Using HighPoint NVMe RAID AICs with the Dell Precision 7920 Tower Workstation

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1. Dell Precision 7920 Tower Workstation introduction

This document provides guidelines and procedures for installing HighPoint NVMe AICs into the Dell Precision 7920 Tower Workstation platform. The guide examines the performance capabilities of each PCIe slot, and provides recommended hardware configurations that can be used to optimize NVMe storage configurations for maximum throughput and capacity.

1.1 Chipset

Dell Precision 7920 Tower Workstation Chipset: Intel C621

1.2 Processor Types

Dell Precision 7920 Tower Workstation processor types:
● Intel Xeon Platinum 81xx Processors
● Intel Xeon Gold 61xx Processors
● Intel Xeon Gold 51xx Processors
● Intel Xeon Silver 41xx Processors
● Intel Xeon Bronze 31xx Processors
● Intel Xeon Gold 52xx processors
● Intel Xeon Silver 42xx processors
● Intel Xeon Bronze 32xx processors
● Intel Xeon Platinum 82xx processors
● Intel Xeon Gold 62xx processors

1.3 Memory

Memory type: DDR4/ LRDIMM/ RDIMM/ ECC
Memory capacities: 128 GB per slot 2666 MHz DDR4/ 64 GB per slot 2933 MHz DDR4/ 128 GB per slot 3200 MHz DDR4
Memory slot: 24 DIMM slots (12 per CPU)

1.4 PCIe slots

Dell Precision 7920 PCIe Expansion Slot Configuration:

Slot	Type	Volatile supported	Max Height (in, cm)	Max Length (in, cm)	Max Wattage	Cards Supported
1	PCIe x8 Gen 3 open ended slot	3.30V/12V	Full Height 4.38in / 11.13cm	Full Length 12.28 in / 31.20cm	25	Storage, UltraSpeed Duo, Tera2 Host Card
2	PCIe x16 Gen 3	3.30V/12V	Full Height 4.38in / 11.13cm	Full Length 12.28 in / 31.20cm	300*	Graphics
3	PCIe x16(x1) Gen 3	3.30V/12V	Full Height 4.38in / 11.13cm	Full Length 12.28 in / 31.20cm	25	Tera2 Host Card, 1GbE NIC, 2.5/5GbE NIC, Serial Port
4	PCIe x16 Gen 3	3.30V/12V	Full Height 4.38in / 11.13cm	Full Length 12.28 in / 31.20cm	300*	Graphics, UltraSpeed Quad, Tera2 Host Card, 10G NIC, Serial, Thunderbolt
5	PCIe x16 (x4) Gen 3	3.30V/12V	Full Height 4.38in / 11.13cm	Full Length 12.28 in / 31.20cm	25	Tera2 Host Card, 1GbE NIC, Serial Port, 2.5/5GbE NIC, Thunderbolt
6	PCIe x16 Gen 3	3.30V/12V	Full Height 4.38in / 11.13cm	Full Length 12.28 in / 31.20cm	300*	Requires optional 2nd CPU Graphics, UltraSpeed Duo, UltraSpeed Quad, or Tera2
7	PCIe x16 Gen 3	3.30V/12V	Full Height 4.38in / 11.13cm	Full Length 12.28 in / 31.20cm	75	Requires optional 2nd CPU Graphics, UltraSpeed Duo, UltraSpeed Quad, or Tera2

