



# Memblaze<sup>®</sup> PBlaze5

## 910/510/920 Series

### Installation User Guide

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# Revision History

Revision Number	Release Date	Description of change(s)	Editor	Revisor
v4.0	Apr 7, 2020	<ul style="list-style-type: none"> <li>Add PBlaze5 920 Series info</li> <li>Update Chapter order, nvmecli is recommended option to upgrade firmware</li> <li>Add note for specific firmware version upgrade, please contact Memblaze pre-sales engineers to obtain corresponding upgrade manual for reference.</li> <li>Remove 700/900 produce series info</li> </ul>	Yu Wang	Bingbing He
v3.9	Aug 28, 2019	<ul style="list-style-type: none"> <li>Add Chapter Firmware Upgrade without Reset</li> </ul>	Yu Wang	Lei Zhu
v3.81	May 29, 2019	<ul style="list-style-type: none"> <li>Update default power mode setting</li> </ul>	Yu Wang	Bingbing He
v3.8	May 8, 2019	<ul style="list-style-type: none"> <li>Add nvme reload driver is required after change sector to different size</li> </ul>	Yu Wang	Hao Wu
v3.7	Mar 14, 2019	<ul style="list-style-type: none"> <li>Update power mode setting, add -s option</li> </ul>	Yu Wang	Fangchun Jin
v3.6	Jan 30, 2018	<ul style="list-style-type: none"> <li>Update the example to change 510/516 power mode</li> </ul>	Yu Wang	Bingbing He
v3.51	Dec 28, 2018	<ul style="list-style-type: none"> <li>Add 510/516 power mode setting</li> <li>Update doc name and Overview to apply to 700/910/510 series</li> <li>Update Hardware Installation screenshot</li> <li>Add Variable Properties Chapter to specify several changeable characters when operations are performed on different PBlaze series SSD</li> <li>Update Chapter Driver Installation and Firmware Upgrade, replaces screenshots with texts</li> <li>Add References Chapter to describe usage of mentioned documents and the way of acquisition</li> </ul>	Yu Wang	Lei Zhu, Hao Wu, Yuanyuan Zhang, Wenqiang Gao, Jingyun Yu
v3.4	Nov 29, 2018	<ul style="list-style-type: none"> <li>Add format and formatnvm command description</li> </ul>	Yu Wang	Lei Zhu
v3.3	Nov 23, 2018	<ul style="list-style-type: none"> <li>Firmware Check under VMware ESXi</li> </ul>	Yu Wang	Hao Wu
v3.2	Nov 9, 2018	<ul style="list-style-type: none"> <li>Update SLES supported in-box driver is 11 SP4 and up</li> </ul>	Yu Wang	Lei Zhu
v3.1	Oct 24, 2018	<ul style="list-style-type: none"> <li>Update firmware update with nvmecli</li> </ul>	Yu Wang	Lei Zhu
v2.5	Oct 10, 2018	<ul style="list-style-type: none"> <li>Update upgrade process required power cycling</li> </ul>	Yu Wang	Hao Wu
v2.4	Jul 20, 2018	<ul style="list-style-type: none"> <li>Add method to set power mode</li> <li>Update check power mode display info</li> </ul>	Yu Wang	Hao Wu
v2.3	Jun 27, 2018	<ul style="list-style-type: none"> <li>Add method to check power mode</li> </ul>	Yu Wang	Hao Wu
v2.2	Jun 20, 2018	<ul style="list-style-type: none"> <li>Update material is applicable for 910/916</li> <li>Update check device description under VMware ESXi</li> <li>Add fw-commit to activate firmware</li> <li>Update variable as &lt;...&gt;</li> <li>Adjust document format</li> </ul>	Yu Wang	Hao Wu



Revision Number	Release Date	Description of change(s)	Editor	Revisor
v2.1	Jan 2, 2018	<ul style="list-style-type: none"><li>Remove driver installation under EXSi</li><li>Add note upgrade nvmecli to 1.3 and up</li></ul>	Yu Wang	
v2.0	Dec 26, 2017	<ul style="list-style-type: none"><li>Add driver installation under Linux via script.</li><li>Update Memblaze provided driver name to mbl_nvme</li><li>Add firmware upgrade, safe erase, get SMART via open source nvmecli</li></ul>	Yu Wang	
v1.0	Sep 27, 2017	Initial Release	Yu Wang	Yuekuan Li



# Overview

The document is used to describe how to install Memblaze® PBlaze5 910/510/920 series NVMe SSD and commonly operation instructions, such as firmware upgrade, secure erase, power mode setting and so on.

## Supported Operation System

System requirements:

- Gen 3.0 x 4/8/16 slot for AIC HHHL (Half Height Half Length) form factor.
- U.2 connector backplane for 2.5" form factor.

Supported Operating Systems:

Table: NVMe Driver Supported OS

NVMe Driver Support	Operation System	
Memblaze Provide	RHEL/CentOS	6.2, 6.3, 6.4
Inbox Driver	RHEL/CentOS	6.5 and up
	SLES	11 SP4 and up
	Ubuntu	Ubuntu 13.04 and up
	Windows	Server 2012 R2
	VMware	6

## As Boot Device Requirement

PBlaze5 supports operation system installation and can be used as boot device directly, which the operating system on platforms that support UEFI 2.3.1 BIOS.

