

Dell™ PowerEdge™ 6950 Systems

Hardware Owner's Manual

Notes, Notices, and Cautions



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



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



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

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About Your System

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

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

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

Other Information You May Need



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

- The *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 and read the updates first because they often supersede information in other documents.

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

Accessing System Features During Startup

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

Table 1-1. Keystrokes for Accessing System Features

| Keystroke | Description |
|-----------|---|
| <F2> | Enters the System Setup program. See "Using the System Setup Program" on page 31. |
| <F10> | Enters the System Diagnostics program. See "Running the System Diagnostics" on page 118. |
| <F11> | Enters the boot mode selection screen, allowing you to choose a boot device. |
| <F12> | Exits PXE boot. |
| <Ctrl+E> | Enters the Baseboard Management Controller (BMC) Management Utility, which allows access to the system event log (SEL). See the <i>BMC User's Guide</i> for more information on setup and use of BMC. |
| <Ctrl+C> | Enters the SAS Configuration Utility. See your SAS adapter <i>User's Guide</i> for more information. |
| <Ctrl+S> | Option is displayed only if you have PXE support enabled through the System Setup Program (see "Integrated Devices Screen" on page 36). This keystroke allows you to configure NIC settings for PXE boot. For more information, see the documentation for the integrated NIC. |
| <Ctrl+D> | If you have the optional Dell Remote Access Controller (DRAC) installed, 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, and connectors located behind the optional rack bezel on the system's front panel.

Figure 1-1. Front-Panel Features and Indicators

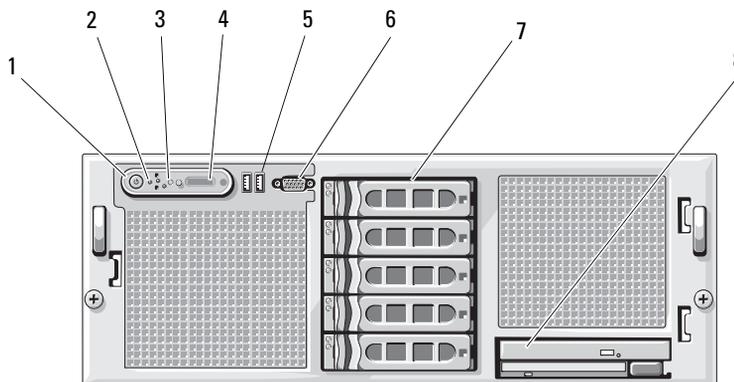


Table 1-2. Front-Panel LED Indicators, Buttons, and Connectors

| Item | Indicator, Button, or Connector | Icon | Description |
|------|----------------------------------|---|--|
| 1 | Power-on indicator, power button |  | <p>The power button controls the DC power supply output to the system.</p> <p>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.</p> |
| 2 | NMI button |  | <p>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.</p> <p>Use this button only if directed to do so by qualified support personnel or by the operating system's documentation.</p> |
| 3 | System identification button |  | <p>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 blue system status indicator on the front and back blinks until one of the buttons is pushed again.</p> |

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

| Item | Indicator, Button, or Connector | Icon | Description |
|------|---|---|--|
| 4 | LCD display | | <p>Provides system ID, status information, and system error messages.</p> <p>The LCD display 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.</p> <p>The LCD display lights amber when the system needs attention due to a problem with power supplies, fans, system temperature, or hard drives.</p> <p>NOTE: If the system is connected to AC power and an error has been detected, the LCD display lights amber regardless of whether the system has been powered on.</p> |
| 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 (optional) | | Five 3.5" drives. |
| 8 | Optical drive and diskette drive (optional) | | Optional slimline optical drive and diskette drive |

NOTE: DVD devices are data only.

Hard-Drive Indicator Codes

The hard-drive carriers have two indicators—a drive-activity indicator and a drive-status indicator. See Figure 1-2.

Figure 1-2. Hard-Drive Indicators

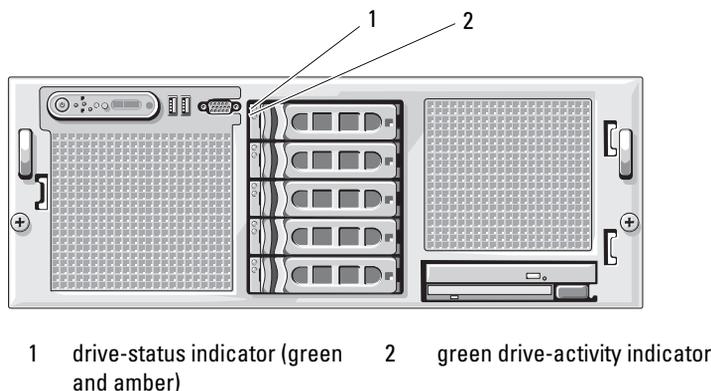


Table 1-3 lists the drive indicator patterns for RAID hard drives. Different patterns are displayed as drive events occur in the system. For example, if a hard drive fails, the "drive failed" pattern appears. After the drive is selected for removal, the "drive being prepared for removal" pattern appears,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

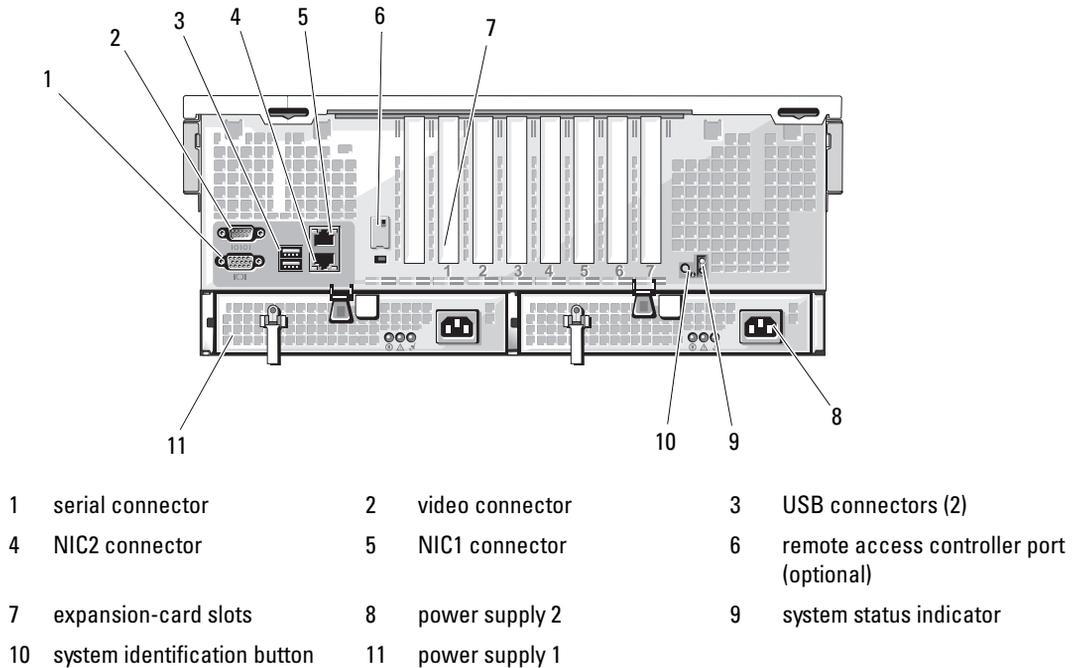
Table 1-3. Hard-Drive Indicator Patterns for RAID

| Condition | Drive-Status Indicator Pattern |
|--------------------------------------|---|
| Identify drive/preparing for removal | Blinks green two times per second |
| Drive ready for insertion or removal | Off NOTE: The drive status indicator remains off until all hard drives are initialized after system power is applied. Drives are not ready for insertion or removal during this time. |
| Drive predicted failure | Blinks green, amber, and off. |
| Drive failed | Blinks amber four times per second. |
| Drive rebuilding | Blinks green slowly. |
| Drive online | Steady green. |
| Rebuild halted | Blinks green three seconds, amber three seconds, and off six seconds. |

Back-Panel Features and Indicators

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

Figure 1-3. Back-Panel Features and Indicators



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 is 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 121. For information about enabling, disabling, and configuring I/O ports and connectors, see "Using the System Setup Program" on page 31.

Power Indicator Codes

The power button on the front panel controls the power input to the system's power supplies. The power indicator can provide information on power status (see Figure 1-1). Table 1-4 lists the power button indicator codes.

Table 1-4. Power Button Indicators

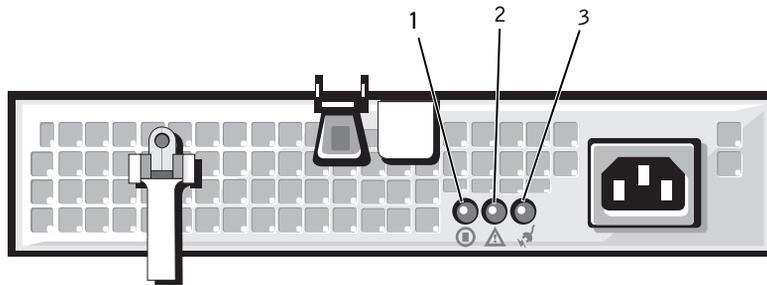
| Indicator | Function |
|-----------|---|
| On | Indicates that power is supplied to the system and the system is operational. |
| Off | Indicates that no power is supplied to the system. |

The indicators on the power supplies show whether power is present or whether a power fault has occurred (see Figure 1-4).

Table 1-5. 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. |

Figure 1-4. Power Supply Indicators



- 1 power supply status indicator 2 power supply fault indicator 3 AC line status indicator

NIC Indicator Codes

Each NIC on the system back panel has an indicator that provides information on network activity and link status. See Figure 1-5. Table 1-6 lists the NIC indicator codes.

Figure 1-5. NIC Indicators

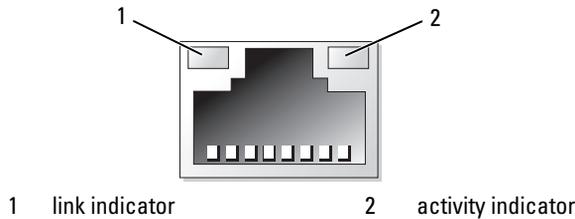


Table 1-6. NIC Indicator Codes

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

LCD Status Messages

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

The LCD lights blue to indicate a normal operating condition, and lights amber to indicate an error condition. The LCD scrolls a message that includes a status code followed by descriptive text. Table 1-7 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 129.

Table 1-7. LCD Status Messages

| Line 1 Message | Line 2 Message | 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"> • The system is powered on. • The power is off and active POST errors are displayed. | This message is for information only. You can change the system string in the System Setup program. See "Using the System Setup Program" on page 31. |
| E1000 | FAILSAFE, Call Support | | See "Getting Help" on page 129. |
| E1A14 | SAS Cable A | SAS cable A is unseated, missing, or bad. | Check the cable connection to the SAS backplane. See "SAS Backplane Board Connectors" on page 127. |
| E1A15 | SAS Cable B | SAS cable B is unseated, missing, or bad. | Check the cable connection to the SAS backplane. See "SAS Backplane Board Connectors" on page 127. |
| E1114 | Temp Ambient | Ambient system temperature is out of acceptable range. | See "Troubleshooting System Cooling Problems" on page 105. |
| E1210 | CMOS Batt | CMOS battery is missing, or the voltage is out of acceptable range. | See "Troubleshooting the System Battery" on page 104. |
| E1211 | ROMB Batt | RAID battery is either missing, bad, or unable to recharge due to thermal issues. | Reseat the RAID battery. See "Installing the SAS RAID Controller Card Battery" on page 76, and "Troubleshooting System Cooling Problems" on page 105. |
| E12nn | XX PwrGd | Specified voltage regulator has failed. | See "Getting Help" on page 129. |
| E1229 | CPU # VCORE | Processor # VCORE voltage regulator has failed. | See "Getting Help" on page 129. |
| E122A | CPU # VTT | Processor # VTT voltage has exceeded the allowable voltage range | See "Getting Help" on page 129. |

Table 1-7. LCD Status Messages (continued)

| Line 1 Message | Line 2 Message | Causes | Corrective Actions |
|-----------------------|-----------------------|--|--|
| E122B | 0.9V Over Voltage | 0.9 V regulator voltage has exceeded the allowable voltage range | See "Getting Help" on page 129. |
| E122C | CPU Power Fault | A voltage regulator failure was detected when the processor regulator(s) was enabled | See "Getting Help" on page 129. |
| E122D | CPU # VDDIO | Processor # VDDIO voltage has exceeded the allowable voltage range | See "Getting Help" on page 129. |
| E122E | CPU # VDDA | Processor # VDDA voltage has exceeded the allowable voltage range | See "Getting Help" on page 129. |
| E1310 | RPM Fan ## | RPM of specified cooling fan is out of acceptable operating range. | See "Troubleshooting System Cooling Problems" on page 105. |
| E1313 | Fan Redundancy | One or more cooling fans has failed. Cooling fan redundancy has been lost. | See "Troubleshooting System Cooling Problems" on page 105. |
| E1410 | CPU # IERR | Specified microprocessor is reporting a system error. | See your system's <i>Information Update Tech Sheet</i> located on support.dell.com for the most current system information. If the problem persists, see "Getting Help" on page 129. |

Table 1-7. LCD Status Messages (continued)

| Line 1 Message | Line 2 Message | Causes | Corrective Actions |
|-----------------------|-----------------------|---|--|
| E1414 | CPU # Thermtrip | Specified microprocessor is out of acceptable temperature range and has halted operation. | See "Troubleshooting System Cooling Problems" on page 105. If the problem persists, ensure that the microprocessor heat sinks are properly installed. See "Troubleshooting the Microprocessors" on page 114. NOTE: The LCD continues to display this message until the system's power cord is disconnected and reconnected to the AC power source, or the SEL is cleared using either Server Assistant or the BMC Management Utility. See the <i>Dell OpenManage Baseboard Management Controller User's Guide</i> for information about these utilities. |
| E1418 | CPU # Presence | Specified processor is missing or bad, and the system is in an unsupported configuration. | See "Troubleshooting the Microprocessors" on page 114. |
| E1423 | CPU # VRM Missing | VRM for specified processor is missing or faulty. | Remove and reseat the specified VRM. See "Processor VRMs" on page 66. If the problem persists, the system board is faulty. See "Getting Help" on page 129. |
| 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> . |
| E141F | CPU Protocol | The system BIOS has reported a processor protocol error. | See "Getting Help" on page 129. |
| E1420 | CPU Bus PERR | The system BIOS has reported a processor bus parity error. | See "Getting Help" on page 129. |
| E1421 | CPU Init | The system BIOS has reported a processor initialization error. | See "Getting Help" on page 129. |

Table 1-7. LCD Status Messages (continued)

| Line 1 Message | Line 2 Message | Causes | Corrective Actions |
|-----------------------|--|---|--|
| E1422 | CPU Machine Chk | The system BIOS has reported a machine check error. | See "Getting Help" on page 129. |
| E1610 | PS # Missing | Specified power supply is improperly installed or removed. | See "Troubleshooting Power Supplies" on page 105. |
| E1614 | PS # Status | Specified power supply is improperly installed or faulty. | See "Troubleshooting Power Supplies" on page 105. |
| 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 105. |
| 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 105. |
| 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 105. |
| E1624 | PS Redundancy | Power supply redundancy has been lost. If the remaining power supply fails the system will shut down. | See "Troubleshooting Power Supplies" on page 105. |
| E1625 | PS AC Current | Power source is out of acceptable range. | Check the AC power source. |
| E1710 | I/O Channel Chk | The system BIOS has reported an I/O channel check error. | See "Getting Help" on page 129. |
| 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 PCI slot #. | Remove and reseat the PCI expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 113. If the problem persists, the system board is faulty. See "Getting Help" on page 129. |

Table 1-7. LCD Status Messages (continued)

| Line 1 Message | Line 2 Message | Causes | Corrective Actions |
|-----------------------|---|--|--|
| 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 buss ##, device ##, function ##. The system BIOS has reported a PCI system error on a component that resides in slot #. | Remove and reseal the PCI expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 113. If the problem persists, the system board is faulty. See "Getting Help" on page 129. |
| 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 129. |
| 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 slot #. | Remove and reseal the PCI expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 113. If the problem persists, the system board is faulty. See "Getting Help" on page 129. |
| E1810 | HDD ## Fault | Specified hard drive has a fault. | See "Troubleshooting a Hard Drive" on page 110. |
| E1811 | HDD ## Rbld Abrt | Specified hard drive has ended rebuild before completion. | See "Troubleshooting a Hard Drive" on page 110. |
| E1812 | HDD ## Removed | Specified hard drive has been removed from the system. | Information only. |
| E1914 | DRAC5 Conn2 Cbl | DRAC 5 cable is missing or | Reconnect the cable. See "RAC Card" on page 56. |
| E2010 | No Memory | No memory is installed in the system. | Install memory modules. See "System Memory" on page 57. |
| E2011 | Mem Config Err | Memory detected, but is not configurable. Error detected during memory configuration. | See "Troubleshooting System Memory" on page 106. |
| E2012 | Unusable Memory | Memory is configured, but not usable. Memory subsystem failure. | See "Troubleshooting System Memory" on page 106. |

Table 1-7. LCD Status Messages (continued)

| Line 1 Message | Line 2 Message | Causes | Corrective Actions |
|-----------------------|-----------------------|--|---|
| E2013 | Shadow BIOS Fail | The system BIOS failed to copy its flash image into memory. | See "Troubleshooting System Memory" on page 106. |
| E2014 | CMOS Fail | CMOS failure. CMOS RAM not functioning properly. | See "Getting Help" on page 129. |
| E2015 | DMA Controller | DMA controller failure. | See "Getting Help" on page 129. |
| E2016 | Int Controller | Interrupt controller failure. | See "Getting Help" on page 129. |
| E2017 | Timer Fail | Timer refresh failure. | See "Getting Help" on page 129. |
| E2018 | Prog Timer | Programmable interval timer error. | See "Getting Help" on page 129. |
| E2019 | Parity Error | Parity error. | See "Getting Help" on page 129. |
| E201A | SIO Err | SIO failure. | See "Getting Help" on page 129. |
| E201B | Kybd Controller | Keyboard controller failure. | See "Getting Help" on page 129. |
| E201C | SMI Init | System management interrupt (SMI) initialization failure. | See "Getting Help" on page 129. |
| E201D | Shutdown Test | BIOS shutdown test failure. | See "Getting Help" on page 129. |
| E201E | POST Mem Test | BIOS POST memory test failure. | See "Troubleshooting System Memory" on page 106. If problem persists, see "Getting Help" on page 129. |
| E201F | DRAC Config | Dell remote access controller (DRAC) configuration failure. | Check screen for specific error messages. Ensure that the DRAC card and cables are properly seated. See "RAC Card" on page 56. If problem persists, see your DRAC documentation. |
| E2020 | CPU Config | CPU configuration failure. | Check screen for specific error messages. |
| E2021 | Memory Population | Incorrect memory configuration. Memory population order incorrect. | Check screen for specific error messages. See "Troubleshooting System Memory" on page 106. |
| E2022 | POST Fail | General failure after video. | Check screen for specific error messages. |

Table 1-7. LCD Status Messages (continued)

| Line 1 Message | Line 2 Message | Causes | Corrective Actions |
|----------------|-------------------------|---|---|
| E2110 | MBE DIMM ## & ## | One of the DIMMs in the set implicated by "## & ##" has had a memory multi-bit error (MBE). | See "Troubleshooting System Memory" on page 106. |
| E2111 | SBE Log Disable DIMM ## | The system BIOS has disabled memory single-bit error (SBE) logging, and will not resume logging further SBEs until the system is rebooted. "##" represents the DIMM implicated by the BIOS. | See "Troubleshooting System Memory" on page 106. |
| I1910 | Intrusion | System cover has been removed. | Information only. |
| I1911 | >3 ERRs Chk Log | LCD overflow message. A maximum of three error messages can display sequentially on the LCD. The fourth message displays as the standard overflow message. | Check the SEL for details on the events. |
| I1912 | SEL Full | System Event Log is full of events, and is unable to log any more events. | Clear the log by deleting event entries. |
| W1228 | ROMB Batt < 24hr | Warns predictively that the RAID battery has less than 24 hours of charge left. | Replace RAID battery. See "Installing the SAS RAID Controller Card Battery" on page 76. |

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 155.

Solving Problems Described by LCD Status Messages

The code and text on the LCD can often specify a very precise fault condition that is easily corrected. For example, if the code E0708 PROC_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 1-8 lists the system messages that can occur and the probable cause and corrective action for each message.



NOTE: If you receive a system message that is not listed in Table 1-8, 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 1-8. System Messages

| Message | Causes | Corrective Actions |
|---|--|--|
| Alert! Node Interleaving disabled! Memory configuration does not support Node Interleaving. | The memory configuration does not support node interleaving. The system will run but with reduced functionality. | Ensure that the memory modules are installed in a configuration that supports node interleaving. See "General Memory Module Installation Guidelines" on page 58. If the problem persists, see "Troubleshooting System Memory" on page 106. |

Table 1-8. System Messages (continued)

| Message | Causes | Corrective Actions |
|---|--|--|
| Attempting to update Remote Configuration. Please wait... | Remote Configuration request has been detected and is being processed. | Wait until the process is complete. |
| BIOS Update Attempt Failed! | Remote BIOS update attempt failed. | Retry the BIOS update. If problem persists, see "Getting Help" on page 129. |
| Caution! NVRAM_CLR jumper is installed on system board. | NVRAM_CLR jumper is installed. CMOS has been cleared. | Remove the NVRAM_CLR jumper. See Figure 6-1 for jumper locations. |
| Diskette drive <i>n</i> seek failure | Incorrect configuration settings in the System Setup program. | Run the System Setup program to correct the settings. See "Using the System Setup Program" on page 31. |
| | Faulty or improperly installed diskette drive. | Replace the diskette. If the problem persists, see "Troubleshooting a Diskette Drive" on page 108. |
| | Loose diskette drive interface cable, or loose power cable. | Reseat diskette drive interface cable, or power cable. See "Troubleshooting a Diskette Drive" on page 108. |
| Diskette read failure | Faulty or improperly inserted diskette. | Replace the diskette. If the problem persists, see "Troubleshooting a Diskette Drive" on page 108. |
| Diskette subsystem reset failed | Faulty or improperly installed diskette. | Replace the diskette. If the problem persists, see "Troubleshooting a Diskette Drive" on page 108. |
| Drive not ready | Diskette missing from or improperly inserted in diskette drive. | Replace the diskette. If the problem persists, see "Troubleshooting a Diskette Drive" on page 108. |
| Error: Memory failure detected. Memory size reduced. Replace the faulty DIMM as soon as possible. | Faulty or improperly seated memory module(s). | See "Troubleshooting System Memory" on page 106. |
| Remote configuration update attempt failed | System unable to process Remote Configuration request. | Retry Remote Configuration. |
| Fatal error caused a system reset: Please check the system event log for details. | Fatal system error. | Check the system event log for the specific cause, then see the appropriate section in "Troubleshooting Your System" on page 97. |

Table 1-8. System Messages (continued)

| Message | Causes | Corrective Actions |
|---|--|---|
| Gate A20 failure | Faulty keyboard controller; faulty system board. | See "Getting Help" on page 129. |
| General failure | The operating system is unable to carry out the command. | This message is usually followed by specific information. Note the information and take the appropriate action to resolve the problem. |
| Invalid NVRAM configuration, Resource Re-allocated | System detected and corrected a resource conflict. | No action is required. |
| Keyboard Controller failure | Faulty keyboard controller; faulty system board | See "Getting Help" on page 129. |
| Manufacturing mode detected | System is in manufacturing mode. | Reboot to take the system out of manufacturing mode. |
| Memory address line failure at <i>address</i> , read <i>value</i> expecting <i>value</i> | Faulty or improperly installed memory modules. | See "Troubleshooting System Memory" on page 106. |
| 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. | Information only. |
| No boot device available | Faulty or missing optical/diskette drive subsystem, hard drive, or hard-drive subsystem, or no boot disk in drive A. | Use a bootable diskette, CD, or hard drive. If the problem persists, see "Troubleshooting a Diskette Drive" on page 108, "Troubleshooting an Optical Drive" on page 109, and "Troubleshooting a Hard Drive" on page 110. See "Using the System Setup Program" on page 31 for information about setting the order of boot devices. |

Table 1-8. System Messages (continued)

| Message | Causes | Corrective Actions |
|--|---|---|
| No boot sector on hard drive | Incorrect configuration settings in System Setup program, or no operating system on hard drive. | Check the hard-drive configuration settings in the System Setup program. See "Using the System Setup Program" on page 31. If necessary, install the operating system on your hard drive. See your operating system documentation. |
| No timer tick interrupt | Faulty system board. | See "Getting Help" on page 129. |
| Not a boot diskette | No operating system on diskette. | Use a bootable diskette. |
| PCIe Degraded Link Width Error: Embedded Bus# <i>nn</i> /Dev# <i>nn</i> /Func <i>n</i> Expected Link Width is <i>n</i> Actual Link Width is <i>n</i> | Faulty or improperly installed PCIe card in the specified slot. | Reseat the PCIe card in the specified slot number. See "Installing an Expansion Card" on page 53. If the problem persists, see "Getting Help" on page 129. |
| PCIe Degraded Link Width Error: Slot <i>n</i> Expected Link Width is <i>n</i> Actual Link Width is <i>n</i> | Faulty or improperly installed PCIe card in the specified slot. | Reseat the PCIe card in the specified slot number. See "Installing an Expansion Card" on page 53. If the problem persists, see "Getting Help" on page 129. |
| PCIe Fatal Error caused a system reset: Slot <i>n</i> or Embedded Bus# <i>nn</i> /Dev# <i>nn</i> /Func <i>n</i> Please check the system event log for details. | Faulty or improperly installed PCIe card in the specified slot. | Reseat the PCIe card in the specified slot number. See "Installing an Expansion Card" on page 53. If the problem persists, see "Getting Help" on page 129. |
| PCI BIOS failed to install | PCI device BIOS (Option ROM) checksum failure is detected during shadowing. Loose cables to expansion card(s); faulty or improperly installed expansion card. | Reseat the expansion cards. Ensure that all appropriate cables are securely connected to the expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 113. |
| Plug & Play Configuration Error | Error encountered in initializing PCI device; faulty system board. | Install the NVRAM_CLR jumper and reboot the system. See Figure 6-1 for jumper locations. If the problem persists, see "Troubleshooting Expansion Cards" on page 113. |

