Dell™ PowerEdge™ C6100 Systems

Hardware Owner's Manual

Regulatory Model XS23-TY3

Notes, Cautions, and Warnings

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

CAUTION: A CAUTION indicates potential damage to hardware or loss of data if instructions are not followed.

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

Regulatory Model XS23-TY3

January 2010 **Rev. A01**

Contents

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About Your System

Accessing System Features During Startup

The following keystrokes provide access to system features during startup.

Keystroke	Description
<F2>	Enters the System Setup program. See "Start Menu" on page 35.
<F11>	Enters the BIOS Boot Manager. See "System Setup Options at Boot" on page 36.
<F12>	Starts Preboot eXecution Environment (PXE) boot.
<Ctrl><C>	Enters the SAS Configuration Utility. For more information, see the SAS adapter documentation.
<Ctrl><H>	Enters the RAID configuration utility. For more information, see the documentation for your SAS RAID card.
<Ctrl><S>	Enters the utility to configure NIC settings for PXE boot. For more information, see the documentation for your integrated NIC.

Front-Panel Features and Indicators

Figure 1-1. Front Panel—3.5" Hard Drives With Four System Boards

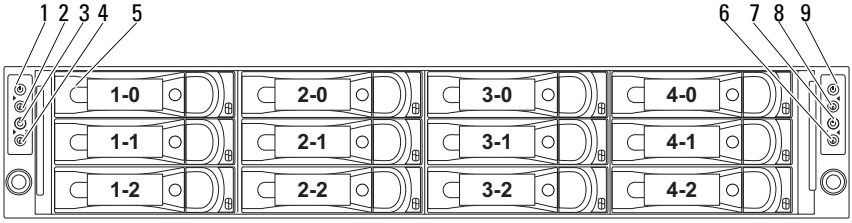


Figure 1-2. Front Panel—3.5" Hard Drives With Three System Boards

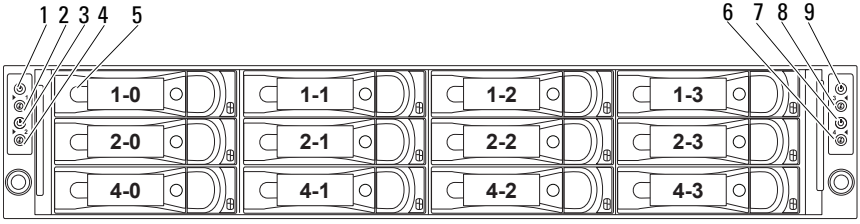


Figure 1-3. Front Panel—3.5" Hard Drives With Two System Boards

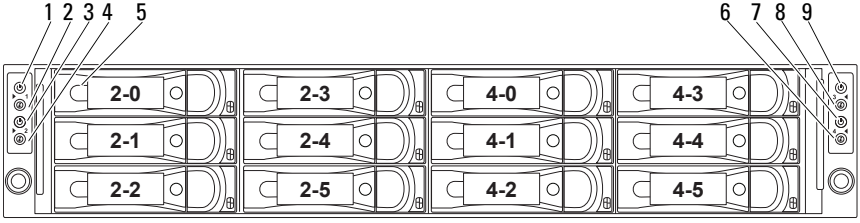


Figure 1-4. Front Panel—2.5" Hard Drives With Four System Boards

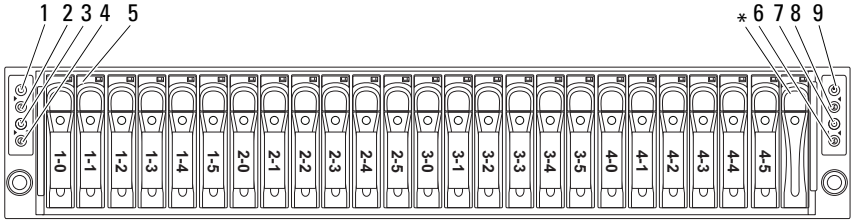


Figure 1-5. Front Panel—2.5" Hard Drives With Three System Boards

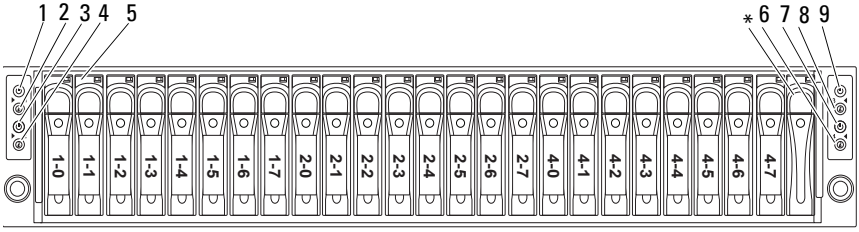
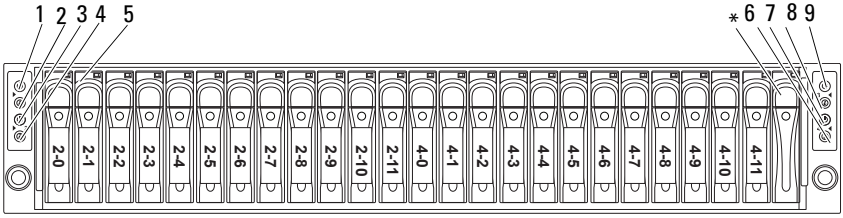


Figure 1-6. Front Panel—2.5" Hard Drives With Two System Boards

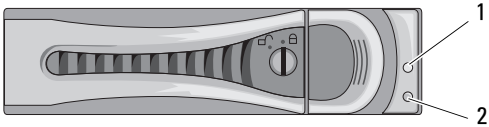


Item	Indicator, Button, or Connector	Icon	Description
1, 3, 7, 9	Power-on indicator/ power button (system boards 1, 2, 4, 3)		The power-on indicator lights when the system power is on. The power button controls the DC power supply output to the system. **NOTE:** When powering on the system, the video monitor can take from several seconds to over 2 minutes to display an image, depending on the amount of memory installed in the system. **NOTE:** On ACPI-compliant operating systems, turning off the system using the power button causes the system to perform a graceful shutdown before power to the system is turned off. **NOTE:** To force an ungraceful shutdown, press and hold the power button for 5 seconds.
2, 4, 6, 8	System identification indicator/button (system boards 1, 2, 4, 3)		The identification button can be used to locate a particular system and system board within a chassis. When the button is pushed, the blue system status indicator on the front and the back blink until the button is pushed again.

Item	Indicator, Button, or Connector	Icon	Description
5	Hard drives		Up to twelve hot-swappable 3.5-inch hard drives. Up to twenty four hot-swappable 2.5-inch hard drives.
*	Drive cover		Applicable only for 2.5" hard drive system.

Hard-Drive Indicator Patterns

Figure 1-7. Hard Drive Indicators



1 hard-drive activity indicator (green)

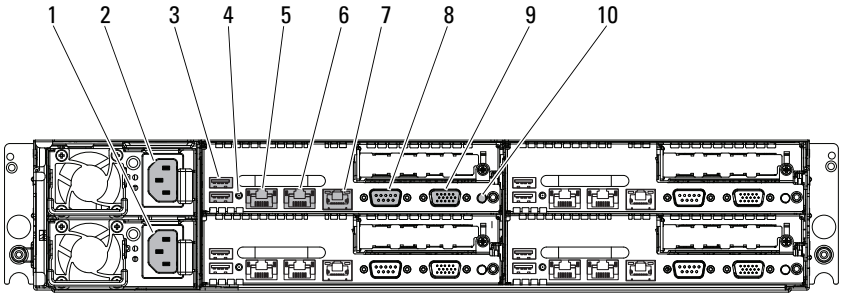
2 hard-drive status indicator (green and amber)

Table 1-1. Hard Drive Status Indicators

Drive-Status Indicator Pattern	Condition
Off	Slot empty
Solid green	Hard drive online/access
Blinks green	Hard drive rebuilding/ hard drive identification/preparing for removal
Blinks green/amber	Rebuild abort
Blinks amber	Hard drive failed

Back-Panel Features and Indicators

Figure 1-8. Back Panel—Four System Boards



Item	Indicator, Button, or Connector	Icon	Description
1	Power supply 2 (PS2)		470W / 750W / 1100W/ 1400W
2	Power supply 1 (PS1)		470W / 750W / 1100W/ 1400W
3	USB connectors (2)		Connect USB devices to the system. The ports are USB 2.0-compliant.
4	System identification indicator		Both the systems management software and the identification buttons located on the front can cause the indicator to flash blue to identify a particular system and system board. Lights amber when the system needs attention due to a problem.
5	Ethernet connector 1		Embedded 10/100/1000 NIC connectors.
6	Ethernet connector 2		Embedded 10/100/1000 NIC connectors.
7	KVM over IP Port		Dedicated management port.
8	Serial connector		Connects a serial device to the system.

Item	Indicator, Button, or Connector	Icon	Description
9	Video connector		Connects a VGA display to the system.
10	Power-on indicator/ power button (system board 1)		The power-on indicator lights when the system power is on. The power button controls the DC power supply output to the system. **NOTE:** When powering on the system, the video monitor can take from several seconds to over 2 minutes to display an image, depending on the amount of memory installed in the system. **NOTE:** On ACPI-compliant operating systems, turning off the system using the power button causes the system to perform a graceful shutdown before power to the system is turned off. **NOTE:** To force an ungraceful shutdown, press and hold the power button for five seconds.

Figure 1-9. Enumeration—Four System Boards

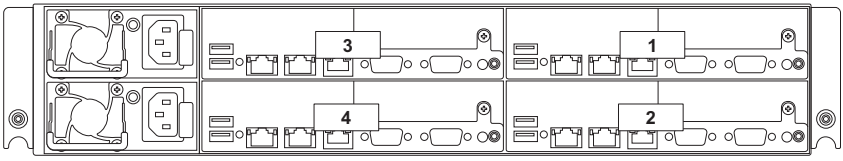


Figure 1-10. Enumeration—Three System Boards

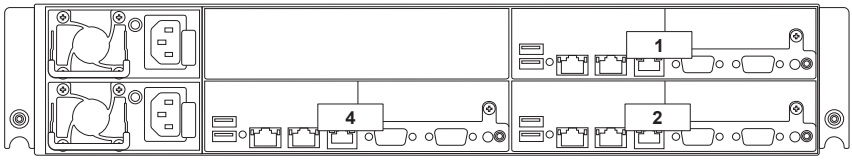
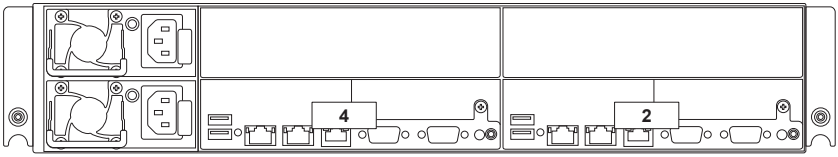
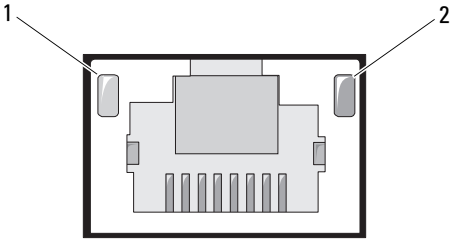


Figure 1-11. Enumeration—Two System Boards



NIC Indicator Codes

Figure 1-12. NIC Indicators

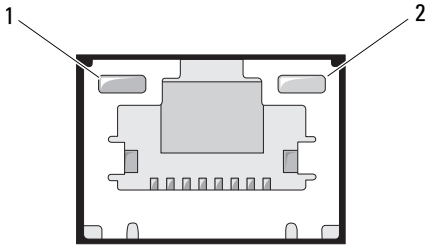


1 link indicator 2 activity indicator

NIC Status Indicator (link)	Condition
Steady amber	Link at 1 Gbps speed
Blinks amber	Identifying port with 1 Gbps connection
Steady green	Link at 100 Mbps speed
Blinks green	Identifying port with 10 Mbps or 100 Mbps connection
Off	Link at 10 Mbps speed

NIC Status Indicator (activity)	Condition
Steady green	Link LAN / No access
Blinks green	Accessing LAN
Off	Idle

Figure 1-13. NIC Indicators (KVM Over IP Port)



1 link indicator 2 activity indicator

NIC Status Indicator (link)	Condition
Steady Green	Link at 100 Mbps speed
Off	Link at 10 Mbps speed

NIC Status Indicator (activity)	Condition
Steady green	Link LAN / No access
Blinks green	LAN access
Green off	Idle

Power and System Board Indicator Codes

The LEDs on the system front panel and back panel display status codes during system startup. For location of the LEDs on the front panel, see Figure 1-1 for 3.5" hard drive and Figure 1-4 for 2.5" hard drive systems. For location of the LEDs on the back panel, see Figure 1-8.

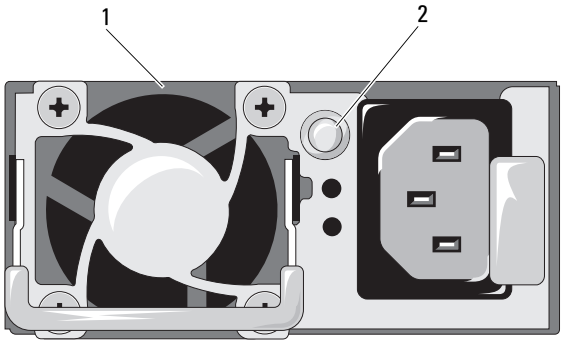
Table 1-2 lists the status associated with the status codes.

Table 1-2. Status Indicator Codes

Component	Indicator	Condition
Power-on indicator	Steady Green	Power On S0/S1
	Blinks Amber	BMC Critical condition event in Power Off mode S4/S5
	Blinks Green/Amber	BMC Critical condition event in Power On mode S0/S1
System identification indicator	Steady Blue	IPMI Via Chassis Identify Command On or ID Button Press ID On
	Blinks Blue	Only IPMI using Chassis Identify Command Blink On
	Off	IPMI using Chassis Identify Command Off or ID Button Press ID Off

Power Supply Indicator Codes

Figure 1-14. Power Supply Status Indicator



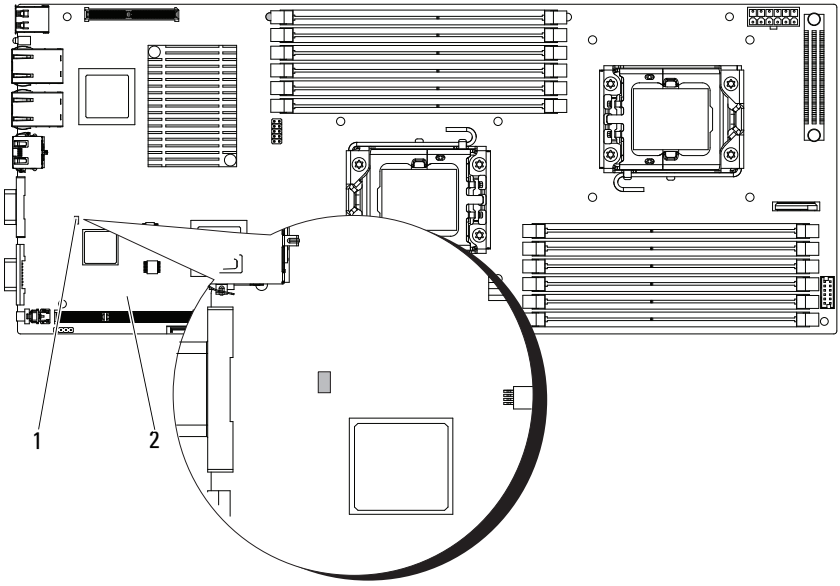
1 power supply 2 power supply indicator

Power Supply Status Indicator	Condition
Steady green	Power supply is on (AC OK/DC OK) or in standby mode (90 VAC–264 VAC)
Steady yellow	Power supply faulty (UVP/OVP/OCP/SCP/OTP/Fan Fault)
Yellow off	Power supply is off or AC input voltage is out of normal operating range (90 VAC–264 VAC)

BMC Heart Beat LED

The system board provides BMC heart beat LED (CR24) for BMC debugs. When BMC firmware is ready, the BMC heart beat LED blinks.

Figure 1-15. BMC Heart Beat LED



1 BMC heart beat LED

2 system board

POST Error Codes

Collecting System Event Log for Investigation

Error Messages are logged in the System Event Log (SEL). The SEL can be accessed through system BIOS and the BMC setup for investigation. You can also access SEL by browsing to the IP address of the BMC.

Code	Log in BMC	Cause	Corrective Actions
0000h	Yes	Timer Count Read/Write Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0003h	Yes	CMOS Battery Error	See "Troubleshooting the System Battery" on page 118.
0004h	Yes	CMOS Diagnostic Status Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0005h	Yes	CMOS Checksum Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
000Bh	Yes	CMOS Memory Size Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.

Code	Log in BMC	Cause	Corrective Actions
000Ch	Yes	RAM Read/Write Test Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0012h	Yes	CMOS Date Time Error	See "Troubleshooting the System Battery" on page 118. If the problem persists, see "Getting Help" on page 143.
0040h	Yes	Refresh Timer Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0041h	Yes	Display Memory Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0044h	Yes	DMAC Controller Error	See "Troubleshooting System Memory" on page 121. If the problem persists, see "Getting Help" on page 143.
0045h	Yes	DMAC1 Channel Register Error	See "Troubleshooting System Memory" on page 121. If the problem persists, see "Getting Help" on page 143.
0046h	Yes	DMAC2 Channel Register Error	See "Troubleshooting System Memory" on page 121. If the problem persists, see "Getting Help" on page 143.

Code	Log in BMC	Cause	Corrective Actions
0047h	Yes	PMM Memory Allocation Error	See "Troubleshooting System Memory" on page 121. If the problem persists, see "Getting Help" on page 143.
0048h	Yes	Password Check Error	Reset password. See "Jumper Settings" on page 139. If the problem persists, see "Getting Help" on page 143.
004Ah	Yes	ADM Module Error	See "Getting Help" on page 143.
004Bh	Yes	Language Module Error	See "Getting Help" on page 143.
005Dh	Yes	ATA SMART Feature Error	See "Getting Help" on page 143.
005Eh	Yes	Non-Critical Password Check Error	Reset password. See "Jumper Settings" on page 139. If the problem persists, see "Getting Help" on page 143.
0060h	Yes	HDD 0 Error	See "Troubleshooting a Hard Drive" on page 123.
0061h	Yes	HDD 1 Error	See "Troubleshooting a Hard Drive" on page 123.
0062h	Yes	HDD 2 Error	See "Troubleshooting a Hard Drive" on page 123.
0063h	Yes	HDD 3 Error	See "Troubleshooting a Hard Drive" on page 123.
0064h	Yes	HDD 4 Error	See "Troubleshooting a Hard Drive" on page 123.
0065h	Yes	HDD 5 Error	See "Troubleshooting a Hard Drive" on page 123.

Code	Log in BMC	Cause	Corrective Actions
0066h	Yes	HDD 6 Error	See "Troubleshooting a Hard Drive" on page 123.
0067h	Yes	HDD 7 Error	See "Troubleshooting a Hard Drive" on page 123.
0080h	Yes	ATAPI 0 Error	
0081h	Yes	ATAPI 1 Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0082h	Yes	ATAPI 2 Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0083h	Yes	ATAPI 3 Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0084h	Yes	ATAPI 4 Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0085h	Yes	ATAPI 5 Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.

Code	Log in BMC	Cause	Corrective Actions
0086h	Yes	ATAPI 6 Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0087h	Yes	ATAPI 7 Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0120h	Yes	CPU1 Thermal Failure due to PROCHOT#	Ensure that the processor heat sinks are properly installed. See "Troubleshooting Processors" on page 126 and "Troubleshooting System Cooling Problems" on page 120.
0121h	Yes	CPU2 Thermal Failure due to PROCHOT#	Ensure that the processor heat sinks are properly installed. See "Troubleshooting Processors" on page 126 and "Troubleshooting System Cooling Problems" on page 120.
0122h	Yes	CPU3 Thermal Failure due to PROCHOT#	Ensure that the processor heat sinks are properly installed. See "Troubleshooting Processors" on page 126 and "Troubleshooting System Cooling Problems" on page 120.