## Variable Properties

Table: Listed Variable Properties

Variables	Value
<Memblaze_Product_Series>	Specifies product series of Memblaze PBlaze SSD familys, such as PBlaze5 910/916
<WinNVMeTool_Version>	Specifies the version of Windows command line tool nvmemgr, such as NVMeWindowsTool_00.06.383
<SSD_MN>	Specifies the make and model of Memblaze PBlaze Series SSD. such as PBlaze5 910 3.84T AIC form factor, the Model Number is P5910CH0384M00
<Namespace_ID>	Specifies the namespace ID of each drive. Such as PBlaze5 910 3.84T AIC form factor, it supports 1 namespace by default, and the namespace ID is 1
<FW_Version>	Specifies the firmware version of Memblaze PBlaze Series SSD, such as PBlaze5 910 firmware version, 2.13.00A.H0, may display as 21300AH0
<Path_to_FW_ServicePack>	Specifies the location to firmware service package.



<Path_to_Release_FW>	Specifies the location to firmware package.
<Release_FW>	Specifies the allBinary.bin type firmware file under <Path_to_Release_FW>, which is required during firmware upgrade.
<Path_to_oob_FW>	Specifies the location to oob firmware (.bin file).

## References

Please contact your local Memblaze sales office or your distributor for latest documents.


Table: References Documents

Title	Description
<Memblaze_Product_Series>_Product_Spec	The document is used to list and describe specifications and capabilities of Memblaze PBlaze series SSD.
Memblaze_nvme-cli_User_Guide	This guide is to describe how to install and use the open source nvme-cli tool, and the utilization of Memblaze specified sub-commands.
Memblaze_nvmemgr_User_Guide	This guide is to describe the installation, supported features of Memblaze provided CLI tool, nvmemgr.

# Hardware Installation

Two main steps is required before successfully running PBlaze5 series SSD.

- Install hardware device
- Install driver (Optional, detailed refer to Driver Installation)

 **Note: Please back up your data before installation.**

## Hardware Installation Steps

1. Reduce potential static electricity in the working environment to the lowest possible. Discharge possible static electricity on your hands before touching the product or wear anti-static gloves or anti-static bracelets.



*This device can be damaged by Electrostatic Discharge (ESD). When handling the device, always wear a grounded wrist strap or use an antistatic glove.*

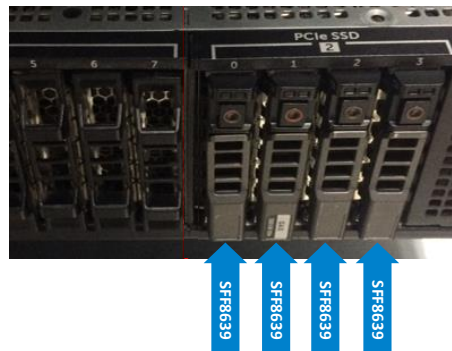


*Any damage to the unit that occurs after its removal from the shipping package and ESD protective bag is the responsibility of the user.*

2. Check if the product is damaged. Should there be hardware damage, please contact Memblaze customer service immediately.
3. Serial number can be recorded for further identifying from console.
4. Make sure that the computer is off, and unplug the power cable. Open the chassis cover, find the PCIe Gen 3.0 x8 or x16 interface (please refer to the mark beside the PCIe slot or other materials such as a server motherboard manual), and make sure there's enough working place for installation. If there is a fixture or a screw baffle behind the PCIe slot, open the fixture or remove the baffle first.



5. For 2.5" form factor drive, platform needs to have SFF8639 connection.







6. Insert AIC form factor drive into the corresponding PCIe slot, and close the fixture or tighten the screws. Make sure the contact is tight.



**Note: Please close the fixture or tighten the screws to avoid damage done to the device during movement.**

7. Close the chassis cover and plug in the power line to start the computer.

## LED status

Both Add-in Card and 2.5" Form factor contain LEDs.

Please refer to latest [<Memblaze Product Series> Product Spec](#) for detailed info about LED indicators behavior.

# Driver Installation

After complete hardware installation, whether needs to install driver is based on has in-box driver supported or not.

- No in-box driver supported, needs install Memblaze provided driver
- Has in-box driver, PBlaze5 NVMe SSD can be used directly

This section is the description about how to install Memblaze provided driver under Linux, Windows and ESXi system.

## Driver installation under Linux via Script

1. Enter the folder stores driver installation script.

```
# cd /<Path_to_FW_ServicePack>/driver/linux/binary
```

Note: Please refer to chapter [Variable Properties](#) for definition of the variable in <...>.

2. Select corresponding operation system.

```
Centos-6.2 centos-6.7 centos-7.2 redhat-6.4 redhat-6.9 redhat-7.4
centos-6.3 centos-6.8 centos-7.3 redhat-6.5 redhat-7.0 suse-11_sp2
centos-6.4 centos-6.9 centos-7.4 redhat-6.6 redhat-7.1 suse-11_sp3
centos-6.5 centos-7.0 redhat-6.2 redhat-6.7 redhat-7.2 suse-11_sp4
centos-6.6 centos-7.1 redhat-6.3 redhat-6.8 redhat-7.3 ubuntu-14.04
```

3. Execute script.

```
#!/install.sh
...
*** Installation finished s10uccessfully
```

## Manually Compile NVMe Driver under Linux

### Driver Introduction

In-box driver is included in Linux kernel 3.10 and higher. Beside the inbox driver, Memblaze also supports several Linux OS as below Table.

Table: NVMe Driver Supported Linux Systems

NVMe Driver Support	Operation System	
Memblaze Provided	RHEL/CentOS	6.2, 6.3, 6.4
Inbox Driver	RHEL/CentOS	6.5 and up
	SLES	11 SP4 and up
	Ubuntu	Ubuntu 13.04 and up

### Provided NVMe Driver Installation Steps

System requirement during driver installation.

