

# Dell™ PowerEdge™ T605 Systems Hardware Owner's Manual

# Notes, Notices, and Cautions



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



**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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Model SCM

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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, programs, and operating systems monitor the system and component status and alert you when a problem arises. System conditions can be reported by any of the following:

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

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

## Other Information You May Need



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

- The *Getting Started Guide* provides an overview of system features, setting up your system, and technical specifications.
- CDs included with your system provide documentation and tools for configuring and managing your system.
- Systems management software documentation describes the features, requirements, installation, and basic operation of the software.
- Operating system documentation describes how to install (if necessary), configure, and use the operating system software.
- Documentation for any components you purchased separately provides information to configure and install these options.

- Updates are sometimes included with the system to describe changes to the system, software, and/or documentation.



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

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

## Accessing System Features During Startup

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

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

Keystroke	Description
<F2>	Enters the System Setup program (see "Entering the System Setup Program" on page 43).
<F10>	Opens the utility partition, allowing you to run the system diagnostics (see "Running the System Diagnostics" on page 193).
<F11>	Enters the boot mode selection screen, allowing you to choose a boot device.
<F12>	Starts PXE boot.
<Ctrl+E>	Enters the Baseboard Management Controller (BMC) Management Utility, which allows access to the system event log (SEL) and configuration of the remote access controller (RAC) card (see the <i>BMC User's Guide</i> for more information on setup and use of BMC).
<Ctrl+C>	This keystroke enters the SAS Configuration Utility (see your SAS controller <i>User's Guide</i> for more information).
<Ctrl+R>	If you have the optional battery-cached SAS RAID controller, this keystroke enters the RAID configuration utility. For more information, see the documentation for your SAS controller card.

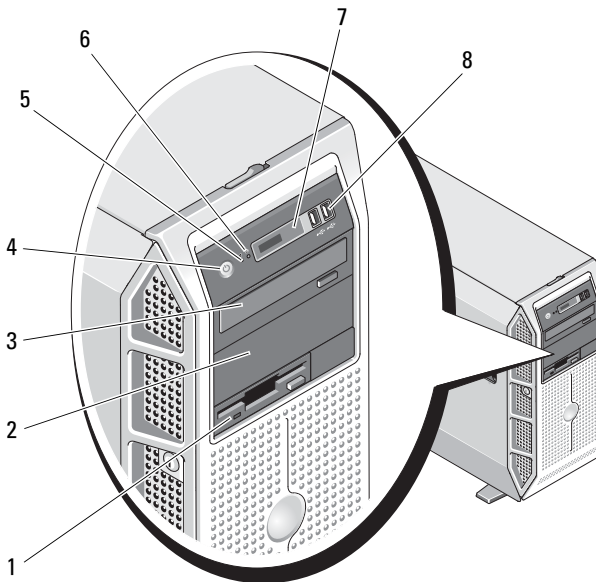
**Table 1-1. Keystrokes for Accessing System Features (continued)**

Keystroke	Description
<Ctrl+S>	If you have PXE support enabled through the System Setup Program (see "Integrated Devices Screen" on page 51), this keystroke allows you to configure NIC settings for PXE boot. For more information, see the documentation for your integrated NIC.




## Front-Panel Features and Indicators

Figure 1-1 shows the controls, indicators, and connectors located on the system's front panel. Table 1-2 provides component descriptions.


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



**Table 1-2. Front-Panel Components**

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

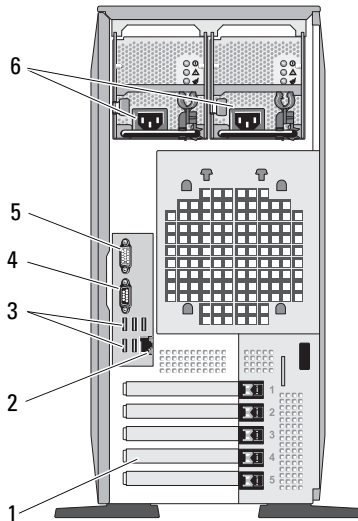
**Table 1-2. Front-Panel Components (continued)**

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

## Back-Panel Features and Indicators

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

**Figure 1-2. Back-Panel Features and Indicators**



- |   |                          |   |                    |
|---|--------------------------|---|--------------------|
| 1 | expansion card slots (5) | 2 | NIC connector      |
| 3 | USB connectors (5)       | 4 | serial connector   |
| 5 | video connector          | 6 | power connector(s) |

### **Connecting External Devices**

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

- Most devices must be connected to a specific connector and device drivers must be installed before the device operates properly. (Device drivers are normally included with your operating system software or with the device itself.) See the documentation that accompanied the device for specific installation and configuration instructions.
- Always attach an external device while your system and the device are turned off. Next, turn on any external devices before turning on the system (unless the documentation for the device specifies otherwise).

See "Using the System Setup Program" on page 43 for information about enabling, disabling, and configuring I/O ports and connectors.



# Power Indicator Codes

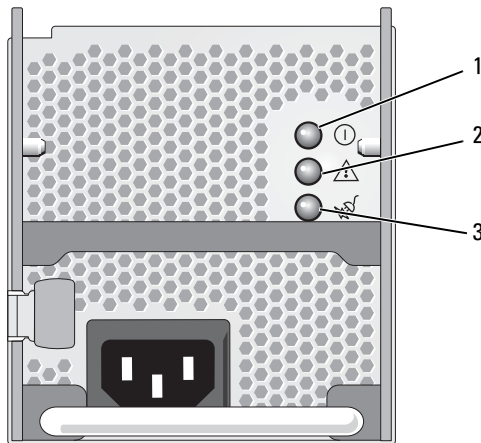
The power button on the front panel controls the power to the system from the system's power supplies. The power indicator lights green when the system is on.

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

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

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

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

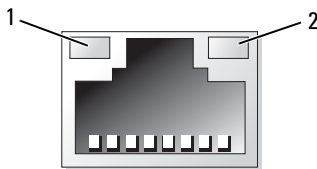


- 1 power supply status (DC out is operational)
- 2 power supply fault
- 3 AC line status (AC in is operational)

# NIC Indicator Codes

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

**Figure 1-4. NIC Indicators**



1 link indicator

2 activity indicator

**Table 1-4. NIC Indicator Codes**

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

# LCD Status Messages

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

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



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



**NOTE:** If your system fails to boot, press the System ID button for at least five seconds until an error code appears on the LCD. Record the code, then see "Getting Help" on page 205.

**Table 1-5. 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"> <li>The system is powered on.</li> <li>The power is off and active errors are displayed.</li> </ul>	This message is for information only. You can change the system ID and name in the System Setup program (see "Entering the System Setup Program" on page 43).
E1000	FAILSAFE, Call Support	Check the system event log for critical failure events.	See "Getting Help" on page 205.
E1114	Temp Ambient	Ambient system temperature is out of acceptable range.	See "Troubleshooting System Cooling Problems" on page 172.
E1118	CPU Temp Interface	The BMC is unable to determine the processor(s) temperature status. Consequently, the BMC increases the processor fan speed to maximum as a precautionary measure.	Turn off power to the system and restart the system. If the problem persists, see "Getting Help" on page 205.
E1210	CMOS Batt	CMOS battery is missing, or the voltage is out of acceptable range.	See "Troubleshooting the System Battery" on page 170.

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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
E1211	ROMB Batt	RAID battery is either missing, bad, or unable to recharge due to thermal issues.	Reseat the RAID battery connector (see "Installing a RAID Battery" on page 116, and "Troubleshooting System Cooling Problems" on page 172).
E1214	## PwrGd	Specified voltage regulator has failed.	See "Getting Help" on page 205.
E1216			
E1217			
E121A	8V PwrGd	8V voltage regulator has failed.	Recycle power to the system or clear the SEL. If the problem persists, see "Getting Help" on page 205.
E121D	1.2V VM Dual PwrGd	1.2V voltage regulator for the VM dual signal has failed.	Recycle power to the system or clear the SEL. If the problem persists, see "Getting Help" on page 205.
E1227	Linear PwrGd	Linear voltage regulator(s) has failed. Represents status of multiple voltage regulators used in the video and LOM circuitry.	See "Getting Help" on page 205.
E1229	CPU # VCORE	Processor # VCORE voltage regulator has failed.	See "Getting Help" on page 205.
E122A	CPU VTT PwrGd	Processor # VTT voltage has exceeded the allowable voltage range.	See "Getting Help" on page 205.
E122D	CPU # VDDIO 1.0V PwrGd	Processor # VDDIO voltage has exceeded the allowable voltage range.	See "Getting Help" on page 205.

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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
E122E	CPU # VDDA	Processor # VDDA voltage has exceeded the allowable voltage range.	See "Getting Help" on page 205.
E122F	2.5V PwrGd	2.5V voltage regulator has failed.	See "Getting Help" on page 205.
E1231	1.2V HTCORE PwrGd	1.2V HTCORE voltage regulator has failed.	See "Getting Help" on page 205.
E1232	VDD 12V PS# PwrGd	The specified power supply has failed or has been removed from the bay while the system was on.	If removed, reinsert the power supply into the bay and reconnect to power. For component failures, see "Getting Help" on page 205.
E1233	Cabled PS PwrGd	Power supply voltage regulator failed.	See "Getting Help" on page 205.
E1234	PCI-X-12V PwrGd	PCI-X-12V voltage regulator has failed.	See "Getting Help" on page 205.
E1235	USB 1.8V Linear PwrGd	1.8V voltage regulator for the USB linear has failed.	See "Getting Help" on page 205.
E1236	VID 1.8V Mem Linear PwrGd	Linear memory 1.8V voltage regulator has failed.	See "Getting Help" on page 205.
E1237	VID 1.2V Linear PwrGd	1.2V video voltage regulator has failed.	See "Getting Help" on page 205.
E1238	VID 1.8V Linear PwrGd	1.8V video voltage regulator has failed.	See "Getting Help" on page 205.
E1239	2.5VAux LOM Linear PwrGd	Aux 2.5V voltage regulator for LOM1 has failed.	See "Getting Help" on page 205.
E123A	1.2VAux LOM Linear PwrGd	1.2V voltage regulator for LOM has failed.	See "Getting Help" on page 205.

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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
E123C	Planar LOM PwrGd	Voltage regulator for the integrated LOM has failed.	Recycle power to the system or clear the SEL. If the problem persists, see "Getting Help" on page 205.
E1310	RPM Fan ##	RPM of specified cooling fan is out of acceptable operating range.	See "Troubleshooting System Cooling Problems" on page 172.
E1313	Fan Redundancy	The system is no longer fan-redundant. Another fan failure will put the system at risk of over-heating.	Check control panel LCD for additional scrolling messages (see "Troubleshooting System Cooling Problems" on page 172).

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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
E1414	CPU # Thermtrip	Specified microprocessor is out of acceptable temperature range and has halted operation.	See "Troubleshooting System Cooling Problems" on page 172. If the problem persists, ensure that the microprocessor heat sinks are properly installed (see "Troubleshooting the Microprocessors" on page 188). <b>NOTE:</b> The LCD continues to display this message until the system's power cable is disconnected and reconnected to the AC power source, or the SEL is cleared using either Server Assistant or the BMC Management Utility. See the <i>Dell OpenManage™ Baseboard Management Controller User's Guide</i> for information about these utilities.
E1418	CPU # Presence	Specified processor is missing or bad, and the system is in an unsupported configuration.	See "Troubleshooting the Microprocessors" on page 188.
E141C	CPU Mismatch	Processors are in a configuration unsupported by Dell.	Ensure that your processors match and conform to the type described in the Microprocessor Technical Specifications outlined in your system's <i>Getting Started Guide</i> .

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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
E141F	CPU Protocol	The system BIOS has reported a processor protocol error.	See "Getting Help" on page 205.
E1421	CPU Init	The system BIOS has reported a processor initialization error.	See "Getting Help" on page 205.
E1422	CPU Machine Chk	The system BIOS has reported a machine check error.	See "Getting Help" on page 205.
E1610	PS # Missing	No power is available from the specified power supply; specified power supply is improperly installed or faulty.	See "Troubleshooting Redundant Power Supplies" on page 171.
E1614	PS # Status	No power is available from the specified power supply; specified power supply is improperly installed or faulty.	See "Troubleshooting Redundant Power Supplies" on page 171.
E1618	PS # Predictive	Power supply voltage is out of acceptable range; specified power supply is improperly installed or faulty.	See "Troubleshooting Redundant Power Supplies" on page 171.
E161C	PS # Input Lost	Power source for specified power supply is unavailable, or out of acceptable range.	Check the AC power source for the specified power supply. If the problem persists, see "Troubleshooting Redundant Power Supplies" on page 171.



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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
E1620	PS # Input Range	Power source for specified power supply is unavailable, or out of acceptable range.	Check the AC power source for the specified power supply. If the problem persists, see "Troubleshooting Redundant Power Supplies" on page 171.
E1624	PS Redundancy	The power supply subsystem is no longer redundant. If the last supply fails, the system will go down.	See "Troubleshooting Redundant Power Supplies" on page 171.
E1625	PS AC Current	Power source is out of acceptable range.	Check the AC power source.
E1710	I/O Channel Chk	The system BIOS has reported an I/O channel check.	See "Getting Help" on page 205.
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 reseal the PCIe expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 186.
	PCI PERR Slot #	The system BIOS has reported a PCI parity error on a component that resides in the specified PCIe slot.	Remove and reseal the PCIe expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 186.

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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
E1712	PCI SERR B## D## F##	The system BIOS has reported a PCI system error on a component that resides in PCI configuration space at bus ##, device ##, function ##.	Remove and reseat the PCIe expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 186.
	PCI SERR Slot #	The system BIOS has reported a PCI system error on a component that resides in the specified slot.	Remove and reseat the PCIe expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 186.
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 205.
E171F	PCIE Fatal Err B## D## F##	The system BIOS has reported a PCIe fatal error on a component that resides in PCIe configuration space at bus ##, device ##, function ##.	Remove and reseat the PCIe expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 186.
	PCIE Fatal Err Slot #	The system BIOS has reported a PCIe fatal error on a component that resides in the specified slot.	Remove and reseat the PCIe expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 186.
E1810	HDD ## Fault	The SAS subsystem has determined that hard drive ## has experienced a fault.	See "Troubleshooting a Hard Drive" on page 181.

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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
E1811	HDD ## Rbld Abprt	The specified hard drive has experienced a rebuild abort.	See "Troubleshooting a Hard Drive" on page 181. If the problem persists, see your RAID documentation.
E1812	HDD ## Removed	The specified hard drive has been removed from the system.	Information only.
E1914	DRAC5 Conn2 Cb1	DRAC 5 cable is missing or disconnected.	Reconnect the cable (see "Installing a RAC Card" on page 120).
E1915	IO55 HTSink Missing MCP55 Htsink Missing	Heat sink sensor reports that the chipset IO55 heat sink is missing. Heat sink sensor reports that the chipset MCP heat sink is missing.	See "Getting Help" on page 205.
E1A14	SAS Cable A	SAS cable A is missing or bad.	Reseat the cable. If the problem persists, replace cable.  If the problem persists, see "Getting Help" on page 205.
E1A15	SAS Cable B	SAS cable B is missing or bad.	Reseat the cable. If the problem persists, replace cable.  If the problem persists, see "Getting Help" on page 205.
E1A15	SAS Cable C	SAS cable C is missing or bad.	Reseat the cable. If the problem persists, replace cable.  If the problem persists, see "Getting Help" on page 205.

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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
E1A15	SAS Cable D	SAS cable D is missing or bad.	Reseat the cable. If the problem persists, replace cable.  If the problem persists, see "Getting Help" on page 205.
E1A18	PDB Ctrl Cable	Control cable for the power distribution board (PDB) is missing or bad.	Reseat the cable. If the problem persists, replace cable.  If the problem persists, see "Getting Help" on page 205.
E1A19	12V Cable Fault	Power cable for the PDB or cabled power supply is missing or bad. The system will not turn on.	Reseat the cable. If the problem persists, replace cable.  If the problem persists, see "Getting Help" on page 205.
E1B01	USB# Overcurrent	Device plugged in the specified USB port caused an overcurrent condition.	Reseat the device cable. If the problem persists, replace or remove the device.
E2010	No Memory	No memory is installed in the system.	Install memory (see "Installing Memory Modules" on page 131).
E2011	Mem Config Err	Memory detected, but is not configurable. Error detected during memory configuration.	See "Troubleshooting System Memory" on page 173.
E2012	Unusable Memory	Memory is configured, but not usable. Memory subsystem failure.	See "Troubleshooting System Memory" on page 173.

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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
E2013	Shadow BIOS Fail	The system BIOS failed to copy its flash image into memory.	See "Troubleshooting System Memory" on page 173.
E2014	CMOS Fail	CMOS failure. CMOS RAM not functioning properly.	See "Getting Help" on page 205.
E2015	DMA Controller	DMA controller failure.	See "Getting Help" on page 205.
E2016	Int Controller	Interrupt controller failure.	See "Getting Help" on page 205.
E2017	Timer Fail	Timer refresh failure.	See "Getting Help" on page 205.
E2018	Prog Timer	Programmable interval timer error.	See "Getting Help" on page 205.
E2019	Parity Error	Parity error.	See "Getting Help" on page 205.
E201A	SIO Err	SIO failure.	See "Getting Help" on page 205.
E201B	Kybd Controller	Keyboard controller failure.	See "Getting Help" on page 205.
E201C	SMI Init	System management interrupt (SMI) initialization failure.	See "Getting Help" on page 205.
E201D	Shutdown Test	BIOS shutdown test failure.	See "Getting Help" on page 205.
E201E	POST Mem Test	BIOS POST memory test failure.	See "Troubleshooting System Memory" on page 173. If problem persists, see "Getting Help" on page 205.

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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
E201F	DRAC Config	Dell remote access controller (DRAC) configuration failure.	Check screen for specific error messages.  Ensure that DRAC cables and connectors are properly seated. If problem persists, see your DRAC documentation.
E2020	CPU Config	Processor configuration failure.	Check screen for specific error messages.
E2021	Memory Population	Incorrect memory configuration. Memory population order incorrect.	Check screen for specific error messages (see "Troubleshooting System Memory" on page 173).
E2022	POST Fail	General failure after video.	Check screen for specific error messages.
E2110	MBE DIMM # & #	One of the DIMMs in the set implicated by "# & #" has had a memory multi-bit error (MBE).	See "Troubleshooting System Memory" on page 173.
E2111	SBE Log Disable DIMM #	The system BIOS has disabled memory single-bit error (SBE) logging, and will not resume logging further SBEs until the system is restarted. "#" represents the DIMM implicated by the BIOS.	See "Troubleshooting System Memory" on page 173.
E2112	Mem Spare DIMM #	The system BIOS has spared the memory because it has determined that the memory had too many errors. "# & #" represents the DIMM pair implicated by the BIOS.	See "Troubleshooting System Memory" on page 173.

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

<b>Code</b>	<b>Text</b>	<b>Causes</b>	<b>Corrective Actions</b>
I1910	Intrusion	System cover has been removed.	Information only.
I1911	>3 ERRs Chk Log	LCD overflow message. A maximum of three error messages can display sequentially on the LCD. The fourth message displays as the standard overflow message.	Check the SEL for details on the events.
I1912	SEL Full	System Event Log is full of events, and is unable to log any more events.	Clear the log by deleting event entries.
I1915	Video Off (LCD lights with a blue or amber background.)	The video has been turned off by the RAC remote user.	Information only.
I1916	Video Off in ## (LCD lights with a blue or amber background.)	The video will be turned off in xx seconds by the RAC remote user.	Information only.
W1228	ROMB Batt < 24hr	Warns predictively that the RAID battery has less than 24 hours of charge left.	Replace RAID battery (see "Installing a RAID Battery" on page 116).

**NOTE:** For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 207.

### **Solving Problems Described by LCD Status Messages**

The code and text on the LCD can often specify a very precise fault condition that is easily corrected. For example, if the code E1418 CPU\_1\_Presence appears, you know that a microprocessor is not installed in socket 1.

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

## Removing LCD Status Messages

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

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

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

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

## System Messages

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



**NOTE:** If you receive a system message that is not listed in Table 1-3, check the documentation for the program 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 1-6. System Messages**

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
Alert! Redundant memory disabled! Memory configuration does not support redundant memory.	Redundant memory was set to enable in CMOS, but the current configuration does not support redundant memory.	See "General Memory Module Installation Guidelines" on page 128 for memory configuration information. If the problem persists, see "Troubleshooting System Memory" on page 173.
Alert! Redundancy was previously lost. Power cycle required to reconfigure redundant memory.	A spare rank event occurred during the previous boot.	See "General Memory Module Installation Guidelines" on page 128 for memory configuration information. If the problem persists, see "Troubleshooting System Memory" on page 173.
Attempting to update Remote Configuration. Please wait...	Remote Configuration request has been detected and is being processed.	Wait until the process is complete.
BIOS Update Attempt Failed!	Remote BIOS update attempt failed.	Retry the BIOS update. If problem persists, see "Getting Help" on page 205.
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).
Decreasing available memory	Faulty or improperly installed memory modules.	See "Troubleshooting System Memory" on page 173.

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

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
Error: Remote Access Controller initialization failure	The Remote Access Controller failed to initialize.	Ensure that the Remote Access Controller is properly installed (see "Installing a RAC Card" on page 120).
Error 8602 - Auxiliary Device Failure Verify that mouse and keyboard are securely attached to correct connectors.	The mouse cable connector is loose or improperly connected, or the mouse is defective.	Check the connection from mouse cable to the system. If the problem persists, try another mouse, or see "Getting Help" on page 205.
Fatal Error caused a system reset: Please check the system event log for details	A fatal system error occurred and caused the system to restart.	Check the SEL for information that was logged during the error. See the applicable troubleshooting section in "Troubleshooting Your System" on page 159 for any faulty components specified in the SEL.
Gate A20 failure	Faulty keyboard controller; faulty system board.	See "Getting Help" on page 205.
General failure	The operating system is unable to carry out the command.	This message is usually followed by specific information. Note the information, and take the appropriate action to resolve the problem.
Keyboard Controller failure	Faulty keyboard controller; faulty system board.	See "Getting Help" on page 205.

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

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
Keyboard data line failure	Keyboard cable connector is loose or improperly connected, defective keyboard, or defective keyboard/mouse controller.	Check the keyboard connection to the system. If the problem persists, try another keyboard, or see "Getting Help" on page 205.
Keyboard stuck key failure		
Keyboard fuse has failed	Overcurrent has been detected at the keyboard connector.	See "Getting Help" on page 205.
Manufacturing mode detected	System is in manufacturing mode.	Restart to take the system out of manufacturing mode.
Memory address line failure at <i>address</i> , read value expecting value	Faulty or improperly installed memory modules.	See "Troubleshooting System Memory" on page 173.
Memory double word logic failure at <i>address</i> , read value expecting value		
Memory odd/even logic failure at <i>address</i> , read value expecting value		
Memory write/read failure at <i>address</i> , read value expecting value		
Memory tests terminated by keystroke	POST memory test terminated by pressing the spacebar.	Information only.

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

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
More than one RAC detected, system halted	More than one RAC card has been detected.	Remove additional RAC card(s). You may only have a maximum of one RAC card installed (see "Installing a RAC Card" on page 106).
No boot device available	Faulty or missing optical drive subsystem, hard drive, or hard-drive subsystem, or no bootable USB key installed.	Use a bootable USB key, CD, or hard drive. If the problem persists, see "Troubleshooting an Internal USB Key" on page 175 and "Troubleshooting a Hard Drive" on page 181. See "Entering the System Setup Program" on page 43 for information on setting the order of boot devices.
No boot sector on hard drive	Incorrect configuration settings in System Setup program, or no operating system on hard drive.	Check the hard-drive configuration settings in the System Setup program (see "Entering the System Setup Program" on page 43). 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 205."
PCI BIOS failed to install	PCIe device BIOS (Option ROM) checksum failure detected during shadowing.  Cables to expansion card(s) loose; faulty or improperly installed expansion card(s).	Reseat the expansion card(s). Ensure that all appropriate cables are securely connected to the expansion card(s). If the problem persists, see "Troubleshooting Expansion Cards" on page 186.

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

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
PCIe Fatal Error caused a system reset: Slot X Embedded Bus#XX/Dev#XX/FuncX  Please check the system event log for details	PCI Express fatal errors occurred during the previous boot.	Reseat the PCIe card in the specified slot number (see "Installing an Expansion Card" on page 111). If the problem persists, see "Getting Help" on page 205.
Plug & Play Configuration Error	Error encountered in initializing PCIe device; faulty system board.	Install the NVRAM_CLR jumper and restart the system. See Figure 6-1 for jumper location. If the problem persists, see "Troubleshooting Expansion Cards" on page 186.
Read fault Requested sector not found	The operating system cannot read from the hard drive or USB device, the system could not find a particular sector on the disk, or the requested sector is defective.	Replace the USB medium or device. Ensure that the USB or hard drive cables are properly connected. See "Troubleshooting a USB Device" on page 165, or "Troubleshooting a Hard Drive" on page 181 for the appropriate drive(s) installed in your system.
Remote configuration update attempt failed	System unable to process Remote Configuration request.	Retry Remote Configuration.

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

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
ROM bad checksum = <i>address</i>	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 186.
SATA PORT <i>x</i> drive not found	SATA port <i>x</i> was turned on in setup, but a drive was not found.	See "Troubleshooting a Hard Drive" on page 181 for the appropriate drive(s) installed in your system.
Sector not found Seek error Seek operation failed	Faulty hard drive, USB device, or USB medium.	See "Troubleshooting a USB Device" on page 165 or "Troubleshooting a Hard Drive" on page 181 for the appropriate drive(s) installed in your system.
Shutdown failure	Shutdown test failure.	See "Troubleshooting System Memory" on page 173.
Spare bank enabled	DIMM sparing has been enabled.	Information only.
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 173).

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

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
This system supports only Opteron(TM) 2000 series processors	Microprocessor(s) is not supported by the system.	Install a supported microprocessor or microprocessor combination (see "Installing a Processor" on page 137).
Time-of-day clock stopped	Faulty battery or faulty chip.	See "Troubleshooting the System Battery" on page 170.
Time-of-day not set - please run SETUP program	Incorrect Time or Date settings; faulty system battery.	Check the Time and Date settings (see "Entering the System Setup Program" on page 43). If the problem persists, replace the system battery (see "System Battery" on page 139).
Timer chip counter 2 failed	Faulty system board.	See "Getting Help" on page 205.
TPM configuration operation honored	System will now restart.	Information only.
TPM failure	A Trusted Platform Module (TPM) function has failed.	See "Getting Help" on page 205.
TPM operation is pending. Press I to Ignore or M to Modify to allow this change and reset the system.	Configuration change has been requested.	Press <b>I</b> to continue system boot. Press <b>M</b> to modify the TPM setting and restart.
Unexpected interrupt in protected mode	DIMMs are improperly seated or the keyboard/mouse controller chip has failed.	Reseat the DIMMs (see "Troubleshooting System Memory" on page 173). If the problem persists, see "Getting Help" on page 205.

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

<b>Message</b>	<b>Causes</b>	<b>Corrective Actions</b>
Unsupported CPU combination	Microprocessor(s) is not supported by the system.	Install a supported microprocessor or microprocessor combination (see "Processors" on page 134).
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: A fatal error has caused system reset! Please check the system event log!	A fatal system error occurred and caused the system to restart.	Check the SEL for information that was logged during the error. See the applicable troubleshooting section in "Troubleshooting Your System" on page 159 for any faulty components specified in the SEL.
Warning! No micro code update loaded for processor n	Micro code update failed.	Update the BIOS firmware (see "Getting Help" on page 205).
Warning: The installed memory configuration is not optimal. For more information on valid memory configurations, please see the system documentation on support.dell.com	Invalid memory configuration.	Ensure that the memory modules are installed in a valid configuration (see "General Memory Module Installation Guidelines" on page 128). If the problem persists, see "Troubleshooting System Memory" on page 173.



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

Message	Causes	Corrective Actions
Write fault Write fault on selected drive	Faulty USB device, USB medium, optical drive assembly, hard drive, or hard-drive subsystem.	See "Troubleshooting a USB Device" on page 165, "Troubleshooting an Internal USB Key" on page 175, and "Troubleshooting a Hard Drive" on page 181.

**NOTE:** For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 207.

## Warning Messages

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



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

## Diagnostics Messages

The system diagnostic utilities produce messages from diagnostic tests run on your system. See "Running the System Diagnostics" on page 193 for more information about system diagnostics.

