

# Dell Precision™ Workstation 470 and 670 Computers User's Guide

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Model WHM and WHL

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For information on other documentation included with your computer, see "[Finding Information](#)."

## 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.

## Abbreviations and Acronyms

For a complete list of abbreviations and acronyms, see the "[Glossary](#)."

If you purchased a Dell™ n Series computer, any references in this document to Microsoft® Windows® operating systems are not applicable.

The *Drivers and Utilities CD*, *Quick Reference Guide*, and *Operating System CD* are optional and may not ship with your computer.

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Models WHM and WHL

September 2006 P/N U3524 Rev. A04



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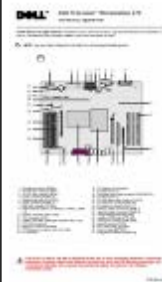
# Information About Your Computer

## Dell Precision™ Workstation 470 and 670 Computers User's Guide

- [Finding Information](#)
- [Specifications](#)
- [Caring for Your Computer](#)

## Finding Information

What Are You Looking For?	Find it Here
<ul style="list-style-type: none"> <li>• A diagnostic program for my computer</li> <li>• Drivers for my computer</li> <li>• My device documentation</li> <li>• Desktop System Software</li> </ul>	<p><b>Drivers and Utilities CD (also known as the ResourceCD)</b></p> <p>Documentation and drivers are already installed on your computer. You can use the CD to <a href="#">reinstall drivers</a> or run the <a href="#">Dell Diagnostics</a>.</p>  <p>Readme files may be included on your CD to provide last-minute updates about technical changes to your computer or advanced technical-reference material for technicians or experienced users.</p> <p><b>NOTE:</b> The latest drivers and documentation updates can be found at <a href="http://support.dell.com">support.dell.com</a>.</p> <p><b>NOTE:</b> The <i>Drivers and Utilities</i> CD is optional and may not ship with your computer.</p>
<ul style="list-style-type: none"> <li>• How to set up my computer</li> <li>• How to care for my computer</li> <li>• Troubleshooting information</li> <li>• How to run the Dell Diagnostics</li> <li>• Error codes and diagnostic lights</li> <li>• How to open my computer cover</li> </ul>	<p><b>Quick Reference Guide</b></p>  <p><b>NOTE:</b> This document is available as a PDF at <a href="http://support.dell.com">support.dell.com</a>.</p> <p><b>NOTE:</b> The <i>Quick Reference Guide</i> is optional and may not ship with your computer.</p>
<ul style="list-style-type: none"> <li>• System board connectors</li> <li>• Location of system board components</li> </ul>	<p><b>System Information Label</b></p> <p>Located on the inside cover of your computer.</p>



- Warranty information
- Safety instructions
- Regulatory information
- Ergonomics information
- End User License Agreement

### Dell™ Product Information Guide



- Service Tag and Express Service Code
- Microsoft Windows License Label

### Service Tag and Microsoft Windows License

These labels are located on your computer.



- Use the Service Tag to identify your computer when you use **support.dell.com** or contact technical support.
- Enter the Express Service Code to direct your call when contacting technical support. The Express Service Code is not available in all countries.

- Latest drivers for my computer
- Answers to technical service and support questions
- Online discussions with other users and technical support
- Documentation for my computer

### Dell Support Website — support.dell.com

**NOTE:** Select your region to view the appropriate support site.


The Dell Support website provides several online tools, including:

- Solutions — Troubleshooting hints and tips, articles from technicians, and online courses
- Community — Online discussion with other Dell customers
- Upgrades — Upgrade information for components, such as memory, the hard drive, and the operating system
- Customer Care — Contact information, order status, warranty, and repair information
- Downloads — Drivers, patches, and software updates
- Reference — Computer documentation, product specifications, and white papers

- Service call status and support history
- Top technical issues for my computer
- Frequently asked questions
- File downloads
- Details on my computer configuration
- Service contract for my

### Dell Premier Support Website — premiersupport.dell.com

The Dell Premier Support website is customized for corporate, government, and education customers. This website may not be available in all regions.

<p>computer</p>	
<ul style="list-style-type: none"> <li>• How to use Windows XP</li> <li>• Documentation for my computer</li> <li>• Documentation for devices (such as a modem)</li> </ul>	<p><b>Windows Help and Support Center</b></p> <ol style="list-style-type: none"> <li>1. Click the <b>Start</b> button and click <b>Help and Support</b>.</li> <li>2. Type a word or phrase that describes your problem and click the arrow icon.</li> <li>3. Click the topic that describes your problem.</li> <li>4. Follow the instructions on the screen.</li> </ol>
<ul style="list-style-type: none"> <li>• How to use Red Hat® Linux</li> <li>• E-mail discussions with Dell Precision® and Linux users</li> <li>• Additional information regarding Linux and my Dell Precision computer</li> </ul>	<p><b>Dell Supported Linux Sites</b></p> <ul style="list-style-type: none"> <li>• <a href="http://linux.dell.com">http://linux.dell.com</a></li> <li>• <a href="http://lists.us.dell.com/mailman/listinfo/linux-precision">http://lists.us.dell.com/mailman/listinfo/linux-precision</a></li> <li>• <a href="http://docs.us.dell.com/docs/software/oslinux/">http://docs.us.dell.com/docs/software/oslinux/</a></li> <li>• <a href="http://docs.us.dell.com/docs/software/OSRHEL3/">http://docs.us.dell.com/docs/software/OSRHEL3/</a></li> <li>• <a href="http://docs.us.dell.com/docs/software/OSRHEL4/">http://docs.us.dell.com/docs/software/OSRHEL4/</a></li> </ul>
<ul style="list-style-type: none"> <li>• How to reinstall my operating system</li> </ul>	<p><b>Operating System CD</b></p> <p>The operating system is already installed on your computer. To reinstall your operating system, use the <i>Operating System</i> CD. See this document for instructions.</p> <p>After you reinstall your operating system, use the <a href="#">Drivers and Utilities</a> CD to reinstall drivers for the devices that came with your computer.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Your operating system <a href="#">product key</a> label is located on your computer.</p> <p><b>NOTE:</b> The color of your CD varies based on the operating system you ordered.</p> <p><b>NOTE:</b> The <i>Operating System</i> CD is optional and may not ship with your computer.</p> </div> </div>

## Specifications

<b>Microprocessor</b>	
Microprocessor type	Intel® Xeon™
Level 1 (L1) cache	8 KB
Level 2 (L2) cache	1024 KB

<b>Memory</b>	
Type	400-MHz DDR2 SDRAM  <b>NOTE:</b> Your computer supports only registered memory.
Memory connectors	Dell Precision 470 computer: 6 Dell Precision 670 computer: 6
Memory capacities	256-MB, 512-MB, 1-GB, 2-GB, and 4-GB ECC
Minimum memory	512 MB
Maximum memory	16 GB

BIOS address	F0000h
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<b>Computer Information</b>	
Chipset	Intel E7525
Data bus width	64 bits
Address bus width	36 bits
DMA channels	eight
Interrupt levels	23
BIOS chip (NVRAM)	4 MB
Memory speed	DDR2 400 MHz
NIC	<p>Integrated network interface with ASF 1.03 support as defined by DMTF</p> <p>Capable of 10/100/1000 communication</p> <p>Green — A good connection exists between a 10-Mbps network and the computer.</p> <p>Orange — A good connection exists between a 100-Mbps network and the computer.</p> <p>Yellow — A good connection exists between a 1-Gb (or 1000-Mbps) connection and the computer.</p> <p>Off — The computer is not detecting a physical connection to the network.</p>
SCSI controller	<p>Dell Precision 470 computer — Add-in U320 SCSI</p> <p>Dell Precision 670 computer — Integrated U320 SCSI</p>
SATA controller	SATA 1.5
System clock	800-MHz data rate

<b>Video</b>	
Type	PCI Express x16 150 W

<b>Audio</b>	
Type	AC97, Sound Blaster emulation
Stereo conversion	16-bit analog-to-digital; 20-bit digital-to-analog

<b>Expansion Bus</b>	
Bus type	<p>one PCI Express x16 150 W</p> <p>one PCI Express x4</p>
Bus speed	PCI: 33 MHz

	PCIX: 100 MHz PCI Express: x4 slot bidirectional speed is 20 Gbps x16 slot bidirectional speed is 80 Gbps
Dell Precision 470 computer	
PCI	
connector	one
connector size	120 pins
connector data width (maximum)	32 bits
PCIX	
connector	one
connector size	188 pins
connector data width (maximum)	64 bits
PCI Express x16	
connector	one
connector size	164 pins
connector data width (maximum)	16 bits
PCI Express x8 (runs at x4 only)	
connector	one
connector size	98 pins
connector data width (maximum)	8 bits
Dell Precision 670 computer	
PCI	
connector	one
connector size	120 pins
connector data width (maximum)	32 bits
PCIX	
connectors	three
connector size	188 pins
connector data width (maximum)	64 bits
PCI Express x16	
connector	one
connector size	164 pins
connector data width (maximum)	16 bits
PCI Express x8 (runs at x4 only)	
connector	one
connector size	98 pins
connector data width (maximum)	4 bits

<b>Drives</b>	
Externally accessible:	
Dell Precision 470 computer	one floppy drive bay (for an optional floppy drive) two CD/DVD drive bays
Dell Precision 670 computer	one floppy drive bay (for an optional floppy drive) three CD/DVD drive bays
Internally accessible:	
Dell Precision 470 computer	two bays for two 1-inch high or one 1.6-inch high hard drives
Dell Precision 670 computer	three bays for three 1-inch high or two 1.6-inch high hard drives  <b>NOTE:</b> You can purchase a conversion bracket from Dell that allows you to use a 5.25-inch drive bay as an additional hard drive bay.

<b>Connectors</b>	
External connectors:	
Serial	two 9-pin connector; 16550C-compatible
Parallel	one 25-hole connector (bidirectional)
IEEE 1394a	Dell Precision 670 computer: two 6-pin connectors  Dell Precision 470 computer: available with add-in PCI IEEE 1394a card
Network adapter	RJ45 connector
PS/2 (keyboard and mouse)	6-pin mini-DIN
USB	two front-panel and six back-panel USB 2.0-compliant connectors
Audio	Dell Precision 670 computer — Three connectors for line-in, line-out, and microphone on back panel; one speaker/headphone and one microphone connector on the front panel  Dell Precision 470 computer — Three connectors for line-in, line-out, and microphone on back panel; one speaker/headphone on the front panel
System board connectors:	
Primary IDE	40-pin connector on PCI local bus
Secondary IDE	40-pin connector on PCI local bus
Serial ATA (SATA_0 and SATA_1)	7-pin connector
Floppy	34-pin connector
Fan	5-pin connector
SCSI	68-pin connector (Dell Precision 670 computer)

I/O panel	34-pin connector
USB/IEEE 1394a	16-pin connector
CD drive audio interface	4-pin connector
Power_1 connector	24-pin connector
Power_2 connector	20 pin connector
Telephony (MODEM)	4-pin connector

### Key Combinations

<Ctrl><Alt><Del>	launches Windows task manager
<F2>	starts embedded system setup (during start-up only)
<F12> or <Ctrl><Alt><F8>	boots from the network (during start-up only)
<Ctrl><Alt><F10>	launches the utility partition (if installed) during computer start-up
<Ctrl><Alt><d>	launches the hard-drive diagnostics utility during computer start-up

### Controls and Lights

Power control	push button
Power light	green light — Blinking green in sleep state; solid green for power-on state.  amber light — Blinking amber indicates a problem with an installed device; solid amber indicates an internal power problem (see " <a href="#">Power Problems</a> ").
Hard-drive access light	green
Link integrity light (on integrated network adapter)	green light for 10-Mb operation; orange light for 100-Mb operation; yellow light for a 1000-Mb (1-Gb) operation
Activity light (on integrated network adapter)	yellow blinking light
Diagnostic lights	four lights on the front panel
Standby power light	AUX_PWR on the system board
Memory power light	AUX_LED on the system board (blinks in S1 or S3 suspend mode)

### Power

DC power supply:	
Wattage	Dell Precision 670 computer: 650 W Dell Precision 470 computer: 550 W
Heat dissipation	Dell Precision 670 computer: 2218 BTU/hr Dell Precision 470 computer: 1877 BTU/hr  <b>Note:</b> Heat dissipation is calculated based upon the power supply wattage rating.



Voltage	90 to 135 V at 50/60 Hz; 180 to 265 V at 50/60 Hz  The power supply has an auto-ranging AC input between the 90-135 VAC and 180-265 VAC ranges.
Backup battery	3-V CR2032 lithium coin cell

### Physical

#### Dell Precision 670 computer

Height	49.1 cm (19.3 inches)
Width	22.2 cm (8.7 inches)
Depth	48.8 cm (19.2 inches)
Weight	19 kg (42 lb)

#### Dell Precision 470 computer

Height	16.5–16.8 cm (6.5–6.6 inches)
Width	44.7 cm (17.6 inches)
Depth	44.5 cm (17.5 inches)
Weight	18.6 kg (41 lb)
Supported monitor weight (in desktop orientation)	45.4 kg (100 lb)

### Environmental

#### Temperature:

Operating	10° to 35°C (50° to 95°F)  <b>NOTE:</b> At 35°C (95°F), the maximum operating altitude is 914 m (3000 ft).
Storage	–40° to 65°C (–40° to 149°F)
Relative humidity	20% to 80% (noncondensing)

#### Maximum vibration:

Operating	0.25 G at 3 to 200 Hz at 0.5 octave/min
Storage	0.5 G at 3 to 200 Hz at 1 octave/min

#### Maximum shock:

Operating	bottom half-sine pulse with a change in velocity of 20 inches/sec (50.8 cm/sec)
Storage	27-G faired square wave with a velocity change of 200 inches/sec (508 cm/sec)

#### Altitude:

Operating	–15.2 to 3048 m (–50 to 10,000 ft)
Storage	–15.2 to 10,668 m (–50 to 35,000 ft)

## Caring for Your Computer

To help maintain your computer, follow these suggestions:

- To avoid losing or corrupting data, never turn off your computer when the hard drive light is on.
- Schedule regular virus scans using virus software.
- Manage hard drive space by periodically deleting unnecessary files and defragmenting the drive.
- Back up files on a regular basis.
- Periodically clean your monitor screen, mouse, and keyboard (see "[Cleaning Your Computer](#)").

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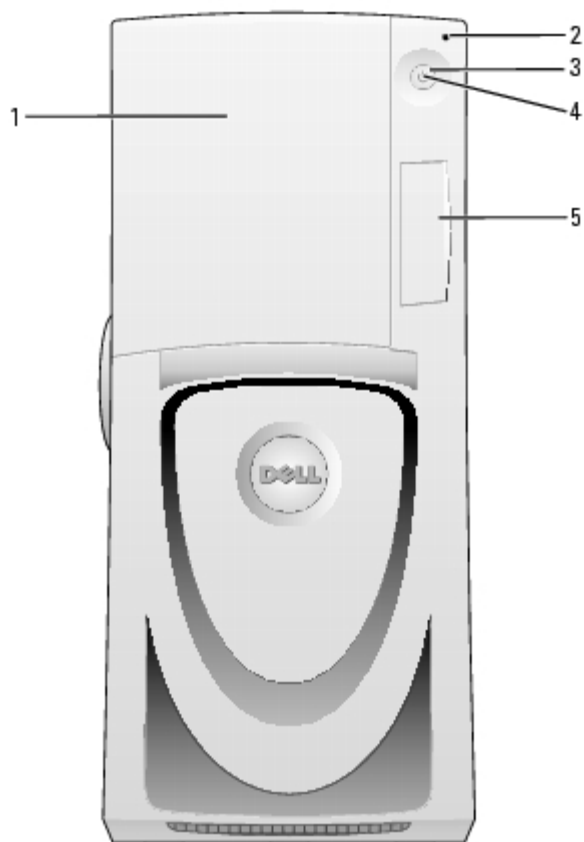
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# Your Dell Precision™ 670 Computer

## Dell Precision™ Workstation 470 and 670 Computers User's Guide

- [Front View](#)
- [Back View](#)
- [Inside Your Computer](#)
- [System Board Components](#)

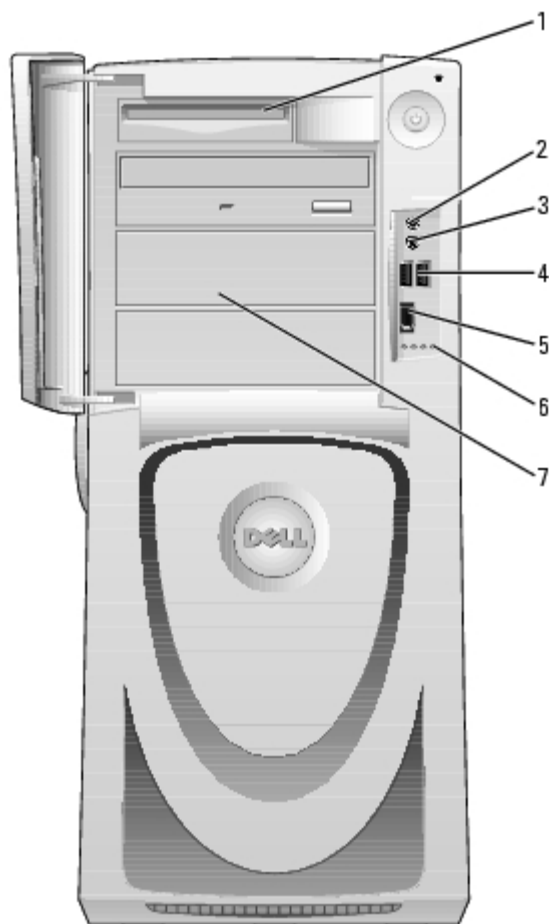
### Front View



1	drive door	Open the drive door to access the optional floppy drive and CD/DVD drives.
2	hard-drive light	The hard-drive light is on when the computer reads data from or writes data to the hard drive. The light might also be on when a device such as your CD player is operating.
3	power button	Press this button to turn on the computer.   <b>NOTICE:</b> To avoid losing data, do not use the power button to turn off the computer. Instead, perform a Microsoft® Windows® shutdown.
4	power light	The power light illuminates and blinks or remains solid to indicate different states: <ul style="list-style-type: none"> <li>○ No light — The computer is turned off.</li> <li>○ Steady green — The computer is in a normal operating state.</li> <li>○ Blinking green — The computer is in a power-saving state.</li> <li>○ Blinking or solid yellow — See "<a href="#">Power Problems</a>."</li> </ul>

		<p>To exit from a power-saving state, press the power button or use the keyboard or the mouse if it is configured as a wake device in the Windows Device Manager. For more information about sleep states and exiting from a power-saving state, see "<a href="#">Power Management</a>."</p> <p>See "<a href="#">Diagnostic Lights</a>" for a description of light codes that can help you troubleshoot problems with your computer.</p>
5	front-panel door	Open the door to use the front-panel connectors and view the diagnostic lights.

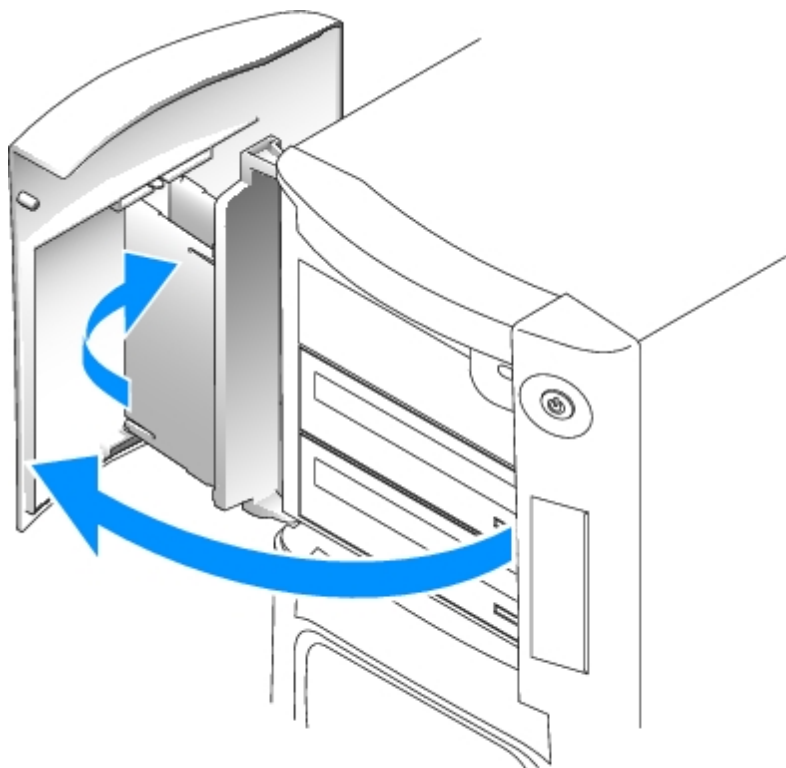
## Front View (Doors Open)



1	floppy drive (optional)	Access the optional floppy drive.
2	headphone connector	Attach headphones.
3	microphone connector	Attach a microphone.
4	USB 2.0 connectors (2)	<p>Use the front USB connectors for devices that you connect occasionally, such as flash memory key or cameras, or for bootable USB devices (see "<a href="#">System Setup</a>" for more information on booting to a USB device).</p> <p>It is recommended that you use the back USB connectors for devices that typically remain connected, such as printers and keyboards.</p>
5	IEEE 1394a connector	Attach high-speed serial multimedia devices, such as a digital video camera.
6	diagnostic	Use the lights to help you troubleshoot a computer problem based on the diagnostic code. For more

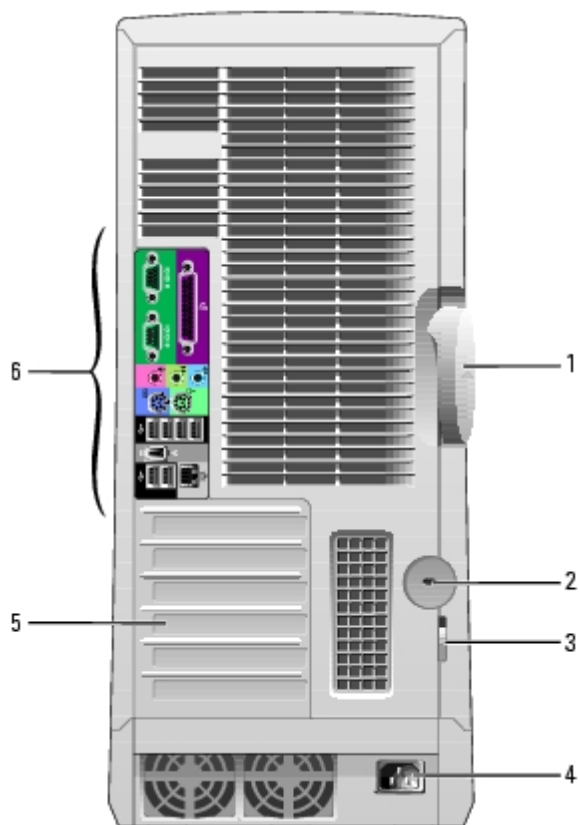
	lights (4)	information, see " <a href="#">Diagnostic Lights</a> ."
7	externally accessible drives	Access additional drives, such as a CD or DVD drive. Drive arrangement varies on computer configuration.

## Opening the Drive Door

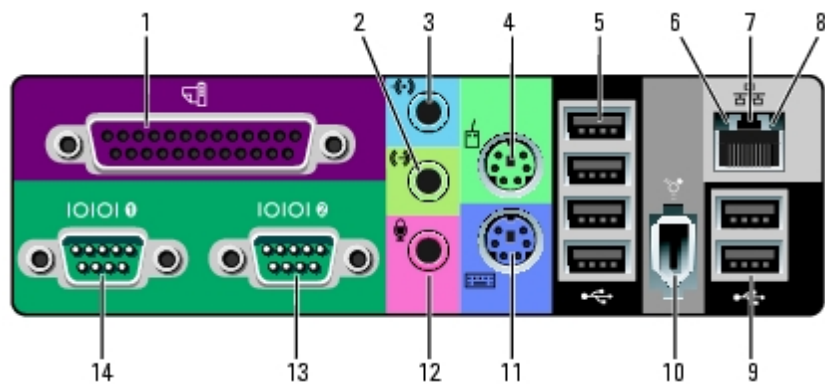


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## Back View



1	cover latch release	To open the computer, lay the computer on its side with the cover latch release at the top and then push the latch to the left. See " <a href="#">Opening the Computer Cover.</a> "
2	security cable slot	Use a security cable with the slot to help secure your computer.
3	padlock ring	Insert a padlock to lock the computer cover.
4	power connector	Insert the power cable.
5	card slots	Access connectors for any installed cards.
6	back panel connectors	Plug serial, USB, and other devices into the appropriate connectors.



1	parallel connector	<p>Connect a parallel device, such as a printer, to the parallel connector. If you have a USB printer, plug it into a USB connector.</p> <p><b>NOTE:</b> The integrated parallel connector is automatically disabled if the computer detects an installed card containing a parallel connector configured to the same address. For more information, see "<a href="#">System Setup Options.</a>"</p>
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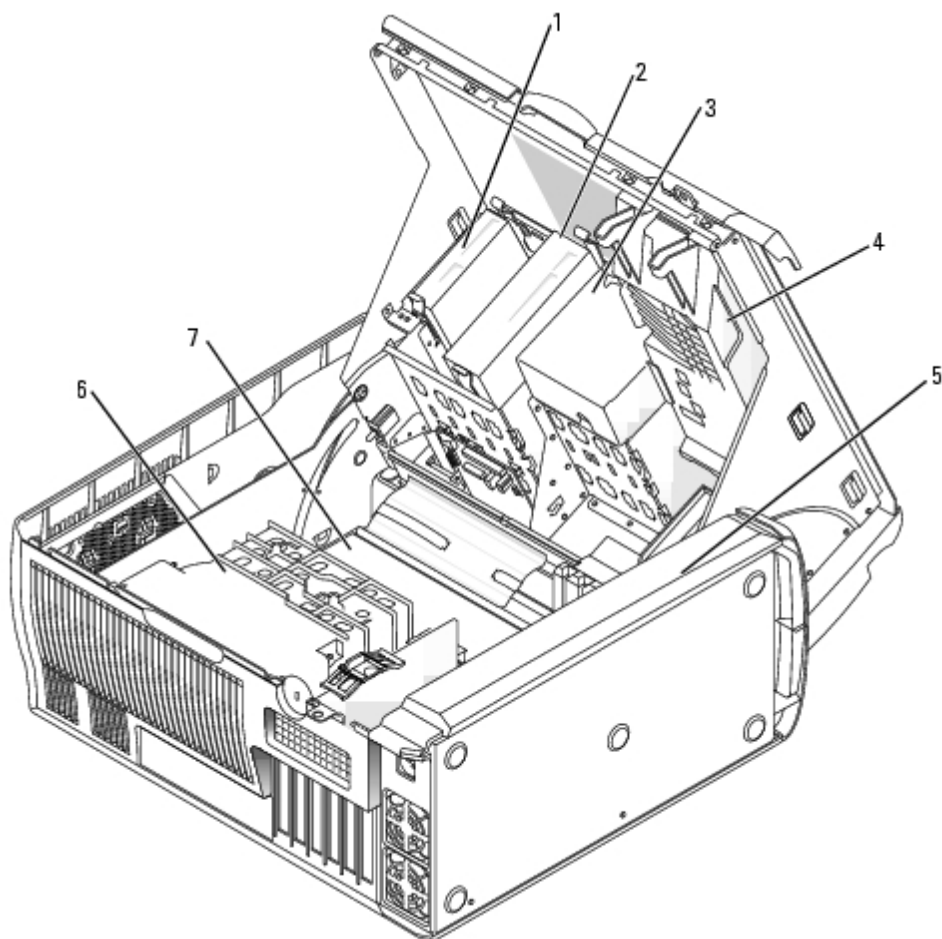
2	line-out connector	Use the green line-out connector to attach headphones and most speakers with integrated amplifiers.  On computers with a sound card, use the connector on the card.
3	line-in connector	Use the blue line-in connector to attach a record/playback device such as a cassette player, CD player, or VCR.  On computers with a sound card, use the connector on the card.
4	mouse connector	Plug a standard mouse into the green mouse connector. Turn off the computer and any attached devices before you connect a mouse to the computer. If you have a USB mouse, plug it into a USB connector.  If your computer is running the Microsoft Windows XP operating system, the necessary mouse drivers have been installed on your hard drive.
5	USB 2.0 connectors (4)	Use the back USB connectors for devices that typically remain connected, such as printers and keyboards.  It is recommended that you use the front USB connectors for devices that you connect occasionally, such as flash memory key or cameras, or for bootable USB devices.
6	link integrity light	<ul style="list-style-type: none"> <li>• Green — A good connection exists between a 10-Mbps network and the computer.</li> <li>• Orange — A good connection exists between a 100-Mbps network and the computer.</li> <li>• Yellow — A good connection exists between a 1000-Mbps (or 1-Gbps) network and the computer.</li> <li>• Off — The computer is not detecting a physical connection to the network.</li> </ul>
7	network adapter connector	To attach your computer to a network or broadband device, connect one end of a network cable to either a network jack or your network or broadband device. Connect the other end of the network cable to the network adapter connector on your computer. A click indicates that the network cable has been securely attached.  <b>NOTE:</b> Do not plug a telephone cable into the network connector.  On computers with a network connector card, use the connector on the card.  It is recommended that you use Category 5 wiring and connectors for your network. If you must use Category 3 wiring, force the network speed to 10 Mbps to ensure reliable operation.
8	network activity light	Flashes a yellow light when the computer is transmitting or receiving network data. A high volume of network traffic may make this light appear to be in a steady "on" state.
9	USB 2.0 connectors (2)	Use the back USB connectors for devices that typically remain connected, such as printers and keyboards.  It is recommended that you use the front USB connectors for devices that you connect occasionally, such as flash memory key or cameras, or for bootable USB devices.
10	IEEE 1394a connector	Attach high-speed serial multimedia devices, such as a digital video camera.
11	keyboard connector	If you have a standard keyboard, plug it into the purple keyboard connector. If you have a USB keyboard, plug it into a USB connector.
12	microphone connector	Use the pink microphone connector to attach a personal computer microphone for voice or musical input into a sound or telephony program.  On computers with a sound card, the microphone connector is on the card.
13, 14	serial connectors	Connect a serial device, such as a handheld device, to the serial port. The default designations are COM1 for serial connector 1 and COM2 for serial

connector 2.

For more information, see "[System Setup Options.](#)"

## Inside Your Computer

**⚠ CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.



1	floppy drive (optional)
2	CD/DVD drive
3	hard drive shroud
4	card cage/video fan
5	power supply
6	processor shroud/fan
7	system board

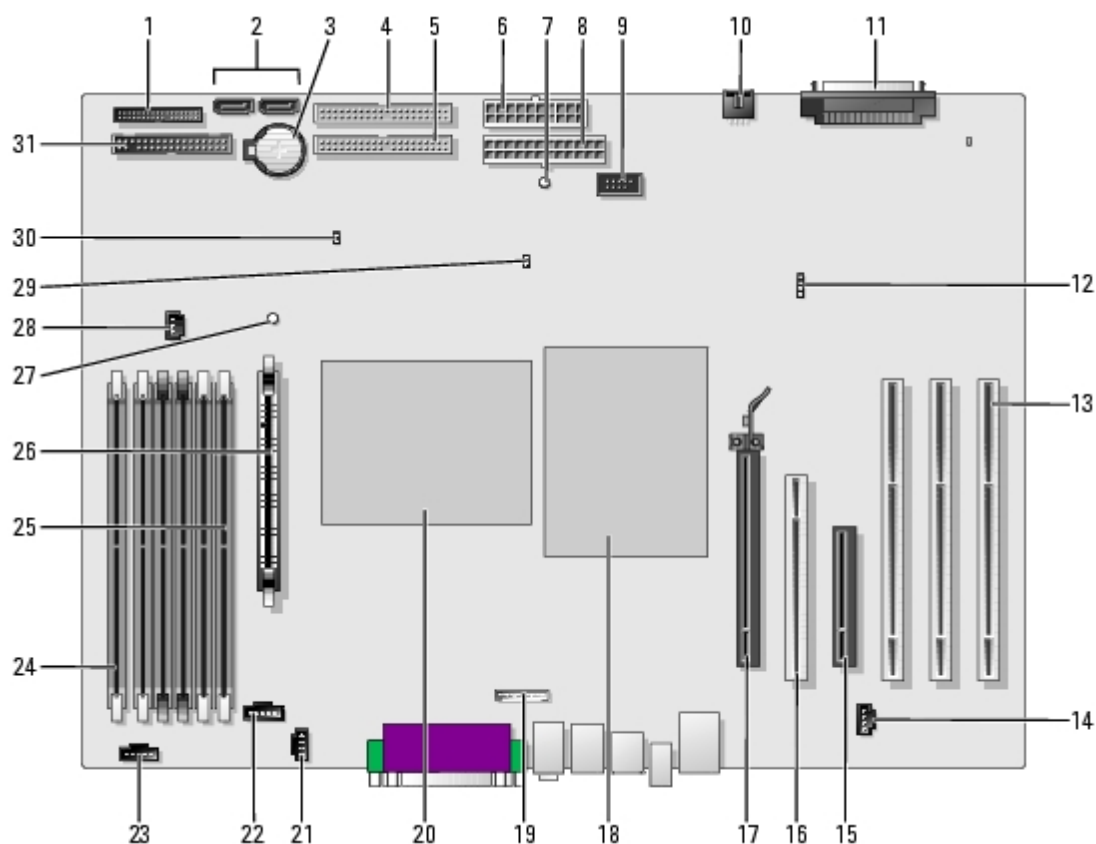
### Cable Colors

Device	Color
Hard drive	Blue cables
Floppy drive (optional)	Black pull-tab



CD/DVD drive	Orange pull-tab
I/O panel	Yellow pull-tab

## System Board Components



1	front-panel connector (PANEL)	17	PCI Express x16 connector
2	SATA connectors (2) (SATA_0 and SATA_1)	18	processor (CPU_0)
3	battery socket (BATTERY)	19	front-panel audio cable connector (FRONTAUDIO)
4	CD/DVD drive connector (IDE1)	20	processor (CPU_1)
5	CD/DVD drive connector (IDE2)	21	CD-drive audio cable connector (CD_IN)
6	power connector (POWER_2)	22	processor fan connector (FAN_P0)
7	standby power light (AUX_PWR)	23	processor fan connector (FAN_P1)
8	power connector (POWER_1)	24	memory module connector (DIMM_1)  The connectors are labeled DIMM_1 through DIMM_6 with DIMM_1 at the edge of the board. See " <a href="#">Memory Overview</a> " for instructions on installing memory.
9	IEEE 1394a	25	memory module connector (DIMM_6)

	connector (FP1394a)		The connectors are labeled DIMM_1 through DIMM_6 with DIMM_6 closest to the processor. See " <a href="#">Memory Overview</a> " for instructions on installing memory.
10	card fan connector (FAN_CCAG)	26	Voltage Regulator Module (VRM)
11	SCSI connector (SCSI)	27	suspend-to-RAM light (STR_LED)
12	auxiliary hard-drive activity light connector (AUX_LED)	28	memory fan connector (FAN_MEM)
13	PCIX card connectors	29	password jumper (PSWD)
14	telephony connector (MODEM)	30	RTC reset jumper (RTCRST)
15	PCI Express x8 connector (runs at x4 only)	31	floppy-drive connector (DISKETTE)
16	PCI connector		

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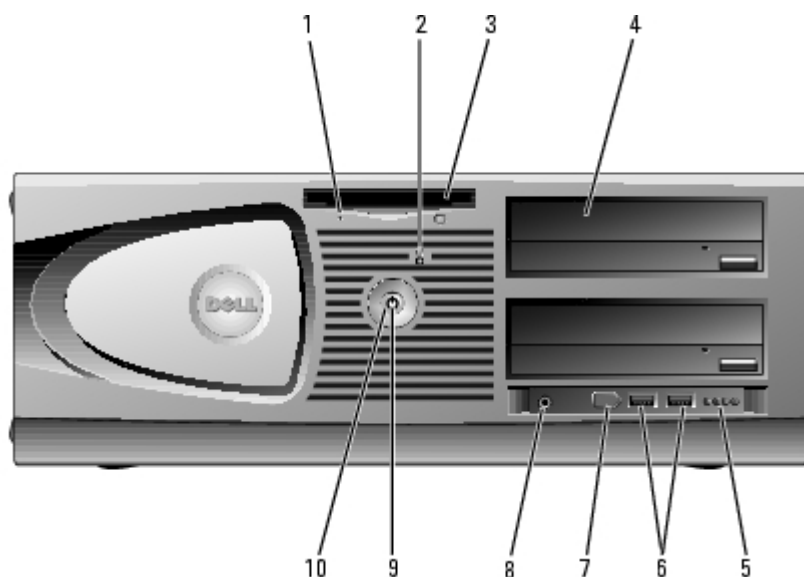
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# Your Dell Precision™ 470 Computer


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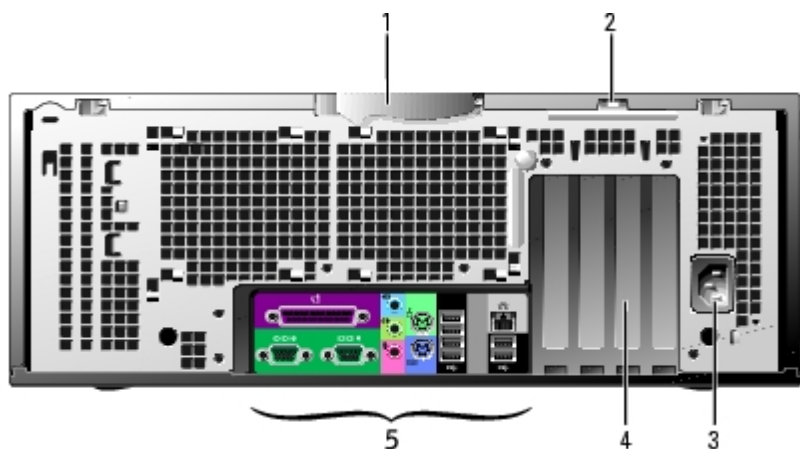
### Front View



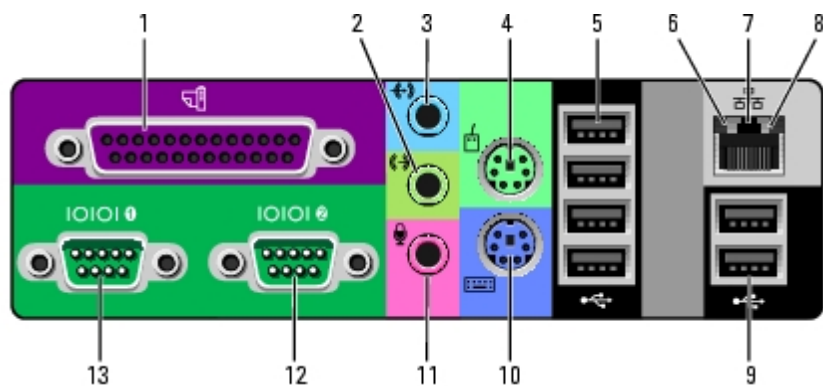
1	floppy-drive activity light	The floppy drive light is on when the computer reads data from or writes data to the optional floppy drive. Wait until this light turns off before you remove the floppy disk from the drive.
2	hard-drive activity light	The hard drive light is on when the computer reads data from or writes data to the hard drive. The light might also be on when a device such as your CD player is operating.
3	floppy drive (optional)	Access the optional floppy drive.
4	CD/DVD drive(s)	Access additional drives, such as a CD or DVD drive. Drive arrangement varies on computer configuration.
5	diagnostic lights (4)	Use the lights to help you troubleshoot a computer problem based on the diagnostic code. For more information, see " <a href="#">Diagnostic Lights</a> ."
6	USB 2.0 connectors (2)	Use the front USB connectors for devices that you connect occasionally, such as flash memory key or cameras, or for bootable USB devices (see " <a href="#">System Setup</a> " for more information on booting to a USB device).  It is recommended that you use the back USB connectors for devices that typically remain connected, such as printers and keyboards.
7	IEEE 1394a connector	Attach high-speed serial multimedia devices, such as digital video cameras.  <b>NOTE:</b> This connector is available if you purchase an add-in IEEE 1394a card.

8	headphone connector	Use the headphone connector to attach headphones and most kinds of speakers.
9	power light	<p>The power light illuminates and blinks or remains solid to indicate different states:</p> <ul style="list-style-type: none"> <li>○ No light — The computer is turned off.</li> <li>○ Steady green — The computer is in a normal operating state.</li> <li>○ Blinking green — The computer is in a power-saving state.</li> <li>○ Blinking or solid yellow— See "<a href="#">Power Problems</a>."</li> </ul> <p>To exit from a power-saving state, press the power button or use the keyboard or the mouse if it is configured as a wake device in the Windows Device Manager. For more information about sleep states and how to exit from a power-saving state, see "<a href="#">Power Management</a>."</p> <p>See "<a href="#">Diagnostic Lights</a>" for a description of light codes that can help you troubleshoot problems with your computer.</p>
10	power button	<p>Press to turn on the computer.</p> <p> <b>NOTICE:</b> To avoid losing data, do not use the power button to turn off the computer. Instead, perform an operating system shutdown.</p>

## Back View



1	cover latch release	To open the computer, lay the computer on its side with the cover latch release at the top and then push the latch to the left (see " <a href="#">Opening the Computer Cover</a> ").
2	padlock ring	Insert a padlock to lock the computer cover.
3	power connector	Insert the power cable.
4	card slots	Access connectors for any installed cards.
5	back panel connectors	Plug serial, USB, and other devices into the appropriate connectors.

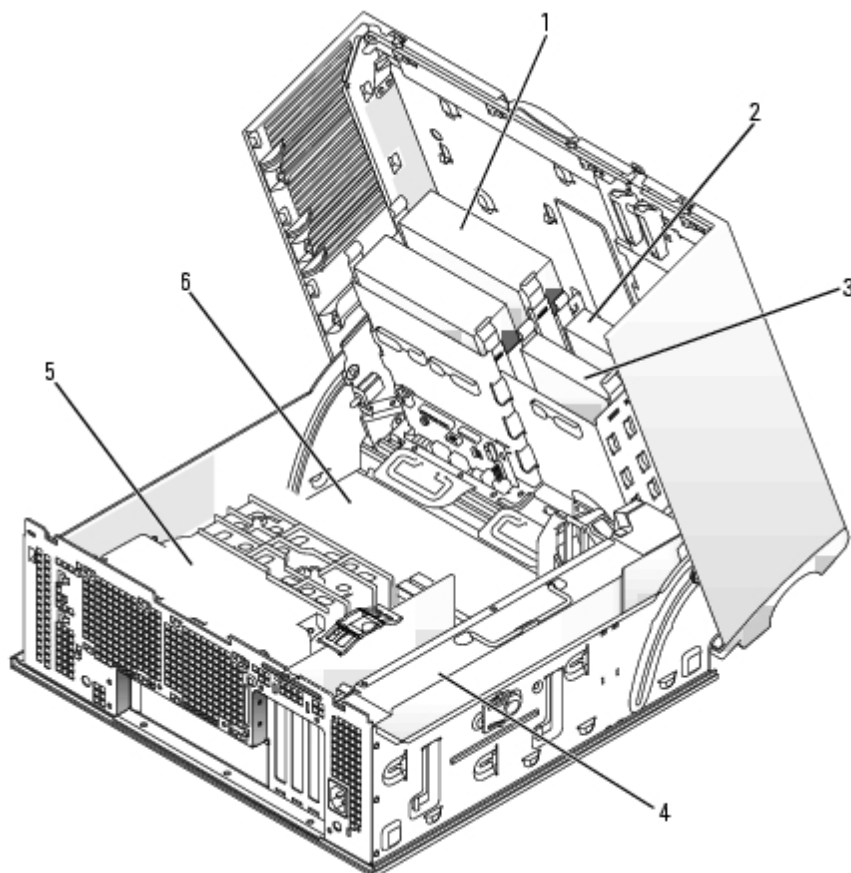


1	parallel connector	<p>Connect a parallel device, such as a printer, to the parallel connector. If you have a USB printer, plug it into a USB connector.</p> <p><b>NOTE:</b> The integrated parallel connector is automatically disabled if the computer detects an installed card containing a parallel connector configured to the same address. For more information, see "<a href="#">System Setup Options</a>."</p>
2	line-in connector	<p>Use the blue line-in connector to attach a record/playback device such as a cassette player, CD player, or VCR.</p> <p>On computers with a sound card, use the connector on the card.</p>
3	line-out connector	<p>Use the green line-out connector to attach headphones and most speakers with integrated amplifiers.</p> <p>On computers with a sound card, use the connector on the card.</p>
4	mouse connector	<p>Plug a standard mouse into the green mouse connector. Turn off the computer and any attached devices before you connect a mouse to the computer. If you have a USB mouse, plug it into a USB connector.</p> <p>If your computer is running the Microsoft® Windows® XP operating system, the necessary mouse drivers have been installed on your hard drive.</p>
5	USB 2.0 connectors (4)	<p>Use the back USB connectors for devices that typically remain connected, such as printers and keyboards.</p> <p>It is recommended that you use the front USB connectors for devices that you connect occasionally, such as flash memory key or cameras, or for bootable USB devices.</p>
6	link integrity light	<ul style="list-style-type: none"> <li>• Green — A good connection exists between a 10-Mbps network and the computer.</li> <li>• Orange — A good connection exists between a 100-Mbps network and the computer.</li> <li>• Yellow — A good connection exists between a 1000-Mbps (or 1-Gbps) network and the computer.</li> <li>• Off — The computer is not detecting a physical connection to the network.</li> </ul>
7	network adapter connector	<p>To attach your computer to a network or broadband device, connect one end of a network cable to either a network jack or your network or broadband device. Connect the other end of the network cable to the network adapter connector on your computer. A click indicates that the network cable has been securely attached.</p> <p><b>NOTE:</b> Do not plug a telephone cable into the network connector.</p> <p>On computers with a network connector card, use the connector on the card.</p> <p>It is recommended that you use Category 5 wiring and connectors for your network. If you must use Category 3 wiring, force the network speed to 10 Mbps to ensure reliable operation.</p>
8	network	<p>Flashes a yellow light when the computer is transmitting or receiving network</p>

	activity light	data. A high volume of network traffic may make this light appear to be in a steady "on" state.
9	USB 2.0 connectors (2)	Use the back USB connectors for devices that typically remain connected, such as printers and keyboards.  It is recommended that you use the front USB connectors for devices that you connect occasionally, such as flash memory key or cameras, or for bootable USB devices.
10	keyboard connector	If you have a standard keyboard, plug it into the purple keyboard connector. If you have a USB keyboard, plug it into a USB connector.
11	microphone connector	Use the pink microphone connector to attach a personal computer microphone for voice or musical input into a sound or telephony program.  On computers with a sound card, the microphone connector is on the card.
12, 13	serial connectors	Connect a serial device, such as a handheld device, to the serial port. The default designations are COM1 for serial connector 1 and COM2 for serial connector 2.  For more information, see " <a href="#">System Setup Options</a> ."

## Inside Your Computer

**⚠ CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.



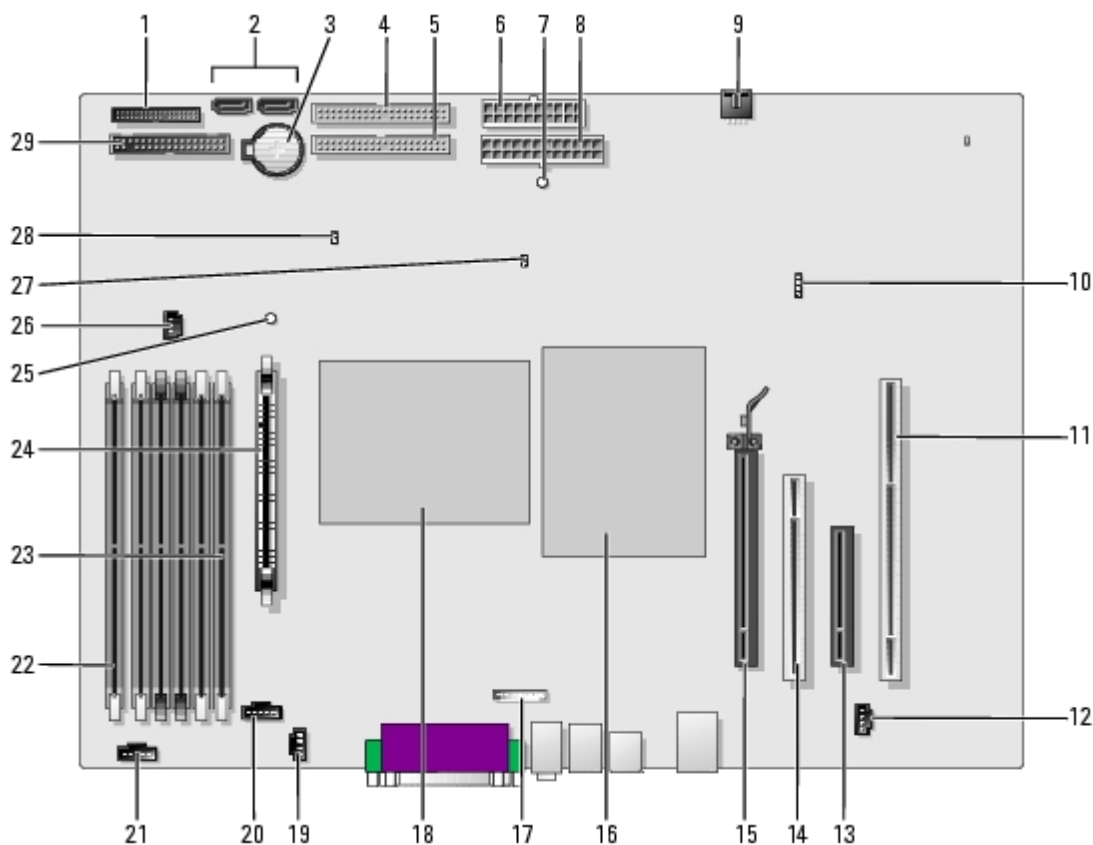
1	CD/DVD drive
2	floppy drive (optional)
3	hard drive

4	power supply
5	airflow shroud
6	system board

### Cable Colors

Device	Color
SATA hard drive	Blue cable
Floppy drive (optional)	Black pull-tab
CD/DVD drive	Orange pull-tab
I/O panel	Yellow pull-tab

## System Board Components



1	front-panel connector (PANEL)	16	processor (CPU_0)
2	SATA connectors (2) (SATA_0 and SATA_1)	17	front-panel audio cable connector (FRONTAUDIO)
3	battery socket (BATTERY)	18	processor (CPU_1)
4	CD/DVD drive connector (IDE1)	19	CD-drive audio cable connector (CD_IN)
5	CD/DVD drive connector (IDE2)	20	processor fan connector (FAN_P0)

5	power connector (POWER2)	21	processor fan connector (FAN_P1)
7	power connector (POWER1)	22	memory module connector (DIMM_1)  The connectors are labeled DIMM_1 through DIMM_6 with DIMM_1 at the edge of the board. See " <a href="#">Memory Overview</a> " for instructions on installing memory.
8	standby power light (AUX_PWR)	23	memory module connector (DIMM_6)  The connectors are labeled DIMM_1 through DIMM_6 with DIMM_6 closest to the processor. See " <a href="#">Memory Overview</a> " for instructions on installing memory.
9	card fan connector (FAN_CCAG)	24	Voltage Regulator Module (VRM)
10	auxiliary hard-drive activity light connector (AUX_LED)	25	suspend-to-RAM light (STR_LED)
11	PCI-X card connector	26	memory fan connector (FAN_MEM)
12	telephony connector (MODEM)	27	password jumper (PSWD)
13	PCI Express x8 connector (runs at x4 only)	28	RTC reset jumper (RTC_RST)
14	PCI connector	29	floppy-drive connector (DISKETTE)
15	PCI Express x16 connector		

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# Advanced Features

## Dell Precision™ Workstation 470 and 670 Computers User's Guide

- [LegacySelect Technology Control](#)
- [Manageability](#)
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- [System Setup](#)
- [Clearing Forgotten Passwords](#)
- [Clearing CMOS Settings](#)
- [Hyper-Threading](#)
- [IEEE 1394a](#)
- [U320 SCSI Controller](#)
- [Power Management](#)
- [Copying CDs and DVDs](#)

## LegacySelect Technology Control

LegacySelect technology control offers legacy-full, legacy-reduced, or legacy-free solutions based on common platforms, hard-drive images, and help desk procedures. Control is provided to the administrator through system setup, Dell OpenManage™ IT Assistant, or Dell™ custom factory integration.

LegacySelect allows administrators to electronically activate or deactivate connectors and media devices that include serial and USB connectors, a parallel connector, a floppy drive, PCI slots, and a PS/2 mouse. Connectors and media devices that are deactivated make resources available. You must restart the computer to effect the changes.

## Manageability

### Alert Standard Format

ASF is a DMTF management standard that specifies "pre-operating system" or "operating system-absent" alerting techniques. The standard is designed to generate an alert on potential security and fault conditions when the operating system is in a sleep state or the computer is powered down. ASF is designed to supersede previous operating system-absent alerting technologies.

Your computer supports the ASF alerts and remote capabilities described in the following table.

Alert	Description
Chassis: Chassis Intrusion - Physical Security Violation/Chassis Intrusion - Physical Security Violation Event Cleared	The computer chassis has been opened or the chassis intrusion alert has been cleared.
BIOS: Corrupt BIOS/Corrupt BIOS Cleared	The BIOS has been corrupted or the BIOS corruption has been resolved.
Boot: Failure to Boot to BIOS	The BIOS did not complete loading upon initiation.
Password: System Password Violation	The system password is invalid (alert occurs after three failed attempts).
CPU: CPU DOA Alert/CPU DOA Alert Cleared	The processor is not functioning.
Heartbeats: Entity Presence	Periodic heartbeats have been transmitted to verify system presence.
Temperature: Generic Critical Temperature Problem/Generic Critical Temperature Problem Cleared	The computer temperature is out of limits or the computer temperature problem has been resolved.

