Dell™ PowerVault™ 220S and 221S Systems User's Guide

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Model AMP01

Notes, Notices, and Cautions

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

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

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

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Introduction

Dell™ PowerVault™ 220S and 221S Systems User's Guide

- Other Documents You May Need
- System Features
- Front-Panel Features
- Back-Panel Features

- Preventing Unauthorized Access to the System
- Power Protection Devices
- Safety and Regulatory Information
- Getting Help

Dell™ PowerVault™ 220S and 221S systems are reliable, flexible, external SCSI expansion enclosures designed to support multiple Dell storage environments and RAID configurations. Each system offers maximized drive-spindle count, hot-plug hard drives, optional redundant power, redundant cooling, rackmount capability, systems management features, and a modular design for easy upgrades. Most major components, including hard drives and power supply/cooling modules are hot-pluggable and can be removed and replaced easily. The enclosure management module (EMM), split-bus module, and SCSI terminator card are "warm-pluggable." This means they can be removed or inserted while the power is on, but all I/O activity has ceased.

This section describes the major hardware features of the system and identifies front- and back-panel components and LED indicators.

Other Documents You May Need

Besides this *User's Guide*, the following documentation is provided for your system:

- The *Installation and Troubleshooting Guide* provides information on installing and troubleshooting your system.

- The Dell OpenManage™ Array Manager documentation provides information about the array management software.

- The *Product Information* document provides important safety and regulatory information.

- The *Rack Installation Guide* describes how to unpack and set up the rack and install your system in the rack.

- Readme files, included on your *Resource* CD, provide information on supported components, peripherals, and software, as well as last-minute updates about technical changes to your system or advanced technical reference material intended for experienced users or technicians.

NOTE: Documentation updates which describe changes to your system are sometimes included with your system. Always read these updates before consulting any other documentation.

You may also have one or more of the following documents:

- RAID controller documentation

- Documentation is included with any options you purchase separately from your system. This documentation includes information that you need to configure and install these options in your system.
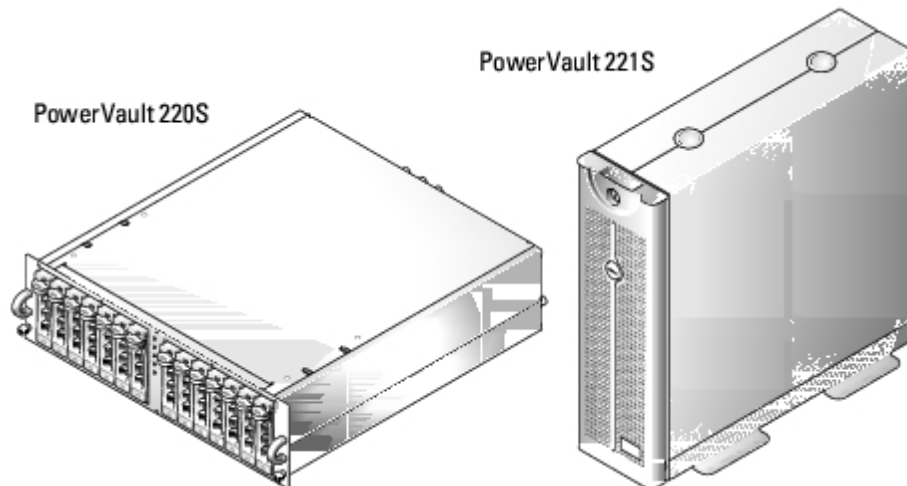

System Features

Your system offers the following features:

- Tower or rack versions (3 units [U] [19 inches])

- Capacity for fourteen 1-inch hot-plug SCSI hard drives (See "Technical Specifications" or your system's readme file for supported hard-drive speeds and capacities.)

- Universal hard-drive carriers

- Support for a variety of RAID controller cards, host-integrated RAID controllers, and host bus adapter (HBA) cards (See your system's readme file for supported RAID controllers and HBA cards.)

- Hot-plug power supply and cooling modules that are combined for easy serviceability. The cooling modules are redundant. Power supply modules may be redundant or nonredundant.

- Optional redundant EMMs

- Support for the following direct-attach configurations:

  - High-availability redundant EMM configuration in joined-bus mode (with a terminator card for nonredundant configurations)

  - High-availability cluster configurations (with redundant EMMs) that allow multiple-server access to the same enclosure

  - Split-bus module (with redundant EMMs) to operate the enclosure using two separate buses

- Enclosure management through in-band SCSI enclosure services (SES) for power supplies and cooling modules and SCSI-accessed fault-tolerant enclosures (SAFTE)

- Storage management through Dell OpenManage Array Manager

- Four sensors for monitoring ambient temperatures and shutdown capability when temperatures reach a critical level

- Audible warning for critical component failure

- Support for Dell servers (See your system's readme file for supported systems. An updated readme can be viewed from the Dell website at **support.dell.com.**)

Figure 1-1 shows the front-view orientation of both systems.