Table 1-8. System Messages (continued)

| Message | Causes | Corrective Actions |
|---|--|---|
| Read fault Requested sector not found | The operating system cannot read from the diskette or hard drive, the system could not find a particular sector on the disk, or the requested sector is defective. | Replace the diskette. Ensure that the diskette and hard drive cables are properly connected. See "Troubleshooting a Diskette Drive" on page 108, "Troubleshooting an Optical Drive" on page 109, or "Troubleshooting a Hard Drive" on page 110 for the appropriate drive(s) installed in your system. |
| Remote Access Controller cable error or incorrect card in the RAC slot. | RAC cables not connected, or RAC card installed in wrong expansion slot. | Check that the RAC cables are connected, and that the RAC card is installed in the correct expansion slot. See "RAC Card" on page 56. |
| Remote Access Controller not installed in the RAC slot. | RAC card installed in wrong expansion slot. | Check that the RAC card is installed in the correct expansion slot. See "RAC Card" on page 56. |
| Remote configuration update attempt failed | System unable to process Remote Configuration request. | Retry Remote Configuration. |
| ROM bad checksum = <i>address</i> | Expansion card improperly installed or faulty. | Reseat the expansion cards. Ensure that all appropriate cables are securely connected to the expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 113. |
| SAS port <i>n</i> hard disk drive not found | SAS cables are not properly seated, or drive missing. | See "Troubleshooting a Hard Drive" on page 110. |
| Sector not found Seek error Seek operation failed | Faulty diskette or hard drive. | See "Troubleshooting a Diskette Drive" on page 108 or "Troubleshooting a Hard Drive" on page 110 for the appropriate drive(s) installed in your system. |
| Shutdown failure | Shutdown test failure. | See "Troubleshooting System Memory" on page 106. |
| The amount of system memory has changed | Memory has been added or removed or a memory module may be faulty. | If memory has been added or removed, this message is informative and can be ignored. If memory has not been added or removed, check the SEL to determine if single-bit or multi-bit errors were detected and replace the faulty memory module. See "Troubleshooting System Memory" on page 106. |

Table 1-8. System Messages (continued)

| Message | Causes | Corrective Actions |
|---|--|--|
| This system supports only Opteron 8000 series processors. | Microprocessor(s) is not supported by the system. | Install a supported microprocessor or microprocessor combination. See "Installing a Processor" on page 64. |
| Time-of-day clock stopped | Faulty battery or faulty chip. | See "Troubleshooting the System Battery" on page 104. |
| Time-of-day not set - please run SETUP program | Incorrect Time or Date settings; faulty system battery. | Check the Time and Date settings. See "Using the System Setup Program" on page 31. If the problem persists, replace the system battery. See "System Battery" on page 78. |
| Timer chip counter 2 failed | Faulty system board. | See "Getting Help" on page 129. |
| Unsupported CPU combination Unsupported CPU stepping detected | Microprocessor(s) is not supported by the system. | Install a supported microprocessor or microprocessor combination. See "Installing a Processor" on page 64. |
| Utility partition not available | The <F10> key was pressed during POST, but no utility partition exists on the boot hard drive. | Create a utility partition on the boot hard drive. See the CDs that came with your system. |
| Warning: Following faulty DIMMs are disabled: CPU n : DIMM n CPU n : DIMM n Total memory size is reduced. | Faulty or improperly seated memory module(s) used by CPU n . | See "Troubleshooting System Memory" on page 106. |
| Warning! No microcode update loaded for processor n | Microcode update failed. | Update the BIOS firmware. See "Getting Help" on page 129. |
| Warning: One or more faulty DIMMs found on CPU n | Faulty or improperly seated memory module(s) used by CPU n . | See "Troubleshooting System Memory" on page 106. |
| Warning: The installed memory configuration is not optimal. For more information on valid memory configurations, please see the system documentation on the technical support web site. | Invalid memory configuration. The system will run but with reduced functionality. | Ensure that the memory modules are installed in a valid configuration. See "General Memory Module Installation Guidelines" on page 58. If the problem persists, see "Troubleshooting System Memory" on page 106. |

Table 1-8. System Messages (continued)

| Message | Causes | Corrective Actions |
|-------------------------------|--|--|
| Write fault | Faulty diskette, optical/diskette drive assembly, hard drive, or hard-drive subsystem. | See "Troubleshooting a Diskette Drive" on page 108, "Troubleshooting an Optical Drive" on page 109, or "Troubleshooting a Hard Drive" on page 110. |
| Write fault on selected drive | | |

NOTE: For the full name of an abbreviation or acronym used in this table, see "Glossary" on page 155.

Warning Messages

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



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

Diagnostics Messages

When you run system diagnostics, an error message may result. Diagnostic error messages are not covered in this section. Record the message on a copy of the Diagnostics Checklist in "Getting Help" on page 129, 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 24 for an explanation of the message and suggestions for correcting errors.

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

Using the System Setup Program

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

Table 2-1. System Setup Program Navigation Keys

| Keys | Action |
|---|--|
| <Enter> | From the main menu, selects an option that has a submenu, such as Memory Information. |
| Up arrow or <Shift><Tab> | Moves to the previous field. |
| Down arrow or <Tab> | Moves to the next field. |
| Spacebar, <+>, <->, left and right arrows | Cycles through the settings in a field. In many fields, you can also type the appropriate value. |
| <Esc> | Exits the System Setup program and restarts the system if any changes were made. |
| <F1> | Displays the System Setup program's help file. |



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

System Setup Options

Main Screen

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

Figure 2-1. Main System Setup Program Screen

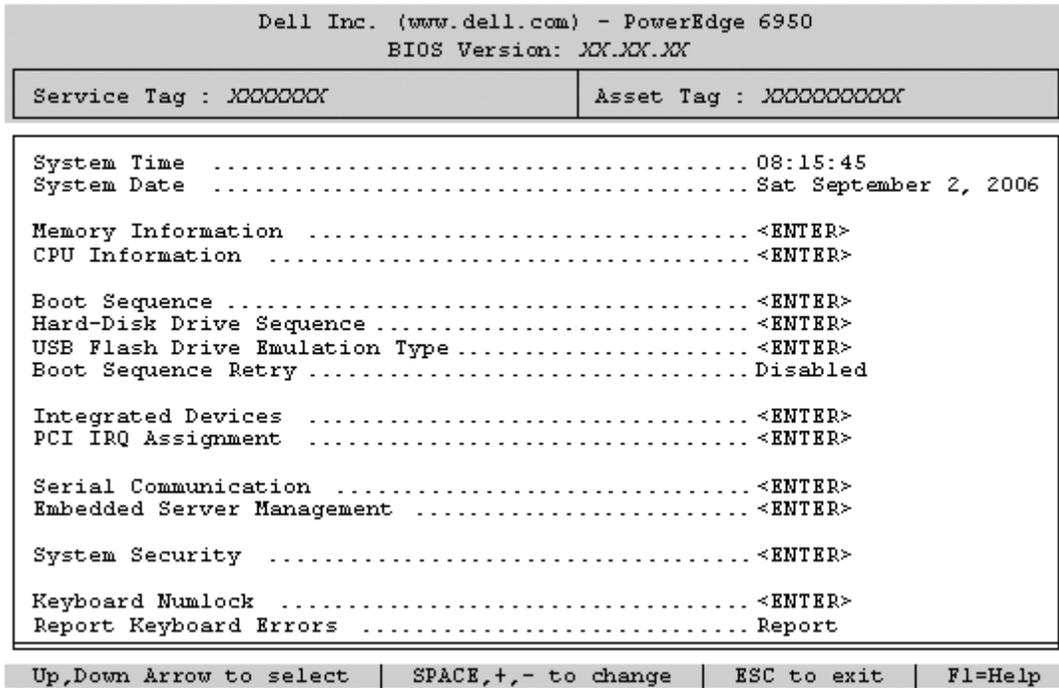


Table 2-2 lists the options and descriptions for the information fields that appear on the main System Setup program screen. For related information, see "System Security Screen Options" on page 37.



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



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

Table 2-2. System Setup Program Options

| Option | Description |
|--------------------|--|
| System Time | Resets the time on the system's internal clock. |
| System Date | Resets the date on the system's internal calendar. |
| Memory Information | Displays information related to installed memory. See "Memory Information Screen" on page 35. |
| CPU Information | Displays information related to microprocessors (speed, cache size, and so on). See "CPU Information Screen" on page 35. |

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

| Option | Description |
|---|--|
| Boot Sequence | Determines the order in which the system searches for boot devices during system startup. Available options can include the diskette drive, CD drive, hard drives, and network. NOTE: System boot is not supported from an external device attached to a SAS adapter. See support.dell.com for the latest support information about booting from external devices. |
| Hard-Disk Drive Sequence | Determines the order in which the system searches the hard drives during system startup. The selections depend on the hard drives installed in your system. |
| USB Flash Drive Emulation Type (Auto default) | Determines the emulation type for a USB flash drive. Hard disk allows the USB flash drive to act as a hard drive. Floppy allows the USB flash drive to act as a removal diskette drive. Auto automatically chooses an emulation type. |
| Boot Sequence Retry | If this field is enabled and the system has failed to boot, the system will reattempt to boot after 30 seconds. |
| Integrated Devices | See "Integrated Devices Screen" on page 36. |
| PCI IRQ Assignment | Displays a screen to change the IRQ assigned to each of the integrated devices on the PCI bus, and any installed expansion card that requires an IRQ. |
| Serial Communication (Off default) | Options are On with Console Redirection via COM2, and Off . |
| Embedded Server Management | Displays a screen to configure the front-panel LCD options and to set a user-defined LCD string. |
| System Security | Displays a screen to configure the system password and setup password features. See "System Security Screen" on page 37, "Using the System Password" on page 38, and "Using the Setup Password" on page 40 for more information. |
| Keyboard NumLock (On default) | Determines whether your system starts up with the NumLock mode activated on 101- or 102-key keyboards (does not apply to 84-key keyboards). |
| Report Keyboard Errors (Report default) | Enables or disables reporting of keyboard errors during the POST. Select Report for host systems that have keyboards attached. Select Do Not Report to suppress all error messages relating to the keyboard or keyboard controller during POST. This setting does not affect the operation of the keyboard itself if a keyboard is attached to the system. |

Memory Information Screen

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

Table 2-3. Memory Information Screen

| Option | Description |
|-----------------------|--|
| System Memory Size | Displays the amount of system memory. |
| System Memory Type | Displays the type of system memory. |
| System Memory Speed | Displays the system memory speed. |
| Video Memory | Displays the amount of video memory. |
| System Memory Testing | This option determines whether system memory tests are run at system boot. Options are Enabled and Disabled . |
| Node Interleaving | If this field is enabled, memory interleaving is supported if a symmetric memory configuration is installed. If this field is set to disabled (the default), the system can support Non-Uniform Memory architecture (NUMA) (asymmetric) memory configurations. See "General Memory Module Installation Guidelines" on page 58. |

CPU Information Screen

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

Table 2-4. CPU Information Screen

| Option | Description |
|---|--|
| 64-bit | Specifies if the installed processor(s) support 64-bit extensions. |
| Core Speed | Displays the clock speed of the processor(s). |
| Bus Speed | Displays the bus speed of the processor(s). |
| Demand-Based Power Management (Disabled default) | Enables or disables demand-based power management. When enabled, the CPU Performance State tables will be reported to the operating system; when disabled, the CPU Performance State tables will not be reported to the operating system. If any of the CPUs do not support demand-based power management, the field will become read-only, and automatically set to Disabled . |
| Processor X ID | Displays the model number of the processor. A submenu displays the amount of level 2 cache and number of cores. |

Enabling PowerNow!™ Technology

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



NOTE: PowerNow! support is dependent on the operating system and version used on your system.

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

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

Integrated Devices Screen

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

Table 2-5. Integrated Devices Screen Options

| Option | Description |
|---|---|
| IDE CD-ROM Controller (Auto default) | Enables the integrated IDE controller. When set to Auto , each channel of the integrated IDE controller is enabled if IDE devices are attached to the channel and an external IDE controller is not detected. NOTE: This CD-ROM option will not appear on this menu screen if your system does not include this optional device. |
| User-Accessible USB Ports (All Ports On default) | Enables or disables the system's user-accessible ports. Options are All Ports On , Only Back Ports On , or All Ports Off . Disabling the USB ports makes system resources available for other devices. |
| Embedded Gb NIC1 (Enabled with PXE default) | Enables or disables the system's integrated NIC1. Options are Enabled without PXE , Enabled with PXE , and Disabled . PXE support allows the system to boot from the network. Changes take effect after the system reboots. |
| MAC Address | Displays the MAC address for NIC1. This field does not have user-selectable settings. |
| Embedded Gb NIC2 (Enabled without PXE default) | Enables or disables the system's integrated NIC2. Options are Enabled without PXE , Enabled with PXE , and Disabled . PXE support allows the system to boot from the network. Changes take effect after the system reboots. |
| MAC Address | Displays the MAC address for NIC2. This field does not have user-selectable settings. |
| TOE Capability | Displays the TCP-IP Offload Engine (TOE) feature status of the NIC. |

System Security Screen

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

Table 2-6. System Security Screen Options

| Option | Description |
|-----------------|---|
| System Password | <p>Displays the current status of your system's password security feature and allows you to assign and verify a new system password.</p> <p>NOTE: See "Using the System Password" on page 38 for instructions on assigning a system password and using or changing an existing system password.</p> |
| Setup Password | <p>Restricts access to the System Setup program in the same way that you restrict access to your system using the system password feature.</p> <p>NOTE: See "Using the Setup Password" on page 40 for instructions on assigning a setup password and using or changing an existing setup password.</p> |
| Password Status | <p>Setting the Setup Password option to Enabled prevents the system password from being changed or disabled at system start-up.</p> <p>To lock the system password, assign a setup password in the Setup Password option and then change the Password Status option to Locked. In this state, you cannot change the system password using the System Password option and cannot be disabled at system start-up by pressing <Ctrl><Enter>.</p> <p>To unlock the system password, enter the setup password in the Setup Password field and then change the Password Status option to Unlocked. In this state, you can disable the system password at system start-up by pressing <Ctrl><Enter> and then change the password using the System Password option.</p> |
| Power Button | <p>Turns system's power off and on.</p> <ul style="list-style-type: none">• If you turn off the system using the power button and the system is running an ACPI-compliant operating system, the system can perform an orderly shutdown before power is turned off.• If the system is not running an ACPI-compliant operating system, power is turned off immediately after the power button is pressed. <p>The button is enabled in the System Setup program. When disabled, the button can only turn on system power.</p> <p>NOTE: You can still turn on the system by using the power button, even if the Power Button option is set to Disabled.</p> |
| NMI Button | <p> NOTICE: Use the NMI button only if directed to do so by qualified support personnel or by the operating system's documentation. Pressing this button halts the operating system and displays a diagnostic screen.</p> <p>Enables or disables the NMI feature.</p> |

Table 2-6. System Security Screen Options (continued)

| Option | Description |
|-------------------------------------|--|
| AC Power Recovery (Last default) | Determines how the system reacts when power is restored to the system. If system is set to Last , the system returns to the last power state. On turns on the system after power is restored. When set to Off , the system remains off after power is restored. |

Exit Screen

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

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

System and Setup Password Features

 **NOTICE:** The password features provide a basic level of security for the data on your system. If your data requires more security, use additional forms of protection, such as data encryption programs.

 **NOTICE:** Anyone can access the data stored on your system if you leave the system running and unattended without having a system password assigned or if you leave your system unlocked so that someone can disable the password by changing a jumper setting.

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

To change or delete an existing password, you must know the password (see "Deleting or Changing an Existing System Password" on page 40). 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 123.

Using the System Password

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

Assigning a System Password

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

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

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

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

You can use up to 32 characters in your password.

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

The password assignment is not case-sensitive. However, certain key combinations are not valid. 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 40), the system accepts your setup password as an alternate system password.

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

To leave the password security enabled:

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

To disable the password security:

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

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

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

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

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



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

Deleting or Changing an Existing System Password

- 1 When prompted, press <Ctrl><Enter> to disable the existing system password.
If you are asked to enter your setup password, contact your network administrator.
- 2 Enter the System Setup program by pressing <F2> during POST.
- 3 Select the **System Security** screen field to verify that the **Password Status** option is set to **Unlocked**.
- 4 When prompted, type the system password.
- 5 Confirm that **Not Enabled** is displayed for the **System Password** option.

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

Using the Setup Password

Read the information in the following sections to assign or change your setup password.

Assigning a Setup Password

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



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

You can use up to 32 characters in your password.

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

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

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

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

Operating With a Setup Password Enabled

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

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



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

Deleting or Changing an Existing Setup Password

- 1 Enter the System Setup program and select the **System Security** option.
- 2 Highlight the **Setup Password** option, press <Enter> to access the setup password window, and press <Enter> twice to clear the existing setup password.

The setting changes to **Not Enabled**.

- 3 If you want to assign a new setup password, perform the steps in "Assigning a Setup Password" on page 40.

Disabling a Forgotten Password

See "Disabling a Forgotten Password" on page 123.

Baseboard Management Controller Configuration

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

- Uses the system's integrated NIC
- Fault logging and SNMP alerting
- Access to system event log and sensor status
- Control of system functions including power on and off

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



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

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

Entering the BMC Setup Module

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

BMC Setup Module Options

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

Installing System Components

This section describes how to install the following system components:

- Front bezel
- System cover
- Cooling fan modules
- Cooling shrouds
- Power supplies
- Expansion cards
- RAC card
- System memory
- Processors
- Diskette drive
- Optical drive
- Hard drives
- SAS controller card
- RAID battery
- External SAS tape drive
- External Fibre Channel device
- System battery
- Control panel assembly
- Fan interposer board
- Power distribution board
- Chassis intrusion switch
- SAS backplane board
- System board

Recommended Tools

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

- Key to the system keylock
- #2 Phillips screwdriver
- T10 Torx driver
- Small flat-blade screwdriver
- Wrist grounding strap

Inside the System



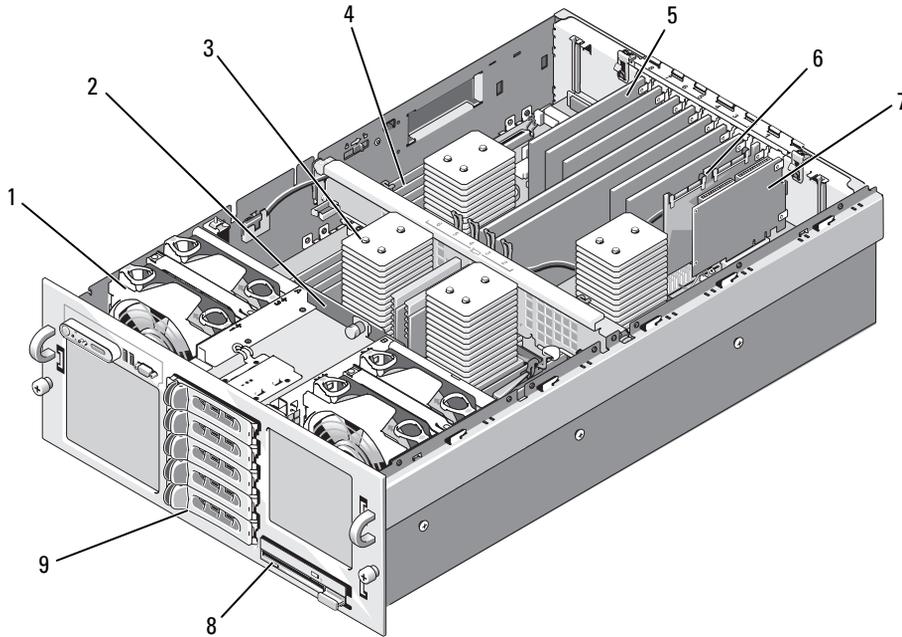
CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.

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



NOTICE: Do not remove the cooling shrouds if the system is turned on. The cooling shrouds must be installed to direct the airflow from the fans.

Figure 3-1. Inside the System



- | | | | | | |
|---|---------------------|---|-----------------------------------|---|-----------------------------------|
| 1 | fan modules (4) | 2 | SAS backplane | 3 | heatsink/processor (4) |
| 4 | memory modules (16) | 5 | expansion cards (7) | 6 | SAS controller card |
| 7 | optional RAC | 8 | optical slimline drive (optional) | 9 | optional 3.5-inch hard drives (5) |

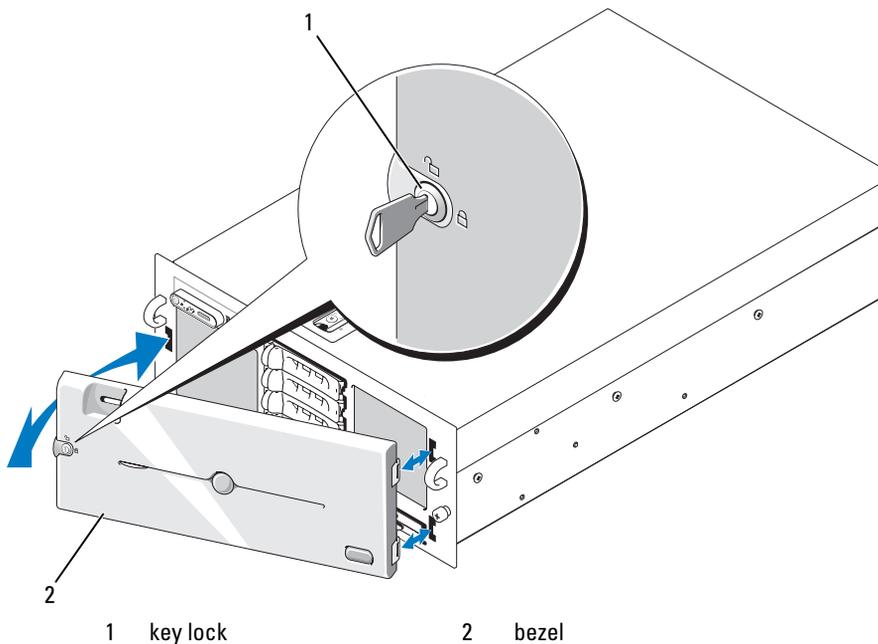
The system board holds the system's control circuitry and other electronic components. The processors and memory modules are installed directly on the system board.

The hard-drive bays provide space for up to five optional 3.5-inch SAS hard drives. The hard drives connect to a SAS controller card or an optional SAS RAID controller card through a SAS backplane. A removable drive carrier supports an optional diskette drive and optional optical drive.

Removing and Replacing the Optional Front Bezel

- 1 Unlock the keylock at the left end of the bezel.
- 2 Rotate the left end of the bezel away from the front panel.
- 3 Unhook the right end of the bezel and pull the bezel away from the system.

Figure 3-2. Removing and Replacing the Optional Front Bezel



To replace the optional bezel, hook the right end of the bezel onto the chassis, then fit the free end of the bezel onto the system. Secure the bezel with the keylock. See Figure 3-2.

Opening and Closing the System

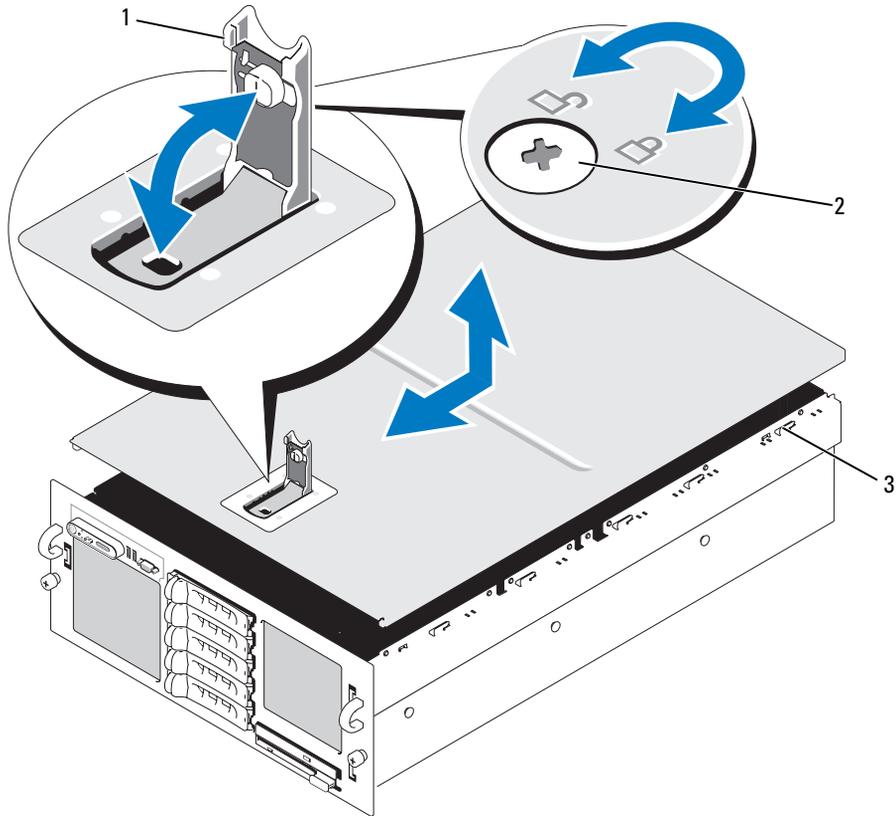
CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.

