




Dell PowerEdge Express Flash NVMe PCIe SSD User's Guide

Regulatory Model: Adapter UCEA-200 and UCEB-200



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Overview

Dell PowerEdge Express Flash Non-Volatile Memory Express (NVMe) Peripheral Component Interconnect Express (PCIe) Solid State Device (SSD) is a high performance storage device designed for solutions requiring low latency, high input/output operations per second (IOPS), and enterprise class storage reliability and serviceability. The Dell PowerEdge Express Flash NVMe PCIe SSD is offered as a Multi-Level Cell (MLC) 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 designed for enterprise and client systems that use solid state devices on a PCI Express bus (PCIe SSDs). Dell NVMe PCIe SSDs comply to 1.0 specification.

 **NOTE:** Dell PowerEdge Express Flash NVMe PCIe SSD is not supported as a bootable device.

 **NOTE:** Dell PowerEdge Express Flash NVMe Peripheral Component Interconnect Express Solid State Device is hereinafter referred to as NVMe PCIe SSD.

NVMe PCIe SSD Architecture

The NVMe PCIe SSD solution consists of a PCIe extender adapter card, which provides PCIe connectivity for up to four NVMe PCIe SSDs. The number of supported PCIe extender adapter cards and NVMe PCIe SSDs depends on the system.

NVMe PCIe SSDs from Dell are available in 400 GB, 800 GB, or 1.6 TB (MLC) capacities and are supported on Dell PowerEdge systems.

In Dell PowerEdge systems, up to two PCIe extender adapter cards connect to an PCIe SSD backplane, allowing connectivity for up to eight NVMe PCIe SSDs. For example, four NVMe PCIe SSDs can be connected to each PCIe extender adapter card for a total maximum of eight NVMe PCIe SSDs.

 **NOTE:** To determine the maximum number of NVMe PCIe SSDs supported on your system, see the system-specific *Owner's Manual* at dell.com/support/manuals.

The following figures show different components of the NVMe PCIe SSD solution.

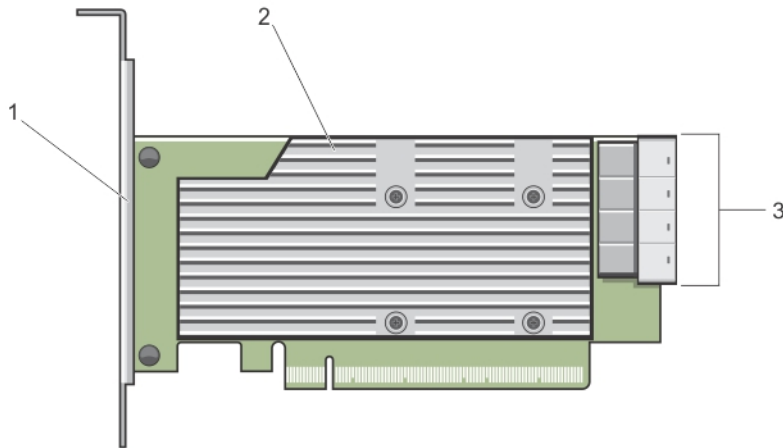


Figure 1. PCIe SSD Extender Adapter Card

- | | | | |
|----|------------------------------|----|----------------------------|
| 1. | bracket | 2. | PCIe extender adapter card |
| 3. | adapter cable connectors (4) | | |

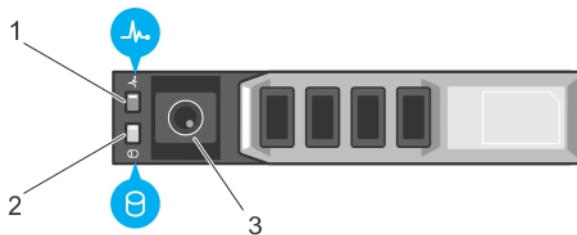


Figure 2. NVMe PCIe SSD

- | | | | |
|----|------------------|----|--------------------|
| 1. | status indicator | 2. | activity indicator |
| 3. | release button | | |

NOTE: For more information on activity and status indicators, see [NVMe PCIe SSD Carrier LED Indicators](#).

PCIe Interface

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

NVMe PCIe SSD Features


The following topics describe the different NVMe PCIe SSD features.

Performance

NVMe SSDs utilize:

- The PCIe 3.0 interface, which is approximately two times faster than the PCIe 2.0 interface.
- The NVMe express technology, which accelerates the SSD's overall speed.


Hot Swap


 **NOTE:** To check if your operating system supports NVMe PCIe SSD hot swap, see [Supported Operating Systems For NVMe PCIe SSD](#).

Dell PowerEdge Express Flash NVMe PCIe SSDs support orderly hot swap allowing you to add or remove a device without halting or restarting the system in which the devices are installed.

Dell-supported NVMe PCIe SSD hot swappable functions are defined below:

Orderly Insertion	You insert a device into a running system where a similar device has not been previously inserted from the time it was last booted. Dell systems that support NVMe PCIe SSDs are configured to handle PCIe resource balancing in the event of a hot insertion. This preset system configuration makes this type of hot insertion an orderly operation.
Orderly Removal	You remove a device from a running system. Prior to physically removing the device, you must notify the system that the device is about to be removed. This notification defines hot removal as an orderly operation.
Orderly Swap	You remove a device from the system in an orderly fashion and replace it with a supported device. The device that is removed and the device that replaced it use the same device driver.

 **WARNING:** Do not remove the NVMe PCIe SSD without notifying the system first. For more information, see [Preparing To Remove An NVMe PCIe SSD](#).

 **NOTE:** Orderly hot swap is only supported when NVMe PCIe SSDs are installed in a supported Dell system running a supported operating system. To ensure that you have the correct hardware set up for your NVMe PCIe SSD, see the system specific *Owner's Manual* at dell.com/support/manuals.

Device Health


The Dell PowerEdge Express Flash NVMe PCIe SSD design is based on MLC 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 or erase cycles and spare blocks are continuously monitored for each Dell PowerEdge Express Flash NVMe PCIe SSD through Dell software management applications such as Human Interface Infrastructure (HII) and Dell OpenManage Server Administrator. For more information see, [Configuring And Managing Your NVMe PCIe SSD](#).

