Dell Express Flash NVMe PCIe SSD User's Guide

May 2020
Rev. A01

DELL EMC

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.

Contents

1

NVMe PCIe SSD overview

Dell NVMe PCIe SSD products include both 2.5-inch (U.2) and add-in controller (AIC) form factors.

Storage management applications enable you to manage and configure the NVMe PCIe SSD. 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.

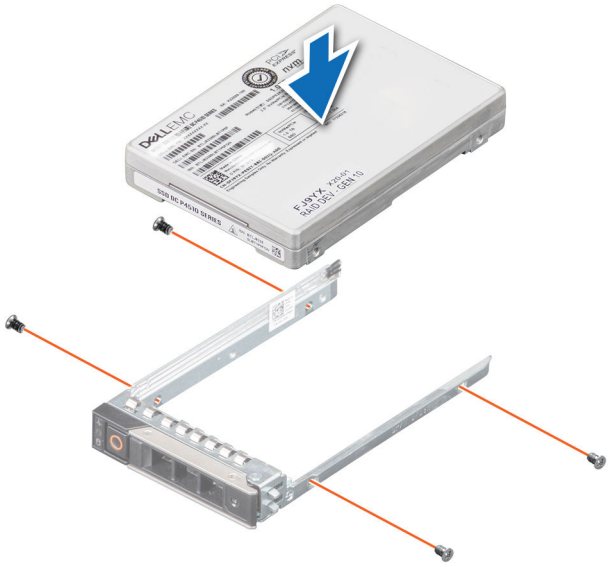
NOTE: The Instant Secure Erase feature on NVMe PCIe SSD drives is compliant with National Institute for Standards and Technology 800-88R1 requirements.

NOTE: This documentation assumes you use OMSA, iDRAC, or HII for all management and configuration tasks. See Related documentation for links to information about the use of these tools.

NOTE: For the safety, regulatory, and ergonomic information associated with these devices, and for more information about iDRAC/LC remote management, see your platform documentation.

NVMe PCIe SSD U.2

Install the NVMe PCIe SSD U.2 into its carrier before installing it into the server.



NVMe PCIe SSD AIC

Install the NVMe PCIe SSD AIC form factor into the appropriate system board slot. See your server documentation for more information.

NVMe PCIe SSD features

NVMe PCIe SSDs offer features including hot swap, device health, SMART, remaining rated write, device write status, and boot capabilities.

Hot swap an NVMe PCIe SSD U.2 device

NOTE: NVMe PCIe SSD AICs do not support hot swap.

Supported NVMe PCIe SSD U.2 device hot swappable functions are defined below:

Orderly or Hot Insertion	Insert a device into a running system where a similar device has not been previously inserted from the time it was last booted. The systems that support NVMe PCIe SSDs are configured to handle PCIe resource balancing in the event of a hot insertion when operating within a Dell supported operating system. This preset system configuration makes hot insertion an orderly operation if performed with supported operating systems.
Orderly Removal	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	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.
Surprise Removal	Remove a device from a running system without first notifying the system that the device is about to be removed. This feature is supported on systems running Microsoft Windows 2019 or later. See Support for Surprise Removal in Windows for information about how to use this function.

Device health

Dell Express Flash NVMe PCIe SSDs include several features such as SMART, remaining rated write endurance, and device write status, that allow you to monitor device health.

Use these features to help maintain the health of your Dell Express Flash SSD.

Self-Monitoring Analysis and Reporting Technology (SMART)

Dell management tools such as Integrated Dell Remote Access Controller and Dell OpenManage Server Administrator use SMART to provide alert content.

Remaining rated write endurance

The NVMe PCIe SSD is warrantied 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 the technical specification sheet for your SSD.

Device write status

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.

Boot from an NVMe PCIe SSD U.2

NOTE: You cannot boot from an NVMe PCIe SSD AIC.

Dell supports installation of operating systems to, and booting from, NVMe PCIe SSD U.2s on select PowerEdge platforms that have been configured for UEFI BIOS boot mode. To determine whether or not an NVMe PCIe SSD U.2 may be used as a boot device on your system, see the system-specific documentation at www.dell.com/manuals.

2

Configure an NVMe PCIe SSD in different operating systems

The NVMe PCIe SSD you ordered with your system is pre-configured and ready for use. The following describes how to access those settings.