CAUTION: Whenever you need to lift the system, get others to assist you. To avoid injury, do not attempt to lift the system by yourself.

Opening the System

- 1 Unless you are installing a hot-plug component such as a cooling fan or hard-disk drive, turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Rotate the latch release lock on the latch in a counter clockwise direction to the unlocked position. See Figure 3-3.
- 3 Lift up on the latch on top of the system and slide the cover back. See Figure 3-3.
- 4 Grasp the cover on both sides and carefully lift the cover away from the system.

Figure 3-3. Removing and Replacing the System Cover



- 1 latch 2 latch release lock 3 J hooks

Closing the System

- 1 Lift up the latch on the cover.
- 2 Align the cover with the left and right edges of the system and offset it slightly towards the back of the system, so that the pins on the inner edge of the cover are aligned with the chassis J hooks. See Figure 3-3.
- 3 Lower the cover onto the chassis and close the latch.
- 4 Rotate the latch release lock in a clockwise direction to secure the cover.

Cooling Fans

This system contains four hot-plug cooling fans, connected directly to the system board.

NOTICE: In the event of a problem with a particular fan, the fan's number is referenced by the system's management software, allowing you to easily identify and replace the proper fan.

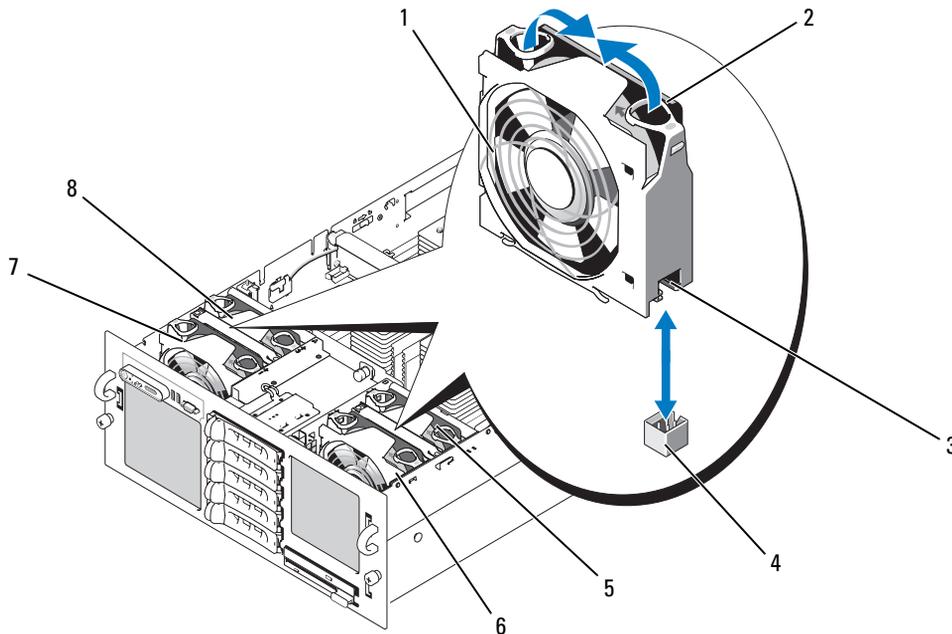
Removing a Cooling Fan

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.

NOTE: The procedure for removing each individual fan module is the same.

- 1 Open the system. See "Opening the System" on page 46.
- 2 Compress the two latches on the top of the fan, then remove the fan. See Figure 3-4.

Figure 3-4. Removing and Replacing a Cooling Fan



- | | | | | | |
|---|-------------------------|---|-------------|---|---------------------|
| 1 | fan | 2 | latches (2) | 3 | fan power connector |
| 4 | fan-bay power connector | 5 | FAN4 | 6 | FAN2 |
| 7 | FAN1 | 8 | FAN3 | | |

Replacing a Cooling Fan

 **NOTE:** The procedure for installing each individual fan is the same.

- 1 Ensure that the fan handle is upright and lower the fan into its retention base until the fan is fully seated. Then lower the fan handle until it snaps into place. See Figure 3-4.
- 2 Close the system. See "Closing the System" on page 47.

Cooling Shrouds

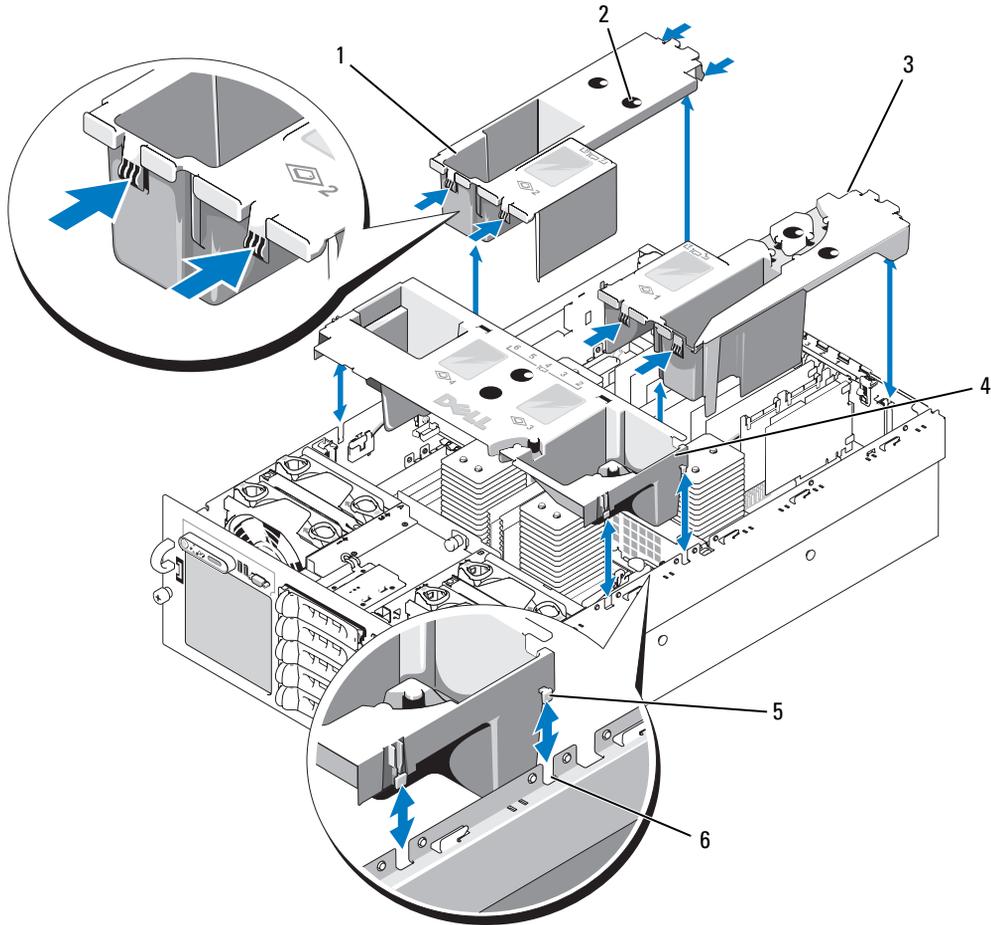
The three cooling shrouds direct airflow within the system.

Removing the Cooling Shrouds

 **NOTICE:** Do not remove the cooling shrouds if the system is turned on. The cooling shrouds must be installed to direct the airflow from the fans.

- 1 First, remove the top cooling shroud by using the finger holes to lift the shroud straight up from the system. See Figure 3-5.
- 2 Remove the left and right cooling shrouds as necessary to access the interior of the system.

Figure 3-5. Removing and Replacing the Cooling Shrouds



- | | | | | | |
|---|---------------------|---|--------------|---|----------------------|
| 1 | left cooling shroud | 2 | finger holes | 3 | right cooling shroud |
| 4 | top cooling shroud | 5 | guide | 6 | slot |

Replacing the Cooling Shrouds

- 1 Slowly lower the left shroud straight down into the system. The guides on the edges of the shroud fit into the corresponding slots in the sides of the chassis. See Figure 3-5.
- 2 Gently press down on the shroud until it is fully seated.
- 3 Install the right shroud.
- 4 Install the top shroud.

Power Supplies

Your system supports two power supplies rated at an output of 1570 W. The second power supply serves as a redundant, hot-plug power source.

➔ **NOTICE:** The system is only in the redundant mode when two power supplies are installed and both power supplies are connected to an AC power source. If some third-party components (such as PCI cards) not tested or supported by Dell are installed, the power supplies may not be redundant at all input voltages.

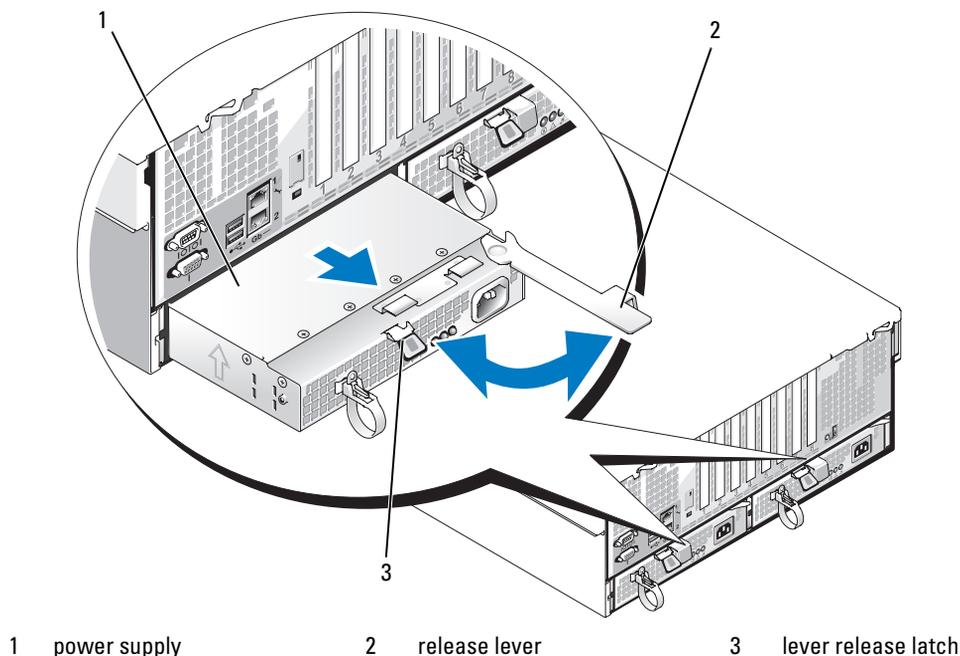
➔ **NOTICE:** Operating the system with only one power supply installed for extended periods of time can cause the system to overheat.

Removing a Power Supply

- 1 Disconnect the power cable from the power source and the power supply you intend to remove.
- 2 Press the lever release latch, then open the release lever and slide the power supply out of the chassis. See Figure 3-6.

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

Figure 3-6. Removing and Replacing a Power Supply



Replacing a Power Supply

- 1 Holding the lever in the open position, slide the new power supply into the chassis until the lever contacts the system chassis. See Figure 3-6.
- 2 Close the release lever until the power supply is fully seated and the lever snaps into place behind the lever release latch. See Figure 3-6.

 **NOTE:** If you unlatched the cable management arm in step 2 of the previous procedure, relatch it. For information about the cable management arm, see the system's *Rack Installation Guide*.

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

 **NOTICE:** When connecting the power cable, insert the cable through the strain-relief loop.

 **NOTE:** After installing a new power supply in a system with two power supplies, allow several seconds for the system to recognize the power supply and determine its status. The power-supply status indicator turns green to signify that the power supply is functioning properly (see Figure 1-4).

Expansion Cards

Expansion Card Installation Guidelines

Your system supports up to eight PCI-Express (PCIe) expansion cards installed in connectors on the system board (see Figure 3-7 and Table 3-1):

- Slots 1 and 2 are x4 lane-width PCIe expansion slots. Slot 2 accommodates a full-length card.
- Slots 3 and 4 are x8 lane-width PCIe expansion slots. Both slots accommodate full-length cards.
- Slots 5 through 7 are x4 lane-width PCIe expansion slots. Slot 5 accommodates a full-length card.
- One expansion slot, labeled INTERNAL_STORAGE, is reserved for the system's SAS controller card.
- If you are installing a Remote Access Control (RAC) card, it must be installed in the special card slot marked RAC_CONN. See "RAC Card" on page 56

Figure 3-7. Expansion Slots

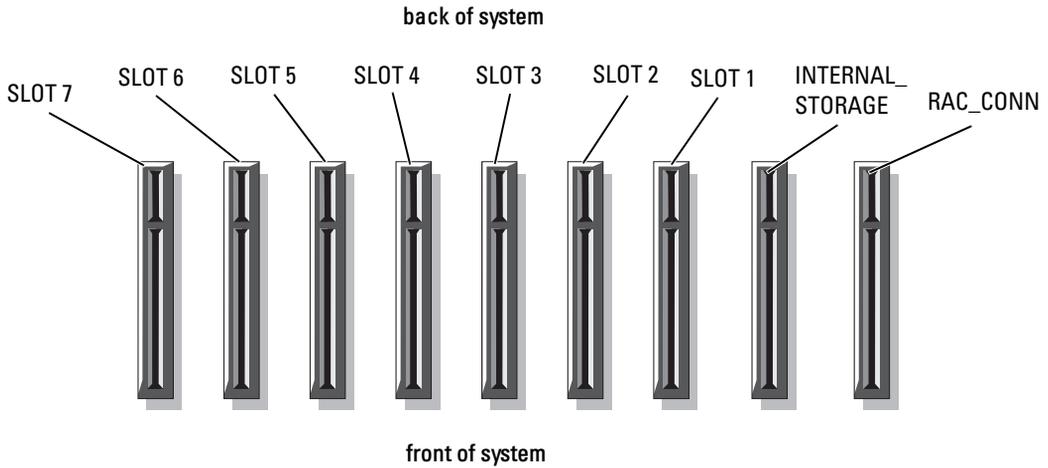


Table 3-1. Expansion Slots

| Slot | Description |
|------------------|-------------------------------|
| SLOT 1 | x4 lane-width PCIe |
| SLOT 2 | x4 lane-width PCIe |
| SLOT 3 | x8 lane-width PCIe |
| SLOT 4 | x8 lane-width PCIe |
| SLOT 5 | x4 lane-width PCIe |
| SLOT 6 | x4 lane-width PCIe |
| SLOT 7 | x4 lane-width PCIe |
| INTERNAL_STORAGE | reserved for controller cards |
| RAC_CONN | reserved for RAC card |

Installing an Expansion Card

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

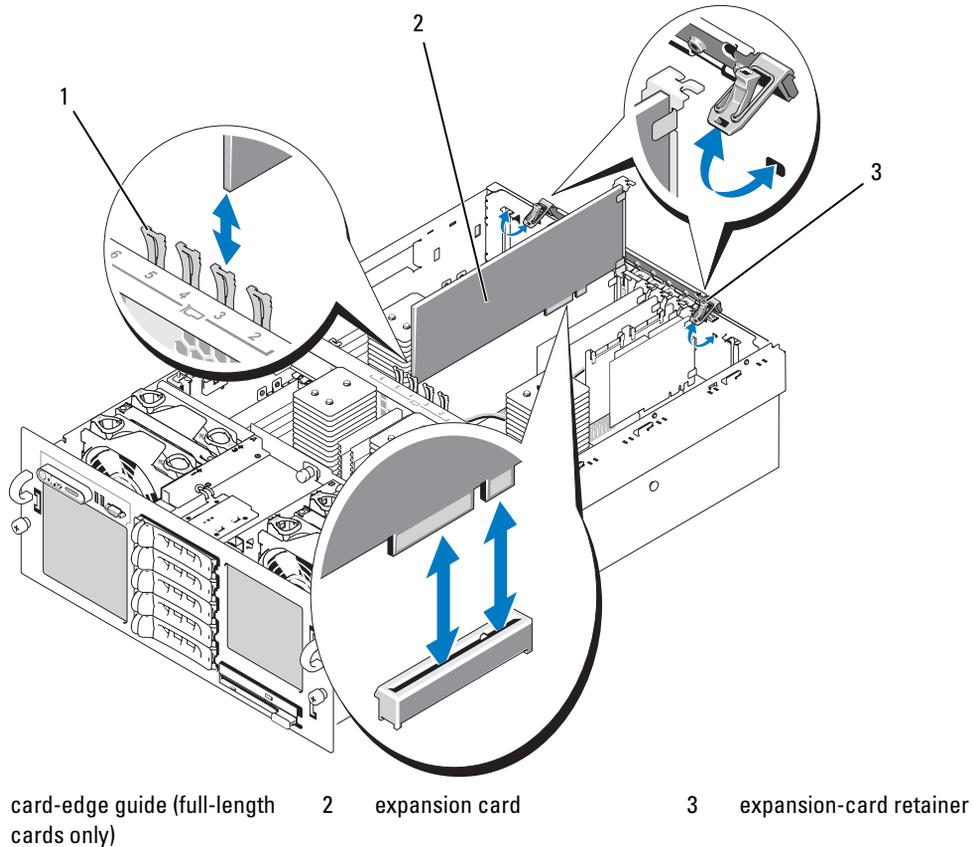
- 1 Unpack the expansion card and prepare it for installation.
For instructions, see the documentation accompanying the card.
- 2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

- 3 Open the system. See "Opening the System" on page 46.
- 4 If you are adding a new card, select the appropriate expansion card slot. See "Expansion Card Installation Guidelines" on page 52.
- 5 Open the expansion-card retainer and remove the filler bracket. See Figure 3-8.
- 6 Install the expansion card:
 - a Holding the card by its edges, position the card so that the card-edge connector aligns with the expansion-card connector on the system board.

 **NOTICE:** If you are installing a SAS RAID controller card, do not press on the memory module when installing the card.

- b Insert the card-edge connector firmly into the expansion-card connector until the card is fully seated.
- c Close the expansion-card retainer. See Figure 3-8.

Figure 3-8. Installing or Removing an Expansion Card



- 1 card-edge guide (full-length cards only)
 - 2 expansion card
 - 3 expansion-card retainer
- 7 Connect any cables to the expansion card.
 - If you are installing a RAC card, see "RAC Card" on page 56.
 - If you are installing a SAS controller card, see "Installing a SAS Controller Card" on page 76.
 - 8 Close the system. See "Closing the System" on page 47.

Removing an Expansion Card

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

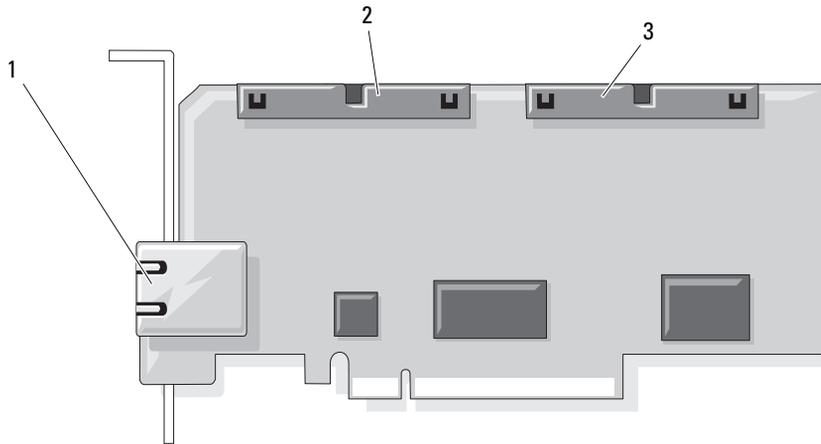
- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.

- 3 Disconnect all cables from the card.
- 4 Remove the expansion card:
 - a Open the expansion-card retainer. See Figure 3-8.
 - b Grasp the expansion card by its edges, and carefully remove it from the expansion-card connector.
- 5 If you are removing the card permanently, install a metal filler bracket over the empty expansion slot opening and close the expansion-card retainer.
 **NOTE:** You must install a filler bracket over an empty expansion slot to maintain Federal Communications Commission (FCC) certification of the system. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.
- 6 Close the system. See "Closing the System" on page 47.

RAC Card

- 1 Unpack the RAC card and prepare it for installation.
For instructions, see the documentation accompanying the card.
- 2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 3 Open the system. See "Opening the System" on page 46.
- 4 Remove the cooling shrouds. See "Removing the Cooling Shrouds" on page 49.
- 5 Remove the plastic filler plug from the system back panel. See Figure 1-3.
- 6 Remove the storage controller card from the expansion slot labeled INTERNAL STORAGE:
 - a Disconnect all data cables from the card.
 - b Grasp the storage controller card by its edges, and carefully remove it from the card connector.
- 7 Install the RAC card in the slot labeled RAC_CONN:
 - a Angle the RAC card so that the NIC connector inserts through the back-panel RAC card opening. See Figure 3-9.
 - b Position the card so that the card-edge connector aligns with the expansion-card connector.
 - c Insert the card-edge connector firmly into the expansion-card connector until the card is fully seated.
- 8 Connect the 50-pin management cable and the 44-pin MII cable supplied with the RAC to the two connectors on the RAC card (see Figure 3-9), and to the two corresponding connectors on the system board.

Figure 3-9. RAC Card Connectors



1 RJ-45 connector

2 44-pin MII cable connector

3 50-pin management cable connector

- 9 Reinstall the storage controller card.
- 10 Reinstall the cooling shrouds. See "Replacing the Cooling Shrouds" on page 50.
- 11 Reconnect all cables to the storage controller card and feed the cables through the appropriate channels and keepers on the cooling shrouds.
- 12 Close the system. See "Closing the System" on page 47.
- 13 Reconnect the system and peripherals to their power sources, and turn them on.
- 14 Enter the System Setup program and verify that the setting for the Boot Sequence has changed to reflect the presence of the RAC card. See "Using the System Setup Program" in your *Hardware Owner's Manual*.
- 15 Exit the System Setup program and reboot the system.

When the system boots, the `Remote Access Control Detected` message displays and the option ROM and firmware information for the RAC displays.

Press `<Ctrl><e>` to enter the RAC configuration screen. See the RAC documentation for information on configuring and using the RAC.

System Memory

You can upgrade your system memory to a maximum of 32 GB (two-processor configurations) or 64 GB (four-processor configurations) by installing 667-MHz registered DDR-II memory modules (DIMMs) in sets of 512-MB, 1-GB, 2-GB, or 4-GB modules. The sixteen memory sockets are located on the system board under the cooling shrouds. Each processor has four memory channels, organized in sets of two.

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

 **NOTICE:** To enable NUMA, run the System Setup program and disable the **Node Interleaving** option. See "Using the System Setup Program" on page 31.

General Memory Module Installation Guidelines

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

- Memory modules must be installed in pairs, beginning with DIMM1 and DIMM2 (processor 1) DIMM5 and DIMM6 (processor 2), DIMM9 and DIMM10 (processor 3), and DIMM13 and DIMM14 (processor 4).
- The memory modules must be identical in speed and technology. The DIMMs in each pair must be the same size.

Memory can either be installed in a two-processor configuration (Table 3-2) or a four-processor configuration (Table 3-3).

Table 3-2. Two-Processor Memory Configurations

| Total System Memory | CPU 1 | | | | CPU 2 | | | |
|---------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| | DIMM1 | DIMM2 | DIMM3 | DIMM4 | DIMM5 | DIMM6 | DIMM7 | DIMM8 |
| 2 GB | 512 MB | 512 MB | | | 512 MB | 512 MB | | |
| 4 GB | 512 MB |
| 4 GB | 1 GB | 1 GB | | | 1 GB | 1 GB | | |
| 6 GB | 1 GB | 1 GB | 512 MB | 512 MB | 1 GB | 1 GB | 512 MB | 512 MB |
| 8 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB |
| 8 GB | 2 GB | 2 GB | | | 2 GB | 2 GB | | |
| 16 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB |
| 16 GB | 4 GB | 4 GB | | | 4 GB | 4 GB | | |
| 24 GB | 4 GB | 4 GB | 2 GB | 2 GB | 4 GB | 4 GB | 2 GB | 2 GB |
| 32 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB |

Table 3-3. Four-Processor Memory Configurations

| Total System Memory | CPU1 | | | | CPU2 | | | | CPU3 | | | | CPU4 | | | |
|---------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | DIMM | | | | DIMM | | | | DIMM | | | | DIMM | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 4GB | 512 MB | 512 MB | | |
| 8 GB | 512 MB |
| 8 GB | 1 GB | 1 GB | | |
| 12 GB | 1 GB | 1 GB | 512 MB | 512 MB | 1 GB | 1 GB | 512 MB | 512 MB | 1 GB | 1 GB | 512 MB | 512 MB | 1 GB | 1 GB | 512 MB | 512 MB |
| 16 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB | 1 GB |
| 16 GB | 2 GB | 2 GB | | |
| 24 GB | 2 GB | 2 GB | 1 GB | 1 GB | 2 GB | 2 GB | 1 GB | 1 GB | 2 GB | 2 GB | 1 GB | 1 GB | 2 GB | 2 GB | 1 GB | 1 GB |
| 32 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB | 2 GB |
| 32 GB | 4 GB | 4 GB | | |
| 48 GB | 4 GB | 4 GB | 2 GB | 2 GB | 4 GB | 4 GB | 2 GB | 2 GB | 4 GB | 4 GB | 2 GB | 2 GB | 4 GB | 4 GB | 2 GB | 2 GB |
| 64 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB | 4 GB |

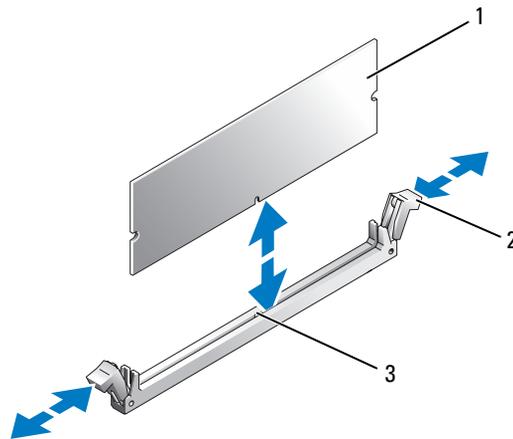
Installing Memory Modules

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

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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Remove the cooling shrouds. See "Removing the Cooling Shrouds" on page 49.
- 4 Locate the memory module sockets. See Figure 6-2.
- 5 Press the ejectors on the memory module socket down and out, as shown in Figure 3-10, to allow the memory module to be inserted into the socket.
- 6 Handle each memory module only on either card edge, ensuring not to touch the middle of the memory module.