SMART: Self-Monitoring Analysis and Reporting Technology (Selbstüberwachende Analyse- und Berichterstellungstechnologie)


Die Funktionen der Self-Monitoring Analysis and Reporting Technology (SMART) (Selbstüberwachende Analyse- und Berichterstellungstechnologie) begrenzen ungeplante Systemausfallzeiten durch Bereitstellung einer Methode für die frühzeitige Erkennung einer Verschlechterung des Gerätezustands sowie von Fehlern. Durch das Überwachen und Speichern kritischer Leistungs- und Kalibrierungsparameter, versuchen die SMART-Funktionen eine Verschlechterung des Gerätezustands und Fehler vorherzusehen. Wenn der Zustand einer unzureichenden Zuverlässigkeit erkannt wird, kann


Sie das Hostsystem vor dem bevorstehenden Risiko eines Geräteausfalls warnen und geeignete Maßnahmen vorschlagen.

 **ANMERKUNG:** Der Dell OpenManage Server Administrator muss zum Erzeugen von SMART-Berichten installiert und ausgeführt werden.

Remaining Rated Write Endurance

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

 **NOTE:** The Dell PowerEdge Express Flash NVMe PCIe SSD warranty expires when it reaches the threshold of total bytes written.

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


Device Write Status

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

Supported Operating Systems For NVMe PCIe SSD

Only the following operating systems support Dell PowerEdge Express Flash NVMe PCIe SSDs:

- Microsoft Windows Server 2012 (x64/EM64T)
- Microsoft Windows Server 2012 R2
- Microsoft Windows Server 2008 R2 SP1(x64/EM64T) or later, including Hyper-V virtualization
- Red Hat Enterprise Linux 6.4 (x64/EM64T) or later
- SUSE Linux Enterprise Server 11 SP3

 **NOTE:** For all operating system documents, see dell.com/support/manuals, then, **Choose from a list of all Dell products** → **Software, Electronics & Peripherals** → **Software** → **Operating System** .

Getting Started With NVMe PCIe SSD

Dell PowerEdge Express Flash Non-Volatile Memory Express (NVMe) Peripheral Component Interconnect Express (PCIe) Solid State Devices (SSD)s are not bootable devices. Your system must have a supported operating system installed to access the NVMe PCIe SSD.

The NVMe PCIe SSDs you ordered with your system are preconfigured and ready for use. For more information, see [Configuring NVMe PCIe SSDs In Different Operating Systems](#) or see [Configuring And Managing Your NVMe PCIe SSD](#).


Setting Up Your NVMe PCIe SSD For First Use

If you are installing a new operating system, follow the steps below to set up your NVMe PCIe SSD for first use:


1. Set up your system and install the operating system software on a storage device other than the NVMe PCIe SSD.

To set up your system, see the system specific *Getting Started Guide*.

2. Install the PCIe SSD driver for your operating system.

 **NOTE:** For the latest list of supported operating systems and driver installation instructions go to dell.com/ossupport. For specific operating system service pack requirements, see the Drivers and Downloads section at dell.com/support. Drivers available on dell.com/support supersede the driver included with the operating system.

For more information, see [Driver Installation](#).

 **NOTE:** For the latest list of supported operating systems and driver installation instructions, see the system specific Owner's Manual at dell.com/support/manuals. For specific operating system service pack requirements, see the Drivers and Downloads section at dell.com/support.

Your NVMe PCIe SSD is now ready for use.

Configuring NVMe PCIe SSDs In Different Operating Systems

In Windows-based systems, Dell PowerEdge Express Flash 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/nvmeX1n1**, 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](#).

Servicing Your NVMe PCIe SSD

If you need to remove or replace your NVMe PCIe SSD, you can remove the NVMe PCIe SSD from a system that's operational through an orderly removal process. This operation is supported in Windows and Linux. See [Supported Operating Systems For NVMe PCIe SSD](#).




To remove your NVMe PCIe SSD from a running system, use the **Prepare to Remove** task in OpenManage Server Administrator. You can safely remove the device from the system under the following conditions after you use the **Prepare to Remove** task:

- The NVMe PCIe SSD LED blinks in a pattern that indicates that the device is preparing for removal.
- The NVMe PCIe SSD is no longer accessible by the system.



 **NOTE:** See the topic [Running Physical Device Tasks](#).

You can remove or replace your NVMe PCIe SSD while the system is offline.

Replacing And Configuring Hardware

-  **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.
-  **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.

All Dell PowerEdge Express Flash Non-Volatile Memory Express (NVMe) Peripheral Component Interconnect Express (PCIe) Solid State Devices (SSDs) connect to the system board through the NVMe PCIe SSD backplane. The NVMe PCIe SSD backplane is mounted on the front-chassis assembly of the system. NVMe PCIe SSDs are supplied in hot-swappable device carriers that are compatible with the PCIe SSD bays.

-  **CAUTION:** Before attempting to remove or install an NVMe PCIe device from a system which is running, see [Preparing To Remove An NVMe PCIe SSD](#).
-  **NOTE:** For information on removing and installing the system components, see the system specific *Owner's Manual* at dell.com/support/manuals.

Removing An NVMe PCIe SSD From The System

If you are removing an NVMe PCIe SSD from a system, which is running, proceed to step 1. Otherwise, skip to step 2.

CAUTION: To prevent data loss, it is mandatory that you prepare the NVMe PCIe SSD for removal before physically removing the NVMe PCIe SSD.

1. Use the **Prepare to Remove** task in OpenManage Server Administrator to safely remove an NVMe PCIe SSD from the system.

See [Preparing To Remove An NVMe PCIe SSD](#).

This task causes the status LEDs on the PCIe SSD to blink.

CAUTION: The NVMe PCIe SSD LED blinks in a pattern that indicates that the device is preparing for removal. When you initiate a prepare to remove operation, ensure that your NVMe PCIe SSD is no longer accessible by the system before you physically remove the NVMe PCIe SSD.

