

Dell PowerEdge Express Flash NVMe PCIe SSD Adapter P4500/P4600

User's Guide

Notes, cautions, and warnings

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

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

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

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Overview

The PowerEdge Express Flash Non-Volatile Memory Express (NVMe) Peripheral Component Interconnect Express (PCIe) Solid State Device (SSD) Adapter is a high-performance storage device designed for solutions requiring low latency, high I/O operations per second (IOPS), and enterprise class storage reliability and serviceability. The NVMe PCIe SSDs offer only P4500 and P4600 Triple-Level Cell (TLC) NAND flash technology with a high-speed PCIe 3.0 compliant interface. The high-speed PCIe 3.0 compliant interface helps improve performance for I/O bound solutions.

NVMe is the standardized, high-performance host controller interface that uses SSD on a PCI Express bus (PCIe SSDs).

NVMe PCIe SSD adapters are available on selected PowerEdge systems for P4500 and P4600 in varying capacities.

Topics:

- [PCIe interface](#)
- [NVMe PCIe SSD adapter features](#)
- [Supported operating systems for NVMe PCIe SSD](#)

PCIe interface

The SSD controller used on the NVMe PCIe SSD has a PCIe Generation 3 (8 GT/s) interface. The interface is a PCIe x4 lane width for a 16-channel flash memory controller, and is used to transmit or receive storage interface commands between the host and the NVMe PCIe SSD.

NVMe PCIe SSD adapter features

The following sections describe the different features of the NVMe PCIe SSD Adapter.

Device health

The NVMe PCIe SSD design is based on NAND flash technology. NAND SSDs have a finite number of program or erase cycles and a finite number of spare blocks (replacements for other worn or faulty NAND blocks).

The program erase cycles and spare blocks are continuously monitored for each NVMe PCIe SSD through various software management applications. For more information, see [Configuring and managing your NVMe PCIe SSD adapter](#).

Self-Monitoring Analysis and Reporting Technology

The Self-Monitoring Analysis and Reporting Technology (SMART) feature set minimizes unscheduled system downtime by providing a method of early detection of device degradation or fault conditions. By monitoring and storing critical performance and calibration parameters, the SMART feature set attempts to predict degradation or fault conditions. Awareness of a negative reliability condition allows the host system to warn you of an impending risk of device failure and advise on appropriate action.

Remaining rated write endurance

NAND SSDs have a finite number of program erase cycles. The NVMe PCIe SSD is warranted to a maximum amount of data written to the device in total bytes written. The NVMe PCIe SSD self monitors for these limits, and software management applications notify you when you reach these limits.

NOTE: If you continue to write to the device after it reaches the threshold of total bytes written, the amount of time the NVMe PCIe SSD retains data while powered off decreases below device specifications. For more information, see [Technical specifications](#).

Device write status

NAND SSDs have a finite number of spare sectors. If the device exhausts the available spare sectors, the NVMe PCIe SSD enters **Write Protect** (Read-Only) mode. In **Write Protect** mode, you can only perform read operations to the device. The NVMe PCIe SSD self-monitors for these limits, and software management applications notify you when you reach these limits.

Supported operating systems for NVMe PCIe SSD

NOTE: NVMe PCIe SSD hot swap is not supported in VMware ESXi 5.5 or while accessing the BIOS or HII configuration.

NOTE: For all operating system documents, see Dell.com/operatingsystemmanuals.

NOTE: NVMe PCIe SSD is not supported as a boot device in SUSE Linux Enterprise Server 11 or VMware.

Only the following operating systems support the NVMe PCIe SSD devices:

- Microsoft Windows Server 2016
- Red Hat Enterprise Linux 7.0 or later
- SUSE Linux Enterprise Server 12 or later
- VMware ESXi 6.0 or later
- Ubuntu 16.04 or later

Technical specifications

NOTE: The specifications provided are for information purposes only and do not constitute an extension of Dell's warranty for this product.

