

Dell™ PowerEdge™ 1950 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 112.
<Ctrl+E>	Enters the Baseboard Management Controller (BMC) Management Utility, which allows access to the system event log (SEL). See the <i>BMC User's Guide</i> for more information on setup and use of BMC.
<Ctrl+C>	Enters the SAS Configuration Utility. See your SAS adapter <i>User's Guide</i> for more information.
<Ctrl+R>	Enters the RAID configuration utility, which allows you to configure an optional RAID card. For more information, see the documentation for your RAID card.
<Ctrl+S>	Option is displayed only if you have PXE support enabled through the System Setup Program (see "Integrated Devices Screen" on page 36). This keystroke allows you to configure NIC settings for PXE boot. For more information, see the documentation for your integrated NIC.
<Ctrl+D>	If you have the optional Dell Remote Access Controller (DRAC) installed, this keystroke allows access to selected DRAC configuration settings. See the DRAC <i>User's Guide</i> for more information on setup and use of DRAC.

Front-Panel Features and Indicators

Figure 1-1 shows the controls, indicators, and connectors located behind the optional rack bezel on the system's front panel.

Figure 1-1. Front-Panel Features and Indicators

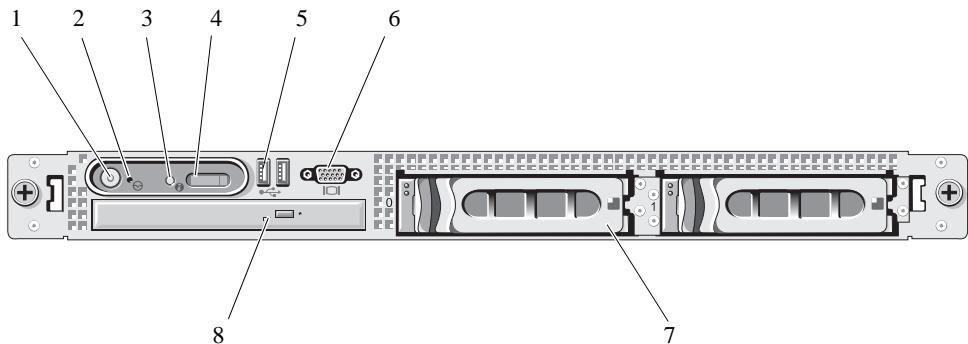


Table 1-2. Front-Panel LED Indicators, Buttons, and Connectors

Item	Indicator, Button, or Connector	Icon	Description
1	Power-on indicator, power button		The power button controls the DC power supply output to the system. NOTE: If you turn off the system using the power button and the system is running an ACPI-compliant operating system, the system performs a graceful shutdown before the power is turned off. If the system is not running an ACPI-compliant operating system, the power is turned off immediately after the power button is pressed.
2	NMI button		Used to troubleshoot software and device driver errors when using certain operating systems. This button can be pressed using the end of a paper clip. Use this button only if directed to do so by qualified support personnel or by the operating system's documentation.
3	System identification button		The identification buttons on the front and back panels can be used to locate a particular system within a rack. When one of these buttons is pushed, the blue system status indicator on the front and back blinks until one of the buttons is pushed again.

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

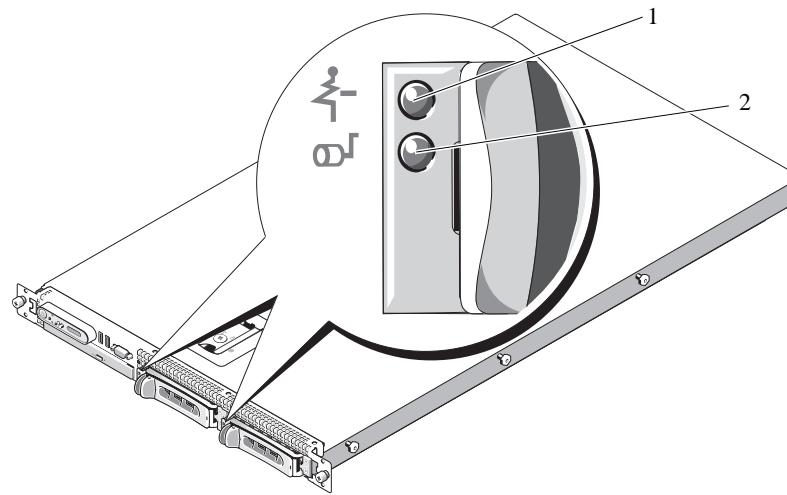
Item	Indicator, Button, or Connector	Icon	Description
4	LCD display		<p>Provides system ID, status information, and system error messages.</p> <p>The LCD display lights during normal system operation. Both the systems management software and the identification buttons located on the front and back of 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)		Four 2.5" drives or two 3.5" drives (shown in figure).
8	Optical drive (optional)		One optional slimline optical drive

NOTE: DVD devices are data only.

Hard-Drive Indicator Codes

If your hard drives are configured with the optional SAS RAID daughter card, two indicators on each of the hard-drive carriers provide information on the status of the hard drives. See Figure 1-2 and Table 1-3. The SAS backplane firmware controls the drive power-on/fault indicator.

Figure 1-2. Hard-Drive Indicators



- 1 drive-status indicator (green and amber) 2 green drive-activity indicator

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

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

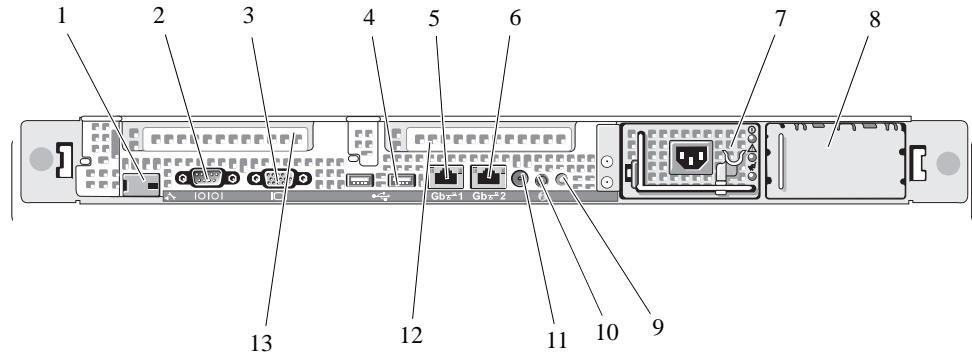
Table 1-3. Hard-Drive Indicator Patterns for RAID

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

Back-Panel Features and Indicators

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

Figure 1-3. Back-Panel Features and Indicators



- | | | | | | |
|----|--|----|--------------------------------------|----|----------------------------------|
| 1 | remote access controller
(optional) | 2 | serial connector | 3 | video connector |
| 4 | USB connectors (2) | 5 | NIC1 connector | 6 | NIC2 connector |
| 7 | power supply 1 | 8 | power supply 2 (optional) | 9 | system status indicator |
| 10 | system identification button | 11 | system status indicator
connector | 12 | left PCI expansion slot (slot 2) |
| 1 | center PCI expansion slot | | | | |
| 3 | (slot 1) | | | | |

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 115. 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

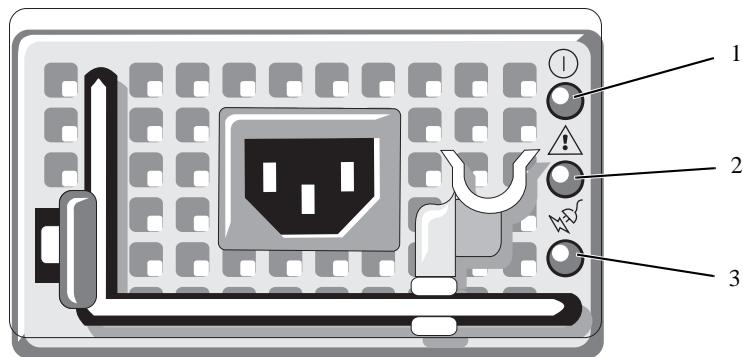
Indicator	Function
On	Indicates that power is supplied to the system and the system is operational.
Off	Indicates that no power is supplied to the system.

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

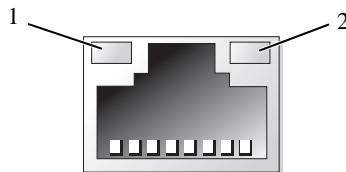


1 power supply status indicator 2 power supply fault indicator 3 AC line status indicator

NIC Indicator Codes

Each NIC on the 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



1 link indicator 2 activity indicator

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 amber blinking	Network data is being sent or received.

LCD Status Messages

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

The LCD lights blue to indicate a normal operating condition, and lights amber to indicate an error condition. The LCD scrolls a message that includes a status code followed by descriptive text. Table 1-7 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:** Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

 **NOTE:** If your system fails to boot, press the System ID button for at least five seconds until an error code appears on the LCD. Record the code, then see "Getting Help" on page 125.

Table 1-7. LCD Status Messages

Code	Text	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 125.
E1114	Temp Ambient	Ambient system temperature is out of acceptable range.	See "Troubleshooting System Cooling Problems" on page 101.
E1116	Temp Memory	Memory has exceeded acceptable temperature and has been disabled to prevent damage to the components.	See "Troubleshooting System Cooling Problems" on page 101.
E12nn	xx PwrGd	Specified voltage regulator has failed.	See "Getting Help" on page 125.
E1210	CMOS Batt	CMOS battery is missing, or the voltage is out of acceptable range.	See "Troubleshooting the System Battery" on page 100.

Table 1-7. LCD Status Messages (*continued*)

Code	Text	Causes	Corrective Actions
E1211	ROMB Batt	RAID battery is either missing, bad, or unable to recharge due to thermal issues.	Reseat the RAID battery connector. See "RAID Battery" on page 60, and "Troubleshooting System Cooling Problems" on page 101.
E1229	CPU # VCORE	Processor # VCORE voltage regulator has failed.	See "Getting Help" on page 125.
E1310	RPM Fan ##	RPM of specified cooling fan is out of acceptable operating range.	See "Troubleshooting System Cooling Problems" on page 101.
E1311	RPM Fan Mod #x	RPM of fan <i>x</i> in the # module is out of acceptable operating range.	See "Troubleshooting System Cooling Problems" on page 101.
E1313	Fan Redundancy	The system is no longer fan-redundant. Another fan failure will put the system at risk of overheating.	Check control panel LCD for additional scrolling messages. See "Troubleshooting System Cooling Problems" on page 101.
E1410	CPU # IERR	Specified microprocessor is reporting an internal error.	See your system's "Information Update Tech Sheet" located on support.dell.com for the most current system information. If the problem persists, see "Getting Help" on page 125.
E1414	CPU # Thermtrip	Specified microprocessor is out of acceptable temperature range and has halted operation.	See "Troubleshooting System Cooling Problems" on page 101. If the problem persists, ensure that the microprocessor heat sinks are properly installed. See "Troubleshooting the Microprocessors" on page 108. 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.

Table 1-7. LCD Status Messages (*continued*)

Code	Text	Causes	Corrective Actions
E1418	CPU # Presence	Specified processor is missing or bad, and the system is in an unsupported configuration.	See "Troubleshooting the Microprocessors" on page 108.
E141C	CPU Mismatch	Processors are in a configuration unsupported by Dell.	See "System Memory" on page 63. 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 125.
E1420	CPU Bus PERR	The system BIOS has reported a processor bus parity error.	See "Getting Help" on page 125.
E1421	CPU Init	The system BIOS has reported a processor initialization error.	See "Getting Help" on page 125.
E1422	CPU Machine Chk	The system BIOS has reported a machine check error.	See "Getting Help" on page 125.
E1610	PS # Missing	No power is available from the specified power supply; specified power supply is improperly installed or faulty.	See "Troubleshooting Power Supplies" on page 100.
E1614	PS # Status	No power is available from the specified power supply; specified power supply is improperly installed or faulty.	See "Troubleshooting Power Supplies" on page 100.
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 100.
E161C	PS # Input Lost	Power source for specified power supply is unavailable, or out of acceptable range.	Check the AC power source for the specified power supply. If the problem persists, see "Troubleshooting Power Supplies" on page 100.
E1620	PS # Input Range	Power source for specified power supply is unavailable, or out of acceptable range.	Check the AC power source for the specified power supply. If the problem persists, see "Troubleshooting Power Supplies" on page 100.

Table 1-7. LCD Status Messages (*continued*)

Code	Text	Causes	Corrective Actions
E1624	PS Redundancy	The power supply subsystem is no longer redundant. If the last supply fails, the system will go down.	See "Troubleshooting Power Supplies" on page 100.
E1710	I/O Channel Chk	The system BIOS has reported an I/O channel check.	See "Getting Help" on page 125.
E1711	PCI PERR B## D## F##	The system BIOS has reported a PCI parity error on a component that resides in PCI configuration space at bus ##, device ##, function ##.	Remove and reseat the PCI expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 107.
	PCI PERR Slot #	The system BIOS has reported a PCI parity error on a component that resides in the specified PCI slot.	If the problem persists, the riser card or system board is faulty. See "Getting Help" on page 125.
E1712	PCI SERR B## D## F##	The system BIOS has reported a PCI system error on a component that resides in PCI configuration space at bus ##, device ##, function ##.	Remove and reseat the PCI expansion cards. If the problem persists, see "Getting Help" on page 125.
	PCI SERR Slot #	The system BIOS has reported a PCI system error on a component that resides in the specified slot.	If the problem persists, the riser card or system board is faulty. See "Getting Help" on page 125.
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 125.
E171F	PCIE Fatal Err B## D## F##	The system BIOS has reported a PCIe fatal error on a component that resides in PCI configuration space at bus ##, device ##, function ##.	Remove and reseat the PCI expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 107.
	PCIE Fatal Err Slot #	The system BIOS has reported a PCIe fatal error on a component that resides in the specified slot.	If the problem persists, the riser card or system board is faulty. See "Getting Help" on page 125.
E1810	HDD ## Fault	The SAS subsystem has determined that hard drive ## has experienced a fault.	See "Troubleshooting a Hard Drive" on page 104.

Table 1-7. LCD Status Messages (*continued*)

Code	Text	Causes	Corrective Actions
E1811	HDD ## Rbld Abrt	The specified hard drive has experienced a rebuild abort.	See "Troubleshooting a Hard Drive" on page 104. If the problem persists, see your RAID documentation.
E1812	HDD ## Removed	The specified hard drive has been removed from the system.	Information only.
E1913	CPU & Firmware Mismatch	The BMC firmware does not support the CPU.	Update to the latest BMC firmware. See the <i>BMC User's Guide</i> for more information on setup and use of BMC.
E1A14	SAS Cable A	SAS cable A is missing or bad.	Reseat the cable. If the problem persists, replace the cable. See "SAS Controller Daughter Card" on page 56.
E1A15	SAS Cable B	SAS cable B is missing or bad.	Reseat the cable. If the problem persists, replace the cable. See "SAS Controller Daughter Card" on page 56.
E1A17	Pwr Cable FB	Flex bay power cable is missing or bad.	Reseat the cable. If the problem persists, replace the cable. See "SAS Controller Daughter Card" on page 56.
E1A18	PDB Ctrl Cable	Flex bay control signals cable is missing or bad.	Reseat the cable. If the problem persists, replace the cable. See "SAS Controller Daughter Card" on page 56.
E2010	No Memory	No memory is installed in the system.	Install memory. See "Installing Memory Modules" on page 65.
E2011	Mem Config Err	Memory detected, but is not configurable. Error detected during memory configuration.	See "Troubleshooting System Memory" on page 102.
E2012	Unusable Memory	Memory is configured, but not usable. Memory subsystem failure.	See "Troubleshooting System Memory" on page 102.
E2013	Shadow BIOS Fail	The system BIOS failed to copy its flash image into memory.	See "Troubleshooting System Memory" on page 102.
E2014	CMOS Fail	CMOS failure. CMOS RAM not functioning properly.	See "Getting Help" on page 125.
E2015	DMA Controller	DMA controller failure.	See "Getting Help" on page 125.

Table 1-7. LCD Status Messages (*continued*)

Code	Text	Causes	Corrective Actions
E2016	Int Controller	Interrupt controller failure.	See "Getting Help" on page 125.
E2017	Timer Fail	Timer refresh failure.	See "Getting Help" on page 125.
E2018	Prog Timer	Programmable interval timer error.	See "Getting Help" on page 125.
E2019	Parity Error	Parity error.	See "Getting Help" on page 125.
E201A	SIO Err	SIO failure.	See "Getting Help" on page 125.
E201B	Kybd Controller	Keyboard controller failure.	See "Getting Help" on page 125.
E201C	SMI Init	System management interrupt (SMI) initialization failure.	See "Getting Help" on page 125.
E201D	Shutdown Test	BIOS shutdown test failure.	See "Getting Help" on page 125.
E201E	POST Mem Test	BIOS POST memory test failure.	See "Troubleshooting System Memory" on page 102. If the problem persists, see "Getting Help" on page 125.
E201F	DRAC Config	Dell remote access controller (DRAC) configuration failure.	Check for specific error messages. Ensure that DRAC cables and connectors are properly seated. If the problem persists, see your DRAC documentation.
E2020	CPU Config	CPU configuration failure.	Check for specific error messages.
E2021	Memory Population	Incorrect memory configuration. Memory population order incorrect.	Check for specific error messages. See "Troubleshooting System Memory" on page 102.
E2022	POST Fail	General failure after video.	Check for specific error messages.
E2110	MBE Crd # DIMM ## & ##	One of the DIMMs in the set implicated by "## & ##" has had a memory multi-bit error (MBE). If no memory card is present, the "Crd #" string is left out of the message.	See "Troubleshooting System Memory" on page 102.

Table 1-7. LCD Status Messages (*continued*)

Code	Text	Causes	Corrective Actions
E2111	SBE Log Disable Crd # DIMM ##	The system BIOS has disabled memory single-bit error (SBE) logging, and will not resume logging further SBEs until the system is rebooted. "##" represents the DIMM implicated by the BIOS. If no memory riser card is present, the "Crd #" string is left out of the message.	See "Troubleshooting System Memory" on page 102.
E2112	Mem Spare Crd # DIMM ##	The system BIOS has spared the memory because it has determined that the memory had too many errors. "## & ##" represents the DIMM pair implicated by the BIOS. If no memory card is present, the "Crd #" string is left out of the message.	See "Troubleshooting System Memory" on page 102.
E2113	Mem Mirror Crd # DIMM ## & ##	The system BIOS has disabled memory mirroring because it has determined that one half of the mirror has had too many errors. "## & ##" represents the DIMM pair implicated by the BIOS. If no memory card is present, the "Crd #" string is left out of the message.	See "Troubleshooting System Memory" on page 102.
E2118	Fatal NB Mem CRC	One of the connections in the FBD memory subsystem link on the Northbound side has failed.	See "Troubleshooting System Memory" on page 102.
E2119	Fatal SB Mem CRC	One of the connections in the FBD memory subsystem link on the Southbound side has failed.	See "Troubleshooting System Memory" on page 102.
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.

Table 1-7. LCD Status Messages (*continued*)

Code	Text	Causes	Corrective Actions
I1912	SEL Full	System Event Log is full of events, and is unable to log any more events.	Clear the log by deleting event entries.
W1228	ROMB Batt < 24hr	Warns predictively that the RAID battery has less than 24 hours of charge left.	Replace RAID battery. See "RAID Battery" on page 60.

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 147.

Solving Problems Described by LCD Status Messages

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

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

Removing LCD Status Messages

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

- Clear the SEL — You can perform this task remotely, but you will lose the event history for the system.
- Power cycle — Turn off the system and disconnect it from the electrical outlet; wait approximately ten seconds, reconnect the power cable, and restart the system.

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

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

System Messages

System messages appear on the screen to notify you of a possible problem with the system. Table 1-8 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: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

Table 1-8. System Messages

Message	Causes	Corrective Actions
Alert! Redundant memory disabled! Memory configuration does not support redundant memory.	Installed memory modules are not the same type and size; faulty memory module(s).	Ensure that all memory modules are of the same type and size and that they are properly installed. If the problem persists, see "Troubleshooting System Memory" on page 102.
Attempting to update Remote Configuration. Please wait....	Remote Configuration request has been detected and is being processed.	Wait until the process is complete.
BIOS Update Attempt Failed!	Remote BIOS update attempt failed.	Retry the BIOS update. If the problem persists, see "Getting Help" on page 125.
Caution! NVRAM_CLR jumper is installed on system board.	NVRAM_CLR jumper is installed. CMOS has been cleared.	Remove NVRAM_CLR jumper. See Figure 6-1 for jumper location.
CPUs with different cache sizes detected!	Microprocessors with different cache sizes are installed.	Ensure that all microprocessors have the same cache size and that they are properly installed. See "Processors" on page 67.
Decreasing available memory	Faulty or improperly installed memory modules.	See "Troubleshooting System Memory" on page 102.
DIMM pairs must be matched in size, speed, and technology. The following DIMM pair is mismatched: DIMM x and DIMM y.	Mismatched or unmatched DIMMs installed; faulty or improperly seated memory module(s).	Ensure that all pairs of memory modules are of the same type and size and that they are properly installed. See "System Memory" on page 63. If the problem persists, see "Troubleshooting System Memory" on page 102.