2. HighPoint NVMe RAID AIC compatibility in Dell Precision 7920 Tower Workstation

HighPoint NVMe RAID AICs	Slot1 PCIe 3.0 x8 CPU0	Slot2 PCIe 3.0 x16 CPU0	Slot3 PCIe 3.0 x16 (x1 electrical) CPU0	Slot4 PCIe 3.0 x16 CPU0	Slot5 PCIe 3.0 x16 (x4 electrical) CPU0	Slot6 PCIe 3.0 x16 CPU1	Slot7 PCIe 3.0 x16 CPU1
Gen3 AICs							
SSD7101A	N/A	√	N/A	√	N/A	√	√
SSD7104	N/A	√	N/A	√	N/A	√	√
SSD7105	N/A	√	N/A	√	N/A	√	√
SSD7202	√	√	N/A	√	N/A	√	√
SSD7204	√	√	N/A	√	N/A	√	√
SSD7140A	N/A	√	N/A	√	N/A	√	√
SSD7120	N/A	√	N/A	√	N/A	√	√
SSD6202A	√	√	N/A	√	N/A	N/A	N/A
Gen4 AICs							
SSD7502	N/A	√	N/A	√	N/A	√	√
SSD7505	N/A	√	N/A	√	N/A	√	√
SSD7540	N/A	√	N/A	√	N/A	√	√

Note1: √ means that the HighPoint NVMe RAID AIC can be used normally in this slot.

*Note2: N/A means that it is an untested slot and HighPoint NVMe RAID AIC using this slot will not optimal performance.*

Note3: Slot2 is designated as the default slot for graphics cards.

*Note4: SSD7120 needs to work with Dell backplane component 76W3N.*

3. Installing HighPoint NVMe RAID AIC into Dell Precision 7920 Tower Workstation

3.1 Install hardware

a. Unlock the side cover by press the latch and pull the latch upward.
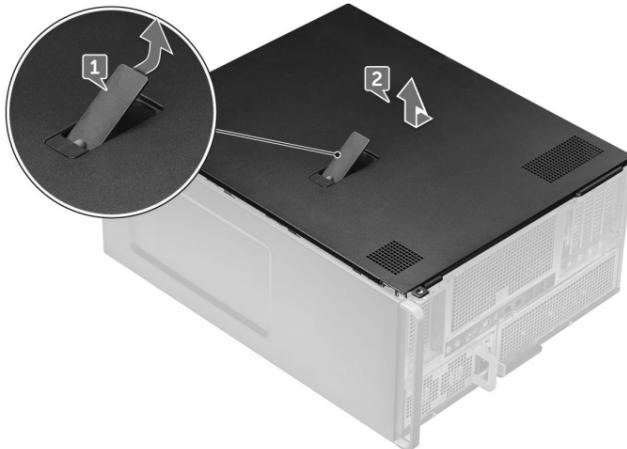
b. Install the HighPoint NVMe RAID AIC into the appropriate PCIe slot.
c. Connect the power cable to the 6-pin power supply of HighPoint NVMe RAID AICs (Required for the SSD7140A/7540).

Connect 6 pin PCIe power cable
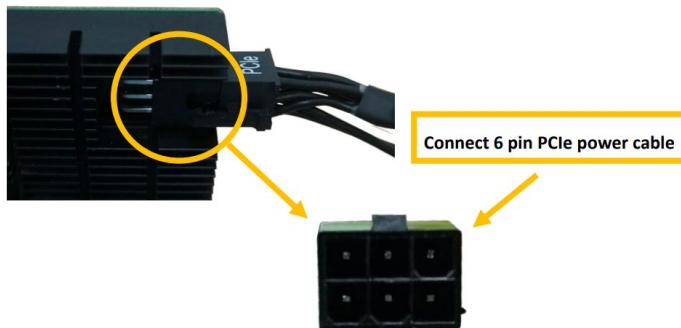
d. If you are installing the SSD7120, connect each SFF-8643 to SFF-8643 cable to the AIC and the backplane component 76W3N connector.
e. Align the side cover with the Dell Precision 7920 Tower Workstation to complete the side cover installation.