Figure 1-1. System Orientation
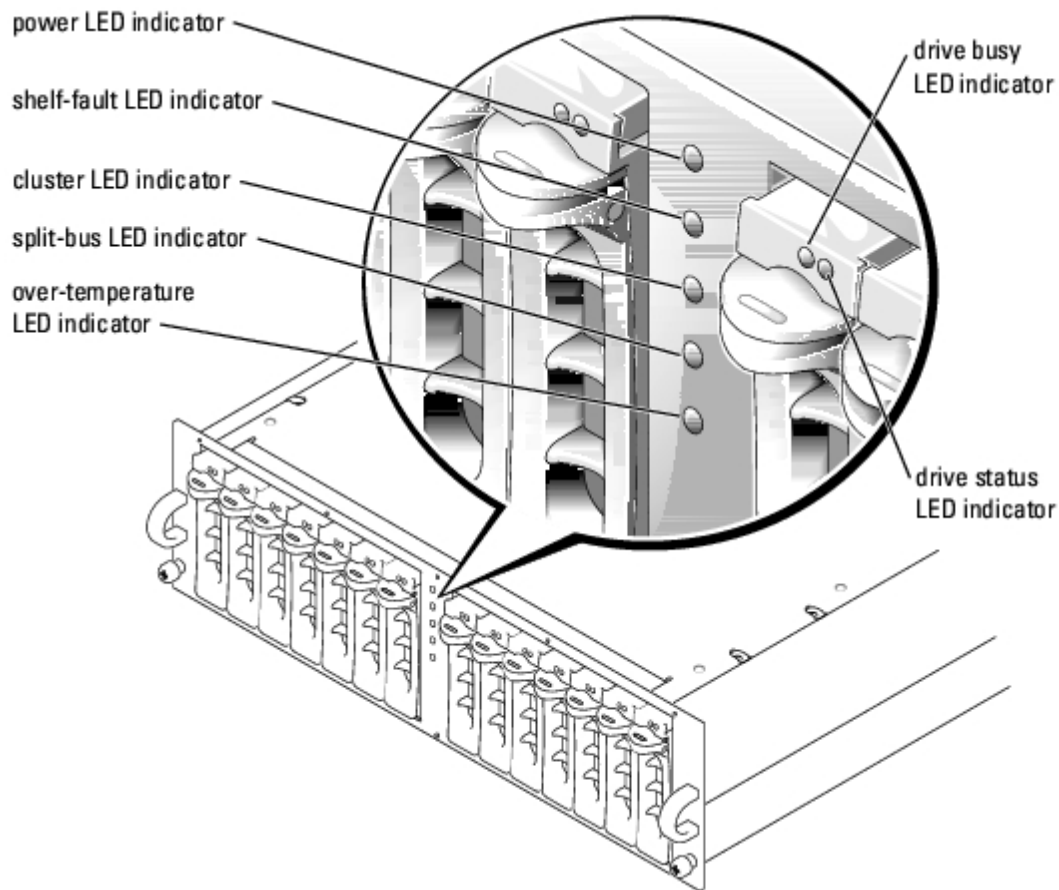

PowerVault 220S

PowerVault 221S

Front-Panel Features

Figure 1-2 illustrates the LED indicators and components on the system's front panel. Table 1-1 lists the functions of the front panel indicators.

Figure 1-2. Front-Panel Features

Table 1-1. Front-Panel Indicators

LED Indicator	LED Icon	Condition
Power (green)	ⓘ	At least one power supply is supplying power to the system.
Shelf-fault (amber)	⚠	One of the following conditions has occurred: power-supply failure, EMM failure, cooling module failure, over-temperature condition, or firmware currently being downloaded. For more information, see "Troubleshooting."
Cluster (green)	◇◇	The system is configured for cluster mode. For more information, see "Split-Bus Module."
Split-bus (green)	◇ ◇	The system is configured for split-bus mode. For more information, see "Split-Bus Module."
Over-temperature (amber)	🌡	An over-temperature condition has occurred. (The system will shut down when the temperature inside the box exceeds 50°C [122°F].) For more information, see "Troubleshooting." For the locations of the temperature probes, see "Temperature Probes."

Audible Alarm

The primary EMM activates an audible alarm if any of the shelf fault conditions listed in Table 1-1 occur. If a critical event occurs, the alarm sounds continuously. If a noncritical event occurs, the alarm sounds every 10 seconds. Table 1-2 lists critical and noncritical events.

✎ **NOTE:** The audible alarm is disabled by default. To enable the alarm, you must change the default setting using your array management software. For more information, see your array management software documentation.

✎ **NOTE:** When the system is on and a split-bus module is not detected, the audible alarm will sound regardless of whether the alarm is enabled or disabled.