1. Gcc, install gcc via bellow command.

```
# yum install gcc
```

2. Make.

```
# yum install make
```

3. kernel-devel

On CentOS/Redhat/Ubuntu:

Please make sure `/lib/modules/`uname -r`/build` is not empty.

If it's empty, find OS related kernel-devel package on [http://vault.centos.org/<Your\\_Centos\\_version>/os/x86\\_64/Packages/](http://vault.centos.org/<Your_Centos_version>/os/x86_64/Packages/) and install it.

**Take CentOS 6.4 for example:**

```
# wget http://vault.centos.org/6.4/os/x86_64/Packages/kernel-devel-2.6.32-358.el6.x86_64.rpm
# yum install kernel-devel-2.6.32-358.el6.x86_64.rpm
```

Make provided NVMe driver source code.

```
# cd /<Path_to_FW_ServicePack>/driver/linux
# make
# make install
```

Note: Please refer to chapter [Variable Properties](#) for definition of the variable in `<...>`.

## Check Device under Linux

Check the device via bellow command under Linux system.

```
# ls /dev/nvme*
/dev/nvmeX /dev/nvmeXn1
```

nvme0 represents controller, nvme0n1 represents namespace.

Device name of NVMe PCIe SSD is `/dev/nvmeXn1`, X represents deployed NVMe PCIe SSD in system (Such as `/dev/nvme0n1`; `/dev/nvme1n1`; `/dev/nvme2n1` and etc.)

## Manually Install NVMe Driver under Windows

### Driver Introduction

PBlaze5 is functional with windows In-box driver. If wants to use `nvmemgr` CLI tool to realize upgrade, format, monitor functions, user needs to update the driver with Memblaze provided windows driver, as following table listed.

Table: NVMe Driver Supported Windows Systems

NVMe Driver Support	Operation System	
In-box Driver	Windows	Server 2012 R2

### Provided NVMe Driver Installation Steps

1. Navigate to **Device Manager > Storage controllers** under Windows, expand all listed controller info.
2. Select Windows in-box nvme driver > **Standard NVM Express Controller**, right-click the mouse to click **Uninstall**.
3. Click **OK** to confirm uninstall Windows in-box driver.
4. Check **Storage controllers** field, no **Standard NVM Express Controller** displayed.
5. Enter folder `\<Path_to_ServicePack>\driver\windows` which stores Memblaze provided Windows nvme driver.



6. According to your OS version, select Memblaze provided Windows nvme driver version, right-click the mouse and click **Install**.
7. Navigate to **Device Manager**, mouse over the top server entry, right-click the mouse and click **Scan for hardware changes**.
8. Check **Storage controllers** field, **Memblaze NVMe driver** displayed.
9. nvmmemgr tool is functional after Memblaze provided nvme driver installed.

```
C:\cygwin64\home\Administrator\<<WinNVMeTool_Version> nvmmemgr list
controller nvme0 <nvme namespace nvme0n1>:
- device path :\\.\Scsi1
- vendor id    :1c5f
- subsystem vendor id : 1c5f
- model number : <SSD_MN>
- fw version   : <FW_Version>
- serial number : <SSD_SN>
```

Note: Please refer to chapter [Variable Properties](#) for definition of the variable in <...>.

## Device Initialization and Check under VMware ESXi

### Device Initialization

1. Start a web browser on a client machine and connect to deployed vSphere URL.
2. Navigate to configuration > **Storage** via vSphere client.
3. Click **New datastore**.
4. Select one datastore type to create, click **Next**.
5. Select Memblaze PBlaze series SSD on which to create datastore, click **Next**.
6. In the Name field, type the name of the new datastore, click **Next**.
7. Select partitioning option, click **Next**.
8. Click **Finish** > **Yes** to complete datastore creation.

### Device Check under VMware ESXi

Check the device via bellow command under VMware ESXi system.

Note: Please refer to chapter [Variable Properties](#) for definition of the variable in <...>.

1. List device name.

```
# esxcli storage core device list | grep -i "Display Name" | grep -i "nvme"
Display Name: Local NVMe Disk (t10.NVMe____<SSD_MN>____<SSD_SN>____<Namespace_ID>)
```

2. List detailed device info.

```
# esxcli storage core device list -d t10.NVMe____<SSD_MN>____<SSD_SN>____<Namespace_ID>
t10.NVMe____<SSD_MN>____<SSD_SN>____<Namespace_ID>
Display Name: Local NVMe Disk (t10.NVMe____<SSD_MN>____<SSD_SN>____<Namespace_ID>)
Has Settable Display Name: true
Size: 3662830
.....
```

### Firmware Check under VMware ESXi

Check the firmware via bellow command under VMware ESXi 6.5.

1. List firmware version.



```
# esxcli nvme device get -A vmhba2
Controller Identify info:
  PCIID: 0x1c5f
  PCISSVID: 0x1c5f
  Serial Number: <SSD_SN>
  Model Number: <SSD_MN>
  Firmware Revision: <SSD_FW_Version>
.....
```

Note: Please refer to chapter [Variable Properties](#) for definition of the variable in <...>.

# Firmware Upgrade

Following is general firmware upgrade instructions description. For specific firmware version upgrade, please contact Memblaze pre-sales engineers to obtain corresponding upgrade manual **<Memblaze\_Product\_Series>\_<FW\_Version>\_Upgrade\_SOP** for reference.