Table 1-8. System Messages (*continued*)

Message	Causes	Corrective Actions
DIMMs must be populated in sequential order beginning with slot 1. The following DIMM is electrically isolated: DIMM x.	The specified DIMM is inaccessible to the system due to its location. DIMMs must be populated in sequential order, beginning with slot 1.	Populate 2, 4, 8, or 12 DIMMs sequentially beginning with slot 1. See "System Memory" on page 63.
DIMMs should be installed in pairs. Pairs must be matched in size, speed, and technology.	Mismatched or unmatched DIMMs installed; faulty or improperly seated memory module(s). The system will operate in a degraded mode with reduced ECC protection. Only memory installed in channel 0 will be accessible.	Ensure that all pairs of memory modules are of the same type and size and that they are properly installed. See "System Memory" on page 63. If the problem persists, see "Troubleshooting System Memory" on page 102.
Dual-rank DIMM paired with Single-rank DIMM - The following DIMM/rank has been disabled by BIOS: DIMM x Rank y	Mismatched DIMMs installed; faulty memory module(s). The system has detected a dual-rank DIMM paired with a single-rank DIMM. The second rank of the dual-rank DIMM will be disabled.	Ensure that all pairs of memory modules are of the same type and size and that they are properly installed. See "System Memory" on page 63. If the problem persists, see "Troubleshooting System Memory" on page 102.
Error: Incorrect memory configuration. DIMMs must be installed in pairs of matched memory size, speed, and technology.	Mismatched or unmatched DIMMs installed; faulty or improperly seated memory module(s).	Ensure that all pairs of memory modules are of the same type and size and that they are properly installed. See "System Memory" on page 63. If the problem persists, see "Troubleshooting System Memory" on page 102.
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 102.
!*** Error: Remote Access Controller initialization failure*** RAC virtual USB devices may not be available...	Remote Access Controller initialization failure.	Ensure that the Remote Access Controller is properly installed. See "RAC Card" on page 71.
FBD training error: The following branch has been disabled: Branch x	The specified branch (channel pair) contains DIMMs that are incompatible with each other.	Ensure that only Dell-qualified memory is used. Dell recommends purchasing memory upgrade kits directly from www.dell.com or your Dell sales agent to ensure compatibility.
Gate A20 failure	Faulty keyboard controller; faulty system board.	See "Getting Help" on page 125.

Table 1-8. System Messages (*continued*)

Message	Causes	Corrective Actions
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 125.
Manufacturing mode detected	System is in manufacturing mode.	Reboot to take the system out of manufacturing mode.
MEMBIST failure - The following DIMM/rank has been disabled by BIOS: DIMM x Rank y	Faulty memory module(s).	See "Troubleshooting System Memory" on page 102.
Memory address line failure at <i>address</i> , read value expecting <i>value</i>	Faulty or improperly installed memory modules.	See "Troubleshooting System Memory" on page 102.
Memory double word logic failure at <i>address</i> , read value expecting <i>value</i>		
Memory odd/even logic failure at <i>address</i> , read value 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 drive subsystem, hard drive, or hard-drive subsystem, or no boot disk in drive A.	Use a CD or hard drive. If the problem persists, see "Troubleshooting an Optical Drive" on page 103 and "Troubleshooting a Hard Drive" on page 104. See "Using the System Setup Program" on page 31 for information on 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 125."
Northbound merge error - The following DIMM has been disabled by BIOS: DIMM x	The specified DIMM was unable to establish a successful data link with the memory controller.	See "Troubleshooting System Memory" on page 102.
PCIe Degraded Link Width Error: Embedded Bus#nn/Dev#nn/Funcn Expected Link Width is n Actual Link Width is n	Faulty or improperly installed PCIe card in the specified slot.	Reseat the PCIe card in the specified slot number. See "Expansion-Card Riser" on page 82. If the problem persists, see "Getting Help" on page 125.
PCIe Degraded Link Width Error: Slot n Expected Link Width is n Actual Link Width is n	Faulty or improperly installed PCIe card in the specified slot.	Reseat the PCIe card in the specified slot number. See "Expansion-Card Riser" on page 82. If the problem persists, see "Getting Help" on page 125.
PCIe Training Error: Embedded Bus#nn/Dev#nn/Funcn PCIe Training Error: Slot n	Faulty or improperly installed PCIe card in the specified slot.	Reseat the PCIe card in the specified slot number. See "Expansion-Card Riser" on page 82. If the problem persists, see "Getting Help" on page 125.
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(s).	Reseat the expansion card(s). Ensure that all appropriate cables are securely connected to the expansion card(s). If the problem persists, see "Troubleshooting Expansion Cards" on page 107.
Plug & Play Configuration Error	Error encountered in initializing PCI device; faulty system board.	Install the NVRAM_CLR jumper and reboot the system. See Figure 6-1 for jumper location. If the problem persists, see "Troubleshooting Expansion Cards" on page 107.

Table 1-8. System Messages (*continued*)

Message	Causes	Corrective Actions
Read fault	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 Expansion Cards" on page 107, or "Troubleshooting a Hard Drive" on page 104 for the appropriate drive(s) installed in your system.
Requested sector not found		
Remote configuration update attempt failed	System unable to process Remote Configuration request.	Retry Remote Configuration.
ROM bad checksum = address	Expansion card improperly installed or faulty.	Reseat the expansion card(s). Ensure that all appropriate cables are securely connected to the expansion card(s). If the problem persists, see "Troubleshooting Expansion Cards" on page 107.
Sector not found	Faulty diskette or hard drive.	
Seek error		
Seek operation failed		See "Troubleshooting a Hard Drive" on page 104 for the appropriate drive(s) installed in your system.
Shutdown failure	Shutdown test failure.	See "Troubleshooting System Memory" on page 102.
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 102.
Time-of-day clock stopped	Faulty battery or faulty chip.	See "Troubleshooting the System Battery" on page 100.
The following DIMM pair is not compatible with the memory controller: DIMM x and DIMM y	The specified DIMM(s) are incompatible with the system.	Ensure that only Dell-qualified memory is used. Dell recommends purchasing memory upgrade kits directly from www.dell.com or your Dell sales agent to ensure compatibility.
The following DIMMs are not compatible: DIMM x and DIMM y	The specified DIMM(s) are incompatible with the system.	Ensure that only ECC FBD1 memory is used. Dell recommends purchasing memory upgrade kits directly from www.dell.com or your Dell sales agent to ensure compatibility.

Table 1-8. System Messages (*continued*)

Message	Causes	Corrective Actions
Time-of-day not set - please run SETUP program	Incorrect Time or Date settings; faulty system battery.	Check the Time and Date settings. See "Using the System Setup Program" on page 31. If the problem persists, replace the system battery. See "System Battery" on page 86.
Timer chip counter 2 failed	Faulty system board.	See "Getting Help" on page 125.
Unsupported CPU combination	Microprocessor(s) is not supported by the system.	Install a supported microprocessor or microprocessor combination. See "Processors" on page 67.
Unsupported CPU stepping detected		
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 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 125, 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 25 for an explanation of the message and suggestions for correcting errors.

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

Using the System Setup Program

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

Table 2-1. System Setup Program Navigation Keys

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



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

System Setup Options

Main Screen

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

Figure 2-1. Main System Setup Program Screen

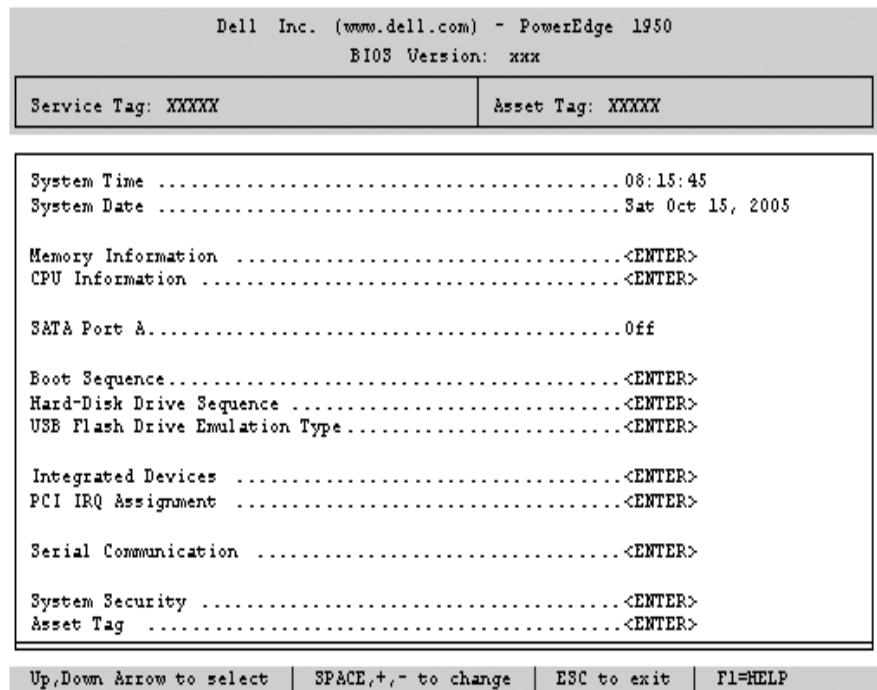


Table 2-2 lists the options and descriptions for the information fields that appear on the main System Setup program screen. For related information, see "System Security Screen Options" on page 37.



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 system, video, and redundant memory, including size, type, and speed of memory modules, system memory test option status, and redundant memory status.
CPU Information	Displays information related to microprocessors (speed, cache size, and so on). See "CPU Information Screen" on page 35."
SATA Port x	Displays type and capacity of drive attached to port x.

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. If you have installed a RAC, additional options, such as virtual floppy and virtual CD-ROM, may be present. NOTE: System boot is not supported from an external device attached to a SAS or SCSI adapter. See support.dell.com for the latest support information about booting from external devices.
USB Flash Drive Type (Auto default)	Determines the emulation type for a USB flash drive. Hard disk allows the USB flash drive to act as a hard drive. Floppy allows the USB flash drive to act as a removal diskette drive. Auto automatically chooses an emulation type.
Integrated Devices	See "Integrated Devices Screen" on page 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 cards that require an IRQ.
Serial Communication (Off default)	Options are On with Console Redirection via COM2, and Off .
Failsafe Baud Rate (57600 default)	Displays the failsafe baud rate used for console redirection when the baud rate cannot be negotiated automatically with the remote terminal. This rate should not be adjusted.
Remote Terminal Type (VT 100/VT 220 default)	Select either VT 100/VT 220 or ANSI .
Redirection After Boot (Enabled default)	Enables or disables BIOS console redirection after your system boots to the operating system.
Embedded Server Management	Displays a screen to configure the front-panel LCD options and to set a user-defined LCD string. For more information, see the systems management software documentation that describes the features, requirements, installation, and basic operation of the embedded software.
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.

CPU Information Screen

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

Table 2-3. CPU Information Screen

Option	Description
Bus Speed	Displays the bus speed of the processors.
Logical Processor (Enabled default)	Displays when the processors support HyperThreading. Enabled permits all logical processors to be used by the operating system. Only the first logical processor of each processor installed in the system is used by the operating system if Disabled is selected.
Virtualization Technology (Disabled default)	Displays when the processor(s) support Virtualization Technology. Enabled permits virtualization software to utilize Virtualization Technology functions incorporated in the processor design. This feature can only be used by software that supports Virtualization Technology.
Adjacent Cache Line Prefetch (Enabled default)	Enables or disables optimal use of sequential memory access. Disable this option for applications that require high use of random memory access.
Hardware Prefetcher (Enabled default)	Enables or disables the hardware prefetcher.
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 family and model number of each processor. A submenu displays processor and core speed, amount of level 2 cache, and the number of cores.

Integrated Devices Screen

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

Table 2-4. Integrated Devices Screen Options

Option	Description
Integrated SAS Controller (Enabled default)	Enables or disables the integrated SAS controller.
Embedded SATA Controller (Off default)	Allows the integrated SATA controller to be set to Off or ATA mode.
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.
TOE Capability	Displays the TCP/IP Offload Engine (TOE) feature status of NIC1.
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 NIC2.

System Security Screen

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

Table 2-5. 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 <i>lock</i> the system password, assign a setup password in the Setup Password option and then change the Password Status option to Locked. In this state, you cannot change the system password using the System Password option and cannot be disabled at system start-up by pressing <Ctrl><Enter>.</p> <p>To <i>unlock</i> the system password, enter the setup password in the Setup Password field and then change the Password Status option to Unlocked. In this state, you can disable the system password at system start-up by pressing <Ctrl><Enter> and then change the password using the System Password option.</p>
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 2-5. 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 117.

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 (however, you cannot disable or change an existing system password).

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

Deleting or Changing an Existing Setup Password

- 1 Enter the System Setup program and select the **System Security** option.
- 2 Highlight the **Setup Password** option, press <Enter> to access the setup password window, and press <Enter> twice to clear the existing setup password.
The setting changes to **Not Enabled**.
- 3 If you want to assign a new setup password, perform the steps in "Assigning a Setup Password" on page 40.

Disabling a Forgotten Password

See "Disabling a Forgotten Password" on page 117.

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:

- Cooling fan modules
- Cooling shrouds
- Power supplies
- SAS controller daughter card or SAS RAID controller daughter card
- RAID battery
- RAID controller expansion card
- Expansion cards
- Boot drive
- System memory
- Processors
- RAC card
- Optical drive
- Hard drives
- SAS backplane boards
- Risers
- Sideplane board
- System battery
- Control panel assembly
- System board

Recommended Tools

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

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

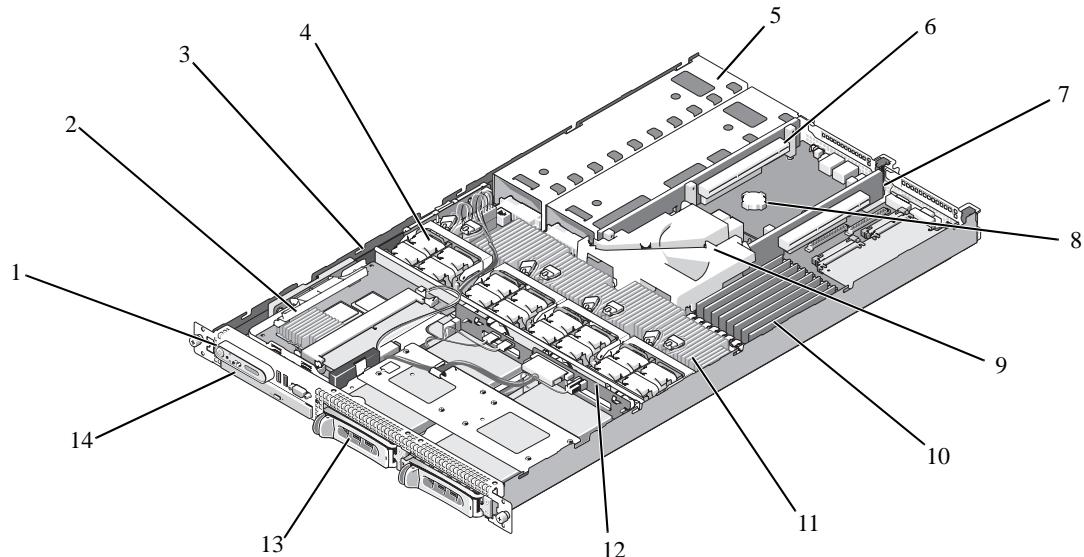
Inside the System

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

! CAUTION: The memory modules can become extremely hot during normal operation. Allow the modules sufficient time to cool before handling.

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

Figure 3-1. Inside the System



1	control panel	2	SAS controller daughter card or SAS RAID controller daughter card (optional)	3	sideplane
4	cooling fan modules (4)	5	power supply bays (2)	6	left riser (slot 2)
7	center riser (slot 1)	8	battery	9	system board cooling shroud
1	memory modules (8)	11	heatsink/microprocessor (2)	12	backplane
0					
1	two 3.5-inch or four 2.5-inch	14	optical slimline drive (optional)		
3	hard drive bays				

The system board holds the system's control circuitry and other electronic components. Several hardware options, such as the microprocessors and memory, are installed directly on the system board. The left and center risers each have one slot and can accommodate up to two half-length PCI-X cards or two half-length PCIe expansion cards. For more information, see "Expansion Cards" on page 61.

The system provides space for one optional slimline optical drive. The optical drive tray connects to the controller on the system board through the sideplane board. For more information, see "Installing the Optical Drive Tray" on page 74.

The hard-drive bays provide space for up to two 3.5-inch or four 2.5-inch SAS/SATA hard drives. The hard drives connect to a SAS controller daughter card or a SAS RAID controller daughter card. For more information, see "Installing a Hot-Plug Hard Drive" on page 76.

During an installation or troubleshooting procedure, you may be required to change a jumper setting. For more information, see "Jumpers and Connectors" on page 115.



NOTE: There are no hot-pluggable components inside this system except for externally accessible components, such as the power supplies and the hard drives.

Removing and Replacing the Front Bezel

1 The system is enclosed by an optional bezel. To upgrade or troubleshoot the system, remove the bezel and cover to access the internal system components. Unless you are installing a hot-plug hard drive, turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.



NOTE: You do not need to remove the front bezel to remove the system cover.

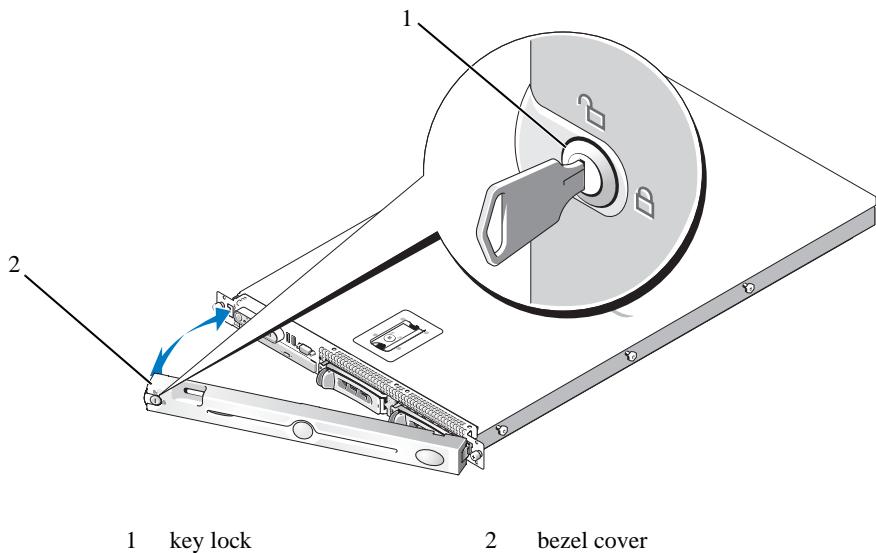
2 Using the system key, unlock the bezel.

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

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

5 Pull the bezel away from the system. See Figure 3-2.

Figure 3-2. Removing the Bezel



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

Opening and Closing the System

- !** CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.
- !** CAUTION: Whenever you need to lift the system, get others to assist you. To avoid injury, do not attempt to lift the system by yourself.
- !** CAUTION: The memory modules can become extremely hot during normal operation. Allow the modules sufficient time to cool before handling.

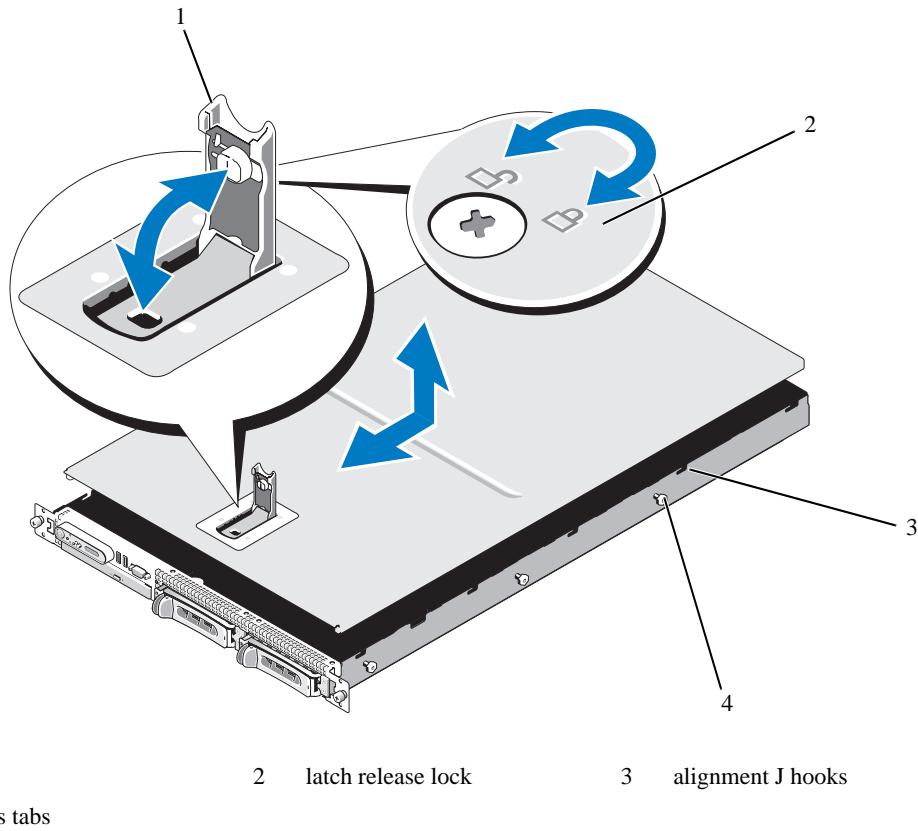
Opening the System

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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Remove the bezel. See "Removing and Replacing the Front Bezel" on page 45.
- 3 To remove the system cover, rotate the latch release lock on the latch in a counter clockwise direction to the unlocked position. See Figure 3-3.

