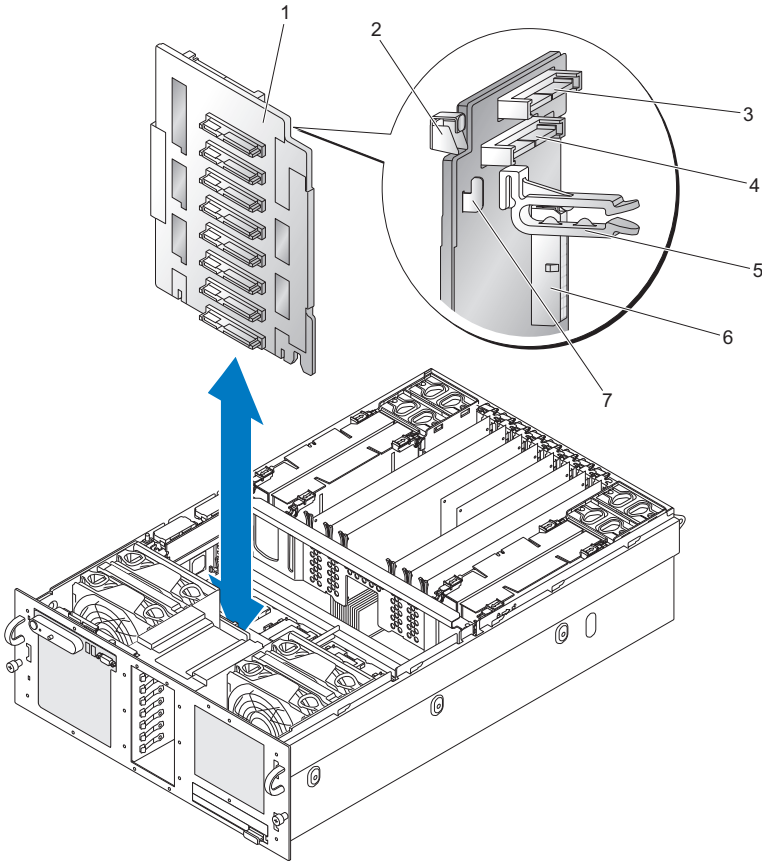
- 1 Position the SAS backplane against the chassis tabs behind the front fans with the fan connections of the SAS backplane directly above their mating connectors.
- 2 Press the SAS backplane down to engage the fan connectors. The blue plunger will snap into place.
- 3 Connect the SATA\_A connector on the SAS backplane. See Figure 3-25.
- 4 Connect the SAS A connector on the SAS backplane. See Figure 3-25.
- 5 Connect the "GND/+12V" connector on the SAS backplane. See Figure 3-25.
- 6 Connect the "Backplane" connector on front of the SAS backplane. See Figure 3-25.
- 7 Connect the "Backplane" connector on back of the SAS backplane. See Figure 3-25.
- 8 Install the hard drives. See "Hard Drives" on page 62.
- 9 Install the optical drive. See "Installing the Optical Drive" on page 89.

### Removing the SAS Backplane (2.5-inch Hard Drives)

- 1 Remove power from the system, including any attached peripherals, and disconnect the system from the electrical outlet.

- 2** Open the system. See "Removing the Top Cover" on page 60.
- 3** Remove the cooling shroud. See "Removing the Cooling Shroud" on page 76.
- 4** Remove the processor heat sinks. See "Removing a Processor Heat Sink" on page 101.
- 5** Remove the hard drives. See "Hard Drives" on page 62.
- 6** Disconnect the SAS A cable from the SAS backplane. See Figure 3-26.

**Figure 3-26. Removing the SAS Backplane (2.5-inch Hard Drives)**



- |   |                 |   |                           |
|---|-----------------|---|---------------------------|
| 1 | SAS backplane   | 2 | Latch                     |
| 3 | SAS A connector | 4 | SAS B connector           |
| 5 | Cable guide     | 6 | Backplane power connector |
| 7 | Chassis hook    |   |                           |

**7** Disconnect the SAS B cable from the SAS backplane. See Figure 3-26.

**8** Remove the cable guide. See Figure 3-26.

- 9 Disconnect the backplane power cable. See Figure 3-26.
- 10 Depress the latch and lift the SAS backplane off the chassis hooks. See Figure 3-26.
- 11 Remove the SAS backplane from the chassis.

### **Installing the SAS Backplane (2.5" Hard Drives)**

- 1 Position the SAS backplane above the chassis hooks. See Figure 3-26.
- 2 Press down on the SAS backplane until the latch clicks.
- 3 Connect the backplane power cable. See Figure 3-26.
- 4 Install the cable guide. See Figure 3-26.
- 5 Connect the SAS B cable to the SAS backplane. See Figure 3-26.
- 6 Connect the SAS A cable from the SAS backplane. See Figure 3-26.
- 7 Install the hard drives. See "Hard Drives" on page 62.
- 8 Install the processor heat sinks. See "Installing a Processor Heat Sink" on page 104.
- 9 Install the cooling shroud. See "Installing the Cooling Shroud" on page 77.
- 10 Close the system. See "Installing the Top Cover" on page 60.

## **Power Interposer Board (Service-only Procedure)**

The Power Interposer Board (PIB) provides power and signals to the 2.5-inch hot-plug hard drive bay.