Code	Log in BMC	Cause	Corrective Actions
0123h	Yes	CPU4 Thermal Failure due to PROCHOT#	Ensure that the processor heat sinks are properly installed. See "Troubleshooting Processors" on page 126 and "Troubleshooting System Cooling Problems" on page 120.
0150h	Yes	Processor failed BIST	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0151h	Yes	Processor failed BIST	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0152h	Yes	Processor failed BIST	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0153h	Yes	Processor failed BIST	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0160h	Yes	CPU1 Processor missing microcode	A BIOS update is required. If the problem persists, see "Getting Help" on page 143.
0161h	Yes	CPU2 Processor missing microcode	A BIOS update is required. If the problem persists, see "Getting Help" on page 143.

Code	Log in BMC	Cause	Corrective Actions
0162h	Yes	CPU3 Processor missing microcode	A BIOS update is required. If the problem persists, see "Getting Help" on page 143.
0163h	Yes	CPU4 Processor missing microcode	A BIOS update is required. If the problem persists, see "Getting Help" on page 143.
0180	Yes	CPU 1 stepping no support	Ensure that your processors match and conform to the type described in the processor technical specifications outlined in your system's *Getting Started Guide*.
0181	Yes	CPU 2 stepping no support	Ensure that your processors match and conform to the type described in the processor technical specifications outlined in your system's *Getting Started Guide*.
0182	Yes	CPU 3 stepping no support	Ensure that your processors match and conform to the type described in the processor technical specifications outlined in your system's *Getting Started Guide*.
0183	Yes	CPU 4 stepping no support	Ensure that your processors match and conform to the type described in the processor technical specifications outlined in your system's *Getting Started Guide*.

Code	Log in BMC	Cause	Corrective Actions
0192h	Yes	L2 cache size mismatch	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
0193h	Yes	CPUID, Processor stepping are different	Ensure that your processors match and conform to the type described in the processor technical specifications outlined in your system's *Getting Started Guide*.
0194h	Yes	CPUID, Processor stepping are different	Ensure that your processors match and conform to the type described in the processor technical specifications outlined in your system's *Getting Started Guide*.
0195h	Yes	Front side bus mismatch	Ensure that your processors match and conform to the type described in the processor technical specifications outlined in your system's *Getting Started Guide*.
0196h	Yes	CPUID, Processor Model are different	Ensure that your processors match and conform to the type described in the processor technical specifications outlined in your system's *Getting Started Guide*.

Code	Log in BMC	Cause	Corrective Actions
0197h	Yes	Processor speeds mismatched	Ensure that your processors match and conform to the type described in the processor technical specifications outlined in your system's *Getting Started Guide*.
0198h	Yes	QPI mismatched	Check the SEL to identify and resolve the problem. If the problem persists, see "Getting Help" on page 143.
8101h	No	USB HC Not Found	See "Troubleshooting a USB Device" on page 114. If the problem persists, see "Getting Help" on page 143.
8102h	No	USB Device Init Error	See "Troubleshooting a USB Device" on page 114. If the problem persists, see "Getting Help" on page 143.
8103h	No	USB Device Disabled	To enable USB device, see "USB Configuration" on page 43. See "Troubleshooting a USB Device" on page 114. If the problem persists, see "Getting Help" on page 143.
8104h	No	USB OHCI EMUL Not Supported	See "Troubleshooting a USB Device" on page 114. If the problem persists, see "Getting Help" on page 143.
8105h	Yes	USB EHCI 64bit Data Structure Error	See "Troubleshooting a USB Device" on page 114. If the problem persists, see "Getting Help" on page 143.

Code	Log in BMC	Cause	Corrective Actions
8301h	No	SMBIOS Not Enough Space In F000	See "Troubleshooting System Memory" on page 121. If the problem persists, see "Getting Help" on page 143.
8302h	No	SMBIOS Not Enough Space In F000	See "Troubleshooting System Memory" on page 121. If the problem persists, see "Getting Help" on page 143.
8400h	Yes	Redirect Memory Error	See "Troubleshooting System Memory" on page 121. If the problem persists, see "Getting Help" on page 143.
F001h	No	System Event Log Full	Check the SEL for details on the events, then clear the SEL.
F002h	No	BMC FRU Header checksum bad	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
F003h	No	BIOS Update BMC FRU failed	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
F004h	No	BMC FRU Internal Area checksum bad	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.

Code	Log in BMC	Cause	Corrective Actions
F005h	No	BIOS Update FRU Internal Area checksum failed	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.
FFFFh	No	Undefined BIOS Error	Remove AC power to the system for 10 seconds and restart the system. If the problem persists, see "Getting Help" on page 143.

Other Information You May Need

WARNING: See the safety and regulatory information that shipped with your system. Warranty information may be included within this document or as a separate document.

The *Getting Started Guide* provides an overview of rack installation, system features, setting up your system, and technical specifications.

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

2

Using the System Setup Program

Start Menu

The system employs the latest AMI CMOS BIOS, which is stored in Flash memory. The Flash memory supports the Plug and Play specification, and contains a System Setup program, the Power On Self Test (POST) routine, and the PCI auto-configuration utility.

This system board supports system BIOS shadowing, enabling the BIOS to execute from 64-bit onboard write-protected DRAM.

This Setup utility should be executed under the following conditions:

- When changing the system configuration, configure items such as:
  - Hard drives, diskette drives, and peripherals
  - Password protection from unauthorized use
  - Power management features
- When a configuration error is detected by the system and you are prompted to make changes to the Setup utility
- When redefining the communication ports to prevent any conflicts
- When changing the password or making other changes to the security setup

NOTE: Only items in brackets [ ] can be modified. Items that are not in brackets are display only.

System Setup Options at Boot

You can initiate Setup by pressing <F2> during POST.

Console Redirection

The console redirection allows a remote user to diagnose and fix problems on a system, which has not successfully booted the operating system. The centerpiece of the console redirection is the BIOS Console. The BIOS Console is a Flash ROM-resident utility that redirects input and output over a serial or modem connection.

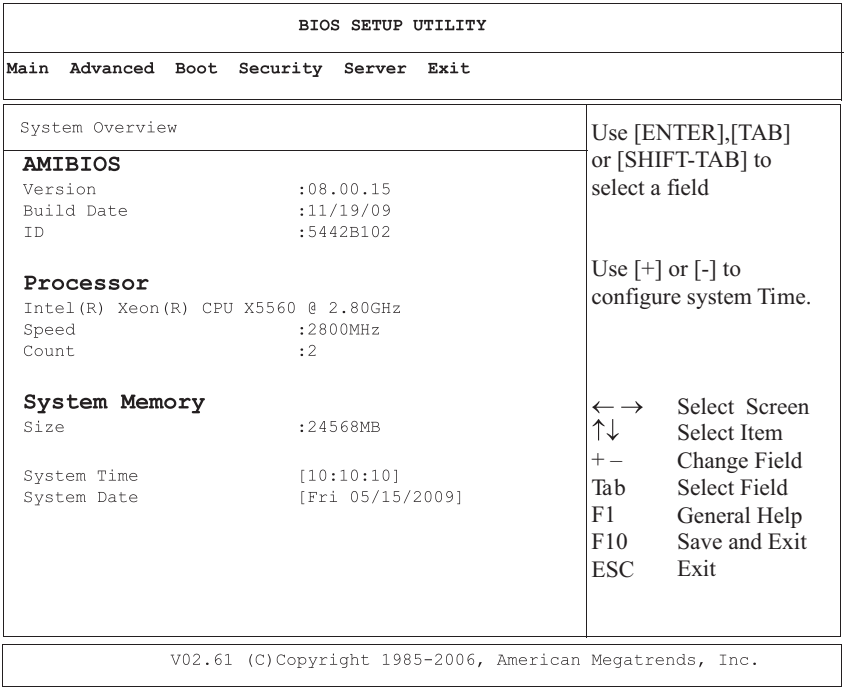
The BIOS supports console redirection to a serial port. If serial port based headless system support is provided by the system, the system must provide support for redirection of all BIOS driven console I/O to the serial port. The driver for the serial console must be capable of supporting the functionality documented in the ANSI Terminal Definition.

Main Menu

The main menu displays information about your system boards and BIOS.

Main Screen

Figure 2-1. Main System Setup Program Screen



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

NOTE: The System Setup program defaults are listed under their respective options in the following sections, where applicable.

AMIBIOS Settings

Option	Description
Version	Displays the BIOS version. Check this version number when updating BIOS from the manufacturer.
Build Date	Displays the date the BIOS was created.
ID	Displays the BIOS ID.

Processor Settings

Option	Description
Type	Displays the type of processor installed on the system board.
Speed	Displays the maximum speed of the processor.
Count	Displays the number of installed processors.

System Memory Settings

Option	Description
Size	Displays how much memory (DRAM) is installed on the system board.
System Time	Scroll to this item to adjust the time.
System Date	Scroll to this item to adjust the date.

Advanced Menu

This option displays a table of items that defines advanced information about your system.

CAUTION: Making incorrect settings to items on these pages may cause the system to malfunction. Unless you have experience adjusting these items, we recommend that you leave these settings at the default values. If making settings to items on these pages causes your system to malfunction or prevents the system from booting, open BIOS and choose Load Optimal Defaults in the Exit menu to boot up normally.

CPU Configuration

Option	Description
Virtualization Technology (VT) (**Disabled** default)	Enable this option when the processor supports VT. A full reset is needed to change its state.
Execute-Disable Bit Capability (**Enabled** default)	Forces the XD feature flag to always return 0.
C1E Support (**Enabled** default)	Enable this option to enable or disable the **Enhanced Halt State**.
Hardware Prefetcher (**Enabled** default)	For UP Platforms, leave it enabled. For DP/MP servers, it may used to tune performance to the specific application.
Adjacent Cache Line Prefetch (**Disabled** default)	Enable this option to enable or disable the Adjacent Cache Line Prefetch Disable Feature.
Hyper-Threading Technology (HT) (**Enabled** default)	When **Disabled** only one thread per enabled core is enabled.
Intel(R) TurboMode tech (**Disabled** default)	Turbo mode allows processor cores to run faster than marked frequency in specific condition.

Option	Description
Active Processor Cores (**All** default)	Number of cores to enable in each processor package.
Frequency Ratio	Sets the processor ratio between Min. and Max. Use [+] or [-] to configure the value.
Intel(R) C-STATE tech (**Enabled** default)	CState: CPU idle is set to C2/C3/C4.
C6 State (**Enabled** default)	C6 Support. When CPU is in idle mode.

Memory Configuration

Option	Description
Memory Frequency (**Auto** default)	Forces a DDR3 frequency slower than the common tck detected using SPD.
Memory Mode (**Independent** default)	Independent: independent channel.
NUMA Support (**Enabled** default)	Enables or disables NUMA: • **Enabled**: efficiently executes software for NUMA aware operating system. • **Disabled**: better memory access performance for non-NUMA operating system.

IDE Configuration

NOTE: The **AHCI Port** is shown in SETUP screen when it is in the Enhanced AHCI or RAID mode.

Option	Description
Configure SATA as	Configures the SATA: • IDE – SATA#1 Configuration (**Enhanced** default) Configures SATA#1. – SATA#2 Configuration (**Enhanced** default) Configures SATA#2. • Primary Master/Slave is SATA Port 0/2 • Secondary Master/Slave is SATA Port 1/3 • AHCI/RAID • AHCI Port 0~5
Hard Disk Write Protect (**Disabled** default)	Enables or disables device write protection. This is effective only if the device is accessed through BIOS.
IDE Detect Time Out (Sec) (**35** default)	Selects the time out value for detecting ATA/ATAPI device(s).

Primary IDE Master

To configure Primary, Secondary, Third or Fourth device on the IDE channel.

Option	Description
Device	Displays the type of device assigned to this channel.
Vendor	Displays the manufacturer's name of the device.
Size	Displays the size of the device (GB).
LAB Mode:	Indicates whether LAB access mode is supported or not supported.
Block (Multi-Sector Transfer) (**Auto** default)	Indicates whether multi-sector transfer is supported.
PIO Mode (**Auto** default)	Indicates whether PIO mode is supported.

Option	Description
Async DMA	Indicates whether Async DMA is supported.
Ultra DMA	Indicates whether Ultra DMA is supported.
S.M.A.R.T.	Indicates whether S.M.A.R.T. mode is supported.
Type (**Auto** default)	Selects which type of device is installed or select Auto to enable the system to automatically configure the device: • Not Installed • **Auto**: Auto detected • **CD/DVD**: ATAPI CD/DVD detected • **ARMD**: ATAPI removable media device detected
LAB/LARGE Mode (**Auto** default)	Enables LAB access mode: • **Disabled**: LAB access mode is disabled. • **Auto**: Enables LAB Mode if the device supports it and the device is not already formatted with LAB mode disabled.
Block (Multi-Sector Transfer) (**Auto** default)	Enables multi-sector transfer block mode: • **Disabled**: data transfer from and to the device occurs one sector at a time • **Auto**: data transfer from and to the device occurs multiple sectors at a time if supported by the device
PIO Mode (**Auto** default)	Selects the device PIO (Programmed Input/Output) mode, which determines the data transfer mode used by IDE drives. PIO mode uses the processor's registers for data transfer: • **Auto**: automatically detects optimal or default PIO mode • **0 ~ 4**: select PIO mode 0 to 4

Option	Description
DMA Mode (**Auto** default)	Selects the devices DMA (Direct Memory Access) mode, which transfers data from channel to channel without using the processor, resulting in faster data transfer then when the processor is used for every byte of transfer: • **Auto**: automatically detects optimal or default DMA mode • **SWDMA0 ~ SWDMA2**: selects SingleWord DMA 0 to 2 • **MWDMA0 ~ MWDMA2**: selects MultiWord DMA 0 to 2 • **UDMA 0 ~ UDMA5**: selects Ultra DMA 0 to 5
S.M.A.R.T. (**Auto** default)	Self Monitoring Analysis and Reporting Technology) reports drive degradation to the operating system to warn you of potential failure: • **Auto**: automatically sets optimal or default S.M.A.R.T. mode • **Disabled**: disables S.M.A.R.T. • **Enabled**: enables S.M.A.R.T.
32Bit Data Transfer (**Enabled** default)	Enables or disables 32-bit data transfer.

USB Configuration

NOTE: The **USB Mass Storage Device Configuration** is shown in SETUP screen when USB Mass Storage is plugged. If USB device (Floppy, CDROM) is used to install RedHat® Linux 9.0, change **USB 2.0 Controller Mode** to **FullSpeed** to work around it, because RedHat Linux 9.0 is not supported completely for hand-off function.

Option	Description
USB Devices Enabled	Displays USB devices currently detected.
Legacy USB Support (**Enabled** default)	Enables support for legacy USB devices. Auto option disables legacy support if no USB devices are connected.

Option	Description
USB 2.0 Controller Mode (**HiSpeed** default)	Configures the USB 2.0 controller in HiSpeed (480 Mbps) or FullSpeed (12 Mbps).
BIOS EHCI Hand-Off (**Enabled** default)	This is a work around for operating systems without EHCI handoff support. The EHCI ownership change should be claimed by EHCI driver.
USB Mass Storage Reset Delay (**20 sec** default)	The number of seconds that the POST waits for the USB mass storage device after the start Unit command is issued.
Device#	USB device model name
Emulation Type (**Auto** default)	If Auto, USB devices, which are less than 530 MB are emulated as floppy and others are be emulated as hard disk. Forced FDD option can be used to force a formatted hard drive to boot as FDD (e.g. ZIP drive)

PCI Configuration

Option	Description
NIC Function Support (**PXE** default)	NIC Function Disable or PXE/iSCSI Support
NIC1 Option ROM (**Enable** default)	Set OnBoard 82576EB Disable/Enable Option ROM
NIC2 Option ROM (**Enable** default)	Set OnBoard 82576EB Disable/Enable Option ROM

Boot Menu

Option	Description
Boot Settings Configuration	Configures the settings during system boot.
Boot Device Priority	Specifies the boot device priority.
Hard Disk Drives	Specifies the boot device priority sequence from the available hard drives.
Removable Drives	Specifies the boot device priority sequence from the available removable drives.
CD/DVD Drives:	Specifies the boot device priority sequence from the available CD/DVD drives.

Boot Settings Configuration

Option	Description
Quick Boot (**Enabled** default)	Allows BIOS to skip certain tests during the POST, which decreases boot up time.
Quiet Boot (**Disabled** default)	Enables or disables this item: • **Disabled**: displays normal POST messages. • **Enabled**: displays OEM logo instead of POST messages.
Wait For 'F1' If Error (**Disabled** default)	Waits for F1 key to be pressed if error occurs.

Security Menu

Option	Description
Supervisor Password	Displays whether the supervisor password is installed or not.
User Password	Displays whether the user password is installed or not.

Option	Description
Change Supervisor Password	Installs, changes or clears the password. If you select these items and press **Enter**, a dialog box appears and then you can enter a password. You can enter no more than six letters or numbers. Press **Enter** after you have typed in the password. A second dialog box asks you to retype the password for confirmation. Press **Enter** after you have retyped it correctly. The password is required at boot time, or when the user enters the Setup Utility.
User Access Level (**Full Access** default)	Sets the user access level: • **No Access**: prevents user access to the Setup Utility. • **View Only**: allows user access to the Setup Utility but the fields cannot be changed. • **Limited**: allows only limited fields to be changed such as date and time. • **Full Access**: allows user access to the Setup Utility and the fields can be changed.
Change User Password	Installs, changes or clears the password.
Password Check (**Setup** default)	Selects the password check mode: **Setup**: checks password while invoking setup. **Always**: checks password while invoking setup as well as on each boot.
Boot Sector Virus Protection (**Disabled** default)	Enables and disables boot sector virus protection

Server Menu

NOTE: Delay time, Minimum time, and Maximum time are only shown in SETUP screen when **AC Power Recovery Delay** is set to **User define**. The selection of Restore on AC Power Loss setup to Power-on or Last State takes 60 seconds for running BMC initialization after AC Power on.

Option	Description
Power Management (**Node Management** default)	Sets power mode. The options are: • Maximum Performance • Operating system Control/EIST • Active Power Controller • Node Management If **Maximum Performance** or **Active Power Controller** is selected, Intel SpeedStep is disabled. If **OS Control/EIST** or **Node Management** is selected, Intel SpeedStep is enabled. ME function is disabled if **OS Control/EIST** is selected.
IOAT2 (**Disabled** default)	Enables or disables IOAT2.
Wake on RING function (**Disabled** default)	Enables or disables Wake on RING function.
WHEA Support (**Disabled** default)	Enables or disables Windows Hardware Error Architecture.
Restore on AC Power Loss (**Power On** default)	Restores the AC power setting. The options are Power Off, Power On and Last State.
AC Power Recovery Delay (**Immediate** default)	Selects the time of system power on after BMC initiates:. • **Immediate**: powers on directly after BMC initiates. • **Random**: randomly selects time to power on. • **User define**: user selects the time. – **Delay Time**: Sets AC power recovery delay time between minimum and maximum.

System Management

Option	Description
Server Board Part Number	Displays server board part number.
Server Board Serial Number	Displays server board serial number.
NIC 1 MAC Address	Displays NIC1 MAC Address.
NIC 2 MAC Address	Displays NIC2 MAC Address.
System Part Number	Displays system part number.
System Serial Number	Displays system serial number.
Chassis Part Number	Displays chassis part number.
Chassis Serial Numbers	Displays chassis serial numbers.
BIOS Version	Displays current BIOS version.
BMC Device ID	Displays BMC device ID.
BMC Firmware Revision	Displays BMC firmware version.
FCB Firmware Revision	Displays FCB firmware version.

