Dell™ PowerEdge™
*SC*1430 Systems

# Hardware Owner's Manual

# Notes, Notices, and Cautions

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

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

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

# Contents

# 1

# About Your System

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

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

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

## Other Information You May Need

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

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

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

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

# Accessing System Features During Startup

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

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

| Keystroke | Description |
| --- | --- |
| <F2> | Enters the System Setup program. See "Using the System Setup Program" on page 27. |
| <F10> | Opens the utility partition, allowing you to run the system diagnostics. See "Running the System Diagnostics" on page 114. |
| <F11> | Enters the boot menu selection screen, allowing you to choose a boot device. |
| <F12> | Initiates PXE boot. |
| <Ctrl+C> | Option is displayed for some SAS controller expansion cards. Enters the SAS Configuration Utility, which includes RAID configuration options. See your SAS adapter *User's Guide* for more information. |
| <Ctrl+R> | Enters the RAID configuration utility, which allows you to configure an optional RAID expansion card. For more information, see the documentation for your RAID card. |
| <Ctrl+S> | Option is displayed only if you have PXE support enabled through the System Setup Program (see "Integrated Devices Screen" on page 32). 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**
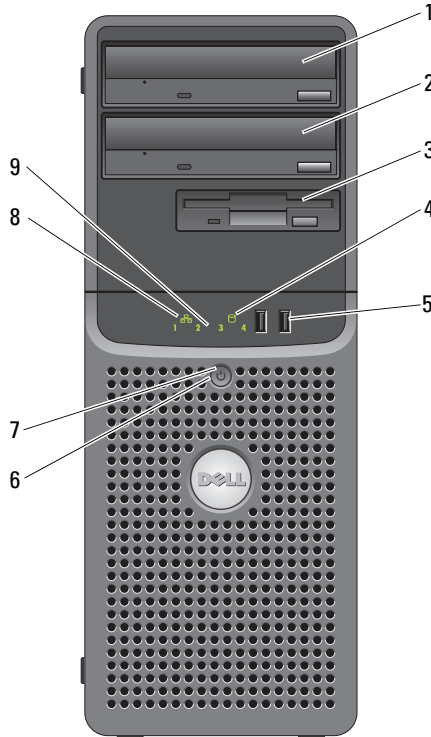


**Table 1-2.** **Front-Panel Components**

| Item | Component | Icon | Description |
|------|-----------|------|-------------|
| 1 | upper 5.25-inch drive bay | | Holds an optical drive. |
| 2 | lower 5.25-inch drive bay | | Holds an optional optical or half-height tape drive, or a fourth hard drive (requires mounting bracket). |
| 3 | flex bay | | Holds a diskette drive or an optional third hard drive. |
| 4 | hard-drive activity indicator | | Indicates hard drive activity. |

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

| Item | Component | Icon | Description |
|------|-----------|------|-------------|
| 5 | USB connectors (2) | $\leftarrow\!\!\!\cdot\!\!\!\Rightarrow$ | Connects USB 2.0-compliant devices to the system. |
| 6 | power button | | The power button controls the DC power supply output to the system. **NOTE:** If you turn off the system using the power button and the system is running an ACPI-compliant operating system, the system performs a graceful shutdown before the power is turned off. If the system is not running an ACPI-compliant operating system, the power is turned off immediately after the power button is pressed. |
| 7 | power light | ⏻ | No light — The system is off. Steady green — The system is powered on. Steady amber — The power supply is probably good. Check the diagnostic indicators to see if the specific problem is identified. See "Diagnostics Indicator Codes" on page 15. Blinking amber — The system is powering up. • If the hard-drive indicator is off, the power supply may need to be replaced. • If the hard-drive indicator is on, the system board is faulty. Check the diagnostic indicators to see if the specific problem is identified. See "Diagnostics Indicator Codes" on page 15. |
| 8 | network link light | | Lights when the system is linked to a network. |
| 9 | diagnostic lights (4) | | Display light-pattern codes to assist in troubleshooting system problems. See "Diagnostics Indicator Codes" on page 15. |

# Back-Panel Features and Indicators

Figure 1-2 shows the connectors located on the system's back panel.

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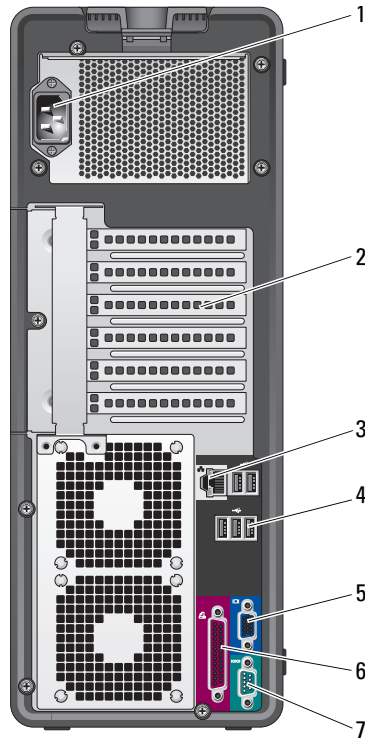


| | | | | | |
|---|---|---|---|---|---|
| 1 | AC power connector | 2 | expansion-card slots (5) | 3 | NIC connector |
| 4 | USB connectors (5) | 5 | video connector | 6 | parallel connector |
| 7 | serial connector | | | | |

## 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 27 for information about enabling, disabling, and configuring I/O ports and connectors.

## NIC Indicator Codes

The NIC on the back panel has an indicator that provides information on network activity and link status. See Figure 1-3. Table 1-3 lists the NIC indicator codes.

**Figure 1-3.   NIC Indicators**



| 1 | link indicator | 2 | activity indicator |
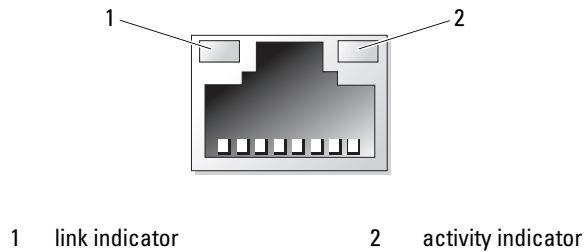
**Table 1-3.   NIC Indicator Codes**

| Indicator Type | Indicator Code | Description |
| --- | --- | --- |
| Activity | Off | When off at the same time that the link indicator is off, the NIC is not connected to the network or the NIC is disabled in the System Setup program. See "Using the System Setup Program" on page 27. |
| | Blinking | Indicates that network data is being sent or received. |
| Link | Off | When off at the same time that the activity indicator is off, the NIC is not connected to the network or the NIC is disabled in the System Setup program. See "Using the System Setup Program" on page 27. |
| | Yellow | 1000-Mbps connection |
| | Orange | 100-Mbps connection |
| | Green | 10-Mbps connection |

# Diagnostics Indicator Codes

The four diagnostic indicator lights on the system front panel display error codes during system startup. Table 1-4 lists the causes and corrective actions associated with these codes and the power light status before system POST. Table 1-5 lists the causes and possible corrective actions for these codes during POST. A highlighted circle indicates the light is on; a non-highlighted circle indicates the light is off.

**Table 1-4.    Diagnostic Indicator Codes Before POST**

| Code | Power Light | Causes | Corrective Action |
|---|---|---|---|
| ①②③④ | off | No electrical power is supplied to the computer. | Connect the computer to a working electrical outlet. <br><br>If the problem is still not resolved, see "Getting Help" on page 123. |
| ①②③④ | green | Normal operation | None |
| ①②③④ (4 on) | off | Normal off condition; the system is connected to an electrical outlet. | Press the power button to turn the computer on. <br><br>If the system does not turn on and the power light is off, see "Getting Help" on page 123. |
| ①②③④ (2,3,4 on) (blinking) | amber | The BIOS is not executing. | Ensure that the processor is seated correctly and restart the system. See "Microprocessor" on page 73). <br><br>If the problem persists, see "Getting Help" on page 123. |
| ①②③④ (1,3 on) (blinking) | blinking amber | A possible power supply or power cable failure has occurred. | Check the power supply connections and the condition of cables. See "Installing the Power Supply" on page 82. <br><br>If the problem persists, see "Getting Help" on page 123. |
| ①②③④ (1,3,4 on) (blinking) | amber | A possible power supply failure has occurred. | Verify that both power supply cables are plugged in to the system board. See "Installing the Power Supply" on page 82. <br><br>If the problem persists, see "Getting Help" on page 123. |
| ①②③④ (1,2 on) (blinking) | amber | A possible system board failure has occurred. | See "Getting Help" on page 123. |

**Table 1-4.   Diagnostic Indicator Codes Before POST *(continued)***

| Code | Power Light | Causes | Corrective Action |
|---|---|---|---|
| ①②③④ (blinking) | off | A processor mismatch exists. | See "Troubleshooting the Microprocessors" on page 110. |

**Table 1-5.   Diagnostic Indicator Codes During POST**

| Code | Causes | Corrective Action |
|---|---|---|
| ①②③④ | BIOS checksum failure detected; system is in recovery mode. | Ensure that all network cards and connections are functioning properly. See "Troubleshooting Your System" on page 95. If the problem persists, see "Getting Help" on page 123. |
| ①②③④ | Possible processor failure. | See "Troubleshooting the Microprocessors" on page 110. |
| ①②③④ | Memory failure. | See "Troubleshooting System Memory" on page 103. |
| ①②③④ | Possible expansion card failure. | See "Troubleshooting Expansion Cards" on page 109. |
| ①②③④ | Possible video failure. | See "Getting Help" on page 123. |
| ①②③④ | Diskette drive or hard drive failure. | Ensure that the diskette drive and hard drives are properly connected. See "Hard Drives" on page 48 and "Diskette Drive" on page 63 for information on the drives installed in your system. |
| ①②③④ | Possible USB failure. | See "Troubleshooting a USB Device" on page 99. |
| ①②③④ | No memory modules detected. | See "Troubleshooting System Memory" on page 103. |
| ①②③④ | System board failure. | See "Getting Help" on page 123. |

Table 1-5.   Diagnostic Indicator Codes During POST *(continued)*

| Code | Causes | Corrective Action |
|---|---|---|
| ①②③④ | Memory configuration error. | See "Troubleshooting System Memory" on page 103. |
| ①②③④ | Possible system board resource and/or system board hardware failure. | See "Troubleshooting IRQ Assignment Conflicts" on page 96. If the problem persists, see "Getting Help" on page 123. |
| ①②③④ | Possible system resource configuration error. | See "Troubleshooting Your System" on page 95. If the problem persists, see "Getting Help" on page 123. |
| ①②③④ | Other failure. | Ensure that the diskette drive, optical drive, and hard drives are properly connected. See "Troubleshooting Your System" on page 95 for the appropriate drive installed in your system. If the problem persists, see "Getting Help" on page 123. |
| ①②③④ | The system is in a normal operating condition after POST. | Information only. |

# System Messages

System messages appear on the screen to notify you of a possible problem with the system. Table 1-6 lists the system messages that can occur and the probable cause and corrective action for each message.

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

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

Table 1-6.   System Messages

| Message | Causes | Corrective Actions |
|---|---|---|
| Alert! Air temperature sensor not detected. | The front panel thermal diode cable is improperly installed or has failed. | Verify that cables are firmly seated in the connectors on the front I/O panel and the system board. See "Front I/O Panel (Service Only Parts Procedure)" on page 89. |

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

| Message | Causes | Corrective Actions |
|---|---|---|
| `Alert! Cable not detected in INTRUDER connector.` | The chassis intrusion switch is not connected to the system board. | Verify that the chassis intrusion switch cable is firmly seated in the INTRUDER connector on the system board. See "Installing the Chassis Intrusion Switch" on page 87. |
| `Alert! FAN_CCAG was not detected.`<br><br>`Alert! FAN_FRONT was not detected.`<br><br>`Alert! FAN_HDD was not detected.`<br><br>`Alert! FAN_MEM was not detected.` | Specified fan is missing, faulty, or improperly installed.<br>• FAN_CCAG — card fan<br>• FAN_FRONT — front fan<br>• FAN_HDD — hard-drive fan for optional fourth hard drive<br>• FAN_MEM — memory fan | See "Troubleshooting System Cooling Problems" on page 102. |
| `Alert! FAN_PSU was not detected.` | The power supply fan is faulty. | See "Getting Help" on page 123. |
| `Alert! Cover was previously removed.` | The system cover has been opened. | Information only. To reset, enter the System Setup program. See "Using the System Setup Program" on page 27. |
| `Alert! Previous FAN_CCAG failure.`<br><br>`Alert! Previous FAN_FRONT failure.`<br><br>`Alert! Previous FAN_HDD failure.`<br><br>`Alert! Previous FAN_MEM failure.`<br><br>`Alert! Previous FAN_PSU failure.` | Specified fan failed before last system startup.<br>• FAN_CCAG — card fan<br>• FAN_FRONT — front fan<br>• FAN_HDD — hard-drive fan for optional fourth hard drive<br>• FAN_MEM — memory fan<br>• FAN_PSU — power supply fan | Information only. |
| `Alert! Previous thermal event.` | BIOS detected a thermal event before the last system startup. | Ensure that thermal grease is applied to the heat sink and the heat sink is installed properly. Ensure that the system fans are functioning properly. See "Replacing the Processor" on page 75 and "Troubleshooting System Cooling Problems" on page 102. |
| `Alert! Previous voltage failure.` | Sensor detected voltage out of range before last system startup. | Information only. |

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

| Message | Causes | Corrective Actions |
|---|---|---|
| `Alert! Processor thermal probe failure detected.` | The processor thermal probe has failed. | See "Getting Help" on page 123. |
| `BIOS Update Attempt Failed!` | Remote BIOS update attempt failed. | Retry the BIOS update. If problem persists, see "Getting Help" on page 123. |
| `CPUs with different cache sizes detected!` | Microprocessors with different cache sizes are installed. | Ensure that all microprocessors have the same cache size and that they are properly installed. See "Microprocessor" on page 73. |
| `Decreasing available memory` | Faulty or improperly installed memory modules. | See "Troubleshooting System Memory" on page 103. |
| `DIMM pairs must be matched in size, speed, and technology. The following DIMM pair is mismatched: DIMM x and DIMM y.` | Mismatched or unmatched DIMMs installed; faulty or improperly seated memory module(s). | Ensure that all pairs of memory modules are of the same type and size and that they are properly installed. See "Memory" on page 76. If the problem persists, see "Troubleshooting System Memory" on page 103. |
| `DIMMs must be populated in sequential order beginning with slot 1. The following DIMM is electrically isolated: DIMM x.` | The specified DIMM is inaccessible to the system due to its location. DIMMs must be populated in sequential order, beginning with slot 1. | Populate 2 or 4 DIMMs sequentially beginning with slot 1. See "Memory" on page 76. |
| `DIMMs should be installed in pairs. Pairs must be matched in size, speed, and technology.` | Mismatched or unmatched DIMMs installed; faulty or improperly seated memory module(s). The system will operate in a degraded mode with reduced ECC protection. Only memory installed in channel 0 will be accessible. | Ensure that all pairs of memory modules are of the same type and size and that they are properly installed. See "Memory" on page 76. If the problem persists, see "Troubleshooting System Memory" on page 103. |
| `Dual-rank DIMM paired with Single-rank DIMM - The following DIMM/rank has been disabled by BIOS: DIMM x Rank y` | Mismatched DIMMs installed; faulty memory module(s). The system has detected a dual-rank DIMM paired with a single-rank DIMM. The second rank of the dual-rank DIMM will be disabled. | Ensure that all pairs of memory modules are of the same type and size and that they are properly installed. See "Memory" on page 76. If the problem persists, see "Troubleshooting System Memory" on page 103. |

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

| Message | Causes | Corrective Actions |
|---|---|---|
| `Diskette drive n seek failure` | Incorrect configuration settings in the System Setup program. | Run the System Setup program to correct the settings. See "Using the System Setup Program" on page 27. |
| | Faulty or improperly installed diskette drive. | Replace the diskette. If the problem persists, see "Troubleshooting a Diskette Drive" on page 105. |
| | Loose diskette drive interface cable, or loose power cable. | Reseat diskette drive interface cable, or power cable. See "Troubleshooting a Diskette Drive" on page 105. |
| `Diskette read failure` | Faulty or improperly inserted diskette. | Replace the diskette. If the problem persists, see "Troubleshooting a Diskette Drive" on page 105. |
| `Diskette subsystem reset failed` | Faulty or improperly installed diskette. | Replace the diskette. If the problem persists, see "Troubleshooting a Diskette Drive" on page 105. |
| `Drive not ready` | Diskette missing from or improperly inserted in diskette drive. | Replace the diskette. If the problem persists, see "Troubleshooting a Diskette Drive" on page 105. |
| `Error: Incorrect memory configuration. DIMMs must be installed in pairs of matched memory size, speed, and technology.` | Mismatched or unmatched DIMMs installed; faulty or improperly seated memory module(s). | Ensure that all pairs of memory modules are of the same type and size and that they are properly installed. See "Memory" on page 76. If the problem persists, see "Troubleshooting System Memory" on page 103. |
| `Error: Memory failure detected. Memory size reduced. Replace the faulty DIMM as soon as possible.` | Faulty or improperly seated memory module(s). | See "Troubleshooting System Memory" on page 103. |
| `FBD training error: The following branch has been disabled: Branch x` | The specified branch (channel pair) contains DIMMs that are incompatible with each other. | Ensure that only Dell-qualified memory is used. Dell recommends purchasing memory upgrade kits directly from **www.dell.com** or your Dell sales agent to ensure compatibility. |
| `Gate A20 failure` | Faulty keyboard controller; faulty system board. | See "Getting Help" on page 123. |

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

| Message | Causes | Corrective Actions |
|---------|--------|-------------------|
| General failure | The operating system is unable to carry out the command. | This message is usually followed by specific information. Note the information and take the appropriate action to resolve the problem. |
| IDE primary drive *n* not found | IDE cables are not properly seated, or drive missing. | See "Troubleshooting an Optical Drive" on page 106. |
| Invalid configuration information - please run SETUP program | System has detected invalid configuration. | Remove the RTCST jumper if it is installed. See Figure 6-1 for the jumper location. |
| Invalid NVRAM configuration, Resource Re-allocated | System detected and corrected a resource conflict. | No action is required. |
| Keyboard Controller failure | Faulty keyboard controller; faulty system board | See "Getting Help" on page 123. |
| Manufacturing mode detected | System is in manufacturing mode. | Reboot to take the system out of manufacturing mode. |
| MEMBIST failure - The following DIMM/rank has been disabled by BIOS: DIMM x Rank y | Faulty memory module(s). | See "Troubleshooting System Memory" on page 103. |
| Memory address line failure at *address*, read *value* expecting *value*<br><br>Memory double word logic failure at *address*, read *value* expecting *value*<br><br>Memory odd/even logic failure at *address,* read *value* expecting *value*<br><br>Memory write/read failure at *address*, read *value* expecting *value* | Faulty or improperly installed memory modules. | See "Troubleshooting System Memory" on page 103. |
| Memory tests terminated by keystroke. | POST memory test terminated by pressing the spacebar. | Information only. |

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

| Message | Causes | Corrective Actions |
|---|---|---|
| `No boot device available` | Faulty or missing optical/diskette drive subsystem, hard drive, or hard-drive subsystem, or no boot disk in drive A. | Use a bootable diskette, CD, or hard drive. If the problem persists, see "Troubleshooting a Diskette Drive" on page 105, "Troubleshooting an Optical Drive" on page 106, and "Troubleshooting a Hard Drive" on page 107. See "Using the System Setup Program" on page 27 for information about setting the order of boot devices. |
| `No boot sector on hard drive` | Incorrect configuration settings in System Setup program, or no operating system on hard drive. | Check the hard-drive configuration settings in the System Setup program. See "Using the System Setup Program" on page 27. 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 123. |
| `Northbound merge error – The following DIMM has been disabled by BIOS: DIMM x` | The specified DIMM was unable to establish a successful data link with the memory controller. | See "Troubleshooting System Memory" on page 103. |
| `Not a boot diskette` | No operating system on diskette. | Use a bootable diskette. |
| `PCIe Degraded Link Width Error: Embedded Bus#nn/Dev#nn/Funcn`<br><br>`Expected Link Width is n`<br><br>`Actual Link Width is n` | Faulty or improperly installed PCIe card in the specified slot. | Reseat the PCIe card in the specified slot number. See "Expansion Cards" on page 70. If the problem persists, see "Getting Help" on page 123. |
| `PCIe Degraded Link Width Error: Slot n`<br><br>`Expected Link Width is n`<br><br>`Actual Link Width is n` | Faulty or improperly installed PCIe card in the specified slot. | Reseat the PCIe card in the specified slot number. See "Expansion Cards" on page 70. If the problem persists, see "Getting Help" on page 123. |
| `PCIe Training Error: Embedded Bus#nn/Dev#nn/Funcn`<br><br>`PCIe Training Error: Slot n` | Faulty or improperly installed PCIe card in the specified slot. | Reseat the PCIe card in the specified slot number. See "Expansion Cards" on page 70. If the problem persists, see "Getting Help" on page 123. |