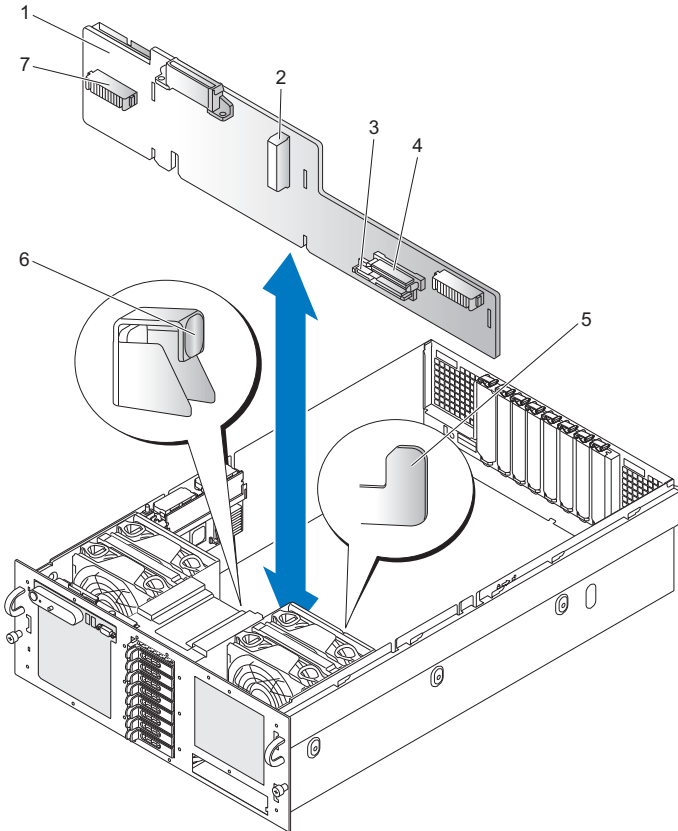


**NOTE:** 3.5-inch systems do not have a Power Interposer Board.

### **Removing the Power Interposer Board**

- 1 Remove the optical drive. See "Removing the Optical Drive" on page 88.
- 2 Remove the SAS backplane. See "Removing the SAS Backplane (2.5-inch Hard Drives)" on page 116.
- 3 Remove the system board. See "Removing the System Board" on page 122.
- 4 Disconnect the control panel connector at the top left of the PIB.
- 5 Disconnect the GND/+12V connector at the top of the PIB.

**Figure 3-27. Removing the Power Interposer Board**



- |   |                              |   |                 |
|---|------------------------------|---|-----------------|
| 1 | Power Interposer Board (PIB) | 2 | PIB power       |
| 3 | SATA_MODULE connector        | 4 | CDROM connector |
| 5 | Chassis hook                 | 6 | Latch           |
| 7 | Fan connector                |   |                 |

- 6 Disconnect the SATA PLANAR connector from the back of the PIB. See Figure 6-7.
- 7 Disconnect the PLANAR connector from the PIB. See Figure 6-7.



- 8 Depress the latch and lift the PIB off the chassis hooks. See Figure 3-27.
- 9 Remove the PIB from the chassis.

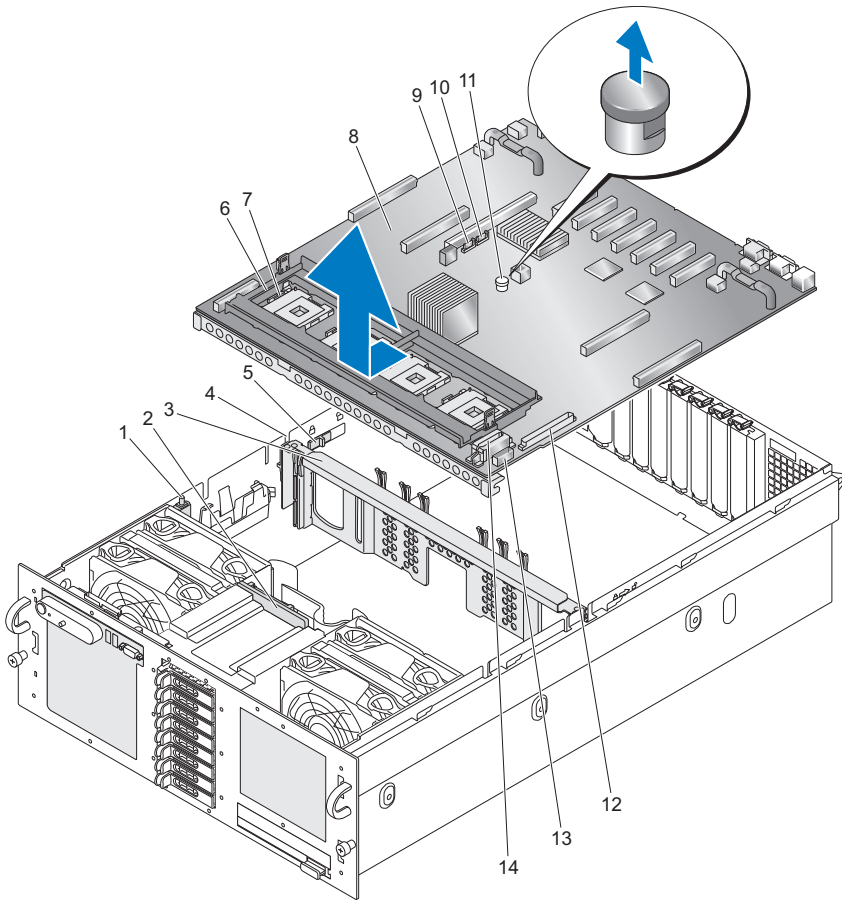
### **Installing the Power Interposer Board**

- 1 Position the Power Interposer board above the chassis hooks. See Figure 3-27.
- 2 Press down on the Power Interposer board until the latch snaps.
- 3 Connect the SATA PLANAR connector to the Power Interposer board.
- 4 Connect the PLANAR connector to the Power Interposer board.
- 5 Connect the control panel connector.
- 6 Install the system board. See "Installing the System Board" on page 124.
- 7 Install the SAS backplane. See "Installing the SAS Backplane (2.5" Hard Drives)" on page 119.
- 8 Install the optical drive. See "Installing the Optical Drive" on page 89.

# System Board (Service-only Procedure)

## Removing the System Board

Figure 3-28. Removing the System Board



- |    |                   |    |                              |
|----|-------------------|----|------------------------------|
| 1  | Intrusion switch  | 2  | SAS backplane                |
| 3  | Center brace      | 4  | Center brace channel         |
| 5  | Center brace lock | 6  | Heat sink retention bracket  |
| 7  | ZIF lever         | 8  | System board                 |
| 9  | SATA_A connector  | 10 | SATA_B connector             |
| 11 | Blue plunger      | 12 | CONTROL PANEL connector      |
| 13 | SIGNAL connector  | 14 | PWR DIST CONN connectors (2) |



**CAUTION: Exercise care when removing the system board to prevent damage to cables, connectors, and components.**

- 1 Ensure power is removed.
- 2 Disconnect any USB, VGA, and serial connections on the back of the chassis.
- 3 Remove the top cover. See "Removing the Top Cover" on page 60.
- 4 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 76.
- 5 Remove the processor heat sinks. See "Removing a Processor Heat Sink" on page 101.
- 6 Remove the SAS controller card. See "Removing a SAS Controller Card" on page 80.
- 7 Remove the RAID battery. See "Removing a RAID Battery" on page 85.
- 8 Disconnect the Intrusion switch from the system board at J1H1.
- 9 Remove the memory risers. See "Removing a Memory Riser" on page 96.
- 10 Remove all PCI Express cards. See "PCI Express Add-in Cards" on page 86.
- 11 Remove the I/O Riser. See "Removing the I/O Riser" on page 110.
- 12 Remove the back fans and fan housings. See "System Fans" on page 70.
- 13 Disconnect SATA\_A from the system board at J3E2.
- 14 Remove the SATA\_A cable from the center brace channel.
- 15 Slide the center brace locks toward the back of the chassis to unlock the center brace, then lift the center brace out of the chassis.