3.2 System BIOS Setting

3.2.1 Disable Secure boot

Note: If you are using the SSD7000/7500/7700 series NVMe RAID AICs in Linux or the unsigned UEFI utility, Secure Boot must be disabled. If you are using an SSD6200 series NVMe RAID AICs, Secure Boot can be enabled.

a. Power up the system.
b. Press **F12** to enter BIOS.
c. Find **Settings→Secure Boot→Secure Boot Enable**, select **Disabled**.
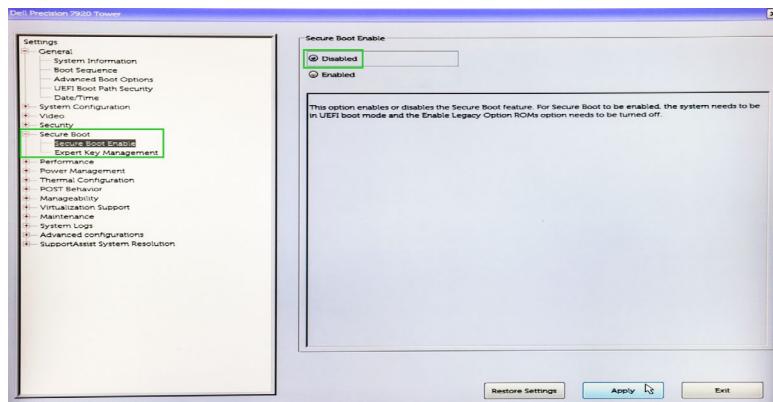
d. Apply configuration and restart system.

3.2.2 Disable Intel VMD Technology

Note: SSD6200 series NVMe RAID AICs don't support Kernel DMA, need to turn off OS Kernel DMA support.

a. Power up the system.
b. Press **F12** to enter BIOS.
c. Find **Settings→ System Configuration → Intel VMD Technology**, select **Disabled**.
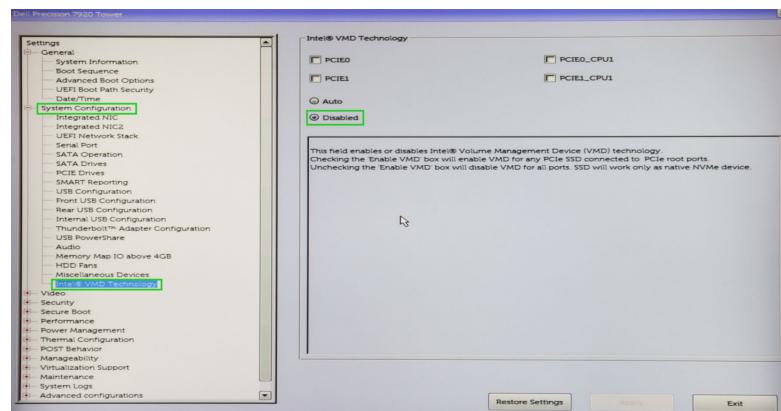
e. Apply configuration and restart system.

3.3 Install software

3.3.1 Installing HighPoint NVMe RAID AICs into the Dell Precision 7920 Tower Workstation (Data RAID configurations)

The following section discusses HighPoint NVMe RAID AIC driver installation for a non-bootable NVMe configuration.

3.3.1.1 Installing the Windows Driver & Management Software

Please refer to the Data RAID Installation Guide (Windows) to install the Windows Device Driver and Management Software.

3.3.1.2 Installing the Linux Driver & Management Software

Please refer to the Data RAID Installation Guide (Linux) to install the Linux Device Driver and Management Software.

3.3.2 Installing HighPoint NVMe RAID AICs into the Dell Precision 7920 Tower Workstation (Boot RAID configurations)

The following section discusses HighPoint NVMe RAID AIC driver installation for a bootable NVMe configuration.

3.3.2.1 Installing a Windows OS to a bootable RAID configuration

Windows BootRAID:
Please refer to HighPoint Windows Boot RAID Windows installation Guide.

3.3.2.2 Installing Linux to a bootable RAID configuration

Debian BootRAID:
Please refer to Linux Debian On HighPoint NVMe RAID Controller Installation Guide.

RHEL BootRAID:

Please refer to Linux_RHEL_On_HighPoint_NVMe_RAID_Controller_Installation Guide.

Ubuntu BootRAID:

Please refer to Linux_Ubuntu_On_HighPoint_NVMe_RAID_Controller_Installation Guide.