- 4 Lift up on the latch on top of the system to guide it back and into an offset position. See Figure 3-3.
- 5 Grasp the cover on both sides and carefully lift the cover away from the system.

Figure 3-3. Removing the Cover



Closing the System

- 1 Lift up the latch on the cover.
- 2 Place the cover on top of the system and offset the cover slightly back so that it clears the chassis J hooks and lays flat on the system chassis. See Figure 3-3.
- 3 Lower the cover into the closed position aligning it with the J hooks and push down on the latch to guide the cover into place.
- 4 Rotate the latch release lock in a clockwise direction to secure the cover.

Cooling Fan Modules

This system contains four cooling fan modules, each comprised of two dual-rotor fans, for a total of eight fans that are connected directly to the system board.

Removing a Cooling Fan Module

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

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

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

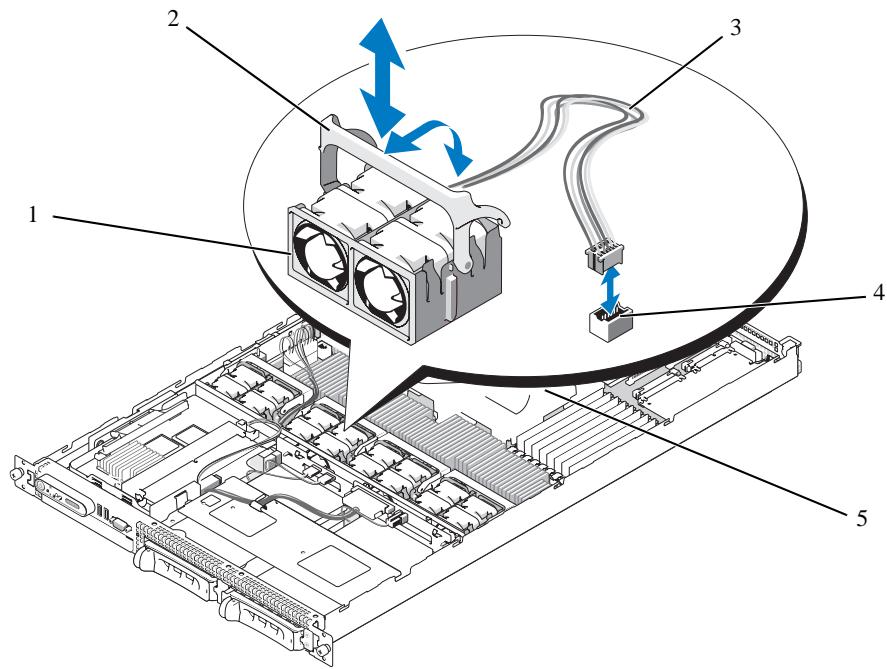
2 Open the system. See "Opening and Closing the System" on page 46.

 **NOTE:** You can remove the fan modules without removing the memory cooling shroud; however, Dell recommends that you remove this shroud before removing a fan module. Do not remove the system board cooling shroud. See "Removing the Memory Cooling Shroud" on page 52.

3 Raise the fan handle, disconnect the module wire harness from the system board, and pull the fan straight up to clear the chassis. See Figure 3-4.

4 Unplug the fan module connector.

Figure 3-4. Removing and Installing a Cooling Fan



- | | | | | | |
|---|------------------------------|---|-----------------------------|---|---------------------|
| 1 | cooling fan modules (4) | 2 | fan module handles | 3 | module wire harness |
| 4 | cooling fan module connector | 5 | system board cooling shroud | | |

Replacing a Cooling Fan Module



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 Attach the fan module connectors.
- 3 If you removed the memory cooling shroud to access the fan modules, replace the shroud. See "Replacing the Memory Cooling Shroud" on page 53.
- 4 Close the system. See "Opening and Closing the System" on page 46.

Removing the Plastic Fan Guide



NOTE: The plastic fan guide is mounted to the chassis between the fans.



NOTE: You may need to remove the system from the rack.

- 1 Remove the cooling fan modules. See "Removing a Cooling Fan Module" on page 48.
- 2 Remove the system from the rack. See the Rack Installation Guide for your system.
- 3 Place the system upside-down on a flat surface.
- 4 Using a #2 Phillips screwdriver, remove the two screws from the bottom of the chassis that secure the fan bracket.
- 5 Turn the system right-side up, place it on a flat surface, and then remove the fan bracket.

Replacing the Plastic Fan Guide

- 1 While the system is out of the rack, and with the top cover removed, place the system on its side on a flat surface.
- 2 Place the fan bracket into its location inside the chassis.
- 3 Holding the fan bracket in place, use a #2 Phillips screwdriver to replace the two screws on the bottom of the chassis.
- 4 Place the system right-side up on a flat surface.
- 5 Replace the cooling fan modules. See "Replacing a Cooling Fan Module" on page 49.
- 6 Replace the system in the rack. See the Rack Installation Guide for your system.

Cooling Shrouds

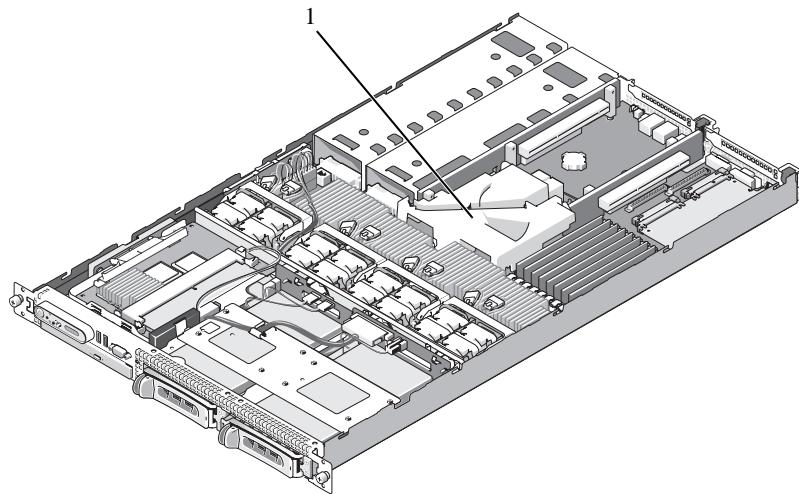
Your system contains two cooling shrouds.

- System board cooling shroud
- Memory cooling shroud

System Board Cooling Shroud

The system board cooling shroud directs airflow over the system memory modules, channeling the air from the four fan modules. See Figure 3-5.

Figure 3-5. System Board Cooling Shroud



1 system board cooling shroud

Removing the System Board Cooling Shroud

- 1 If applicable, remove the bezel. See "Removing and Replacing the Front Bezel" on page 45.
- 2 Turn off the system and attached peripherals, and then disconnect the system from the electrical outlet.
- 3 Open the system. See "Opening the System" on page 46.
- 4 Remove the memory cooling shroud. See "Removing the Memory Cooling Shroud" on page 52.
- 5 Remove both the center and left risers from the system board. See "Removing an Expansion-Card Riser" on page 82.
- 6 Press the tabs on the front side of the shroud (nearest to the processors), and then lift the shroud up and away from the system.

Installing the System Board Cooling Shroud

- 1 Align the back of the shroud to the front of the posts of the center and rear card risers on the motherboard.
- 2 Press down gently on the front of the shroud until it engages with the plastic tabs on the motherboard.
- 3 Place the center and left risers. See "Installing an Expansion-Card Riser" on page 83.
- 4 Replace the memory cooling shroud. See "Replacing the Memory Cooling Shroud" on page 53.
- 5 Close the system. See "Closing the System" on page 47.

- 6 If applicable, replace the bezel. See "Removing and Replacing the Front Bezel" on page 45.
- 7 Attach any peripherals, connect the system to the electrical source, and then turn on the system.

Memory Cooling Shroud

The memory cooling shroud covers both the memory modules (DIMMs) and the processors. This shroud can be removed and installed. See Figure 3-6 and "System Board Removal" on page 91.

Removing the Memory Cooling Shroud

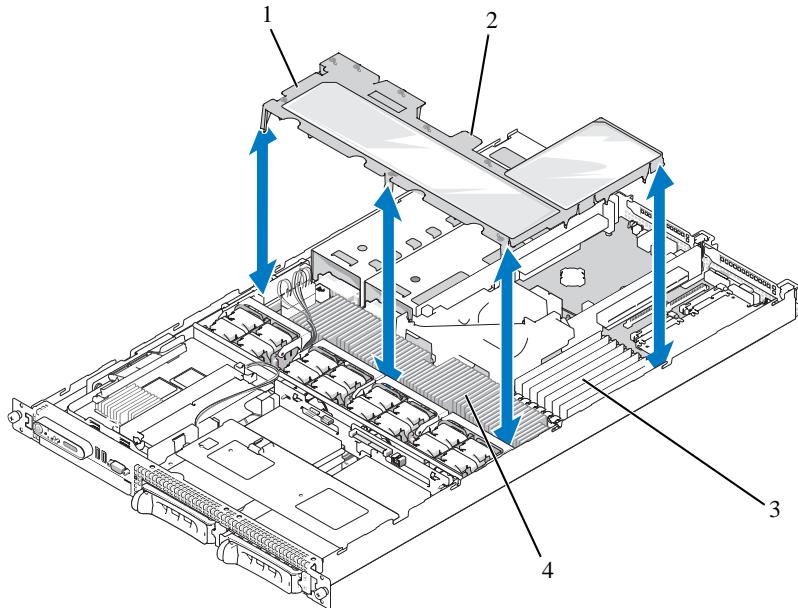
 **CAUTION:** Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell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

 **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.

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

- 1 To remove the cooling shroud, locate the release tab on the shroud edge that is nearest to the adjacent system board shroud. See Figure 3-6.
- 2 Pull up on the release tab to release the memory cooling shroud.
- 3 Unseat the shroud from the securing tabs located on the periphery of the shroud.
- 4 Carefully lift the shroud straight up to disengage it from the system board, and then lift the shroud away from the system.

Figure 3-6. Memory Cooling Shroud



- | | | | | | |
|---|-----------------------|---|---------------------------|---|--------------------|
| 1 | memory cooling shroud | 2 | memory shroud release tab | 3 | memory modules (8) |
| 4 | system processors (2) | | | | |

Replacing the Memory Cooling Shroud

- 1 To install the memory cooling shroud, align the shroud directly over the memory modules and the processors.
- 2 Using the interior system board cooling shroud as a guide, slowly lower the shroud straight down onto the system, directly over the processors and memory modules.
- 3 Gently press around the periphery of the shroud until it engages with the external tabs and snaps into place.

Power Supplies

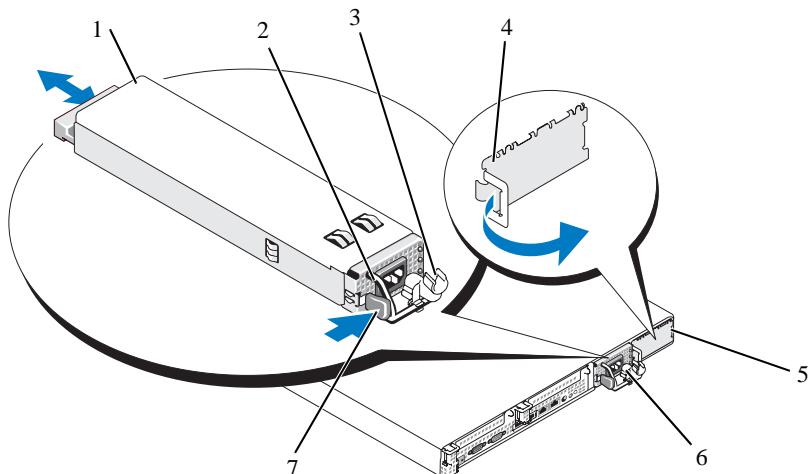
Your system supports one or two power supplies rated at an output of 670 W. If only one power supply is installed, it must be installed in the left power supply bay (bay 1). If two power supplies are installed, the second power supply serves as a redundant, hot-plug power source.

- **NOTICE:** In a non-redundant configuration, the power supply blank must be installed in the unoccupied power supply bay to ensure proper system cooling. See "Installing the Power Supply Blank" on page 56.

Removing a Power Supply

- ▶ NOTICE: The system requires one power supply for the system to operate normally. The system is in the redundant mode when two power supplies are installed and both power supplies are connected to an AC power source. Remove and replace only one power supply at a time in a system that is powered on. Operating the system with only one power supply installed and without a power supply blank installed for extended periods of time can cause the system to overheat.
- ▶ NOTICE: If only one power supply is installed, it must be installed in the left power supply bay (1).
- ▶ NOTICE: If you connect the system to a power source in the range of 120 to 220 VAC, and if two power supplies are installed, the second power supply serves as a redundant, hot-plug power source.
- ▶ NOTE: On your rack system, 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*.
- 1 If your system has a single power supply, turn off the system and all attached peripherals. For a redundant system, you can leave the system running and proceed to the next step.
- 2 Disconnect the power cable from the power source.
- 3 Disconnect the power cable from the power supply and remove the cable from the cable retention bracket.
- ▶ NOTICE: On a rack system, you may need to temporarily unlatch and lift the cable management arm. For information about the cable management arm, see the system's *Rack Installation Guide*.
- 4 Release the locking tab on the left side of the power supply by pressing in toward the right until the power supply is released from the chassis. See Figure 3-7.
- 5 Holding the power-supply handle, pull the power supply straight out to clear the chassis.

Figure 3-7. Removing and Installing a Power Supply



- | | | |
|----------------------|---------------------------------|--------------------------------|
| 1 power-supply | 2 power-supply handle | 3 cable retention bracket |
| 4 power supply blank | 5 power-supply bay 2 (optional) | 6 redundant power supply bay 1 |
| 7 locking tab | | |

Replacing a Power Supply

- 1 If you are adding a second power supply, remove the power supply blank. See "Removing a Power Supply" on page 54.
 - 2 Holding the power-supply handle, slide the new power supply into the chassis until it is fully seated and contacts the system chassis. See Figure 3-7.
- NOTICE: On a rack system, you may need to temporarily unlatch and lift the cable management arm. For information about the cable management arm, see the system's *Rack Installation Guide*.
- 3 Insert the power cable through the cable retention bracket, connect the power cable to the power supply, and plug the cable into a power outlet.
- NOTICE: For more information about the power cable retention bracket, see the *Getting Started With Your System* guide.
- 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).

Removing the Power Supply Blank

Press the latch on the left side to release and remove the blank, rotating the blank slightly to clear the bay, and remove from the chassis.

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

Installing the Power Supply Blank

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

SAS Controller Daughter Card

Your system includes a dedicated slot on the sideplane for an optional SAS controller daughter card. The SAS controller daughter card provides the SAS storage subsystem for your system's two optional internal hard drives. The optional SAS RAID controller daughter card allows you to set up any internal hard drives in a RAID configuration.

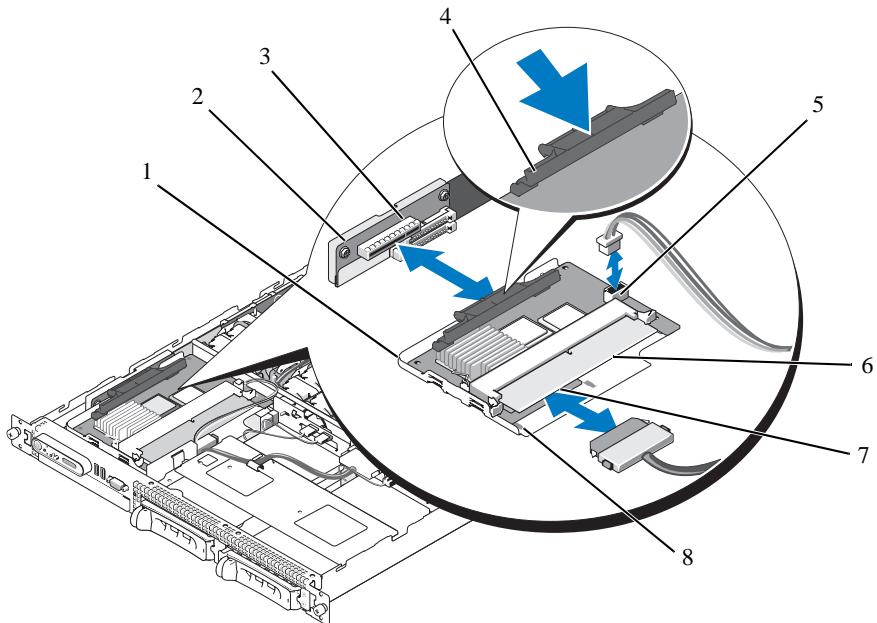
Removing a SAS Controller Daughter Card

- 1 If you are removing a SAS RAID controller daughter card, disconnect the battery cable from the card by releasing the tab on the cable connector on the daughter card. See Figure 3-26.
- 2 Pull on the release latch on the daughter card (see Figure 3-8) and slide the daughter card tray towards the hard drives.
- 3 Continue to hold the guide rails outward as you pull the SAS controller daughter card upward from the rails.

Installing a SAS Controller Daughter Card or SAS RAID Controller Daughter Card

- NOTICE: If you are installing a SAS RAID daughter card, be careful not to press on the memory module on the card (see Figure). to avoid damaging the memory module or its socket.
- NOTICE: If you are installing a new or replacement SAS RAID daughter card, do not remove the card's plastic cover until you have completed installing the card.
- 1 Hold the metal daughter card tray by its edges with the release latch and edge connector facing the sideplane board. See Figure 3-8.
 - 2 Align the two slots in the daughter card tray and the corresponding tabs on the chassis, then lower the card tray onto the chassis.
 - 3 Slide the daughter card tray towards the sideplane until the edge connector on the daughter card fits into the socket on the sideplane board and the release latch engages. See Figure 3-8.

Figure 3-8. Installing a SAS Controller Daughter Card

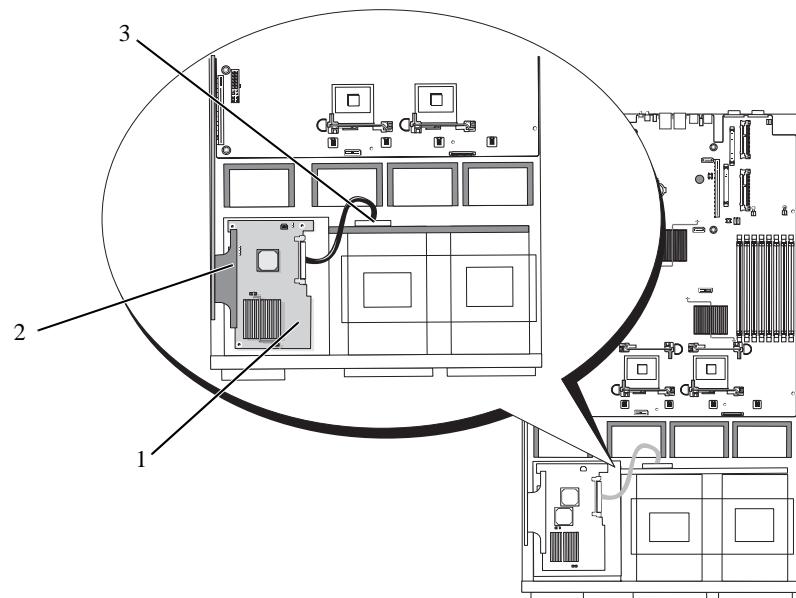


- | | | | | | |
|---|--|---|---|---|--|
| 1 | SAS controller daughter card and tray assembly | 2 | sideplane | 3 | daughter card socket |
| 4 | release latch | 5 | RAID battery connector (SAS RAID controller daughter card only) | 6 | RAID memory module (DIMM) (SAS RAID controller daughter card only) |
| 7 | SAS RAID connector 0 (to backplane SAS A) | 8 | alignment slots in card tray (2) | | |

- 4 Attach any cables from the internal storage daughter card to the backplane, referring to Figure 3-9 and Figure 3-10 for the cabling guidelines for your system's card and backplane configuration.