- 16 Lift the ZIF levers on processors 1 and 4 to facilitate removing the heat sink retention bracket.
- 17 Remove the heat sink retention bracket by removing the eight screws that hold it to the system board.
- 18 Disconnect the PWR DIST CONN connectors from the system board at J9K1 and J9K2.
- 19 Disconnect the SIGNAL connector from the system board at J9K3.
- 20 Disconnect the CONTROL PANEL connector from the system board at J9J1.
- 21 Reposition the PWR DIST CONN, SIGNAL, and CONTROL PANEL wiring to facilitate removal of the system board.
- 22 Disconnect SAS\_B connector on the SAS backplane.
- 23 Lift the system board blue plunger, slide the system board forward to disengage it from the chassis, and then lift the system board out of the chassis.

## Installing the System Board



**CAUTION: Exercise care when removing the system board to prevent damage to cables, connectors, and components.**

- 1 Ensure power is removed.
- 2 Position the system board above the chassis with USB, VGA, and serial connectors at the back of the chassis and with the front edge of the system board as far forward within the chassis as possible.
- 3 Tilt the forward edge of the system board down slightly, lower the system board fully into the chassis, and then slide the system board back until the system board blue plunger snaps into place.
- 4 Connect the SIGNAL connector to the system board at J9K3.
- 5 Connect the PWR DIST CONN connectors to the system board at J9K1 and J9K2.
- 6 Connect the CONTROL PANEL connector to the system board at J9J1.
- 7 Connect the SAS\_B connector to the SAS backplane.
- 8 Lift the ZIF levers on processors 1 and 4.

- 9** Install the heat sink retention bracket, ensuring the blue lifts are under the ZIF levers. Secure the heat sink retention bracket with eight screws.
- 10** Lower the ZIF levers on processors 1 and 4.
- 11** Lower the center brace into the chassis until the brace locks snap into place.
- 12** Route the SATA\_A cable through the channel in the center brace.
- 13** Connect the SATA\_A connector to the system board at J3E2.
- 14** Install the back fans and housings. See "System Fans" on page 70.
- 15** Install the I/O riser. See "Installing the I/O Riser" on page 111.
- 16** Install PCI Express cards as necessary. See "PCI Express Add-in Cards" on page 86.
- 17** Install the memory risers. See "Installing a Memory Riser" on page 98.
- 18** Connect the INTRUSION switch to the system board at J1H1 and route the wire next to the chassis.
- 19** Install the RAID battery. See "Installing a RAID Battery" on page 84.
- 20** Install the SAS controller. See "Installing an SAS Controller Card" on page 80.
- 21** Install the processor heat sinks. See "Installing a Processor Heat Sink" on page 104.
- 22** Install the cooling shroud. See "Installing the Cooling Shroud" on page 77.
- 23** Install the top cover. "Installing the Top Cover" on page 60.
- 24** Connect USB, VGA, and SERIAL connections on the back of the chassis as necessary.
- 25** Turn the system on and run the system diagnostics to verify that the system operates correctly.  
See "Running the System Diagnostics" on page 149 for information about running the diagnostics and troubleshooting processor problems.



# 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**

<b>Look/listen for:</b>	<b>Action</b>
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 34.
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 129.

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

<b>Look/listen for:</b>	<b>Action</b>
An unfamiliar constant scraping or grinding sound when you access a drive.	See "Getting Help" on page 165.
The keyboard indicators.	See "Troubleshooting the Keyboard" on page 130.
The USB diskette drive activity indicator.	See "Troubleshooting a USB Device" on page 132.
The USB CD drive activity indicator.	See "Troubleshooting a USB Device" on page 132.
The CD drive activity indicator.	See "Troubleshooting an Optical Drive" on page 141.
The hard drive activity indicator.	See "Troubleshooting a Hard Drive" on page 142.

## 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 129.

### Troubleshooting IRQ Assignment Conflicts

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

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

<b>IRQ Line</b>	<b>Assignment</b>
IRQ0	System timer
IRQ1	Keyboard controller
IRQ2	Interrupt controller 1 to enable IRQ8 through IRQ15
IRQ3	Serial port 2 (COM2 and COM4)
IRQ4	Serial port 1 (COM1 and COM3)



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

<b>IRQ Line</b>	<b>Assignment</b>
IRQ5	Remote access controller
IRQ6	Diskette drive controller
IRQ7	Reserved
IRQ8	Real-time clock
IRQ9	ACPI functions (used for power management)
IRQ10	Available
IRQ11	Available
IRQ12	PS/2 mouse port unless the mouse is disabled through the System Setup program
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 13 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** 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.

- 3** Determine whether the system has monitors attached to both the front and back video connectors.

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

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

- 4** Change the monitor connection from the front to the back (or back to the front). If the problem is not resolved, continue to the next step.
- 5** If the Dell Remote Assistant Card (DRAC) is installed and configured, connect into the DRAC from another computer and run the appropriate online diagnostic test. See "Using PowerEdge Diagnostics" on page 149.

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

If the tests fail, see "Getting Help" on page 165.

## 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 42.
- 2** Examine the keyboard and its cable for signs of damage.
- 3** Swap the faulty keyboard with a known working keyboard.  
If the problem is resolved, replace the faulty keyboard. See "Getting Help" on page 165.
- 4** Run the appropriate online diagnostic test. See "Using PowerEdge Diagnostics" on page 149.

If the problem is not resolved, see "Getting Help" on page 165.

## **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 PowerEdge Diagnostics" on page 149.  
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 known working mouse.  
If the problem is resolved, replace the faulty mouse. See "Getting Help" on page 165.
- 4** Enter the System Setup program and ensure that the USB port is enabled. See "Using the System Setup Program" on page 41.  
If the problem is not resolved, see "Getting Help" on page 165.

## **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 41.

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

3 Run the appropriate online diagnostic test. See "Using PowerEdge Diagnostics" on page 149.

If the tests run successfully but the problem persists, see "Troubleshooting a Serial I/O Device" on page 132.

## Troubleshooting a Serial I/O Device

### Problem

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

### Action

1 Remove power from the system and any peripheral devices connected to the serial port.

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

If the problem is resolved, replace the interface cable.