Table 1. Technical specifications

Features	Description
NAND type	Triple-Level Cell (P4500/P4600)
Hot swappable	No
Embedded data protection enabled	Yes
Device write cache	Yes
Bootable device	No
Self-monitoring enabled	Yes
Offline data retention	Up to three months after total bytes written reaches 100%
General	
Model	P4500/P4600 adapter
Device protocol	NVMe
NVMe standard	1.2 (P4500/P4600)
Bus protocol	PCIe
Bus protocol version	3.0
Bus Link Width	x8 (P4500/P4600)
Physical Dimensions	
Height	Max. 14.47 mm
Width	Max. 68.90 mm
Length	Max. 167.65 mm
Device Capacity	
Un-formatted capacity	P4500: 4TB
	P4600: 2TB and 4TB
User-addressable sectors	1 TB: 1,953,525,168 LBAs
	2 TB: 3,907,029,168 LBAs
	4 TB: 7,814,037,168 LBAs
Bytes per sector	512 Bytes

P4500: 4TB	0.63 DWPD over 5 years
P4600: 2TB	2.87 DWPD over 5 years
4TB	2.97 DWPD over 5 years

Environment

Operating temperature	0°C to 55°C
Shock	50G Trapezoidal, 170 in/s
Vibration	2.17 GRMS (Operating), 3.13 GRMS (Non-operating)

Power Requirements

Active power	25 W (FW Limit)
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Electrical characteristics

Voltage input	3.3 V and 12 V
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Getting started with NVMe PCIe SSD adapter

The NVMe PCIe SSD adapters you ordered with your system are ready for use. For more information, see [Configuring NVMe PCIe SSD adapter in different operating systems](#), or see [Configuring and managing your NVMe PCIe SSD adapter](#).

Configuring NVMe PCIe SSD adapter in different operating systems

In Windows-based systems, the NVMe PCIe SSDs have a controller entity and a device entity. The controller entity is displayed under the **Storage** controller menu in the **Device Manager**.

Use the controller entity when installing or updating the NVMe PCIe SSD driver. You can configure the NVMe PCIe SSD for use on Windows from **Computer Management > Storage > Disk Management Tool**.

On Linux-based systems, you can configure the NVMe PCIe SSD from the partitioning tool by specifying or selecting the device name. The device name for NVMe PCIe SSDs is `/dev/nvmeXn1`, where X is the number corresponding to each NVMe PCIe SSD in the system (For example: `/dev/nvme0n1`; `/dev/nvme1n1`; `/dev/nvme2n1` and so on).

Use OpenManage Server Administrator for managing and performing NVMe PCIe SSD-related tasks. For more information, see [Configuring and managing your NVMe PCIe SSD adapter](#).

In VMware systems, you can configure the NVMe PCIe SSD as datastore or for a passthrough operation. You can use vSphere Client to configure the NVMe PCIe SSD. Configuring PCIe devices as passthrough is not recommended due to the following limitations:

- You cannot take snapshots of the Virtual Machine (VM).
- Your VM cannot use failover features such as VMotion and Distributed Resources Scheduler (DRS).
- You cannot hot-add any other device to the VM such as a USB key. To add an additional device, first shut down the VM.

Configuring NVMe PCIe SSD as passthrough is not recommended outside of Dell-specific solutions. See the solution-specific documentation at Dell.com/support/manuals.

Replacing and configuring hardware for NVMe PCIe SSD adapter

- ⚠ **CAUTION:** All work must be performed at an electrostatic discharge (ESD)-safe workstation to meet the EIA-625-requirements for handling electrostatic discharge sensitive devices. All actions must be performed following the latest revisions of the IPC-A-610 ESD recommended practices.
- ⚠ **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.
- ℹ **NOTE:** For complete information on U.S. Terms and Conditions of Sale, Limited Warranties and Returns, Export Regulations, Software License Agreement, Safety, Environmental and Ergonomic Instructions, Regulatory Notices, and Recycling Information, see the Safety, Environmental and Regulatory Information, End User License Agreement, and Warranty and Support Information that shipped with your system.

The NVMe PCIe SSD adapter is directly connected to the system board.

- ℹ **NOTE:** For information on removing and installing system components, see the system specific Owner's Manual at Dell.com/support/manualsDell.com/support/DHMSmanuals.

Topics:

- [Removing NVMe PCIe SSD adapter from system](#)
- [Installing NVMe PCIe SSD adapter in system](#)

Removing NVMe PCIe SSD adapter from 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 the electrical outlet and peripherals.

- ℹ **NOTE:** Dell recommends that you always use a static mat and static strap while working on components in the interior of the system.

- 2 Open the system.
- 3 Locate the adapter on the system board.

- ⚠ **CAUTION:** To prevent damage to the adapter, hold the adapter by its edges only.