Table 1-2. Audible Alarm Critical and Noncritical Events

Critical Events	Noncritical Events
Two or more cooling-module blowers have failed or a cooling module is not installed.	One power supply has failed.
One or more temperature sensors are in the critical range.	One cooling module blower has failed or is not installed.
Split-bus module not installed.	- One or more temperature sensors are in the warning range. - One EMM has failed.

NOTE: It is rare for both EMMs to fail simultaneously. However, if this event occurs, the system cannot issue critical or noncritical event alarms for any system component. If both power supplies fail simultaneously, the system can issue critical or noncritical event alarms only if 5-V power is available.

Hard-Drive Carrier LED Indicators

Each of your system's 14 hard-drive carriers have two LED indicators (see Figure 1-2). The first LED is a green busy indicator, controlled by the hard drive, that is illuminated when the hard drive is active on the SCSI bus. The second LED is a two-color (green and amber) status indicator. Table 1-3 lists the status indicator flash patterns.

Table 1-3. Hard-Drive Carrier Indicator Patterns

Condition	Status Indicator Pattern
Slot empty, ready for insert/remove	Off
Drive online, prepare for operation	Steady green
Drive identify	Flashes green four times per second
Prepare for removal	Flashes green twice per second at equal intervals
Drive rebuild	Flashes green twice per second at unequal intervals
Drive fail	Flashes amber four times per second
Predicted failure	Flashes green, then amber, then off, repeating this sequence every two seconds

Back-Panel Features

Figure 1-3 illustrates the back-panel features for redundant systems. Figure 1-4 illustrates the back-panel features for nonredundant systems.