Voltage: Generic Critical Voltage Problem/Generic Critical Voltage Problem Cleared	The voltage from integrated voltage regulators is out of limits or the voltage problem has been resolved.
Power Supply: Critical Power Supply Problem/Critical Power Supply Problem Cleared	The computer power supply voltage is out of limits or the computer power supply voltage problem has been resolved.
Cooling Device: Generic Critical Fan Failure/Generic Critical Fan Failure Cleared	The fan speed (rpm) is out of limits or the fan speed (rpm) problem has been resolved.
Connectivity: Ethernet Connectivity Enabled/Ethernet Connectivity Disabled	The Ethernet connectivity is enabled or the Ethernet connectivity is disabled.

For more information about Dell's ASF implementation, see the *ASF User's Guide* and the *ASF Administrator's Guide*, which are available on the Dell Support website at [support.dell.com](http://support.dell.com).

## Dell OpenManage IT Assistant

IT Assistant configures, manages, and monitors computers and other devices on a corporate network. IT Assistant manages assets, configurations, events (alerts), and security for computers equipped with industry-standard management software. It supports instrumentation that conforms to SNMP, DMI, and CIM industry standards.

Dell OpenManage Client instrumentation, which is based on DMI and CIM, is available for your computer. For information on IT Assistant, see the *Dell OpenManage IT Assistant User's Guide* available on the Dell Support website at [support.dell.com](http://support.dell.com).

## Dell OpenManage Client Instrumentation

Dell OpenManage Client Instrumentation is software that enables remote management programs such as IT Assistant to do the following:

- Access information about your computer, such as how many it has and what operating system it is running.
- Monitor the status of your computer, such as listening for thermal alerts from temperature probes or hard-drive failure alerts from storage devices.
- Change the state of your computer, such as updating its BIOS or shutting it down remotely.

A managed system is one that has Dell OpenManage Client Instrumentation set up on a network that uses IT Assistant. For information about Dell OpenManage Client Instrumentation, see the *Dell OpenManage Client Instrumentation User's Guide* available on the Dell Support website at [support.dell.com](http://support.dell.com).

## Security

### Chassis Intrusion Detection



**NOTE:** When the admin password is enabled, you must know the admin password before you can reset the **Chassis Intrusion** setting.

This feature detects that the chassis was opened and alerts the user. To change the **Chassis Intrusion** setting:

1. [Enter system setup](#).
2. Press the down-arrow key to move to the **System Security** option **Chassis Intrusion** field.
3. Press <Enter> to access the menu.
4. Use the left- and right-arrow key to select an option setting.

5. Exit system setup.

## Option Settings

- **Enabled** — If the computer cover is opened, the setting changes to **Detected**, and the following alert message displays during the boot routine at the next computer start-up:

Alert! Cover was previously removed.

To reset the **Detected** setting, [enter system setup](#). In the **Chassis Intrusion** option, press the left- or right-arrow key to select **Reset**, and then choose **Enabled**, **Enabled-Silent**, or **Disabled**.

- **Enabled-Silent** (default) — If the computer cover is opened, the setting changes to **Detected**. No alert message appears during the boot sequence at the next computer start-up.
- **Disabled** — No intrusion monitoring occurs and no messages appear.

## Padlock Ring and Security Cable Slot

Use one of the following methods to secure your computer:

- Use a padlock alone or a padlock and looped security cable with the padlock ring. (For the location of the padlock on the Dell Precision 670 computer, see "[Inside Your Computer](#)" and for the Dell Precision 470 computer, see "[Inside Your Computer](#).") A padlock alone prevents the computer from being opened.

A security cable looped around a stationary object is used in conjunction with a padlock to prevent unauthorized movement of the computer.

- Attach a commercially available antitheft device to the security cable slot on the back of the computer.



**NOTE:** Before you purchase an antitheft device, make sure that it works with the security cable slot on your computer.

Antitheft devices usually include a segment of metal-stranded cable with an attached locking device and key. The documentation that comes with the device contains instructions for installing it.

## Password Protection



**NOTICE:** Although passwords provide security for the data on your computer, they are not foolproof. If your data requires more security, it is your responsibility to obtain and use additional forms of protection, such as data encryption programs.

## System Password



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

## Option Settings

You cannot change or enter a new system password if the following option is displayed:

- **Disabled** — The system password is disabled by a jumper setting on the system board.

You can only assign a system password when one of the two following options is displayed:

- **Set** — A system password is assigned.
- **Not Set** — No system password is assigned and the password jumper on the system board is in the enabled position (the default).

## Assigning a System Password

To escape from the field without assigning a system password, press <Tab> or the <Shift><Tab> key combination to move to another field, or press <Esc> at any time before you complete step 5.

1. [Enter system setup](#) and verify that **Password Changes** is set to **Unlocked**.
2. Highlight **System Password**, and then press <Enter>.
3. Type your new system password.

You can use up to 32 characters. To erase a character when entering your password, press <Backspace> or the left-arrow key. The password is not case sensitive.

Certain key combinations are not valid. If you enter one of these combinations, the cursor does not move.

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

4. Press <Enter>.

If the new system password is less than 32 characters, the whole field fills with placeholders. Then the option heading changes to **Confirm Password**, followed by another empty 32-character field in square brackets.

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

The password setting changes to **Set**.

6. Exit system setup.

Password protection takes effect when you restart the computer.

## Typing Your System Password

When you start or restart your computer, the following prompt appears on the screen.

```
Type the system password and press <Enter>.
```

```
Enter password:
```

If you have assigned an admin password, the computer accepts your admin password as an alternate system password.

If you type a wrong or incomplete system password, the following message appears on the screen:

```
** Incorrect password. **
```

If you again type an incorrect or incomplete system password, the same message appears on the screen. The third and subsequent times you type an incorrect or incomplete system password, the computer displays the following message:

```
** Incorrect password. **
Number of unsuccessful password attempts: 3
System halted! Must power down.
```

Even after your computer is turned off and on, the previous message is displayed each time you type an incorrect or incomplete system password.



**NOTE:** You can use **Password Changes** in conjunction with **System Password** and **Admin Password** to further

protect your computer from unauthorized changes.

## Changing or Deleting an Existing System Password

To change a system password:

1. [Enter system setup](#).
2. Highlight **System Password** and press <Enter>.
3. Enter your old password and enter the new password at the **New Password** and **Confirm New Password** prompts.

To delete a system password:

1. [Enter system setup](#).
2. Highlight **System Password** and press <Enter>.
3. Enter your old password and enter a blank password at the **New Password** and **Confirm New Password** prompts. The setting changes to **Not Set**.
4. If you want to assign a new admin password, see "[Assigning a System Password](#)."

## Admin Password

### Option Settings

- **Set** — Does not allow assignment of admin passwords; users must enter an admin password to make changes to system setup.
- **Not Set** — Allows assignment of admin passwords; password feature is enabled but no password is assigned.
- **Disabled** — The admin password is disabled by a jumper setting on the system board.

### Assigning an Admin Password

The admin password can be the same as the system password.



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

1. [Enter system setup](#) and verify that **Admin Password** is set to **Not Set**.
2. Highlight **Admin Password** and press <Enter>.

The computer prompts you to type and verify the password. If a character is not permitted, the computer emits a beep.

3. Type and then verify the password.


After you verify the password, the **Admin Password** setting changes to **Set**. The next time you enter system setup, the computer prompts you for the admin password.

4. Exit system setup.

A change to **Admin Password** becomes effective immediately (you do not need to restart the computer).

## Operating Your Computer With an Admin Password Enabled

When you [enter system setup](#), you can view, but not modify, system setup options. To modify options, go into **Unlock Setup** in the **Security** group and enter the admin password.

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

## Changing or Deleting an Existing Admin Password

To change the admin password:

1. [Enter system setup](#).
2. Highlight **Admin Password** and press <Enter>.
3. Enter your old password and enter the new password at the **New Password** and **Confirm New Password** prompts.

To delete the admin password:

1. [Enter system setup](#).
2. Highlight **Admin Password** and press <Enter>.
3. Enter your old password and enter a blank password at the **New Password** and **Confirm New Password** prompts. The setting changes to **Not Set**.

## Disabling a Forgotten Password and Setting a New Password

To reset system and/or admin passwords, see "[Clearing Forgotten Passwords](#)."

---

# System Setup

## Overview

Use system setup as follows:

- To change the system configuration information after you add, change, or remove any hardware in your computer
- To set or change a user-selectable option such as the user password
- To read the current amount of memory or set the type of hard drive installed

Before you use system setup, it is recommended that you write down the system setup screen information for future reference.

## Entering System Setup

1. Turn on (or restart) your computer.

- When the blue DELL™ logo appears, press <F2> immediately.

If you wait too long and the operating system logo appears, continue to wait until you see the Microsoft® Windows® desktop. Then [shut down your computer](#) and try again.

## System Setup Screens

The system setup screen displays current or changeable configuration information for your computer. Information on the screen is divided into three areas: the options list, active options field, and key functions.

**Options List** — This field appears on the left side of the system setup window. The field is a scrollable list containing features that define the configuration of your computer, including installed hardware, power conservation, and security features.

Scroll up and down the list by using the up- and down-arrow keys. As an option is highlighted, the **Option Field** displays more information about that option and the option's current and available settings.


**Option Field** — This field contains information about each option. In this field you can view your current settings and make changes to your settings.

Use the left- and right-arrow keys to highlight an option. Press <Enter> to make that selection active.

**Key Functions** — This field appears below the **Option Field** and lists keys and their functions within the active system setup field.

## System Setup Options

 **NOTE:** Depending on your computer and installed devices, the items listed in this section may or may not appear.

 **NOTE:** The system setup program defaults are listed under their respective options where applicable.

System	
System Info	Lists the computer name, version number of the BIOS, date of the BIOS, Asset Tag, and Service Tag.
Processor Info	Identifies whether the computer's processor supports Hyper-Threading, and identifies the processor speed, bus speed, clock speed, EM64T, L2 cache, multiple-core capabilities, number of processors, and processor type.
Memory Info	Indicates amount of installed memory, computer memory speed, and channel mode (dual or single).
Date/Time	Displays current date and time settings. You can modify these settings.
Boot Sequence	The computer attempts to boot from the sequence of devices specified in the list on the screen.
Drives	

SCSI Controller	Available on the Dell Precision 670 computer. This field enables and disables the integrated SCSI controller.
Diskette Drive	Enables and disables the floppy drives and sets read permission for the internal floppy drive. <b>Off</b> disables all floppy drives. <b>Internal</b> enables the internal floppy drive. <b>USB</b> disables the internal floppy drive and enables a USB drive if the USB controller is enabled and a USB drive is connected. <b>Read Only</b> enables the internal drive controller and allows the internal floppy drive read-only permission.
Drive 0	Identifies the primary hard drive attached to the SATA0 connector on the system board.
Drive 1	Identifies the secondary hard drive attached to the SATA1 connector on the system board.
Drive 2	Identifies the primary hard drive attached to the IDE1 connector on the system board.
Drive 3	Identifies the secondary hard drive attached to the IDE1 connector on the system board.
Drive 4	Identifies the primary hard drive attached to the IDE2 connector on the system board.
Drive 5	Identifies the secondary hard drive attached to the IDE2 connector on the system board.
SATA Operation	Configures the operating mode of the integrated hard drive controller.
SMART Reporting	Control whether hard driver errors for internal SATA and IDE drives are reported during system start-up.
<b>Onboard Devices</b>	
Integrated NIC ( <b>On</b> default )	You can set the NIC to <b>On</b> (default), <b>Off</b> , <b>On w/ PXE</b> , or <b>On w/ RPL</b> . When the <b>On w/ PXE</b> or <b>On w/ RPL</b> setting is active (available only for the future boot process), the computer attempts to boot from a network server. If a boot routine is not available from the network server, the computer attempts to boot from the next device in the boot sequence list.
Integrated Audio ( <b>On</b> default )	Enables or disables the onboard audio controller.
USB Controller ( <b>On</b> default )	Enables or disables the integrated USB controller. <b>Off</b> disables the controller. <b>On</b> enables the controller. <b>No Boot</b> enables the controller, but the BIOS will not recognize USB storage devices.
1394 Controller ( <b>On</b> default )	Enables or disables onboard IEEE 1394a controller (for the Dell Precision 670 computer only).
LPT Port Mode ( <b>PS/2</b> default )	Determines the mode of operating of the internal parallel port. <b>Off</b> disables the port. <b>AT</b> configures the port for IBM AT compatibility. <b>PS/2</b> configures the port for IBM PS/2 compatibility. <b>EPP</b> configures the port for the EPP bidirectional protocol. <b>ECP</b> configures the port for the ECP bidirectional protocol.  <b>NOTE:</b> If you set the <b>LPT Port Mode</b> to <b>ECP</b> , the <b>LPT Port DMA</b> appears in the option menu.
LPT Port Address ( <b>378H</b> default )	Determines the address that the built-in parallel port uses.
Serial Port #1 ( <b>Auto</b> default )	<b>Auto</b> , the default setting, automatically configures a connector to a particular designation ( <b>COM1</b> or <b>COM3</b> ).
Serial Port #2 ( <b>Auto</b> default )	<b>Auto</b> , the default setting, automatically configures a connector to a particular designation ( <b>COM2</b> or <b>COM4</b> ).
PS/2 Mouse Port ( <b>On</b> default )	Enables or disables the integrated legacy PS/2-compatible mouse controller.
<b>Video</b>	
Primary	Determines which video controller will become the primary video controller when 2 controllers are available in



Video ( <b>PEG</b> default )	the system. The default is <b>PEG</b> , the PCI Express Graphics video controller.
<b>Performance</b>	
CPU Count ( <b>On</b> default )	Enables the second CPU. This option is only valid in dual processor systems.
Multiple CPU Core ( <b>On</b> default )	Specifies whether the processor will have one or two cores enabled. This option is only valid in a system with one or two dual core processors.
Hyper-Threading ( <b>Off</b> default )	Determines whether each physical processor appears as one or two logical processors. The performance of some programs improves with additional logical processors. <b>On</b> enables Hyper-Threading. <b>Off</b> disables Hyper-Threading.
SpeedStep ( <b>Off</b> default )	Specifies whether enhanced SpeedStep technology will be enabled for all supported processor(s) in the system.
HDD Acoustic Mode ( <b>Quiet</b> default )	<ul style="list-style-type: none"> <li>• <b>Bypass</b> — Your computer does not test or change the current acoustics mode setting.</li> <li>• <b>Performance</b> — The hard drive operates at its maximum speed.</li> <li>• <b>Quiet</b> (default) — The hard drive operates at its most quiet setting.</li> <li>• <b>Suggested</b> — The hard drive operates at the level suggested by the drive manufacturer.</li> </ul> <p><b>NOTE:</b> Switching to performance mode may cause the drive to be noisier.</p> <p><b>NOTE:</b> Changing the acoustics setting does not alter your hard drive image.</p>
<b>Security</b>	
Admin Password ( <b>Not Set</b> default )	This option provides restricted access to the computer's system setup program in the same way that access to the computer can be restricted with the <b>System Password</b> option.
System Password ( <b>Not Set</b> default )	Displays the current status of the computer's password security feature and allows a new system password to be assigned and verified.
Password Changes ( <b>Unlocked</b> default )	This option locks the system password field with the admin password. When the field is locked, a valid admin password is required to modify or delete the system password.
Chassis Intrusion ( <b>On Silent</b> default )	When enabled, this option alerts you, during the next computer start-up, that the computer cover has been opened.
Execute Disable ( <b>On</b> default )	Specifies whether execute disable memory protection technology will be on or off.
<b>Power Management</b>	
AC Recovery ( <b>Off</b> default )	Determines what happens when AC power is restored to the computer.
Auto Power On ( <b>Off</b> default )	<p>Sets time and days of week to automatically turn on the computer. Choices are <b>every day</b> or every <b>Monday through Friday</b>.</p> <p>Time is kept in a 24-hour format (<i>hours:minutes</i>). Change the start-up time by pressing the left- or right-arrow key to increase or decrease the numbers, or type numbers in both the date and time fields.</p>

	<p>The default setting is <b>Disabled</b>.</p> <p>This feature does not work if you turn off your computer using a power strip or surge protector.</p>
<p>Auto Power Time</p> <p>(<b>Off</b> default)</p>	Allows you to specify a particular time when the system will turn on automatically.
<p>Low Power Mode</p> <p>(<b>Off</b> default)</p>	When <b>Low Power Mode</b> is selected, remote wakeup events no longer power up from <b>Hibernate</b> or <b>Off</b> from the onboard network controller.
<p>Remote Wake-Up</p> <p>(<b>Off</b> default)</p>	<p>This option allows the computer to power up when a NIC or Remote Wakeup-capable modem receives a wake up signal.</p> <p><b>Off</b> is the default setting. <b>On w/ Boot to NIC</b> allows the computer to attempt to boot from a network prior to using the boot sequence.</p> <p><b>NOTE:</b> Normally, the computer can be powered up remotely from suspend mode, hibernate mode, or when it is powered off. When <b>Low Power Mode</b> (in the <b>Power Management</b> menu) is enabled, the computer can only be powered up remotely from <b>Suspend</b>.</p>
<p>Suspend Mode</p> <p>(<b>S3</b> default)</p>	The options are <b>S1</b> , a suspend state where the computer is running in a low-power mode, and <b>S3</b> , a standby state where the power is reduced or turned off for most components; however, system memory remains active.
<b>Maintenance</b>	
<p>SERR DMI Message</p> <p>(<b>On</b> default)</p>	Controls the SERR DMI message mechanism. Some graphics cards require the SERR DMI message mechanism to be disabled.
<p>Asset Tag</p> <p>(<b>Set</b> default)</p>	Used for customer info.
<p>Owner Tag</p> <p>(<b>Not Set</b> default)</p>	Used for owner info.
<p>Load Defaults</p>	This setting restores the computer's factory-installed default settings.
<p>Event Log</p>	Displays the system event log.
<b>POST Behavior</b>	
<p>Fastboot</p> <p>(<b>On</b> default)</p>	When set to <b>On</b> (default), your computer starts more quickly because it skips certain configurations and tests.
<p>Numlock Key</p> <p>(<b>On</b> default)</p>	This option involves the rightmost bank of keys on your keyboard. When set to <b>On</b> (default), this option activates the numeric and mathematical features shown at the top of each key. When set to <b>Off</b> , this option activates the cursor-control functions labeled on the bottom of each key.
<p>POST Hotkeys</p>	Determines whether the sign-on screen displays a message stating the keystroke sequence that is required to enter system setup or the Quickboot feature. <b>Setup and Boot Menu</b> display both messages (F2=Setup and F12=Boot Menu). <b>Setup</b> displays the setup message only (F2=Setup). <b>Boot Menu</b> displays the Quickboot message only (F12=Boot Menu). <b>None</b> displays no message.
<p>Keyboard Errors</p> <p>(<b>Report</b> default)</p>	When set to <b>Report</b> (enabled) and an error is detected during POST, the BIOS displays the error message and prompts you to press <F1> to continue or press <F2> to enter system setup. When set to <b>Do Not Report</b> (disabled), if an error is detected during POST, the BIOS displays the error message and continues booting the computer.

## Boot Sequence

This feature allows you to change the boot sequence for devices.

### Option Settings

- **Onboard or USB Floppy Drive** — The computer attempts to boot from the floppy drive. If the floppy disk in the drive is not bootable, or if no floppy disk is in the drive, the computer generates an error message.
- **Onboard IDE Hard Drive** — The computer attempts to boot from the primary hard drive. If no operating system is on the drive, the computer generates an error message.
- **Onboard or USB CD Drive** — The computer attempts to boot from the CD drive. If no CD is in the drive, or if the CD has no operating system, the computer generates an error message.
- **Onboard Network Controller** — Network boot.
- **USB Device** — Insert the memory device into a USB port and restart the computer. When **F12 = Boot Menu** appears in the upper-right corner of the screen, press <F12>. The BIOS detects the device and adds the USB flash option to the boot menu.



**NOTE:** To boot to a USB device, the device must be bootable. To make sure that your device is bootable, check the device documentation.

### Changing Boot Sequence for the Current Boot

You can use this feature, for example, to tell the computer to boot from the CD drive so that you can run the Dell Diagnostics on the *Drivers and Utilities* CD, but the computer needs to boot from the hard drive when the diagnostic tests are complete. You can also use this feature to restart your computer to a USB device such as a floppy drive, memory key, or CD-RW drive.



**NOTE:** If you are booting to a USB floppy drive, you must first set the floppy drive to **OFF** in [system setup](#).

1. If you are booting to a USB device, connect the USB device to a USB connector (for the location of USB connectors, see "[Your Dell Precision™ 670 Computer](#)" or "[Your Dell Precision™ 470 Computer](#)."
2. Turn on (or restart) your computer.
3. When **F2 = Setup**, **F12 = Boot Menu** appears in the upper-right corner of the screen, press <F12>.

If you wait too long and the operating system logo appears, continue to wait until you see the Microsoft Windows desktop. Then [shut down your computer](#) and try again.

The **Boot Device Menu** appears, listing all available boot devices.

4. Use the up- and down-arrow keys to highlight the item from which you want the computer to boot for the current boot only and press <Enter>.


For example, if you are booting to a USB memory key, highlight **USB Device** and press <Enter>.



**NOTE:** To boot to a USB device, the device must be bootable. To make sure that your device is bootable, check the device documentation.


### Changing Boot Sequence for Future Boots


1. [Enter system setup](#).
2. Use the arrow keys to highlight the **Boot Sequence** menu option and press <Enter> to access the Boot Sequence.

 **NOTE:** Write down your current boot sequence in case you want to restore it.

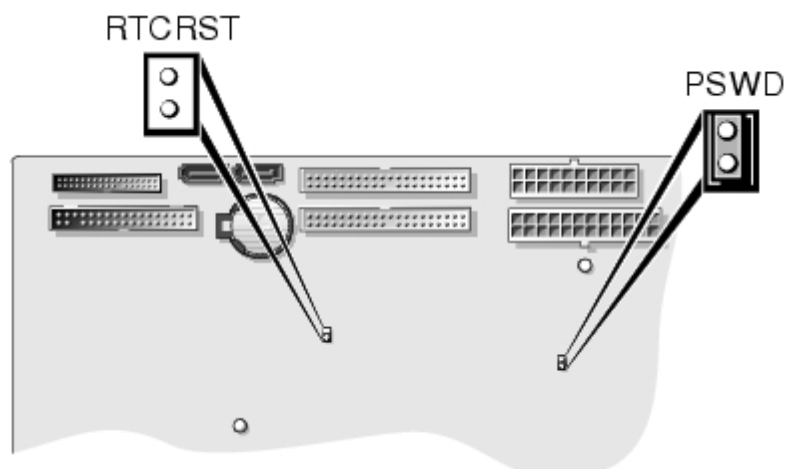
3. Press the up- and down-arrow keys to move through the list of devices.
4. Press the spacebar to enable or disable a device (only devices that are preceded by a number are bootable).
5. Press the up- and down-arrow keys to move a selected device up or down the list.






## Clearing Forgotten Passwords

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

 **NOTICE:** This process erases both the system and admin passwords.


1. Follow the procedures in "[Removing and Replacing Parts](#)."




Jumper	Setting	Description
PSWD	 (default)	Password features are enabled.
		Password features are disabled.
RTCRST		Real-time clock reset.
 <i>jumpered</i>  <i>unjumpered</i>		

2. Locate the password jumper (PSWD) on the system board (for the Dell Precision 470 computer, see "[System Board Components](#)" and for the Dell Precision 670 computer, see "[System Board Components](#)"), and remove the jumper plug to clear the password.
3. [Close the computer cover](#).
4. Connect your computer and monitor to electrical outlets, and turn them on.
5. After the Microsoft® Windows® desktop appears on your computer, [shut down the computer](#).
6. Turn off the monitor and disconnect it from the electrical outlet.

7. Disconnect the computer power cable from the electrical outlet, and press the power button to ground the system board.
8. [Open the computer cover.](#)
9. Locate the password jumper on the system board (for the Dell Precision 470 computer, see "[System Board Components](#)" and for the Dell Precision 670 computer, see "[System Board Components](#)") and attach the jumper plug to reenable the password feature.
10. [Close the computer cover.](#)

 **NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.


11. Connect your computer and devices to electrical outlets, and turn them on.

 **NOTE:** This procedure enables the password feature. When you [enter system setup](#), both system and admin password options appear as **Not Set**—meaning that the password feature is enabled but no password is assigned.


12. Assign a new system and/or admin password.

---

## Clearing CMOS Settings

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

1. Follow the procedures in "[Removing and Replacing Parts.](#)"
2. Reset the current CMOS settings:
  - a. Locate the password and CMOS jumpers (RTC\_RST) on the system board (for the Dell Precision 470 computer, see "[System Board Components](#)" and for the Dell Precision 670 computer, see "[System Board Components](#)").
  - b. Remove the jumper plug from its pins.
  - c. Place the password jumper plug on the RTC\_RST pins and wait approximately 5 seconds.
  - d. Remove the jumper plug from the RTC\_RST pins and place it back on the password pins.
  - e. [Close the computer cover.](#)

 **NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

3. Connect your computer and devices to electrical outlets, and turn them on.

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## Hyper-Threading

Hyper-Threading is an Intel® technology that can enhance overall computer performance by allowing one physical processor to function as two logical processors, capable of performing certain tasks simultaneously. It is recommended that you use the Microsoft® Windows® XP Service Pack 1 (SP1) operating system because Windows XP is optimized to take advantage of Hyper-Threading technology. While many programs can benefit from Hyper-Threading, some programs have not been optimized for Hyper-Threading and may require an update from the software manufacturer. Contact the software manufacturer for updates and information about using Hyper-Threading with your software.

To determine if your computer is using Hyper-Threading technology:

1. Click the **Start** button, right-click **My Computer**, and then click **Properties**.
2. Click **Hardware** and click **Device Manager**.
3. In the **Device Manager** window, click the plus (+) sign next to the processor type. If Hyper-Threading is enabled, the processor is listed twice.

You can enable or disable Hyper-Threading through system setup. For more information, see "[System Setup Options](#)."

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## IEEE 1394a

IEEE 1394a is a digital interface that can move large amounts of data between computers and peripheral devices. IEEE 1394a is ideal for use with multimedia devices because it speeds the transfer of data and large files, which enables a computer to connect directly to devices such as digital video cameras.

 **NOTE:** The connector can accept six-pin IEEE 1394a devices with the use of an adapter.

Your computer provides a standard IEEE 1394a connector on both the front and back panels (see "[Your Dell Precision™ 670 Computer](#)" or "[Your Dell Precision™ 470 Computer](#)"). The front connector on the Dell Precision 470 computer is available with an optional card.


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## U320 SCSI Controller

The U320 SCSI controller is PCI-X based and operates in a low voltage differential (LVD) mode while running at U320 (320 MBps) speeds. The bus is backward compatible and can run at U160 (160 MBps), Ultra2 (80 MBps), and Ultra (40 MBps) speeds.

If single-ended (SE) devices are connected to the same bus as the LVD devices (such as U320, U160, or Ultra2), the SCSI bus operates in SE mode and runs at a maximum of Ultra (40 MBps) speed.

For more information about installing a SCSI device and SCSI ID settings for your Dell Precision 670 computer, see "[Drives for the Dell Precision 670 Computer](#)" and for your Dell Precision 470 computer, see "[Drives for the Dell Precision 470 Computer](#)."


 **NOTE:** Due to resource constraints, you can not install more than one SCSI controller, regardless of make or model.

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## Power Management

Your computer can be set to use less power when you are not working. You control the power usage through the operating system installed on your computer and certain option settings in system setup. These periods of reduced power are called "sleep states:"

- **Standby** — In this sleep state, power is reduced or turned off for most components, including the cooling fans. However, system memory remains active.

 **NOTE:** All components installed in the computer must support this feature and have the appropriate drivers loaded to enter standby mode. For more information, see the manufacturer's documentation for each component.

- **Hibernate** — This sleep state reduces power consumption to a minimum by writing all data in system memory to a hard drive and then removing system power. Waking up from this state restarts the computer, and the memory contents are restored. Operation then resumes where the computer left off when it entered the hibernation state.

 **NOTE:** All components installed in the computer must support this feature and have the appropriate drivers loaded to enter hibernation. For more information, see the manufacturer's documentation for each component.

- **Shutdown** — This sleep state removes all power from the computer except a small auxiliary amount. As long as the

computer remains connected to an electrical outlet, it can be automatically or remotely started. For example, the **Auto Power On** option in system setup allows the computer to automatically start at a specified time. Also, your network administrator can remotely start your computer using a power management event such as Remote Wake Up.

The following table lists the sleep states and the methods you can use to wake the computer from each state.

Sleep State	Wake-Up Methods
Standby	<ul style="list-style-type: none"> <li>• Press the power button</li> <li>• Auto power on</li> <li>• Move or click the mouse</li> <li>• Type on the keyboard</li> <li>• USB device activity</li> <li>• Power management event</li> </ul>
Hibernate	<ul style="list-style-type: none"> <li>• Press the power button</li> <li>• Auto power on</li> <li>• Power management event</li> </ul>
Shutdown	<ul style="list-style-type: none"> <li>• Press the power button</li> <li>• Auto power on</li> <li>• Power management event</li> </ul>

 **NOTE:** For more information on power management, see your operating system documentation.

## Copying CDs and DVDs


 **NOTE:** Ensure that you observe all copyright laws when creating CDs or DVDs.

This section applies only to computers that have a CD-RW, DVD+/-RW, or CD-RW/DVD (combo) drive.


 **NOTE:** The types of CD or DVD drives offered by Dell may vary by country.

The following instructions explain how to make an exact copy of a CD or DVD. You can also use Sonic DigitalMedia for other purposes, such as creating music CDs from audio files stored on your computer or backing up important data. For help, open Sonic DigitalMedia and then click the question mark icon in the upper-right corner of the window.

## How to Copy a CD or DVD

 **NOTE:** CD-RW/DVD combo drives cannot write to DVD media. If you have a CD-RW/DVD combo drive and you experience recording problems, check for available software patches on the Sonic support website at [www.sonic.com](http://www.sonic.com).

The DVD-writable drives installed in Dell™ computers can write to and read DVD+/-R, DVD+/-RW and DVD+R DL (dual layer) media, but cannot write to and may not read DVD-RAM or DVD-R DL media.

 **NOTE:** Most commercial DVDs have copyright protection and cannot be copied using Sonic DigitalMedia.

1. Click the **Start** button, point to **All Programs® Sonic® DigitalMedia Projects**, and then click **Copy**.
2. Under the **Copy** tab, click **Disc Copy**.
3. To copy the CD or DVD:
  - *If you have one CD or DVD drive*, ensure that the settings are correct and click the **Disc Copy** button. The computer reads your source CD or DVD and copies the data to a temporary folder on your computer hard drive.

When prompted, insert a blank CD or DVD into the drive and click **OK**.

- *If you have two CD or DVD drives, select the drive into which you have inserted your source CD or DVD and click the **Disc Copy** button. The computer copies the data from the source CD or DVD to the blank CD or DVD.*

Once you have finished copying the source CD or DVD, the CD or DVD that you have created automatically ejects.

## Using Blank CDs and DVDs

CD-RW drives can write to CD recording media only (including high-speed CD-RW) while DVD-writable drives can write to both CD and DVD recording media.

Use blank CD-Rs to record music or permanently store data files. After creating a CD-R, you cannot write to that CD-R again (see the Sonic documentation for more information). Use blank CD-RWs to write to CDs or to erase, rewrite, or update data on CDs.

Blank DVD+/-Rs can be used to permanently store large amounts of information. After you create a DVD+/-R disc, you may not be able to write to that disc again if the disc is "finalized" or "closed" during the final stage of the disc creation process. Use blank DVD+/-RWs if you plan to erase, rewrite, or update information on that disc later.

### CD-Writable Drives

Media Type	Read	Write	Rewritable
CD-R	Yes	Yes	No
CD-RW	Yes	Yes	Yes

### DVD-Writable Drives

Media Type	Read	Write	Rewritable
CD-R	Yes	Yes	No
CD-RW	Yes	Yes	Yes
DVD+R	Yes	Yes	No
DVD-R	Yes	Yes	No
DVD+RW	Yes	Yes	Yes
DVD-RW	Yes	Yes	Yes
DVD+R DL	Yes	Yes	No
DVD-R DL	Maybe	No	No
DVD-RAM	Maybe	No	No

## Helpful Tips

- Use Microsoft® Windows® Explorer to drag and drop files to a CD-R or CD-RW only after you start Sonic DigitalMedia and open a DigitalMedia project.
- Use CD-Rs to burn music CDs that you want to play in regular stereos. CD-RWs do not play in most home or car stereos.
- You cannot create audio DVDs with Sonic DigitalMedia.
- Music MP3 files can be played only on MP3 players or on computers that have MP3 software installed.
- Commercially available DVD players used in home theater systems may not support all available DVD formats. For a list



of formats supported by your DVD player, see the documentation provided with your DVD player or contact the manufacturer.

- Do not burn a blank CD-R or CD-RW to its maximum capacity; for example, do not copy a 650-MB file to a blank 650-MB CD. The CD-RW drive needs 1–2 MB of the blank space to finalize the recording.
- Use a blank CD-RW to practice CD recording until you are familiar with CD recording techniques. If you make a mistake, you can erase the data on the CD-RW and try again. You can also use blank CD-RWs to test music file projects before you record the project permanently to a blank CD-R.

See the Sonic website at [www.sonic.com](http://www.sonic.com) for additional information.

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# RAID

## Dell Precision™ Workstation 470 and 670 Computers User's Guide

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## Features

Adaptec Embedded HostRAID supports:

- RAID levels 0 and 1, using HostRAID technology
- Operating system-independent configuration and RAID creation for SCSI using SCSISelect
- Operating system-independent configuration and RAID creation for Serial ATA using Adaptec RAID Configuration (ARC)
- Easy array configuration and status using RAID Storage Manager

(Install the RAID Storage Manager as described in "[Installing and Using RAID Storage Manager](#).")

- Event logging

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## Installing the Driver

When you install a driver in a new computer or update a driver in an existing computer, you need a driver disk. To obtain drivers:

- Visit the Dell Support website at **support.dell.com** and download the latest drivers for your controller. Follow the instructions provided with the download.
- Use the drivers provided with your *Drivers and Utilities* CD. See your *User's Guide* for more information about your *Drivers and Utilities* CD.

## Installing the Driver on a Computer Without an Operating System

1. [Create a driver disk](#).
2. Restart the computer.

3. If you are creating an array, press <Ctrl><a> when you are prompted to enter the ARC utility. For instructions on creating an array from the BIOS, see "[Creating an Array](#)."
4. When the array is finished building, insert the Windows setup CD and restart the computer.
5. Press <F6> when you are prompted to install a third-party driver.  
Press <F6> immediately—you only have 5 seconds. If you miss your chance, restart the Windows installation to complete it correctly. Otherwise, Windows will not recognize your controller.
6. Insert the driver disk you created in step 1 and wait until you are prompted to install a driver.
7. Press <s> to specify that the driver is on the floppy disk, and press <Enter>.  
Windows searches the disk for a suitable driver.
8. When the Embedded HostRAID driver is found, press <Enter>.
9. Follow the instructions on the screen to complete your installation.

## Installing the Driver on a Computer With an Operating System Installed

1. [Create a driver disk](#).
2. Restart the computer.  
Windows launches the **Found New Hardware Wizard**, which searches for the controller driver.
3. Insert the driver disk you created in step 1, select the floppy drive as the source, and then click **Next**.
4. If necessary, select the appropriate driver for your operating system.
5. Click **Next** as needed to complete the controller installation.
6. Remove the driver disk.
7. If you are prompted to restart the computer, do so.

Your installation is complete. If you want to create an array from the BIOS, see "[Creating an Array](#)." If you want to create an array from the operating system, see "[Installing and Using RAID Storage Manager](#)."


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## Installing and Using RAID Storage Manager

With the RAID Storage Manager, you can locally manage a computer containing a supported RAID controller that has the Windows operating system installed. See the online help for information about creating, configuring, and managing arrays.

 **NOTE:** Your controller may not support all of the features described. In most cases, if a feature is not supported by your controller, the feature does not appear in the interface.

## Installing the RAID Storage Manager on Windows

 **NOTE:** When you are installing the RAID Storage Manager on a FAT 32 file system, the folder being installed is automatically hidden.

1. Insert the *Drivers and Utilities* CD and wait for the Autorun executable to start the installation. If this does not happen, browse the CD and click **Autorun**.
2. Click **Install RAID Storage Manager**.
3. Click **Next** in the **Install Shield** window.

4. Read the license agreement. If you agree to its terms, click **Yes**. If not, click **No** and terminate the installation.
5. Follow setup instructions to finish the installation.
6. When you are prompted to restart your computer, accept the default (**Yes**) and click **Finish**. The computer restarts to complete the installation.

## Using RAID Storage Manager

The action buttons are:

- **Logout** — Selecting **Logout** ends your session and returns you to the **Login** screen.
- **Rescan** — Used to rescan the configuration of the computer. Typically, when a rescan is required, it occurs automatically; for example, after an array is created.

The remaining buttons open additional windows that provide more detailed information, and allow you to perform actions or change settings of a specific aspect of your storage subsystem.

- **Events**
- **Options**
- **Help**
- **Properties**

Immediately following the header frame is a controller information line including the model number of the first RAID controller found in the computer.

Beneath the controller information are **Physical Devices** and **Logical Devices** views that show connected devices and existing arrays on this controller. Controller information and device views are repeated for each additional RAID controller in the computer.

Select the controller by clicking anywhere on the controller information. When you select the controller, the **Events**, **Properties**, and **Tasks** buttons change from blue to amber, indicating that clicking any of them displays an additional window with information and options specific to this controller.

## Pop-Up Tool Tips

If you position the cursor over a device or button, a pop-up tool tip appears. For buttons, the tips contain helpful information about the function of the button, while for devices the tips display additional information.

## Physical Devices

The **Physical Devices** view displays information about the drives attached to the RAID controller. The devices shown are organized by the channel or port to which they are connected and they are listed in numerical order.

The display for each channel includes information on maximum speed capability, the number of the channel on the controller, and the number of devices found (excluding the SCSI controller).

Selecting a channel or device turns the **Events**, **Properties**, and **Tasks** buttons amber. The amber color indicates that clicking any of these buttons displays an additional window with information and options specific to that device or channel.

At the top of the **Physical Devices** view, grouped to the right of **View**, are three view selection buttons. These buttons select the physical devices connected to the controller.

## Changing How Drives are Displayed

By default, the **Physical Devices** view displays a condensed snapshot of the controller configuration that hides detailed information about the drives. More information is available by either positioning the mouse pointer over the device or clicking the arrow to the left of a row of devices.

The selected display mode button appears in a lighter shade of blue than the other two buttons. The default display is the **Text Description View**, but in the condensed view that is used when the RAID Storage Manager is loaded, the display is the same in all three modes.

If you change the display mode by selecting one of the other view buttons, a yellow arrow flashes to the left of any devices where the condensed display hides information.

An icon is always the first entry on each device line. If a + symbol appears with the hard drive icon, the drive is a hot spare. Different icons are used to represent other devices.

## View

When you expand the default display mode, the following information about each device appears:

- Capacity of the drive
- Drive manufacturer and model number
- SCSI drive ID or Serial ATA port number

When you expand them, the **Full Size Capacity View** button and the **Relative Size Capacity View** button represent each drive as a bar. A drive that is not used as part of any array is blue and is surrounded by a dotted line.

The **Full Size Capacity View** button displays a full-length bar for each drive, regardless of capacity. The **Relative Size Capacity View** button displays a bar for each drive, with the largest capacity drive full-length and the other drives proportional to the drive capacity, relative to the largest drive.

Any part of a drive used in an array is shown as a gray segment within the bar. Selecting any gray segment highlights it in amber, and in the **Logical Devices** view.

In either the **Full Size Capacity View** or the **Relative Size Capacity View**, a small portion at each end of the drive may be shown in dark gray.

The segment at the end of the drive may vary in size from drive to drive because, in addition to the RAID signature, the controller may also limit the usable capacity of each drive.

This is done because hard drives that appear to have the same capacity and that are made by different manufacturers, or even different models from the same manufacturer, actually vary slightly in the true capacity available. In normal operation, this is not an issue, it can be when assigning hot spares or replacing a failed drive.

If the controller uses the maximum capacity of each drive and a hot spare or replacement drive is just a few megabytes smaller, it is not possible to replace the failed drive. By rounding drive capacities down to the nearest 2 MB, this possibility is effectively eliminated.

## Logical Devices


As described earlier, when the RAID Storage Manager loads, the **Logical Devices** view is expanded and you can see the arrays present on the controller.

At the top of this view are the following buttons: **Create**, **Modify**, and **Delete**. Each button opens a wizard for the corresponding function.

**Modify** allows you to:

- Change an array from one RAID level to another.
- Change the stripe size for a RAID 0.

The main area of the **Logical Devices** view is used to display the arrays on this controller. It defaults to a condensed view of top-level arrays.

 **NOTE:** The **Options** button allows you to display second-level arrays if your controller supports them.

In this condensed view, the RAID level of each device, as well as whether it is protected by a hot spare, is visible. If a global hot spare exists, all arrays that the hot spare is large enough to protect shows as protected.

In the expanded view, the icons for the arrays are arranged vertically and next to them are the capacity, name, and type of arrays.

Selecting an array by clicking on it highlights the following in amber:

- All the drives or segments that form the array in the **Physical Devices** view.
- The **Events**, **Properties**, and **Tasks** buttons in the header frame. Selecting any of these three buttons displays a new window with additional information and options specific to that array.

## Accessing RAID Storage Manager

### Starting the RAID Storage Manager in the Windows Operating System

1. Open the program by clicking the **Start button**, pointing to **Programs® RAID Storage Manager**, and clicking **RAID Storage Manager**.
2. The program flash screen appears briefly, then a login dialog box opens. Enter the user name and password you use to log on to your operating system, and click **Connect**.

 **NOTE:** Your RAID Storage Manager permissions vary according to your operating system permissions:

**Administrator:** The Administrator log in allows you to view and modify the RAID configuration. You can create and delete logical devices, add and remove hot-spare drives, and verify logical devices. To log in as Administrator, you must be a member of the Administrator group for your operating system. Use the Administrator user name and password or your own user name and password if you are a member of the Administrator group.

**User:** The User log in allows you to view the RAID configuration, verify logical devices, and add and remove hot-spares. You cannot create or delete logical devices. To log in as User, use your normal network user name and password.

**Guest:** The Guest log in allows you to view the RAID configuration only. You cannot change or modify any information. To log in as Guest, click **Cancel** when the RAID Storage Manager **Log in** window opens.


## Creating an Array

To create an array:

1. In the **Controller** view, click the controller that you want to configure.
2. Right-click **Create logical drive**.  
The **Configuration** wizard opens.
3. Click either **Express** configuration or **Custom** configuration. See "[Choosing Between Express and Custom Configuration](#)" for more information.

If you select **Express** configuration, the RAID Storage Manager automatically:

- Creates one or more logical devices, based on the number and size of ready physical drives in your computer.
- Defines a hot-spare drive, if four or more ready physical drives of the same size are available.

 **NOTE:** For HostRAID controllers, Express configuration creates a single RAID Level-1 logical device; it does not create a hot spare drive.

If you select **Custom** configuration, the RAID Storage Manager guides you through:

- Defining the RAID level of the logical devices.
  - Selecting the physical drives that you want to include for each logical device.
  - Defining the number and size of the logical devices.
  - Fine-tuning your configuration for optimal performance.
4. Click **Next** and review the configuration summary.
  5. Click **Apply**.  
The RAID Storage Manager configures the controller and initializes the logical devices.


---


## Choosing Between Express and Custom Configuration

In the Configuration wizard, you can choose from two methods to configure your controller:

### Express Configuration

Click the **Express** configuration for a quick and easy method to automatically configure your controller. This path creates the most efficient configuration based on the number and capacity of the ready physical drives available in your computer. If four or more ready drives of the same capacity are available, this choice also defines a hot-spare drive for the controller. If four or more ready drives are available, the largest drive is designated as the hot-spare drive.

 **NOTE:** For HostRAID controllers, **Express** configuration creates a RAID level-1 logical drive.

 **NOTE:** When you choose **Express** configuration, you have the opportunity to review and approve the configuration before the RAID Storage Manager applies the configuration. If you need to modify the configuration, you can do so from the configuration summary.

### Custom Configuration


Click the **Custom** configuration for a method that lets you manually configure your controller.

Choose this method to do any of the following:

- Define the RAID level of the logical drives.
- Select the physical drives that you want to include for each logical drive.
- Define the number and size of the logical drives.
- Fine tune your configuration for optimal performance
- Review the configuration summary.

---

## Deleting an Array

 **NOTICE:** Deleting an array destroys all data on the array. Deleting the array on which the operating system resides destroys the operating system and all data, and the computer no longer boots. Only delete data arrays, or backup data

before deleting the boot array. For some operating systems, deleting a disk group and its associated logical drives might change the drive-letter assignments of the remaining drives when you restart the computer.

- ➔ **NOTICE:** If you delete a disk group, you delete all logical devices that are defined in that disk group. All data and programs on the logical devices in the disk group are lost during this procedure.

To delete a disk group:

1. In the **Physical devices** view, click the array.

- ➔ **NOTICE:** Before proceeding, ensure that you have backed up any data and programs that you want to save.

2. Right-click **Delete disk group**.
3. Click **Yes**.

---

## Manually Rebuilding a Failed Drive

Use this action to rebuild a degraded logical device when a physical drive in the disk group is failed. Normally, the controller rebuilds a logical device when it detects the removal and reinsertion of a drive that is part of a disk group. Use this operation to force the rebuild to begin immediately, without physically removing and replacing the disk drive.

- 🔧 **NOTE:** The controllers can rebuild RAID level-1 logical devices. They cannot, however, rebuild RAID level-0 logical devices because RAID level-0 is not redundant.

To manually rebuild a failed drive:

1. In the **Physical devices** view, click the failed physical drive.
2. Right-click **Rebuild drive**.
3. Click **Yes**.

- 🔧 **NOTE:** During the rebuild operation, the failed drive enters the rebuild state and the logical device remains degraded until the rebuild operation is completed.

---

## Rebuilding to a Hot-Spare

When a hot-spare drive is available, the rebuild operation begins automatically without the need to replace the failed drive. If more than one drive fails within the same disk group, no rebuild takes place. If multiple drives fail in separate disk groups (one physical drive per array), the controller initiates a rebuild operation for the logical devices within the disk group containing the first failed physical drive. The rebuild operation is performed on the first hot-spare drive of sufficient size to become a valid member of the disk group.


---

## Verifying an Array

Use this action to check redundant logical drives for inconsistent or bad data. Verification is similar to **Verify with Fix**, except that the RAID Storage Manager does not repair the drive if bad data is found. Verification can be a lengthy operation. You cannot perform any other actions on the controller until the verification is completed. You can verify the logical drive immediately or schedule it for another time. You can also schedule the verification as a recurring task. A recurring task starts at the initial start time, then runs periodically according to the given interval: the same time each day, the same time each week, or the same time each month.

- 🔧 **NOTE:** You cannot perform any other actions on the controller until the verification is completed. For example, you cannot schedule a verification if another logical drive verification is in progress.



 **NOTE:** Do not turn off the computer while verification is in progress.

To verify a logical drive:

1. In the **Logical devices** view, click the logical drive you want to verify.
2. Right-click **Verify** or **Verify with Fix**.
3. *To verify the logical drive now*, click **Yes**. *To schedule the verification for a later date and time*, click **Schedule**. The RAID Storage Manager displays the **Scheduler** pane:
  - From the drop-down lists and calendar display, select the day, month, year, and time you want the task performed.
  - From the **Recurring** drop-down list, select the interval at which you want the task to recur: **Never**, **Daily**, **Weekly**, or **Monthly**.
  - Click **OK** to schedule the task; click **Cancel** to cancel the scheduled task and return to the initial confirmation pane.

## SATA Host RAID

With the Adaptec RAID Configuration Utility (ACU), you can create and manage RAID arrays with drives connected to a SATA controller. This section explains how to use ACU and two host RAID levels to provide the proper level of fault tolerance and event notification. See "[SCSI Host RAID](#)."

HostRAID supports the following RAID levels:

- RAID 0 — Striping mode for boosting performance
- RAID 1 — Mirroring mode for data security


## Creating Arrays

Before creating arrays, make sure the disks for the array are connected and installed in your computer. Note that disks with no usable space, or disks that are part of the RAID array are shown in gray and cannot be used. See "Configuring Drives."

To create an array:

1. Turn on your computer and press <Ctrl><a> when you are prompted to access the ARC utility.
2. From the ARC menu, select **Array Configuration Utility (ACU)** and press <Enter>.
3. From the ACU menu, select **Create Array by using the up- and down-arrow keys**.
4. Select the disks for the new array and click **Insert**. To deselect any disk, highlight the disk and click **Delete**.
5. Press <Enter> when disks for the new array are selected. The **Array Properties** menu displays.


## Assigning Array Properties

 **NOTE:** Once the array is created and its properties are assigned, you cannot change the array properties using the ACU.

Tips for assigning an array:


- Before adding a new drive to an array, back up any data contained on the new drive. Otherwise, all data will be lost.

- If you stop the Build or Clear process on a RAID 1 from ACU, you can restart it by simultaneously pressing <Ctrl><r>.
- If you created a RAID 1 using the **Quick Init** option, you may notice that data comparisons do not match when you run a consistency check.
- The ACU allows you to use drives of different sizes in a RAID 1. However, during a build operation, only the smaller drive can be selected as the source or first drive.
- It is recommended that you *do not* migrate or build an array on Windows dynamic disks (volumes), as it will result in data loss.

 **NOTICE:** Do not interrupt the creation of a RAID 0 using the **Migrate** option. If you do, there is no way to restart, and no way to recover the data that was on the source drive.

To assign properties to the new array:

1. In the **Array Properties** menu, select an array type and press <Enter>. Note that only the available array types, RAID 0 and RAID 1, are displayed. RAID 0 and RAID 1 require a minimum of two drives.
2. Type in an optional label of no more than 15 characters for the array, and press <Enter>.
3. For RAID 0, select the desired stripe size. Available stripe sizes are 16, 32, and 64 KB (default).

 **NOTE:** It is recommended that you do not change the default.

You can select between the different creation methods for RAID 0 and RAID 1. The following table gives examples of when each is appropriate.

RAID Level	Create Via	When Appropriate
RAID 0	No Init	Creating a RAID 0 on new drives.
RAID 0	Migrate*	Creating a RAID 0 on a new drive and one drive with data you want to preserve.
RAID 1	Build*	Any time you wish to create a RAID 1, but especially if you have data on one drive that you want to preserve.
RAID 1	Clear	Creating a RAID 1 on new drives, or when you want to ensure that the array contains no data after creation.
RAID 1	Quick Init	Fastest way to create a RAID 1 (is appropriate when using new drives).

\*If you select **Migrate** for RAID 0 or **Build** for RAID 1, you are asked to select the source drive. The contents of the source drive are preserved; however, the data on the new drive is lost.

4. When you are finished, select **Done**.

## Configuring Drives

If an installed disk does not appear in the disk selection list for creating a new array, or if it appears grayed out, you may have to initialize it before you can use it as part of an array. Drives attached to the controller must be configured before they can be used in an array.


1. Turn on your computer and press <Ctrl><a> when you are prompted to access the ARC utility.
2. From the ARC menu, select **Array Configuration Utility (ACU)**.
3. Select **Configure Drives**.
4. Use the up- and down-arrow keys to highlight the disk you want to configure and select **Insert**.

5. Repeat step 4 so that all drives to be initialized are selected.
6. Press <Enter>.
7. Read the warning message and ensure that you have selected the correct disk drives to initialize. Press <y> to continue.

## Rebuilding Arrays

 **NOTE:** Rebuilding applies to Fault Tolerant arrays (RAID 1) only.


If an array Build process (or initialization) is interrupted or critical with one member missing, you must perform a Rebuild to get the array to **Optimal** status. For a critical array Rebuild operation, the optimal drive is the source drive.

 **NOTE:** If no spare exists and a hard disk drive fails, you need to create a spare before you can rebuild an array. See "[Add/Delete Hotspares](#)" before continuing your Rebuild.

1. From the **Main Menu**, select **Manage Arrays**.
2. From the **List of Arrays**, select the array you want to rebuild.
3. Press <Ctrl><r> to rebuild.

## Verifying Drives


If you are notified of a mismatch of data during a build of RAID 1, you have an option of synchronizing your drives.

 **NOTE:** You only have the synchronize option available if the array is **Optimal**. If the array has failed, you need to rebuild the array.

1. Select the drives you need to synchronize.
2. Press <Ctrl><s>.
3. Select **Yes** when the following prompt is displayed:

Do you want utility to automatically fix errors? (Yes/No)  
When the synchronization is complete, you are notified with a fix message.

## Deleting Arrays

 **NOTICE:** Back up the data on an array before you delete it. Otherwise, all data on the array is lost. Deleted arrays cannot be restored.

To delete an existing array:

1. Turn on your computer and press <Ctrl><a> when you are prompted to access the ARC utility.
2. From the ARC menu, select **Array Configuration Utility (ACU)** and press <Enter>.
3. From the ACU menu, select **Manage Arrays** using the up- and down-arrow keys.
4. Select the array you want to delete and press <Delete>.
5. In the **Array Properties** dialog box, select **Delete** and press <Enter>.  
The following prompt is displayed:

```
Warning!! Deleting the array will render array unusable. Do you
want to delete the array?(Yes/No):
```

6. Select **Yes** to delete the array or partition or **No** to return to the previous menu.

*RAID 1 only—the following prompt is also displayed:*

```
Deleting the partition will result in data loss! Do you also want
to delete the partition? Choose which member:
[NONE] [MEMBER #0] [MEMBER #1] [BOTH]
```

7. Select **[BOTH]** and press <Enter>.
8. Press <Esc> to return to the previous menu.

## Add/Delete Hotspares

Select the **Add/Delete Hotspares** option to add, delete, or view hotspares.