- 4 Lift the adapter to remove it from the system board.
- 5 Close the system.
- 6 Reconnect the system to its electrical outlet and peripherals, and turn on the system.

Installing NVMe PCIe SSD adapter in 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.

NOTE: To determine which PCIe slot and which size of bracket to use, consult the slot priority matrix in your server Owner's Manual. Following the slot priority matrix ensures that the optimal PCIe slot is selected to maximize performance.

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

NOTE: Dell recommends that you always use a static mat and static strap while working on components in the interior of the system.

- 2 Open the system.

CAUTION: To prevent damage to the adapter, you must hold the adapter by its edges only.

- 3 Determine which bracket, half height or full height, is required, and install the appropriate bracket.
- 4 Align the card-edge connector with the connector on the system board.
- 5 Press the card edge down until the adapter is fully seated.
- 6 Close the system.
- 7 Reconnect the system to its electrical outlet and attached peripherals, and turn on the system.

Configuring and managing your NVMe PCIe SSD adapter

The storage management applications discussed in the following topics enable you to manage and configure the NVMe PCIe SSD Adapter. These applications also allow you to control and monitor multiple NVMe PCIe SSDs, and provide online maintenance.

The NVMe PCIe SSD solution supports Unified Extensible Firmware Interface (UEFI) and Human Interface Infrastructure (HII) for pre-operating system device management, OpenManage Server Administrator (OMSA) application for operating system device management, and Integrated Dell Remote Access Controller (iDRAC) with Lifecycle Controller for local or remote device management. The NVMe PCIe SSD solution supports UEFI, HII and iDRAC with Lifecycle Controller management on select PowerEdge systems only. OMSA for NVMe PCIe SSD device management is available on all supported PowerEdge systems.

NOTE: For more information about iDRAC/LC remote management, check your platform Owner's Manual.

NOTE: iDRAC support for P4500/P4600 is available only on the 14th generation of Dell systems.

Topics:

- [OpenManage Server Administrator](#)
- [Human Interface Infrastructure configuration utility](#)

OpenManage Server Administrator

The OpenManage Server Administrator is a storage management application that provides features for managing components of the NVMe PCIe SSD solution on supported operating systems. The OpenManage Server Administrator application enables you to perform the NVMe PCIe SSD functions from a single graphical or command-line interface. For more information, see the OpenManage Server Administrator online help accessible from the application.

All storage management features for the NVMe PCIe SSD solution are accessible by selecting the **Storage** object, and then the **PCIe SSD Subsystem** in the **Server Administrator** tree view.

Storage information

To access **Storage Information**:

- 1 Expand the **Storage** tree object to display the storage component objects.
- 2 Expand the **PCIe SSD Subsystem** tree object.
The **Storage Information** window is displayed under **Information/Configuration**.
- 3 To make changes to the Storage Information properties, click **Properties**.

Configure and manage NVMe PCIe SSD adapter

Use the **Physical Device Properties** screen to view information about NVMe PCIe SSD Adapter and to run NVMe PCIe SSD Adapter tasks.

To view the complete set of NVMe PCIe SSD properties, select **Full View** from the **Options** taskbar. Physical device properties are described below:

Name	Displays the name of the NVMe PCIe SSD. The name includes the slot ID in which the NVMe PCIe SSD Adapter is installed.
State	Displays the current state of the NVMe PCIe SSD Adapter.
Bus Protocol	Displays the technology that the NVMe PCIe SSD Adapter is using.
Device Name	In Windows: \\.\PhysicalDriveX . In Linux: /dev/nvmeXn1 .
Media	Displays the media type of the physical SSD.
Remaining Rated Write Endurance	Displays the warranted wear out level of the NVMe PCIe SSD (in percentage).
Firmware Revision	Displays the currently running firmware version on the NVMe PCIe SSD.
Driver Version	Displays the currently running driver version of the NVMe PCIe SSD.
Model Number	Displays the Piece Part Identification (PPID) of the NVMe PCIe SSD.
Capacity	Displays the full capacity of the device.
Vendor ID	Displays the hardware vendor of the device.
Product ID	Displays the product ID of the device.
Serial No.	Displays the serial number of the device.
PCIe Negotiated Link Speed	Displays the speed of data transfer that the device negotiated upon initial communication. This speed depends the speed of the device.
PCIe Maximum Link Speed	Displays the highest possible speed at which the device can transfer data.
PCIe Maximum Link Width	Displays the link width of the device.
Form Factor	Displays the form factor of the NVMe PCIe SSD installed in the system.