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

| Message | Causes | Corrective Actions |
|---------|--------|--------------------|
| `PCI BIOS failed to install` | PCI device BIOS (Option ROM) checksum failure is detected during shadowing. Loose cables to expansion card(s); faulty or improperly installed expansion card. | Reseat the expansion cards. Ensure that all appropriate cables are securely connected to the expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 109. |
| `Plug & Play Configuration Error` | Error encountered in initializing PCI device; faulty system board. | Install the RTCRST jumper and reboot the system. See Figure 6-1 for jumper location. If the problem persists, see "Troubleshooting Expansion Cards" on page 109. |
| `Read fault`<br>`Requested sector not found` | The operating system cannot read from the diskette or hard drive, the system could not find a particular sector on the disk, or the requested sector is defective. | Replace the diskette. Ensure that the diskette and hard drive cables are properly connected. See "Troubleshooting a USB Device" on page 99, "Troubleshooting a Diskette Drive" on page 105, or "Troubleshooting a Hard Drive" on page 107 for the appropriate drive(s) installed in your system. |
| `Remote configuration update attempt failed` | System unable to process Remote Configuration request. | Retry Remote Configuration. |
| `ROM bad checksum = address` | Expansion card improperly installed or faulty. | Reseat the expansion cards. Ensure that all appropriate cables are securely connected to the expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 109. |
| `SATA port n hard disk drive not found` | SATA cables are not properly seated, or drive missing. | See "Troubleshooting a Hard Drive" on page 107. |
| `Sector not found`<br>`Seek error`<br>`Seek operation failed` | Faulty diskette or hard drive. | See "Troubleshooting a Diskette Drive" on page 105 or "Troubleshooting a Hard Drive" on page 107 for the appropriate drive(s) installed in your system. |
| `Shutdown failure` | Shutdown test failure. | See "Troubleshooting System Memory" on page 103. |

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

| Message | Causes | Corrective Actions |
|---------|--------|--------------------|
| 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 103. |
| The following DIMM pair is not compatible with the memory controller: DIMM x and DIMM y | The specified DIMM(s) are incompatible with the system. | Ensure that only Dell-qualified memory is used. Dell recommends purchasing memory upgrade kits directly from **www.dell.com** or your Dell sales agent to ensure compatibility. |
| The following DIMMs are not compatible: DIMM x and DIMM y | The specified DIMM(s) are incompatible with the system. | Ensure that only ECC FBD1 memory is used. Dell recommends purchasing memory upgrade kits directly from **www.dell.com** or your Dell sales agent to ensure compatibility. |
| Time-of-day clock stopped | Faulty battery or faulty chip. | See "Troubleshooting the System Battery" on page 102. |
| Time-of-day not set - please run SETUP program | Incorrect Time or Date settings; faulty system battery. | Check the Time and Date settings. See "Using the System Setup Program" on page 27. If the problem persists, replace the system battery. See "System Battery" on page 79. |
| Timer chip counter 2 failed | Faulty system board. | See "Getting Help" on page 123. |
| Unsupported CPU combination<br><br>Unsupported CPU stepping detected | Microprocessor(s) is not supported by the system. | Install a supported microprocessor or microprocessor combination. See "Microprocessor" on page 73. |
| 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! No microcode update loaded for processor n | Microcode update failed. | Update the BIOS firmware. See "Getting Help" on page 123. |

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

| Message | Causes | Corrective Actions |
|---------|--------|--------------------|
| `Warning: The current memory configuration is not optimal. Dell recommends a population of 2 or 4 DIMMs. DIMMs should be populated sequentially starting in slot 1.` | System has detected a legal but non-optimal population of DIMMs. The system will run with all memory accessible but will experience sub-optimal performance. | Populate 2 or 4 DIMMs sequentially beginning with slot 1. See "Memory" on page 76. |
| `Write fault`<br>`Write fault on selected drive` | Faulty diskette, optical/diskette drive assembly, hard drive, or hard-drive subsystem. | See "Troubleshooting a Diskette Drive" on page 105, "Troubleshooting an Optical Drive" on page 106, or "Troubleshooting a Hard Drive" on page 107. |

**NOTE:** For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 149.

# Warning Messages

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

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

# Diagnostics Messages

When you run system diagnostics, an error message may result. Diagnostic error messages are not covered in this section. Record the message on a copy of the Diagnostics Checklist in "Getting Help" on page 123, and then follow the instructions in that section for obtaining technical assistance.

# Alert Messages

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

# 2

# Using the System Setup Program

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

You can use the System Setup program to:

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

## Entering the System Setup Program

1   Turn on or restart your system.

2   Press <F2> immediately after you see the following message display briefly on the screen:

    <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 17 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 SC1430
                        BIOS Version: XXX

 Service Tag : XXXXXX                        Asset Tag: XXXXXXX


  System Time ........................................08:15:45
  System Date ........................................Wed March 28, 2006

  Memory Information .................................<ENTER>
  CPU Information ....................................<ENTER>

  IDE Primary Drive 0................................Off
  IDE Primary Drive 1................................Off
  SATA Port 0........................................Off
  SATA Port 1 .......................................Off
  SATA Port 2 .......................................Off
  SATA Port 3 .......................................Off

  Boot Sequence......................................<ENTER>
  Hard-Disk Drive Sequence...........................<ENTER>
  Hard-Disk Failover.................................Off
  USB Flash Drive Emulation Type.....................<ENTER>

  Integrated Devices ................................<ENTER>
  PCI IRQ Assignment ................................<ENTER>

  System Security ...................................<ENTER>

  System Event Log ..................................<ENTER>

  Keyboard Numlock ..................................On
  Report Keyboard Errors ............................Report