You can safely remove the NVMe PCIe SSD from the operating system under the following conditions after you use the **Prepare to Remove** task:

- The NVMe PCIe SSD is blinking the prepare for removal LED pattern. For more information, see the table NVMe PCIe SSD States and LED Indicator Codes.
 - The NVMe PCIe SSD is no longer accessible by the operating system.
2. Press the release button and open the NVMe PCIe SSD carrier release handle to release the NVMe PCIe SSD.
See figure Removing and Installing an NVMe PCIe SSD From/Into the System.
 3. Slide out the NVMe PCIe SSD.

NOTE: To maintain proper system cooling, all empty NVMe PCIe SSD bays must have device blanks installed. For instructions on how to install an NVMe PCIe SSD bay, see the system specific *Owner's Manual* at dell.com/support/manuals.

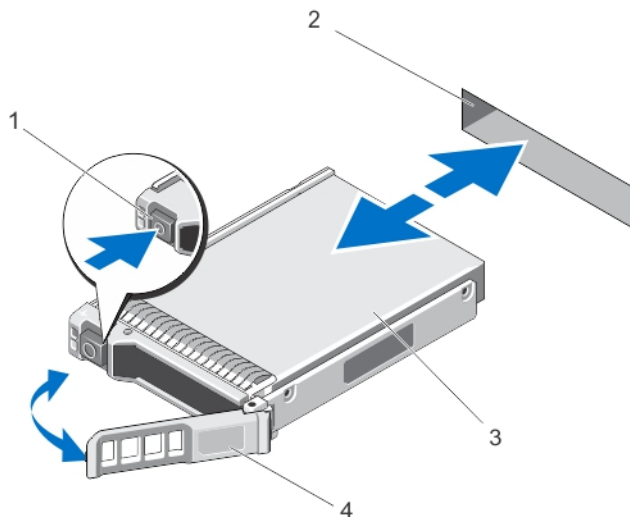


Figure 3. Removing and Installing an NVMe PCIe SSD From/Into the System

- | | |
|-------------------|---------------------------------|
| 1. release button | 2. NVMe PCIe SSD slot |
| 3. NVMe PCIe SSD | 4. NVMe PCIe SSD carrier handle |

Installing An NVMe PCIe SSD In The System

 **WARNING:** Inserting an NVMe PCIe SSD carrier and attempting to lock its lever next to a partially installed carrier can damage the partially installed carrier's shield spring, making it unusable.


When installing an NVMe PCIe SSD, ensure that the adjacent devices are installed.

1. Press the release button and open the handle.
2. Slide the NVMe PCIe SSD carrier into the NVMe PCIe SSD bay until the carrier contacts the backplane.
3. Close the NVMe PCIe SSD carrier handle to lock the device in place.
See figure Removing and Installing an NVMe PCIe SSD From/Into the System.

Removing The PCIe Extender Adapter Card

Follow the steps below to remove the PCIe extender adapter card:

1. Perform a controlled shutdown of the system in which the PCIe extender adapter card is installed.
2. Disconnect the system from the electrical outlet and remove the system cover.

 **CAUTION:** Running a system without the system cover installed may cause damage due to improper cooling.

3. Disconnect the data cables from the PCIe extender adapter card.
4. Remove any retention mechanism, such as a bracket screw that might be holding the PCIe extender adapter card in the system.

5. Lift the adapter card from the system's PCIe slot.
See figure Removing and Installing a PCIe Extender Adapter Card.

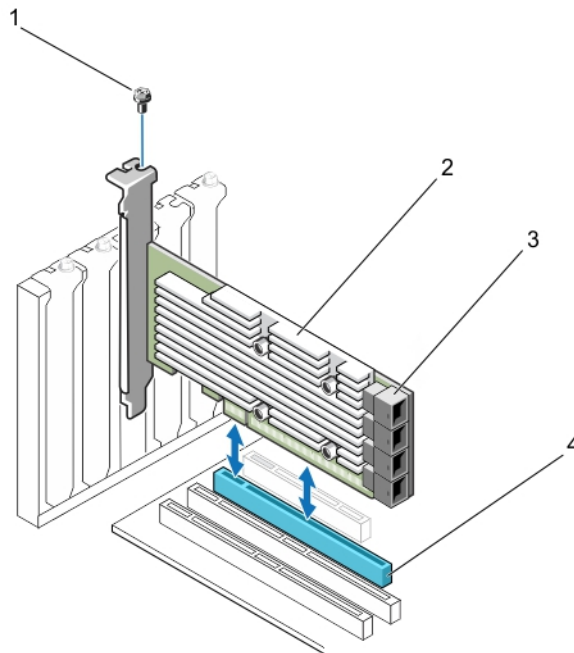




Figure 4. Removing and Installing a PCIe Extender Adapter Card

- | | |
|----------------------------|-------------------------------|
| 1. screw | 2. PCIe extender adapter card |
| 3. adapter ports (A,B,C,D) | 4. x16 PCIe slot |

Installing The PCIe Extender Adapter Card

 **NOTE:** Contact Dell technical support if the PCIe extender adapter card is damaged. See [Contacting Dell](#).

1. Unpack the PCIe extender adapter card.
2. Turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.
3. Disconnect all attached devices and remove the system cover.
4. Select an empty PCIe x16 slot.
To determine the correct PCIe slot for your PCIe Extender Adapter card, see the system specific *Owner's Manual* at dell.com/support/manuals.
5. Remove the filler bracket on the back of the system aligned with the PCIe slot you have selected.
6. Align the PCIe extender adapter card with the PCIe slot you have selected.

 **CAUTION:** Never apply pressure to the extender adapter card while inserting it in the PCIe slot. Applying pressure may break the adapter module.

7. Insert the PCIe extender adapter card until the card is firmly seated in the PCIe slot.

8. Tighten the bracket screw (if any) or use the retention clips to secure the PCIe extender adapter card to the system chassis.
9. Connect the cables from the PCIe backplane to the PCIe extender adapter card.

For more information, see figure Removing and Installing a PCIe Extender Adapter Card.