Figure 3-10. Installing and Removing a Memory Module



1 memory module

2 memory module socket
ejectors (2)

3 alignment key

- 7 Align the memory module's edge connector with the alignment key of the memory module socket, and insert the memory module in the socket.

 **NOTE:** The memory module socket has an alignment key that allows you to install the memory module in the socket in only one way.

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

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

- 9 Repeat step 5 through step 8 of this procedure to install the remaining memory modules. See Table 3-2 or Table 3-3.
- 10 Replace the cooling shrouds. See "Removing and Replacing the Cooling Shrouds" on page 50.
- 11 Close the system. See "Closing the System" on page 47.
- 12 Start up the system, press <F2> to enter the System Setup program, and check the **System Memory** setting on the main **System Setup** screen.
The system should have already changed the value to reflect the newly installed memory.
- 13 If the value is incorrect, one or more of the memory modules may not be installed properly. Repeat step 2 through step 12 of this procedure, checking to ensure that the memory modules are firmly seated in their sockets.
- 14 Run the system memory test in the system diagnostics. See "Running the System Diagnostics" on page 117.

Removing Memory Modules



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



CAUTION: The memory modules are hot to the touch for some time after the system has been powered down. Allow time for the memory modules to cool before handling them. Handle the memory modules by the card edges and avoid touching the components on the memory module.

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Remove the cooling shrouds. See "Removing the Cooling Shrouds" on page 49.
- 4 Locate the memory module sockets. See Figure 6-2.
- 5 Press down and out on the ejectors on each end of the socket until the memory module pops out of the socket. See Figure 3-10.

Handle each memory module only on either card edge, ensuring not to touch the middle of the memory module.

- 6 Replace the cooling shrouds. See "Replacing the Cooling Shrouds" on page 50.
- 7 Close the system. See "Closing the System" on page 47.

Processors

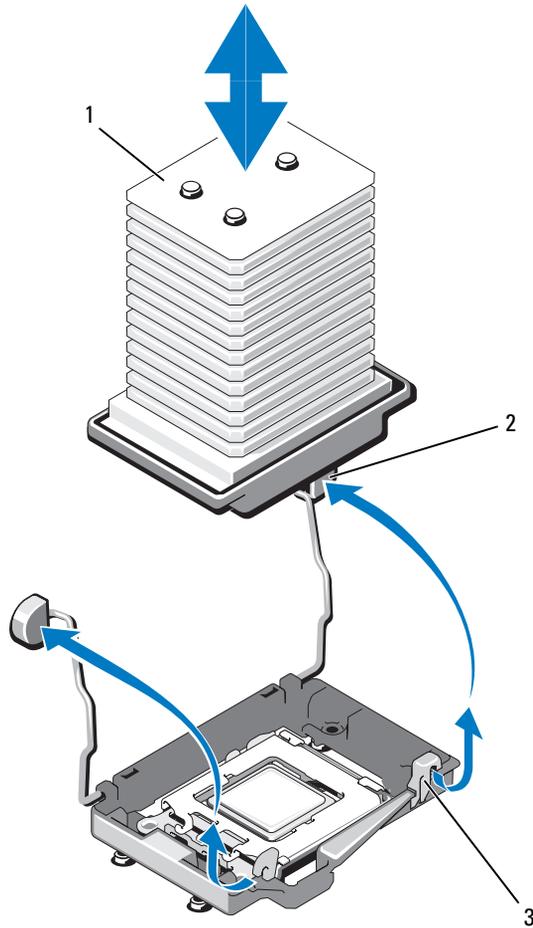
Your system supports either two or four processors. You can add a third and fourth processor, or upgrade processors to take advantage of future options in speed and functionality. Each processor and its associated internal cache memory are contained in a land grid array (LGA) package that is installed in a socket on the system board.

 **NOTICE:** All processors must have the same frequency and core voltage.

Removing a Processor

- 1 Prior to upgrading your system, download and install the latest system BIOS version from support.dell.com.
 - 2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
 - 3 Open the system. See "Opening the System" on page 46.
 - 4 Remove the cooling shrouds. See "Removing the Cooling Shrouds" on page 49.
-  **NOTICE:** When you remove the heat sink, the possibility exists that the processor might adhere to the heat sink and be removed from the socket. It is recommended that you remove the heat sink while the processor is warm.
-  **NOTICE:** Never remove the heat sink from a processor unless you intend to remove the processor. The heat sink is necessary to maintain proper thermal conditions.
-  **NOTICE:** The processor and heat sink can become extremely hot. Be sure the processor has had sufficient time to cool before handling.
- 5 Press the blue tab on the end of one of the heat-sink retention levers to disengage the lever, then lift the lever 90 degrees. See Figure 3-11.

Figure 3-11. Removing and Installing the Heat Sink

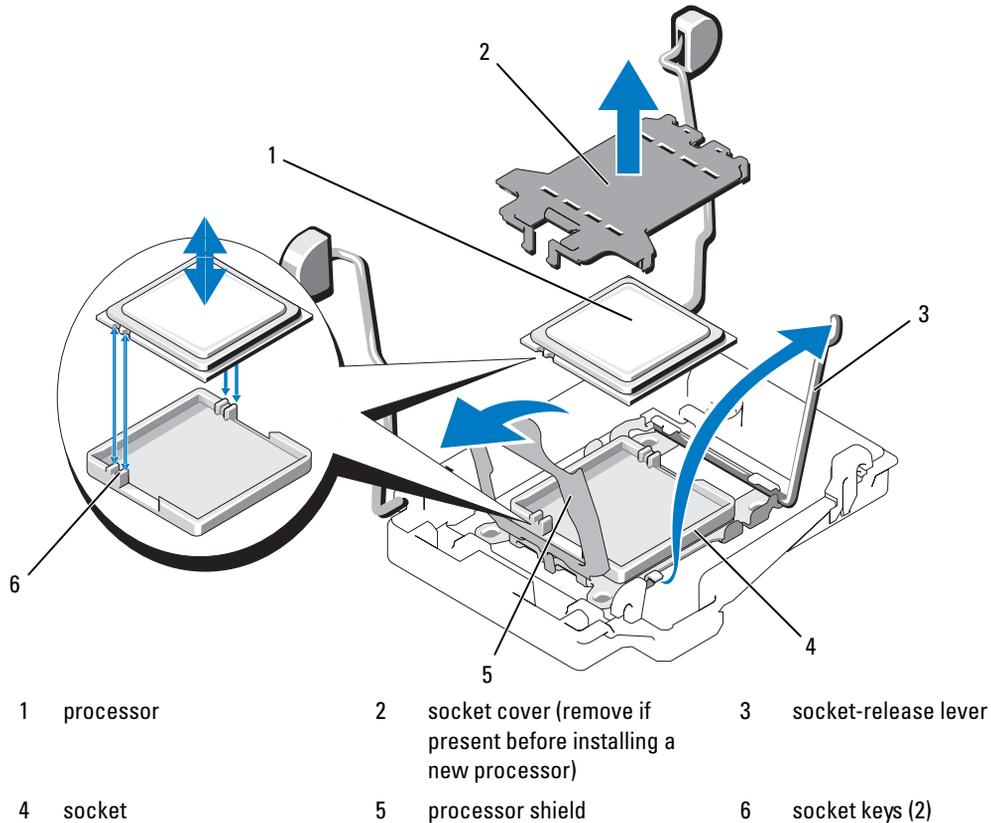


- 1 heat sink 2 heat-sink retention lever (2) 3 retention lever latch

- 6 Wait 30 seconds for the heat sink to loosen from the processor.
- 7 Open the other heat sink retention lever.
- 8 If the heat sink does not separate from the processor, carefully rotate the heat sink in a clockwise, then counterclockwise, direction until it releases from the processor. Do not pry the heat sink from the processor.
- 9 Lift the heat sink off of the processor and set the heat sink upside down.
- 10 Use a clean lint-free cloth to remove any thermal grease from the surface of the processor shield.

- 11 Pull the socket-release lever 90 degrees upward until the processor is released from the socket. See Figure 3-12.

Figure 3-12. Removing and Installing the Processor



- 12 Open the processor shield and then lift the processor out of the socket. Leave the release lever up so that the socket is ready for the new processor.

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

Installing a Processor

- 1 Unpack the new processor.
- 2 Align the processor with the two socket keys on the socket. See Figure 3-12.

3 If you are adding a processor to an empty socket, perform the following steps:

- a** Remove the protective cover from the processor socket. See Figure 3-12.
- b** Pull the socket-release lever 90 degrees upward. See Figure 3-12.
- c** Lift the processor shield. See Figure 3-12.

4 Install the processor in the socket.

 **NOTICE:** Positioning the processor incorrectly can permanently damage the system board or the processor when you turn the system on.

- a** If the release lever on the processor socket is not fully open, move it to that position.
- b** With the processor and the socket keys aligned, set the processor lightly in the socket.

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

- c** Close the processor shield. See Figure 3-12.
- d** Rotate the socket release lever back down until it snaps into place, securing the processor. See Figure 3-12.

5 Install the heat sink.

 **NOTE:** If you did not receive a replacement heat sink, use the heat sink that you removed in step 9.

- a** If you receive a heat sink and pre-applied thermal grease with your processor kit, remove the protective sheet from the thermal grease layer on top of the heat sink. See Figure 3-11.

If you did not receive a replacement heat sink with your processor kit, apply new thermal grease:

- Using a clean lint-free cloth, remove the existing thermal grease from the heat sink.
- Open the grease packet included with your processor kit and apply thermal grease evenly to the top of the processor.

- b** Place the heat sink onto the processor. See Figure 3-11.
- c** Close one of the two heat sink retention levers until it locks. See Figure 3-11.
- d** Close the remaining heat sink retention lever.

 **NOTICE:** If you are adding a third and fourth processor, you must also install a voltage regulator module (VRM) for each processor. See "Installing a VRM" on page 66.

6 Replace the cooling shrouds. See "Replacing the Cooling Shrouds" on page 50.

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

8 Restart the system.

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

- 9 Press <F2> to enter the System Setup program, and check that the processor information matches the new system configuration.
See "Using the System Setup Program" on page 31 for instructions about using the System Setup program.
- 10 Run the system diagnostics to verify that the new processor operates correctly.
See "Running the System Diagnostics" on page 117 for information about running the diagnostics.

Processor VRMs

If you add a third and fourth processor, you must also install a voltage regulator module (VRM) for each processor.

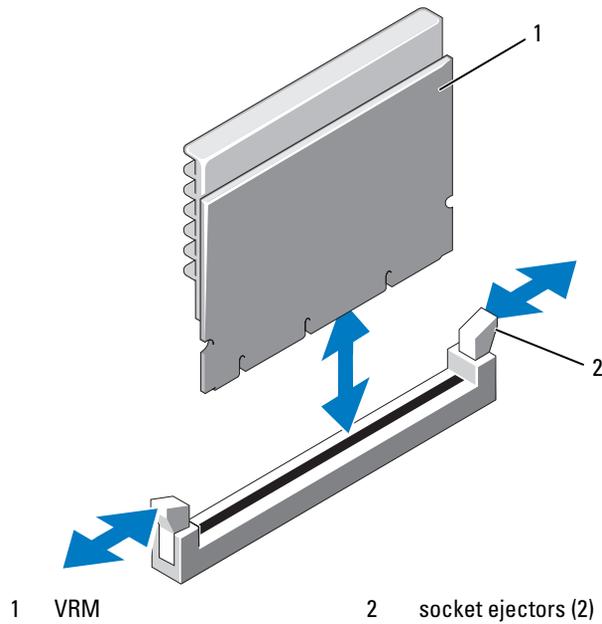
Installing a VRM



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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Remove the top cooling shroud. See "Removing the Cooling Shrouds" on page 49.
- 4 Locate the two VRM sockets. See Figure 6-2.
- 5 Press the ejectors on the socket down and out, as shown in Figure 3-13, to allow the VRM to be inserted into the socket.

Figure 3-13. Installing and Removing a VRM



6 Holding the VRM by its edges, align the edge connector with the socket, and insert the VRM in the socket.

NOTE: The VRM socket has an alignment key that allows you to install the VRM in the socket in only one way.

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

8 Repeat step 5 through step 7 of this procedure to install the second VRM.

9 Replace the top cooling shroud. See "Replacing the Cooling Shrouds" on page 50.

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

Removing a VRM

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: The VRMs are hot to the touch for some time after the system has been powered down. Allow time for the VRMs to cool before handling them. Handle the VRMs by the card edges.

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

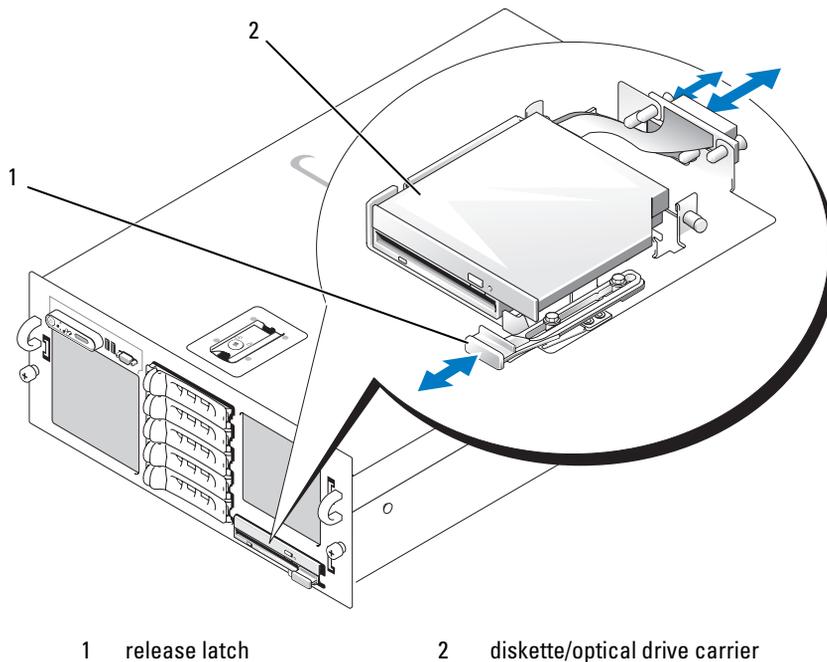
2 Open the system. See "Opening the System" on page 46.

- 3 Remove the top cooling shroud. See "Removing the Cooling Shrouds" on page 49.
- 4 Locate the VRM sockets. See Figure 6-2.
- 5 Press down and out on the ejectors on each end of the socket and lift the VRM out of the socket. See Figure 3-13.

Installing a Diskette Drive

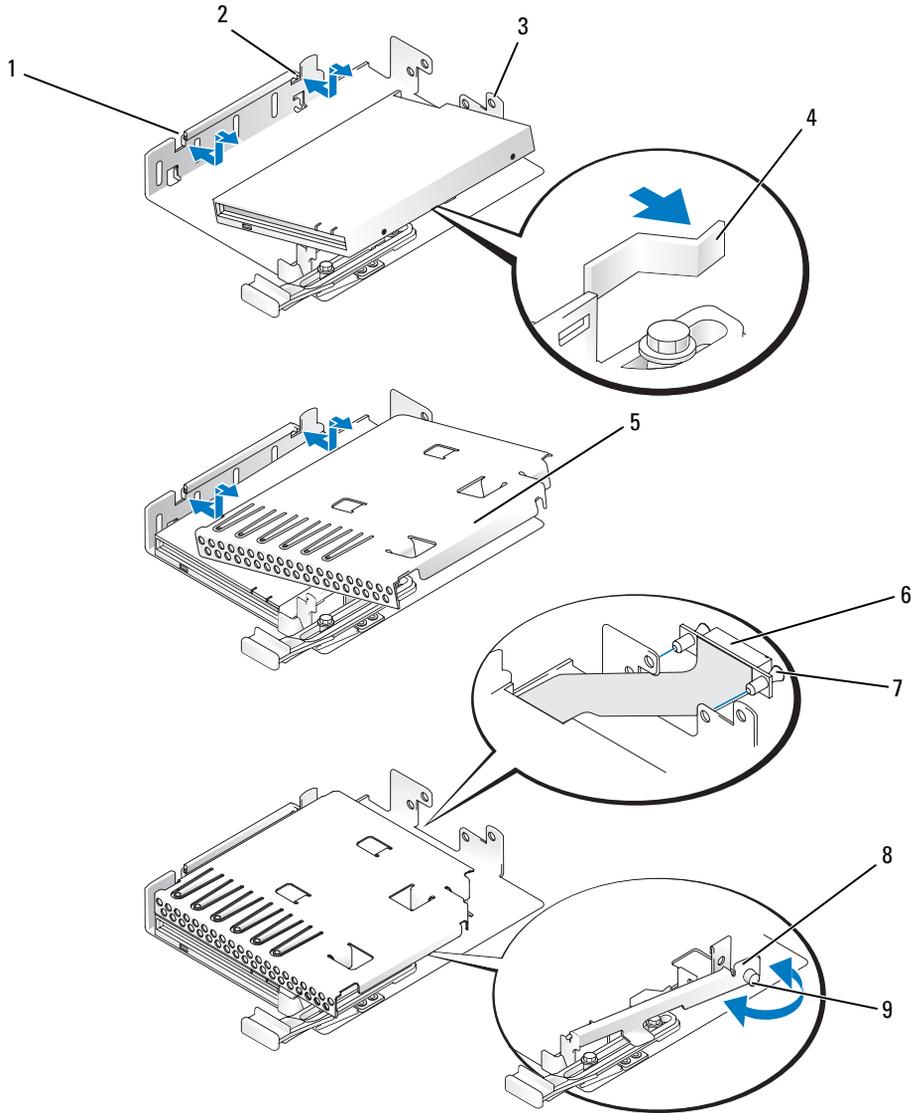
- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Remove the front bezel, if attached. See "Removing and Replacing the Optional Front Bezel" on page 45.
- 3 To remove the drive carrier, pull the release latch forward, then slide the carrier out of the chassis. See Figure 3-14.

Figure 3-14. Removing and Installing the Diskette/Optical Drive Carrier



- 4 Remove the optical drive or optical drive filler plate from the carrier:
 - a Loosen the thumbscrew on the latch securing the optical drive or filler plate. See Figure 3-15.
 - b Remove the latch.
 - c Lift the optical drive or optical drive filler plate from the carrier.

Figure 3-15. Installing a Diskette Drive in the Drive Carrier



- | | | | | | |
|---|--------------------------------|---|----------------------------|---|-----------------|
| 1 | diskette/optical drive carrier | 2 | alignment pins | 3 | diskette drive |
| 4 | retention spring | 5 | optical drive filler plate | 6 | interface board |
| 7 | plastic rivets (2) | 8 | latch | 9 | thumbscrew |

- 5 To remove the diskette drive filler plate, pull the retention spring slightly away from the filler plate, then lift the filler plate from the carrier.
- 6 Deflect the retention spring slightly, then insert the diskette drive into the carrier.
The pins on the carrier fit into the corresponding holes in the side of the drive. See Figure 3-15.
- 7 Replace the optical drive or optical drive filler plate in the carrier.
The pins on the carrier fit into the corresponding holes in the side of the drive.
- 8 Reinstall the latch and tighten the thumbscrew.
- 9 Slide in the drive carrier until the tray snaps into place. See Figure 3-15
- 10 Replace the front bezel, if applicable. See "Removing and Replacing the Optional Front Bezel" on page 45.
- 11 Reconnect the system and peripherals to their electrical outlets.

Installing an Optical Drive

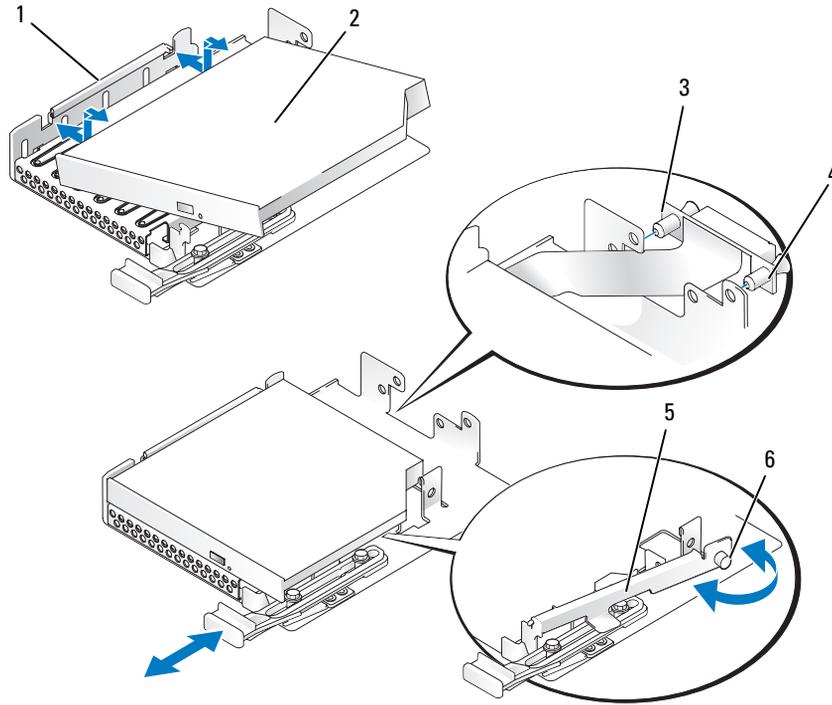
The optional slimline optical drive is mounted on a tray that slides into the front panel and connects to the controller on the system board through the SAS backplane.



NOTE: DVD devices are data only.

- 1 Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.
- 2 Remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 45.
- 3 To remove the drive carrier, pull the release latch forward, then slide the carrier out of the chassis. See Figure 3-14.
- 4 Remove the optical drive filler plate from the carrier:
 - a Loosen the thumbscrew from the latch securing the optical drive or filler plate. See Figure 3-16.
 - b Remove the latch.
 - c Lift the optical drive filler plate from the carrier.

Figure 3-16. Installing an Optical Drive in the Drive Carrier



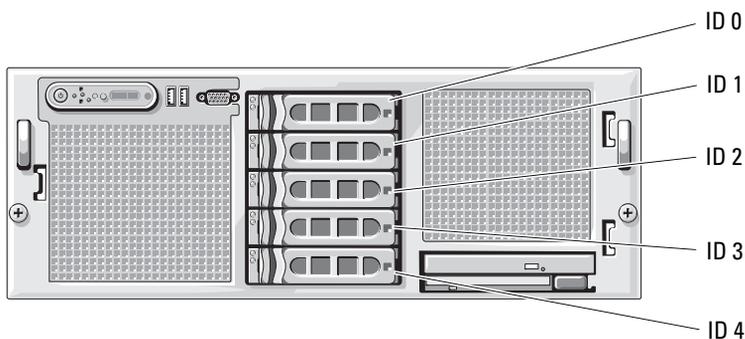
- | | | | | | |
|---|--------------------------------|---|---------------|---|-----------------|
| 1 | diskette/optical drive carrier | 2 | optical drive | 3 | interface board |
| 4 | plastic rivets (2) | 5 | latch | 6 | thumbscrew |

- 5 Install the new optical drive in the carrier. See Figure 3-16.
The pins on the carrier fit into the corresponding holes in the side of the drive.
- 6 Attach the interface board to the back of the carrier, using the two plastic rivets. See Figure 3-16.
- 7 Reinstall the latch and tighten the thumbscrew.
- 8 Slide in the drive carrier until the tray snaps into place. See Figure 3-14
- 9 Replace the front bezel, if applicable. See "Removing and Replacing the Optional Front Bezel" on page 45.
- 10 Reconnect the system and peripherals to their electrical outlets.

Hard Drives

Your system can accommodate up to five 3.5-inch SAS hard drives. All drives connect to the system board through a SAS backplane board. See "SAS Backplane (Service-Only Procedure)" on page 87 for information on these backplane options. Systems with an optional SAS RAID controller card support hot-plug drive operation. Figure 3-17 shows the ID numbers of the drives.

Figure 3-17. Hard-Drive ID Numbers



Before You Begin

NOTICE: Before you attempt 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 board.

You may need to use different programs than those provided with the operating system to partition and format the 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.

Configuring the Boot Device

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 31 for information about the System Setup program.

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.

- 1 Remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 45.
- 2 Insert your finger under the shrouded end of the blank and press in on the latch to eject the blank outward from the bay.
- 3 Pry the ends of the blank outward until the blank is free.

Installing a Drive Blank

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.