  Up,Down Arrow to select  |  SPACE,+,- to change  |  ESC to exit  |  F1=HELP
```

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

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

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

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

| Option | Description |
|---|---|
| System Time | Resets the time on the system's internal clock. |
| System Date | Resets the date on the system's internal calendar. |
| Memory Information | Displays information related to installed system and video memory, including size, type, and speed of memory modules, system video memory size and system memory test option. |

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

| Option | Description |
|---|---|
| CPU Information | Displays information related to microprocessors (speed, cache size, and so on). Enable or disable Hyper-Threading technology, if supported, by changing the setting of the **Logical Processor** option. See Table 2-3. |
| SATA Port X | Displays type and capacity of SATA drive attached to Port X on the system board. |
| 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. Only the first IDE device found will be available in the boot sequence. |
| Hard-Disk Drive Sequence | Specifies the order in which hard drives are configured in the system. The first hard drive in the system will be the bootable C: drive in DOS/DOS-like operating systems. |
| Hard-Disk Failover (**Off** default) | When this field is set to **On** and the first hard drive is not available, the system attempts to boot from the other hard drives in the order specified in **Hard-Disk Drive Sequence** before searching for the next device in **Boot Sequence**. This feature may be used to boot to a mirrored drive in a software RAID 1 configuration. |
| USB Flash Drive Type (**Auto** default) | Determines the emulation type for a USB flash drive. **Hard disk** allows the USB flash drive to act as a hard drive. **Floppy** allows the USB flash drive to act as a removal diskette drive. **Auto** automatically chooses an emulation type. |
| Integrated Devices | See "Integrated Devices Screen" on page 32. |
| 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. |
| System Security | Displays a screen to configure the system password and setup password features, AC power recovery, and chassis intrusion detection. See Table 2-5. See "Using the System Password" on page 36 and "Using the Setup Password" on page 38 for more information. |
| System Event Log | Select to view or clear the System Event Log (SEL). See "System Event Log" on page 34. |
| Keyboard NumLock (**On** default) | Determines whether your system starts up with the NumLock mode activated on 101- or 102-key keyboards (does not apply to 84-key keyboards). |
| Report Keyboard Errors (**Report** default) | Enables or disables reporting of keyboard errors during the POST. Select **Report** for host systems that have keyboards attached. Select **Do Not Report** to suppress all error messages relating to the keyboard or keyboard controller during POST. This setting does not affect the operation of the keyboard itself if a keyboard is attached to the system. |

## CPU Information Screens

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

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

| Option | Description |
|---|---|
| 64-bit Technology | Specifies if the installed processor(s) support Intel 64-bit extensions. |
| Core Speed | Displays the clock speed of the processor(s). |
| Bus Speed | Displays the bus speed of the processor(s). |
| Logical Processor (**Enabled** default) | Displays when the processor(s) support HyperThreading. **Enabled** permits all logical processors to be used by the operating system. Only the first logical processor of each processor installed in the system is used by the operating system if **Disabled** is selected. |
| Virtualization Technology (**Disabled** default) | Displays when the processor(s) support Virtualization Technology. **Enabled** permits virtualization software to use Virtualization Technology incorporated in the processor design. This feature can only be used by software that supports Virtualization Technology. |
| Adjacent Cache Line Prefetch (**Enabled** default) | Enables or disables optimal use of sequential memory access. Disable this option for applications that require high use of random memory access. |
| Hardware Prefetcher (**Enabled** default) | Enables or disables the hardware prefetcher. |
| Demand-Based Power Management (**Disabled** default) | Enables or disables demand-based power management. When enabled, the CPU Performance State tables will be reported to the operating system; when disabled, the CPU Performance State tables will not be reported to the operating system. If any of the CPUs do not support demand-based power management, the field will become read-only, and automatically set to **Disabled**. |
| Processor X ID | Displays the family and model number of each processor. A submenu displays processor core speed, amount of level 2 cache, and number of cores. |

## Integrated Devices Screen

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

**Table 2-4.   Integrated Devices Screen Options**

| Option | Description |
|---|---|
| Embedded SATA (**Off** default) | Allows the integrated SATA controller to be set to **Off** or **ATA Mode**. |
| Optional Hard-Disk Drive Fan | Displays **Installed** if the optional fourth hard-drive carrier fan cable is connected to the system board connector and is functioning. Otherwise, displays **Not Installed**. |
| IDE Controller (**Auto** default) | Enables the integrated IDE controller. When set to **Auto**, each channel of the integrated IDE controller is enabled if IDE devices are attached to the channel. |
| Diskette Controller (**Auto** default) | Enables or disables the system's diskette drive controller. When **Auto** is selected, the system turns off the controller when necessary to accommodate a controller card installed in an expansion slot. You can also configure the drive as **Read-Only**, or **Off**. When using the **Read-Only** setting, the drive cannot be used to write to a disk. |
| User Accessible USB Ports (**All Ports On** default) | Enables or disables the system's user accessible USB ports. Options are **All Ports On**, **Only Back Ports On**, and **All Ports Off**. |
| Embedded Gb NIC1 (**Enabled with PXE** default) | Enables or disables the system's integrated NIC. Options are **Enabled without PXE**, **Enabled with PXE**, and **Disabled**. PXE support allows the system to boot from the network. Changes take effect after the system reboots. |
| MAC Address | Displays the MAC address for the integrated 10/100/1000 NIC. This field does not have user-selectable settings. |
| Serial Port 1 (**Auto** default) | Serial port options are **COM1**, **COM3**, **Auto**, and **Off**.<br><br>When the serial port is set to **Auto**, the integrated port automatically attempts to use **COM1** first, and then **COM3**. If both addresses are in use, the port is disabled.<br><br>If you set the serial port to **Auto** and add an expansion card with a port configured to the same designation, the system automatically remaps the integrated port to the next available port designation that shares the same IRQ setting. |
| Parallel Port (**378h** default) | Selects the address for the parallel port. Options are **378h**, **278h**, **3BCh**, and **Off**.<br><br>The system automatically disables the built-in parallel port if an expansion card containing a parallel port at the same address is detected. |
| Parallel Port Mode (**PS2** default) | Sets the parallel port mode of operation between **AT** mode and **PS/2** mode. In **AT** mode, the integrated parallel port can output data only to an attached device. In **PS/2** mode, the built-in parallel port can both input and output data. |

## System Security Screen

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

**Table 2-5.** **System Security Screen Options**

| Option | Description |
|---|---|
| System Password | Displays the current status of your system's password security feature and allows you to assign and verify a new system password.<br>**NOTE:** See "Using the System Password" on page 36 for instructions on assigning a system password and using or changing an existing system password. |
| Setup Password | Restricts access to the System Setup program in the same way that you restrict access to your system using the system password feature.<br>**NOTE:** See "Using the Setup Password" on page 38 for instructions on assigning a setup password and using or changing an existing setup password. |
| Password Status | Setting the **Setup Password** option to **Enabled** prevents the system password from being changed or disabled at system start-up.<br><br>To *lock* the system password, assign a setup password in the **Setup Password** option and then change the **Password Status** option to **Locked**. In this state, you cannot change the system password using the **System Password** option and cannot be disabled at system start-up by pressing <Ctrl><Enter>.<br><br>To *unlock* the system password, enter the setup password in the **Setup Password** field and then change the **Password Status** option to **Unlocked**. In this state, you can disable the system password at system start-up by pressing <Ctrl><Enter> and then change the password using the **System Password** option. |
| AC Power Recovery (**Last** default) | Determines how the system reacts when power is restored to the system. If system is set to **Last**, the system returns to the last power state. **On** turns on the system after power is restored. When set to **Off**, the system remains off after power is restored. |
| Chassis Intrusion (**Enabled** default) | Enables the chassis intrusion detection feature. When this option is set to **Enabled-Silent**, chassis intrusions are detected, but no warning message is reported during startup. When this option is set to **Enabled**, the field automatically shows **Detected** when the chassis cover has been removed. Intrusions are not detected when this option is set to **Disabled** |

## 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 Event Log

The system event log records events that have been detected on your system. If you experience problems with your system, you should check the system event log (see Table 2-2) for information to assist in troubleshooting. Events are recorded in two columns, giving an event type and event data to provide more specific component information. Table 2-6 presents the possible log entries, causes, and possible corrective actions.

**Table 2-6.  System Event Log Entries**

| Event Type | Event Data | Causes | Corrective Actions |
|---|---|---|---|
| Log Cleared | | User cleared the log (or initial log entry from factory). | Information only. |
| PCI PERR | Slot # or Bus # and Device, Function # of the device | A parity error was detected on the PCI bus. | See "Troubleshooting Expansion Cards" on page 109. |
| PCI SERR | Slot # or Bus # and Device, Function # of the device | A system error was detected on the PCI bus. | See "Troubleshooting Expansion Cards" on page 109. |
| Intrusion | | The cover was opened or the chassis intrusion cable was not detected. | Information only. To reset, enter the System Security screen. See "System Security Screen" on page 33. |
| PCIe Fatal Error | Slot # or Bus # and Device, Function # of the device | This error is generated when a fatal error is detected on the PCIE bus. | See "Troubleshooting Expansion Cards" on page 109. |
| Chipset Error | Bus, Device, and Function # | A chipset error was detected on the system board. | See "Getting Help" on page 123. |
| ECC Warning Threshold | DIMM # | Correctable ECC errors have increased from a normal rate. | See "Troubleshooting System Memory" on page 103. |
| ECC Critical Threshold | DIMM # | Correctable ECC errors have reached a critical rate. | See "Troubleshooting System Memory" on page 103. |
| Memory Log Disabled | | The ECC single bit error rate is exceeded. | Information only. Memory errors have been detected and logging is disabled. |
| Uncorrectable ECC Error | DIMM Pair | The chipset is unable to correct the memory errors. | See "Troubleshooting System Memory" on page 103. |

**Table 2-6.  System Event Log Entries** *(continued)*

| Event Type | Event Data | Causes | Corrective Actions |
|---|---|---|---|
| Out Of Range | Thermal CPU_0 | Thermal threshold exceeded on CPU0. | Ensure that thermal grease is applied to the heat sink and the heat sink is installed properly. Ensure that the system fans are functioning properly. See "Replacing the Processor" on page 75 and "Troubleshooting System Cooling Problems" on page 102. |
| | Thermal CPU_1 | Thermal threshold exceeded on CPU1. | |
| | Thermal front (air) | Thermal threshold exceeded on air temperature sensor or front panel thermal diode was not detected. | Verify that cables are firmly seated in the connectors on the front I/O panel and the system board. See "Front I/O Panel (Service Only Parts Procedure)" on page 89. |
| | FAN_FRONT | Bad or missing fan detected. | See "Troubleshooting System Cooling Problems" on page 102. |
| | FAN_MEM | | |
| | FAN_CCAG | | |
| | FAN_HDD (Hard - Disk fan) | | |
| | FAN_PSU | | |
| | Voltage CPU_0 | Voltage threshold exceeded. The power supply or the system board may be faulty. | See "Getting Help" on page 123. |
| | Voltage CPU_1 | | |
| | +VTT | | |
| | +VCC | | |

**NOTE:** For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 149.

# System and Setup Password Features

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

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

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

To change or delete an existing password, you must know the password. See "Deleting or Changing an Existing System Password" on page 37. 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. See "Disabling a Forgotten Password" on page 39.

## Using the System Password

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

### Assigning a System Password

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

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

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

1  Verify that the **Password Status** option is set to **Unlocked**.

2  Highlight the **System Password** option and press <Enter>.

3  Type your new system password.

   You can use up to 32 characters in your password.

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

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

   **NOTE:** To escape from the field without assigning a system password, press <Enter> to move to another field, or press <Esc> at any time prior to completing step 5.

4  Press <Enter>.

5  To confirm your password, type it a second time and press <Enter>.

   The setting shown for the **System Password** changes to **Enabled**. Exit the System Setup program and begin using your system.

**6** Either reboot your system now for your password protection to take effect or continue working.

    ✎ **NOTE:** Password protection does not take effect until you reboot the system.

### Using Your System Password to Secure Your System

✎ **NOTE:** If you have assigned a setup password (see "Using the Setup Password" on page 38), the system accepts your setup password as an alternate system password.

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

To leave the password security enabled:

**1** Turn on or reboot your system by pressing <Ctrl><Alt><Del>.

**2** Type your password and press <Enter>.

To disable the password security:

**1** Turn on or reboot your system by pressing <Ctrl><Alt><Del>.

**2** Type your password and press <Ctrl><Enter>.

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

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

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

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

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

### Deleting or Changing an Existing System Password

**1** When prompted, press <Ctrl><Enter> to disable the existing system password.

    If you are asked to enter your setup password, contact your network administrator.

**2** Enter the System Setup program by pressing <F2> during POST.

**3** Select the **System Security** screen field to verify that the **Password Status** option is set to **Unlocked**.

**4** When prompted, type the system password.

**5** Confirm that **Not Enabled** is displayed for the **System Password** option.

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

## Using the Setup Password

### Assigning a Setup Password

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

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

You can use up to 32 characters in your password.

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

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

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

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

### Operating With a Setup Password Enabled

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

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

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

**Deleting or Changing an Existing Setup Password**

1  Enter the System Setup program and select the **System Security** option.

2  Highlight the **Setup Password** option, press <Enter> to access the setup password window, and press <Enter> twice to clear the existing setup password.

   The setting changes to **Not Enabled**.

3  If you want to assign a new setup password, perform the steps in "Assigning a Setup Password" on page 38.

# Disabling a Forgotten Password

See "Disabling a Forgotten Password" on page 122.

# 3

# Installing System Components

This section describes how to install the following system components:

- Front drive bezel
- Hard drives
- Diskette drive
- Optical and tape drives
- Expansion cards
- SAS controller card
- Microprocessor
- Memory
- System battery
- Power supply
- Cooling Fans
- Chassis intrusion switch
- Bezel
- Front I/O panel
- System board

## Recommended Tools

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

- #2 Phillips screwdriver
- Long #2 Phillips screwdriver (blade at least 6 inches long)
- Needle-nose pliers
- Wire cutter (optional)
- Small flat-blade driver
- Wrist grounding strap

# Inside the System

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

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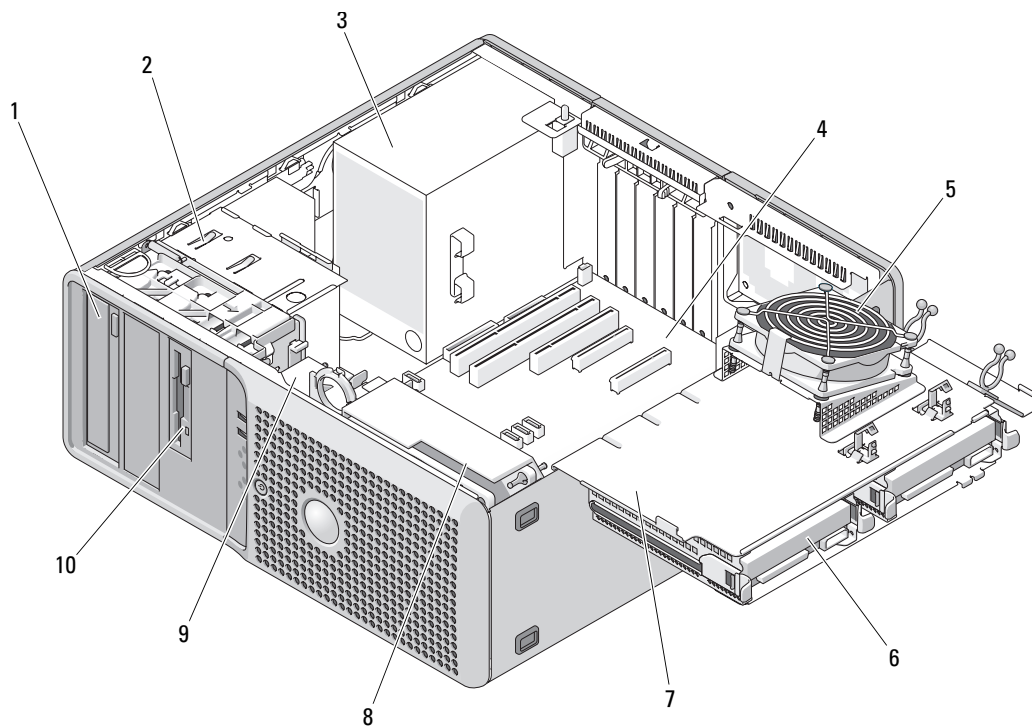


| | | | | | |
|---|---|---|---|---|---|
| 1 | 5.25-inch drive bays (2) | 2 | drive cage | 3 | power supply |
| 4 | system board | 5 | memory fan | 6 | hard drives (2) |
| 7 | rotatable hard-drive carrier | 8 | front fan | 9 | expansion-card fan |
| 10 | flex bay | | | | |

The system board can accommodate two processors, five expansion cards, and four memory modules. The rotatable hard-drive carrier provides space for up to two SAS or SATA hard drives. Drive bays in the front of the system provide space for an optical drive; an optional diskette drive or third hard drive; and an optional tape drive, second optical drive, or fourth hard drive. A controller expansion card is required for SAS hard drives or for more that two SATA hard drives. The optional third hard drive requires a mounting screw kit. The fourth hard drive requires a special drive carrier for installation. Power is supplied to the system board and internal peripherals through a single nonredundant power supply.

# Opening the System

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

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

2   Press the power button to ground the system board.

3   If you have installed a padlock through the padlock ring on the back panel, remove the padlock.

4   Lay the system on its side as shown in Figure 3-2.

5   Open the system by sliding the cover release tab toward the rear of the system and lifting off the cover.

# 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   Insert the bottom edge of the cover into the bottom of the system chassis. See Figure 3-2.

   b   Press down on the cover until the cover release tab snaps into place.

4   If applicable, install the padlock.

5   Reconnect the system to the electrical outlet, and 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 removed.`