3 Remove power from 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 165.

## 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 41.

- 2 Remove power from 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 165.
- 5 If possible, swap the interface cable with a known working cable.  
If the problem is resolved, replace the interface cable.  
If the problem persists, see "Getting Help" on page 165.
- 6 Remove power from 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 165.

## Troubleshooting a NIC

### Problem

- NIC cannot communicate with network.

### Action

- 1 Run the appropriate online diagnostic test. See "Running the System Diagnostics" on page 149.
- 2 Check the appropriate indicator on the NIC connector. See "NIC Indications" on page 22.
  - 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 41.
- 5 Ensure that the NICs, hubs, and switches on the network are all set to the same data transmission speed. See the network equipment documentation.
- 6 Ensure that all network cables are of the proper type and do not exceed the maximum length. See Network Cable Requirements in your *Getting Started Guide*.

## 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 Remove power from the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Remove all expansion cards installed in the system. See "PCI Express Add-in Cards" on page 86.
- 4 Let the system dry thoroughly for at least 24 hours.
- 5 Reinstall all expansion cards installed in the system. See "PCI Express Add-in Cards" on page 86.

- 6 Close the system. See "Installing the Top Cover" on page 60.
- 7 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 165.
- 8 If the system starts properly, shut down the system and reinstall all of the expansion cards that you removed. See "PCI Express Add-in Cards" on page 86.
- 9 Run the appropriate online diagnostic test. See "Using PowerEdge Diagnostics" on page 149.  
If the tests fail, see "Getting Help" on page 165.

## 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 "Removing the Top Cover" on page 60.
- 2 Ensure that the following components are properly installed:
  - Expansion cards and risers
  - Power supplies
  - Fans
  - Processors and processor heat sinks
  - Memory modules
  - Drive-carrier connections to the SAS backplane, if applicable
- 3 Ensure that all cables are properly connected.
- 4 Close the system. See "Installing the Top Cover" on page 60.

- 5 Run the system board tests in the system diagnostics. See "Executing System Diagnostics" on page 150.

If the tests fail, see "Getting Help" on page 165.

## 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 41.
- 2 Remove power from 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 with a CR2032 battery only. See "System Battery" on page 108.

If the problem is not resolved by replacing the battery, see "Getting Help" on page 165.



**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 PowerEdge Diagnostics" on page 149.
- 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 68.

- 3 Ensure that the power supply is properly installed by removing and reinstalling it. See "Removing a Power Supply" on page 68 and "Installing a Power Supply" on page 69.



**NOTE:** After installing a power supply, allow several seconds for the system to recognize the power supply and to determine if it is working properly. The power indicator turns green to signify that the power supply is functioning properly. 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 68.

- 5 Install a new power supply. See "Installing a Power Supply" on page 69. If the problem persists, see "Getting Help" on page 165.

## Troubleshooting System Cooling

### 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 138.

## 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 PowerEdge Diagnostics" on page 149.
- 2 Open the system. See "Removing the Top Cover" on page 60.



**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 3-1.
- 4 Ensure that the faulty fan's power cable is firmly attached to the fan power connector. See "System Fans" on page 70.



**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 70.

If the replacement fan is working properly, close the system. See "Installing the Top Cover" on page 60.

If the replacement fan does not operate, see "Getting Help" on page 165.

## 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 Run the appropriate online diagnostic test. See "Using PowerEdge Diagnostics" on page 149.
- 2 Turn on the system and attached peripherals.  
If an error message does not appear, continue to the next step.  
If an error messages appears, go to step 14.
- 3 Enter the System Setup program and check the system memory setting. See "Entering the System Setup Program" on page 41.

If the amount of memory installed matches the system memory setting, go to step 14.

- 4 Remove power from the system and attached peripherals, and disconnect the system from the electrical outlet.
- 5 Open the system. See "Removing the Top Cover" on page 60.
- 6 Remove the memory risers. See "Removing a Memory Riser" on page 96.
- 7 Remove the memory riser covers. See "Removing the Memory Riser Cover" on page 99.
- 8 Reseat the memory modules in their sockets. See "Installing Memory Modules" on page 99.
- 9 Install the memory riser covers. See "Removing the Memory Riser Cover" on page 99.
- 10 Install the memory risers. See "Installing a Memory Riser" on page 98.
- 11 Close the system. See "Installing the Top Cover" on page 60.
- 12 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.
- 13 Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 41.

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

- a Remove power from the system and attached peripherals, and disconnect the system from its electrical outlet.
  - b Open the system. See "Removing the Top Cover" on page 60.
-  **NOTE:** Several configurations for memory modules exist; see "General Memory Module Installation Guidelines" on page 92.
- c Swap the memory module in socket 1 with another of the same capacity. See "Installing Memory Modules" on page 99.
  - d Close the system. See "Installing the Top Cover" on page 60.
  - e Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.
  - f As the system boots, observe the monitor screen and the indicators on the keyboard.

- 14** If a memory error occurs:
- a** Remove power from the system and attached peripherals, and disconnect the system from its electrical outlet.
  - b** Open the system. See "Removing the Top Cover" on page 60.
  - c** Perform step c through step f in step 13 for each memory module installed.

If the problem persists, see "Getting Help" on page 165.

## 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 drive's Optical Drive Controller is enabled. See "Using the System Setup Program" on page 41.
- 3** Run the appropriate online diagnostic test. See "Using PowerEdge Diagnostics" on page 149.
- 4** Remove power from the system and attached peripherals, and disconnect the system from the electrical outlet.
- 5** Open the system. See "Removing the Top Cover" on page 60.
- 6** Ensure that the interface cable is securely connected to the optical drive and to the backplane.
- 7** Close the system. See "Installing the Top Cover" on page 60.
- 8** 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 165.

## 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. If possible, back up all files on the hard drive before you proceed.

- 1 Run the appropriate online diagnostics test. See "Using PowerEdge Diagnostics" on page 149.

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

- 2 If you are experiencing problems with multiple hard drives, skip to step 7. For a problem with a single hard drive, continue to the next step.
- 3 Remove power from your system, reseal the hard drive, and restart the system.
- 4 If your system has a SAS RAID controller 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.

- 5 Ensure that the required device drivers for your controller card are installed and are configured correctly. See the operating system documentation for more information.



**NOTICE:** Do not perform the following step if you have a SAS RAID controller card.

- 6 If you have the non-RAID SAS controller card, 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 65.

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 165.

If the hard drive functioned properly in another bay but does not function in the original bay, the SAS backplane has a defective connector. See "Getting Help" on page 165.