## Firmware Upgrade under Linux + nvmecli (Recommended)

**Note: open source nvme-cli tool is required to install. Please refer to [Memblaze nvme-cli User Guide](#) for nvme-cli installation, for better user experience please upgrade nvme-cli to 1.6+.**

Please refer to chapter [Variable Properties](#) for definition of the variable in <...>.

1. Check running slot and firmware storage info.

```
# nvme fw-log /dev/nvme0n1 -o json
{
  "nvme0n1" : {
    "Active Firmware Slot (afi)" : 1,
    "Firmware Rev Slot 1" : "xxxx (<SSD_FW_Version>)" //nvme-cli version bellow 1.6, the numbering
                                                    of slot starts from 0 to 6
    "Firmware Rev Slot 2" : "0 (.....)", // Slot without firmware may not be shown under different OS.
    "Firmware Rev Slot 3" : "0 (.....)",
    "Firmware Rev Slot 4" : "0 (.....)",
    "Firmware Rev Slot 5" : "0 (.....)",
    "Firmware Rev Slot 6" : "0 (.....)",
    "Firmware Rev Slot 7" : "0 (.....)"
  }
}
```

Slot 1 is read-only for factory firmware storage, only slot 2 and 3 can be selected. As above example, current working slot is 1, select slot 2 to activate.

2. Download firmware.

```
# cd <Path_to_Release_FW>
# nvme fw-download /dev/nvme0 -f ./<Release_FW>
Firmware download success
```

3. Activate firmware with specific slot after download. Such as slot 2.

```
# nvme fw-activate /dev/nvme0 -s 2 -a 1
Success activating firmware action:1 slot:2, but firmware requires conventional reset
```

Or on nvmecli version 1.5 and up, firmware activation command changes to fw-commit.

```
# nvme fw-commit /dev/nvme1 -s 2 -a 1
```

4. The new firmware can only be activated after a power cycling (off and then on again).

```
# shutdown -P 0
```

5. Check firmware active status.

```
# nvme fw-log /dev/nvme0n1 -o json
{
  "nvme0n1" : {
    "Active Firmware Slot (afi)" : 2,
    "Firmware Rev Slot 1" : "xxxx (<SSD_FW_Version>)"
    "Firmware Rev Slot 2" : "xxxx (<SSD_FW_Version>)"
    "Firmware Rev Slot 3" : "0 (.....)",
  }
}
```

```
"Firmware Rev Slot 4" : "0 (.....)",
"Firmware Rev Slot 5" : "0 (.....)",
"Firmware Rev Slot 6" : "0 (.....)"
"Firmware Rev Slot 7" : "0 (.....)"
}
}
```

Current working slot is 2, firmware upgrade is being applied successfully.

## Firmware Upgrade under Linux + nvmeadm

Operation procedure of firmware update, two methods for user to upgrade.

**Note:** nvmeadm tool is required to install. Please refer to [Memblaze nvmeadm User Guide](#) for nvmeadm installation.

### Automatically Upgrade

1. Enter the folder stores firmware .tar file.

```
# cd /<Path_to_Release_FW>
```

Note: Please refer to chapter [Variable Properties](#) for definition of the variable in <...>.

2. Activate firmware after download firmware automatically.

```
# nvmeadm fwdownload -i <Release_FW> -c nvme0
Current running FW version: <SSD_FW_Version>
header: xxxx
FW image version: <SSD_FW_Version>
fwdownload: firmware image size 1351684
fwdownload success.
Auto-activate this firmware...
slot used: 2 total_slots: 3
Error in command "Firmware Activate" : Firmware Application requires conventional reset.
Fw activate success..
```

3. The new firmware can only be activated after a power cycling (off and then on again).

```
# shutdown -P 0
```

4. Check running slot and newly upgrade firmware info.

```
# nvmeadm getlogpage -c nvme0 -p -l 3
Active Firmware Info           : 0x2
- current working slot         : 2
- slot that is going to be activated : NONE
Firmware Revision on Slot 1    : <SSD_FW_Version>
Firmware Revision on Slot 2    : <SSD_FW_Version>
Firmware Revision on Slot 3    : Empty
Firmware Revision on Slot 4    : Empty
Firmware Revision on Slot 5    : Empty
Firmware Revision on Slot 6    : Empty
Firmware Revision on Slot 7    : Empty
```

Total 3 slot supported, slot 1 is read-only for factory firmware storage. Current working slot is 2, which the Firmware Revision displayed is newly upgrade firmware version.

### Upgrade via Specified Slot

Note: Please refer to chapter [Variable Properties](#) for definition of the variable in <...>.

1. Enter the folder stores firmware .tar file.

```
# cd /<Path_to_FW_Package>
```

- Download firmware.

```
# nvmemgr fwdownload -n -i <Release_FW> -c nvme0
Current running FW version: <SSD_FW_Version>
header:xxxx
FW image version: <SSD_FW_Version>
fwdownload: firmware image size 1658884
fwdownload success.
```

- Check and choose available slot to download and upgrade firmware. Check firmware version of different slot through bellow command.

```
# nvmemgr getlogpage -c nvme0 -p -l 3
Active Firmware Info           : 0x2
- current working slot         : 2
- slot that is going to be activated : NONE
Firmware Revision on Slot 1    : <SSD_FW_Version>
Firmware Revision on Slot 2    : <SSD_FW_Version>
Firmware Revision on Slot 3    : Empty
Firmware Revision on Slot 4    : Empty
Firmware Revision on Slot 5    : Empty
Firmware Revision on Slot 6    : Empty
Firmware Revision on Slot 7    : Empty
```

Slot 1 is read-only for factory firmware storage, only slot 2 and 3 can be selected. As above example, current working slot is 2, so slot 3 can be chosen to activate.