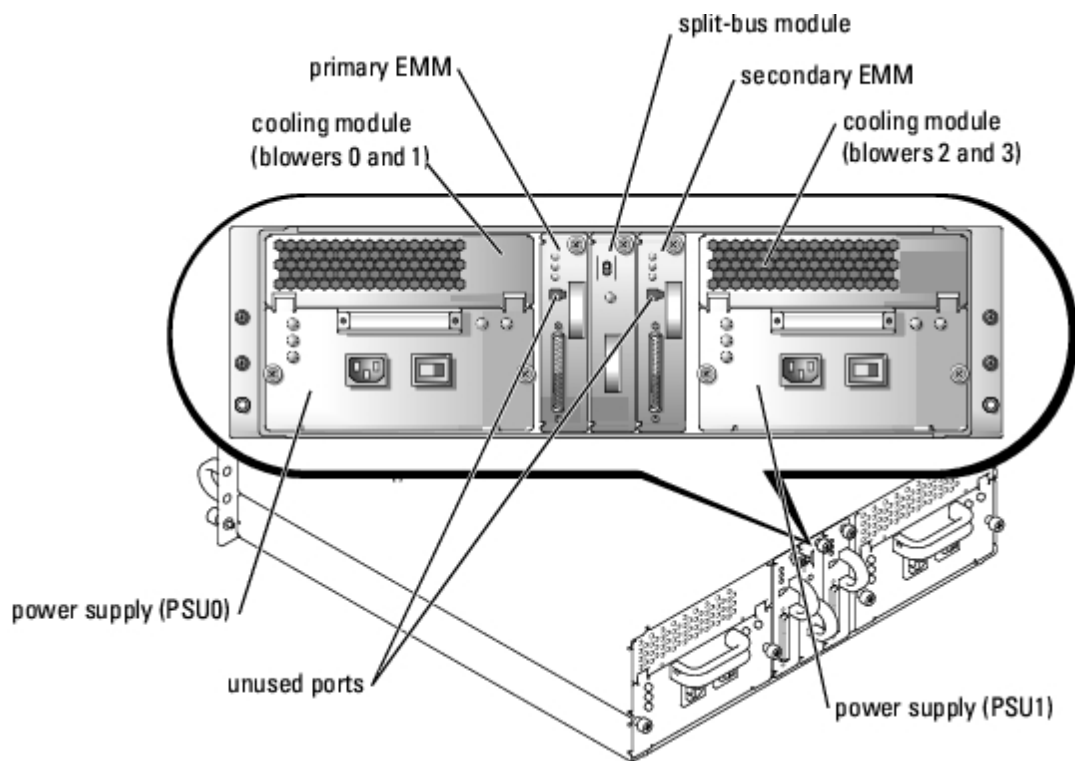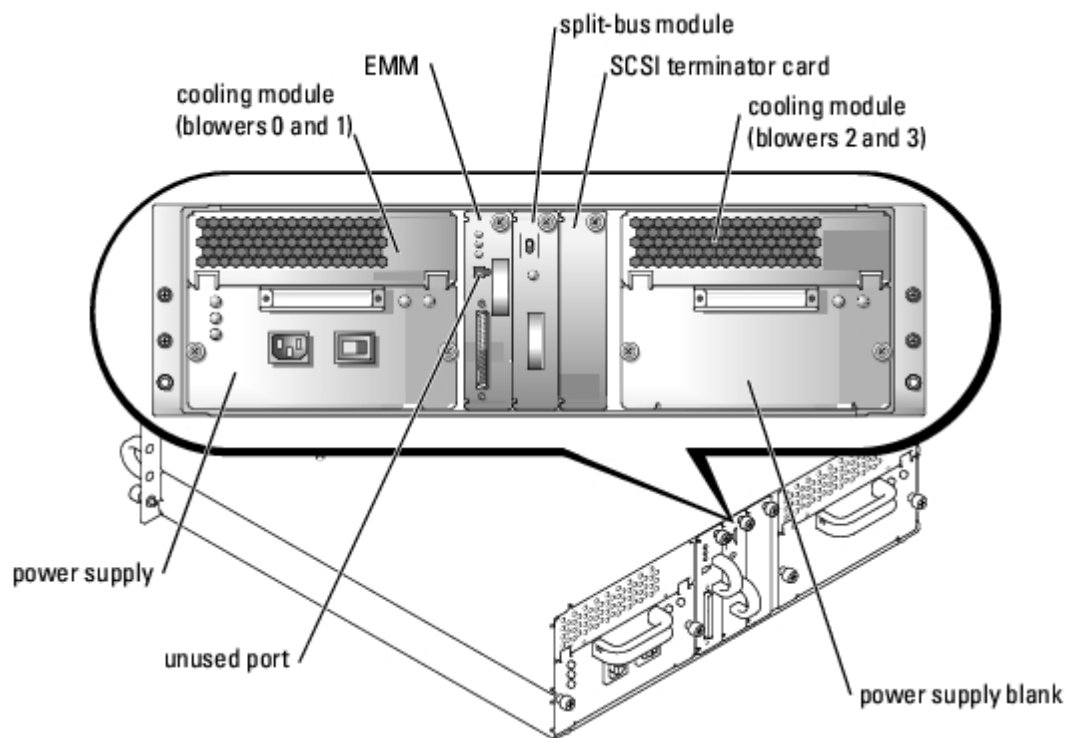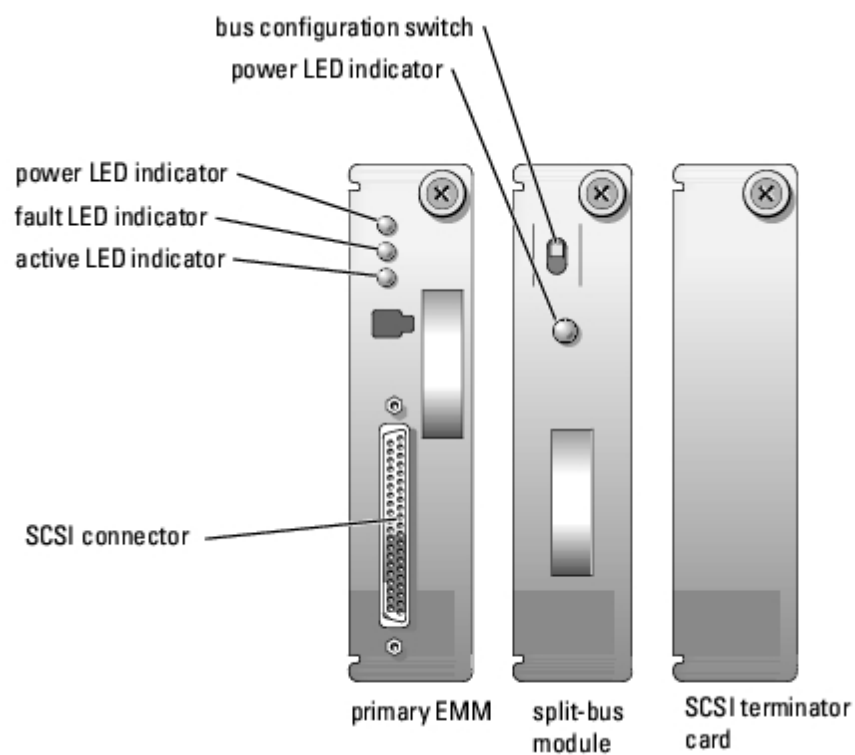**Figure 1-3. Back-Panel Features (Redundant Systems)**

Figure 1-4. Back-Panel Features (Nonredundant Systems)

Back-Panel Modules

Figure 1-5 illustrates the back-panel module features and indicators.

Figure 1-5. Back-Panel Module Features and Indicators

primary EMM   split-bus module   SCSI terminator card

Split-Bus Module

Your system supports three SCSI bus modes controlled by the split-bus module:

- Cluster mode

- Split-bus mode

- Joined-bus mode

These modes are controlled by the position of the bus configuration switch when the system is turned on. illustrates the switch position for each mode.