NOTE: The backplane connector cables are labeled as **PCIe BP A**, **PCIe BP B**, **PCIe BP C**, and **PCIe BP D** for connection to the backplane. The PCIe extender adapter card cable connectors are labeled as adapter port **A**, **B**, **C**, and **D** respectively for connection to the card. These cables must not be reversed. For more information, see figure Cabling a PCIe Extender Adapter Card.

10. Replace the system cover.
11. Reconnect the power cable and turn on the system.

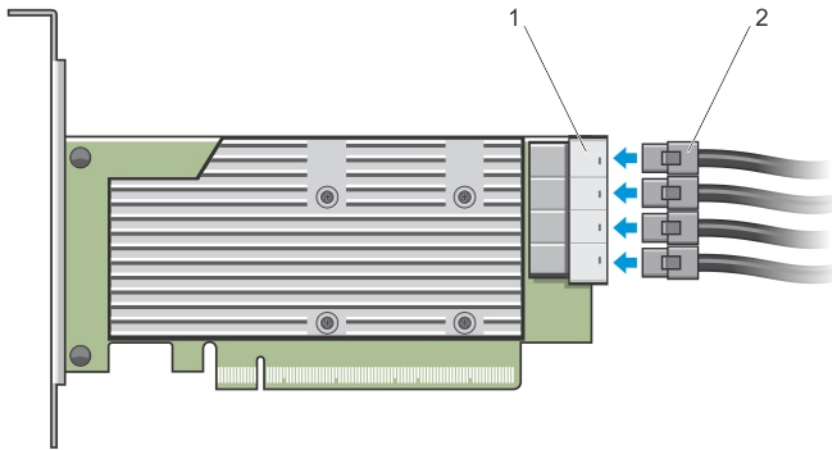


Figure 5. Cabling a PCIe Extender Adapter Card

1. PCIe extender adapter card
2. backplane connector cables

NOTE: Depending on the maximum number of NVMe PCIe SSDs supported on your system, fewer NVMe PCIe SSD cables may be required.

Driver Installation





For the current list of operating systems supported by Dell PowerEdge Express Flash Non-Volatile Memory Express (NVMe) Peripheral Component Interconnect Express (PCIe) Solid State Devices (SSDs), see [Supported Operating Systems For NVMe PCIe SSD](#).

Downloading NVMe PCIe SSD Drivers

To download NVMe PCIe SSD drivers:


1. Go to **dell.com/support/drivers**.
2. Enter **Service Tag or Express Service Code** or select **Choose from a list of all Dell products**.
3. Select **Servers, Storage & Networking**.
4. Select **PowerEdge**.
5. Select your system.
The drivers that are applicable to your selection are displayed.
6. Select **Solid State Storage**.
The NVMe PCIe SSD drivers that are applicable to your system are displayed.
From the available list, download the latest NVMe PCIe SSD drivers to a USB drive, CD, or DVD.

Installing Or Upgrading The NVMe PCIe SSD Driver For Microsoft Windows Server 2008, Windows Server 2012, and Windows Server 2012 R2

-  **NOTE:** For a complete list of supported operating systems, see [Supported Operating Systems For NVMe PCIe SSD](#).
-  **NOTE:** Use the procedures in this section to install or upgrade the driver for Windows. The driver is updated frequently. To ensure that you have the current version of the driver, download the updated Windows driver from **dell.com/support**. For more information, see [Downloading NVMe PCIe SSD Drivers](#).
-  **NOTE:** Close all applications on your system before you update the driver.
-  **NOTE:** Windows Server 2012 R2 contains an in-box NVMe driver; however Dell requires updating to the latest driver to ensure full express flash PCIe support.


To install or upgrade the PCIe SSD driver for Windows server using DUP:

1. Insert the media containing the latest driver that you downloaded in Downloading NVMe PCIe SSD Drivers.
2. Double-click the executable and follow the on screen instructions to install the NVMe PCIe SSD driver using DUP.


-  **NOTE:** Dell provides the DUP to update drivers on systems running Windows Server 2008 R2 SP1, Windows Server 2012, and Windows Server 2012 R2 operating systems. DUP is an executable application that updates drivers for specific devices. DUP supports command line interface and silent execution. For more information, see the DUP documentation at dell.com/esmanuals.

When DUPs are not used to upgrade the driver, follow the instructions below:

1. Insert the media containing the latest driver that you downloaded in [Downloading NVMe PCIe SSD Drivers](#).
2. Click **Start** → **Control Panel** → **System and Security**.
3. Select **Device Manager** under the **System** option.
The **Device Manager** screen is displayed.
4. Double-click the entry to expand **Storage** controllers. Alternatively, you can click on the plus symbol next to the **Storage** controllers.
For example, a 1.6 GB NVMe PCIe SSD device is displayed as Dell Express Flash NVMe XS1715 1.6GB.


-  **NOTE:** If there is no NVMe PCIe SSD driver installed, the NVMe PCIe device will be listed under the **Other** devices option. In this case, the NVMe PCIe device is displayed as **PCIe device**.


5. Double-click the NVMe PCIe device for which you want to install or update the driver.
6. Click the **Driver** tab and click **Update Driver**.
The **Update Device Driver** screen is displayed.
7. Select **Browse my computer for driver software**.
8. Select **Let me pick from a list of device drivers on my computer**.
9. Select **Have Disk**.
10. Follow the steps in the wizard and browse to the location of the driver files.
11. Select the **INF** file from the driver media.
12. Click **OK** to exit the wizard.
13. Click **Next**.


-  **NOTE:** If there is more than one NVMe PCIe SSD in the system, repeat steps 4–13 for all remaining devices in the system.

14. Restart the system for the changes to take effect.

Installing Or Upgrading The NVMe PCIe SSD Driver For Red Hat Enterprise Linux Or SUSE Linux Enterprise Server

-  **NOTE:** For a complete list of supported operating systems, see [Supported Operating Systems For NVMe PCIe SSD](#).


-  **NOTE:** Use the procedures in this section to install or upgrade the driver for Linux. The driver is updated frequently. To ensure that you have the current version of the driver, download the updated Linux driver from dell.com/support. For more information, see [Downloading NVMe PCIe SSD Drivers](#).