- Activate firmware with specific slot after download. Such as slot 3.

```
# nvmemgr fwactivate -c nvme0 -a 1 -s 3
Command warning : Firmware Application requires conventional reset.
fw activate success.
```

- The new firmware can only be activated after a power cycling (off and then on again).

```
# shutdown -P 0
```

- Check running slot and newly upgrade firmware info.

```
# nvmemgr getlogpage -c nvme0 -p -l 3
Active Firmware Info           : 0x3
- current working slot         : 3
- slot that is going to be activated : NONE
Firmware Revision on Slot 1    : <SSD_FW_Version>
Firmware Revision on Slot 2    : <SSD_FW_Version>
Firmware Revision on Slot 3    : <SSD_FW_Version>
Firmware Revision on Slot 4    : Empty
Firmware Revision on Slot 5    : Empty
Firmware Revision on Slot 6    : Empty
Firmware Revision on Slot 7    : Empty
```

Current working slot is 3, which the Firmware Revision displayed is newly upgrade firmware version.

## Firmware Upgrade under Windows + nvmemgr

- Following Windows driver installation steps to complete driver installation. Refer to Provided NVMe Driver Installation Steps.
- nvmemgr tool is functional after driver installation. The CLI tool under Windows has the same command syntax with tool under Linux. Please refer to [Firmware Upgrade under Linux + nvmemgr](#) to complete firmware upgrade.



## Firmware Upgrade under VMware

1. nvmeMgr tool is required to install.
2. Find Memblaze PBlaze Series SSD to download firmware.

```
# [root@localhost:~] lspci | grep -i mass
0000:03:00.0 Mass storage controller: LSI PERC H730 Mini [vmhba0]
0000:0a:00.0 Mass storage controller: [vmhba3] // PBlaze5
0000:83:00.0 Mass storage controller: [vmhba2]
0000:84:00.0 Mass storage controller: [vmhba1]
[root@localhost:~] esxcli nvme device get -A vmhba3 | more
Controller Identify Info:
  PCIID: 0x1c5f
  PCISSVID: 0x1c5f
  Serial Number: <SSD_SN>
  Model Number: <SSD_MN>
  Firmware Revision: <FW_Version>
```

Choose vmhba3 to download firmware.

```
# [root@localhost:~] esxcli nvme device list
HBA Name Status Signature
-----
vmhba3 Online nvmeMgmt-nvme00100000
vmhba2 Online nvmeMgmt-nvme001310000
vmhba1 Online nvmeMgmt-nvme001320000
```

3. Check and choose available slot to download and upgrade firmware.

```
# [root@localhost:~] esxcli nvme device log get -A vmhba3 -l 3
Active Firmware Info: 0x1
  Firmware Slot to Be Activated at Next Controller Reset: 0
  Firmware Slot Being Activated: 1
  Firmware Revision for Slot 1: <SSD_FW_Version>
  Firmware Revision for Slot 2:
  Firmware Revision for Slot 3:
  Firmware Revision for Slot 4:
  Firmware Revision for Slot 5:
  Firmware Revision for Slot 6:
  Firmware Revision for Slot 7:
```

As above example, current working slot is 1, so slot 2 can be chosen to activate.

4. Download the firmware .tar file to vmhba3 and slot2.

```
# cd <Path_to_Release_FW>
# [root@localhost:~] esxcli nvme device firmware download -s 2 -A vmhba3 -f ./<Release_FW>
Load firmware success. fw_size = 1351684 Byte
Download firmware to NVMe controller successfully.
Commit downloaded firmware to slot 2 successfully..
```

5. Complete firmware download.

```
# [root@localhost:~] esxcli nvme device log get -A vmhba3 -l 3
Active Firmware Info: 0x1
  Firmware Slot to Be Activated at Next Controller Reset: 0
  Firmware Slot Being Activated: 1
  Firmware Revision for Slot 1: <SSD_FW_Version>
  Firmware Revision for Slot 2: <SSD_FW_Version> // newly downloaded firmware
  Firmware Revision for Slot 3:
  Firmware Revision for Slot 4:
  Firmware Revision for Slot 5:
```

```
Firmware Revision for Slot 6:  
Firmware Revision for Slot 7:
```

6. Activate the firmware to slot 2.

```
# esxcli nvme device firmware activate -s 2 -A vmhba3  
Activate firmware in slot 2 successfully but need code reboot..
```

Check slot status after activating the firmware, the slot 2 will be activated at next controller reset.

```
# [root@localhost:~] esxcli esxcli nvme device log get -A vmhba3 -l 3  
Active Firmware Info: 0x21  
Firmware Slot to Be Activated at Next Controller Reset: 2  
Firmware Slot Being Activated: 1  
Firmware Revision for Slot 1: <SSD_FW_Version>  
Firmware Revision for Slot 2: <SSD_FW_Version>  
Firmware Revision for Slot 3:  
Firmware Revision for Slot 4:  
Firmware Revision for Slot 5:  
Firmware Revision for Slot 6:  
Firmware Revision for Slot 7:
```