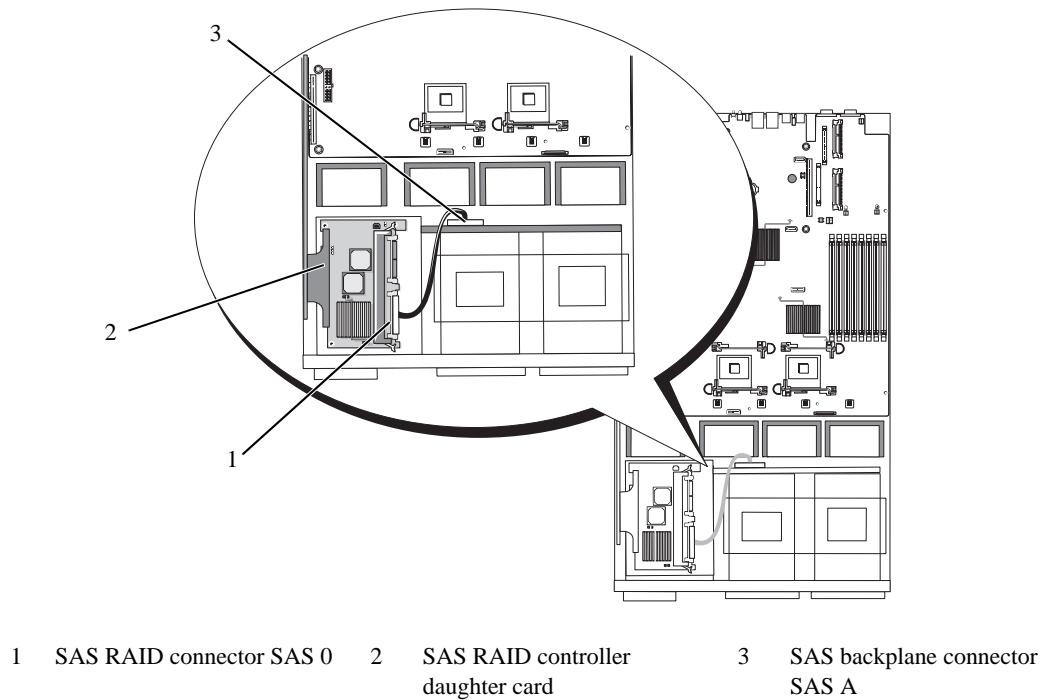
► **NOTICE:** You must follow the cabling diagrams for connecting the hard drives to either of the internal storage daughter cards that are illustrated in the following figures to ensure proper connection. Figure 3-9 illustrates the cable routing for the SAS controller daughter card and Figure 3-10 illustrates the cable routing for the SAS RAID controller daughter card.

Figure 3-9. Cable Routing for the SAS Controller Daughter Card



- 1 SAS connector SAS 0 2 SAS controller daughter card 3 SAS backplane connector SAS A

Figure 3-10. Cable Routing for the SAS RAID Controller Daughter Card



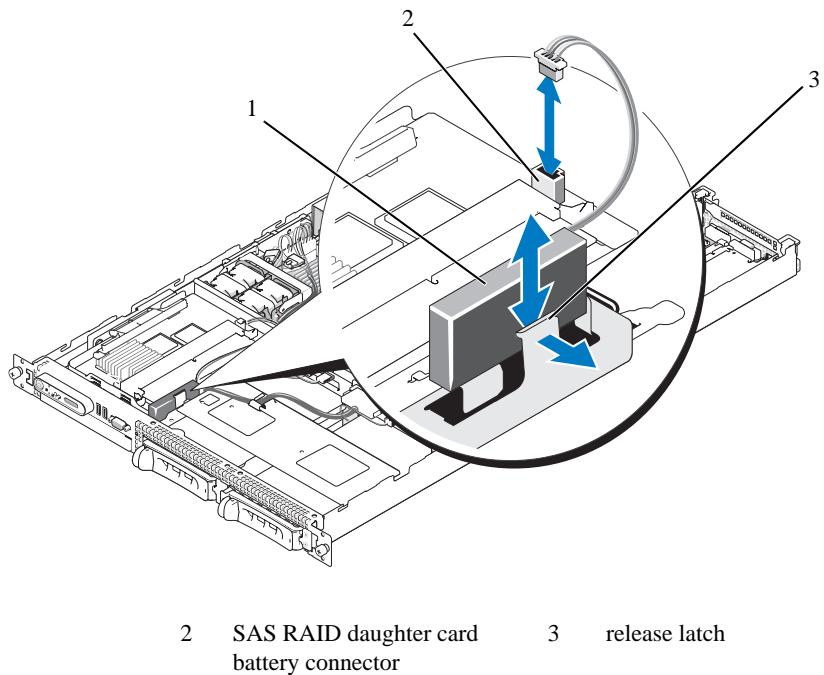
- 1 SAS RAID connector SAS 0 2 SAS RAID controller daughter card 3 SAS backplane connector SAS A

RAID Battery

Installing a RAID Battery

- 1 Locate the RAID battery pocket on the chassis that is adjacent to hard drive bay 0. See Figure 3-11.
- 2 Insert the battery in the battery pocket.
- 3 Connect the battery cable to the RAID controller daughter card. See Figure 3-11.

Figure 3-11. Installing a SAS RAID Battery



Removing a RAID Battery

- 1 Disconnect the RAID battery cable from the SAS RAID daughter card. See Figure 3-11.
- 2 Press the release latch toward the hard-drive bays and remove the battery from the battery pocket.

Expansion Cards

The system is available with one of two optional PCI riser configurations.

PCIe Riser Board Expansion Slots

The PCIe riser configuration provides two PCI Express expansion slots with the following features:

- Two PCIe risers, installed in the left and center riser connectors.
- Two x8-lane PCIe expansion slots.
- Support for full height/half-length PCI cards in both slots.

PCI-X Riser Board Expansion Slots

The PCI-X riser configuration provides two PCI-X slots with the following features:

- Two PCI-X risers, installed in the left and center riser connectors.
- Two PCI-X 64-bit/133-MHz expansion slots (on separate buses).
- Support for full height/half-length PCI cards in both slots.

Expansion Card Installation Guidelines

-  NOTE: You cannot combine PCIe and PCI-X risers. Two risers must be installed or the system will not power up.
-  NOTE: The expansion-card slots are not hot-pluggable.

To identify expansion slots, see Figure 3-12. The two expansion card slots are on separate buses.

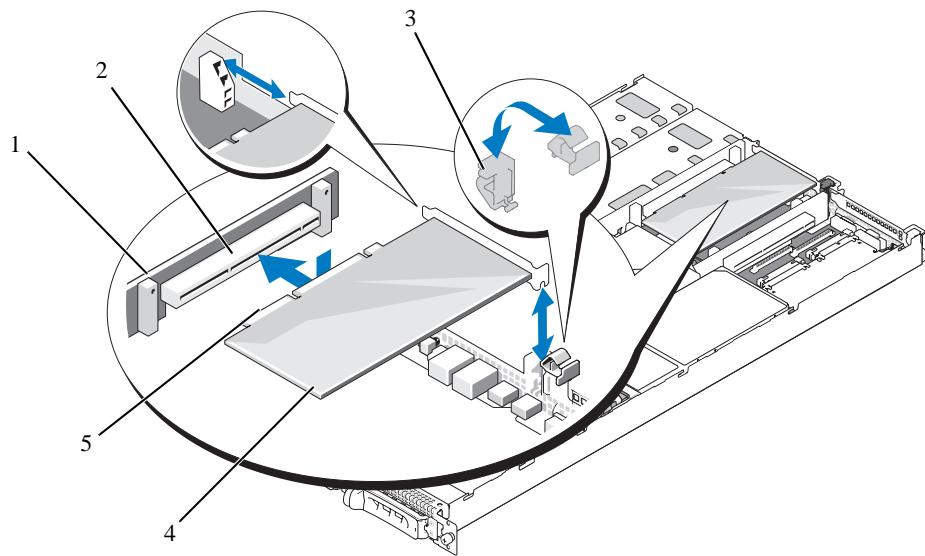
Installing an Expansion Card

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

- 1 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 and Closing the System" on page 46.
- 4 If you are adding a new card, open the expansion-card latch and remove the filler bracket. See Figure 3-12.
- 5 Install the expansion card:
 - a Position the expansion card so that the card-edge connector aligns with the expansion-card connector on the PCI riser board.

- b Insert the card-edge connector firmly into the expansion-card connector until the card is fully seated.
- c When the card is seated in the connector, close the expansion-card latch. See Figure 3-12.

Figure 3-12. Installing an Expansion Card



- | | | |
|------------------|----------------------------|------------------------|
| 1 PCI riser | 2 expansion-card connector | 3 expansion-card latch |
| 4 expansion card | 5 card-edge connector | |

6 Connect any cables to the expansion card.

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

7 Close the system. See "Opening and Closing the System" on page 46.

Removing an Expansion Card

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

- 1 Turn off the system, 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 Disconnect all cables from the card.

- 4 Remove the expansion card:
 - a Open the expansion-card latch. See Figure 3-12.
 - 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 latch.
-  NOTE: You must install a filler bracket over an empty expansion slot to maintain Federal Communications Commission (FCC) certification of the system. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.
- 6 Close the system. See "Opening and Closing the System" on page 46.

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.

Configuring the Boot Drive

The drive or device from which the system boots is determined by the boot order specified in the System Setup program. See "Using the System Setup Program" on page 31 for information about the System Setup program.

System Memory

You can upgrade your system memory to a maximum of 32 GB by installing 533-MHz or 667-MHz fully buffered (FB) DDR II memory modules (DIMMs) in sets of 256-MB, 512-MB, 1-GB, 2-GB, or 4-GB modules. The eight memory sockets are located on the system board under the memory cooling shroud. You can purchase memory upgrade kits from Dell.

 NOTICE: If you remove your original memory modules from the system during a memory upgrade, keep them separate from any new memory modules that you may have, even if you purchased the new memory modules from Dell. Use only 533-MHz or 667-MHz DDR II fully buffered DIMMS (FBDs).

The memory module sockets are divided into two equal branches (0 and 1). Each branch consists of two channels:

- Channel 0 and channel 1 are in branch 0.
- Channel 2 and channel 3 are in branch 1.

Each channel consists of two memory module sockets:

- Channel 0 contains DIMM_1, DIMM_5.
- Channel 1 contains DIMM_2, DIMM_6.
- Channel 2 contains DIMM_3, DIMM_7.
- Channel 3 contains DIMM_4, DIMM_8.

The first DIMM socket of each channel has white release tabs.

General Memory Module Installation Guidelines

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

- Use only qualified FBDs. FBDs can be either single-ranked or dual-ranked. FBDs marked with a 1R are single-ranked and modules marked with a 2R are dual-ranked.
- A minimum of two identical FBDs must be installed.
- DIMM sockets must be populated by lowest number first.
- Memory modules must be installed in pairs of matched memory size, speed, and technology, and the total number of memory modules in the configuration must total two, four, or eight. For best system performance, all four, or eight memory modules should be identical in size, speed, and technology.
- Memory sparing and memory mirroring require eight memory, and all memory modules must be of identical memory size, speed, and technology.
- Memory sparing and memory mirroring cannot be implemented at the same time.

Non-Optimal Memory Configurations

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

Memory Sparing Support

The system supports memory sparing if eight identical memory modules are installed in the system. The memory sparing feature must be enabled in the System Setup program and can be used only if memory mirroring is not enabled.(See "Using the System Setup Program" on page 31.)

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

Table 3-1. Memory Sparing Configurations

DIMMs	Size/Type	Total Memory	Available	Spare
8	256-MB single-rank	2 GB	1 GB	1 GB
	512-MB single-rank	4 GB	2 GB	2 GB
	1-GB single-rank	8 GB	4 GB	4 GB
	2-GB single-rank	16 GB	8 GB	8 GB
	2-GB dual-rank	16 GB	12 GB	4 GB
	4-GB dual-rank	32 GB	24 GB	8 GB

Memory Mirroring Support

The system supports memory mirroring if eight identical memory modules are installed in the system.

Mirroring must be enabled in the System Setup program and can be used only if memory sparing is not enabled. (See "Using the System Setup Program" on page 31.) In a mirrored configuration, the total available system memory is one-half of the total installed memory.

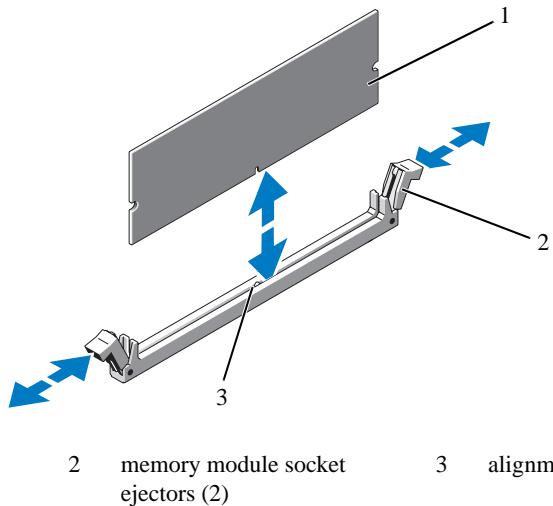
Installing Memory Modules

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

! 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 Open the system. See "Opening and Closing the System" on page 46.
- 2 Remove the memory cooling shroud. See "Removing the Memory Cooling Shroud" on page 52.
- 3 Locate the memory module sockets. See Figure 6-2.
- 4 Press the ejectors on the memory module socket down and out, as shown in Figure 3-13, to allow the memory module to be inserted into the socket.
- 5 Handle each memory module only on either card edge, ensuring not to touch the middle of the memory module.

Figure 3-13. Installing and Removing a Memory Module



- 6 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.
- 7 Press down on the memory module with your thumbs while pulling up on the ejectors with your index fingers to lock the memory module into the socket.

When the memory module is properly seated in the socket, the ejectors on the memory module socket align with the ejectors on the other sockets that have memory modules installed.
- 8 Repeat step 3 through step 7 of this procedure to install the remaining memory modules. See Table 3-1.
- 9 Replace the memory cooling shroud. See "Replacing the Memory Cooling Shroud" on page 53.
- 10 Close the system. See "Opening and Closing the System" on page 46.
- 11 Press <F2> to enter the System Setup program, and check the **System Memory** setting on the main **System Setup** screen.

The system should have already changed the value to reflect the newly installed memory.
- 12 If the value is incorrect, one or more of the memory modules may not be installed properly. Repeat step 1 through step 11 of this procedure, checking to ensure that the memory modules are firmly seated in their sockets.
- 13 Run the system memory test in the system diagnostics. See "Running the System Diagnostics" on page 111.

Removing Memory Modules

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! 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 Open the system. See "Opening and Closing the System" on page 46.
- 2 Remove the memory cooling shroud. See "Removing the Memory Cooling Shroud" on page 52.
- 3 Locate the memory module sockets. See Figure 6-2.
- 4 Press down and out on the ejectors on each end of the socket until the memory module pops out of the socket. See Figure 3-13.
Handle each memory module only on either card edge, ensuring not to touch the middle of the memory module.
- 5 Replace the memory cooling shroud. See "Replacing the Memory Cooling Shroud" on page 53.
- 6 Close the system. See "Opening and Closing the System" on page 46.

Activating the Integrated NIC TOE

To add TCP/IP Offload Engine (TOE) or iSCSI TOE functionality to the system's integrated NIC, install the appropriate TOE or iSCSI TOE NIC hardware key in the **TOE_KEY** socket on the system board. See Figure 6-2.

Processors

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

The following items are included in the processor upgrade kit:

- Processor
- Heat sink

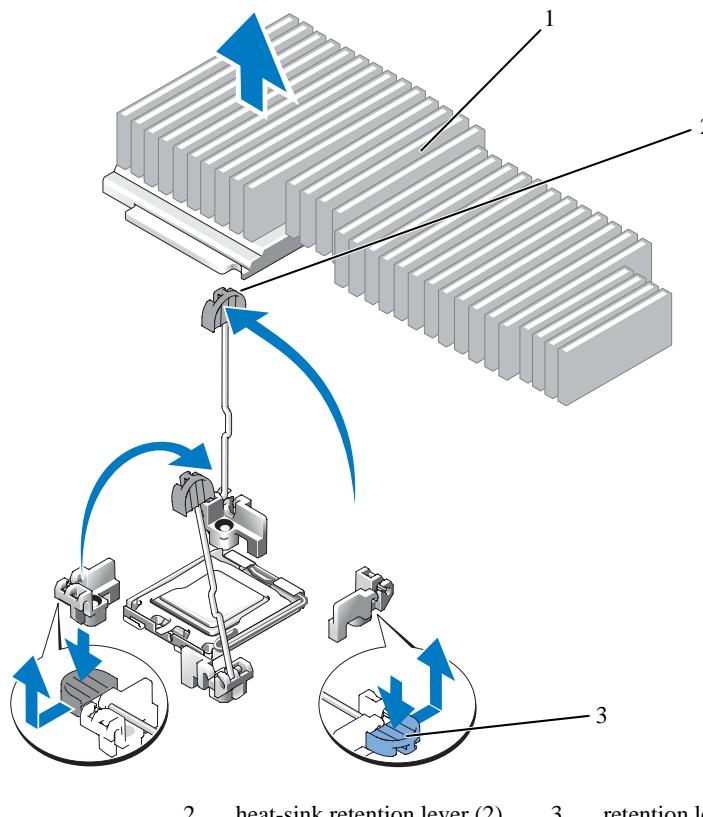
Removing the Processor

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

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

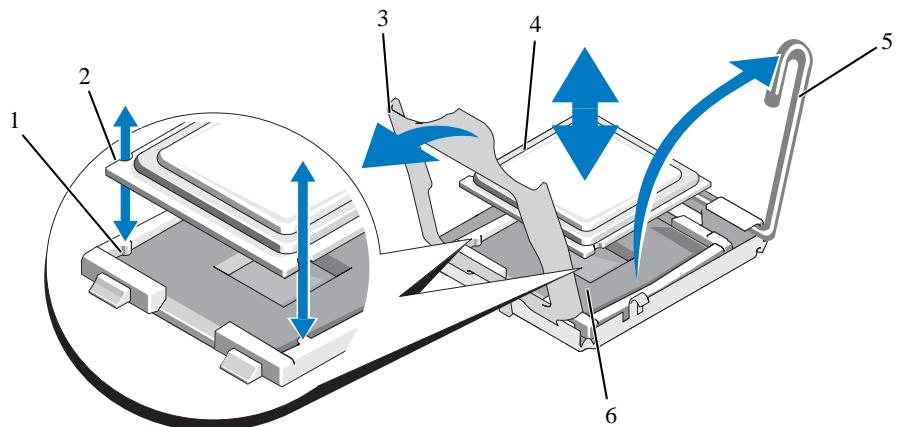
- 2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
 - 3 Open the system. See "Opening and Closing the System" on page 46.
 - 4 Remove the memory cooling shroud. See "Removing the Memory Cooling Shroud" on page 52.
- NOTICE: When you remove 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 3-14.

Figure 3-14. Installing and Removing the Heat Sink



- 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 has not separated 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 so as not to contaminate the thermal grease.
- 10 Pull the socket-release lever 90 degrees upward until the processor is released from the socket. See Figure 3-15.
- 11 Rotate the processor shield upward and out of the way.

Figure 3-15. Installing and Removing the Processor



- | | | | | | |
|---|----------------|---|----------------------|---|------------------|
| 1 | socket key (2) | 2 | notch in processor | 3 | processor shield |
| 4 | processor | 5 | socket-release lever | 6 | ZIF socket |

- 12 Lift the processor shield to release the processor, 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 LGA 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 socket keys on the ZIF socket. See Figure 3-15.
- 3 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 positioned all the way up, move it to that position.
 - b With the processor and the socket keys aligned, set the processor lightly in the socket.
-  NOTICE: Do not use force to seat the processor. When the processor is positioned correctly, it engages easily into the socket.

 - c When the processor is fully seated in the socket, rotate the socket release lever back down until it snaps into place, securing the processor. See Figure 3-15.
 - d Close the processor shield. See Figure 3-15.
- 4 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.

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

 - Using a clean lint-free cloth, remove the existing thermal grease from the heat sink you removed in step 9.
 - 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 3-14.
 - c Close one of the two heat sink retention levers until it locks. See Figure 3-14.
 - d Repeat for the other heat sink retention lever.
- 5 Close the system. See "Closing the System" on page 47.

As the system boots, it detects the presence of the new processor and automatically changes the system configuration information in the System Setup program.
- 6 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.
- 7 Run the system diagnostics to verify that the new processor operates correctly.

See "Running the System Diagnostics" on page 111 for information about running the diagnostics.

RAC Card

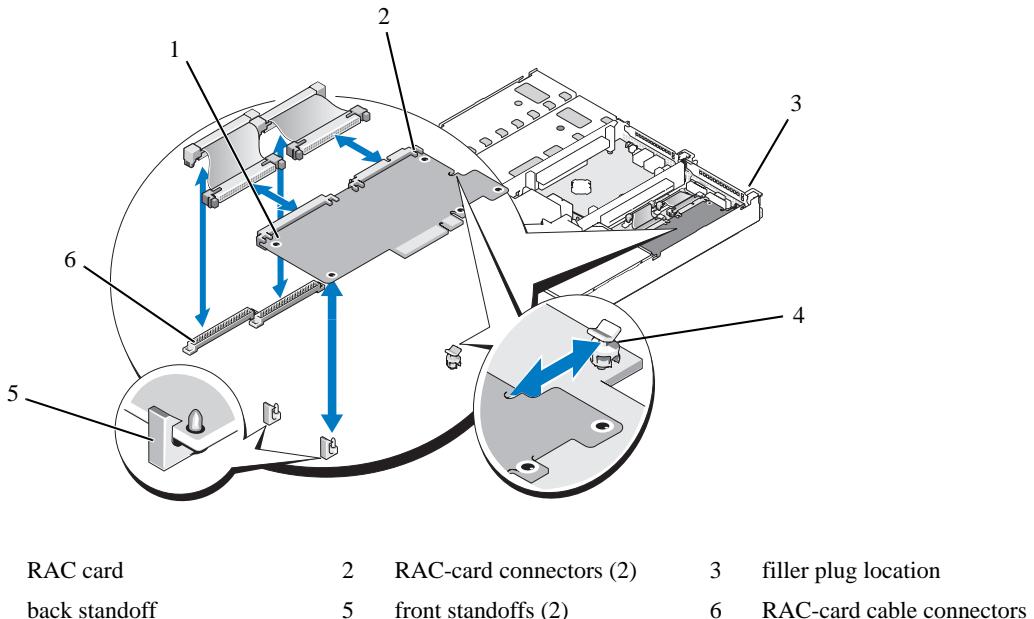
! CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell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

The optional Remote Access Controller (RAC) provides a set of advanced features for managing the server remotely. The following procedure describes the steps for installing or removing the optional RAC card.