Running physical device tasks

- 1 Expand the **Storage** tree object to display the storage component objects.
- 2 Expand the **PCIe SSD Subsystem** object.
- 3 Select **PCIe SSD in slot X**.
- 4 Select **Physical Devices**.
- 5 Select a task from the **Available Tasks** drop-down menu.
- 6 Click **Execute**.

NVMe PCIe SSD adapter available tasks

The following are in the NVMe PCIe SSD adapter drop-down menu:

- Cryptographic Erase
- Export Log

Performing cryptographic erase task for NVMe PCIe SSD

 **CAUTION:** Performing a cryptographic erase on an NVMe PCIe SSD results in permanent loss of all data on the NVMe PCIe SSD.

 **NOTE:** During cryptographic erase, the host is not able to access the NVMe PCIe SSD.

- 1 Expand the **Storage** tree object to display the storage component objects.
 - a On Linux platforms, unmount any file systems mounted on the device.
- 2 Expand the **PCIe SSD Subsystem** object.
- 3 Select the **PCIe SSD in slot X**.
- 4 Select the **Cryptographic Erase** task from the **Available Tasks** drop-down menu.
- 5 Click **Execute**.

The following caution message is displayed: "When you perform the Cryptographic Erase operation, any data on the disk will be lost permanently. Are you sure you want to continue?"
- 6 Select **Cryptographic Erase** to proceed.

A pop-up message is displayed: Are you sure you want to perform 'Cryptographic Erase' on this physical device?
- 7 Click **OK** to proceed, or select **Go Back** to previous page to cancel the operation.

Exporting the log

- 1 Expand the **Storage** tree object to display the storage components.
- 2 Expand the **PCIe SSD Subsystem** object.
- 3 Select **PCIe SSD in slot X**.
- 4 Select the **Export Log** task from the **Available Tasks** drop-down menu.
- 5 Click **Execute**.
- 6 Note where the log file will be exported.
- 7 Click **Export Log** and follow the instructions to complete.

Human Interface Infrastructure configuration utility

The Human Interface Infrastructure (HII) configuration utility is a standardized way of viewing and setting a device configuration. The HII configuration utility provides pre-operating system functionality and management for NVMe PCIe SSDs including:

- Viewing physical device properties
- Running physical device operations
- Retrieving debug information

 **NOTE:** HII is only available starting on select Dell 13th generation PowerEdge Dell Hyperconverged Infrastructure with Microsoft Software Defined Stack systems.

NOTE: Do not insert or remove an NVMe PCIe SSD from the HII configuration utility.

Entering the HII configuration utility

To enter the HII configuration utility:

- 1 Turn on the system.
- 2 Press F2 during system startup to enter the system setup.
- 3 Navigate to the **Device Settings** option.
- 4 Select the desired NVMe PCIe SSD to view its HII configuration page. Each device includes an entry such as: PCIe SSD in Bay X Slot Y: Dell NVMe PCIe SSD Configuration Data. PCIe SSD in Slot X: Dell NVMe PCIe SSD Configuration Data.

Viewing physical device properties

Follow the steps to view physical device properties:

- 1 Select **View Physical Device Properties** in the HII configuration utility.
- 2 Press **Esc** to return to the previous screen.
- 3 To exit the PCIe SSD HII configuration utility, click **Exit** in the top-right corner of the System Setup menu.

Erasing physical devices

CAUTION: Performing a cryptographic erase on an NVMe PCIe SSD results in permanent loss of all data on the NVMe PCIe SSD.

NOTE: During a cryptographic erase, the host cannot access the NVMe PCIe SSD.

NOTE: If the system reboots or experiences a power loss during a cryptographic erase, the operation aborts. Reboot the system and restart the process.

NOTE: The cryptographic erase operation takes a few seconds to complete. While this operation is in progress, you cannot navigate away from this page.

To perform a cryptographic erase on an NVMe PCIe SSD from the HII configuration utility, do the following:

- 1 Navigate to the **Select Physical Device Operations** menu of the HII configuration utility.
- 2 Select **Cryptographic Erase**.
The following warning message displays: Performing a cryptographic erase results in permanent loss of all data on the device. Do you want to continue?.
You can select **Yes** or **No**.
- 3 Press **Esc** to return to the previous screen.
- 4 To exit the HII configuration utility, click **Exit** in the top-right corner of the System Setup menu.