6   To reset the chassis intrusion detector, press <F2> to enter the System Setup program. See "Using the System Setup Program" on page 27.

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

**Figure 3-2.   Opening and Closing the System**
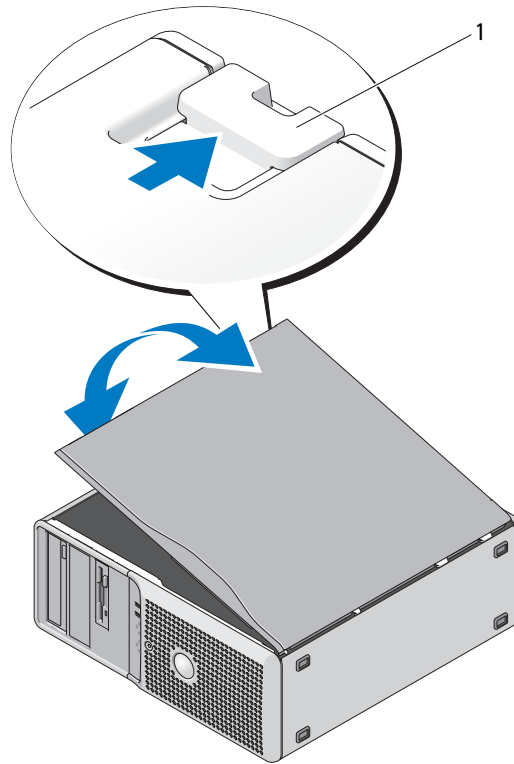


1    release tab

# Rotatable Hard-Drive Carrier

### Rotating the Hard-Drive Carrier Out of the System

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

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

2  Open the system. See "Opening the System" on page 43.

3  Press the release latch on the P3 power-cable connector beside the power supply and pull the two connectors apart. See Figure 3-3

4  Press the card retention mechanism release-tab and rotate the card retention mechanism so that it rests against the rotatable hard-drive carrier.

Figure 3-3.    Rotatable Hard-Drive Carrier Retention Mechanism
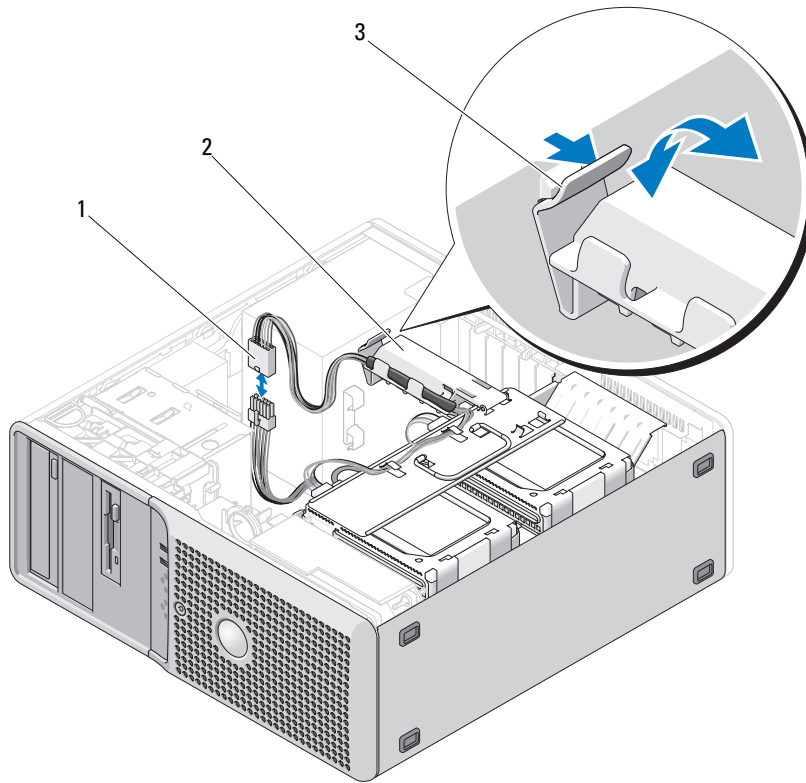


| 1 | P3 power connector | 2 | card retention mechanism | 3 | release tab |

5 Press down against the card retention mechanism until it clicks into place, locked against the hard-drive carrier.

6 Grasp the handle on the hard-drive carrier and rotate the carrier out of the chassis. See Figure 3-4. Rotate the carrier approximately 180 degrees from its original position, as shown in Figure 3-1, but do not force it any further.

**Figure 3-4. Rotating the Hard-Drive Carrier Out of and Into the System**
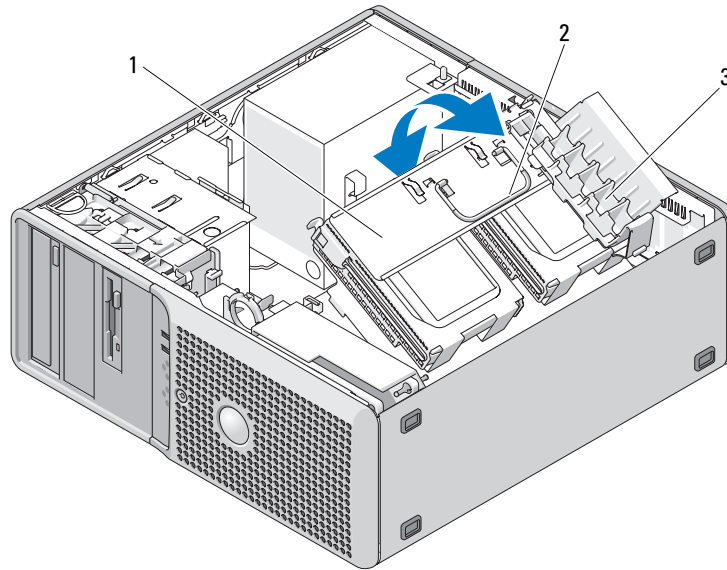


| 1 | rotatable hard-drive carrier | 2 | handle | 3 | card-retention mechanism |

### Rotating the Hard-Drive Carrier Into the System

**1** Grasp the handle on the hard-drive carrier and rotate the carrier back into the chassis until the metal tabs on each side of the carrier are seated, securing the carrier. See Figure 3-4.

**2** Pull up on the card retention mechanism to release it from the hard-drive carrier.

**3** Rotate the card retention mechanism back into its original position; push its tip so that its tab clicks into place. See Figure 3-4.

**4** Reconnect the P3 power-cable connectors.

## Removing and Replacing the Front Drive Bezel

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

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

**2** Open the system. See "Opening the System" on page 43."

✏ **NOTE:** This sliding plate secures and releases the drive bezel and helps to secure the drives.

**3** Pull the lever on the sliding plate to the right until it releases the front drive bezel from its side hinges.

**4** Carefully tilt the front drive bezel away from the chassis and lift it out as shown in Figure 3-5.

**5** To replace the front drive bezel, reverse the steps above and snap the bezel into place.

**Figure 3-5. Removing and Replacing the Front Drive Bezel**
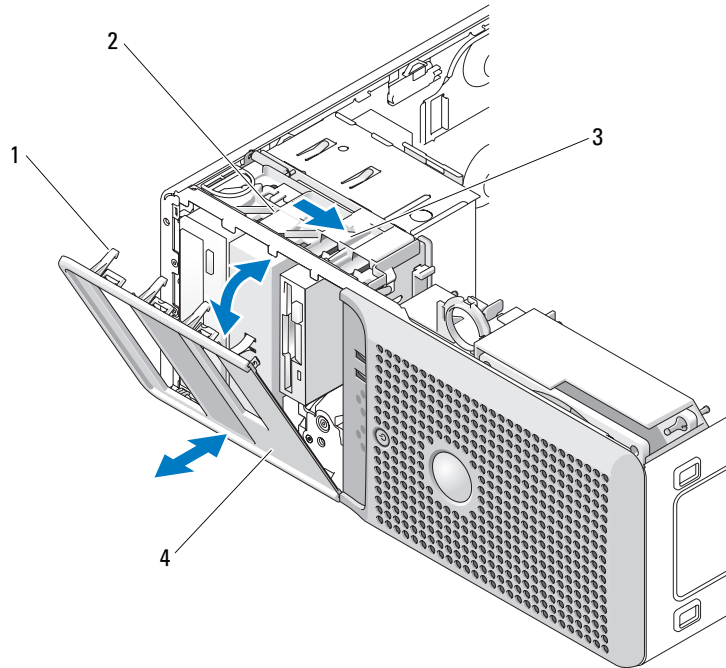


| 1 | front drive bezel tabs | 2 | sliding plate | 3 | sliding plate lever |
|---|---|---|---|---|---|
| 4 | front drive bezel | | | | |

### Removing and Replacing the Front Drive Bezel Insert

**1** To remove the front drive bezel insert, press the two insert tabs on the front drive bezel inward and lift out the insert. See Figure 3-6.

**2** To replace the front drive bezel insert, reverse the step above and snap the insert into place.

**Figure 3-6.  Removing and Replacing the Front Drive Bezel Insert**
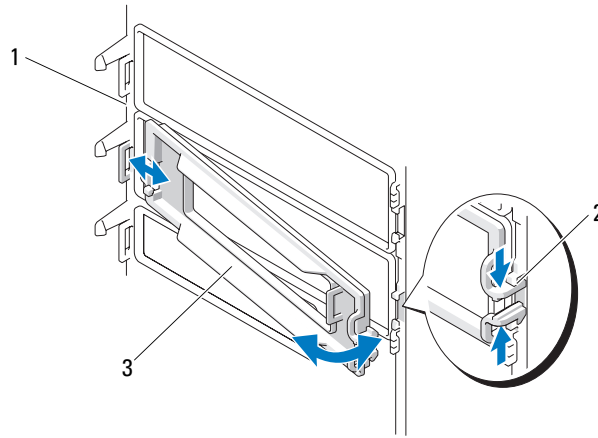


| | | | | | |
|---|---|---|---|---|---|
| 1 | front drive bezel | 2 | insert tabs | 3 | drive bezel inserts |

# Hard Drives

📝 **NOTE:** The system's drive configuration must consist of all SATA hard drives or all SAS hard drives.

## Hard Drive Installation Guidelines

Up to four hard drives are supported in internal drive bays. All drives must be either SAS or SATA; mixed configurations are not supported. Up to two SATA drives may be connected to the system's integrated SATA controller. If more than two SATA drives or any number of SAS drives are installed, they must all be connected to an optional SAS controller expansion card. Table 3-1 describes the possible drive configurations.

**Table 3-1.  Hard-Drive Configurations**

| Drive Number | Drive Type | Location | Controller |
|---|---|---|---|
| 1 | SATA | rotatable drive carrier (HDD0) | integrated SATA (SATA_0 connector)* |
| 1 | SAS | rotatable drive carrier (HDD0) | expansion card (primary SAS connector) |
| 2 | SATA | rotatable drive carrier (HDD1) | integrated SATA (SATA_1 connector)* |
| 2 | SAS | rotatable drive carrier (HDD1) | expansion card (primary SAS connector) |
| 3 | SAS or SATA | flex bay | expansion card (primary SAS connector) |
| 4 | SAS or SATA | optional drive carrier in lower 5.25-inch drive bay | expansion card (primary SAS connector) |

*If more than two SATA drives are installed, all drives must be connected to a SAS controller expansion card.

## Removing a Hard Drive from the Rotatable Carrier

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

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

2 Open the system. See "Opening the System" on page 43.

   📝 **NOTE:** If only one SATA hard drive is to be installed, it should be connected to the SATA0 connector on the system board.

3 Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

4 Disconnect the hard drive power cable from the hard drive that you are removing.

5 Disconnect the data cable from the hard drive that you are removing.

6 Press the drive release tabs on each side of the hard-drive bracket toward each other and slide the drive up and out of the hard-drive bay. See Figure 3-7.

**Figure 3-7.   Removing and Installing a Hard Drive in the Drive Carrier**
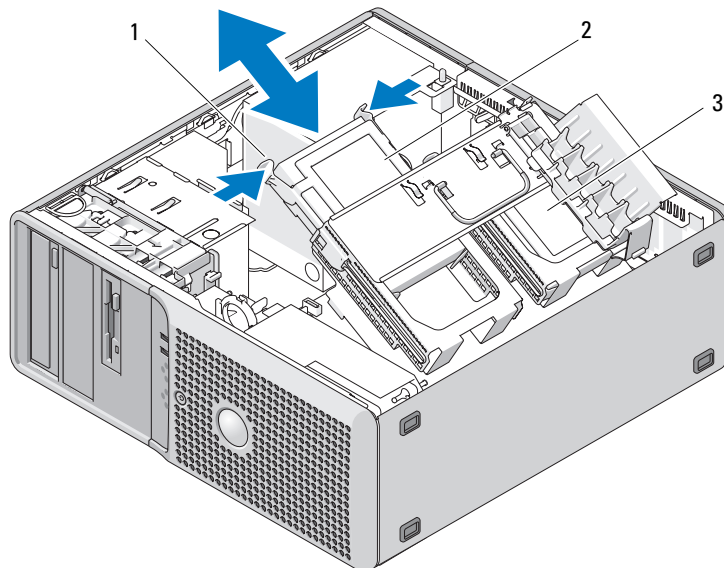


| 1 | drive release tabs (2) | 2 | hard drive in primary hard-drive bay | 3 | secondary hard drive bay |

**NOTE:** If you do not intend to replace the drive, it is highly recommended that you remove the drive from the guide bracket (see Figure 3-8) 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.

7 Rotate the hard-drive carrier back into place. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

8 Close the system. See "Closing the System" on page 43.

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

## Installing a Hard Drive in the Rotatable Carrier

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

1 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.

4 Open the system. See "Opening the System" on page 43.

5 Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

6 If you are replacing a hard drive, remove the drive that you are replacing. See "Removing a Hard Drive from the Rotatable Carrier" on page 49.

If a there is a hard-drive bracket in the empty hard-drive bay, remove the bracket by pressing its tabs toward it each other and pulling it up and out of the drive bay.

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

Flex the hard-drive bracket open and align the side holes in the new hard drive with the pins on the bracket; release the tension upon the bracket so that the hard drive is securely fastened. See Figure 3-8.

**Figure 3-8.    Installing a Hard Drive in a Drive Bracket**



| 1 | drive | 2 | hard-drive bracket |
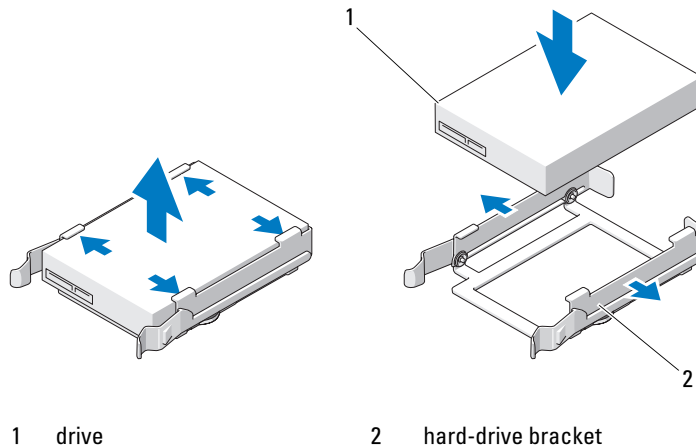
⊘ **NOTICE:** SAS drives and SATA drives cannot be mixed in the system. The drives must be either all SATA or all SAS hard drives.

8   Slide the hard drive into the hard-drive bay until it clicks securely into place.

9   Connect a data cable and a power cable to the hard drive.

  ✍ **NOTE:** The only SATA connectors on the board that support hard drives are those labeled SATA0 and SATA1. If only one SATA hard drive is to be installed, it should be connected to the SATA0 connector.

  • If you are installing a SATA hard drive and have only one or two drives in your system, connect the integrated SATA controller data cable and the power cable as shown in Figure 3-9.

  • If you are installing a SATA hard drive and have three or four drives in your system, connect the data cable from the SAS controller card and the power cable as shown in Figure 3-10.

  • If you are installing a SAS hard drive, connect the data cable from the SAS controller card and the power cable as shown in Figure 3-10.

**Figure 3-9.   Cabling a SATA Hard Drive in a One- or Two-Drive Configuration**
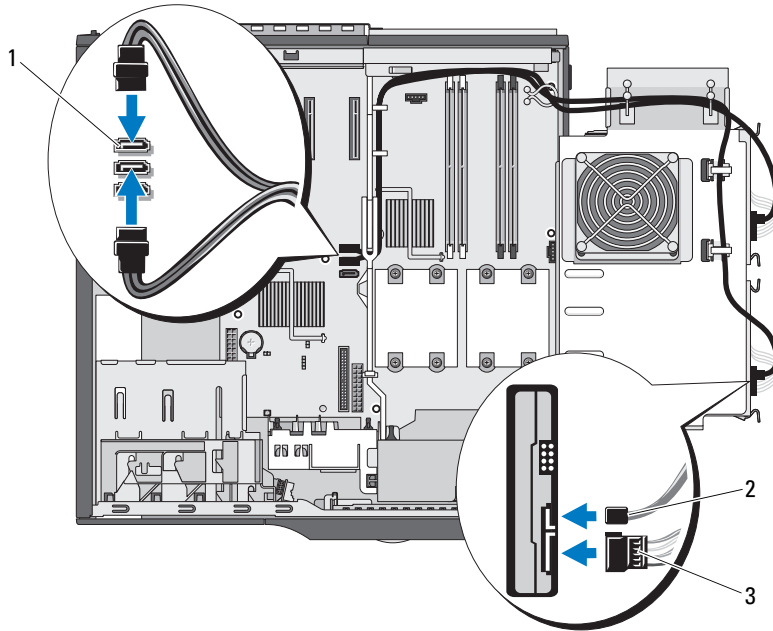


| 1 | integrated SATA connector | 2 | SATA data cable | 3 | hard-drive power cable |
|---|---|---|---|---|---|

**Figure 3-10.  Cabling a Hard Drive in the Drive Carrier (SAS or More Than Two SATA Drives)**
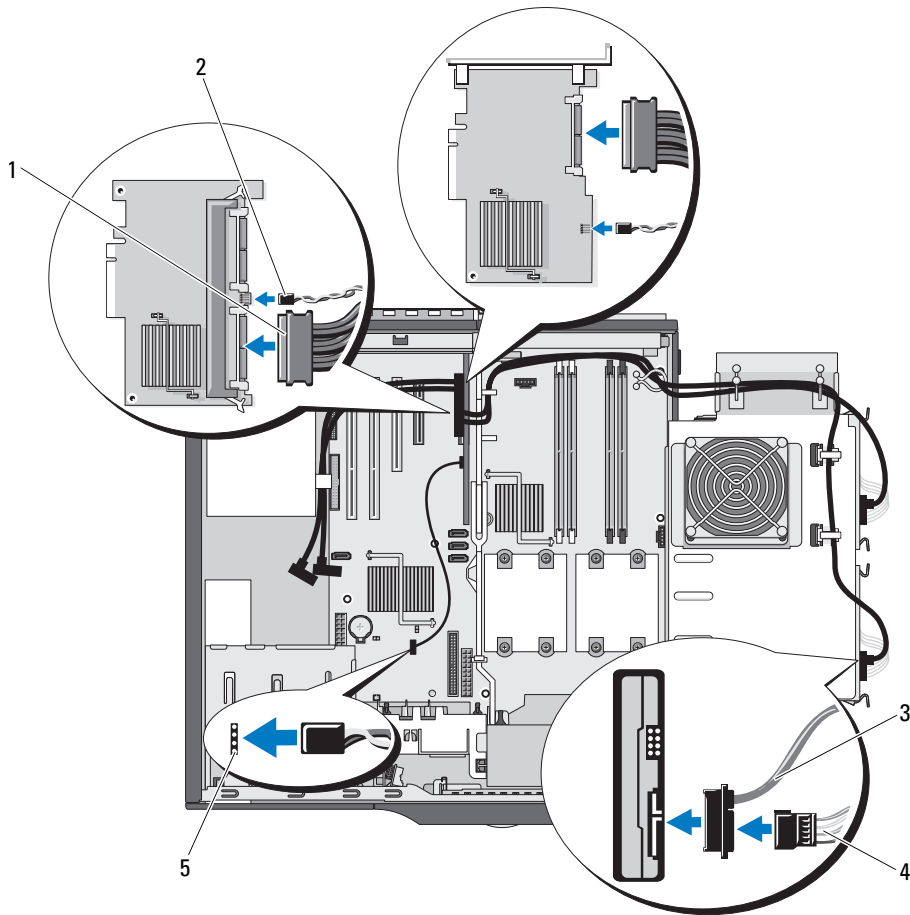


| 1 | SAS cable | 2 | hard-drive activity indicator cable | 3 | data cable |
| 4 | power cable | 5 | AUX_LED connector | | | | |

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

Ensure that the SAS cable is connected to the blue primary connector if the SAS controller card has two connectors.

11  Rotate the hard-drive carrier back into place. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

12  Close the system. See "Closing the System" on page 43.

**13** Reconnect the system to the electrical outlet, and 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.

**14** Enter the System Setup program (see "Entering the System Setup Program" on page 27), and ensure that the drive's controller is enabled.

**15** Exit the System Setup program and reboot the system.

**16** Partition and logically format the drive.

See the documentation for your operating system for instructions.

**17** (Optional) Test the hard drive by running the system diagnostics. See "Running the System Diagnostics" on page 113.

**18** If the drive you just installed is the primary drive, install your operating system on the hard drive.

### Removing an Optional Third Hard Drive

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

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

**2** Open the system. See "Opening the System" on page 43.

**3** Remove the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

⊘ **NOTICE:** If metal shields are present in your system configuration, they must be installed at all times while your system is in use or your system may not function properly.

**4** If metal shields are present in your system, slide the sliding-plate lever to the right and hold it in place as you pull to remove the vented metal insert from the flex bay.

**5** Disconnect the power cable and the data cable from the back of the hard drive.

**6** Slide the sliding-plate lever to the right to release the shoulder screw and slide the drive out of the flex bay. See Figure 3-11.

**7** Set the drive aside in a secure location.

**Figure 3-11.    Removing and Installing a Third Hard Drive**
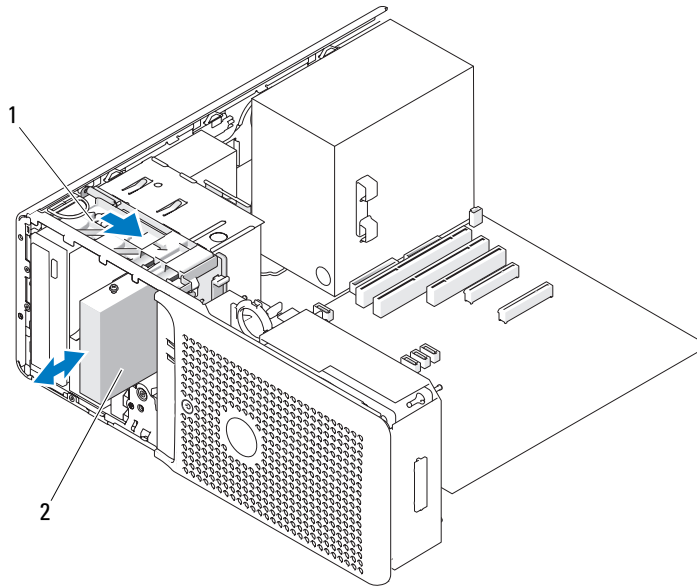


| 1 | drive bay sliding plate | 2 | hard drive |

🚫 **NOTICE:** If metal shields are present in your system configuration, they must be installed at all times while your system is in use or your system may not function properly.

8  If you are not installing another drive in the drive bay, reinstall the vented metal insert over the flex bay and the empty space beneath it.

    **a**   Insert the metal insert's two upper screws and its two lower screws into the corresponding slots inside the flex bay.

    **b**   Push the vented metal insert until it clicks into place and its metal tabs rest flush against the chassis surface.

9  Reinstall the drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

10  Close the system. See "Closing the System" on page 43.

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

### Installing an Optional Third Hard Drive

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

**NOTE:** Four mounting screws are required to install an optional third hard drive. If you purchase an upgrade from Dell, these screws are included in the kit.

1   If you are installing a new drive, unpack the drive and prepare it for installation.

Check the documentation for the drive to verify that it is configured for your system.

**NOTE:** The screws installed in the following step must be installed in the front four screw holes in order for the drive to be installed.

2   Install four screws in the front four holes on the sides of the drive.

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 43.

5   Remove the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

**NOTICE:** If metal shields are present in your system configuration, they must be installed at all times while your system is in use or your system may not function properly.

6   If the flex bay is not populated and metal shields are present in your system, slide the sliding-plate lever to the right and hold it in place as you pull to remove the vented metal insert from the flex bay.

7   If you already have a diskette drive installed in the flex bay, remove it. See "Removing the Diskette Drive" on page 63.

8   If you already have a hard drive installed in the flex bay, remove the hard drive. See "Removing an Optional Third Hard Drive" on page 54.

9   Gently slide the drive into place in the flex bay; the drive clicks through two notches before it is securely installed.

10  Ensure that the hard-drive indicator and data cables are correctly connected to the SAS controller expansion card. See Figure 3-12 and "Installing a SAS Controller Expansion Card" on page 72.

11  If you are upgrading from two SATA hard drives, connect the first two hard drives to the SAS controller card as described in the following steps:

   a   Remove the SATA data cables from the hard drives in the rotatable drive carrier and the SATA_0 and SATA_1 connectors on the system board. See "Removing a Hard Drive from the Rotatable Carrier" on page 49.

   b   Route the two long data cables from the SAS controller card, as shown in Figure 3-12, through the clips on chassis bottom, chassis sides, and the rotatable drive carrier, to the first two hard drives.

   c   Connect the data and power cables to the first two hard drives as shown in Figure 3-12.

12  Connect a data cable and a power cable to the back of the third hard drive. See Figure 3-12.

**Figure 3-12.  Cabling a Third or Fourth Hard Drive**
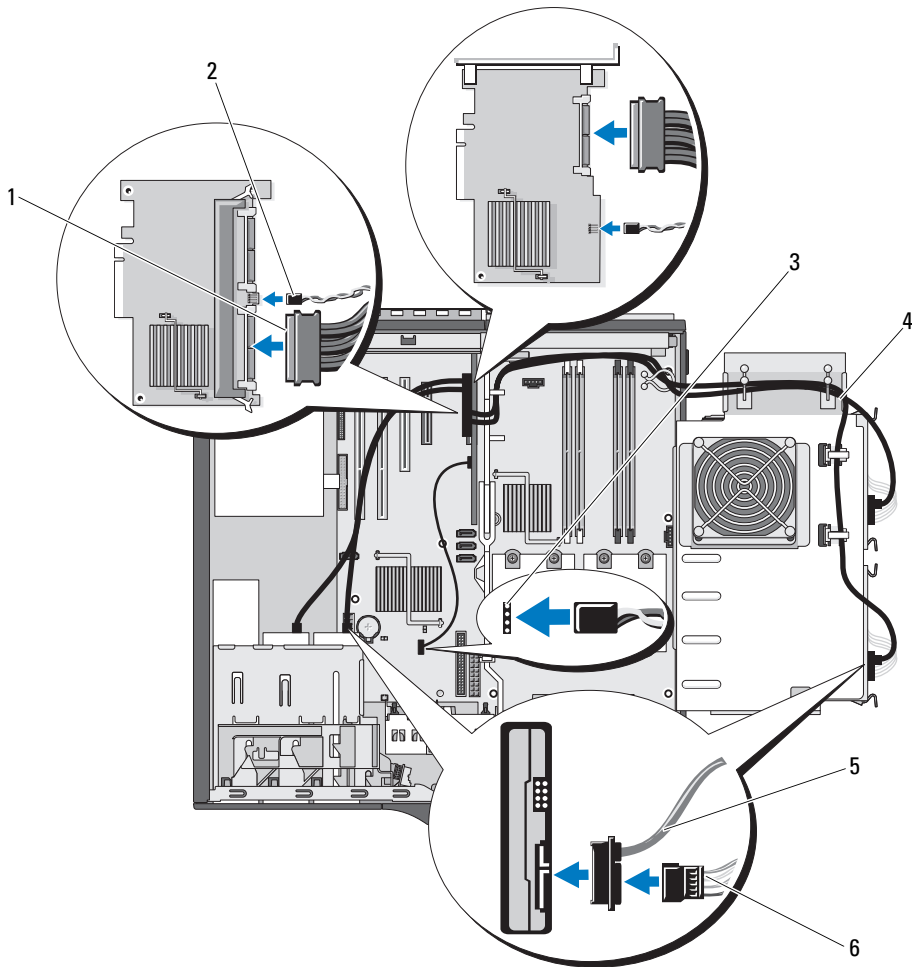


| | | | | | |
|---|---|---|---|---|---|
| 1 | SAS cable | 2 | hard-drive activity indicator cable | 3 | AUX_LED connector |
| 4 | long SAS data cables (2) | 5 | SAS data cable | 6 | power cable |

🚫 **NOTICE:** If metal shields are present in your system configuration, they must be installed at all times while your system is in use or your system may not function properly.

**13** If metal shields are present in your system, install the vented metal insert over the flex bay and the empty space beneath it:

    **a** Insert the metal insert's two upper screws and its two lower screws into the corresponding slots inside the flex bay.

    **b**   Push the vented metal insert until it clicks into place and its metal tabs rest flush against the chassis surface.

**14** Reinstall the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

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

Ensure that the SAS cable is connected to the blue primary connector if the SAS controller card has two connectors.

**16** Close the system. See "Closing the System" on page 43.

**17** Reconnect the system to the electrical outlet, and 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.

**18** Enter the System Setup program (see "Entering the System Setup Program" on page 27), and ensure that the drive's controller is enabled.

**19** Exit the System Setup program, and reboot the system.

**20** Partition and logically format your drive before you proceed to the next step.

See the documentation for your operating system for instructions.

**21** (Optional) Test the hard drive. See "Running the System Diagnostics" on page 113 for instructions.

### Removing an Optional Fourth Hard Drive

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

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

**2** Open the system. See "Opening the System" on page 43.

**3** Remove the front drive bezel. See "Removing and Replacing the Front Drive Bezel" in "Troubleshooting Your System."

**4** Pull the drive bay sliding plate downward in the direction of the arrow on the plate. See Figure 3-13.

**5** Hold the sliding plate in position and slowly pull the optional hard-drive carrier out of the bay until you can access the cable connections to the back of the drive.

**6** Disconnect the power and interface cables from the drive. See Figure 3-12.

**7** Disconnect the drive carrier fan cable from the FAN_HDD connector on the system board. See Figure 6-2.

**8** Pull the drive carrier out of the bay.

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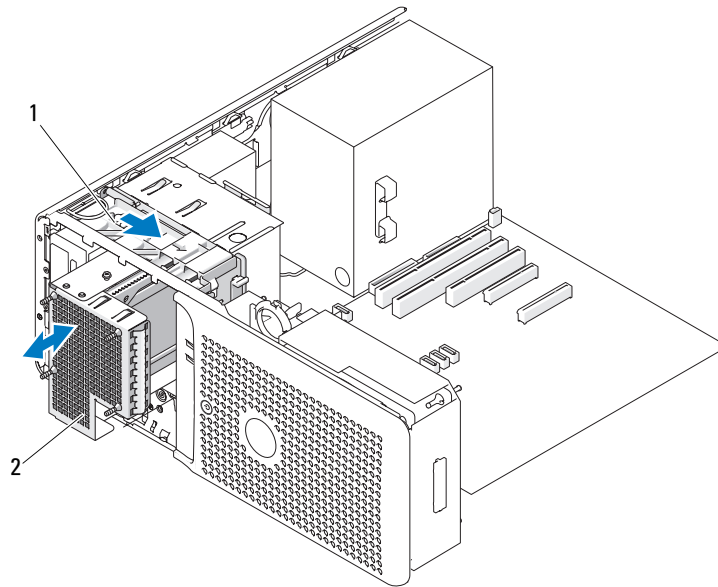


| 1 | drive bay sliding plate | 2 | optional hard-drive carrier in lower 5.25-inch drive bay |

⊘ **NOTICE:** If metal shields are present, they must be installed at all times while your system is in use or your system may not function properly.

9   If you are not installing another drive in the bay, install the 5.25-inch metal shield in its place; align its screws in the metal rails and push the shield back until it clicks into place.

10   If you are installing another drive in the bay, see "Installing an Optional Fourth Hard Drive" on page 59 or "Installing an Optical or Tape Drive" on page 68.

11   Replace the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

12   Close the system. See "Closing the System" on page 43.

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

## Installing an Optional Fourth Hard Drive

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

**NOTICE:** If the fan cable from the optional hard-drive carrier is not correctly connected to the FAN_HDD connector on the system board and detected by the system BIOS, premature drive failure can occur. Follow the steps in this section carefully and verify fan detection through the System Setup program as described.

**NOTE:** Installing a fourth hard drive requires an optional hard-drive carrier with a cooling fan.

1 If you are installing a new drive, unpack the drive and prepare it for installation.

Check the documentation for the drive to verify that it is configured for your system.

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 43.

4 Remove the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

5 If the flex bay is not populated and metal shields are present in your system, slide the sliding-plate lever to the right and hold it in place as you pull to remove the vented metal insert from the flex bay.

6 If an optical or tape drive is installed in the lower 5.25-inch drive bay, remove it. See "Removing an Optical or Tape Drive" on page 66.

7 If you are replacing a hard drive, remove the hard-drive carrier. See "Removing an Optional Fourth Hard Drive" on page 58.

8 Press the drive release tabs on each side of the hard-drive bracket toward each other and slide the drive out of the drive carrier. See Figure 3-14.

If there is a hard-drive bracket in the empty drive carrier, remove the bracket by pressing its tabs toward it each other and pulling it up and out of the drive carrier.

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

Flex the hard-drive bracket open and align the side holes in the new hard drive with the pins on the bracket; release the tension upon the bracket so that the hard drive is securely fastened. See Figure 3-8.

10 Slide the hard drive into the hard-drive carrier until it clicks securely into place. See Figure 3-14.

**Figure 3-14. Installing a Fourth Hard Drive in the Optional Hard-Drive Carrier**
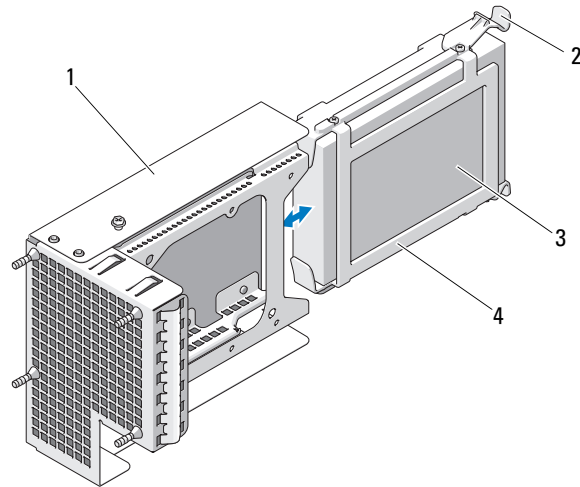


| 1 | optional hard-drive carrier | 2 | drive release tabs (2) | 3 | hard drive |
|---|------------------------------|---|------------------------|---|------------|
| 4 | hard-drive bracket | | | | |

**11** Carefully insert the drive carrier into the lower 5.25-inch drive bay, passing the fan cable through the opening on the bottom of the drive bay, and slide the drive carrier far enough into the system to access the connectors on the back of the drive.

**12** Attach the power and data cables to the hard drive. See Figure 3-12.

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