Remote Access Configuration

Option	Description
Remote Access (**Enabled** default)	Selects remote access type.
Serial Port Number (**COM1** default)	Selects serial port for console redirection. Make sure the selected port is enabled. This item disappears when **Remote Access** is disabled.
Serial Port Mode (**115200 8,n,1** default)	Selects serial port settings. This item disappears when **Remote Access** is disabled.
Flow Control (**None** default)	Selects flow control for console redirection. This item disappears when **Remote Access** is disabled.

Option	Description
Redirection After BIOS POST (**Always** default)	Selects the settings for the redirection. This item disappears when **Remote Access** is disabled: • **Disabled**: turns off the redirection after POST. • **Boot Loader**: redirection is active during POST and boot loader. • **Always**: redirection is always active. (Some operating systems may not work if set to **Always**)
Terminal Type (**VT100** default)	Selects the target terminal type. This item disappears when **Remote Access** is disabled.
VT-UTF8 Combo Key Support (**Enabled** default)	Enables or disables VT-UTF8 combination key support for ANSI/VT100 terminals. This item disappears when **Remote Access** is disabled.
Terminal Display Mode (**Normal mode** default)	Selects Terminal Display Mode. Options: • Normal Mode • Recorder Mode

NOTE: When **Flow Control** is set to **Software**, the Hyper Terminal on remote side is discontinued by pressing <Ctrl><S>. But the <Ctrl><S> is also the **Setup Key Stroke** for setting onboard NIC PXE Option ROM Configuration. Therefore, we suggest users change <Ctrl><S> to <Ctrl><B> in PXE OPROM Configuration in order to avoid that the Hyper Terminal on remote side is discontinued when pressing <Ctrl><S>.

IPMI Configuration

Option	Description
Status Of BMC	Displays BMC status.
BMC Firmware Revision	Displays BMC Firmware Revision.
View BMC System Event Log	Selecting this option and pressing **Enter**, displays: Total Number Of Entries, SEL Entry Number, SEL Record ID, SEL Record Type, Event Time Stamp, Generator ID, Event Message Format Version, Event Sensor Type, Event Sensor Number, Event Dir Type, and Event Data.

Option	Description
Clear BMC System Event Log	Clears BMC System Event Log.
BMC PEF status	Displays BMC PEF status.
Set BMC NIC (**Shared** default)	Sets the type of BMC NIC from BIOS. BMC is reset.
Set LAN Configuration	Allows LAN Configuration settings.

LAN Configuration

Option	Description
Channel Number (**01** default)	Enters channel number for SET LAN Config Command. Proper value is below 16.
BMC IP address source (**DHCP** default)	Sets BMC IP address source from BIOS.

Power Throttling Configuration

Option	Description
Power Throttling	Enable or disable Power throttling
Power CAP	Enable or disable Power CAP
Chassis CAP	Set Chassis CAP value

NOTE: The default values are dependant on BMC setting

IP Address

Option	Description
IP Address (default value depends on BMC setting)	Enters IP address in decimal in the form of XXX.XXX.XXX.XXX (XXX is less than 256 and in decimal only). **NOTE:** When BMC IP status is static, IP Address is useful

Subnet Mask

Option	Description
Subnet Mask (default value depends on BMC setting)	Enters subnet mask in decimal in the form of XXX.XXX.XXX.XXX (XXX is less than 256 and in decimal only).

NOTE: When BMC IP status is static, **Subnet Mask** is useful.

Default Gateway IP

Option	Description
Default Gateway IP (default value depends on BMC setting)	Enters default Gateway IP in decimal in the form of XXX.XXX.XXX.XXX (XXX is less than 256 and in decimal only).

Exit Menu

Option	Description
Save Changes and Exit	Select this item and press **Enter** to save any changes that you have made in the Setup utility and exit the Setup utility. When the Save Changes and Exit dialog box appears, Select [OK] to save the changes and exit, or press N to return to the setup main menu.
Discard Changes and Exit	Select this item and press **Enter** to discard any changes that you have made in the Setup utility and exit the Setup utility. When the Discard Changes and Exit dialog box appears, Select [OK] to discard changes and exit, or press N to return to the setup main menu.
Discard Changes	Select this item and press **Enter** to discard any changes you have made without leaving the setup utility

Option	Description
Load Optimal Defaults	Select this item and press **Enter**, a dialog box asks if you want to install optimal settings for all the items in the Setup utility. Select [OK] to indicate Yes, and then press **Enter** to install the optimal settings. The optimal settings default values are quite demanding and your system might not function properly if you are using slower memory chips or other kinds of low-performance components.
Load Failsafe Defaults	If you select this item and press **Enter**, a dialog box asks if you want to install fail-safe settings for all the items in the Setup utility. Select [OK] to indicate Yes, and then press **Enter** to install the fail-safe settings. The fail-safe settings default values are not demanding so a system should be able to operate with the fails safe settings even if it is installed with slower memory chips or other kinds of low-performance components.

3

Installing System Components

Safety Instructions

WARNING: Working on systems that are still connected to a power supply can be extremely dangerous.

CAUTION: System components and electronic circuit boards can be damaged by discharge of static electricity.

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

To avoid injury to yourself or damage to your system, follow these guidelines:

- Always disconnect the system from the power outlet whenever you are working inside the system.
- If possible, wear a grounded wrist strap when you are working inside the system. Alternatively, discharge any static electricity by touching the bare metal chassis of the system case, or the bare metal body of any other grounded appliance.
- Hold electronic circuit boards by the edges only. Do not touch the components on the board unless it is necessary to do so. Do not flex or stress the circuit board.
- Leave all components inside the static-proof packaging until you are ready to use the component for the installation.

Recommended Tools

- Phillips screwdriver
- Flat-tipped screwdriver
- Set of jewelers screwdrivers

Inside the System

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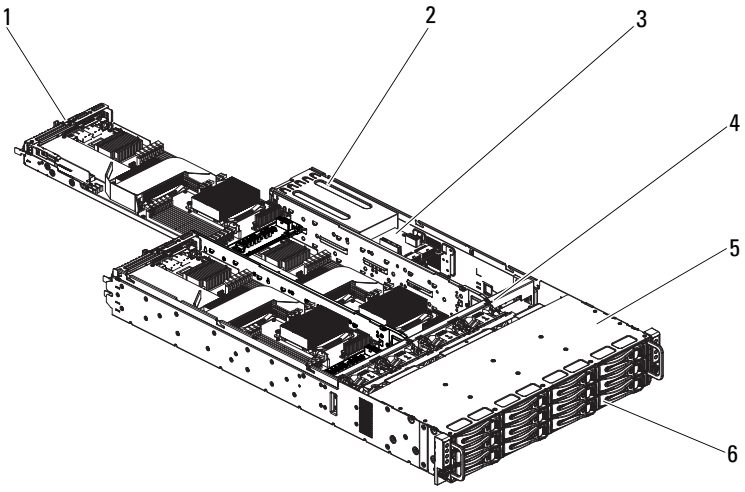
CAUTION: This system must be operated with the system cover installed to ensure proper cooling.

NOTE: The illustration in this section shows a system with 3.5-inch hard drives.

Figure 3-1. Inside the System



1	system board assembly (4)	2	power supply (2)
3	power distribution board (2)	4	cooling fan (4)
5	hard-drive bay	6	hard drive (12)

Hard Drives

The installation and removal procedures for the 3.5-inch hard drive and the 2.5-inch hard drive are similar. Following is an example showing the replacement procedure of a 3.5-inch hard drive.

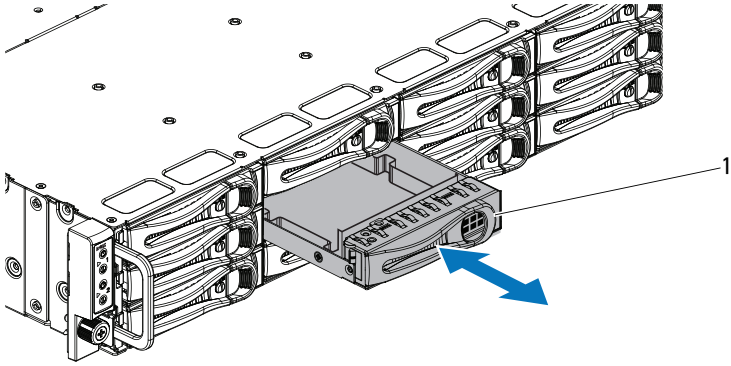
Removing a Hard-Drive Blank

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

NOTE: This section is applicable to systems with hot-swappable hard drives only.

1 Grasp the front of the hard-drive blank, pull and slide the blank out until it is free of the drive bay. See Figure 3-2.

Figure 3-2. Removing or Installing a Hard-Drive Blank



1 hard-drive blank

Installing a Hard-Drive Blank

Align the hard-drive blank with the drive bay and insert the blank into the drive bay until the retention latch clicks into place. See Figure 3-2.

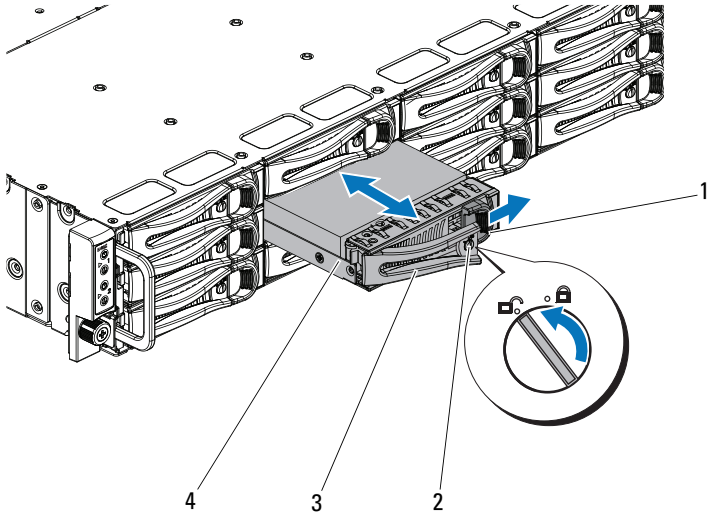
Removing a Hard-Drive Carrier

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

1. Turn the lock lever counterclockwise until it points to the unlock symbol.
2. Slide the release button to open the release handle. See Figure 3-3.
3. Using the release handle, pull the hard-drive carrier out of the hard-drive bay.

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

Figure 3-3. Removing and Installing a Hard-Drive Carrier



1	release button	2	lock lever
3	release handle	4	hard-drive carrier

Installing a Hard Drive Carrier

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

1. With the lever on the hard-drive carrier open, slide the hard-drive carrier into the drive bay until the hard-drive carrier makes contact with the backplane. See Figure 3-3.
2. Close the release handle to lock the hard drive in place.
3. Turn the lock lever clockwise to the lock symbol. See Figure 3-3.

Removing a Hard Drive From a Hard-Drive Carrier

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

CAUTION: Combining SATA and SAS hard drives in the same system configuration is not supported.

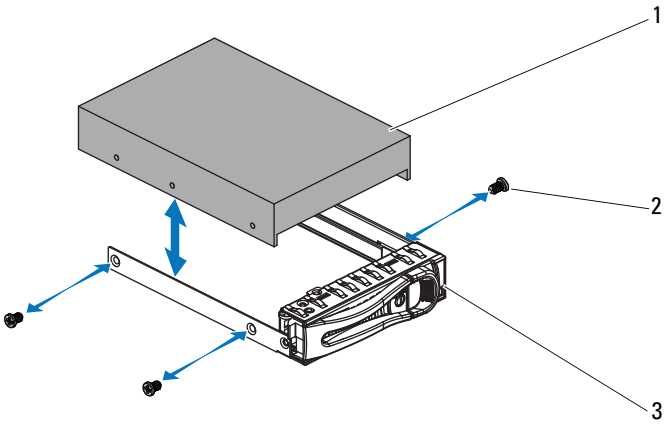
CAUTION: Use only hard drives that have been tested and approved for use with the SAS/SATA backplane.

CAUTION: When installing a hard-drive carrier, ensure that the adjacent drives are fully installed. Inserting a hard-drive carrier and attempting to lock its handle next to a partially installed carrier can damage the partially installed carrier's shield spring and make it unusable.

CAUTION: To prevent data loss, ensure that your operating system supports hot-swappable drive installation. See the documentation supplied with the operating system.

1. Remove the four screws. See Figure 3-4.
2. Lift the hard drive out of the hard-drive carrier.

Figure 3-4. Removing and Installing a Hard Drive from the Hard-Drive Carrier



1 hard drive
2 screw (4)
3 hard-drive carrier

Installing a Hard Drive Into a Hard-Drive Carrier

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

1. Place the hard drive into the hard-drive carrier. See Figure 3-4.
2. Secure the hard drive to the hard-drive carrier with four screws. See Figure 3-4.

Power Supplies

Table 3-1. PSU and System Board Support Matrix

PSU	Two System Boards	Three System Boards	Four System Boards
1400 W	Full configuration*	Full configuration	Up to two processors, twelve hard drives, and nine memory modules
1100 W	Full configuration	Up to two processors, nine hard drives, and nine memory modules	Up to two processors, nine hard drives, and nine memory modules
750 W	Up to two processors, six hard drives, and nine memory modules	Up to two processors, six hard drives, and four memory modules	N/A
470 W	Up to two processors, up to two hard drives, and six memory modules	N/A	N/A

* Full configuration denotes support for the maximum number of processors, hard drives, and memory modules.

Removing a Power Supply

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

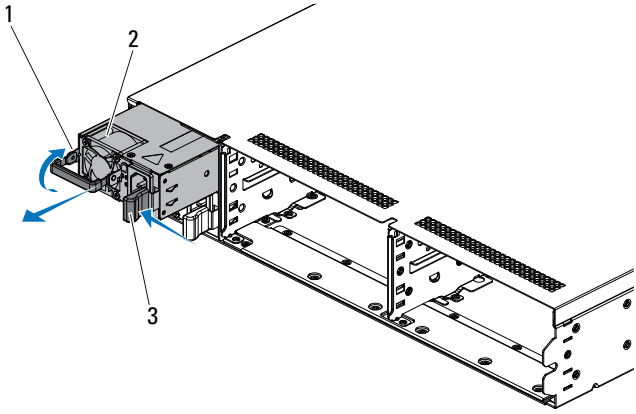
CAUTION: The system requires one power supply to operate normally.

1. Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
2. Disconnect the power cable from the power source and the power supply.

3 Press the release lever and using the handle, slide the power supply out of the system. See Figure 3-5.

NOTE: Removing the power supply may require considerable force.

Figure 3-5. Removing and Installing a Power Supply



1 handle
2 power supply
3 release lever

Installing a Power Supply

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

CAUTION: The system requires one power supply to operate normally.

1 Verify that both power supplies are of the same type and have the same maximum output power.

NOTE: The maximum output power is printed on the power supply label.

2 Slide the new power supply into the chassis until the power supply is fully seated and the release lever snaps into place. See Figure 3-5.

3 Connect the power cable to the power supply and plug the cable into a power outlet.

NOTE: When installing a new power supply in a system with two power supplies, allow several seconds for the system to recognize the power supply and determine its status.

System-Board Assembly

Removing a System-Board Assembly

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

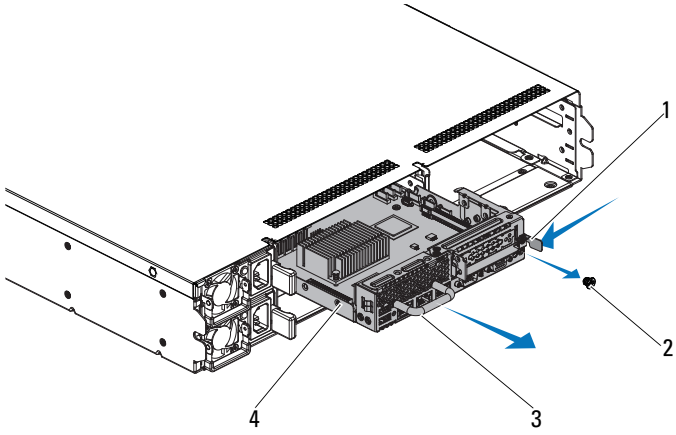
1 Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.

2 Disconnect all the external cables from the system board.

3 Remove the screw that secures the retaining latch. See Figure 3-6.

4 Press the retaining latch and using the handle, slide the system-board assembly out of the chassis. See Figure 3-6.

Figure 3-6. Removing and Installing the System-Board Assembly



1	retaining latch	2	screw
3	handle	4	system-board assembly

Installing a System-Board Assembly

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

1. Slide the system-board assembly into the chassis until it snaps into place. See Figure 3-6.
2. Reconnect all the external cables to the system board
3. Replace the screw that secures the retaining latch. See Figure 3-6.
4. Reconnect the system to its electrical outlet and turn on the system, including any attached peripherals.

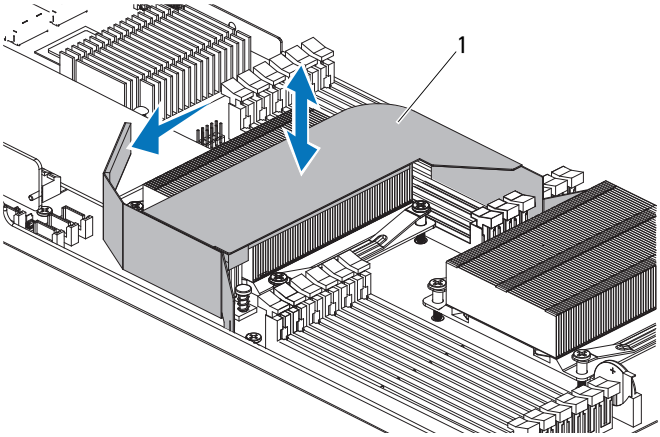
Cooling Shroud

Removing the Cooling Shroud

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

1. Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.
2. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.
3. Push out one side of the cooling shroud in the direction of the arrow. See Figure 3-7.
4. Gently lift the cooling shroud out of the system board assembly. See Figure 3-7.

Figure 3-7. Removing and Installing the Cooling Shroud



1 cooling shroud

Installing the Cooling Shroud

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

1. Align and press the cooling shroud down on the system board. See Figure 3-7.
2. Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.
3. Reconnect the system to its electrical outlet and turn on the system, including any attached peripherals.

Heat Sinks

Removing the Heat Sink

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

1. Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.
2. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.
3. Remove the cooling shroud. See "Removing the Cooling Shroud" on page 63.

WARNING: The heat sink may be hot to touch for some time after the system has been powered down. Allow the heat sink to cool before removing it.

CAUTION: Never remove the heat sink from a processor unless you intend to remove the processor. The heat sink is necessary to maintain proper thermal conditions.

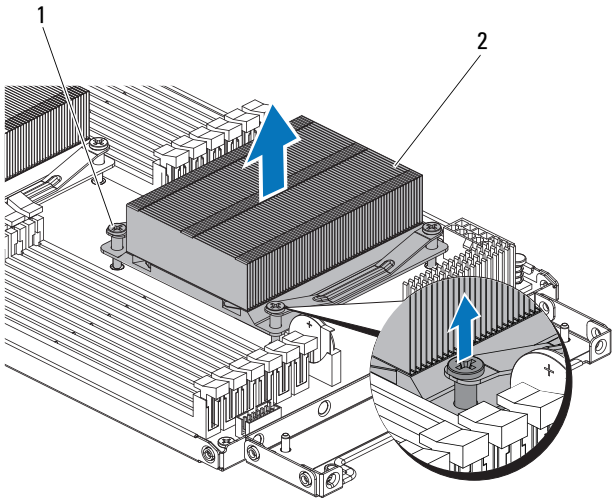
4 Using a Phillips screwdriver, loosen one of the heat-sink retention screws. See Figure 3-8.