Removing a Hot-Plug Hard Drive

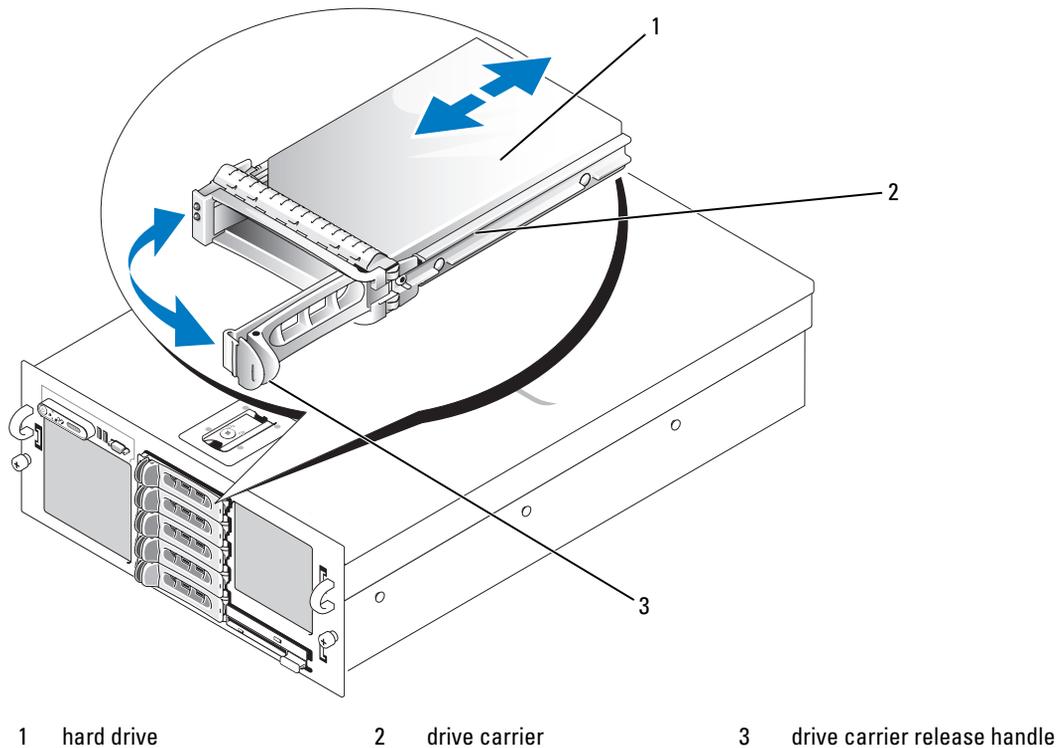
- 1 Remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 45.
- 2 From the RAID management software, prepare the drive for removal and wait until the hard-drive indicators on the drive carrier signal that the drive can be removed safely. See your SAS RAID controller documentation 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.

- 3 Open the drive carrier release handle to release the drive. See Figure 3-18.
- 4 Slide the hard drive out until it is free of the drive bay.
- 5 If you do not replace the hard drive, insert a drive blank in the vacated drive bay. See "Installing a Drive Blank" on page 73.

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

Figure 3-18. Removing and Installing a Hot-Plug Hard Drive



Installing a Hot-Plug Hard Drive

- ➔ **NOTICE:** When installing a hard drive, ensure that the adjacent drives are fully installed. Inserting a hard-drive carrier and attempting to lock its handle next to a partially installed carrier can damage the partially installed carrier's shield spring and make it unusable.
- ➔ **NOTICE:** Not all operating systems support hot-plug drive installation. See the documentation supplied with your operating system.

- 1 Remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 45.
- 2 If a drive blank is present in the bay, remove it. See "Removing a Drive Blank" on page 73.
- 3 Install the hot-plug hard drive.
 - a Open the handle on the hard-drive carrier.
 - b Insert the hard-drive carrier into the drive bay until the carrier contacts the backplane.
 - c Close the handle to lock the drive in place.
- 4 Replace the front bezel, if applicable. See "Removing and Replacing the Optional Front Bezel" on page 45.

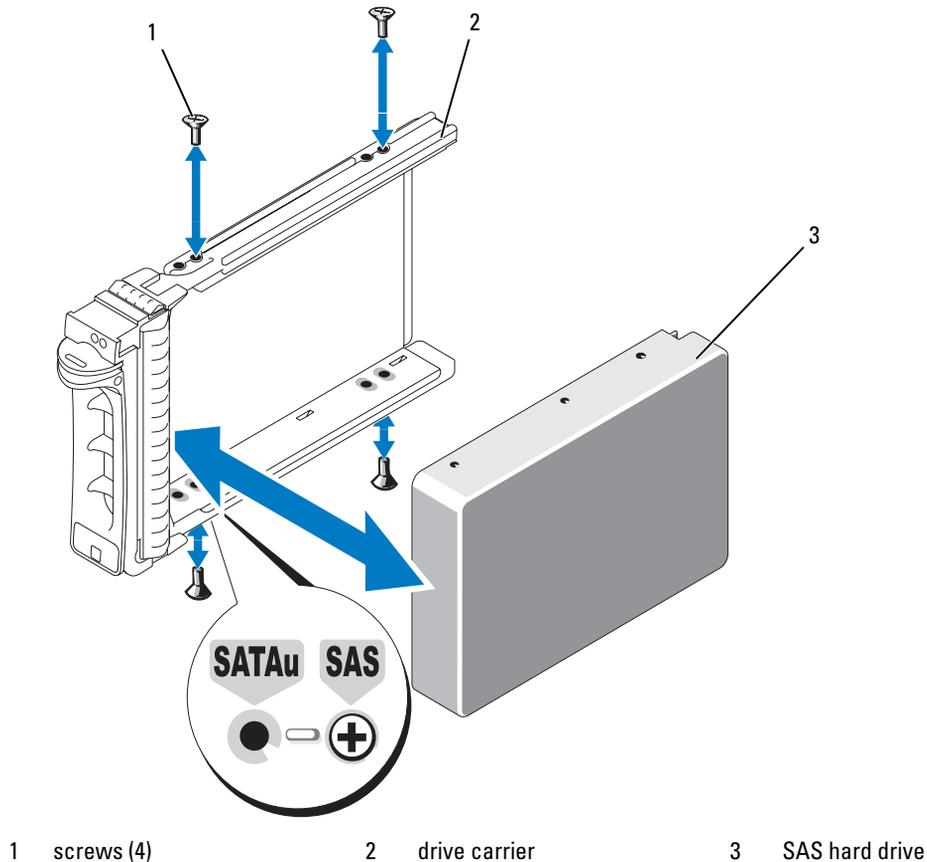
Replacing a Hard Drive in a Hard-Drive Carrier

To remove a hard drive from a drive carrier, remove the four screws from the slide rails on the hard-drive carrier and separate the hard drive from the carrier.

To install a new hard drive in a drive carrier, perform the following steps:

- 1 Insert the hard drive into the hard-drive carrier with the connector end of the drive at the back. See Figure 3-19.
- 2 Viewing the assembly as shown in Figure 3-19, align the bottom rear 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 3-19.

Figure 3-19. Installing a SAS Hard Drive Into a Drive Carrier



SAS Controller Cards

Removing a SAS Controller Card

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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Disconnect the data cable(s) from the controller card.
- 4 If you are removing a SAS RAID controller, disconnect the RAID battery cable from the card.
- 5 Remove the card from the expansion slot.
See "Removing an Expansion Card" on page 55.

Installing a SAS Controller Card

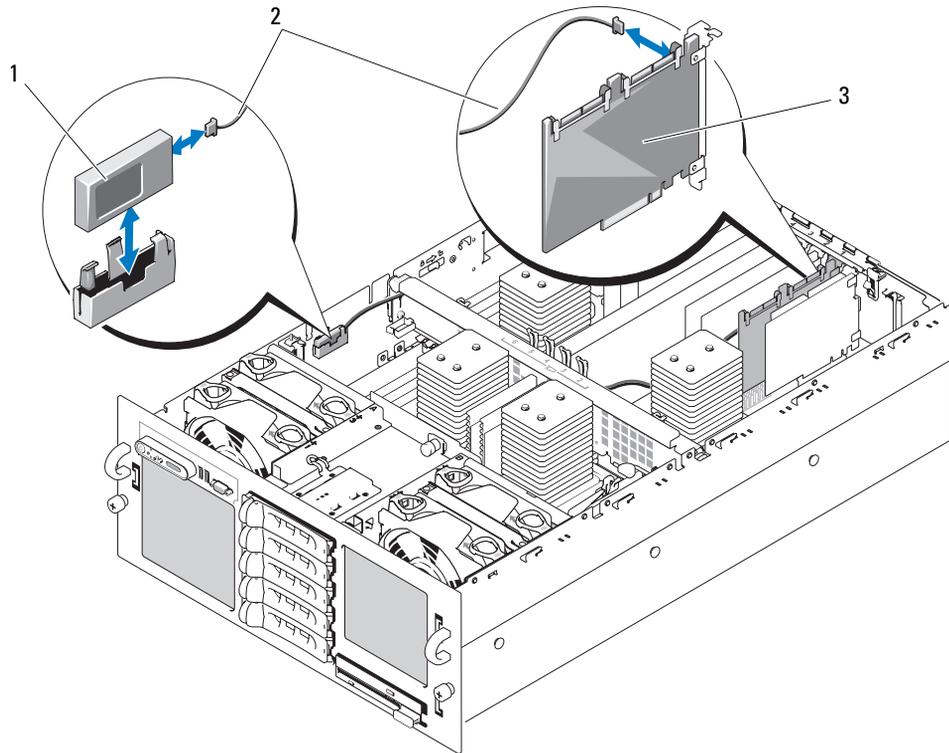
 **CAUTION:** Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Install the controller card in the expansion slot labeled INTERNAL_STORAGE.
For instructions on installing the card, see "Installing an Expansion Card" on page 53.
- 4 Connect the card to the SAS backplane
 - If you are installing a SAS controller card, connect the SAS data cable to connector SAS A on the backplane. See Figure 6-3.
 - If you are installing a SAS RAID controller card, connect the SAS data cable from the blue connector 0 on the card to connector SAS A on the backplane, and from connector 1 on the card to connector SAS B on the backplane. See Figure 6-3.

Installing the SAS RAID Controller Card Battery

To install the RAID battery, insert the battery into the plastic battery holder on the inner side of the chassis, and connect the battery cable to the connector on the SAS RAID controller card next to the RAID memory module.

Figure 3-20. Installing the RAID Battery



1 RAID battery

2 RAID battery cable

3 RAID controller card

Connecting an External SAS Tape Drive

This subsection describes how to connect an external SAS tape drive to the optional external SAS controller card.

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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Ground yourself by touching an unpainted metal surface on the back of the system and unpack the drive.
- 4 Unpack the tape drive and controller card.

- 5 Install the external SAS controller card in an expansion slot. See "Installing an Expansion Card" on page 53.
- 6 Connect the tape drive's interface cable to the drive.
- 7 Connect the other end of the interface cable to the external SAS connector on the controller card bracket.
- 8 Connect the tape drive's power cable to an electrical outlet.
- 9 Close the system. See "Closing the System" on page 47.
- 10 Reconnect the system and peripherals to their electrical outlets, and turn them on.
- 11 Perform a tape backup and verification test with the drive as instructed in the software documentation that came with the drive.

Connecting an External Fibre Channel Storage Device

This subsection describes how to connect external Fibre Channel devices to an optional Fibre Channel HBA card.

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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Ground yourself by touching an unpainted metal surface on the back of the system, unpack the drive, and compare the jumper and switch settings with those in the documentation that came with the drive.
- 4 Install the Fibre Channel HBA in an expansion slot. See "Installing an Expansion Card" on page 53.
- 5 Connect the end of the Fibre Channel cable to the connector on the HBA card bracket.
- 6 Close the system. See "Closing the System" on page 47.
- 7 Reconnect the system and peripherals to their electrical outlets, and turn them on.

System Battery

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

Replacing the System Battery

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

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

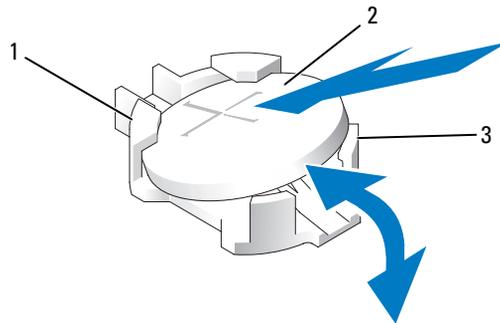
- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Remove the cooling shrouds. See "Removing the Cooling Shrouds" on page 49.
- 4 Locate the battery socket. See Figure 6-2.

➡ 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 Remove the system battery. See Figure 3-21.
 - a Support the battery connector by pressing down firmly on the positive side of the connector.
 - b While supporting the battery connector, press the battery toward the positive side of the connector and pry it up out of the securing tabs at the negative side of the connector.

Figure 3-21. Replacing the System Battery



1 positive side of battery connector

2 system battery

3 negative side of battery connector

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

- 6 Install the new system battery.
 - a Support the battery connector by pressing down firmly on the positive side of the connector.
 - b Hold the battery with the "+" facing up, and slide it under the securing tabs at the positive side of the connector.
 - c Press the battery straight down into the connector until it snaps into place.
- 7 Replace the cooling shrouds. See "Replacing the Cooling Shrouds" on page 50.
- 8 Close the system. See "Closing the System" on page 47.
- 9 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.
- 10 Enter the System Setup program to confirm that the battery is operating properly. See "Using the System Setup Program" on page 31.
- 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, turn off 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 129 for instructions on obtaining technical assistance.

Control Panel Assembly (Service-Only Procedure)

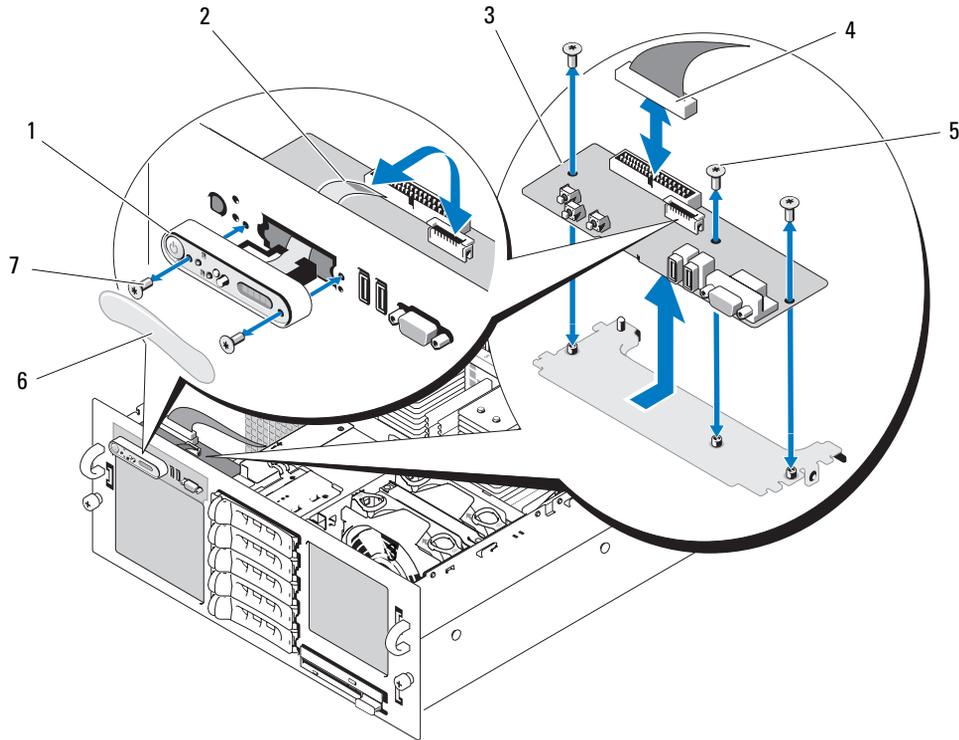
Removing the Control Panel



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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Disconnect the control panel data cable from the control panel board. See Figure 3-22.
- 4 Disconnect the display module cable from the control panel board. See Figure 3-22.
- 5 Remove the three Torx screws securing the control panel board to the system chassis and remove the board.
- 6 Remove the display module:
 - a Insert the end of a paper clip into the hole on the right side of the display module and gently pry the label off.
 - b Remove the two Torx screws that secure the display module to the system chassis.
- 7 Remove the display module from the chassis cutout.

Figure 3-22. Removing and Installing the Control Panel



- | | | | | | |
|---|---------------------------|---|--------------------------------|---|----------------------|
| 1 | display module | 2 | display module cable | 3 | control panel board |
| 4 | control panel board cable | 5 | control panel board screws (3) | 6 | display module label |
| 7 | display module screws (2) | | | | |

Installing the Control Panel

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 Insert the control panel assembly display module into the chassis cutout and secure it with the two Torx screws.
- 2 Affix the control panel label to the display module.
- 3 Install the control panel board in the system chassis and secure with the three Torx screws. See Figure 3-22.
- 4 Connect the display module cable to the control panel board. See Figure 3-22.
- 5 Connect the control panel cable to the control panel board and secure the cable in the cable guides on the chassis.

- 6 Close the system. See "Closing the System" on page 47.
- 7 Replace the front bezel, if applicable. See "Removing and Replacing the Optional Front Bezel" on page 45.
- 8 Reconnect the system to the power source and turn on the system and attached peripherals.

Fan Interposer Board (Service-Only Procedure)

Removing a Fan Interposer Board



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

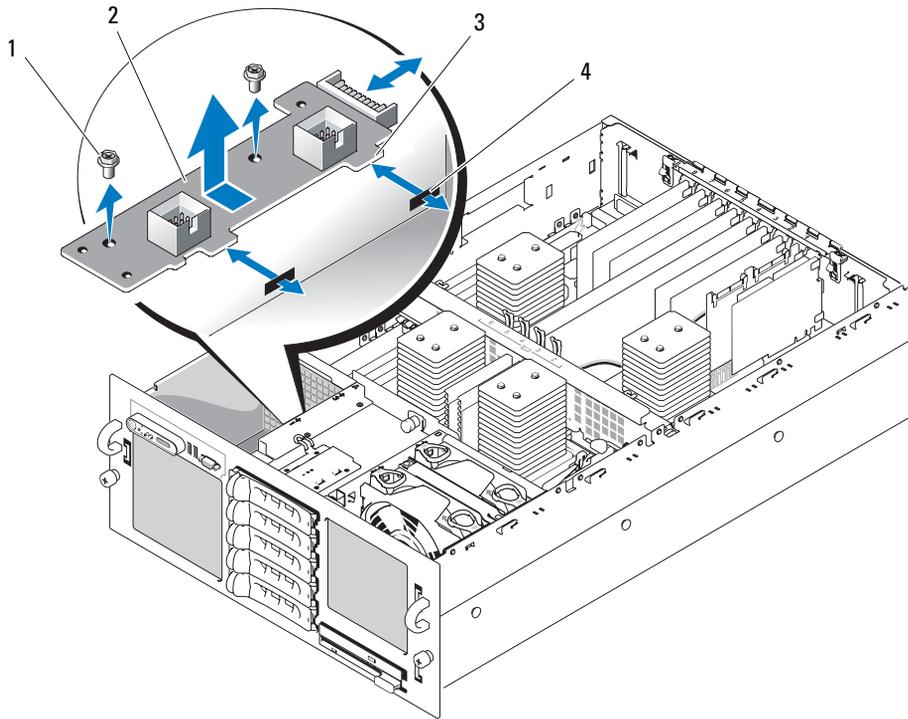
- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.



NOTICE: To prevent damage to the drives and backplane, you must remove the SAS drives and diskette/optical drive carrier from the system before removing the backplane. You must note the number of each hard drive and temporarily label them before removal so that you can replace them in the same locations.

- 3 To remove the optical/diskette drive carrier, pull the release latch forward, then slide the carrier out of the chassis. See Figure 3-18.
- 4 Remove fans 1 and 3 or 2 and 4 (depending on which fan interposer board is being replaced). See "Removing a Cooling Fan" on page 48.
- 5 Remove the SAS backplane. See "SAS Backplane (Service-Only Procedure)" on page 87.
- 6 Remove the two screws and remove the fan interposer board. See Figure 3-23.

Figure 3-23. Removing and Installing a Fan Interposer Board



- | | | | | | |
|---|------------|---|----------------------|---|-------------------|
| 1 | screws (2) | 2 | fan interposer board | 3 | securing tabs (2) |
| 4 | slots (2) | | | | |

Installing a Fan Interposer Board

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

- 1 Slip the two securing tabs on the fan interposer board into the two slots on the side of the fan bay. See Figure 3-23.
- 2 Secure the fan interposer board with the two screws.
- 3 Reinstall the SAS backplane. See "Installing the SAS Backplane" on page 89.
- 4 Install the fans. See "Replacing a Cooling Fan" on page 49.
- 5 Install the optical drive/diskette drive carrier.
Slide the drive carrier into its drive bay and press in the release latch. See Figure 3-14.

- 6 Install the SAS hard drives in their original locations. See "Installing a Hot-Plug Hard Drive" on page 74.
- 7 Close the system. See "Closing the System" on page 47.
- 8 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

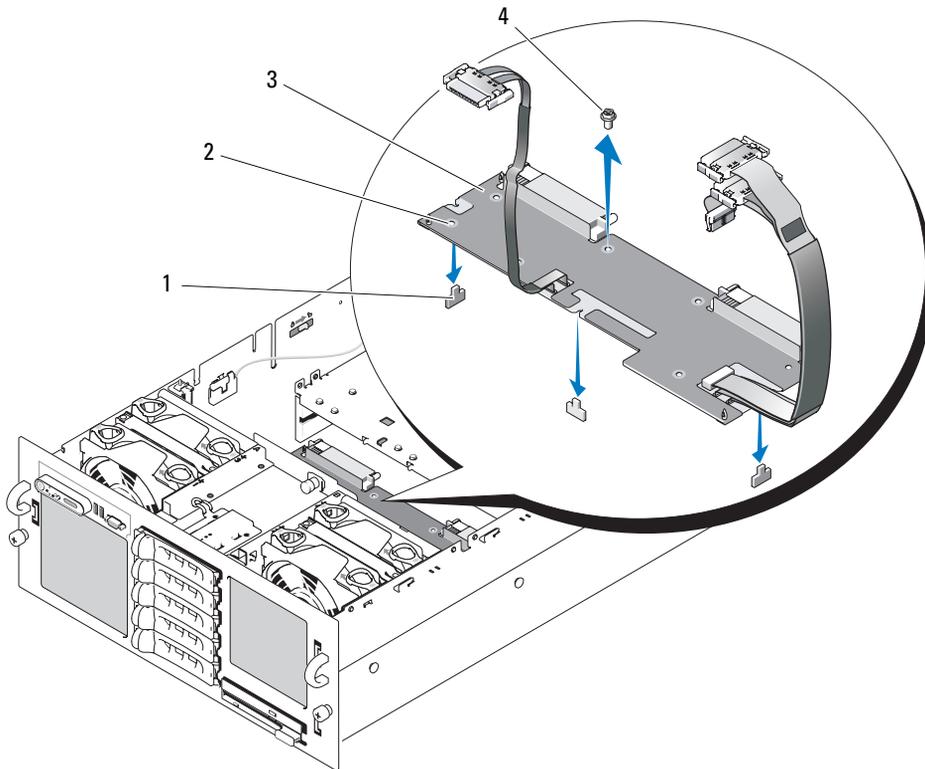
Power Distribution Board (Service-Only Procedure)

Removing the Power Distribution Board

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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Remove the power supplies. See "Removing a Power Supply" on page 51.
- 4 Remove the system board. See "Removing the System Board" on page 89.
- 5 Remove the seven screws securing the board. See Figure 3-24.
- 6 Lift the power distribution board out of the chassis.

Figure 3-24. Removing and Installing the Power Distribution Board



- 1 retention tabs (3) 2 retention slots (3) 3 power distribution board
4 screws (7)

Installing the Power Distribution Board

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

- 1 Position the three retention slots on the power distribution board with the three retention tabs on the bottom of the chassis. See Figure 3-24.
- 2 Secure the power distribution board with the seven screws.
- 3 Install the system board. See step 3 through step 14 in "Installing the System Board."
- 4 Install the power supplies. See "Replacing a Power Supply" on page 52.
- 5 Close the system. See "Closing the System" on page 47.
- 6 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

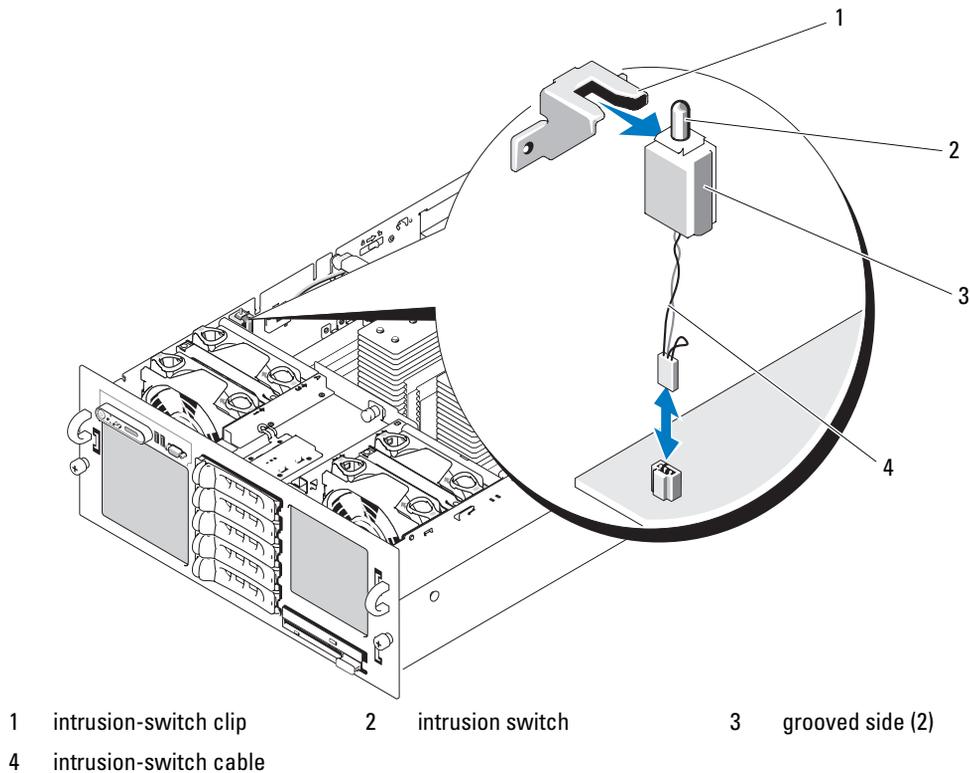
Chassis Intrusion Switch (Service-Only Procedure)

Removing the Chassis Intrusion Switch

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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Remove the top cooling shroud. See "Removing the Cooling Shrouds" on page 49.
- 4 If present, remove the heat sink from processor 4. See "Processors" on page 62.
- 5 Disconnect the intrusion-switch cable from its system board connector. See Figure 3-25.
- 6 Grasp the intrusion switch and slowly and firmly pull the switch out from the intrusion-switch clip.