Figure 1-6. Bus Configuration Switch Modes
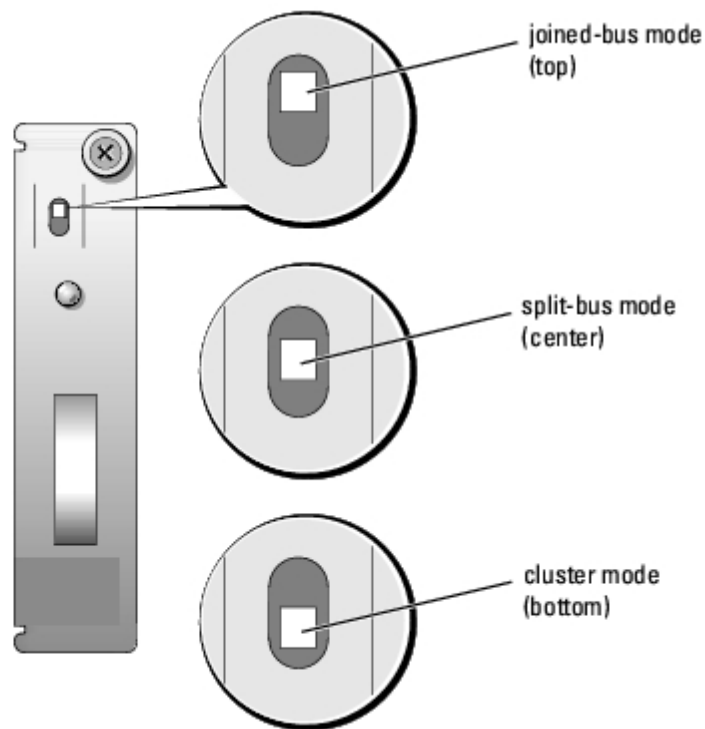
The only difference between cluster mode and joined-bus mode is the SCSI ID occupied by the enclosure services processor. When cluster mode is detected, the processor SCSI ID changes from 6 to 15, allowing a second initiator to occupy SCSI ID 6. As a result, hard-drive slot 13 (normally occupying SCSI ID 15) is disabled, leaving 13 available hard-drive slots in cluster mode. For more information on SCSI ID assignments and cluster mode operation, see your *Installation and Troubleshooting Guide*. See Table 1-4 for a description of the split-bus module modes and functions.

✐ **NOTE:** To change the SCSI bus mode, you must change the position of the bus configuration switch *before* turning on the system. Using the bus configuration switch while the system is on will not affect system operation.

Table 1-4. Split-Bus Module Modes

Mode	LED Icon	Position of Bus Configuration Switch	Function
Joined-bus mode	◇	Top	LVD termination on the split-bus module is disabled, electrically joining the two SCSI buses to form one contiguous bus. In this mode, neither the split-bus nor the cluster LED indicators on the front of the system (see Figure 1-2 for locations) are illuminated.
Split-bus mode	◇ ◇	Center	LVD termination on the split-bus module is enabled and the two buses are electrically isolated, resulting in two seven-drive SCSI buses. The split-bus LED indicator on the front of the system (see Figure 1-2 for location) is illuminated while the system is in split-bus mode.
Cluster mode	◇ ◇	Bottom	LVD termination is disabled and the buses are electrically joined. The cluster LED on the front of the system is illuminated while the system is in cluster mode.

The split-bus module has only one LED indicator (see Figure 1-5), which is illuminated when the module is receiving power.

Enclosure Management Module (EMM)

The EMM serves two primary functions in your storage system:

- SCSI bus expansion — Acts as a buffer for the SCSI bus, electrically dividing the bus into two independent segments while logically allowing all SCSI bus traffic to pass through it transparently. The buffer improves the quality of the SCSI signals and allows longer cable length connections.

- Management functions — Includes SES and SAFTE reporting to the host initiator, control of all enclosure LED indicators, and monitoring of all enclosure environmental elements such as temperature sensors, cooling modules, and power supplies.

A system with redundant enclosure management features two EMMs that are designated as primary and secondary and that can be configured in either a cluster, joined-bus, or split-bus mode. A nonredundant configuration consists of one EMM and one SCSI terminator card, and can be configured only in a joined-bus mode. In a redundant system, only one EMM per SCSI bus is active at one time, so only one EMM per SCSI bus can respond to SCSI commands from an initiator.

In joined-bus and cluster modes, if a secondary EMM receives a message that the primary EMM has failed, the fault LED indicator on the primary EMM is illuminated and the condition is reported back to the host initiator. The secondary EMM will then become active and hold the failed primary in a state of reset until it is replaced. If the primary EMM detects that the secondary has failed, the secondary's fault LED indicator is illuminated and the failed status is reported back to the host initiator.

> **NOTE:** In split-bus mode, each EMM controls half of the enclosure. If one EMM fails in split-bus mode, the second EMM will report the failure, but will not assume control of the entire SCSI bus.