Installing a RAC Card

- 1 Turn off the system, including any attached peripherals, and then disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46
- 3 If applicable, remove the plastic filler plug from the system back panel. See Figure 3-16.
- 4 Remove any PCI cards attached to the center riser. See "Removing an Expansion Card" on page 62.
- 5 Remove the center riser card from the system board. See "Expansion-Card Riser" on page 82.
- 6 Angle the RAC card so that its NIC connector inserts through the back-panel RAC card opening, aligning the card with the back standoff.

Figure 3-16. Installing and Removing a RAC Card



- 7 Align the front edge of the RAC card with the front plastic retention standoffs, and then press down on the front of the card until it is fully seated. See Figure 3-16.

When the front of the card is fully seated, the front plastic standoffs snap over the front edge of the card.
- 8 Connect the two small cables (44-pin cable and 50-pin cable), ensuring that connector labeled "Planar" is attached to the appropriate system board connector and the connector labeled "DRAC" is attached to the appropriate RAC card connector.
- 9 Replace the center riser card. See "Expansion-Card Riser" on page 82.
- 10 Replace any PCI cards that were removed from the center riser. See "Installing an Expansion Card" on page 61.
- 11 Close the system. See "Closing the System" on page 47.
- 12 Reconnect the system and peripherals to their power sources, and then turn them on.

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

Removing the RAC Card and Cables

- 1 Turn off the system, including any attached peripherals, and then disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 46.
- 3 Remove any PCI cards attached to the center riser. See "Removing an Expansion Card" on page 62.
- 4 Remove the center riser card from the system board. See "Expansion-Card Riser" on page 82.
- 5 Remove the RAC card cables from the system board connectors by pressing the metal tabs inward and then pulling up.
- 6 Remove the RAC card cables from the RAC connectors by pressing the metal tabs inward and then pulling up.
- 7 Remove the RAC card by pressing outwardly on the front standoffs, and then lifting the RAC card up and out of the system.
- 8 Replace the center riser card. See "Expansion-Card Riser" on page 82.
- 9 Replace any PCI cards that were removed from the center riser. See "Installing an Expansion Card" on page 61.
- 10 Close the system. See "Closing the System" on page 47.
- 11 Reconnect the system and peripherals to their power sources, and then turn them on.

Optical Drive

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

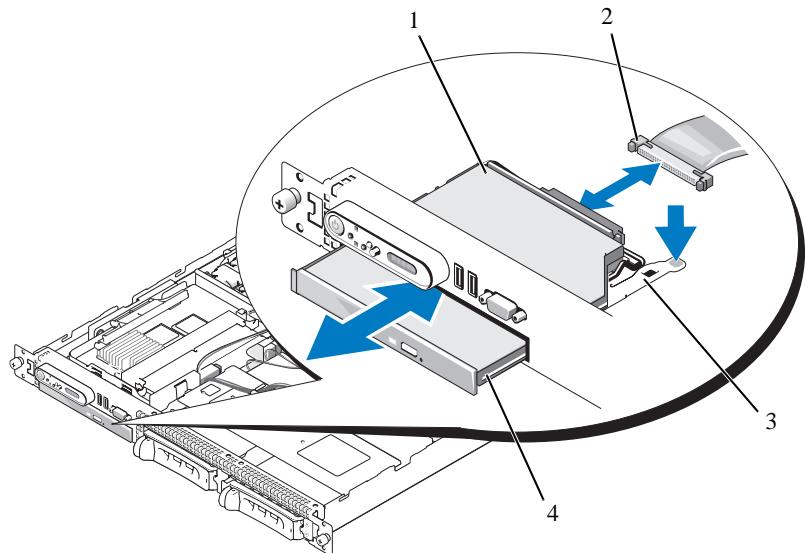
 NOTE: DVD devices are data only.

Removing the Optical Drive Tray

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

- 1 Turn off the system, including any attached peripherals, and then disconnect the system from its electrical outlet.
- 2 Remove the bezel. See "Removing and Replacing the Front Bezel" on page 45.
- 3 Open the system. See "Opening and Closing the System" on page 46.
- 4 Remove the SAS controller daughter card. See "Removing a SAS Controller Daughter Card" on page 56.
- 5 Disconnect the optical-drive cable from the back of the drive. See Figure 3-17.
- 6 To remove the optical drive, press forward on the blue tray release tab, and then slide the drive tray out of the system. See Figure 3-17.

Figure 3-17. Removing and Installing the Optical Drive Tray



- | | | |
|-----------------------|-----------------------|-----------------------------|
| 1 optical -drive tray | 2 optical-drive cable | 3 optical-drive release tab |
| 4 optical drive | | |

Installing the Optical Drive Tray

- 1 Align the optical drive tray with its opening in the front panel.
The optical drive opening is located directly below the SAS daughter card bay.
- 2 Slide in the drive tray until the tray snaps into place. See Figure 3-17.
- 3 Connect the optical-drive cable from the back of the drive. See Figure 3-17.
- 4 Replace the SAS controller daughter card. See "Installing a SAS Controller Daughter Card or SAS RAID Controller Daughter Card" on page 56.
- 5 Close the system. See "Opening and Closing the System" on page 46.
- 6 Replace the bezel. See "Removing and Replacing the Front Bezel" on page 45.
- 7 Reconnect your system and peripherals to their electrical outlets, and turn on the system.

Hard Drives

This subsection describes how to install and configure SAS or SATA hard drives in the system's internal hard-drive bays. Your system features the option of two 3.5-inch (SAS/SATA) internal hard-drive bays or four 2.5-inch (SAS only) internal hard-drive bays that accommodate up to either two or four hard drives. All drives connect to the system board through one of two optional backplane boards.

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

Before You Begin

Hard drives are supplied in special hot-pluggable drive carriers that fit in the hard-drive bays. Depending on your configuration, you received one of the following two drive carrier types:

- SATA drive carrier — Usable only with a SATA hard drive.
- SATAU drive carrier — Usable with either a SAS hard drive or a SATA hard drive with a universal interposer card. The interposer card provides enhanced functionality that makes the SATA hard drive usable in some storage systems.

-  **NOTICE:** Before you attempt to remove or install a drive while the system is running, see the documentation for the optional SAS RAID daughter card to ensure that the host adapter is configured correctly to support hot-pluggable 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 SAS or SATA hard drives.

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

When you format a high-capacity hard drive, allow enough time for the formatting to be completed. Long format times for these drives are normal. A 9-GB hard drive, for example, can take up to 2.5 hours to format.

Removing a Drive Blank

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

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

For 3.5-inch hard drive configurations:

- 1 Remove the front bezel, if attached. See "Removing and Replacing the 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.

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

- 1 Remove the front bezel, if attached. See "Replacing the System Battery" on page 86.
- 2 Open the drive blank release handle to release the blank. See Figure 3-18.
- 3 Slide the drive blank out until it is free of the drive bay.

Installing a Drive Blank

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

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

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

- 1 Remove the front bezel, if attached. See "Removing and Replacing the Front Bezel" on page 45.
- 2 Open the handle on the hard-drive blank.
- 3 Insert the hard-drive blank into the drive bay until it is fully seated.
- 4 Close the handle to lock the blank in place.
- 5 Replace the front bezel, if it was removed in step 1.

Installing a Hot-Plug Hard Drive

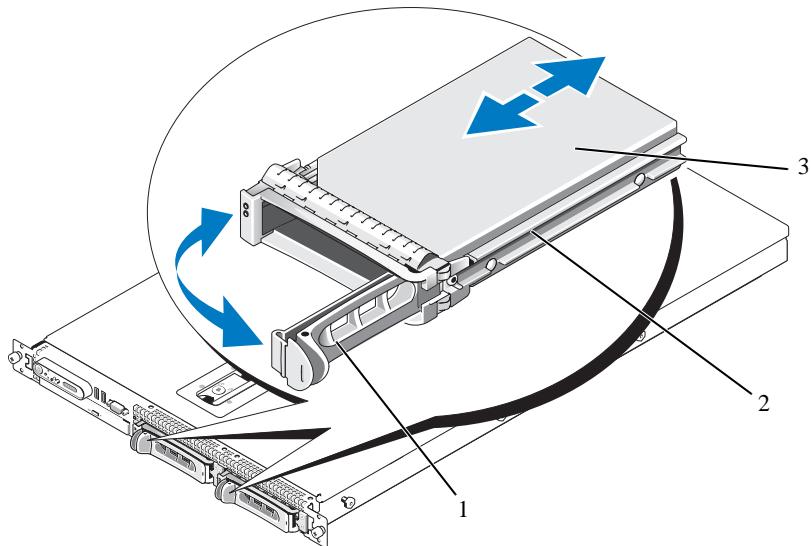
- ➔ NOTICE: When installing a hard drive, ensure that the adjacent drives are fully installed. Inserting a hard-drive carrier and attempting to lock its handle next to a partially installed carrier can damage the partially installed carrier's shield spring and make it unusable.
- ➔ NOTICE: Not all operating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

- 1 Remove the front bezel if attached. See "Removing and Replacing the Front Bezel" on page 45.
- 2 If a drive blank is present in the bay, remove it. See "Removing a Drive Blank" on page 75.

3 Install the hot-plug hard drive.

a Open the hard-drive carrier handle. See Figure 3-18.

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



1 drive carrier release handle

2 drive carrier

3 hard drive

► NOTICE: Do not insert a hard-drive carrier and attempt to lock its handle next to a partially installed carrier. Doing so can damage the partially installed carrier's shield spring and make it unusable. Ensure that the adjacent drive carrier is fully installed.

- b Insert the hard-drive carrier into the drive bay until the carrier contacts the backplane. See Figure 3-18.
 - c Close the hard-drive carrier handle to lock it in place.
- 4 Replace the front bezel if it was removed in step 1. See "Removing and Replacing the Front Bezel" on page 45.

Replacing a Hard-Drive Carrier

Removing a Hard Drive From a Hard-Drive Carrier

- 1 If you are removing a SATA hard drive from a SATAu drive carrier, remove the interposer card:
 - a Viewing the hard drive carrier from the rear, locate the release lever on the left end of the interposer card.
 - b Push the lever away from the carrier rail to release the left end of the card.
 - c Rotate the left end away from the hard drive to release the connector.
 - d Pull the right end of the interposer card clear of the slots in the carrier rail.
- 2 Remove the four screws from the slide rails on the hard-drive carrier and separate the hard drive from the carrier.

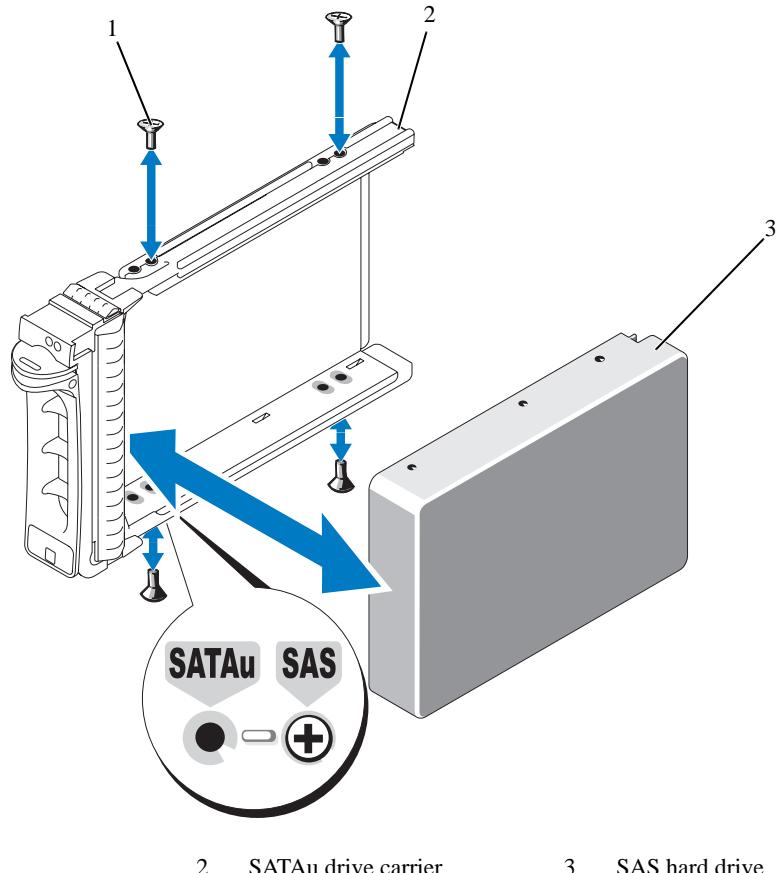
Installing a SAS Hard Drive Into a SATAu Drive Carrier

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

- 1 Insert the SAS hard drive into the hard-drive carrier with the connector end of the drive at the rear. 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 rear of the hard drive will be flush with the rear of the hard-drive carrier.
- 3 Attach the four screws to secure the hard drive to the hard-drive carrier. See Figure 3-19.

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

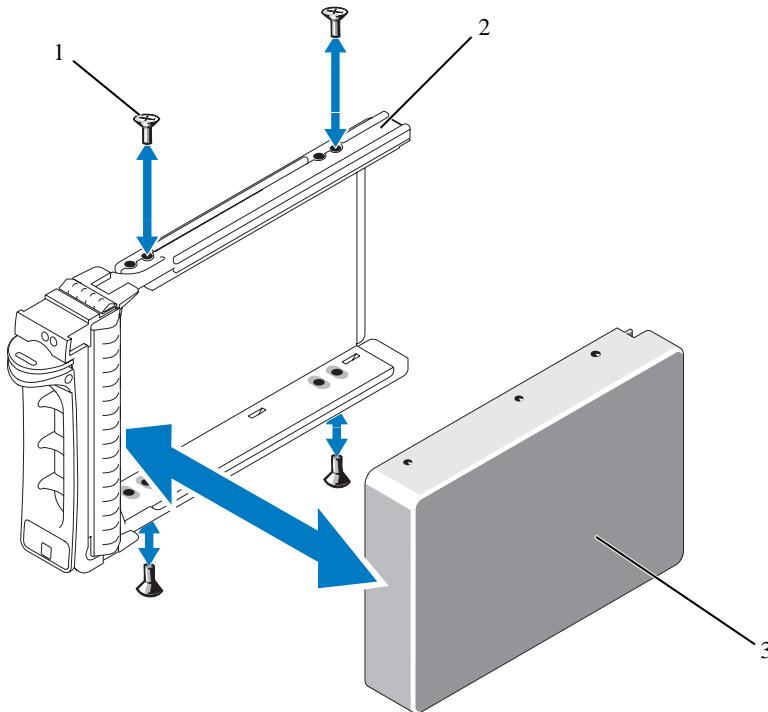


Installing a SATA Hard Drive Into a SATA Drive Carrier

 NOTE: SATA hard drives that connect directly to the SAS backplane must be installed in SATA drive carriers (labeled "SATA"). Only SATA hard drives with interposer cards can be installed in SATAU drive carriers.

- 1 Insert the SATA hard drive into the hard-drive carrier with the connector end of the drive at the rear. See Figure 3-20.
- 2 Align the screw holes on the hard drive with the holes on the hard-drive carrier. See Figure 3-20.
- 3 Attach the four screws to secure the hard drive to the hard-drive carrier. See Figure 3-20.

Figure 3-20. Installing a SATA Hard Drive Into a SATA Drive Carrier



1 screws (4)

2 SATA drive carrier

3 SATA hard drive

Installing a SATA Hard Drive and Interposer Card Into a SATAU Hard-Drive Carrier

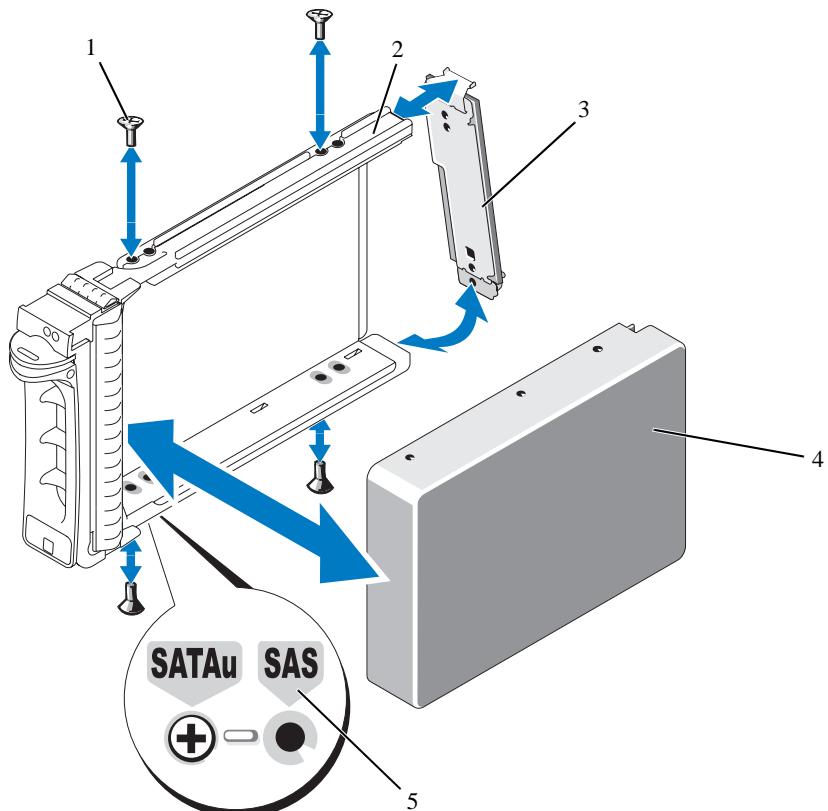


NOTE: When you install a SATA hard drive into a SATAU drive carrier, you must install an interposer card onto the back of the hard drive. The SATAU drive carrier is labeled "SATAU" and also has marks indicating the SAS and SATA mounting screws.

- 1 Insert the SATA hard drive into the SATAU hard-drive carrier with the connector end of the drive at the rear. See Figure 3-21.
- 2 Viewing the assembly as shown in Figure 3-21, align the bottom rear screw hole on the hard drive with the hole labeled "SATAU" on the hard drive carrier.
When aligned correctly, the rear of the interposer will be flush with the rear of the hard-drive carrier.
- 3 Attach the four screws to secure the hard drive to the hard-drive carrier. See Figure 3-21.

- 4 Attach the interposer card to the rear of the SATA hard drive:
- Angle the top of the interposer card into the inside top carrier rail so that the tabs on the interposer card bracket attach to the slots on the inside of the carrier rail. See Figure 3-21.
 - Rotate the bottom end of the card toward the hard drive to seat the connector. See Figure 3-21.
 - Push the bottom end of the card towards the hard drive until the latch on the card bracket clicks into place.

Figure 3-21. Installing a SATA Hard Drive and Interposer Card Into a SATAu Drive Carrier



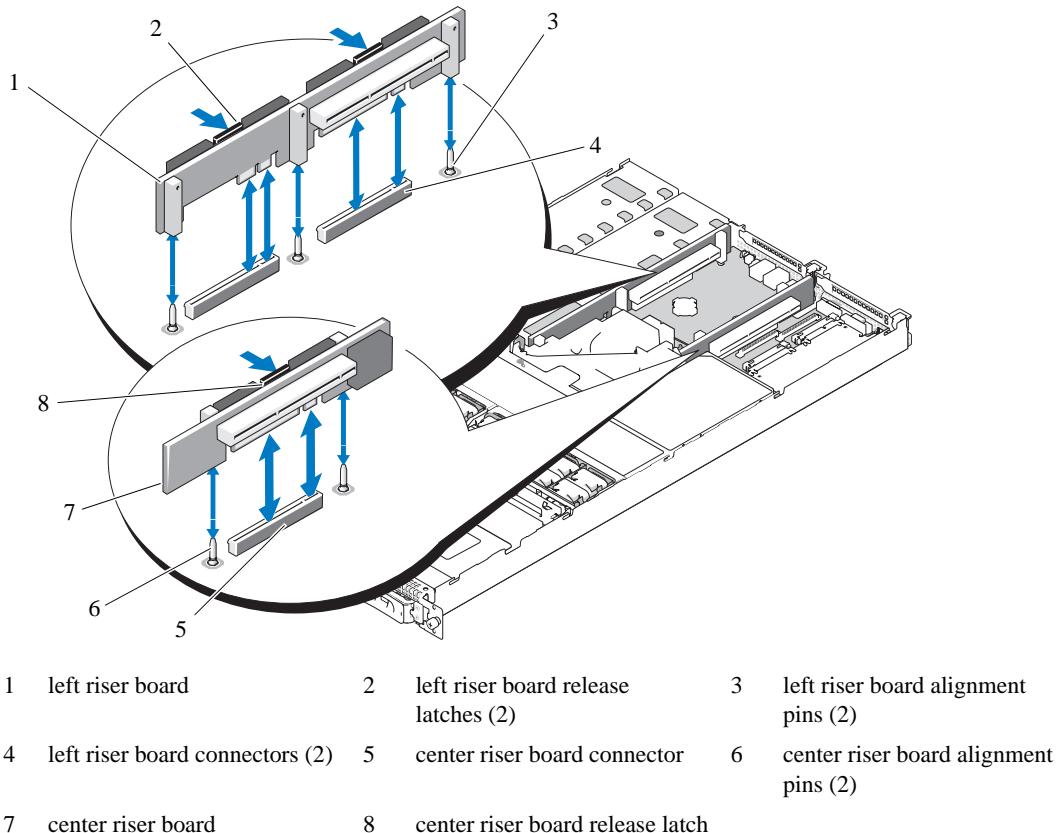
Expansion-Card Riser

Removing an Expansion-Card Riser

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

- 1 If applicable, remove the bezel. See "Removing and Replacing the 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 and Closing the System" on page 46.