7. After warm reboot firmware will be activated at slot 2.

```
# [root@localhost:~] esxcli nvme device log get -A vmhba3 -l 3  
Active Firmware Info: 0x2  
Firmware Slot to Be Activated at Next Controller Reset: 0  
Firmware Slot Being Activated: 2 // Slot 2 is activated.  
Firmware Revision for Slot 1: <SSD_FW_Version>  
Firmware Revision for Slot 2: <SSD_FW_Version>  
Firmware Revision for Slot 3:  
Firmware Revision for Slot 4:  
Firmware Revision for Slot 5:  
Firmware Revision for Slot 6:  
Firmware Revision for Slot 7:
```

# Firmware Upgrade without Reset

Table: Firmware Upgrade Without Reset on PBlaze5 Series

Product Series	PBlaze5 910/916 Series	PBlaze5 510/516 Series	PBlaze5 920 Series
Firmware Upgrade without Reset	2.13.00D.M0 and up	Not support	Support

Following is general firmware upgrade instructions description. For specific firmware version upgrade, please contact Memblaze pre-sales engineers to obtain corresponding upgrade manual **<Memblaze\_Product\_Series>\_<FW\_Version>\_Upgrade\_SOP** for reference.

## Firmware Upgrade without Reset under Linux + nvmecli

**Note:** open source nvme-cli tool is required to install. Please refer to [Memblaze nvme-cli User Guide](#) for nvme-cli installation, for better user experience please upgrade nvme-cli to 1.6+.

Please refer to chapter [Variable Properties](#) for definition of the variable in <...>.

1. Check running slot and firmware storage info.

```
# nvme fw-log /dev/nvme0n1 -o json
{
  "nvme0n1" : {
    "Active Firmware Slot (afi)" : 1,
    "Firmware Rev Slot 1" : "xxxx (<SSD_FW_Version>)" //nvme-cli version bellow 1.6, the numbering
                                                    of slot starts from 0 to 6
    "Firmware Rev Slot 2" : "0 (.....)", // Slot without firmware may not be shown under different OS.
    "Firmware Rev Slot 3" : "0 (.....)",
    "Firmware Rev Slot 4" : "0 (.....)",
    "Firmware Rev Slot 5" : "0 (.....)",
    "Firmware Rev Slot 6" : "0 (.....)",
    "Firmware Rev Slot 7" : "0 (.....)"
  }
}
```

Slot 1 is read-only for factory firmware storage, only slot 2 and 3 can be selected. As above example, current working slot is 1, select slot 2 to activate.

2. Download firmware.

```
# cd <Path_to_Release_FW>
# nvme fw-download /dev/nvme0 -f ./<Release_FW>
Firmware download success
```

3. Activate firmware with specific slot after download. Such as slot 2.

```
# nvme fw-activate /dev/nvme0 -s 2 -a 3
```

Or on nvmecli version 1.5 and up, firmware activation command changes to fw-commit.

```
# nvme fw-commit /dev/nvme1 -s 2 -a 3
Success committing firmware action:3 slot:2
```

4. Check firmware active status.

```
# nvme fw-log /dev/nvme0n1 -o json
{
  "nvme0n1" : {
```

```
"Active Firmware Slot (afi)" : 2,  
"Firmware Rev Slot 1" : "xxxx (<SSD_FW_Version>)"  
"Firmware Rev Slot 2" : "xxxx (<SSD_FW_Version>)"  
"Firmware Rev Slot 3" : "0 (.....)",  
"Firmware Rev Slot 4" : "0 (.....)",  
"Firmware Rev Slot 5" : "0 (.....)",  
"Firmware Rev Slot 6" : "0 (.....)"  
"Firmware Rev Slot 7" : "0 (.....)"  
}  
}
```

Current working slot is 2, firmware upgrade is being applied successfully.

# Secure or Safe Erase

Re-format a specified namespace on the given device. Can erase all data in namespace (user data erase) or delete data encryption key if specified. Can also be used to change LBA sector size to change the namespaces reported physical block format.

## Safe Erase under Linux +nvmecli

**Note:** open source nvme-cli tool is required to install. Please refer to [Memblaze nvme-cli User Guide](#) for nvme-cli installation.



**Warning:** All user data will be deleted after safe erase. Remember to back your data before the operation.

### USAGE:

```
nvme format <device> [OPTIONS]
```

### OPTIONS:

```
[ --namespace-id=<NUM>, -n <NUM> ]      --- Identifier of desired namespace
[ --lbaformat=<NUM>, -l <NUM> ]          --- LBA format to apply (required)
                                          0: 512 bytes
                                          1: 4096 bytes
                                          2: 512B
                                          3: 4096B
[ --ses=<NUM>, -s <NUM> ]              --- [0-2]: secure erase
                                          0: Safe erase all user data
                                          1: Safe erase all user data and delete encryption key
                                          2: Cryptographic Erase: All user data will be erased
                                          cryptographically by deleting the encryption key
```

## Safe Erase + nvmecli

Example1:

The sector size of PBlaze5 is 512 bytes by default. Secure erase device and format sector to the same size such as 512 bytes, (if no -l parameter designated, sector size will be formatted to 512 bytes by default).

```
# nvme format /dev/nvme0n1 -s 1
```

Example2:

Secure erase device and format sector to different size, such as from 512 bytes to 4K (4096B).

```
# nvmecli formatnvme -c nvme0 -l 1 -s 1
```

nvme reload driver is required after change sector to different size.

```
# modprobe -r nvme
# modprobe nvme
```

**Note:** No I/O request on PBlaze5 device before executing format command.



### Crypto erase + nvmecli

Format device by deleting encryption key. PBlaze5 only supports encryption (crypto erase) with 4K sector size setting.