**14** Route the fan cable over the card fan and through the plastic clips on the bottom of the system chassis, as shown in Figure 3-15. Connect the fan cable securely to the FAN_HDD connector on the system board. See Figure 3-15 and Figure 6-2.

**Figure 3-15.   Connecting the Cooling Fan for an Optional Fourth Hard Drive**
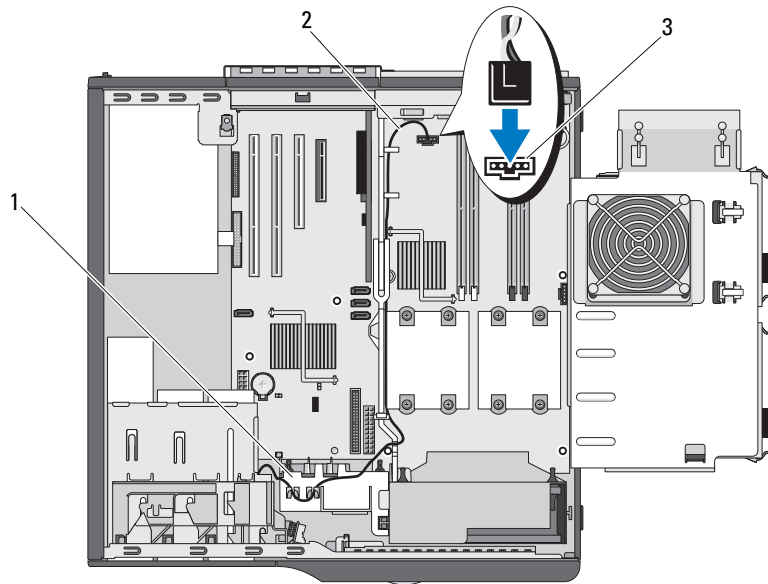


| | 1 | card fan | 2 | fan power cable | 3 | FAN_HDD connector |

**15** Check all cable connections, and fold cables out of the way to allow for airflow between the fan and cooling vents.

**16** Reinstall the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

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

**18** Close the system. See "Closing the System" on page 43.

**19** Reconnect the system to the electrical outlet, and 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.

**20** Enter the System Setup program (see "Entering the System Setup Program" on page 27), and ensure that the drive's controller is enabled.

 **NOTICE:** If the fan cable from the optional hard-drive carrier is not correctly connected to the FAN_HDD connector on the system board and detected by the system BIOS, premature drive failure can occur.

**21** Verify that the **Optional Hard-Disk Drive** field in System Setup displays **Installed**. See "Integrated Devices Screen" on page 32.

**22** Exit the System Setup program, and reboot the system.

**23** Partition and logically format your drive before you proceed to the next step.

See the documentation for your operating system for instructions.

**24** (Optional) Test the hard drive. See "Running the System Diagnostics" on page 113 for instructions.

# Diskette Drive

### Removing the Diskette Drive

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

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

**2** Open the system. See "Opening the System" on page 43.

**3** Remove the front drive bezel. See "Removing and Replacing the Front Drive Bezel" in "Troubleshooting Your System."

**4** Disconnect the power and interface cables from the diskette drive. See Figure 3-16.

**5** Pull the drive bay sliding plate downward in the direction of the arrow on the plate. See Figure 3-16.

**6** Hold the sliding plate in position and slowly pull the drive out of the bay.

**Figure 3-16. Removing or Installing a Diskette Drive**



| 1 | drive bay sliding plate | 2 | interface cable | 3 | power cable |
|---|---|---|---|---|
| 4 | DSKT connector | | | |

7 If the drive is being permanently removed, install a front drive bezel insert. See "Removing and Replacing the Front Drive Bezel Insert" on page 47.

8 Replace the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

9 Close the system. See "Closing the System" on page 43.

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

### Installing a Diskette Drive

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

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

2 Open the system. See "Opening the System" on page 43.

**3** Unpack the replacement diskette drive, and prepare it for installation.

**4** Check the documentation for the drive to verify that it is configured for your system.

**5** Attach the four shoulder screws to the drive as shown in Figure 3-17.

✍ **NOTE:** Spare shoulder screws are attached to the inside of the front drive bezel.

**6** Remove the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

**Figure 3-17.   Installing Diskette Drive Shoulder Screws**



1     screws (4)

**7** Remove the front drive bezel insert. See "Removing and Replacing the Front Drive Bezel Insert" on page 47.

**8** From the front of the chassis, slide the drive into the drive bay until the shoulder screws snap securely into the sliding plate.

**9** Connect the power cable to the drive. See Figure 3-16.

**10** Connect the interface cable from the drive to the DSKT connector on the system board. See Figure 3-16 and Figure 6-2.

**11** Close the system. See "Closing the System" on page 43.

**12** Replace the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

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

**14** Enter the System Setup program and ensure that the drive's controller is enabled. See "Using the System Setup Program" on page 27.

**15** (Optional) Test the drive by running the system diagnostics. See "Running the System Diagnostics" on page 113.

# Optical and Tape Drives

Only an optical drive can be installed in the upper 5.25-inch drive bay. Either an optical or a tape drive can be installed in the lower 5.25-inch drive bay, unless it is occupied by an optional third hard drive.
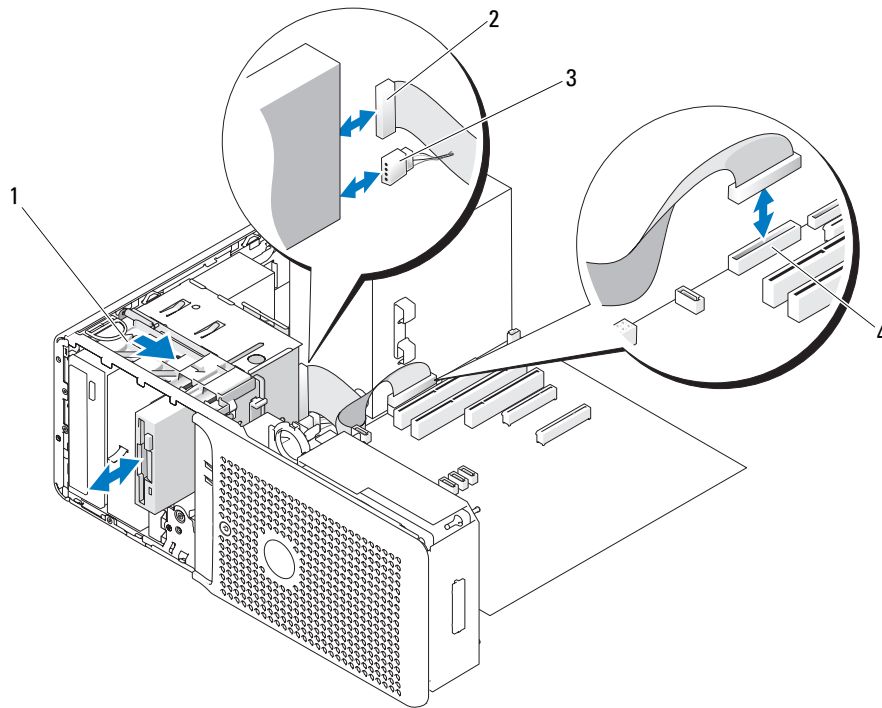
## Removing an Optical or Tape Drive

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

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

2 Open the system. See "Opening the System" on page 43.

3 Remove the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

4 Disconnect the power and data cables from the back of the drive. See Figure 3-18.

5 Slide the sliding-plate lever to the right to release the shoulder screw and slide the drive out to remove it from the drive bay.

**Figure 3-18. Removing and Installing an Optical or Tape Drive**
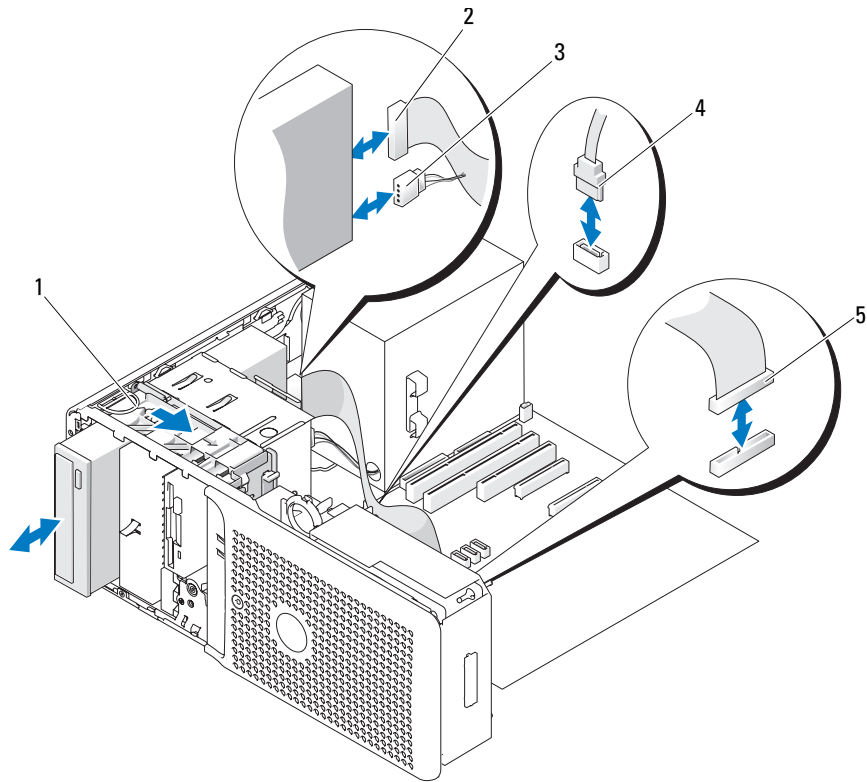


| 1 | drive bay sliding plate | 2 | interface cable | 3 | power cable |
|---|---|---|---|---|---|
| 4 | SATA cable | 5 | IDE connector | | | |

⊘ **NOTICE:** If metal shields are present, they must be installed at all times while your system is in use or your system may not function properly.

6 If you are not installing another drive in the bay, install the 5.25-inch metal shield in its place; align its screws in the metal rails and push the shield back until it clicks into place.

7 If you are installing another drive in the bay, see "Installing an Optical or Tape Drive" on page 68.

8 If the drive is being permanently removed, install a front drive bezel insert. See "Removing and Replacing the Front Drive Bezel Insert" on page 47.

9 Replace the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

10 Close the system. See "Closing the System" on page 43.

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

## Installing an Optical or Tape Drive

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

1 Unpack the drive and prepare the drive 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 70) and 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 Attach the three shoulder screws to the drive. See Figure 3-19.

📝 **NOTE:** Spare shoulder screws are attached to the inside of the front drive bezel insert.

**Figure 3-19.  Installing Optical or Tape Drive Shoulder Screws**
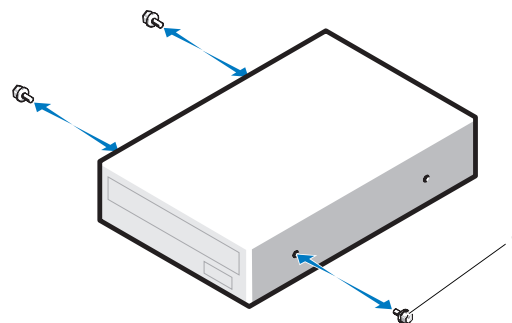


1        screws (3)

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

**4** Open the system. See "Opening the System" on page 43.

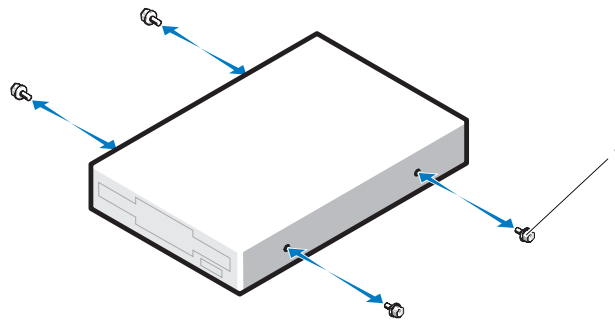**5** Remove the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

**6** If necessary, remove the drive bezel insert from the empty drive bay. See "Removing and Replacing the Front Drive Bezel Insert" on page 47.

**7** If another device is installed in the drive bay, remove that device. See "Removing an Optical or Tape Drive" on page 66.

◗ **NOTICE:** If metal shields are present, they must be installed at all times while your system is in use or your system may not function properly.

**8** If the drive bay is unpopulated and metal shields are present, slide the sliding plate lever to the right and hold it in place as you pull to remove the 5.25-inch metal shield.

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

**10** Attach the power and data cables to the optical or tape drive. See Figure 3-18.

  - If you are installing an IDE drive, another drive may be attached to the same data cable by another connector. The other end of the data cable should connect to the IDE connector on the system board. See Figure 6-2.

  - If you are installing a SATA tape drive (when available), connect the other end of the data cable to the SATA_2 or SATA_3 connector on the system board. See Figure 3-18 and Figure 6-2.

  - 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.

**11** Check all cable connections, and fold cables out of the way to allow for airflow between the fan and cooling vents.

**12** Close the system. See "Closing the System" on page 43.

**13** Replace the front drive bezel. See "Removing and Replacing the Front Drive Bezel" on page 46.

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

**15** If you installed an IDE drive, enter the System Setup program and ensure that the drive's IDE controller is enabled. See "Using the System Setup Program" on page 27.

**16** (Optional) Test the drive by running the system diagnostics. See "Running the System Diagnostics" on page 113.

# Expansion Cards

## Installing an Expansion Card

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

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

2 Open the system. See "Opening the System" on page 43.

3 Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

4 Press the two release tabs on the card retention door towards each other and pivot the door open. See Figure 3-20.

**Figure 3-20. Removing and Installing an Expansion Card**
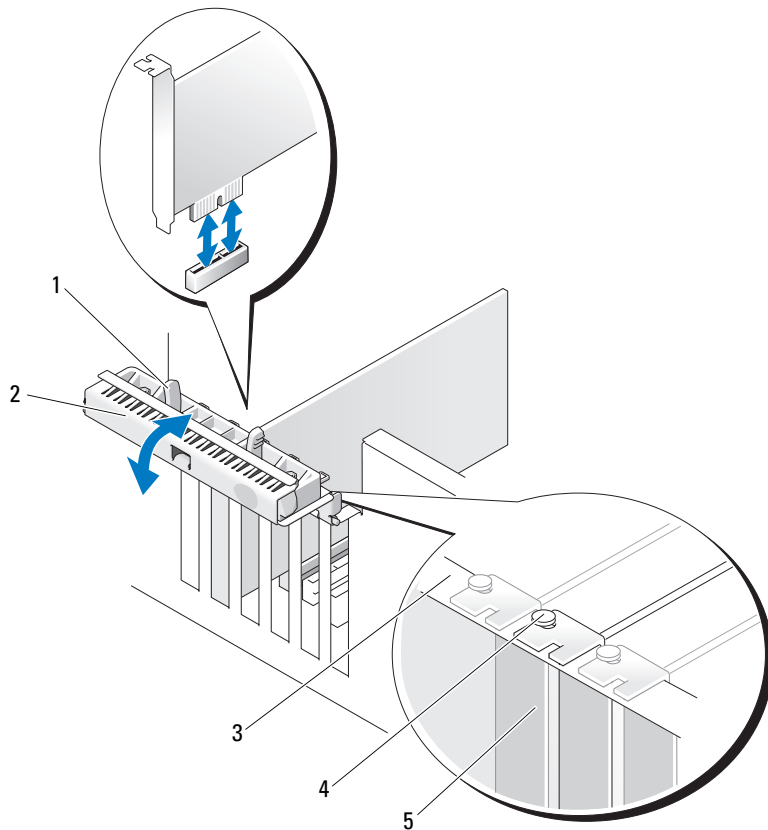


| 1 | release tab | 2 | card retention door | 3 | alignment bar |
|---|---|---|---|---|---|
| 4 | alignment guide | 5 | filler bracket | | |

**5** 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 Federal Communications Commission (FCC) certification of the system. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

**6** 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.

**7** Place the card-edge connector in the expansion-card connector and press down firmly. Ensure that the card is fully seated in the slot and all cards and filler brackets are flush with the alignment bar.

**8** Close the card retention door to secure the card(s) 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 Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

11 Close the system. See "Closing the System" on page 43.

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

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

### Removing an Expansion Card

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

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

2  Open the system. See "Opening the System" on page 43.

3  Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

4  Press the two release tabs on the card retention door inward to open it. See Figure 3-20.

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 opening.

   **NOTE:** 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.

8  Close the card retention door to secure the remaining card(s) in the system. See Figure 3-20.

9  Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

10 Close the system. See "Closing the System" on page 43.

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

## Installing a SAS Controller Expansion Card

Read the installation instructions in the documentation for your SAS controller expansion card. Install the card in expansion card slot 1 (see Figure 6-2 for slot location and "Installing an Expansion Card" on page 70), and connect the hard-drive activity indicator cable from the card to the AUX_LED connector

on the system board (see Figure 6-2 for the connector location). If your expansion card has two interface connectors, connect the data cable to the primary controller interface connector. See "Hard Drives" on page 48 for information about connecting hard drives.

# Microprocessor

You can upgrade the system processor(s) to take advantage of future options in speed and functionality, or add a second processor. 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 the Processor

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

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

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

3 Open the system. See "Opening the System" on page 43.

⊘ **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.

4 Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

5 Rotate the processor access door to its open position. See Figure 3-21.

  ✐ **NOTE:** To loosen the four captive screws on the sides of the heat-sink assembly, you need a Phillips screwdriver with at least a 6-inch blade.

6 Loosen but do not remove the four screws on the sides of the heat-sink assembly. Leave the screws in place to retain the springs under the screws.

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

8 Lift to remove the heat-sink assembly from the system.

9 If the heat sink has not separated from the processor, carefully rotate the heat sink in a clockwise, then counterclockwise, direction until it releases from the processor. Do not pry the heat sink off of the processor.

10 Lift the heat sink off of the processor and set the heat sink aside.

**Figure 3-21.   Installing and Removing the Heat Sink**
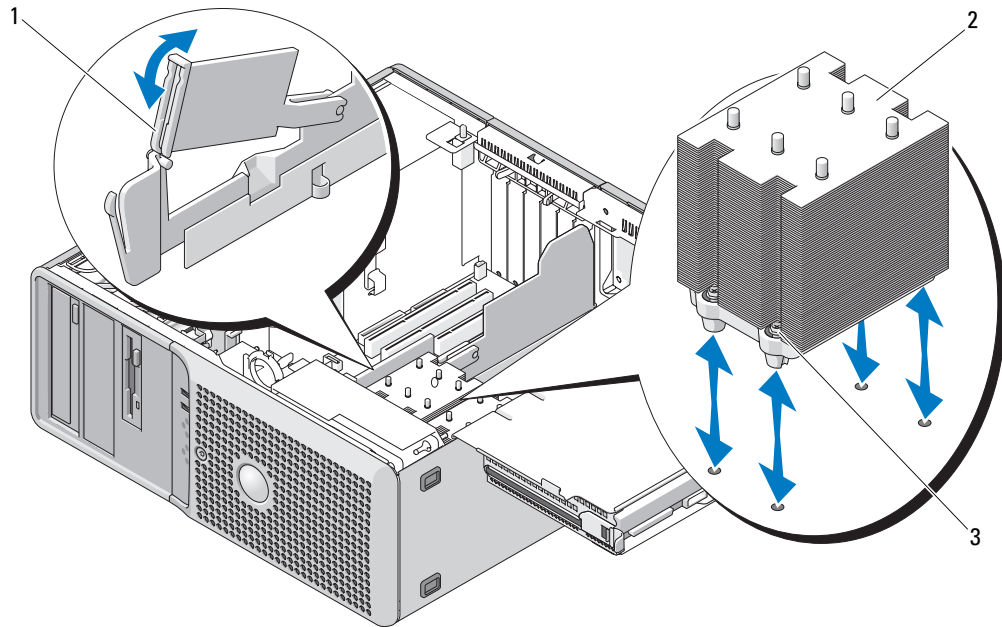


| 1 | processor access door | 2 | heat-sink assembly | 3 | captive screw housing (4) |

11  Pull the socket-release lever 90 degrees upward until the processor shield is released from the socket. See Figure 3-22.

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

**Figure 3-22.    Installing and Removing a Processor**
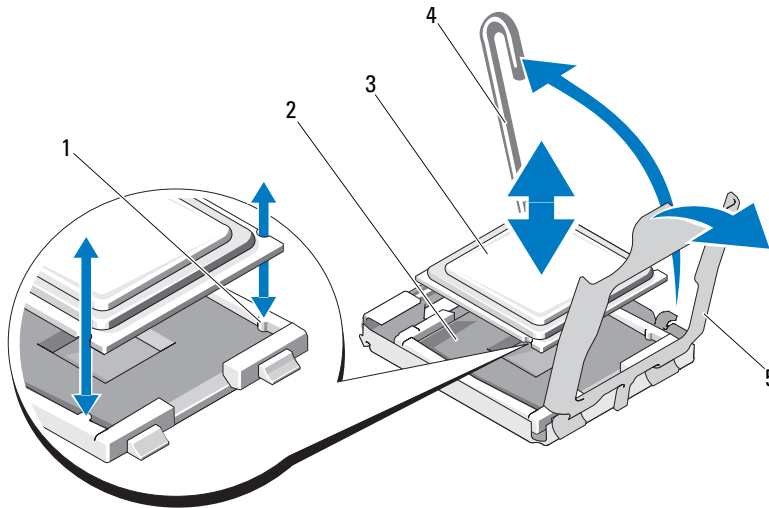


| 1 | socket key (2) | 2 | ZIF socket | 3 | processor |
|---|---|---|---|---|---|
| 4 | socket-release lever | 5 | processor shield | | |

13  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.

## Replacing the Processor

1  Unpack the new processor.

2  Align the processor with the socket keys on the ZIF socket. See Figure 3-22.

3  Install the processor in the socket.

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

   **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, making sure all pins are matched with the correct holes in the socket.

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

**c** When the processor is fully seated in the socket, rotate the socket release lever back down until it snaps into place, securing the processor. See Figure 3-22.

**d** Close the processor shield. See Figure 3-22.

**4** Install the heat sink.

**a** Using a clean lint-free cloth, remove the existing thermal grease from the heat sink.

✐ **NOTE:** If you did not receive a replacement heat sink, use the heat sink that you removed in "Removing the Processor" on page 73.

**b** Remove the protective sheet from the thermal grease layer on top of the processor. If you receive the processor without the thermal grease pre-applied, open the grease packet included with your processor kit and apply thermal grease evenly to the top of the processor.

**c** Place the heat-sink assembly back onto the heat-sink assembly bracket. See Figure 3-21.

**d** Rotate the heat-sink assembly down towards the system base and tighten the four capture screws.

**5** Close the processor access door.

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

**7** Rotate the hard-drive carrier back into place. See "Rotating the Hard-Drive Carrier Into the System" on page 46).

**8** Close the system. See "Closing the System" on page 43.

**9** Reconnect the system to the electrical outlet and 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.

**10** Press <F2> to enter the System Setup program, and check that the processor information matches the new system configuration. See "Using the System Setup Program" on page 27 for instructions about using the System Setup program.

**11** Run the system diagnostics to verify that the new processor operates correctly. See "Running the System Diagnostics" on page 113 for information about running the diagnostics and troubleshooting processor problems.

# Memory

You can upgrade your system memory to a maximum of 8 GB by installing 533MHz or, when available, 667MHz fully buffered DIMMs (FBDs) in dual sets of 256-MB, 512-MB, 1-GB, or 2-GB. The memory sockets are located on the system board beneath the rotatable hard-drive carrier. See Figure 6-2.

◯ **NOTICE:** If you remove your original memory modules from the system during a memory upgrade, keep them separate from any new memory modules that you may have. Use only 533 MHz or, when available, 667 MHz FBDs.

## General Memory Module Installation Guidelines

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

- Use only qualified FBDs. FBDs can be either single-ranked or dual-ranked. FBDs marked with a 1R are single-ranked and modules marked with a 2R are dual-ranked.
- A minimum of two identical FBDs must be installed.
- DIMM sockets must be populated by lowest number first.
- FBDs must be installed in pairs of matched memory size, speed, and technology. For best system performance, all FBDs should be identical memory size, speed, and technology.

## Non-Optimal Memory Configurations

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

## Installing Memory Modules

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

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

2 Open the system. See "Opening the System" on page 43.

3 Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

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

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

5 Press the ejectors on the memory module socket down and out, as shown in Figure 3-23, to allow the memory module to be inserted into the socket.

Figure 3-23.  Installing and Removing a Memory Module
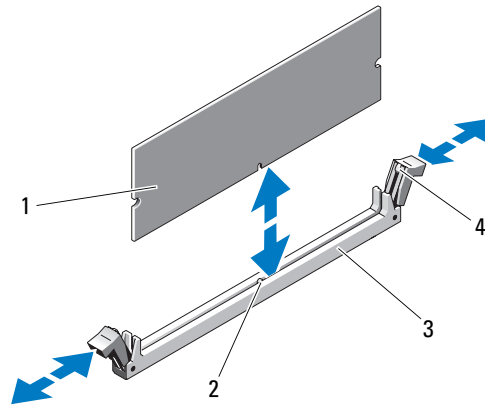


| 1 | memory module | 2 | alignment key | 3 | socket |
| 4 | memory module socket ejectors (2) | | | | |

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

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

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

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

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

9   Close the system. See "Closing the System" on page 43.

10  Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

11  Reconnect the system and peripherals to power and turn them on.

12  (Optional) Press <F2> to enter the System Setup program, and check the System Memory setting on the main System Setup screen.

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

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

**14** Run the system memory test in the system diagnostics. See "Running the System Diagnostics" on page 113.

## Removing Memory Modules

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

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

**2** Open the system. See "Opening the System" on page 43.

**3** Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

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

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

**5** Press down and out on the ejectors on each end of the socket until the memory module pops out of the socket. See Figure 3-23.

**6** Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

**7** Close the system. See "Closing the System" on page 43.

**8** Connect the power cable to the power supply and the power outlet.

# System Battery

## Replacing the System Battery

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

**1** Enter the System Setup program and record the option settings on the System Setup screens. See "Using the System Setup Program" on page 27.

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

**3** Open the system. See "Opening the System" on page 43.

**4** See Figure 6-2 for the location of the system battery and then remove any cables that block access to the battery.

**5** Remove the system battery.

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

    **a** Support the battery connector by pressing down firmly on the positive side of the connector. See Figure 3-24.

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

**Figure 3-24.   Replacing the System Battery**
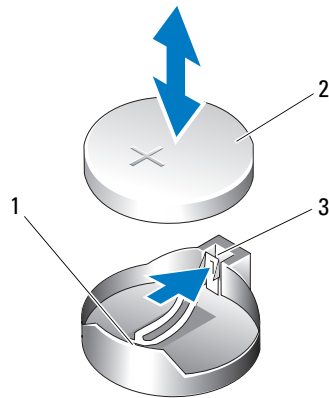


| 1 | positive side of connector | 2 | system battery | 3 | negative side of connector |

**6** Install the new system battery (see Figure 3-24):

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

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

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