1. Turn on your computer and press <Ctrl><a> when you are prompted to access the ARC utility.
2. From the ARC menu, select **Array Configuration Utility (ACU)**.
3. From the ACU menu, select **Add/Delete Hotspares** by using the up- and down-arrow keys.
4. Use the up- and down-arrow keys to highlight the disk you want to designate as a Hotspare, select **Insert**, and then press <Enter>.
5. Select **Yes** when the following prompt is displayed:

```
Do you want to create spare? (Yes/No)
```

The Spare you have selected appears in the **Assigned Hot Spare Drive** menu.

## Viewing Array Properties

To view the properties of an existing array:

1. At the BIOS prompt, press <Ctrl><a>.
2. From the ARC menu, select **Array Configuration Utility (ACU)**.
3. From the ACU menu, select **Manage Arrays**.
4. From the **List of Arrays** dialog box, select the array you want to view and press <Enter>.

The **Array Properties** dialog box appears, showing detailed information on the array. The physical disks associated with the array are displayed here.

5. Press <Esc> to return to the previous menu.

---

## Using the Controller Configuration Utility

1. Turn on your computer and press <Ctrl><a> when you are prompted to access the ARC utility.
2. If multiple controllers are installed, select the controller you want to configure and press <Enter>.

3. From the ARC menu, select **SATASelect**.

The **Controller Configuration** and **SATA Configuration** menu options are displayed.

4. Select **Controller Configuration**.

You can modify the following **Controller Interface** options:

- **Runtime BIOS** (Default: Enabled) — Enables or disables the controller's runtime BIOS. The BIOS must be enabled if you want to boot from the controller.

If **Runtime BIOS** is enabled and the **Array-based BBS Support** option is disabled, the controller BIOS is enabled and post to the first array (or drive) attached to the controller as a bootable hard disk drive.

---

## Using the Disk Utilities

The Disk Utilities enable you to format or verify the media of your Serial ATA hard disks.

1. Turn on your computer and press <Ctrl><a> when you are prompted to access the ARC utility.
2. From the ARC menu, select **Disk Utilities**.
3. Select the desired disk and press <Enter>.

The following options appear:


- **Format Disk** — Simulates a low-level format of the hard drive by writing zeros to the entire disk. Serial ATA drives are low-level formatted at the factory and do not need to be low-level formatted again.

 **NOTICE:** Formatting destroys all data on the drive. Be sure to back up your data before performing this operation.

- **Verify Disk Media** — Scans the media of a disk drive for defects.
- 

## SCSI Host RAID

With the SCSISelect utility, you can create and maintain RAID arrays with drives connected to a SCSI controller.

 **NOTE:** Only the Dell Precision® 670 computer has RAID arrays with drives connected to a SCSI controller on the system board. You cannot use the SCSISelect utility with the Dell Precision 470 computer.

This section explains how to use the SCSISelect utility to create and manage RAID arrays on your computer. Use HostRAID to provide the proper level of fault tolerance and event notification.

HostRAID supports the following RAID levels:

- RAID 0 — Striping mode for boosting performance
- RAID 1 — Mirroring mode for data security

## Using SCSISelect Utility Menus

To select a SCSISelect menu option, move the cursor to the option with the arrow keys and then press <Enter>. In some cases, selecting an option displays another menu. You can return to the previous menu at any time by pressing <Esc>.

## Starting the SCSI Select Utility

1. Turn on or restart your computer.

During the startup process, pay careful attention to the messages that appear on your screen.

2. When the following message appears on your screen, press <Ctrl><a> (this message appears for only a few seconds):

```
Press <Ctrl><A> for SCSI Select (TM) Utility!
```

3. From the device menu that appears, select a channel and press <Enter>.
4. From the **Options** menu, select **Configure/View HostRAID Settings** and press <Enter>.

After scanning the device is completed, the **Main** menu appears. The **Main** menu displays the following information:

- o ID — Indicates ID number of hard drive.
- o Type — Indicates available non-array hard drive, RAID type, or global spare:
  - o Striped (R0)
  - o Mirrored (R1)
  - o Hard Drive
  - o Spare
- o Vendor — Indicates vendor of hard drive.
- o Product — Indicates model of hard drive or name of built array.
- o Size — Indicates size of hard drive.
- o Status — Indicates available RAID status:
  - o Free — Available drive
  - o Optimal — No defect
  - o Degraded — One drive in a mirrored array is in failed status, and a Rebuild option is available.
  - o Dead — One drive in a RAID 0 array is in failed state or missing.
  - o Building — The drive is a target of an ongoing Rebuild operation.
  - o Verifying — Checking the data integrity of redundant data stored on fault-tolerant arrays.

## Viewing Array

To view an array, select the array and press <Enter>. A detailed view of the hard drives appears. From this window you can see the status of the individual hard drives. The status levels you might see are:

- Optimal — No defect.
- Building — The drive is a target of an ongoing Rebuild operation.
- Verify — Checking the data integrity of redundant data stored on fault-tolerant arrays.

Missing drive information indicates that a member is missing and the array is not optimal


## Exiting the SCSI Select Utility


1. Press <Esc> until a message prompts you to exit (if you changed any settings, you are prompted to save the changes before you exit).
  2. At the prompt, select **Yes** to exit. If prompted, press any key to restart the computer. Any changes you made in SCSISelect take effect after the computer restarts.
- 

## Creating Arrays

Before creating the array, make sure that the disks for the array are connected and installed in your computer, and then follow these steps:

1. Turn on the computer and press <Ctrl><a> when you are prompted to access SCSISelect.
2. Select **Configure/View HostRAID Settings**.
3. From the **Main** menu, select **C** to create a RAID array.

 **NOTE:** You must have at least two hard drives to create an array.

 **NOTE:** If the hard drive you select is already part of an array configuration, it will not be available for selection.

4. Select the RAID type you want to build. As you highlight the selections, you receive an allowance message regarding minimum and maximum drives. Press <Enter>.

The allowance messages for the different RAID types are as follows:

- RAID-0

Min 2 drives

- RAID-1

Min 2 drives, max 2 drives

5. From the **Select RAID Member** menu, press the spacebar to select the hard drives you want to use in the array. An **X** appears next to the drives you have selected.

## Creating RAID 0 Arrays

1. From the **Select RAID Type** window, select RAID-0 and press <Enter>.
2. Select the hard drives you want to use and press <Enter>.
3. Select **Yes** to quick build this array, and then press <Enter>.
4. Select **Enable Write Cache** if you want to enable cache on the drive and press <Enter>.
5. Select the stripe size and press <Enter>. You can select from 16K, 32K, or 64K (default). If a partition exists on any of the selected drives, you receive a message that the partition will be deleted.
6. Assign a RAID name by entering up to 15 alphabetic or numeric characters, and then press <Enter>. The following message appears:


Do you want to make this array bootable?

7. Select **Yes** if you want to make the array bootable.  
The following message appears: *Create Array?*
8. Select **Yes**.  
The following message appears: *Are you sure?*
9. Select **Yes** and press <Enter> to create a RAID 0 array.  
After your array is created, you automatically return to the **Main** menu.

## Creating RAID 1 Arrays

There are two ways to create a RAID 1 array. You can create a new RAID 1 array or you can migrate from an existing single drive to a RAID 1 array. To create a RAID 1 array using either option:

1. From the **Select RAID Type** window, select **RAID-1**.
2. Select the hard drives you want using the spacebar to toggle, and then press <Enter>.
3. Select **Yes** to quick build this array, and then press <Enter>.
4. Select **Disable Write Cache** from the write cache options window and press <Enter>.
5. The **RAID-1 Build Option** window appears if you selected **No** for the quick build option. Select an option and press <Enter>.
  - Create new RAID-1 — The default option.
  - Copy from (ID#) to (ID#) — Copy from a source drive to a target drive if the source is equal to or smaller than the target.
  - Copy from (ID#) to (ID#) — Copy from a source drive to a target drive if the source is equal to or smaller than the target.

 **NOTE:** If a valid partition table or boot block is detected in the target drive, you receive a warning that that the information will be destroyed.

6. After entering your options, if a partition exists on any of the selected drives, you get a message that the partition will be deleted. Assign a RAID name by entering up to 15 alphabetic or numeric characters, and then press <Enter>. The following message appears: *Do you want to make this array bootable?*
7. Select **Yes** if you want to make the array bootable.  
The following message appears: *Create Array?*
8. Select **Yes**.  
The following message appears: *Are you sure?*
9. Select **Yes** and press <Enter> to create a RAID 1 array.  
If you select **No**, the RAID creation terminates and you return to the **Main** menu.

After your array is created, the progress bar appears showing the percentage completed in the creation process. If for any reason you want to stop the build process and return to the **Main** menu, press <Esc>. You may continue the build process by selecting the **Rebuild** function later.


 **NOTE:** You might not be able to use the array if the build has not been entirely completed.

To add a spare to an existing RAID 1 array, see "[Adding a Spare Drive](#)."

## Creating a Configured Single Disk



1. From the **Select RAID Type** window, select **Configured Single** and press <Enter>.
2. Select the hard drives you want to use and press <Enter>.

 **NOTE:** If a valid partition table or boot block is detected in the target drive, you get a warning message that the dynamic partition disk(s) will be converted to the basic partition disk(s).

---

## Deleting Arrays

1. From the **Main** menu, select the array you need to delete by moving the cursor, and then press <Enter>.
  2. Select **D**.  
The following message appears: `Delete Array?`
  3. For RAID 0, go to step 4. For RAID 1, select one of these options, then continue to step 4:
    - Drive ID 1 — Deletes all data on the drive 1
    - Drive ID 2 — Deletes all data on the drive 2
    - Drive ID 1 & 2 — Deletes all data on both drives
    - None — Breaks the array but keeps any existing data on both drives
  4. Select **Yes** and press <Enter>.  
The following message appears: `Are you sure?`
  5. Select **Yes** and press <Enter>.  
If you select **No**, you return to the **Main** menu.
- 

## Adding a Spare Drive

With RAID 1 you have the option to create a maximum of 2 spare drives. You can create a spare before you define your RAID or you can add a spare later to an existing RAID 1 array.

1. From the **Main** menu, select **S** to add a spare.  
The following options appear:
  - Add Spare
  - Delete Spare (only available if a spare already exists)
2. Select a drive and press <Enter>.
3. Select **Yes** when the following message appears:


`Are you Sure?`

`Yes/No`


After you select your spare drive, it appears as a spare in the **Main** menu.

---

## Rebuilding Arrays

 **NOTE:** Rebuilding applies to Fault Tolerant arrays (RAID 1) only.

If an array Build process (or initialization) is interrupted or critical with one member missing, you must perform a Rebuild to get the array to **Optimal** status. For a critical array Rebuild operation, the optimal drive is the source drive.


-  **NOTE:** If no spare exists and a hard disk drive fails, you need to create a spare before you can rebuild an array. See "Adding a Spare Drive" before continuing your Rebuild.

To rebuild an array for RAID 1:

1. From the **Main** menu, select an array for Rebuild and press <Enter>.
2. Select **R** for Rebuild.  
If your array rebuilds successfully, the following message appears: Build/Rebuild Completed.
3. Press any key to return to the **Main** menu.

-  **NOTE:** During the Rebuild process, you can stop the Rebuild by pressing <Esc>. You get a pop-up window displaying **Stop Build?** If you select **Yes**, you return to the **Main** menu.

## Verifying Data Integrity


-  **NOTE:** To verify data integrity, your RAID 1 must be at **Optimal** status.

1. From the **Main** menu, select array, press <Enter>, and then select **V**.
2. Select **Yes** and press <Enter>.  
If you select **No**, you return to the **Main** menu.

-  **NOTE:** During the Verify process, you can stop the Verify by pressing <Esc>. You get a pop-up window displaying **Stop Verify?** If you select **Yes**, you return to the **Main** menu.

3. If a message asking if you want to automatically fix errors appears, select **Yes to AutoFix**. This executes a comparison of mirrored drives, a copy from the primary drive to secondary drive when a miscompare occurs, and a report at the end of the verification process.

If you select **No**, this executes a comparison of mirrored drives, a log of errors, and a report at the end of the verification process.

-  **NOTE:** To fix errors found (if any), run **Verify** again with **Autofix=Yes**.

After you select your verification option, the following message appears: Depending on your disk capacity, verifying may take several minutes to several hours. Are you sure?


4. When your Verify is completed, you get a verification message and log. Press <Esc> to exit.

If your Verify is unsuccessful, you get the following message: WARNING: Failed !!!

5. Press <Enter> and return to the **Main** menu.

## Bootable Array

1. From the **Main** menu, select an array, press <Enter>, and then select **B** for the **Bootable** function.
2. Select **Mark Bootable** and press <Enter>.

-  **NOTE:** **Mark Bootable** gives boot priority to the array regardless of the SCSI ID priority.

## Write Cache

1. From the **Main** menu, select **Array**, press <Enter>, and then select **W** for the write cache setting change.
2. Select **Write Cache Setting** from the write cache options window and press <Enter>.
3. For the non-RAID array drives, select **W** from the **Main** menu.
4. Choose the drive and press <Enter>.

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# Removing and Replacing Parts

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## Before You Begin

This chapter provides procedures for removing and installing the components in your computer. Unless otherwise noted, each procedure assumes that the following conditions exist:


- You have performed the steps in "[Turning Off Your Computer](#)" and "[Before Working Inside Your Computer](#)."
- You have read the safety information in your Dell™ *Product Information Guide*.
- A component can be replaced by performing the removal procedure in reverse order.

## Recommended Tools

The procedures in this document may require the following tools:

- Small flat-blade screwdriver
- Phillips screwdriver
- Flash BIOS update program floppy disk or CD

## Turning Off Your Computer

 **NOTICE:** To avoid losing data, save and close any open files and exit any open programs before you turn off your computer.









1. Shut down the operating system:
  - a. Save and close any open files, exit any open programs, click the **Start** button, and then click **Turn Off Computer**.
  - b. In the **Turn off computer** window, click **Turn off**.

The computer turns off after the operating system shutdown process finishes.

2. Ensure that the computer and any attached devices are turned off. If your computer and attached devices did not automatically turn off when you shut down your operating system, turn them off now.



## Before Working Inside Your Computer

Use the following safety guidelines to help protect your computer from potential damage and to help ensure your own personal safety.

-  **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.
-  **CAUTION:** Handle components and cards with care. Do not touch the components or contacts on a card. Hold a card by its edges or by its metal mounting bracket. Hold a component such as a processor by its edges, not by its pins.
-  **NOTICE:** Only a certified service technician should perform repairs on your computer. Damage due to servicing that is not authorized by Dell is not covered by your warranty.
-  **NOTICE:** When you disconnect a cable, pull on its connector or on its strain-relief loop, not on the cable itself. Some cables have a connector with locking tabs; if you are disconnecting this type of cable, press in on the locking tabs before you disconnect the cable. As you pull connectors apart, keep them evenly aligned to avoid bending any connector pins. Also, before you connect a cable, ensure that both connectors are correctly oriented and aligned.
-  **NOTICE:** To avoid damaging the computer, perform the following steps before you begin working inside the computer.
  1. [Turn off your computer.](#)
-  **NOTICE:** To disconnect a network cable, first unplug the cable from your computer and then unplug it from the network wall jack.
  2. Disconnect any telephone or telecommunication lines from the computer.
  3. Disconnect your computer and all attached devices from their electrical outlets, and then press the power button to ground the system board.
-  **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.
  4. [Open the computer cover.](#)
-  **NOTICE:** Before touching anything inside your computer, ground yourself by touching an unpainted metal surface, such as the metal at the back of the computer. While you work, periodically touch an unpainted metal surface to dissipate any static electricity that could harm internal components.

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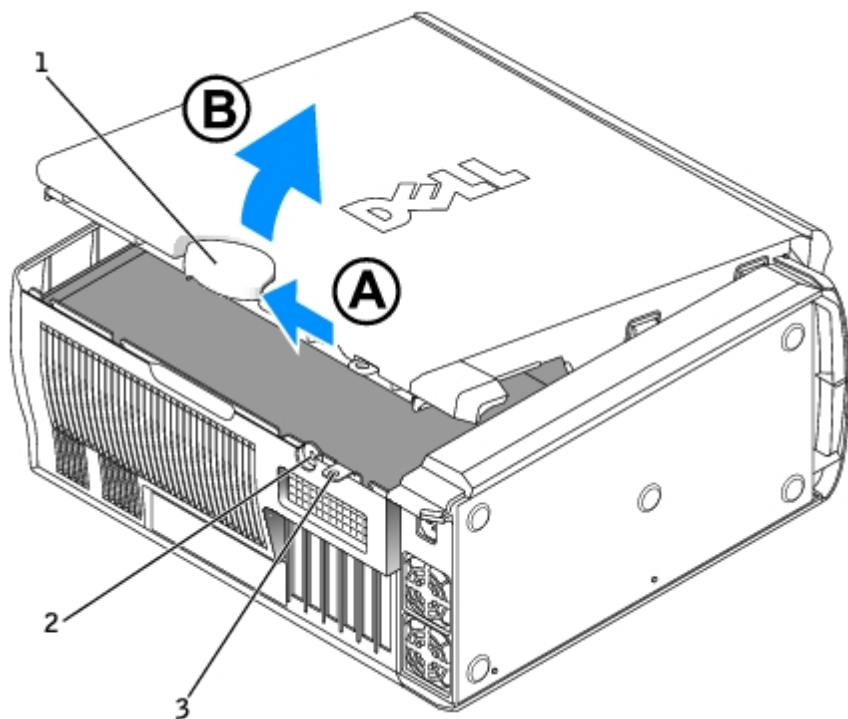
## Opening the Computer Cover

-  **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.
-  **CAUTION:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer chassis.
  1. Follow the procedures in "[Removing and Replacing Parts.](#)"
  2. Lay the computer on its side as shown in the illustration.

**NOTICE:** Ensure that sufficient space exists to accommodate the open cover—at least 30 cm (1 ft) of desk top space.

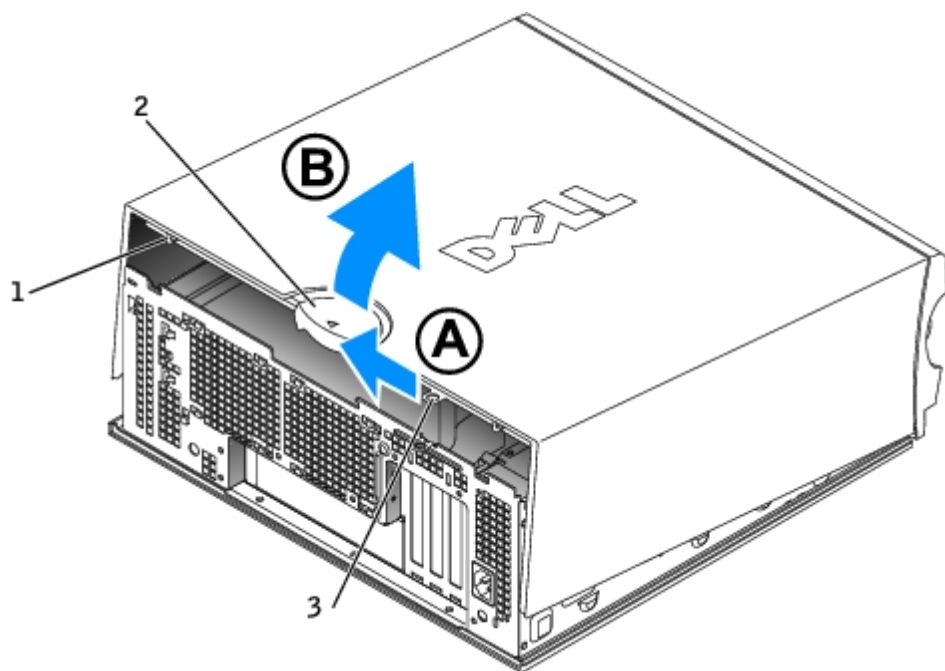
3. Slide the cover release latch toward the top of the computer.
4. Raise the cover, and pivot it toward the front of the computer.

### Dell Precision 670 Workstation



1	cover release latch
2	security cable slot
3	padlock ring

### Dell Precision 470 Workstation



1	security cable slot
2	cover release latch
3	padlock ring

## Memory

For information on the type of memory supported by your computer, see "[Specifications](#)."

- ➡ **NOTICE:** Before you install new memory modules, download the most recent BIOS for your computer from the Dell™ Support website at [support.dell.com](http://support.dell.com).

## Memory Overview

- 📌 **NOTE:** Your computer supports ECC and registered memory.

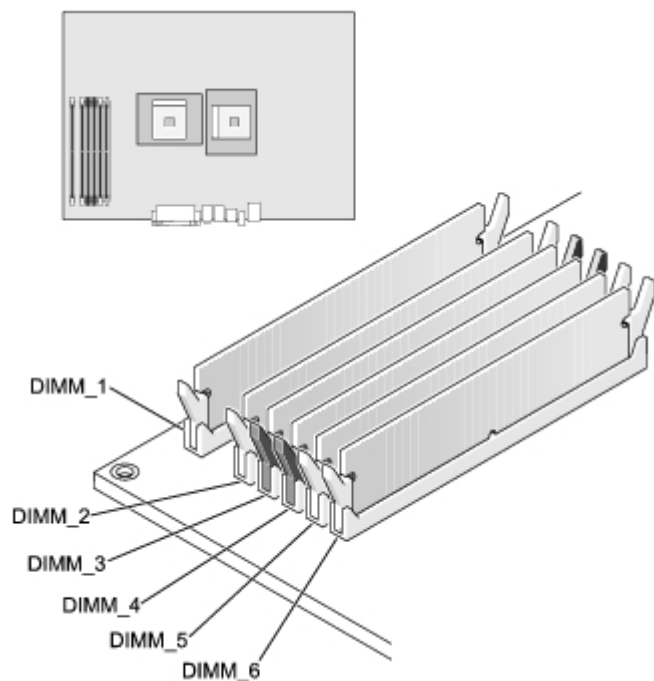
- Memory modules should be installed in *pairs of matched size, speed, and rank (1R is single rank and 2R is dual rank)*. See the label on the memory module to determine its size, speed rank, and organization. Be sure that your memory module labels match.

Example: 256MB 1Rx8 PC2-5400R-544-10:

- Size = 256 MB
- Speed = 5400
- Rank = 1R
- Organization = x8



- Memory modules can be single rank (1R) or dual rank (2R) and should be installed in the following order:
  - The highest rank memory module in DIMM\_1 and DIMM\_2
  - Equal or lower rank memory modules in DIMM\_3 and DIMM\_4
  - Single rank (1R) memory modules in DIMM\_5 and DIMM\_6
- If only two memory modules are installed, they must be installed in DIMM\_1 and DIMM\_2. These connectors are located on the outside edge of the board (for your Dell Precision 670, see "[System Board Components](#)" and for your Dell Precision 470 computer, see "[System Board Components](#).")
- Memory modules should be installed in the following order: connectors DIMM\_1 and DIMM\_2, DIMM\_3 and DIMM\_4, and then DIMM\_5 and DIMM\_6.
- If dual-rank modules are installed in DIMM\_3 and DIMM\_4, then DIMM\_5 and DIMM\_6 cannot be used.
- Dual-rank memory modules are not supported in DIMM\_5 and DIMM\_6.



**NOTE:** Memory purchased from Dell is covered under your computer warranty.

**NOTICE:** If you remove your original memory modules from the computer during a memory upgrade, keep them separate from any new modules that you may have, even if you purchased the new modules from Dell. If possible, *do not* pair an original memory module with a new memory module. Otherwise, your computer may not start properly. You should install your original memory modules in pairs in connectors DIMM\_1 and DIMM\_2, connectors DIMM\_3 and DIMM\_4, and then DIMM\_5 and DIMM\_6 (see "[Memory Overview](#)").

**NOTICE:** If you install more than 4 GB of memory, you must also install a fan to cool the computer. If you do not install a fan, you will get an error message stating that you must install a fan or remove some memory.



## Installing Memory

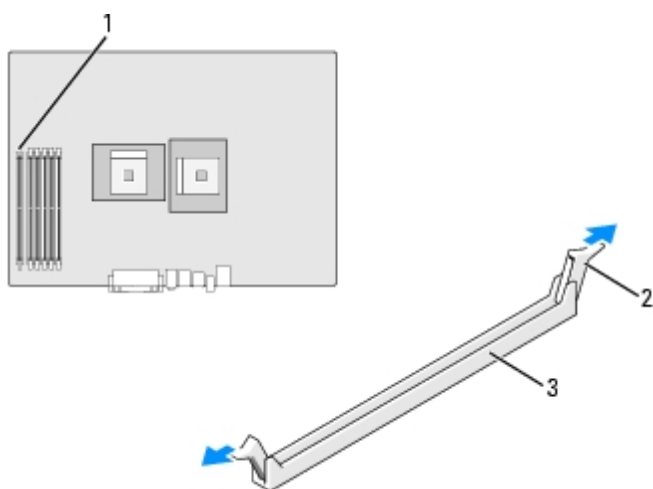
**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

**NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer chassis.

**NOTE:** If you have incorrectly installed memory, when you start your computer you will receive an error message. Press <F2> to enter system setup and help identify the error. See "[Memory Overview](#)" for information on installation guidelines.

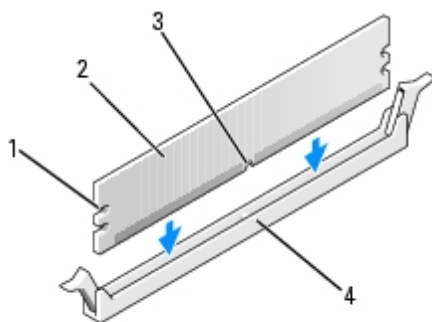
1. Follow the procedures in "[Removing and Replacing Parts](#)."
2. Press out the securing clip at each end of the memory module connector.

**NOTE:** Memory modules should be installed in the following order: connectors DIMM\_1 and DIMM\_2, DIMM\_3 and DIMM\_4, and then DIMM\_5 and DIMM\_6. See "[Memory Overview](#)" for information on installation guidelines.



1	DIMM_1 connector
2	securing clips (2)
3	connector

3. Align the notch on the bottom of the module with the crossbar in the connector.



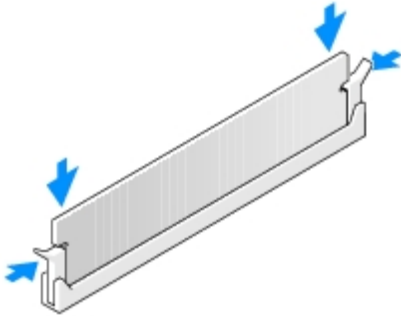
1	cutouts (2)
2	memory module
3	notch

4	crossbar
---	----------

➡ **NOTICE:** To avoid damage to the memory module, press the module straight down into the connector while you apply equal force to each end of the module.

4. Insert the module into the connector until the module snaps into position.

If you insert the module correctly, the securing clips snap into the cutouts at each end of the module.



5. [Close the computer cover.](#)

➡ **NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

6. Connect your computer and devices to electrical outlets, and turn them on.
7. Press <F2> to enter system setup and check the value for **System Memory**.

The value of **System Memory** should reflect the newly installed memory. Verify the new total. If it is correct, skip to [step 10](#).

8. If the memory total is incorrect, turn off and disconnect your computer and devices from their electrical outlets.
9. [Open the computer cover](#) and check the installed memory modules to ensure that they are seated properly in their sockets. Then repeat [step 5](#) through [step 7](#).
10. When the **System Memory** total is correct, press <Esc> to exit system setup.
11. Run the [Dell Diagnostics](#) to verify that the memory modules are operating properly.

## Removing Memory

⚠ **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

➡ **NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer chassis.

1. Follow the procedures in "[Removing and Replacing Parts](#)."
2. Press out the securing clip at each end of the memory module connector.
3. Grasp the module and pull up.

If the module is difficult to remove, gently ease the module back and forth to remove it from the connector.

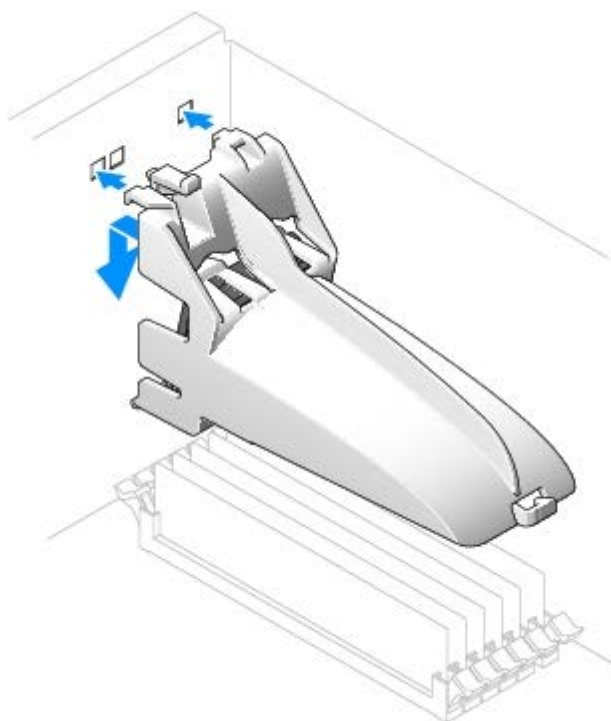
## Memory Fan and Shroud

**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

**NOTICE:** If you install more than 4 GB of memory, you must also install a fan to cool the computer. If you do not install a fan, you will get an error message stating that you must install a fan or remove some memory.

### Installing the Memory Fan and Shroud

1. Follow the procedures in "[Removing and Replacing Parts](#)."
2. Align the tabs on the back of the shroud with the back of computer.
3. Insert the tabs and lower the shroud in place over the memory modules.
4. Connect the fan cable to the memory fan connector labeled "FAN\_MEM" on the system board (for your Dell Precision 670, see "[System Board Components](#)" and for your Dell Precision 470 computer, see "[System Board Components](#)").



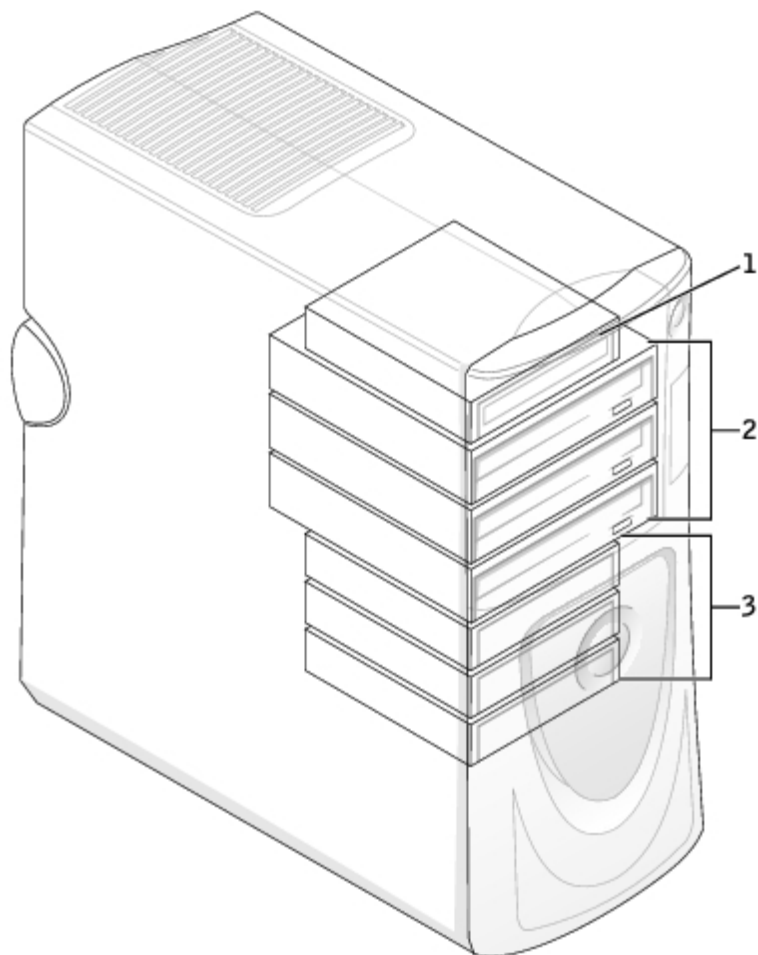
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## Drives for the Dell Precision 670 Computer

### Overview

Your computer supports:

- Three hard drives (Serial ATA and SCSI)
- One floppy drive (optional)
- Three CD or DVD drives (One bay may be used for an additional hard drive using an add-in bay bracket.)



1	floppy drive (optional)
2	CD/DVD drive(s)
3	hard drive(s)

## Connecting Cables

When you connect two IDE devices to a single IDE interface cable and configure them for the cable select setting, the device attached to the last connector on the interface cable is the primary or boot device (drive 0), and the device attached to the middle connector on the interface cable is the secondary device (drive 1). See the drive documentation in your upgrade kit for information on configuring devices for the cable select setting.

Since cable select is the default setting, any additional drives that are installed do not need to be set as a primary or secondary drive.

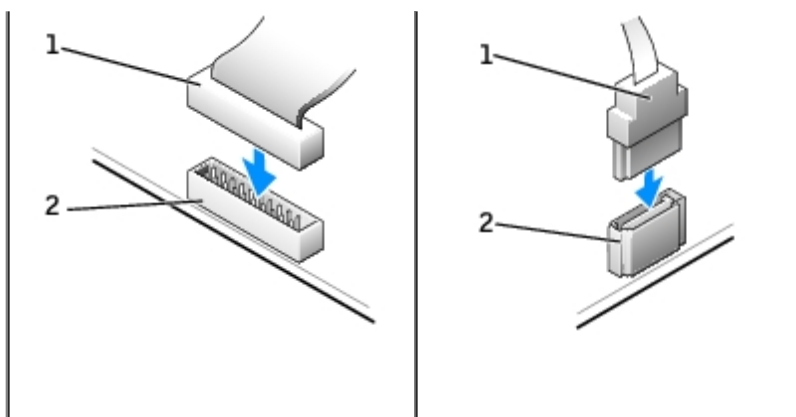
Hard drives should be connected to the connector labeled SATA\_0 and SATA\_1.

IDE CD/DVD drives should be connected to the connector labeled IDE1 and IDE2.

When you install a drive, you connect two cables—a DC power cable and a data cable—to the back of the drive and to the system board. Some drives may also have an audio connector; one end of the audio cable attaches to the drive connector and the other attaches to the system board.

## Drive Connectors

IDE Drive Connector	Serial ATA Connector




1	interface cable
2	interface connector

When connecting and disconnecting a serial ATA cable, hold the cable by the connector at each end.

## SCSI Device Installation Guidelines

This section describes how to configure and install SCSI devices in your computer. To install a SCSI device, you can use one or both of the following SCSI controllers:

- The SCSI connector on the system board. To locate the SCSI system board connector, see the system board illustration (for the Dell Precision 670 computer, see "[System Board Components](#)") or the interior service label.

 **NOTE:** The system board SCSI controller supports hard drives only. Do not connect CD or DVD drives, tape drives, or DAT drives.

- A SCSI controller card installed in your computer.

## SCSI ID Numbers

Internal SCSI devices must have a unique SCSI ID number from 0 to 15. If you are using the SCSI connector on the system board and a SCSI controller card installed in your computer, you have two separate SCSI buses operating. Each SCSI bus has a set of SCSI ID numbers from 0 to 15.

When SCSI devices are shipped from the factory, the default SCSI ID numbers are assigned as shown in the following table.


System Board Controller		Controller Card	
Device	ID	Device	ID
Controller	7	Controller	7
Boot hard drive	0	Boot hard drive	0
		CD or DVD drive	5
		tape or DAT drive	6

**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. If two or more devices use the same ID, your computer may hang during POST and in SCSI BIOS.

SCSI devices installed by Dell are configured correctly during the manufacturing process. You do not need to set the SCSI ID for these SCSI devices.

If you attach additional optional SCSI devices, see the documentation for each device for information about setting the

appropriate SCSI ID number.

-  **NOTICE:** Dell recommends that you use only SCSI cables purchased from Dell. Cables purchased elsewhere are not guaranteed to work with Dell computers.

## Device Termination

SCSI logic requires that termination be enabled for the two devices at opposite ends of the SCSI chain and disabled for all devices in between.

It is recommended that you use terminated cables and that you disable termination on all devices. See the documentation provided with any optional SCSI device you purchase for information on disabling termination on the device.

## General Guidelines


Follow these general guidelines when installing SCSI devices in your computer:

- Although you install SCSI devices essentially the same way as other devices, their configuration requirements are different. For details on configuring your particular SCSI subsystem, see the documentation for your SCSI devices and/or your host adapter card.
- Configure the device for a SCSI ID number and disable termination, if necessary.
- To use an external SCSI device, you must have a SCSI controller card installed in your computer. Connect one end of the external SCSI cable to the connector on the back of the SCSI device. Attach the other end of the external SCSI cable to the connector on the controller card installed in the computer.
- After you install a SCSI hard drive, **Primary Drive 0** and **Primary Drive 1** should be set to **None** in [system setup](#) if no IDE hard drives are installed. If you have any IDE devices on the second IDE channel, such as a CD or tape drive, **Secondary Drive 0** and/or **Secondary Drive 1** should be set to **Auto**.
- To partition and format SCSI hard drives, you may need to use programs other than those provided with the operating system. See the documentation that came with your SCSI software drivers for information on installing the appropriate drivers and preparing your SCSI hard drive for use.


## SCSI Cables


Ultra 320, Ultra 160/m, and Ultra2/Wide LVD drives (typically hard drives) both use a 68-pin cable. One end of the cable attaches to the SCSI connector on the system board or the SCSI controller card installed in your computer. The remaining connectors on the cable attach to the various drives.

Narrow SCSI drives (tape drives, CD drives, and some hard drives) use a 50-pin cable. One end of this cable attaches to the SCSI controller card. The remaining connectors on the cable attach to the various Narrow SCSI devices.

-  **NOTICE:** Dell recommends that you use only SCSI cables purchased from Dell. Cables purchased elsewhere are not guaranteed to work with Dell computers.

## Hard Drive

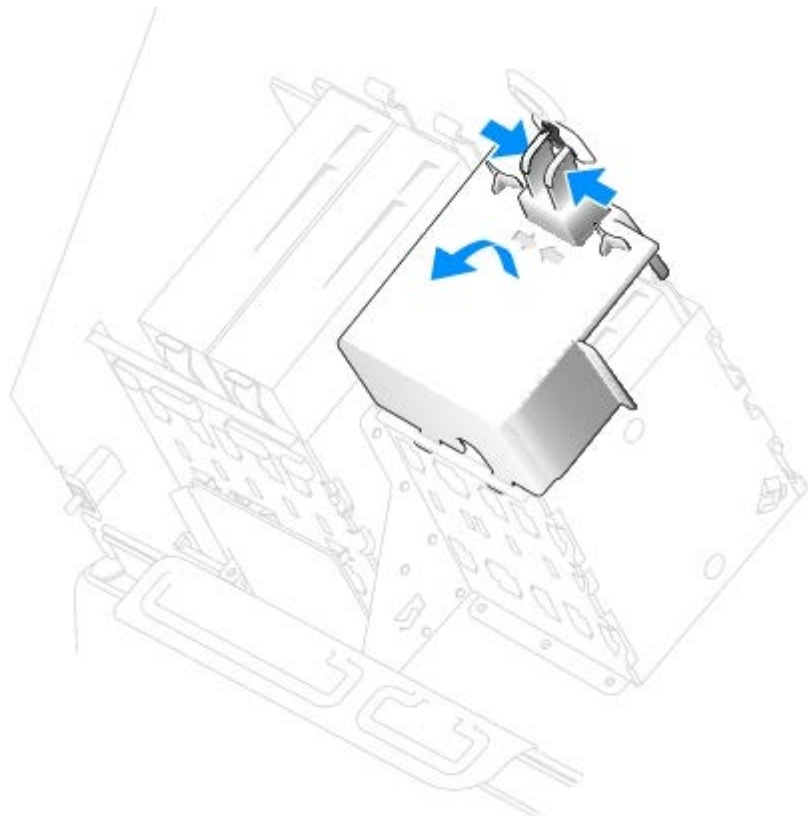
-  **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

-  **NOTICE:** To avoid damage to the drive, do not set it on a hard surface. Instead, set the drive on a surface, such as a foam pad, that will sufficiently cushion it.

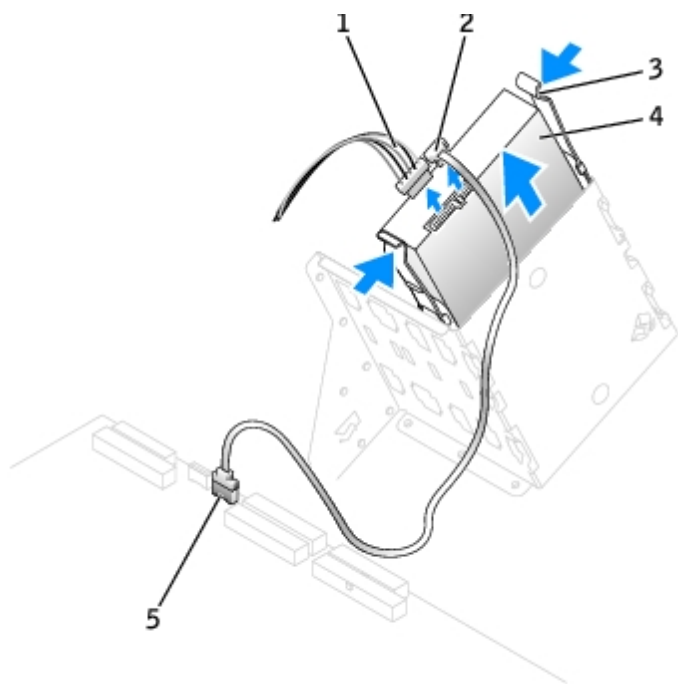
1. If you are replacing a hard drive that contains data you want to keep, back up your files before you begin this procedure.
2. Follow the procedures in "[Removing and Replacing Parts](#)."

## Removing a Hard Drive

1. Press in on the top shroud tabs and tilt the shroud back.
2. Lift the shroud away from the hard drive.




3. Disconnect the power and hard-drive cables from the drive.
4. Press in on the tabs on each side of the drive and slide the drive up and out.

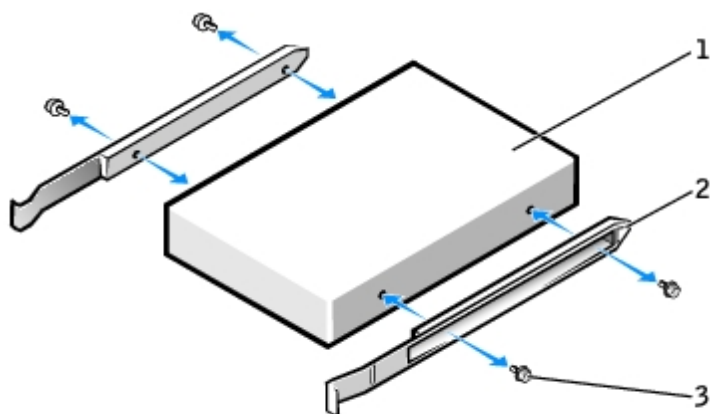


1	power cable
2	hard-drive cable
3	tabs (2)
4	hard drive
5	system board connector

## Installing a Hard Drive

 **NOTE:** SATA2\_0 is the bootable connector.

1. Unpack the replacement hard drive, and prepare it for installation.
2. Check the documentation for the drive to verify that it is configured for your computer.
3. If your replacement hard drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket rails to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).

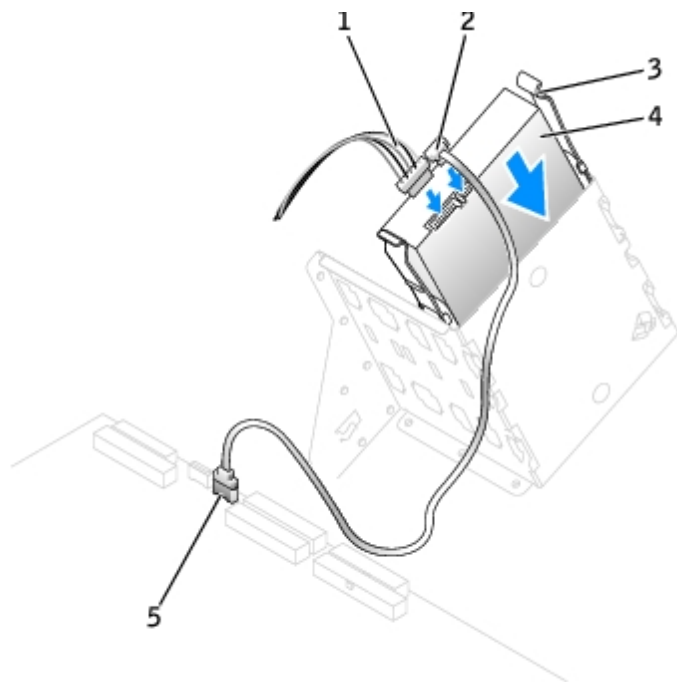




1	drive
2	bracket rails (2)
3	screws (4)

4. Gently slide the drive into place until the tabs securely click into position.

**NOTE:** If you are installing a hard drive in the lower bay, place the drive in the bay so that the power connector is on the left-hand side (opposite of the top hard drive).



1	power cable
2	hard-drive cable
3	tabs (2)
4	hard drive
5	system board connector

5. If you are installing a drive that has its own controller card, install the controller card in an expansion slot.

See the documentation that accompanied the drive and controller card to verify that the configuration is correct for your computer.

**NOTE:** Match the colored strip on the cable with pin 1 on the drive (pin 1 is marked as "1").

6. Connect the power and hard-drive cables to the drive.

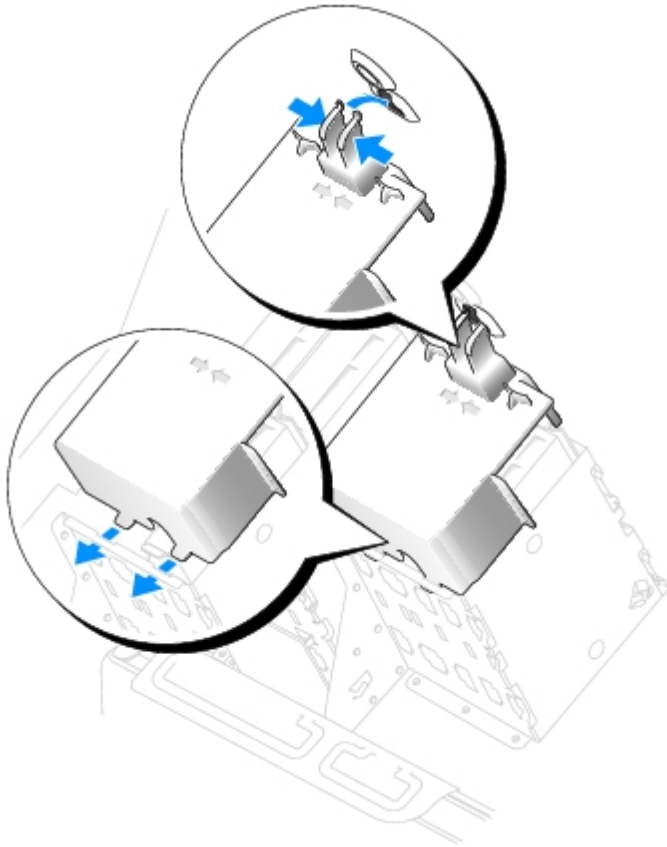
7. Ensure that all connectors are properly cabled and firmly seated.

**NOTE:** When replacing the hard-drive shroud, ensure that all the cables are properly routed.

8. Insert the bottom tabs of the shroud into the holes on the drive cage and rotate the shroud up.

9. Press in on the top tabs and lock them into place.

10. Gently press on the shroud to ensure that it is secure.



11. [Close the computer cover.](#)

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

12. Connect your computer and devices to electrical outlets, and turn them on.

See the documentation that came with the drive for instructions on installing any software required for drive operation.

13. If the drive you just installed is the primary drive, insert a bootable medium into your boot drive.
14. Turn on the computer.
15. [Enter system setup](#), and update the your drive configuration.
16. After you have updated the system settings, exit system setup, and restart the computer.
17. Partition and logically format your drive before you proceed to the next step.

See the documentation for your operating system for instructions.

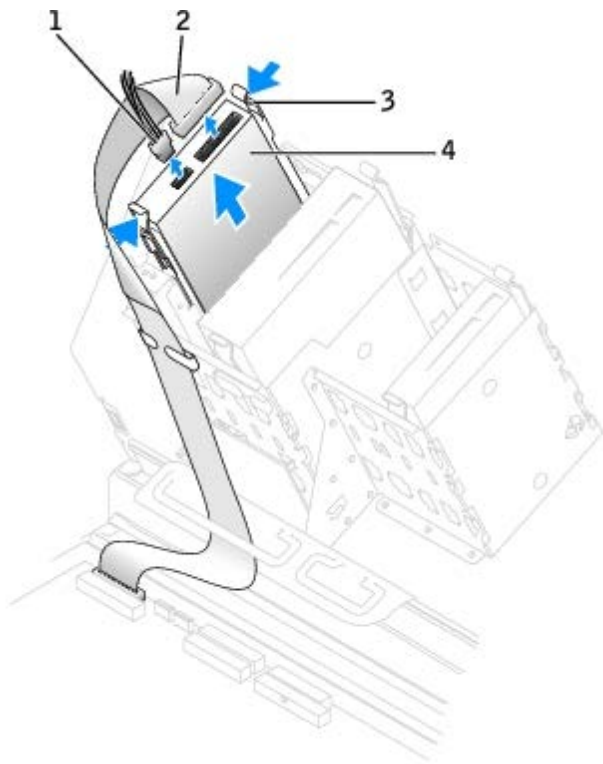
18. Test the hard drive by running the [Dell Diagnostics](#).
19. If the drive you just installed is the primary drive, install your operating system on the hard drive.

## Floppy Drive (Optional)

**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

## Removing a Floppy Drive

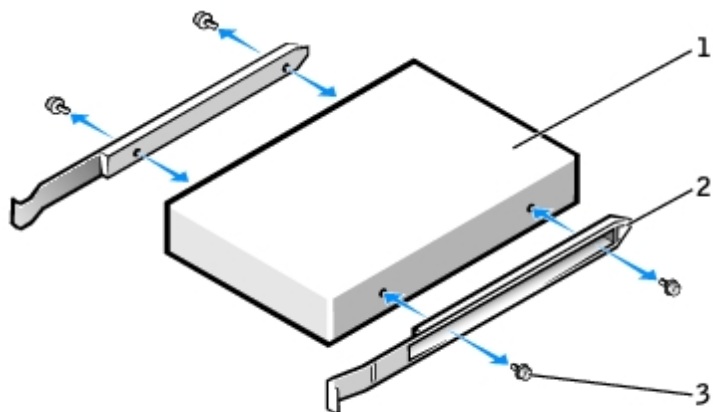
1. Follow the procedure in "[Removing and Replacing Parts](#)."
2. Disconnect the power and floppy-drive cables from the back of the floppy drive.
3. Press inward on the two tabs on the sides of the drive, slide the drive upward, and remove it from the floppy-drive bay.



1	power cable
2	floppy-drive cable
3	tabs (2)
4	floppy drive

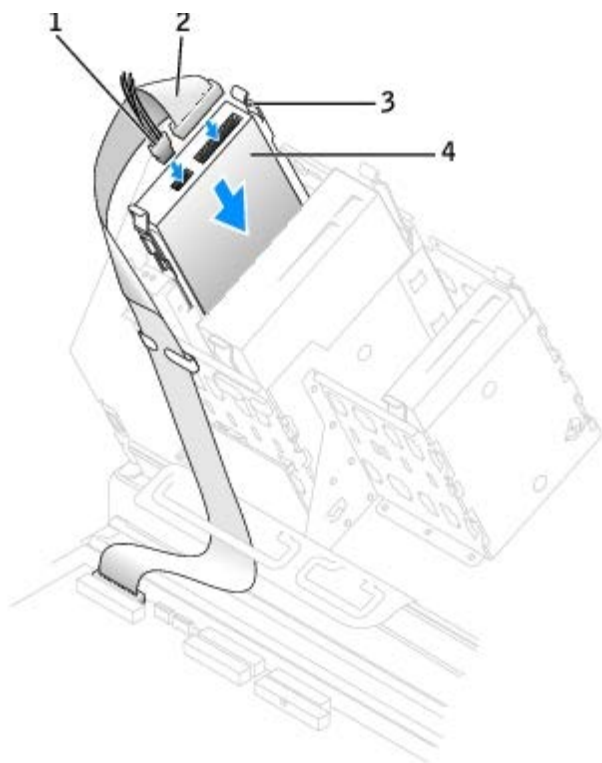
## Installing a Floppy Drive

1. If you are replacing a drive and the new drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).



1	drive
2	bracket rails (2)
3	screws (4)

2. Gently slide the drive into place until the tabs securely click into position.




1	power cable
2	floppy-drive cable
3	tabs (2)
4	floppy drive

3. Attach the power and floppy-drive cables to the floppy drive.

4. If you are installing a new floppy drive rather than replacing a drive, remove the front-panel inserts.

From inside the drive bay, gently press on each side of the insert until it pops out.

5. Check all cable connections, and fold cables out of the way to provide airflow for the fan and cooling vents.
6. [Close the computer cover](#).