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

5 Remove the other three heat-sink retention screws.

6 Gently lift the heat sink off the processor and set the heat sink aside with thermal grease side facing up.

Figure 3-8. Removing and Installing the Heat Sink



1 screw (4)

2 heat sink

Installing the Heat Sink

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

1. Using a clean lint-free cloth, remove the thermal grease from the heat sink.
2. Apply new thermal grease evenly to the center of the top of the new processor.

CAUTION: Using excess thermal grease can cause grease to contact the processor shield, which can cause contamination of the processor socket.

3. Place the heat sink on the processor. See Figure 3-8.
4. Using a Phillips screwdriver, tighten the four heat-sink retention screws.
5. Replace the cooling shroud, see "Removing the Cooling Shroud" on page 63.
6. Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.
7. Reconnect the system to its electrical outlet and turn on the system, including any attached peripherals.

Processor

Removing a Processor

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

1. Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.
2. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.
3. Remove the cooling shroud. See "Removing the Cooling Shroud" on page 63.

4 Remove the heat sink, see "Removing the Heat Sink" on page 64.

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

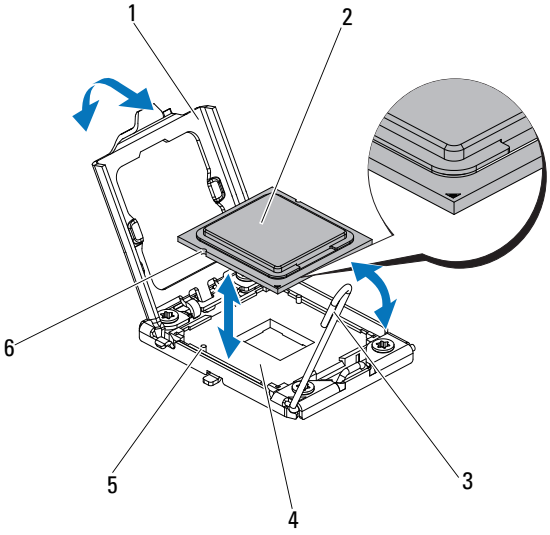
5 Position your thumb firmly over the processor socket-release lever and release the lever from the locked position. Rotate the lever 90 degrees upward until the processor is released from the socket. See Figure 3-9.

6 Rotate the processor shield upward and out of the way. See Figure 3-9.

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

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

Figure 3-9. Removing and Installing a Processor



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

Installing a Processor

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

NOTE: When installing only one processor, the processor must be installed in the processor0 socket (for the socket location, see "System Board Connectors" on page 129).

NOTE: If you are upgrading your processors, prior to upgrading your system, download and install the latest system BIOS version from **support.dell.com**. Follow the instructions included in the file download to install the update on your system.

1. Unpack the processor if it has not been used previously.

   If the processor has already been used, remove any thermal grease from the top of the processor using a lint-free cloth.

2. Align the processor with the socket keys on the ZIF socket. See Figure 3-9.

CAUTION: Positioning the processor incorrectly can permanently damage the system board or the processor. Be careful not to bend the pins in the ZIF socket.

3. With the release lever on the processor socket in the open position, align the processor with the socket keys and set the processor lightly in the socket. See Figure 3-9.

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

4. Close the processor shield.
5. Rotate the socket release lever down until it snaps into place.
6. Using a clean lint-free cloth, remove the thermal grease from the heat sink.
7. Apply thermal grease evenly to the center of the top of the new processor.

CAUTION: Using excess thermal grease can cause grease to contact the processor shield, which can cause contamination of the processor socket.

8. Place the heat sink on the processor. See Figure 3-8.
9. Using a Phillips screwdriver, tighten the heat-sink retention screws. See Figure 3-8.

10 Replace the cooling shroud. See "Installing the Cooling Shroud" on page 64.

11 Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.

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

13 Press <F2> to enter the System Setup program, and check that the processor information matches the new system configuration. See "System Setup Options at Boot" on page 36.

Expansion-Card Assembly and Expansion Card

Removing the Expansion Card

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

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

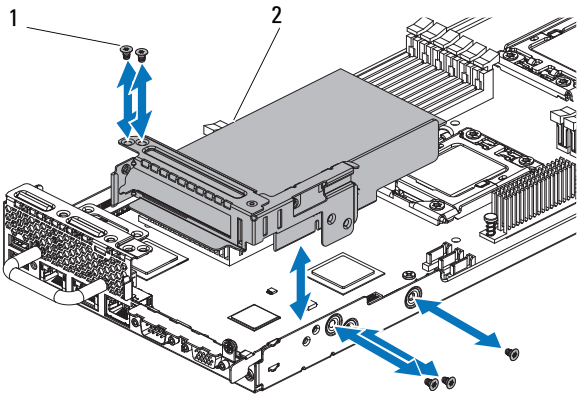
2 Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

3 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 63.

4 Remove the five screws that secure the expansion-card assembly. See Figure 3-10.

5 Lift the expansion-card assembly out of the system-board assembly. See Figure 3-10.

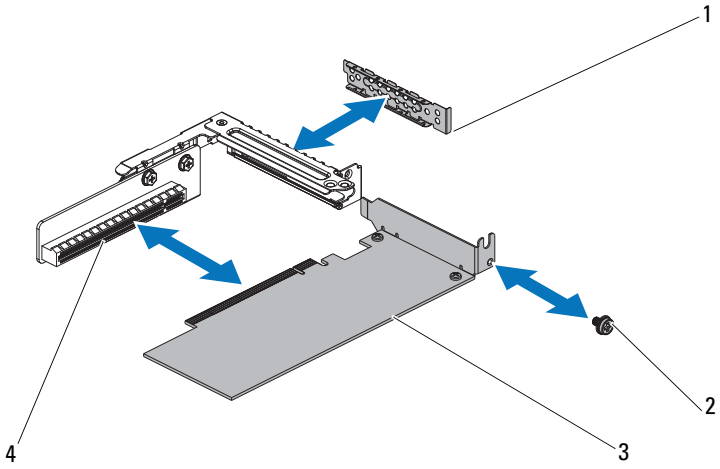
Figure 3-10. Removing the Expansion-Card Assembly



1 screw (5) 2 expansion-card assembly

6 Remove the screw securing the expansion card.

Figure 3-11. Removing the Expansion Card



1 expansion-card slot cover 2 screw

3 expansion card 4 expansion-card connector

7 Grasp the expansion card by its edges, and carefully remove it from the expansion-card connector.

8 If you are removing the card permanently, install a metal filler bracket over the empty expansion slot opening, and close the expansion-card latch.

NOTE: You must install a filler bracket over an empty expansion slot to maintain Federal Communications Commission (FCC) certification of the system. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

Installing the Expansion Card

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

CAUTION: Expansion cards can only be installed in the slots on the expansion-card riser. Do not attempt to install expansion cards directly into the riser connector on the system board.

1 Unpack the expansion card and prepare it for installation.

For instructions, see the documentation accompanying the card.

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

3 Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

4 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 63.

5 Remove the five screws that secure the expansion-card assembly.

6 Lift the expansion-card assembly away from the system-board assembly.

7 Remove the screw securing the filler bracket.

8 Grasp the filler bracket by its edges, and carefully remove it from the expansion-card connector.

NOTE: Keep this bracket in case you need to remove the expansion card. Filler brackets must be installed over empty expansion-card slots to maintain FCC certification of the system. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

9 Holding the card by its edges, position the card so that the card-edge connector aligns with the expansion-card connector on the expansion-card assembly.

10 Insert the card-edge connector firmly into the expansion-card connector until the card is fully seated.

11 Replace the screw securing the expansion card.

12 Place the expansion-card assembly into the system-board assembly.

13 Replace the five screws that secure the expansion-card assembly.

14 Replace the cooling shroud. See "Installing the Cooling Shroud" on page 64.

15 Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.

16 Reconnect the system to its electrical outlet and turn on the system, including any attached peripherals.

Expansion-Card Connector

Removing the Expansion-Card Connector

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

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

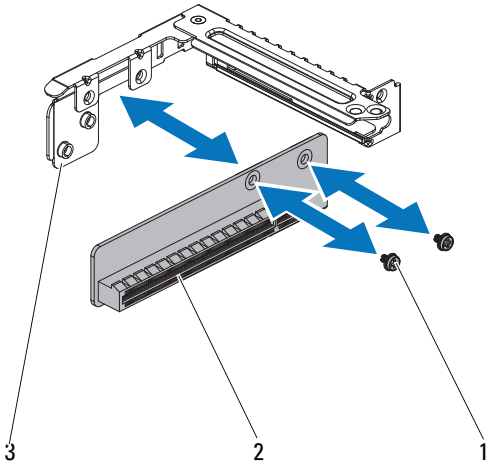
2 Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

3 Remove the expansion card. See "Removing the Expansion Card" on page 69.

4 Remove the two screws securing the expansion-card connector to the expansion-card bracket. See Figure 3-12.

5 Pull the expansion-card connector away from the expansion-card bracket. See Figure 3-12.

Figure 3-12. Removing and Installing the Expansion-Card Connector



1 screw (2)

2 expansion-card connector

3 expansion-card bracket

Installing the Expansion-Card Connector

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

1. Place the expansion-card connector into the expansion-card bracket. See Figure 3-12.
2. Replace the two screws securing the expansion-card connector to the expansion-card bracket. See Figure 3-12.
3. Install the expansion card. See "Installing the Expansion Card" on page 71.
4. Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.
5. Reconnect the system to its electrical outlet and turn on the system, including any attached peripherals.

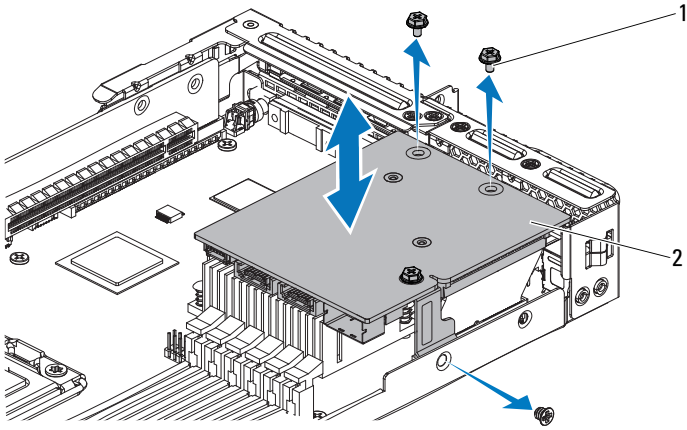
Mezzanine Card

Removing the SAS Mezzanine Card

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

1. Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.
2. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.
3. Disconnect all the cables from the mezzanine card.
4. Remove the three screws that secure the mezzanine card. See Figure 3-13.
5. Lift the mezzanine card out of the system-board assembly. See Figure 3-13.

Figure 3-13. Removing and Installing the SAS Mezzanine Card



1 screw (3) 2 mezzanine card

Installing the SAS Mezzanine Card

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

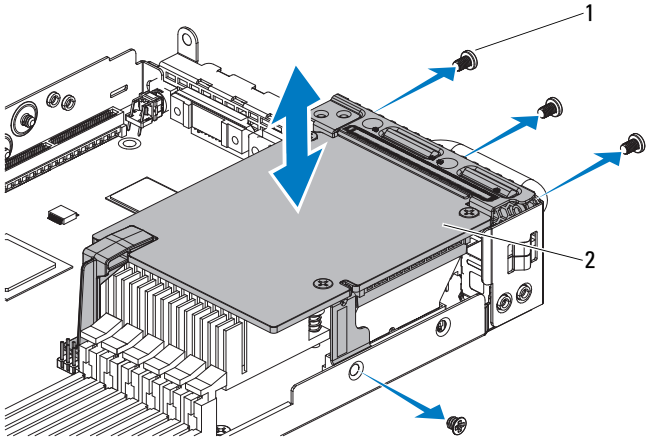
1. Place the mezzanine card on the system-board assembly. See Figure 3-13 and Figure 5-11.
2. Replace the three screws that secure the mezzanine card. See Figure 3-13.
3. Reconnect all the cables to the mezzanine card.
4. Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.
5. Reconnect the system to its electrical outlet and turn on the system, including any attached peripherals.

Removing the Infiniband Mezzanine Card

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

1. Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.
2. Disconnect all the cables from the mezzanine card.
3. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.
4. Remove the three screws that secure the mezzanine card to the back of system board tray. See Figure 3-14.
5. Remove the screw that secures the mezzanine card side bracket to the system board tray. See Figure 3-14
6. Lift the mezzanine card out of the system-board assembly. See Figure 3-14.

Figure 3-14. Removing and Installing the Screws—Infiniband Mezzanine Card



1 screw (4) 2 Infiniband mezzanine card

Installing the Infiniband Mezzanine Card

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

1. Place the mezzanine card on the system-board assembly. See Figure 3-14 and Figure 5-11.
2. Replace the three screws that secure the mezzanine card to the back of the system board tray. See Figure 3-14.
3. Replace the screw that secures the mezzanine card side bracket to the system board tray. See Figure 3-14.
4. Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.
5. Reconnect all the cables to the mezzanine card.
6. Reconnect the system to its electrical outlet and turn on the system, including any attached peripherals.

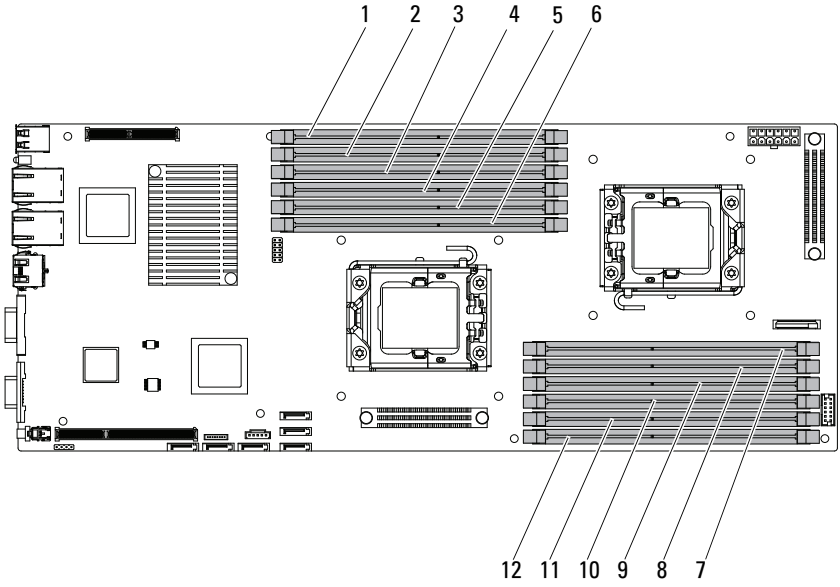
System Memory

Each system board has twelve unbuffered or registered DDR3-DIMM slots for the installation of up to twelve DDR3-1066/1333 memory chips to support processor 0 and processor 1. See "System Board Connectors" on page 129 for the location of the memory modules.

Supported DIMM Configuration

For the sequence of the twelve DIMM sockets, see Figure 3-15. When you insert the DIMM(s), always start with DIMM0_CHA. See Table 3-2 for possible memory configurations.

Figure 3-15. Memory Slot Locations



1	DIMM0_CHC	2	DIMM1_CHC
3	DIMM0_CHB	4	DIMM1_CHB
5	DIMM0_CHA	6	DIMM1_CHA
7	DIMM1_CHA	8	DIMM0_CHA
9	DIMM1_CHB	10	DIMM0_CHB
11	DIMM1_CHC	12	DIMM0_CHC

Table 3-2. Memory Module Configurations

DIMM	DIMM0	DIMM1	DIMM0	DIMM1	DIMM0	DIMM1
Processor 0						
	CH A		**CH B**		**CH C**	
1	✓	–	–	–	–	–
4	✓	–	✓	–	–	–

Table 3-2. Memory Module Configurations

DIMM	DIMM0	DIMM1	DIMM0	DIMM1	DIMM0	DIMM1
6	✓	–	✓	–	✓	–
12	✓	✓	✓	✓	✓	✓

Processor 1

	CH A		CH B		CH C	
1	–	–	–	–	–	–
4	✓	–	✓	–	–	–
6	✓	–	✓	–	✓	–
12	✓	✓	✓	✓	✓	✓

NOTE: An empty DIMM socket is marked as "_". For best performance, all the memory modules installed must be of the same speed, capacity, and from the same manufacturer.

Removing Memory Modules

WARNING: The memory modules are hot to the touch for some time after the system has been powered down. Allow time for the memory modules to cool before handling them. Handle the memory modules by the card edges and avoid touching the components on the memory module.

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

1. Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
2. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.
3. Remove the cooling shroud. See "Removing the Cooling Shroud" on page 63.
4. Locate the memory module sockets. See Figure 3-15.

5 Press down and out on the ejectors on each end of the socket until the memory module pops out of the socket. See Figure 3-16.

   Handle each memory module only on either card edge, making sure not to touch the middle of the memory module.

6 Replace the cooling shroud. See "Installing the Cooling Shroud" on page 64.

7 Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.

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

Installing Memory Modules

WARNING: The memory modules are hot to the touch for some time after the system has been powered down. Allow time for the memory modules to cool before handling them. Handle the memory modules by the card edges and avoid touching the components on the memory module.

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

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

2 Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

3 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 63.

4 Locate the memory module sockets. See Figure 3-15.

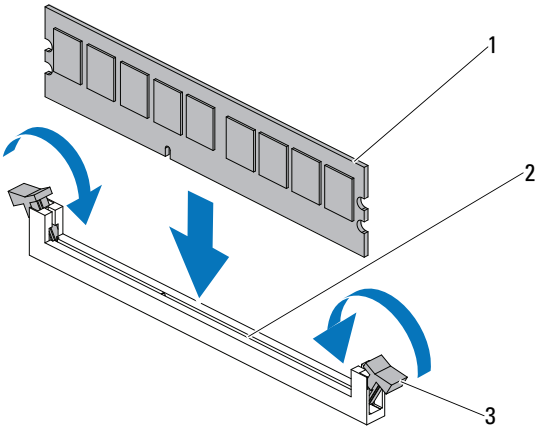
5 Press the ejectors on the memory module socket down and out, as shown in Figure 3-16, to allow the memory module to be inserted into the socket.

6 Handle each memory module only on either card edge, making sure not to touch the middle of the memory module.

7 Align the memory module's edge connector with the alignment key of the memory module socket, and insert the memory module in the socket. See Figure 3-16.

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

Figure 3-16. Inserting and Removing a DIMM



1 memory module
2 memory module socket
3 memory module socket ejector (2)

8 Press down on the memory module with your thumbs to lock the memory module into the socket. See Figure 3-16.

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

9 Repeat step 5 through step 8 of this procedure to install the remaining memory modules in the approved configurations. See Table 3-2.

10 Replace the cooling shroud. See "Installing the Cooling Shroud" on page 64.

11 Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.

12 Start up the system, press <F2> to enter the System Setup program, and check the System Memory settings on the main System Setup screen.