- 7 Check the cable connections inside the system:
  - a Remove power from the system, including any attached peripherals, and disconnect the system from the electrical outlet.
  - b Open the system. See "Removing the Top Cover" on page 60.
  - c Verify that the cable connections between SAS backplane(s) and the SAS card are correct. See "Installing an SAS Controller Card" on page 80.
  - d Verify that the SAS cables are securely seated in their connectors.
  - e Verify that the power connectors on the SAS backplane(s) are securely seated in their connectors.
  - f Close the system. See "Installing the Top Cover" on page 60.
  - 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 165.

# Troubleshooting a SAS or SAS RAID Controller Card



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

## Problem

- Error message indicates a problem with the SAS or SAS RAID controller card.
- SAS or SAS RAID controller 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 PowerEdge Diagnostics" on page 149.
- 2 Enter the System Setup program and ensure that the SAS or SAS RAID controller card is enabled. See "Using the System Setup Program" on page 41.
- 3 Restart the system and press the applicable key sequence to enter the configuration utility program:
  - <Ctrl><c> for a SAS controller
  - <Ctrl><r> for a SAS RAID controllerSee 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 power from the system and attached peripherals, and disconnect the system from its electrical outlet.
- 6 Open the system. See "Removing the Top Cover" on page 60.



- 7 Ensure that the controller card is firmly seated in its connector. See "SAS Controller Card" on page 78.
- 8 If you have a SAS RAID controller card, ensure that the following RAID components are properly installed and connected:
  - Memory module
  - Battery
- 9 Verify that the cable connections between the SAS backplane(s) and the SAS controller card are correct. See "Installing an SAS Controller Card" on page 80.
- 10 Ensure that the cables are firmly connected to the SAS controller card and the SAS backplane.
- 11 Close the system. See "Installing the Top Cover" on page 60.
- 12 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals. If the problem persists, proceed as follows:
  - If you have a SAS controller card, see "Getting Help" on page 165.
  - If you have a SAS RAID controller card, replace the SAS RAID card battery. See "Installing a RAID Battery" on page 84. If replacing the battery does not solve the problem, see "Getting Help" on page 165.

## 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 41.
- 2** Remove power from the system and attached peripherals, and disconnect the system from the electrical outlet.
- 3** Open the system. See "Removing the Top Cover" on page 60.
- 4** Ensure that each expansion card is firmly seated in its connector. See "PCI Express Add-in Cards" on page 86.
- 5** Close the system. See "Installing the Top Cover" on page 60.
- 6** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.  
If the problem persists, go to the next step.
- 7** Remove power from the system and attached peripherals, and disconnect the system from the electrical outlet.
- 8** Open the system. See "Removing the Top Cover" on page 60.
- 9** Remove all expansion cards installed in the system. See "PCI Express Add-in Cards" on page 86.
- 10** Close the system. See "Installing the Top Cover" on page 60.
- 11** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 12** Run the appropriate online diagnostic test.  
If the tests fail, see "Getting Help" on page 165.
- 13** For each expansion card you removed in step 9, perform the following steps:
  - a** Remove power from the system and attached peripherals, and disconnect the system from the electrical outlet.
  - b** Open the system. See "Removing the Top Cover" on page 60.
  - c** Reinstall one of the expansion cards.
  - d** Close the system. See "Installing the Top Cover" on page 60.
  - e** Run the appropriate diagnostic test.  
If the tests fail, see "Getting Help" on page 165.

# Troubleshooting Processors

## Problem


- Error message indicates a processor problem.
- Front panel status LCD indicates a problem with the processors or system board.
- A processor 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 PowerEdge Diagnostics" on page 149.
- 2 Remove power from the system and attached peripherals, and then disconnect the system from the electrical outlet.
- 3 Open the system. See "Removing the Top Cover" on page 60.
- 4 Ensure that each processor and processor heat sink is properly installed. See "Processors" on page 101.
- 5 Close the system. See "Installing the Top Cover" on page 60.
- 6 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 7 Run the appropriate online diagnostic test.
- 8 If the tests fail or the problem persists, continue to the next step.
- 9 If only one processor is installed, see "Getting Help" on page 165, otherwise continue to the next step.
- 10 Perform the following steps for each processor until a faulty processor is identified:
  - a Remove power from the system and attached peripherals, and then disconnect the system from the electrical outlet.
  - b Open the system. See "Removing the Top Cover" on page 60.

- c Remove all the processors. See "Processors" on page 101.
  - d Install a processor into the socket for processor 1. See "Processors" on page 101.
-  **NOTE:** To locate the processors, see Figure 3-1.
- e Close the system. See "Installing the Top Cover" on page 60.
  - f Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
  - g Run the appropriate online diagnostic test.
  - h If the test completes successfully, then repeat steps a through g.
  - i If the test fails, the processor in the system is faulty. See "Getting Help" on page 165.
- 11** Reinstall the processors. See "Processors" on page 101.

# 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 PowerEdge Diagnostics

To assess a system problem, first use the online PowerEdge 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 and keyboard) are functioning, you can use the system diagnostics to help identify the problem.


## Executing 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.

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

Testing Option	Function
Extended Test	Performs a more thorough check of the system. This test can take an hour or longer.
Custom Test	Tests a particular device.
Information	Displays test results.