## Alert Messages

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



# 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 32 for an explanation of the message and suggestions for correcting errors.

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

## Using the System Setup Program

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

**Table 2-1. System Setup Program Navigation Keys**

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



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

## System Setup Options

### Main Screen


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

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

Dell Inc. (www.dell.com) - PowerEdge T605 BIOS Version: XXX	
Service Tag : XXXXXX	Asset Tag : XXXXXX
System Time ..... 01:12:45 System Date ..... Fri Nov 30, 2007	
Memory Information .....	<ENTER>
CPU Information .....	<ENTER>
SATA Configuration .....	<ENTER>
Boot Sequence .....	<ENTER>
Hard-Disk Drive Sequence.....	<ENTER>
USB Flash Drive Emulation Type.....	<ENTER>
Boot Sequence Retry .....	Disabled
Integrated Devices .....	<ENTER>
PCI IRQ Assignment .....	<ENTER>
Serial Communication .....	<ENTER>
Embedded Server Management .....	<ENTER>
System Security .....	<ENTER>
Keyboard Numlock .....	On
Report Keyboard Errors .....	Report

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

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

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

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

Option	Description
System Time	Sets the time on the system's internal clock.
System Date	Sets the date on the system's internal calendar.

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

<b>Option</b>	<b>Description</b>
Memory Information	Displays a screen to view memory information and to configure certain memory features (see Table 2-3).
CPU Information	Displays information related to microprocessors (speed, cache size, and so on). See Table 2-4.
SATA Configuration	Enables or disables a Serial Advanced Technology Attachment (SATA) device (such as hard drive, CD drive, or DVD drive). See "SATA Configuration Screen" on page 50.
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. <b>NOTE:</b> System boot is not supported from an external device attached to a SAS or SCSI adapter. See <a href="http://support.dell.com">support.dell.com</a> for the latest support information about booting from external devices.
Hard-Disk Drive Sequence	Determines the order in which the system searches the hard drives during system startup. The selections depend on the hard drives installed in your system.
USB Flash Drive Emulation Type (Auto default)	Determines the emulation type for a USB flash drive. <b>Hard disk</b> allows the USB flash drive to act as a hard drive. <b>Floppy</b> allows the USB flash drive to act as a removable diskette drive. <b>Auto</b> automatically chooses an emulation type.
Boot Sequence Retry (Disabled default)	Enables or disables the Boot Sequence Retry feature. When set to <b>Enabled</b> , the system re-attempts the boot sequence after a 30-second timeout if the previous boot attempt failed.
Integrated Devices	Displays a screen to configure the system's integrated devices.
PCI IRQ Assignment	Displays a screen to change the IRQ assigned to each of the integrated devices on the PCI bus, and any installed expansion cards that require an IRQ.

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

<b>Option</b>	<b>Description</b>
Serial Communication	Displays a screen to configure serial communication, external serial connector, fail-safe baud rate, remote terminal type, and redirection after boot.
Embedded Server Management	Displays a screen to configure the front-panel LCD options and to set a user-defined LCD string.
System Security	Displays a screen to configure the system password and setup password features (see Table 2-8). For further information, see "Using the System Password" on page 56 and "Using the Setup Password" on page 59.
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 <b>Report</b> for host systems that have keyboards attached. Select <b>Do Not Report</b> to suppress all error messages relating to the keyboard or keyboard controller during POST. This setting does not affect the operation of the keyboard itself if a keyboard is attached to the system.

## Memory Information Screen

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

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

<b>Option</b>	<b>Description</b>
System Memory Size	Displays the amount of system memory.
System Memory Type	Displays the type of system memory.
System Memory Speed	Displays the system memory speed.
Video Memory	Displays the amount of video memory.
System Memory Testing	Specifies whether system memory tests are run at system boot. Options are <b>Enabled</b> and <b>Disabled</b> .

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

<b>Option</b>	<b>Description</b>
Redundant Memory (Disabled default)	Enables or disables the redundant memory feature. When set to <b>Spare Mode</b> , the first rank of memory on each DIMM is reserved for memory sparing (see "Memory Sparing Support" on page 129). Redundant memory feature is disabled if the Node Interleaving field is enabled.
Node Interleaving	If this field is enabled, memory interleaving is supported if a symmetric memory configuration is installed. If this field is set to disabled (the default), the system can support Non-Uniform Memory architecture (NUMA) (asymmetric) memory configurations.  <b>NOTE:</b> The Node Interleaving field must be set to <b>Disabled</b> when using the redundant memory feature.
Memory Optimizer Technology (Enabled default)	Sets the behavior of the two DRAM controllers for memory optimization. When set to <b>Enabled</b> , the two controllers run in parallel 64-bit mode for improved memory performance (running single-bit ECC). When set to <b>Disabled</b> , the controllers are joined in 128-bit mode running multi-bit Advanced ECC, but memory performance is not optimized.

## **CPU Information Screen**

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

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

<b>Option</b>	<b>Description</b>
64-bit	Specifies if the installed processors support 64-bit extensions.
Core Speed	Displays the clock speed of the processors.
Bus Speed	Displays the bus speed of the processors.



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

<b>Option</b>	<b>Description</b>
Virtualization Technology (Enabled default)	<b>NOTE:</b> Disable this feature if your system will not be running virtualization software.  Displays when the processors support virtualization technology. <b>Enabled</b> permits virtualization software to use virtualization technology incorporated in the processor design. This feature can only be used by software that supports virtualization technology.
Demand-Based Power Management (Enabled default)	<b>NOTE:</b> Check your operating system documentation to verify if the operating system supports this feature.  Enables or disables demand-based power management. When enabled, the CPU Performance State tables will be reported to the operating system; when disabled, the CPU Performance State tables will not be reported to the operating system. If any of the processors do not support demand-based power management, the field will become read-only, and automatically set to <b>Disabled</b> .
Processor X ID	Displays the family, model, and stepping of the specified processor.

### **Enabling AMD PowerNow!™ Technology**

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



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

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

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

## SATA Configuration Screen

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



**NOTE:** When a SAS Card is installed in the system, the **SATA Configuration** screen changes. The **SATA controller** field displays **ATA Mode** and will be unchoosable. **Port A, Port B, Port C, and Port D** display **off** and are also unchoosable. When the SAS Card is unplugged, the **SATA Configuration** screen settings will be loaded to default values.

**Table 2-5. SATA Configuration Screen**

Option	Description
SATA Controller ( <b>QDMA</b> default)	Allows the integrated SATA controller to be set to <b>Off</b> or <b>QDMA</b> mode. <b>Off</b> disables the SATA subsystem. <b>QDMA</b> mode sets the SATA subsystem to native SATA mode.
Port A ( <b>Off</b> default)	Displays the model number, drive type, and size of the device attached to Port A. When set to <b>Auto</b> (default), the port is enabled if devices are attached to the port.
Port B ( <b>Off</b> default)	Displays the model number, drive type, and size of the device attached to Port B. When set to <b>Auto</b> (default), the port is enabled if devices are attached to the port.
Port C ( <b>Off</b> default)	Displays the model number, drive type, and size of the device attached to Port C. When set to <b>Auto</b> (default), the port is enabled if devices are attached to the port.
Port D ( <b>Off</b> default)	Displays the model number, drive type, and size of the device attached to Port D. When set to <b>Auto</b> ( <b>off</b> is the default), the port is enabled if devices are attached to the port.

## Integrated Devices Screen

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

**Table 2-6. Integrated Devices Screen Options**

<b>Option</b>	<b>Description</b>
SAS Controller ( <b>Enabled</b> default)	Enables or disables the integrated SAS controller.
IDE CD-ROM Controller ( <b>Auto</b> default)	Enables or disables the integrated optical drive IDE controller.
Diskette Controller ( <b>Auto</b> default)	Enables or disables the integrated diskette drive controller.
User Accessible USB Ports ( <b>All Ports On</b> default)	Enables or disables the system's user accessible USB ports. Options are <b>All Ports On</b> , <b>Only Back Ports On</b> , and <b>All Ports Off</b> .
Internal USB Port ( <b>On</b> default)	Enables or disables the system's internal USB port.
Embedded Gb NICx (NIC1 default: <b>Enabled with PXE</b> ; Other NICs: <b>Enabled</b> )	Enables or disables the system's integrated NIC. Options are <b>Enabled</b> , <b>Enabled with PXE</b> , <b>Enabled with iSCSI Boot</b> , and <b>Disabled</b> . PXE support allows the system to boot from the network. Changes take effect after the system restarts.
MAC Address	Displays the MAC address for the integrated 10/100/1000 NIC. This field does not have user-selectable settings.
Capability Detected	Displays the NIC features provided by the LOM NIC hardware key installed in the TOE_KEY socket on the system board.  <b>NOTE:</b> Some LOM features may require the installation of an additional driver.

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

<b>Option</b>	<b>Description</b>
OS Watchdog Timer (Disabled default)	<b>NOTE:</b> This feature is usable only with operating systems that support WDAT implementations of the Advanced Configuration and Power Interface (ACPI) 3.0b specification.  Sets a timer that monitors the operating system for activity and aids in recovery if the system stops responding. When this field is set to <b>Enabled</b> , the operating system is allowed to initialize the timer. When set to <b>Disabled</b> , the timer is not initialized.

## Serial Communication Screen

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

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

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

## System Security Screen

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



**NOTE:** Systems shipping in China are not equipped with TPM.



**Table 2-8. 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><b>NOTE:</b> See "Using the System Password" on page 56 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><b>NOTE:</b> See "Using the Setup Password" on page 59 for instructions on assigning a setup password and using or changing an existing setup password.</p>
Password Status	<p>Setting the <b>Setup Password</b> option to <b>Enabled</b> 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 <b>Setup Password</b> option and then change the <b>Password Status</b> option to <b>Locked</b>. In this state, you cannot change the system password using the <b>System Password</b> option and it cannot be disabled at system start-up by pressing &lt;Ctrl&gt;&lt;Enter&gt;.</p> <p>To <i>unlock</i> the system password, enter the setup password in the <b>Setup Password</b> field and then change the <b>Password Status</b> option to <b>Unlocked</b>. In this state, you can disable the system password at system start-up by pressing &lt;Ctrl&gt;&lt;Enter&gt; and then change the password using the <b>System Password</b> option.</p>

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

Option	Description
TPM Security (Off default)	<p>Sets the reporting of the Trusted Platform Module (TPM) in the system.</p> <p><b>NOTE:</b> The TPM is a microchip that is integrated into the system board, and it can be used by both operating systems and programs. It is capable of creating, storing, and protecting cryptographic keys. See <a href="http://support.dell.com">support.dell.com</a> for additional TPM documentation.</p> <p>When set to <b>Off</b> (default), presence of the TPM is not reported to the operating system.</p> <p>When set to <b>On with Pre-boot Measurements</b>, the system reports the TPM to the operating system and stores the pre-boot measurements (compliant with Trusted Computing Group standards) to the TPM during POST.</p> <p>When set to <b>On without Pre-boot Measurements</b>, the system reports the TPM to the operating system and bypasses pre-boot measurements.</p>
TPM Activation	<p>Changes the operational state of the TPM.</p> <p>When set to <b>Activate</b>, the TPM is enabled and activated at default settings.</p> <p>When set to <b>Deactivate</b>, the TPM is disabled and deactivated.</p> <p>The <b>No Change</b> state initiates no action. The operational state of the TPM remains unchanged (all user settings for the TPM are preserved).</p> <p><b>NOTE:</b> This field is read-only when <b>TPM Security</b> is set to <b>Off</b>.</p>

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


Option	Description
TPM Clear (No default)	<p> <b>NOTICE:</b> Clearing the TPM will cause loss of all encryption keys in the TPM. This option will prevent booting to the operating system and will result in loss of data if the encryption keys cannot be restored. Be sure to back up the TPM keys prior to enabling this option.</p> <p>When set to <b>Yes</b>, all the contents of the TPM are cleared.</p> <p><b>NOTE:</b> This field is read-only when <b>TPM Security</b> is set to <b>Off</b>.</p>
Power Button (Enabled default)	<p>Turns system's power off and on. On an ACPI-compliant operating system, the system performs an orderly shutdown before power is turned off.</p> <p>The button is enabled in the System Setup program. When disabled, the button can only turn on system power.</p> <p><b>NOTE:</b> You can still turn on the system by using the power button, even if the <b>Power Button</b> option is set to <b>Disabled</b>.</p>
NMI Button (Disabled default)	<p> <b>NOTICE:</b> 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>Sets the NMI feature <b>On</b> or <b>Off</b>.</p>
AC Power Recovery (Last default)	<p>Determines how the system reacts when power is restored to the system. If system is set to <b>Last</b>, the system returns to the last power state. <b>On</b> turns on the system after power is restored. When set to <b>Off</b>, the system remains off after power is restored.</p>


## 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. If you leave your system unlocked, 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 58). 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 203.

### 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 <Esc> at any time prior to completing step 5, or press <Enter> to move to another field.


- 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 restart your system now for your password protection to take effect or continue working.

 **NOTE:** Password protection does not take effect until you restart 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 59), 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 restart your system by pressing <Ctrl><Alt><Del>.
- 2 Type your password and press <Enter>.

To disable the password security:

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

When the **Password Status** option is set to **Locked** after turning on or restarting your system, 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** field to verify that the **Password Status** option is set to **Unlocked**.
- 4 When prompted, type the system password.

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

## Using the Setup Password

### Assigning a Setup Password

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



**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. 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, but 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 59.

## **Disabling a Forgotten Password**

See "Disabling a Forgotten Password" on page 203.

## **Baseboard Management Controller Configuration**

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

- Uses the system's integrated NIC
- Enables fault logging and SNMP alerting
- Provides access to system event log and sensor status
- Allows control of system functions including power on and off
- Functions independently of the system's power state or the system's operating system

- Provides text console redirection for system setup, text-based utilities, and operating system consoles



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

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

## Entering the BMC Setup Module

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

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

## BMC Setup Module Options

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



# Installing System Components

This section describes how to install the following system components:

- Front drive bezel
- Cooling shrouds
- Power supplies
- Hard drives
- Diskette drive
- Optical and tape drives
- Expansion cards
- SAS controller card
- RAID battery
- RAC card
- Internal USB memory key
- Expansion card fan
- System fan
- Memory
- Integrated TCP/IP Offload Engine (TOE)
- Processors
- System battery
- Chassis intrusion switch
- Power distribution board
- SAS/SATA backplane
- Control panel
- System board

## Recommended Tools

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

- #1 Phillips screwdriver
- Wrist grounding strap

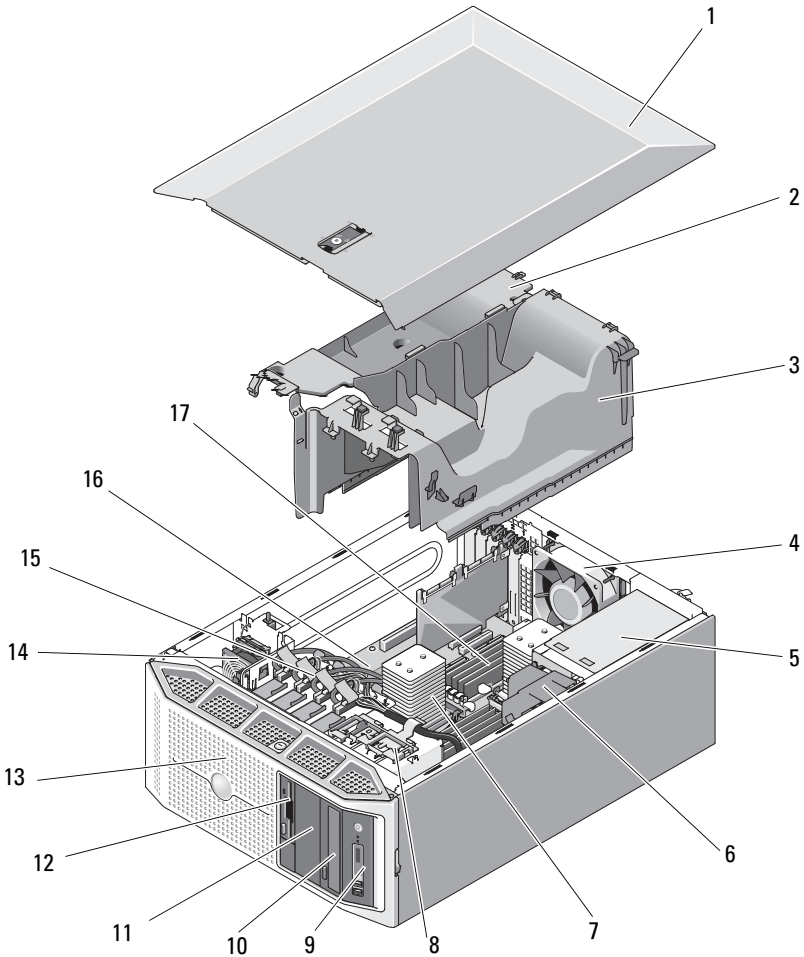
## Inside the System

In Figure 3-1, the system cover is opened to provide an interior view of the system.

The system board can accommodate two processors, five expansion cards, and eight memory modules. The hard drive bays provide space for up to four SAS or SATA hard drives. Drive bays in the front of the system provide space for an optical drive, an optional tape drive or second optical drive, an optional diskette drive, and hot-pluggable hard drives (when available). A controller expansion card is required for SAS hard drives. Power is supplied to the system board and internal peripherals through either redundant power supplies or a single non-redundant power supply.



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



- |   |                         |   |                                 |
|---|-------------------------|---|---------------------------------|
| 1 | system cover            | 2 | expansion card shroud           |
| 3 | processor shroud        | 4 | system fan                      |
| 5 | power supplies          | 6 | power distribution board shroud |
| 7 | heat sink and processor | 8 | drive release latch             |

9	control panel	10	optical disk drive
11	5.25" drive bay	12	3.5" floppy drive
13	front drive bezel	14	expansion card fan
15	3.5" hard drives	16	system board
17	system memory		

## Front Drive Bezel

The front drive bezel is the cover for the optional optical drive, floppy drive, tape drive, or hot-plug hard drives (when available). To remove or install any of these drives, you must first remove the front drive bezel.



**NOTE:** If you are removing or installing a hot-plug hard drive (when available), the system may remain turned on and in the upright position when removing the front drive bezel (see "Removing a Hot-plug Hard Drive" on page 88). If you plan to remove or install any other system components, the system should be in the orientation shown in Figure 3-1 (see "Opening the System" on page 68).

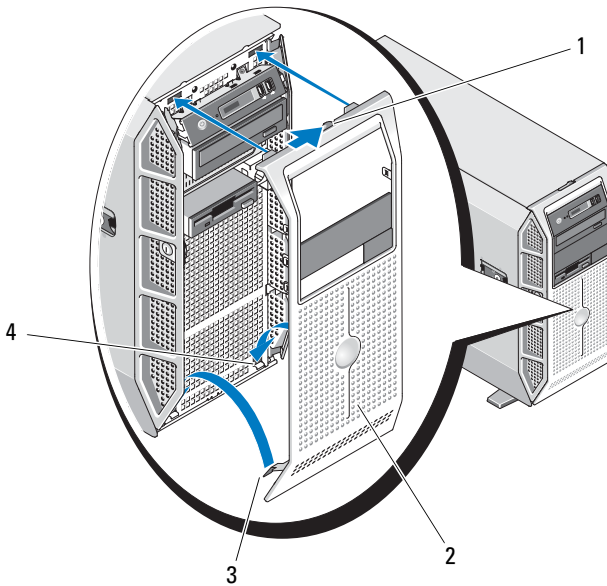
### Removing the Front Drive Bezel

- 1 Using the system key, unlock the bezel.
- 2 Slide the lever in the direction of the arrow until it releases the bezel from the top of the chassis (see Figure 3-2).
- 3 Rotate the top end of the bezel away from the chassis, and lift the bezel out from the chassis, removing the bezel tabs from the slots as shown in Figure 3-2.

### Installing the Front Drive Bezel

- 1 Insert the bezel tabs into the bezel tab slots in the chassis (see Figure 3-2).
- 2 Firmly press the top end of the bezel into the chassis until the lever locks into place.
- 3 Using the system key, lock the bezel.

**Figure 3-2. Removing and Installing the Front Drive Bezel**



- |   |                |   |                     |
|---|----------------|---|---------------------|
| 1 | lever          | 2 | front drive bezel   |
| 3 | bezel tabs (2) | 4 | bezel tab slots (2) |

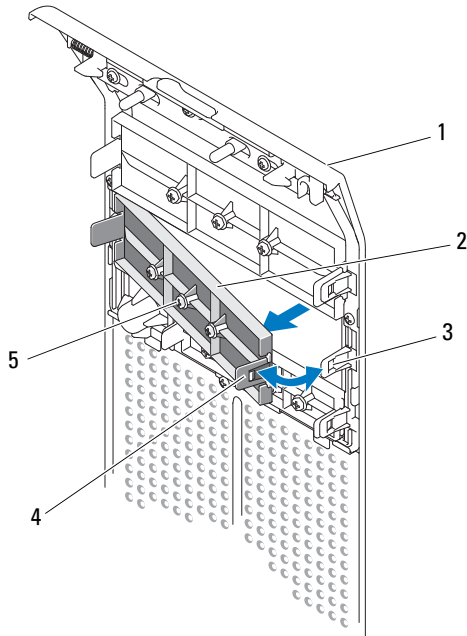
### **Removing an Insert on the Front Drive Bezel**

If you install a drive in the 3.5-inch or 5.25-inch drive bays, first remove the corresponding insert on the front drive bezel. From the back of the bezel, squeeze one of the insert tabs inward to unhook it from the tab notch, and pull the insert away from the bezel (see Figure 3-3).

### **Installing an Insert on the Front Drive Bezel**

If you remove a drive in the 3.5-inch or 5.25-inch drive bays, replace the corresponding insert on the front drive bezel. From the back of the bezel, fit one of the insert tabs into a tab notch on the bezel, and push the insert into the bezel until the opposite tab snaps into place (see Figure 3-3).

**Figure 3-3. Removing and Installing a Front Drive Bezel Insert**



- |   |   |   |                    |
|---|---|---|--------------------|
| 1 | front drive bezel                             | 2 | drive bezel insert |
| 3 | tab notch                                     | 4 | insert tab         |
| 5 | screws for an optional<br>5.25-inch drive (3) |   |                    |

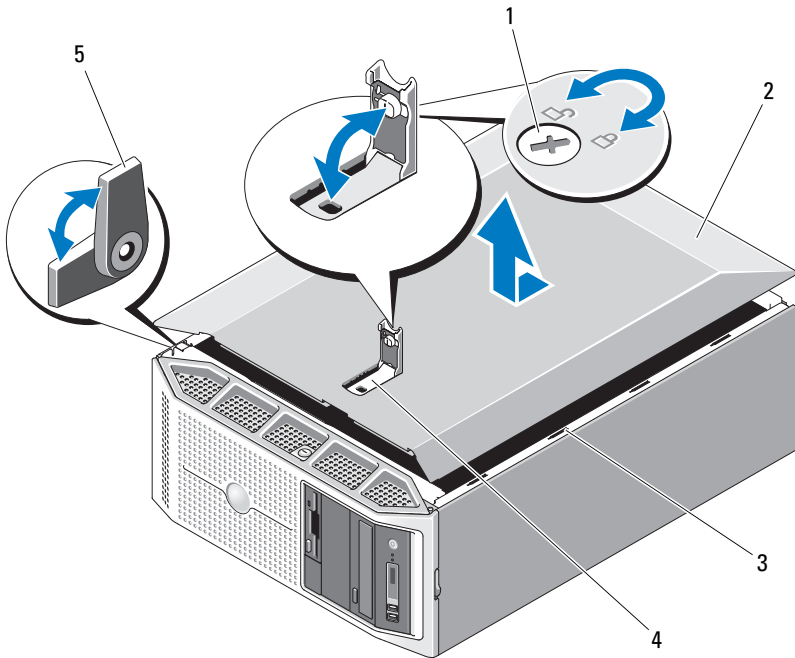
## Opening the System

**⚠ 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.

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Press the power button to ground the system board.

- 3 Rotate the system feet inward (see Figure 3-4).
- 4 Lay the system on its side as shown in Figure 3-4.
- 5 To remove the system cover, turn the latch release lock on the cover latch counterclockwise to the unlocked position. See Figure 3-4.
- 6 Lift up the cover latch. See Figure 3-4.
- 7 Grasp the cover on both sides and carefully lift the cover away from the system.

**Figure 3-4. Opening and Closing the System**



- |   |                    |   |              |
|---|--------------------|---|--------------|
| 1 | latch release lock | 2 | system cover |
| 3 | hook slot          | 4 | cover latch  |
| 5 | foot               |   |              |

## Closing the System

- 1 Ensure that all internal cables are connected and folded out of the way.
- 2 Ensure that no tools or extra parts are left inside the system.
- 3 Reinstall the system cover:
  - a Lift up the cover latch.
  - b Place the cover on top of the system and offset the cover slightly back so that it clears the hook slots and lays flat on the system chassis. See Figure 3-4.
  - c Push the latch down to lever the cover into the closed position.
  - d Turn the latch release lock clockwise to the locked position. See Figure 3-4.
- 4 Place the system upright and on its feet on a flat, stable surface.
- 5 Rotate the system feet outward (see Figure 3-4).
- 6 Reattach any peripherals, then connect the system to the electrical outlet.
- 7 Turn on the system and attached peripherals.

After you open and close the cover, the chassis intrusion detector, if enabled, causes the following message to appear on the screen at the next system start-up:

Alert! Cover was previously opened.

- 8 To reset the chassis intrusion detector, press <F2> to enter the System Setup program. See "Entering the System Setup Program" on page 43.



**NOTE:** If a setup password has been assigned by someone else, contact your network administrator for information on resetting the chassis intrusion detector.

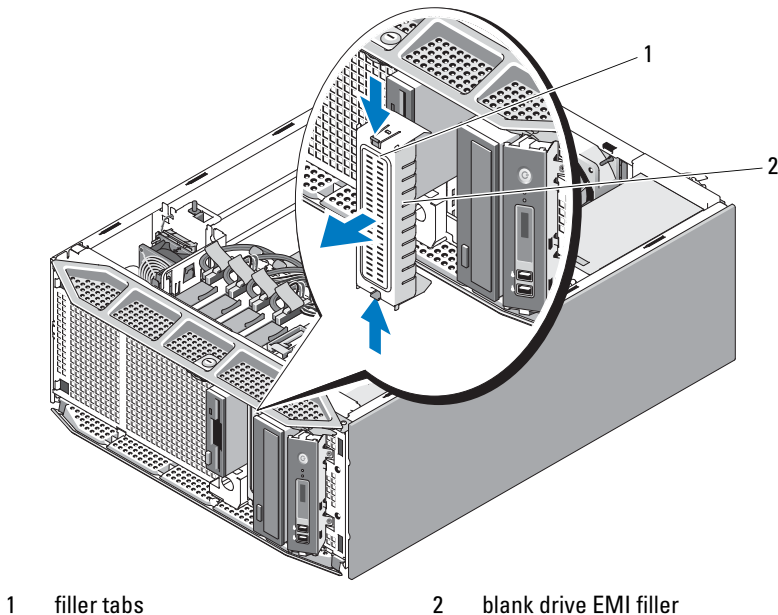
## Removing and Installing Blank Drive EMI Fillers

Depending on the configuration of your system, a blank drive EMI filler might be installed in place of an optical or diskette drive. These are essential for airflow efficiency and for electromagnetic interference (EMI) protection.

You must remove the blank drive EMI filler if you decide to replace it with an optional diskette or optical drive. Squeeze the filler tabs, and pull the filler out of the chassis. See Figure 3-5.

To replace the blank drive EMI filler, push the filler into the slot on the chassis until the filler tabs lock into place.

**Figure 3-5. Removing and Installing a Blank Drive EMI Filler**



# Cooling Shrouds

The system contains two internal cooling shrouds for directing airflow from the fans to system components. The processor cooling shroud directs air over the system processor(s) and memory modules, and the expansion card cooling shroud directs air over the expansion cards.



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

## Removing the Expansion Card Shroud



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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Press the shroud latch in the direction of the arrow. Holding the shroud by the gripping points, lift the shroud upward and away from the back of the system until the shroud tabs are free from the tab slots. See Figure 3-6.