 **NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

7. Connect your computer and devices to electrical outlets, and turn them on.

See the documentation that came with the drive for instructions on installing any software required for drive operation.

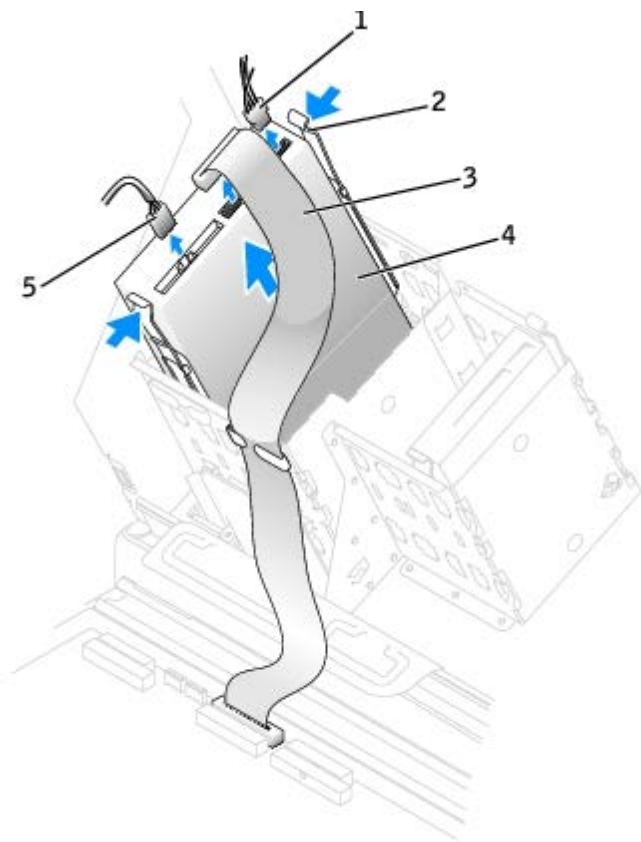
8. [Enter system setup](#) and update the appropriate **Diskette Drive A** option to reflect the size and capacity of your new floppy drive.
9. To verify that your computer works correctly, run the [Dell Diagnostics](#).

## CD/DVD Drive

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

### Removing a CD/DVD Drive

1. Follow the procedures in "[Removing and Replacing Parts](#)."
2. Disconnect the power and CD/DVD drive cables from the drive.
3. Press inward on the two tabs on the sides of the drive, and then slide the drive upward and remove it from the drive bay.



1	power cable
2	tabs (2)
3	CD/DVD drive cable
4	CD/DVD drive
5	audio cable (some drives do not have this cable)

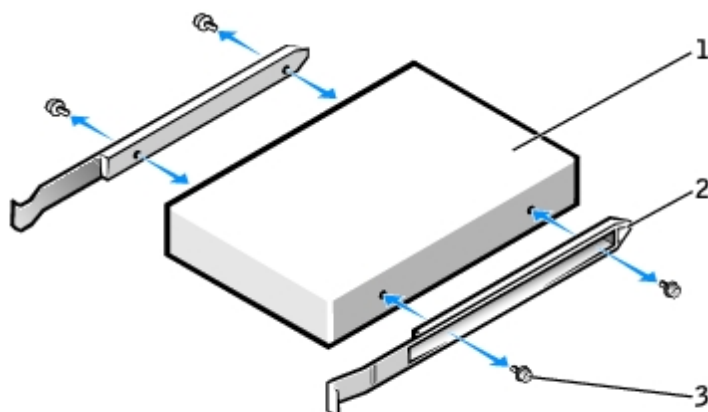
## Installing a CD/DVD Drive

**NOTE:** A fourth hard drive can be added to the CD/DVD bay using an add-in bay bracket. Contact Dell to order a bracket.

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

Check the documentation that accompanied the drive to verify that the drive is configured for your computer. If you are installing an IDE drive, configure the drive for the cable select setting.

2. Connect the new drive to the set of rails that are attached to the inside of the cover. If a set of rails is not attached inside the computer cover, [contact Dell](#).
3. If you are installing a replacement drive and the new drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).



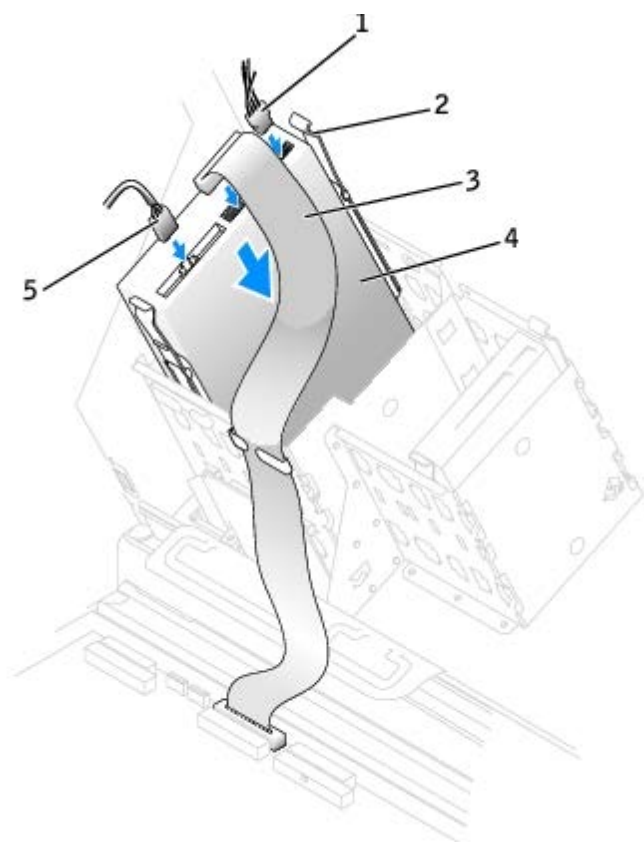
1	drive
2	bracket rails (2)
3	screws (4)

4. Gently slide the drive into place until the tabs securely click into position.
5. If you are installing a drive that has its own controller card, install the controller card in an expansion slot.

See the documentation that accompanied the drive and controller card to verify that the configuration is correct for your computer.

6. Connect the power and CD/DVD drive cables to the drive.

If you are adding a drive that has an audio cable, connect the audio cable to the audio connector on the system board.



1	power cable
2	tabs (2)
3	CD/DVD drive cable
4	CD/DVD drive
5	audio cable (some drives do not have this cable)

7. If you are installing a new CD/DVD drive rather than replacing a drive, remove the front-panel inserts.

From inside the drive bay, gently press on each side of the insert until it pops out.

8. Check all cable connections, and fold cables out of the way to provide airflow for the fan and cooling vents.
9. [Close the computer cover.](#)

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

10. Connect your computer and devices to electrical outlets, and turn them on.

See the documentation that came with the drive for instructions on installing any software required for drive operation.

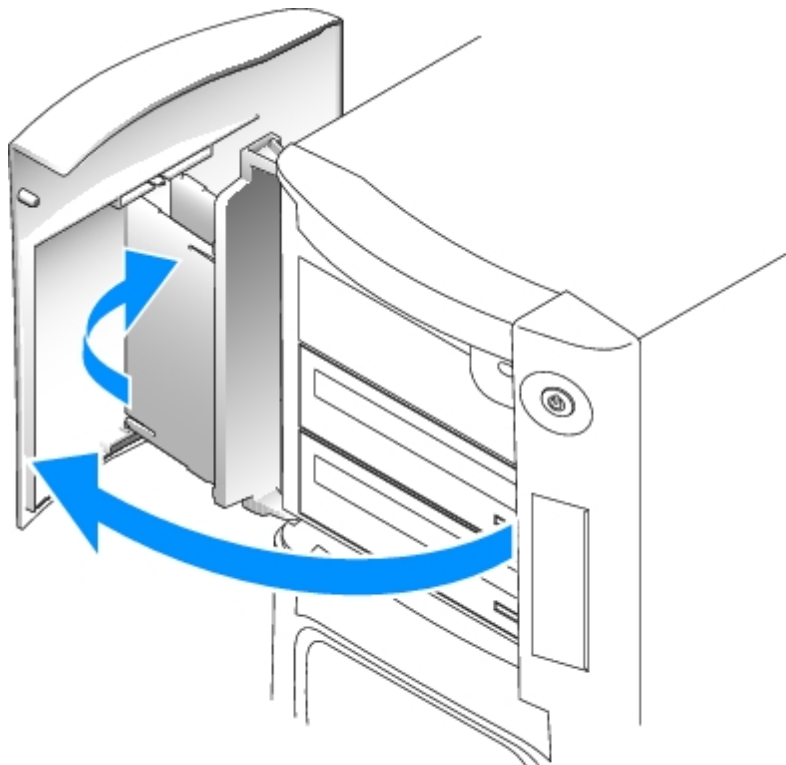
11. Update your configuration information by setting the appropriate **Drive** option (**0** or **1**) under **Drives: Secondary** to **Auto**. See "[Advanced Features](#)" for more information.
12. Verify that your computer works correctly by running the [Dell Diagnostics](#).

## Drive Door for the Dell Precision 670 Computer

**⚠ CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

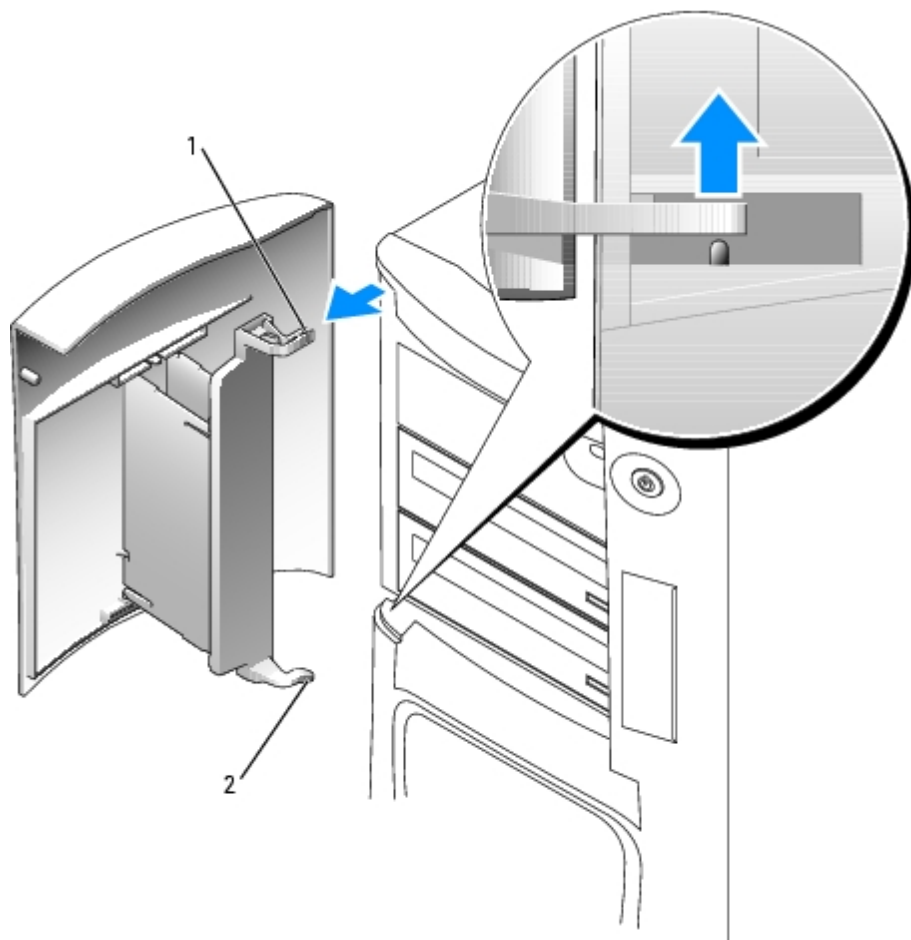
### Removing the Drive Door

1. Open the drive door.



2. Unsnap the top bracket hinge and pull the top of the drive door outward, away from the computer.





1	top bracket hinge
2	bottom bracket hinge

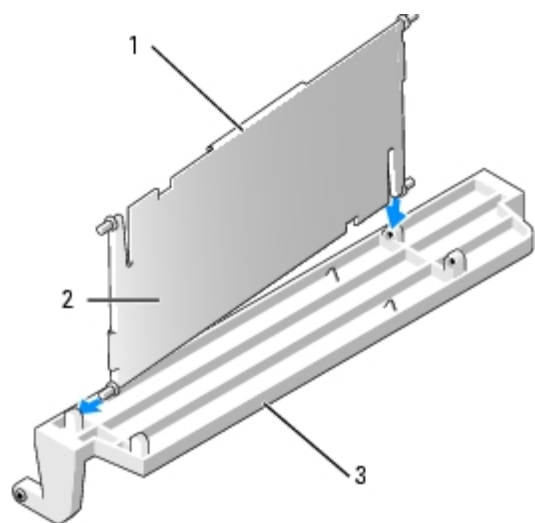
3. Lift the bottom bracket hinge away from the computer.

## Replacing the Drive Door

To prevent damage to your computer, the drive door is designed to "break away" from the computer if it is opened too far. If the drive door detaches from the computer without disassembling, perform the removal procedure in reverse.

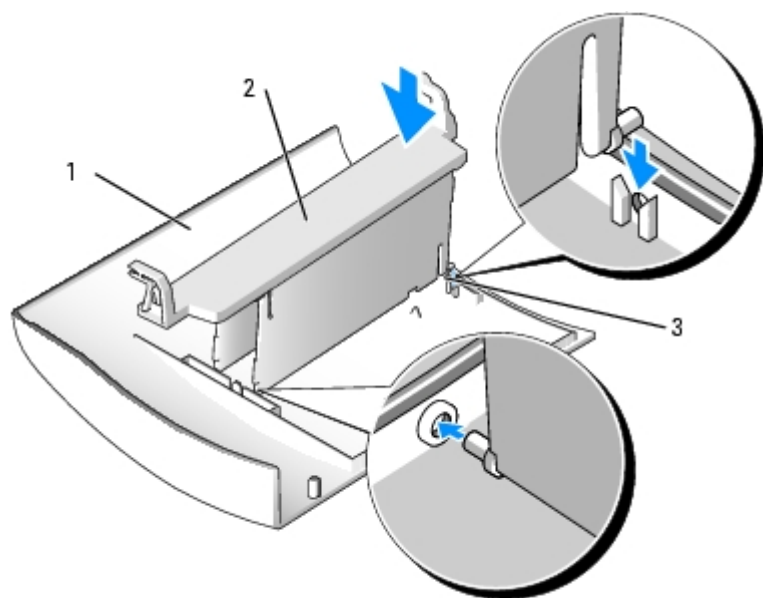
If the drive door is open and it is opened too far, instead of breaking away from the computer in one piece, the drive door may disassemble into several smaller pieces. If the drive door disassembles:

1. If necessary, reattach the door hinges to the door bracket. Ensure that the hinge tabs are away from the door bracket.



1	hinge tab
2	door hinge
3	door bracket

2. Attach the door bracket/door hinge assembly to the door, starting with the lower part of each door hinge.



1	door
2	door bracket/door hinge assembly
3	lower part of the door hinge

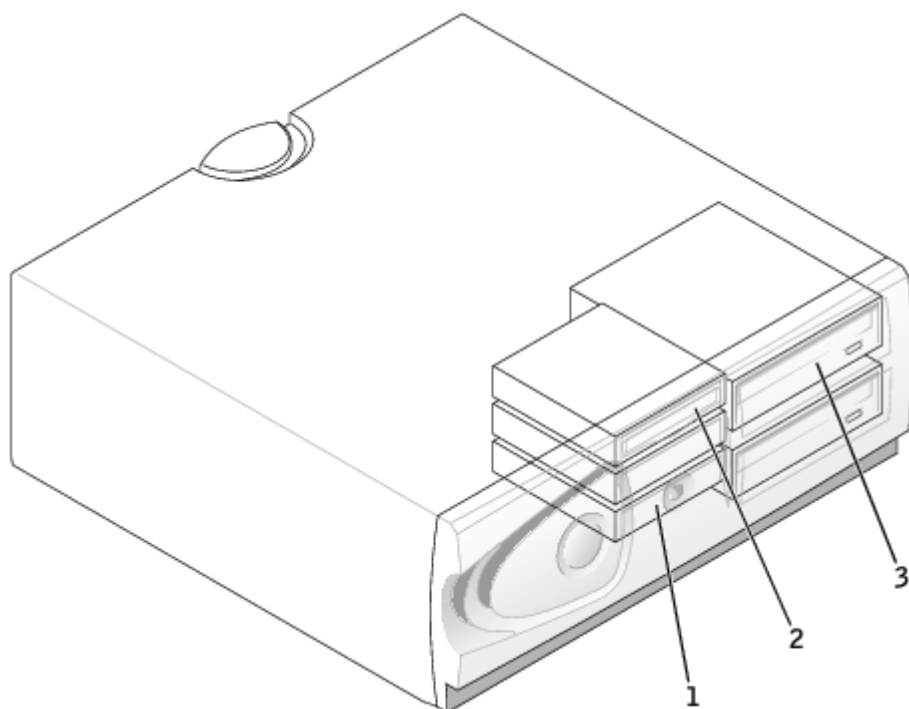
3. Attach the drive door to the computer, starting with the bottom bracket hinge.

## Drives for the Dell Precision 470 Computer

## Overview

Your computer supports:

- Two hard drives (Your computer supports SCSI with an add-in controller and Serial ATA.)
- One floppy drive (optional)
- Two CD or DVD drives



1	hard drive(s)
2	floppy drive (optional)
3	CD/DVD drive(s)

## Connecting Cables

When you connect two IDE devices to a single IDE interface cable and configure them for the cable select setting, the device attached to the last connector on the interface cable is the primary or boot device (drive 0), and the device attached to the middle connector on the interface cable is the secondary device (drive 1). See the drive documentation in your upgrade kit for information on configuring devices for the cable select setting.

Since cable select is the default setting, any additional drives that are installed do not need to be set as a primary or secondary drive.

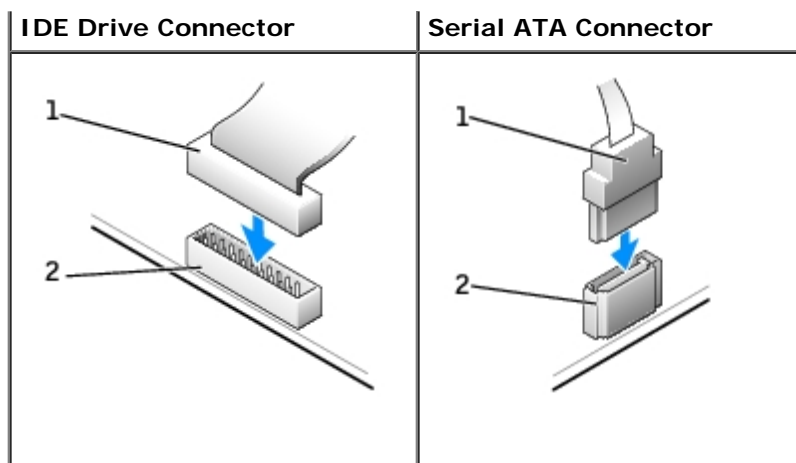
Hard drives should be connected to the connector labeled SATA\_0 and SATA\_1.

IDE CD/DVD drives should be connected to the connector labeled IDE1 and IDE2.

When you install a drive, you connect two cables—a DC power cable and a data cable—to the back of the drive and to the system board. Some drives may also have an audio connector; one end of the audio cable will attach to the drive connector and the other will attach to the system board.

## Drive Connectors





1	interface cable
2	interface connector

When connecting and disconnecting a serial ATA cable, hold the cable by the connector at each end.

## SCSI Device Installation Guidelines

This section describes how to configure and install SCSI devices in your computer.

**NOTE:** The system board SCSI controller supports hard drives only. Do not connect CD or DVD drives, tape drives, or DAT drives.

## SCSI ID Numbers

Internal SCSI devices must have a unique SCSI ID number from 0 to 15. If you are using the SCSI connector on the system board and a SCSI controller card installed in your computer, you have two separate SCSI buses operating. Each SCSI bus has a set of SCSI ID numbers from 0 to 15.

When SCSI devices are shipped from the factory, the default SCSI ID numbers are assigned as shown in the following table.

System Board Controller		Controller Card	
Device	ID	Device	ID
Controller	7	Controller	7
Boot hard drive	0	Boot hard drive	0
		CD or DVD drive	5
		tape or DAT drive	6

**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. If two or more devices use the same ID, your computer may hang during POST and in SCSI BIOS.

SCSI devices installed by Dell are configured correctly during the manufacturing process. You do not need to set the SCSI ID for these SCSI devices.

If you attach additional optional SCSI devices, see the documentation for each device for information about setting the appropriate SCSI ID number.

**NOTICE:** Dell recommends that you use only SCSI cables purchased from Dell. Cables purchased elsewhere are not guaranteed to work with Dell computers.

## Device Termination

SCSI logic requires that termination be enabled for the two devices at opposite ends of the SCSI chain and disabled for all devices in between.

It is recommended that you use terminated cables and that you disable termination on all devices. See the documentation provided with any optional SCSI device you purchased for information on disabling termination on the device.

## General Guidelines


Follow these general guidelines when installing SCSI devices in your computer:

- Although you install SCSI devices essentially the same way as other devices, their configuration requirements are different. For details on configuring your particular SCSI subsystem, see the documentation for your SCSI devices and/or your host adapter card.
- Configure the device for a SCSI ID number and disable termination, if necessary.
- To use an external SCSI device, you must have a SCSI controller card installed in your computer. Connect one end of the external SCSI cable to the connector on the back of the SCSI device. Attach the other end of the external SCSI cable to the connector on the controller card installed in the computer.
- After you install a SCSI hard drive, **Primary Drive 0** and **Primary Drive 1** should be set to **None** in [system setup](#) if no EIDE hard drives are installed. If you have any EIDE devices on the second EIDE channel, such as a CD or tape drive, **Secondary Drive 0** and/or **Secondary Drive 1** should be set to **Auto**.
- You may need to use programs other than those provided with the operating system to partition and format SCSI hard drives. See the documentation that came with your SCSI software drivers for information on installing the appropriate drivers and preparing your SCSI hard drive for use.


## SCSI Cables


Ultra 320 (optional on the Dell Precision 470 computer), Ultra 160/m and Ultra2/Wide LVD drives (typically hard drives) both use a 68-pin cable. One end of the cable attaches to the SCSI connector on the system board or the SCSI controller card installed in your computer. The remaining connectors on the cable attach to the various drives.

Narrow SCSI drives (tape drives, CD drives, and some hard drives) use a 50-pin cable. One end of this cable attaches to the SCSI controller card. The remaining connectors on the cable attach to the various Narrow SCSI devices.

-  **NOTICE:** Dell recommends that you use only SCSI cables purchased from Dell. Cables purchased elsewhere are not guaranteed to work with Dell computers.

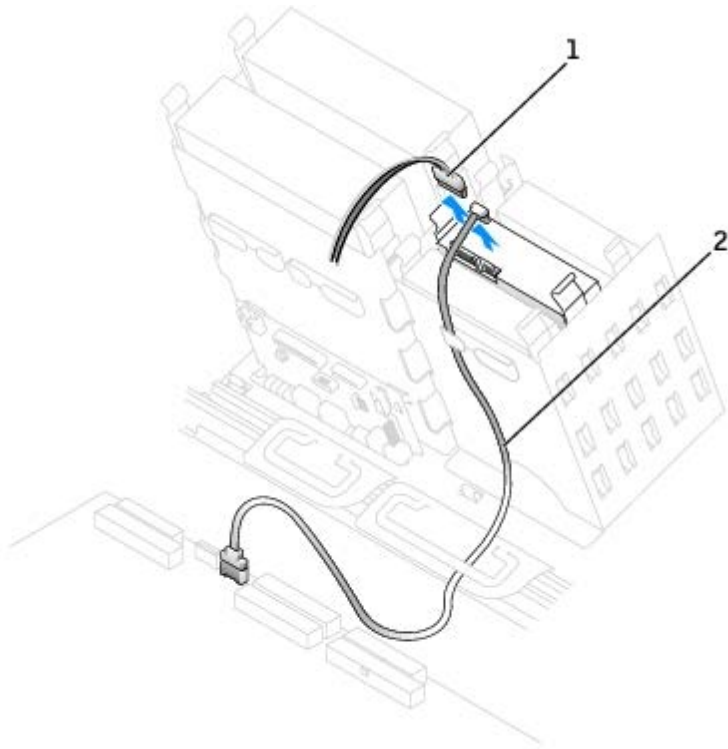
## Hard Drive

-  **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

-  **NOTICE:** To avoid damage to the drive, do not set it on a hard surface. Instead, set the drive on a surface, such as a foam pad, that will sufficiently cushion it.

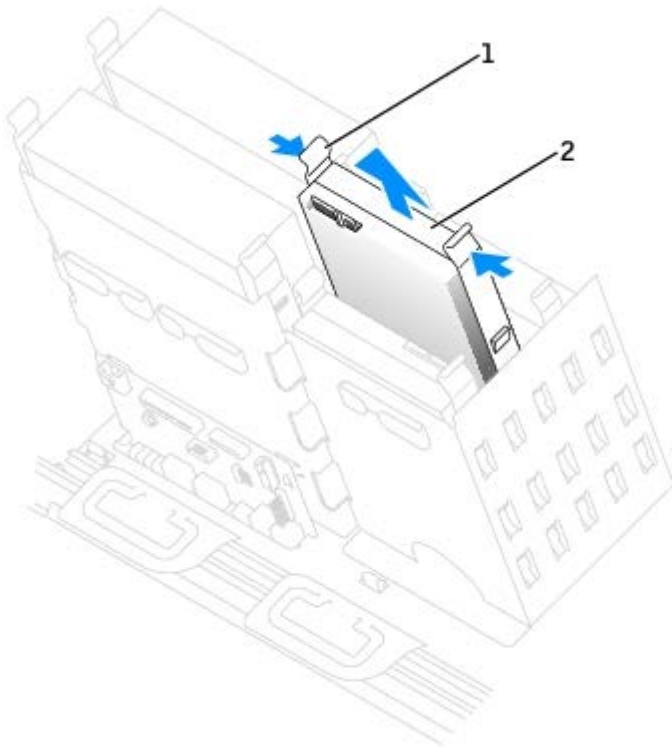
## Removing a Hard Drive

1. If you are replacing a hard drive that contains data you want to keep, back up your files before you begin this procedure.
2. Follow the instructions in "[Removing and Replacing Parts](#)."
3. Disconnect the power and hard-drive cables from the drive.




1	power cable
2	serial ATA hard-drive cable

4. Press in on the tabs on each side of the drive and slide the drive up and out.

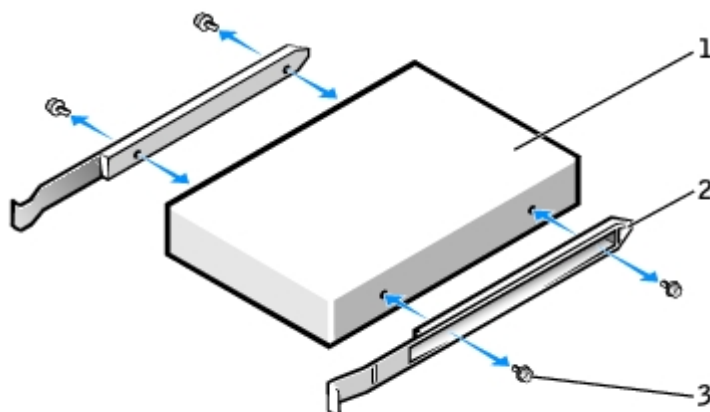


1	tab (2)
2	hard drive

## Installing a Hard Drive


 **NOTE:** SATA2\_0 is the bootable connector.

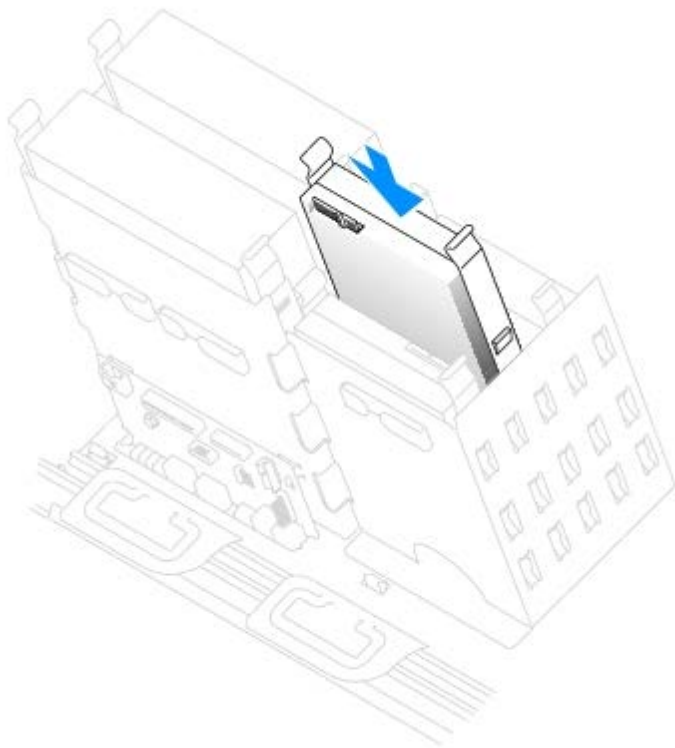
1. Unpack the replacement hard drive, and prepare it for installation.
2. Check the documentation for the drive to verify that it is configured for your computer.
3. If your replacement hard drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket rails to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).



1	drive
2	bracket rails (2)
3	screws (4)

4. Gently slide the drive into place until the tabs securely click into position.

 **NOTE:** If you are installing a hard drive in the lower bay, the drive should be placed in the bay so that the power connector is on the left-hand side (opposite of the top hard drive).

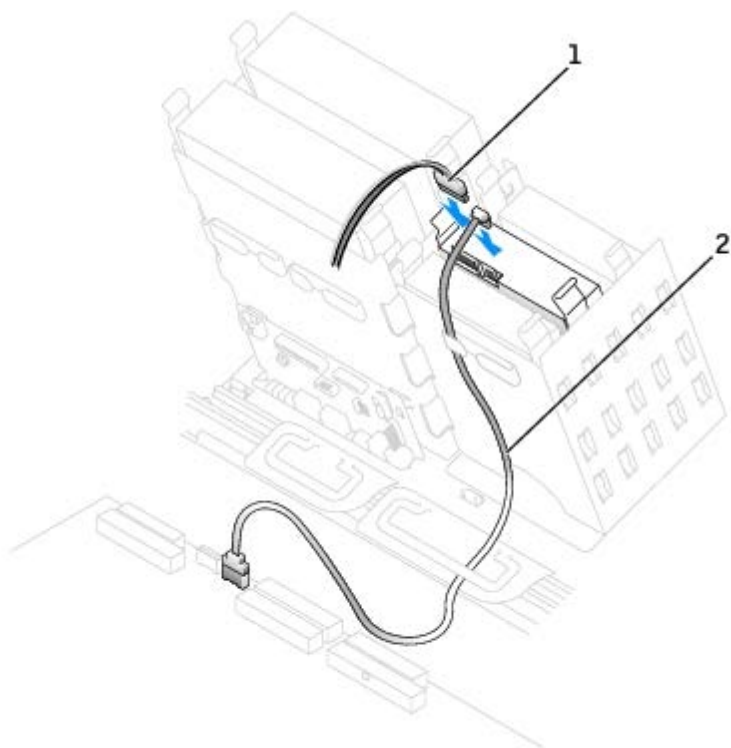


5. If you are installing a drive that has its own controller card, install the controller card in an expansion slot.

See the documentation that accompanied the drive and controller card to verify that the configuration is correct for your computer.

**NOTICE:** Match the colored strip on the cable with pin 1 on the drive (pin 1 is marked as "1").

6. Connect the power and hard-drive cables to the drive.





1	power cable
2	serial ATA hard-drive cable

7. Ensure that all connectors are properly cabled and firmly seated.
8. [Close the computer cover.](#)



**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

9. Connect your computer and devices to electrical outlets, and turn them on.

See the documentation that came with the drive for instructions on installing any software required for drive operation.

10. If the drive you just installed is the primary drive, insert a bootable medium into your boot drive.
11. Turn on the computer.
12. [Enter system setup](#), and update the your drive configuration.
13. After you have updated the system settings, exit system setup, and restart the computer.
14. Partition and logically format your drive before you proceed to the next step.

See the documentation for your operating system for instructions.

15. Test the hard drive by running the [Dell Diagnostics](#).
16. If the drive you just installed is the primary drive, install your operating system on the hard drive.

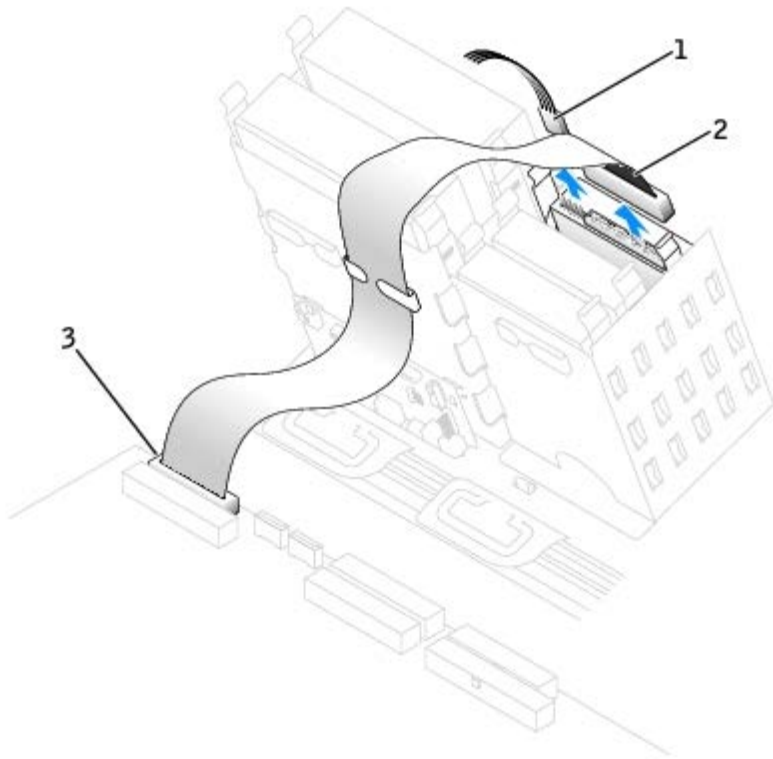
## Floppy Drive (Optional)



**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

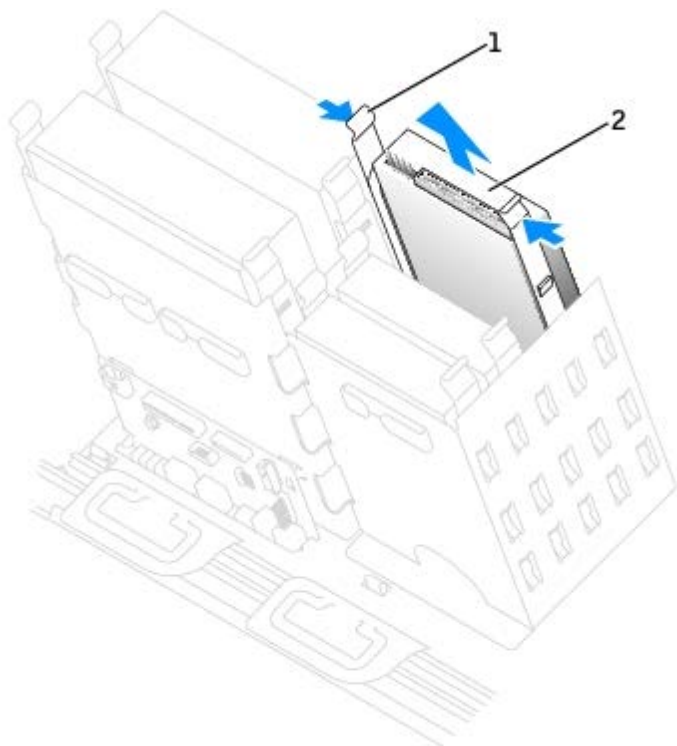
## Removing a Floppy Drive

1. Follow the procedures in "[Removing and Replacing Parts](#)."
2. Disconnect the power and floppy-drive cables from the back of the floppy drive.



1	power cable
2	floppy-drive cable
3	floppy-drive connector (DSKT)

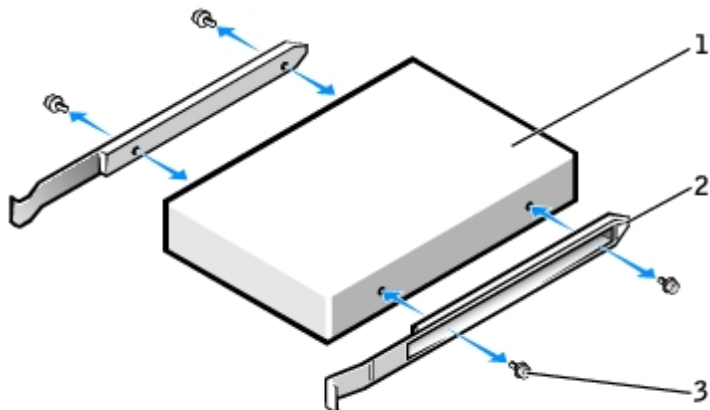
3. Press inward on the two tabs on the sides of the drive, slide the drive upward, and then remove it from the floppy-drive bay.



1	tabs (2)
2	floppy drive (optional)

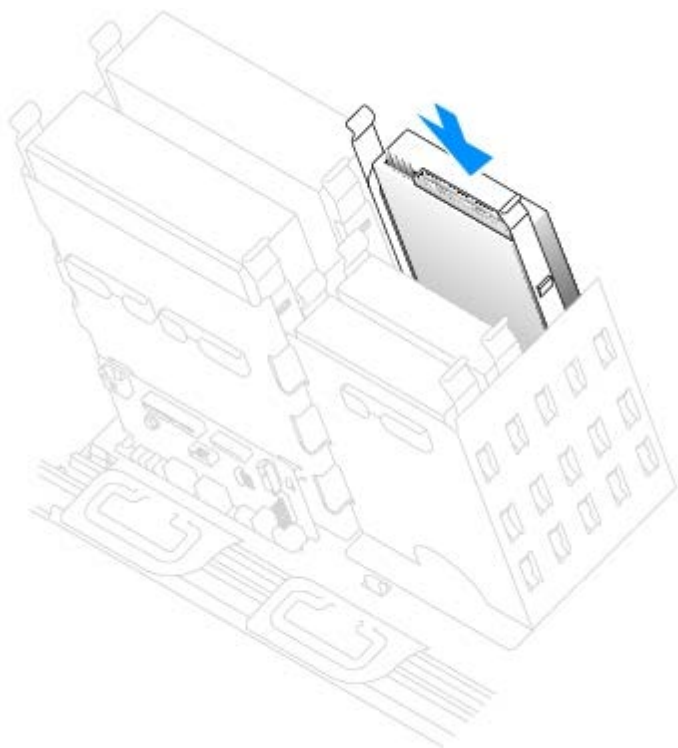
## Installing a Floppy Drive

1. If you are replacing a drive and the new drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).

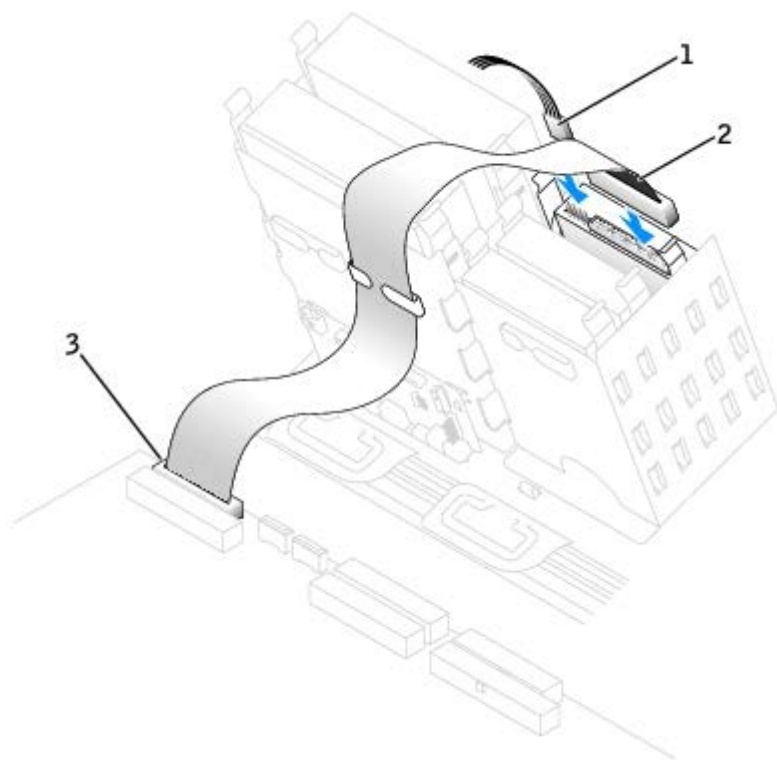


1	drive
2	bracket rails (2)
3	screws (4)

2. Gently slide the drive into place until the tabs securely click into position.



3. Attach the power and floppy-drive cables to the floppy drive.



1	power cable
2	floppy-drive cable
3	system board connector

4. If you are installing a new floppy drive rather than replacing a drive, remove the front-panel inserts.

From inside the drive bay, gently press on each side of the insert until it pops out.

5. Check all cable connections, and fold cables out of the way to provide airflow for the fan and cooling vents.
6. [Close the computer cover.](#)

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

7. Connect your computer and devices to electrical outlets, and turn them on.

See the documentation that came with the drive for instructions on installing any software required for drive operation.

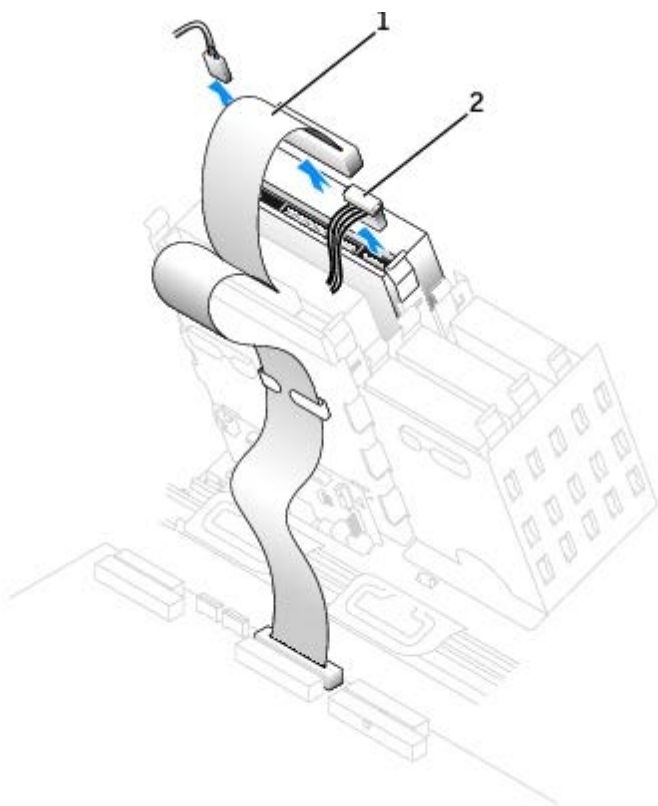
8. [Enter system setup](#) and update the appropriate **Diskette Drive A** option to reflect the size and capacity of your new floppy drive.
9. To verify that your computer works correctly, run the [Dell Diagnostics](#).

## CD/DVD Drive

**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

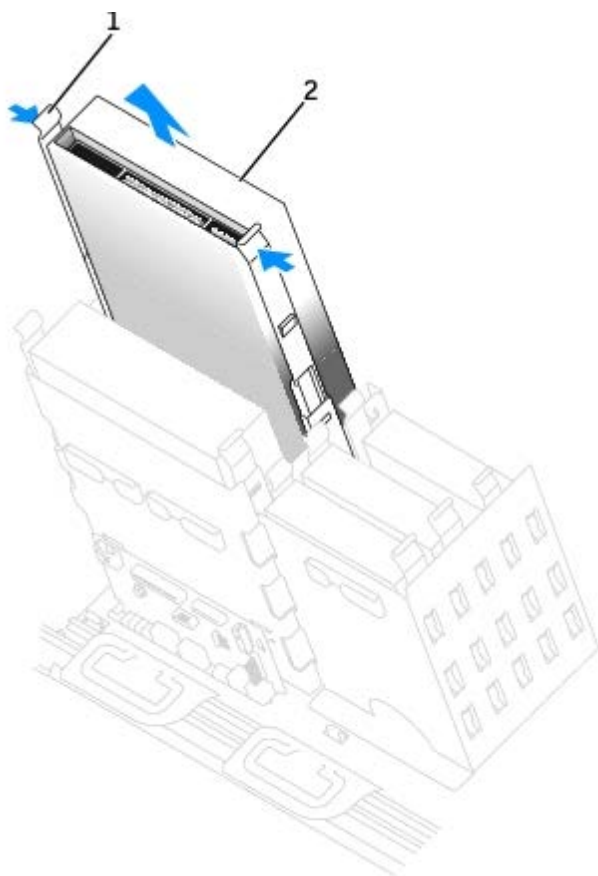
## Removing a CD/DVD Drive

1. Follow the procedures in "[Removing and Replacing Parts.](#)"
2. Disconnect the power and CD/DVD drive cables from the back of the drive.



1	CD/DVD drive cable
2	power cable

3. Press inward on the two tabs on the sides of the drive, and then slide the drive upward and remove it from the drive bay.



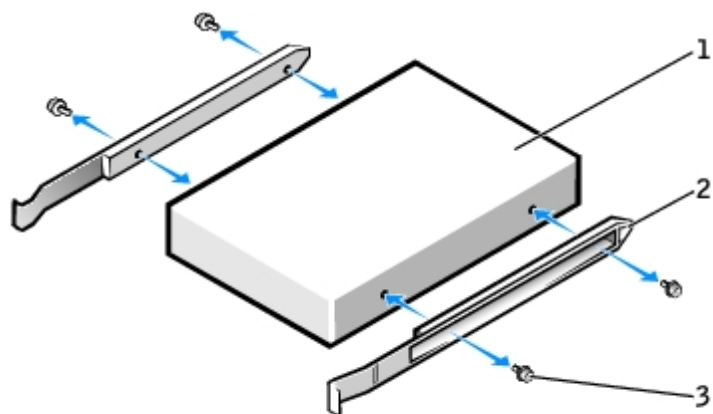
1	tabs (2)
2	CD/DVD drive

## Installing a CD/DVD Drive

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

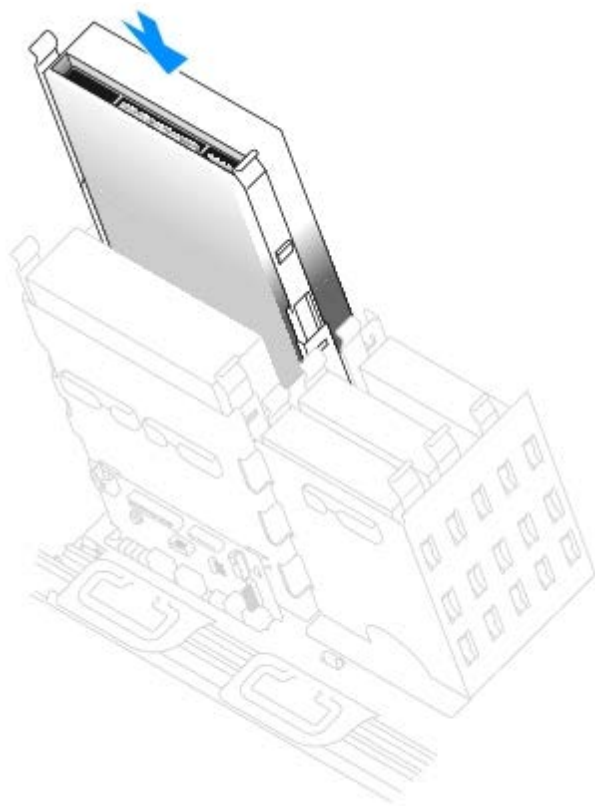
Check the documentation that accompanied the drive to verify that the drive is configured for your computer. If you are installing an IDE drive, configure the drive for the cable select setting.

2. Connect the new drive to the set of rails that are attached to the inside of the computer cover. If a set of rails is not attached inside the cover, [contact Dell](#) for the number to call for assistance.
3. If you are installing a replacement drive and the new drive does not have the bracket rails attached, remove the rails from the old drive by removing the two screws that secure each rail to the drive. Attach the bracket to the new drive by aligning the screw holes on the drive with the screw holes on the bracket rails and then inserting and tightening all four screws (two screws on each rail).



1	drive
2	bracket rails (2)
3	screws (4)

4. Gently slide the drive into place until the tabs securely click into position.

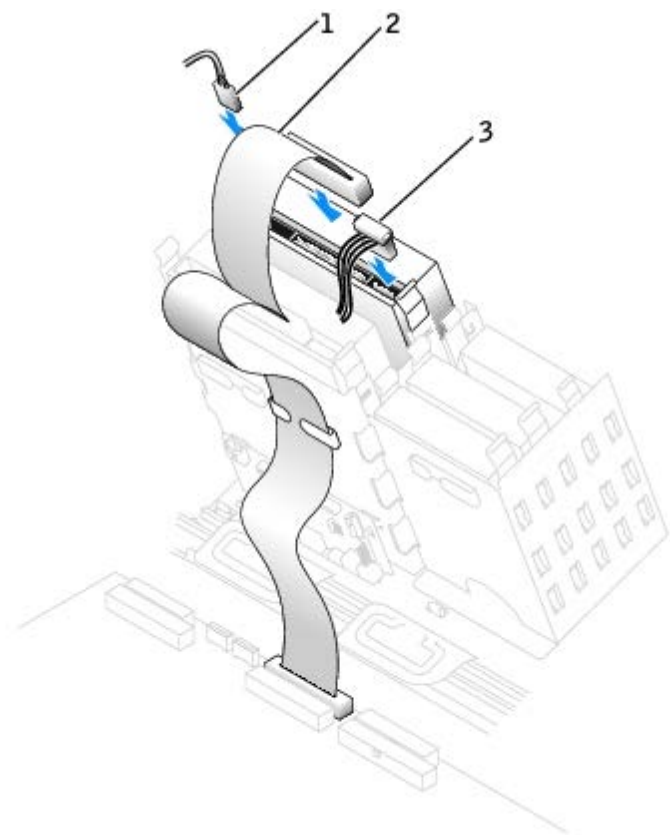


5. If you are installing a drive that has its own controller card, install the controller card in an expansion slot.

See the documentation that accompanied the drive and controller card to verify that the configuration is correct for your computer.

6. Connect the power and CD/DVD drive cables to the drive.

If you are adding a drive that has an audio cable, connect the audio cable to the audio connector on the system board.



1	audio cable (some drives do not have this cable)
2	CD/DVD drive cable
3	power cable

7. If you are installing a new CD/DVD drive rather than replacing a drive, remove the front-panel inserts.

From inside the drive bay, gently press on each side of the insert until it pops out.

8. Check all cable connections, and fold cables out of the way to provide airflow for the fan and cooling vents.
9. [Close the computer cover.](#)

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

10. Connect your computer and devices to electrical outlets, and turn them on.


See the documentation that came with the drive for instructions on installing any software required for drive operation.

11. Update your configuration information by setting the appropriate **Drive** option (**0** or **1**) under **Drives: Secondary** to **Auto**. See "[Advanced Features](#)" for more information.
12. To verify that your computer works correctly, run the [Dell Diagnostics](#).

## Cards

**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.



-  **NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer chassis.

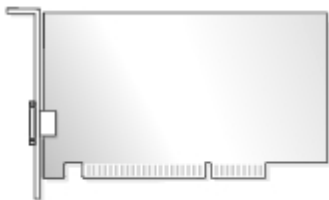
Your Dell™ Precision 670 computer provides the following slots for PCI and PCI Express cards:

- One PCI card slot
- Three PCIx slots
- One PCI Express x16 card slot
- One PCI Express x8 card slot (runs at x4 only)

Your Dell™ Precision 470 computer provides the following slots for PCI and PCI Express cards:

- One PCI card slot
- One PCIx slots
- One PCI Express x16 card slot
- One PCI Express x8 card slot (runs at x4 only)

## PCI Cards



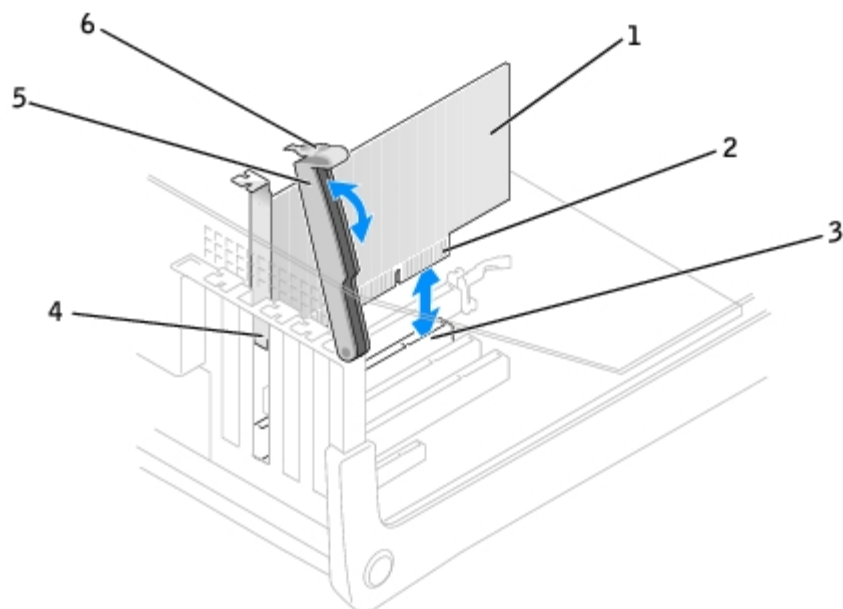
If you are installing or replacing a card, follow the procedures in the next section. If you are removing but not replacing a card, see "[Removing a PCI Card.](#)"

If you are replacing a card, remove the current driver for the card from the operating system.