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

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

Interposer Extenders

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

Removing the Interposer Extender

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

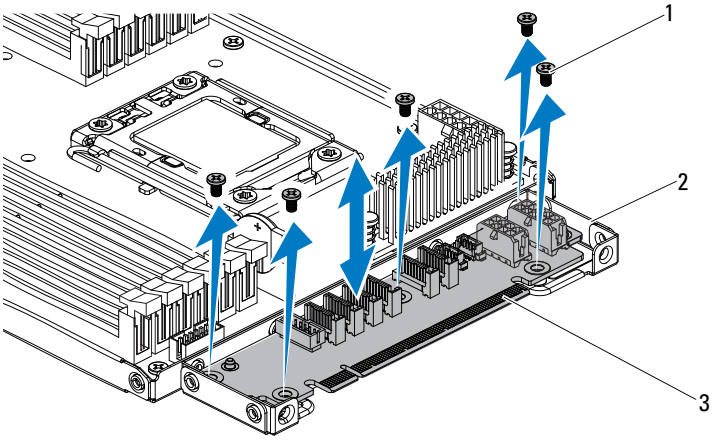
2 Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

3 Remove the five screws that secure the interposer extender to the interposer-extender tray. See Figure 3-17.

4 Disconnect all the cables from the interposer extender. See Figure 5-9.

5 Lift the interposer extender out of the interposer-extender tray. See Figure 3-17.

Figure 3-17. Removing and Installing the Interposer Extender



1 screw (5)
2 interposer-extender tray
3 interposer extender

Installing the Interposer Extender

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

1. Place the interposer extender into the interposer-extender tray.
2. Replace the five screws that secure the interposer extender to the interposer-extender tray.
3. Connect all the cables to the interposer extender. See Figure 5-9.
4. Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.
5. Reconnect the system to its electrical outlet and turn on the system, including any attached peripherals.

System Battery

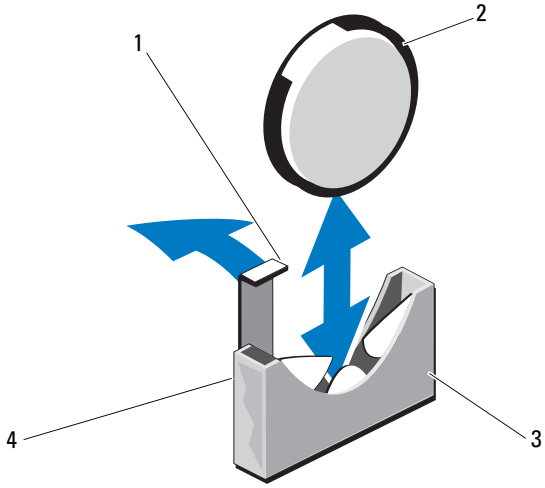
Replacing the System Battery

WARNING: 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. See your safety information for additional information.

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

1. Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.
2. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

Figure 3-18. Replacing the System Battery



1	retention clip	2	system battery
3	negative side of battery connector	4	positive side of battery connector

3 Locate the battery socket. See "System Board Connectors" on page 129.

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

4 Gently pull the retention clip over the battery towards the positive side of the connector and lift the battery out of the connector. See Figure 3-18.

5 Hold the new battery with the "+" facing the retention clip on the battery connector. See Figure 3-18.

6 Gently pull the retention clip towards the positive side of the connector and slide the battery into the connector until the retention clip snaps into place. See Figure 3-18.

7 Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.

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

9 Enter the System Setup program to confirm that the battery is operating properly. See "Using the System Setup Program" on page 35.

10 Enter the correct time and date in the System Setup program's **Time** and **Date** fields.

11 Exit the System Setup program.

RAID Battery (Optional)

Removing the RAID Battery

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

NOTE: The information in this section applies only to systems with the optional RAID controller card.

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

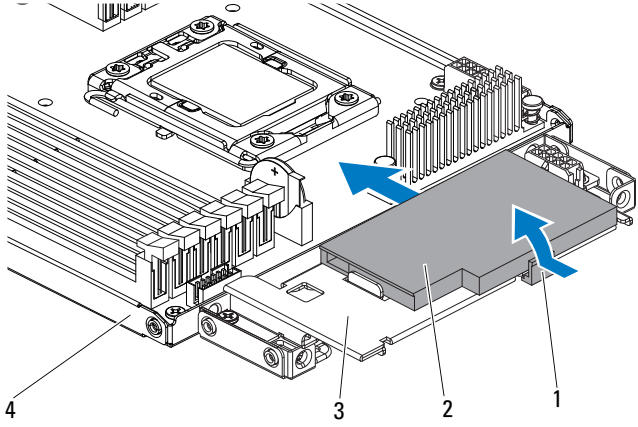
2 Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

3 To disconnect the RAID battery cable from the connector on the PERC card, press the tab on the RAID battery cable connector, and gently pull the cable connector out of the connector on the PERC card.

4 Press the RAID battery latch and lift the RAID battery to release it from the RAID battery carrier. See Figure 3-19.

5 Slide and lift the RAID battery away from the RAID battery carrier. See Figure 3-19.

Figure 3-19. Removing and Installing the RAID Battery



1	RAID battery latch	2	RAID battery
3	RAID battery carrier	4	system-board assembly

Installing the RAID Battery

1 Insert the RAID battery into the battery carrier until the RAID battery latch locks into place. See Figure 3-19.

2 Connect the RAID battery cable to the connector on the PERC card.

3 Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.

4 Reconnect the system to the electrical outlet and turn the system on, including any attached peripherals.

Removing the RAID Battery Carrier

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

NOTE: The information in this section applies only to systems with the optional RAID controller card.

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

2 Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

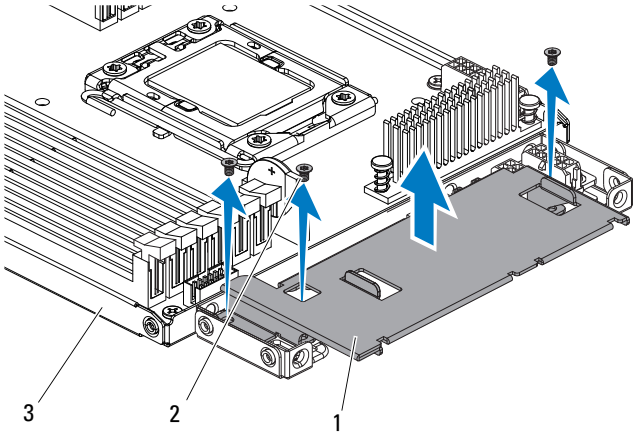
3 Remove the RAID battery. See "Removing the RAID Battery" on page 85.

4 Remove the three screws securing the RAID battery carrier to the interposer extender. See Figure 3-20.

5 Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.

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

Figure 3-20. Removing and Installing the RAID Battery Carrier



1	RAID battery carrier	2	screws (3)
3	system-board assembly		

Installing the RAID Battery Carrier

1. Place the RAID battery carrier in position on the interposer extender. See Figure 3-20.
2. Replace the screws securing the RAID battery carrier to the interposer extender. See Figure 3-20.
3. Install the RAID battery into the RAID battery carrier. See "Installing the RAID Battery" on page 86.
4. Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.
5. Reconnect the system to the electrical outlet and turn the system on, including any attached peripherals.

System Board

Removing a System Board

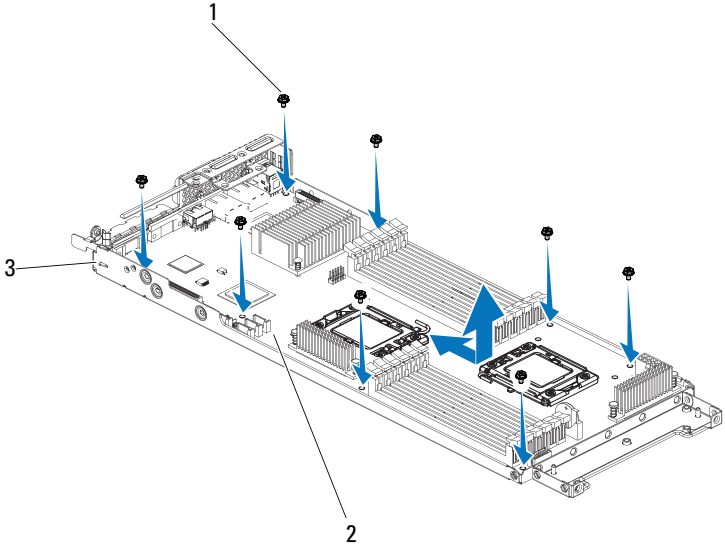
CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell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

1. Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
2. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.
3. Remove the cooling shroud. See "Removing the Cooling Shroud" on page 63.
4. Remove the heat sink. See "Removing the Heat Sink" on page 64.
5. Remove the expansion-card assembly. See "Removing the Expansion Card" on page 69.
6. If installed, remove the SAS mezzanine card or the Inifniband mezzanine card. See "Removing the SAS Mezzanine Card" on page 74 or "Removing the Infiniband Mezzanine Card" on page 76 .
7. Disconnect the hard drive and power cables from the system board.
8. Remove the eight screws and then slide the system board. See Figure 3-21.

CAUTION: Do not lift the system board by grasping a memory module, processor, or other components.

9. Grasp the system board by the edges and lift the system board away from the system-board assembly. See Figure 3-21.

Figure 3-21. Removing and Installing System Board



1	screw (8)	2	system board
3	system-board assembly		

Installing a System Board

1. Unpack the new system board.
2. Holding the system board by the edges, slide the system board into the system-board assembly.
3. Replace the eight screws to secure the system board to the system-board assembly.
4. Transfer the processors to the new system board. See "Removing a Processor" on page 66 and "Installing a Processor" on page 68.
5. Remove the memory modules and transfer them to the same locations on the new board. See "Interposer Extenders" on page 82 and "Installing Memory Modules" on page 80.
6. Replace the cooling shroud, see "Installing the Cooling Shroud" on page 64.

7 Connect the hard drive and power cables to the system board.

8 If applicable, install the SAS mezzanine card or the Infniband mezzanine card. See "Installing the SAS Mezzanine Card" on page 75 or "Installing the Infiniband Mezzanine Card" on page 77.

9 Install the expansion-card assembly. See "Installing the Expansion Card" on page 71.

10 Replace the system-board assembly. See "Installing a System-Board Assembly" on page 62.

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

Opening and Closing the System

WARNING: Whenever you need to lift the system, get others to assist you. To avoid injury, do not attempt to lift the system by yourself.

CAUTION: This system must be operated with the system cover installed to ensure proper cooling.

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

Opening the System

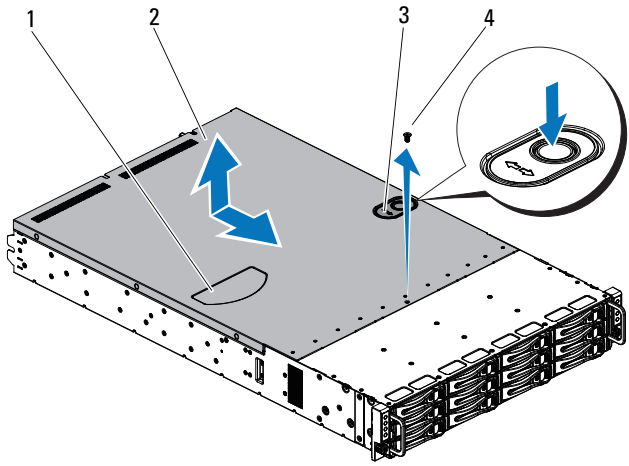
1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Remove the securing screw from the system cover. See Figure 3-22.

3 Press the cover release latch lock. See Figure 3-22.

4 Grasp cover on both the sides with your palm on the traction pad, slide out and lift the cover away from the system. See Figure 3-22.

Figure 3-22. Opening and Closing the System



1	traction pad	2	system cover
3	cover release latch lock	4	securing screw

Closing the System

1. Place the cover on the chassis and slide it to the front of the chassis until it snaps into place. See Figure 3-22.
2. Secure the cover with the securing screw. See Figure 3-22.

Cooling Fans

Removing a Cooling Fan

WARNING: Do not attempt to operate the system without the cooling fans.

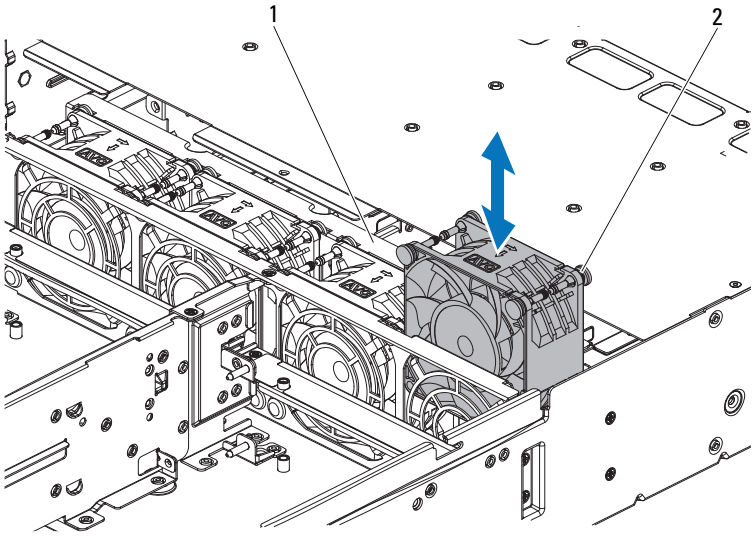
WARNING: The cooling fan can continue to spin for some time after the system has been powered down. Allow time for the fan to stop spinning before removing it from the system.

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

1. Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.
2. Open the system. See "Opening the System" on page 91.
3. Disconnect the fan's power cable from the fan-controller board.

   Note the routing of the cable underneath the tabs on the chassis as you remove them from the system. You must route these cables properly when you replace them to prevent the cables from being pinched or crimped.
4. Lift the fan out of the cooling-fan cage.

Figure 3-23. Removing and Installing a Cooling Fan



1 cooling-fan cage

2 cooling fan (4)

Installing a Cooling Fan

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

1. Align the cooling fan and slide it in the cooling-fan cage until the cooling fan is firmly seated. See Figure 3-23.

   NOTE: The fan blades should face the front panel of the system.

2. Connect the fan's power cable to the connector on the fan-controller board.

   You must route these cables properly through the tabs on the chassis to prevent them from being pinched or crimped.

3. Close the system. See "Closing the System" on page 92.
4. Reconnect the system to its electrical outlet and turn on the system, including any attached peripherals.

Power Distribution Boards

Removing a Power Distribution Board

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

NOTE: This system has two power distribution boards. The procedure to remove and install both the power distribution boards is similar. To access the second power distribution board at the bottom, remove the power distribution board at the top.

1. Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.
2. Open the system. See "Opening the System" on page 91.
3. Remove the power supply. See "Removing a Power Supply" on page 59.

4 Disconnect all the cables from the first power distribution board. See Figure 5-13.

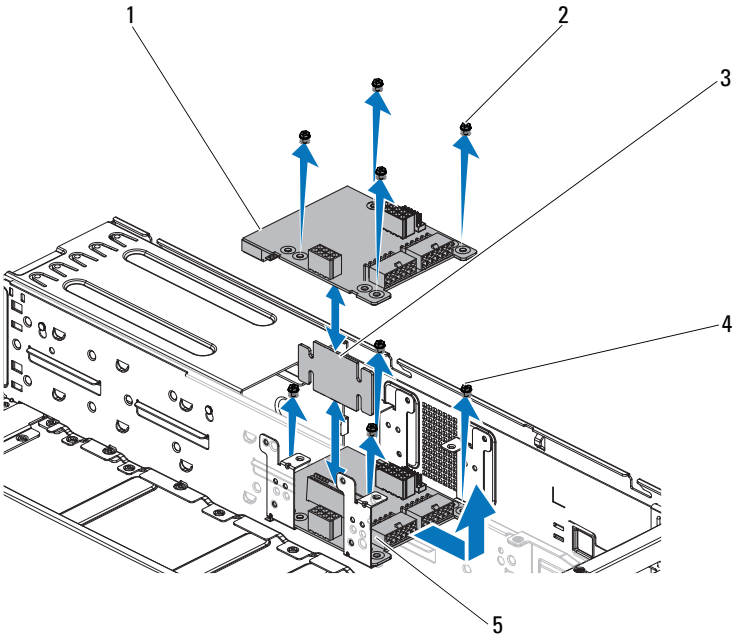
Note the routing of the cable underneath the tabs on the chassis as you remove them from the system. You must route these cables properly when you replace them to prevent the cables from being pinched or crimped.

5 Remove the screws securing the first power distribution board to the system. See Figure 3-24.

6 Lift the power distribution board out of the system. See Figure 3-24.

NOTE: To remove the second power distribution board that is below the first power distribution board, remove the power distribution board connector and angle the board before lifting.

Figure 3-24. Removing and Installing a Power Distribution Board



1	1st power distribution board	2	screw (4)
3	power distribution board-connector	4	screw (4)
5	2nd power distribution board		

Installing a Power Distribution Board

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

CAUTION: If removed, you must replace the second power distribution board at the bottom and the power distribution board-connector before replacing the first power distribution board at the top.

1. If removed, first place the second power distribution board in the system. See Figure 3-24. Otherwise skip to step 5.

   NOTE: To install the second power distribution board that is below the first power distribution board, angle the board during installation.

2. Replace the screws securing the second power distribution board to the system. See Figure 3-24.
3. Replace the power distribution board-connector. See Figure 3-24.
4. Connect all the cables to the second power distribution board. See Figure 5-13.

   You must route these cables properly through the tabs on the chassis to prevent them from being pinched or crimped.
5. Replace the screws securing the first power distribution board to the system. See Figure 3-24.
6. Connect all the cables to the first power distribution board. See Figure 5-13.

   You must route these cables properly through the tabs on the chassis to prevent them from being pinched or crimped.

7 Replace the power supply. See "Installing a Power Supply" on page 60.

8 Close the system. See "Closing the System" on page 92.

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

Fan Controller Board

Removing the Fan Controller Board

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

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

2 Open the system. See "Opening the System" on page 91.

3 Remove the power distribution boards. See "Removing a Power Distribution Board" on page 94.

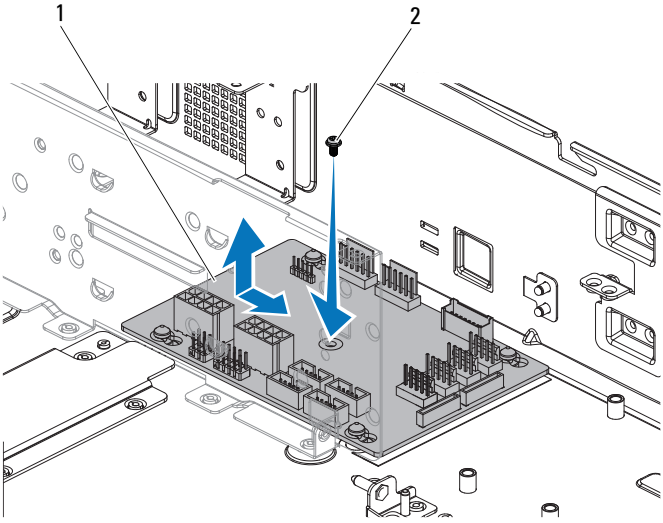
4 Disconnect all the cables from the fan controller board. See Figure 5-12.

Note the routing of the cable underneath the tabs on the chassis as you remove them from the system. You must route these cables properly when you replace them to prevent the cables from being pinched or crimped.

5 Remove the screw securing the fan controller board to the chassis. See Figure 3-25.

6 Slide and lift the fan controller board out of the chassis. See Figure 3-25.

Figure 3-25. Removing and Installing the Fan Controller Board



1 fan controller board 2 screw

Installing the Fan Controller Board

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

1. Place the fan controller board into the chassis and slide it into place. See Figure 3-25.
2. Replace the screw to secure the fan controller board to the chassis. See Figure 3-25.
3. Connect all the cables to the fan controller board. See Figure 5-12.

   You must route these cables properly through the tabs on the chassis to prevent them from being pinched or crimped.