## Removing the Processor Shroud

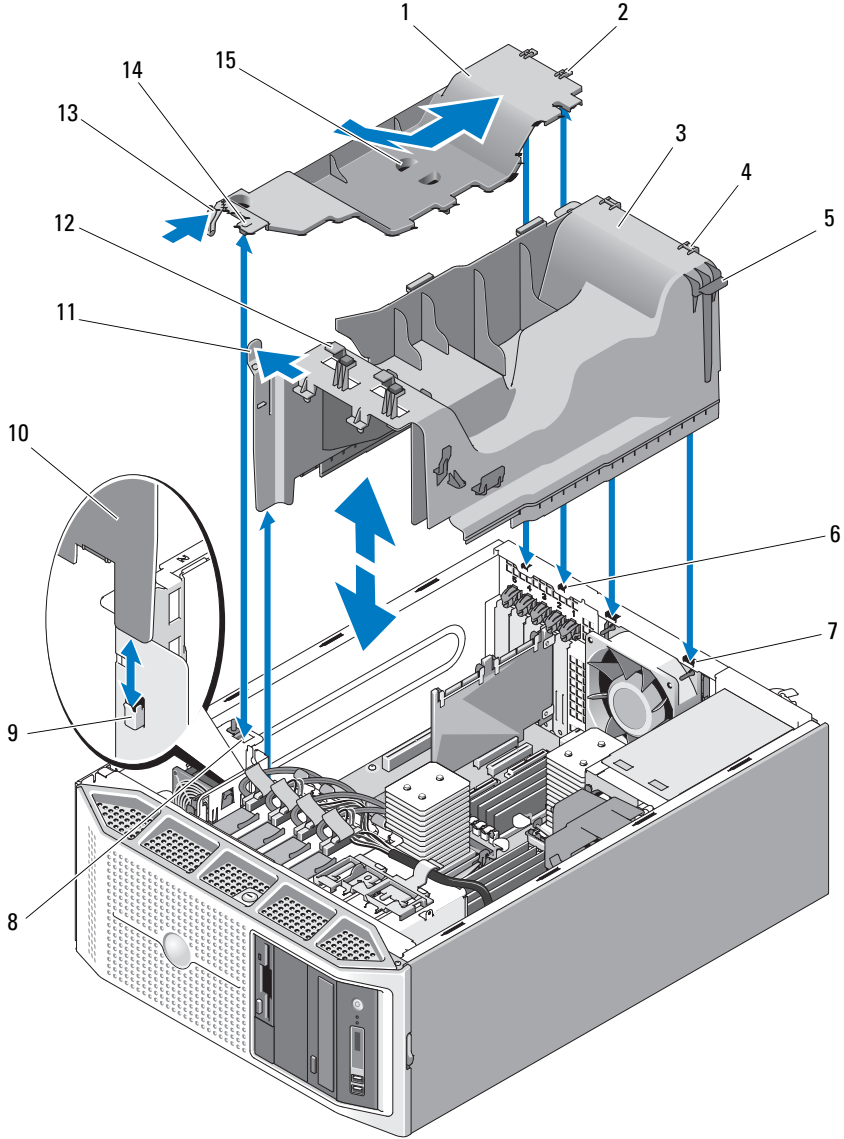


**CAUTION:** The DIMMs and heat sinks are hot to the touch for some time after the system has been powered down. Allow the DIMMs and heat sinks to cool before handling them.

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 If present, disconnect the floppy drive and IDE ribbon cables from the system board. Remove the cables from under the ribbon cable slot and lay the cables away from the processor shroud.



**Figure 3-6. Removing and Installing the Expansion Card and Processor Shrouds**



1 expansion card shroud

2 rear shroud alignment tabs (2)

3 processor shroud

4 shroud alignment tabs (2)

- |    |                        |    |                            |
|----|------------------------|----|----------------------------|
| 5  | shroud touch point     | 6  | rear shroud tab slots (2)  |
| 7  | tab slots (2)          | 8  | front shroud tab slot      |
| 9  | shroud alignment guide | 10 | front shroud lip           |
| 11 | release latch          | 12 | cable guides (4)           |
| 13 | shroud latch           | 14 | front shroud alignment tab |
| 15 | gripping points        |    |                            |

- 5 Disconnect the SATA cable(s) from the system board and remove the cable(s) from the cable guides. Lay the SATA cables away from the processor shroud.
- 6 If present, disconnect any SAS cables from the SAS card to the hard drives and remove the cables from the cable guides. Lay the SAS cables away from the processor shroud.
- 7 Disconnect all power cables to any drives in the system.
- 8 Pull the release latch in the direction of the arrow. Holding the latch and the shroud touch point, lift the shroud up and out of the chassis. See Figure 3-6.

## Installing the Processor Shroud

- 1 Carefully lower the shroud into the chassis, inserting the front shroud lip under the shroud alignment guide, and inserting the shroud alignment tabs into the tab slots in the chassis. Make sure that no cables are pinned under the bottom edges of the shroud, and press down on the shroud until the shroud latch locks into place. See Figure 3-6.
- 2 Route the SATA cable(s) under the cable guides, and connect the SATA cables to the SATA connectors on the system board. See Figure 3-11 for SATA hard drive cable-routing guidelines and Figure 3-22 for SATA optical drive cable-routing guidelines.
- 3 Route the ribbon cables under the ribbon cable slot, and connect the cables to the connectors on the system board. See Figure 3-17 for ribbon cable routing guidelines.
- 4 If applicable, route the SAS-card cables through the shroud cable guides, and connect the cables to the hard drives. See Figure 3-12 for cable routing guidelines.

- 5 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 6 Close the system. See "Closing the System" on page 70.
- 7 Place the system upright and on its feet on a flat, stable surface.
- 8 Reattach any peripherals, then connect the system to the electrical outlet.
- 9 Turn on the system and attached peripherals.

### **Installing the Expansion Card Shroud**

- 1 Insert the rear shroud alignment tabs into the rear shroud tab slots, and then lower the shroud into the chassis. Align the front shroud alignment tab with the front shroud tab slot, and press downward on the shroud to lock the latch into place. See Figure 3-6.
- 2 Close the system. See "Closing the System" on page 70.
- 3 Place the system upright and on its feet on a flat, stable surface.
- 4 Reattach any peripherals, then connect the system to the electrical outlet.
- 5 Turn on the system and attached peripherals.

## **Power Supplies**

Depending on your configuration, your system supports up to two hot-pluggable redundant power supplies rated at 675 W, or a single non-redundant power supply rated at 650 W.

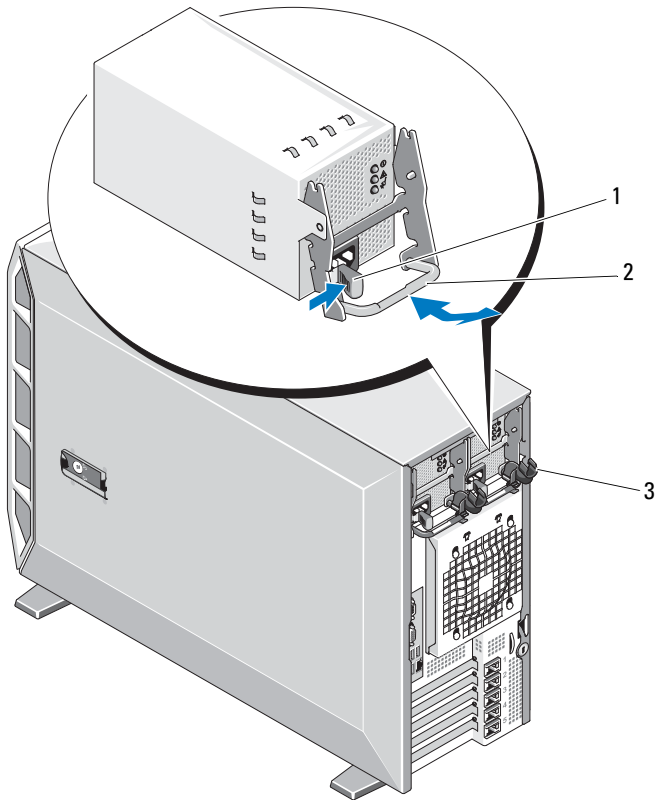
If your system has redundant power supplies, see "Removing a Redundant Power Supply" on page 76 or "Installing a Redundant Power Supply" on page 77. If your system has a non-redundant power supply see "Removing a Non-redundant Power Supply" on page 78 or "Installing a Non-redundant Power Supply" on page 81.

If two redundant power supplies are installed, the second power supply provides power redundancy. In redundant mode, the system distributes the power load across both power supplies to maximize efficiency. When a power supply is removed with the system powered on, the full power load is picked up by the remaining power supply.

## Removing a Redundant Power Supply

- ➔ **NOTICE:** The system requires one power supply to operate the system normally. On power-redundant systems, remove and replace only one power supply at a time in a system that is powered on.
  - ➔ **NOTICE:** If you are replacing a redundant power supply while your system is running, make sure that both the power supply status and the AC line status LEDs are green before removing the power supply. See Figure 1-3 to identify the power supply LEDs. If one or both of the LEDs are not green, see "Troubleshooting Redundant Power Supplies" on page 171.
- 1 If your system has a single hot-plug power supply, turn off the system and all attached peripherals. For a redundant system, you can leave the system running and proceed to the next step.
  - 2 Disconnect the power cable from the power source.
  - 3 Disconnect the power cable from the power supply and remove the cable from the cable retention bracket.
  - 4 Release the locking tab on the power supply by pressing in toward the center of the power supply, and rotate the power-supply handle up until the power supply is released from the chassis. See Figure 3-7.
  - 5 Pull the power supply straight out to clear the chassis.

**Figure 3-7. Removing and Installing a Redundant Power Supply**



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

### **Installing a Redundant Power Supply**

- 1 With the power-supply handle in the extended position, slide the new power supply into the chassis. See Figure 3-7.
- 2 Rotate the handle down until it is completely flush with the power-supply faceplate and the locking tab engages. See Figure 3-7.

- 3 Connect the power cable to the power supply.
  - a Route the power cable into the cable retention bracket from the power supply side of the bracket (see Figure 3-7).
  - b Loop the cable from the cable retention bracket up to the power plug at the back of the power supply, and connect the cable.
  - c Plug the other end of the cable into a power distribution unit (PDU) or power outlet.



**NOTE:** After installing a new power supply, allow several seconds for the system to recognize the power supply and determine whether it is working properly. The power supply status indicator will turn green to signify that the power supply is functioning properly. See Figure 1-3.

## Removing a Non-redundant Power Supply

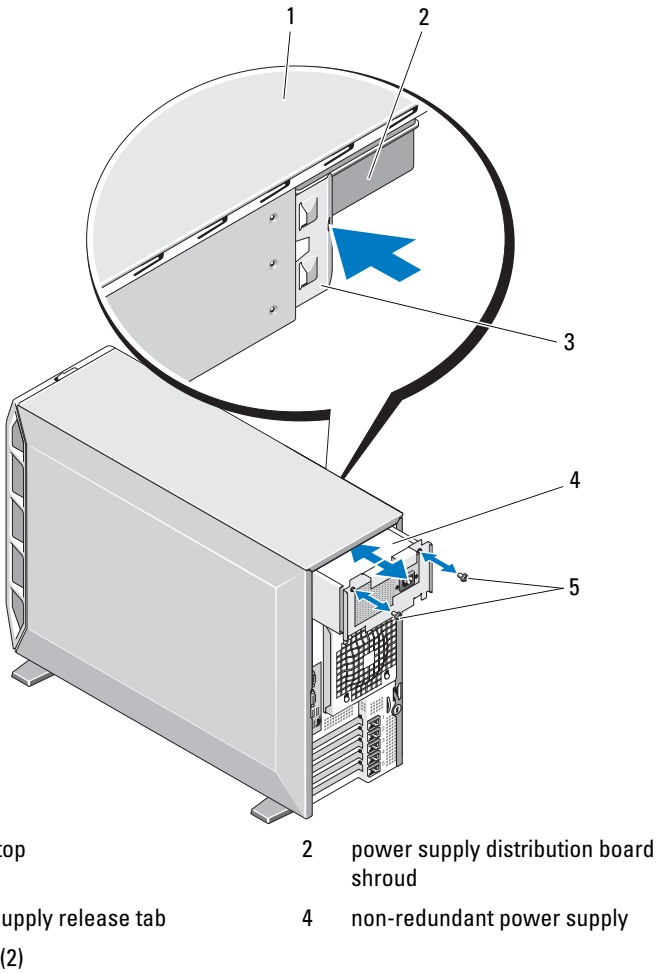


**CAUTION:** Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 Remove the processor shroud. See "Removing the Processor Shroud" on page 72.
- 5 Depending on your system configuration, disconnect the power cables from the following components where applicable (see Figure 6-1 for connector locations):
  - PWR1 connector on the system board
  - PWR2 connector on the system board
  - PWR3 connector on the system board
  - BP\_PWR connector on the optional SAS/SATA backplane
  - Hard drives

- Diskette drive
  - Tape backup unit
  - Optical drives
- 6** Remove the two screws that secure the power supply to the system. See Figure 3-8.
  - 7** Press the power supply release tab, and slide the power supply out from the back of the system. See Figure 3-8.
  - 8** If you plan to replace a non-redundant power supply with redundant power supplies, you will need to replace the power supply cage cover with the power supply distribution board and its shroud.
    - a** Remove the power supply cage cover by pulling the blue release pins until they unlock from the power supply cage, and lift the cover out of the chassis. See Figure 3-41.
    - b** Install the power supply distribution board and its shroud. See "Installing the Power Supply Distribution Board" on page 148.

**Figure 3-8. Removing and Installing a Non-redundant Power Supply**






## Installing a Non-redundant Power Supply

- 1** If you are installing a non-redundant power supply to replace redundant power supplies, you will need to replace the power supply distribution board with the power supply cage cover.
  - a** Remove the power supply distribution board. See "Removing the Power Supply Distribution Board" on page 144.
  - b** Install the power supply cage cover by pressing the cover into the power supply cage until the retention pins lock into place. See Figure 3-41.
- 2** Slide the power supply into the back of the system until the power supply release tab snaps into place. See Figure 3-8.
- 3** Install the two Phillips screws to secure the power supply to the system. See Figure 3-8.
- 4** Depending on your system configuration, connect the following power cables:
  - PWR1 connector on the system board
  - PWR2 connector on the system board
  - PWR3 connector on the system board
  - BP\_PWR connector on the optional SAS/SATA backplane
  - Hard drives
  - Diskette drive
  - Tape backup unit
  - Optical drives
- 5** Install the processor shroud. See "Installing the Processor Shroud" on page 74.
- 6** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 7** Close the system. See "Closing the System" on page 70.
- 8** Place the system upright and on its feet on a flat, stable surface.
- 9** Reattach any peripherals, then connect the system to the electrical outlet.
- 10** Turn on the system and attached peripherals.


# Hard Drives

 **NOTE:** The system's drive configuration must consist of all SATA hard drives or all SAS hard drives. Combining SATA and SAS drives is not supported.

## Hard Drive Installation Guidelines


Your system can contain up to four 3.5-inch SATA or SAS hard drives in either a removable fixed hard drive bay (see Figure 3-9), or, when available, a lever-release drive bay (see Figure 3-13). These drives connect either to the system board, an optional controller card, or a SAS/SATA backplane. SAS or SATA drives can be hot-pluggable only if your system has a lever-release drive bay.

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 restart your system while the drive is being formatted. Doing so can cause a drive failure.

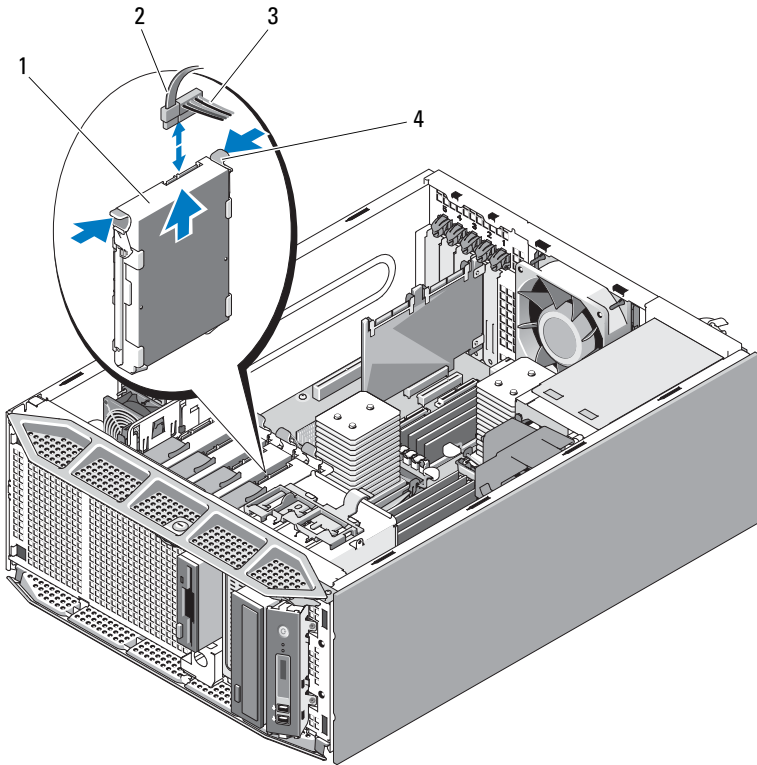
When you format a hard drive, allow enough time for the formatting to be completed. Be aware that high-capacity hard drives can take a number of hours to format.

## Removing a Hard Drive

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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Disconnect the blue data cable and the power cable from the hard drive in the drive bay.
- 4 Press the blue carrier release tabs on each side of the hard-drive bracket toward each other and slide the drive and its bracket up and out of the bay. See Figure 3-9.

**Figure 3-9. Removing and Installing a Hard Drive**



- |   |             |   |                         |
|---|-------------|---|-------------------------|
| 1 | hard drive  | 2 | data cable              |
| 3 | power cable | 4 | carrier release tab (2) |

**NOTE:** If you do not intend to replace the drive, it is recommended that you remove the drive from the guide bracket (see Figure 3-10) and insert the empty guide bracket back into the drive bay. This eliminates the likelihood that the empty bracket will be misplaced or improperly stored while not in use.

- 5 Close the system. See "Closing the System" on page 70.
- 6 Place the system upright and on its feet on a flat, stable surface.
- 7 Reattach any peripherals, then connect the system to the electrical outlet.
- 8 Turn on the system and attached peripherals.

## Installing a Hard Drive



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

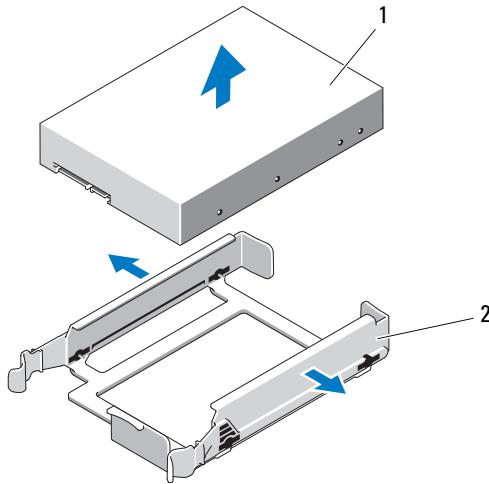
- 1 Unpack the replacement hard drive and prepare it for installation.
- 2 Check the documentation for the hard drive to verify that the drive is configured for your system.
- 3 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 4 Open the system. See "Opening the System" on page 68.
- 5 If you are replacing a hard drive, remove the drive that you are replacing. See "Removing a Hard Drive" on page 82.

If there is a hard-drive bracket in the empty hard-drive bay, remove the bracket by pressing the two carrier release tabs toward each other and pulling it up and out of the drive bay. See Figure 3-9.

If a replacement hard drive does not have the hard-drive bracket attached, remove the bracket from the old drive.

- 6 Snap the new drive into the guide bracket. See Figure 3-10.
- 7 Insert the guide bracket assembly into the drive bay until it snaps into place. See Figure 3-9.

**Figure 3-10. Installing a Hard Drive in a Drive Bracket**



1 hard drive

2 hard-drive bracket

**➡ NOTICE:** SAS drives and SATA drives cannot be mixed in the system. The drives must be either SATA or SAS hard drives.

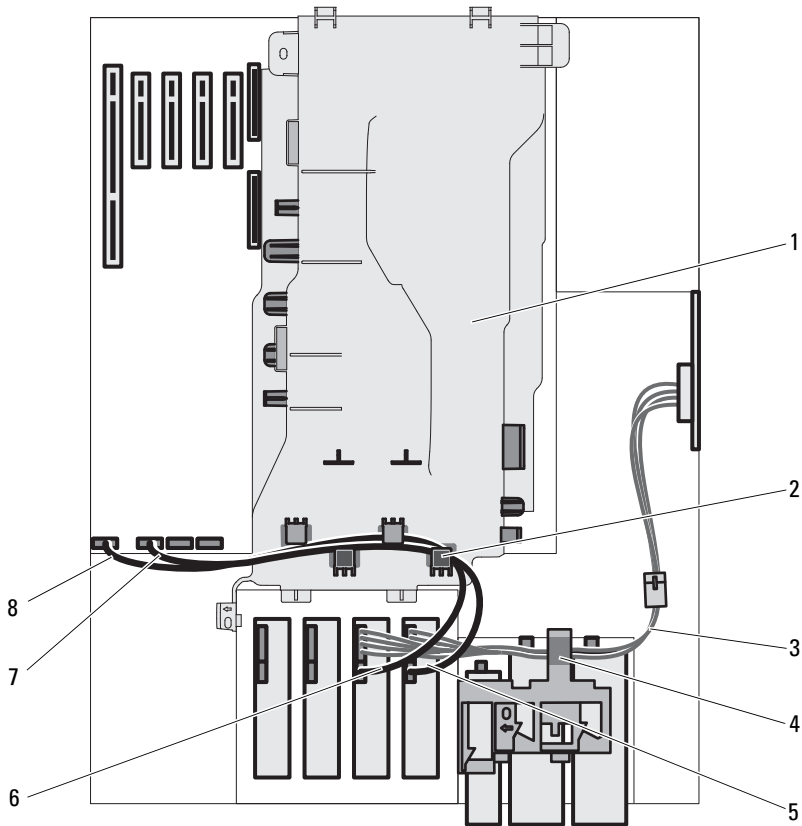
**🔧 NOTE:** The SAS or SAS/RAID controller card must be installed in PCIe SLOT2. See Figure 6-1.

**8** Connect the power cable to the hard drive.

**9** Connect the data cable to the hard drive:

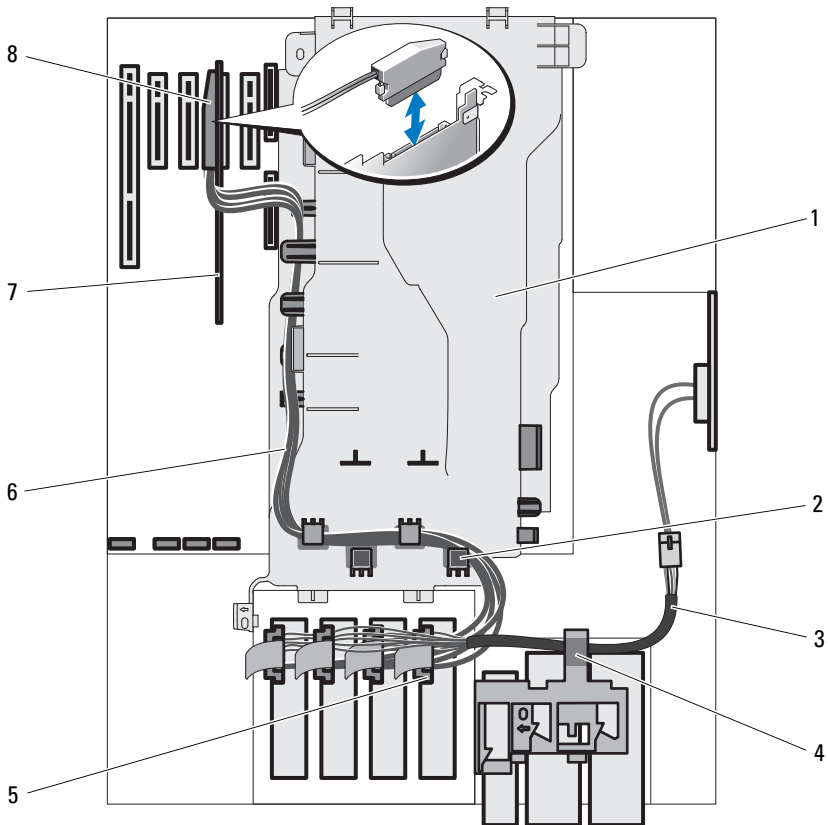
- For connection to the integrated SATA controller (SATA hard drives only), connect the SATA data cable to the SATA\_A (first drive) and SATA\_B (second drive) connectors on the system board. See Figure 3-11. See Figure 6-1 for the location of the hard drive connectors on the system board.
- For connection to a SAS or SAS/RAID controller expansion card (SAS or SATA hard drives), connect the data cables from the controller card and the power cables as shown in Figure 3-12. See "Installing a SAS Controller Card" on page 112 for instructions about installing the card.

**Figure 3-11. Cabling SATA Hard Drives to the Integrated SATA Controller**



- |   |                                    |   |                                      |
|---|------------------------------------|---|--------------------------------------|
| 1 | processor shroud                   | 2 | shroud cable guides (4)              |
| 3 | SATA power cables                  | 4 | drive bay release latch              |
| 5 | SATA_A cable to primary hard drive | 6 | SATA_B cable to secondary hard drive |
| 7 | SATA_B cable to system board       | 8 | SATA_A cable to system board         |

**Figure 3-12. Cabling SAS or SATA Hard Drives to a SAS Controller Expansion Card**



- |   |                             |   |                                  |
|---|-----------------------------|---|----------------------------------|
| 1 | processor shroud            | 2 | shroud cable guides              |
| 3 | SAS power cables            | 4 | drive release latch              |
| 5 | SAS connector to hard drive | 6 | SAS data cables                  |
| 7 | SAS controller card         | 8 | connector to SAS controller card |

**10** Ensure that all connectors are properly cabled and firmly seated.

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

**12** Place the system upright and on its feet on a flat, stable surface.

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

- 14** Turn on the system and attached peripherals.  
See the documentation that came with the drive for instructions on installing any software required for drive operation.
- 15** Press <F2> to enter the System Setup program (see "Entering the System Setup Program" on page 43), and ensure that the drive's controller is enabled.
- 16** Exit the System Setup program and restart the system.
- 17** Partition and logically format the drive.  
See the documentation for your operating system for instructions.
- 18** (Optional) Test the hard drive by running the system diagnostics. See "Using Dell PowerEdge Diagnostics" on page 193.
- 19** If the drive you just installed is the primary drive, install your operating system on the hard drive.

## Removing a Hot-plug Hard Drive

When available, your system may have an optional lever-release drive bay, providing space for up to four hot-plug SAS or four hot-plug SATA hard drives. The hard drives plug into the SAS/SATA backplane, and they are supplied in special hot-plug drive carriers that fit in the lever release drive bays.

- 1** Remove the front drive bezel, if attached. See "Removing the Front Drive Bezel" on page 66.
- 2** From the RAID management software, prepare the drive for removal and wait until the hard-drive indicators on the drive carrier signal that the drive can be removed safely. See your SAS/RAID controller documentation for information about hot-plug drive removal.

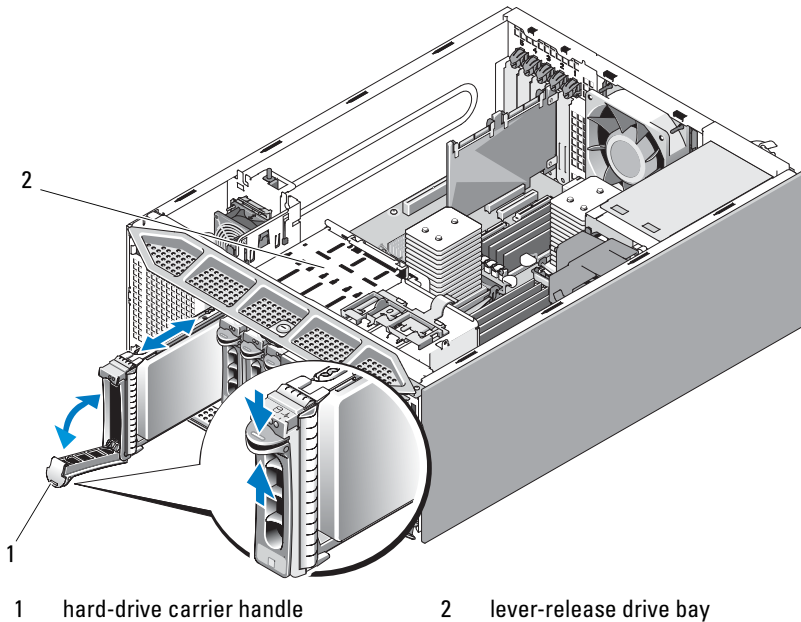
If the drive has been online, the green activity/fault indicator will flash as the drive is powered down. When both drive indicators are off, the drive is ready for removal.