If you are installing or replacing a PCI Express card, see "[Installing a PCI Express Card.](#)"

## Installing a PCI Card

13. Follow the procedures in "[Removing and Replacing Parts.](#)"
14. Press the lever on the card retention arm and raise the retention arm.



1	PCI card	4	filler bracket
2	edge connector	5	retention arm
3	card connector	6	lever

15. If you are installing a new card, remove the filler bracket to create a card-slot opening. Then continue with [step 17](#).

16. If you are replacing a card that is already installed in the computer, remove the card.

If necessary, disconnect any cables connected to the card. Grasp the card by its top corners, and ease it out of its connector.

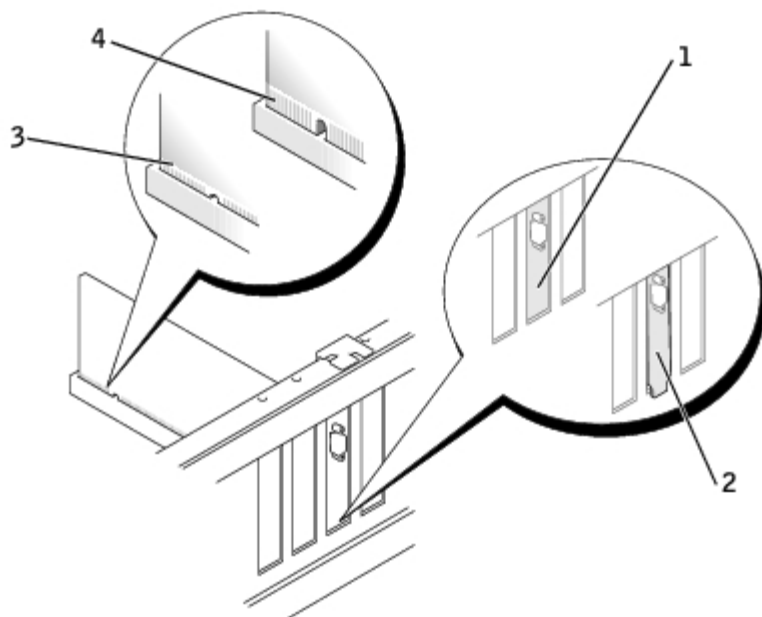
17. Prepare the card for installation.

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

**⚠ CAUTION:** Some network adapters automatically start the computer when they are connected to a network. To guard against electrical shock, be sure to unplug your computer from its electrical outlet before installing any cards.

18. Place the card in the connector and press down firmly. Ensure that the card is fully seated in the slot.

If the card is full-length, insert the end of the card into the card guide bracket as you lower the card toward its connector on the system board. Insert the card firmly into the card connector on the system board.

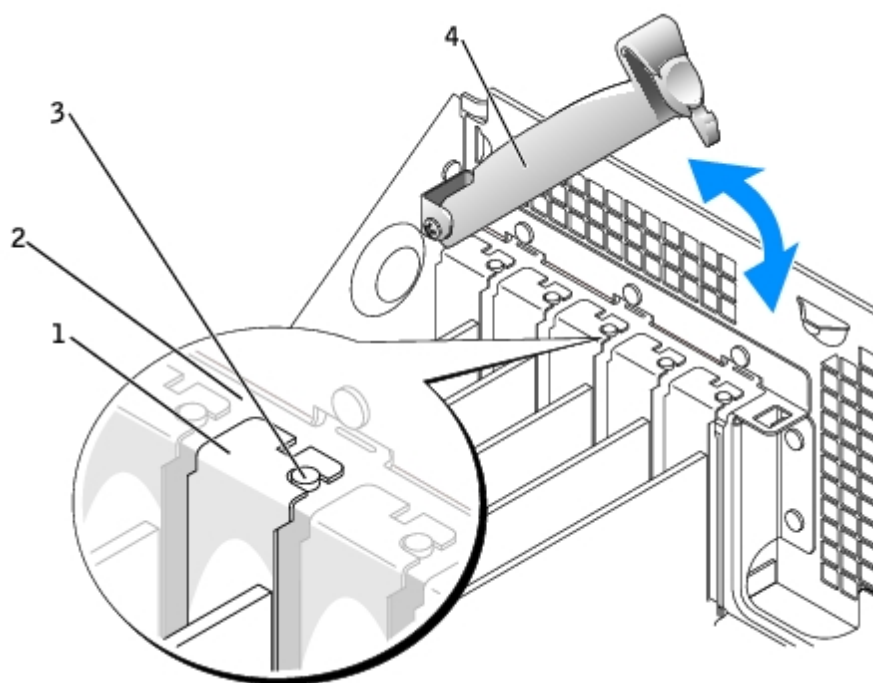


1	bracket within slot
2	bracket caught outside of slot
3	fully seated card
4	not fully seated card

19. Before you lower the retention arm, ensure that:

- The tops of all cards and filler brackets are flush with the alignment bar.
- The notch in the top of the card or filler bracket fits around the alignment guide.

20. Press the retention arm into place, securing the card(s) in the computer.



1	filler bracket
2	alignment bar

3	alignment guide
4	retention arm

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

21. Connect any cables that should be attached to the card.

See the documentation for the card for information about the card's cable connections.

- ➔ **NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

22. Close the computer cover, reconnect the computer and devices to electrical outlets, and then turn them on.

23. If you installed a sound card:

- a. [Enter system setup](#), select **Integrated Devices**, and then change the setting for **Sound** to **Off**.
- b. Connect external audio devices to the sound card's connectors. Do not connect external audio devices to the microphone, speaker/headphone, or line-in connectors on the back panel.

24. If you installed an add-in network adapter:


- a. [Enter system setup](#), select **Integrated Devices**, and then change the setting for **Network Interface Card** to **Off**.
- b. Connect the network cable to the add-in network adapter's connectors. Do not connect the network cable to the integrated connector on the back panel.

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

## Removing a PCI Card

1. Follow the procedures in "[Before You Begin](#)."
2. Press the lever on the card retention arm and raise the retention arm.
3. If necessary, disconnect any cables connected to the card.
4. Grasp the card by its top corners, and ease it out of its connector.
5. If you are removing the card permanently, install a filler bracket in the empty card-slot opening.

If you need a filler bracket, [contact Dell](#).

-  **NOTE:** Installing filler brackets over empty card-slot openings is necessary to maintain FCC certification of the computer. The brackets also keep dust and dirt out of your computer.

6. Lower the retention arm and press it into place, securing the card(s) in the computer.

- ➔ **NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

7. Close the computer cover, reconnect the computer and devices to electrical outlets, and then turn them on.

8. Remove the card's driver from the operating system.

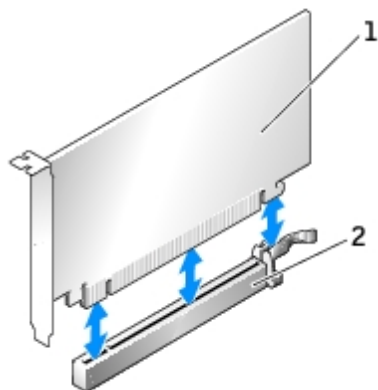
9. If you removed a sound card:

- a. Enter system setup, select **Integrated Devices**, and then change the setting for **Sound** to **On**.

- b. Connect external audio devices to the audio connectors on the back panel of the computer.
10. If you removed an add-in network connector:
  - a. Enter system setup, select **Integrated Devices**, and then change the setting for **Network Interface Card** to **On**.
  - b. Connect the network cable to the integrated connector on the back panel of the computer.

## PCI Express Cards

Your computer supports one PCI Express x16 card and one PCI Express x8 card, runs at x4 only.



1	PCI Express x16 card
2	PCI Express x16 card slot

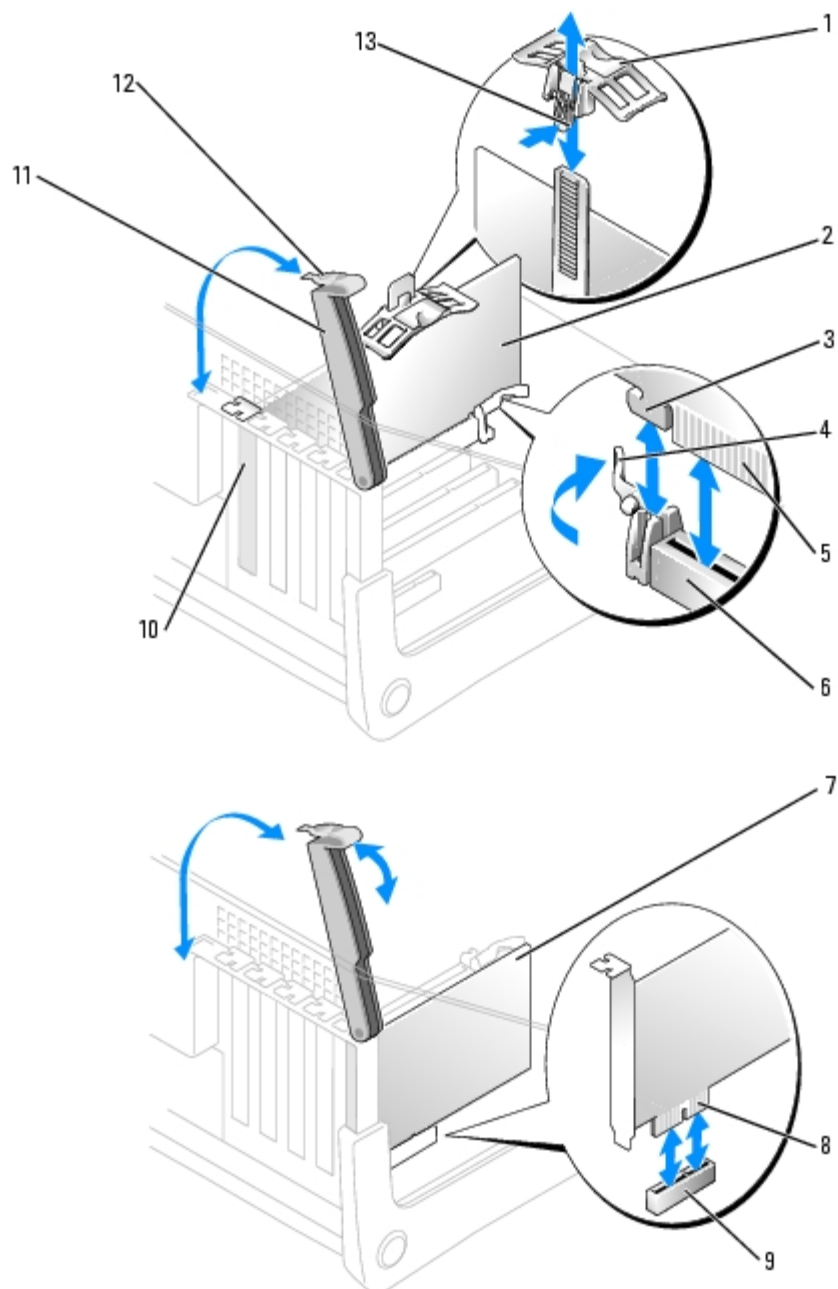
If you are installing or replacing a PCI Express card, follow the procedures in the next section. If you are removing but not replacing a PCI Express card, see "[Removing a PCI Express Card](#)."

If you are replacing a card, remove the current driver for the card from the operating system.

If you are installing or replacing a PCI card, see "[Installing a PCI Card](#)."

## Installing a PCI Express Card

1. Follow the procedures in "[Removing and Replacing Parts](#)."
2. Press the lever on the card retention arm and raise the retention arm.



1	top of retention mechanism	8	edge connector
2	x16 card	9	card connector
3	securing slot	10	filler bracket
4	securing tab	11	retention arm
5	edge connector	12	lever
6	card connector	13	tab
7	card		

3. If you are installing a new card, remove the filler bracket to create a card-slot opening. Then continue with [step 17](#).
4. If you are replacing a card that is already installed in the computer, remove the card.

If necessary, disconnect any cables connected to the card. If your card includes a card retention bar, remove the bar. Gently pull the securing tab, grasp the card by its top corners, and ease it out of its connector.

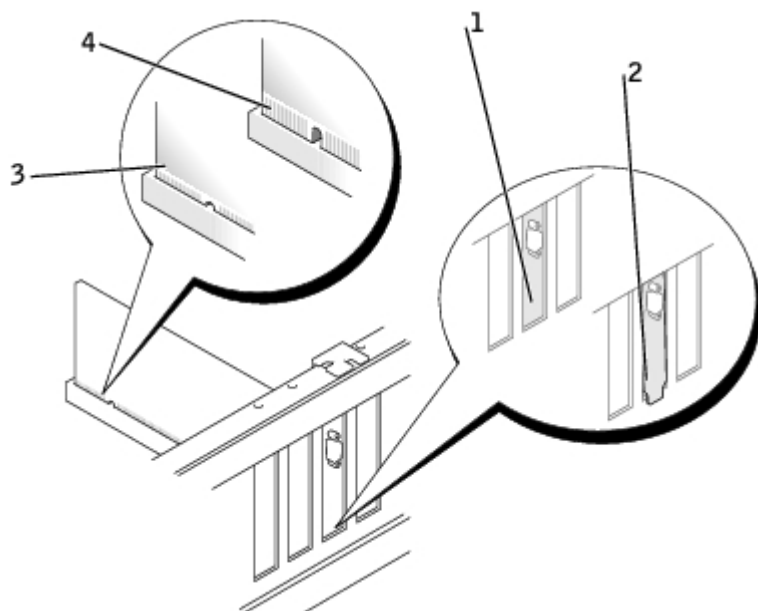
5. Prepare the card for installation.

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

**⚠ CAUTION:** Some network adapters automatically start the computer when they are connected to a network. To guard against electrical shock, be sure to unplug your computer from its electrical outlet before installing any cards.

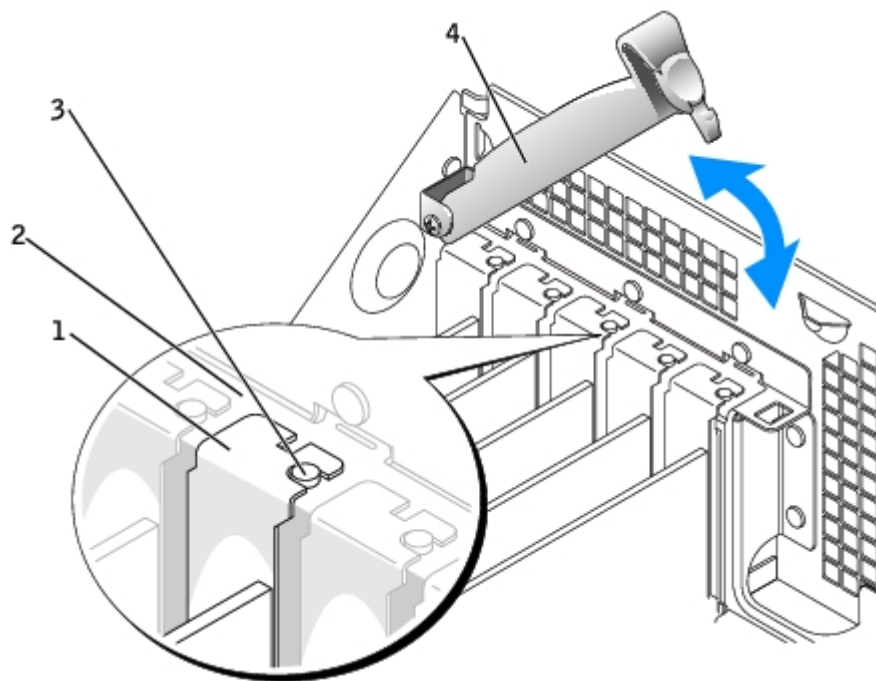
6. If you are installing the card into the x16 card connector, position the card so the securing slot is aligned with the securing tab, and gently pull the securing tab.
7. Place the card in the connector and press down firmly. Ensure that the card is fully seated in the slot.

If the card is full-length, insert the end of the card into the card guide bracket as you lower the card toward its connector on the system board. Insert the card firmly into the card connector on the system board.



1	bracket within slot
2	bracket caught outside of slot
3	fully seated card
4	not fully seated card

8. If you replaced a card that was already installed in the computer and you removed a card retention bar, you can reinstall the bar.
9. Before you lower the retention arm, ensure that:
  - The tops of all cards and filler brackets are flush with the alignment bar.
  - The notch in the top of the card or filler bracket fits around the alignment guide.
10. Press the retention arm into place, securing the card(s) in the computer.



1	filler bracket
2	alignment bar
3	alignment guide
4	retention arm

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

11. Connect any cables that should be attached to the card.

See the documentation for the card for information about the card's cable connections.

➡ **NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

12. [Close the computer cover](#), reconnect the computer and devices to electrical outlets, and then turn them on.

13. If you installed a sound card:

- a. [Enter system setup](#), select **Integrated Devices**, and then change the setting for **Sound** to **Off**.
- b. Connect external audio devices to the sound card's connectors. Do not connect external audio devices to the microphone, speaker/headphone, or line-in connectors on the back panel.

14. If you installed an add-in network adapter:

- a. [Enter system setup](#), select **Integrated Devices**, and then change the setting for **Network Interface Card** to **Off**.
- b. Connect the network cable to the add-in network adapter's connectors. Do not connect the network cable to the integrated connector on the back panel.

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

## Removing a PCI Express Card



1. Follow the procedures in "[Removing and Replacing Parts.](#)"
2. Press the lever on the card retention arm and raise the retention arm.
3. If necessary, disconnect any cables connected to the card.
4. If your card includes a card retention bar, remove the bar.
5. Gently pull back and hold the securing tab, grasp the card by its top corners, and then ease it out of its connector.
6. If you are removing the card permanently, install a filler bracket in the empty card-slot opening.

If you need a filler bracket, [contact Dell](#).



**NOTE:** Installing filler brackets over empty card-slot openings is necessary to maintain FCC certification of the computer. The brackets also keep dust and dirt out of your computer.

7. Lower the retention arm and press it into place, securing the card(s) in the computer.



**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

8. Close the computer cover, reconnect the computer and devices to electrical outlets, and then turn them on.
9. Remove the card's driver from the operating system.
10. If you installed a sound card:
  - a. [Enter system setup](#), select **Integrated Devices**, and then change the setting for **Sound** to **Off**.
  - b. Connect external audio devices to the sound card's connectors. Do not connect external audio devices to the microphone, speaker/headphone, or line-in connectors on the back panel.
11. If you installed an add-in network adapter:
  - a. [Enter system setup](#), select **Integrated Devices**, and then change the setting for **Network Interface Card** to **Off**.
  - b. Connect the network cable to the add-in network adapter's connectors. Do not connect the network cable to the integrated connector on the back panel.
12. Install any drivers required for the card as described in the card documentation.

---

## Processor Airflow Shroud

### Installing the Airflow Shroud



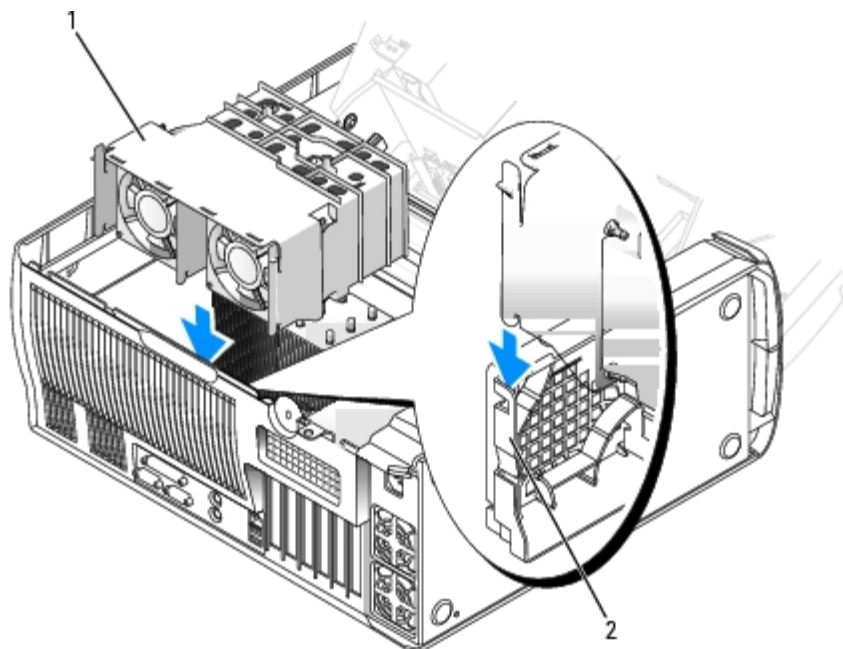
**CAUTION:** Before you perform this procedure, follow the safety instructions located in the *Product Features Guide*.



**CAUTION:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer chassis.

1. Follow the procedures in "[Removing and Replacing Parts.](#)"
2. If you have added a second processor to your computer:
  - a. [Remove the airflow shroud insert.](#)

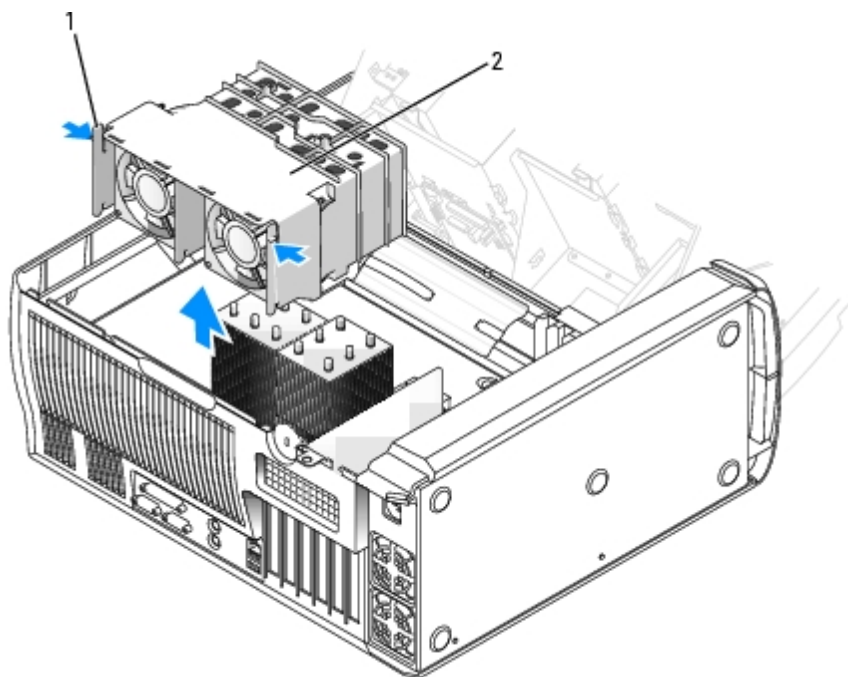
- b. [Install the second fan in the airflow shroud insert.](#)
3. Connect the fan power cable to the connector on the board. For the Dell Precision 670 computer, see "[System Board Components](#)" and for the Dell Precision 470 computer, see "[System Board Components](#)."
4. Align the shroud rails with the guide mounted on the back of the computer.
5. Gently slide the shroud down over the heat sink until the anchors snap into place.



1	airflow shroud
2	shroud guide

## Removing the Airflow Shroud

- ⚠ CAUTION:** Before you perform this procedure, follow the safety instructions located in the *Product Features Guide*.
- ⚠ CAUTION:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer chassis.
1. Follow the procedures in "[Removing and Replacing Parts](#)."
  2. Unplug the fan power cable from the system board (for the Dell Precision 670 computer, see "[System Board Components](#)" and for the Dell Precision 470 computer, see "[System Board Components](#)").
  3. Press in the two tabs at the top-back corners of the shroud to disengage the anchors.
  4. While pressing the tabs inward, slide the shroud up and out of the computer.

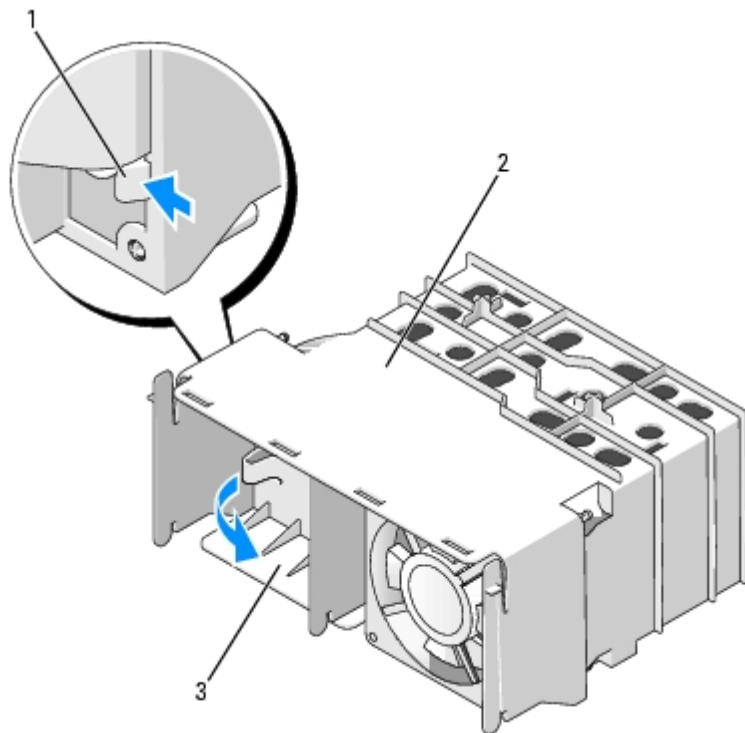


1	tabs (2)
2	airflow shroud

## Removing the Airflow Shroud Insert

If you have added a second processor to your computer, you must remove the insert from the airflow shroud in order to install the processor airflow shroud.

1. Press in the single tab on the left side of the shroud.
2. While pressing the tab inward, slide the insert out of the shroud.

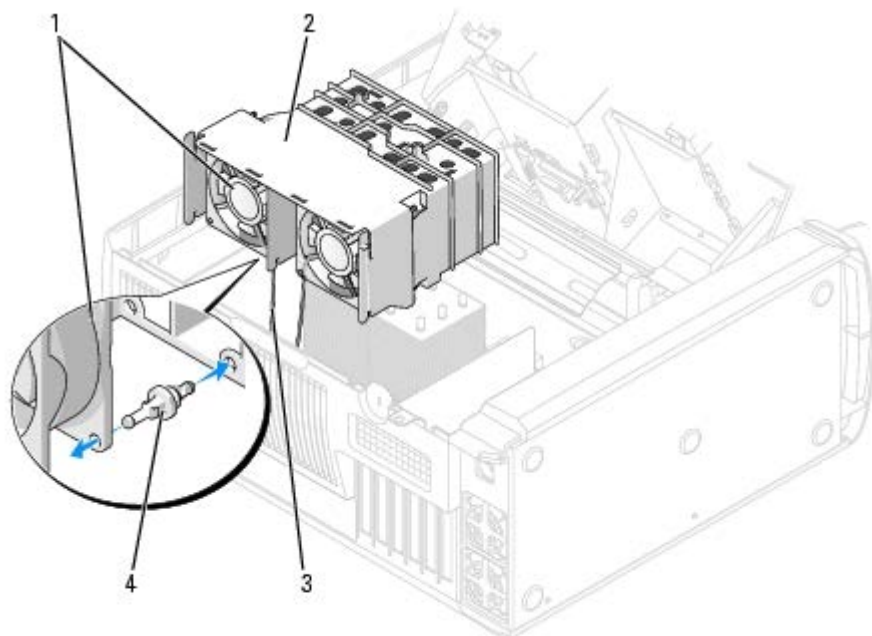


1	tab
2	airflow shroud
3	airflow shroud insert

## Installing the Second Fan

If you have added a second processor to your computer, you must install the second fan in the airflow shroud before installing the airflow shroud in the computer.

1. [Remove the airflow shroud insert.](#)
2. Feed the ends of the rubber grommets through the holes at each corner of the fan on the air- intake side. Airflow orientation is shown on the side of the fan.
3. With the fan power cable oriented downward, align the grommets in the fan with the holes in each corner of the shroud and pull through until they snap into place.
4. Follow the instructions for "[Installing the Airflow Shroud.](#)"



1	second fan
2	airflow shroud
3	fan power cable
4	rubber grommets (4)


## Processor


**⚠ CAUTION:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer chassis.


## Installation Guidelines

- Your computer is designed for dual-processor operations. The heat sinks (CPU\_0 and CPU\_1) are keyed to fit their specific connector.
- For single-processor operations, the processor must be installed in socket CPU\_0. The VRM for the single processor is already installed and cannot be removed. Processor socket 1 and VRM connector must be empty. To locate these components, see the system board components illustration (for the Dell Precision 670 computer, see "[System Board Components](#)" and for the Dell Precision 470 computer, see "[System Board Components](#)") or the system board label inside your computer.
- For dual-processor operations, both processor sockets and the VRM connector must be populated. To locate the VRM connector, see the system board components illustration (for the Dell Precision 670 computer, see "[System Board Components](#)" and for the Dell Precision 470 computer, see "[System Board Components](#)") or the system board label inside your computer.
- For dual-processor operations, the two processors and the VRMs must be identical. If the processors do not match, you will receive a system message. If the processors voltage don't match or the VRM is not properly installed, the diagnostic lights indicate an error.
- If you are upgrading your processor, keep your original processor heat sink and securing clips for future troubleshooting.
- If you are removing the second processor (CPU\_1), you must also remove the VRM.

## Installing the Processor


 **CAUTION:** The processor can get very hot during normal operation. Ensure that the processor has had sufficient time to cool before you touch it.

 **CAUTION:** Before you perform this procedure, follow the safety instructions located in the *Product Information Guide*.


 **NOTICE:** If you are installing a second processor, you must remove the first heat sink before you can install the second processor and heat sink.

1. Follow the procedures in "[Removing and Replacing Parts](#)."
2. Remove the [processor airflow shroud](#).

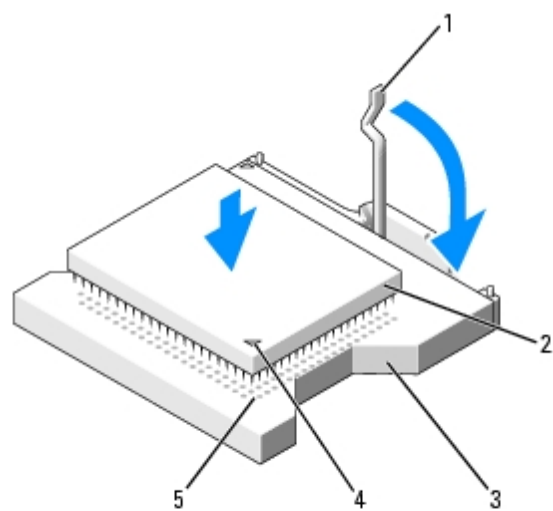
If you are replacing a processor, see "[Installing the Processor](#)."

 **NOTICE:** You must position the processor correctly in the socket to avoid permanent damage to the processor and the computer.

3. If the release lever is not extended to the release position, move it to that position.
4. Align pin-1 (the imprinted corner) of the processor and pin-1 of the socket.

 **NOTICE:** Processor pins are delicate. To avoid damage, ensure that the processor aligns properly with the socket, and do not use excessive force when you install the processor.

5. Carefully set the processor in the socket and press it down lightly to seat it.
6. Rotate the release lever back toward the system board until it snaps into place, securing the processor.

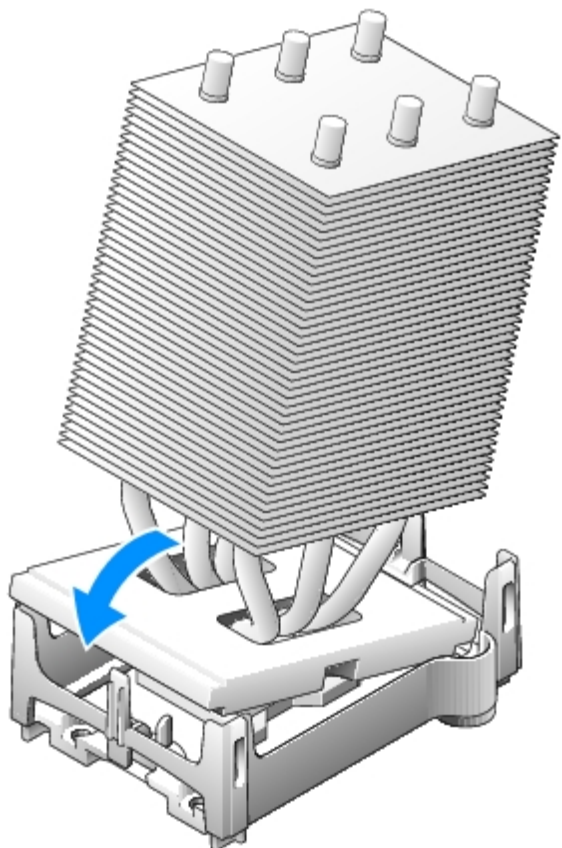


1	release lever
2	processor
3	processor socket
4	processor pin-1 indicator
5	socket pin-1 indicator


7. Remove the thermal grease protective cover and place the heat sink in the base.

8. Install the heat sink:

- a. Slide one end of the heat sink under the retention tab.
- b. Pull out the other retention tab and lower the heat sink until it fits securely in the base.




9. Replace the retention module clips.
10. If you installed a processor replacement kit from Dell, return the original heat sink assembly and processor to Dell in the same package in which your replacement kit was sent.
11. If you are installing a second processor, install the VRM.
12. Replace the [airflow shroud](#).
13. [Close the computer cover](#).


 **NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

14. Connect your computer and devices to electrical outlets, and turn them on.


## Removing the Processor

 **NOTE:** It is recommended that only a technically knowledgeable person perform this procedure.


 **CAUTION:** The processor can get very hot during normal operation. Ensure that the processor has had sufficient time to cool before you touch it.

 **CAUTION:** Before you perform this procedure, follow the safety instructions located in the *Product Information Guide*.

1. Remove the [processor airflow shroud](#).

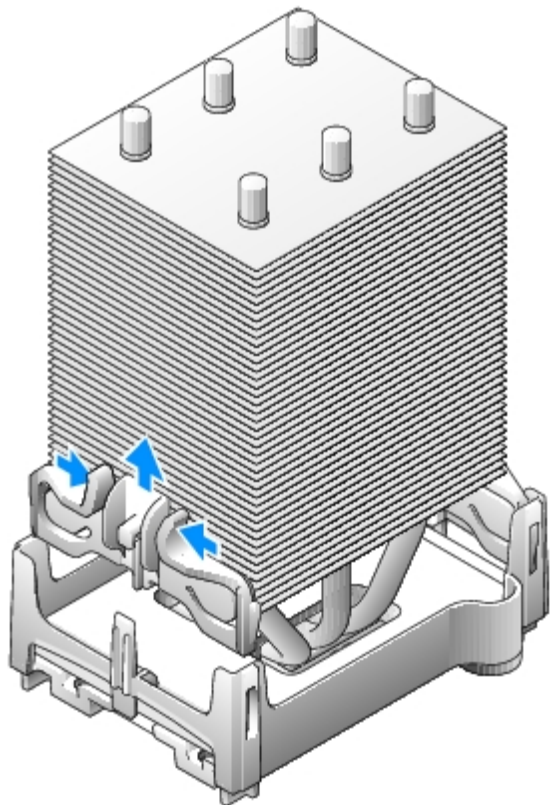
 **NOTICE:** If you are installing a processor upgrade kit from Dell, discard the original heat sink. If you are *not* installing a processor upgrade kit from Dell, reuse the original heat sink when you install your new processor.

2. If you have dual processors, remove the VRM.


 **NOTE:** If you have dual processors, remove the primary heat sink and processor before removing the secondary ones.

3. Remove the heat sink:

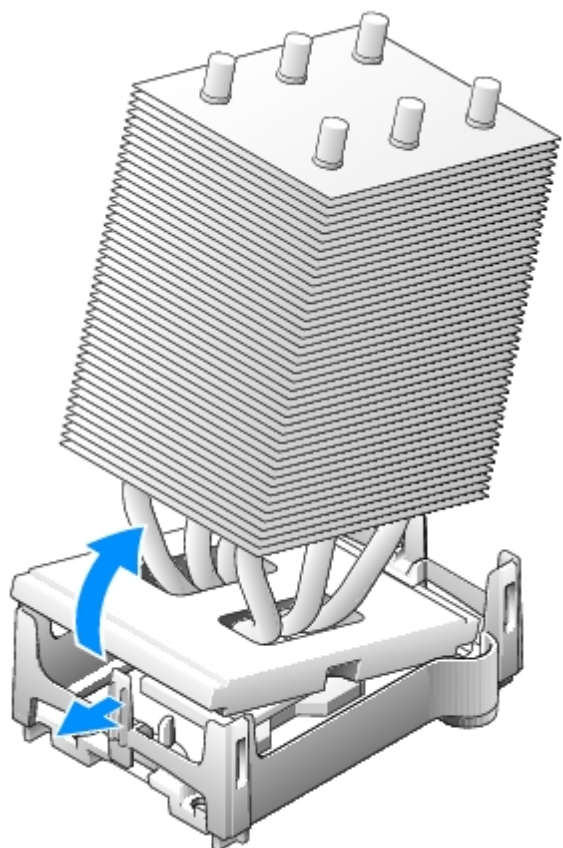
- a. Remove the two retention module clips by pressing the tabs together and lifting the retention module clips up.



- b. On the retention base, locate the tab at the back of the computer. Push out on the tab (towards the back of the computer). The heat sink pops up slightly.
- c. Push out on the second retention tab while lifting the heat sink up and out of the retention base.

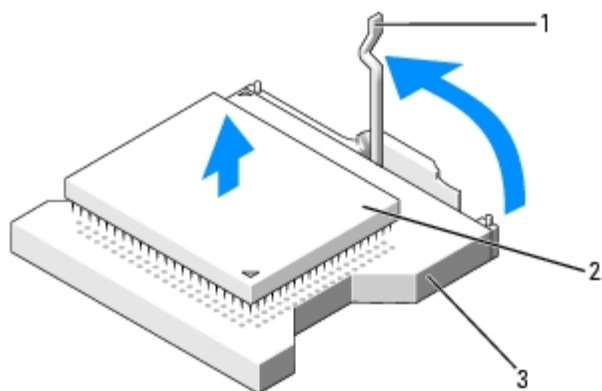
 **NOTICE:** Lay the heat sink down with the thermal material facing upward.





4. Pull the release lever straight up until the processor is released.

**NOTICE:** Be careful not to bend any of the pins when you remove the processor from the socket. Bending the pins can permanently damage the processor.




1	release lever
2	processor
3	socket

5. Remove the processor from the socket.

If you are replacing the processor, leave the release lever extended in the release position so that the socket is ready for the new processor and go to "[Installing the Processor.](#)"

6. Replace the [airflow shroud](#).


7. [Close the computer cover.](#)


 **NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

8. Connect your computer and devices to electrical outlets, and turn them on.
- 

## Battery

### Replacing the Battery

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

 **NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

A coin-cell battery maintains computer configuration, date, and time information. The battery can last several years.

The battery may need replacing if you have repeatedly reset the time and date information after turning on the computer or if one of the following messages appear:

```
Time-of-day not set - please run SETUP program
```

or


```
Invalid configuration information -  
please run SETUP program
```

or

```
Strike the F1 key to continue,  
F2 to run the setup utility
```


To determine whether you need to replace the battery, reenter the time and date in system setup and exit the program to save the information. Turn off your computer and disconnect it from the electrical outlet for a few hours; then reconnect the computer, turn it on, and enter system setup. If the date and time are not correct in system setup, replace the battery.

You can operate your computer without a battery; however, without a battery, the configuration information is erased if the computer is turned off or unplugged from the electrical outlet. In this case, you must enter system setup and reset the configuration options.

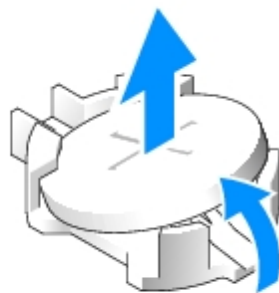
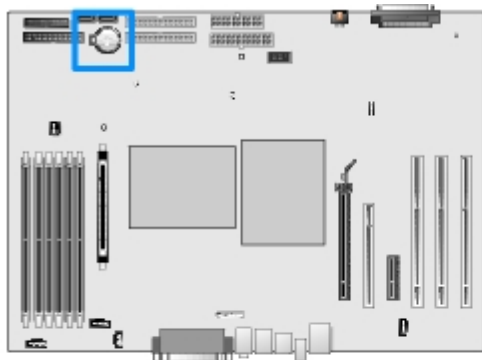
 **CAUTION:** A new battery can explode if it is incorrectly installed. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

To replace the battery:

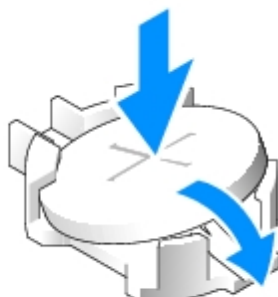
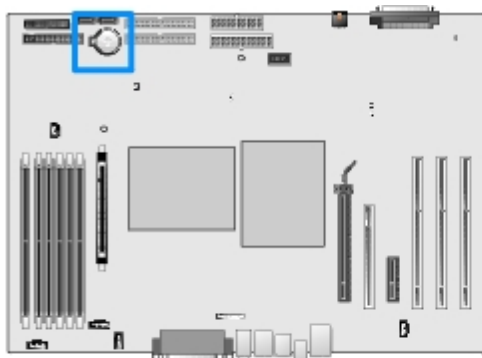
1. Follow the procedures in "[Removing and Replacing Parts.](#)"
2. Locate the battery socket (for the Dell Precision 670 computer, see "[System Board Components](#)" and for the Dell Precision 470 computer, see "[System Board Components](#)").

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

3. Remove the battery by carefully prying it out of its socket with your fingers or with a blunt, nonconducting object such as a plastic screwdriver.



4. Insert the new battery into the socket with the side labeled "+" facing up, and snap the battery into place.



5. [Close the computer cover.](#)

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

6. Connect your computer and devices to electrical outlets, and turn them on.
7. Properly dispose of the old battery. For more information, see your *Product Information Guide*.

## VRM

**CAUTION:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

**NOTICE:** A VRM must be installed to operate dual processors. To locate the VRM connector, see the system board components illustration (for the Dell Precision 670 computer, see "[System Board Components](#)" and for the Dell Precision 470 computer, see "[System Board Components](#)") or the system board label inside your computer.

## Installing a VRM

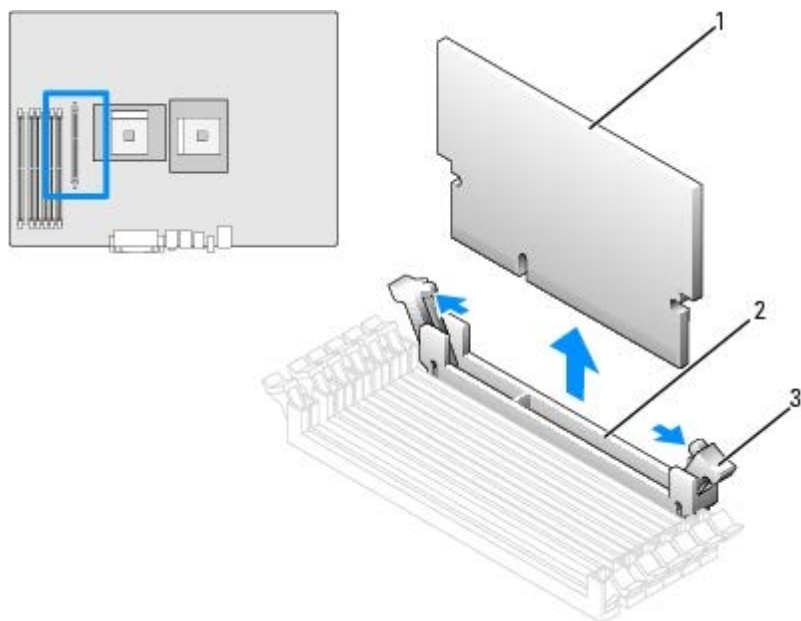
**CAUTION:** Before you perform this procedure, follow the safety instructions located in the *Product Information Guide*.

**NOTICE:** Install the VRM after you have installed the processors.

1. Follow the procedures in "[Removing and Replacing Parts](#)."

2. Remove the processor airflow shroud.
3. Press the securing clips at each end of the VRM connector outward until they snap open.

To locate the VRM connector, see the system board components illustration (for the Dell Precision 670 computer, see "[System Board Components](#)" and for the Dell Precision 470 computer, see "[System Board Components](#)") or see the system board label inside your computer.



1	VRM
2	connector
3	securing clips (2)

4. Align the notch on the bottom of the VRM with the ridges inside the connector.
5. Press the VRM straight down into the connector until the securing clips snap into place at the ends of the module.
6. Install the processor airflow shroud.
7. [Close the computer cover.](#)

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

8. Connect your computer and devices to electrical outlets, and turn them on.

## Removing a VRM

**CAUTION:** Before you perform this procedure, follow the safety instructions located in the *Product Information Guide*.

**NOTICE:** Remove the VRM before you remove the processors.

1. Remove the processor airflow shroud.
2. Press the securing clips at each end of the connector outward simultaneously until the VRM slightly pops out from the connector.

3. Grasp the VRM by its top corners, and ease it out of the connector.
4. If you are installing a new VRM, see "[Installing a VRM.](#)"

If you are not installing a new VRM, continue with step 5.

5. Install the processor airflow shroud.
6. [Close the computer cover.](#)

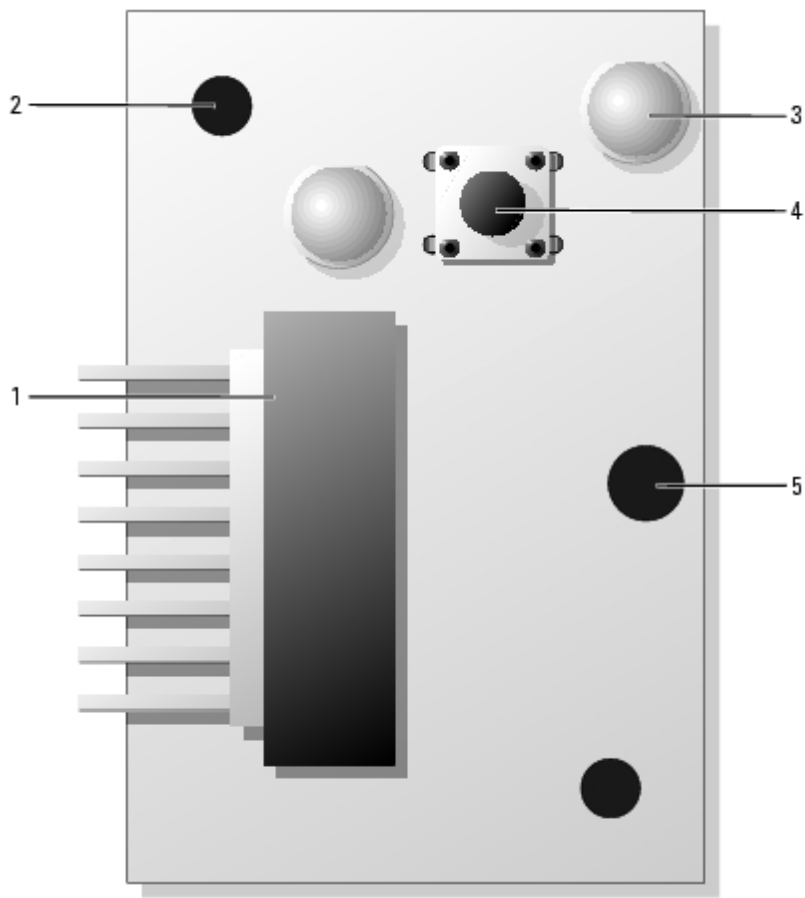
**ⓘ NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

7. Connect your computer and devices to electrical outlets, and turn them on.

## Control Panel

**⚠ CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

### Control Panel Components



1	control-panel connector
2	alignment hole

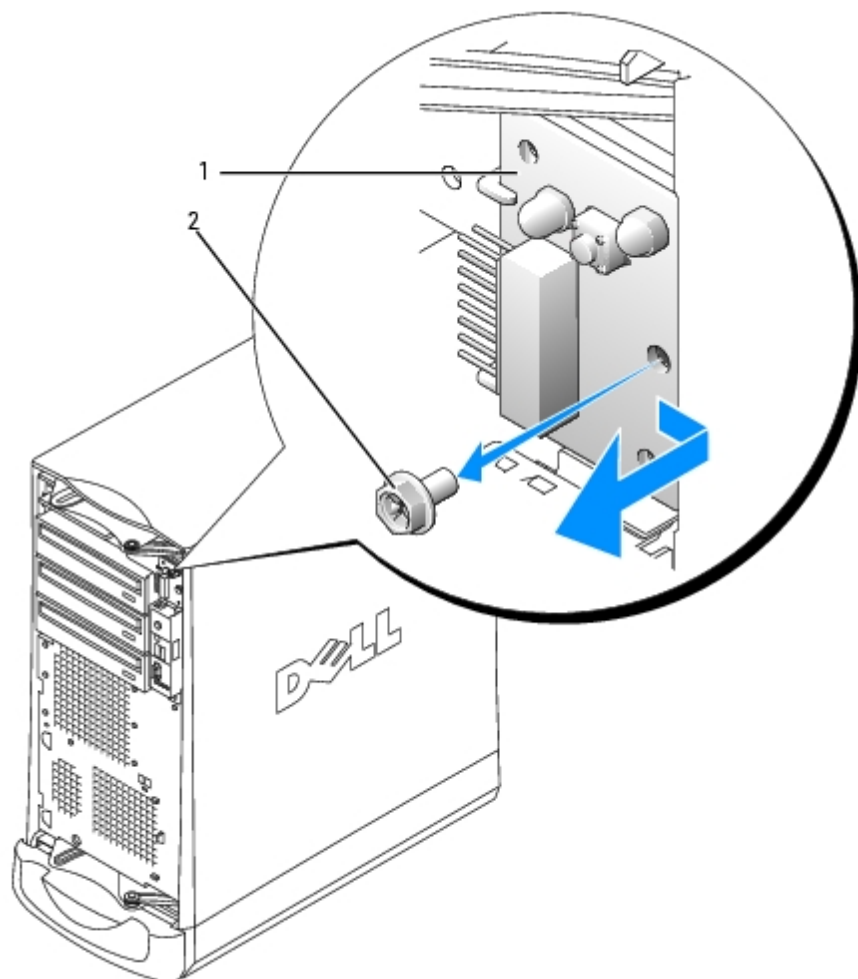
3	hard-drive access light
4	power button
5	screw hole

## Removing the Control Panel

**NOTICE:** Before disconnecting a device from the computer or removing a component from the system board, verify that the standby power light on the system board has turned off. To locate this light for the Dell Precision 670 computer, see "[System Board Components](#)" and for the Dell Precision 470 computer, see "[System Board Components](#)."

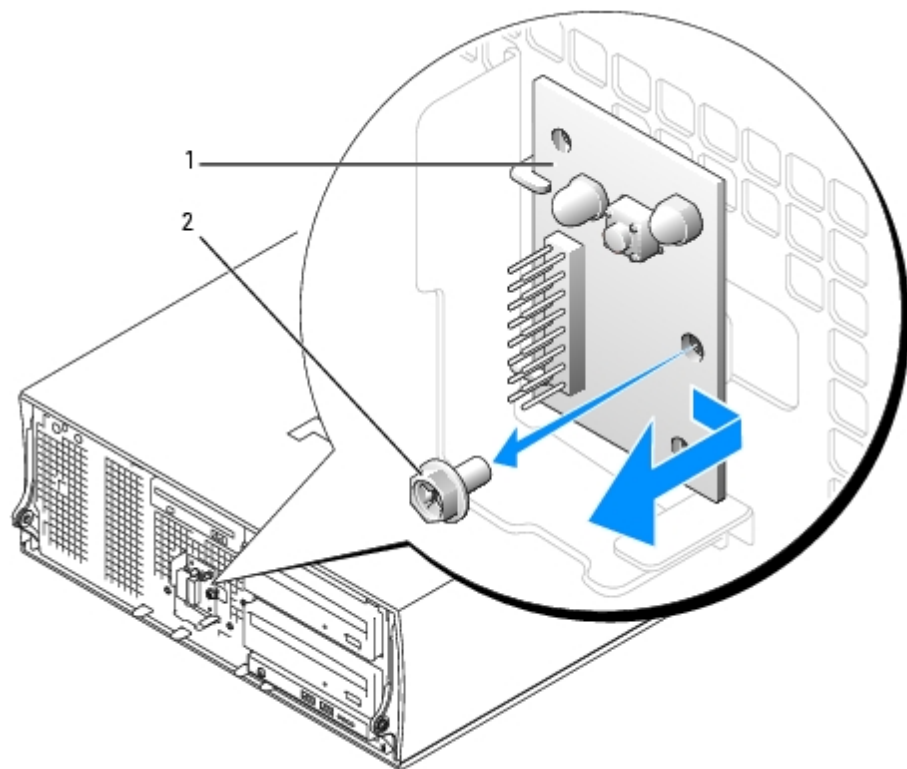
1. Remove the [front panel](#).
2. Disconnect the control-panel cable from the I/O panel connector.
3. Disconnect the I/O panel cable from the connector on the system board. To locate the system board connector on the Dell Precision 670 computer, see "[System Board Components](#)" and for the Dell Precision 470 computer, see "[System Board Components](#)."
4. Remove the mounting screw from the control panel.