4 Replace the power distribution boards. See "Installing a Power Distribution Board" on page 96.

5 Close the system. See "Closing the System" on page 92.

6 Reconnect the system to its electrical outlet and turn on the system, including any attached peripherals.

Midplanes

Removing the Midplanes

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

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

2 Open the system. See "Opening the System" on page 91.

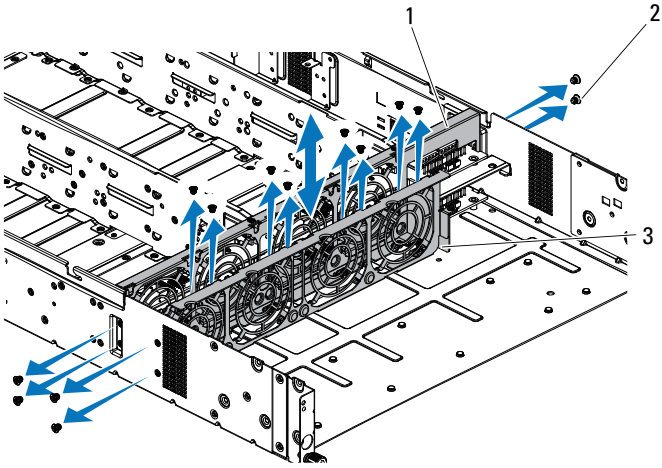
3 Remove the system-board assemblies. See "Removing a System-Board Assembly" on page 61.

4 Remove the cooling fans. See "Removing a Cooling Fan" on page 92.

5 Remove the screws that secure the cooling-fan brackets to the chassis. See Figure 3-26.

6 Lift the cooling-fan brackets out of the chassis. Figure 3-26.

Figure 3-26. Removing and Installing the Cooling-Fan Brackets



1 cooling fan bracket (long) 2 screw (14)

3 cooling fan bracket (short)

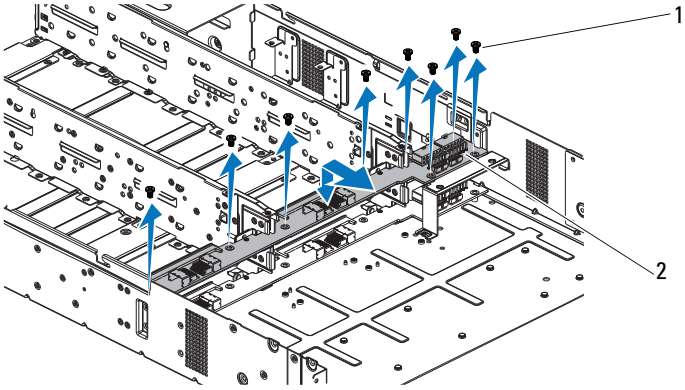
7 Remove the screws that secure the upper midplane to the midplane holder. Figure 3-27.

8 Disconnect all the cables from the upper midplane. See Figure 5-9.

Note the routing of the cable underneath the tabs on the chassis as you remove them from the system. You must route these cables properly when you replace them to prevent the cables from being pinched or crimped.

9 Lift the upper midplane out. Figure 3-27.

Figure 3-27. Removing and Installing the Upper Midplane

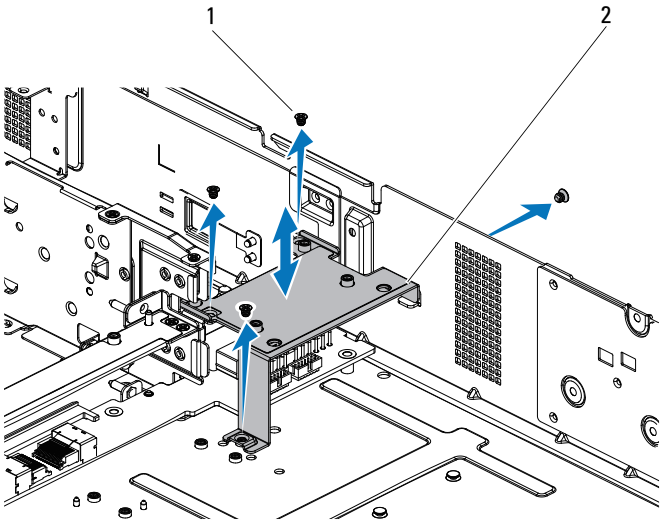


1 screw (9) 2 upper midplane

10 Remove the screws that secure the mid-plane holder support to the chassis. See Figure 3-28.

11 Lift the mid-plane holder support out of the chassis. Figure 3-28.

Figure 3-28. Removing and Installing the Mid-Plane Holder Support

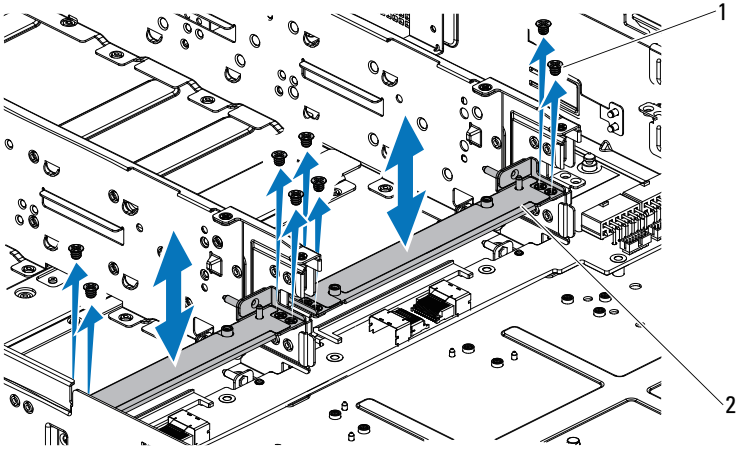


1 screw (4) 2 mid-plane holder support

12 Remove the screws that secure the mid-plane holder to the chassis. Figure 3-29.

13 Lift the mid-plane holder out of the chassis. See Figure 3-29.

Figure 3-29. Removing and Installing the Mid-Plane Holder



1	screw (8)	2	mid-plane holder

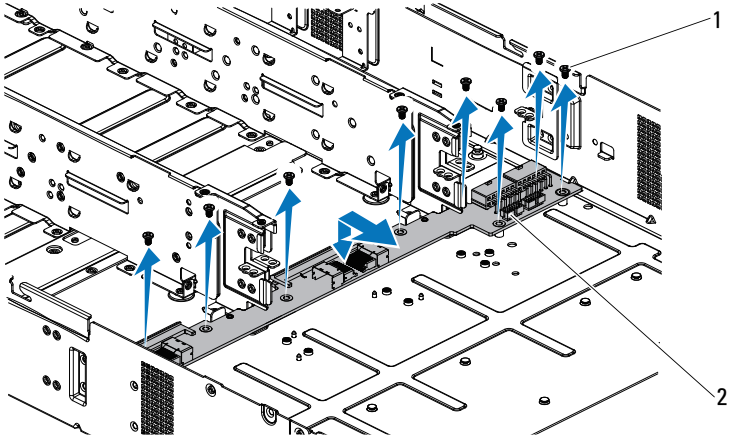
14 Remove the screws that secure the lower midplane to the chassis. Figure 3-30.

15 Disconnect all the cables from the lower midplane. See Figure 5-9.

Note the routing of the cable underneath the tabs on the chassis as you remove them from the system. You must route these cables properly when you replace them to prevent the cables from being pinched or crimped.

16 Lift the lower midplane out of the chassis. See Figure 3-30.

Figure 3-30. Removing and Installing the Lower Midplane



1 screw (8) 2 lower midplane

Installing the Midplanes

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

1. Place the lower midplane into the chassis. See Figure 3-30.
2. Replace the screws that secure the lower midplane to the chassis. See Figure 3-30.
3. Connect all the cables to the lower midplane. See Figure 5-9.

   You must route these cables properly through the tabs on the chassis to prevent them from being pinched or crimped.
4. Place the midplane holder into the chassis. See Figure 3-29.
5. Replace the screws that secure the midplane holder to the chassis. See Figure 3-29
6. Place the mid-plane holder support into the chassis. See Figure 3-28.

7 Replace the screws that secure the mid-plane holder support to the chassis. See Figure 3-28.

8 Place the upper midplane on the midplane holder. See Figure 3-27.

9 Replace the screws that secure the midplane to the midplane holder. Figure 3-27.

10 Connect all the cables to the upper midplane. See Figure 5-9.

You must route these cables properly through the tabs on the chassis to prevent them from being pinched or crimped.

11 Place the fan bracket into the chassis. Figure 3-26.

12 Replace the screws that secure the fan bracket to the chassis. Figure 3-26.

13 Replace the cooling fans. See "Installing a Cooling Fan" on page 94.

14 Replace the system-board assemblies. See "Installing a System-Board Assembly" on page 62.

15 Close the system, see "Closing the System" on page 92.

16 Reconnect the system to its electrical outlet and turn on the system, including any attached peripherals.

Backplanes

NOTE: Following is the replacement procedure of SATA2 and SAS backplane for 3.5-inch hard drive systems. Replacement procedure for 2.5-inch of SATA2 and SAS backplane is similar to backplane for 3.5-inch hard drive systems.

Removing the Backplane

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

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

2 Remove all the hard drives. See "Removing a Hard-Drive Carrier" on page 56.

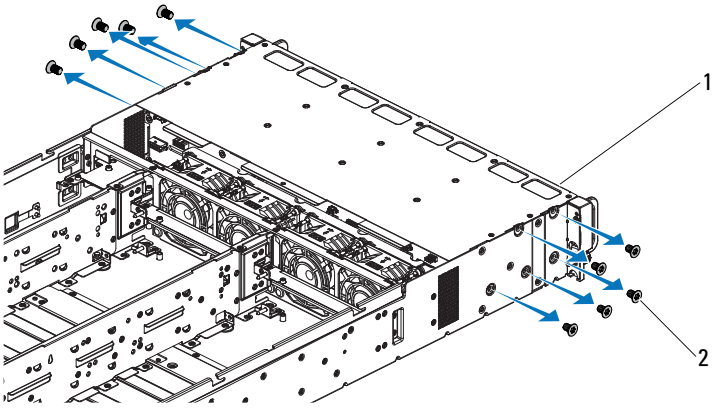
3 Open the system. See "Opening the System" on page 91.

CAUTION: To prevent damage to the drives and backplane, you must remove the hard drives from the system before removing the backplane.

CAUTION: You must note the number of each hard drive and temporarily label them before removal so that you can replace them in the same locations.

4 Remove the screws that secure the hard-drive cage to the chassis. See Figure 3-31.

Figure 3-31. Removing and Installing the Backplane



1 hard-drive cage 2 screw (10)

5 Remove the screws that secure the front-panel assemblies to the chassis. See Figure 3-32.

6 Disconnect all the cables from the backplane. See Figure 5-3 for 3.5-inch hard drives and Figure 5-6 for 2.5-inch hard drives.

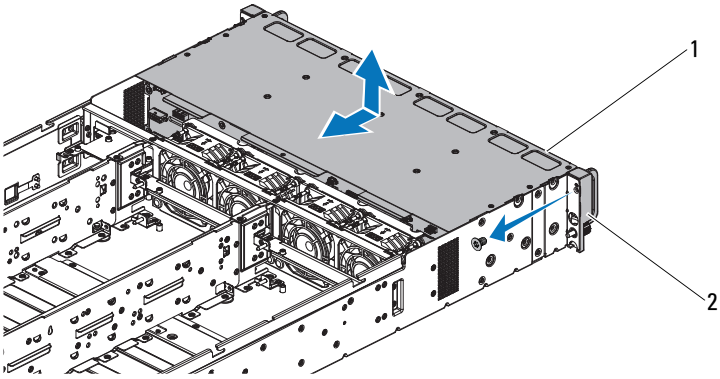
Note the routing of the cable underneath the tabs on the chassis as you remove them from the system. You must route these cables properly when you replace them to prevent the cables from being pinched or crimped.

7 Disconnect front panel cables from the fan controller board. See Figure 5-12.

Note the routing of the cable underneath the tabs on the chassis as you remove them from the system. You must route these cables properly when you replace them to prevent the cables from being pinched or crimped.

8 Remove the hard-drive cage from the chassis. See Figure 3-32.

Figure 3-32. Removing and Installing the Hard-Drive Cage

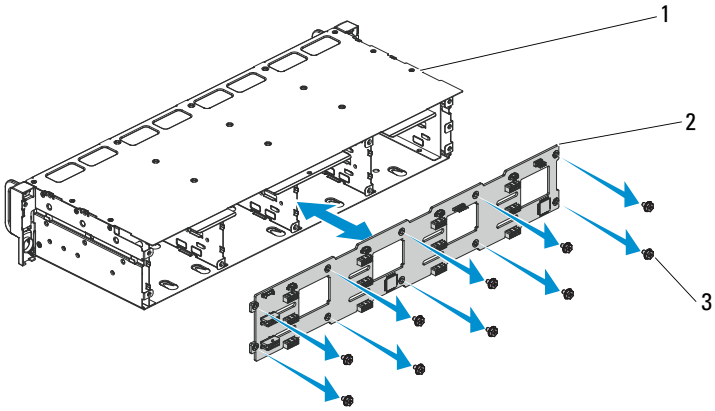


1 hard-drive cage 2 front-panel assembly (2)

9 Remove the screws that secure the backplane to the hard-drive cage. See Figure 3-33.

10 Remove the backplane from the hard-drive cage. See Figure 3-33.

Figure 3-33. Removing and Installing the Backplane From the Hard-Drive Cage



1 hard-drive cage
2 backplane
3 screws (10)

Installing the Backplane

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

1. Install the backplane into the hard-drive cage. See Figure 3-33.
2. Replace the screws that secure the backplane to the hard-drive cage. See Figure 3-33.
3. Replace the hard-drive cage into the chassis. See Figure 3-32.
4. Replace the screws that secure the front-panel assemblies to the chassis. See Figure 3-32.
5. Connect all the cables to the backplane. See Figure 5-3 for 3.5-inch hard drives and Figure 5-6 for 2.5-inch hard drives.

   You must route these cables properly through the tabs on the chassis to prevent them from being pinched or crimped.

6 Connect front panel cables to the fan controller board. See Figure 5-12.

You must route these cables properly through the tabs on the chassis to prevent them from being pinched or crimped.

7 Replace the screws that secure the hard-drive cage. See Figure 3-31.

8 Close the system, see "Closing the System" on page 92.

9 Replace the hard drives. See "Installing a Hard Drive Into a Hard-Drive Carrier" on page 58.

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

Front Panels

Removing the Front Panel

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

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

2 Remove all the hard drives. See "Removing a Hard-Drive Carrier" on page 56.

3 Open the system. See "Opening the System" on page 91.

4 Disconnect all the cables from the backplane. See Figure 5-3 for 3.5-inch hard drives and Figure 5-6 for 2.5-inch hard drives.

Note the routing of the cable underneath the tabs on the chassis as you remove them from the system. You must route these cables properly when you replace them to prevent the cables from being pinched or crimped.

5 Disconnect front panel cables from the fan controller board. See Figure 5-12.

Note the routing of the cable underneath the tabs on the chassis as you remove them from the system. You must route these cables properly when you replace them to prevent the cables from being pinched or crimped.

6 Remove the screws that secure the hard-drive cage to the chassis. See Figure 3-31.

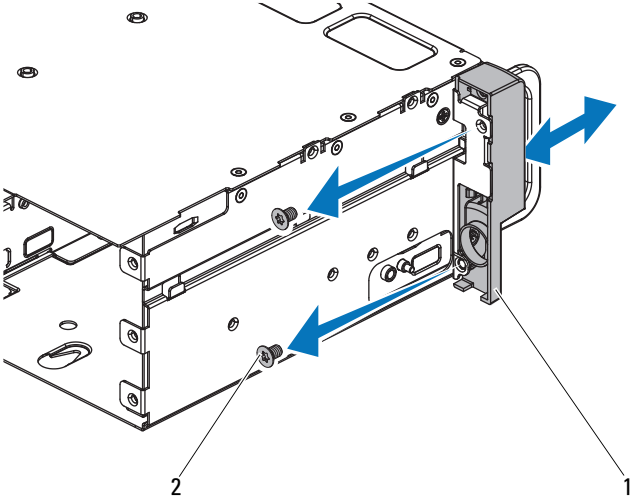
7 Remove the screws that secure the front-panel assemblies to the chassis. See Figure 3-32.

8 Remove the hard-drive cage from the chassis. See Figure 3-32.

9 Remove the screws that secure the front-panel assembly to the hard-drive cage. See Figure 3-34.

10 Remove the front-panel assembly from the hard-drive cage. See Figure 3-34.

Figure 3-34. Removing and Installing a Front Panel Assembly

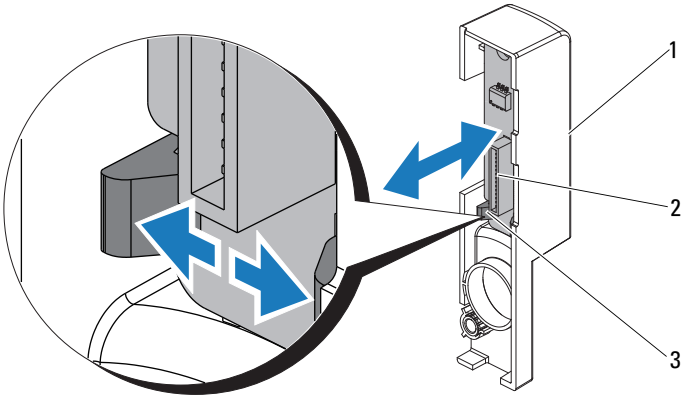


1 front-panel assembly 2 screw (2)

11 Push aside the retention hooks on the front-panel assembly. See Figure 3-35.

12 Remove the front panel from the front-panel assembly. See Figure 3-35.

Figure 3-35. Removing and Installing a Front Panel



1	front panel assembly	2	front panel
3	retention hooks		

Installing Front Panel

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

1. Push aside the retention hooks on the front-panel assembly and place the front panel into the front-panel assembly. See Figure 3-35.
2. Replace the front-panel assembly into the hard-drive cage. See Figure 3-34.
3. Replace the screws that secure the front-panel assembly to the hard-drive cage. See Figure 3-34.
4. Replace the hard-drive cage into the chassis. See Figure 3-32.
5. Replace the screws that secure the front-panel assemblies to the chassis. See Figure 3-32.
6. Replace the screws that secure the hard-drive cage to the chassis. See Figure 3-31.

7 Connect front panel cables to the fan controller board. See Figure 5-12.

   You must route these cables properly through the tabs on the chassis to prevent them from being pinched or crimped.

8 Connect all the cables to the backplane. See Figure 5-3 for 3.5-inch hard drives and Figure 5-6 for 2.5-inch hard drives.

   You must route these cables properly through the tabs on the chassis to prevent them from being pinched or crimped.

9 Close the system. See "Closing the System" on page 92.

10 Replace the hard drives. See "Installing a Hard Drive Into a Hard-Drive Carrier" on page 58.

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

4

Troubleshooting Your System

Safety First—For You and Your System

WARNING: Whenever you need to lift the system, get others to assist you. To avoid injury, do not attempt to lift the system by yourself.

WARNING: Before removing the system cover, disconnect all power, then unplug the AC power cord, and then disconnect all peripherals, and all LAN lines.

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

Installation Problems

Perform the following checks if you are troubleshooting an installation problem:

- Check all cable and power connections (including all rack cable connections).
- Unplug the power cord and wait for one minute. Then reconnect the power cord and try again.
- If the network is reporting an error, verify that the system has enough memory and disk space.
- Remove all added peripherals, one at a time, and try to turn on the system. If after removing a peripheral the system works, it may be a problem with the peripheral or a configuration problem between the peripheral and the system. Contact the peripheral vendor for assistance.
- If the system does not power on, check the LED display. If the power LED is not on, you may not be receiving AC power. Check the AC power cord to make sure that it is securely connected.

Troubleshooting System Startup Failure

If your system halts during startup, especially after installing an operating system or reconfiguring your system's hardware, check for invalid memory configurations. These could cause the system to halt at startup without any video output. See "System Memory" on page 77.