Figure 3-25. Removing and Installing the Chassis Intrusion Switch



Installing the Chassis Intrusion Switch

 **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 Connect the intrusion-switch cable to its system board connector. See Figure 3-25.
- 2 Align the two grooved sides of the top of the intrusion switch with the inside of the intrusion-switch clip and then gently, but firmly, press in the switch until it is fully seated. See Figure 3-25.
- 3 If applicable, reinstall the heat sink onto processor 4. See "Processors" on page 62.
- 4 Replace the top cooling shroud. See "Replacing the Cooling Shrouds" on page 50.
- 5 Close the system. See "Closing the System" on page 47.
- 6 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

SAS Backplane (Service-Only Procedure)

Removing the SAS Backplane

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

- 1 If applicable, remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 45.
- 2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 3 Open the system. See "Opening the System" on page 46.

 **NOTICE:** To prevent damage to the drives and backplane, you must remove the SAS drives and diskette/optical drive carrier from the system before removing the backplane.

 **NOTICE:** You must note the number of each hard drive and temporarily label them before removal so that you can replace them in the same locations.

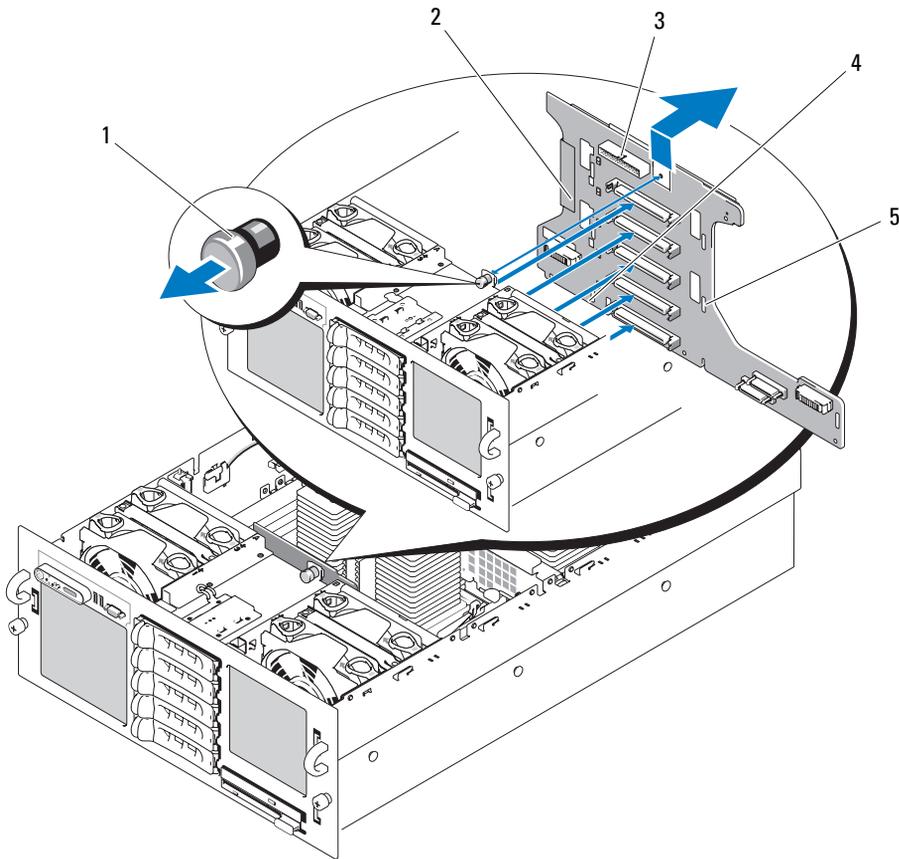
- 4 Remove all SAS hard drives. See "Removing a Hot-Plug Hard Drive" on page 73.
- 5 To remove the optical/diskette drive carrier, pull the release latch forward, then slide the carrier out of the chassis. See Figure 3-18.
- 6 Remove the cooling shrouds. See "Removing the Cooling Shrouds" on page 49.

 **NOTICE:** When disconnecting the control-panel cable, hold the white pull-tab next to the control-panel cable connector to prevent damage to the SAS backplane or the cable itself.

- 7 Disconnect the control-panel cable from the control-panel cable connector on the front of the SAS backplane. See Figure 6-3.
- 8 Disconnect the SAS, interface, and power cables from the back of the SAS backplane.

- 9 Remove the SAS backplane:
- a Pull the spring-loaded blue retention pin away from the front of the backplane, then slide the backplane upward. See Figure 3-26.
 - b When the backplane cannot slide upward any farther, pull the backplane toward the back of the system to remove it from the retention hooks.
 - c Lift the board out of the system, being careful to avoid damaging components on the face of the board.
 - d Place the SAS backplane face down on a work surface.

Figure 3-26. Removing and Installing the SAS Backplane



- | | | | | | |
|---|-----------------------------|---|---------------------|---|-------------------------------|
| 1 | retention pin | 2 | SAS backplane | 3 | control-panel cable connector |
| 4 | installation alignment slot | 5 | retention slots (7) | | |

Installing the SAS Backplane

 **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 Install the SAS backplane:
 - a Slowly lower the backplane into the system, being careful to avoid damaging components on the face of the board.
 - b Align the installation alignment slot on the bottom of the backplane with the alignment pin on the bottom of the chassis. See Figure 3-26.
 - c Slide the retention slots on the backplane over the retention hooks on the chassis.
 - d Slide the backplane downward until the blue retention pin snaps into place.
- 2 Connect the SAS, interface, and power cables to the back of the SAS backplane.
- 3 Connect the control-panel cable to the front of the SAS backplane.
- 4 Install the SAS hard drives in their original locations. See "Hard Drives" on page 72.
- 5 Install the optical drive/diskette drive carrier.
Slide the drive carrier into its drive bay and press in the release latch. See Figure 3-14.
- 6 Install the cooling shrouds. See "Replacing the Cooling Shrouds" on page 50.
- 7 Close the system. See "Closing the System" on page 47.
- 8 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

System Board (Service-Only Procedure)

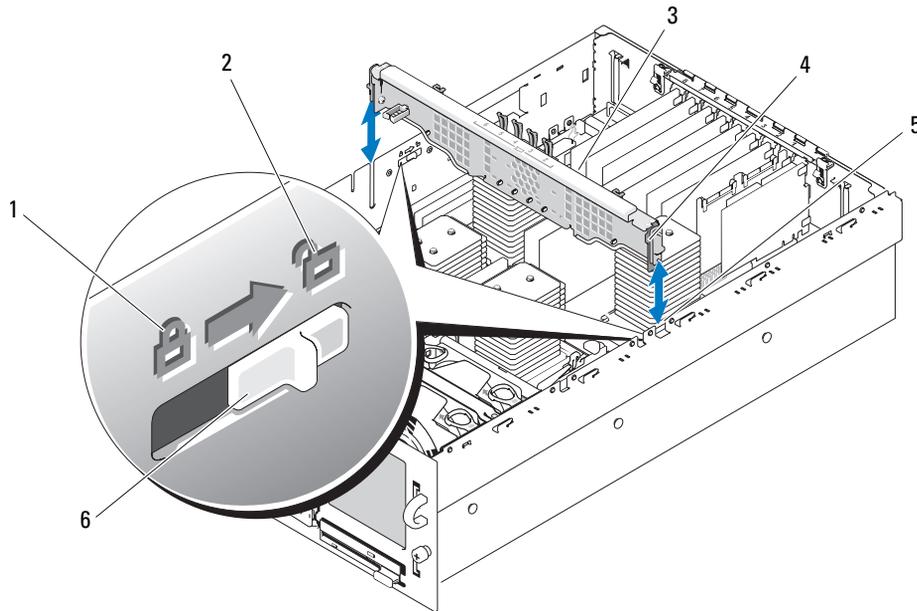
Removing the System Board

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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
-  **NOTICE:** To prevent damage to the drives and backplane, you must remove the SAS drives and diskette/optical drive carrier from the system before removing the backplane.
-  **NOTICE:** Note the number of each hard drive and temporarily label them before removal so that you can replace them in the same locations.
- 3 Remove the cooling shrouds. See "Removing the Cooling Shrouds" on page 49.
- 4 Remove the processor heat sinks. See "Processors" on page 62.

- 5 Disconnect the SAS, interface, and power cables from the back of the SAS backplane.
- 6 Remove all expansion cards and the controller card. See "Removing an Expansion Card" on page 55.
- 7 If present, disconnect and remove the RAC card.
- 8 If present, remove the VRMs for processors 3 and 4. See "Removing a VRM" on page 67.
- 9 Place the two slide switches on each side of the chassis in the unlocked position to release the chassis crossbar, then lift up the crossbar and remove it. See Figure 3-27.

Figure 3-27. Removing and Installing the Chassis Crossbar

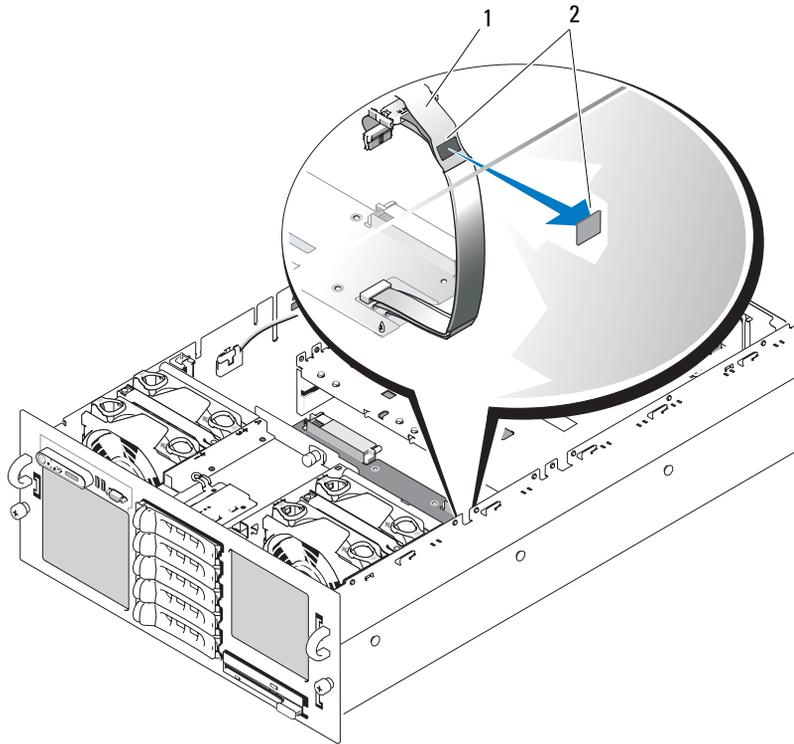


- | | | | | | |
|---|-----------------|---|-------------------|---|--------------------|
| 1 | locked position | 2 | unlocked position | 3 | crossbar |
| 4 | guides (2) | 5 | slots (2) | 6 | slide switches (2) |

- 10 Disconnect all data interface cables, the chassis intrusion switch cable, and the RAID battery cable (if applicable) from the system board.
- 11 Disconnect the power distribution cable harness from the system board.

The power distribution cable harness and the side of the chassis have Velcro pads to hold the cable harness in place while you remove the system board. Bend the cable harness straight up and secure it to the side of the chassis. See Figure 3-28.

Figure 3-28. Securing the Power Distribution Cable Harness



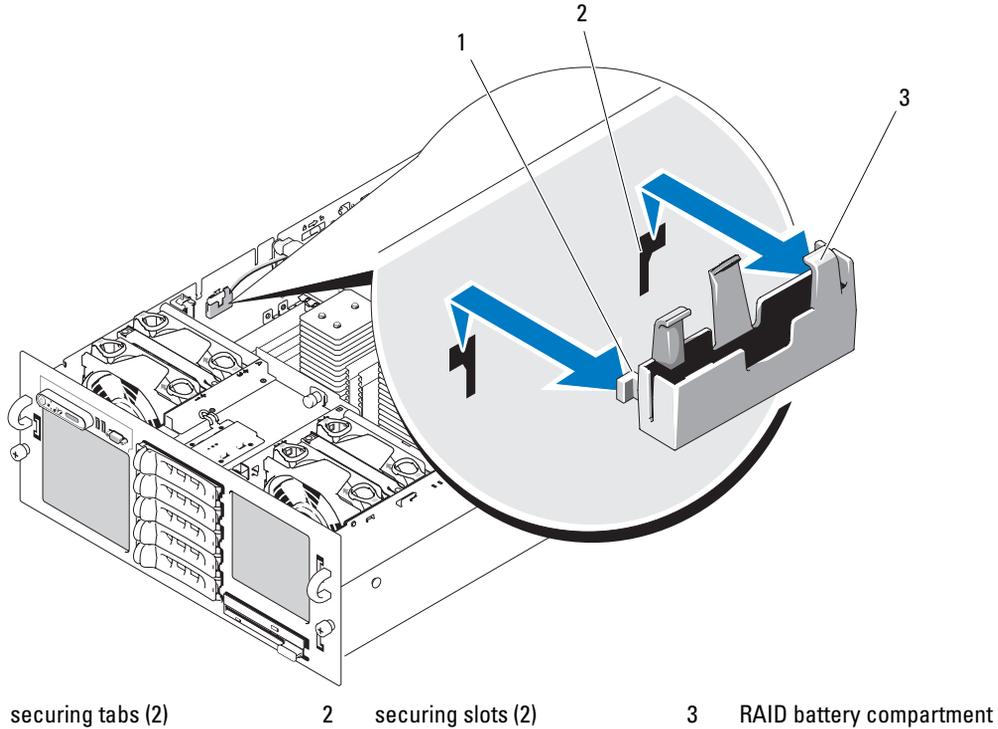
1 power distribution cable harness

2 Velcro pads (2)

12 Remove the RAID battery compartment:

- a** Lift the snap lever and gently pull the RAID battery compartment straight up. See Figure 3-29.
- b** Lift the battery compartment away from the side of the chassis.

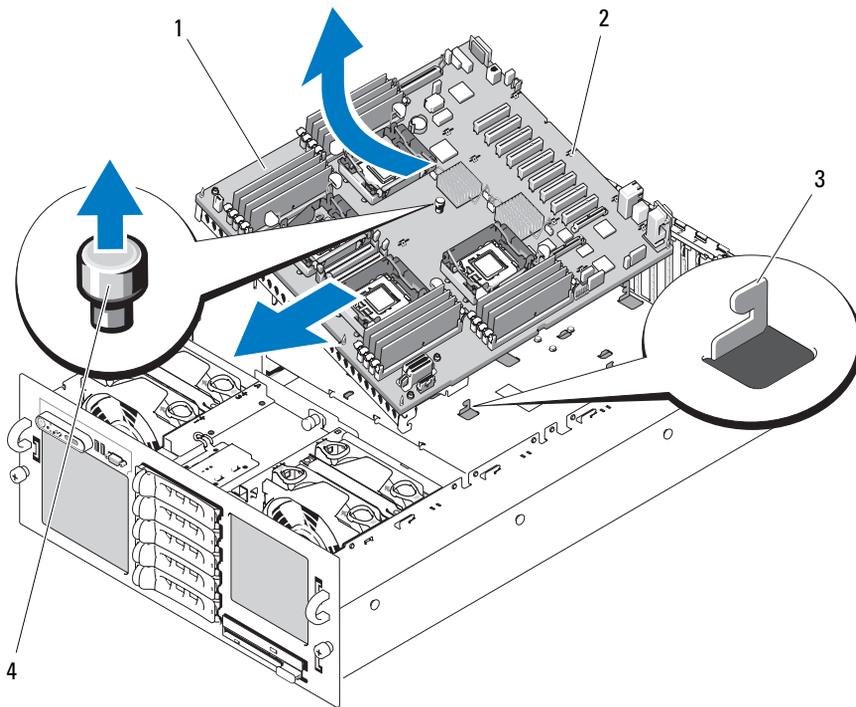
Figure 3-29. Removing and Installing the RAID Battery Compartment



13 Remove the system board:

- a** Pull up the spring-loaded blue retention pin located in the center of the system board, and then slide the system board toward the front of the chassis until it stops. See Figure 3-30.
- b** Slowly and evenly lift the system board above the retention hooks, ensuring that the system board is clear of all retention hooks, then evenly lift up the left side of the system board. See Figure 3-30.
- c** Lift the system board out of the chassis, left side first.

Figure 3-30. Removing and Installing the System Board



1 system board
4 retention pin

2 retention slots

3 retention hooks

Installing the System Board

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

1 Transfer the processors to the new system board. See Figure 6-2 for the location of the system board connectors.

NOTE: Do not install the heat sinks at this time.

2 Remove the memory modules and transfer them to the same locations on the new board. See "Removing Memory Modules" on page 61 and "Installing Memory Modules" on page 60.

3 Install the new system board:

- a Lower the right side of the system board into the chassis.
- b Slowly lower the left side of the system board into the chassis.

- 14** Install the SAS hard drives in their original locations. See "Installing a Hot-Plug Hard Drive" on page 74.
- 15** Close the system. See "Closing the System" on page 47.
- 16** Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.
- 17** Replace the bezel. See "Removing and Replacing the Optional Front Bezel" on page 45.

Troubleshooting Your System

Safety First—For You and Your System

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

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

Start-Up Routine

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

Table 4-1. Start-Up Routine Indications

| Look/listen for: | Action |
|--|---|
| A status or error message displayed on the front-panel LCD. | See "LCD Status Messages" on page 16. |
| An error message displayed on the monitor. | See "System Messages" on page 24. |
| Alert messages from the systems management software. | See the systems management software documentation. |
| The monitor's power indicator. | See "Troubleshooting the Video Subsystem" on page 99. |
| The keyboard indicators. | See "Troubleshooting the Keyboard" on page 100. |
| The USB CD drive activity indicator. | See "Troubleshooting a USB Device" on page 101. |
| The CD drive activity indicator. | See "Troubleshooting an Optical Drive" on page 109. |
| The hard-drive activity indicator. | See "Troubleshooting a Hard Drive" on page 110. |
| An unfamiliar constant scraping or grinding sound when you access a drive. | See "Getting Help" on page 129. |

Checking Basic Power Problems

- 1 If the power indicator on the system front panel or power supplies does not indicate that power is available to the system, ensure that the power cables are securely connected to the power supplies.
- 2 If the system is connected to a PDU or UPS, turn the PDU or UPS off and then on.
- 3 If the PDU or UPS is not receiving power, plug it into another electrical outlet. If it still is not receiving power, try another PDU or UPS.
- 4 Reconnect the system to the electrical outlet and turn on the system.

If the system still is not working properly, see "Troubleshooting Power Supplies" on page 105.

Checking the Equipment

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

Troubleshooting IRQ Assignment Conflicts

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

Table 4-2. IRQ Assignment Defaults

| IRQ Line | Assignment |
|----------|---|
| IRQ0 | System timer |
| IRQ1 | Keyboard controller |
| IRQ2 | Interrupt controller 1 to enable IRQ8 through IRQ15 |
| IRQ3 | <i>Available</i> |
| IRQ4 | Serial port 1 (COM1 and COM3) |
| IRQ5 | Remote access controller |
| IRQ6 | Diskette drive controller |
| IRQ7 | Parallel port |
| IRQ8 | Real-time clock |
| IRQ9 | ACPI functions (used for power management) |
| IRQ10 | <i>Available</i> |
| IRQ11 | <i>Available</i> |
| IRQ12 | <i>Available</i> |

Table 4-2. IRQ Assignment Defaults (continued)

| IRQ Line | Assignment |
|-----------------|-------------------------|
| IRQ13 | Math coprocessor |
| IRQ14 | IDE CD drive controller |
| IRQ15 | <i>Available</i> |

Troubleshooting External Connections

Loose or improperly connected cables are the most likely source of problems for the system, monitor, and other peripherals (such as a printer, keyboard, mouse, or other external device). Ensure that all external cables are securely attached to the external connectors on your system. See "Front-Panel Features and Indicators" on page 11 and "Back-Panel Features and Indicators" on page 14 for the front- and back-panel connectors on your system.

Troubleshooting the Video Subsystem

Problem

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

Action

1 Check the system and power connections to the monitor.

2 Determine whether the system has an expansion card with a video output connector.

In this system configuration, the monitor cable should normally be connected to the connector on the expansion card, *not* to the system's integrated video connector.

To verify that the monitor is connected to the correct video connector, turn off the system and wait for 1 minute, then connect the monitor to the other video connector and turn the system on again.

3 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 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.

If the test runs successfully, the problem is not related to video hardware.

If the test fails, see "Getting Help" on page 129.

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 31.
- 2** Examine the keyboard and its cable for signs of damage.
- 3** Swap the faulty keyboard with a working keyboard.
If the problem is resolved, replace the faulty keyboard. See "Getting Help" on page 129.
- 4** Run the appropriate online diagnostic test. See "Running the System Diagnostics" on page 117.
If the problem is not resolved, see "Getting Help" on page 129.

Troubleshooting the Mouse

Problem

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

Action

- 1** Examine the mouse and its cable for signs of damage.
If the mouse is not damaged, go to step 4.
- 2** Enter the System Setup program and ensure that the USB ports are enabled. See "Using the System Setup Program" on page 31.
If the mouse is damaged, continue to the next step.
- 3** Swap the faulty mouse with a working mouse.
If the problem is resolved, replace the faulty mouse. See "Getting Help" on page 129.
- 4** If the problem is not resolved, see "Getting Help" on page 129.
- 5** Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.
If the test fails, continue to the next step.

Troubleshooting Serial I/O Problems

Problem

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

Action

- 1 Enter the System Setup program and ensure that the serial port is enabled and configured correctly for your application. See "Using the System Setup Program" on page 31.
- 2 If the problem is confined to a particular application, see the application documentation for specific port configuration requirements that the program may require.
- 3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.
If the tests run successfully but the problem persists, see Troubleshooting a Serial I/O Device.

Troubleshooting a Serial I/O Device

Problem

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

Action

- 1 Turn off the system and any peripheral devices connected to the serial port.
- 2 Swap the serial interface cable with a working cable, and turn on the system and the serial device.
If the problem is resolved, replace the interface cable.
- 3 Turn off the system and the serial device, and swap the device with a comparable device.
- 4 Turn on the system and the serial device.
If the problem is resolved, replace the serial device. See "Getting Help" on page 129.
If the problem persists, see "Getting Help" on page 129.

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 31.

- 2 Turn off the system and any USB devices.
- 3 Disconnect the USB devices, and connect the malfunctioning device to the other USB connector.
- 4 Turn on the system and the reconnected device.
If the problem is resolved, the USB connector might be defective. See "Getting Help" on page 129.
- 5 If possible, swap the interface cable with a working cable.
If the problem is resolved, replace the interface cable. See "Getting Help" on page 129.
- 6 Turn off the system and the USB device, and swap the device with a comparable device.
- 7 Turn on the system and the USB device.
If the problem is resolved, replace the USB device. See "Getting Help" on page 129.
If the problem persists, see "Getting Help" on page 129.

Troubleshooting a NIC

Problem

- NIC cannot communicate with network.

Action

- 1 Run the appropriate online diagnostic test. See "Running the System Diagnostics" on page 117.
- 2 Check the appropriate indicator on the NIC connector. See "NIC Indicator Codes" on page 16.
 - 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 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 documentation.
- 4 Enter the System Setup program and confirm that the NICs are enabled. See "Using the System Setup Program" on page 31.
- 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. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening and Closing the System" on page 46.
- 3 Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 55.
- 4 Let the system dry thoroughly for at least 24 hours.
- 5 Close the system. See "Opening and Closing the System" on page 46.
- 6 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
If the system does not start properly, see "Getting Help" on page 129.
- 7 If the system starts properly, shut down the system and reinstall all of the expansion cards that you removed. See "Installing an Expansion Card" on page 53.
- 8 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.
If the test fails, see "Getting Help" on page 129.

Troubleshooting a Damaged System

Problem

- System was dropped or damaged.

Action



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

- 1 Open the system. See "Opening and Closing the System" on page 46.
- 2 Ensure that the following components are properly installed:
 - Expansion cards
 - Power supplies

- Fans
 - Processors and heat sinks
 - Memory modules
 - Drive-carrier connections to the backplane board
- 3 Ensure that all cables are properly connected.
 - 4 Close the system. See "Opening and Closing the System" on page 46.
 - 5 Run the system board tests in the system diagnostics. See "Using Dell PowerEdge Diagnostics" on page 117.
If the tests fail, see "Getting Help" on page 129.

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 31.
- 2 Turn off the system and disconnect it from the electrical outlet for at least one hour.
- 3 Reconnect the system to the electrical outlet and turn on the system.
- 4 Enter the System Setup program.

If the date and time are not correct in the System Setup program, replace the battery. See "System Battery" on page 78.

If the problem is not resolved by replacing the battery, see "Getting Help" on page 129.



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

- 1 Locate the faulty power supply.

The power supply's fault indicator is lit. See "Power Indicator Codes" on page 15.



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 can cause the system to overheat.

- 2 Remove the faulty power supply. See "Power Supplies" on page 51.
- 3 Ensure that the power supply is properly installed by removing and reinstalling it. See "Power Supplies" on page 51.



NOTE: After installing a new 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 15.

If the problem persists, see "Getting Help" on page 129.