Example: Crypto erase (-s 2) and format sector size from 512B to 4K (-l 1).

```
# nvme format /dev/nvme0 -l 1 -s 2
```

nvme reload driver is required after change sector to different size.

```
# modprobe -r nvme  
# modprobe nvme
```

**Note: No I/O request on PBlaze5 device before executing format command.**

## Secure Erase under Linux + nvmeadm

Secure erase is an option of nvmeadm tool “formatnvme” command to PBlaze5 device.

**Note:** nvmeadm tool is required to install. Please refer to [Memblaze nvmeadm User Guide](#) for nvmeadm installation.



**Warning:** All user data will be cleared after secure erase. Remember to back your data before the operation.

### USAGE:

```
nvmeadm formatnvme <device> [OPTIONS]
```

### OPTIONS:

```
[--lbaformat=<id>, -l<id>]    --- LBA format to apply (required)
                                0   Use LBA format 0 (sector size 512B) to format.
                                1   Use LBA format 1 (sector size 4096B) to format.
                                2   Use LBA format 0 (sector size 512B) to format.
                                3   Use LBA format 1 (sector size 4096B) to format.
                                4   Use LBA format 0 (sector size 512B) to format.
                                5   Use LBA format 1 (sector size 4096B) to format.

[--secureerase=<id>, -s<id>]  --- [0-2]: secure erase
                                0   No security erase needed. The default value.
                                1   User data should be erased first.
                                2   User data should be erased first by deleting the encryption key.
```

### Example1:

The sector size of PBlaze5 is 512 bytes by default. Secure erase device and format sector to the same size such as 512 bytes, (if no -l parameter designated, sector size will be formatted to 512 bytes by default).

```
# nvmeadm formatnvme -c nvme0 -l 0 -s 1
```

### Example2:

Secure erase device and format sector to different size, such as from 512 bytes to 4K (4096B).

```
# nvmeadm formatnvme -c nvme0 -l 1 -s 1
```

nvme reload driver is required after change sector to different size.

```
# modprobe -r nvme
# modprobe nvme
```

**Note:** No I/O request on PBlaze5 device before executing format command.

# Power Mode Management

## Power Mode Setting

Table: PBlaze5 Supported Power Modes and Default Power Setting

Product Series	PBlaze5 910/920 Series	PBlaze5 510/516 Series
Supported Power Mode ID	0 = 25W, 1 = 24W, 2 = 23W, 3 = 22W, 4 = 21W, 5 = 20W, 6 = 19W, 7 = 18W, 8 = 17W, 9 = 16W, 10 = 15W, 11 = 14W, 12 = 13W, 13 = 12W, 14 = 11W, 15 = 10W	0 = 14W, 1 = 13W, 2 = 12W, 3 = 11W, 4 = 10W, 5 = 9W, 6 = 8W, 7 = 7W
Default Power Mode	25W	14W

For PBlaze5 910/920 series, set power mode to 20w(Power mode ID is 5), Power Management feature ID is 2:

```
# nvme set-feature /dev/nvme0 -f 2 -v 5 -s 1
set-feature:02 (Power Management), value:0x000005
```

For PBlaze5 510/516, set power mode to 10w(Power mode ID is 4), Power Management feature ID is 2:

```
# nvme set-feature /dev/nvme0 -f 2 -v 4 -s 1
set-feature:02 (Power Management), value:0x000004
```

## Check Current Power Mode Setting

Table: PBlaze5 Supported Power Modes and Default Power Setting

Product Series	PBlaze5 910/916	PBlaze5 510/516
Supported Power Mode (HEX)	0x00 = 25W, 0x01 = 24W, 0x02 = 23W, 0x03 = 22W, 0x04 = 21W, 0x05 = 20W, 0x06 = 19W, 0x07 = 18W, 0x08 = 17W, 0x09 = 16W, 0x0a = 15W, 0x0b = 14W, 0x0c = 13W, 0x0d = 12W, 0x0e = 11W, 0x0f = 10W	0x00 = 14W, 0x01 = 13W, 0x02 = 12W, 0x03 = 11W, 0x04 = 10W, 0x05 = 9W, 0x06 = 8W, 0x07 = 7W

For PBlaze5 910/920 series, Power Management feature ID is 2, current power mode displays as 0x00000f(0x0f), so power mode is 10W:

```
# nvme get-feature /dev/nvme0 -f 2
get-feature:0x2 (Power Management), Current value:0x00000f
```

For PBlaze5 510/516, Power Management feature ID is 2, current power mode displays as 00000000 (0x00), so power mode is default 14W:

```
# nvme get-feature /dev/nvme0 -f 2
get-feature:0x2 (Power Management), Current value:00000000 //Default power mode display with no "0x" prefix
```



# Monitor Device Status

**Note:** nvmemgr tool is required to install. Please refer to [Memblaze nvmemgr User Guide](#) for nvmemgr installation.

## Sub-command “monitor” to list device status

The ‘monitor’ sub-command is used to monitor and display SN, capacity, firmware, controller temperature, power, performance and etc. in real time.