## Using the Custom Test Options

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

### Selecting Devices for Testing

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

### Selecting Diagnostics Options

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

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

## Viewing Information and Results

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

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



# 6

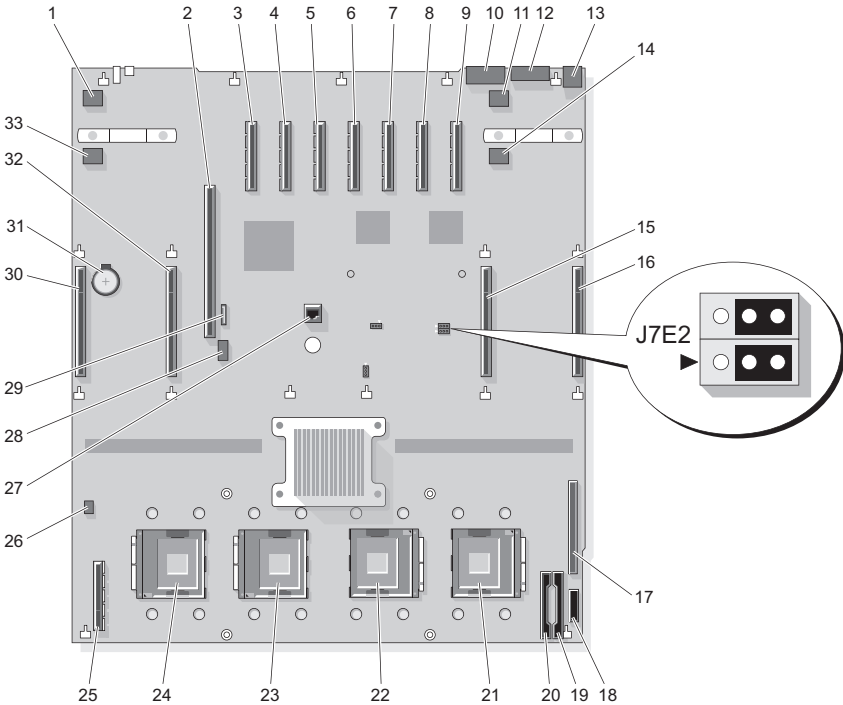
## Jumpers and Connectors

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

### System Board Jumpers and Connectors

Figure 6-1 shows the location of the configuration jumpers and connectors on the system board. Table 6-1 lists the jumper settings. Table 6-2 shows the location and describes the system board connectors.

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



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

Jumpers	Location	Setting	Description
Clear NVRAM	J7E2	1 - 3	Clear NVRAM
		3 - 5 (default)	Normal mode
Password enable	J7E2	2 - 4	Enable password
		4 - 6 (default)	Disable password

## System Board Connectors

See Figure 6-1 and Table 6-2 for the location and description of system board connectors.

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

	<b>Connector</b>	<b>Description</b>
1	J1A1	FAN 7
2	J3E3	I/O RISER
3	J4A3	PCIE_X4_7
4	J4A4	PCIE_X4_6
5	J5A1	PCIE_X4_5
6	J5A2	PCIE_X8_4
7	J6A1	PCIE_X8_3
8	J7A1	PCIE_X8_2
9	J7A2	PCIE_X8_1
10	J8A1	SERIAL
11	J8B2	FAN 6
12	J8A2	VGA
13	J9A1	USB_1-2
14	J8A3	FAN 8
15	J8F1	MEMORY RISER_B
16	J9D1	MEMORY RISER_A
17	J9J1	CONTROL PANEL
18	J9K3	PWR DIST CONN
19	J9K1	PWR DIST CONN
20	J9K2	PWR DIST CONN
21	CPU 1	Processor 1
22	CPU 2	Processor 2
23	CPU 3	Processor 3
24	CPU 4	Processor 4
25	J1K1	INT STORAGE
26	J1H1	INTRUSION

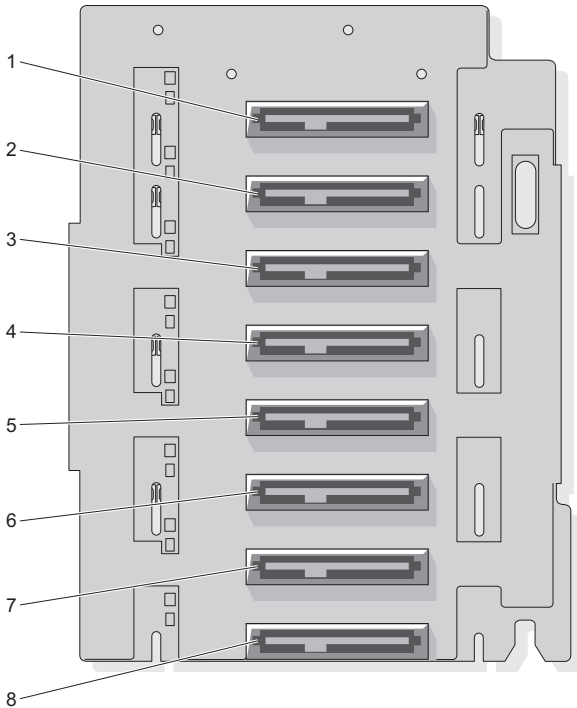
**Table 6-2. System Board Connectors**

	<b>Connector</b>	<b>Description</b>
27	J5E1	TOE KEY HEADER
28	J3E4	INT-USB
29	J3E2	SATA_A
30	J1F1	MEMORY RISER_D
31	XBT1D1	BATTERY
32	J2D2	MEMORY RISER_C
33	J1B2	FAN 5

## **SAS Backplane Connectors**

Figure 6-3 shows the locations of the connectors on the SAS backplane for 2.5-inch systems.

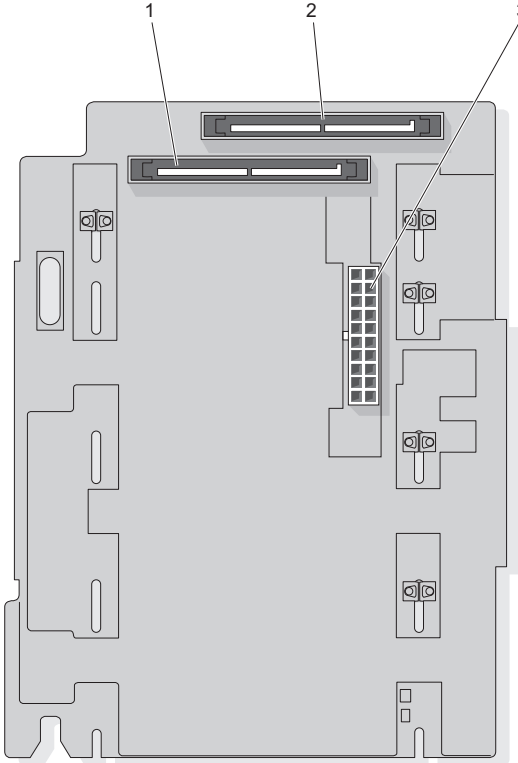
**Figure 6-2. SAS Backplane Connectors (2.5-Inch System) (Front)**