The primary EMM is always plugged into the slot on the left (viewed from the back of the system). In a redundant joined-bus configuration, the primary EMM assumes control of all enclosure functionality. In addition, the primary EMM is the only module that reports status of the system to the host initiator through SES and SAFTE protocols. Because the secondary EMM must assume the responsibilities of the primary in the event that the primary fails, both the primary and secondary EMMs are continuously monitoring the status of the system's components.

EMM LED Indicators

Table 1-5 lists the functions of each EMM LED indicator. See Figure 1-5 for the location of the indicator LEDs.

> **NOTE:** If you have a nonredundant system with only one EMM installed, the only indicators that function are the power LED and active LED indicators.

Table 1-5. EMM LED Indicators

LED Indicator	LED Icon	Condition
Power (green)	ⓘ	The system is receiving power.
Fault (amber)	⚠	An EMM has failed.
Active (green)	⌐ᴧᴡ	The EMM is operating normally.

Temperature Probes

Your system contains four temperature probes that monitor system temperature and shut down the system in the event of overheating. Each EMM and both the primary and secondary backplanes contain temperature probes. Table 1-6 identifies the location of each probe.

Table 1-6. Temperature Probe Locations

Probe	Location
Probe 0	Primary EMM
Probe 1	Secondary EMM
Probe 2	Drive backplane behind drive ID #3
Probe 3	Drive backplane behind drive ID #13

Power Supply/Cooling Modules

Your system supports two combined power supply and cooling modules. While the system is designed to operate normally with only one functional power supply, both cooling modules (with two blowers each) must be present for proper cooling. If only one power supply is needed, a blank must be inserted into the other slot to mount the second cooling module.

The power supply blank has the capacity to transfer power and control signals to and from the cooling module. In this nonredundant power-supply configuration, the cooling modules operate at higher speeds to maintain proper system cooling and produce a higher acoustical noise than in the redundant power-supply configuration.

If one blower within a cooling module fails, your system reverts to a nonredundant fan configuration. The remaining three blowers in the two cooling modules operate at higher speeds to maintain proper system cooling and produce higher acoustical noise than in the redundant fan configuration (with four blowers in two cooling modules).

⚠ **CAUTION: The system will operate for only *five minutes* with one cooling module installed. This allows you the necessary time to replace a failed cooling module. If both cooling modules are installed, the system will still operate if a single blower fails. While it is rare for more than one blower to fail simultaneously, if this event occurs, the system may shut down to prevent overheating.**

The cooling module is securely mounted to the power supply using a hook-and-latch fastener. This simplifies the removal and installation of cooling modules and power supplies.

Table 1-7 lists the function of each power supply and cooling module LED indicator. See Figure 1-7 for the location of the LED indicators.

Table 1-7. Power Supply/Cooling Module LED Indicators

Module Icon	LED Indicator	LED Icon	Function
Power supply ⚡	Power on (green)	⏻	DC output voltages are within specifications.
	Fault (amber)	⚠	One of the DC output voltages is not within specifications.
	AC status (green)	🔌	AC input voltage is within specifications regardless of the position of the power switch.
Cooling module ✻	Blower A fault (amber)	⚠	Cooling module blower A has failed.
	Blower B fault (amber)	⚠	Cooling module blower B has failed.

Figure 1-7. Power Supply and Cooling Module LED Features and Indicators
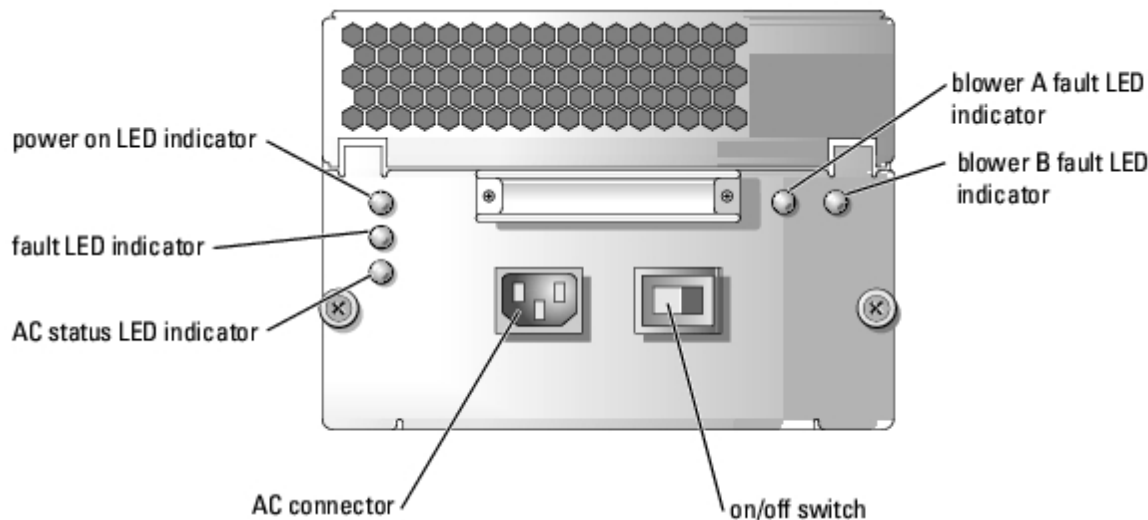
Preventing Unauthorized Access to the System