Rocky Linux BootRAID:

Please refer to Linux Rocky Linux On HighPoint NVMe RAID Controller Installation Guide.

4. Test HighPoint NVMe RAID AIC

4.1 Performance Testing

4.1.1 Recommended Hardware Configuration

- **Dell T7920:**
  CPU: Intel Xeon Bronze 3204 Processor*1
  Memory: 32GB
  PCIe slot: slot 4
- **HighPoint NVMe RAID AICs:**

Gen3 HighPoint NVMe RAID AICs	SSD7101A
	SSD7104
	SSD7105
	SSD7140A
	SSD7202
	SSD7204
Gen4 HighPoint NVMe RAID AICs	SSD7502
	SSD7505
	SSD7540

- **Disk:**
  Samsung 980 Pro 2TB
  Note: Samsung 980 Pro 2TB Disk spec.
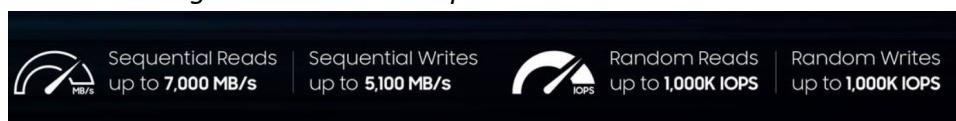
4.1.2 Test tool

Benchmark Tool: Iometer/ CrystalDiskMark

- **Iometer script setting:**
  We will upload the Iometer script to a web page where you can download it.
  Note: If you use the SSD6200 series NVMe RAID AICs, you will need to download another iometer script.
  - The "**2m-seq-read.icf**" script tests the Sequential read performance of 2M large data blocks.
  - The "**2m-seq-write.icf**" script tests the Sequential write performance of 2M large data blocks.

- The "**4k-rand-read.icf**" script tests the Random read performance of 4k small data blocks.
- The "**4k-rand-write.icf**" script tests the Random write performance of 4k small data blocks.

a. Open IOmeter with administrator rights.

b. Click the folder icon to open the script, then select the script to be configured.
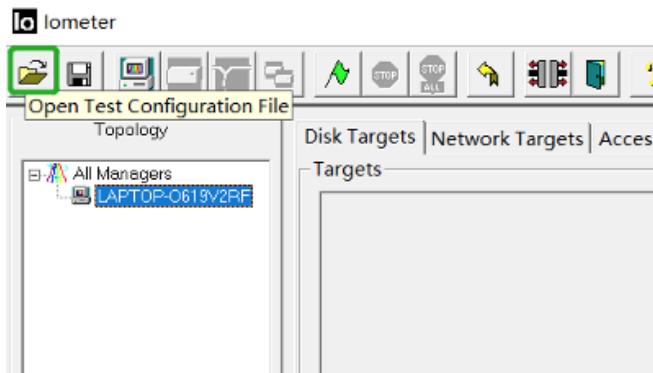

c. Select **2M-seq-read**.
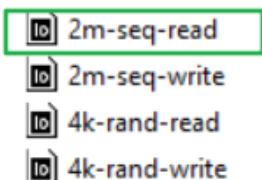
d. The **Disk Targets** page will change, the **Target** should be the test disk (the RAID array). The **Maximum Disk Size** should be set to **16777216** Sectors.
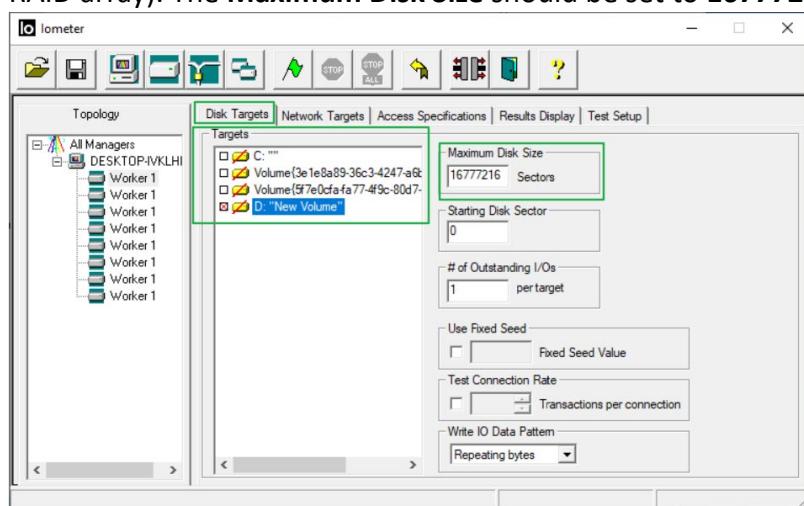
e. After confirming the settings, click the green mark to start the performance test.