**7** Replace all the expansion cards you removed in step 4. See "Installing an Expansion Card" on page 70.

**8** Close the system. See "Closing the System" on page 43.

**9** Reconnect the system to the electrical outlet and turn on the system and attached peripherals.

**10** Enter the System Setup program to confirm that the battery operates properly.

**11** From the main screen, select System Time to enter the correct time and date.

**12** Re-enter any system configuration information that is no longer displayed on the System Setup screens, and then exit the System Setup program.

**13** To test the newly installed battery, see "Troubleshooting the System Battery" on page 102.

# Power Supply

## Removing the Power Supply

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

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

2 Open the system. See "Opening the System" on page 43.

3 Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

4 Disconnect the DC power cables from the system board (POWER1 and POWER2), the drives, and any other cards or devices to which they are connected.

   🖉 **NOTE:** Note the routing of the DC power cables underneath the tabs in the system frame as you release the tabs and remove the cables from the system board and drives. You must route these cables properly when you replace them to prevent their being pinched or crimped.

5 Using a #2 Phillips screwdriver, remove the four Phillips screws that secure the power supply to the back panel.

6 Press the power-supply release tab down and slide the power supply toward the front of the system, then lift it out of the system chassis. See Figure 3-25.

**Figure 3-25.   Removing the Power Supply**
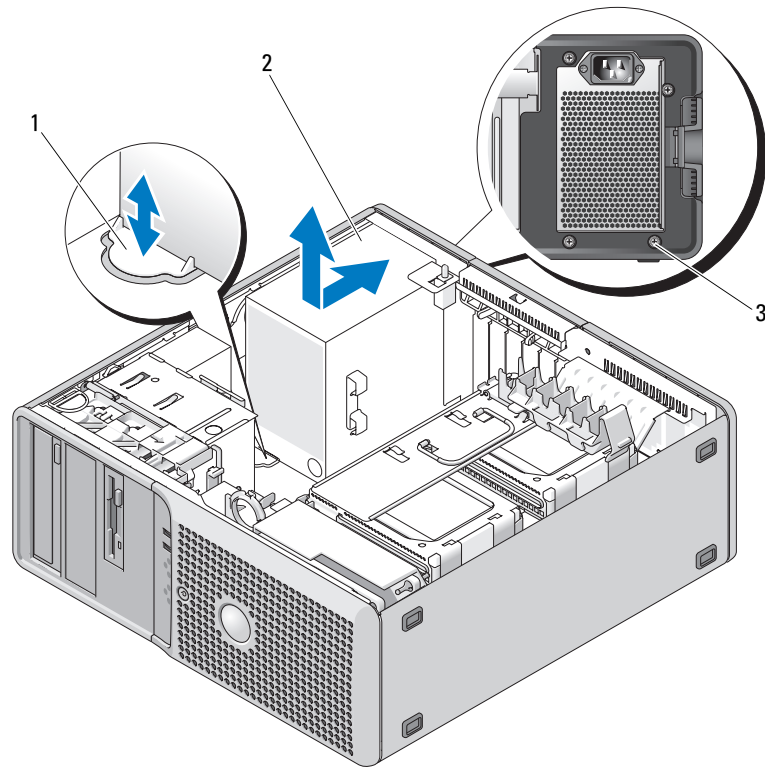


| 1 | power supply release tab | 2 | power supply | 3 | screws (4) |

## Installing the Power Supply

1  Prepare the new power supply for installation.

2  Align the power supply mounting holes with the mounting holes on the back panel.

3  Slide the power supply toward the back panel, into the hooks on the side and bottom of the chassis, until it snaps into place over the power-supply release tab.

4  Using a #2 Phillips screwdriver, install the four Phillips screws that secure the power supply to the back panel.

5  Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

6  Reconnect the power-supply cables.

7  Close the system. See "Closing the System" on page 43.

# Replacing the Cooling Fans

The system incorporates three cooling fans, and a fourth fan is included with the optional fourth hard-drive carrier. The card fan and front fan must be removed to access certain other system components. The memory fan on the rotatable hard-drive carrier should be removed only if it is being replaced. The fourth hard-drive fan is integrated in the optional fourth hard-drive carrier.

## Replacing the Card and Front Fans

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

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

2   Open the system. See "Opening the System" on page 43.

3   Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

4   Disconnect the card fan cable from the FAN_CCAG connector on the system board. See Figure 6-2.

5   Pull to remove the full-length card retainer beside the card fan. See Figure 3-26.

6   Press the tab between the card fan and the front fan towards the card fan as you lift it up and out of the system.

**Figure 3-26.   Removing and Installing the Card Fan**
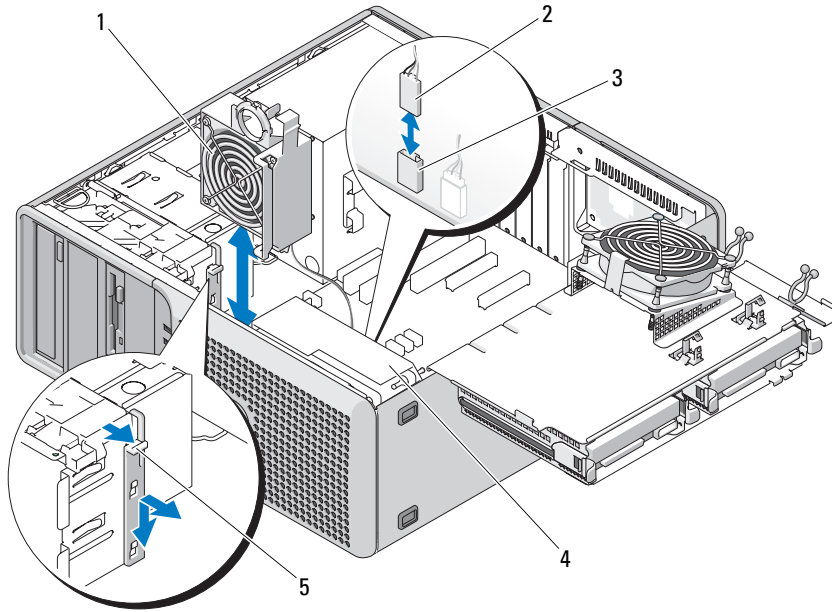


| 1 | card fan | 2 | card fan cable | 3 | card fan system-board connector (FAN_CCAG) |
|---|----------|---|----------------|---|--------------------------------------------|
| 4 | front fan | 5 | full-length card retainer | | |

**7** Disconnect the front fan cable from the FAN_FRONT connector on the system board. See Figure 6-2.

**8** Remove the cables from the channel at the bottom of the front fan assembly.

**9** Unscrew the fan case and lift to remove the front fan assembly from the system. See Figure 3-27.

**10** Perform the preceding steps in reverse order to reinstall the fans.

**Figure 3-27.    Removing and Installing the Front Fan**
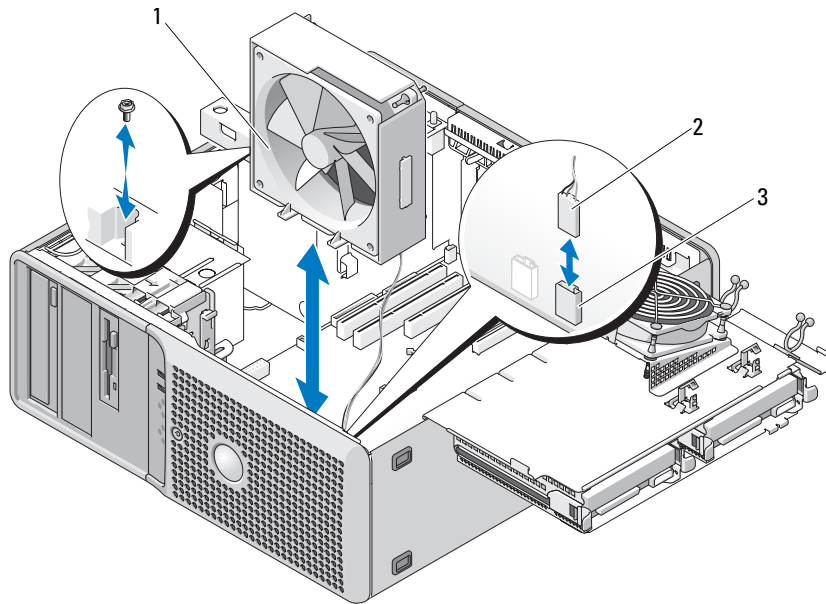


| | | | | | |
|---|---|---|---|---|---|
| 1 | front fan assembly | 2 | front fan cable | 3 | front fan system-board connector (FAN_FRONT) |

## Replacing the Memory Fan

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

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

**2** Open the system. See "Opening the System" on page 43.

**3** Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

**4** Disconnect the card fan cable from the FAN_MEM connector on the system board. See Figure 6-2.

**5** Remove the hard-drive from the bay beneath to the memory fan. See "Removing a Hard Drive from the Rotatable Carrier" on page 49.

**6** Pull the four fan grommets out of the holes in the hard-drive carrier. Optionally, cut the grommets with a wire cutter if available.

**7** Place the new fan with the grommets aligned with the holes in the hard-drive carrier and press into place. Use needle-nose pliers to pull the grommets completely through the mounting holes.

**8** Reinstall the hard drive. See "Installing a Hard Drive in the Rotatable Carrier" on page 50.

**9** Connect the card fan cable from the FAN_MEM connector on the system board. See Figure 6-2.

**10** Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

**11** Close the system. See "Closing the System" on page 43.

### Replacing the Fourth Hard-Drive Fan

The fourth hard-drive fan is integrated in the optional fourth hard-drive carrier and is replaced as part of the carrier assembly. See "Removing an Optional Fourth Hard Drive" on page 58.

# Chassis Intrusion Switch

### Removing the Chassis Intrusion Switch

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

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

**2** Open the system. See "Opening the System" on page 43.

**3** Disconnect the chassis intrusion switch cable from the INTRUDER connector on the system board. See Figure 3-28.

**4** Slide the chassis intrusion switch out of the securing bracket notch. See Figure 3-28.

**5** Remove the switch and its attached cable from the system.

**Figure 3-28.   Removing and Installing the Chassis Intrusion Switch**



| 1 | chassis intrusion switch | 2 | securing bracket notch | 3 | INTRUDER connector |

## Installing the Chassis Intrusion Switch

1  Align the chassis intrusion switch with the securing bracket notch. See Figure 3-28.

2  Slide the switch into the securing bracket notch.

3  Connect the switch cable to the INTRUDER connector on the system board.

4  Close the system. See "Closing the System" on page 43.

5  Reconnect the system to the electrical outlet, and turn on the system.

# Removing and Replacing the Bezel (Service Only Parts Procedure)

## Removing the Bezel

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

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

2  Open the system. See "Opening the System" on page 43.

**3** Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

**4** Remove the card and front fans. See "Replacing the Card and Front Fans" on page 83.

**5** Using a #2 Phillips screwdriver, remove the three bezel release screws. See Figure 3-29. To remove the lower screw, angle the screwdriver over the top of the CPU1 heat sink, if populated.

**6** Rotate the top of the bezel away from the system chassis and remove it.

**Figure 3-29.  Removing the Bezel**
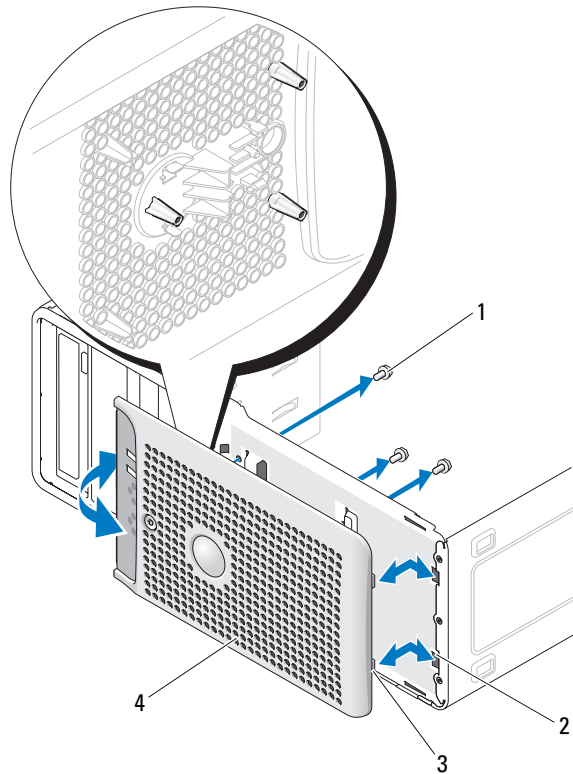


| 1 | bezel release screws (3) | 2 | slots (2) | 3 | hooks (3) |
|---|---|---|---|---|---|
| 4 | bezel | | | | |

## Replacing the Bezel

**1** Insert the hooks on the bottom of the bezel into the slots in the chassis and rotate it into position.

**2** Attach the three bezel release screws to secure the bezel to the system chassis. See Figure 3-29.

**3** Reinstall the front and card fans. See "Replacing the Card and Front Fans" on page 83.

**4** Reinstall the processor heat sink and shroud assembly. See "Replacing the Processor" on page 75.

**5** Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

**6** Close the system. See "Closing the System" on page 43.

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

# Front I/O Panel (Service Only Parts Procedure)

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

## Removing the Front I/O Panel

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

**2** Remove the system cover. See "Opening the System" on page 43.

**3** Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

**4** Remove the front bezel. See "Removing the Bezel" on page 87.

◯ **NOTICE:** Carefully note the routing of each cable before you disconnect it, so that you are sure to re-route cables correctly.

**5** Note the routing of each cable as you disconnect the I/O panel ribbon cable and the thermal diode cable from the I/O panel.

Disconnect the I/O panel ribbon cable from the I/O panel connector by pulling the yellow cable loop.

**6** Remove the mounting screw holding the I/O panel bracket assembly to the front chassis. See Figure 3-30.

**7** Lift the I/O panel out of the system.

**8** If you are replacing the I/O panel, perform the following steps:

  **a** Remove the screw attaching the I/O board to the mounting bracket. See Figure 3-30.

  **b** Slide the board to the side to remove the two hooks from the slots in the mounting bracket.

  **c** Disconnect the thermal diode cable and set it aside to install on the new I/O panel.

Figure 3-30.   Removing and Installing the Front I/O-Panel
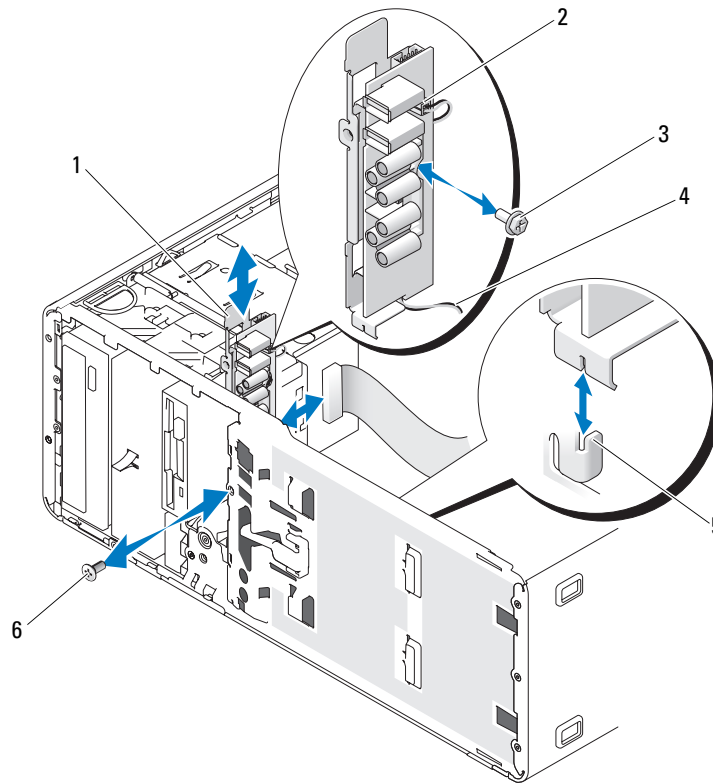


| 1 | I/O panel | 2 | thermal diode cable connector | 3 | I/O board mounting screw |
| 4 | thermal diode cable | 5 | holding tab | 6 | assembly mounting screw |

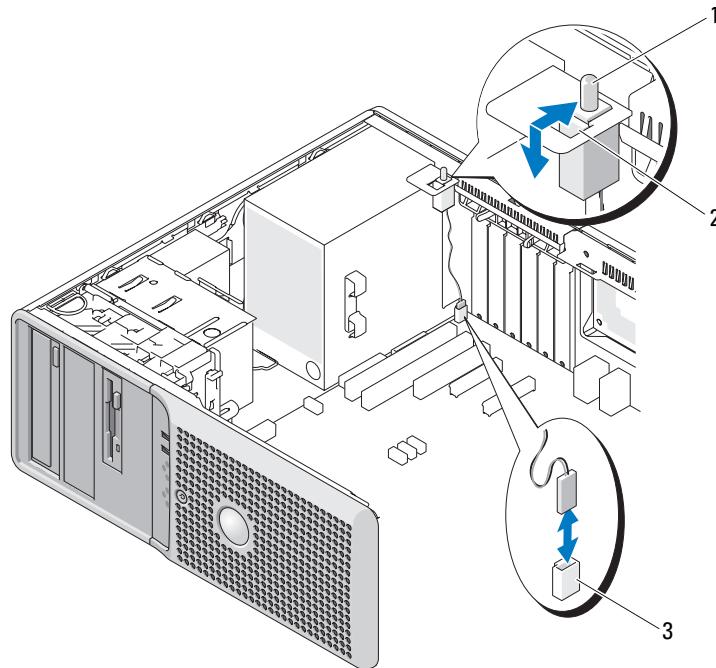## Replacing the Front I/O Panel

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

1  If you are replacing the I/O panel, perform the following steps:

  a   Remove the screw attaching the new I/O board to the mounting bracket. See Figure 3-30.

  b   Slide the board to the side to disengage the two hooks from the slots in the mounting bracket.

  c   Connect the thermal diode cable that you removed in step 8 of "Removing the Front I/O Panel" on page 89 to the connector on the new I/O panel board.

**d** Place the I/O panel board on the mounting bracket, routing the thermal diode cable under the board, and slide the board to the side to engage the hooks in the mounting bracket slots.

**e** Reinstall the screw connecting the I/O panel board to the mounting bracket.

**2** Fit the I/O panel bracket assembly into the holding tab on the front of the chassis. See Figure 3-30.

**3** Secure the I/O panel bracket assembly by installing the I/O panel assembly mounting screw.

**4** Connect the cables the new I/O panel that you removed in step 5 of "Removing the Front I/O Panel" on page 89.

**5** Reinstall the front bezel. See "Replacing the Bezel" on page 88.

**6** Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

**7** Close the system. See "Closing the System" on page 43.

**8** Reconnect the system to the electrical outlet, and turn on the system.

# Thermal Diode Cable (Service Only Parts Procedure)

To replace a faulty thermal diode cable, follow the steps in "Removing the Front I/O Panel" on page 89 to remove the front I/O panel and remove the old thermal diode cable. Then, install the new cable and reinstall the front I/O panel as described in "Replacing the Front I/O Panel" on page 90.

# System Board (Service Only Parts Procedure)

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

⚠ **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.**

### Removing the System Board

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

**2** Remove the system cover. See "Opening the System" on page 43.

**3** Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

**4** Remove the processor access door assembly:

**a** Remove the green screw that attaches the processor access door assembly to the system board and to the system chassis.

**b** Lift to remove the processor access door assembly from the system.

**5** Remove the card and front fans. See "Replacing the Card and Front Fans" on page 83.

**6** Disconnect the following cables from the system board. See Figure 6-2.

- Two power-supply cables from the POWER1 and POWER2 connectors
- If applicable, diskette data cable from the DSKT connector
- I/O panel cable from the FRONT PANEL connector
- 5.25-inch device data cable from the IDE connector
- Memory cooling fan cable from the FAN_MEM connector
- If applicable, data cable(s) from the SATA connector(s)

**7** Remove all expansion cards and any attached cables. See "Removing an Expansion Card" on page 72.

**8** Remove all memory modules. See "Removing Memory Modules" on page 79.

✍ **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.

**9** Remove the processors. See "Removing the Processor" on page 73.

**10** Using a #2 Phillips screwdriver, remove the nine system board mounting screws that secure the system board to the chassis. See Figure 3-31.

✍ **NOTE:** To remove all of the screws, you need a Phillips screwdriver with a blade at least 6 inches long.

**Figure 3-31.   System Board Mounting Points**
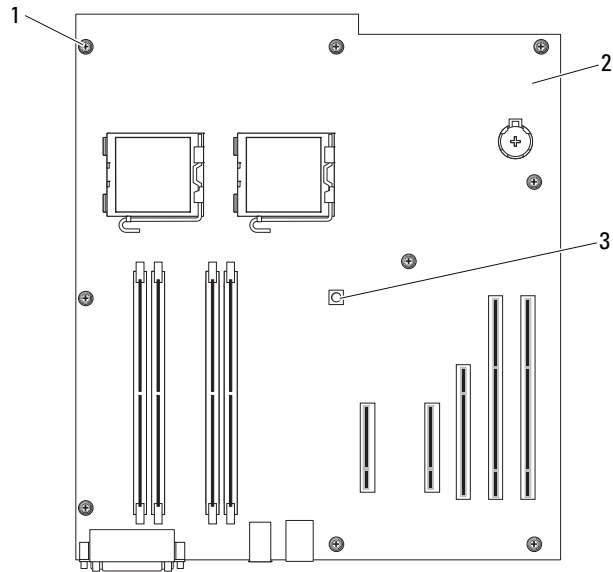


| 1 | screws (9) | 2 | system board | 3 | mounting hole for processor access door (green screw) |

**11** Carefully route any loose cables away from the edges of the system board.

**12** Gently slide the system board toward the front of the system, then lift the system board up and out of the chassis.

**13** Place the system board on a flat, nonconductive surface.

## Installing the System Board

**1** Lower the system board into the chassis, aligning the I/O ports on the system board with the I/O connector openings on the back panel of the chassis.

**2** Using a #2 Phillips screwdriver, install the nine screws on the system board that secure it to the chassis. See Figure 3-31.

> **NOTICE:** To prevent damaging the processor, clean the heat sink to remove any thermal grease and then apply fresh thermal grease to the processor before installing the heat sink.

**3** Install the processors. See "Replacing the Processor" on page 75.

**4** Install the memory modules in the same sockets from which they were removed. See "Installing Memory Modules" on page 77.

**5** Reinstall the processor access door assembly, using the green screw to attach it to the system board and system chassis.

6   Install the expansion cards and connect any cables. See "Installing an Expansion Card" on page 70.

7   Connect the cables that you removed in "Removing the System Board" on page 91. See Figure 6-2.

8   Reinstall the card and front fans. See "Replacing the Card and Front Fans" on page 83.

9   Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

10  Close the system. See "Closing the System" on page 43.

11  Reconnect the system to the electrical outlet, and turn on the system.

# 4

# Troubleshooting Your System

## Safety First—For You and Your System

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

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

## Start-Up Routine

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

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

| Look/listen for: | Action |
| --- | --- |
| A code displayed on the system diagnostic indicators. | See "Diagnostics Indicator Codes" on page 15. |
| An error message displayed on the monitor. | See "System Messages" on page 17. |
| The monitor's power indicator. | See "Troubleshooting the Video Subsystem" on page 96. |
| The keyboard indicators. | See "Troubleshooting the Keyboard" on page 97. |
| The diskette drive activity indicator. | See "Troubleshooting a Diskette Drive" on page 105. |
| The CD drive activity indicator. | See "Troubleshooting an Optical Drive" on page 106. |
| The hard-drive activity indicator. | See "Troubleshooting a Hard Drive" on page 107. |
| An unfamiliar constant scraping or grinding sound when you access a drive. | See "Getting Help" on page 123. |

## 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 96.

### Troubleshooting IRQ Assignment Conflicts

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

Table 4-2. IRQ Assignment Defaults

| IRQ Line | Assignment |
| --- | --- |
| IRQ0 | System timer |
| IRQ1 | Keyboard controller |
| IRQ2 | Interrupt controller 1 to enable IRQ8 through IRQ15 |
| IRQ3 | *Available* |
| IRQ4 | Serial port (COM1 and COM3) |
| IRQ5 | Parallel port |
| IRQ6 | Diskette drive controller |
| IRQ7 | Reserved |
| IRQ8 | Real-time clock |
| IRQ9 | ACPI functions (used for power management) |
| IRQ10 | *Available* |
| IRQ11 | *Available* |
| IRQ12 | Mouse |
| IRQ13 | Math coprocessor |
| IRQ14 | IDE CD drive controller (available if disabled in System Setup program) |
| IRQ15 | Reserved (available if IDE CD controller is disabled in System Setup program) |

### 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 Figure 1-2 for the back-panel connectors on your system.

### Troubleshooting the Video Subsystem

#### *Problem*

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

*Action*

1 Check the system and power connections to the monitor.

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

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

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

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

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

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

4 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.

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

If the tests fail, see "Getting Help" on page 123.

## Troubleshooting the Keyboard

*Problem*

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

*Action*

1 Enter the System Setup program and ensure that the USB ports are enabled. See "Using the System Setup Program" on page 27.

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

3 Swap the faulty keyboard with a working keyboard.

If the problem is resolved, replace the faulty keyboard. See "Getting Help" on page 123.

4 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.

If the problem is not resolved, see "Getting Help" on page 123.

### Troubleshooting the Mouse

***Problem***

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

***Action***

1   Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.

     If the test fails, continue to the next step.

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

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

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

3   Swap the faulty mouse with a working mouse.

     If the problem is resolved, replace the faulty mouse. See "Getting Help" on page 123.

4   Enter the System Setup program and ensure that the USB port is enabled. See "Using the System Setup Program" on page 27.

     If the problem is not resolved, see "Getting Help" on page 123.

# Troubleshooting Serial I/O Problems

***Problem***

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

***Action***

1   Enter the System Setup program and ensure that the serial port is enabled and configured correctly for your application. See "Using the System Setup Program" on page 27.

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

3   Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.

     If the tests run successfully but the problem persists, see "Troubleshooting a Serial I/O Device" on page 99.

## 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 123.

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 123.

   If the problem persists, see "Getting Help" on page 123.

## Troubleshooting a USB Device

### Problem

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

### Action

1 Enter the System Setup program, and ensure that the USB ports are enabled. See "Using the System Setup Program" on page 27.

2 Turn off the system and any USB devices.

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

4 Turn on the system and the reconnected device.

   If the problem is resolved, the USB connector might be defective. See "Getting Help" on page 123.

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

   If the problem is resolved, replace the interface cable. See "Getting Help" on page 123.

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

7 Turn on the system and the USB device.

   If the problem is resolved, replace the USB device. See "Getting Help" on page 123.

   If the problem persists, see "Getting Help" on page 123.