-  **NOTE:** RHEL 6.5 contains an in-box NVMe driver; however Dell requires updating to the latest driver to ensure full express flash PCIe support.

SUSE Linux Enterprise Server 11 drivers are provided in the Kernel Module Package (KMP) format while Red Hat Enterprise Linux 6 drivers are provided in the Kernel Module Loader (KMOD) format. KMODs are

normal Red Hat Packet Manager (RPM)s and are driver packaging methods that contain kernel modules, instituted to better handle kernel update situations. To install or update the NVMe PCIe SSD driver:

1. Uncompress the zipped tarball driver release package.
2. Install the driver package using the command: `rpm -ihv < driver rpm package name >.rpm`

 **NOTE:** Use `rpm -Uvh <package name>` when updating an existing package.

3. Restart the system for the driver update to take effect.
4. After the system restarts, verify the driver has been installed with the system command: `# modinfo nvme`

The version shown in the output must match with the version of the package.

5. Verify that the driver has been loaded with the system command: `# lsmod | grep nvme` or `# cat /proc/modules | grep nvme`

These commands return `nvme` if the driver is loaded.

The NVMe PCIe SSDs are ready for use. See, [Configuring NVMe PCIe SSDs In Different Operating Systems](#).

Configuring And Managing Your NVMe PCIe SSD

Dell storage management applications enable you to manage and configure the Dell PowerEdge Express Flash Non-Volatile Memory Express (NVMe) Peripheral Component Interconnect Express (PCIe) Solid State Device (SSD) subsystem, control, and monitor multiple NVMe PCIe SSDs, and provide online maintenance.

The Dell PowerEdge Express Flash NVMe PCIe SSD solution supports Unified Extensible Firmware Interface (UEFI) and Human Interface Infrastructure (HII), for pre-operating system management and the Dell OpenManage Server Administrator application for operating system management.

Human Interface Infrastructure Configuration Utility

The 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.



CAUTION: Hot swapping NVMe PCIe SSDs is not supported in the HII Configuration utility. Hot swapping an NVMe PCIe SSD while in the HII Configuration utility may not be detected and handled properly.

Entering The HII Configuration Utility

Follow the steps 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.


The HII configuration is displayed for the various devices that support HII. For example the PCIe SSD device will be displayed as: PCIe Solid State Drive in Slot 0 in Bay 1: Dell NVMe PCIe SSD Configuration Data.


Viewing Physical Device Properties

Follow the steps to view physical device properties:

1. Select an **NVMe PCIe SSD** in the PCIe SSD HII Configuration utility.
2. Select **View Physical Device Properties**.
3. Press <Esc> to return to the **System Setup** screen.

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.

Follow the steps below to perform a cryptographic erase on an NVMe PCIe SSD from the HII Configuration utility:

1. Select the NVMe PCIe SSD on which you want to perform a cryptographic erase.
2. Navigate to the **Select Physical Device Operations** menu of the HII Configuration utility.
3. Select **Cryptographic Erase**.
The following warning message is displayed: "Performing a cryptographic erase will result in permanent loss of all data on the device. Do you want to continue?"
4. Select **Yes** to confirm, then select **Continue**. If you select **No**, the operation is not performed. When the operation is complete, the following message is displayed: "Erase operation has completed successfully."
5. Select **OK** to return to the previous screen.
6. Press <Esc> to return to the **System Setup** screen.

Blink LED


The **LED blink** option allows you to identify a physical device in the system. Perform the following steps to start or stop the option:

1. Select an NVMe PCIe SSD.
2. Navigate to the **Select Physical Device Operations** menu in the HII Configuration utility.
3. Select the **Blink** option to begin activity LED blinking or the **Unblink** option to end LED blinking.
4. Press <Esc> to return to the **System Setup** screen.

Exporting The Log


The log contains debug information of the NVMe PCIe SSD, which helps while troubleshooting.

Follow the steps below to export the NVMe PCIe SSD log from the HII Configuration utility:

1. Select an NVMe PCIe SSD.
2. Select the **Export Log** option.
3. Select the file system target device where the log will be exported.
4. Select the directory where you want to save the log.
5. Confirm the export log path.
6. Select **Export Log**.
 **NOTE:** The log file is saved as: **PCIeSSD_SlotX_BayY_MDHMS.log**, where X = slot number, Y = Bay number, M = Month, D = Date, and HMS = Hour, Min, Sec.
7. Click **OK** to return to the previous screen.
8. Press <Esc> to return to the **System Setup** screen.

Exiting The HII Configuration Utility


To exit the HII Configuration utility, click the **Exit** button on the top right corner in the **System Setup** menu of the HII Configuration utility.

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

 **NOTE:** Press <Esc> from any PCIe SSD HII page to return to the previous page.

Dell OpenManage Server Administrator

The Dell OpenManage Server Administrator is a storage management application for Dell systems that provides features for managing components of the NVMe PCIe SSD solution. The Dell OpenManage Server Administrator application enables you to perform NVMe PCIe SSD functions from a single graphical or command-line interface.

 **NOTE:** The graphical user interface (GUI) is wizard driven with features for novice and advanced users, and a detailed online help. The command line interface, available on selected operating systems, enables you to perform NVMe PCIe SSD management tasks that are fully featured and scriptable. For more information, see the OpenManage Server Administrator online help accessible through the application.

Launching Storage Management

Storage Management is installed as a Dell OpenManage Server Administrator service. 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 then select **PCIe SSD Extender**.
The **Storage Information** window is displayed under **Information/Configuration**.

3. Click **Properties**.

Storage properties may include the following:

ID	Displays the storage ID assigned to the component by storage management. Storage management enumerates the storage components attached to the system starting with zero.
Status	Displays the combined status for the NVMe PCIe SSD subsystem and its lower-level components.
Name	Displays the name of the extender.
State	Displays the current state of the NVMe PCIe SSD subsystem. Possible values are: <ul style="list-style-type: none">– Ready: The component is functioning normally.– Degraded: The component has encountered a failure and is operating in a degraded state.– Failed: The component has encountered a failure and is no longer functioning.