- 3** Open the drive carrier release handle to release the drive. See Figure 3-13.
- 4** Slide the hard drive out until it is free of the drive bay.
- 5** If you do not replace the hard drive, insert a drive blank in the vacated drive bay. See "Installing a Hot-plug Hard Drive Blank" on page 91.



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

**Figure 3-13. Removing and Installing a Hot-plug Hard Drive**



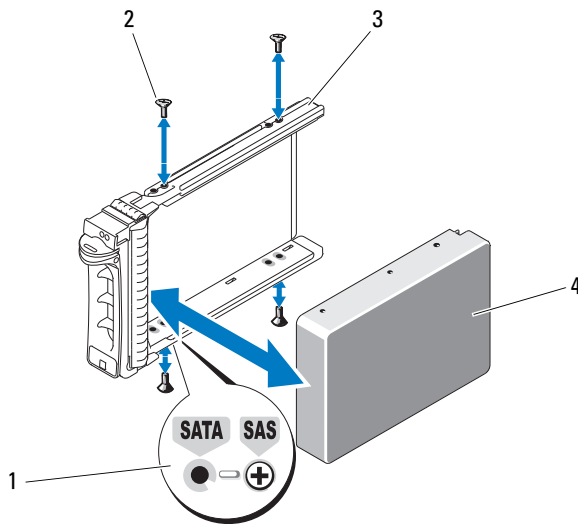
### Installing a Hot-plug Hard Drive

- ✍ NOTE:** It is recommended that you use only drives that have been tested and approved for use with the SAS/SATA backplane.
- ➡ NOTICE:** Not all operating systems support hot-plug drive installation. See the documentation supplied with your operating system.
- 1 Remove the front drive bezel, if attached. See "Removing the Front Drive Bezel" on page 66.
  - 2 If a drive blank is present in the bay, remove it. See "Removing a Hot-plug Hard Drive Blank" on page 91.

- 3** If you are replacing a hot-plug hard drive, remove the drive that you are replacing. See "Removing a Hot-plug Hard Drive" on page 88.
- If a replacement hard drive does not have the lever-release hard drive bracket attached, remove the bracket from the old drive and install it on the new drive. See Figure 3-14.

The SAS/SATA hard-drive bracket has mounting holes to enable either a "SAS" or "SATA" mounting position, depending on your hard drive type. See Figure 3-14.

**Figure 3-14. Removing and Installing a Lever-release Hard Drive Bracket**




- |   |                |   |            |
|---|----------------|---|------------|
| 1 | mounting holes | 2 | screws (4) |
| 3 | drive bracket  | 4 | hard drive |

- 4** Install the hot-plug hard drive.
- a** Open the handle on the hard-drive carrier.
  - b** Insert the hard-drive carrier into the drive bay until the carrier contacts the backplane.
  - c** Close the handle to lock the drive in place.

- 5 Install the front drive bezel. See "Installing the Front Drive Bezel" on page 66.

## Removing a Hot-plug Hard Drive Blank

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

Remove the drive blank as you would the hot-plug hard drive:

- 1 Remove the front bezel, if attached. See "Removing the Front Drive Bezel" on page 66.
- 2 Open the hot-plug drive blank release handle to release the blank. See Figure 3-13.
- 3 Slide the drive blank out until it is free of the drive bay.

## Installing a Hot-plug Hard Drive Blank


Install the drive blank as you would a hot-plug hard drive:

- 1 Remove the front bezel, if attached. See "Removing the Front Drive Bezel" on page 66.
- 2 Open the handle on the drive blank.
- 3 Insert the drive blank into the drive bay until the blank is fully seated.
- 4 Close the handle to lock the blank in place.
- 5 Install the front bezel. See "Installing the Front Drive Bezel" on page 66.

## Diskette Drive

The 3.5-inch drive bay supports an optional standard diskette drive.

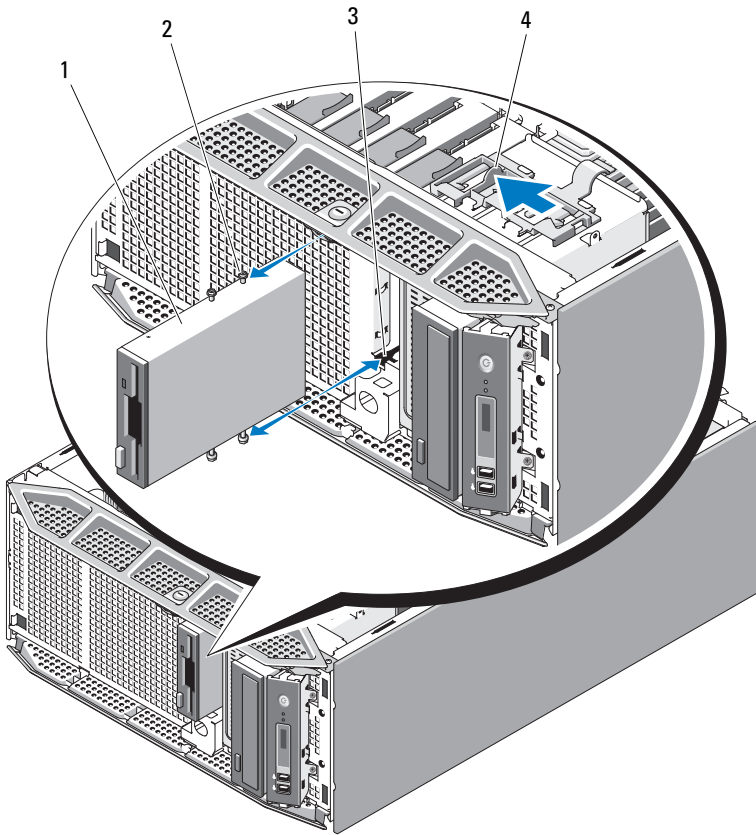
### Removing the Diskette Drive

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

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

- 1** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2** Open the system. See "Opening the System" on page 68.
- 3** Remove the front drive bezel. See "Removing the Front Drive Bezel" on page 66.
- 4** Disconnect the power and data cables from the diskette drive.
- 5** Slide the drive release latch in the direction of the arrow. See Figure 3-15.
- 6** Hold the latch in position and slowly pull the drive out of the bay.

**Figure 3-15. Removing or Installing a Diskette Drive**



- |   |                       |   |                                |
|---|-----------------------|---|--------------------------------|
| 1 | diskette drive        | 2 | diskette drive shoulder screws |
| 3 | drive bay screw slots | 4 | drive release latch            |

**7** If you are permanently removing the drive, replace the 3.5-inch insert on the front drive bezel. See "Installing an Insert on the Front Drive Bezel" on page 67.

If you are replacing the diskette drive, see "Installing a Diskette Drive" on page 94.

**8** Replace the front drive bezel. See "Installing the Front Drive Bezel" on page 66.

- 9 Close the system. See "Closing the System" on page 70.
- 10 Place the system upright and on its feet on a flat, stable surface.
- 11 Reattach any peripherals, then connect the system to the electrical outlet.
- 12 Turn on the system and attached peripherals.

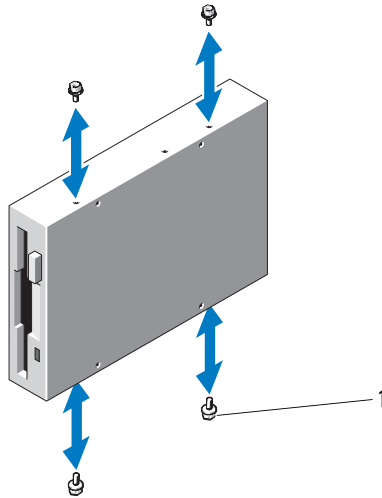
## Installing a Diskette Drive



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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and attached peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 Unpack the replacement diskette drive, and prepare it for installation.
- 5 Check the documentation for the drive to verify that it is configured for your system.
- 6 Remove the front drive bezel. See "Removing the Front Drive Bezel" on page 66.
- 7 Remove the 3.5-inch insert on the front drive bezel. See "Removing an Insert on the Front Drive Bezel" on page 67.
- 8 Remove the four shoulder screws from the back of the insert; the 3.5-inch insert holds four screws.
- 9 Attach the four screws to the diskette drive as shown in Figure 3-16.

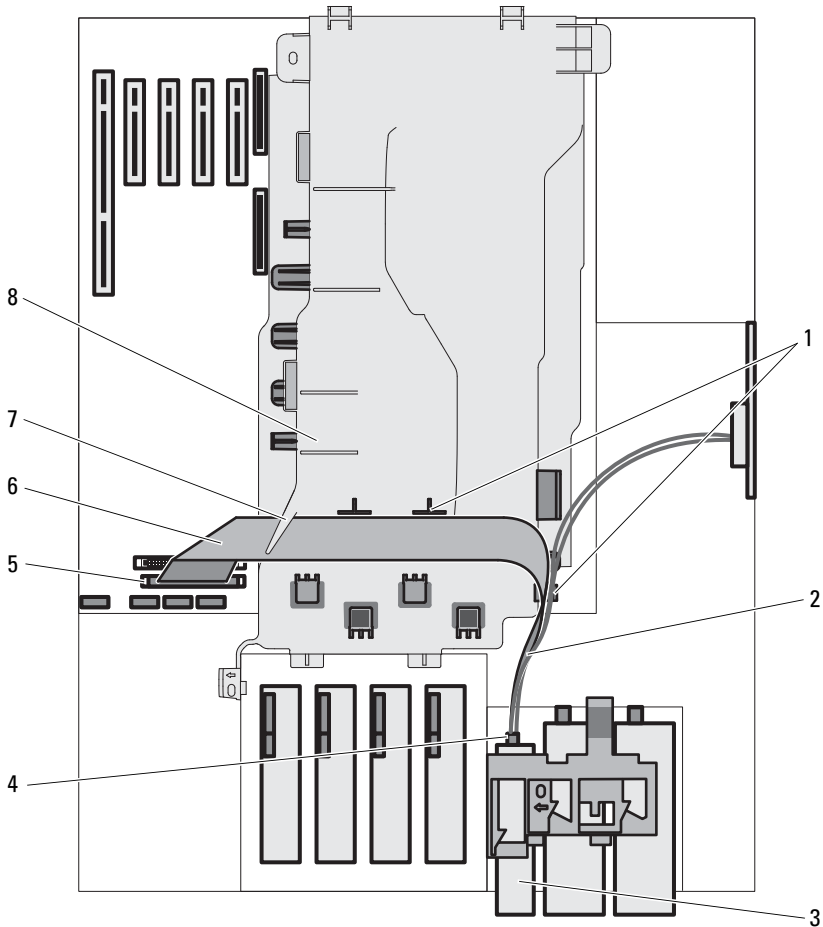
**Figure 3-16. Installing Diskette Drive Shoulder Screws**



1 screws (4)

- 10** From the front of the chassis, slide the drive into the drive bay until the shoulder screws fit into their slots and snap securely into the sliding plate.
- 11** Connect the power cable to the drive.
- 12** Connect the data cable from the drive to the diskette drive connector (FLOPPY) on the system board. See Figure 6-1 for the connector location.
- 13** Route the diskette drive data cable through the ribbon cable notch and ribbon cable guides in the processor shroud as shown in Figure 3-17.

**Figure 3-17. Cabling the Optional Diskette Drive to the System Board**



- |   |                                  |   |                            |
|---|----------------------------------|---|----------------------------|
| 1 | ribbon cable guides              | 2 | diskette drive power cable |
| 3 | diskette drive                   | 4 | diskette drive connectors  |
| 5 | FLOPPY connector on system board | 6 | diskette drive data cable  |
| 7 | ribbon cable notch               | 8 | processor shroud           |



- 14 Replace the front drive bezel. See "Installing the Front Drive Bezel" on page 66.
- 15 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 16 Close the system. See "Closing the System" on page 70.
- 17 Place the system upright and on its feet on a flat, stable surface.
- 18 Reattach any peripherals, then connect the system to the electrical outlet.
- 19 Turn on the system and attached peripherals.
- 20 Enter the System Setup program and ensure that the drive's controller is enabled. See "Using the System Setup Program" on page 43.
- 21 (Optional) Test the drive by running the system diagnostics. See "Running the System Diagnostics" on page 193.

## Optical and Tape Drives

In the two 5.25-inch drive bays, you can install optical (SATA or PATA) or tape drives (SATA, SAS, or SCSI).

### Removing an Optical or Tape Drive

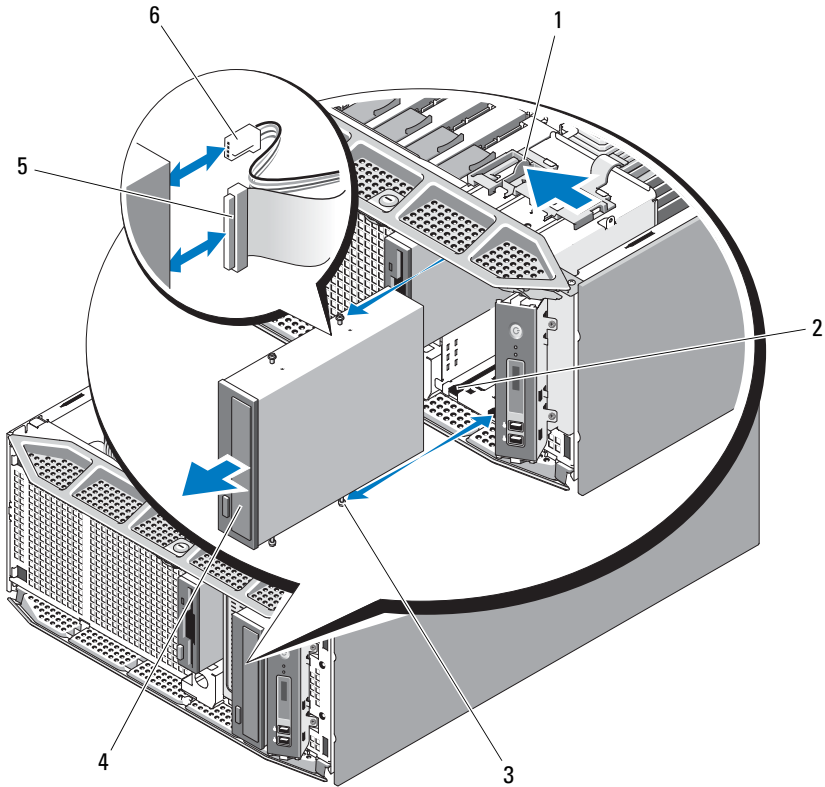


**CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the front drive bezel. See "Removing the Front Drive Bezel" on page 66.
- 4 Disconnect the power and data cables from the back of the drive. See Figure 3-18 for disconnecting SCSI or PATA connections and Figure 3-19 for disconnecting SATA or SAS connections.

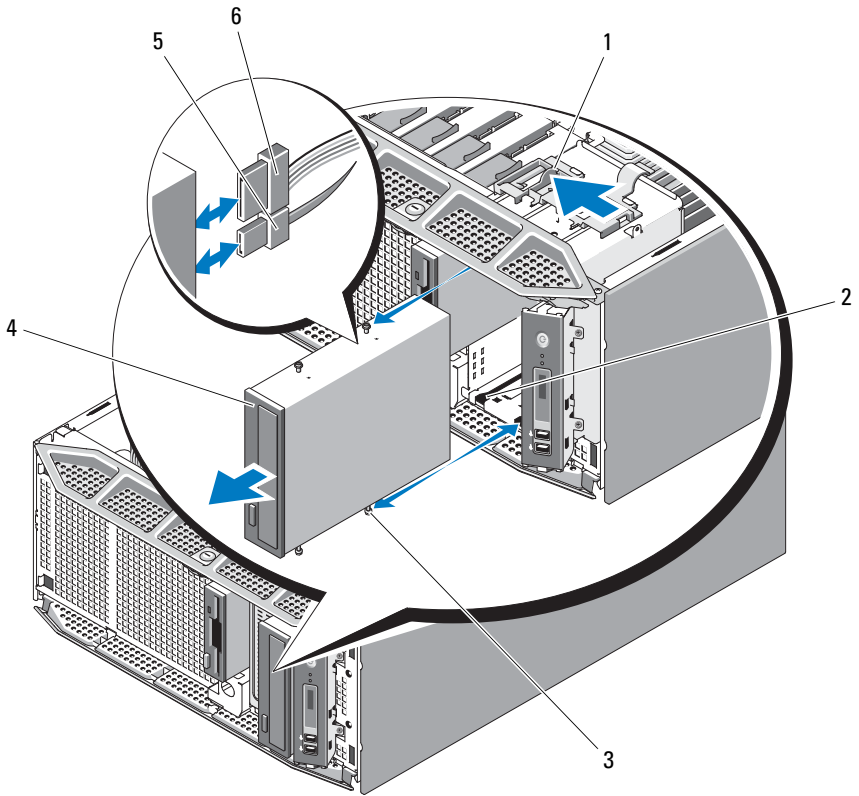
- 5 Slide the drive release latch in the direction of the arrow to release the shoulder screws.
- 6 Slide the drive out to remove it from the drive bay.

**Figure 3-18. Removing and Installing an Optical or Tape Drive (SCSI or PATA Connection)**



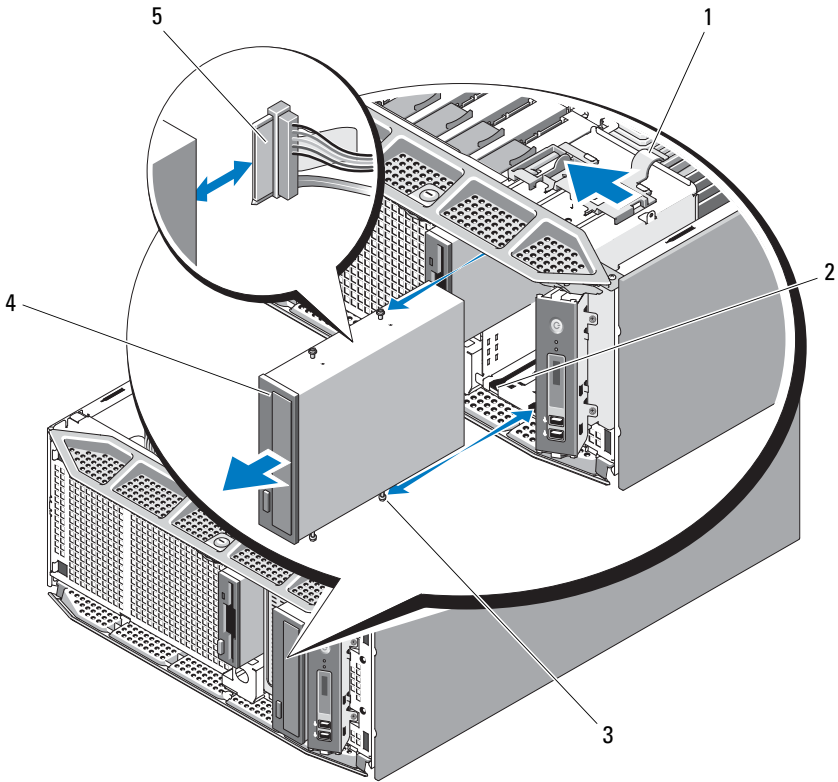
- |   |                        |   |                       |
|---|------------------------|---|-----------------------|
| 1 | drive release latch    | 2 | drive bay screw slots |
| 3 | drive alignment screws | 4 | optical/tape drive    |
| 5 | data cable             | 6 | power cable           |

**Figure 3-19. Removing and Installing an Optical Drive (SATA Connection)**



- |   |                        |   |                       |
|---|------------------------|---|-----------------------|
| 1 | drive release latch    | 2 | drive bay screw slots |
| 3 | drive alignment screws | 4 | optical drive         |
| 5 | data cable             | 6 | power cable           |

**Figure 3-20. Removing and Installing a Tape Drive (SAS Connection)**



- |   |                        |   |                       |
|---|------------------------|---|-----------------------|
| 1 | drive release latch    | 2 | drive bay screw slots |
| 3 | drive alignment screws | 4 | SAS tape drive        |
| 5 | SAS cable              |   |                       |

- 7 If you are installing another drive in the bay, see "Installing an Optical or Tape Drive" on page 101.
- 8 If the drive is being permanently removed, install an insert on the front drive bezel. See "Installing an Insert on the Front Drive Bezel" on page 67.
- 9 Replace the front drive bezel. See "Installing the Front Drive Bezel" on page 66.

- 10 Close the system. See "Closing the System" on page 70.
- 11 Place the system upright and on its feet on a flat, stable surface.
- 12 Reattach any peripherals, then connect the system to the electrical outlet.
- 13 Turn on the system and attached peripherals.

## Installing an Optical or Tape Drive



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

- 1 Unpack the drive and prepare it for installation. For instructions, see the documentation that accompanied the drive.

If you are installing a SCSI tape drive, you must have a SCSI controller card installed (see "Installing an Expansion Card" on page 111). You must configure the tape drive according to the documentation that came with the tape drive, based on the following guidelines:

- a Each device attached to a SCSI host adapter must have a unique SCSI ID number (narrow SCSI devices use IDs 0 to 7; wide SCSI devices use IDs from 0 to 15). Set the drive's SCSI ID to avoid conflicts with other devices on the SCSI bus. For the default SCSI ID setting, see the documentation provided with the drive.

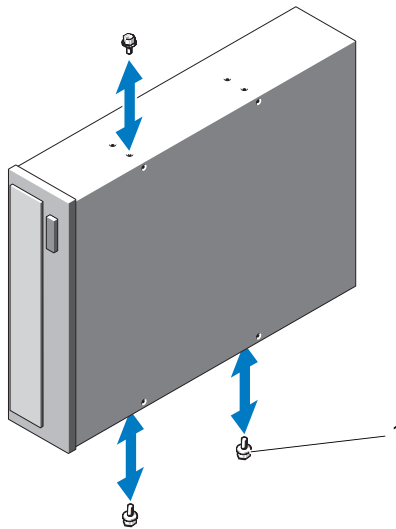


**NOTE:** There is no requirement that SCSI ID numbers be assigned sequentially or that devices be attached to the cable in order by ID number.

- b SCSI logic requires that the two devices at opposite ends of a SCSI chain be terminated and that all devices in between be unterminated. Therefore, you enable the tape drive's termination if it is the last device in a chain of devices (or sole device) connected to the SCSI controller.
- 2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet and peripherals.
  - 3 Open the system. See "Opening the System" on page 68.
  - 4 Remove the front drive bezel. See "Removing the Front Drive Bezel" on page 66.

- 5 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 6 If another drive is installed, remove it (see "Removing an Optical or Tape Drive" on page 97) and remove the three shoulder screws to attach to the new drive (see Figure 3-21).
- 7 If the drive bay is empty, remove the insert on the front drive bezel. See "Removing an Insert on the Front Drive Bezel" on page 67.
- 8 Remove the three shoulder screws from the insert, and attach one of them to the top row of holes and two to the bottom row of holes on the drive. See Figure 3-21.

**Figure 3-21. Installing Optical or Tape Drive Shoulder Screws**



1 screws (3)

- 9 Gently slide the drive into place until you hear a click or feel the drive securely installed.

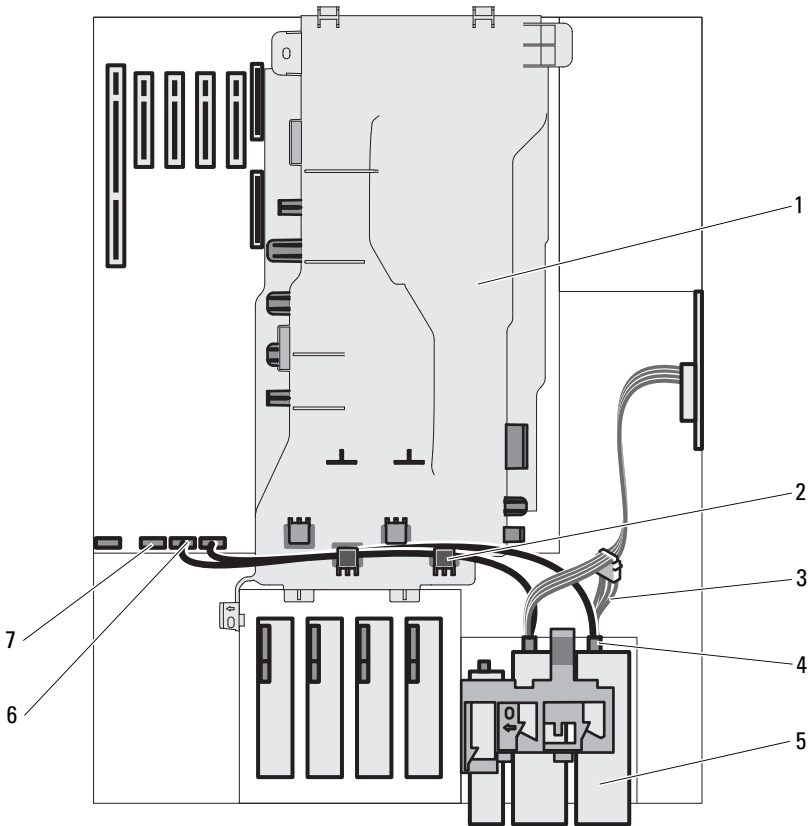
**10** Attach the power cable to the drive:

- If you are installing a SATA tape drive, connect one end of the IDE/SATA power cable adapter to the IDE power cable in the system, and connect the other end to the drive.
- If you are installing an optical drive, SAS tape drive, or SCSI tape drive, attach the SCSI/PATA power cable (see Figure 3-18), SATA power cable (see Figure 3-19), or SAS cable (see Figure 3-20) to the drive. Ensure that cables are secured in their respective clips.

**11** Attach the data cable, and check the cable connections:

- If you are installing a SATA optical or tape drive, connect the cable from the SATA connector on the system board to the drive. See Figure 3-19 for SATA drive connections; see Figure 3-22 for SATA cabling guidelines.

**Figure 3-22. Cabling SATA Optical or Tape Drives**

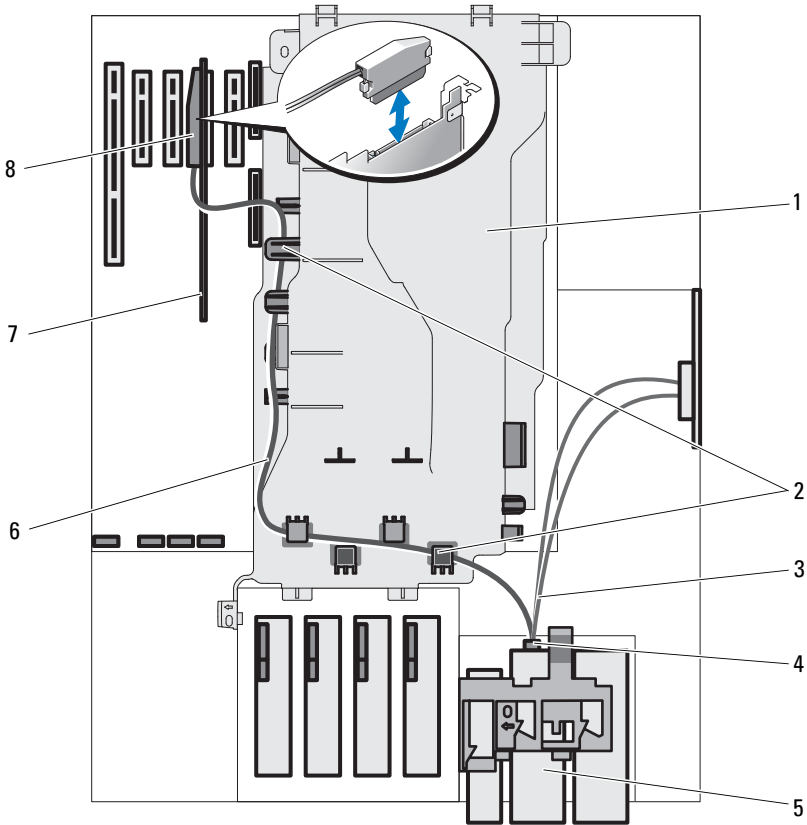


- |   |                                  |   |                                  |
|---|----------------------------------|---|----------------------------------|
| 1 | processor shroud                 | 2 | shroud cable guides              |
| 3 | SATA power cable                 | 4 | SATA drive connector             |
| 5 | SATA optical/tape drive          | 6 | SATA_D connector on system board |
| 7 | SATA_C connector on system board |   |                                  |

- If you are installing a SAS tape drive, connect the cable from the connector on the SAS expansion card to the tape drive. See Figure 3-20 for SAS drive connections; see Figure 3-23 for SAS cabling guidelines.