### Dell Precision 670 Workstation Computer



1	control panel
2	mounting screw

## Dell Precision 470 Computer



1	control panel
2	mounting screw

5. Lift the control panel away from the computer.

## Replacing the Control Panel

To replace the control panel, perform the [removal procedure](#) in reverse.

## Front Panel

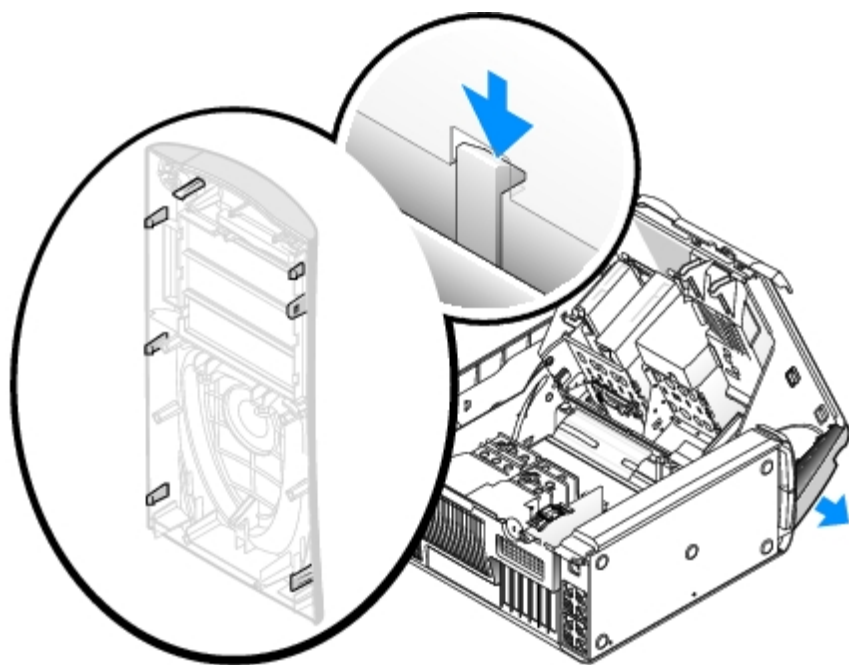
**⚠ CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

## Removing the Front Panel

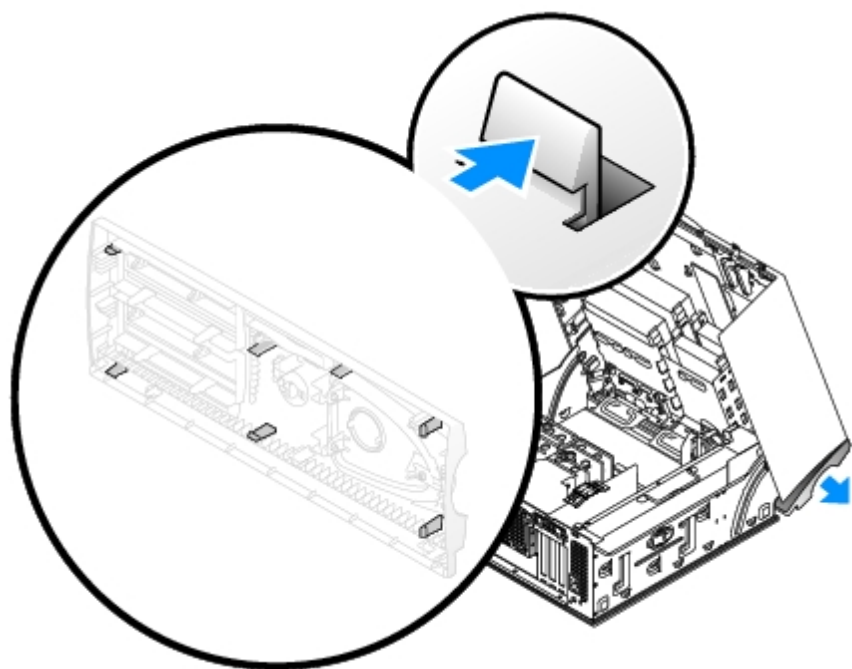
1. Disconnect and remove all drives (for the Dell Precision 670 computer, see "[Drives for the Dell Precision 670 Computer](#)" and for the Dell Precision 470 computer, see "[Drives for the Dell Precision 470 Computer](#)").
2. Release the front panel by pressing each of the front-panel release tabs.

Dell Precision 670 computers and Dell Precision 470 computers each have seven release tabs.

## Dell Precision 670 Computer



### Dell Precision 470 Computer



3. Close the computer cover halfway and pull the front panel away from the computer.

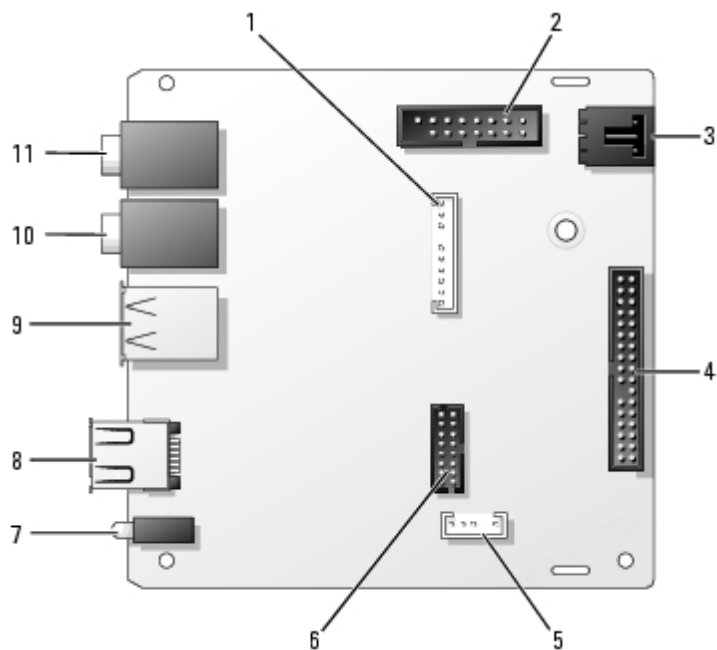
## Replacing the Front Panel

To replace the front panel, perform the removal procedure in reverse.

## I/O Panel

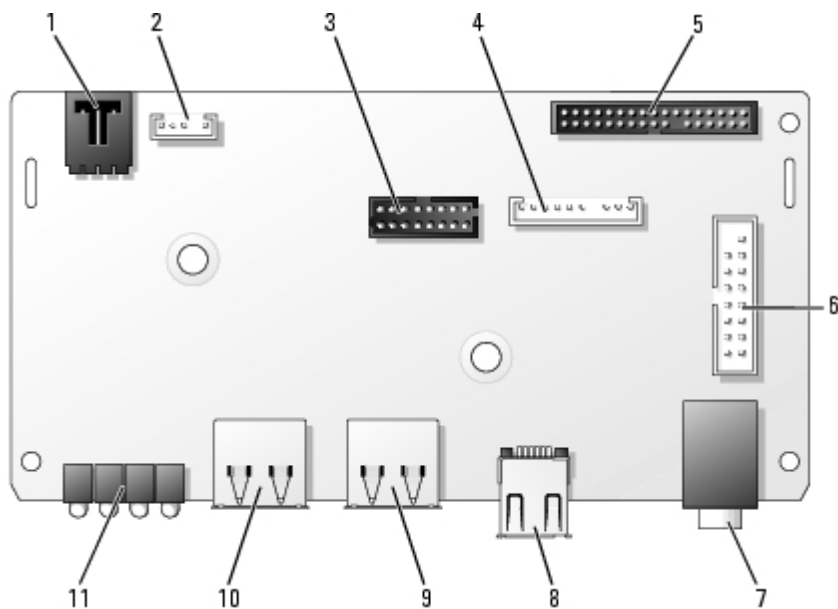
### I/O Panel for the Dell Precision 670 Computer





1	audio connector	7	diagnostic lights (4)
2	control panel connector	8	IEEE 1394a connector
3	chassis-intrusion switch connector	9	USB 2.0 connectors (2)
4	front panel connector	10	microphone connector
5	speaker connector	11	headphone connector
6	front-panel IEEE 1394a connector		

### I/O Panel for the Dell Precision 470 Computer



1	chassis-intrusion switch connector	7	headphone connector
2	external speaker connector	8	IEEE 1394a connector
3	front-panel IEEE 1394a connector	9	USB 2.0 connector
4	audio cable connector	10	USB 2.0 connector
5	front panel connector	11	diagnostic lights (4)

6	control panel connector		
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## Removing the I/O Panel

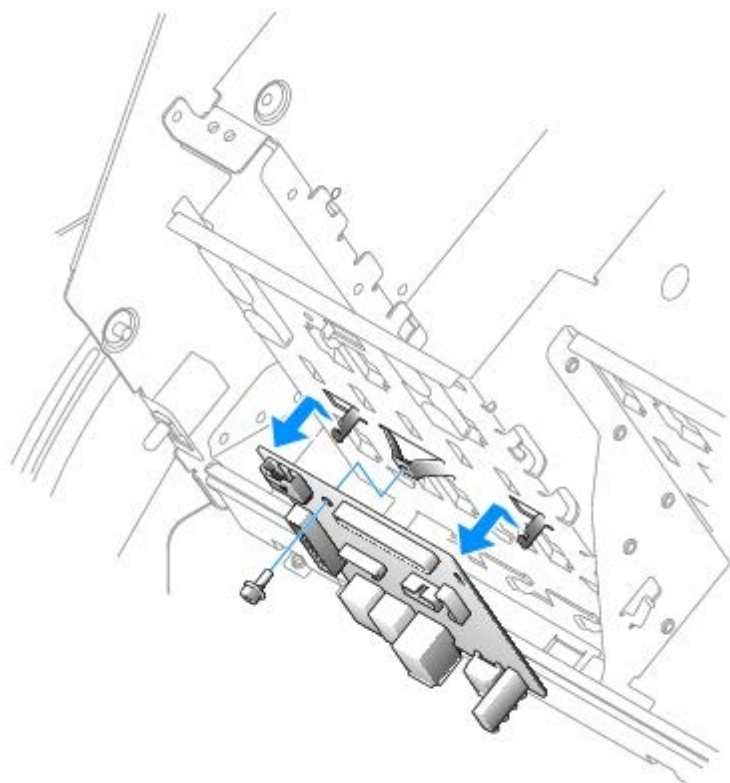
- ⚠ CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.
- ⚠ CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.

1. Follow the procedures in "[Removing and Replacing Parts.](#)"
2. Disconnect all cables that are connected to the I/O panel.

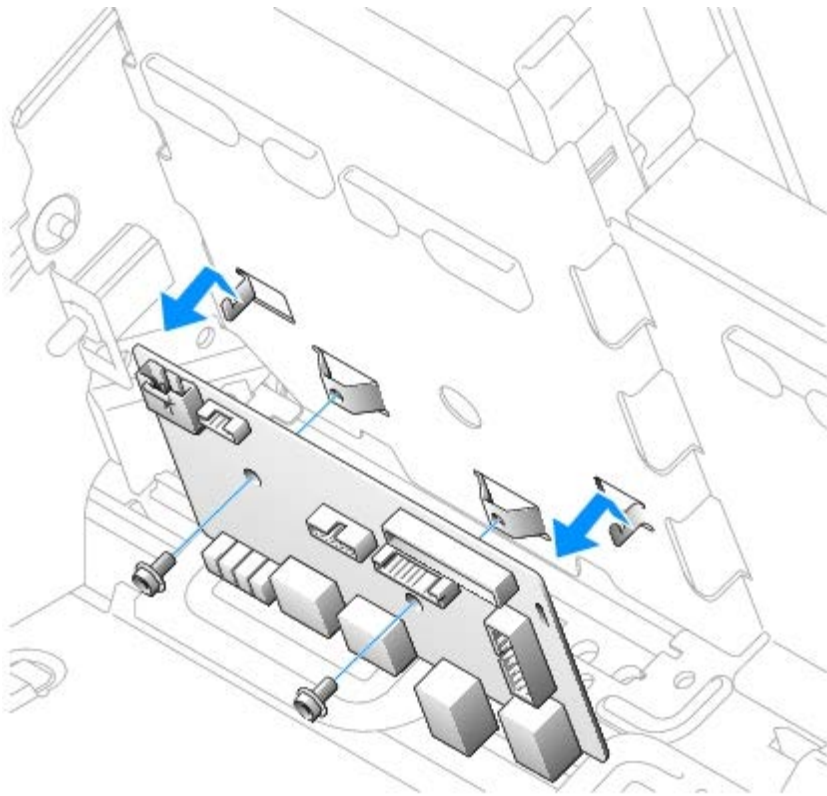
Note the routing of the control panel cable as you remove it from the computer so that you can replace it correctly.

3. From inside the computer cover, remove the mounting screw that secures the I/O panel to the computer.
4. Remove the I/O panel from the computer.

### Dell Precision 670 Computer



### Dell Precision 470 Computer



## Replacing the I/O Panel

To replace the I/O panel, follow the removal procedures in the reverse order.

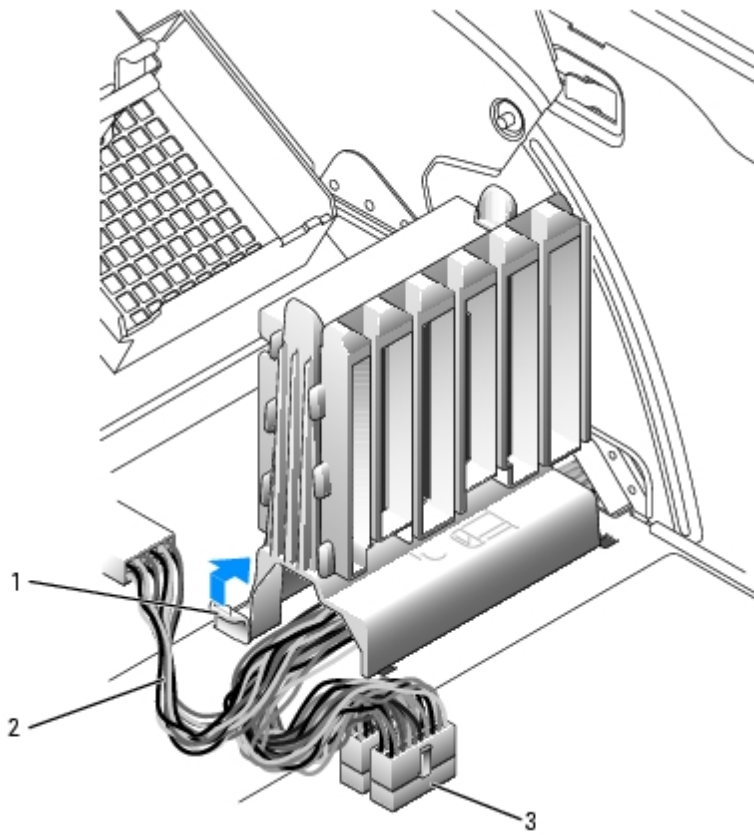
## Power Supply for the Dell Precision 670 Computer

- ⚠ CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.
- ⚠ CAUTION:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

## Removing the Power Supply

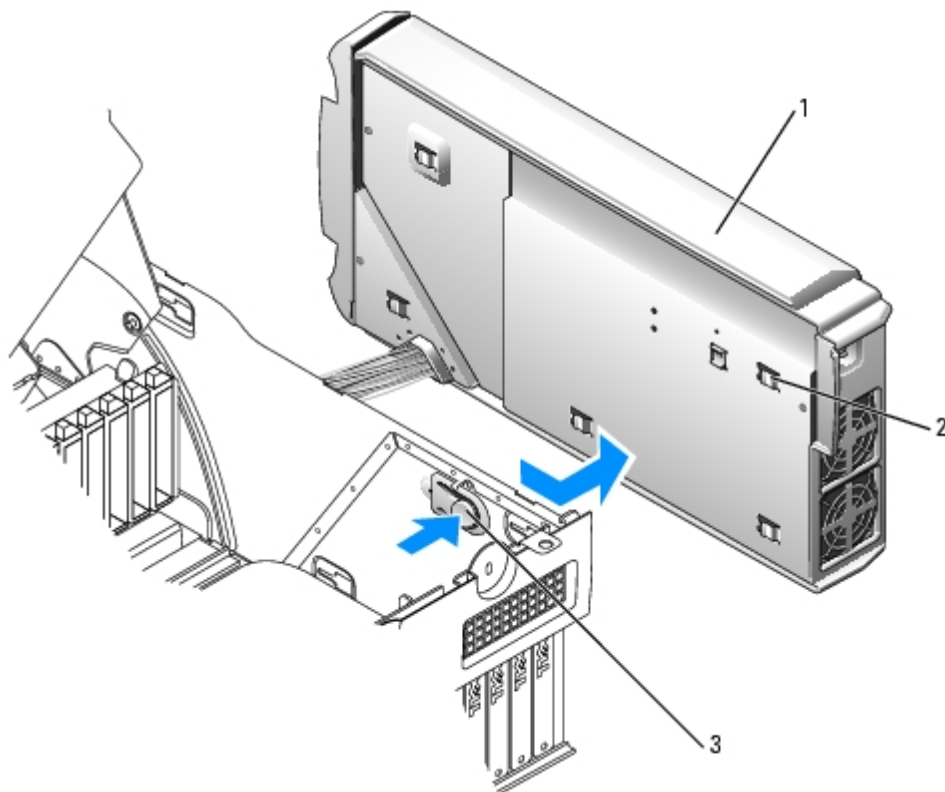
- 🕒 NOTICE:** Before disconnecting a device from the computer, wait 10 to 20 seconds after disconnecting the computer from its electrical outlet. Before removing a component from the system board, verify that the standby power light on the system board has turned off. To locate this light, see "[System Board Components](#)."

1. Follow the procedures in "[Removing and Replacing Parts](#)."
2. Remove the cards.
3. Remove the card guide:
  - a. Pull up on the guide release button.
  - b. Slide the guide to the right.
  - c. Lift the guide out of the four securing slots in the computer.



1	release button
2	power cables
3	system board connector

4. While pressing the power-supply release button, slide the power supply toward the back of the computer.



1	power supply
2	power-supply securing tabs (5)
3	power-supply release button

5. Lift the power supply away from the computer.
6. Slide the power supply cables out of the computer (through the hole).


## Replacing the Power Supply

1. Slide the power supply cables through the hole into the computer.
2. Insert the power-supply securing tabs into the power-supply securing slot on the computer, ensuring that each securing tab is connected to its slot on the computer.
3. Slide the power supply toward the front of the computer.
4. Install the card guide:
  - a. Place the guide into the four securing slots in the computer.
  - b. Slide the guide to the left until it locks into position.
5. Connect the power supply cables.
6. [Close the cover.](#)


## Power Supply for the Dell Precision 470 Computer

**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in

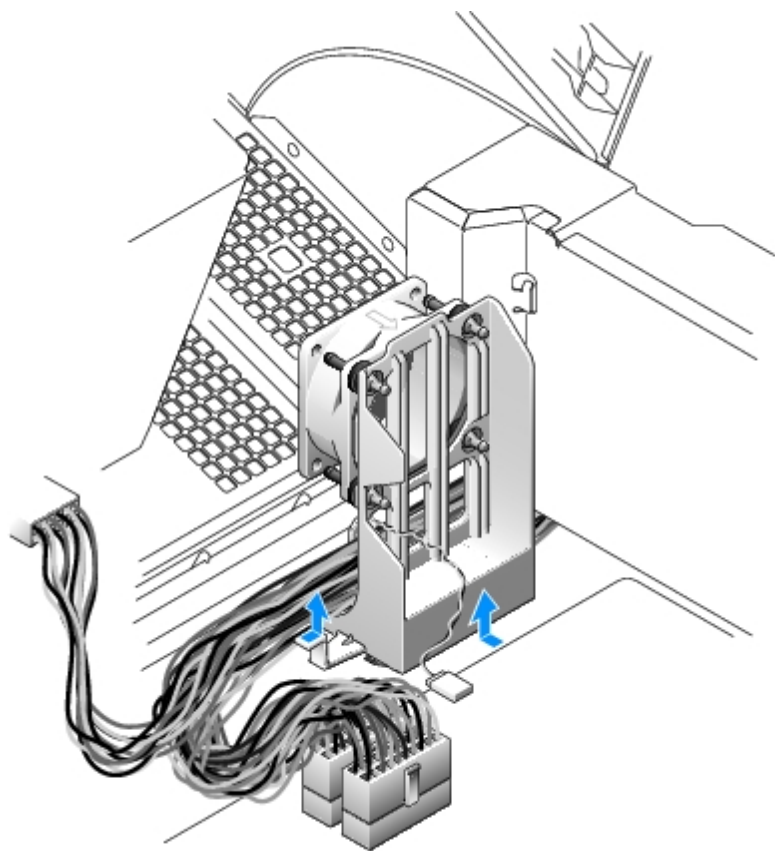
 the *Product Information Guide*.

 **CAUTION:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer chassis.

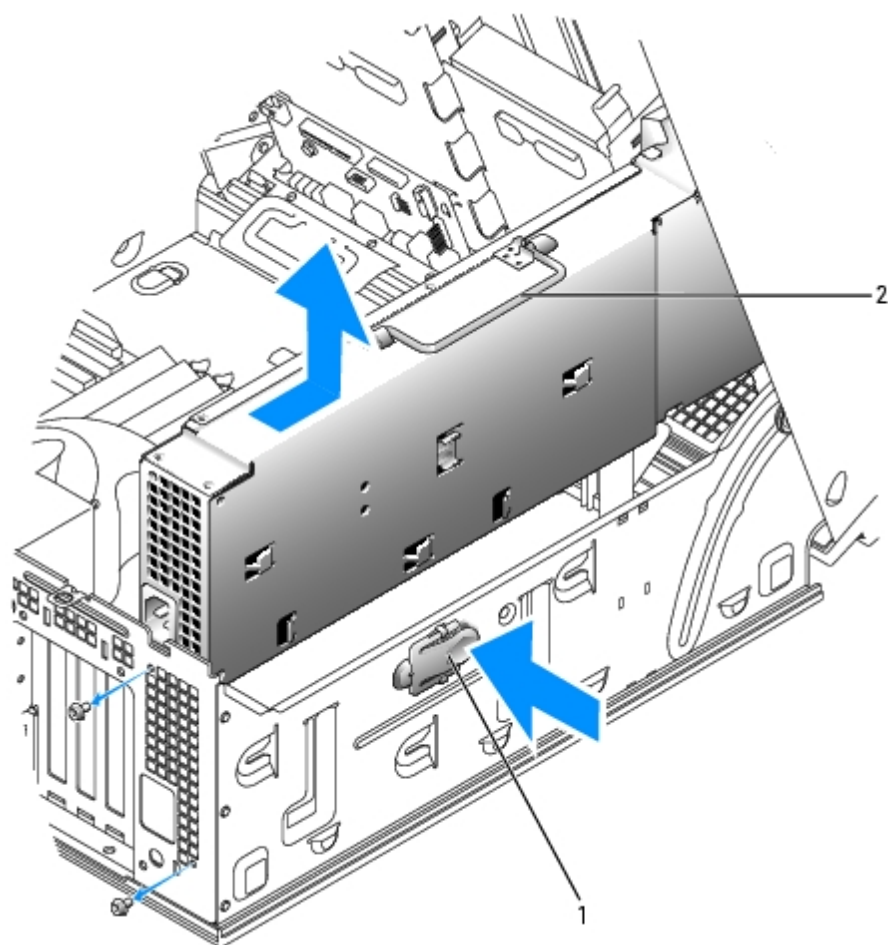
## Removing the Power Supply

 **NOTICE:** Before disconnecting a device from the computer, wait 10 to 20 seconds after disconnecting the computer from its electrical outlet. Before removing a component from the system board, verify that the standby power light on the system board has turned off. To locate this light, see "[System Board Components](#)."

1. Follow the procedures in "[Removing and Replacing Parts](#)."
2. Remove the card guide:
  - a. Pull up on the guide release button.
  - b. Slide the guide to the right.
  - c. Lift the guide out of the four securing slots in the computer.



3. Disconnect the power supply cables from the system board.
4. Lift the handle on the power supply.
5. While pressing the release button, slide the power supply toward the front of the computer.



1	release button
2	power supply handle

6. Lift the power supply away from the computer.

## Replacing the Power Supply

1. Insert the power-supply securing tabs into the power-supply securing slot on the computer, ensuring that each securing tab is connected to its slot on the computer.
2. Slide the power supply toward the back of the computer.
3. Connect the power supply cables.

## System Board

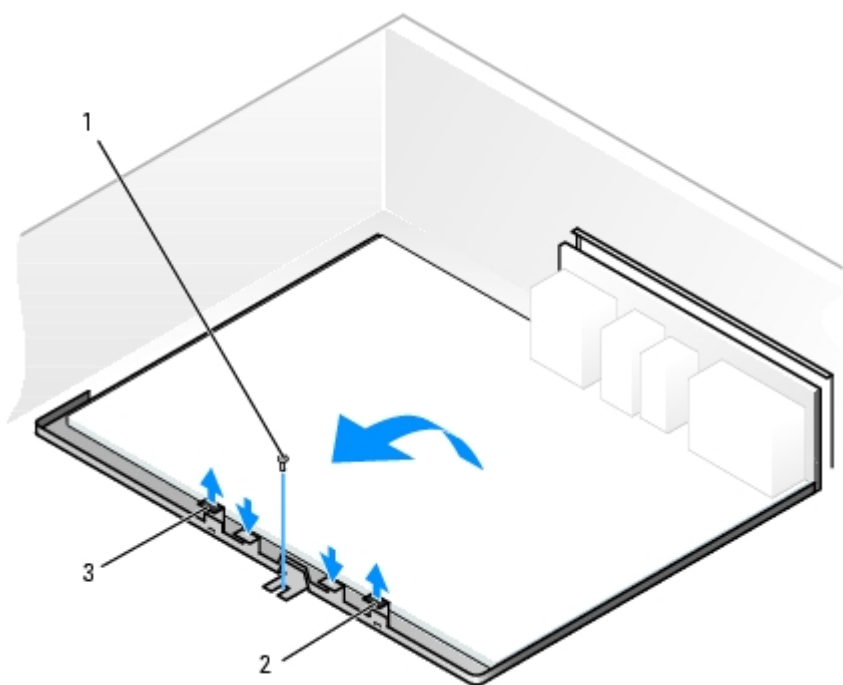
**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

**CAUTION:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer chassis.

**NOTICE:** The system board and metal tray are connected and are removed as one piece.

## Removing the System Board

1. Follow the procedures in "[Removing and Replacing Parts.](#)"
2. Remove any components that restrict access to the system board.
3. Disconnect all cables from the system board.
4. Before you remove the existing system board assembly, visually compare the replacement system board to the existing system board to make sure that you have the correct part.
5. Remove the system board screw.



1	system board screw
2	tab
3	tab

6. Pull up on the two tabs, slide the system board assembly toward the front of the computer, and then lift the assembly up and away.
7. Place the system board assembly that you just removed next to the replacement system board.

## Replacing the System Board


1. Transfer components from the existing system board to the replacement system board:
  - a. Remove the memory modules and install them on the replacement board.

**CAUTION:** The processor package and heat-sink assembly can get hot. To avoid burns, ensure that the package and assembly have had sufficient time to cool before you touch them.


- b. Remove the heat-sink assembly and processor from the existing system board and transfer them to the replacement system board.



2. Configure the settings of the replacement system board.
3. Set the jumpers on the replacement system board so they are identical to the ones on the existing board.

 **NOTE:** Some components and connectors on the replacement system board may be in different locations than the corresponding connectors on the existing system board.

4. Orient the replacement board by aligning the notches on the bottom of the board with the tabs on the computer.
5. Slide the system board assembly toward the back of the computer until the assembly clicks into position.
6. Replace any components and cables that you removed from the system board.
7. Reconnect all cables to their connectors at the back of the computer.
8. [Close the computer cover.](#)

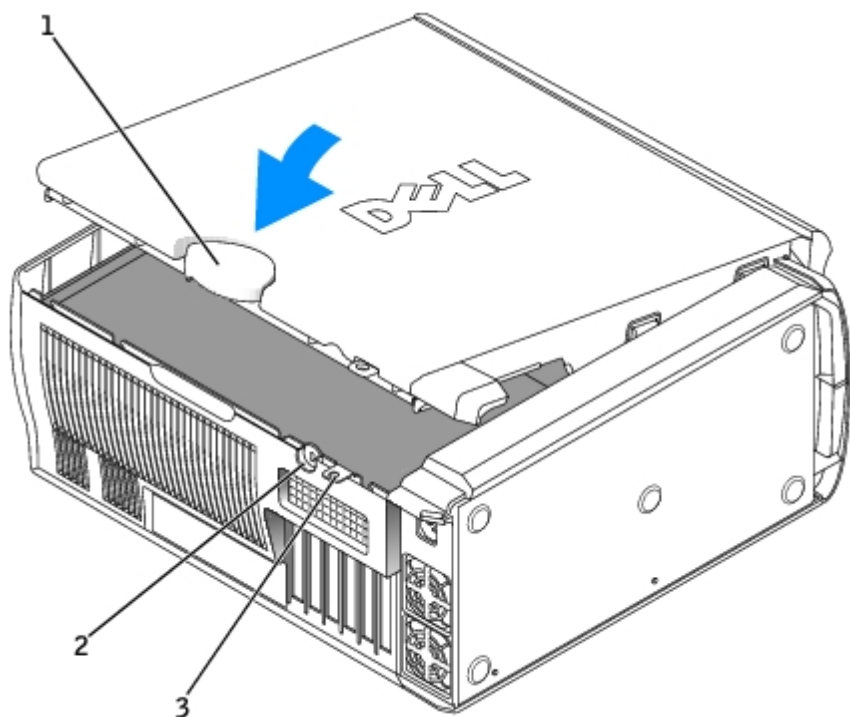
 **NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

9. Connect your computer and devices to electrical outlets, and turn them on.

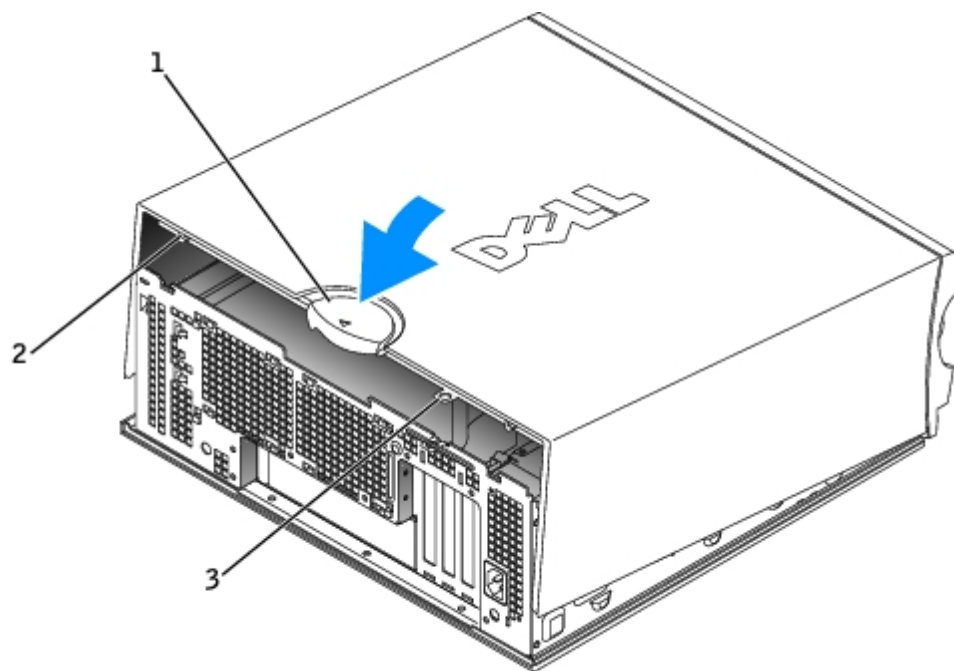
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## Closing the Computer Cover

1. Ensure that all cables are connected, and fold cables out of the way.
2. Ensure that no tools or extra parts are left inside the computer.
3. Pivot the cover down and into position.
4. Press down on the cover to close it.
5. Once the cover is closed, slide the release latch to the right until the latch clicks into place.



1	cover release latch
2	security cable slot
3	padlock ring



1	cover release latch
2	security cable slot
3	padlock ring

6. If you are using a padlock to secure your computer, install the padlock.

**NOTICE:** To connect a network cable, first plug the cable into the network wall jack and then plug it into the computer.

7. Connect your computer and devices to electrical outlets, and turn them on.

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# Tools to Help Solve Problems

## Dell Precision™ Workstation 470 and 670 Computers User's Guide

- [Troubleshooting Tips](#)
- [System Lights](#)
- [Diagnostic Lights](#)
- [Beep Codes](#)
- [Error Messages](#)
- [Dell Diagnostics](#)
- [Drivers](#)
- [Using Microsoft® Windows® XP System Restore](#)
- [Resolving Software and Hardware Incompatibilities](#)
- [Reinstalling Microsoft® Windows® XP](#)

## Troubleshooting Tips

Follow these tips when you troubleshoot your computer:

- If you added or removed a part before the problem started, review the installation procedures and ensure that the part is correctly installed.
- If a peripheral device does not work, ensure that the device is properly connected.
- If an error message appears on the screen, write down the exact message. This message may help technical support personnel diagnose and fix the problem(s).
- If an error message occurs in a program, see the program's documentation.

## System Lights

Your power button light and hard-drive light may indicate a computer problem.

Power Light	Hard-Drive Light	Problem Description	Suggested Resolution
Solid green	N/A	Power is on, and the computer is operating normally.	No corrective action is required.
Blinking green	Blank	The computer is in the suspended state (Microsoft® Windows® XP).	Press the power button, move the mouse, or press a key on the keyboard to wake the computer. See " <a href="#">Power Management</a> ."
Blinks green several times and then turns off	N/A	A configuration error exists.	Check the diagnostic lights to see if the specific problem is identified.
Solid yellow	N/A	The Dell Diagnostics is running a test, or a device on the system board may be faulty or incorrectly installed.	If the Dell Diagnostics is running, allow the testing to complete.  Check the diagnostic lights to see if the specific problem is identified.  If the computer does not boot, <a href="#">contact Dell</a> for technical assistance.
Blinking yellow	Blank	A power supply or system board failure has occurred.	Check the diagnostic lights to see if the specific problem is identified. See " <a href="#">Power Problems</a> ."
Blinking yellow	Solid green	A system board or VRM failure has occurred.	Check the diagnostic lights to see if the specific problem is identified.



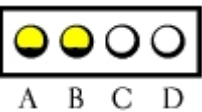
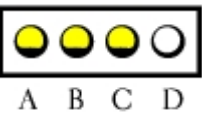

Solid green and a beep code during POST	N/A	A problem was detected while the BIOS was executing.	See " <a href="#">Beep Codes</a> " for instructions on diagnosing the beep code. Also, check the diagnostic lights to see if the specific problem is identified.
Solid green power light and no beep code and no video during POST	N/A	The monitor or the graphics card may be faulty or incorrectly installed.	Check the diagnostic lights to see if the specific problem is identified. See " <a href="#">Video and Monitor Problems</a> ."
Solid green power light and no beep code but the computer locks up during POST	N/A	An integrated system board device may be faulty.	Check the diagnostic lights to see if the specific problem is identified. If the problem is not identified, <a href="#">contact Dell</a> for technical assistance.

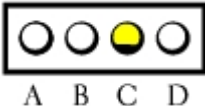
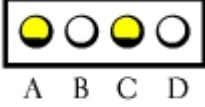

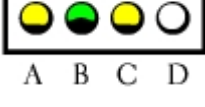
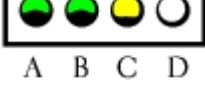



## Diagnostic Lights

**⚠ CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.



To help you troubleshoot a problem, your computer has four lights labeled "A," "B," "C," and "D" on the front panel. The lights can be yellow, green, or off. When the computer starts normally, the lights flash. After the computer starts, all four lights display solid green. If the computer malfunctions, the color and sequence of the lights identify the problem.

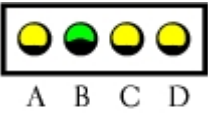


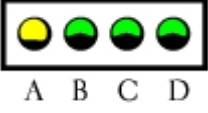
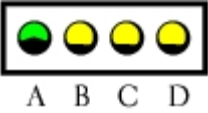
### Diagnostic Light Codes Before POST

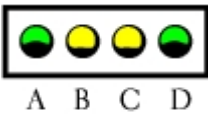
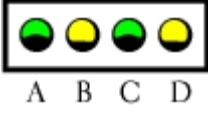
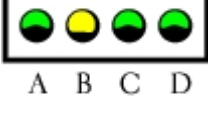
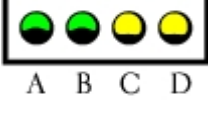
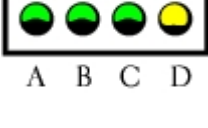
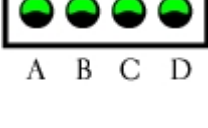

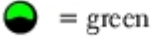
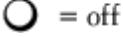
Light Pattern		Problem Description	Suggested Resolution
	off off off off	No electrical power is supplied to the computer.	Connect the computer to an electrical outlet. Ensure that the front-panel power light is on. If the power light is off, ensure that the computer is connected to a working electrical outlet and then press the power button.  If the problem is still not resolved, <a href="#">contact Dell</a> for technical assistance.
	yellow off off off	The computer is in a normal off condition; the computer is connected to an electrical outlet.	Press the power button to turn the computer on.  If the computer does not turn on, ensure that the front-panel power light is on. If the power light is off, ensure that the computer is connected to a working electrical outlet and then press the power button.  If the problem is still not resolved, <a href="#">contact Dell</a> for technical assistance.
	yellow yellow off off	The computer is in a reduced power or "sleep" state.	Use one of the appropriate methods to "wake up" the computer. See " <a href="#">Advanced Features</a> ."  If the problem is not resolved and you are trying to wake the computer with a USB mouse or keyboard, substitute the mouse or keyboard with a working PS/2 mouse or keyboard and then try to wake the computer.
	yellow yellow yellow off	The BIOS is not executing.	Ensure that the processor is seated correctly and restart the computer.  If the problem is still not resolved, <a href="#">contact Dell</a> for technical assistance.
	off yellow off off	A possible power supply or power cable failure has occurred.	Perform the procedure in " <a href="#">Power Problems</a> ."  If the problem is still not resolved, <a href="#">contact Dell</a> for technical assistance.

 A B C D	off off yellow off	A possible system board failure has occurred.	<a href="#">Contact Dell</a> for technical assistance.
 A B C D	yellow off yellow off	A processor and/or VRM mismatch exists.	Perform the procedure in " <a href="#">Processor Problems.</a> "
 A B C D	green yellow yellow off	A possible VRM 0 failure has occurred.	<a href="#">Contact Dell</a> for technical assistance.
 A B C D	yellow green yellow green	A possible VRM 1 failure has occurred.	Perform the procedure in " <a href="#">Processor Problems.</a> "
 A B C D	green green yellow off	A possible VRM 0 and VRM 1 failure has occurred.	<a href="#">Contact Dell</a> for technical assistance.
 = yellow  = green  = off			

### Diagnostic Light Codes During POST

Light Pattern		Problem Description	Suggested Resolution
 A B C D	yellow yellow green yellow	A possible processor failure has occurred.	Reinstall the processor and restart the computer.
 A B C D	yellow yellow green green	Memory modules are detected, but a memory failure has occurred.	<ol style="list-style-type: none"> <li>1. Reseat the memory modules to ensure that your computer is successfully communicating with the memory.</li> <li>2. Restart the computer.</li> <li>3. If the problem still exists, remove all the memory modules and install one memory module in memory module connector 1 (DIMM_1).</li> <li>4. Restart the computer.</li> </ol> <p>The following message appears: Alert! Operating in Debug Mode. Please Populate Memory in Pairs for Normal Operation.</p> <ol style="list-style-type: none"> <li>5. Press &lt;F1&gt; to boot to the operating system.</li> <li>6. Run the <a href="#">Dell Diagnostics</a>.</li> <li>7. If the memory module passes, shut down the computer,</li> </ol>

			<p>remove the memory module, and then repeat the process with the remaining memory modules until a memory error occurs during start-up or diagnostic testing.</p> <p>If the first memory module tested is defective, repeat the process with the remaining modules to ensure that the remaining modules are not defective.</p> <p>8. When the defective memory module is identified, <a href="#">contact Dell</a> for a replacement.</p> <p><b>NOTE:</b> If necessary, the computer can operate in debug mode until new memory modules are installed.</p>
	<p>yellow</p> <p>green</p> <p>yellow</p> <p>yellow</p>	<p>A possible expansion card failure has occurred.</p>	<ol style="list-style-type: none"> <li>1. Determine if a conflict exists by removing a card (not the graphics card) and then restarting the computer.</li> <li>2. If the problem persists, reinstall the card that you removed, remove a different card, and then restart the computer.</li> <li>3. Repeat this process for each card. If the computer starts normally, troubleshoot the last card removed from the computer for resource conflicts (see "<a href="#">Resolving Software and Hardware Incompatibilities</a>").</li> <li>4. If the problem persists, <a href="#">contact Dell</a>.</li> </ol>
	<p>yellow</p> <p>green</p> <p>yellow</p> <p>green</p>	<p>A possible graphics card failure has occurred.</p>	<ul style="list-style-type: none"> <li>• If the computer has a graphics card, remove the card, reinstall it, and then restart the computer.</li> <li>• If the problem still exists, install a graphics card that you know works and restart the computer.</li> <li>• If the problem persists or the computer has integrated graphics, <a href="#">contact Dell</a>.</li> </ul>
	<p>yellow</p> <p>green</p> <p>green</p> <p>yellow</p>	<p>A possible floppy or hard drive failure has occurred.</p>	<p>Reseat all power and data cables and restart the computer.</p>
	<p>yellow</p> <p>green</p> <p>green</p> <p>green</p>	<p>A possible USB failure has occurred.</p>	<p>Reinstall all USB devices, check cable connections, and then restart the computer.</p>
	<p>green</p> <p>yellow</p> <p>yellow</p> <p>yellow</p>	<p>No memory modules are detected.</p>	<ol style="list-style-type: none"> <li>1. Reseat the memory modules to ensure that your computer is successfully communicating with the memory.</li> <li>2. Restart the computer.</li> <li>3. If the problem still exists, remove all the memory modules and install one memory module in memory module connector 1.</li> <li>4. Restart the computer.</li> </ol> <p>The following message appears: Alert! Operating in Debug Mode. Please Populate Memory in Pairs for Normal Operation.</p> <ol style="list-style-type: none"> <li>5. Press &lt;F1&gt; to boot to the operating system.</li> <li>6. Run the <a href="#">Dell Diagnostics</a>.</li> <li>7. If the memory module passes, shut down the computer, remove the memory module, and then repeat the process with the remaining memory modules until a memory error occurs during start-up or diagnostic testing.</li> </ol> <p>If the first memory module tested is defective, repeat the process with the remaining modules to ensure that the remaining modules are not defective.</p> <p>8. When the defective memory module is identified, <a href="#">contact Dell</a></p>

			for a replacement.
			<b>NOTE:</b> If necessary, the computer can operate in debug mode until new memory modules are installed.
	green yellow yellow green	System board failure has occurred.	<a href="#">Contact Dell</a> for technical assistance.
	green yellow green yellow	Memory modules are detected, but a memory configuration or compatibility error exists.	<ul style="list-style-type: none"> <li>• Ensure that no special memory module requirements exist.</li> <li>• Verify that the memory modules that you are installing are compatible with your computer.</li> <li>• Reinstall the memory modules and restart the computer.</li> <li>• If the problem persists, <a href="#">contact Dell</a>.</li> </ul>
	green yellow green green	A possible expansion card failure has occurred.	<ol style="list-style-type: none"> <li>1. Determine if a conflict exists by removing a card (not a graphics card) and restarting the computer.</li> <li>2. If the problem persists, reinstall the card that you removed, remove a different card, and then restart the computer.</li> <li>3. Repeat this process for each card. If the computer starts normally, troubleshoot the last card removed from the computer for resource conflicts (see "<a href="#">Resolving Software and Hardware Incompatibilities</a>").</li> </ol> <p>If the problem persists, <a href="#">contact Dell</a>.</p>
	green green yellow yellow	A possible system board resource and/or hardware failure has occurred.	<p>Perform the procedures in "<a href="#">Resolving Software and Hardware Incompatibilities</a>."</p> <p>If the problem persists, <a href="#">contact Dell</a>.</p>
	green green green yellow	Other failure has occurred.	<ul style="list-style-type: none"> <li>• Ensure that the cables are properly connected to the system board from the hard drive, CD drive, and DVD drive.</li> <li>• If the problem persists, <a href="#">contact Dell</a>.</li> </ul>
	green green green green	The computer is in a normal operating condition after POST.	None.
 = yellow  = green  = off			

## Beep Codes

Your computer might emit a series of beeps during start-up if the monitor cannot display errors or problems. This series of beeps, called a beep code, identifies a problem. One possible beep code (code 1-3-1) consists of one beep, a burst of three beeps, and then one beep. This beep code tells you that the computer encountered a memory problem.

If your computer beeps during start-up:

1. Write down the beep code on the [Diagnostics Checklist](#).
2. Run the [Dell Diagnostics](#) to identify a more serious cause.
3. [Contact Dell](#) for technical assistance.


Code	Cause
1-1-2	Microprocessor register failure
1-1-3	NVRAM read/write failure
1-1-4	ROM BIOS checksum failure
1-2-1	Programmable interval timer failure
1-2-2	DMA initialization failure
1-2-3	DMA page register read/write failure
1-3	Video Memory Test failure
1-3-1 through 2-4-4	Memory not being properly identified or used
3-1-1	Slave DMA register failure
3-1-2	Master DMA register failure
3-1-3	Master interrupt mask register failure
3-1-4	Slave interrupt mask register failure
3-2-2	Interrupt vector loading failure
3-2-4	Keyboard Controller Test failure
3-3-1	NVRAM power loss
3-3-2	Invalid NVRAM configuration
3-3-4	Video Memory Test failure
3-4-1	Screen initialization failure
3-4-2	Screen retrace failure
3-4-3	Search for video ROM failure
4-2-1	No timer tick
4-2-2	Shutdown failure
4-2-3	Gate A20 failure
4-2-4	Unexpected interrupt in protected mode
4-3-1	Memory failure above address 0FFFFh
4-3-3	Timer-chip counter 2 failure
4-3-4	Time-of-day clock stopped
4-4-1	Serial or parallel port test failure
4-4-2	Failure to decompress code to shadowed memory
4-4-3	Math-coprocessor test failure
4-4-4	Cache test failure

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## Error Messages



Fill out the [Diagnostics Checklist](#) as you complete these checks.

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

If the message is not listed, see the documentation for the operating system or the program that was running when the message appeared.

**A filename cannot contain any of the following characters: \ / : \* ? " < > | —** Do not use these characters in filenames.

**A required .DLL file was not found —** The program that you are trying to open is missing an essential file. To remove and then reinstall the program:

1. Click the **Start** button, click **Control Panel**, and then click **Add or Remove Programs**.
2. Select the program you want to remove.
3. Click the **Change or Remove Program** icon.
4. See the program documentation for installation instructions.

**Alert! Card-cage fan failure**

**Alert! chipset heatsink not detected —** The chip set heat sink is not properly installed.

**Alert! CPU 0 Fan Failure —**

**Alert! CPU 1 Fan Failure —**

Ensure that the [cooling fan and airflow shroud](#) are properly installed and working.

**Alert! Error initializing PCI Express slot n (or bridge) —** The computer encountered a problem while trying to configure a PCI Express card.

**Alert! Memory configured incorrectly. Please enter setup for memory info details —** See "[Memory Problems](#)."

**Alert! Memory fan has failed or is not present. A memory fan is required for the current memory configuration. please see the documentation that came with your computer for more information. System halted! —**

See "[Memory](#)."

**Alert! OS Install Mode enabled —**

Amount of available memory is limited to 256 MB.

**Alert! Previous attempts at booting this system have failed at checkpoint [nnnn]. For help in resolving this problem, please note this checkpoint and contact Dell Technical Support —** [Contact Dell](#) and report the checkpoint code (nnnn) to the support technician.

**Alert! Previous Fan Failures —**

**Alert! Previous Processor Thermal Failure —**

**Alert! Previous Shutdown Due to Thermal Event —**

Ensure that nothing is blocking the airflow vents and that all the fans are properly installed and operating correctly. Also, ensure that the processor heat sink is properly installed.

**Alert! Previous Voltage Failure** — See "[Power Problems](#)."

**Alert! System Battery Voltage is Low** — Replace the battery.

**Alert! Uncorrectable Memory Error Previously Detected... Address xxxxxxxxh, Device DIMM\_Y** — See "[Memory Problems](#)."

**Attachment failed to respond** — See "[Drive Problems](#)."

**Bad command or file name** — Ensure that you spelled the command correctly, put spaces in the proper place, and used the correct path name.

**Bad error-correction code (ECC) on disk read** — See "[Drive Problems](#)."

**bb/dd/f: Error allocating IRQ for PCI Device** —

**bb/dd/f: Error allocating I/O Bar for PCI Device** —

**bb/dd/f: Error allocating Mem BAR for PCI Device** —

**bb/dd/f: Error allocating PMem BAR for PCI Device** —

**bb/dd/f: Error allocating Upper Memory Block for PCI Device** —

where **bb** is the bus number, **dd** is the device number, and **f** is the function number. All numbers are in hexadecimal —

The computer encountered a problem while trying to configure an expansion card or integrated LegacySelect device.

If the device number points to an expansion card, the card can be removed. If the device number points to an integrated device, disable the device in [system setup](#).

**Controller has failed** — See "[Drive Problems](#)"

**Data error** — See "[Drive Problems](#)."

**Decreasing available memory** — See "[Memory Problems](#)."

**Diskette drive 0 seek failure** — See "[Drive Problems](#)."

**Diskette read failure** — See "[Drive Problems](#)."

**Diskette subsystem reset failed** — Run the [Dell Diagnostics](#).

**Diskette write protected** — Slide the write-protect notch to the open position.

**Drive not ready** — Put a floppy disk in the drive.

**Error: Memory configured incorrectly** — See "[Memory Overview](#)" for memory installation guidelines.

**Gate A20 failure** — See "[Lockups and Software Problems](#)."

**Hard-disk configuration error** —

**Hard-disk controller failure** —

**Hard-disk drive failure** —

**Hard-disk drive failure** —

See "[Drive Problems](#)."

**Insert bootable media** — Insert a bootable floppy disk or CD.

**Invalid configuration information - please run SETUP program** — [Enter system setup](#) and correct the computer configuration information.

**Keyboard failure** — See "[Keyboard Problems](#)."

**Memory address line failure at address, read value expecting value** — See "[Lockups and Software Problems](#)."

**Memory allocation error** —

1. Turn off the computer, wait 30 seconds, and then restart the computer.
2. Try to run the program again.
3. If the error message appears again, see the software documentation for additional troubleshooting suggestions.

**Memory data line failure at address, read value expecting value** —

**Memory double word logic failure at address, read value expecting value** —

**Memory odd/even logic failure at address, read value expecting value** —

**Memory write/read failure at address, read value expecting value** —

**Memory size in CMOS invalid** —

See "[Memory Problems](#)."

**No boot device available** —

- If the floppy drive is your boot device, ensure that a bootable floppy disk is in the drive.
- If the hard drive is your boot device, ensure that the cables are connected and that the drive is installed properly and partitioned as a boot device.
- [Enter system setup](#) and ensure that the boot sequence information is correct.

**No boot sector on hard-disk drive** — [Enter system setup](#) and ensure that the computer configuration information for the hard drive is correct.

If the message continues to appear after you ensure that the information in system setup is correct, see your operating system documentation for reinstallation information.

**No timer tick interrupt** — Run the [Dell Diagnostics](#).

**Non-system disk or disk error** — Replace the floppy disk with one that has a bootable operating system or remove the floppy disk from drive A and restart the computer.

**Not a boot diskette** — Insert a bootable floppy disk and restart your computer.

**Not enough memory or resources. Close some programs and try again** — Close all windows and open the program that you want to use. In some cases, you might have to restart your computer to restore computer resources. If so, run the program that you want to use first.

**Operating system not found** — [Contact Dell](#).

**Power Supply fan failure** —

**Read fault** —

**Requested sector not found** —

**Reset failed** —

See "[Drive Problems](#)."

**Sector not found** —

- Run the Windows error-checking utility to check the file structure on the floppy disk or hard drive. See the "[Windows Help and Support Center](#)" for instructions.
- If a large number of sectors are defective, back up the data (if possible), and then reformat the floppy disk or hard drive.

**Seek error** — See "[Drive Problems](#)."

**Shutdown failure** — Run the [Dell Diagnostics](#).

**Time-of-day clock stopped** —

**Time-of-day not set** —

[Enter system setup](#) and correct the date or time. If the problem persists, replace the battery.

**Timer chip counter 2 failed** — Run the [Dell Diagnostics](#).

**Unexpected interrupt in protected mode** — Run the [Dell Diagnostics](#).

**NOTICE: The [primary/secondary/primary serial] IDE [master/slave] hard drive SELF MONITORING SYSTEM has reported that a parameter has exceeded its normal operating range. Dell recommends that you back up your data regularly. A parameter out of range may or may not indicate a potential hard drive problem** —

If no replacement drive is immediately available and the drive is not the only bootable drive, [enter system setup](#) and change the appropriate drive setting to **None**. Then remove the drive from the computer.


**Write fault** —

### Write fault on selected drive —

See "[Drive Problems](#)."

x:\ is not accessible. The device is not ready — The floppy drive cannot read the disk. Insert a floppy disk into the drive and try again.