Configuring And Managing NVMe PCIe SSDs


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

To view the complete 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 comprises the bay ID and the slot in which the NVMe PCIe SSD is installed.
State	Displays the current state of the NVMe PCIe SSD.
Bus Protocol	Displays the technology that the NVMe PCIe SSD is using.
Device Name	In Windows: \\.\PhysicalDrive1 . In Linux: /dev/nvme0n1 .
Media	Displays the media type of the physical device.
Remaining Rated Write Endurance	Displays the warranted wear out level of the NVMe PCIe SSD (in percentage).
Revision	Displays the current running firmware version on the NVMe PCIe SSD.
Driver Version	Displays the current 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.

Negotiated Speed Displays the speed of data transfer that the device negotiated upon initial communication. This speed is dependent on the speed of the device, the capable speed of the PCIe extender card, and the current speed of the PCIe extender card on that connector.

Capable Speed Displays the highest possible speed at which the device can transfer data.

 **NOTE:** For physical device properties status, see table NVMe PCIe SSD States and LED Indicator Codes.

Ausführen von Aufgaben für physikalische Geräte

1. Erweitern Sie das Strukturobjekt **Storage** (Speicher), um die Speicherkomponenten-Objekte anzuzeigen.
2. Erweitern Sie das Objekt **PCIe-SSD SubSystem**.
3. Erweitern Sie das Objekt **PCIe-SSD Extender**.
4. Erweitern Sie das Objekt **Enclosure (Backplane)** (Gehäuse (Rückwandplatine)).
5. Wählen Sie das Objekt **Physical Devices** (Physikalische Geräte) aus.
6. Wählen Sie eine Aufgabe aus dem Drop-Down-Menü **Available Tasks** (Verfügbare Aufgaben) aus.
7. Klicken Sie auf **Execute** (Ausführen).

NVMe PCIe SSD Drop-Down Menu Tasks


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


- Blink
- Unblink
- Prepare to Remove
- Cryptographic Erase
- Export Log

Blink And Unblink Task For PCIe SSD

The **Blink** task allows you to find a device within a system by blinking the status LED on the device. You can use this task to locate a failed device. If you need to cancel the **Blink** task or if the physical device continues to blink indefinitely, use the **Unblink** task.

Preparing To Remove An NVMe PCIe SSD

 **WARNING:** The identify LED pattern is the same LED pattern as prepare for removal. When you initiate a prepare to remove operation, ensure that your NVMe PCIe SSD is no longer accessible by the system before you physically remove the NVMe PCIe SSD.

 **CAUTION:** To prevent data loss, it is mandatory that you use the Prepare to Remove task before physically removing a device.

Use the **Prepare to Remove** task to safely remove an NVMe PCIe SSD from the system. This task causes the status LEDs on the device to blink. You can safely remove the device from the system under the following conditions after you use the **Prepare to Remove** task:

- The NVMe PCIe SSD LED blinks in a pattern that indicates that the device is preparing for removal. See table NVMe PCIe SSD States and LED Indicator Codes.

- The NVMe PCIe SSD is no longer accessible by the system.

To perform the **Prepare to Remove** task:


1. Expand the **Storage** tree object to display the storage component objects.
2. Expand the **PCIe-SSD SubSystem** object.
3. Expand the **PCIe-SSD Extender** object.
4. Expand the **Enclosure (Backplane)** object.
5. Select the **Physical Devices** object.
6. Select **Prepare To Remove** task.
7. Click **Execute**.


The following warning message is displayed:

"Warning: Are you sure you want to prepare the physical device for removal?"

8. Select **Prepare to Remove Physical Device** to proceed or select **Go Back** to previous page to cancel the operation.

Performing Cryptographic Erase Task For NVMe PCIe SSD

 **CAUTION:** Performing a cryptographic erase on an NVMe PCIe SSD overwrites all blocks and will result 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.
2. Expand the **NVMe PCIe-SSD SubSystem** object.
3. Expand the **NVMe PCIe-SSD Extender** object.
4. Expand the **Enclosure (Backplane)** object.
5. Select the **Physical Devices** object.
6. Select **Cryptographic Erase** task.
7. Click **Execute**.

The following caution message is displayed: "Caution: Performing a cryptographic erase will result in permanent loss of all data on the device. Do you want to continue?"

8. Select **Cryptographic Erase** to proceed or select **Go Back** to previous page to cancel the operation.

Exporting The Log

The log contains debug information of the NVMe PCIe SSD, used for troubleshooting.

You can export the log through the **Physical Device Available Tasks** drop down menu. To export the log:


1. Expand the **Storage** tree object to display the storage component objects.
2. Expand the **NVMe PCIe-SSD SubSystem** object.
3. Expand the **NVMe PCIe-SSD Extender** object.
4. Expand the **Enclosure (Backplane)** object.
5. Select the **Physical Devices** object.
6. Select the **Export Log** task.
7. Click **Execute**.
8. Select **Export Log** to proceed or select **Return to Previous Page** to cancel the operation.

State Name	Slot/Device State	Status LED (Green)	Status LED (Amber)
	indicating the device has received a Prepare for Removal command from the host operating system.		
Device failed	The host operating system no longer has access to the device because the device is not responding or has encountered a critical error condition.	Off	On for 250 msec Off for 250 msec

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 which is indicated by the rapid blinking of the activity LED.

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 steady blinking stops and the device is fully accessible.

 **CAUTION:** Removing an NVMe PCIe SSD from the system without preparing the device for removal first, causes the NVMe PCIe SSD to enter recovery mode the next time it is inserted in the system.

 **NOTE:** It is recommended to use power backup solutions for all Dell systems.

General Errors

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

NVMe Drive Description Is Truncated

Description	In Windows 2012 R2, the drive description is truncated from the Device Manager → Disk Drives view. For example, you will see NVMe Dell Express Flash or NVMe Dell Express Fla SCSI Disk Device instead of NVMe Dell Express Flash SCSI Disk Device .
Cause	In Windows 2012 R2, there is a new flag <code>STOR_FEATURE_DEVICE_NAME_NO_SUFFIX</code> that removes the <code>suffix</code> in the device friendly name. This is only seen in Windows 2012 R2 and this flag is enabled by design of the Windows 2012 R2 in-box driver. The Dell provided NVMe driver uses the correct flag, but you may see the device name truncated intermittently.
Solution	This is a known issue and the message can be safely ignored.