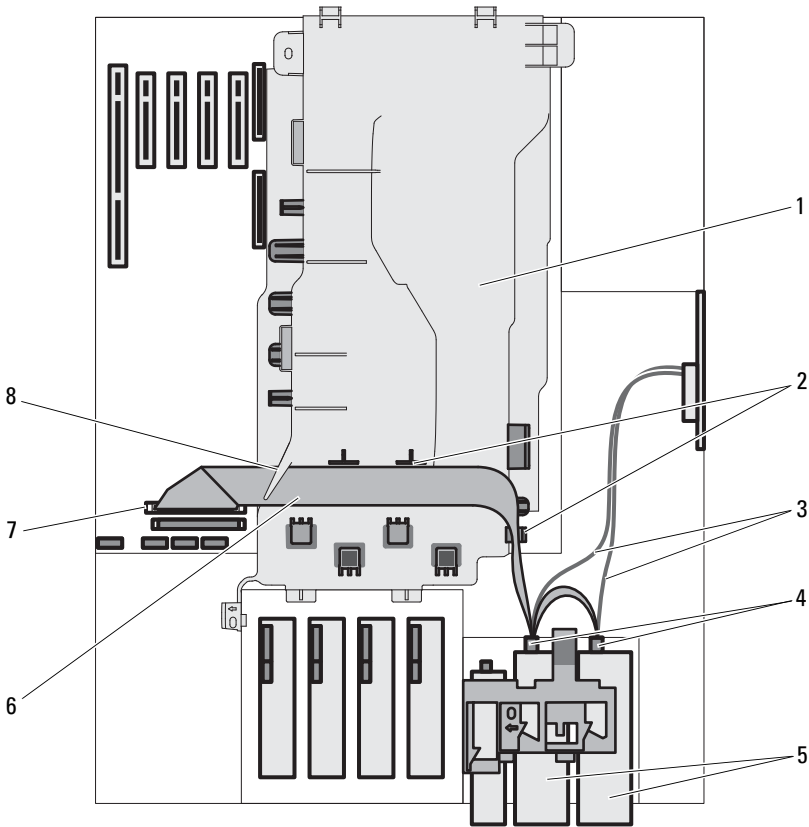
**Figure 3-23. Cabling a SAS Tape Drive**



- |   |                    |   |                                 |
|---|--------------------|---|---------------------------------|
| 1 | processor shroud   | 2 | shroud cable guides             |
| 3 | SAS power cable    | 4 | SAS drive connector             |
| 5 | SAS tape drive     | 6 | SAS data cable                  |
| 7 | SAS expansion card | 8 | SAS connector on expansion card |

- If you are installing a PATA optical drive, connect the data cable from the IDE connector on the system board to the optical drive. See Figure 3-18 for PATA drive connections; see Figure 3-24 for PATA cabling guidelines.

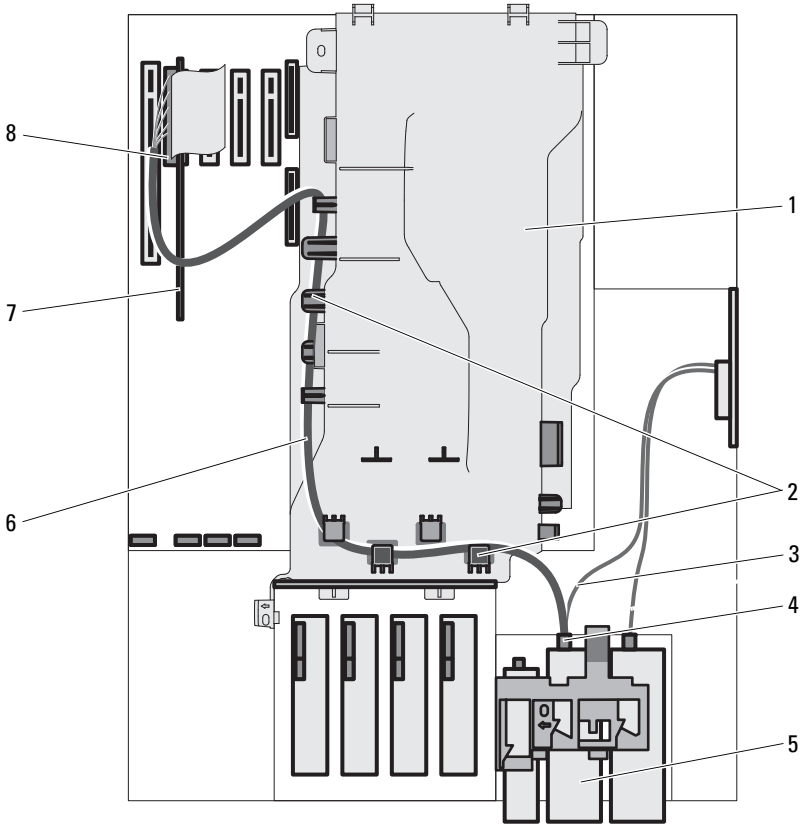
**Figure 3-24. Cabling a PATA Optical Drive**



- |   |                               |   |                       |
|---|-------------------------------|---|-----------------------|
| 1 | processor shroud              | 2 | ribbon cable guides   |
| 3 | IDE power cables              | 4 | PATA drive connectors |
| 5 | PATA optical drives           | 6 | PATA data cable       |
| 7 | IDE connector on system board | 8 | ribbon cable notch    |

- If you are installing a SCSI tape drive, connect the SCSI interface cable in the drive kit from the SCSI controller card to the drive. See Figure 3-18 for SCSI drive connections; see Figure 3-25 for SCSI cabling guidelines.

**Figure 3-25. Cabling a SCSI Tape Drive**



- |   |                     |   |                               |
|---|---------------------|---|-------------------------------|
| 1 | processor shroud    | 2 | shroud cable guides           |
| 3 | power cable         | 4 | SCSI drive connector          |
| 5 | SCSI tape drive     | 6 | SCSI data cable               |
| 7 | SCSI expansion card | 8 | SCSI expansion card connector |

**12** Replace the front drive bezel. See "Installing the Front Drive Bezel" on page 66.

**13** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.

- 14 Close the system. See "Closing the System" on page 70.
- 15 Place the system upright and on its feet on a flat, stable surface.
- 16 Reattach any peripherals, then connect the system to the electrical outlet.
- 17 Turn on the system and attached peripherals.
- 18 (Optional) Test the drive by running the system diagnostics. See "Running the System Diagnostics" on page 193.

## Expansion Cards

The system board can accommodate up to five expansion cards:

- One 3.3-V, full-length PCI-X (slot 5)
- Three 3.3-V, half-length PCIe x4 (slots 1 through 3)
- One 3.3-V, half-length PCIe x8 (slot 4)



**NOTE:** Slot 1 is reserved for an optional RAC card and slot 2 is reserved for an optional SAS/RAID card.

See Figure 6-1 for the location of the expansion card slots.

### 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.

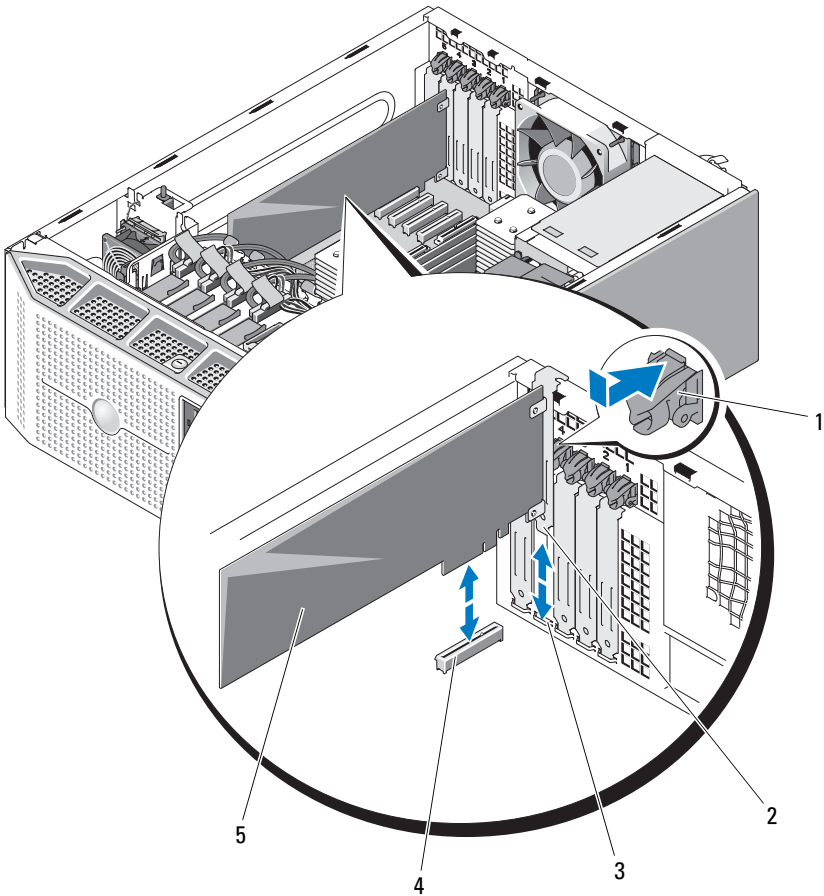
- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 Open the expansion card latch adjacent to the slot. See Figure 3-26.
- 5 If necessary, disconnect any cables from the card.
- 6 Grasp the card by its top corners and ease it out of its connector.

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



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

**Figure 3-26. Removing and Installing an Expansion Card**



- |   |                           |   |                          |
|---|---------------------------|---|--------------------------|
| 1 | expansion card latch      | 2 | expansion card tab       |
| 3 | expansion card guide slot | 4 | expansion card connector |
| 5 | expansion card            |   |                          |
- 
- 8** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
  - 9** Close the system. See "Closing the System" on page 70.
  - 10** Place the system upright and on its feet on a flat, stable surface.

- 11 Reattach any peripherals, then connect the system to the electrical outlet.
- 12 Turn on the system and attached peripherals.
- 13 Remove the card's device driver from the operating system.

## Installing an Expansion Card



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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 If you are installing a new card, remove the filler bracket.



**NOTE:** Keep this bracket in case you need to remove the expansion card.

Filler brackets must be installed over empty expansion-card slots to maintain FCC certification of the system. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

- 5 Prepare the card for installation.

See the documentation that came with the card for information on configuring the card, making internal connections, or otherwise customizing it for your system.

- 6 Open the expansion-card latch adjacent to the slot. See Figure 3-26.
- 7 Insert the card into the expansion card connector on the system board and press down firmly. Ensure that the card is fully seated in the guide slot. See Figure 6-1 for the location of the five expansion card connectors.
- 8 Close the expansion-card latch to secure the card in the system.




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

- 9 Connect any cables that should be attached to the card.  
See the documentation for the card for information about the card's cable connections.
- 10 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 11 Close the system. See "Closing the System" on page 70.
- 12 Place the system upright and on its feet on a flat, stable surface.
- 13 Reattach any peripherals, then connect the system to the electrical outlet.
- 14 Turn on the system and attached peripherals.
- 15 Install any device drivers required for the card as described in the documentation for the card.

## SAS Controller Card

Your system can have an optional SAS controller expansion card that provides the SAS storage subsystem for your system's internal or hot-plug (when available) hard drives. The controller supports either all-SAS or all-SATA hard drive configurations. The controller also enables you to set up the hard drives in RAID configurations as supported by the version of the SAS controller included with your system. Both RAID and non-RAID versions of the controller are available for your system. A SAS/RAID controller card can only be installed in its dedicated slot (slot 2) on the system board. See the RAID user documentation for information on the available RAID configurations and for instructions on how to set up a RAID.

### Installing a SAS Controller Card

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

 **NOTICE:** When installing a SAS/RAID controller, do not press on the RAID card DIMM while installing the RAID card into the system board.





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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.

- 4 Prepare the card for installation.

See the documentation that came with the card for information on configuring the card, making internal connections, or otherwise customizing it for your system.

- 5 Open the expansion card retainer adjacent to the slot. See Figure 3-26.
- 6 Insert the SAS card into the expansion card connector on the system board and press down firmly (a SAS/RAID card can only be installed in slot 2). See Figure 3-26. Ensure that the card is fully seated in the slot. See Figure 6-1 for the location of the expansion card slots on the system board.
- 7 Close the expansion-card retainer to secure the card in the system.



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

- 8 Your SAS controller card can either be cabled directly to the internal hard drives, or cabled to the SAS/SATA backplane if your system has a lever-release hard drive bay (when available).

Using the appropriate interface cable, attach one end of the cable to connector 0 on the SAS controller card and the other end to either the internal hard drives or the SAS/SATA backplane connector.

- See Figure 3-12 for SAS cabling guidelines to the internal hard drives.
- See Figure 3-27 for SAS cabling guidelines to the SAS/SATA backplane.

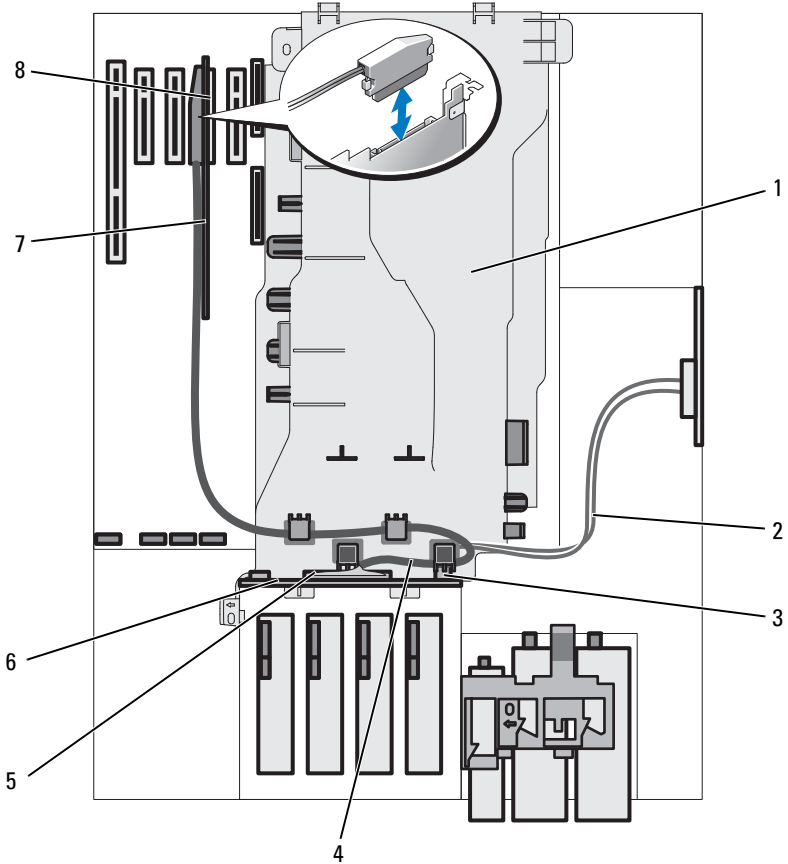


**NOTE:** Be sure to connect the cable according to the connector labels on the cable. The cable is not operational if reversed.

- 9 If applicable, connect the LED cable from the SAS controller card to the system board connector (PERC\_LED). See Figure 6-1 to locate the connector.

10 Install any device drivers required for the card as described in the documentation for the card.

**Figure 3-27. SAS Controller Card Cabling to SAS/SATA backplane**



- |   |                                    |   |   |
|---|------------------------------------|---|---|
| 1 | processor shroud                   | 2 | SAS/SATA backplane power cable (routed under processor shroud)  |
| 3 | SAS/SATA backplane power connector | 4 | SAS data cable (routed through hole in top of processor shroud) |
| 5 | SAS/SATA backplane data connector  | 6 | SAS/SATA backplane  |
| 7 | SAS controller card                | 8 | SAS controller card connector                                   |

- 11 For battery-cached SAS/RAID controllers, install the RAID battery. See "Installing a RAID Battery" on page 116.
- 12 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 13 Close the system. See "Closing the System" on page 70.
- 14 Place the system upright and on its feet on a flat, stable surface.
- 15 Reattach any peripherals, then connect the system to the electrical outlet.
- 16 Turn on the system and attached peripherals.

## Removing a SAS Controller Card

- 1 Disconnect the SAS cable, LED cable, and RAID battery cable (if applicable) from the SAS controller card.
- 2 Grasp the card by its top corners and ease it out of its connector. See "Removing an Expansion Card" on page 108.
- 3 If you are removing the card permanently, install a filler bracket in the empty card slot.



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

- 4 If applicable, remove the RAID battery from the battery holder. See "Installing and Removing a RAID Battery" on page 117.

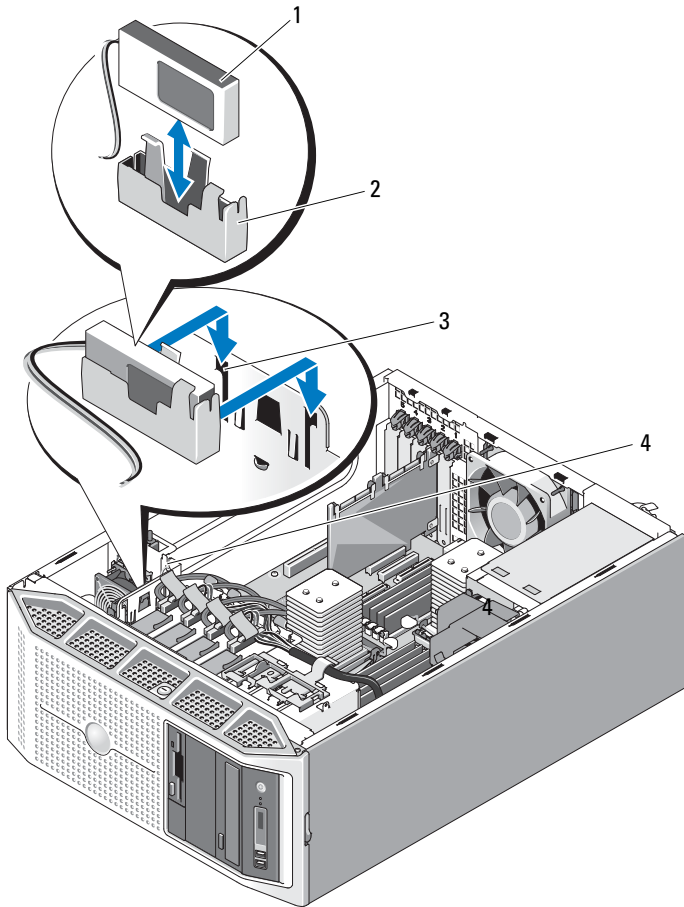
## RAID Battery

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

## Installing a RAID Battery

- 1** Insert the RAID battery into the battery carrier. See Figure 3-28.
- 2** Locate the battery bay towards the front of the chassis next to the hard drive bay (see Figure 3-28).
- 3** Insert the battery carrier and RAID battery into the system's battery carrier slots, ensuring that the battery carrier is aligned and fully seated in the slots.
- 4** Connect the battery cable to the SAS/RAID controller card. See the documentation for your card for more information.
- 5** Route the battery cable through the cable guides on the side of the processor shroud and through the battery cable slot in the chassis. See Figure 3-28 for the slot location.

**Figure 3-28. Installing and Removing a RAID Battery**



- |   |                           |   |                    |
|---|---------------------------|---|--------------------|
| 1 | RAID battery              | 2 | battery carrier    |
| 3 | battery carrier slots (2) | 4 | battery cable slot |

### **Removing a RAID Battery**

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

- 2 Pull the battery carrier upwards and out of the battery carrier slots on the chassis. See Figure 3-28.
- 3 Pull back gently on the two guides holding the RAID battery in the battery carrier and draw out the RAID battery from the battery carrier. See Figure 3-28.

## Configuring the Boot Device



**NOTE:** System boot is not supported from an external device attached to a SAS or SCSI adapter. See [support.dell.com](http://support.dell.com) for the latest support information about booting from external devices.

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

The System Setup program provides options that the system uses to scan for installed boot devices. See "Using the System Setup Program" on page 43 for information about the System Setup program.

## RAC Card

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

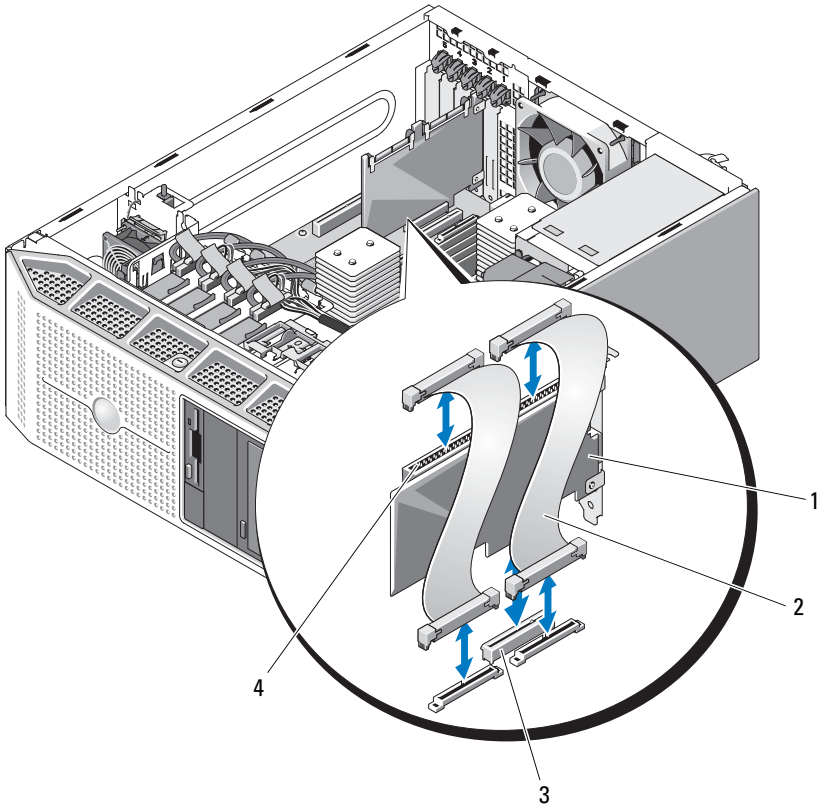
### Removing the RAC Card




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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 Disconnect the two short ribbon cables to the RAC card. See Figure 3-29.


**Figure 3-29. Removing and Installing a RAC Card**




- 1 RAC card
  - 2 RAC card cables (2)
  - 3 RAC card connector
  - 4 RAC card cable connectors (2)
- 5** Remove the RAC card from the expansion slot. See "Removing an Expansion Card" on page 108 for information on removing the card.

- 6 If you are not replacing the RAC card, disconnect and remove the ribbon cables from the system board.
-  **NOTICE:** When detaching the RAC cables from the system board, squeeze the metal ends of the cable connectors and gently work the connector out of the socket. Do not pull on the cable to unseat the connector. Doing so can damage the cable.
- 7 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 8 Close the system. See "Closing the System" on page 70.
- 9 Place the system upright and on its feet on a flat, stable surface.
- 10 Reattach any peripherals, then connect the system to the electrical outlet.
- 11 Turn on the system and attached peripherals.

## Installing a RAC Card

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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
  - 2 Open the system. See "Opening the System" on page 68.
  - 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
  - 4 Install the RAC card in expansion slot 1. See "Installing an Expansion Card" on page 111 for information on installing the card. See Figure 6-1 for the expansion slot location.
  - 5 Connect the two short ribbon cables to the system board and then to the RAC card. See Figure 6-1 for the connector locations.
-  **NOTICE:** Be careful when attaching cables to the system board that you do not damage the surrounding system board components.
- a Connect one cable to the RAC\_CONN1 connector on the system board and to connector 1 on the RAC card.



- b Connect the second cable to the RAC\_CONN2 connector on the system board and to connector 2 on the RAC card.
- 6 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 7 Close the system. See "Closing the System" on page 70.
- 8 Place the system upright and on its feet on a flat, stable surface.
- 9 Reattach any peripherals, then connect the system to the electrical outlet.
- 10 Turn on the system and attached peripherals.


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

## Internal USB Memory Key Connector

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

To boot from the USB memory key, you must configure the USB memory key with a boot image and then specify the USB memory key in the boot sequence in the System Setup program. See "System Setup Options" on page 44. For information on creating a bootable file on the USB memory key, see the user documentation that accompanied the USB memory key.

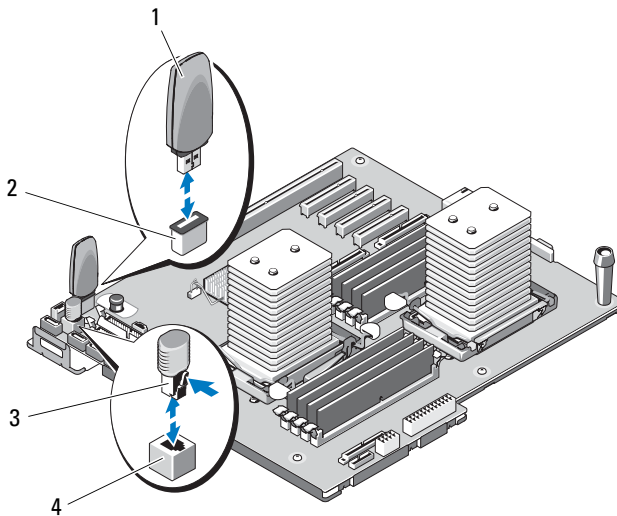
### Installing the Optional Internal USB Memory Key

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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.

- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 Locate the USB connector on the system board (see Figure 6-1).
- 5 Insert the USB memory key into the USB connector on the board. See Figure 3-30.
- 6 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 7 Close the system. See "Closing the System" on page 70.
- 8 Place the system upright and on its feet on a flat, stable surface.
- 9 Reattach any peripherals, then connect the system to the electrical outlet.
- 10 Turn on the system and attached peripherals.
- 11 Enter the System Setup program and verify that the USB key has been detected by the system. See "Using the System Setup Program" on page 43.

**Figure 3-30. Installing an Internal USB Key or NIC TOE key**



- 1 USB memory key
- 3 TOE key

- 2 internal USB connector
- 4 internal TOE connector


## Integrated TOE

The TCP/IP Offload Engine (TOE) functionality of the system's integrated NIC is activated by the TOE hardware key installed in the TOE socket on the system board. See Figure 3-30 for installing or removing the TOE key; see Figure 6-1 for the socket location on the system board. See the user documentation that came with the hardware key for information on how to set up and configure the TOE feature.