f. **Result Display** will be automatically configured as **Start of Test.**
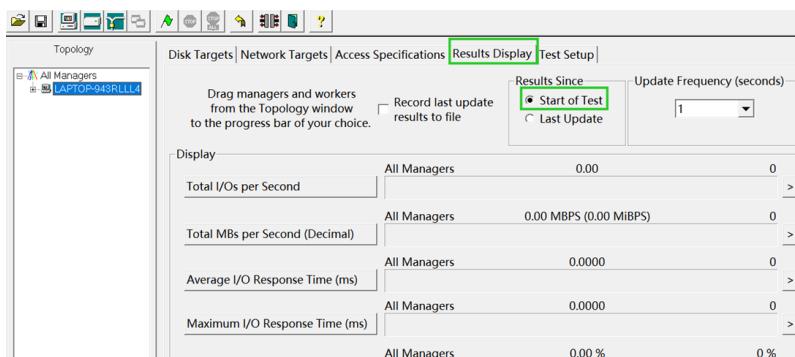
- **CrystalDiskMark script setting:**
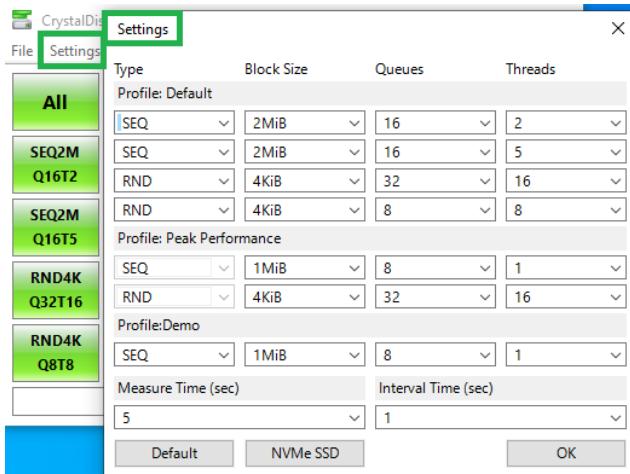
a. Open CrystalDiskMark with administrator rights.

b. Click **Settings.**
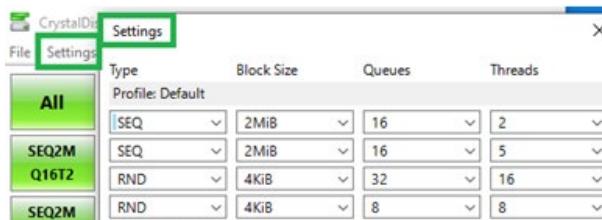
**Note1:** *Please refer to the following Screenshot for recommended settings:*
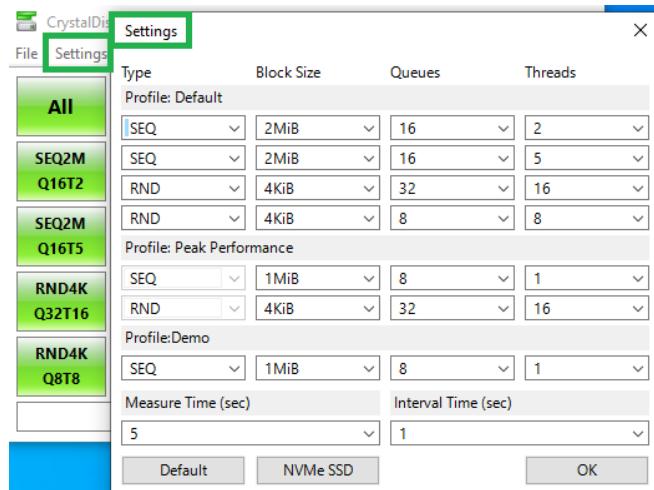
Note2: *The above recommended setting will meet the needs of most NVMe RAID AICs and achieve optimal performance in testing. In testing, you can also choose to adjust the settings in the script yourself for optimal performance.*