For all other startup issues, note any system messages that appear onscreen. See "Using the System Setup Program" on page 35 for more information.

Troubleshooting External Connections

Ensure that all external cables are securely attached to the external connectors on your system before troubleshooting any external devices. See Figure 1-1, Figure 1-4, and Figure 1-8 for the front- and back-panel connectors on your system.

Troubleshooting the Video Subsystem

1. Check the system and power connections to the monitor.
2. Check the video interface cabling from the system to the monitor.

Troubleshooting a USB Device

Use the following steps to troubleshoot a USB keyboard and/or mouse. For other USB devices, go to step 5.

1. Disconnect the keyboard and mouse cables from the system briefly and reconnect them.
2. Connect the keyboard/mouse to the USB port(s) on the opposite side of the system.
3. If the problem is resolved, restart the system, enter the System Setup program, and check if the nonfunctioning USB ports are enabled.
4. Replace the keyboard/mouse with another working keyboard/mouse.

   If the problem is resolved, replace the faulty keyboard/mouse.

   If the problem is not resolved, proceed to the next step to begin troubleshooting the other USB devices attached to the system.

5 Power down all attached USB devices and disconnect them from the system.

6 Restart the system and, if your keyboard is functioning, enter the system setup program. Verify that all USB ports are enabled. See "USB Configuration" on page 43.

If your keyboard is not functioning, you can also use remote access. If the system is not accessible, see "Jumper Settings" on page 139 for instructions on setting the NVRAM_CLR jumper inside your system and restoring the BIOS to the default settings.

7 Reconnect and power on each USB device one at a time.

8 If a device causes the same problem, power down the device, replace the USB cable, and power up the device.

If the problem persists, replace the device.

If all troubleshooting fails, see "Getting Help" on page 143.

Troubleshooting a Serial I/O Device

1 Turn off the system and any peripheral devices connected to the serial port.

2 Swap the serial interface cable with another working cable, and turn on the system and the serial device.

If the problem is resolved, replace the interface cable.

3 Turn off the system and the serial device, and swap the device with a comparable device.

4 Turn on the system and the serial device.

If the problem is resolved, replace the serial device.

If the problem persists, see "Getting Help" on page 143.

Troubleshooting a NIC

1. Restart the system and check for any system messages pertaining to the NIC controller.
2. Check the appropriate indicator on the NIC connector. See "NIC Indicators (KVM Over IP Port)" on page 19.
   - If the link indicator does not light, check all cable connections.
   - If the activity indicator does not light, the network driver files might be damaged or missing.

     Remove and reinstall the drivers if applicable. See the NIC's documentation.
   - Change the auto-negotiation setting, if possible.
   - Use another connector on the switch or hub.

   If you are using a NIC card instead of an integrated NIC, see the documentation for the NIC card.
3. Ensure that the appropriate drivers are installed and the protocols are bound. See the NIC's documentation.
4. Enter the System Setup program and confirm that the NIC ports are enabled. See "Using the System Setup Program" on page 35.
5. Ensure that the NICs, hubs, and switches on the network are all set to the same data transmission speed. See the documentation for each network device.
6. Ensure that all network cables are of the proper type and do not exceed the maximum length.

   If all troubleshooting fails, see "Getting Help" on page 143.

Troubleshooting a Wet System

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

1. Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
2. Open the system. See "Opening the System" on page 91.
3. Disassemble components from the system. See "Installing System Components" on page 53.
   - Cooling shroud
   - Hard drives
   - SAS backplane
   - Expansion-card
   - Power supplies
   - Fans
   - Processors and heat sinks
   - Memory modules
4. Let the system dry thoroughly for at least 24 hours.
5. Reinstall the components you removed in step 3.
6. Close the system. See "Closing the System" on page 92.
7. Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

   If the system does not start properly, see "Getting Help" on page 143.
8. If the system starts properly, shut down the system and reinstall the expansion card that you removed. See "Installing the Expansion Card" on page 71.
9. If the system fails to start, see "Getting Help" on page 143.

Troubleshooting a Damaged System

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

1. Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
2. Open the system. See "Opening the System" on page 91.
3. Ensure that the following components are properly installed:
   - Expansion-card assembly
   - Power supplies
   - Fans
   - Processors and heat sinks
   - Memory modules
   - Hard-drive carriers
   - Cooling shroud
4. Ensure that all cables are properly connected.
5. Close the system. See "Closing the System" on page 92.
6. If the system fails to start, see "Getting Help" on page 143.

Troubleshooting the System Battery

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

1. Re-enter the time and date through the System Setup program. See "System Setup Options at Boot" on page 36.
2. Turn off the system and disconnect it from the electrical outlet for at least one hour.
3. Reconnect the system to the electrical outlet and turn on the system.

4 Enter the System Setup program.

If the date and time are not correct in the System Setup program, replace the battery. See "Replacing the System Battery" on page 84.

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

If the problem is not resolved by replacing the battery, see "Getting Help" on page 143.

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

Troubleshooting Power Supplies

1 Identify the faulty power supply by the power supply's fault indicator. See "Power and System Board Indicator Codes" on page 20.

CAUTION: At least one power supply must be installed for the system to operate. Operating the system with only one power supply installed for extended periods of time can cause the system to overheat.

2 Reseat the power supply by removing and reinstalling it. See "Power Supplies" on page 59.

NOTE: After installing a power supply, allow several seconds for the system to recognize the power supply and to determine if it is working properly. The power indicator turns green to signify that the power supply is functioning properly.

If the problem persists, replace the faulty power supply.

3 If all troubleshooting fails, see "Getting Help" on page 143.

Troubleshooting System Cooling Problems

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

Ensure that none of the following conditions exist:

- System cover, cooling shroud, drive blank, power supply blank, or front or back filler panel is removed.
- Ambient temperature is too high.
- External airflow is obstructed.
- Cables inside the system obstruct airflow.
- An individual cooling fan is removed or has failed. See "Troubleshooting a Fan" on page 120.

Troubleshooting a Fan

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

1. Locate the faulty fan indicated by the diagnostic software.
2. Turn off the system and all attached peripherals.
3. Open the system. See "Opening the System" on page 91.
4. Reseat the fan's power cable.
5. Restart the system.

   If the fan functions properly, close the system. See "Closing the System" on page 92.

6 If the fan does not function, turn off the system and install a new fan. See "Cooling Fans" on page 92.

7 Restart the system.

If the problem is resolved, close the system. See "Closing the System" on page 92.

If the replacement fan does not operate, see "Getting Help" on page 143.

Troubleshooting System Memory

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

NOTE: Invalid memory configurations can cause your system to halt at startup without video output. See "System Memory" on page 77 and verify that your memory configuration complies with all applicable guidelines.

1 If the system is not operational, turn off the system and attached peripherals, and unplug the system from the power source. Wait at least 10 seconds and then reconnect the system to power.

2 Turn on the system and attached peripherals and note the messages on the screen.

Go to step 13 if an error message appears indicating a fault with a specific memory module.

3 Enter the System Setup program and check the system memory settings. See "System Memory Settings" on page 38. Make any changes to the memory settings, if needed.

If the memory settings match the installed memory but a problem is still indicated, go to step 13.

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

5 Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

6 Remove the cooling shroud. See "Removing the Cooling Shroud" on page 63.

7 Check the memory channels and ensure that they are populated correctly. See "Memory Configuration" on page 40.

8 Reseat the memory modules in their sockets. See "Installing Memory Modules" on page 80.

9 Replace the cooling shroud. See "Installing the Cooling Shroud" on page 64.

10 Install the system-board assembly. See "Installing a System-Board Assembly" on page 62.

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

12 Enter the System Setup program and check the system memory settings. See "System Memory Settings" on page 38.

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

13 Turn off the system and attached peripherals, and disconnect the system from the power source.

14 Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

15 If a diagnostic test or error message indicates a specific memory module as faulty, swap or replace the module.

16 To troubleshoot an unspecified faulty memory module, replace the memory module in the first DIMM socket with a module of the same type and capacity. See "Installing Memory Modules" on page 80.

17 Install the system-board assembly. See "Installing a System-Board Assembly" on page 62.

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

19 As the system boots, observe any error message that appears and the diagnostic indicators on the front of the system.

20 If the memory problem is still indicated, repeat step 13 through step 19 for each memory module installed.

If the problem persists after all memory modules have been checked, see "Getting Help" on page 143.

Troubleshooting a Hard Drive

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

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

1. If your system has a RAID controller and your hard drives are configured in a RAID array, perform the following steps:
   a. Restart the system and enter the host adapter configuration utility program by pressing <Ctrl><H> for a RAID controller or <Ctrl><C> for a SAS controller.

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

   b. Ensure that the hard drive(s) have been configured correctly for the RAID array.

   c. Take the hard drive offline and reseat the drive. See "Removing a Hard Drive From a Hard-Drive Carrier" on page 57.

   d. Exit the configuration utility and allow the system to boot to the operating system.
2. Ensure that the required device drivers for your controller card are installed and are configured correctly. See the operating system documentation for more information.
3. Restart the system, enter the System Setup program, and verify that the controller is enabled and the drives appear in the System Setup program. See "Using the System Setup Program" on page 35.

   If the problem persists, see "Getting Help" on page 143.

Troubleshooting a Storage Controller

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

1. Enter the System Setup program and ensure that the SAS controller is enabled. See "Using the System Setup Program" on page 35.
2. Restart the system and press the applicable key sequence to enter the configuration utility program.
   - <Ctrl><C> for a SAS controller
   - <Ctrl><H> for a RAID controller

   See the controller's documentation for information about configuration settings.
3. Check the configuration settings, make any necessary corrections, and restart the system.

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

4. Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.
5. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.
6. Ensure that the controller card is firmly seated into the system board connector. See "Installing the Expansion Card" on page 71.
7. If you have a battery-cached RAID controller, ensure that the RAID battery is properly connected and, if applicable, the memory module on the RAID card is properly seated.

8 Ensure that the cables are firmly connected to the storage controller and the SAS backplane board.

9 Install the system-board assembly. See "Installing a System-Board Assembly" on page 62.

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

If the problem persists, see "Getting Help" on page 143.

Troubleshooting Expansion Cards

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

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

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

2 Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

3 Ensure that each expansion card is firmly seated in its connector. See "Installing the Expansion Card" on page 71.

4 Install the system-board assembly. See "Installing a System-Board Assembly" on page 62.

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

6 If the problem is not resolved, see "Getting Help" on page 143.

Troubleshooting Processors

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

1. Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
2. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.
3. Ensure that each processor and heat sink are properly installed. See "Installing a Processor" on page 68.
4. Install the system-board assembly. See "Installing a System-Board Assembly" on page 62.
5. Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.
6. If the problem persists, turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
7. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.
8. Remove processor 2. See "Removing a Processor" on page 66.
9. Install the system-board assembly. See "Installing a System-Board Assembly" on page 62.
10. Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

    If the problem persists, the processor is faulty. See "Getting Help" on page 143.
11. Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.
12. Remove the system-board assembly. See "Removing a System-Board Assembly" on page 61.

13 Replace processor 1 with processor 2. See "Installing a Processor" on page 68.

14 Repeat step 9 through step 11.

If you have tested both the processors and the problem persists, the system board is faulty. See "Getting Help" on page 143.

IRQ Assignment Conflicts

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

Table 4-1. Assignment Specific IRQ Requirements

IRQ Line	Assignment	IRQ Line	Assignment
IRQ0	8254 timer	IRQ8	RTC
IRQ1	Keyboard controller	IRQ9	SCI
IRQ2	Cascade for IRQ9	IRQ10	VGA
IRQ3	Serial port	IRQ11	USB controller
IRQ4	Serial port	IRQ12	Mouse controller
IRQ5	Free	IRQ13	Numeric data Processor
IRQ6	Free	IRQ14	Primary IDE controller
IRQ7	Free	IRQ15	Secondary IDE controller

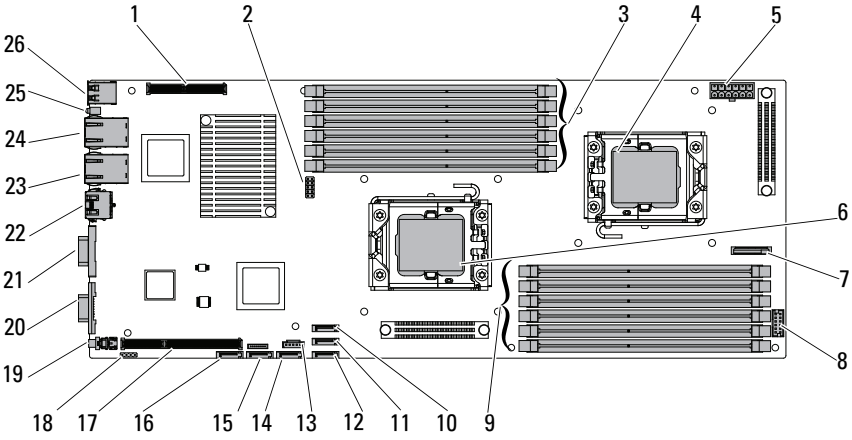
5

Jumpers and Connectors

System Board Connectors

This section provides specific information about the system jumpers. It also provides some basic information on jumpers and switches and describes the connectors on the various boards in the system.

Figure 5-1. System Board Connectors



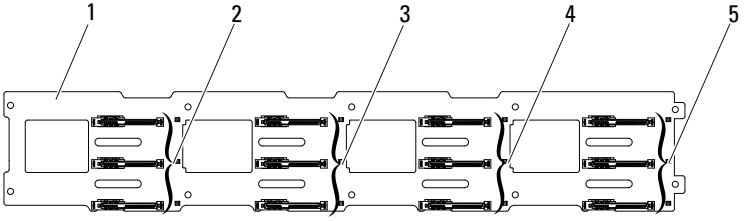
1	PCI-E mezzanine card connector	2	system configuration jumper
3	DIMM sockets for processor 1	4	processor 0
5	main power connector	6	processor 1
7	system battery	8	front panel connector
9	DIMM sockets for processor 0	10	onboard SATA2 connector 1
11	onboard SATA2 connector 2	12	onboard SATA2 connector 3
13	SGPIO connector	14	onboard SATA2 connector 4
15	onboard SATA2 connector 5	16	onboard SATA2 connector 6

17	expansion slot	18	BMC debug connector
19	power button	20	VGA port
21	serial port	22	KVM over IP port
23	NIC2 connector (RJ45)	24	NIC1 connector (RJ45)
25	ID LED	26	USB port

Backplane Connectors

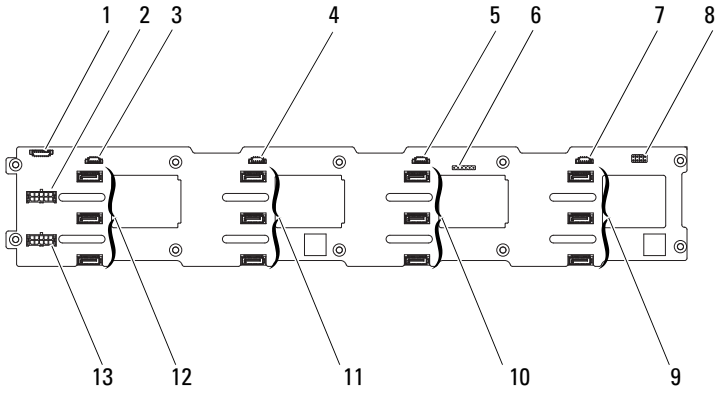
3.5" drives

Figure 5-2. Front View of the Backplane



1	3.5" backplane	2	SATA2 and SAS connectors 1, 2, and 3 for system board 1 (from top to bottom)
3	SATA2 and SAS connectors 1, 2, and 3 for system board 2 (from top to bottom)	4	SATA2 and SAS connectors 1, 2, and 3 for system board 3 (from top to bottom)
5	SATA2 and S AS connectors 1, 2, and 3 for system board 4 (from top to bottom)		

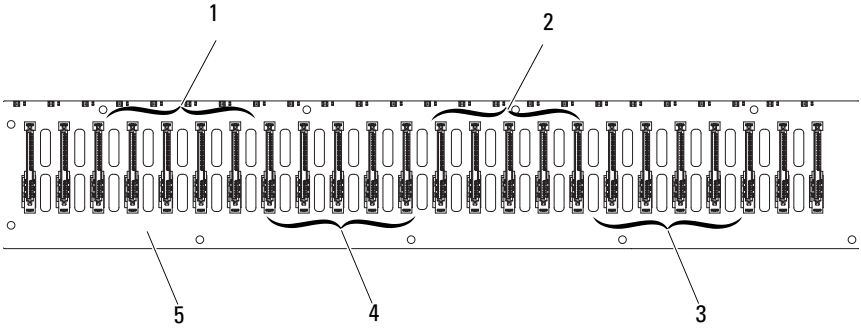
Figure 5-3. Back View of the Backplane



1	system fan board connector	2	backplane power connector for power supply 1
3	SGPIO connector for system board 4	4	SGPIO connector for system board 3
5	SGPIO connector for system board 2	6	CPLD JTAG connector
7	SGPIO connector for system board 1	8	backplane jumper
9	SATA2 hard drive connectors 1, 2, and 3 for system board 1 (from top to bottom)	10	SATA2 hard drive connectors 1, 2, and 3 for system board 2 (from top to bottom)
11	SATA2 hard drive connectors 1, 2, and 3 for system board 3 (from top to bottom)	12	SATA2 hard drive connectors 1, 2, and 3 for system board 4 (from top to bottom)
13	backplane power connector for power supply 2		

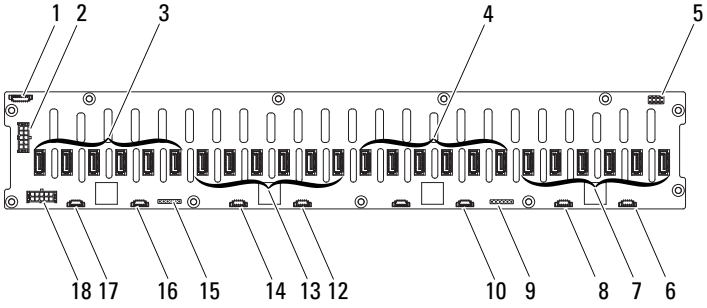
2.5" drives

Figure 5-4. Front View of the Backplane



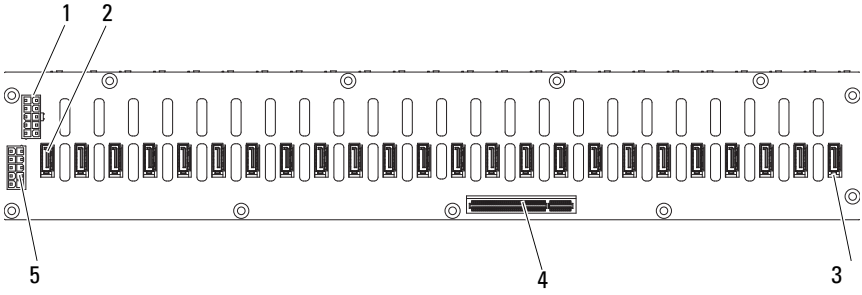
1	SATA2 and SAS connectors 1 to 6 for system board 1 (from left to right)	2	SATA2 and SAS connectors 1 to 6 for system board 3 (from left to right)
3	SATA2 and SAS connectors 1 to 6 for system board 4 (from left to right)	4	SATA2 and SAS connectors 1 to 6 for system board 2 (from left to right)
5	2.5" backplane		