## Cooling Fans

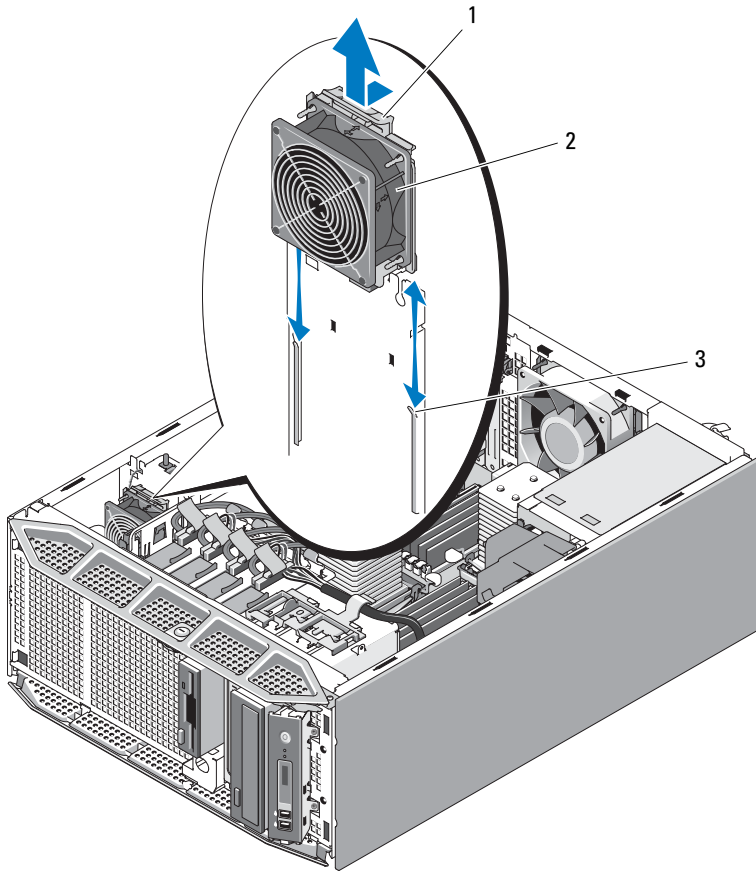
The system contains two cooling fans, an expansion card fan for the expansion cards, and a system fan for the processor and memory modules.

### Removing the Expansion Card Fan

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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 If present, remove the RAID battery and battery carrier. See "Installing and Removing a RAID Battery" on page 117.
- 5 Disconnect the fan's power cable from the system board, and un-route the cable from the adjacent slot on the chassis.
- 6 Press and hold the fan release tab, and slide the fan up and out of the securing slots (see Figure 3-31).
- 7 Replace the expansion card fan. See "Installing the Expansion Card Fan" on page 124.

**Figure 3-31. Removing and Installing the Expansion Card Fan**



- 1 fan release tab
- 3 securing slots

- 2 expansion card fan

### **Installing the Expansion Card Fan**

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

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

- 1 Hold the replacement fan with the fan cable on the top side, and align the edges of the fan with the securing slots on the chassis.
- 2 Slide the fan down into the securing slots until the fan release tab locks into place. See Figure 3-31.
- 3 Route the fan power cable through the adjacent slot in the chassis, and connect the cable to the FAN\_1 connector on the system board (see Figure 6-1 for the connector location).
- 4 If a RAID battery was previously installed, re-install it. See "Installing a RAID Battery" on page 116.
- 5 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 6 Close the system. See "Closing the System" on page 70.
- 7 Place the system upright and on its feet on a flat, stable surface.
- 8 Reattach any peripherals, then connect the system to the electrical outlet.
- 9 Turn on the system and attached peripherals.

## Removing the System Fan

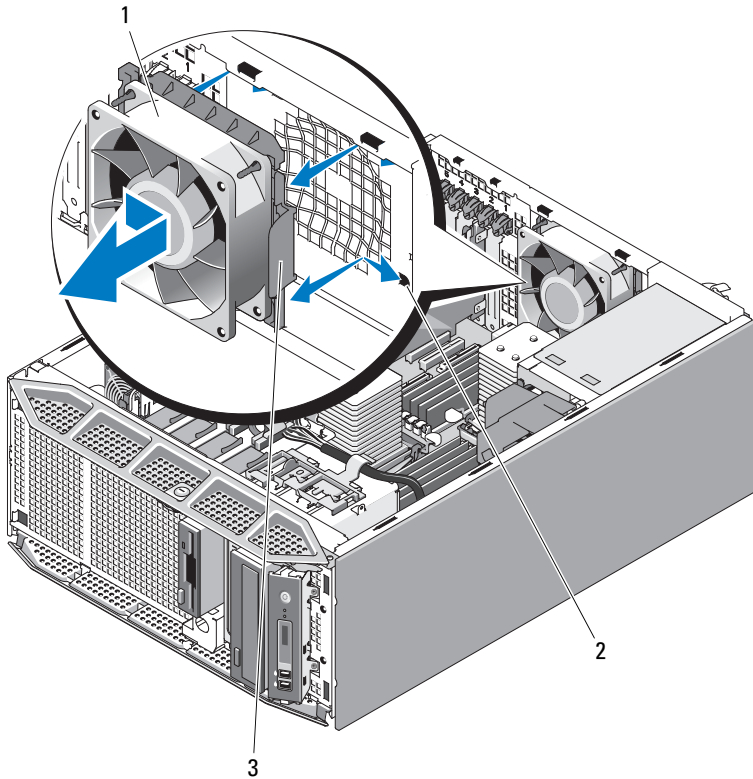


**CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 Remove the processor shroud. See "Removing the Processor Shroud" on page 72.
- 5 Disconnect the fan's power cable from the system board.

- 6 Press and hold the fan release tab, and slide the fan in the direction of the arrow and out of the securing slots (see Figure 3-32).
- 7 Replace the system fan. See "Installing the System Fan" on page 126.

**Figure 3-32. Removing and Installing the System Fan**



- |   |                 |   |                |
|---|-----------------|---|----------------|
| 1 | system fan      | 2 | securing slots |
| 3 | fan release tab |   |                |

### Installing the System Fan



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

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

- 1** Hold the replacement fan with the fan cable on the left side (opposite of the power supply), and align the edges of the fan with the securing slots.
- 2** Slide the fan left into the securing slots until the fan release tab locks into place. See Figure 3-32.
- 3** Connect the cable to the FAN\_2 connector on the system board (see Figure 6-1 for the connector location).
- 4** Install the processor shroud. See "Installing the Processor Shroud" on page 74.
- 5** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 6** Close the system. See "Closing the System" on page 70.
- 7** Place the system upright and on its feet on a flat, stable surface.
- 8** Reattach any peripherals, then connect the system to the electrical outlet.
- 9** Turn on the system and attached peripherals.

# System Memory

You can upgrade your system memory to a maximum of 16 GB (for a one-processor configuration) or 32 GB (for a two-processor configuration). You can install 667-MHz registered parity DDR2 memory modules (DIMMs) in sets of 512-MB, 1-GB, 2-GB, or 4-GB modules. The memory sockets are located on the system board under the processor shroud and are split into two separate groups of four sockets each. Each four-socket group is adjacent to its respective processor.

## General Memory Module Installation Guidelines

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

- Memory must be installed in configurations of two, four, or eight DIMMs. The minimum configuration for a two-processor system is four DIMMs.
- DIMMs must be installed in matched pairs of identical speed, technology, and size in the following pairs of sockets:
  - DIMM A1 and DIMM A2
  - DIMM A3 and DIMM A4
  - DIMM B1 and DIMM B2
  - DIMM B3 and DIMM B4
- Minimum configurations must occupy the lower-numbered sockets (DIMM A1 and DIMM A2 for a one-processor configuration and also DIMM B1 and DIMM B2 for a two-processor configuration).

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



**Table 3-1. Memory Configurations**

Total System Memory		DIMM Socket			
Single-Processor System	Dual-Processor System	DIMM A1/ DIMM B1	DIMM A2/ DIMM B2	DIMM A3/ DIMM B3	DIMM A4/ DIMM B4
1 GB	2 GB	512 MB	512 MB		
2 GB	4 GB	512 MB	512 MB	512 MB	512 MB
2 GB	4 GB	1 GB	1 GB		
4 GB	8 GB	1 GB	1 GB	1 GB	1 GB
4 GB	8 GB	2 GB	2 GB		
6 GB	12 GB	2 GB	2 GB	1 GB	1 GB
8 GB	16 GB	2 GB	2 GB	2 GB	2 GB
8 GB	16 GB	4 GB	4 GB		
12 GB	24 GB	4 GB	4 GB	2 GB	2 GB
16 GB	32 GB	4 GB	4 GB	4 GB	4 GB

## Memory Sparing Support

Memory sparing is supported in single- or dual-processor systems that have one of the fully populated memory configurations shown in Table 3-1. The memory sparing feature must be enabled in the **Memory Information** screen of the System Setup program. See "Entering the System Setup Program" on page 43. To use memory sparing, you must disable node interleaving.

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

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

Memory sparing allocates only the first rank of memory of a DIMM. For a single-rank DIMM, the entire capacity of the DIMM must be allocated for sparing along with the adjacent single-rank DIMM to spare a memory

channel. For dual-rank DIMMs, two DIMMs are also required for sparing, but as only the first rank of each DIMM is allocated, only half of a dual-rank DIMM's capacity is allocated for sparing. The second ranks on both DIMMs are available memory.

Memory sparing calculates the appropriate DIMMs to spare by searching the DIMM sockets, starting with the higher-numbered socket pair (specifically, sockets A3 and A4 or sockets B3 and B4), for an amount of memory large enough to spare one of the available channels of memory. If the DIMMs in these sockets are sufficient to spare a channel of the available memory, the first rank of each of those two DIMMs are spared. If the amount of memory is not large enough to spare an available memory channel, the system spares the DIMM ranks in the lower-numbered sockets. Table 3-2 shows how memory sparing works in various memory configurations.

**Table 3-2. Memory Sparing in Single- and Dual-Processor Configurations**

Processor 1				Processor 2				Available Memory	Spared Memory
DIMM A1	DIMM A2	DIMM A3	DIMM A4	DIMM B1	DIMM B2	DIMM B3	DIMM B4	1 CPU / 2 CPUs	1 CPU / 2 CPUs
512 MB	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB	1 GB / 2 GB	1 GB / 2 GB
1 GB	1 GB	1 GB	1 GB	1 GB	1 GB	1 GB	1 GB	2 GB / 4 GB	2 GB / 4 GB
2 GB	2 GB	2 GB	2 GB	1 GB	1 GB	1 GB	1 GB	4 GB / 8 GB	2 GB / 4 GB
2 GB	2 GB	2 GB	2 GB	2 GB	2 GB	2 GB	2 GB	4 GB / 8 GB	2 GB / 4 GB
4 GB	4 GB	4 GB	4 GB	4 GB	4 GB	4 GB	4 GB	8 GB / 16 GB	4 GB / 8 GB




Indicates a spared single-rank DIMM (512-MB, 1-GB, or 2-GB). The entire capacity of this DIMM is reserved for sparing.




Indicates a spared dual-rank DIMM (2-GB and higher). One-half of this DIMM's capacity is reserved for sparing.


## Installing Memory Modules

 **CAUTION:** 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 and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 Remove the processor shroud. See "Removing the Processor Shroud" on page 72.

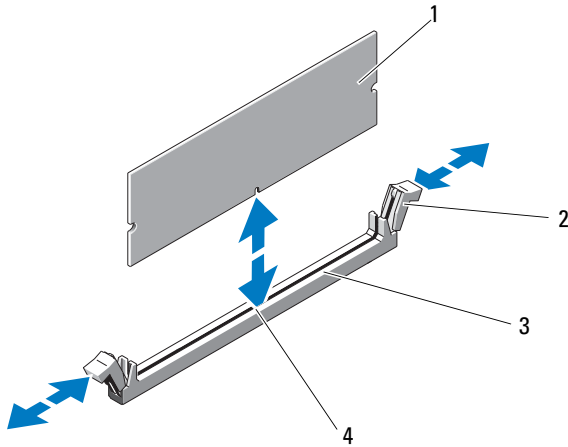
 **NOTICE:** Never remove the expansion card shroud or processor shroud without first powering down the system. Overheating of the system can develop quickly resulting in a shutdown of the system and the loss of data.

- 5 Locate the memory module sockets on the system board. See Figure 6-1.

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

- 6 Press the ejectors on the memory module socket down and out, as shown in Figure 3-33, to allow the memory module to be inserted into the socket.

**Figure 3-33. Installing and Removing a Memory Module**



- |   |                      |   |                                   |
|---|----------------------|---|-----------------------------------|
| 1 | memory module        | 2 | memory module socket ejectors (2) |
| 3 | memory module socket | 4 | alignment key                     |


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

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


- 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.


- Repeat step 6 through step 8 of this procedure to install the remaining memory modules.
- Install the processor shroud. See "Installing the Processor Shroud" on page 74.
- Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.

-  **NOTICE:** Never operate your system with the expansion shroud or processor shroud removed. Overheating of the system can develop quickly resulting in a shutdown of the system and the loss of data.
- 12 Close the system. See "Closing the System" on page 70.
  - 13 Place the system upright and on its feet on a flat, stable surface.
  - 14 Reattach any peripherals, then connect the system to the electrical outlet.
  - 15 Turn on the system and attached peripherals.
  - 16 (Optional) Enter the System Setup program, and check the **System Memory** setting on the main **System Setup** screen. See "Entering the System Setup Program" on page 43.  
The system should have already changed the value to reflect the newly installed memory.
  - 17 If the value is incorrect, one or more of the memory modules may not be installed properly. Repeat step 2 through step 16 of this procedure, checking to ensure that the memory modules are firmly seated in their sockets.
  - 18 Run the system memory test in the system diagnostics. See "Running the System Diagnostics" on page 193.


## Removing Memory Modules

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

- 1 Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet and peripherals.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 Remove the processor shroud. See "Removing the Processor Shroud" on page 72.

 **NOTICE:** Never remove the expansion card shroud or processor shroud without first powering down the system. Overheating of the system can develop quickly resulting in a shutdown of the system and the loss of data.


5 Locate the memory module sockets on the system board. See Figure 6-1.

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

6 Press down and out on the ejectors on each end of the socket until the memory module pops out of the socket. See Figure 3-33.

7 Install the processor shroud. See "Installing the Processor Shroud" on page 74.

8 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.


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

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

## 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.

### Removing a Processor

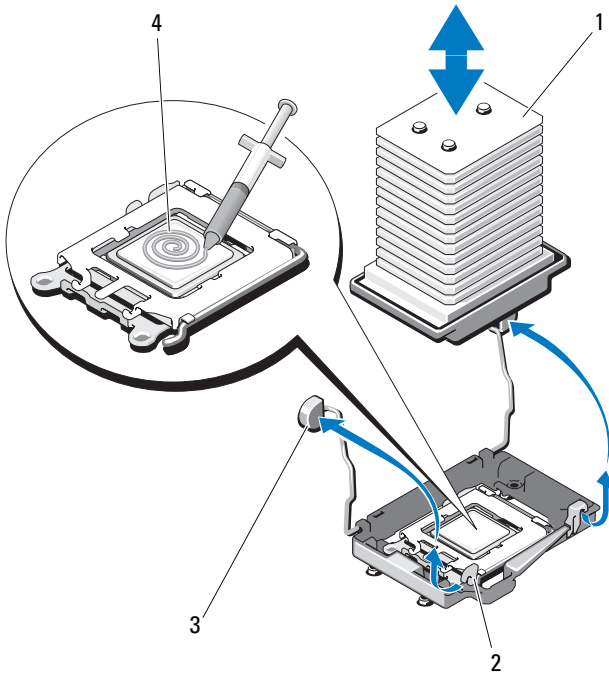
 **CAUTION:** Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell 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](http://support.dell.com).

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

- 3 Open the system. See "Opening the System" on page 68.
  - 4 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
  - 5 Remove the processor shroud. See "Removing the Processor Shroud" on page 72.
-  **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 still warm.
-  **NOTICE:** Never remove the heat sink from a processor unless you intend to remove the processor. The heat sink is necessary to maintain proper thermal conditions.
- 6 Unlatch the two heat-sink release levers by pressing down on the ends of the levers and pulling them outward, releasing them from the release lever retainers. Swing the levers up to release the heat sink. See Figure 3-34.

**Figure 3-34. Installing and Removing the Heat Sink**



- |   |                    |   |                             |
|---|--------------------|---|-----------------------------|
| 1 | heat sink          | 2 | release lever retainers (2) |
| 3 | release levers (2) | 4 | thermal grease              |

- 7 Wait 30 seconds for the heat sink to loosen from the processor.
- 8 Gently lift the heat sink off of the processor and set the heat sink aside.

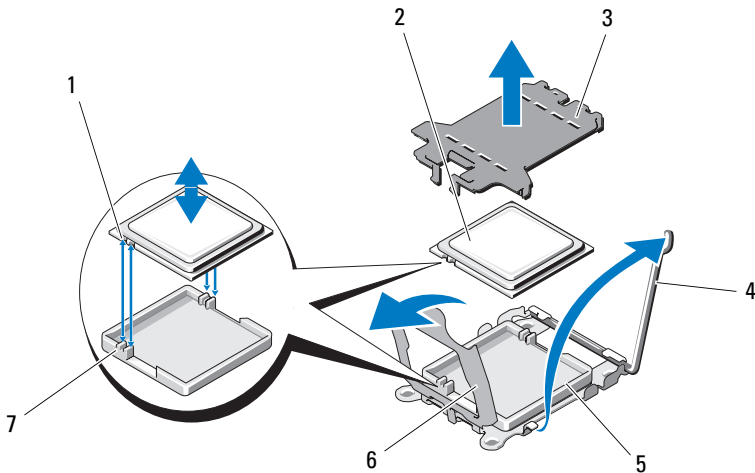
**NOTE:** Lay the heat sink on its side to avoid contaminating the thermal adhesive on the bottom of the heat sink.

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

- 9 Position your thumb firmly over the socket-release lever and release the lever from the locked position. Rotate the lever 90 degrees upward until the processor is released from the socket. See Figure 3-35.
- 10 Rotate the processor shield upward and out of the way.



**Figure 3-35. Installing and Removing a Processor**



- |                          |                        |
|--------------------------|------------------------|
| 1 notch in processor (2) | 2 processor            |
| 3 ZIF socket shield      | 4 socket-release lever |
| 5 ZIF socket             | 6 processor shield     |
| 7 socket key (2)         |                        |


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

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


### Installing a Processor

- 1 Unpack the new processor.
- 2 If you are installing a second processor for the first time, remove and discard the protective shield on top of the ZIF socket. See Figure 3-35.
- 3 Align the processor with the socket keys on the ZIF socket. See Figure 3-35.

4 Install the processor in the socket.


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

- a If the release lever on the processor socket is not positioned all the way up, move it to that position.
- b With the processor and the socket keys aligned, set the processor lightly in the socket.

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

- c Close the processor shield. See Figure 3-35.
- d When the processor is fully seated in the socket, rotate the socket release lever back down until it snaps into place, securing the processor. See Figure 3-35.

5 Install the heat sink.

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

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

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

- Using a clean lint-free cloth, remove the thermal grease from the heat sink removed from the old processor.
- Open the grease packet included with your processor kit and apply thermal grease evenly to the top of the new processor. See Figure 3-34.

- b Place the heat sink on the processor. See Figure 3-34.
- c Lower the heat-sink retainers over the edges of the heat sink. One at a time, press the tabs on the retainers down and inward until they lock into place, securing the heat sink.

- 6 Install the processor shroud. See "Installing the Processor Shroud" on page 74.
- 7 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 8 Close the system. See "Closing the System" on page 70.
- 9 Place the system upright and on its feet on a flat, stable surface.
- 10 Reattach any peripherals, then connect the system to the electrical outlet.
- 11 Turn on the system and attached peripherals.  
As the system boots, it detects the presence of the new processor and automatically changes the system configuration information in the System Setup program.
- 12 Press <F2> to enter the System Setup program, and check that the processor information matches the new system configuration. See "Entering the System Setup Program" on page 43.
- 13 Run the system diagnostics to verify that the new processor operates correctly.  
See "Running the System Diagnostics" on page 193 for information about running the diagnostics.

## System Battery

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

### Replacing the System Battery



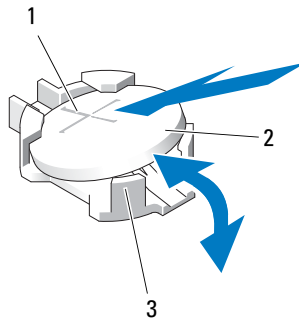
**CAUTION:** Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell 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 the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 Remove the processor shroud. See "Removing the Processor Shroud" on page 72.

**Figure 3-36. Replacing the System Battery**



- |   |                                    |   |                |
|---|------------------------------------|---|----------------|
| 1 | positive side of battery connector | 2 | system battery |
| 3 | negative side of battery connector |   |                |

- 5 Locate the battery socket. See Figure 6-1 for the socket location.

**➔ 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.

- 6 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. See Figure 3-36.



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

- 7 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. See Figure 3-36.
- 8 Install the processor shroud. See "Installing the Processor Shroud" on page 74.
- 9 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 10 Close the system. See "Closing the System" on page 70.
- 11 Place the system upright and on its feet on a flat, stable surface.
- 12 Reattach any peripherals, then connect the system to the electrical outlet.
- 13 Turn on the system and attached peripherals.
- 14 Enter the System Setup program to confirm that the battery is operating properly. See "Entering the System Setup Program" on page 43.
- 15 Enter the correct time and date in the System Setup program's **Time** and **Date** fields.
- 16 Exit the System Setup program.
- 17 To test the newly installed battery, turn off the system and disconnect it from the electrical outlet for at least an hour.
- 18 After an hour, reconnect the system to its electrical outlet and turn it on.
- 19 Enter the System Setup program and if the time and date are still incorrect, see "Getting Help" on page 205 for instructions on obtaining technical assistance.

# Chassis Intrusion Switch

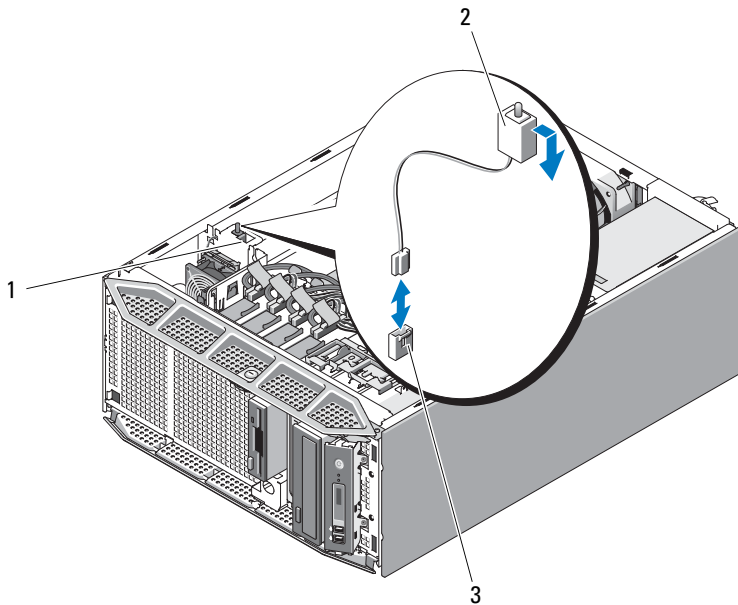
## Removing the Chassis Intrusion Switch



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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 Disconnect the chassis intrusion switch cable from the INTRUSION connector on the system board. See Figure 3-37.
- 5 Slide the chassis intrusion switch out of the securing bracket notch. See Figure 3-37.
- 6 Remove the switch and its attached cable from the system.

**Figure 3-37. Removing and Installing the Chassis Intrusion Switch**



- 1 securing bracket notch
- 2 chassis intrusion switch
- 3 INTRUSION connector on system board

### **Installing the Chassis Intrusion Switch**

- 1 Align the chassis intrusion switch with the securing bracket notch. See Figure 3-37.
- 2 Slide the switch into the securing bracket notch.
- 3 Connect the switch cable to the INTRUSION connector on the system board. See Figure 6-1 for the connector location.
- 4 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 5 Close the system. See "Closing the System" on page 70.
- 6 Place the system upright and on its feet on a flat, stable surface.

- 7 Reattach any peripherals, then connect the system to the electrical outlet.
- 8 Turn on the system and attached peripherals.

## Power Supply Distribution Board

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

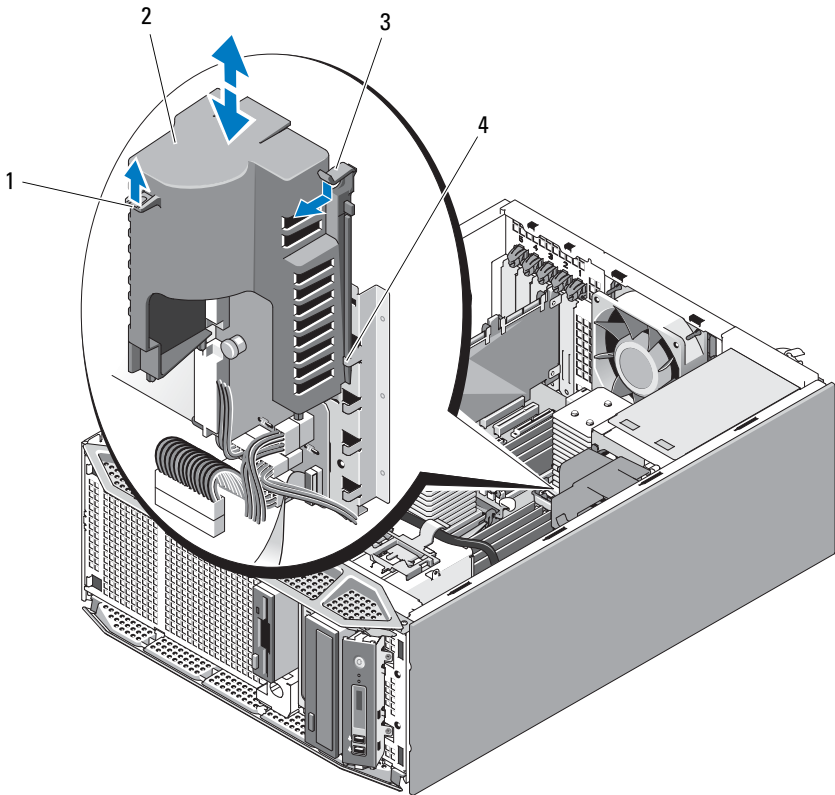
### Removing the Power Supply Distribution Board

- 1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 2 Remove the redundant power supplies. See "Removing a Redundant Power Supply" on page 76.
- 3 Open the system. See "Opening the System" on page 68.
- 4 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 5 Remove the processor shroud. See "Removing the Processor Shroud" on page 72.
- 6 Remove the power supply distribution board shroud.

Pull the release latch in the direction of the arrow. Holding the latch and the shroud touch point, lift the shroud up and out of the chassis. See Figure 3-38.



**Figure 3-38. Removing and Installing the Power Supply Distribution Board Shroud**

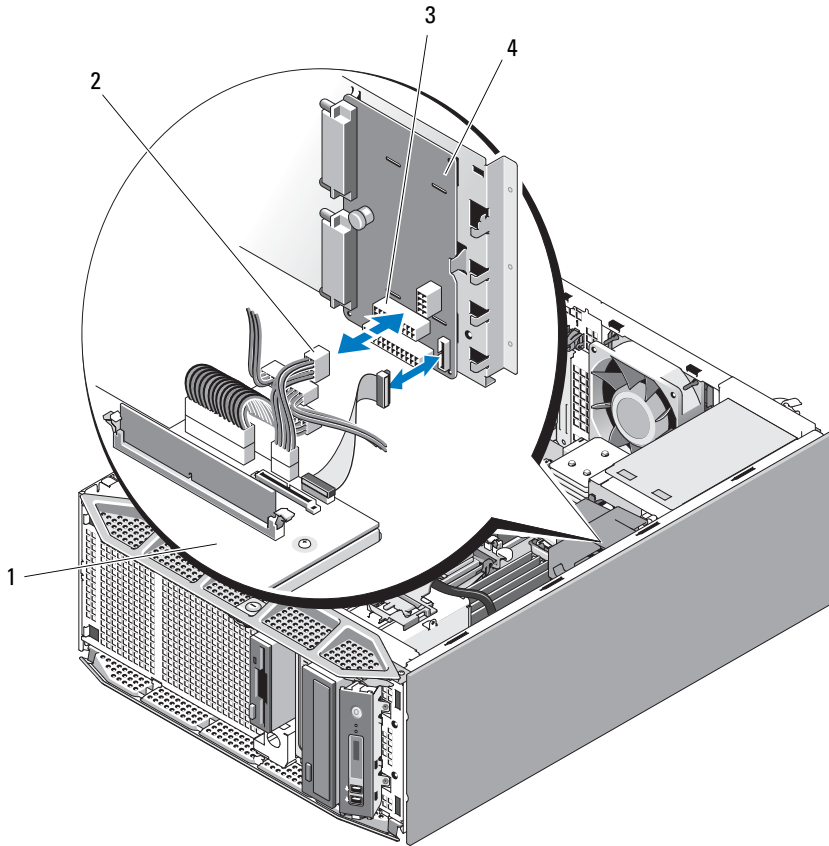


- |   |                      |   |  |
|---|----------------------|---|--|
| 1 | shroud touch point   | 2 | power supply distribution board shroud |
| 3 | shroud release latch | 4 | shroud alignment guides                |

**7** Disconnect the four power cables from the connectors on the power supply distribution board. See Figure 3-39.

If you intend to replace the power supply distribution board, leave the power cables attached to the system board.