c. **Test Size:** set to 8GiB; Test **Drive:** set to the RAID Volume.
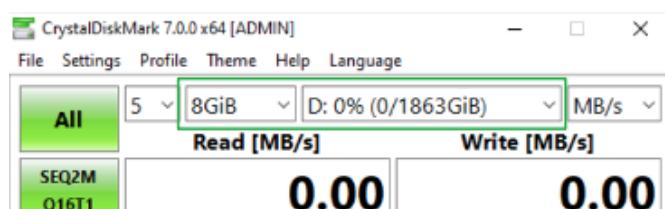
d. After confirming the settings, click **ALL** to start the performance test.
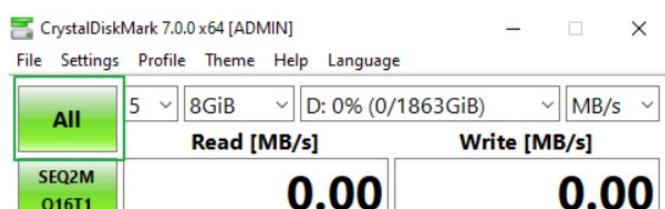
4.1.3 Gen3 HighPoint NVMe RAID AIC test results

- **Iometer**

(script setting)	Gen3 RAID AIC	Legacy	RAID0	RAID1	RAID10
2m-Seq-Read (MiB/s)	SSD7204	3,577	7,131	7,095	7,123
	SSD7202	3,575	7,055	6,960	/
	SSD7101A	3,570	14,104	6,972	14,094
	SSD7140A	3,567	14,232	6,948	14,228
	SSD7105	3,567	14,259	7,120	13,559

	SSD7104	3,577	14,102	7,052	14,101
2m-Seq-Write (MiB/s)	SSD7204	3,446	6,925	3,378	3,430
	SSD7202	3,437	6,801	6,960	/
	SSD7101A	3,502	13,565	3,509	6,803
	SSD7140A	3,511	13,804	3,517	6,900
	SSD7105	3,486	13,654	3,496	6,804
	SSD7104	3,523	13,552	3,515	6,802
4k-Rand-Read (IOPS)	SSD7204	288,474	98,543	103,354	110,057
	SSD7202	289,564	107,111	101,762	/
	SSD7101A	284,276	102,725	97,047	108,564
	SSD7140A	291,209	113,061	101,003	109,909
	SSD7105	287,648	269,112	264,118	265,857
	SSD7104	291,404	96,326	100,858	94,404
4k-Rand-Write (IOPS)	SSD7204	250,427	89,374	72,171	62,152
	SSD7202	251,248	94,220	76,536	/
	SSD7101A	254,509	93,419	70,305	70,128
	SSD7140A	252,133	111,186	70,457	67,946
	SSD7105	256,764	234,011	200,019	201,931
	SSD7104	254,281	89,843	71,001	60,166