Software RAID Array Created Using PCIe SSDs Is Not Detected After SLES 11 SP3 Or SLES 11 SP2 Is Rebooted

- Cause** The **boot.md** service is not started during RAID creation. The **boot.md** service must be activated for the init process to start the MD-RAID device.
- Solution** Run the command **# chkconfig boot.md** to verify if the **boot.md** service is on or off. This command should start the **boot.md** service. If it does not, run the command **# chkconfig boot.md on** to enable it.

HII Prompts The User To Save Settings When Exiting The Utility

- Cause** The HII browser prompts you to save settings when exiting although there is nothing to save.
- Description** When exiting the HII after performing a cryptographic erase or exporting the log for PCIe NVMe devices, you may be prompted to save changes. The prompt is misleading as it may imply settings are not saved or that the action is not complete. This is not the case as there is nothing to save after these actions take place.
- Solution** You can exit the utility without consequence. Selecting save or not to save when exiting the utility after a cryptographic erase or log export will not change the settings or action that was taken.

NVMe PCIe SSD Is Not Listed In the Operating System

- Cause** Hardware is not correctly installed.
- Solution** Check the following components:
- **Devices:** Ensure that the NVMe PCIe SSDs are installed in an NVMe PCIe SSD backplane.
 -  **CAUTION: NVMe PCIe SSDs must be used with NVMe PCIe SSD backplanes. To ensure that you have the correct configuration for the NVMe PCIe SSD, see the platform-specific Owner's Manual at dell.com/support/manuals.**
 - **Backplane:** Ensure that the cables for the NVMe PCIe SSD backplane are connected correctly.
 -  **NOTE:** The backplane connector cables are labeled as **PCIe BP A**, **PCIe BP B**, **PCIe BP C**, and **PCIe BP D** for connecting to the backplane. The PCIe extender adapter card cable connectors are labeled as adapter port A, B, C, and D respectively for connecting to the card. These cables must not be reversed.
- Cables:** PCIe cables are unique for the configuration. Ensure that the backplane cable connectors mate with the backplane and the extender card cable connectors mate with the extender card. See [Replacing And Configuring Hardware](#).
- **Extender card:** Ensure that the PCIe extender card is plugged into the correct supported slot. See the system specific *Owner's Manual* at [dell.com/support/manuals](#).

An Error Message Is Displayed When Running Cryptographic Erase In HII

Description	When you run a cryptographic erase on Human Interface Infrastructure (HII), the following error message is displayed: "Operation Failed".
Cause	NVMe PCIe SSD is not accessible because it was hot swapped.
Solution	Hot swap is not supported in pre-operating system environments. If an NVMe PCIe SSD is hot-removed or hot-inserted while in Unified Extensible Firmware Interface (UEFI) or HII, the device is not accessible until the host system has been power cycled. Perform the following steps to recover from this situation: <ol style="list-style-type: none">1. Power off the system.2. Install your NVMe PCIe SSD.3. Power on the system.

NVMe PCIe SSD Is Not Seen In Device Management In The Operating System

Cause	The device driver is not installed.
Solution	See Driver Installation .

Cannot Update The Firmware Using Dell Update Package (DUP)

Cause	The device driver is not installed.
Solution	Before you update the device firmware using DUP, install the device driver. For more information, see Driver Installation .

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: <ol style="list-style-type: none">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 non-existent device entry.

I/O Device Error On Write To NVMe PCIe SSD

Cause	NVMe PCIe SSDs have a finite number of write cycles, when an NVMe PCIe SSD exhausts the number of writes it goes in to the Write Protect mode (Read Only).
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 (where X is the number corresponding the to the device).

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)

Solution By using OpenManage Server Administrator, you may check the PCIe SSD state to confirm if the PCIe SSD is in **Read-Only Mode**. Alternatively, you can boot into the HII and do the same. For further instructions, contact a Dell Technical Service representative.

NVMe PCIe SSD Performance Measurement Not Optimal

Cause NVMe PCIe SSD has not been pre-conditioned and/or BIOS settings are not optimal.

Description There are a number of factors that may alter the performance of an NVMe PCIe SSD. It is recommended to take basic setup measures to ensure performance optimization of these devices.

Solution

- Without pre-conditioning the NVMe PCIe SSD, performance measurements can be misleading as it may not reflect long term performance of the device. Pre-conditioning activates flash management, which stabilizes data throughput over a period of time. For Solid State Storage Performance Test Specification, refer to snia.org.
- Configure the server for low latency performance. To achieve maximum performance with Dell PowerEdge Express Flash NVMe PCIe SSDs, change the server performance profile in the BIOS settings to **Performance**.

In Windows Server 2012 R2, OpenManage Server Administrator Does Not Detect PCIe NVMe Devices

Cause The operating system is using the in-box NVMe driver.

Description Windows Server 2012 R2 contains an in-box NVMe driver, which is not supported by Dell OpenManage Server Administrator.

Solution Install the latest NVMe driver available on dell.com/support.


In Windows Server 2012 R2, Updating The Driver From Windows In-Box NVMe Driver To Dell NVMe Driver Is Reported As Downgrade

Cause	Windows in-box NVMe driver does not use the same versioning scheme as Dell.
Description	The Windows in-box NVMe driver uses a 6.xxxx-based versioning scheme, which is greater than the Dell NVMe driver.
Solution	Continue the Dell NVMe driver update process. Windows Server 2012 R2 contains an in-box NVMe driver; however Dell requires updating to the latest driver to ensure full express flash PCIe support.

Windows Event ID 11 Error Reported In Windows Event Log

Cause	This issue exists in the in-box Windows NVMe driver.
Description	Event ID 11 Error is reported in the Windows event log during each system boot.
Solution	Install the latest NVMe driver available on dell.com/support .