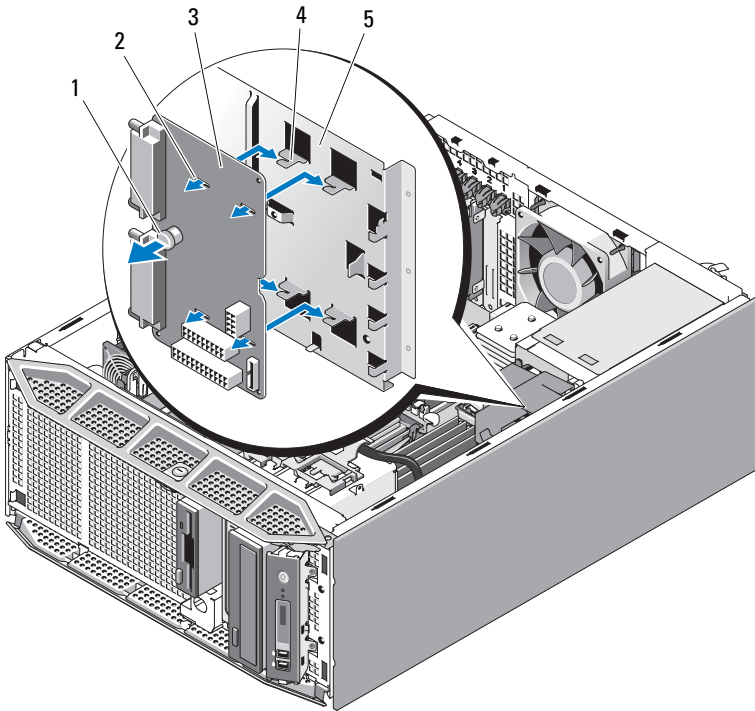
**Figure 3-39. Power Supply Distribution Board Connections**



- |   |                      |   |                                 |
|---|----------------------|---|---------------------------------|
| 1 | system board         | 2 | power cables (4)                |
| 3 | power connectors (4) | 4 | power supply distribution board |

**8** Pull and hold the blue release pin, and slide the board to the left. Pull the board away from the power supply cage until the securing slots are free from the securing tabs, and lift the board out of the chassis. See Figure 3-40.

**Figure 3-40. Removing and Installing the Power Supply Distribution Board**



- |   |                                 |   |                    |
|---|---------------------------------|---|--------------------|
| 1 | release pin                     | 2 | securing slots (4) |
| 3 | power supply distribution board | 4 | securing tabs (4)  |
| 5 | power supply cage               |   |                    |

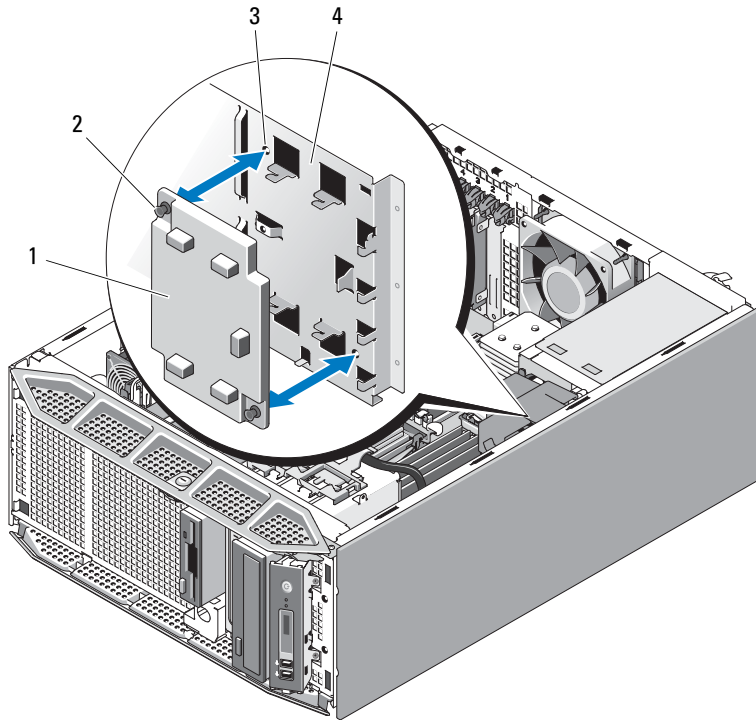
**9** If you intend to replace the redundant power supplies with a non-redundant power supply, install the power supply cage cover on the power supply cage.

- a** Press the power supply cage cover into the power supply cage until the the blue release pins lock into the release pin alignment holes. See Figure 3-41.

To remove the power supply cage cover, pull the blue release pins until the cover is free from the alignment holes, and lift the cover out of the chassis.

- b Install a non-redundant power supply. See "Installing a Non-redundant Power Supply" on page 81.

**Figure 3-41. Removing and Installing the Power Supply Cage Cover**



- |   |                                 |   |                   |
|---|---------------------------------|---|-------------------|
| 1 | power supply cage cover         | 2 | release pins (2)  |
| 3 | release pin alignment holes (2) | 4 | power supply cage |

### **Installing the Power Supply Distribution Board**


- 1 If present, remove the power supply cage cover.  
Pull the blue release pins until the cover is free from the alignment holes, and lift the cover out of the chassis. See Figure 3-41.
- 2 Position the power supply distribution board so that the securing tabs on the chassis are fully inserted into the securing slots on the board. See Figure 3-40.

- 3 Slide the power supply distribution board to the right until the blue release pin locks into place, securing the board.
- 4 Connect the four power cables from the system board to the connectors on the power supply distribution board. See Figure 3-39.
- 5 Install the power supply distribution board shroud.  
Slide the edges of the shroud under the shroud alignment guides until the release latch locks into place. See Figure 3-38.
- 6 Install the processor shroud. See "Installing the Processor Shroud" on page 74.
- 7 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 8 Close the system. See "Closing the System" on page 70.
- 9 Place the system upright and on its feet on a flat, stable surface.
- 10 Install the redundant power supplies. See "Installing a Redundant Power Supply" on page 77.
- 11 Reattach any peripherals, then connect the system to the electrical outlet.
- 12 Turn on the system and attached peripherals.

## SAS/SATA Backplane

If your system has front-loading hot-plug hard drives (when available), the system contains a SAS/SATA backplane board to which the hard drives connect.

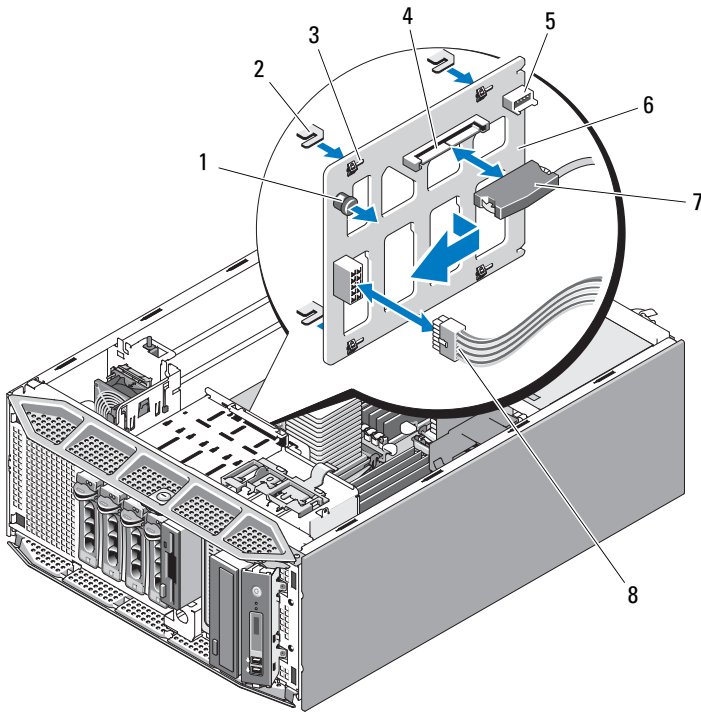
### Removing the SAS/SATA Backplane

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

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

- 2** Remove the front-drive bezel. See "Removing the Front Drive Bezel" on page 66.
- 3** Open the system. See "Opening the System" on page 68.
- 4** Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 5** Remove the processor shroud. See "Removing the Processor Shroud" on page 72.
- 6** Open the drive-carrier release handle on each hard drive and partially extend the drive(s) out of their drive bays. See "Removing a Hot-plug Hard Drive" on page 88.
- 7** Disconnect the following cables from the backplane (see Figure 3-42):
  - SAS cable
  - Power cable
  - Backplane cable
- 8** Remove the SAS/SATA backplane:
  - a** Pull the blue backplane release pin. See Figure 3-42.
  - b** While pulling the release pin, slide the backplane to the left.
  - c** Pull the backplane board until the securing slots are free from the securing tabs, and lift the board from the chassis.


**Figure 3-42. Removing and Installing the SAS/SATA Backplane**



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


### **Installing the SAS/SATA Backplane**

- 1 Position the SAS/SATA backplane so that the securing tabs on the chassis are fully inserted into the securing slots on the backplane. See Figure 3-42.
- 2 Slide the backplane to the right until the release pin snaps into place.

- 3 Reconnect the following cables to the backplane (see Figure 3-42):
  - SAS cable
  - Power cable
  - Backplane cable
- 4 Reseat the hot-plug hard drives in the system. See "Installing a Hot-plug Hard Drive" on page 89.  
 **NOTE:** Reinstall the hard drives in the same drive bays from which they were removed.
- 5 Install the processor shroud. See "Installing the Processor Shroud" on page 74.
- 6 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 7 Close the system. See "Closing the System" on page 70.
- 8 Place the system upright and on its feet on a flat, stable surface.
- 9 Install the front-drive bezel. See "Installing the Front Drive Bezel" on page 66.
- 10 Reattach any peripherals, then connect the system to the electrical outlet.
- 11 Turn on the system and attached peripherals.

## Control Panel

### Removing the Control Panel

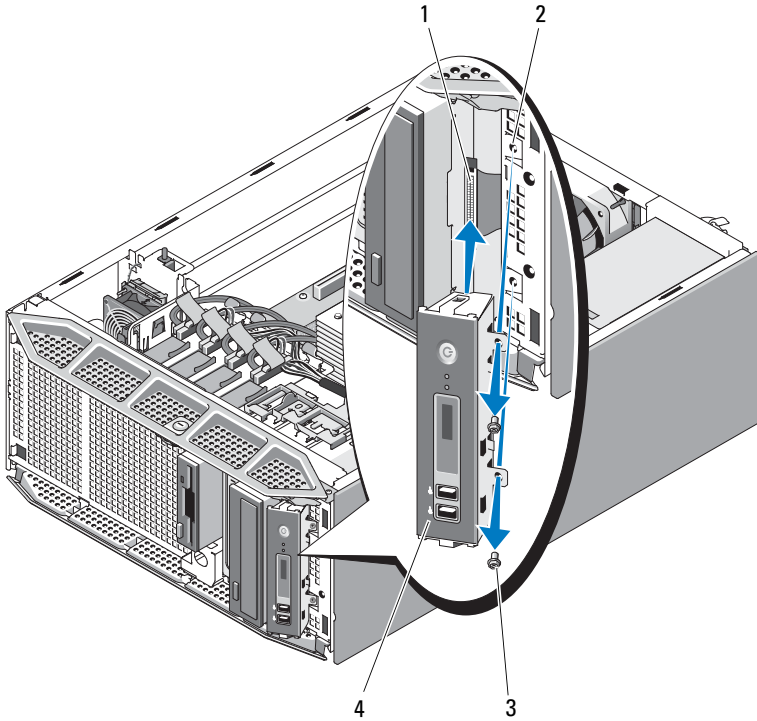
 **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 2 Remove the front-drive bezel. See "Removing the Front Drive Bezel" on page 66.
- 3 Open the system. See "Opening the System" on page 68.



- 4 Disconnect the control panel cable at back of the control panel. See Figure 3-43.
  - a Squeeze the metal tabs on the ends of the cable connector.
  - b Gently work the connector out of the socket.

**Figure 3-43. Removing and Installing the Control Panel**




- |   |                     |   |                 |
|---|---------------------|---|-----------------|
| 1 | control panel cable | 2 | screw holes (2) |
| 3 | screws (2)          | 4 | control panel   |


- 5 Remove the two screws that secure the control panel to the system and remove the panel. See Figure 3-43.


## Installing the Control Panel

- 1 Insert the control panel into the system as shown in Figure 3-43.
- 2 Install the two Phillips screws to secure the control panel to the system. See Figure 3-43.
- 3 Connect the control panel cable to the back of the control panel. See Figure 3-43.
- 4 Plug the front cable into the system board. Ensure that the cable is bent in a U shape towards the DIMMs so that the cable fits properly with the shroud installed.
- 5 Close the system. See "Closing the System" on page 70.
- 6 Place the system upright and on its feet on a flat, stable surface.
- 7 Install the front-drive bezel. See "Installing the Front Drive Bezel" on page 66.
- 8 Reattach any peripherals, then connect the system to the electrical outlet.
- 9 Turn on the system and attached peripherals.

## System Board

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

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

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

## Removing the System Board

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

- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 4 Remove the processor shroud. See "Removing the Processor Shroud" on page 72.
- 5 Depending on your configuration, disconnect the following cables from the system board. See Figure 6-1 for connector locations.
  - Three power-supply cables from the PWR1, PWR2, and PWR3 connectors
  - I/O panel cable from the CTRL\_PNL connector
  - SATA cable(s) from the SATA connector(s)
  - Diskette data cable from the FLOPPY connector
  - PATA data cable from IDE connector
  - Expansion card fan cable from the FAN1 connector
  - System fan cable from the FAN2 connector
  - SAS LED cable from the PERC\_LED connector
  - SAS/SATA backplane cable from BP\_12C connector
  - Intrusion switch cable from the INTRUSION connector
- 6 If applicable, remove all expansion cards and any attached cables. See "Removing an Expansion Card" on page 108.
- 7 If applicable, remove the RAC card. See "Removing the RAC Card" on page 118.
- 8 If applicable, remove the SAS controller card. See "Removing a SAS Controller Card" on page 115.
- 9 Remove the internal USB memory key, if present. See Figure 6-1 for the USB socket location.
- 10 Remove the TOE hardware key, if present. See Figure 6-1 for the TOE\_KEY socket location.
- 11 Remove all memory modules. See "Removing Memory Modules" on page 133.



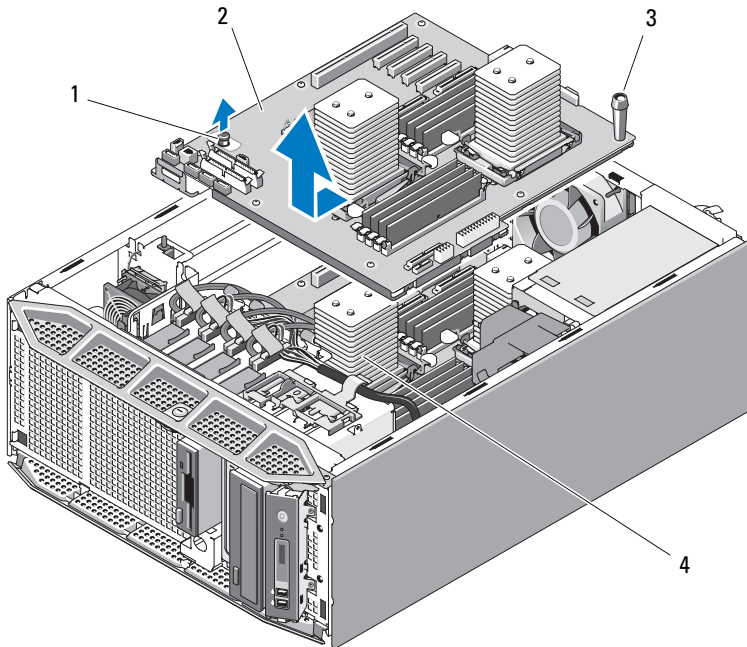
**NOTE:** Record the memory-module socket locations to ensure proper reinstallation of the memory modules.

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

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

- 12 Remove the processor(s). See "Removing a Processor" on page 134.
- 13 If applicable, remove the SAS/SATA backplane. See "Removing the SAS/SATA Backplane" on page 149.
- 14 Carefully route any loose cables away from the edges of the system board.
- 15 Remove the system board from the chassis. See Figure 3-44.
  - a Pull and hold the blue system board release pin.
  - b While holding the release pin and the system board touch point, slide the system board towards the front of the system, and lift the board out of the chassis.

**Figure 3-44. Removing and Installing the System Board**



- |   |                          |   |                             |
|---|--------------------------|---|-----------------------------|
| 1 | system board release pin | 2 | system board                |
| 3 | system board touch point | 4 | system board securing slots |

## Installing the System Board

- 1 Align the back connectors on the system board with the cutouts in the back of the chassis. Ensure the system-board tray is square with the chassis so that the securing tabs on the chassis fully insert into the system-board securing slots.
- 2 Slide the system board towards the back of the system until the blue release pin locks into place. See Figure 3-44.
- 3 If applicable, install the SAS/SATA backplane. See "Installing the SAS/SATA Backplane" on page 151.
- 4 Install the processor(s). See "Installing a Processor" on page 137.
- 5 Install the memory modules in the same sockets from which they were removed. See "Installing Memory Modules" on page 131.
- 6 Install the TOE NIC hardware key, if previously present. See Figure 6-1 for the TOE\_KEY socket location.
- 7 Install the internal USB memory key, if previously present. See "Installing the Optional Internal USB Memory Key" on page 121.
- 8 If applicable, install the SAS controller card. See "Installing a SAS Controller Card" on page 112.
- 9 If applicable, install the RAC card. See "Installing a RAC Card" on page 120.
- 10 If applicable, install the expansion cards and any attached cables. See "Installing an Expansion Card" on page 111.
- 11 Depending on your configuration, connect the following cables that you removed in "Removing the System Board" on page 154. See Figure 6-1 for connector locations.
  - Three power-supply cables to the PWR1, PWR2, and PWR3 connectors
  - I/O panel cable to the CTRL-PNL connector
  - SATA cable(s) to the SATA connector(s)

- Diskette data cable to the FLOPPY connector
  - PATA data cable to IDE connector
  - Expansion card fan cable to the FAN1 connector
  - System fan cable to the FAN2 connector
  - SAS LED cable to the PERC\_LED connector
  - SAS/SATA backplane cable to BP\_12C connector
  - Intrusion switch cable to the INTRUSION connector
- 12** Close the system. See "Closing the System" on page 70.
  - 13** Place the system upright and on its feet on a flat, stable surface.
  - 14** Install the front-drive bezel. See "Installing the Front Drive Bezel" on page 66.
  - 15** Reattach any peripherals, then connect the system to the electrical outlet.
  - 16** Turn on the system and attached peripherals.

# 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.



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## Start-Up Routine

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

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

Look/listen for:	Action
A status or error message displayed on the front-panel LCD.	See "LCD Status Messages" on page 18.
An error message displayed on the monitor.	See "System Messages" on page 32.
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 160.
The keyboard indicators.	See "Troubleshooting the Keyboard" on page 161.

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

<b>Look/listen for:</b>	<b>Action</b>
The USB diskette drive activity indicator.	See "Troubleshooting a Diskette Drive" on page 176.
The USB CD drive activity indicator.	See "Troubleshooting an Optical Drive" on page 178.
The hard-drive activity indicator.	See "Troubleshooting a Hard Drive" on page 181.
An unfamiliar constant scraping or grinding sound when you access a drive.	See "Getting Help" on page 205.

## 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 160.

### Troubleshooting External Connections

Loose or improperly connected cables are the most likely source of problems for the system, monitor, and other peripherals (such as a printer, keyboard, mouse, or other external device). Ensure that all external cables are securely attached to the external connectors on your system. See "Front-Panel Features and Indicators" on page 13 and "Back-Panel Features and Indicators" on page 15 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 Check the video interface cabling from the system to the monitor.
  - 3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 193.
- If the tests run successfully, the problem is not related to video hardware.
- If the tests fail, see "Getting Help" on page 205.

## Troubleshooting the Keyboard

### *Problem*

- System message indicates a problem with the keyboard
- Keyboard is not functioning or is functioning improperly.

### *Action*

- 1 Check to see if the keyboard cable has disconnected from the system.
- 2 Swap the faulty keyboard with a working keyboard.  
If the problem is resolved, replace the faulty keyboard.
- 3 If other USB devices are connected to ports adjacent to the keyboard and mouse USB ports, power off the devices and disconnect them from the USB ports.

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

If the mouse and keyboard do not immediately return to operation after disconnecting the other USB devices, restart your system. If the mouse and keyboard operations are restored after system restart, reconnect the disconnected USB devices and power them on one at a time.

If mouse and keyboard operation do not return after system restart, proceed to the next step.

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



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

- a** Turn off the system and attached peripherals and unplug the system from the power source.
- b** Open the system. See "Opening the System" on page 68.
- c** Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- d** Locate the NVRAM\_CLR jumper on your system board (see "System Board Jumpers and Connectors" on page 197) and set the jumper to the clear position (see Table 6-2).
- e** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- f** Close the system. See "Closing the System" on page 70.
- g** Reconnect the system and peripherals to power and restart.  
If the mouse and keyboard are operational, proceed to the next step.  
If the mouse and keyboard are still not operational, see "Getting Help" on page 205.
- h** Repeat step a through step c.
- i** Set the NVRAM\_CLR jumper to the default position (see Table 6-2).
- j** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- k** Close the system. See "Closing the System" on page 70.
- l** Reconnect the system and peripherals to power and restart.
- m** Enter the System Setup program and reenter any custom BIOS settings that were reset. Be sure to leave all USB ports enabled.

## **Troubleshooting the Mouse**

### ***Problem***

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

### **Action**

- 1 Check to see if the mouse cable has disconnected from the system.
- 2 Swap the faulty mouse with a working mouse.  
If the problem is resolved, replace the faulty mouse.
- 3 If other USB devices are connected to ports adjacent to the keyboard and mouse USB ports, power off the devices and disconnect them from the USB ports.

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

If the mouse and keyboard do not immediately return to operation after disconnecting the other USB devices, restart your system. If the mouse and keyboard operations are restored after system restart, reconnect the disconnected USB devices and power them on one at a time.

If mouse and keyboard operation do not return after system restart, proceed to the next step.

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



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- a Turn off the system and attached peripherals and unplug the system from the power source.
- b Open the system. See "Opening the System" on page 68.
- c Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- d Locate the NVRAM\_CLR jumper on your system board (see "System Board Jumpers and Connectors" on page 197) and set the jumper to the clear position (see Table 6-2).
- e Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.

- f** Close the system. See "Closing the System" on page 70.
- g** Reconnect the system and peripherals to power and restart.  
If the mouse and keyboard are operational, proceed to the next step.  
If the mouse and keyboard are still not operational, see "Getting Help" on page 205.
- h** Repeat step a through step c.
- i** Set the NVRAM\_CLR jumper to the default position (see Table 6-2).
- j** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- k** Close the system. See "Closing the System" on page 70.
- l** Reconnect the system and peripherals to power and restart.
- m** Enter the System Setup program and reenter any custom BIOS settings that were reset. Be sure to leave all USB ports enabled.

## Troubleshooting Serial I/O Problems

### ***Problem***

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

### ***Action***

- 1** Enter the System Setup program and ensure that the serial port is enabled and configured correctly for your program. See "Entering the System Setup Program" on page 43.
- 2** If the problem is confined to a particular program, see the program documentation for specific port configuration requirements that the program may require.
- 3** Run the appropriate online diagnostic test. See "Running the System Diagnostics" on page 193.

If the tests run successfully but the problem persists, see "Troubleshooting a USB Device" on page 165.

## Troubleshooting a Serial I/O Device

### ***Problem***

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

### ***Action***

- 1** Turn off the system and any peripheral devices connected to the serial port.
- 2** Swap the serial interface cable with a working cable, and turn on the system and the serial device.

If the problem is resolved, replace the interface cable. See "Getting Help" on page 205.

- 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 205.

If the problem persists, see "Getting Help" on page 205.

## Troubleshooting a USB Device

### ***Problem***

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

### ***Action***

- 1** If a single USB device is experiencing a problem, perform the following procedure. For problems with multiple USB devices, skip to step 2.
  - a** Turn off the USB device, disconnect the USB cable from the system briefly, and reconnect the cable.
  - b** Restart the system, enter the System Setup program, and ensure that all USB ports are enabled (see "Entering the System Setup Program" on page 43).

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

If the problem is resolved, replace the interface cable.

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

If the USB device functions, the USB connector on the system is likely defective. Otherwise, the USB device is faulty and needs to be replaced (see "Getting Help" on page 205).

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

- 3 Restart the system and reconnect the USB devices.

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

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

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



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- a Turn off the system and attached peripherals and unplug the system from the power source.
- b Open the system. See "Opening the System" on page 68.
- c Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- d Locate the NVRAM\_CLR jumper on your system board (see "System Board Jumpers and Connectors" on page 197) and set the jumper to the enabled position.
- e Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.

- f** Close the system. See "Closing the System" on page 70.
- g** Reconnect the system and peripherals to power and restart.  
If all USB devices are operational, proceed to the next step.  
If the USB devices are still not functioning, see "Getting Help" on page 205.
- h** Repeat step a through step c.
- i** Set the NVRAM\_CLR jumper to the disabled position.
- j** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- k** Close the system. See "Closing the System" on page 70.
- l** Reconnect the system and peripherals to power and restart.
- m** Enter the System Setup program and reenter any custom BIOS settings that were reset. Be sure to leave all USB ports enabled.

## Troubleshooting a NIC

### ***Problem***

- NIC cannot communicate with network.

### ***Action***

- 1** Run the appropriate online diagnostic test. See "Using Server Administrator Diagnostics" in "Running the System Diagnostics" on page 194.
- 2** Check the appropriate indicator on the NIC connector. See "NIC Indicator Codes" on page 18.
  - If the link indicator does not light, check all cable connections.
  - If the activity indicator does not light, the network driver files might be damaged or missing.  
Remove and reinstall the drivers if applicable. See the NIC's documentation.
  - Change the autonegotiation setting, if possible.
  - Use another connector on the switch or hub.

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

- 3 Ensure that the appropriate drivers are installed and the protocols are bound. See the NIC's documentation.
- 4 Enter the System Setup program and confirm that the NICs are enabled. See "Entering the System Setup Program" on page 43.
- 5 Ensure that the NICs, hubs, and switches on the network are all set to the same data transmission speed. See the network equipment documentation.
- 6 Ensure that all network cables are of the proper type and do not exceed the maximum length.

If the problem persists, see "Getting Help" on page 205.

## Troubleshooting a Wet System

### *Problem*

- Liquid spilled on the system.
- Excessive humidity.

### *Action*



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- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 108.
- 4 Let the system dry thoroughly for at least 24 hours.
- 5 Close the system. See "Closing the System" on page 70.



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

If the system does not start properly, see "Getting Help" on page 205.

- 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 111.

- 8 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 193.

If the tests fail, see "Getting Help" on page 205.

## Troubleshooting a Damaged System

### *Problem*

- System was dropped or damaged.

### *Action*



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- 1 Open the system. See "Opening the System" on page 68.
- 2 Ensure that the following components are properly installed:
  - Expansion cards
  - Power supplies
  - Fans
  - Processors and heat sinks
  - Memory modules
  - Drive-carrier connections to the SAS/SATA backplane, if applicable
- 3 Ensure that all cables are properly connected.
- 4 Close the system. See "Closing the System" on page 70.

- 5 Run the system board tests in the system diagnostics. See "Running the System Diagnostics" on page 193.

If the tests fail, see "Getting Help" on page 205.

## Troubleshooting the System Battery

### *Problem*

- System message indicates a problem with the battery.
- System Setup program loses system configuration information.
- System date and time do not remain current.



**NOTE:** If the system is turned off for long periods of time (for weeks or months), the NVRAM may lose its system configuration information. This situation is caused by a defective battery.