- **CrystalDiskMark**

(script setting)	Gen3 RAID AIC	RAID0	RAID1	RAID10
2m-Seq (MB/s)	SSD7202	SEQ2M Q16T2: 7074.91 / 6730.27 SEQ2M Q16T5: 7060.69 / 6692.83 RND4K Q32T16: 444.31 / 425.55 RND4K Q8T8: 438.69 / 429.56	SEQ2M Q16T2: 7091.12 / 6725.04 SEQ2M Q16T5: 7078.22 / 6689.80 RND4K Q32T16: 440.25 / 506.39 RND4K Q8T8: 471.39 / 419.18	/
	SSD7204	SEQ2M Q16T2: 7122.95 / 6791.48 SEQ2M Q16T5: 7124.09 / 6786.24 RND4K Q32T16: 417.50 / 392.74 RND4K Q8T8: 414.47 / 384.82	SEQ2M Q16T2: 6963.16 / 3350.97 SEQ2M Q16T5: 6957.24 / 3348.16 RND4K Q32T16: 441.38 / 310.59 RND4K Q8T8: 433.22 / 294.02	SEQ2M Q16T2: 7124.35 / 3390.86 SEQ2M Q16T5: 7119.09 / 3386.57 RND4K Q32T16: 487.63 / 297.40 RND4K Q8T8: 424.38 / 255.19
	SSD7140A	SEQ2M Q16T2: 14236.98 / 13617.61 SEQ2M Q16T5: 14226.60 / 13574.97 RND4K Q32T16: 391.94 / 359.46 RND4K Q8T8: 380.76 / 368.01	SEQ2M Q16T2: 6930.84 / 3490.67 SEQ2M Q16T5: 6959.38 / 3487.24 RND4K Q32T16: 436.88 / 306.49 RND4K Q8T8: 433.70 / 270.95	SEQ2M Q16T2: 14231.73 / 6773.42 SEQ2M Q16T5: 14217.63 / 6783.36 RND4K Q32T16: 446.54 / 277.30 RND4K Q8T8: 395.94 / 256.32
	SSD7105	SEQ2M Q16T2: 13424.18 / 13462.88 SEQ2M Q16T5: 14210.59 / 13448.44 RND4K Q32T16: 1132.28 / 985.26 RND4K Q8T8: 1128.55 / 982.52	SEQ2M Q16T2: 7125.28 / 3465.07 SEQ2M Q16T5: 7128.84 / 3459.74 RND4K Q32T16: 1131.55 / 848.46 RND4K Q8T8: 1082.23 / 852.08	SEQ2M Q16T2: 12399.89 / 6712.32 SEQ2M Q16T5: 10877.84 / 6711.32 RND4K Q32T16: 1117.56 / 858.85 RND4K Q8T8: 1120.41 / 862.78
	SSD7101A	SEQ2M Q16T2: 14060.18 / 13454.60 SEQ2M Q16T5: 14035.57 / 13407.48 RND4K Q32T16: 424.24 / 390.23 RND4K Q8T8: 418.41 / 395.03	SEQ2M Q16T2: 6990.54 / 3470.71 SEQ2M Q16T5: 6979.00 / 3469.89 RND4K Q32T16: 441.76 / 310.91 RND4K Q8T8: 437.15 / 291.71	SEQ2M Q16T2: 14173.42 / 6725.75 SEQ2M Q16T5: 14115.45 / 6694.82 RND4K Q32T16: 411.13 / 286.03 RND4K Q8T8: 403.28 / 256.64

SSD7104			

Note: / *means that this AIC does not support the creation of RAID10.*

4.1.4 Gen4 HighPoint NVMe RAID AIC test results

- **Iometer**

(script setting)	Gen4 RAID AIC	Legacy	RAID0	RAID1	RAID10
2m-Seq-Read (MiB/s)	SSD7502	6,797	12,923	12,265	/
	SSD7505	6,616	14,262	12,842	13,394
	SSD7540	6,766	14,250	13,692	14,203
2m-Seq-Write (MiB/s)	SSD7502	4,982	10,001	5,043	/
	SSD7505	4,964	7,996	5,010	8,124
	SSD7540	4,921	13,729	5,076	6,779
4k-Rand-Read (IOPS)	SSD7502	277,885	282,417	275,942	/
	SSD7505	265,493	276,836	273,057	283,353
	SSD7540	271,934	275,643	282,067	273,398
4k-Rand-Write (IOPS)	SSD7502	197,619	199,971	175,741	/
	SSD7505	199,597	200,291	169,763	169,337
	SSD7540	206,730	210,599	186,545	191,290