## Dell Diagnostics

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

### When to Use the Dell Diagnostics

If you experience a problem with your computer, perform the checks in "[Solving Problems](#)" and run the Dell Diagnostics before you contact Dell for technical assistance.

It is recommended that you print these procedures before you begin.


 **NOTICE:** The Dell Diagnostics works only on Dell™ computers.

[Enter system setup](#), review your computer's configuration information, and then ensure that the device you want to test displays in system setup and is active.

Start the Dell Diagnostics from either your hard drive or from the *Drivers and Utilities* CD (also known as the ResourceCD).

### Starting the Dell Diagnostics From Your Hard Drive

1. Turn on (or restart) your computer.
2. When the DELL™ logo appears, press <F12> immediately.

 **NOTE:** If you see a message stating that no diagnostics utility partition has been found, run the [Dell Diagnostics](#) from your *Drivers and Utilities* CD.

If you wait too long and the operating system logo appears, continue to wait until you see the Microsoft® Windows® desktop. Then shut down your computer and try again.


3. When the boot device list appears, highlight **Boot to Utility Partition** and press <Enter>.
4. When the Dell Diagnostics **Main Menu** appears, select the test you want to run.

### Starting the Dell Diagnostics From the Drivers and Utilities CD

1. Insert the *Drivers and Utilities* CD.
2. Shut down and restart the computer.

When the DELL logo appears, press <F12> immediately.

If you wait too long and the Windows logo appears, continue to wait until you see the Windows desktop. Then shut down your computer and try again.

 **NOTE:** The next steps change the boot sequence for one time only. On the next start-up, the computer boots according to the devices specified in system setup.

3. When the boot device list appears, highlight **IDE CD-ROM Device** and press <Enter>.
4. Select the **IDE CD-ROM Device** option from the CD boot menu.
5. Select the **Boot from CD-ROM** option from the menu that appears.
6. Type 1 to start the ResourceCD menu.
7. Type 2 to start the Dell Diagnostics.
8. Select **Run the 32 Bit Dell Diagnostics** from the numbered list. If multiple versions are listed, select the version appropriate for your computer.
9. When the Dell Diagnostics **Main Menu** appears, select the test you want to run.


## Dell Diagnostics Main Menu

1. After the Dell Diagnostics loads and the **Main Menu** screen appears, click the button for the option you want.

Option	Function
Express Test	Performs a quick test of devices. This test typically takes 10 to 20 minutes and requires no interaction on your part. Run <b>Express Test</b> first to increase the possibility of tracing the problem quickly.
Extended Test	Performs a thorough check of devices. This test typically takes an hour or more and requires you to answer questions periodically.
Custom Test	Tests a specific device. You can customize the tests you want to run.
Symptom Tree	Lists the most common symptoms encountered and allows you to select a test based on the symptom of the problem you are having.

2. If a problem is encountered during a test, a message appears with an error code and a description of the problem. Write down the error code and problem description and follow the instructions on the screen.

If you cannot resolve the error condition, [contact Dell](#).

 **NOTE:** The Service Tag for your computer is located at the top of each test screen. If you contact Dell, technical support will ask for your Service Tag.

3. If you run a test from the **Custom Test** or **Symptom Tree** option, click the applicable tab described in the following table for more information.

Tab	Function
Results	Displays the results of the test and any error conditions encountered.
Errors	Displays error conditions encountered, error codes, and the problem description.
Help	Describes the test and may indicate requirements for running the test.
Configuration	Displays your hardware configuration for the selected device.  The Dell Diagnostics obtains configuration information for all devices from system setup, memory, and various internal tests, and it displays the information in the device list in the left pane of the screen. The device list may not display the names of all the components installed on your computer or all devices attached to your computer.

Parameters	Allows you to customize the test by changing the test settings.
------------	---

4. When the tests are completed, if you are running the Dell Diagnostics from the *Drivers and Utilities* CD, remove the CD.
5. Close the test screen to return to the **Main Menu** screen. To exit the Dell Diagnostics and restart the computer, close the **Main Menu** screen.

---


## Drivers

### What Is a Driver?

A driver is a program that controls a device such as a printer, mouse, or keyboard. All devices require a driver program.

A driver acts like a translator between the device and any other programs that use the device. Each device has its own set of specialized commands that only its driver recognizes.

Dell ships your computer to you with required drivers already installed—no further installation or configuration is needed.

 **NOTICE:** The *Drivers and Utilities* CD may contain drivers for operating systems that are not on your computer. Ensure that you are installing software appropriate for your operating system.

Many drivers, such as the keyboard driver, come with your Microsoft® Windows® operating system. You may need to install drivers if you:

- Upgrade your operating system.
- Reinstall your operating system.
- Connect or install a new device.

### Identifying Drivers


If you experience a problem with any device, identify whether the driver is the source of your problem and, if necessary, update the driver.

### Windows XP

1. Click the **Start** button and click **Control Panel**.
2. Under **Pick a Category**, click **Performance and Maintenance**.
3. Click **System**.
4. In the **System Properties** window, click the **Hardware** tab.
5. Click **Device Manager**.
6. Scroll down the list to see if any device has an exclamation point (a yellow circle with a [!]) on the device icon.

If an exclamation point is next to the device name, you may need to reinstall the driver or install a new driver.

### Reinstalling Drivers and Utilities

 **NOTICE:** The Dell Support website at [support.dell.com](http://support.dell.com) and your *Drivers and Utilities* CD provide approved drivers for Dell™ computers. If you install drivers obtained from other sources, your computer might not work correctly.

## Using Windows XP Device Driver Rollback

If a problem occurs on your computer after you install or update a driver, use Windows XP Device Driver Rollback to replace the driver with the previously installed version.

1. Click the **Start** button and click **Control Panel**.
2. Under **Pick a Category**, click **Performance and Maintenance**.
3. Click **System**.
4. In the **System Properties** window, click the **Hardware** tab.
5. Click **Device Manager**.
6. Right-click the device for which the new driver was installed and click **Properties**.
7. Click the **Drivers** tab.
8. Click **Roll Back Driver**.

If Device Driver Rollback does not resolve the problem, then use [System Restore](#) to return your computer to the operating state that existed before you installed the new driver.

## Using the Drivers and Utilities CD

If using Device Driver Rollback or [System Restore](#) does not resolve the problem, then reinstall the driver from the *Drivers and Utilities* CD (also known as the ResourceCD).

## Manually Reinstalling Drivers

1. After extracting the driver files to your hard drive as described in the previous section, click the **Start** button and right-click **My Computer**.
2. Click **Properties**.
3. Click the **Hardware** tab and click **Device Manager**.
4. Double-click the type of device for which you are installing the driver.
5. Double-click the name of the device for which you are installing the driver.
6. Click the **Driver** tab and click **Update Driver**.
7. Click **Install from a list or specific location (Advanced)** and click **Next**.
8. Click **Browse** and browse to the location to which you previously extracted the driver files.
9. When the name of the appropriate driver appears, click **Next**.
10. Click **Finish** and restart your computer.


---

## Using Microsoft® Windows® XP System Restore

The Microsoft® Windows® XP operating system provides System Restore to allow you to return your computer to an earlier




operating state (without affecting data files) if changes to the hardware, software, or other system settings have left the computer in an undesirable operating state. See the "[Windows Help and Support Center](#)" for information on using System Restore.

 **NOTICE:** Make regular backups of your data files. System Restore does not monitor your data files or recover them.

## Creating a Restore Point

1. Click the **Start** button and click **Help and Support**.
2. Click **System Restore**.
3. Follow the instructions on the screen.

## Restoring the Computer to an Earlier Operating State

 **NOTICE:** Before you restore the computer to an earlier operating state, save and close any open files and exit any open programs. Do not alter, open, or delete any files or programs until the system restoration is complete.

1. Click the **Start** button, point to **All Programs® Accessories® System Tools**, and then click **System Restore**.
2. Ensure that **Restore my computer to an earlier time** is selected and click **Next**.
3. Click a calendar date to which you want to restore your computer.

The **Select a Restore Point** screen provides a calendar that allows you to see and select restore points. All calendar dates with available restore points appear in boldface type.

4. Select a restore point and click **Next**.

If a calendar date has only one restore point, then that restore point is automatically selected. If two or more restore points are available, click the restore point that you prefer.


5. Click **Next**.

The **Restoration Complete** screen appears after System Restore finishes collecting data and then the computer restarts.

6. After the computer restarts, click **OK**.

To change the restore point, you can either repeat the steps using a different restore point, or you can undo the restoration.

## Undoing the Last System Restore

 **NOTICE:** Before you undo the last system restore, save and close all open files and exit any open programs. Do not alter, open, or delete any files or programs until the system restoration is complete.

1. Click the **Start** button, point to **All Programs® Accessories® System Tools**, and then click **System Restore**.
2. Click **Undo my last restoration** and click **Next**.
3. Click **Next**.

The **System Restore** screen appears and the computer restarts.

4. After the computer restarts, click **OK**.

## Enabling System Restore

If you reinstall Windows XP with less than 200 MB of free hard-disk space available, System Restore is automatically disabled. To see if System Restore is enabled:

1. Click the **Start** button and click **Control Panel**.
  2. Click **Performance and Maintenance**.
  3. Click **System**.
  4. Click the **System Restore** tab.
  5. Ensure that **Turn off System Restore** is unchecked.
- 

## Resolving Software and Hardware Incompatibilities

If a device is either not detected during the operating system setup or is detected but incorrectly configured, you can use the Hardware Troubleshooter to resolve the incompatibility. In the Microsoft® Windows® 2000 operating system, you can also use Device Manager to resolve incompatibilities.

### Windows XP

To resolve incompatibilities using the Hardware Troubleshooter:

1. Click the **Start** button and click **Help and Support**.
2. Type `hardware troubleshooter` in the **Search** field and click the arrow to start the search.
3. Click **Hardware Troubleshooter** in the **Search Results** list.
4. In the **Hardware Troubleshooter** list, click **I need to resolve a hardware conflict on my computer**, and click **Next**.

### Windows 2000

To resolve incompatibilities using Device Manager:

1. Click the **Start** button, point to **Settings**, and then click **Control Panel**.
2. In the **Control Panel** window, double-click **System**.
3. Click the **Hardware** tab.
4. Click **Device Manager**.
5. Click **View** and click **Resources by connection**.
6. Double-click **Interrupt request (IRQ)**.

Incorrectly configured devices are indicated by a yellow exclamation point (!) or a red x if the device has been disabled.

7. Double-click any device marked with an exclamation point to display the **Properties** window.

The **Device** status area in the **Properties** window reports the cards or devices that need to be reconfigured.

8. Reconfigure the devices or remove the devices from the Device Manager. See the documentation that came with the device for information on configuring the device.


To resolve incompatibilities using the Hardware Troubleshooter:

1. Click the **Start** button and click **Help**.
2. Click **Troubleshooting and Maintenance** on the **Contents** tab, click **Windows 2000 troubleshooters**, and then click **Hardware**.
3. In the **Hardware Troubleshooter** list, click **I need to resolve a hardware conflict on my computer** and click **Next**.

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## Reinstalling Microsoft® Windows® XP

 **NOTICE:** You must use Windows XP Service Pack 1 or later when you reinstall Windows XP.

 **NOTE:** Desktop System Software (DSS) is a utility that provides updates and patches for your operating system. Use this utility if you installed a unique image on your computer or if you had to reinstall your operating system. DSS is available on your *Drivers and Utilities* CD and at [support.dell.com](http://support.dell.com).


### Before You Begin

If you are considering reinstalling the Windows XP operating system to correct a problem with a newly installed driver, first try using Windows XP [Device Driver Rollback](#). If Device Driver Rollback does not resolve the problem, then use [System Restore](#) to return your operating system to the operating state it was in before you installed the new device driver.

 **NOTICE:** Before performing the installation, back up all data files on your primary hard drive. For conventional hard drive configurations, the primary hard drive is the first drive detected by the computer.

To reinstall Windows XP, you need the following items:


- Dell™ *Operating System* CD
- Dell *Drivers and Utilities* CD


 **NOTE:** The *Drivers and Utilities* CD contains drivers that were installed during assembly of the computer. Use the *Drivers and Utilities* CD to load any required drivers, including the drivers required if your computer has a RAID controller.

### Reinstalling Windows XP

To reinstall Windows XP, perform all the steps in the following sections in the order in which they are listed.

The reinstallation process can take 1 to 2 hours to complete. After you reinstall the operating system, you must also reinstall the device drivers, virus protection program, and other software.

 **NOTICE:** The *Operating System* CD provides options for reinstalling Windows XP. The options can overwrite files and possibly affect programs installed on your hard drive. Therefore, do not reinstall Windows XP unless a Dell technical support representative instructs you to do so.

 **NOTICE:** To prevent conflicts with Windows XP, disable any virus protection software installed on your computer before you reinstall Windows XP. See the documentation that came with the software for instructions.

### Booting From the Operating System CD

1. Save and close any open files and exit any open programs.
2. Insert the *Operating System* CD. Click **Exit** if `Install Windows XP` message appears.
3. Restart the computer.
4. Press <F12> immediately after the DELL™ logo appears.

If the operating system logo appears, wait until you see the Windows desktop, and then shut down the computer and try again.

5. Press the arrow keys to select **CD-ROM**, and press <Enter>.
6. When the `Press any key to boot from CD` message appears, press any key.

## Windows XP Setup

1. When the **Windows XP Setup** screen appears, press <Enter> to select **To set up Windows now**.
2. Read the information on the **Microsoft Windows Licensing Agreement** screen, and press <F8> to accept the license agreement.
3. If your computer already has Windows XP installed and you want to recover your current Windows XP data, type `r` to select the repair option, and remove the CD.
4. If you want to install a new copy of Windows XP, press <Esc> to select that option.
5. Press <Enter> to select the highlighted partition (recommended), and follow the instructions on the screen.

The **Windows XP Setup** screen appears, and the operating system begins to copy files and install the devices. The computer automatically restarts multiple times.



**NOTE:** The time required to complete the setup depends on the size of the hard drive and the speed of your computer.



**NOTICE:** Do not press any key when the following message appears: `Press any key to boot from the CD`.

6. When the **Regional and Language Options** screen appears, select the settings for your location and click **Next**.
7. Enter your name and organization (optional) in the **Personalize Your Software** screen, and click **Next**.
8. At the **Computer Name and Administrator Password** window, enter a name for your computer (or accept the one provided) and a password, and click **Next**.
9. If the **Modem Dialing Information** screen appears, enter the requested information and click **Next**.
10. Enter the date, time, and time zone in the **Date and Time Settings** window, and click **Next**.
11. If the **Networking Settings** screen appears, click **Typical** and click **Next**.
12. If you are reinstalling Windows XP Professional and you are prompted to provide further information regarding your network configuration, enter your selections. If you are unsure of your settings, accept the default selections.

Windows XP installs the operating system components and configures the computer. The computer automatically restarts.



**NOTICE:** Do not press any key when the following message appears: `Press any key to boot from the CD`.

13. When the **Welcome to Microsoft** screen appears, click **Next**.
14. When the `How will this computer connect to the Internet?` message appears, click **Skip**.

15. When the **Ready to register with Microsoft?** screen appears, select **No, not at this time** and click **Next**.
16. When the **Who will use this computer?** screen appears, you can enter up to five users.
17. Click **Next**.
18. Click **Finish** to complete the setup, and remove the CD.
19. [Reinstall the appropriate drivers](#) with the *Drivers and Utilities* CD.
20. Reinstall your virus protection software.
21. Reinstall your programs.



**NOTE:** To reinstall and activate your Microsoft Office or Microsoft Works Suite programs, you need the Product Key number located on the back of the Microsoft Office or Microsoft Works Suite CD sleeve.

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# Solving Problems

## Dell Precision™ Workstation 470 and 670 Computers User's Guide


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- [Processor Problems](#)
- [Serial or Parallel Device Problems](#)
- [Sound and Speaker Problems](#)
- [Video and Monitor Problems](#)

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## Battery Problems

Fill out the [Diagnostics Checklist](#) as you complete these checks.

 **CAUTION:** There is a danger of a new battery exploding if it is incorrectly installed. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.


 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

**Replace the battery** — If you have to repeatedly reset time and date information after turning on the computer, or if an incorrect time or date displays during start-up, replace the battery. If the battery still does not work properly, [contact Dell](#).

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## Card Problems

Fill out the [Diagnostics Checklist](#) as you complete these checks.

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

**Check the card seating and cable** —

1. Turn off the computer and devices, disconnect them from their electrical outlets, wait 10 to 20 seconds, and then [open the computer cover](#).
2. Ensure that each card is firmly seated in its connector. Reseat any loose cards.
3. Ensure that all cables are firmly connected to their corresponding connectors on the cards. If any cables appear loose, reconnect them.

For instructions on which cables should be attached to specific connectors on a card, see the card's documentation.

4. [Close the computer cover](#), reconnect the computer and devices to electrical outlets, and then turn them on.

**Test the graphics card —**

1. Turn off the computer and devices, disconnect them from their electrical outlets, wait 10 to 20 seconds, and then open the computer cover.
2. Remove all cards except the graphics card.

If your primary hard drive is connected to a drive controller card and not to one of the system board IDE connectors, leave the drive controller card installed in the computer.

3. [Close the computer cover](#), reconnect the computer and devices to electrical outlets, and then turn them on.
4. Run the [Dell Diagnostics](#).

**Test the cards —**

1. Turn off the computer and devices, disconnect them from their electrical outlets, wait 10 to 20 seconds, and then open the computer cover.
2. Reinstall one of the cards that you removed previously.
3. [Close the computer cover](#), reconnect the computer and devices to electrical outlets, and then turn them on.
4. Run the [Dell Diagnostics](#).

If any of the tests fail, the card you just reinstalled is faulty and needs to be replaced.


5. Repeat this process until you have reinstalled all cards.

## Clearing NVRAM and Restoring Default Settings

**Clear the computer's non-volatile random access memory (NVRAM) and restore the computer's system settings to their default values —**

1. Turn on or restart your computer.
2. When Press <F2> to Enter Setup appears in the upper-right corner of the screen, press <F2> immediately.
3. If you wait too long and the Microsoft® Windows® logo appears, continue to wait until you see the Windows desktop. Then shut down your computer through the **Start** menu and try again.
4. Under the **Maintenance** tab, highlight **Load Default**, press <Enter>, select **Continue**, and then press <Enter> again to restore the defaults.
5. Press <Esc> to save the default settings and exit system setup.

## Drive Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

Fill out the [Diagnostics Checklist](#) as you complete these checks.

**Ensure that Microsoft® Windows® recognizes the drive —** Click the **Start** button and click **My Computer**. If the floppy, CD, or DVD drive, is not listed, perform a full scan with your antivirus software to check for and remove viruses. Viruses can sometimes prevent Windows from recognizing the drive.

**Test the drive —**

- Insert another floppy disk, CD, or DVD to eliminate the possibility that the original one is defective.
- Insert a bootable floppy disk and restart the computer.


**Clean the drive or disk** — See "[Cleaning Your Computer](#)."

**Check the cable connections**

**[Check for software and hardware incompatibilities](#)**

**Run the [Dell Diagnostics](#)**

## CD and DVD drive problems

 **NOTE:** High-speed CD or DVD drive vibration is normal and may cause noise, which does not indicate a defect in the drive or the CD or DVD.

 **NOTE:** Because of different regions worldwide and different disc formats, not all DVD titles work in all DVD drives.

**Adjust the Windows volume control** —

- Click the speaker icon in the lower-right corner of your screen.
- Ensure that the volume is turned up by clicking the slide bar and dragging it up.
- Ensure that the sound is not muted by clicking any boxes that are checked.

**Check the speakers and subwoofer** — See "[Sound and Speaker Problems](#)."

## Problems writing to a CD/DVD-RW drive

**Close other programs** — The CD/DVD-RW drive must receive a steady stream of data when writing. If the stream is interrupted, an error occurs. Try closing all programs before you write to the CD/DVD-RW.

**Turn off Standby mode in Windows before writing to a CD/DVD-RW disc** — See your computer documentation for information on [power management modes](#).

## Hard drive problems

**Running the Dell IDE Hard Drive Diagnostics** —

The Dell IDE Hard Drive Diagnostics is a utility that tests the hard drive to troubleshoot or confirm a hard drive failure.

1. Turn on your computer (if your computer is already on, restart it).
2. When **F2 = Setup** appears in the upper-right corner of the screen, press <Ctrl><Alt><d>.
3. Follow the instructions on the screen.

**Run Check Disk** —

*Windows XP*



1. Click the **Start** button and click **My Computer**.
2. Right-click **Local Disk C:**.
3. Click **Properties**.
4. Click the **Tools** tab.
5. Under **Error-checking**, click **Check Now**.
6. Click **Scan for and attempt recovery of bad sectors**.
7. Click **Start**.


#### Windows 2000


1. Double-click **My Computer** on the Windows desktop.
2. Click the **Tools** tab.
3. Under **Error-checking**, click **Check Now**.
4. Click **Start**.

#### MS-DOS®

Type `scandisk x:` at an MS-DOS prompt, where *x* is the hard drive letter, and then press <Enter>. Click the **Start** button and click **My Computer**.

## E-Mail, Modem, and Internet Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

 **NOTE:** Connect the modem to an analog telephone jack only. The modem does not operate while it is connected to a digital telephone network.

**Check the Microsoft Outlook® Express Security Settings** — If you cannot open your e-mail attachments:

1. In Outlook Express, click **Tools**, click **Options**, and then click **Security**.
2. Click **Do not allow attachments** to remove the checkmark.

**Check the telephone line connection** —

**Check the telephone jack** —

**Connect the modem directly to the telephone wall jack** —

**Use a different telephone line** —

- Verify that the telephone line is connected to the jack on the modem. (The jack has either a green label or a connector-shaped icon next to it.)
- Ensure that you hear a click when you insert the telephone line connector into the modem.
- Disconnect the telephone line from the modem and connect it to a telephone. Listen for a dial tone.
- If you have other telephone devices sharing the line, such as an answering machine, fax machine, surge protector, or line splitter, then bypass them and use the telephone to connect the modem directly to the telephone wall jack. If you are using a line that is 3 m (10 ft) or more in length, try a shorter one.

**Run the Modem Helper diagnostics** — Click the **Start** button, point to **All Programs**, and then click **Modem Helper**. Follow the instructions on the screen to identify and resolve modem problems. (Modem Helper is not available on all computers.)


**Verify that the modem is communicating with Windows** —

1. Click the **Start** button and click **Control Panel**.
2. Click **Printers and Other Hardware**.
3. Click **Phone and Modem Options**.
4. Click the **Modems** tab.
5. Click the COM port for your modem.
6. Click **Properties**, click the **Diagnostics** tab, and then click **Query Modem** to verify that the modem is communicating with Windows.

If all commands receive responses, the modem is operating properly.

**Ensure that you are connected to the Internet** — Ensure that you have subscribed to an Internet provider. With the Outlook Express e-mail program open, click **File**. If **Work Offline** has a checkmark next to it, click the checkmark to remove it and connect to the Internet. For help, contact your Internet service provider.

## IEEE 1394a Device Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

Ensure that the IEEE 1394a device is properly inserted into the connector

**Ensure that the IEEE 1394a device is recognized by Windows** —

*Windows XP*

1. Click the **Start** button and click **Control Panel**.
2. Click **Printers and Other Hardware**.  
If your IEEE 1394a device is listed, Windows recognizes the device.


*Windows 2000*

1. Click the **Start** button, point to **Settings® Control Panel**, and then click **System**.
2. Click the **Hardware** tab.
3. Click **Device Manager** and ensure that there is not a ! next to the device name.
4. Click **Printers and Other Hardware**.

If your IEEE 1394a device is listed, Windows recognizes the device.

**If you have problems with an IEEE 1394a device** — Contact the IEEE 1394a device manufacturer.

## Keyboard Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

**Check the keyboard cable** —


- Ensure that the keyboard cable is firmly connected to the computer.
- Shut down the computer, reconnect the keyboard cable as shown in the *Quick Reference Guide* for your computer, and then restart the computer.
- Check the cable connector for bent or broken pins and for damaged or frayed cables. Straighten bent pins.
- Remove keyboard extension cables and connect the keyboard directly to the computer.

**Test the keyboard** — Connect a properly working keyboard to the computer, and try using the keyboard. If the new keyboard works, the original keyboard is faulty.

Run the [Dell Diagnostics](#)

[Check for software and hardware incompatibilities](#)

## Lockups and Software Problems


 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

### The computer does not start up

Check the [Diagnostic Lights](#)

Ensure that the power cable is firmly connected to the computer and to the electrical outlet

### The computer stops responding

 **NOTICE:** You might lose data if you are unable to perform an operating system shutdown.

**Turn the computer off** — If you are unable to get a response by pressing a key on your keyboard or moving your mouse, press and hold the power button for at least 8 to 10 seconds until the computer turns off. Then restart your computer.


### A program stops responding

**End the program** —

*Windows XP, Windows 2000*

1. Press <Ctrl><Shift><Esc> simultaneously.
2. Click **Applications**.
3. Click the program that is no longer responding.
4. Click **End Task**.

### A program crashes repeatedly

 **NOTE:** Software usually includes installation instructions in its documentation or on a floppy disk or CD.

**Check the software documentation** — If necessary, uninstall and then reinstall the program.

## A program is designed for an earlier Windows operating system

### If You Are Using Windows XP, Run the Program Compatibility Wizard —

The Program Compatibility Wizard configures a program so it runs in an environment similar to non-Windows XP operating system environments.

1. Click the **Start** button, point to **All Programs® Accessories**, and then click **Program Compatibility Wizard**.
2. In the welcome screen, click **Next**.
3. Follow the instructions on the screen.

## A solid blue screen appears

**Turn the computer off** — If you are unable to get a response by pressing a key on your keyboard or moving your mouse, press and hold the power button for at least 8 to 10 seconds until the computer turns off. Then restart your computer.

## Other software problems

### Check the software documentation or contact the software manufacturer for troubleshooting information —

- Ensure that the program is compatible with the operating system installed on your computer.
- Ensure that your computer meets the minimum hardware requirements needed to run the software. See the software documentation for information.
- Ensure that the program is installed and configured properly.
- Verify that the device drivers do not conflict with the program.
- If necessary, uninstall and then reinstall the program.

**Back up your files immediately**


**Use a virus-scanning program to check the hard drive, floppy disks, or CDs**

**Save and close any open files or programs and shut down your computer through the Start menu**

**Run the [Dell Diagnostics](#)** — If all tests run successfully, the error condition is related to a software problem.

## Memory Problems

Fill out the [Diagnostics Checklist](#) as you complete these checks.

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

**If you receive an error message during boot —**

1. Press <F2> and enter system setup.
2. Select **Memory Info** under **Info**.

System setup identifies the problem and provides information with how to correct.

See "[Memory Overview](#)" for memory installation guidelines.

**If you receive an insufficient memory message —**

- Save and close any open files and exit any open programs you are not using to see if that resolves the problem.
- See the software documentation for minimum memory requirements. If necessary, install additional memory.
- Reseat the memory modules to ensure that your computer is successfully communicating with the memory.
- Run the [Dell Diagnostics](#).

**If you experience other memory problems —**

- Reseat the memory modules to ensure that your computer is successfully communicating with the memory.
- Ensure that you are following the memory installation guidelines.
- Run the [Dell Diagnostics](#).

**If you receive an insufficient memory message —**

1. Save and close any open files and exit any open programs you are not using to see if that resolves the problem.
2. Confirm that the computer has sufficient memory to run your programs. See the software documentation for minimum memory requirements. If necessary, install additional memory.
3. Reseat the memory modules to ensure that your computer is successfully communicating with the memory.
4. Restart the computer.
5. Run the [Dell Diagnostics](#). If any of the diagnostics tests fail, [contact Dell](#).

**If you experience other memory problems —**

1. Reseat the memory modules to ensure that your computer is successfully communicating with the memory.
2. Restart the computer.
3. If the problem still exists, remove all the memory modules and install one memory module in memory module connector DIMM\_1.
4. Restart the computer.  
The following message appears: Alert! Operating in Debug Mode. Please Populate Memory in Pairs for Normal Operation.
5. Press <F1> to boot to the operating system.
6. Run the [Dell Diagnostics](#).
7. If the memory module passes, shut down the computer, remove the memory module, and then repeat the process with the remaining memory modules until a memory error occurs during start-up or diagnostic testing.
8. If the first memory module tested is defective, repeat the process with the remaining modules to ensure that the remaining modules are not defective.
9. When the defective memory module is identified, see "[Contacting Dell](#)" for a replacement.

**NOTE:** If necessary, the computer can operate in debug mode until new memory modules are installed.

## Mouse Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

#### Check the mouse cable —

1. Check the cable connector for bent or broken pins and for damaged or frayed cables. Straighten bent pins.
2. Remove mouse extension cables, if used, and connect the mouse directly to the computer.
3. Shut down the computer, reconnect the mouse cable as shown in the *Quick Reference Guide for your computer*, and then restart the computer.

#### Restart the computer —

1. Simultaneously press <Ctrl><Esc> to display the **Start** menu.
2. Type **u**, press the keyboard arrow keys to highlight **Shut down** or **Turn Off**, and then press <Enter>.
3. After the computer turns off, reconnect the mouse cable as shown on the in the *Quick Reference Guide for your computer*.
4. Start the computer.

**Test the mouse** — Connect a properly working mouse to the computer, and try using the mouse. If the new mouse works, the original mouse is faulty.

#### Check the mouse settings —

##### *Windows XP*

1. Click the **Start** button, click **Control Panel**, and then click **Printers and Other Hardware**.
2. Click **Mouse**.
3. Try adjusting the settings.

##### *Windows 2000*

1. Click the **Start** button, point to **Settings**, and then click **Control Panel**.
2. Double-click the **Mouse** icon.
3. Try adjusting the settings.

##### *If you are using a PS/2 mouse*

1. [Enter system setup](#) and ensure that **Mouse Port** under the **Integrated Devices** option is set to **On**.
2. Exit system setup and restart the computer.

#### [Reinstall the mouse driver](#)

#### [Run the Dell Diagnostics](#)

#### [Check for software and hardware incompatibilities](#)

## Network Problems

Fill out the [Diagnostics Checklist](#) as you complete these checks.

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

**Check the network cable connector** — Ensure that the network cable is firmly inserted into both the network connector on the back of the computer and the network jack.

**Check the network lights on the back of the computer** — No light indicates that no network communication exists. Replace the network cable.


**Restart the computer and log on to the network again**

**Check your network settings** — Contact your network administrator or the person who set up your network to verify that your network settings are correct and that the network is functioning.

[Check for software and hardware compatibilities](#)

## Power Problems

Fill out the [Diagnostics Checklist](#) as you complete these checks.

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

**If the power light is green and the computer is not responding** — See "[Diagnostic Lights](#)."

**If the power light is blinking green** — The computer is in standby mode. Press a key on the keyboard or move the mouse to resume normal operation.

**If the power light is off** — The computer is either turned off or is not receiving power.

- Reseat the power cable into both the power connector on the back of the computer and the electrical outlet.
- If the computer is plugged into a power strip, ensure that the power strip is plugged into an electrical outlet and that the power strip is turned on. Also bypass power protection devices, power strips, and power extension cables to verify that the computer turns on properly.
- Ensure that the electrical outlet is working by testing it with another device, such as a lamp.
- Ensure that the main power cable and front panel cable are securely connected to the system board (for the Dell Precision 670 computer, see "[System Board Components](#)" and for the Dell Precision 470 computer, see "[System Board Components](#)").

**If the power light is amber and green or steady amber** — A device might be malfunctioning or incorrectly installed.

- Remove and then reinstall the memory modules.
- Remove and then reinstall any cards.
- Remove and then reinstall the graphics card, if applicable.

**If the power light is blinking amber** — The computer is receiving electrical power, but an internal power problem might exist.


- Ensure that the voltage selection switch is set to match the AC power at your location (if applicable).
- Ensure that the processor power cable is securely connected to the system board (for the Dell Precision 670 computer, see "[System Board Components](#)" and for the Dell Precision 470 computer, see "[System Board Components](#)").


**Eliminate interference** — Some possible causes of interference are:

- Power, keyboard, and mouse extension cables
- Too many devices on a power strip
- Multiple power strips connected to the same electrical outlet

## Printer Problems

Fill out the [Diagnostics Checklist](#) as you complete these checks.

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

 **NOTE:** If you need technical assistance for your printer, contact the printer's manufacturer.

**Check the printer documentation** — See the printer documentation for setup and troubleshooting information.

**Ensure that the printer is turned on**

**Check the printer cable connections** —

- See the printer documentation for cable connection information.
- Ensure that the printer cables are securely connected to the printer and the computer.

**Test the electrical outlet** — Ensure that the electrical outlet is working by testing it with another device, such as a lamp.

**Verify that the printer is recognized by Windows** —

### *Windows XP*

1. Click the **Start** button, click **Control Panel**, and then click **Printers and Other Hardware**.
2. Click **View installed printers or fax printers**.

If the printer is listed, right-click the printer icon.

3. Click **Properties** and click the **Ports** tab. For a parallel printer, ensure that the **Print to the following port(s):** setting is **LPT1 (Printer Port)**. For a USB printer, ensure that the **Print to the following port(s):** setting is **USB**.

### *Windows 2000*

1. Click the **Start** button, point to **Settings**, and then click **Printers**.


If the printer is listed, right-click the printer icon.

2. Click **Properties** and click the **Ports** tab.

For a parallel printer, ensure that the **Print to the following port(s):** setting is **LPT1 (Printer Port)**. For a USB printer, ensure that the **Print to the following port(s):** setting is **USB**.

**Reinstall the printer driver** — See the printer documentation for instructions

## Processor Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

Fill out the [Diagnostics Checklist](#) as you complete these checks.

**If you receive an error message for the microprocessor** —



- If two microprocessors are installed, ensure that they are identical. If the microprocessors aren't identical, you may receive an error message for the following:
  - Different cache sizes
  - Different speeds
  - Different types

Enter system setup and ensure that values for **Processor 0** and **Processor 1** under the **CPU Information** option are identical:

- If two microprocessors are installed, ensure that a VRM is installed for the second microprocessor.
- Remove and reinstall the microprocessor.
- Run the **System Board Devices** and **Processor Cache** test groups in the Dell Diagnostics.


Verify that the VRM is working:


- If two microprocessors are installed, ensure that a VRM is properly installed for the second microprocessor.
- Reseat the VRM (see [VRM](#)).
- Run the **System Board Devices** and **Processor Cache** test groups in the [Dell Diagnostics](#).

If the system will not boot after changing the processor and VRM configurations, it is most like a configuration error. Check the diagnostic lights to make sure.

## Serial or Parallel Device Problems

Fill out the [Diagnostics Checklist](#) as you complete these checks.

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.


 **NOTE:** If you are having a problem with a printer, see "[Printer Problems](#)."

**Check the option setting** — See the device's documentation for the recommended settings. Then [enter system setup](#) and go to the **Integrated Devices** option settings. Ensure that the **Serial Port** setting or the **Parallel Port** setting matches the recommended settings.


Run the [Dell Diagnostics](#)

## Sound and Speaker Problems

Fill out the [Diagnostics Checklist](#) as you complete these checks.

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

### No sound from speakers

 **NOTE:** The volume control in some MP3 players overrides the Windows volume setting. If you have been listening to MP3 songs, ensure that you did not turn the player volume down or off.

**Check the speaker cable connections** — Ensure that the speakers are connected as shown on the setup diagram supplied with the speakers. If you purchased an audio card, ensure that the speakers are connected to

the card.

**Ensure that the subwoofer and the speakers are turned on** — See the setup diagram supplied with the speakers. If your speakers have volume controls, adjust the volume, bass, or treble to eliminate distortion.

**Adjust the Windows volume control** — Click or double-click the speaker icon in the lower-right corner of your screen. Ensure that the volume is turned up and that the sound is not muted.

**Disconnect headphones from the headphone connector** — Sound from the speakers is automatically disabled when headphones are connected to the computer's front-panel headphone connector.

**Test the electrical outlet** — Ensure that the electrical outlet is working by testing it with another device, such as a lamp.

**Enable digital mode** — Your speakers do not work if the CD drive is operating in analog mode.

*Windows XP*

1. Click the **Start** button, click **Control Panel**, and then click **Sounds, Speech, and Audio Devices**.
2. Click **Sounds and Audio Devices**.
3. Click the **Hardware** tab.
4. Double-click the name of your CD drive.
5. Click the **Properties** tab.
6. Check the **Enable digital CD audio for this CD-ROM device** box.

*Windows 2000*

1. Click the **Start** button, point to **Settings® Control Panel**, and then click **Sounds and Multimedia**.
2. Click the **Hardware** tab.
3. Click the name of your CD drive and click **Properties**.
4. Click the **Properties** tab.
5. Check the **Enable digital CD audio for this CD-ROM device** box.

**Eliminate possible interference** — Turn off nearby fans, fluorescent lights, or halogen lamps to check for interference.

**Run the speaker diagnostics**

[Reinstall the audio driver](#)

**Check the device option setting** — [Enter system setup](#) and ensure that **Sound** under the **Integrated Devices** option is set to **On**. Exit system setup and restart your computer.

**Run the [Dell Diagnostics](#)**

[Check for software and hardware compatibilities](#)

## No sound from headphones

**Check the headphone cable connection** — Ensure that the headphone cable is securely inserted into the headphone connector.

**Disable digital mode** — Your headphones do not work if the CD drive is operating in digital mode.

*Windows XP*

1. Click the **Start** button, click **Control Panel**, and then click **Sounds, Speech, and Audio Devices**.
2. Click **Sounds and Audio Devices**.

3. Click the **Hardware** tab.
4. Double-click the name of your CD drive.
5. Click the **Properties** tab.
6. Uncheck the **Enable digital CD audio for this CD-ROM device** box.

#### Windows 2000

1. Click the **Start** button, point to **Settings® Control Panel**, and then click **Sounds and Multimedia**.
2. Click the **Hardware** tab.
3. Click the name of your CD drive and click **Properties**.
4. Click the **Properties** tab.
5. Uncheck the **Enable digital CD audio for this CD-ROM device** box.

**Adjust the Windows volume control** — Click or double-click the speaker icon in the lower-right corner of your screen. Ensure that the volume is turned up and that the sound is not muted.

## Video and Monitor Problems

Fill out the [Diagnostics Checklist](#) as you complete these checks.



**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

### If the screen is blank



**NOTE:** See the monitor documentation for troubleshooting procedures.

#### Check the monitor cable connection —

- If you purchased a graphics card, ensure that the monitor is connected to the card.
- Ensure that your monitor is properly connected (see the *Setup and Quick Reference Guide* that came with your computer).
- If you are using a graphics extension cable and removing the cable solves the problem, the cable is defective.
- Swap the computer and monitor power cables to determine if the power cable is defective.
- Check the connector for bent or broken pins. (It is normal for monitor cable connectors to have missing pins.)

**Check the monitor power light** — If the power light is off, firmly press the button to ensure that the monitor is turned on. If the power light is lit or blinking, the monitor has power. If the power light is blinking, press a key on the keyboard or move the mouse.

**Test the electrical outlet** — Ensure that the electrical outlet is working by testing it with another device, such as a lamp.

**Test the monitor** — Connect a properly working monitor to the computer, and try using the monitor. If the new monitor works, the original monitor is faulty.

#### Check the [Diagnostic Lights](#)

**Check the card setting** — [Enter system setup](#) and ensure that **Primary Video Controller** under the **Integrated Devices** option is set correctly. For a PCI card, set **Primary Video Controller** to **Auto**. Exit system setup and restart your computer.

#### Run the [Dell Diagnostics](#)

## If the screen is difficult to read

**Check the monitor settings** — See the monitor documentation for instructions on adjusting the contrast and brightness, demagnetizing (degaussing) the monitor, and running the monitor self-test.

**Move the subwoofer away from the monitor** — If your speaker system includes a subwoofer, ensure that the subwoofer is at least 60 cm (2 ft) away from the monitor.

**Move the monitor away from external power sources** — Fans, fluorescent lights, halogen lamps, and other electrical devices can cause the screen image to appear "shaky." Turn off nearby devices to check for interference.

### **Adjust the Windows display settings** —

#### *Windows XP*

1. Click the **Start** button, click **Control Panel**, and then click **Appearance and Themes**.
2. Click **Display** and click the **Settings** tab.
3. Try different settings for **Screen resolution** and **Color quality**.

#### *Windows 2000*

1. Click the **Start** button, point to **Settings**, and then click **Control Panel**.
2. Double-click the **Display** icon and click the **Settings** tab.
3. Try different settings for **Screen area** or **Desktop area**.


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# Cleaning Your Computer


## Dell Precision™ Workstation 470 and 670 Computers User's Guide

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the *Product Information Guide*.

## Computer, Keyboard, and Monitor

 **CAUTION:** Before you clean your computer, disconnect the computer from the electrical outlet. Clean your computer with a soft cloth dampened with water. Do not use liquid or aerosol cleaners, which may contain flammable substances.

- Use a vacuum cleaner with a brush attachment to gently remove dust from the slots and holes on your computer and from between the keys on the keyboard.

 **NOTICE:** Do not wipe the display screen with any soap or alcohol solution. Doing so may damage the antiglare coating.

- To clean your monitor screen, lightly dampen a soft, clean cloth with water. If possible, use a special screen-cleaning tissue or solution suitable for the monitor's antistatic coating.
- Wipe the keyboard, computer, and plastic part of the monitor with a soft cleaning cloth moistened with a solution of three parts water and one part dish washing detergent.


Do not soak the cloth or let water drip inside your computer or keyboard.

## Mouse

If your screen cursor skips or moves abnormally, clean the mouse. To clean a non-optical mouse:

1. Turn the retainer ring on the underside of your mouse counterclockwise, and then remove the ball.
2. Wipe the ball with a clean, lint-free cloth.
3. Blow carefully into the ball cage to dislodge dust and lint.
4. If the rollers inside the ball cage are dirty, clean the rollers with a cotton swab moistened lightly with isopropyl alcohol.
5. Recenter the rollers in their channels if they are misaligned. Ensure that fluff from the swab is not left on the rollers.
6. Replace the ball and retainer ring, and turn the retainer ring clockwise until it clicks into place.

## Floppy Drive

 **NOTICE:** Do not attempt to clean drive heads with a swab. You might accidentally misalign the heads, which prevents the drive from operating.

Clean your floppy drive using a commercially available cleaning kit. These kits contain pretreated floppy disks to remove contaminants that accumulate during normal operation.

## CDs and DVDs

- ➡ **NOTICE:** Always use compressed air to clean the lens in the CD/DVD drive, and follow the instructions that come with the compressed air. Never touch the lens in the drive.

If you notice problems, such as skipping, with the playback quality of your CDs or DVDs, try cleaning the discs.

1. Hold the disc by its outer edge. You can also touch the inside edge of the center hole.

- ➡ **NOTICE:** To prevent damage to the surface, do not wipe in a circular motion around the disc.

2. With a soft, lint-free cloth, gently wipe the bottom of the disc (the unlabeled side) in a straight line from the center to the outer edge of the disc.

For stubborn dirt, try using water or a diluted solution of water and mild soap. You can also purchase commercial products that clean discs and provide some protection from dust, fingerprints, and scratches. Cleaning products for CDs are safe to use on DVDs.

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# Features of Microsoft Windows XP

## Dell Precision™ Workstation 470 and 670 Computers User's Guide

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- 

## Transferring Information to a New Computer

The Microsoft® Windows® XP operating system provides a Files and Settings Transfer wizard to move data from the source computer to the new computer. You can move data such as:

- E-mails
- Toolbar settings
- Window sizes
- Internet bookmarks

You can transfer the data to the new computer over a network or serial connection, or you can store it on a removable medium, such as a writable CD or floppy disk.

To prepare the new computer for the file transfer:

1. Click the **Start** button, point to **All Programs® Accessories® System Tools**, and then click **Files and Settings Transfer Wizard**.
2. When the **Files and Settings Transfer Wizard** welcome screen appears, click **Next**.
3. On the **Which computer is this?** screen, click **New Computer** and click **Next**.
4. On the **Do you have a Windows XP CD?** screen, click **I will use the wizard from the Windows XP CD** and click **Next**.
5. When the **Now go to your old computer** screen appears, go to your old or source computer. *Do not* click **Next** at this time.

To copy data from the old computer:

1. On the old computer, insert the Windows XP *Operating System* CD.
2. On the **Welcome to Microsoft Windows XP** screen, click **Perform additional tasks**.
3. Under **What do you want to do?**, click **Transfer files and settings**.
4. On the **Files and Settings Transfer Wizard** welcome screen, click **Next**.
5. On the **Which computer is this?** screen, click **Old Computer** and click **Next**.
6. On the **Select a transfer method** screen, click the transfer method you prefer.
7. On the **What do you want to transfer?** screen, select the items you want to transfer and click **Next**.

After the information has been copied, the **Completing the Collection Phase** screen appears.

8. Click **Finish**.

To transfer data to the new computer:

1. On the **Now go to your old computer** screen on the new computer, click **Next**.
2. On the **Where are the files and settings?** screen, select the method you chose for transferring your settings and files and click **Next**.

The wizard reads the collected files and settings and applies them to your new computer.


When all of the settings and files have been applied, the **Finished** screen appears.

3. Click **Finished** and restart the new computer.

---

## Microsoft® Windows® Classic View

You can change the appearance of the Windows desktop, **Start** menu, and Control Panel so that they look more like previous versions of the Windows operating system.

 **NOTE:** The procedures in this document were written for the Windows default view, so they may not work if you set your Dell™ computer to the Windows classic view.

### Desktop

1. Click the **Start** button and click **Control Panel**.
2. Under **Pick a category**, click **Appearance and Themes**.
3. Under **Pick a task...**, click **Change the computer's theme**.
4. In the **Theme** drop-down menu, click **Windows Classic**.
5. Click **OK**.

### Start Menu

1. Right-click the **Start** button and click **Properties**.
2. Click the **Start Menu** tab.
3. Click **Classic Start menu** and click **OK**.

### Control Panel

1. Click the **Start** button and click **Control Panel**.
2. In the left panel, click **Switch to Classic View**.

---

## Choosing a Wallpaper



You can set background colors and patterns on the Windows desktop choosing a wallpaper.

1. Click the **Start** button, click **Control Panel**, and then click **Appearance and Themes**.
2. Under **Pick a task...**, click **Change the desktop background**.
3. In the **Display Properties** window, click one of the following options:
  - The name of the wallpaper image
  - **(None)** for no wallpaper image
  - **Browse** to select a wallpaper image from a directory



**NOTE:** You can choose either an HTML file or any image file, such as a bitmap or JPEG file, as a wallpaper.

4. To select the placement of your wallpaper on your desktop, click one of the following options in the **Position** drop-down menu:
    - **Tile** to place multiple copies of an image across the screen
    - **Center** to place a single copy of an image in the center of the screen
    - **Stretch** to place a single copy of an image to fit the size of the screen
  5. Click **OK** to accept the settings and close the **Display Properties** window.
- 

## Choosing a Screen Saver

1. Click the **Start** button, click **Control Panel**, and then click **Appearance and Themes**.
2. Under **Pick a task...**, click **Choose a screen saver**.
3. Choose a screen saver from the **Screen Saver** drop-down menu or click **(None)** if you prefer not to activate a screen saver.

If you select a screen saver, you can click **Settings** to change the various features of the screen saver.

4. Click **Preview** to run the currently selected screen saver and press <Esc> to cancel the preview.
  5. Click **OK** to accept the settings and close the **Display Properties** window.
- 

## Choosing a Desktop Theme

To change the appearance of your desktop and add sound effects by using desktop themes:

1. Click the **Start** button, click **Control Panel**, and then click **Appearance and Themes**.
  2. Under **Pick a task...**, click **Change the computer's theme**.
  3. In the **Display Properties** window, select a theme from the **Theme** drop-down menu.
  4. Click **OK**.
- 

## Creating and Arranging Shortcuts

A shortcut is an icon on the desktop that provides quick access to programs, files, folders, and drives you might frequently use.

## Creating Shortcuts

1. Open Windows Explorer or My Computer and find the file, program, or drive for which you want to create a shortcut.

 **NOTE:** If you cannot see your desktop, minimize any open windows to make your desktop visible.

2. Right-click and drag the highlighted item to the Windows desktop.
3. Click **Create Shortcut(s) Here** in the pop-up menu.

You can double-click the shortcut icon that appears on your desktop to open the item.

## Arranging Shortcuts

To move a shortcut, click and drag the shortcut to the desired location.

To arrange all the shortcut icons at one time:


1. Right-click an empty spot on the Windows desktop to display a pop-up menu.
2. Point to **Arrange Icons By** and click the option for the icon arrangement you prefer.

---

## Desktop Cleanup Wizard

Your computer is set up to use the Desktop Cleanup Wizard to move programs that are not frequently used to a designated folder 7 days after you first start your computer and every 60 days after that. The appearance of the **Start** menu changes as programs are moved.

To turn off the Desktop Cleanup Wizard, perform the following steps.

 **NOTE:** You can run the Desktop Cleanup Wizard any time by clicking **Clean Desktop Now** under **Run Desktop Cleanup Wizard every 60 days**.

1. Right-click an empty spot on the desktop and click **Properties**.
2. Click the **Desktop** tab and click **Customize Desktop**.
3. Click **Run Desktop Cleanup Wizard every 60 days** to remove the check mark.
4. Click **OK**.

To run the Desktop Cleanup Wizard at any time:

1. Right-click an empty spot on the desktop and click **Properties**.
  2. Click the **Desktop** tab and click **Customize Desktop**.
  3. Click **Clean Desktop Now**.
  4. When the Desktop Cleanup Wizard appears, click **Next**.
-

## Internet Connection Firewall

The Internet Connection Firewall provides basic protection from unauthorized access to the computer while the computer is connected to the Internet. When the firewall is enabled for a network connection, the firewall icon appears with a red background in the **Network Connections** section of the Control Panel.

Note that enabling the Internet Connection Firewall does not reduce the need for virus-checking software.


For more information, see the Help and Support Center (Microsoft® Windows® XP).

## Setting Up a Home and Office Network

### Connecting to a Network Adapter

Before you connect your computer to a network, the computer must have a network adapter installed and a network cable connected to it.

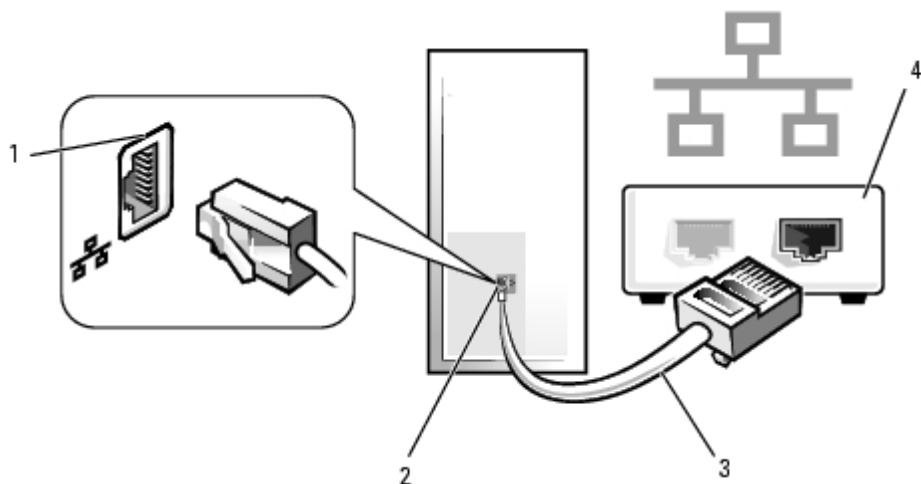
To connect a network cable:

 **NOTE:** Plug the network cable into the network adapter connector on the computer. Do not plug the network cable into the modem connector on the computer. Do not plug a network cable into a telephone wall jack.

1. Connect the network cable to the network adapter connector on the back of your computer.

Insert the cable until it clicks into place, and then gently pull it to ensure that it is secure.

2. Connect the other end of the network cable to a network device.



1	network adapter connector
2	network adapter connector on computer
3	network cable
4	network device

### Network Setup Wizard

The Microsoft® Windows® XP operating system provides a Network Setup Wizard to guide you through the process of

sharing files, printers, or an Internet connection between computers in a home or small office.

1. Click the **Start** button, point to **All Programs® Accessories® Communications**, and then click **Network Setup Wizard**.
2. On the welcome screen, click **Next**.
3. Click **Checklist for creating a network**.

 **NOTE:** Selecting the connection method **This computer connects directly to the Internet** enables the integrated firewall provided with Windows XP.

4. Complete the checklist and required preparations.
5. Return to the Network Setup Wizard and follow the instructions on the screen.


---

## User Accounts and Fast User Switching

### Adding User Accounts


After the Microsoft® Windows® XP operating system is installed, the administrator or a user with administrator rights can create additional user accounts.

1. Click the **Start** button and click **Control Panel**.
2. In the **Control Panel** window, click **User Accounts**.
3. Under **Pick a task**, click **Create a new account**.
4. Under **Name the new account**, type the name of the new user and click **Next**.
5. Under **Pick an account type**, click one of the following options:
  - **Computer administrator** — You can change all computer settings.
  - **Limited** — You can change only your own personal settings, such as your password. You cannot install programs or use the Internet.

 **NOTE:** Additional options may be available, depending on whether you are using Windows XP Home Edition or Windows XP Professional. Also, options available in Windows XP Professional vary depending on whether your computer is connected to a domain.

6. Click **Create Account**.

### Fast User Switching

 **NOTE:** Fast User Switching is unavailable if your computer is running Windows XP Professional and is a member of a computer domain, or if your computer has less than 128 MB of memory.

Fast User Switching allows multiple users to access one computer without requiring the previous user to log off.

1. Click the **Start** button and click **Log Off**.
2. In the **Log Off Windows** window, click **Switch User**.

When you use Fast User Switching, programs that previous users were using remain running in the background, which might slow your computer's response time. Also, multimedia programs, such as games and DVD software, might not work with Fast User Switching. For more information, see the Windows Help and Support Center.