### *Action*

- 1 Re-enter the time and date through the System Setup program. See "Entering the System Setup Program" on page 43.
- 2 Turn off the system and disconnect it from the electrical outlet for at least one hour.
- 3 Reconnect the system to the electrical outlet and turn on the system.
- 4 Enter the System Setup program. See "Entering the System Setup Program" on page 43.

If the date and time are not correct in the System Setup program, replace the battery. See "System Battery" on page 139.

If the problem is not resolved by replacing the battery, see "Getting Help" on page 205.



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

# Troubleshooting Redundant Power Supplies

## *Problem*

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

## *Action*



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

- 1 Run the appropriate online diagnostics test. See "Running the System Diagnostics" on page 193.
- 2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 3 Locate the faulty power supply.

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



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

- 4 Ensure that the power supply is properly installed by removing and reinstalling it. See "Installing a Redundant Power Supply" on page 77.



**NOTE:** After installing a power supply, allow several seconds for the system to recognize the power supply and to determine if it is working properly. The power indicator turns green to signify that the power supply is functioning properly. See "Power Indicator Codes" on page 17.

- 5 If the problem persists, remove the faulty power supply. See "Removing a Redundant Power Supply" on page 76.

- 6 Install a new power supply. See "Installing a Redundant Power Supply" on page 77.

If the problem persists, see "Getting Help" on page 205.

## Troubleshooting System Cooling Problems

### **Problem**

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

### **Action**

Ensure that none of the following conditions exist:

- System cover, drive blanks, or shrouds are removed.
- Ambient temperature is too high.
- External airflow is obstructed.
- Cables inside the system obstruct airflow.
- An individual cooling fan is removed or has failed. See "Troubleshooting a Fan" on page 172.

## Troubleshooting a Fan

### **Problem**

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

### **Action**



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

- 1 Run the appropriate diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 193.

- 2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 3 Open the system. See "Opening the System" on page 68.
- 4 Locate the faulty fan indicated by the LCD display or diagnostic software. For the identification number of each fan, see "Integrated TOE" on page 123.
- 5 Ensure that the faulty fan's power cable is firmly attached to the fan power connector. See "Integrated TOE" on page 123.
- 6 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.
- 7 If the problem is not resolved, install a new fan. See "Integrated TOE" on page 123.  
If the replacement fan is working properly, close the system. See "Closing the System" on page 70.  
If the replacement fan does not operate, see "Getting Help" on page 205.

## Troubleshooting System Memory

### *Problem*

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

### *Action*



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

- 1 If the system is operational, run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 193.

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

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

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

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

- 4** Enter the System Setup program and check the system memory setting. See "Entering the System Setup Program" on page 43.

If the installed memory does not match the amount of memory shown in the System Setup program, proceed to the next step.

If the memory settings and installed memory indicate no problems, go to step 12.

- 5** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 6** Open the system. See "Opening the System" on page 68.
- 7** Ensure that the memory banks are populated correctly. See "General Memory Module Installation Guidelines" on page 128.  
If the memory modules are populated correctly, continue to the next step.
- 8** Reseat the memory modules in their sockets. See "Installing Memory Modules" on page 131.
- 9** Close the system. See "Closing the System" on page 70.
- 10** Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.
- 11** Enter the System Setup program and check the system memory setting. See "Entering the System Setup Program" on page 43.

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

- 12 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
- 13 Open the system. See "Opening the System" on page 68.
- 14 If a diagnostic test or error message indicates a specific memory module as faulty, swap or replace the module. Otherwise, swap the memory module in the first DIMM socket with a module of the same type and capacity that is known to be good. See "Installing Memory Modules" on page 131.
- 15 Close the system. See "Closing the System" on page 70.
- 16 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.
- 17 As the system boots, observe any error message that appears and the diagnostic indicators on the front of the system.
- 18 If the memory problem is still indicated, repeat step 12 through step 17 for each memory module installed.

If the problem persists, see "Getting Help" on page 205.

## Troubleshooting an Internal USB Key

### *Problem*

- System cannot read data from a USB memory key.

### *Action*



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

- 1 Enter the System Setup program and ensure that the USB key port is enabled. See "Entering the System Setup Program" on page 43.
- 2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

- 3 Open the system. See "Opening the System" on page 68.
- 4 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 5 Reseat the USB key.
- 6 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 7 Close the system. See "Closing the System" on page 70.
- 8 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.  
If the problem is not resolved, proceed to the next step.
- 9 Repeat step 2, step 3, and step 4.
- 10 Insert a different USB key that you know works properly.
- 11 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 12 Close the system. See "Closing the System" on page 70.
- 13 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.  
If the problem is not resolved, see "Getting Help" on page 205.

## Troubleshooting a Diskette Drive

### *Problem*

- Error message indicates a diskette drive problem.

### *Action*



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

- 1 Enter the System Setup program and verify that the diskette drive is configured correctly. See "Entering the System Setup Program" on page 43.



- 2** Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 193.
- 3** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 4** Open the system. See "Opening the System" on page 68.
- 5** Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 6** Ensure that the diskette drive interface cable is securely connected to the diskette drive and the system board.
- 7** Ensure that a power cable is properly connected to the drive.
- 8** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 9** Close the system. See "Closing the System" on page 70.
- 10** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 11** Run the appropriate online diagnostic test to see whether the diskette drive works correctly.  
If the problem persists, continue with the following steps.
- 12** Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
- 13** Open the system. See "Opening the System" on page 68.
- 14** Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 15** Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 108.
- 16** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 17** Close the system. See "Closing the System" on page 70.
- 18** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 19** Run the appropriate online diagnostic test to see whether the diskette drive works correctly.

If the tests run successfully, an expansion card may be conflicting with the diskette drive logic, or an expansion card may be faulty. Continue to the next step.

If the tests fail, see "Getting Help" on page 205.

- 20** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- 21** Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 22** Open the system. See "Opening the System" on page 68.
- 23** Reinstall one of the expansion cards you removed in step 15. See "Installing an Expansion Card" on page 111.
- 24** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 25** Close the system. See "Closing the System" on page 70.
- 26** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 27** Run the appropriate online diagnostic test to see whether the diskette drive works correctly.
- 28** Repeat step 20 through step 27 until all expansion cards are reinstalled or one of the expansion cards causes the tests to fail.

If the problem is not resolved, see "Getting Help" on page 205.

## Troubleshooting an Optical Drive

### *Problem*

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

### *Action*



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

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

- 1 Try using a different CD or DVD that you know works properly.
- 2 Enter the System Setup program and ensure that the optical drive controller is enabled. See "Entering the System Setup Program" on page 43.
- 3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 193.
- 4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 5 Open the system. See "Opening the System" on page 68.
- 6 Ensure that the interface cable is securely connected to the optical drive and to the controller.
- 7 Ensure that the power cable is properly connected to the drive.
- 8 Close the system. See "Closing the System" on page 70.
- 9 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

If the problem is not resolved, see "Getting Help" on page 205.

## Troubleshooting a SCSI Tape Drive

### *Problem*

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

### *Action*

- 1 Remove the tape cartridge you were using when the problem occurred, and replace it with a tape cartridge that you know works.
- 2 Ensure that the SCSI device drivers for the tape drive are installed and are configured correctly. See "Installing an Optical or Tape Drive" on page 101.

- 3 Reinstall the tape-backup software as instructed in the tape-backup software documentation.
- 4 Ensure that the tape drive's interface/DC power cable is connected to the tape drive and SCSI controller card.
- 5 Verify that the tape drive is configured for a unique SCSI ID number and that the tape drive is terminated or not terminated, based on the interface cable used to connect the drive.  
  
See the documentation for the tape drive for instructions on selecting the SCSI ID number and enabling or disabling termination.
- 6 Run the appropriate online diagnostics tests. See "Using Dell PowerEdge Diagnostics" on page 193.
- 7 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.



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

- 8 Open the system. See "Opening the System" on page 68.
- 9 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 10 Ensure that the SCSI controller card is firmly seated in its connector. See "Installing an Expansion Card" on page 111.
- 11 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 12 Close the system. See "Closing the System" on page 70.
- 13 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 14 If the problem is not resolved, see the documentation for the tape drive for additional troubleshooting instructions.
- 15 If you cannot resolve the problem, see "Getting Help" on page 205 for information on obtaining technical assistance.

# Troubleshooting a Hard Drive

If your system has hot-pluggable hard drives in a front-loading hard drive bay (when available), see "Troubleshooting a Hot-plug Hard Drive" on page 182.

## **Problem**

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

## **Action**



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



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

- 1 Run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 193.

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

- 2 If you are experiencing problems with multiple hard drives, skip to step 6. For a problem with a single hard drive, continue to the next step.
- 3 If your system has a SAS RAID controller, perform the following steps.
  - a Restart the system and press <Ctrl><R> to enter the host adapter configuration utility.  
See the documentation supplied with the host adapter for information about the configuration utility.
  - b Ensure that the hard drive has been configured correctly for the RAID.
  - c Exit the configuration utility and allow the system to boot to the operating system.
- 4 Ensure that the required device drivers for your SAS controller card or SAS RAID controller are installed and are configured correctly. See the operating system documentation for more information.

- 5 Verify that the controller is enabled and the drives appear in the System Setup program. See "Entering the System Setup Program" on page 43.
- 6 Check the cable connections inside the system:
  - a Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
  - b Open the system. See "Opening the System" on page 68.
  - c Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
  - d Verify that the cable connections between the hard drive(s) and the drive controller are correct. Check if the connections are to the SATA connectors on the system board, a SAS expansion card, or a SAS RAID controller. See "Hard Drives" on page 82.
  - e Verify that the SAS or SATA cables are securely seated in their connectors.
  - f Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
  - g Close the system. See "Closing the System" on page 70.
  - h Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

If the problem persists, see "Getting Help" on page 205.

## Troubleshooting a Hot-plug Hard Drive


### *Problem*

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

### *Action*



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

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

- 1 Run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 193.

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

- 2 Remove the front drive bezel. See "Removing the Front Drive Bezel" on page 66.
- 3 If you are experiencing problems with multiple hard drives, skip to step 9. For a problem with a single hard drive, continue to the next step.
- 4 Turn off your system, reseal the hard drive, and restart the system.
- 5 If your system has a SAS RAID controller, perform the following steps.
  - a Restart the system and press <Ctrl><R> to enter the host adapter configuration utility.  
See the documentation supplied with the host adapter for information about the configuration utility.
  - b Ensure that the hard drive has been configured correctly for the RAID.
  - c Exit the configuration utility and allow the system to boot to the operating system.
- 6 Ensure that the required device drivers for your controller are installed and are configured correctly. See the operating system documentation for more information.
- 7 Verify that the controller is enabled and the drives appear in the System Setup program. See "Entering the System Setup Program" on page 43.

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

- 8 If you have a non-RAID SAS controller, remove the hard drive and swap its drive bay location with another hard drive that is functioning properly.

If the problem is resolved, reinstall the hard drive in the original bay. See "Installing a Hot-plug Hard Drive" on page 89.

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 205.

If the hard drive functioned properly in another bay but does not function in the original bay, the SAS/SATA backplane has a defective connector. See "Getting Help" on page 205.

- 9 Check the cable connections inside the system:
  - a Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
  - b Open the system. See "Opening the System" on page 68.
  - c Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
  - d Remove the processor shroud. See "Removing the Processor Shroud" on page 72.
  - e Verify that the cable connections between the SAS/SATA backplane and the SAS controller are correct. See "Installing the SAS/SATA Backplane" on page 151.
  - f Verify that the SAS cables are securely seated in their connectors.
  - g Verify that the power cable on the SAS/SATA backplane is securely seated in the connector.
  - h Install the processor shroud. See "Installing the Processor Shroud" on page 74.
  - i Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
  - j Close the system. See "Closing the System" on page 70.
  - k Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

If the problem persists, see "Getting Help" on page 205.

## Troubleshooting a SAS or SAS RAID Controller



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

### ***Problem***

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



### **Action**



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

- 1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 193.
- 2 Enter the System Setup program and ensure that the SAS or SAS RAID controller is enabled. See "Entering the System Setup Program" on page 43.
- 3 Restart the system and press the applicable key sequence to enter the configuration utility:
  - <Ctrl><C> for a SAS controller
  - <Ctrl><R> for a SAS RAID controller

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

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

If the problem is not resolved, continue to the next step.
- 5 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet and peripherals.
- 6 Open the system. See "Opening the System" on page 68.
- 7 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 8 Ensure that the controller card is firmly seated into the system board connector. See "Installing an Expansion Card" on page 111.
- 9 If you have a SAS RAID controller, ensure that the following RAID components are properly installed and connected:
  - Memory module
  - Battery

- 10 Verify that the cable connections between the hard drives and the SAS controller are correct. See "Hard Drives" on page 82.  
Ensure that the cables are firmly connected to the SAS controller and the hard drives.
- 11 If your system has hot-pluggable hard drives in a front-loading drive bay (when available), verify that the cable connections between the SAS/SATA backplane and the SAS controller are correct. See "Installing the SAS/SATA Backplane" on page 151.
- 12 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 13 Close the system. See "Closing the System" on page 70.
- 14 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals. If the problem persists, see "Getting Help" on page 205.

## Troubleshooting Expansion Cards



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

### *Problem*

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

### *Action*



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

- 1 Run the appropriate online diagnostic test for the expansion card which is exhibiting issues. See "Using Dell PowerEdge Diagnostics" on page 193. Follow any recommended actions provided by the diagnostics. If the problem persists, go to the next step.

- 2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 3 Open the system. See "Opening the System" on page 68.
- 4 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 5 Ensure that each expansion card is firmly seated in its connector. See "Installing an Expansion Card" on page 111.
- 6 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 7 Close the system. See "Closing the System" on page 70.
- 8 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

If the problem persists, go to the next step.

- 9 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 10 Open the system. See "Opening the System" on page 68.
- 11 Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 12 Remove all expansion cards in the system. See "Removing an Expansion Card" on page 108.



**NOTE:** If your operating system is running off a disk controller card (such as a SAS controller card), do not remove it.

- 13 Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 14 Close the system. See "Closing the System" on page 70.
- 15 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 16 Run the appropriate online diagnostic test.  
If the tests fail, see "Getting Help" on page 205.
- 17 For each expansion card you removed in step 12, perform the following steps:

- a Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
- b Open the system. See "Opening the System" on page 68.
- c Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- d Reinstall one of the expansion cards.
- e Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- f Close the system. See "Closing the System" on page 70.
- g Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- h Run the appropriate online diagnostic test.

If the tests fail, repeat step 17 for each expansion card until you are able to single out the faulty expansion card.

If the tests fail for all expansion cards, see "Getting Help" on page 205.

## 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 If possible, run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 193.

- 2** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 3** Open the system. See "Opening the System" on page 68.
- 4** Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 5** Remove the processor shroud. See "Removing the Processor Shroud" on page 72.
- 6** Ensure that each processor and heat sink is properly installed. See "Installing a Processor" on page 137.
- 7** Install the processor shroud. See "Installing the Processor Shroud" on page 74.
- 8** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 9** Close the system. See "Closing the System" on page 70.
- 10** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 11** If possible, run the appropriate online diagnostic test. See "Running the System Diagnostics" on page 193.  
If the tests fail or the problem persists, continue to the next step.
- 12** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 13** Open the system. See "Opening the System" on page 68.
- 14** Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 15** Remove the processor shroud. See "Removing the Processor Shroud" on page 72.
- 16** Remove processor 2. See "Removing a Processor" on page 134.  
To locate processor 2, see Figure 6-1.  
If only one processor is installed, replace the processor. See "Getting Help" on page 205.
- 17** Install the processor shroud. See "Installing the Processor Shroud" on page 74.

- 18** Install the expansion card shroud. See "Installing the Expansion Card Shroud" on page 75.
- 19** Close the system. See "Closing the System" on page 70.
- 20** Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
- 21** Run the appropriate online diagnostic test.
  - If the tests complete successfully, go to step 22.
  - If the tests fail, the processor is faulty. See "Getting Help" on page 205.
- 22** Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 23** Open the system. See "Opening the System" on page 68.
- 24** Remove the expansion card shroud. See "Removing the Expansion Card Shroud" on page 72.
- 25** Remove the processor shroud. See "Removing the Processor Shroud" on page 72.
- 26** Swap processor 1 with processor 2. See "Removing a Processor" on page 134.
- 27** If you have tested each processor and the problem persists, the system board is faulty. See "Getting Help" on page 205.







# Running the System Diagnostics

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

## Using Dell PowerEdge Diagnostics

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

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

## System Diagnostics Features

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

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

- View status messages that inform you if tests are completed successfully.
- View error messages that inform you of problems encountered during testing.

## When to Use the System Diagnostics

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

## Running the System Diagnostics

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



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

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

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



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

## System Diagnostics Testing Options

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

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

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

## Using the Custom Test Options

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

### Selecting Devices for Testing

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



**NOTE:** After you select all the devices and components that you want to test, highlight **All Devices** and then click **Run Tests**.

### Selecting Diagnostics Options

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

- **Non-Interactive Tests Only** — When checked, runs only tests that require no user intervention.
- **Quick Tests Only** — When checked, runs only the quick tests on the device. Extended tests will not run when you select this option.
- **Show Ending Timestamp** — When checked, time stamps the test log.

- **Test Iterations** — Selects the number of times the test is run.
- **Log output file pathname** — When checked, enables you to specify where the test log file is saved.

## Viewing Information and Results

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

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

# Jumpers and Connectors

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

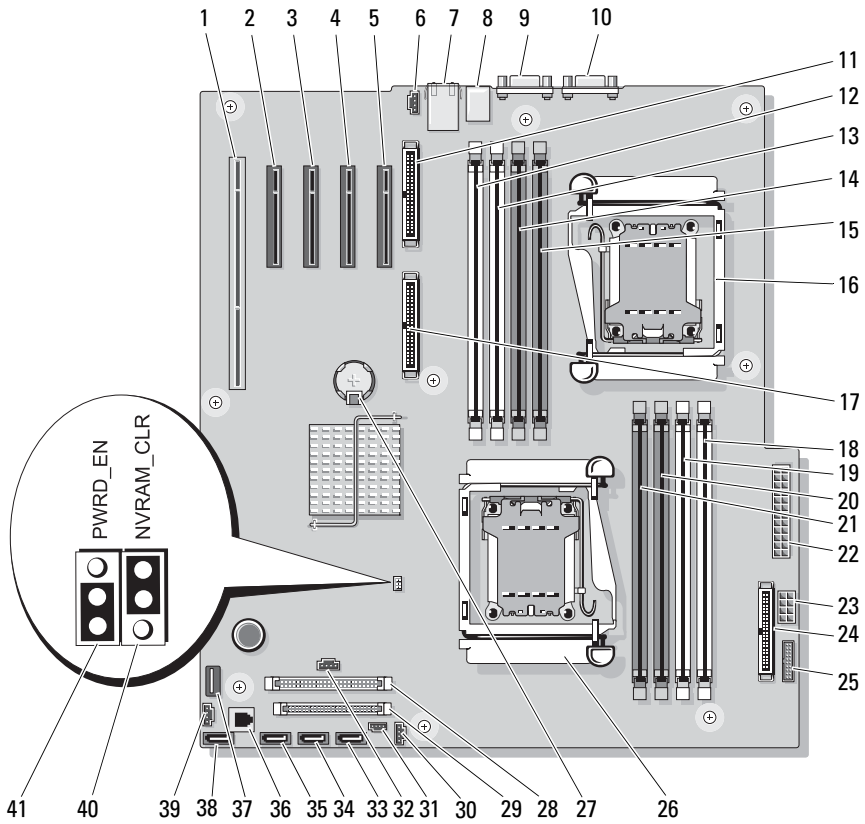
## System Board Jumpers and Connectors



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

Figure 6-1 shows the locations of the configuration jumpers and the system board connectors. Table 6-1 lists the descriptions of the system board connectors, and Table 6-2 lists the jumper settings.

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



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





<b>Item</b>	<b>Connector</b>	<b>Description</b>
1	PCIX_5	PCI-X connector (slot 5)
2	PCIE_X8_4	PCIe x8 connector (slot 4)
3	PCIE_X4_3	PCIe x4 connector (slot 3)
4	PCIE_X4_2 PERC SLOT	PCIe x4 connector (slot 2) (reserved for SAS card)
5	PCIE_X4_1 DRAC SLOT	PCIe x4 connector (slot 1) (reserved for RAC card)
6	FAN2	Rear system fan connector
7	USB1_ETH1	NIC connector, USB connectors (2)
8	USB2	USB connectors (3)
9	COM1	Serial connector
10	VGA	Video connector
11	RAC_CONN2	Remote Access Control (RAC) card 2
12	DIMM4B (B1)	First memory module slot (processor 2)
13	DIMM4A (B2)	Second memory module slot (processor 2)
14	DIMM3B (B3)	Third memory module slot (processor 2)
15	DIMM4A (B4)	Fourth memory module slot (processor 2)
16	CPU2	Microprocessor 2
17	RAC_CONN1	Remote Access Control (RAC) card 1
18	DIMM2B (A1)	First memory module slot (processor 1)
19	DIMM2A (A2)	Second memory module slot (processor 1)
20	DIMM1B (A3)	Third memory module slot (processor 1)
21	DIMM1A (A4)	Fourth memory module slot (processor 1)
22	PWR2	Power connector
23	PWR1	Power connector
24	CTRL_PNL	Control panel connector
25	PWR3	Power connector

**Table 6-1. System Board Jumpers and Connectors (continued)**


<b>Item</b>	<b>Connector</b>	<b>Description</b>
26	CPU1	Microprocessor 1
27	BATTERY	System battery
28	IDE	PATA drive connector
29	FLOPPY	Diskette drive connector
30	J_I2C_BP	SAS/SATA backplane connector
31	INTRUSION	Chassis intrusion switch connector
32	PERC_LED	SAS card LED connector
33	SATA_D	SATA_D drive connector
34	SATA_C	SATA_C drive connector
35	SATA_B	SATA_B drive connector
36	TOE	TCP/IP Offload Engine Key
37	USB_INT	Internal USB key
38	SATA_A	SATA_A drive connector
39	FAN1	Front system fan connector
40	NVRAM_CLR	NVRAM jumper
41	PWRD_EN	Password clear jumper



**Table 6-2. System Board Jumper Settings**

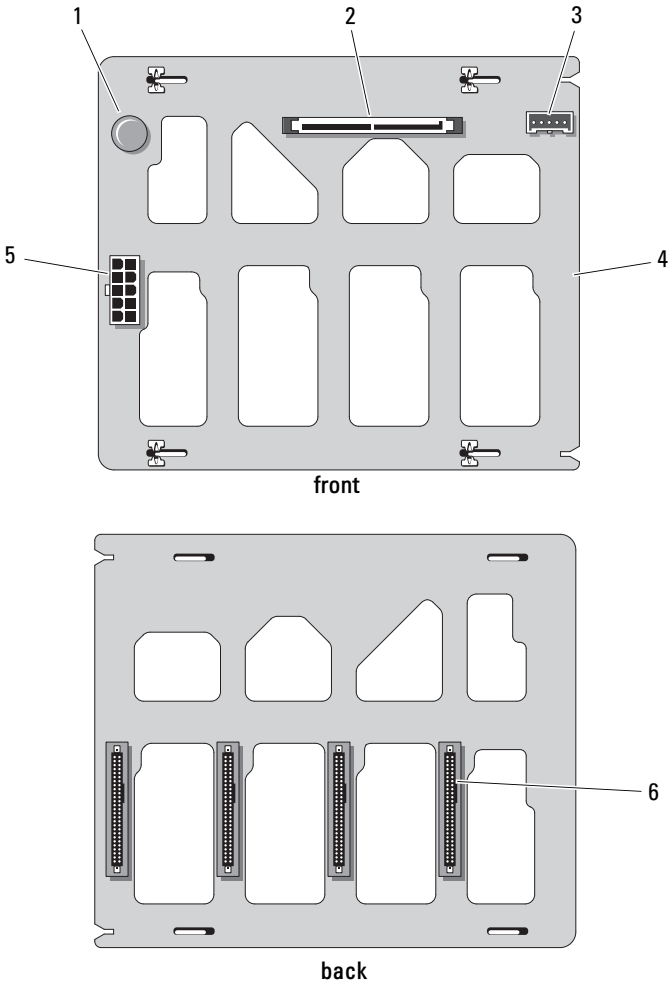
Jumper	Setting	Description
PWRD_EN	 (default)	The password feature is enabled.
		The password feature is disabled.
NVRAM_CLR	 (default)	The configuration settings are retained at system boot.
		The configuration settings are cleared at the next system boot. (If the configuration settings become corrupted to the point where the system will not boot, move the jumper to this position and boot the system. Move the jumper back to the default position before restoring the configuration information.)

## SAS/SATA Backplane Board Connectors

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

The SAS/SATA backplane is present in systems that have a front-loading hot-plug hard drive bay (when available). Figure 6-2 shows the locations of the SAS/SATA backplane connectors.

**Figure 6-2. SAS/SATA Backplane Connectors**



- |   |                     |   |                               |
|---|---------------------|---|-------------------------------|
| 1 | release pin         | 2 | SAS/SATA connector            |
| 3 | backplane connector | 4 | SAS/SATA backplane            |
| 5 | power connector     | 6 | SAS/SATA drive connectors (4) |

# Disabling a Forgotten Password

The password jumper on the system board enables the system password features or disables them and clears any password(s) currently in use.



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

- 1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
- 2 Open the system. See "Opening the System" on page 68.
- 3 Move the PWRD\_EN jumper to the disabled position.  
See Figure 6-1 to locate the password jumper on the system board.
- 4 Close the system. See "Closing the System" on page 70.
- 5 Reconnect the system to the electrical outlet, and turn on the system.

The existing passwords are not disabled (erased) until the system boots with the password jumper plug in the disabled position. However, before you assign a new system and/or setup password, you must move the jumper plug to the enabled position.



**NOTE:** If you assign a new system and/or setup password with the jumper plug still in the disabled position, the system disables the new password(s) the next time it boots.

- 6 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
- 7 Open the system. See "Opening the System" on page 68.
- 8 Move the PWRD\_EN jumper from the disabled position to the enabled position.
- 9 Close the system, reconnect the system to the electrical outlet, and turn on the system.
- 10 Assign a new system and/or setup password.  
To assign a new password using the System Setup program, see "Using the System Password" on page 56.



# Getting Help

## Contacting Dell

For customers in the United States, call 800-WWW-DELL (800-999-3355).



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

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

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



# Glossary

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

**A** — Ampere(s).

**AC** — Alternating current.

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

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

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

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

**ASCII** — American Standard Code for Information Interchange.

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

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

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

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

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

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

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

**BMC** — Baseboard management controller.

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

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

**BTU** — British thermal unit.

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

**C** — Celsius.

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

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

**cm** — Centimeter(s).

**cmos** — Complementary metal-oxide semiconductor.

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

**COM $n$**  — The device names for the serial ports on your system.



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

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

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

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

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

**DC** — Direct current.

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

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

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

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

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

**DIN** — *Deutsche Industrie Norm*.

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

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

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

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

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

**DVD** — Digital versatile disc.

**ECC** — Error checking and correction.

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

**EMC** — Electromagnetic compatibility.

**EMI** — Electromagnetic interference.

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

**ESD** — Electrostatic discharge.

**ESM** — Embedded server management.

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

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

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

**F** — Fahrenheit.

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

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

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

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

**ft** — Feet.

**FTP** — File transfer protocol.

**g** — Gram(s).

**G** — Gravities.

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

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

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

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

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

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

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

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

**Hz** — Hertz.

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

**ID** — Identification.

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

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

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

**IP** — Internet Protocol.

**IPX** — Internet package exchange.

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

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

**K** — Kilo-; 1000.

**Kb** — Kilobit(s); 1024 bits.

**KB** — Kilobyte(s); 1024 bytes.

**Kbps** — Kilobit(s) per second.

**KBps** — Kilobyte(s) per second.

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

**kg** — Kilogram(s); 1000 grams.

**kHz** — Kilohertz.

**KMM** — Keyboard/monitor/mouse.

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

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

**lb** — Pound(s).

**LCD** — Liquid crystal display.

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

**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).

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

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

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

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

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

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

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

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

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

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

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

**system diskette** — See *bootable diskette*.

**system memory** — See *RAM*.

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

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

**TCP/IP** — Transmission Control Protocol/Internet Protocol.

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

**TOE** — TCP/IP offload engine. A technology to improve data-transfer performance over IP networks by allowing the operating system to offload all TCP/IP traffic to specialized hardware on the network adapter, while leaving TCP/IP control decisions to the host server.

**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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