# Troubleshooting a NIC

### Problem

- NIC cannot communicate with network.

### Action

1. Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.
2. Check the appropriate indicator on the NIC connector.

   - If the link indicator does not light, check all cable connections.
   - If the activity indicator does not light, the network driver files might be damaged or missing. Remove and reinstall the drivers if applicable. See the NIC's documentation.
   - Change the autonegotiation setting, if possible.
   - Use another connector on the switch or hub.

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

3. Ensure that the appropriate drivers are installed and the protocols are bound. See the NIC's documentation.
4. Enter the System Setup program and confirm that the NICs are enabled. See "Using the System Setup Program" on page 27.
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.

# Troubleshooting a Wet System

### Problem

- Liquid spilled on the system.
- Excessive humidity.

### Action

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

1. Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
2. Open the system. See "Opening the System" on page 43.
3. Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 72.

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

**5** Close the system. See "Closing the System" on page 43.

**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 123.

**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 70.

**8** Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.

If the tests fail, see "Getting Help" on page 123.

# Troubleshooting a Damaged System

*Problem*

• System was dropped or damaged.

*Action*

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

**1** Open the system. See "Opening the System" on page 43.

**2** Ensure that the following components are properly installed:

   • Expansion cards

   • Power supplies

   • Fans

   • Processors and heat sinks

   • Memory modules

**3** Ensure that all cables are properly connected.

**4** Close the system. See "Closing the System" on page 43.

**5** Run the system board tests in the system diagnostics. See "Running the System Diagnostics" on page 113.

If the tests fail, see "Getting Help" on page 123.

# Troubleshooting the System Battery

## Problem

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

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

## Action

1 Re-enter the time and date through the System Setup program. See "Using the System Setup Program" on page 27.

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

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

4 Enter the System Setup program.

If the date and time are not correct in the System Setup program, replace the battery. See "Replacing the System Battery" on page 79.

If the problem is not resolved by replacing the battery, see "Getting Help" on page 123.

**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 System Cooling Problems

## Problem

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

## Action

Ensure that none of the following conditions exist:

- System cover, drive blank, or front or back filler panel is removed.
- Ambient temperature is too high.
- External airflow is obstructed.
- Cables inside the system obstruct airflow.
- An individual cooling fan is removed or has failed. See "Troubleshooting a Fan" on page 103.

### Troubleshooting a Fan

*Problem*

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

*Action*

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

1  Run the appropriate diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.

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 43.

4  Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

5  Locate the faulty fan indicated by the system message or the diagnostic software.

6  Ensure that the faulty fan's power cable is firmly attached to the fan power connector. See "Replacing the Card and Front Fans" on page 83.

7  Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

8  Close the system. See "Closing the System" on page 43.

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

10  If the problem is not resolved, install a new fan. See "Replacing the Card and Front Fans" on page 83.

   If the replacement fan is working properly, close the system. See "Closing the System" on page 43.

   If the replacement fan does not operate, see "Getting Help" on page 123.

# Troubleshooting System Memory

*Problem*

- Faulty memory module.
- Faulty system board.
- Diagnostic indicator code indicates a problem with system memory.

*Action*

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

1   Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.

2   Turn on the system and attached peripherals.

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

   If an error messages appears, go to step 13.

3   Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 27.

   If the amount of memory installed matches the system memory setting, go to step 13.

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 43.

6   Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

7   Ensure that the memory banks are populated correctly. See "General Memory Module Installation Guidelines."

   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 77.

9   Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

10  Close the system. See "Closing the System" on page 43.

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

12  Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 27.

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

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

   b   Open the system. See "Opening the System" on page 43.

   c   Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

   📝 **NOTE:** Several configurations for the memory modules exist; see "General Memory Module Installation Guidelines."

**d** Swap the memory module in socket 1 with another of the same capacity. See "Installing Memory Modules" on page 77.

**e** Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

**f** Close the system. See "Closing the System" on page 43.

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

**h** As the system boots, observe the monitor screen and the indicators on the keyboard.

**13** Perform the following steps:

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

**b** Open the system. See "Opening the System" in "Installing System Components."

**c** Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

**d** Repeat step d through step h in step 12 for each memory module installed.

If the problem persists, see "Getting Help" on page 123."

# Troubleshooting a Diskette Drive

### *Problem*

- Error message indicates a diskette drive problem.

### *Action*

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

**1** Enter the System Setup program and verify that the diskette drive is configured correctly. See "Using the System Setup Program" on page 27.

**2** Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.

**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 43.

**5** Ensure that the diskette drive interface cable is securely connected to the diskette drive and the system board.

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

**7** Close the system. See "Closing the System" on page 43.

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

**9** Run the appropriate online diagnostic test to see whether the diskette drive works correctly.

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

**11** Open the system. See "Opening the System" on page 43.

**12** Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 72.

**13** Close the system. See "Closing the System" on page 43.

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

**15** 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 123.

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

**17** Open the system. See "Opening the System" on page 43.

**18** Reinstall one of the expansion cards you removed in step 12. See "Installing an Expansion Card" on page 70.

**19** Close the system. See "Closing the System" on page 43.

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

**21** Run the appropriate online diagnostic test to see whether the diskette drive works correctly.

**22** Repeat step 16 through step 21 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 123.

# Troubleshooting an Optical Drive

*Problem*

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

*Action*

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

**1** Try using a different CD or DVD that you know works properly.

**2** Enter the System Setup program and ensure that the drive's IDE controller is enabled. See "Using the System Setup Program" on page 27.

**3** Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.

**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 43.

**6** Ensure that the interface cable is securely connected to the optical drive and to the controller.

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

**8** Close the system. See "Closing the System" on page 43.

**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 123.

# Troubleshooting a Hard Drive

### Problem

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

### Action

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

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

**1** Run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 113.

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 5. 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 program.

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

**b** Ensure that the hard drive has been configured correctly for the RAID.

**c** Exit the configuration utility and allow the system to boot to the operating system.

**4** Ensure that the required device drivers for your SAS RAID controller are installed and are configured correctly. See the operating system documentation for more information.

**5** 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 43.

**c** Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

**d** Verify that the cable connections between the hard drive(s) and the drive controller are correct, whether the connections are to the SATA connectors on the system board or a SAS RAID controller. See "Hard Drives" on page 48.

**e** Verify that the SAS or SATA cables are securely seated in their connectors.

**f** Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

**g** Close the system. See "Closing the System" on page 43.

**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 123.

# Troubleshooting a SAS RAID Controller

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

### Problem

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

### Action

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

**1** Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.

**2** Enter the System Setup program and ensure that the SAS RAID controller is enabled. See "Using the System Setup Program" on page 27.

**3** Restart the system and press the applicable key sequence for the installed controller card to enter the configuration utility program:

- <Ctrl><C>

   OR

- <Ctrl><R>

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

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

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

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

6   Open the system. See "Opening the System" on page 43.

7   Ensure that the controller card is firmly seated into the system board connector. See "Installing an Expansion Card" on page 70.

8   Ensure that the following RAID components, if present, are properly installed and connected:

    •   Memory module

    •   Battery

9   Verify that the cable connections between the hard drives and the SAS controller are correct. See "Hard Drives" on page 48.

   Ensure that the cables are firmly connected to the SAS controller and the hard drives.

10   Close the system. See "Closing the System" on page 43.

11   Reconnect the system to its electrical outlet, and turn on the system and attached peripherals. If the problem persists, see "Getting Help" on page 123.

# Troubleshooting Expansion Cards

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

**Problem**

•   Error message indicates a problem with an expansion card.

•   Expansion card performs incorrectly or not at all.

**Action**

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

1   Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 113.

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 43.

4   Ensure that each expansion card is firmly seated in its connector. See "Installing an Expansion Card" on page 70.

5   Close the system. See "Closing the System" on page 43.

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

If the problem persists, go to the next step.

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

**8** Open the system. See "Opening the System" on page 43.

**9** Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 72.

**10** Close the system. See "Closing the System" on page 43.

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

**12** Run the appropriate online diagnostic test.

If the tests fail, see "Getting Help" on page 123.

**13** For each expansion card you removed in step 9, perform the following steps:

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

   **b** Open the system. See "Opening the System" on page 43.

   **c** Reinstall one of the expansion cards.

   **d** Close the system. See "Closing the System" on page 43.

   **e** Run the appropriate diagnostic test.

   If the tests fail, see "Getting Help" on page 123.

# Troubleshooting the Microprocessors

### Problem

- Error message indicates a processor problem.
- Diagnostic indicator code indicates a problem with the processors or system board.
- A heat sink is not installed for each processor.

### Action

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

**1** If possible, run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 113.

**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 43.

**4** Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

**5** Visually inspect to ensure that each processor and heat sink are properly installed. See "Replacing the Processor" on page 75.

**6** Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

**7** Close the system. See "Closing the System" on page 43.

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

**9** If possible, run the appropriate online diagnostic test.

If the tests fail or the problem persists, continue to the next step.

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

**11** Open the system. See "Opening the System" on page 43.

**12** Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

**NOTICE:** When removing and replacing a processors and heat sink to complete the following steps, do not disturb the thermal grease on the top of the processor and bottom of the heat sink. Place the processor and heat sink aside, while they are removed, on a flat surface and avoid contact with the thermal grease.

**13** Remove processor 2 if installed. See "Replacing the Processor" on page 75.

To locate the processors, see Figure 6-2.

If only one processor is installed, replace the processor. See "Getting Help" on page 123.

**14** Rotate the hard-drive carrier back into the system. See "Rotating the Hard-Drive Carrier Into the System" on page 46.

**15** Close the system. See "Closing the System" on page 43.

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

**17** Run the appropriate online diagnostic test.

- If the tests complete successfully, go to step 18.
- If the tests fail, the processor is faulty. See "Getting Help" on page 123.

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

**19** Open the system. See "Opening the System" on page 43.

**20** Rotate the hard-drive carrier out of the system. See "Rotating the Hard-Drive Carrier Out of the System" on page 44.

**21** Swap processor 1 with the processor you removed in step 13. See "Replacing the Processor" on page 75.

**22** Repeat step 14 through step 21.

If the tests fail, the processor is faulty. See "Getting Help" on page 123.

If you have tested both processors and the problem persists, the system board is faulty. See "Getting Help" on page 123.

5

# Running the System Diagnostics

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

## Using Dell PowerEdge Diagnostics

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

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

## System Diagnostics Features

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

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

# When to Use the System Diagnostics

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

# Running the System Diagnostics

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

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

1   As the system boots, press <F10> during POST.

2   From the utility partition main menu, select **Run System Diagnostics**, or select **Run Memory Diagnostics** if you are troubleshooting memory.

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

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

# System Diagnostics Testing Options

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

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

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

# Using the Custom Test Options

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

### Selecting Devices for Testing

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

### Selecting Diagnostics Options

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

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

### Viewing Information and Results

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

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

# 6

# Jumpers and Connectors

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

## System Board Jumpers

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

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

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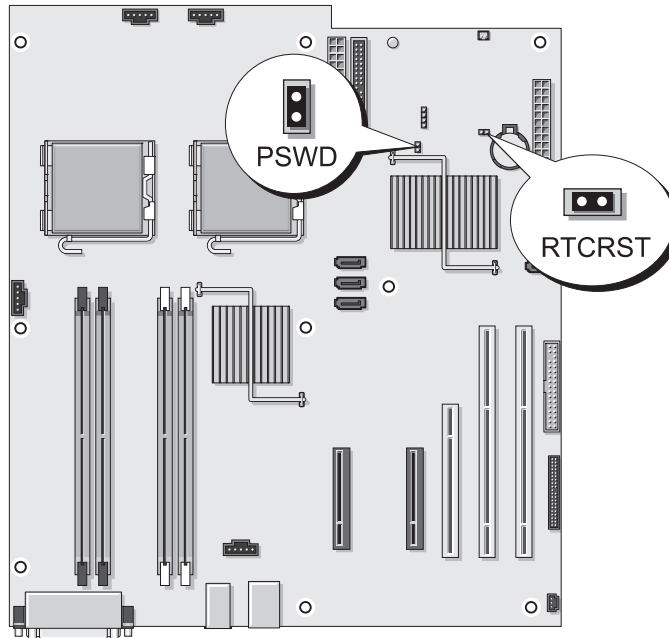


**Table 6-1.   System Board Jumper Settings**

| Jumper | Setting | Description |
| --- | --- | --- |
| PSWD |  (default) | The password feature is enabled. |
| |  | The password feature is disabled. |
| RTCRST |  (default) | The CMOS settings are retained. |
| |  | The CMOS settings are reset. |

## Clearing CMOS Settings

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

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

2  Remove the system cover. See "Opening the System" on page 43.

3  Remove the jumper plug from the PSWD jumper. See Figure 6-1.

**4** Place the jumper plug on the RTCRST jumper and wait approximately 5 seconds.

**5** Remove the jumper plug from the RTCRST jumper and replace it on the PSWD jumper.

**6** Close the system. See "Closing the System" on page 43.

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

# System Board Connectors

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

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

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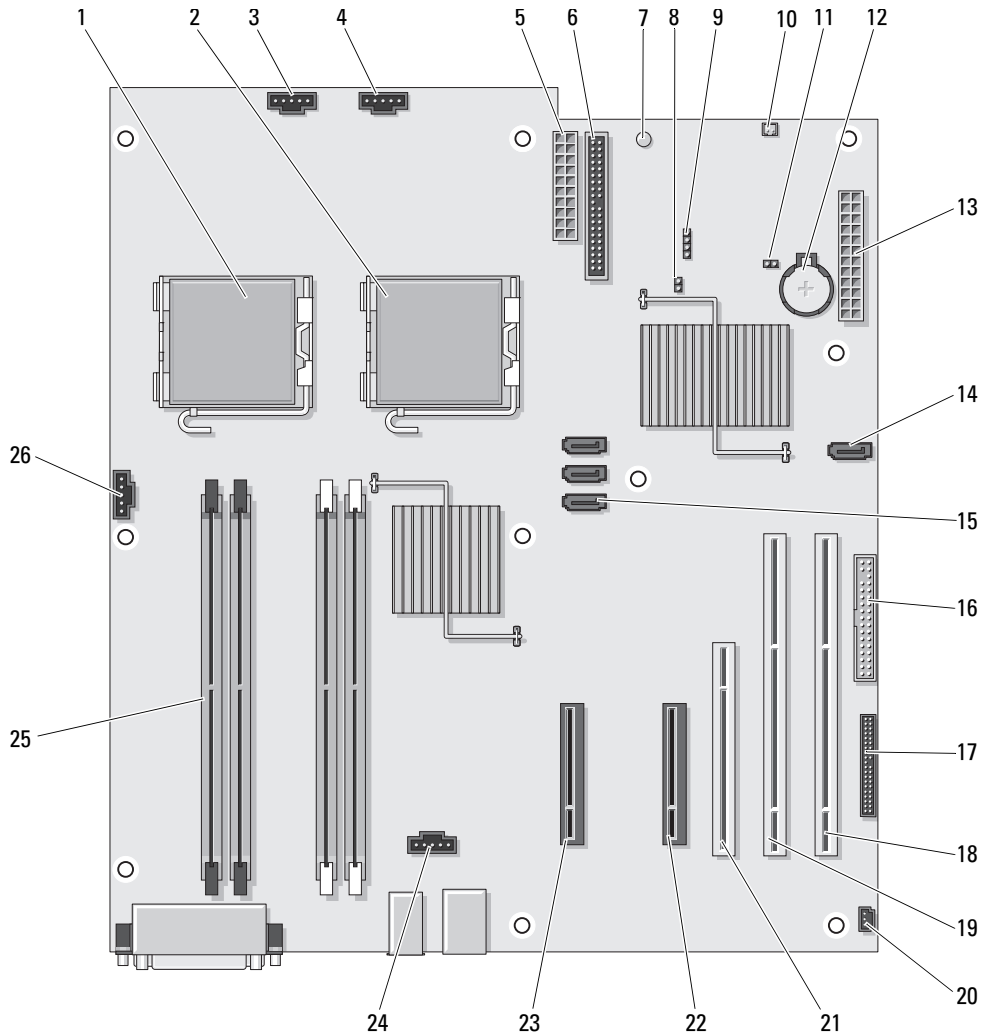
**Table 6-2. System Board Connectors**

| Item | Connector | Description |
|------|-----------|-------------|
| 1 | CPU_0 | primary processor connector |
| 2 | CPU_1 | secondary processor connector |
| 3 | FAN_FRONT | front fan connector |
| 4 | FAN_CCAG | card cage fan |
| 5 | POWER2 | power connector |
| 6 | IDE | IDE drive connector |
| 7 | AUX_PWR | standby power light |
| 8 | PSWD | password jumper |
| 9 | AUX_LED | auxiliary hard-drive LED connector |
| 10 | THRM | thermal diode connector |
| 11 | RTCRST | RTC reset jumper |
| 12 | BATTERY | battery socket |
| 13 | POWER1 | main power connector |
| 14 | SATA_3 | SATA connector |
| 15 | SATA_2, SATA_1, SATA_0 | SATA connectors |
| 16 | DSKT | diskette drive connector |
| 17 | FRONTPANEL | front panel connector |
| 18 | SLOT6_PCIX | PCI-X card slot |
| 19 | SLOT5_PCIX | PCI-X card slot |
| 20 | INTRUDER | chassis intrusion header |
| 21 | SLOT4_PCI | legacy 5-V PCI card slot |
| 22 | SLOT3_PCIE | PCI Express x8 card slot, wired as x4 |
| 23 | SLOT1_PCIE | PCI Express x8 card slot, wired as x4 |