Figure 3-22. Expansion-Card Riser Removal



- 4 If applicable, remove the expansion card from the riser.
- 5 Press the release latch(es) on the riser board and lift the riser board straight up from the system board. See Figure 3-22.

The left riser board has two release latches; the center riser board has one latch.

Installing an Expansion-Card Riser

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

- 1 Align the riser board with the alignment pins on the system board, then lower the board onto the pins.
- 2 Press down on the riser board until the edge connector(s) on the board is (are) fully seated in the riser board connector on the system board. See Figure 3-22.
- 3 If applicable, install the expansion card in the expansion-card slot.
- 4 Close the system. See "Opening and Closing the System" on page 46.
- 5 Replace the bezel. See "Removing and Replacing the Front Bezel" on page 45.
- 6 Reconnect your system and peripherals to their electrical outlets, and turn on the system.

Backplane Board

Removing the Backplane Board

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

The removal procedure varies slightly, depending on which backplane board you have in your system.

- 1 If applicable, remove the bezel. See "Removing and Replacing the 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 and Closing the System" on page 46.
- 4 Remove the hard drives.

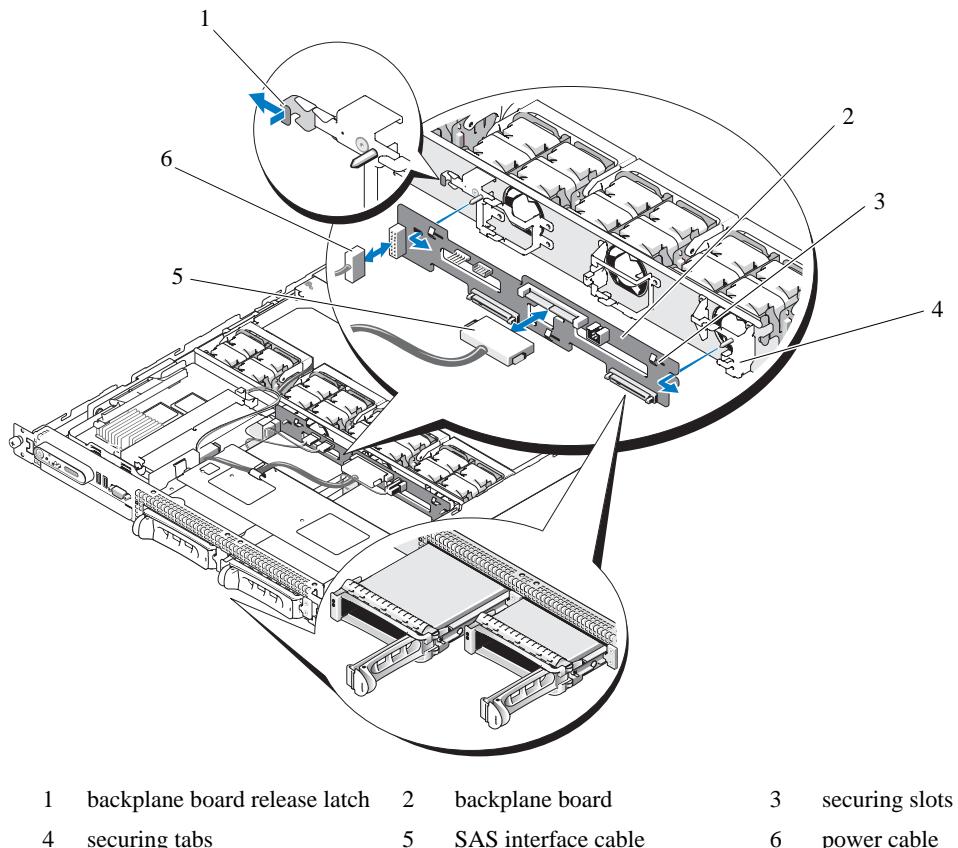
 **NOTICE:** To properly reinstall the hard drives, ensure that you record which hard drive you remove from which bay.

- 5 Disconnect the SAS cable and power cable from the backplane.
 - If you are removing a 3.5-inch hard drive (two-drive) backplane, see Figure 3-23.
 - If you are removing a 2.5-inch hard drive (four-drive) backplane, see Figure 6-4.

6 Remove the backplane board:

- If you are removing a 3.5-inch hard drive (two-drive) backplane, press the release latch at the left end of the board, slide the board to its right, and lift the backplane off of the securing tabs. See Figure 3-23.
- If you are removing a 2.5-inch hard drive (four-drive) backplane, press the release latch at each end of the backplane and lift the backplane off of the securing tabs. See Figure 6-4.

Figure 3-23. 2.5-Inch Hard Drive Backplane Board Removal and Installation



Installing the Backplane Board

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

- 1 Replace the backplane board:
 - If you are installing a 3.5-inch hard drive (two-drive) backplane, fit the board onto the securing tabs, press the release latch at the left end of the board and slide the board to its left. See Figure 3-23.
 - If you are installing a 2.5-inch hard drive (four-drive) backplane, fit the board onto the securing tabs on the back of the drive cage and slide the board downwards until the release latch at each end of the backplane clicks into place. See Figure 6-4.
- 2 Connect the SAS cable and power cable to the backplane connectors.
- 3 Reinstall the hard drives.
 -  NOTE: Reinstall the hard drives in the same drive bays from which they were removed.
- 4 Close the system.
- 5 If applicable, replace the bezel.

Sideplane Board

Removing the Sideplane Board

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

- 1 If applicable, remove the bezel. See "Removing and Replacing the 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 and Closing the System" on page 46.
- 4 Remove the SAS controller daughter card. See "Removing a SAS Controller Daughter Card" on page 56.
- 5 Disconnect the control panel cable and optical drive cable (if applicable) from the sideplane. See Figure 6-8.
- 6 Press inward on the two sideplane release latches marked in blue and lift the sideplane up and away from the system board.

Installing the Sideplane Board

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

- 1 Align the guide on the end of the sideplane board with the pins on the system board, and lower the sideplane until that the sideplane connector is fully seated into the connector on the system board.
- 2 Connect the control panel cable and optical drive cable (if applicable) to the sideplane. See Figure 6-8.
- 3 Replace the SAS controller daughter card. See "Installing a SAS Controller Daughter Card or SAS RAID Controller Daughter Card" on page 56.
- 4 Close the system. See "Opening and Closing the System" on page 46.
- 5 Replace the bezel. See "Removing and Replacing the Front Bezel" on page 45.
- 6 Reconnect your system and peripherals to their electrical outlets, and turn on the system.

System Battery

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

Replacing the System Battery

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

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

- 1 Turn off the system, 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 If an expansion card is installed in the left riser board, remove the card. See "Removing an Expansion Card" on page 62.
- 4 Locate the battery socket. See Figure 3-24.

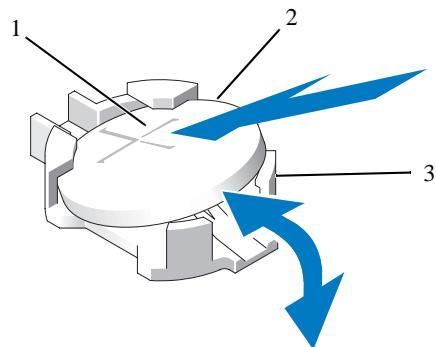
► NOTICE: If you pry the battery out of its socket with a blunt object, be careful not to touch the system board with the object. Ensure that the object is inserted between the battery and the socket before you attempt to pry out the battery. Otherwise, you may damage the system board by prying off the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

- 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 3-24. 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 If you removed an expansion card in step 3, replace the card now. See "Installing an Expansion Card" on page 61.

8 Close the system. See "Opening and Closing the System" on page 46.

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 125 for instructions on obtaining technical assistance.

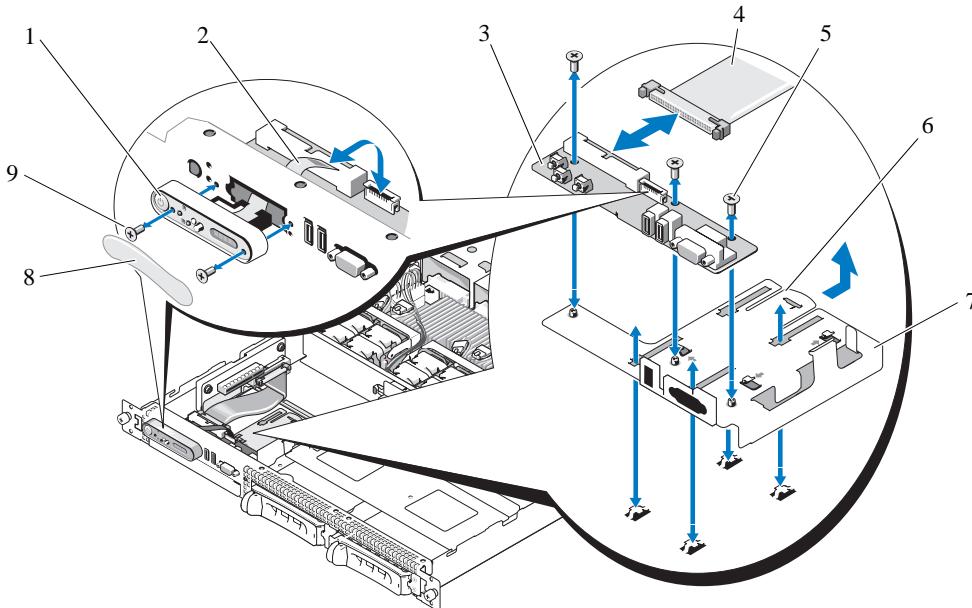
Control Panel Assembly

Removing the Control Panel

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

- 1 If applicable, remove the bezel. See "Removing and Replacing the 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 and Closing the System" on page 46.
 - 4 Remove the SAS controller daughter card. See "Removing a SAS Controller Daughter Card" on page 56.
 - 5 Disconnect the control panel cable at the back of the control panel board. See Figure 3-25.
- NOTICE: Do not pull on the cable to unseat the connector. Doing so can damage the cable.
- a Squeeze the metal tabs on the ends of the cable connector.
 - b Gently work the connector out of the socket.
- 6 Disconnect the front panel cable from the control panel board. See Figure 3-25.
 - 7 Lift the release tab at the back of the control panel carrier and slide the carrier towards the back of the system, then lift the carrier out of the system. See Figure 3-25.
 - 8 Remove the three screws that secure the control panel board to the carrier and remove the board. See Figure 3-25.
 - 9 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 Using a T10 Torx driver, remove the two screws that secure the display module to the system chassis. See Figure 3-25.
 - c Remove the display module from the chassis cutout.

Figure 3-25. Control Panel Removal and Installation



- | | | | | | |
|---|-----------------------|---|--|---|---------------------------------------|
| 1 | display module | 2 | display module LCD cable | 3 | control panel circuit board |
| 4 | control panel cable | 5 | control-panel circuit board
securing screws (3) | 6 | control panel carrier release
tab |
| 7 | control panel carrier | 8 | display module label | 9 | display module securing
screws (2) |

Installing the Control Panel

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

- 1 Insert the display module into the chassis cutout and secure it with the two screws.
- 2 Affix the control panel label to the display module.
- 3 Install the control panel board on the carrier, and secure it with the three Phillips screws. See Figure 3-25.
- 4 Install the carrier in the system chassis.
- 5 Connect the display module ribbon cable to the control panel board.
- 6 Connect the control panel ribbon cable to the control panel board.

- 7 Replace the SAS controller daughter card. See "Installing a SAS Controller Daughter Card or SAS RAID Controller Daughter Card" on page 56.
- 8 Close the system. See "Opening and Closing the System" on page 46.
- 9 Reconnect the system to the power source and turn on the system and attached peripherals.
- 10 If applicable, install the bezel. See "Removing and Replacing the Front Bezel" on page 45.

System Board

Removing the System Board

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

- 1 If applicable, remove the bezel. See "Removing and Replacing the 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 and Closing the System" on page 46.
- 4 Disconnect any cables from the system board back panel.
- 5 Remove the memory cooling shroud. See "Removing the Memory Cooling Shroud" on page 52.
- 6 Remove both power supplies. See "Removing a Power Supply" on page 54.
- 7 Remove the sideplane from the system board. See "Removing the Sideplane Board" on page 85.
- 8 Remove both the center and left risers from the system board. See "Removing an Expansion-Card Riser" on page 82.
- 9 Remove the four fan modules. See "Removing a Cooling Fan Module" on page 48.
- 10 If applicable, remove the RAC card. See "RAC Card" on page 71.
- 11 Remove the memory modules. See "Removing Memory Modules" on page 67.

 **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.

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

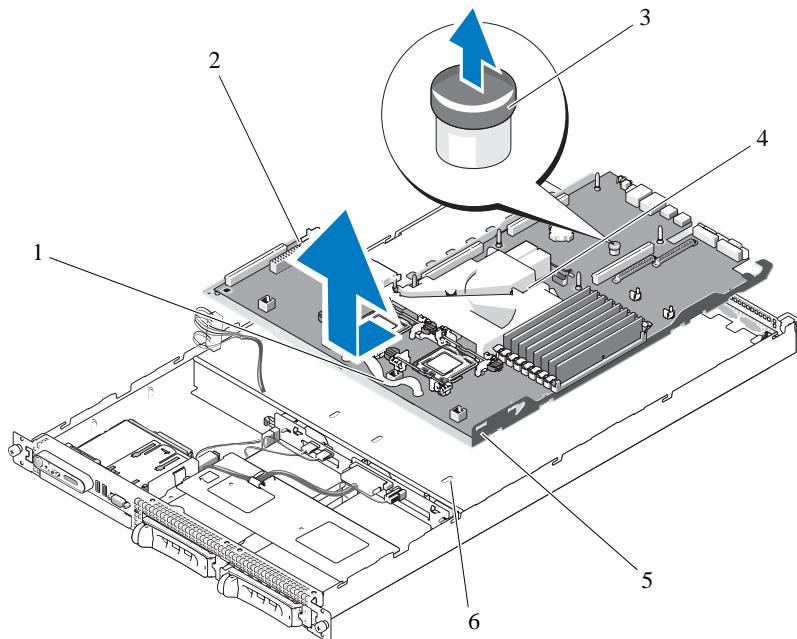
 **NOTE:** Your system also comes with a pre installed system board cooling shroud. Do not remove the system board cooling shroud. See Figure 3-5.

- 12 Remove the heatsink(s) and microprocessor(s). See "Removing the Processor" on page 67.
- 13 If applicable, remove the TOE key. See "Activating the Integrated NIC TOE" on page 67.

14 Remove the system board:

- a Pull the system-board release pin. See Figure 3-26.
- b While pulling the release pin, grasp the system board release handle and slide the system-board tray toward the front of the chassis.
- c Lift up the system-board tray and remove it from the chassis.

Figure 3-26. System Board Removal



- | | | |
|------------------------------------|--|-------------------------------|
| 1 system-board tray release handle | 2 system board attached to system-board tray | 3 system board release pin |
| 4 system board cooling shroud | 5 system-board securing tabs | 6 system-board securing slots |

Installing the System Board

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

- 1 Lower the system-board tray until the tray sits flat on the bottom of the chassis.
- 2 Ensure that all system-board securing tabs are fully inserted into the system-board securing slots. See Figure 3-26.

- 3 Slide the system-board tray toward the back of the chassis until it locks into position.
- 4 If applicable, replace the RAC card. See "RAC Card" on page 71.
- 5 If applicable, replace the TOE key. See "Activating the Integrated NIC TOE" on page 67.
- 6 Replace the heatsink(s) and microprocessor(s).
- 7 Replace the memory modules. See "Installing Memory Modules" on page 65.
- 8 Replace both the center and left risers. See "Installing an Expansion-Card Riser" on page 83.
- 9 Replace any expansion card(s). See "Installing an Expansion Card" on page 61.
- 10 Replace the sideplane board. See "Installing the Sideplane Board" on page 86.
- 11 Replace the fan modules. See "Replacing a Cooling Fan Module" on page 49.
- 12 Replace the memory cooling shroud. See "Replacing the Memory Cooling Shroud" on page 53.
- 13 Replace the power supplies. See "Replacing a Power Supply" on page 55.
- 14 Connect any cables to the system.
- 15 Close the system. See "Opening and Closing the System" on page 46.
- 16 Replace the bezel. See "Removing and Replacing the 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:** Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

Start-Up Routine

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

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 17.
An error message displayed on the monitor.	See "System Messages" on page 25.
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 95.
The keyboard indicators.	See "Troubleshooting the Keyboard" on page 95.
The USB CD drive activity indicator.	See "Troubleshooting a USB Device" on page 97.
The CD drive activity indicator.	See "Troubleshooting an Optical Drive" on page 103.
The hard-drive activity indicator.	See "Troubleshooting a Hard Drive" on page 104.
An unfamiliar constant scraping or grinding sound when you access a drive.	See "Getting Help" on page 125.

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 94.

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	Reserved
IRQ7	Reserved
IRQ8	Real-time clock
IRQ9	ACPI functions (used for power management)
IRQ10	<i>Available</i>
IRQ11	<i>Available</i>
IRQ12	<i>Available</i>
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 rear video connectors.

The system supports only one monitor attached to either the front or rear video connector. When a monitor is connected to the front panel, the back-panel video 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 Server Administrator Diagnostics" on page 111.

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

If the tests fail, see "Getting Help" on page 125.

Troubleshooting the Keyboard

Problem

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

Action

- 1 Examine the keyboard and its cable for signs of damage.

- 2 Swap the faulty keyboard with a working keyboard.

If the problem is resolved, replace the faulty keyboard. See "Getting Help" on page 125.

- 3 Enter the System Setup program and ensure that the USB ports are enabled. See "Using the System Setup Program" on page 31.

If the problem is not resolved, see "Getting Help" on page 125.

- 4 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 111.

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 125.
- 4 If the problem is not resolved, see "Getting Help" on page 125.
- 5 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 111.
If the test fails, continue to the next step.

Troubleshooting Basic I/O Functions

Problem

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

Action

- 1 Enter the System Setup program and ensure that the serial port is enabled, and the serial port/COM ports are configured appropriately for any applications you are using. See "Using the System Setup Program" on page 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 Server Administrator Diagnostics" on page 111.
If the tests run successfully but the problem persists, see "Troubleshooting a Serial I/O Device" on page 97.

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 125.
If the problem persists, see "Getting Help" on page 125.

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 125.
- 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 125.
- 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 125.
If the problem persists, see "Getting Help" on page 125.

Troubleshooting a NIC

Problem

- NIC cannot communicate with network.

Action

- 1 Run the appropriate online diagnostic test. See "Running the System Diagnostics" on page 111.
- 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: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening and Closing the System" on page 46.
- 3 Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 62.

- 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 125.
- 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 61.
- 8 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 111.
If the tests fail, see "Getting Help" on page 125.

Troubleshooting a Damaged System

Problem

- System was dropped or damaged.

Action

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- 1 Open the system. See "Opening and Closing the System" on page 46.
- 2 Ensure that the following components are properly installed:
 - Expansion cards and risers
 - Power supplies
 - Processor and heatsink
 - Memory modules
 - Fans
 - Drive-carrier connections to the SAS backplane board, if applicable
- 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 "Running the System Diagnostics" on page 112.
If the tests fail, see "Getting Help" on page 125.

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 86.

If the problem is not resolved by replacing the battery, see "Getting Help" on page 125.

 NOTE: Some software may cause the system time to speed up or slow down. If the system seems to operate normally except for the time kept in the System Setup program, the problem may be caused by software rather than by a defective battery.

Troubleshooting Power Supplies

Problem

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

Action

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

- 1 Run the appropriate online diagnostics test. See "Using Server Administrator Diagnostics" on page 111.
- 2 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, without a power supply blank installed, can cause the system to overheat.

Remove the faulty power supply. See "Power Supplies" on page 53.

- 3 Ensure that the power supply is properly installed by removing and reinstalling it. See "Power Supplies" on page 53.

► **NOTE:** After installing a power supply, allow several seconds for the system to recognize the power supply and to determine if it is working properly. The power indicator turns green to signify that the power supply is functioning properly. See "Power Indicator Codes" on page 15.

If the problem persists, see "Getting Help" on page 125.

Troubleshooting System Cooling Problems

Problem

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

Action

Ensure that none of the following conditions exist:

- Ambient temperature is too high.
- External airflow is obstructed.
- Cables inside the system obstruct airflow.
- An individual cooling fan has failed. See "Troubleshooting a Fan" on page 101.

Troubleshooting a Fan

Problem

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

Action

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

- 1 Run the appropriate diagnostic test. See "Using Server Administrator Diagnostics" on page 111.

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

 CAUTION: The cooling fans are not hot-pluggable. To maintain proper cooling while the system is on, only replace one fan at a time.