Exporting the log

The **Export Log** option exports the NVMe PCIe SSD log to a text file. The log contains debug information of the NVMe PCIe SSD which can be useful while troubleshooting.

NOTE: To save the log, you need a writable media with a UEFI-compatible file system attached to the system.

NOTE: If there are no application devices inserted into the system when entering the Export Log HII screen, then the only option is to return to the previous page.

To export the NVMe PCIe SSD log from the HII configuration utility, do the following:

- 1 Navigate to the **Export Log** menu of the HII configuration utility.
- 2 Select the file system device to which the log will be exported.
- 3 Select the directory into which you want to save the log.
- 4 Enter the file name under which you want to save the log in the **File Name** text box.
For example, **NVMe.log**.
- 5 Click **Export** and follow the instructions to complete.
- 6 To exit the HII configuration utility, click **Exit** in the top-right corner of the System Setup menu.

Exiting the HII configuration utility

NOTE: Clicking **Exit** in any HII page takes you back to the System Setup main menu.

NOTE: Press **Esc** from any HII page to return to the previous page.

To exit the HII configuration utility, click **Exit** in the top-right corner of the System Setup menu.

Troubleshooting

NOTE: To get help for your NVMe PCIe SSD, see [Contacting Dell](#).

Topics:

- [Self-Monitoring Analysis and Reporting Technology errors](#)
- [Ungraceful system shutdown or power loss](#)
- [General errors](#)

Self-Monitoring Analysis and Reporting Technology errors

The NVMe PCIe SSD solution is always monitored for errors by its internal software. If an error occurs, it is detected and recorded in an internal log. Based on the criticality of the error, the software may inform the host server that further action is needed. It signifies that the error condition occurred a specific number of times and that the device health needs attention.

Ungraceful system shutdown or power loss

If the host system experiences a power loss, the NVMe PCIe SSD may not have time to perform its internal shut down procedure. In such an event, the device may enter a recovery mode.

This recovery process is also known as rebuilding. During rebuilding, there is very limited access from the host operating system. After the recovery procedure is complete, the device is fully accessible from the host operating system.

NOTE: Dell recommends that you use power backup solutions for all Dell systems.

General errors

The following section describes general errors related to NVMe PCIe SSD.

Linux fails to boot and prompts for the root password

Cause	A stale volume mount point is still present after a device removal or cryptographic erase.
Solution	Perform the following steps to recover from this situation: 1 Enter the root password to enter maintenance mode. 2 Remount the root filesystem as read-write using the following command: <code>mount -orw, remount/.</code> 3 Manually edit <code>/etc/fstab</code> to remove the nonexistent device entry.

I/O device error on write to NVMe PCIe SSD

Description	Windows event log may report the following entries on the first write attempt to an NVMe PCIe SSD: Event ID 7: The device, \Device\Harddisk\DRX, has a bad block. When attempting to initialize the device using Computer Management > Storage > Disk Management, the following message is displayed: Virtual Disk Manager, Data Error (cyclic redundancy check). Linux messages log may report the following entries on a write attempt to an NVMe PCIe SSD: · Buffer I/O error on device nvmeXn1, logical block Y (where X is the number corresponding to the device and Y is the logical block) · nvmeXn1: unable to read partition table (where X is the number corresponding to the device)
Cause	NVMe PCIe SSDs have a finite number of write cycles. When an NVMe PCIe SSD exhausts the number of writes, it goes into Write Protect (Read Only) mode.
Solution	By using system management applications, you may check the NVMe PCIe SSD state to confirm if the NVMe PCIe SSD is in Read-Only Mode . For further instructions, contact a Dell Technical Service representative.

NVMe PCIe SSD performance measurement not optimal

Description	There are a number of factors that may alter the performance of an NVMe PCIe SSD. Dell recommends to take basic setup measures to ensure performance optimization of these devices.
Cause	NVMe PCIe SSD has not been preconditioned and/or BIOS settings are not optimal.
Solution	· Without preconditioning the NVMe PCIe SSD, performance measurements can be misleading as they may not reflect long-term performance of the device. Preconditioning enables flash management, which stabilizes data throughput over a period. For the Solid-State Storage Performance Test Specification, see snia.org. · Configure the server for low latency performance. To achieve maximum performance with NVMe PCIe SSDs, change the server performance profile in the BIOS settings to Performance.