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# Appendix

## Dell Precision™ Workstation 470 and 670 Computers User's Guide


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  - [Product Information](#)
  - [Returning Items for Warranty Repair or Credit](#)
  - [Before You Call](#)
  - [Dell Contact Numbers and E-Mail Addresses](#)
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- 


## Contacting Dell

If you need help with a technical problem, Dell is ready to assist you.

 **CAUTION:** If you need to remove the computer covers, first disconnect the computer power and modem cables from all electrical outlets.


1. Complete the procedures in "[Solving Problems](#)."
2. Run the [Dell Diagnostics](#).
3. Make a copy of the [Diagnostics Checklist](#) and fill it out.
4. Use Dell's extensive suite of online services available at Dell Support (**support.dell.com**) for help with installation and troubleshooting procedures.
5. If the preceding steps have not resolved the problem, contact Dell.

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

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

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

For instructions on using the technical support service, see "[Technical Support Service](#)."

 **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

mobile\_support@us.dell.com

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

sales@dell.com

apmarketing@dell.com (Asian/Pacific countries only)

sales\_canada@dell.com (Canada only)

- Electronic Information Service

info@dell.com

## AutoTech Service

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

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

The AutoTech service is available 24 hours a day, 7 days a week. You can also access this service through the technical support service. For the telephone number to call, see the contact numbers 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. For the telephone number to call, see the contact numbers for your region.

## Technical Support Service

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

To contact Dell's technical support service, see "[Contacting Dell](#)" and then call the number for your country as listed in "[Contacting Dell](#)."

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## Problems With Your Order

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

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## Product Information

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

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## 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 numbers for your region.


2. Include a copy of the invoice and a letter describing the reason for the return.
3. Include a copy of the [Diagnostics Checklist](#) indicating the tests you have run and any error messages reported by the Dell Diagnostics.
4. Include any accessories that belong with the item(s) being returned (power cables, software floppy disks, guides, and so on) if the return is for credit.
5. Pack the equipment to be returned in the original (or equivalent) packing materials.

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


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

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## Before You Call

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

Remember to fill out the [Diagnostics Checklist](#). If possible, turn on your computer 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 itself. Ensure that the computer documentation is available.

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

Diagnostics Checklist
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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:
Devices:
Expansion cards:
Are you connected to a network? Yes No
Network, version, and network adapter:
Programs and versions:
See your operating system documentation to determine the contents of the system's start-up files. If the computer is connected to a printer, print each file. Otherwise, record the contents of each file before calling Dell.
Error message, beep code, or diagnostic code:
Description of problem and troubleshooting procedures you performed:

## Dell Contact Numbers and E-Mail Addresses

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

- [www.dell.com](http://www.dell.com)
- [support.dell.com](http://support.dell.com) (technical support)
- [premiersupport.dell.com](http://premiersupport.dell.com) (technical support for educational, government, healthcare, and medium/large business customers, including Premier, Platinum, and Gold customers)

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.

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

Country (City) International Access Code Country Code City Code	Department Name or Service Area, Website and E-Mail Address	Area Codes, Local Numbers, and Toll-Free Numbers
<b>Anguilla</b>	General Support	toll-free: 800-335-0031
<b>Antigua and Barbuda</b>	General Support	1-800-805-5924
<b>Argentina (Buenos Aires)</b>  International Access Code: <b>00</b>  Country Code: <b>54</b>  City Code: <b>11</b>	Website: <a href="http://www.dell.com.ar">www.dell.com.ar</a>	
	Tech Support and Customer Care	toll-free: 0-800-444-0733
	Sales	0-810-444-3355
	Tech Support Fax	11 4515 7139
	Customer Care Fax	11 4515 7138

<b>Aruba</b>	General Support	toll-free: 800-1578
<b>Australia (Sydney)</b> International Access Code: <b>0011</b> Country Code: <b>61</b> City Code: <b>2</b>	E-mail (Australia): au_tech_support@dell.com	
	E-mail (New Zealand): nz_tech_support@dell.com	
	Home and Small Business	1-300-65-55-33
	Government and Business	toll-free: 1-800-633-559
	Preferred Accounts Division (PAD)	toll-free: 1-800-060-889
	Customer Care	toll-free: 1-800-819-339
	Corporate Sales	toll-free: 1-800-808-385
	Transaction Sales	toll-free: 1-800-808-312
	Fax	toll-free: 1-800-818-341
<b>Austria (Vienna)</b> International Access Code: <b>900</b> Country Code: <b>43</b> City Code: <b>1</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: tech_support_central_europe@dell.com	
	Home/Small Business Sales	0820 240 530 00
	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
	Home/Small Business Technical Support	0820 240 530 14
	Preferred Accounts/Corporate Technical Support	0660 8779
	Switchboard	0820 240 530 00
<b>Bahamas</b>	General Support	toll-free: 1-866-278-6818
<b>Barbados</b>	General Support	1-800-534-3066
<b>Belgium (Brussels)</b> International Access Code: <b>00</b> Country Code: <b>32</b> City Code: <b>2</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: tech_be@dell.com	
	E-mail for French Speaking Customers: <b>support.euro.dell.com/be/fr/emaildell/</b>	
	Technical Support	02 481 92 88
	Customer Care	02 481 91 19
	Corporate Sales	02 481 91 00
	Fax	02 481 92 99
	Switchboard	02 481 91 00
<b>Bermuda</b>	General Support	1-800-342-0671
<b>Bolivia</b>	General Support	toll-free: 800-10-0238
<b>Brazil</b> International Access Code: <b>00</b> Country Code: <b>55</b> City Code: <b>51</b>	Website: <b>www.dell.com/br</b>	
	Customer Support, Technical Support	0800 90 3355
	Tech Support Fax	51 481 5470
	Customer Care Fax	51 481 5480
	Sales	0800 90 3390
<b>British Virgin Islands</b>	General Support	toll-free: 1-866-278-6820
<b>Brunei</b> Country Code: <b>673</b>	Customer Technical Support (Penang, Malaysia)	604 633 4966
	Customer Service (Penang, Malaysia)	604 633 4949
	Transaction Sales (Penang, Malaysia)	604 633 4955

<b>Canada (North York, Ontario)</b>  International Access Code: <b>011</b>	Online Order Status: <b>www.dell.ca/ostatus</b>	
	AutoTech (automated technical support)	toll-free: 1-800-247-9362
	TechFax	toll-free: 1-800-950-1329
	Customer Care (Home Sales/Small Business)	toll-free: 1-800-847-4096
	Customer Care (med./large business, government)	toll-free: 1-800-326-9463
	Technical Support (Home Sales/Small Business)	toll-free: 1-800-847-4096
	Technical Support (med./large bus., government)	toll-free: 1-800-387-5757
	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
<b>Cayman Islands</b>	General Support	1-800-805-7541
<b>Chile (Santiago)</b>  Country Code: <b>56</b>  City Code: <b>2</b>	Sales, Customer Support, and Technical Support	toll-free: 1230-020-4823
<b>China (Xiamen)</b>  Country Code: <b>86</b>  City Code: <b>592</b>	Tech Support website: <b>support.dell.com.cn</b>	
	Tech Support E-mail: cn_support@dell.com	
	Tech Support Fax	818 1350
	Technical Support (Dimension™ and Inspiron™)	toll-free: 800 858 2969
	Technical Support (OptiPlex™, Latitude™, and Dell Precision™)	toll-free: 800 858 0950
	Technical Support (servers and storage)	toll-free: 800 858 0960
	Technical Support (projectors, PDAs, printers, switches, routers, and so on)	toll-free: 800 858 2920
	Customer Experience	toll-free: 800 858 2060
	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 2222
	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	
<b>Colombia</b>	General Support	980-9-15-3978
<b>Costa Rica</b>	General Support	0800-012-0435
<b>Czech Republic (Prague)</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: czech_dell@dell.com	

International Access Code: <b>00</b> Country Code: <b>420</b> City Code: <b>2</b>	Technical Support	02 2186 27 27
	Customer Care	02 2186 27 11
	Fax	02 2186 27 14
	TechFax	02 2186 27 28
	Switchboard	02 2186 27 11
<b>Denmark (Copenhagen)</b> International Access Code: <b>00</b> Country Code: <b>45</b>	Website: <b>support.euro.dell.com</b>	
	E-mail Support (portable computers): den_nbk_support@dell.com	
	E-mail Support (desktop computers): den_support@dell.com	
	E-mail Support (servers): Nordic_server_support@dell.com	
	Technical Support	7023 0182
	Customer Care (Relational)	7023 0184
	Home/Small Business Customer Care	3287 5505
	Switchboard (Relational)	3287 1200
	Fax Switchboard (Relational)	3287 1201
Switchboard (Home/Small Business)	3287 5000	
Fax Switchboard (Home/Small Business)	3287 5001	
<b>Dominica</b>	General Support	toll-free: 1-866-278-6821
<b>Dominican Republic</b>	General Support	1-800-148-0530
<b>Ecuador</b>	General Support	toll-free: 999-119
<b>El Salvador</b>	General Support	01-899-753-0777
<b>Finland (Helsinki)</b> International Access Code: <b>990</b> Country Code: <b>358</b> City Code: <b>9</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: fin_support@dell.com	
	E-mail Support (servers): Nordic_support@dell.com	
	Technical Support	09 253 313 60
	Technical Support Fax	09 253 313 81
	Relational Customer Care	09 253 313 38
	Home/Small Business Customer Care	09 693 791 94
	Fax	09 253 313 99
	Switchboard	09 253 313 00
<b>France (Paris) (Montpellier)</b> International Access Code: <b>00</b> Country Code: <b>33</b> City Codes: <b>(1) (4)</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: <b>support.euro.dell.com/fr/fr/emaildell/</b>	
	<b>Home and Small Business</b>	
	Technical Support	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

	<b>Corporate</b>	
	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
<b>Germany (Langen)</b> International Access Code: <b>00</b> Country Code: <b>49</b> City Code: <b>6103</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: tech_support_central_europe@dell.com	
	Technical Support	06103 766-7200
	Home/Small Business Customer Care	0180-5-224400
	Global Segment Customer Care	06103 766-9570
	Preferred Accounts Customer Care	06103 766-9420
	Large Accounts Customer Care	06103 766-9560
	Public Accounts Customer Care	06103 766-9555
	Switchboard	06103 766-7000
<b>Greece</b> International Access Code: 00 Country Code: 30	Website: <b>support.euro.dell.com</b>	
	E-mail: <b>support.euro.dell.com/gr/en/emailldell/</b>	
	Technical Support	080044149518
	Gold Technical Support	08844140083
	Switchboard	2108129800
	Sales	2108129800
	Fax	2108129812
<b>Grenada</b>	General Support	toll-free: 1-866-540-3355
<b>Guatemala</b>	General Support	1-800-999-0136
<b>Guyana</b>	General Support	toll-free: 1-877-270-4609
<b>Hong Kong</b> International Access Code: <b>001</b> Country Code: <b>852</b>	Website: <b>support.ap.dell.com</b>	
	E-mail: ap_support@dell.com	
	Technical Support (Dimension™ and Inspiron™)	2969 3189
	Technical Support (OptiPlex™, Latitude™, and Dell Precision™)	2969 3191
	Technical Support (PowerApp™, PowerEdge™, PowerConnect™, and PowerVault™)	2969 3196
	Gold Queue EEC Hotline	2969 3187
	Customer Advocacy	3416 0910
	Large Corporate Accounts	3416 0907
	Global Customer Programs	3416 0908
	Medium Business Division	3416 0912
	Home and Small Business Division	2969 3105
<b>India</b>	Technical Support	1600 33 8045
	Sales	1600 33 8044
	Website: <b>support.euro.dell.com</b>	

<b>Ireland (Cherrywood)</b> International Access Code: <b>16</b> Country Code: <b>353</b> City Code: <b>1</b>	E-mail: dell_direct_support@dell.com	
	Technical Support	1850 543 543
	U.K. Technical Support (dial within U.K. only)	0870 908 0800
	Home User Customer Care	01 204 4014
	Small Business Customer Care	01 204 4014
	U.K. Customer Care (dial within U.K. only)	0870 906 0010
	Corporate Customer Care	1850 200 982
	Corporate Customer Care (dial within U.K. only)	0870 907 4499
	Ireland Sales	01 204 4444
	U.K. Sales (dial within U.K. only)	0870 907 4000
	Fax/SalesFax	01 204 0103
	Switchboard	01 204 4444
	<b>Italy (Milan)</b> International Access Code: <b>00</b> Country Code: <b>39</b> City Code: <b>02</b>	Website: <b>support.euro.dell.com</b>
E-mail: <b>support.euro.dell.com/it/it/emaildell/</b>		
<b>Home and Small Business</b>		
Technical Support		02 577 826 90
Customer Care		02 696 821 14
Fax		02 696 821 13
Switchboard		02 696 821 12
<b>Corporate</b>		
Technical Support		02 577 826 90
Customer Care		02 577 825 55
Fax		02 575 035 30
Switchboard		02 577 821
<b>Jamaica</b>		General Support (dial from within Jamaica only)
<b>Japan (Kawasaki)</b> International Access Code: <b>001</b> Country Code: <b>81</b> City Code: <b>44</b>	Website: <b>support.jp.dell.com</b>	
	Technical Support (servers)	toll-free: 0120-198-498
	Technical Support outside of Japan (servers)	81-44-556-4162
	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 (Axim™)	toll-free: 0120-981-690
	Technical Support outside of Japan (Axim)	81-44-556-3468
	Faxbox Service	044-556-3490
	24-Hour Automated Order Service	044-556-3801
	Customer Care	044-556-4240
	Business Sales Division (up to 400 employees)	044-556-1465
	Preferred Accounts Division Sales (over 400 employees)	044-556-3433

	Large Corporate Accounts Sales (over 3500 employees)	044-556-3430
	Public Sales (government agencies, educational institutions, and medical institutions)	044-556-1469
	Global Segment Japan	044-556-3469
	Individual User	044-556-1760
	Switchboard	044-556-4300
<b>Korea (Seoul)</b> International Access Code: <b>001</b> Country Code: <b>82</b> City Code: <b>2</b>	Technical Support	toll-free: 080-200-3800
	Sales	toll-free: 080-200-3600
	Customer Service (Seoul, Korea)	toll-free: 080-200-3800
	Customer Service (Penang, Malaysia)	604 633 4949
	Fax	2194-6202
	Switchboard	2194-6000
<b>Latin America</b>	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
<b>Luxembourg</b> International Access Code: <b>00</b> Country Code: <b>352</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: tech_be@dell.com	
	Technical Support (Brussels, Belgium)	3420808075
	Home/Small Business Sales (Brussels, Belgium)	toll-free: 080016884
	Corporate Sales (Brussels, Belgium)	02 481 91 00
	Customer Care (Brussels, Belgium)	02 481 91 19
	Fax (Brussels, Belgium)	02 481 92 99
Switchboard (Brussels, Belgium)	02 481 91 00	
<b>Macao</b> Country Code: <b>853</b>	Technical Support	toll-free: 0800 582
	Customer Service (Penang, Malaysia)	604 633 4949
	Transaction Sales	toll-free: 0800 581
<b>Malaysia (Penang)</b> International Access Code: <b>00</b> Country Code: <b>60</b> City Code: <b>4</b>	Technical Support (Dell Precision, OptiPlex, and Latitude)	toll-free: 1 800 88 0193
	Technical Support (Dimension and Inspiron)	toll-free: 1 800 88 1306
	Customer Service	04 633 4949
	Transaction Sales	toll-free: 1 800 888 202
	Corporate Sales	toll-free: 1 800 888 213
<b>Mexico</b> International Access Code: <b>00</b> Country Code: <b>52</b>	Customer Technical Support	001-877-384-8979 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
<b>Montserrat</b>	General Support	toll-free: 1-866-278-6822
<b>Netherlands Antilles</b>	General Support	001-800-882-1519
<b>Netherlands (Amsterdam)</b> International Access Code: <b>00</b> Country Code: <b>31</b> City Code: <b>20</b>	Website: <b>support.euro.dell.com</b> E-mail (Technical Support): (Enterprise): nl_server_support@dell.com (Latitude): nl_latitude_support@dell.com (Inspiron): nl_inspiron_support@dell.com (Dimension): nl_dimension_support@dell.com (OptiPlex): nl_optiplex_support@dell.com (Dell Precision): nl_workstation_support@dell.com	
	Technical Support	020 674 45 00
	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
<b>New Zealand</b> International Access Code: <b>00</b> Country Code: <b>64</b>	E-mail (New Zealand): nz_tech_support@dell.com	
	E-mail (Australia): au_tech_support@dell.com	
	Home and Small Business	0800 446 255
	Government and Business	0800 444 617
	Sales	0800 441 567
Fax	0800 441 566	
<b>Nicaragua</b>	General Support	001-800-220-1006
<b>Norway (Lysaker)</b> International Access Code: <b>00</b> Country Code: <b>47</b>	Website: <b>support.euro.dell.com</b> E-mail Support (portable computers): nor_nbk_support@dell.com	
	E-mail Support (desktop computers): nor_support@dell.com	
	E-mail Support (servers): nordic_server_support@dell.com	
	Technical Support	671 16882
	Relational Customer Care	671 17514
	Home/Small Business Customer Care	23162298




	Switchboard	671 16800
	Fax Switchboard	671 16865
<b>Panama</b>	General Support	001-800-507-0962
<b>Peru</b>	General Support	0800-50-669
<b>Poland (Warsaw)</b> International Access Code: <b>011</b> Country Code: <b>48</b> City Code: <b>22</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: <b>pl_support_tech@dell.com</b>	
	Customer Service Phone	57 95 700
	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
<b>Portugal</b> International Access Code: <b>00</b> Country Code: <b>351</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: <b>support.euro.dell.com/pt/en/emailldell/</b>	
	Technical Support	707200149
	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
<b>Puerto Rico</b>	General Support	1-800-805-7545
<b>St. Kitts and Nevis</b>	General Support	toll-free: 1-877-441-4731
<b>St. Lucia</b>	General Support	1-800-882-1521
<b>St. Vincent and the Grenadines</b>	General Support	toll-free: 1-877-270-4609
<b>Singapore (Singapore)</b> International Access Code: <b>005</b> Country Code: <b>65</b>	Technical Support	toll-free: 800 6011 051
	Customer Service (Penang, Malaysia)	604 633 4949
	Transaction Sales	toll-free: 800 6011 054
	Corporate Sales	toll-free: 800 6011 053
<b>South Africa (Johannesburg)</b> International Access Code: <b>09/091</b> Country Code: <b>27</b> City Code: <b>11</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: <b>dell_za_support@dell.com</b>	
	Technical Support	011 709 7710
	Customer Care	011 709 7707
	Sales	011 709 7700
	Fax	011 706 0495
<b>Southeast Asian and Pacific Countries</b>	Switchboard	011 709 7700
	Customer Technical Support, Customer Service, and Sales (Penang, Malaysia)	604 633 4810
<b>Spain (Madrid)</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: <b>support.euro.dell.com/es/es/emailldell/</b>	
	<b>Home and Small Business</b>	
	Technical Support	902 100 130
	Customer Care	902 118 540

International Access Code: <b>00</b> Country Code: <b>34</b> City Code: <b>91</b>	Sales	902 118 541
	Switchboard	902 118 541
	Fax	902 118 539
	<b>Corporate</b>	
	Technical Support	902 100 130
	Customer Care	902 118 546
	Switchboard	91 722 92 00
	Fax	91 722 95 83
<b>Sweden (Upplands Vasby)</b> International Access Code: <b>00</b> Country Code: <b>46</b> City Code: <b>8</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: swe_support@dell.com	
	E-mail Support for Latitude and Inspiron: Swe-nbk_kats@dell.com	
	E-mail Support for OptiPlex: Swe_kats@dell.com	
	E-mail Support for Servers: Nordic_server_support@dell.com	
	Technical Support	08 590 05 199
	Relational Customer Care	08 590 05 642
	Home/Small Business Customer Care	08 587 70 527
	Employee Purchase Program (EPP) Support	20 140 14 44
	Fax Technical Support	08 590 05 594
Sales	08 590 05 185	
<b>Switzerland (Geneva)</b> International Access Code: <b>00</b> Country Code: <b>41</b> City Code: <b>22</b>	Website: <b>support.euro.dell.com</b>	
	E-mail: Tech_support_central_Europe@dell.com	
	E-mail for French-speaking HSB and Corporate Customers: <b>support.euro.dell.com/ch/fr/emaildell/</b>	
	Technical Support (Home and Small Business)	0844 811 411
	Technical Support (Corporate)	0844 822 844
	Customer Care (Home and Small Business)	0848 802 202
	Customer Care (Corporate)	0848 821 721
	Fax	022 799 01 90
Switchboard	022 799 01 01	
<b>Taiwan</b> International Access Code: <b>002</b> Country Code: <b>886</b>	Technical Support (portable and desktop computers)	toll-free: 00801 86 1011
	Technical Support (servers)	toll-free: 0080 60 1256
	Transaction Sales	toll-free: 0080 651 228
	Corporate Sales	toll-free: 0080 651 227
<b>Thailand</b> International Access Code: <b>001</b> Country Code: <b>66</b>	Technical Support	toll-free: 0880 060 07
	Customer Service (Penang, Malaysia)	604 633 4949
	Sales	toll-free: 0880 060 09
<b>Trinidad/Tobago</b>	General Support	1-800-805-8035
<b>Turks and Caicos Islands</b>	General Support	toll-free: 1-866-540-3355

<b>U.K. (Bracknell)</b> International Access Code: <b>00</b> Country Code: <b>44</b> City Code: <b>1344</b>	Website: <b>support.euro.dell.com</b>	
	Customer Care website: <b>support.euro.dell.com/uk/en/ECare/Form/Home.asp</b>	
	E-mail: dell_direct_support@dell.com	
	Technical Support (Corporate/Preferred Accounts/PAD [1000+ employees])	0870 908 0500
	Technical Support (direct/PAD and general)	0870 908 0800
	Global Accounts Customer Care	01344 373 186
	Home and Small Business Customer Care	0870 906 0010
	Corporate Customer Care	01344 373 185
	Preferred Accounts (500–5000 employees) Customer Care	0870 906 0010
	Central Government Customer Care	01344 373 193
	Local Government & Education Customer Care	01344 373 199
	Health Customer Care	01344 373 194
	Home and Small Business Sales	0870 907 4000
	Corporate/Public Sector Sales	01344 860 456
	Home and Small Business Fax	0870 907 4006
<b>Uruguay</b>	General Support	toll-free: 000-413-598-2521
<b>U.S.A. (Austin, Texas)</b> International Access Code: <b>011</b> Country Code: <b>1</b>	Automated Order-Status Service	toll-free: 1-800-433-9014
	AutoTech (portable and desktop computers)	toll-free: 1-800-247-9362
	<b>Consumer</b> (Home and Home Office)	
	Technical Support	toll-free: 1-800-624-9896
	Customer Service	toll-free: 1-800-624-9897
	DellNet™ Service and Support	toll-free: 1-877-Dellnet (1-877-335-5638)
	Employee Purchase Program (EPP) Customers	toll-free: 1-800-695-8133
	Financial Services website: <b>www.dellfinancialservices.com</b>	
	Financial Services (lease/loans)	toll-free: 1-877-577-3355
	Financial Services (Dell Preferred Accounts [DPA])	toll-free: 1-800-283-2210
	<b>Business</b>	
	Customer Service and Technical Support	toll-free: 1-800-822-8965
	Employee Purchase Program (EPP) Customers	toll-free: 1-800-695-8133
	Printers and Projectors Technical Support	toll-free: 1-877-459-7298
	<b>Public</b> (government, education, and healthcare)	
	Customer Service and Technical Support	toll-free: 1-800-456-3355
	Employee Purchase Program (EPP) Customers	toll-free: 1-800-234-1490
	Dell Sales	toll-free: 1-800-289-3355 or toll-free: 1-800-879-3355
	Dell Outlet Store (Dell refurbished computers)	toll-free: 1-888-798-7561
	Software and Peripherals Sales	toll-free: 1-800-671-3355
Spare Parts Sales	toll-free: 1-800-357-3355	

	Extended Service and Warranty Sales	toll-free: 1-800-247-4618
	Fax	toll-free: 1-800-727-8320
	Dell Services for the Deaf, Hard-of-Hearing, or Speech-Impaired	toll-free: 1-877-DELLTTY (1-877-335-5889)

## FCC Notices (U.S. Only)

Most Dell computer systems are classified by the Federal Communications Commission (FCC) as Class B digital devices. To determine which classification applies to your computer system, examine all FCC registration labels located on the bottom, side, or back panel of your computer, on card-mounting brackets, and on the cards themselves. If any one of the labels carries a Class A rating, your entire system is considered to be a Class A digital device. If *all* labels carry an FCC Class B rating as distinguished by either an FCC ID number or the FCC logo, (  ), your system is considered to be a Class B digital device.

Once you have determined your system's FCC classification, read the appropriate FCC notice. Note that FCC regulations provide that changes or modifications not expressly approved by Dell could void your authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

## Class A

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instruction manual, may cause harmful interference with radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

## Class B

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instruction manual, may cause interference with radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

## FCC Identification Information

The following information is provided on the device or devices covered in this document in compliance with FCC regulations:

Model numbers: WHL and WHM

- Company name:

Dell Inc.  
One Dell Way  
Round Rock, Texas 78682 USA  
512-338-4400

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# Glossary

## Dell Precision™ Workstation 470 and 670 Computers User's Guide

Terms in this Glossary are provided for informational purposes only and may or may not describe features included with your particular computer.

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### A

**AC** — alternating current — The form of electricity that powers your computer when you plug the AC adapter power cable into an electrical outlet.

**ACPI** — advanced configuration and power interface — A power management specification that enables Microsoft® Windows® operating systems to put a computer in standby or hibernate mode to conserve the amount of electrical power allocated to each device attached to the computer.

**AGP** — accelerated graphics port — A dedicated graphics port that allows system memory to be used for video-related tasks. AGP delivers a smooth, true-color video image because of the faster interface between the video circuitry and the computer memory.

**antivirus software** — A program designed to identify, quarantine, and/or delete viruses from your computer.

**APR** — advanced port replicator — A docking device that allows you to conveniently use a monitor, keyboard, mouse, and other devices with your portable computer.

**array** — A logical disk created from available space and made up of one or more segments on one or more physical disks. Arrays are typically used to provide data redundancy or enhanced I/O performance.

**ASF** — alert standards format — A standard to define a mechanism for reporting hardware and software alerts to a management console. ASF is designed to be platform- and operating system-independent.

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### B

**backup** — A copy of a program or data file on a floppy disk, CD, or hard drive. As a precaution, back up the data files from your hard drive regularly.

**battery** — An internal power source used to operate portable computers when not connected to an AC adapter and an electrical outlet.

**battery life span** — The length of time (years) during which a portable computer battery is able to be depleted and recharged.

**battery operating time** — The length of time (minutes or hours) that a portable computer battery holds a charge while powering the computer.

**BIOS** — basic input/output system — A program (or utility) that serves as an interface between the computer hardware and the operating system. Unless you understand what effect the settings have on the computer, do not change the settings for this program. Also referred to as *system setup*.

**bit** — The smallest unit of data interpreted by your computer.

**Bluetooth™ technology** — A wireless technology standard for short-range (9 m [29 feet]) networking devices that allows for enabled devices to automatically recognize each other.

**boot sequence** — Specifies the order of the devices from which the computer attempts to boot.

**bootable CD** — A CD that you can use to start your computer. In case your hard drive is damaged or your computer has a virus, ensure that you always have a bootable CD or floppy disk available. Your *Drivers and Utilities* or Resource CD is a bootable CD.

**bootable disk** — A disk that you can use to start your computer. In case your hard drive is damaged or your computer has a

virus, ensure that you always have a bootable CD or floppy disk available.

**bps** — bits per second — The standard unit for measuring data transmission speed.

**BTU** — British thermal unit — A measurement of heat output.

**bus** — A communication pathway between the components in your computer.

**bus speed** — The speed, given in MHz, that indicates how fast a bus can transfer information.

**byte** — The basic data unit used by your computer. A byte is usually equal to 8 bits.

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## C

**C** — Celsius — A temperature measurement system where 0° is the freezing point and 100° is the boiling point of water.

**cache** — A special high-speed storage mechanism which can be either a reserved section of main memory or an independent high-speed storage device. The cache enhances the efficiency of many processor operations.

**L1 cache** — Primary cache stored inside the processor.

**L2 cache** — Secondary cache which can either be external to the processor or incorporated into the processor architecture.

**carnet** — An international customs document that facilitates temporary imports into foreign countries. Also known as a *merchandise passport*.

**CD** — compact disc — An optical form of storage media, typically used for audio and software programs.

**CD drive** — A drive that uses optical technology to read data from CDs.

**CD player** — The software used to play music CDs. The CD player displays a window with buttons that you use to play a CD.

**CD-R** — CD recordable — A recordable version of a CD. Data can be recorded only once onto a CD-R. Once recorded, the data cannot be erased or written over.

**CD-RW** — CD rewritable — A rewritable version of a CD. Data can be written to a CD-RW disc, and then erased and written over (rewritten).

**CD-RW drive** — A drive that can read CDs and write to CD-RW (rewritable CDs) and CD-R (recordable CDs) discs. You can write to CD-RW discs multiple times, but you can write to CD-R discs only once.

**CD-RW/DVD drive** — A drive, sometimes referred to as a combo drive, that can read CDs and DVDs and write to CD-RW (rewritable CDs) and CD-R (recordable CDs) discs. You can write to CD-RW discs multiple times, but you can write to CD-R discs only once.

**clock speed** — The speed, given in MHz, that indicates how fast computer components that are connected to the system bus operate.

**COA** — Certificate of Authenticity — The Windows alpha-numeric code located on a sticker on your computer. You may need the COA to complete the operating system setup or reinstallation. Also referred to as the *Product Key* or *Product ID*.

**Control Panel** — A Windows utility that allows you to modify operating system and hardware settings, such as display settings.

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

**CRIMM** — continuity rambus in-line memory module — A special module that has no memory chips and is used to fill unused RIMM slots.

**cursor** — The marker on a display or screen that shows where the next keyboard, touch pad, or mouse action will occur. It often is a blinking solid line, an underline character, or a small arrow.

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## D

**DDR SDRAM** — double-data-rate SDRAM — A type of SDRAM that doubles the data burst cycle, improving system performance.

**DDR2** — a second generation double-data-rate SDRAM that is not compatible with the first generation.

**dead partition** — State of nonredundant array that has suffered a single drive failure, or a redundant array that has suffered multiple drive failures. A failed array is inaccessible and data is lost.

**degraded** — A redundant (for example, a RAID 1) array in which one or more members have failed. The data is intact but redundancy has been compromised. Any further failure cause the array to fail and result in data loss.

**device** — Hardware such as a disk drive, printer, or keyboard that is installed in or connected to your computer.

**device driver** — See *driver*.

**DIN connector** — A round, six-pin connector that conforms to DIN (Deutsche Industrie-Norm) standards; it is typically used to connect PS/2 keyboard or mouse cable connectors.

**disk striping** — A technique for spreading data over multiple disk drives. Disk striping can speed up operations that retrieve data from disk storage. Computers that use disk striping generally allow the user to select the data unit size or stripe width.

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

**docking device** — See *APR*.

**DMTF** — Distributed Management Task Force — A consortium of hardware and software companies who develop management standards for distributed desktop, network, enterprise, and Internet environments.

**domain** — A group of computers, programs, and devices on a network that are administered as a unit with common rules and procedures for use by a specific group of users. A user logs on to the domain to gain access to the resources.

**DRAM** — dynamic random-access memory — Memory that stores information in integrated circuits containing capacitors.

**driver** — Software that allows the operating system to control a device such as a printer. Many devices do not work properly if the correct driver is not installed in the computer.

**DSL** — Digital Subscriber Line — A technology that provides a constant, high-speed Internet connection through an analog telephone line.

**dual display mode** — A display setting that allows you to use a second monitor as an extension of your display. Also referred to as *extended display mode*.

**DVD** — digital versatile disc — A disc usually used to store movies. DVDs are double-sided, whereas CDs are single-sided. DVD drives read most CD media as well.

**DVD drive** — A drive that uses optical technology to read data from DVDs and CDs.

**DVD player** — The software used to watch DVD movies. The DVD player displays a window with buttons that you use to watch a movie.

**DVD+RW** — DVD rewritable — A rewritable version of a DVD. Data can be written to a DVD+RW disc, and then erased and written over (rewritten). (DVD+RW technology is different from DVD-RW technology.)

**DVD+RW drive** — A drive that can read DVDs and most CD media and write to DVD+RW (rewritable DVDs) discs.

**DVI** — digital video interface — A standard for digital transmission between a computer and a digital video display; the DVI adapter works through the computer's integrated graphics.

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## E

**ECC** — error checking and correction — A type of memory that includes special circuitry for testing the accuracy of data as it passes in and out of memory.

**ECP** — extended capabilities port — A parallel connector design that provides improved bidirectional data transmission. Similar to EPP, ECP uses direct memory access to transfer data and often improves performance.

**EIDE** — enhanced integrated device electronics — An improved version of the IDE interface for hard drives and CD drives.

**EMI** — electromagnetic interference — Electrical interference caused by electromagnetic radiation.

**ENERGY STAR®** — Environmental Protection Agency requirements that decrease the overall consumption of electricity.



**EPP** — enhanced parallel port — A parallel connector design that provides bidirectional data transmission.

**ESD** — electrostatic discharge — A rapid discharge of static electricity. ESD can damage integrated circuits found in computer and communications equipment.

**expansion card** — A circuit board that installs in an expansion slot on the system board in some computers, expanding the capabilities of the computer. Examples include video, modem, and sound cards.

**expansion slot** — A connector on the system board (in some computers) where you insert an expansion card, connecting it to the system bus.

**Express Service Code** — A numeric code located on a sticker on your Dell™ computer. Use the Express Service Code when contacting Dell for assistance. Express Service Code service may not be available in some countries.

**extended display mode** — A display setting that allows you to use a second monitor as an extension of your display. Also referred to as *dual display mode*.

**extended PC Card** — A PC Card that extends beyond the edge of the PC Card slot when installed.

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## F

**Fahrenheit** — A temperature measurement system where 32° is the freezing point and 212° is the boiling point of water.

**failed** — State of nonredundant array that has suffered a single drive failure, or a redundant array that has suffered multiple drive failures. A failed array is inaccessible and data is lost.

**fault-tolerant array** — Refers to an array that can continue to function after a disk drive failure without loss of data. Fault tolerant, or redundant arrays, include RAID 1 and RAID 10 arrays.

**FCC** — Federal Communications Commission — A U.S. agency responsible for enforcing communications-related regulations that state how much radiation computers and other electronic equipment can emit.

**floppy drive** — A disk drive that can read and write to floppy disks.

**folder** — A term used to describe space on a disk or drive where files are organized and grouped. Files in a folder can be viewed and ordered in various ways, such as alphabetically, by date, and by size.

**format** — The process that prepares a drive or disk for file storage. When a drive or disk is formatted, the existing information on it is lost.

**FSB** — front side bus — The data path and physical interface between the processor and RAM.

**FTP** — file transfer protocol — A standard Internet protocol used to exchange files between computers connected to the Internet.

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## G

**G** — gravity — A measurement of weight and force.

**GB** — gigabyte — A measurement of data storage that equals 1024 MB (1,073,741,824 bytes). When used to refer to hard drive storage, the term is often rounded to 1,000,000,000 bytes.

**GHz** — gigahertz — A measurement of frequency that equals one thousand million Hz, or one thousand MHz. The speeds for computer processors, buses, and interfaces are often measured in GHz.

**graphics mode** — A video mode that can be defined as x horizontal pixels by y vertical pixels by z colors. Graphics modes can display an unlimited variety of shapes and fonts.

**GUI** — graphical user interface — Software that interacts with the user by means of menus, windows, and icons. Most programs that operate on the Windows operating systems are GUIs.

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## H

**hard drive** — A drive that reads and writes data on a hard disk. The terms hard drive and hard disk are often used interchangeably.

**heat sink** — A metal plate on some processors that helps dissipate heat.

**help file** — A file that contains descriptive or instructional information about a product. Some help files are associated with a particular program, such as *Help* in Microsoft Word. Other help files function as stand-alone reference sources. Help files typically have a filename extension of **.hlp** or **.chm**.

**hibernate mode** — A power management mode that saves everything in memory to a reserved space on the hard drive and then turns off the computer. When you restart the computer, the memory information that was saved to the hard drive is automatically restored.

**hot swap** — To remove a component from the computer and install a new component while the power is on and the computer is running.

**hotspare** — A spare hard drive that automatically replaces a failed hard drive on any array associated with any HBA.

**HTML** — hypertext markup language — A set of codes inserted into an Internet web page intended for display on an Internet browser.

**HTTP** — hypertext transfer protocol — A protocol for exchanging files between computers connected to the Internet.

**Hz** — hertz — A unit of frequency measurement that equals 1 cycle per second. Computers and electronic devices are often measured in kilohertz (kHz), megahertz (MHz), gigahertz (GHz), or terahertz (THz).

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## I

**IC** — Industry Canada — The Canadian regulatory body responsible for regulating emissions from electronic equipment, much as the FCC does in the United States.

**IC** — integrated circuit — A semiconductor wafer, or chip, on which thousands or millions of tiny electronic components are fabricated for use in computer, audio, and video equipment.

**IDE** — integrated device electronics — An interface for mass storage devices in which the controller is integrated into the hard drive or CD drive.

**IEEE 1394a** — Institute of Electrical and Electronics Engineers, Inc. — A high-performance serial bus used to connect IEEE 1394a-compatible devices, such as digital cameras and DVD players, to the computer.

**infrared sensor** — A port that allows you to transfer data between the computer and infrared-compatible devices without using a cable connection.

**integrated** — Usually refers to components that are physically located on the computer's system board. Also referred to as *built-in*.

**initialize** — Process of preparing a drive for use by the controller. When a drive is initialized, the controller records the RAID signature on the drive.

**I/O** — input/output — An operation or device that enters and extracts data from your computer. Keyboards and printers are I/O devices.

**I/O address** — An address in RAM that is associated with a specific device (such as a serial connector, parallel connector, or expansion slot) and allows the processor to communicate with that device.

**IrDA** — Infrared Data Association — The organization that creates international standards for infrared communications.

**IRQ** — interrupt request — An electronic pathway assigned to a specific device so that the device can communicate with the processor. Each device connection must be assigned an IRQ. Although two devices can share the same IRQ assignment, you cannot operate both devices simultaneously.

**ISP** — Internet service provider — A company that allows you to access its host server to connect directly to the Internet, send and receive e-mail, and access websites. The ISP typically provides you with a software package, user name, and access phone numbers for a fee.

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## K

**Kb** — kilobit — A unit of data that equals 1024 bits. A measurement of the capacity of memory integrated circuits.

**KB** — kilobyte — A unit of data that equals 1024 bytes but is often referred to as 1000 bytes.

**key combination** — A command requiring you to press multiple keys at the same time.

**kHz** — kilohertz — A measurement of frequency that equals 1000 Hz.

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## L

**LAN** — local area network — A computer network covering a small area. A LAN usually is confined to a building or a few nearby buildings. A LAN can be connected to another LAN over any distance through telephone lines and radio waves to form a wide area network (WAN).

**LCD** — liquid crystal display — The technology used by portable computer and flat-panel displays.

**LED** — light-emitting diode — An electronic component that emits light to indicate the status of the computer.

**legacy disk** — Drive that contained a valid partition when connected to the controller. The controller manages the drive as a legacy disk array where there is a one-to-one logical-to-physical mapping of an array to disk.

**local bus** — A data bus that provides a fast throughput for devices to the processor.

**LPT** — line print terminal — The designation for a parallel connection to a printer or other parallel device.

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## M

**Mb** — megabit — A measurement of memory chip capacity that equals 1024 Kb.

**Mbps** — megabits per second — One million bits per second. This measurement is typically used for transmission speeds for networks and modems.

**MB** — megabyte — A measurement of data storage that equals 1,048,576 bytes. 1 MB equals 1024 KB. When used to refer to hard drive storage, the term is often rounded to 1,000,000 bytes.

**MB/sec** — megabytes per second — One million bytes per second. This measurement is typically used for data transfer ratings.

**memory** — A temporary data storage area inside your computer. Because the data in memory is not permanent, it is recommended that you frequently save your files while you are working on them, and always save your files before you shut down the computer. Your computer can contain several different forms of memory, such as RAM, ROM, and video memory. Frequently, the word memory is used as a synonym for RAM.

**memory address** — A specific location where data is temporarily stored in RAM.

**memory mapping** — The process by which the computer assigns memory addresses to physical locations at start-up. Devices and software can then identify information that the processor can access.

**memory module** — A small circuit board containing memory chips, which connects to the system board.

**MHz** — megahertz — A measure of frequency that equals 1 million cycles per second. The speeds for computer processors, buses, and interfaces are often measured in MHz.

**modem** — A device that allows your computer to communicate with other computers over analog telephone lines. Three types of modems include: external, PC Card, and internal. You typically use your modem to connect to the Internet and exchange e-mail.

**module bay** — A bay that supports devices such as optical drives, a second battery, or a Dell Travellite™ module.

**monitor** — The high-resolution TV-like device that displays computer output.

**mouse** — A pointing device that controls the movement of the cursor on your screen. Typically you roll the mouse over a hard, flat surface to move the pointer or cursor on your screen.

**ms** — millisecond — A measure of time that equals one thousandth of a second. Access times of storage devices are often measured in ms.

## N

**network adapter** — A chip that provides network capabilities. A computer may include a network adapter on its system board, or it may contain a PC Card with an adapter on it. A network adapter is also referred to as a *NIC* (network interface controller).

**NIC** — See *network adapter*.

**notification area** — The section of the Windows taskbar that contains icons for providing quick access to programs and computer functions, such as the clock, volume control, and print status. Also referred to as *system tray*.

**ns** — nanosecond — A measure of time that equals one billionth of a second.

**NVRAM** — nonvolatile random access memory — A type of memory that stores data when the computer is turned off or loses its external power source. NVRAM is used for maintaining computer configuration information such as date, time, and other system setup options that you can set.

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## O

**optical drive** — A drive that uses optical technology to read or write data from CDs, DVDs, or DVD+RWs. Example of optical drives include CD drives, DVD drives, CD-RW drives, and CD-RW/DVD combo drives.

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## P

**parallel connector** — An I/O port often used to connect a parallel printer to your computer. Also referred to as an *LPT port*.

**partition** — A physical storage area on a hard drive that is assigned to one or more logical storage areas known as logical drives. Each partition can contain multiple logical drives.

**PC Card** — A removable I/O card adhering to the PCMCIA standard. Modems and network adapters are common types of PC Cards.

**PCI** — peripheral component interconnect — PCI is a local bus that supports 32- and 64-bit data paths, providing a high-speed data path between the processor and devices such as video, drives, and networks.

**PCMCIA** — Personal Computer Memory Card International Association — The organization that establishes standards for PC Cards.

**PIN** — personal identification number — A sequence of numerals and/or letters used to restrict unauthorized access to computer networks and other secure computers.

**PIO** — programmed input/output — A method of transferring data between two devices through the processor as part of the data path.

**pixel** — A single point on a display screen. Pixels are arranged in rows and columns to create an image. A video resolution, such as 800 x 600, is expressed as the number of pixels across by the number of pixels up and down.

**Plug-and-Play** — The ability of the computer to automatically configure devices. Plug and Play provides automatic installation, configuration, and compatibility with existing hardware if the BIOS, operating system, and all devices are Plug and Play compliant.

**POST** — power-on self-test — Diagnostics programs, loaded automatically by the BIOS, that perform basic tests on the major computer components, such as memory, hard drives, and video. If no problems are detected during POST, the computer continues the start-up.

**processor** — A computer chip that interprets and executes program instructions. Sometimes the processor is referred to as the CPU (central processing unit).

**program** — Any software that processes data for you, including spreadsheet, word processor, database, and game packages. Programs require an operating system to run.

**PS/2** — personal system/2 — A type of connector for attaching a PS/2-compatible keyboard, mouse, or keypad.

**PXE** — pre-boot execution environment — A WfM (Wired for Management) standard that allows networked computers that do not have an operating system to be configured and started remotely.

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## Q

**quick init** — An array initialized using the Quick Init option is available immediately, with no on-going background controller activity. All data written to an array that has been quick initialized is protected.

---

## R

**RAID** — redundant array of independent disks — A method of providing data redundancy.

**RAID 0** — A single level array consisting of two or more equal-sized segments residing on different drives. RAID 0 distributes data evenly across its respective drives in equal-sized sections called stripes. RAID 0 arrays are not redundant.

**RAID 1** — A single level array consisting of two equal-sized segments residing on two different drives. Provides redundancy by storing identical copies on two drives.

**RAM** — random-access memory — The primary temporary storage area for program instructions and data. Any information stored in RAM is lost when you shut down your computer.

**readme file** — A text file included with a software package or hardware product. Typically, readme files provide installation information and describe new product enhancements or corrections that have not yet been documented.

**read-only** — Data and/or files you can view but cannot edit or delete. A file can have read-only status if:

- o It resides on a physically write-protected floppy disk, CD, or DVD.
- o It is located on a network in a directory and the system administrator has assigned rights only to specific individuals.

**rebuild** — Background regeneration of redundant data on a RAID 1.

**redundant** — The ability of an array to maintain operability when one or more hardware failures occur. RAID 1 is redundant. In the event of the drive failure

**refresh rate** — The frequency, measured in Hz, at which your screen's horizontal lines are recharged (sometimes also referred to as its *vertical frequency*). The higher the refresh rate, the less video flicker can be seen by the human eye.

**resolution** — The sharpness and clarity of an image produced by a printer or displayed on a monitor. The higher the resolution, the sharper the image.

**RFI** — radio frequency interference — Interference that is generated at typical radio frequencies, in the range of 10 kHz to 100,000 MHz. Radio frequencies are at the lower end of the electromagnetic frequency spectrum and are more likely to have interference than the higher frequency radiations, such as infrared and light.

**ROM** — read-only memory — Memory that stores data and programs that cannot be deleted or written to by the computer. ROM, unlike RAM, retains its contents after you shut down your computer. Some programs essential to the operation of your computer reside in ROM.

**RPM** — revolutions per minute — The number of rotations that occur per minute. Hard drive speed is often measured in rpm.

**RTC** — real time clock — Battery-powered clock on the system board that keeps the date and time after you shut down the computer.

**RTCST** — real-time clock reset — A jumper on the system board of some computers that can often be used for troubleshooting problems.

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## S

**ScanDisk** — A Microsoft utility that checks files, folders, and the hard disk's surface for errors. ScanDisk often runs when you restart the computer after it has stopped responding.

**SDRAM** — synchronous dynamic random-access memory — A type of DRAM that is synchronized with the optimal clock speed

of the processor.

**serial connector** — An I/O port often used to connect devices such as a handheld digital device or digital camera to your computer.

**Service Tag** — A bar code label on your computer that identifies your computer when you access Dell Support at [support.dell.com](http://support.dell.com) or when you call Dell for customer service or technical support.

**setup program** — A program that is used to install and configure hardware and software. The **setup.exe** or **install.exe** program comes with most Windows software packages. *Setup program* differs from *system setup*.

**shortcut** — An icon that provides quick access to frequently used programs, files, folders, and drives. When you place a shortcut on your Windows desktop and double-click the icon, you can open its corresponding folder or file without having to find it first. Shortcut icons do not change the location of files. If you delete a shortcut, the original file is not affected. Also, you can rename a shortcut icon.

**shutdown** — The process of closing windows and exiting programs, exiting the operating system, and turning off your computer. You can lose data if you turn off your computer before completing a shutdown.

**simple volume** — A volume made up of drive space from a single drive. It can consist of a single regions on a drive, or concatenated multiple regions of the same drive.

**smart card** — A card that is embedded with a processor and a memory chip. Smart cards can be used to authenticate a user on computers equipped for smart cards.

**software** — Anything that can be stored electronically, such as computer files or programs.

**S/PDIF** — Sony/Philips Digital Interface — An audio transfer file format that allows the transfer of audio from one file to another without converting it to and from an analog format, which could degrade the quality of the file.

**standby mode** — A power management mode that shuts down all unnecessary computer operations to save energy.

**stripe** — Contiguous set of data distributed across all the drives in an array. A striped array distributes data evenly across all members in equal-sized sections called stripes.

**surge protectors** — Prevent voltage spikes, such as those that may occur during an electrical storm, from entering the computer through the electrical outlet. Surge protectors do not protect against lightning strikes or against brownouts, which occur when the voltage drops more than 20 percent below the normal AC-line voltage level.

Network connections cannot be protected by surge protectors. Always disconnect the network cable from the network connector during electrical storms.

**SVGA** — super-video graphics array — A video standard for video cards and controllers. Typical SVGA resolutions are 800 x 600 and 1024 x 768.

The number of colors and resolution that a program displays depends on the capabilities of the monitor, the video controller and its drivers, and the amount of video memory installed in the computer.

**S-video TV-out** — A connector used to attach a TV or digital audio device to the computer.

**SXGA** — super-extended graphics array — A video standard for video cards and controllers that supports resolutions up to 1280 x 1024.

**SXGA+** — super-extended graphics array plus — A video standard for video cards and controllers that supports resolutions up to 1400 x 1050.

**system board** — The main circuit board in your computer. Also known as the *motherboard*.

**system setup** — A utility that serves as an interface between the computer hardware and the operating system. System setup allows you to configure user-selectable options in the BIOS, such as date and time or system password. Unless you understand what effect the settings have on the computer, do not change the settings for this program.

**system tray** — See *notification area*.

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## T

**TAPI** — telephony application programming interface — Enables Windows programs to operate with a wide variety of telephony devices, including voice, data, fax, and video.

**text editor** — A program used to create and edit files that contain only text; for example, Windows Notepad uses a text editor. Text editors do not usually provide word wrap or formatting functionality (the option to underline, change fonts, and so on).

**travel module** — A plastic device designed to fit inside the module bay of a portable computer to reduce the weight of the computer.

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## U

**UPS** — uninterruptible power supply — A backup power source used when the electrical power fails or drops to an unacceptable voltage level. A UPS keeps a computer running for a limited amount of time when there is no electrical power. UPS systems typically provide surge suppression and may also provide voltage regulation. Small UPS systems provide battery power for a few minutes to enable you to shut down your computer.

**USB** — universal serial bus — A hardware interface for a low-speed device such as a USB-compatible keyboard, mouse, joystick, scanner, set of speakers, printer, broadband devices (DSL and cable modems), imaging devices, or storage devices. Devices are plugged directly into a 4-pin socket on your computer or into a multi-port hub that plugs into your computer. USB devices can be connected and disconnected while the computer is turned on, and they can also be daisy-chained together.

**UTP** — unshielded twisted pair — Describes a type of cable used in most telephone networks and some computer networks. Pairs of unshielded wires are twisted to protect against electromagnetic interference, rather than relying on a metal sheath around each pair of wires to protect against interference.

**UXGA** — ultra extended graphics array — A video standard for video cards and controllers that supports resolutions up to 1600 x 1200.

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## V

**video controller** — The circuitry on a video card or on the system board (in computers with an integrated video controller) that provides the video capabilities—in combination with the monitor—for your computer.

**video memory** — Memory that consists of memory chips dedicated to video functions. Video memory is usually faster than system memory. The amount of video memory installed primarily influences the number of colors that a program can display.

**video mode** — A mode that describes how text and graphics are displayed on a monitor. Graphics-based software, such as Windows operating systems, displays in video modes that can be defined as *x* horizontal pixels by *y* vertical pixels by *z* colors. Character-based software, such as text editors, displays in video modes that can be defined as *x* columns by *y* rows of characters.

**video resolution** — See *resolution*.

**virus** — A program that is designed to inconvenience you or to destroy data stored on your computer. A virus program moves from one computer to another through an infected disk, software downloaded from the Internet, or e-mail attachments. When an infected program starts, its embedded virus also starts.

A common type of virus is a boot virus, which is stored in the boot sectors of a floppy disk. If the floppy disk is left in the drive when the computer is shut down and then turned on, the computer is infected when it reads the boot sectors of the floppy disk expecting to find the operating system. If the computer is infected, the boot virus may replicate itself onto all the floppy disks that are read or written in that computer until the virus is eradicated.

**V** — volt — The measurement of electric potential or electromotive force. One V appears across a resistance of 1 ohm when a current of 1 ampere flows through that resistance.

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## W

**W** — watt — The measurement of electrical power. One W is 1 ampere of current flowing at 1 volt.

**Whr** — watt-hour — A unit of measure commonly used to indicate the approximate capacity of a battery. For example, a 66-Whr battery can supply 66 W of power for 1 hour or 33 W for 2 hours.

**wallpaper** — The background pattern or picture on the Windows desktop. Change your wallpaper through the Windows

Control Panel. You can also scan in your favorite picture and make it wallpaper.

**write-protected** — Files or media that cannot be changed. Use write-protection when you want to protect data from being changed or destroyed. To write-protect a 3.5-inch floppy disk, slide its write-protect tab to the open position.

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## X

**XGA** — extended graphics array — A video standard for video cards and controllers that supports resolutions up to 1024 x 768.

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## Z

**ZIF** — zero insertion force — A type of socket or connector that allows a computer chip to be installed or removed with no stress applied to either the chip or its socket.

**Zip** — A popular data compression format. Files that have been compressed with the Zip format are called Zip files and usually have a filename extension of **.zip**. A special kind of zipped file is a self-extracting file, which has a filename extension of **.exe**. You can unzip a self-extracting file by double-clicking it.

**Zip drive** — A high-capacity floppy drive developed by Iomega Corporation that uses 3.5-inch removable disks called Zip disks. Zip disks are slightly larger than regular floppy disks, about twice as thick, and hold up to 100 MB of data.

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