Troubleshooting System Cooling Problems

Problem

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

Action

Ensure that none of the following conditions exist:

- System cover, cooling shroud, drive blank, or front or back filler panel is removed.
- Ambient temperature is too high.
- External airflow is obstructed.
- Cables inside the system obstruct airflow.
- An individual cooling fan is removed or has failed. See "Troubleshooting a Fan" on page 106.

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.
- Fan status indicator indicates a problem with the fan.

Action



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

- 1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.
- 2 Open the system. See "Opening and Closing the System" on page 46.



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 panel, the diagnostic software, or the fan indicator that is blinking amber. For the identification number of each fan, see Figure 3-4.
- 4 Ensure that the faulty fan's power cable is firmly attached to the fan power connector. For a hot-plug fan, remove and reseat the fan. See "Cooling Fans" on page 48.



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 "Cooling Fans" on page 48.

If the replacement fan is working properly, close the system. See "Opening and Closing the System" on page 46.

If the replacement fan does not operate, see "Getting Help" on page 129.

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. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.

- 1 If the system is operational, run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.

If diagnostics indicates a fault, follow the corrective actions provided by the diagnostic program. If the problem is not resolved or if the system is not operational, continue to the next step.

- 2 Turn off the system and attached peripherals, unplug the system from the power source and press the power button, and reconnect the system to power.
- 3 Turn on the system and attached peripherals and, as the system boots, note the messages on the screen.

If the amount of system memory detected during POST does not match the amount of memory installed or you receive a general memory error message, proceed to step 4.

If an error messages appears indicating a fault with a specific memory module, go to step 11.

- 4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 5 Open the system. See "Opening and Closing the System" on page 46.
- 6 Ensure that the memory banks are populated correctly. See "General Memory Module Installation Guidelines" on page 58.

If the memory modules are populated correctly, continue to the next step.

- 7 Reseat the memory modules in their sockets. See "Installing Memory Modules" on page 60.
- 8 Close the system. See "Opening and Closing the System" on page 46.
- 9 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.
- 10 Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 31.

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

- 11 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
- 12 Open the system. See "Opening and Closing the System" on page 46.



NOTE: Several configurations for memory modules exist; see "General Memory Module Installation Guidelines" on page 58.

- 13 If a diagnostic test or error message indicates a specific memory module as faulty, swap or replace the module. Otherwise, swap the memory module in socket 1 with a module of the same type and capacity that is known to be good. See "Installing Memory Modules" on page 60.
- 14 Close the system. See "Opening and Closing the System" on page 46.

- 15 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.
- 16 As the system boots, observe any error message that appears and the diagnostic indicators on the front of the system.
- 17 If the memory problem is still indicated, repeat step 11 through step 17 for each memory module installed.
If the problem persists after all memory modules have been checked, see "Getting Help" on page 129.

Troubleshooting a Diskette Drive

Problem

- Error message indicates a diskette drive problem.

Action



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

- 1 Enter the System Setup program and verify that the diskette drive is configured correctly. See "Using the System Setup Program" on page 31.
- 2 Remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 45.
- 3 Remove the diskette/optical drive carrier and ensure that the diskette drive cable is securely attached. Reinstall the diskette/optical drive carrier, making sure it is fully inserted and properly seated in the system chassis. See Figure 3-14.
- 4 Run the appropriate online diagnostic test to see whether the diskette drive works correctly. If it does not, proceed to the next step.
See "Using Dell PowerEdge Diagnostics" on page 117.
- 5 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 6 Open the system. See "Opening and Closing the System" on page 46.
- 7 Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 55.
- 8 Close the system. See "Opening and Closing the System" on page 46.
- 9 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 10 Run the appropriate online diagnostic test to see whether the diskette drive works correctly.
If the tests run successfully, an expansion card may be conflicting with the diskette drive logic, or an expansion card may be faulty. Continue to the next step.
If the test fails, see "Getting Help" on page 129.
- 11 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

- 12 Open the system. See "Opening and Closing the System" on page 46.
 - 13 Reinstall one of the expansion cards you removed in step 7. See "Installing an Expansion Card" on page 53.
 - 14 Close the system. See "Opening and Closing the System" on page 46.
 - 15 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
 - 16 Run the appropriate online diagnostic test to see whether the diskette drive works correctly.
 - 17 Repeat step 11 through step 16 until all expansion cards are reinstalled or one of the expansion cards causes the tests to fail.
- If the problem is not resolved, see "Getting Help" on page 129.

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.



NOTE: DVD devices are data only.

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.

- 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 IDE controller is enabled. See "Using the System Setup Program" on page 31.
 - 3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.
 - 4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
 - 5 Open or remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 45
 - 6 Open the system. See "Opening and Closing the System" on page 46.
 - 7 Ensure that the interface cable is securely connected to the optical drive and to the sideplane.
 - 8 Close the system. See "Opening and Closing the System" on page 46.
 - 9 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- If the problem is not resolved, see "Getting Help" on page 129.

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. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.



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

- 1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117. Depending on the results of the diagnostics test, proceed as needed through the following steps.
- 2 Remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 45.
- 3 If you are experiencing problems with multiple hard drives, skip to step 8. For a problem with a single hard drive, continue to the next step.
- 4 Turn off your system, reseal the hard drive, and restart the system.
- 5 If your system has a SAS RAID controller card, perform the following steps.
 - a Restart the system and press <Ctrl><C> to enter the host adapter configuration utility program.
See the documentation supplied with the controller card for information about the configuration utility.
 - b Ensure that the hard drive has been configured correctly.
 - c Exit the configuration utility and allow the system to boot to the operating system.
- 6 Ensure that the required device drivers for your controller 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.

- 7 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 74.

If the hard drive functions properly in the original bay, the drive carrier could have intermittent problems. Replace the hard-drive carrier. See "Getting Help" on page 129.

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 129.

- 8 Check the cable connections inside the system:
 - a Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
 - b Open the system. See "Opening and Closing the System" on page 46.
 - c Verify that the cable connections between the SAS backplane and the controller card are correct. See "Installing a SAS Controller Card" on page 76.
 - d Verify that the data cables are securely seated in their connectors.
 - e Verify that the power connector on the SAS backplane is securely seated in its connector.
 - f Close the system. See "Opening and Closing the System" on page 46.
 - 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 129.

Troubleshooting a SAS Controller or SAS RAID Controller

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

Problem

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

Action



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

- 1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 117.
- 2 Enter the System Setup program and ensure that the SAS or SAS RAID controller is enabled. See "Using the System Setup Program" on page 31.
- 3 Restart the system and press <Ctrl><C> to enter the configuration utility program:
See the controller's documentation for information about configuration settings.
- 4 Check the configuration settings, make any necessary corrections, and restart the system.
If the problem is not resolved, continue to the next step.
- 5 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
- 6 Open the system. See "Opening and Closing the System" on page 46.
- 7 Ensure that the controller card is firmly seated into the INTERNAL STORAGE system board connector. See "Installing a SAS Controller Card" on page 76.

- 8 If you have a SAS RAID controller, ensure that the following components are properly installed and connected:
 - Memory module
 - RAID battery
- 9 Verify that the cable connections between the backplane and the SAS controller are correct. See "SAS Backplane (Service-Only Procedure)" on page 87.
- 10 Close the system. See "Opening and Closing the System" on page 46.
- 11 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, see "Getting Help" on page 129.
 - If you have a RAID controller, replace the RAID battery. See "Installing the SAS RAID Controller Card Battery" on page 76. If replacing the battery does not solve the problem, see "Getting Help" on page 129.

Troubleshooting an External SAS Tape Drive

Problem

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

Action

- 1 Remove the tape cartridge you were using when the problem occurred, and replace it with a tape cartridge that you know works.
- 2 Ensure that the device drivers for the tape drive are installed and are configured correctly.
- 3 Run the appropriate online diagnostics tests. See "Using Dell PowerEdge Diagnostics" on page 117.
- 4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.



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

- 5 Open the system. See "Opening and Closing the System" on page 46.
- 6 Ensure that the controller card is firmly seated in its connector on the system board.

- 7 Ensure that the tape drive's interface/DC power cable is connected to the tape drive and controller card.
- 8 Close the system. See "Opening and Closing the System" on page 46.
- 9 Reconnect the system to the electrical outlet, and turn on the system, including attached peripherals.
- 10 If the problem is not resolved, see the documentation for the tape drive for additional troubleshooting instructions.
- 11 Reinstall the tape-backup software as instructed in the tape-backup software documentation.
- 12 If you cannot resolve the problem, see "Getting Help" on page 129.

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 "Running the System Diagnostics" on page 117.
- 2 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
- 3 Open the system. See "Opening and Closing the System" on page 46.
- 4 Ensure that each expansion card is firmly seated in its connector. See "Expansion Cards" on page 52.
- 5 Close the system. See "Opening and Closing the System" on page 46.
- 6 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
If the problem persists, go to the next step.
- 7 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 8 Open the system. See "Opening and Closing the System" on page 46.
- 9 Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 55
- 10 Close the system. See "Opening and Closing the System" on page 46.
- 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 test fails, see "Getting Help" on page 129.
- 13** For each expansion card you removed in step 9, perform the following steps:
 - a** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
 - b** Open the system. See "Opening and Closing the System" on page 46.
 - c** Reinstall one of the expansion cards. See "Installing an Expansion Card" on page 53.
 - d** Close the system. "Opening and Closing the System" on page 46.
 - e** Run the appropriate diagnostic test.
If the test fails, see "Getting Help" on page 129.

Troubleshooting the Microprocessors

Problem

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

Action



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

- 1** Run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 117.
- 2** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 3** Open the system. See "Opening and Closing the System" on page 46.
- 4** Ensure that each processor and heat sink are properly installed. See "Removing a Processor" on page 62.
- 5** Close the system. See "Opening and Closing the System" on page 46.
- 6** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 7** Run the appropriate online diagnostic test.
If the test fails or the problem persists, continue to the next step.
- 8** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 9** Open the system. See "Opening and Closing the System" on page 46.
- 10** Replace processor 1 with another processor of the same type. See "Removing a Processor" on page 62 and "Installing a Processor" on page 64.

- 11** Close the system. See "Opening and Closing the System" on page 46.
- 12** Run the appropriate online diagnostic test.
If the tests complete successfully, replace processor 1. See "Getting Help" on page 129.
If the test fails, see "Getting Help" on page 129.

Running the System Diagnostics

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

Using Dell PowerEdge Diagnostics

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

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

System Diagnostics Features

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

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

When to Use the System Diagnostics

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

Running the System Diagnostics

The system diagnostics is run from the utility partition on your hard drive.

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

- 1 As the system boots, press <F10> during POST.
- 2 From the utility partition main menu, select **Run System Diagnostics**, or select **Run Memory Diagnostics** if you are troubleshooting memory.

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

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

System Diagnostics Testing Options

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

Table 5-1. System Diagnostics Testing Options

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

Using the Custom Test Options

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

Selecting Devices for Testing

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

Selecting Diagnostics Options

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

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

Viewing Information and Results

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

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

Jumpers and Connectors

This section provides specific information about the system jumpers. It also provides some basic information on jumpers and switches and describes the connectors on the various boards in the system.

System Board Jumpers

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



NOTE: To access the jumpers, remove the cooling shrouds. See "Removing the Cooling Shrouds" on page 49.

Figure 6-1. System Board Jumpers

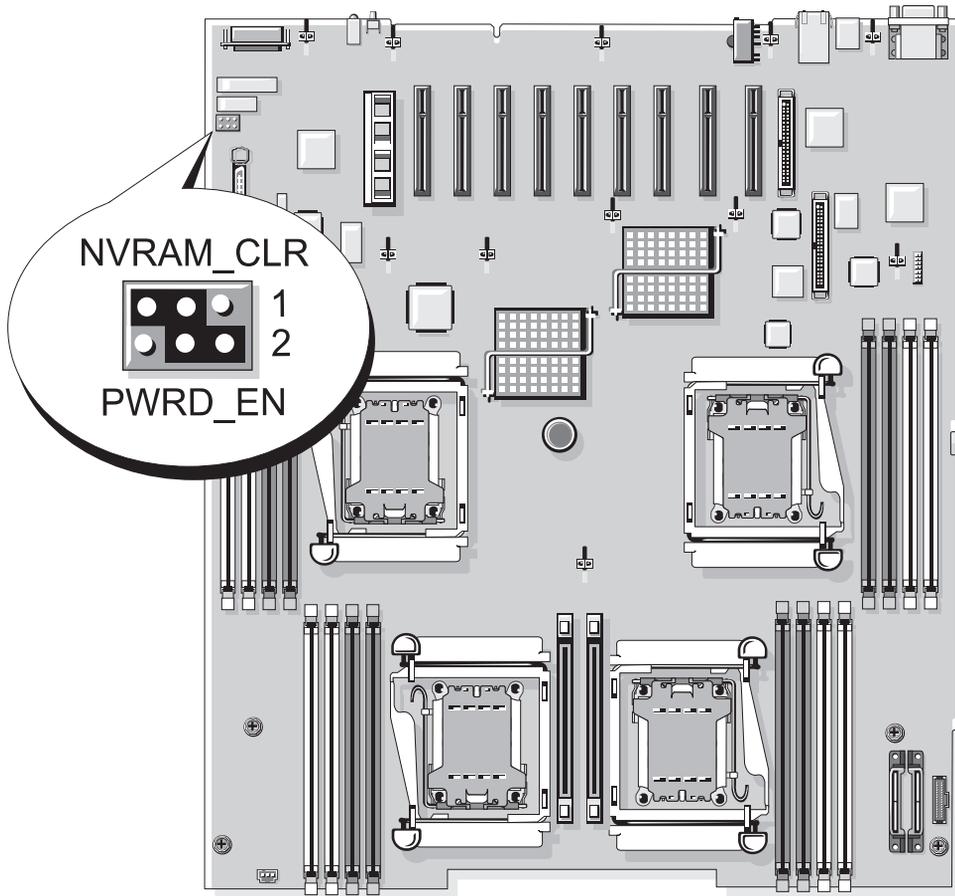


Table 6-1. System Board Jumper Settings

| Jumper | Setting | Description |
|-------------|---|---|
| 1 PSWD_EN |  (default) | The password feature is enabled. |
| |  | The password feature is disabled. |
| 2 NVRAM_CLR |  (default) | The configuration settings are retained at system boot. |
| |  | The configuration settings are cleared at the next system boot. |

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 155.

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 31. The password jumper enables these password features or disables them and clears any password(s) currently in use.

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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening and Closing the System" on page 46.
- 3 Lift up the memory module shroud.
- 4 Remove the jumper plug from the password jumper.
See Figure 6-1 to locate the password jumper on the system board.
- 5 Close the system.

- 6 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.

- 7 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 8 Open the system. See "Opening and Closing the System" on page 46.
- 9 Install the jumper plug on the password jumper.
- 10 Lower the memory module shroud.
- 11 Close the system.
- 12 Reconnect your system and peripherals to their electrical outlets, and turn on the system.
- 13 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 38.

System Board Connectors

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

Figure 6-2. System Board Connectors

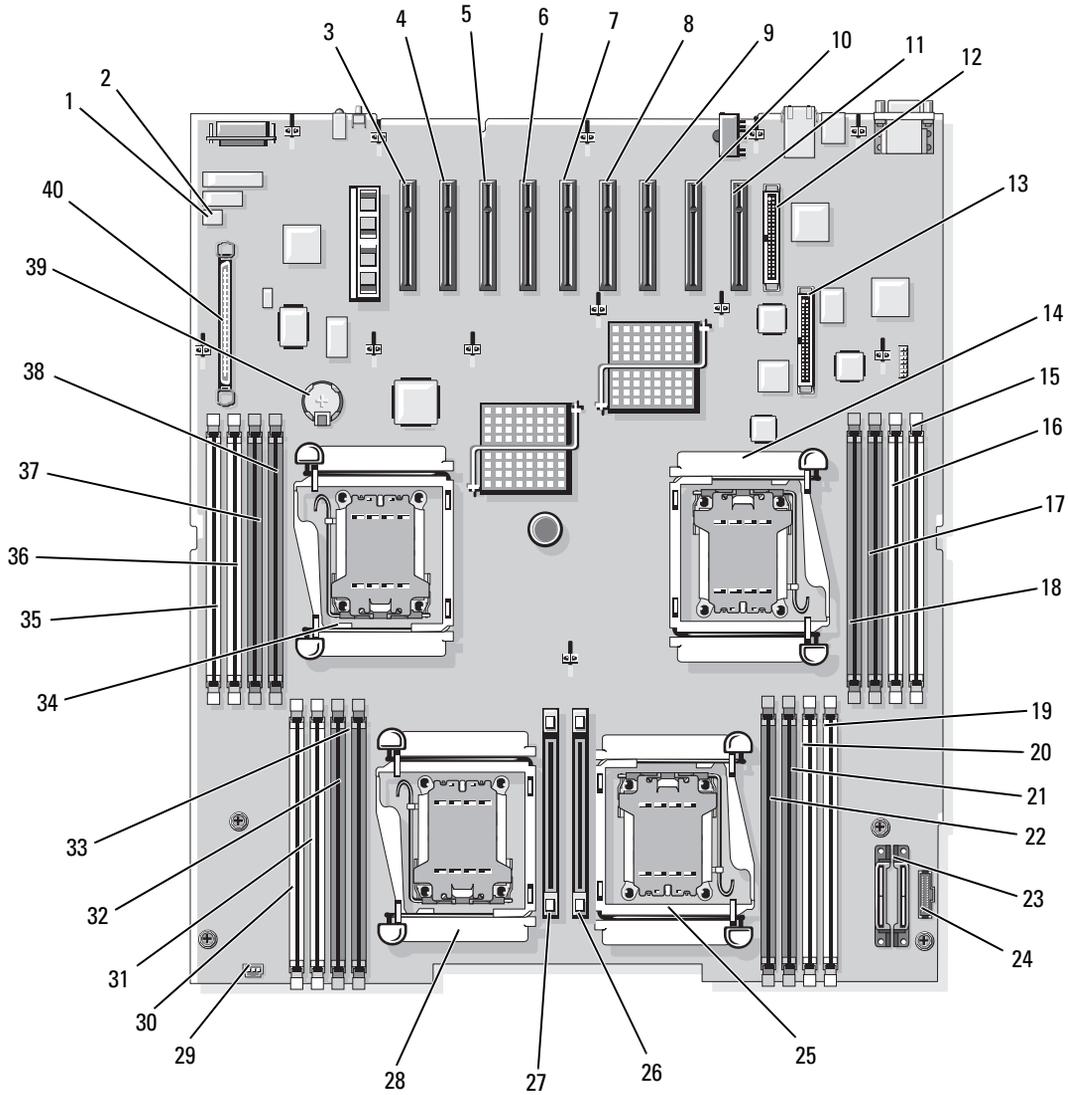


Table 6-2. System Board Connectors

| Connector Label | Description |
|----------------------|--|
| 1 PSWD_EN | Password jumper |
| 2 NVRAM_CLR | Configuration jumper |
| 3 SLOT 7 | x4 PCIe expansion card connector |
| 4 SLOT 6 | x4 PCIe expansion card connector |
| 5 SLOT 5 | x4 PCIe expansion card connector |
| 6 SLOT 4 | x8 PCIe expansion card connector |
| 7 SLOT 3 | x8 PCIe expansion card connector |
| 8 SLOT 2 | x4 PCIe expansion card connector |
| 9 SLOT 1 | x4 PCIe expansion card connector |
| 10 INTERNAL_STORAGE | SAS controller card connector |
| 11 RAC_CONN | remote access card (RAC) connector |
| 12 RAC_CONN1 | Connector for the 40-pin RAC cable |
| 13 RAC_CONN2 | Connector for the 50-pin RAC cable |
| 14 CPU 1 | Processor 1 connector |
| 15 DIMM 1 | Memory module connector, slot 1 |
| 16 DIMM 2 | Memory module connector, slot 2 |
| 17 DIMM 3 | Memory module connector, slot 3 |
| 18 DIMM 4 | Memory module connector, slot 4 |
| 19 DIMM 9 | Memory module connector, slot 9 |
| 20 DIMM 10 | Memory module connector, slot 10 |
| 21 DIMM 11 | Memory module connector, slot 11 |
| 22 DIMM 12 | Memory module connector, slot 12 |
| 23 12V | 12 V power connector |
| 24 PWR_3.3Stby_Cntrl | Power distribution board signal connector |
| 25 CPU 3 | Processor 3 connector |
| 26 VRM 3 | Voltage regulator module (VRM) 3 connector |
| 27 VRM 4 | VRM 4 connector |
| 28 CPU 4 | Processor 4 connector |
| 29 INTRUSION | Intrusion switch connector |

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 155.

Table 6-2. System Board Connectors (continued)

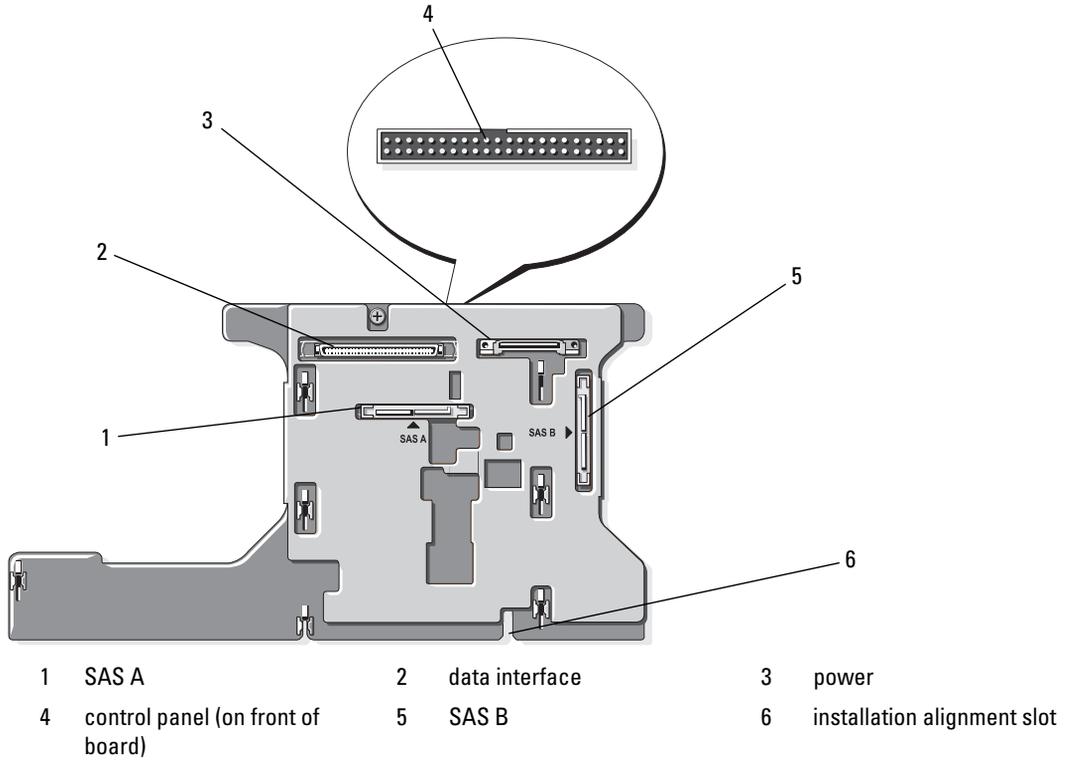
| Connector Label | Description |
|------------------------|--------------------------------------|
| 30 DIMM 13 | Memory module connector, slot 13 |
| 31 DIMM 14 | Memory module connector, slot 14 |
| 32 DIMM 15 | Memory module connector, slot 15 |
| 33 DIMM 16 | Memory module connector, slot 16 |
| 34 CPU 2 | Processor 2 connector |
| 35 DIMM 5 | Memory module connector, slot 5 |
| 36 DIMM 6 | Memory module connector, slot 6 |
| 37 DIMM 7 | Memory module connector, slot 7 |
| 38 DIMM 8 | Memory module connector, slot 8 |
| 39 BATTERY | Connector for the 3.0-V coin battery |
| 40 CONTROL_PANEL | Control panel cable connector |

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 155.

SAS Backplane Board Connectors

Figure 6-3 shows the location of the connectors on the backplane board.

Figure 6-3. SAS Backplane Board Connectors



Getting Help

Technical Assistance

If you need assistance with a technical problem, perform the following steps:

- 1 Complete the procedures in "Troubleshooting Your System" on page 97.
- 2 Run the system diagnostics and record any information provided.
- 3 Make a copy of the Diagnostics Checklist, and fill it out.
- 4 Use Dell's extensive suite of online services available at Dell Support at support.dell.com for help with installation and troubleshooting procedures.

For more information, see "Online Services" on page 129.

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

 **NOTE:** Call technical support from a phone near or at the system so that technical support can assist you with any necessary procedures.

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

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

For instructions on using the technical support service, see "Technical Support Service" on page 130 and "Before You Call" on page 132.

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

Online Services

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

You can contact Dell electronically using the following addresses:

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

www.euro.dell.com (Europe only)

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

www.dell.ca (Canada only)

- Anonymous file transfer protocol (FTP)
[ftp.dell.com/](ftp://ftp.dell.com/)

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

- Electronic Support Service
support@us.dell.com
apsupport@dell.com (Asian/Pacific countries only)
support.jp.dell.com (Japan only)
support.euro.dell.com (Europe only)
- Electronic Quote Service
apmarketing@dell.com (Asian/Pacific countries only)
sales_canada@dell.com (Canada only)

AutoTech Service

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

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

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

Automated Order-Status Service

To check on the status of any Dell™ products that you have ordered, you can go to support.dell.com, or you can call the automated order-status service. A recording prompts you for the information needed to locate and report on your order. See the contact information for your region.

Technical Support Service

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

To contact Dell's technical support service, see "Before You Call" on page 132 and then see the contact information for your region.

Dell Enterprise Training and Certification

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

Problems With Your Order

If you have a problem with your order, such as missing parts, wrong parts, or incorrect billing, contact Dell for customer assistance. Have your invoice or packing slip available when you call. See the contact information for your region.