In Windows Server, OpenManage Server Administrator does not detect PCIe NVMe devices

In Windows Server 2016

Description	Windows Server 2016 contains an in-box NVMe driver that is supported by OpenManage Server Administrator.
Cause	The operating system is not using the in-box or required NVMe driver.
Solution	Remove any NVMe drivers that is not specifically released for the Windows Server 2016.

System is unable to inventory or manage NVMe PCIe SSDs from HII utility

Description	NVMe PCIe SSDs are not discovered in the HII utility.
Cause	HII support for NVMe PCIe SSDs was added on select 13th generation PowerEdge systems. There is no pre-OS management for NVMe PCIe SSDs in previous PowerEdge servers.
Solution	Use Dell's OpenManage Server Administrator to manage your NVMe PCIe SSD.

Getting help

Contacting Dell

Dell provides several online and telephone based support and service options. If you do not have an active internet connection, you can find contact information about your purchase invoice, packing slip, bill, or Dell product catalog. Availability varies by country and product, and some services may not be available in your area. To contact Dell for sales, technical assistance, or customer service issues:

- 1 Go to Dell.com/support.
- 2 Select your country from the drop-down menu on the lower right corner of the page.
- 3 For customized support:
 - a Enter your system Service Tag in the **Enter your Service Tag** field.
 - b Click **Submit**.

The support page that lists the various support categories is displayed.
- 4 For general support:
 - a Select your product category.
 - b Select your product segment.
 - c Select your product.

The support page that lists the various support categories is displayed.
- 5 For contact details of Dell Global Technical Support:
 - a Click [Global Technical Support](#).
 - b The **Contact Technical Support** page is displayed with details to call, chat, or e-mail the Dell Global Technical Support team.

Documentation matrix

The documentation matrix provides information on documents that you can refer to for setting up and managing your system.

Table 2. Documentation matrix

To...	See the...
Install your system into a rack	Rack documentation included with your rack solution
Set up your system and know the system technical specifications	<i>Getting Started With Your System</i> that shipped with your system or see Dell.com/poweredge manuals
Install the operating system	Operating system documentation at Dell.com/operatingsystem manuals
Get an overview of the Dell Systems Management offerings	<i>Dell OpenManage Systems Management Overview Guide</i> at Dell.com/openmanage manuals > OpenManage software
Configure and log in to iDRAC, set up managed and management system, know the iDRAC features, and troubleshoot by using iDRAC	<i>Integrated Dell Remote Access Controller User's Guide</i> at Dell.com/idrac manuals
Know about the RACADM subcommands and supported RACADM interfaces	<i>RACADM Command Line Reference Guide</i> for iDRAC at Dell.com/idrac manuals
Launch, enable, and disable Dell Lifecycle Controller, know the features, use and troubleshoot Dell Lifecycle Controller	<i>Dell Lifecycle Controller User's Guide</i> at Dell.com/idrac manuals

To...	See the...
Use Dell Lifecycle Controller Remote Services	<i>Dell Lifecycle Controller Remote Services Quick Start Guide</i> at Dell.com/idracmanuals
Set up, use, and troubleshoot OpenManage Server Administrator	<i>Dell OpenManage Server Administrator User's Guide</i> at Dell.com/openmanagemanuals > OpenManage Server Administrator
Install, use, and troubleshoot OpenManage Essentials	<i>Dell OpenManage Essentials User's Guide</i> at Dell.com/openmanagemanuals > OpenManage Essentials
Know the features of the storage controller cards, deploy the cards, and manage the storage subsystem	Storage controller documentation at Dell.com/storagecontrollermanuals
Check the event and error messages generated by the system firmware and agents that monitor system components	<i>Dell Event and Error Messages Reference Guide</i> at Dell.com/openmanagemanuals > OpenManage software

Documentation feedback

Click the **Feedback** link in any of the Dell documentation pages, fill out the form, and click **Submit** to send your feedback.

Locating your system Service Tag

Your system is identified by a unique Express Service Code and Service Tag number. The Express Service Code and Service Tag are found on the front of a physical DR Series system by pulling out the information tag. The service tag can also be found on the Support page in the GUI. This information is used to route support calls to the appropriate personnel for resolution.