3 Locate the faulty fan indicated by the LCD display or diagnostic software. For the identification number of each fan, see "Removing and Installing a Cooling Fan" on page 49.

4 Ensure that the faulty fan's power cable is firmly attached to the fan power connector. See "Cooling Fan Modules" 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 Fan Modules" 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 125.

Troubleshooting System Memory

Problem

- Faulty memory module.
- Faulty system board.
- Front-panel status LCD indicates a problem with system memory.

Action

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

1 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 111.

2 Turn on the system and attached peripherals.

If an error message does not appear, continue to the next step.

If an error message appears, go to step 12.

3 Enter the System Setup program and check the system memory setting. See "Entering the System Setup Program" on page 31.

If the amount of memory installed matches the system memory setting, go to step 12.

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 Remove the memory cooling shroud. See "Removing the Memory Cooling Shroud" on page 52.

- 7 Reseat the memory modules in their sockets. See "Installing Memory Modules" on page 65.
 - 8 Replace the memory cooling shroud. See "Replacing the Memory Cooling Shroud" on page 53.
 - 9 Close the system. See "Opening and Closing the System" on page 46.
 - 10 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.
 - 11 Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 31.

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

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

 NOTE: Several configurations for memory modules exist; see "General Memory Module Installation Guidelines" on page 64.

 - c Swap the memory module in socket 1 with another of the same capacity. See "Installing Memory Modules" on page 65.
 - d Close the system. See "Opening and Closing the System" on page 46.
 - e Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.
 - f As the system boots, observe the monitor screen and the indicators on the keyboard.
 - 12 Perform the following steps:
 - a Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
 - b Open the system. See "Opening and Closing the System" on page 46.
 - c Perform step c through step f in step 11 for each memory module installed.
- If the problem persists, see "Getting Help" on page 125.

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

- 1 Try using a different CD or DVD that you know works properly.
- 2 Enter the System Setup program and ensure that the drive's IDE controller is enabled. See "Using the System Setup Program" on page 31.
- 3 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 111.
- 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 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 Remove the SAS controller daughter card or the SAS RAID controller daughter card, as applicable. See "Removing a SAS Controller Daughter Card" on page 56.
- 9 Close the system. See "Opening and Closing the System" on page 46.
- 10 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

If the problem is not resolved, see "Getting Help" on page 125.

Troubleshooting a Hard Drive

Problem

- Device driver error.
- One or more hard drives not recognized by the system.

Action

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

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

- 1 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 111.
Depending on the results of the diagnostics test, proceed as needed through the following steps.
- 2 Remove the bezel. See "Removing and Replacing the 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, reseat the hard drive, and restart the system.
- 5 If your system has a SAS RAID controller daughter card, perform the following steps.
 - a Restart the system and press <Ctrl><R> to enter the host adapter configuration utility program.

See the documentation supplied with the host adapter for information about the configuration utility.

- b Ensure that the hard drive has been configured correctly for the RAID.
 - c Exit the configuration utility and allow the system to boot to the operating system.
- 6 Ensure that the required device drivers for your controller daughter card are installed and are configured correctly. See the operating system documentation for more information.



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

- 7 If you have the non-RAID SAS controller daughter 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 76.

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 125.

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 125.

- 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 SAS backplane(s) and the SAS daughter card are correct. See "Installing a SAS Controller Daughter Card or SAS RAID Controller Daughter Card" on page 56.
- d Verify that the SAS cables are securely seated in their connectors.
- e Verify that the power connectors on the SAS backplane(s) are securely seated in their connectors.
- f Close the system. See "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 125.

Troubleshooting a SAS or SAS RAID Controller Daughter Card



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

Problem

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

Action

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

- 1 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 111.
- 2 Enter the System Setup program and ensure that the SAS or SAS RAID controller daughter card is enabled. See "Using the System Setup Program" on page 31.
- 3 Restart the system and press the applicable key sequence to enter the configuration utility program:
 - <Ctrl><C> for a SAS controller
 - <Ctrl><R> for a SAS RAID controllerSee the controller's documentation for information about configuration settings.
- 4 Check the configuration settings, make any necessary corrections, and restart the system.
If the problem is not resolved, continue to the next step.
- 5 Remove the bezel. See "Removing and Replacing the Front Bezel" on page 45.
- 6 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
- 7 Open the system. See "Opening and Closing the System" on page 46.
- 8 Ensure that the controller card is firmly seated in its connector. See "SAS Controller Daughter Card" on page 56.
- 9 If you have a SAS RAID controller daughter card, ensure that the following RAID components are properly installed and connected:
 - Memory module
 - Battery
- 10 Verify that the cable connections between the SAS backplane(s) and the SAS controller daughter card are correct. See "Installing a SAS Controller Daughter Card or SAS RAID Controller Daughter Card" on page 56.
- 11 Ensure that the cables are firmly connected to the SAS controller daughter card and the SAS backplane board.
- 12 Close the system. See "Opening and Closing the System" on page 46.
- 13 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 daughter card, see "Getting Help" on page 125.
 - If you have a SAS RAID controller daughter card, replace the SAS RAID daughter card battery. See "Installing a RAID Battery" on page 60. If replacing the battery does not solve the problem, see "Getting Help" on page 125.

Troubleshooting Expansion Cards

 NOTE: When troubleshooting an expansion card, see the documentation for your operating system and the expansion card.

Problem

- Error message indicates a problem with an expansion card.
- Expansion card performs incorrectly or not at all.

Action

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

- 1 Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" on page 111.
- 2 Open or remove the bezel. See "Removing and Replacing the Front Bezel" on page 45.
- 3 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 4 Open the system. See "Opening and Closing the System" on page 46.
- 5 Ensure that each expansion card is firmly seated in its connector. See "Installing an Expansion Card" on page 61.
- 6 Close the system. See "Opening and Closing the System" on page 46.
- 7 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
If the problem persists, go to the next step.
- 8 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 9 Open the system. See "Opening and Closing the System" on page 46.
- 10 Remove all expansion cards installed in the system. See "Installing an Expansion Card" on page 61.
- 11 Close the system. See "Opening and Closing the System" on page 46.
- 12 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 13 Run the appropriate online diagnostic test.
If the tests fail, see "Getting Help" on page 125.
- 14 For each expansion card you removed in step 10, perform the following steps:
 - a Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
 - b Open the system. See "Opening and Closing the System" on page 46.
 - c Reinstall one of the expansion cards.

- d Close the system. See "Opening and Closing the System" on page 46.
- e Run the appropriate diagnostic test.
If the tests fail, see "Getting Help" on page 125.

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

- 1 Run the appropriate online diagnostics test. See "Using Server Administrator Diagnostics" on page 111.
- 2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 3 Open the system. See "Opening and Closing the System" on page 46.
- 4 Ensure that each processor and heat sink are properly installed. See "Removing the Processor" on page 67.
- 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 tests fail 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 Remove processor 2, leaving only processor 1 installed. See "Removing the Processor" on page 67.
If only one processor is installed, see "Getting Help" on page 125.
- 11 Close the system. See "Opening and Closing the System" on page 46.
- 12 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 13 Run the appropriate online diagnostic test.
If the tests complete successfully, go to step 19.
- 14 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 15 Open the system. See "Opening and Closing the System" on page 46.

16 Replace processor 1 with another processor of the same capacity. See "Removing the Processor" on page 67.

17 Close the system. See "Opening and Closing the System" on page 46.

18 Run the appropriate online diagnostic test.

If the tests complete successfully, replace processor 1. See "Getting Help" on page 125.

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

20 Open the system. See "Opening and Closing the System" on page 46.

21 Reinstall the processor that you removed in step 10. See "Removing the Processor" on page 67.

22 Close the system. See "Opening and Closing the System" on page 46.

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

If the problem persists, see "Getting Help" on page 125.

Running the System Diagnostics

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

Using Server Administrator Diagnostics

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

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

System Diagnostics Features

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

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

When to Use the System Diagnostics

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

Running the System Diagnostics

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

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

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

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

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

System Diagnostics Testing Options

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

Table 5-1. System Diagnostics Testing Options

Testing Option	Function
Express Test	Performs a quick check of the system. This option runs device tests that do not require user interaction. Use this option to quickly identify the source of your problem.
Extended Test	Performs a more thorough check of the system. This test can take an hour or longer.
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 system board cooling shroud by lifting the release latch and sliding the shroud towards the front of the system. See Figure 3-13.

 NOTE: Lift up the memory module airflow shroud for easy access to the jumpers.

Figure 6-1. System Board Jumpers

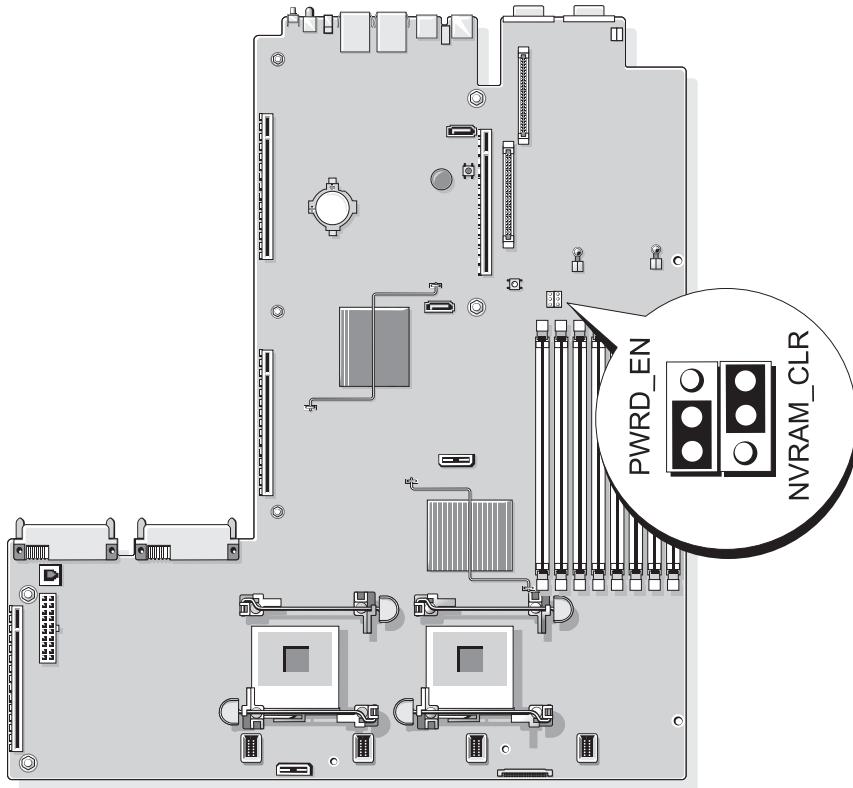


Table 6-1. System Board Jumper Settings

Jumper	Setting	Description
1 PWRD_EN	[<input checked="" type="checkbox"/> <input type="checkbox"/>]	(default) The password feature is enabled.
	[<input type="checkbox"/> <input checked="" type="checkbox"/>]	The password feature is disabled.
2 NVRAM_CLR	[<input checked="" type="checkbox"/> <input type="checkbox"/>]	The configuration settings are retained at system boot.
	[<input type="checkbox"/> <input checked="" type="checkbox"/>]	The configuration settings are cleared at the next system boot. (If the configuration settings become corrupted to the point where the system will not boot, install the jumper and boot the system. Remove the jumper before restoring the configuration information.)

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 147.

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.

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

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

Figure 6-2. System Board Connectors

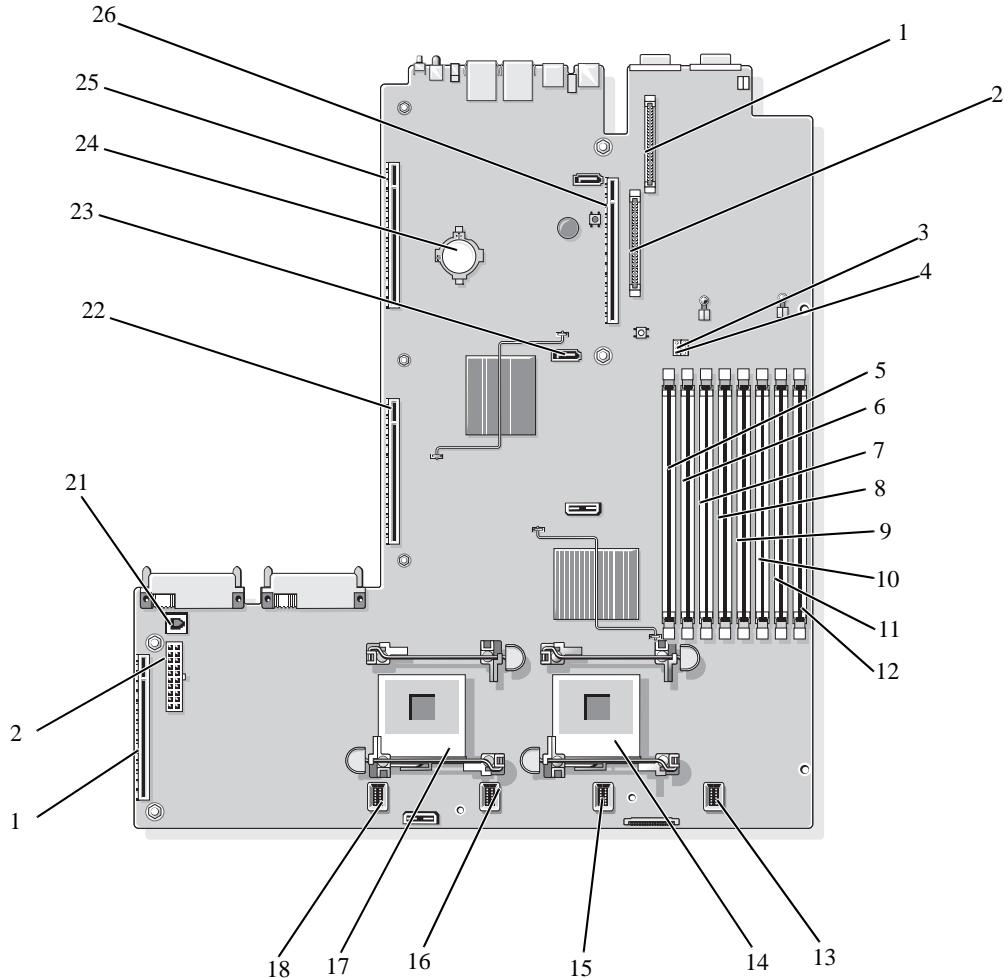


Table 6-2. System Board Connectors

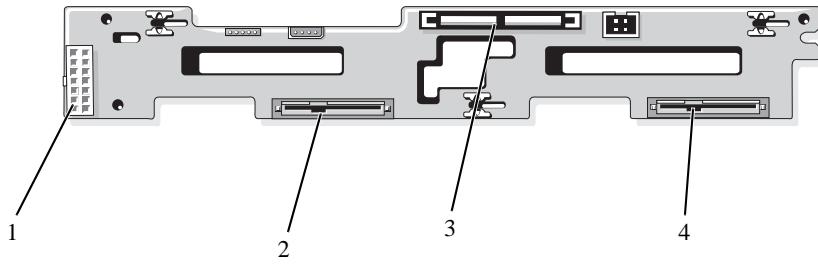
Connector	Description
1 RAC_CONN2	Connector for the remote access control connector (RAC)
2 RAC_CONN1	Connector for the remote access control connector
3 NVRAM_CLR	Configuration jumper
4 PWRD_EN	Password jumper
5 DIMM 1	Memory module connector, slot 1
6 DIMM 5	Memory module connector, slot 5
7 DIMM 2	Memory module connector, slot 2
8 DIMM 6	Memory module connector, slot 6
9 DIMM 3	Memory module connector, slot 3
10 DIMM 7	Memory module connector, slot 7
11 DIMM 4	Memory module connector, slot 4
12 DIMM 8	Memory module connector, slot 8
13 FAN_MOD4	System cooling fan module 4 connector
14 CPU1	Microprocessor connector 1
15 FAN_MOD3	System cooling fan module 3 connector
16 FAN_MOD2	System cooling fan module 2 connector
17 CPU2	Microprocessor connector 2
18 FAN_MOD1	System cooling fan module 1 connector
19 SIDEPLANE	Sideplane connector
20 BACKPLANE	Backplane power connector
21 TOE_KEY	TCP/IP offload engine key
22 LEFT PCIe RISER	Left riser board connector
23 SATA_A	SATA A connector
24 BATTERY	Connector for the 3.0-V coin battery
25 LEFT PCI-X RISER	Left riser board connector (PCIe or PCI-X)
26 CENTER RISER	Center riser board connector (PCIe or PCI-X)

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 147.

SAS/SATA Backplane Board Connectors

Figure 6-3 shows the location of the connectors on the SAS/SATA backplane board that supports two 3.5-inch hard drives (Option 1).

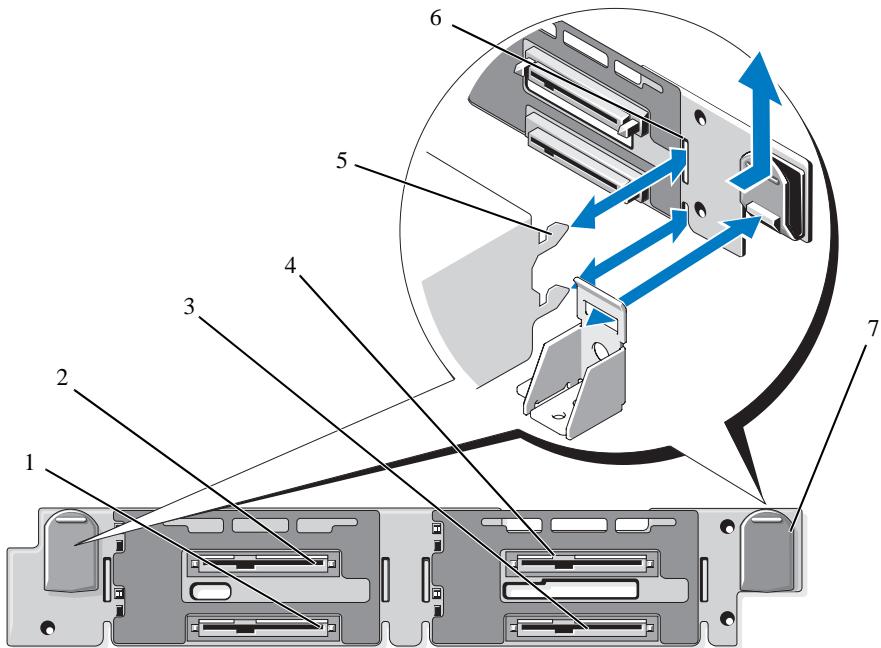
Figure 6-3. SAS 3.5-Inch-Drive Backplane Board Components - Option 1



- | | | | | | |
|---|---------------------------|---|-------------------|---|-----------------|
| 1 | backplane power connector | 2 | Drive 0 connector | 3 | SAS A connector |
| 4 | Drive 1 connector | | | | |

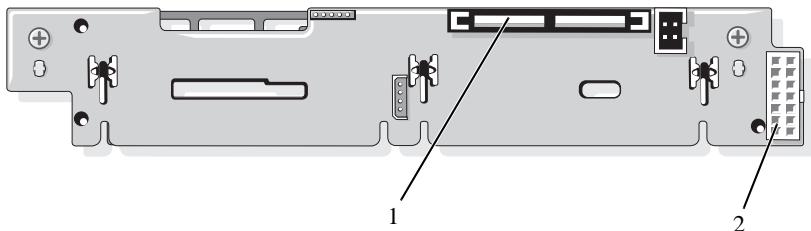
Figure 6-4 and Figure 6-5 show the location of the connectors on the SAS/SATA backplane board that supports four 2.5-inch hard drives (Option 2).

Figure 6-4. SAS 2.5-Inch-Drive Backplane Board Components - Option 2 (Front)



- | | | | | | |
|---|---------------------|---|-------------------|---|-------------------|
| 1 | Drive 1 connector | 2 | Drive 0 connector | 3 | Drive 3 connector |
| 4 | Drive 2 connector | 5 | securing tabs | 6 | securing slots |
| 7 | release latches (2) | | | | |

Figure 6-5. SAS Backplane Board Components - Option 2 (Back)



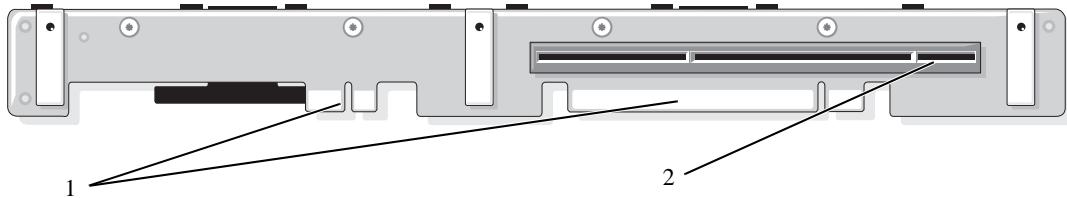
- | | | | |
|---|-----------------|---|---------------------------|
| 1 | SAS A connector | 2 | backplane power connector |
|---|-----------------|---|---------------------------|

Expansion-Card Riser-Board Components and PCI Buses

There are two expansion card configurations for this system. Each riser (center riser and left riser) contains one slot for either a PCI-X configuration or a PCIe configuration. This system supports only one configuration (PCI-X or PCIe) for both risers. Figure 6-6 and Figure 6-7 show the components on the optional PCI-X expansion-card riser boards, including the expansion-card slots and buses. "PCIe Riser Board Expansion Slots" on page 61 and "PCI-X Riser Board Expansion Slots" on page 61 list the PCI bus and operating speed for each expansion-card slot.