### Example:

```
#nvmemgr monitor -i 1000 -c nvme0
(c) 2015 Memblaze Technology Co., Ltd (All Rights Reserved)
-----
Manufacture Name:      Memblaze Technology Co.,Ltd
Model Number:         EEFDHAR2TATCT-AAR1ZABYYES
Serial Number:        Z09000013
Available Capacity:   2.00TB //User available capacity
Percentage of Spare Space 100% //Remaining percentages of effective Over-provisioning, initial for 100% (no
                        bad block). As bad block increment, available OP will decrease and enter device
                        read-only status if OP is lower than threshold of spare space.
Threshold of Spare Space 5% // Device will enter read-only status if OP is lower than threshold of spare space.
                        (While as the real mass tests, OP will not decrease to 5% as bad block
                        increment at the end life of device.)
Percentage of Device Life Used 1% //100% represents device endurance is used up.
                        (device may continue workable, but with error rate increased significantly)
Total Read             1.04GB //Host read amount of data
Total Write:          31.23TB //Host write amount of data

Name:                 /dev/nvme0
Firmware:             100005K0 //Firmware version
Power Cycles:         752
Power-on Hours:      265

Device Temperature:   Current  Max    Min
                    27C     40C   26C //Device maximum and minimum
                    //temperature can be preserved after restart.
Power:                7W      14W   7W //Device maximum and minimum
                    //power can be preserved after restart.
Status:               Safe    // There are Safe, Read-only, Abnormal mode.
                    //When shows abnormal, please analyze with Critical Warning
                    //in SMART info (Critical Warning is not 0).

Current Read IOPS:    0.00K
Current Write IOPS:   0.00K
Current Read Bandwidth: 0.00MB/s
Current Write Bandwidth: 0.00MB/s
```

## Check SMART info + nvmemgr

The acronym SMART stands for Self-Monitoring, Analysis and Reporting Technology. SMART information is collected by storage drive itself and contains data relevant to check reliability. The aims of SMART is to monitor SSD health and give early warning once exceeds corresponding thresholds. This data can be read and interpreted with the help of utilities (such as Memblaze provided NVMe SSD management tool).

There are standard SMART defined by NVMe standard and additional SMART defined by Memblaze. It can be achieved via getlogpage sub-command.

- 2 Standard SMART information log
- 224 PBlaze5 specific SMART log

**Example: Get standard SMART info via Memblaze nvmemgr tool**

```
# nvmemgr getlogpage -p -c nvme0 -l 2
```

Full content of the SMART can be listed from generated .csv file.

```
[root@aetest ~]# ls log*
log01.csv log02.csv log03.csv
[root@aetest ~]# cat log02.csv
Critical Warning ,0x0 //Not 0 represents device is abnormal
- Spare space below the threshold ,NO //Yes represents OP is lower than threshold
- Temperature above the threshold ,NO //Yes represents device temperature exceeds the threshold
- Device reliability degraded ,NO //Yes represents device is abnormal
- Media in read-only mode ,NO //Yes represents device is abnormal
- Volatile memory backup device failed ,NO //Yes represents device is abnormal
Device Temperature ,0x135
- In units of Kelvin : 309
- In units of Celsius : 36 //Current Max (board, core, Flash temperature)
Percentage of Spare Space ,100(0x64) // Same as monitor output
Threshold of Spare Space ,5(0x5) // Same as monitor output
Percentage of Device Life Used ,8(0x8) // Same as monitor output
Data Read ,0x01c4cab32
- Total read from controller ,237.393 TB // Same as monitor output
Data Written ,0x01fe077d7
- Total write to controller ,267.402 TB // Same as monitor output

Read Commands Completed by Controller ,0x0b0d5b9332
Write Commands Completed by Controller ,0x0cb99f6866
Controller Busy Time(minutes) ,0x00
Power Cycles ,11
Power-on Hours ,552
Number of Unsafe Shutdown ,0x00
Number of Media Errors ,0x00 //Not 0 represents read error appears.
Number of Error Log Entries Over Life ,0x00
```

**Check SMART info + nvmecli**

**Note:** open source nvme-cli tool is required to install. Please refer to [Memblaze nvme-cli User Guide](#) for nvme-cli installation.

The acronym SMART stands for Self-Monitoring, Analysis and Reporting Technology. SMART information is collected by storage drive itself and contains data relevant to check reliability. The aims of SMART is to monitor SSD health and give early warning once exceeds corresponding thresholds. This data can be read and interpreted with the help of utilities, such as open source nvmecli management tool.

There are standard SMART defined by NVMe standard and additional SMART defined by Memblaze, the definition of SMART output please refer to latest [Memblaze Product Series](#) *Product Spec*.

**Get Standard SMART info**

```
# nvme smart-log /dev/nvme0
```

**Get Memblaze defined SMART info**

```
# nvme memblaze smart-log-add /dev/nvme0
```

# OoB Firmware Upgrade

**Note:** nvmemgr tool is required to install. Please refer to [Memblaze nvmemgr User Guide](#) for nvmemgr installation.

1. Check oob version

```
# nvmemgr --type p5 oob-fw-version -c nvme0  
the current oob firmware version : <oob_Version>
```

2. Enter the folder stores oob firmware .bin file and execute download operation.

```
# cd <Path_to_oob_FW>  
# nvmemgr --type p5 oob-fw-download -i OOB_Firmware.bin -c nvme0  
start to update oob firmware, file name : OOB_Firmware.bin, file size : 31068 bytes  
oob firmware download successfully
```

There is no prompt after download execution, continue next step after execution is complete.

3. Activate the oob firmware

```
# nvmemgr --type p5 oob-fw-activate -c nvme0  
activate oob firmware
```

4. Check oob version again and make sure the upgrade process is successful.

```
# nvmemgr --type p5 oob-fw-version -c nvme0  
the current oob firmware version : <oob_Version>
```