NVMe PCIe SSD Technical Specifications

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

Features	Description
NAND type	Multi Level Cell (MLC): 400 GB, 800 GB, and 1.6 TB
Hot swappable	Yes
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	NVMe PCIe SSD
Device protocol	NVMe
NVMe Standard	1.0
Bus protocol	PCIe
Bus protocol version	3.0
Backplane interface	Combo-connector (SFF-8639)
	 NOTE: For more information on the combo-connector, see SFF-8639 (PCIe SAS Combo-Connector) .
Mechanical Dimensions	
Height	69.90 mm
Width	14.8 mm
Length	100.2 mm
Device Capacity	
Unformatted capacity	400 GB, 800 GB, and 1.6 TB
User-addressable sectors	400 GB: 781,422,768 LBAs 800 GB: 1,562,824,368 LBAs

	1600 GB: 3,125,627,568 LBAs
Bytes per sector	512 B
Device life (total bytes written) – MLC	400 GB: 4.6 PB
	800 GB: 9.1 PB
	1600 GB: 18 PB

Environment

Operating temperature	0 °C to 70 °C
Shock	1500 G/1.0ms
Vibration	7 Hz–500 Hz at 3.08G

Power Requirements

Active power	25 W (FW Limit)
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Electrical characteristics

Voltage input	3.3 Volts and 12 Volts
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SFF-8639 (PCIe SAS Combo-Connector)

The combo-connector, also known as a 6x unshielded connector, is a high-speed plug and receptacle connector pair. It is a common connector that supports both SAS and PCIe-based devices.

Systems utilizing the combo-connector can simultaneously support dual-port SAS or quad-lane PCIe device configurations in an isolated manner. Quad-port SAS devices may be supported by sharing two lanes between SAS and PCIe.





 **NOTE:** The combo-connector can support both SAS drives and NVMe PCIe SSDs interchangeably. However, the Dell PowerEdge Express Flash PCIe SSD backplane with PCIe SAS combo-connector supports PCIe SSDs only.

Wie Sie Hilfe bekommen

Ausfindig machen der Service-Tag-Nummer

Ihr System wird durch einen eindeutigen Express-Servicecode und eine eindeutige Service-Tag-Nummer identifiziert. Der Express-Servicecode und die Service-Tag-Nummer befinden sich an der Rückseite des Systems; ziehen Sie das Informations-Tag aus. Mithilfe dieser Informationen kann Dell Support Anrufe an den richtigen Mitarbeiter weiterleiten.

Zugehörige Dokumentation

-  **ANMERKUNG:** Rufen Sie für die Dokumentation von PowerEdge und PowerVault die Seite **dell.com/support/manuals** auf und geben Sie die Service-Tag-Nummer ein, um Ihre Systemdokumentation zu erhalten.
-  **ANMERKUNG:** Rufen Sie für alle Dokumente zu Dell OpenManage die Seite **dell.com/openmanagemanuals** auf.
-  **ANMERKUNG:** Um zu Betriebssystemdokumenten zu gelangen, gehen Sie zu **dell.com/operatingsystemmanuals**.
-  **ANMERKUNG:** Um zu Speicher-Controller- und PCIe SSD-Dokumenten zu gelangen, gehen Sie zu **dell.com/storagecontrollermanuals**.

Die Produktdokumentation beinhaltet:

Handbuch zum Einstieg	Stellt eine Übersicht über die Systemfunktionen, das Einrichten des Systems und die technischen Spezifikationen bereit. Dieses Dokument wird auch mit dem System mitgeliefert.
Benutzerhandbuch	Bietet Informationen zu Systemfunktionen, zur Fehlerbehebung am System und zur Installation oder zum Austausch von Systemkomponenten.
Anweisungen für die Rack-Montage	Beschreibt die Montage Ihres Systems in ein Rack. Dieses Dokument ist im Lieferumfang Ihrer Rack-Lösung enthalten.
Administratorhandbuch	Enthält Informationen über die Konfiguration und die Verwaltung des Systems.
Fehlerbehebungshandbuch	Enthält Informationen zur Fehlerbehebung in der Software und dem System.
OpenManage Server Administrator Benutzerhandbuch	Enthält Informationen über die Verwendung von Dell OpenManage Server Administrator zur Verwaltung des Systems.



ANMERKUNG: Lesen Sie für sämtliche Dokumentation im Zusammenhang mit Dell OpenManage Server Administrator die Seite dell.com/openmanage/manuals.

Kontaktaufnahme mit Dell



ANMERKUNG: Dell bietet verschiedene Optionen für Online- und Telefonsupport an. Wenn Sie über keine aktive Internetverbindung verfügen, so finden Sie Kontaktinformationen auf der Eingangsrechnung, dem Lieferschein, der Rechnung oder im Dell Produktkatalog. Die Verfügbarkeit ist abhängig von Land und Produkt und einige Dienste sind in Ihrem Gebiet möglicherweise nicht verfügbar.

So erreichen Sie den Verkauf, den technischen Support und den Kundendienst von Dell:

1. Rufen Sie die Website dell.com/contactdell auf.
2. Wählen Sie das Land bzw. die Region im Drop-Down-Menü in der oberen linken Ecke aus.
3. Wählen Sie Ihr Geschäftsfeld aus.
Die Hauptsupportseite für das ausgewählte Geschäftsfeld wird angezeigt.
4. Wählen Sie gemäß Ihrem Anliegen die entsprechende Option aus.



ANMERKUNG: Wenn Sie bereits ein Dell-System erworben haben, werden Sie möglicherweise nach der Service-Tag-Nummer gefragt.

Feedback zur Dokumentation

Wenn Sie uns Ihre Meinung zu diesem Dokument mitteilen möchten, schreiben Sie an documentation_feedback@dell.com. Alternativ können Sie auf den Link **Feedback** klicken, der sich auf allen Seiten der Dell-Dokumentation befindet, das Formular ausfüllen und auf **Submit** (Senden) klicken, um uns Ihre Rückmeldung zukommen zu lassen.