Windows

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

NOTE: When configured in Dell S140 RAID volumes, separate device entries are not shown. For more information, see the Dell S140 documentation at www.dell.com/manuals.

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

Support for Surprise Removal in Windows

It is recommended that you notify the system prior to removing an NVMe PCIe SSD U.2 even though you can remove an NVMe PCIe SSD U.2 without prior notification in Windows system.

CAUTION: To prevent data loss or corruption when doing a surprise removal of an NVMe PCIe SSD U.2 device, ensure that the data on your drive is no longer in use.

NOTE: It is strongly recommended that you notify the system prior to removing an NVMe PCIe SSD U.2. Refer the OpenManage Server Administrator documentation at, www.dell.com/openmanagemanuals > OpenManage Server Administrator or *iDRAC User's Guide* available at www.dell.com/idracmanuals for more information.

NOTE: Orderly hot swap is only supported when an NVMe PCIe SSD device is installed in a supported Dell system running a supported operating system. Do not insert or remove an NVMe PCIe SSD device while accessing the system BIOS or HII configuration. To ensure that you have the correct hardware setup for your NVMe PCIe SSD device, see the system specific owner's manual at www.dell.com/manuals.

Linux

On Linux-based systems, you can configure NVMe PCIe SSDs 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
```

Use OpenManage Server Administrator for managing and performing NVMe PCIe SSD-related tasks.

NOTE: Surprise removal is not supported on Linux-based systems.

VMware

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

- Inability to take snapshots of the Virtual Machine (VM).
- VM is no longer able to use fail over features such as VMotion and Distributed Resources Scheduler (DRS).
- Loss of hot swap capability for other devices such as USB drives. To add another device, you must first shut down the VM.

Configuring an NVMe PCIe SSD for passthrough operation is not recommended except as defined by Dell-specific solutions. See the solution-specific documentation at www.dell.com/manuals.

NOTE: Surprise removal is not supported on VMware systems.

3

Troubleshooting

NOTE: To get help for your NVMe PCIe SSD, see Contacting Dell EMC.

NVMe PCIe SSD carrier LED indicators

The LEDs on the NVMe PCIe SSD U.2 carrier indicate the state of each physical device. Each NVMe PCIe SSD carrier in your enclosure has an activity LED (green) and a status LED (bicolor, green/amber). The activity LED flashes whenever the device is accessed.

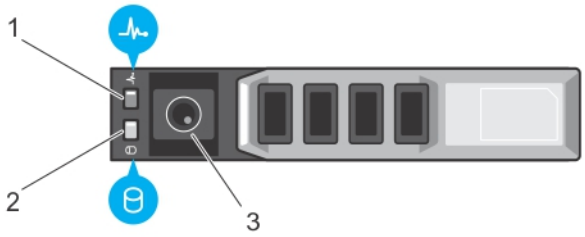


Figure 1. NVMe PCIe SSD device carrier LED indicators

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

While the operating system is running, the status indicator provides the current status of the device. The following table lists the device states along with the associated LED indicator codes.

Table 1. NVMe PCIe SSD U.2 states and LED indicator codes

State Name	Slot/Device State	Status LED (Green)	Status LED (Amber)
Device status off	The server or device is not powered up.	Off	Off
Device online	The device is powered up.	On	Off
Device identify (blink)	The device is identifying the slot location or is indicating the device has received a `Prepare for Removal` command from the host operating system.	On for 250 msec Off for 250 msec	Off
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
Read only	The device will only service read operations.	Off	On for 250 msec Off for 250 msec
Predicted failure	The SMART feature set has predicted a degradation or fault condition.	Off for 250 msec On for 250 msec	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.

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.

NVMe drive properties intermittently not available in iDRAC

Description	NVMe drive properties via sideband (iDRAC) may not be available after a PCIe SSD is hot-inserted into the system. This is most likely to occur if the PCIe SSD is formatted with a file system or has existing data.
Cause	Side band controller on the NVMe drives does not complete initialization in time for iDRAC to inventory the device.
Solution	After an AC power cycle, the system should list the inserted devices in iDRAC.

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.
  NOTE: 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 www.dell.com/manuals.
- **Backplane**: Ensure that the cables for the NVMe PCIe SSD backplane are connected correctly.
- **Cables**: PCIe cables are unique for the configuration. Ensure that the backplane cable connectors are connected to the backplane and the extender card or system board.
- **Extender card**: Ensure that the PCIe extender card, if used in your server configuration, is plugged into the correct supported slot. See the system-specific owner's manual at www.dell.com/manuals.

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 several factors that may alter the performance of an NVMe PCIe SSD. It is recommended that you configure performance optimization of these devices using the basic setup options.