| 24 | FAN_HDD | fan connector for optional fourth hard drive |
| 25 | DIMM_$n$ | memory module connectors |
| 26 | FAN_MEM | memory fan connector |

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

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

2   Open the system. See "Opening the System" on page 43.

3   Remove the PSWD jumper and set it aside.

    See Figure 6-1 to locate the password jumper on the system board.

4   Close the system. See "Closing the System" on page 43.

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 removed. However, before you assign a new system and/or setup password, you must install the jumper plug.

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

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

7   Open the system.

8   Reinstall the PSWD jumper.

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 36.

# 7

# Getting Help

## Obtaining Assistance

1  Complete the procedures in "Troubleshooting Your System" on page 95.

2  Run the system diagnostics and record any information provided.

3  Make a copy of the Diagnostics Checklist (see "Diagnostics Checklist" on page 127), and fill it out.

4  Use Dell's extensive suite of online services available at Dell Support at **support.dell.com** for help with installation and troubleshooting procedures.

   For more information, see "Online Services" on page 123.

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

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

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

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

For instructions on using the technical support service, see "Support Service" on page 124 and "Before You Call" on page 125.

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

### Online Services

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

You can contact Dell electronically using the following addresses:

• World Wide Web

   **www.dell.com/**

   **www.dell.com/ap/** (Asian/Pacific countries only)

   **www.dell.com/jp** (Japan only)

   **www.euro.dell.com** (Europe only)

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

www.dell.ca (Canada only)

- Anonymous file transfer protocol (FTP)

  ftp.dell.com/

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

- Electronic Support Service

  support@us.dell.com

  apsupport@dell.com (Asian/Pacific countries only)

  support.jp.dell.com (Japan only)

  support.euro.dell.com (Europe only)

- Electronic Quote Service

  apmarketing@dell.com (Asian/Pacific countries only)

  sales_canada@dell.com (Canada only)

## AutoTech Service

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

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

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

## Automated Order-Status Service

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

## Support Service

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

To contact Dell's support service, see "Before You Call" on page 125 and then see the contact information for your region.

# Dell Enterprise Training and Certification

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

# Problems With Your Order

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

# Product Information

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

# Returning Items for Warranty Repair or Credit

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

1  Call Dell to obtain a Return Material Authorization Number, and write it clearly and prominently on the outside of the box.

   For the telephone number to call, see the contact information for your region.

2  Include a copy of the invoice and a letter describing the reason for the return.

3  Include a copy of any diagnostic information, including the Diagnostics Checklist (see "Diagnostics Checklist" on page 127), indicating the tests you have run and any error messages reported by the system diagnostics.

4  Include any accessories that belong with the item(s) being returned (such as power cables, media such as CDs and diskettes, and guides) if the return is for credit.

5  Pack the equipment to be returned in the original (or equivalent) packing materials.

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

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

# Before You Call

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

Remember to fill out the Diagnostics Checklist (see "Diagnostics Checklist" on page 127). If possible, turn on your system before you call Dell for technical assistance and call from a telephone at or near the computer. You may be asked to type some commands at the keyboard, relay detailed information during operations, or try other troubleshooting steps possible only at the computer system itself. Ensure that the system documentation is available.

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

**Diagnostics Checklist**

Name:

Date:

Address:

Phone number:

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

Express Service Code:

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

Operating system and version:

Peripherals:


Expansion cards:

Are you connected to a network? Yes No

Network, version, and network card:

Programs and versions:


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

Error message, beep code, or diagnostic code:

Description of problem and troubleshooting procedures you performed:

# Contacting Dell

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

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

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

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

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

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

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

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|---|---|---|
| Anguilla | Website: www.dell.com.ai | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 800-335-0031 |
| Antigua and Barbuda | Website: www.dell.com.ag | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | 1-800-805-5924 |
| Argentina (Buenos Aires) | Website: www.dell.com.ar | |
| International Access Code: 00 | E-mail: la-techsupport@dell.com | |
| Country Code: 54 | E-mail for desktop and portable computers: la-techsupport@dell.com | |
| City Code: 11 | E-mail for servers and EMC® storage products: la_enterprise@dell.com | |
| | Customer Care | toll-free: 0-800-444-0730 |
| | Technical Support | toll-free: 0-800-444-0733 |
| | Technical Support Services | toll-free: 0-800-444-0724 |
| | Sales | 0-810-444-3355 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|---|---|---|
| Aruba | Website: www.dell.com.aw | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 800-1578 |
| Australia (Sydney) | Website: support.ap.dell.com | |
| International Access Code: 0011 | E-mail: support.ap.dell.com/contactus | |
| Country Code: 61 | General Support | 13DELL-133355 |
| City Code: 2 | | |
| Austria (Vienna) | Website: support.euro.dell.com | |
| International Access Code: 900 | E-mail: tech_support_central_europe@dell.com | |
| Country Code: 43 | Home/Small Business Sales | 0820 240 530 00 |
| City Code: 1 | Home/Small Business Fax | 0820 240 530 49 |
| | Home/Small Business Customer Care | 0820 240 530 14 |
| | Preferred Accounts/Corporate Customer Care | 0820 240 530 16 |
| | Support for XPS | 0820 240 530 81 |
| | Home/Small Business Support for all other Dell computers | 0820 240 530 17 |
| | Preferred Accounts/Corporate Support | 0820 240 530 17 |
| | Switchboard | 0820 240 530 00 |
| Bahamas | Website: www.dell.com.bs | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 1-866-278-6818 |
| Barbados | Website: www.dell.com/bb | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | 1-800-534-3142 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|---|---|---|
| Belgium (Brussels) | Website: **support.euro.dell.com** | |
| International Access Code: **00** | Tech Support for XPS | 02 481 92 96 |
| Country Code: **32** | Tech Support for all other Dell computers | 02 481 92 88 |
| City Code: **2** | Tech Support Fax | 02 481 92 95 |
| | Customer Care | 02 713 15 65 |
| | Corporate Sales | 02 481 91 00 |
| | Fax | 02 481 92 99 |
| | Switchboard | 02 481 91 00 |
| Bermuda | Website: www.dell.com/bm | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | 1-877-890-0751 |
| Bolivia | Website: www.dell.com/bo | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 800-10-0238 |
| Brazil | Website: **www.dell.com/br** | |
| International Access Code: **00** | E-mail: la-techsupport@dell.com | |
| Country Code: **55** | Customer Support, Tech Support | 0800 90 3355 |
| City Code: **51** | Technical Support Fax | 51 3481 5470 |
| | Customer Care Fax | 51 3481 5480 |
| | Sales | 0800 90 3390 |
| British Virgin Islands | General Support | toll-free: 1-866-278-6820 |
| Brunei | Technical Support (Penang, Malaysia) | 604 633 4966 |
| Country Code: **673** | Customer Care (Penang, Malaysia) | 604 633 4888 |
| | Transaction Sales (Penang, Malaysia) | 604 633 4955 |

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|---|---|---|
| **Canada (North York, Ontario)** | Online Order Status: **www.dell.ca/ostatus** | |
| International Access Code: **011** | AutoTech (automated Hardware and Warranty Support) | toll-free: 1-800-247-9362 |
| | Customer Service (Home Sales/Small Business) | toll-free: 1-800-847-4096 |
| | Customer Service (med./large business, government) | toll-free: 1-800-326-9463 |
| | Customer Service (printers, projectors, televisions, handhelds, digital jukebox, and wireless) | toll-free: 1-800-847-4096 |
| | Hardware Warranty Support (Home Sales/Small Business) | toll-free: 1-800-906-3355 |
| | Hardware Warranty Support (med./large bus., government) | toll-free: 1-800-387-5757 |
| | Hardware Warranty Support (printers, projectors, televisions, handhelds, digital jukebox, and wireless) | 1-877-335-5767 |
| | Sales (Home Sales/Small Business) | toll-free: 1-800-387-5752 |
| | Sales (med./large bus., government) | toll-free: 1-800-387-5755 |
| | Spare Parts Sales & Extended Service Sales | 1 866 440 3355 |
| **Cayman Islands** | E-mail: la-techsupport@dell.com | |
| | General Support | 1-877-262-5415 |
| **Chile (Santiago)** | Website: **www.dell.com/cl** | |
| Country Code: **56** | E-mail: la-techsupport@dell.com | |
| City Code: **2** | Sales and Customer Support | toll-free: 1230-020-4823 |

| Country (City)<br>International Access Code<br>Country Code<br>City Code | Department Name or Service Area,<br>Website and E-Mail Address | Area Codes,<br>Local Numbers, and<br>Toll-Free Numbers |
|---|---|---|
| China (Xiamen) | Technical Support website: **support.dell.com.cn** | |
| Country Code: **86** | Technical Support E-mail: cn_support@dell.com | |
| City Code: **592** | Customer Care E-mail: customer_cn@dell.com | |
| | Technical Support Fax | 592 818 1350 |
| | Technical Support (Dell™ Dimension™ and Inspiron) | toll-free: 800 858 2968 |
| | Technical Support (OptiPlex™, Latitude™, and Dell Precision™) | toll-free: 800 858 0950 |
| | Technical Support (servers and storage) | toll-free: 800 858 0960 |
| | Technical Support (projectors, PDAs, switches, routers, and so on) | toll-free: 800 858 2920 |
| | Technical Support (printers) | toll-free: 800 858 2311 |
| | Customer Care | toll-free: 800 858 2060 |
| | Customer Care Fax | 592 818 1308 |
| | Home and Small Business | toll-free: 800 858 2222 |
| | Preferred Accounts Division | toll-free: 800 858 2557 |
| | Large Corporate Accounts GCP | toll-free: 800 858 2055 |
| | Large Corporate Accounts Key Accounts | toll-free: 800 858 2628 |
| | Large Corporate Accounts North | toll-free: 800 858 2999 |
| | Large Corporate Accounts North Government and Education | toll-free: 800 858 2955 |
| | Large Corporate Accounts East | toll-free: 800 858 2020 |
| | Large Corporate Accounts East Government and Education | toll-free: 800 858 2669 |
| | Large Corporate Accounts Queue Team | toll-free: 800 858 2572 |
| | Large Corporate Accounts South | toll-free: 800 858 2355 |
| | Large Corporate Accounts West | toll-free: 800 858 2811 |
| | Large Corporate Accounts Spare Parts | toll-free: 800 858 2621 |
| Colombia | Website: **www.dell.com/cl** | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | 01-800-915-4755 |

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

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

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

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|---|---|---|
| **Hong Kong** | Website: support.ap.dell.com | |
| International Access Code: **001** | Technical Support E-mail: HK_support@Dell.com | |
| Country Code: **852** | Technical Support (Dimension and Inspiron) | 2969 3188 |
| | Technical Support (OptiPlex, Latitude, and Dell Precision) | 2969 3191 |
| | Technical Support (PowerApp™, PowerEdge™, PowerConnect™, and PowerVault™) | 2969 3196 |
| | Customer Care | 3416 0910 |
| | Large Corporate Accounts | 3416 0907 |
| | Global Customer Programs | 3416 0908 |
| | Medium Business Division | 3416 0912 |
| | Home and Small Business Division | 2969 3105 |
| **India** | E-mail: india_support_desktop@dell.com india_support_notebook@dell.com india_support_Server@dell.com | |
| | Technical Support | 1600338045 and 1600448046 |
| | Sales (Large Corporate Accounts) | 1600 33 8044 |
| | Sales (Home and Small Business) | 1600 33 8046 |

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

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

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

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

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

| Country (City) International Access Code Country Code City Code | Department Name or Service Area, Website and E-Mail Address | Area Codes, Local Numbers, and Toll-Free Numbers |
|---|---|---|
| **Poland (Warsaw)** | Website: **support.euro.dell.com** | |
| International Access Code: **011** | E-mail: pl_support_tech@dell.com | |
| Country Code: **48** | Customer Service Phone | 57 95 700 |
| City Code: **22** | Customer Care | 57 95  999 |
| | Sales | 57 95 999 |
| | Customer Service Fax | 57 95 806 |
| | Reception Desk Fax | 57 95 998 |
| | Switchboard | 57 95 999 |
| **Portugal** | Website: **support.euro.dell.com** | |
| International Access Code: **00** | Technical Support | 707200149 |
| Country Code: **351** | Customer Care | 800 300 413 |
| | Sales | 800 300 410 or  800 300 411 or 800 300 412 or 21 422 07 10 |
| | Fax | 21 424 01 12 |
| **Puerto Rico** | E-mail: la-techsupport@dell.com | |
| | General Support | 1-877-537-3355 |
| **St. Kitts and Nevis** | Website: **www.dell.com/kn** | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 1-866-540-3355 |
| **St. Lucia** | Website: **www.dell.com/lc** | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | 1-800-882-1521 |
| **St. Vincent and the Grenadines** | Website: **www.dell.com/vc** | |
| | E-mail: la-techsupport@dell.com | |
| | General Support | toll-free: 1-877-441-4740 |

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

| Country (City)<br>International Access Code<br>Country Code<br>City Code | Department Name or Service Area,<br>Website and E-Mail Address | Area Codes,<br>Local Numbers, and<br>Toll-Free Numbers |
|---|---|---|
| **Spain (Madrid)** | Website: **support.euro.dell.com** | |
| International Access Code: **00** | **Home and Small Business** | |
| Country Code: **34** | Technical Support | 902 100 130 |
| City Code: **91** | Customer Care | 902 118 540 |
| | Sales | 902 118 541 |
| | Switchboard | 902 118 541 |
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# Glossary

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

**A** — Ampere(s).

**AC** — Alternating current.

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

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

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

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

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

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

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

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

**beep code** — A diagnostic message in the form of a pattern of beeps from your system's speaker. For example, one beep, followed by a second beep, and then a burst of three beeps is beep code 1-1-3.

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

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

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

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

**BMC** — Baseboard management controller.

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

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

**BTU** — British thermal unit.

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

**C** — Celsius.

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

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

**cm** — Centimeter(s).

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

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

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

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

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

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

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

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

**DC** — Direct current.

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

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

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

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

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

**DIN** — *Deutsche Industrie Norm*.

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

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

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

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

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

**DVD** — Digital versatile disc.

**ECC** — Error checking and correction.

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

**EMC** — Electromagnetic compatibility.

**EMI** — Electromagnetic interference.

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

**ESD** — Electrostatic discharge.

**ESM** — Embedded server management.

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

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

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

**F** — Fahrenheit.

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

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

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

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

**ft** — Feet.

**FTP** — File transfer protocol.

**g** — Gram(s).

**G** — Gravities.

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

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

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

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

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

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

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

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

**Hz** — Hertz.

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

**ID** — Identification.

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

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

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

**IP** — Internet Protocol.

**IPX** — Internet package exchange.

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

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

**K** — Kilo-; 1000.

**Kb** — Kilobit(s); 1024 bits.

**KB** — Kilobyte(s); 1024 bytes.

**Kbps** — Kilobit(s) per second.

**KBps** — Kilobyte(s) per second.

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

**kg** — Kilogram(s); 1000 grams.

**kHz** — Kilohertz.

**KMM** — Keyboard/monitor/mouse.

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

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

**lb** — Pound(s).

**LCD** — Liquid crystal display.

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

**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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