- 1 Drive 0
- 3 Drive 2
- 5 Drive 4
- 7 Drive 6

- 2 Drive 1
- 4 Drive 3
- 6 Drive 5
- 8 Drive 7

**Figure 6-3. SAS Backplane Connectors (2.5-Inch System) (Back)**



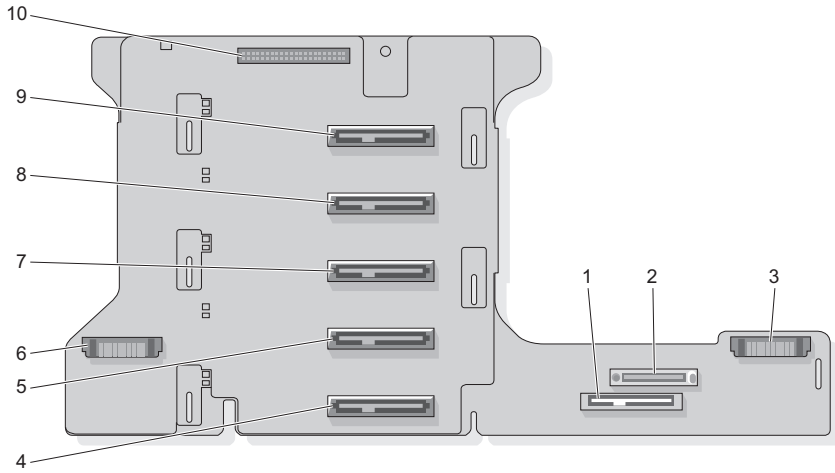
1 SAS B

2 SAS\_A

3 Backplane power

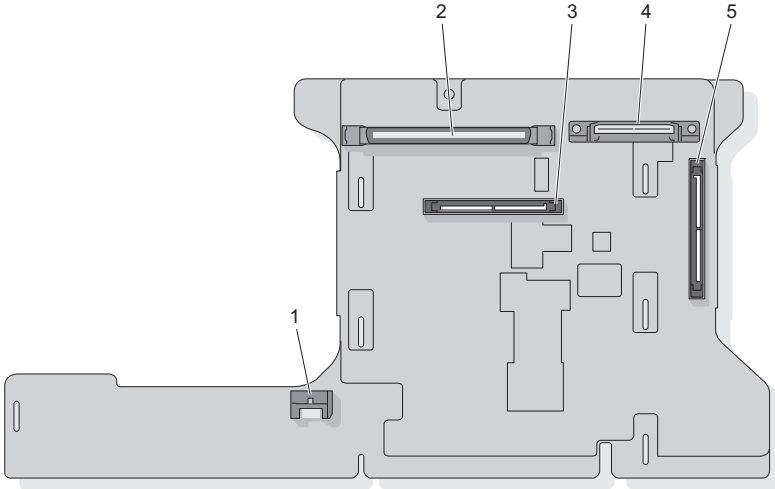
Figure 6-4 and Figure 6-5 show the locations of the connectors on the SAS backplane for 3.5-inch systems.

**Figure 6-4. SAS Backplane Connectors: 3.5-inch x5 Option (Front)**



- |   |              |    |               |
|---|--------------|----|---------------|
| 1 | SATA_MODULE  | 2  | CDROM         |
| 3 | Fans (right) | 4  | Hard disk 4   |
| 5 | Hard disk 3  | 6  | Fans (left)   |
| 7 | Hard disk 2  | 8  | Hard disk 1   |
| 9 | Hard disk 0  | 10 | Control panel |

**Figure 6-5. SAS Backplane Connectors: 3.5-inch x5 Option (Back)**



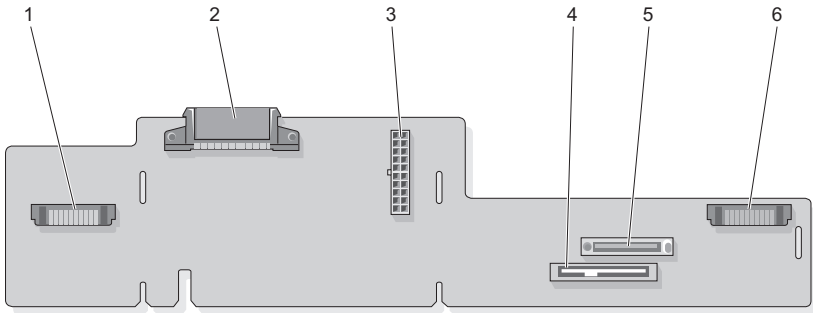
- |   |             |   |               |
|---|-------------|---|---------------|
| 1 | SATA_A      | 2 | Control Panel |
| 3 | Backplane B | 4 | GND/+12V      |
| 5 | Backplane A |   |               |

## Power Interposer Connectors

Figure 6-6 and Figure 6-7 show the locations for the Power Interposer connections on 2.5-inch systems.

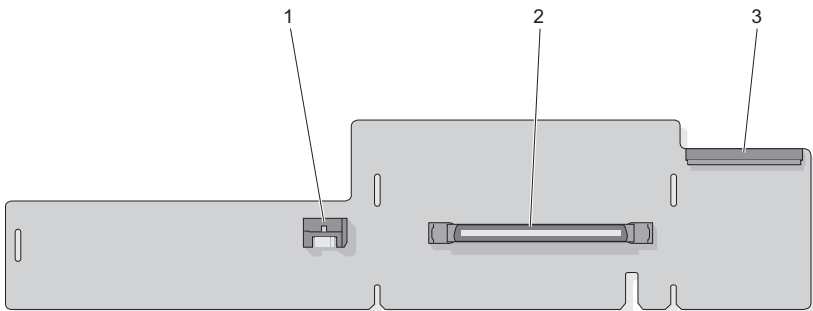


**Figure 6-6. Power Interposer Connectors: 2.5-inch x8 Option (Front)**



- |   |                 |   |             |
|---|-----------------|---|-------------|
| 1 | Fan             | 2 | GND/+12v    |
| 3 | Backplane power | 4 | SATA_MODULE |
| 5 | CDROM           | 6 | FAN         |

**Figure 6-7. Power Interposer Connectors: 2.5-inch x8 Option (Back)**



- |   |               |   |        |
|---|---------------|---|--------|
| 1 | SATA_PLANAR   | 2 | PLANAR |
| 3 | Control panel |   |        |

# 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 41. 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 Remove power from the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Removing the Top Cover" on page 60.
- 3 Remove any expansion cards in slots 1 and 2 to gain access to the password jumper.
- 4 Remove the jumper plug from the password jumper. See Figure 6-1 to locate the password jumper (labeled "J7E2") on the system board.
- 5 Reinstall any expansion cards removed in step 3.
- 6 Close the system.
- 7 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.

- 8 Remove power from the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 9 Open the system. See "Removing the Top Cover" on page 60.
- 10 Remove any expansion cards in slots 1 and 2 to gain access to the password jumper.
- 11 Install the jumper plug on the password jumper.
- 12 Reinstall any expansion cards removed in step 10.
- 13 Lower the memory module shroud.
- 14 Close the system.