The PowerVault 220S can be secured with the lock on the rack door. The PowerVault 221S has a keylock mechanism on the top of the front bezel that prevents unauthorized access to the system.

Power Protection Devices

A number of devices are available to protect against power problems such as power surges, transients, and power failures. The following subsections describe some of these devices.

Surge Protectors

Surge protectors are available in a variety of types and usually provide a level of protection commensurate with the cost of the device. Surge protectors prevent voltage spikes, such as those caused during an electrical storm, from entering a system through the electrical outlet. Surge protectors, however, do not offer protection against brownouts, which occur when the voltage drops more than 20 percent below the normal AC line voltage level.

Line Conditioners

Line conditioners go beyond the overvoltage protection of surge protectors. Line conditioners keep a system's AC power source voltage at a fairly constant level and, therefore, can handle brownouts. Because of this added protection, line conditioners cost more than surge protectors—up to several hundred dollars. However, these devices cannot protect against a complete loss of power.

Uninterruptible Power Supplies

Uninterruptible power supply (UPS) systems offer the most complete protection against variations in power because they use battery power to keep the system running when AC power is lost. The battery is charged by the AC power while it is available, so once AC power is lost, the battery can provide power to the system for a limited amount of time—from 15 minutes to an hour or so—depending on the UPS system.

UPS systems range in price from a few hundred dollars to several thousand dollars, with the more expensive units allowing you to run larger systems for a longer period of time when AC power is lost. UPS systems that provide only 5 minutes of battery power let you conduct an orderly shutdown of the system, but are not intended to provide continued operation. Surge protectors should be used with all UPS systems, and the UPS system should be Underwriters Laboratories (UL) safety-approved.

Safety and Regulatory Information

See your *Product Information* document for important safety and regulatory information for your system.

Getting Help

Dell provides a number of tools to help with the installation, setup, and operation of your system. For more information on these tools, see "Getting Help" in your *Installation and Troubleshooting Guide.*

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Technical Specifications

Dell™ PowerVault™ 220S and 221S Systems User's Guide

Drives	
SCSI hard drives	support for up to fourteen 1-inch-by-3.5-inch LVD Ultra 160 and Ultra 320 hot-plug hard drives, at speeds of 10K or 15K rpm and capacities of 18 GB, 36 GB, 73 GB, or 146 GB.
Bus	
Configurations	support for any of the following: • one 14-device SCSI bus (joined-bus mode) • one clustered 13-device SCSI bus (cluster mode) • two independent 7-device SCSI buses (split-bus mode)
Back-Panel Connectors	
SCSI connector	68-pin shielded P-type SCSI for connection to host
Backplane Board Connectors	
Hard drives	fourteen 80-pin SCA-2 connectors
Power supply/cooling module	2 high-current connectors
Enclosure management modules (EMM)	210-pin connector
Split-bus module	180-pin connector
Enclosure Modules	
EMM	2 warm-pluggable modules
Split-bus module	1 warm-pluggable module with an external slide switch to change between split-bus, joined-bus, and cluster modes
SCSI terminator card	1 warm-pluggable module to the terminate SCSI bus in nonredundant EMM configurations
LED Indicators	
Front panel	5 LED status indicators for power, fault, split bus, cluster mode, and over-temperature
Hard-drive carrier	1 single-color activity LED and 1 two-color LED status indicator per drive
EMM	3 LED status indicators for power, fault, and active status
Split-bus module	1 LED indicator for power

Power supply and cooling module	3 LED status indicators for power supply status, power supply fault, and AC status and 2 for cooling module fault

Power Supplies

Wattage	600 W
Heat dissipation	200 W
Voltage	100–240 V rated (actual 85–264 V)
Frequency	50–60 Hz
Amperage	9.4 A at 100 V, 4.6 A at 200 V

Physical

Height	13.26 cm (5.22 inches)
Width	44.58 cm (17.55 inches)
Depth	50.8 cm (20 inches)
Weight	
PowerVault 220S	32.4 kg (71.5 lb.) maximum redundant configuration with all hard drives installed
PowerVault 221S	42.2 kg (93.0 lb.) maximum redundant configuration with all hard drives installed

Environmental

Temperature:	
Operating	10° to 35°C (50° to 95°F)
Storage	–40° to 65°C (–40° to 149°F)
Relative humidity	
Operating	8% to 80% (noncondensing)
Storage	8% to 95% (noncondensing)
Altitude	
Operating	–16 to 3048 m (–50 to 10,000 ft)
BTU per hour	2750

Available Hard-Drive Power (Per Slot)

Supported hard-drive power consumption	up to 1.3 A at +12V up to 1.5 A at +5V

Glossary
Dell™ PowerVault™ 220S and 221S Systems User's Guide

The following list defines or identifies technical terms, abbreviations, and acronyms used in Dell™ documents.