Cause	NVMe PCIe SSD has not been preconditioned, or the BIOS settings are not optimized.
Solution	Without preconditioning the NVMe PCIe SSD, performance measurements can be misleading as they might not reflect long-term performance of the device. Preconditioning enables flash management, which stabilizes data throughput over a period of time. For the Solid-State Storage Performance Test Specification, see snia.org.

System becomes unresponsive when NVMe PCIe SSD is surprise removed

Description	The system becomes unresponsive when the device is removed without first preparing the device for removal.
Cause	Surprise removal is only supported in PowerEdge servers for NVMe PCIe SSD running under Windows.
Solution	Execute the Prepare For Removal operation for the specific NVMe PCIe SSD from a Dell Management application.

System becomes unresponsive or fails when NVMe PCIe SSD is inserted

Description	The system becomes unresponsive or fails when inserting an NVMe PCIe SSD while accessing the system BIOS or HII configuration utilities.
Cause	Hot insertion is not supported in pre-operating system configuration utilities.
Solution	Insert only after allowing the operating system to fully load or when the server is powered off.

4

Related documentation

To...	Refer to...
Install your system into a rack	Rack documentation included with your rack solution.
Set up your system and know the system technical specifications	*Getting Started Guide* available at www.dell.com/poweredgemanuals
Install the operating system	Operating system documentation at www.dell.com/operatingsystemmanuals
Get an overview of the Dell Systems Management offerings	Dell OpenManage Systems Management Overview Guide at www.dell.com/openmanagemanuals
Configure and log in to iDRAC, set up managed and management system, know the iDRAC features and troubleshoot using iDRAC	Integrated Dell Remote Access Controller User's Guide at www.dell.com/idracmanuals
Know about the RACADM subcommands and supported RACADM interfaces	RACADM Command Line Reference Guide for iDRAC and CMC at *iDRAC RACADM CLI Guide* available at www.dell.com/idracmanuals
Launch, enable and disable Lifecycle Controller, know the features, use and troubleshoot Lifecycle Controller	Dell Lifecycle Controller User's Guide at www.dell.com/idracmanuals > Lifecycle Controller
Use Lifecycle Controller Remote Services	Dell Lifecycle Controller Remote Services Quick Start Guide at **Dell.com/openmanagemanuals** *Lifecycle Controller Remote Services Quick Start Guide* available at www.dell.com/idracmanuals
Set up, use, and troubleshoot OpenManage Server Administrator	Dell OpenManage Server Administrator User's Guide at www.dell.com/openmanagemanuals > OpenManage Server Administrator
Install, use and troubleshoot OpenManage Essentials	Dell OpenManage Essentials User's Guide at www.dell.com/openmanagemanuals > OpenManage Essentials
Know the system features, remove and install system components, and troubleshoot components	Owner's Manual at www.dell.com/poweredgemanuals
Know the features of the storage controller cards, deploy the cards, and manage the storage subsystem	Storage controller documentation at www.dell.com/storagecontrollermanuals
Check the event and error messages generated by the system firmware and agents that monitor system components	Dell Event and Error Messages Reference Guide at For information about the event and error messages generated by the system firmware and agents that monitor system components, go to qrl.dell.com > **Look Up** > **Error Code**, type the error code, and then click **Look it up**.

Your product documentation includes:

Getting Started Guide	Provides an overview of system features, setting up your system, and technical specifications. This document is also shipped with your system.
Owner's Manual	Provides information about system features and describes how to troubleshoot the system and install or replace system components.
Rack Installation Instructions	Describes how to install your system into a rack. This document is shipped with your rack solution.
Administrator's Guide	Provides information about configuring and managing the system.

Troubleshooting Guide	Provides information about troubleshooting the software and the system.
OpenManageServer Administrator User's Guide	Provides information about using Dell OpenManage Server Administrator to manage your system.

5

Getting help

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.

Contacting Dell EMC

Dell EMC 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 EMC product catalog. Availability varies by country and product, and some services may not be available in your area. To contact Dell EMCfor sales, technical assistance, or customer service issues:

1. Go to Dell.com/support/home.
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 EMC 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 EMC Global Technical Support team.

Documentation feedback

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