Figure 5-5. Back View of the Backplane—Type 1



1	system fan board connector	2	backplane power connector for power supply 1
3	SATA2 hard drive connectors 1 to 6 for system board 4 (from right to left)	4	SATA2 hard drive connectors 1 to 6 for system board 2 (from right to left)
5	backplane jumper	6	SGPIO connector A for system board 1
7	SATA2 hard drive connectors 1 to 6 for system board 1 (from right to left)	8	SGPIO connector B for system board 1
9	CPLD JTAG connector 1	10	SGPIO connector A for system board 2
11	SGPIO connector B for system board 2	12	SGPIO connector A for system board 3
13	SATA2 hard drive connectors 1 to 6 for system board 3 (from right to left)	14	SGPIO connector B for system board 3
15	CPLD JTAG connector 2	16	SGPIO connector A for system board 4
17	SGPIO connector B for system board 4	18	backplane power connector for power supply 2

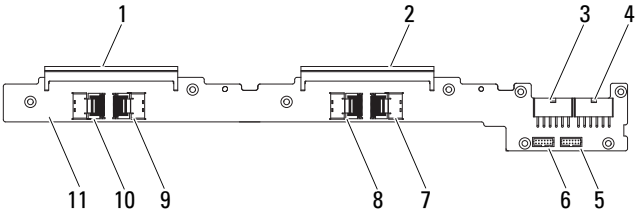
Figure 5-6. Back View of the Backplane—Type 2



1	power supply connector 2	2	HDD connector number 23-Port 24
3	HDD connector number 0-Port 1	4	PCIEx8 connector
5	power supply connector 1		

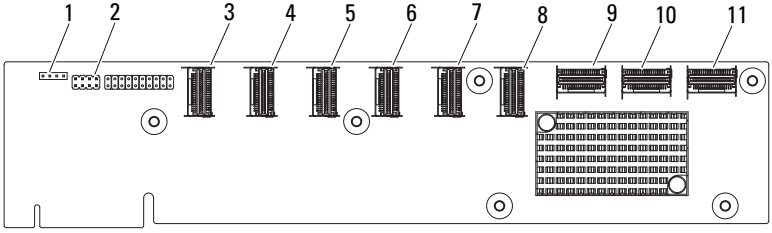
Midplane Connectors

Figure 5-7. Midplane Connectors—3.5"



1	midplane connector 1	2	midplane connector 2
3	midplane power connector for system boards 1 and 2	4	midplane power connector for system boards 3 and 4
5	front panel connector for system boards 3 and 4	6	front panel connector for system boards 1 and 2
7	mini-SAS connector for system boards 3 and 4 (hard drive 1, 2, 3, and 4)	8	mini-SAS connector for system boards 3 and 4 (hard drive 5 and 6)
9	mini-SAS connector for system boards 1 and 2 (hard drive 1, 2, 3, and 4)	10	mini-SAS connector for system boards 1 and 2 (hard drive 5 and 6)
11	midplane		

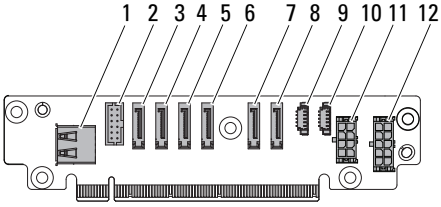
Figure 5-8. Midplane Connectors—2.5"



1	UART connector	2	SEL connector
3	Mini-SAS 1 Ports 1-4	4	Mini-SAS 2 Ports 5-8
5	Mini-SAS 3 Ports 9-12	6	Mini-SAS 4 Ports 13-16
7	Mini-SAS 5 Ports 17-20	8	Mini-SAS 6 Ports 21-24
9	Motherboard 1 Mini-SAS connector	10	Motherboard 2 Mini-SAS connector
11	Motherboard 4 Mini-SAS connector		

Interposer Extender Connectors

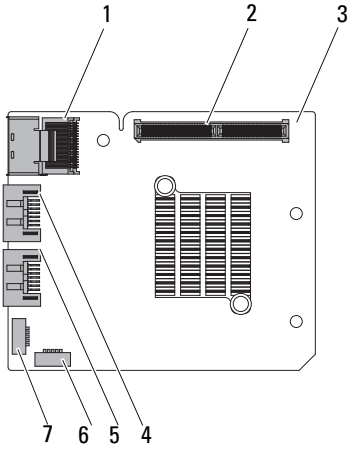
Figure 5-9. Interposer Extender Connectors



1	USB connector	2	front panel connector
3	onboard SATA2 connector 1	4	onboard SATA2 connector 2
5	onboard SATA2 connector 3	6	onboard SATA2 connector 4
7	onboard SATA2 connector 5	8	onboard SATA2 connector 6
9	SGPIO connector A	10	SGPIO connector B
11	2x4-pin power connector	12	2x5-pin power connector

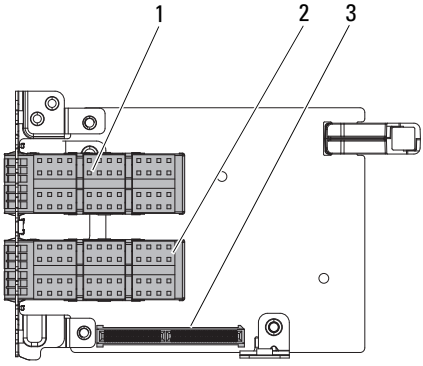
Mezzanine Card Connectors

Figure 5-10. Mezzanine Card Connectors—SAS



1	mini-SAS connector	2	daughter card connector
3	mezzanine card	4	SAS port 4
5	SAS port 5	6	SGPIO connector A
7	SGPIO connector B		

Figure 5-11. Mezzanine Card Connectors—Infiniband



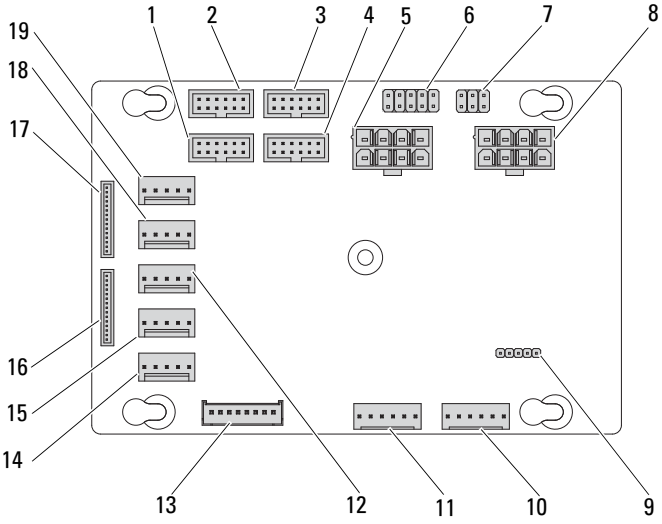
1 QSFP cage 1

2 QSFP cage 2

3 bridge card connector

Fan Controller Board Connectors

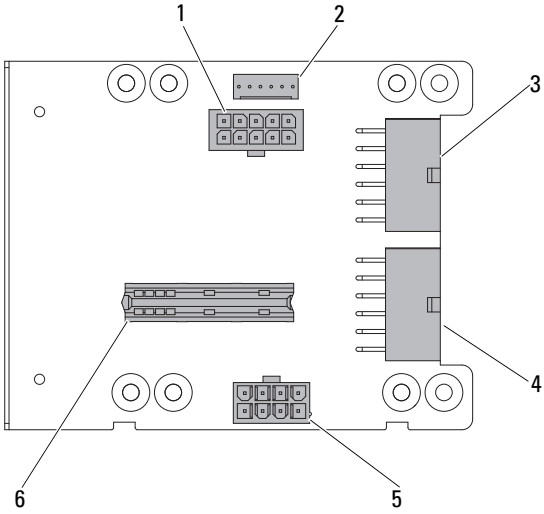
Figure 5-12. Fan Controller Board Connectors



1	front panel connector for system board 4	2	front panel connector for system board 2
3	front panel connector for system board 1	4	front panel connector for system board 3
5	system fan board power connector 1	6	2 or 3 system boards use the jumper for P12V to power on
7	system fan control connector	8	system fan board power connector 2
9	PIC firmware update connector	10	system fan board connector 2
11	system fan board connector 1	12	system fan connectors 3
13	hard drive backplane I2C connector	14	system fan connectors 5
15	system fan connectors 4	16	front panel connector 2
17	front panel connector 1	18	system fan connectors 3
19	system fan connectors 1		

Power Distribution Board Connectors

Figure 5-13. Power Distribution Board Connectors



1	backplane power connector	2	system fan board connector
3	main power connector for system boards 3 and 4	4	main power connector for system boards 1 and 2
5	system fan board power connector	6	bridge card connector

Jumper Settings

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

System Configuration Jumper Settings

The function of system configuration jumper installed on each system board is shown below:

Figure 5-14. System Configuration Jumper

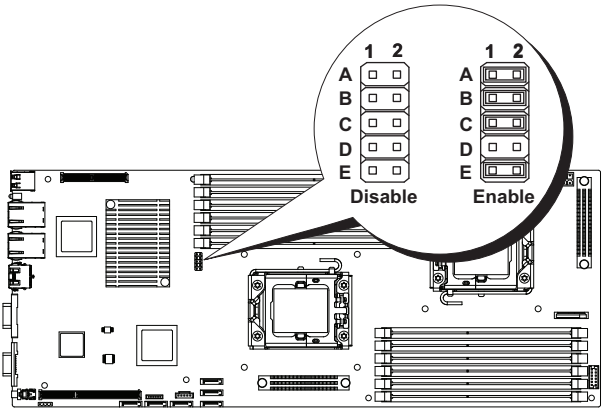


Table 5-1. System Configuration Jumper

Jumper	Function	Off	On
A	ME Function Disable for Debugs	*Disable	Enable
B	Reserved for BIOS PCI-E Setup	-	-
C	BIOS Clear Password	*Disable	Enable
D	BIOS Clear CMOS	*Disable	Enable
E	System Reset	*Disable	Enable

NOTE: The * in the table of system configuration jumper describes the default status and the default state is not active state.

Backplane Jumper Settings

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

The function of jumpers installed on 3.5" backplane and 2.5" backplane is the same. Following is an example using the jumpers installed on 3.5" backplane.

Figure 5-15. Jumpers Installed on Backplane

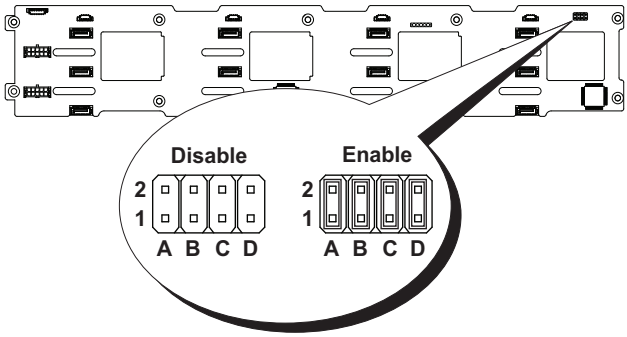


Table 5-2. Jumpers Installed on Backplane

Jumper	Function	Off	On
A	hard drive Type Select	*Disable	Enable
B	SAS Code Select	*Disable	Enable
C	MFG Test	*Disable	Enable
D	LED Control	*Disable	Enable

NOTE: The * in the table of backplane jumper describes the default status and the default state is not active state. When connecting the 1CH SAS mezzanine card, insert the jumper cover onto the hard drive type select jumper. For onboard SATA2 connectors, do not insert the jumper cover onto the hard drive type select jumper.

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Getting Help

Contacting Dell

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

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

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

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

Glossary

A — Ampere(s).

AC — Alternating current.

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

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

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

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

backup — A copy of a program or data file. As a precaution, back up your system's hard drive(s) on a regular basis.

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

BMC — Baseboard management controller.

bootable media — A CD, diskette, or USB memory key that is used to start your system if the system will not boot from the hard drive.

BTU — British thermal unit.

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

C — Celsius.

cache — A fast storage area that keeps a copy of data or instructions for quick data retrieval.

cm — Centimeter(s).

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

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

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

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

CPU — Central processing unit. See *processor*.

DC — Direct current.

DDR — Double-data rate. A technology in memory modules that potentially doubles the data rate by transferring data on both the rising and falling pulses of a clock cycle.

device driver — A program that allows the operating system or some other program to interface correctly with a peripheral.

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

diagnostics — A comprehensive set of tests for your system.

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

DNS — Domain Name System. A method of translating Internet domain names, such as **www.example.com**, into IP addresses, such as 208.77.188.166.

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

driver — See *device driver*.

DVD — Digital versatile disc or digital video disc.

ECC — Error checking and correction.

EMI — Electromagnetic interference.

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

ESD — Electrostatic discharge.

ESM — Embedded server management.

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

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

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

F — Fahrenheit.

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

Fibre Channel — A high-speed network interface used primarily with networked storage devices.

flash memory — A type of electronic chip that can be programmed and reprogrammed using a software utility.

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

FTP — File transfer protocol.

g — Gram(s).

G — Gravities.

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

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

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

host adapter — A controller that implements communication between the system's bus and the peripheral device, typically a storage device.

hot-plug — The ability to insert or install a device, typically a hard drive or an internal cooling fan, into the host system while the system is powered on and running.

Hz — Hertz.

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

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

iDRAC — Internet Dell Remote Access Controller. A remote access controller that uses the Internet SCSI protocol.

IP — Internet Protocol.

IPv6 — Internet Protocol version 6.

IPX — Internet package exchange.

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

iSCSI — Internet SCSI (see *SCSI*). A protocol that enables SCSI device communication across a network or the Internet.

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

K — Kilo-; 1000.

Kb — Kilobit(s); 1024 bits.

KB — Kilobyte(s); 1024 bytes.

Kbps — Kilobit(s) per second.

KBps — Kilobyte(s) per second.

kg — Kilogram(s); 1000 grams.

kHz — Kilohertz.

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

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

LCD — Liquid crystal display.

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

LGA — Land grid array.

local bus — On a system with local-bus expansion capability, certain peripheral devices (such as the video adapter circuitry) can be designed to run much faster than they would with a traditional expansion bus. See also *bus*.

LOM — LAN on motherboard.

LVD — Low voltage differential.

m — Meter(s).

mA — Milliampere(s).

MAC address — Media Access Control address. Your system's unique hardware number on a network.

mAh — Milliampere-hour(s).

Mb — Megabit(s); 1,048,576 bits.

MB — Megabyte(s); 1,048,576 bytes. However, when referring to hard-drive capacity, the term is often rounded to mean 1,000,000 bytes.

Mbps — Megabits per second.

MBps — Megabytes per second.

MBR — Master boot record.

memory address — A specific location, usually expressed as a hexadecimal number, in the system's RAM.

memory module — A small circuit board containing DRAM chips that connects to the system board.

memory — An area in your system that stores basic system data. A system can contain several different forms of memory, such as integrated memory (ROM and RAM) and add-in memory modules (DIMMs).

memory key — A portable flash memory storage device integrated with a USB connector.

MHz — Megahertz.

mirroring — A type of data redundancy in which a set of physical drives stores data and one or more sets of additional drives stores duplicate copies of the data. Mirroring functionality is provided by software. See also *striping* and *RAID*.

mm — Millimeter(s).

ms — Millisecond(s).

NAS — Network Attached Storage. NAS is one of the concepts used for implementing shared storage on a network. NAS systems have their own operating systems, integrated hardware, and software that are optimized to serve specific storage needs.

NIC — Network interface controller. A device that is installed or integrated in a system to allow connection to a network.

NMI — Nonmaskable interrupt. A device sends an NMI to signal the processor about hardware errors.

ns — Nanosecond(s).

NVRAM — Nonvolatile random-access memory. Memory that does not lose its contents when you turn off your system. NVRAM is used for maintaining the date, time, and system configuration information.

parity — Redundant information that is associated with a block of data.

parity stripe — In RAID arrays, a striped hard drive containing parity data.

partition — You can divide a hard drive into multiple physical sections called *partitions* with the **fdisk** command. Each partition can contain multiple logical drives. You must format each logical drive with the **format** command.

PCI — Peripheral Component Interconnect. A standard for local-bus implementation.

PDB — Power distribution board. A power source with multiple power outlets that provides electrical power to servers and storage systems in a rack.

peripheral — An internal or external device, such as a diskette drive or keyboard, connected to a system.

pixel — A single point on a video display. Pixels are arranged in rows and columns to create an image. A video resolution, such as 640 x 480, is expressed as the number of pixels across by the number of pixels up and down.

POST — Power-on self-test. Before the operating system loads when you turn on your system, the POST tests various system components such as RAM and hard drives.

processor — The primary computational chip inside the system that controls the interpretation and execution of arithmetic and logic functions. Software written for one processor must usually be revised to run on another processor. *CPU* is a synonym for processor.

PXE — Preboot eXecution Environment. A way of booting a system via a LAN (without a hard drive or bootable diskette).

RAC — Remote access controller.

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

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

R-DIMM — A registered DDR3 memory module.

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

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

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

ROMB — RAID on motherboard.

SAN — Storage Area Network. A network architecture that enables remote network-attached storage devices to appear to a server to be locally attached.

SAS — Serial-attached SCSI.

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

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

SD card — Secure digital flash memory card.

SDRAM — Synchronous dynamic random-access memory.

sec — Second(s).

serial port — A legacy I/O port with a 9-pin connector that transfers data one bit at a time and is most often used to connect a modem to the system.

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

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

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

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

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

SVGA — Super video graphics array. VGA and SVGA are video standards for video adapters with greater resolution and color display capabilities than previous standards.

system board — As the main circuit board, the system board usually contains most of your system's integral components, such as the processor(s), RAM, controllers for peripherals, and various ROM chips.

system configuration information — Data stored in memory that tells a system what hardware is installed and how the system should be configured for operation.

system memory — See *RAM*.

System Setup program — A BIOS-based program that allows you to configure your system's hardware and customize the system's operation by setting features such as password protection. Because the System Setup program is stored in NVRAM, any settings remain in effect until you change them again.

TCP/IP — Transmission Control Protocol/Internet Protocol.

termination — Some devices (such as the last device at each end of a SCSI cable) must be terminated to prevent reflections and spurious signals in the cable. When such devices are connected in a series, you may need to enable or disable the termination on these devices by changing jumper or switch settings on the devices or by changing settings in the configuration software for the devices.

TOE — TCP/IP offload engine.

U-DIMM — An unregistered (unbuffered) DDR3 memory module.

uplink port — A port on a network hub or switch used to connect to other hubs or switches without requiring a crossover cable.

UPS — Uninterruptible power supply. A battery-powered unit that automatically supplies power to your system in the event of an electrical failure.

USB — Universal Serial Bus. A USB connector provides a single connection point for multiple USB-compliant devices, such as mice and keyboards. USB devices can be connected and disconnected while the system is running.

USB memory key — See *memory key*.

utility — A program used to manage system resources—memory, disk drives, or printers, for example.

V — Volt(s).

VAC — Volt(s) alternating current.

VDC — Volt(s) direct current.

VGA — Video graphics array. VGA and SVGA are video standards for video adapters with greater resolution and color display capabilities than previous standards.

video adapter — The logical circuitry that provides (in combination with the monitor) your system's video capabilities. A video adapter may be integrated into the system board or may be an expansion card that plugs into an expansion slot.

video memory — Most VGA and SVGA video adapters include memory chips in addition to your system's RAM. The amount of video memory installed primarily influences the number of colors that a program can display (with the appropriate video drivers and monitor capabilities).

video resolution — Video resolution (800 x 600, for example) is expressed as the number of pixels across by the number of pixels up and down. To display a program at a specific graphics resolution, you must install the appropriate video drivers and your monitor must support the resolution.

virtualization — The ability via software to share the resources of a single computer across multiple environments. A single physical system may appear to the user as multiple virtual systems able to host multiple operating systems.

W — Watt(s).

WH — Watt-hour(s).

XML — Extensible Markup Language. XML is a way to create common information formats and to share both the format and the data on the World Wide Web, intranets, and elsewhere.

ZIF — Zero insertion force.

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