A

Abbreviation for ampere(s).

AC

Abbreviation for alternating current.

beep code

A diagnostic message in the form of a pattern of beeps from your system's speaker. For example, one beep, followed by a second beep, and then a burst of three beeps is beep code 1-1-3.

BTU

British Thermal Unit, a measurement of heat output

bus

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

C

Abbreviation for Celsius.

component

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

controller

A chip that controls the transfer of data between the microprocessor and memory or between the micro-processor and a peripheral device such as a disk drive or the keyboard.

DC

Abbreviation for direct current.

DIN

Acronym for *Deutsche Industrie Norm*.

DMI

Abbreviation for Desktop Management Interface. DMI enables the management of your system's software and hardware. DMI collects information about the system's components, such as the operating system, memory, peripherals, expansion cards, and asset tag. Information about the system's components is displayed as a MIF file or through the Dell Inspector program.

EEPROM

Acronym for electrically erasable programmable read-only memory.

EMM

Acronym for Enclosure Management Module.

EPROM

Acronym for erasable programmable read-only memory.

expansion bus

Your system contains an expansion bus that allows the microprocessor to communicate with controllers for peripheral devices, such as a network card or an internal modem.

F

Abbreviation for Fahrenheit.

GB

Abbreviation for gigabyte(s). A gigabyte equals 1,024 megabytes or 1,073,741,824 bytes.

HBA

Abbreviation for host bus adapter.

host adapter

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

Hz

Abbreviation for hertz.

I/O

Abbreviation for input/output. The keyboard is an input device, and a printer is an output device. In general, I/O activity can be differentiated from computational activity. For example, when a program sends a document to the printer, it is engaging in output activity; when the program sorts a list of terms, it is engaging in computational activity.

IRQ

Abbreviation for interrupt request. A signal that data is about to be sent to or received by a peripheral device travels by an IRQ line to the microprocessor. Each peripheral connection must be assigned an IRQ number. For example, the first serial port in your system (COM1) is assigned to IRQ4 by default. Two devices can share the same IRQ assignment, but you cannot operate both devices simultaneously.

K

Kilo, indicating 1,000.

LED

Abbreviation for light-emitting diode. An electronic device that lights up when a current is passed through it.

local bus

On a system with local-bus expansion capability, certain peripheral devices (such as the video adapter circuitry) can be designed to run much faster than they would with a traditional expansion bus. Some local-bus designs allow peripherals to run at the same speed and with the same width data path as the system's microprocessor.

MB

Abbreviation for megabyte(s). The term *megabyte* means 1,048,576 bytes; however, when referring to hard-disk drive storage, the term is often rounded to mean 1,000,000 bytes.

MHz

Abbreviation for megahertz.

ms

Abbreviation for millisecond(s).

RAID

Abbreviation for redundant array of independent disks.

readme file

A text file included with a software package or hardware product that contains information supplementing or updating the documentation for the software or hardware. Typically, readme files provide installation information, describe new product enhancements or corrections that have not yet been documented, and list known problems or other things you need to be aware of as you use the software or hardware.

rpm

Abbreviation for revolutions per minute.

SAFTE

Acronym for SCSI accessed fault tolerant enclosure.

SCSI

Acronym for small computer system interface. An I/O bus interface with faster data transmission rates than standard ports. You can connect up to seven devices (15 for some newer SCSI types) to one SCSI interface.

SDMS

Abbreviation for SCSI device management system.

sec

Abbreviation for second(s).

SES

Acronym for SCSI enclosure services.

SNMP

Abbreviation for Simple Network Management Protocol. SNMP is an industry-standard interface that allows a network manager to remotely monitor and manage workstations.

system board

As the main circuit board, the system board usually contains most of your system's integral components, such as the following:

- Microprocessor

- RAM

- Controllers for standard peripheral devices, such as the keyboard

- Various ROM chips

Frequently used synonyms for system board are *motherboard* and *logic board*.

UPS

Abbreviation for uninterruptible power supply. A battery-powered unit that automatically supplies power to your system in the event of an electrical failure.

V

Abbreviation for volt(s).

VAC

Abbreviation for volt(s) alternating current.

W

Abbreviation for watt(s).

warm-pluggable

A warm-pluggable component can be removed and installed while the system is powered on. However, all I/O activity must be terminated before the component is replaced.

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