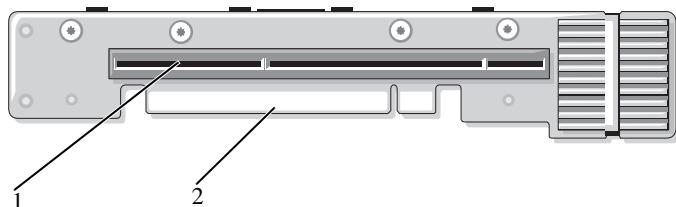
 NOTE: Because the orientation and physical connectors are similar, the PCIe expansion card configuration is not shown.

Figure 6-6. Optional PCI-X Expansion-Card Left Riser Board Components



1 connector to system board 2 slot 2 PCI-X 64 bit/133 MHz

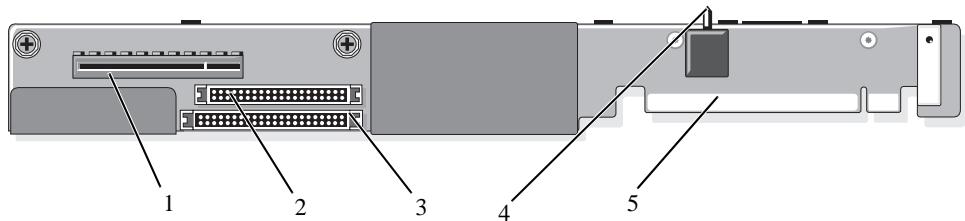
Figure 6-7. Optional PCI-X Expansion-Card Center Riser Board Components



1 slot 1 PCI-X 2 connector to system board

SAS Sideplane Board Connectors

Figure 6-8. Side Plane Components



- | | | | | | |
|---|-----------------------------|---|---------------------------|---|-----------------------------|
| 1 | SAS daughter card connector | 2 | control panel connector | 3 | IDE/optical drive connector |
| 4 | chassis intrusion switch | 5 | connector to system board | | |

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 93.
- 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 125.
- 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 126 and "Before You Call" on page 128.

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

Online Services

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

You can contact Dell electronically using the following addresses:

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

- www.euro.dell.com** (Europe only)
- www.dell.com/la** (Latin American countries)
- www.dell.ca** (Canada only)
- Anonymous file transfer protocol (FTP)
ftp.dell.com/
Log in as user : anonymous, and use your e-mail address as your password.
- Electronic Support Service
support@us.dell.com
apsupport@dell.com (Asian/Pacific countries only)
- support.jp.dell.com** (Japan only)
- support.euro.dell.com** (Europe only)
- Electronic Quote Service
apmarketing@dell.com (Asian/Pacific countries only)
sales_canada@dell.com (Canada only)

AutoTech Service

Dell's automated 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 128 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™ portable 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 portable 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.

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	General Support	toll-free: 800-335-0031
Antigua and Barbuda	General Support	1-800-805-5924
Argentina (Buenos Aires)	Website: www.dell.com.ar	
International Access Code: 00	E-mail: us_latin_services@dell.com	
Country Code: 54	E-mail for desktop and portable computers: la-techsupport@dell.com	
City Code: 11	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	General Support	toll-free: 800-1578
Australia (Sydney)	Website: support.ap.dell.com	
International Access Code: 0011	E-mail: support.ap.dell.com/contactus	
Country Code: 61	General Support	13DELL-133355
City Code: 2		

Country (City)	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
International Access Code		
Country Code		
City Code		
Austria (Vienna)	Website: support.euro.dell.com	
International Access Code: 900	E-mail: tech_support_central_europe@dell.com	
Country Code: 43	Home/Small Business Sales	0820 240 530 00
City Code: 1	Home/Small Business Fax	0820 240 530 49
	Home/Small Business Customer Care	0820 240 530 14
	Preferred Accounts/Corporate Customer Care	0820 240 530 16
	Support for XPS portable computers only	0820 240 530 81
	Home/Small Business Support for all other Dell computers	0820 240 530 14
	Preferred Accounts/Corporate Support	0660 8779
	Switchboard	0820 240 530 00
Bahamas	General Support	toll-free: 1-866-278-6818
Barbados	General Support	1-800-534-3066
Belgium (Brussels)	Website: support.euro.dell.com	
International Access Code: 00	Tech Support for XPS portable computers only	02 481 92 96
Country Code: 32	Tech Support for all other Dell computers	02 481 92 88
City Code: 2	Tech Support Fax	02 481 92 95
	Customer Care	02 713 15 65
	Corporate Sales	02 481 91 00
	Fax	02 481 92 99
	Switchboard	02 481 91 00
Bermuda	General Support	1-800-342-0671
Bolivia	General Support	toll-free: 800-10-0238
Brazil	Website: www.dell.com/br	
International Access Code: 00	Customer Support, Tech Support	
Country Code: 55		0800 90 3355
City Code: 51	Technical Support Fax	51 481 5470
	Customer Care Fax	51 481 5480
	Sales	0800 90 3390
British Virgin Islands	General Support	toll-free: 1-866-278-6820

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
Brunei	Technical Support (Penang, Malaysia)	604 633 4966
Country Code: 673	Customer Care (Penang, Malaysia)	604 633 4888
	Transaction Sales (Penang, Malaysia)	604 633 4955
Canada (North York, Ontario)	Online Order Status: www.dell.ca/ostatus	
International Access Code: 011	AutoTech (automated Hardware and Warranty Support)	toll-free: 1-800-247-9362
	Customer Service (Home Sales/Small Business)	toll-free: 1-800-847-4096
	Customer Service (med./large business, government)	toll-free: 1-800-326-9463
	Customer Service (printers, projectors, televisions, handhelds, digital jukebox, and wireless)	toll-free: 1-800-847-4096
	Hardware Warranty Support (Home Sales/Small Business)	toll-free: 1-800-906-3355
	Hardware Warranty Support (med./large bus., government)	toll-free: 1-800-387-5757
	Hardware Warranty Support (printers, projectors, televisions, handhelds, digital jukebox, and wireless)	1-877-335-5767
	Sales (Home Sales/Small Business)	toll-free: 1-800-387-5752
	Sales (med./large bus., government)	toll-free: 1-800-387-5755
	Spare Parts Sales & Extended Service Sales	1 866 440 3355
Cayman Islands	General Support	1-800-805-7541
Chile (Santiago)	Sales and Customer Support	toll-free: 1230-020-4823
Country Code: 56		
City Code: 2		

Country (City)	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
International Access Code		
Country Code		
City Code		
China (Xiamen)	Technical Support website: support.dell.com.cn	
Country Code: 86	Technical Support E-mail: cn_support@dell.com	
City Code: 592	Customer Care E-mail: customer_cn@dell.com	
	Technical Support Fax	592 818 1350
	Technical Support (Dell™ Dimension™ and Inspiron)	toll-free: 800 858 2968
	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	General Support	980-9-15-3978
Costa Rica	General Support	0800-012-0435

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
Czech Republic (Prague)	Website: support.euro.dell.com	
International Access Code: 00	E-mail: czech_dell@dell.com	
Country Code: 420	Technical Support	22537 2727
	Customer Care	22537 2707
	Fax	22537 2714
	Technical Fax	22537 2728
	Switchboard	22537 2711
Denmark (Copenhagen)	Website: support.euro.dell.com	
International Access Code: 00	Technical Support for XPS portable computers only	7010 0074
Country Code: 45	Technical Support for all other Dell computers	7023 0182
	Customer Care (Relational)	7023 0184
	Home/Small Business Customer Care	3287 5505
	Switchboard (Relational)	3287 1200
	Switchboard Fax (Relational)	3287 1201
	Switchboard (Home/Small Business)	3287 5000
	Switchboard Fax (Home/Small Business)	3287 5001
Dominica	General Support	toll-free: 1-866-278-6821
Dominican Republic	General Support	1-800-148-0530
Ecuador	General Support	toll-free: 999-119
El Salvador	General Support	01-899-753-0777
Finland (Helsinki)	Website: support.euro.dell.com	
International Access Code: 990	Technical Support	09 253 313 60
Country Code: 358	Customer Care	09 253 313 38
City Code: 9	Fax	09 253 313 99
	Switchboard	09 253 313 00

Country (City)	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
International Access Code		
Country Code		
City Code		
France (Paris) (Montpellier)	Website: support.euro.dell.com	
International Access Code: 00	Home and Small Business	
Country Code: 33	Technical Support for XPS portable computers only	0825 387 129
City Codes: (1) (4)	Technical Support for all other Dell computers	0825 387 270
	Customer Care	0825 823 833
	Switchboard	0825 004 700
	Switchboard (calls from outside of France)	04 99 75 40 00
	Sales	0825 004 700
	Fax	0825 004 701
	Fax (calls from outside of France)	04 99 75 40 01
	Corporate	
	Technical Support	0825 004 719
	Customer Care	0825 338 339
	Switchboard	01 55 94 71 00
	Sales	01 55 94 71 00
	Fax	01 55 94 71 01
Germany (Langen)	Website: support.euro.dell.com	
International Access Code: 00	E-mail: tech_support_central_europe@dell.com	
Country Code: 49	Technical Support for XPS portable computers only	06103 766-7222
City Code: 6103	Technical Support for all other Dell computers	06103 766-7200
	Home/Small Business Customer Care	0180-5-224400
	Global Segment Customer Care	06103 766-9570
	Preferred Accounts Customer Care	06103 766-9420
	Large Accounts Customer Care	06103 766-9560
	Public Accounts Customer Care	06103 766-9555
	Switchboard	06103 766-7000

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
Greece	Website: support.euro.dell.com	
International Access Code: 00	Technical Support	00800-44 14 95 18
Country Code: 30	Gold Service Technical Support	00800-44 14 00 83
	Switchboard	2108129810
	Gold Service Switchboard	2108129811
	Sales	2108129800
	Fax	2108129812
Grenada	General Support	toll-free: 1-866-540-3355
Guatemala	General Support	1-800-999-0136
Guyana	General Support	toll-free: 1-877-270-4609
Hong Kong	Website: support.ap.dell.com	
International Access Code: 001	Technical Support E-mail: HK_support@Dell.com	
Country Code: 852	Technical Support (Dimension and Inspiron)	2969 3188
	Technical Support (OptiPlex, Latitude, and Dell Precision)	2969 3191
	Technical Support (PowerApp™, PowerEdge™, PowerConnect™, and PowerVault™)	2969 3196
	Customer Care	3416 0910
	Large Corporate Accounts	3416 0907
	Global Customer Programs	3416 0908
	Medium Business Division	3416 0912
	Home and Small Business Division	2969 3105
India	E-mail: india_support_desktop@dell.com india_support_notebook@dell.com india_support_Server@dell.com	
	Technical Support	1600338045 and 1600448046
	Sales (Large Corporate Accounts)	1600 33 8044
	Sales (Home and Small Business)	1600 33 8046

Country (City)	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
International Access Code		
Country Code		
City Code		
Ireland (Cherrywood)	Website: support.euro.dell.com	
International Access Code: 00	E-mail: dell_direct_support@dell.com	
Country Code: 353	Technical Support for XPS portable computers only	1850 200 722
City Code: 1	Technical Support for all other Dell computers	1850 543 543
	U.K. Technical Support (dial within U.K. only)	0870 908 0800
	Home User Customer Care	01 204 4014
	Small Business Customer Care	01 204 4014
	U.K. Customer Care (dial within U.K. only)	0870 906 0010
	Corporate Customer Care	1850 200 982
	Corporate Customer Care (dial within U.K. only)	0870 907 4499
	Ireland Sales	01 204 4444
	U.K. Sales (dial within U.K. only)	0870 907 4000
	Fax/Sales Fax	01 204 0103
	Switchboard	01 204 4444
Italy (Milan)	Website: support.euro.dell.com	
International Access Code: 00	Home and Small Business	
Country Code: 39	Technical Support	02 577 826 90
City Code: 02	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
Jamaica	General Support (dial from within Jamaica only)	1-800-682-3639

Country (City)	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
International Access Code		
Country Code		
City Code		
Japan (Kawasaki)	Website: support.jp.dell.com	
International Access Code: 001	Technical Support (servers)	toll-free: 0120-198-498
Country Code: 81	Technical Support outside of Japan (servers)	81-44-556-4162
City Code: 44	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 (PDAs, projectors, printers, routers)	toll-free: 0120-981-690
	Technical Support outside of Japan (PDAs, projectors, printers, routers)	81-44-556-3468
	Faxbox Service	044-556-3490
	24-Hour Automated Order 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
	Large Corporate Accounts Sales (over 3500 employees)	044-556-3430
	Public Sales (government agencies, educational institutions, and medical institutions)	044-556-1469
	Global Segment Japan	044-556-3469
	Individual User	044-556-1760
	Switchboard	044-556-4300
Korea (Seoul)	E-mail: krsupport@dell.com	
International Access Code: 001	Support	toll-free: 080-200-3800
Country Code: 82	Support (Dimension, PDA, Electronics and Accessories)	toll-free: 080-200-3801
City Code: 2	Sales	toll-free: 080-200-3600
	Fax	2194-6202
	Switchboard	2194-6000

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
Latin America	Customer Technical Support (Austin, Texas, U.S.A.) Customer Service (Austin, Texas, U.S.A.) Fax (Technical Support and Customer Service) (Austin, Texas, U.S.A.) Sales (Austin, Texas, U.S.A.) SalesFax (Austin, Texas, U.S.A.)	512 728-4093 512 728-3619 512 728-3883 512 728-4397 512 728-4600 or 512 728-3772
Luxembourg	Website: support.euro.dell.com	
International Access Code: 00	Support	342 08 08 075
Country Code: 352	Home/Small Business Sales Corporate Sales Customer Care Fax	+32 (0)2 713 15 96 26 25 77 81 +32 (0)2 481 91 19 26 25 77 82
Macao	Technical Support	toll-free: 0800 105
Country Code: 853	Customer Service (Xiamen, China) Transaction Sales (Xiamen, China)	34 160 910 29 693 115
Malaysia (Penang)	Website: support.ap.dell.com	
International Access Code: 00	Technical Support (Dell Precision, OptiPlex, and Latitude)	toll-free: 1 800 880 193
Country Code: 60	Technical Support (Dimension, Inspiron, and Electronics and Accessories)	toll-free: 1 800 881 306
City Code: 4	Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault) Customer Care	toll-free: 1800 881 386 toll-free: 1800 881 306 (option 6)
	Transaction Sales	toll-free: 1 800 888 202
	Corporate Sales	toll-free: 1 800 888 213

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
Mexico	Customer Technical Support	001-877-384-8979 or 001-877-269-3383
International Access Code: 00		
Country Code: 52	Sales	50-81-8800 or 01-800-888-3355
	Customer Service	001-877-384-8979 or 001-877-269-3383
	Main	50-81-8800 or 01-800-888-3355
Montserrat	General Support	toll-free: 1-866-278-6822
Netherlands Antilles	General Support	001-800-882-1519
Netherlands (Amsterdam)	Website: support.euro.dell.com	
International Access Code: 00	Technical Support for XPS portable computers only	020 674 45 94
Country Code: 31	Technical Support for all other Dell computers	020 674 45 00
City Code: 20	Technical Support Fax	020 674 47 66
	Home/Small Business Customer Care	020 674 42 00
	Relational Customer Care	020 674 4325
	Home/Small Business Sales	020 674 55 00
	Relational Sales	020 674 50 00
	Home/Small Business Sales Fax	020 674 47 75
	Relational Sales Fax	020 674 47 50
	Switchboard	020 674 50 00
	Switchboard Fax	020 674 47 50
New Zealand	Website: support.ap.dell.com	
International Access Code: 00	E-mail: support.ap.dell.com/contactus	
Country Code: 64	General Support	0800 441 567
Nicaragua	General Support	001-800-220-1006

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
Norway (Lysaker)	Website: support.euro.dell.com	
International Access Code: 00	Technical Support for XPS portable computers only	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	General Support	001-800-507-0962
Peru	General Support	0800-50-669
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	General Support	1-800-805-7545
St. Kitts and Nevis	General Support	toll-free: 1-877-441-4731
St. Lucia	General Support	1-800-882-1521
St. Vincent and the Grenadines	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
Singapore (Singapore)	Website: support.ap.dell.com	
International Access Code: 005	Technical Support (Dimension, Inspiron, and Electronics and Accessories)	toll-free: 1800 394 7430
Country Code: 65	Technical Support (OptiPlex, Latitude, and Dell Precision)	toll-free: 1800 394 7488
	Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault)	toll-free: 1800 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)	Website: support.euro.dell.com	
International Access Code: 00	E-mail: czech_dell@dell.com	
Country Code: 421	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)	Website: support.euro.dell.com	
International Access Code: 09/091	E-mail: dell_za_support@dell.com	
Country Code: 27	Gold Queue	011 709 7713
City Code: 11	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

Country (City)	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
International Access Code		
Country Code		
City Code		
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 portable computers only	0771 340 340
Country Code: 46	Technical Support for all other Dell products	08 590 05 199
City Code: 8	Relational Customer Care	08 590 05 642
	Home/Small Business Customer Care	08 587 70 527
	Employee Purchase Program (EPP) Support	20 140 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 portable computers only	0848 33 88 57
City Code: 22	Technical Support (Home and Small Business) for all other Dell products	0844 811 411
	Technical Support (Corporate)	0844 822 844
	Customer Care (Home and Small Business)	0848 802 202
	Customer Care (Corporate)	0848 821 721
	Fax	022 799 01 90
	Switchboard	022 799 01 01

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
Taiwan	Website: support.ap.dell.com	
International Access Code: 002	E-mail: ap_support@dell.com	
Country Code: 886	Technical Support (OptiPlex, Latitude, Inspiron, Dimension, and Electronics and Accessories)	toll-free: 00801 86 1011
	Technical Support (PowerApp, PowerEdge, PowerConnect, and PowerVault)	toll-free: 00801 60 1256
	Customer Care	toll-free: 00801 60 1250 (option 5)
	Transaction Sales	toll-free: 00801 65 1228
	Corporate Sales	toll-free: 00801 651 227
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	General Support	1-800-805-8035
Turks and Caicos Islands	General Support	toll-free: 1-866-540-3355

Country (City)	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
International Access Code		
Country Code		
City Code		
U.K. (Bracknell)	Website: support.euro.dell.com	
International Access Code: 00	Customer Care website: support.euro.dell.com/uk/en/ECare/Form/Home.asp	
Country Code: 44	E-mail: dell_direct_support@dell.com	
City Code: 1344	Technical Support (Corporate/Preferred Accounts/PAD [1000+ employees])	0870 908 0500
	Technical Support for XPS portable computers only	0870 366 4180
	Technical Support (direct and general) for all other products	0870 908 0800
	Global Accounts Customer Care	01344 373 186
	Home and Small Business Customer Care	0870 906 0010
	Corporate Customer Care	01344 373 185
	Preferred Accounts (500–5000 employees) Customer Care	0870 906 0010
	Central Government Customer Care	01344 373 193
	Local Government & Education Customer Care	01344 373 199
	Health Customer Care	01344 373 194
	Home and Small Business Sales	0870 907 4000
	Corporate/Public Sector Sales	01344 860 456
	Home and Small Business Fax	0870 907 4006
Uruguay	General Support	toll-free: 000-413-598-2521

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
U.S.A. (Austin, Texas)	Automated Order-Status Service	toll-free: 1-800-433-9014
International Access Code: 011	AutoTech (portable and desktop computers)	toll-free: 1-800-247-9362
Country Code: 1	Hardware and Warranty Support (Dell TV, Printers, and Projectors) for Relationship customers	toll-free 1-877-459-7298
	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
	Printers and Projectors Support	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)
U.S. Virgin Islands	General Support	1-877-673-3355
Venezuela	General Support	8001-3605

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.

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

ESD — Electrostatic discharge.

ESM — Embedded server management.

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

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

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

F — Fahrenheit.

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

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).

RAC — Remote access controller.

RAID — Redundant array of independent disks. A method of providing data redundancy. Some common implementations of RAID include RAID 0, RAID 1, RAID 5, RAID 10, and RAID 50. See also *guarding*, *mirroring*, and *striping*.

RAM — Random-access memory. The system's primary temporary storage area for program instructions and data. Any information stored in RAM is lost when you turn off your system.

RAS — Remote Access Service. This service allows users running the Windows operating system to remotely access a network from their system using a modem.

readme file — A text file, usually shipped with software or hardware, that contains information supplementing or updating the product's documentation.

read-only file — A read-only file is one that you are prohibited from editing or deleting.

ROM — Read-only memory. Your system contains some programs essential to its operation in ROM code. A ROM chip retains its contents even after you turn off your system. Examples of code in ROM include the program that initiates your system's boot routine and the POST.

ROMB — RAID on motherboard.

rpm — Revolutions per minute.

RTC — Real-time clock.

SAS — Serial-attached SCSI.

SATA — Serial Advanced Technology Attachment. A standard interface between the system board and storage devices.

SCSI — Small computer system interface. An I/O bus interface with faster data transmission rates than standard ports.

SDRAM — Synchronous dynamic random-access memory.

sec — Second(s).

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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