- 15** Reconnect your system and peripherals to their electrical outlets, and turn on the system.
- 16** 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 50.



# Getting Help

## Obtaining Assistance

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

- 1 See "Troubleshooting Your System" on page 127 for information and procedures that pertain to the problem your computer is experiencing.
- 2 See "Running the System Diagnostics" on page 149 for procedures on how to run Dell Diagnostics.
- 3 Fill out the "Diagnostics Checklist" on page 169.
- 4 Use Dell's extensive suite of online services available at Dell Support ([support.dell.com](http://support.dell.com)) for help with installation and troubleshooting procedures. See "Online Services" on page 166 for a more extensive list of Dell Support online.
- 5 If the preceding steps have not resolved the problem, see "Contacting Dell" on page 170.



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



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

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

For instructions on using the Dell Support, see "Support Service" on page 167.



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

## Online Services

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

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

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

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

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

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

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

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

- Dell Support websites  
[support.dell.com](http://support.dell.com)  
[support.jp.dell.com](http://support.jp.dell.com) (Japan only)  
[support.euro.dell.com](http://support.euro.dell.com) (Europe only)
- Dell Support e-mail addresses  
**[mobile\\_support@us.dell.com](mailto:mobile_support@us.dell.com)**  
**[support@us.dell.com](mailto:support@us.dell.com)**  
**[la-techsupport@dell.com](mailto:la-techsupport@dell.com)** (Latin America and Caribbean countries only)  
**[apsupport@dell.com](mailto:apsupport@dell.com)** (Asian/Pacific countries only)
- Dell Marketing and Sales e-mail addresses  
**[apmarketing@dell.com](mailto:apmarketing@dell.com)** (Asian/Pacific countries only)  
**[sales\\_canada@dell.com](mailto:sales_canada@dell.com)** (Canada only)
- Anonymous file transfer protocol (FTP)  
**[ftp.dell.com](ftp://ftp.dell.com)**

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

## **Automated Order-Status Service**

To check on the status of any Dell products that you have ordered, you can go to [support.dell.com](http://support.dell.com), or you can call the automated order-status service. A recording prompts you for the information needed to locate and report on your order. For the telephone number to call for your region, see "Contacting Dell" on page 170.

## **Support Service**

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

To contact Dell's support service, see "Before You Call" on page 168 and then see the contact information for your region.

## **Dell Enterprise Training and Certification**

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

## **Problems With Your Order**

If you have a problem with your order, such as missing parts, wrong parts, or incorrect billing, contact Dell for customer assistance. Have your invoice or packing slip handy when you call. For the telephone number to call for your region, see "Contacting Dell" on page 170.

## **Product Information**

If you need information about additional products available from Dell, or if you would like to place an order, visit the Dell website at [www.dell.com](http://www.dell.com). For the telephone number to call for your region or to speak to a sales specialist, see "Contacting Dell" on page 170.

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

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

- 1 Call Dell to obtain a Return Material Authorization Number, and write it clearly and prominently on the outside of the box.  
For the telephone number to call for your region, see "Contacting Dell" on page 170.
- 2 Include a copy of the invoice and a letter describing the reason for the return.
- 3 Include a copy of the Diagnostics Checklist (see "Diagnostics Checklist" on page 169), indicating the tests that you have run and any error messages reported by the Dell Diagnostics (see "Running the System Diagnostics" on page 149).
- 4 Include any accessories that belong with the item(s) being returned (such as power cables, media such as CDs and diskettes, and guides) if the return is for credit.
- 5 Pack the equipment to be returned in the original (or equivalent) packing materials.

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

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

## Before You Call



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

Remember to fill out the Diagnostics Checklist (see "Diagnostics Checklist" on page 169). If possible, turn on your computer before you call Dell for assistance and call from a telephone at or near the computer. You may be asked to type some commands at the keyboard, relay detailed information during operations, or try other troubleshooting steps possible only at the computer itself. Ensure that the computer documentation is available.



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



## **Diagnostics Checklist**

Name:

Date:

Address:

Phone number:

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

Express Service Code:

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

Operating system and version:

Devices:

Expansion cards:

Are you connected to a network? Yes No

Network, version, and network adapter:

Programs and versions:

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

Error message, beep code, or diagnostic code:

Description of problem and troubleshooting procedures you performed:

## Contacting Dell

For customers in the United States, call 800-WWW.DELL (800.999.3355).



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

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

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

# Glossary

**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 communications between the processor and peripheral devices and 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.

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

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

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

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

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

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

**DC** — Direct current.

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

the output.

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

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

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

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

**DIN** — Deutsche Industrie Norm.

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

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

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

**DNS** — Domain Name System. A method of translating Internet domain names, such as `www.dell.com`, into IP addresses, such as `143.166.83.200`.

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

**DVD** — Digital versatile disc.

**ECC** — Error checking and correction.

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

**EMC** — Electromagnetic compatibility.

**EMI** — Electromagnetic interference.

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

**ESD** — Electrostatic discharge.

**ESM** — Embedded server management.

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

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

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

**F** — Fahrenheit.

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

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

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

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

**FT** — Feet.

**FTP** — File transfer protocol.

**G** — Gram(s).

**G** — Gravities.

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

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

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

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

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

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

**HEADLESS SYSTEM** — A system or device that functions without having a keyboard, mouse, or monitor attached. Normally, headless systems are managed over a network using an Internet browser.

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

**Hz** — Hertz.

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

**ID** — Identification.

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

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

**INTERNAL PROCESSOR CACHE** — An instruction and data cache built into the processor.

**IP** — Internet Protocol.

**IPX** — Internet package exchange.

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

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

**K** — Kilo-; 1000.

**Kb** — Kilobit(s); 1024 bits.

**KB** — Kilobyte(s); 1024 bytes.

**KBPS** — Kilobit(s) per second.

**KBPS** — Kilobyte(s) per second.

**KEY COMBINATION** — A command requiring you to press multiple keys at the same time (for example, <Ctrl><Alt><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** — A UNIX-like operating system that runs on a variety of hardware systems. Linux is open source software, which is freely available; however, the full distribution of Linux along with technical support and training are available for a fee from vendors such as Red Hat Software.

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

**LVD** — Low voltage differential.

**M** — Meter(s).

**MA** — Milliamper(e)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).

**MOTHERBOARD** — See system board.

**MS** — Millisecond(s).

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

**MT/s** — Million transfers per second.

**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, and 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.

**TOE** — TCP/IP Offload Engine.

**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** — An operating system written in the C programming language. A precursor to Linux.

**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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