Product Information

If you need information about additional products available from Dell, or if you would like to place an order, visit the Dell website at www.dell.com. For the telephone number to call to speak to a sales specialist, see the contact information for your region.

Returning Items for Warranty Repair or Credit

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

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

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

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

Before You Call

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

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



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

Diagnostics Checklist

Name:

Date:

Address:

Phone number:

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

Express Service Code:

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

Operating system and version:

Peripherals:

Expansion cards:

Are you connected to a network? Yes No

Network, version, and network card:

Programs and versions:

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

Description of problem and troubleshooting procedures you performed:

Contacting Dell

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

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

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



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



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

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



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

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

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|---|--|--|
| Argentina (Buenos Aires) International Access Code: 00 Country Code: 54 City Code: 11 | Website: www.dell.com.ar E-mail: la-techsupport@dell.com E-mail for desktop and portable computers: la-techsupport@dell.com E-mail for servers and EMC® storage products: la_enterprise@dell.com | Customer Care toll-free: 0-800-444-0730 Technical Support toll-free: 0-800-444-0733 Technical Support Services toll-free: 0-800-444-0724 Sales 0-810-444-3355 |
| Aruba | Website: www.dell.com.aw E-mail: la-techsupport@dell.com General Support | toll-free: 800-1578 |
| Australia (Sydney) International Access Code: 0011 Country Code: 61 City Code: 2 | Website: support.ap.dell.com E-mail: support.ap.dell.com/contactus Technical Support (XPS) General Support | toll-free: 1300 790 877 13DELL-133355 |
| Austria (Vienna) International Access Code: 900 Country Code: 43 City Code: 1 | Website: support.euro.dell.com E-mail: tech_support_central_europe@dell.com Home/Small Business Sales Home/Small Business Fax Home/Small Business Customer Care Preferred Accounts/Corporate Customer Care Support for XPS Home/Small Business Support for all other Dell computers Preferred Accounts/Corporate Support Switchboard | 0820 240 530 00 0820 240 530 49 0820 240 530 14 0820 240 530 16 0820 240 530 81 0820 240 530 17 0820 240 530 17 0820 240 530 00 |
| Bahamas | Website: www.dell.com.bs E-mail: la-techsupport@dell.com General Support | toll-free: 1-866-874-3038 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|--|--|--|
| Barbados | Website: www.dell.com/bb E-mail: la-techsupport@dell.com General Support | 1-800-534-3142 |
| Belgium (Brussels) International Access Code: 00 Country Code: 32 City Code: 2 | Website: support.euro.dell.com Tech Support for XPS Tech Support for all other Dell computers Tech Support Fax Customer Care Corporate Sales Fax Switchboard | 02 481 92 96 02 481 92 88 02 481 92 95 02 713 15 65 02 481 91 00 02 481 92 99 02 481 91 00 |
| Bermuda | Website: www.dell.com/bm E-mail: la-techsupport@dell.com General Support | 1-877-890-0751 |
| Bolivia | Website: www.dell.com/bo E-mail: la-techsupport@dell.com General Support | toll-free: 800-10-0238 |
| Brazil International Access Code: 00 Country Code: 55 City Code: 51 | Website: www.dell.com/br E-mail: BR-TechSupport@dell.com Customer Care and Tech Support Technical Support Fax Customer Care Fax Sales | 0800 90 3355 51 2104 5470 51 2104 5480 0800 722 3498 |
| British Virgin Islands | General Support | toll-free: 1-866-278-6820 |
| Brunei Country Code: 673 | Technical Support (Penang, Malaysia) Customer Care (Penang, Malaysia) Transaction Sales (Penang, Malaysia) | 604 633 4966 604 633 4888 604 633 4955 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|--|---|---|
| Canada (North York, Ontario) International Access Code: 011 | Online Order Status: www.dell.ca/ostatus Website: support.ca.dell.com | |
| | AutoTech (automated Hardware and Warranty Support) | toll-free: 1-800-247-9362 |
| | Customer Service (Home/Home Office) | toll-free: 1-800-847-4096 |
| | Customer Service (small/med./large business, government) | toll-free: 1-800-387-5757 |
| | Customer Service (printers, projectors, televisions, handhelds, digital jukebox, and wireless) | toll-free: 1-800-847-4096 |
| | Hardware Warranty Phone Support (XPS) | toll-free: 1-866-398-8977 |
| | Hardware Warranty Phone Support (Home/Home Office) | toll-free: 1-800-847-4096 |
| | Hardware Warranty Phone Support (small/med./large business, government) | toll-free: 1-800-387-5757 |
| | Hardware Warranty Phone Support (printers, projectors, televisions, handhelds, digital jukebox, and wireless) | 1-877-335-5767 |
| | Sales (Home Sales/Small Business) | toll-free: 1-800-387-5752 |
| | Sales (med./large bus., government) | toll-free: 1-800-387-5755 |
| | Spare Parts Sales & Extended Service Sales | 1 866 440 3355 |
| Cayman Islands | E-mail: la-techsupport@dell.com General Support | 1-877-262-5415 |
| Chile (Santiago) Country Code: 56 City Code: 2 | Website: www.dell.com/cl E-mail: la-techsupport@dell.com Sales and Customer Support | toll-free: 1230-020-4823 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|--|--|---|
| China (Xiamen) Country Code: 86 City Code: 592 | Technical Support website: support.dell.com.cn Technical Support E-mail: support.dell.com.cn/email Customer Care E-mail: customer_cn@dell.com | |
| | Technical Support Fax | 592 818 1350 |
| | Technical Support (XPS) | toll-free: 800 858 0540 |
| | Technical Support (Dimension and Inspiron) | toll-free: 800 858 2969 |
| | Technical Support (OptiPlex, Latitude, and Dell Precision) | toll-free: 800 858 0950 |
| | Technical Support (servers and storage) | toll-free: 800 858 0960 |
| | Technical Support (projectors, PDAs, switches, routers, and so on) | toll-free: 800 858 2920 |
| | Technical Support (printers) | toll-free: 800 858 2311 |
| | Customer Care | toll-free: 800 858 2060 |
| | Customer Care Fax | 592 818 1308 |
| | Home and Small Business | toll-free: 800 858 2222 |
| | Preferred Accounts Division | toll-free: 800 858 2557 |
| | Large Corporate Accounts GCP | toll-free: 800 858 2055 |
| | Large Corporate Accounts Key Accounts | toll-free: 800 858 2628 |
| | Large Corporate Accounts North | toll-free: 800 858 2999 |
| | Large Corporate Accounts North Government and Education | toll-free: 800 858 2955 |
| | Large Corporate Accounts East | toll-free: 800 858 2020 |
| | Large Corporate Accounts East Government and Education | toll-free: 800 858 2669 |
| | Large Corporate Accounts Queue Team | toll-free: 800 858 2572 |
| | Large Corporate Accounts South | toll-free: 800 858 2355 |
| | Large Corporate Accounts West | toll-free: 800 858 2811 |
| | Large Corporate Accounts Spare Parts | toll-free: 800 858 2621 |
| Colombia | Website: www.dell.com/cl E-mail: la-techsupport@dell.com General Support | 01-800-915-4755 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|--|---|--|
| Costa Rica | Website: www.dell.com/cr E-mail: la-techsupport@dell.com General Support | 0800-012-0231 |
| Czech Republic (Prague) International Access Code: 00 Country Code: 420 | Website: support.euro.dell.com E-mail: czech_dell@dell.com Technical Support Customer Care Fax Technical Fax Switchboard | 22537 2727 22537 2707 22537 2714 22537 2728 22537 2711 |
| Denmark (Copenhagen) International Access Code: 00 Country Code: 45 | Website: support.euro.dell.com Technical Support for XPS Technical Support for all other Dell computers Customer Care (Relational) Home/Small Business Customer Care Switchboard (Relational) Switchboard Fax (Relational) Switchboard (Home/Small Business) Switchboard Fax (Home/Small Business) | 7010 0074 7023 0182 7023 0184 3287 5505 3287 1200 3287 1201 3287 5000 3287 5001 |
| Dominica | Website: www.dell.com/dm E-mail: la-techsupport@dell.com General Support | toll-free: 1-866-278-6821 |
| Dominican Republic | Website: www.dell.com/do E-mail: la-techsupport@dell.com General Support | 1-800-156-1588 |
| Ecuador | Website: www.dell.com/ec E-mail: la-techsupport@dell.com General Support (calling from Quito) General Support (calling from Guayaquil) | toll-free: 999-119-877-655-3355 toll-free: 1800-999-119-877-655-3355 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|--|---|--|
| El Salvador | Website: www.dell.com/ec E-mail: la-techsupport@dell.com General Support | 800-6132 |
| Finland (Helsinki) International Access Code: 990 Country Code: 358 City Code: 9 | Website: support.euro.dell.com E-mail: fi_support@dell.com Technical Support Customer Care Switchboard Sales under 500 employees Fax Sales over 500 employees Fax | 0207 533 555 0207 533 538 0207 533 533 0207 533 540 0207 533 530 0207 533 533 0207 533 530 |
| France (Paris) (Montpellier) International Access Code: 00 Country Code: 33 City Codes: (1) (4) | Website: support.euro.dell.com Home and Small Business Technical Support for XPS Technical Support for all other Dell computers Customer Care Switchboard Switchboard (calls from outside of France) Sales Fax Fax (calls from outside of France) Corporate Technical Support Customer Care Switchboard Sales Fax | 0825 387 129 0825 387 270 0825 823 833 0825 004 700 04 99 75 40 00 0825 004 700 0825 004 701 04 99 75 40 01 0825 004 719 0825 338 339 01 55 94 71 00 01 55 94 71 00 01 55 94 71 01 |

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

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|--|--|---|
| Hong Kong International Access Code: 001 Country Code: 852 | Website: support.ap.dell.com | |
| | Technical Support E-mail: support.dell.com.cn/email | |
| | Technical Support (XPS) | 00852-3416 6923 |
| | Technical Support (Dimension and Inspiron) | 00852-2969 3188 |
| | Technical Support (OptiPlex, Latitude, and Dell Precision) | 00852-2969 3191 |
| | Technical Support (servers and storage) | 00852-2969 3196 |
| | Technical Support (projectors, PDAs, switches, routers, and so on) | 00852-3416 0906 |
| | Customer Care | 00852-3416 0910 |
| | Large Corporate Accounts | 00852-3416 0907 |
| | Global Customer Programs | 00852-3416 0908 |
| Medium Business Division | 00852-3416 0912 | |
| Home and Small Business Division | 00852-2969 3105 | |
| India | Website: support.ap.dell.com | |
| | E-mail: india_support_desktop@dell.com india_support_notebook@dell.com india_support_Server@dell.com | |
| | Technical Support (XPS computers) | 0802 506 8033 or toll-free: 1800 425 2066 |
| | Technical Support (portables, desktops, servers, and storage) | 1600338045 and 1600448046 |
| | Sales (Large Corporate Accounts) | 1600 33 8044 |
| Sales (Home and Small Business) | 1600 33 8046 | |

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

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|--|---|---|
| Jamaica | E-mail: la-techsupport@dell.com General Support (dial from within Jamaica only) | 1-800-440-9205 |
| Japan (Kawasaki) | Website: support.jp.dell.com | |
| International Access Code: 001 | Technical Support (XPS) | toll-free: 0120-937-786 |
| Country Code: 81 | Technical Support outside of Japan (XPS) | 044-520-1235 |
| City Code: 44 | XPS Customer Care (if ordered items are missing or have been damaged during shipment) | 044-556-4240 |
| | Technical Support (Dimension and Inspiron) | toll-free: 0120-198-226 |
| | Technical Support outside of Japan (Dimension and Inspiron) | 81-44-520-1435 |
| | Technical Support (Dell Precision, OptiPlex, and Latitude) | toll-free: 0120-198-433 |
| | Technical Support outside of Japan (Dell Precision, OptiPlex, and Latitude) | 81-44-556-3894 |
| | Technical Support (Dell PowerApp™, Dell PowerEdge™, Dell PowerConnect™, and Dell PowerVault™) | toll-free: 0120-198-498 |
| | Technical Support outside of Japan (PowerApp, PowerEdge, PowerConnect, and PowerVault) | 81-44-556-4162 |
| | Technical Support (projectors, PDAs, printers, routers) | toll-free: 0120-981-690 |
| | Technical Support outside of Japan (projectors, PDAs, printers, routers) | 81-44-556-3468 |
| | Faxbox Service | 044-556-3490 |
| | 24-Hour Automated Order Status Service | 044-556-3801 |
| | Customer Care | 044-556-4240 |
| | Business Sales Division (up to 400 employees) | 044-556-1465 |
| | Preferred Accounts Division Sales (over 400 employees) | 044-556-3433 |
| | Public Sales (government agencies, educational institutions, and medical institutions) | 044-556-5963 |
| | Global Segment Japan | 044-556-3469 |
| | Individual User | 044-556-1760 |
| | Switchboard | 044-556-4300 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|--|---|---|
| Korea (Seoul) | E-mail: krsupport@dell.com | |
| International Access Code: 001 | Support | toll-free: 080-200-3800 |
| Country Code: 82 | Technical Support (XPS) | toll-free: 080-999-0283 |
| City Code: 2 | Support (Dimension, PDA, Electronics, and Accessories) | toll-free: 080-200-3801 |
| | Sales | toll-free: 080-200-3600 |
| | Fax | 2194-6202 |
| | Switchboard | 2194-6000 |
| Latin America | Customer Technical Support (Austin, Texas, U.S.A.) | 512 728-4093 |
| | Customer Service (Austin, Texas, U.S.A.) | 512 728-3619 |
| | Fax (Technical Support and Customer Service) (Austin, Texas, U.S.A.) | 512 728-3883 |
| | Sales (Austin, Texas, U.S.A.) | 512 728-4397 |
| | SalesFax (Austin, Texas, U.S.A.) | 512 728-4600 or 512 728-3772 |
| Luxembourg | Website: support.euro.dell.com | |
| International Access Code: 00 | Support | 342 08 08 075 |
| Country Code: 352 | Home/Small Business Sales | +32 (0)2 713 15 96 |
| | Corporate Sales | 26 25 77 81 |
| | Customer Care | +32 (0)2 481 91 19 |
| | Fax | 26 25 77 82 |
| Macao | Technical Support | toll-free: 0800 105 |
| Country Code: 853 | Customer Service (Xiamen, China) | 34 160 910 |
| | Transaction Sales (Xiamen, China) | 29 693 115 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|--|--|---|
| Malaysia (Penang) | Website: support.ap.dell.com | |
| International Access Code: 00 | Technical Support (XPS) | toll-free: 1800 885 784 |
| Country Code: 60 | Technical Support (Dell Precision, OptiPlex, and Latitude) | toll-free: 1 800 880 193 |
| City Code: 4 | Technical Support (Dimension, Inspiron, and Electronics and Accessories) | toll-free: 1 800 881 306 |
| | Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault) | toll-free: 1800 881 386 |
| | Customer Care | toll-free: 1800 881 306 (option 6) |
| | Transaction Sales | toll-free: 1 800 888 202 |
| | Corporate Sales | toll-free: 1 800 888 213 |
| Mexico | E-mail: la-techsupport@dell.com | |
| International Access Code: 00 | Customer Technical Support | 001-877-384-8979 |
| Country Code: 52 | | or 001-877-269-3383 |
| | Sales | 50-81-8800 |
| | | or 01-800-888-3355 |
| | Customer Service | 001-877-384-8979 |
| | | or 001-877-269-3383 |
| | Main | 50-81-8800 |
| | | or 01-800-888-3355 |
| Montserrat | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 1-866-278-6822 |
| Netherlands Antilles | E-mail: la-techsupport@dell.com | |
| | General Support | 001-800-882-1519 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|--|--|---|
| Netherlands (Amsterdam) | Website: support.euro.dell.com | |
| International Access Code: 00 | Technical Support for XPS | 020 674 45 94 |
| Country Code: 31 | Technical Support for all other Dell computers | 020 674 45 00 |
| City Code: 20 | Technical Support Fax | 020 674 47 66 |
| | Home/Small Business Customer Care | 020 674 42 00 |
| | Relational Customer Care | 020 674 4325 |
| | Home/Small Business Sales | 020 674 55 00 |
| | Relational Sales | 020 674 50 00 |
| | Home/Small Business Sales Fax | 020 674 47 75 |
| | Relational Sales Fax | 020 674 47 50 |
| | Switchboard | 020 674 50 00 |
| | Switchboard Fax | 020 674 47 50 |
| New Zealand | Website: support.ap.dell.com | |
| International Access Code: 00 | E-mail: support.ap.dell.com/contactus | |
| Country Code: 64 | Technical Support (XPS) | toll-free: 0800 335 540 |
| | General Support | 0800 441 567 |
| Nicaragua | E-mail: la-techsupport@dell.com | |
| | General Support | 001-800-220-1377 |
| Norway (Lysaker) | Website: support.euro.dell.com | |
| International Access Code: 00 | Technical Support for XPS | 815 35 043 |
| Country Code: 47 | Technical Support for all other Dell products | 671 16882 |
| | Relational Customer Care | 671 17575 |
| | Home/Small Business Customer Care | 23162298 |
| | Switchboard | 671 16800 |
| | Fax Switchboard | 671 16865 |
| Panama | E-mail: la-techsupport@dell.com | |
| | General Support | 011-800-507-1264 |
| Peru | E-mail: la-techsupport@dell.com | |
| | General Support | 0800-50-669 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|--|--|---|
| Poland (Warsaw) | Website: support.euro.dell.com | |
| International Access Code: 011 | E-mail: pl_support_tech@dell.com | |
| Country Code: 48 | Customer Service Phone | 57 95 700 |
| City Code: 22 | Customer Care | 57 95 999 |
| | Sales | 57 95 999 |
| | Customer Service Fax | 57 95 806 |
| | Reception Desk Fax | 57 95 998 |
| | Switchboard | 57 95 999 |
| Portugal | Website: support.euro.dell.com | |
| International Access Code: 00 | Technical Support | 707200149 |
| Country Code: 351 | Customer Care | 800 300 413 |
| | Sales | 800 300 410 or 800 300 411 or 800 300 412 or 21 422 07 10 |
| | Fax | 21 424 01 12 |
| Puerto Rico | E-mail: la-techsupport@dell.com | |
| | General Support | 1-877-537-3355 |
| St. Kitts and Nevis | Website: www.dell.com/kn | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 1-866-540-3355 |
| St. Lucia | Website: www.dell.com/lc | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 1-866-464-4352 |
| St. Vincent and the Grenadines | Website: www.dell.com/vc | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 1-866-464-4353 |

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|---|--|---|
| Singapore (Singapore) International Access Code: 005 Country Code: 65 | NOTE: The phone numbers in this section should be called from within Singapore or Malaysia only. Website: support.ap.dell.com | |
| | Technical Support (XPS) | toll-free: 1800 394 7464 |
| | Technical Support (Dimension, Inspiron, and Electronics and Accessories) | toll-free: 1 800 394 7430 |
| | Technical Support (OptiPlex, Latitude, and Dell Precision) | toll-free: 1 800 394 7488 |
| | Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault) | toll-free: 1 800 394 7478 |
| | Customer Care | toll-free: 1 800 394 7430 (option 6) |
| | Transaction Sales | toll-free: 1 800 394 7412 |
| | Corporate Sales | toll-free: 1 800 394 7419 |
| Slovakia (Prague) International Access Code: 00 Country Code: 421 | Website: support.euro.dell.com E-mail: czech_dell@dell.com | |
| | Technical Support | 02 5441 5727 |
| | Customer Care | 420 22537 2707 |
| | Fax | 02 5441 8328 |
| | Tech Fax | 02 5441 8328 |
| | Switchboard (Sales) | 02 5441 7585 |
| South Africa (Johannesburg) International Access Code: 09/091 Country Code: 27 City Code: 11 | Website: support.euro.dell.com E-mail: dell_za_support@dell.com | |
| | Gold Queue | 011 709 7713 |
| | Technical Support | 011 709 7710 |
| | Customer Care | 011 709 7707 |
| | Sales | 011 709 7700 |
| | Fax | 011 706 0495 |
| | Switchboard | 011 709 7700 |
| Southeast Asian and Pacific Countries | Technical Support, Customer Service, and Sales (Penang, Malaysia) | 604 633 4810 |

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

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| International Access Code: 002 | E-mail: support.dell.com.cn/email | |
| Country Code: 886 | Technical Support (XPS) | toll-free: 0080 186 3085 |
| | Technical Support (OptiPlex, Latitude, Inspiron, Dimension, and Electronics and Accessories) | toll-free: 0080 186 1011 |
| | Technical Support (servers and storage) | toll-free: 0080 160 1256 |
| | Customer Care | toll-free: 0080 160 1250 (option 5) |
| | Transaction Sales | toll-free: 0080 165 1228 |
| | Corporate Sales | toll-free: 0080 165 1227 |
| Thailand | Website: support.ap.dell.com | |
| International Access Code: 001 | Technical Support (OptiPlex, Latitude, and Dell Precision) | toll-free: 1800 0060 07 |
| Country Code: 66 | Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault) | toll-free: 1800 0600 09 |
| | Customer Care | toll-free: 1800 006 007 (option 7) |
| | Corporate Sales | toll-free: 1800 006 009 |
| | Transaction Sales | toll-free: 1800 006 006 |
| Trinidad/Tobago | Website: www.dell.com/tt | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 1-888-799-5908 |
| Turks and Caicos Islands | Website: www.dell.com/tc | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 1-877-441-4735 |

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| U.K. (Bracknell) International Access Code: 00 Country Code: 44 City Code: 1344 | Website: support.euro.dell.com E-mail: dell_direct_support@dell.com Customer Care website: support.euro.dell.com/uk/en/ECare/form/home.asp | |
| | Sales | |
| | Home and Small Business Sales | 0870 907 4000 |
| | Corporate/Public Sector Sales | 01344 860 456 |
| | Customer Care | |
| | Home and Small Business Customer Care | 0870 906 0010 |
| | Corporate Customer Care | 01344 373 185 |
| | Preferred Accounts (500–5000 employees) | 0870 906 0010 |
| | Global Accounts Customer Care | 01344 373 186 |
| | Central Government Customer Care | 01344 373 193 |
| | Local Government & Education Customer Care | 01344 373 199 |
| | Health Customer Care | 01344 373 194 |
| | Technical Support | |
| | Technical Support for XPS computers only | 0870 366 4180 |
| | Technical Support (Corporate/Preferred Accounts/PCA [1000+ employees]) | 0870 908 0500 |
| | Technical Support for all other products | 0870 353 0800 |
| | General | |
| | Home and Small Business Fax | 0870 907 4006 |
| Uruguay | Website: www.dell.com/uy E-mail: la-techsupport@dell.com General Support | toll-free: 000-413-598-2521 |

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

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| U.S. Virgin Islands | E-mail: la-techsupport@dell.com General Support | toll-free: 1-877-702-4360 |
| Venezuela | Website: www.dell.com/ve E-mail: la-techsupport@dell.com General Support | 0800-100-4752 |

Glossary

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

A — Ampere(s).

AC — Alternating current.

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

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

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

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

ASCII — American Standard Code for Information Interchange.

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

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

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

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

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

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

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

BMC — Baseboard management controller.

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

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

BTU — British thermal unit.

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

C — Celsius.

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

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

cm — Centimeter(s).

cmos — Complementary metal-oxide semiconductor.

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

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

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

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

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

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

CPU — Central processing unit. See *processor*.

DC — Direct current.

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

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

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

diagnostics — A comprehensive set of tests for your system.

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

DIN — *Deutsche Industrie Norm*.

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

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

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

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

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

DVD — Digital versatile disc.

ECC — Error checking and correction.

EEPROM — Electronically erasable programmable read-only memory.

EMC — Electromagnetic compatibility.

EMI — Electromagnetic interference.

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.

FBD — Fully buffered DIMM.

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.

hot plug — Describes the feature of the system that enables you to swap a component of the system while the system is running.

Hz — Hertz.

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

ID — Identification.

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

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

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

IP — Internet Protocol.

IPX — Internet package exchange.

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

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

K — Kilo-; 1000.

Kb — Kilobit(s); 1024 bits.

KB — Kilobyte(s); 1024 bytes.

Kbps — Kilobit(s) per second.

KBps — Kilobyte(s) per second.

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

kg — Kilogram(s); 1000 grams.

kHz — Kilohertz.

KMM — Keyboard/monitor/mouse.

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

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

lb — Pound(s).

LCD — Liquid crystal display.

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

LGA — Land grid array. A type of processor socket. Unlike the PGA interface, 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 — Milliampere(s).

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

mAh — Milliampere-hour(s).

Mb — Megabit(s); 1,048,576 bits.

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

Mbps — Megabits per second.

MBps — Megabytes per second.

MBR — Master boot record.

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

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

memory — An area in your system that stores basic system data. A system can contain several different forms of memory, such as integrated memory (ROM and RAM) and add-in memory modules (DIMMs).

MHz — Megahertz.

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

mm — Millimeter(s).

ms — Millisecond(s).

MS-DOS® — Microsoft Disk Operating System.

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

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

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

ns — Nanosecond(s).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

PS/2 — Personal System/2.

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

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).

SEL — System event log. Used in the system management software to record system events and errors.

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

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

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

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

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

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

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

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

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

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

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

system diskette — See *bootable diskette*.

system memory — See *RAM*.

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

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

TCP/IP — Transmission Control Protocol/Internet Protocol.

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

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

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

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

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

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

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

V — Volt(s).

VAC — Volt(s) alternating current.

VDC — Volt(s) direct current.

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

video adapter — The logical circuitry that provides (in combination with the monitor) your system's video capabilities. A video adapter may be integrated into the system board or may be an expansion card that plugs into an expansion slot.

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

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

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

W — Watt(s).

WH — Watt-hour(s).

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

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

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

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

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

ZIF — Zero insertion force.

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