- **CrystalDiskMark**

(script setting)	Gen4 RAID AIC	RAID0	RAID1	RAID10
2m-Seq (MB/s)	SSD7502			/
	SSD7505			
	SSD7540			
4k-Rand (IOPS)	SSD7502			
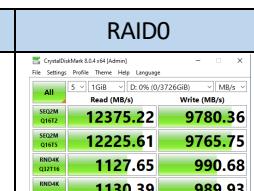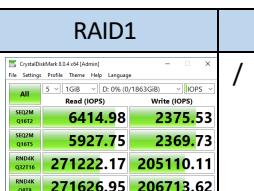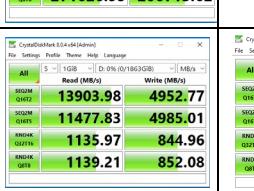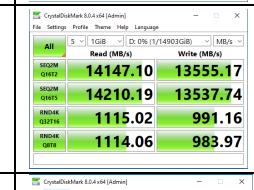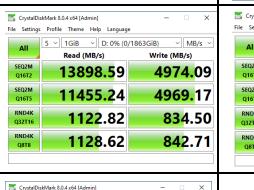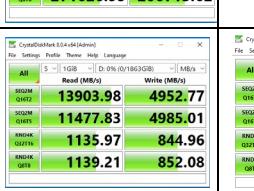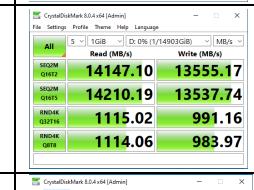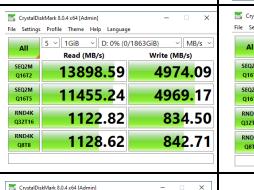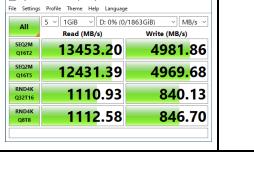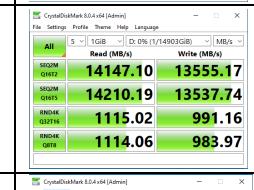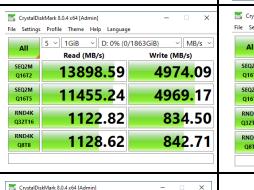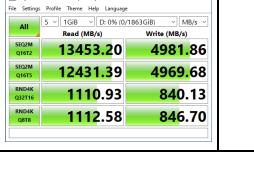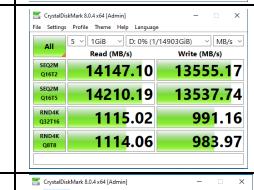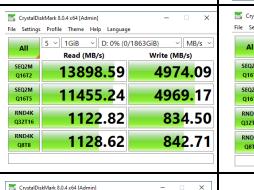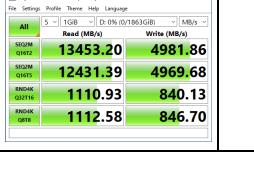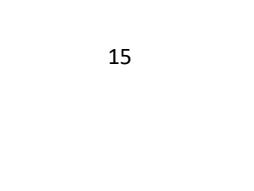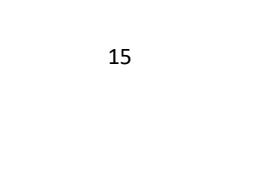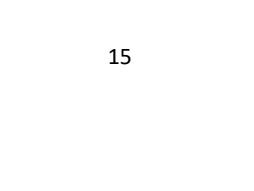
Using HighPoint NVMe RAID AICs with the Dell Precision 7920 Tower Workstation

	SSD7505			
	SSD7540			
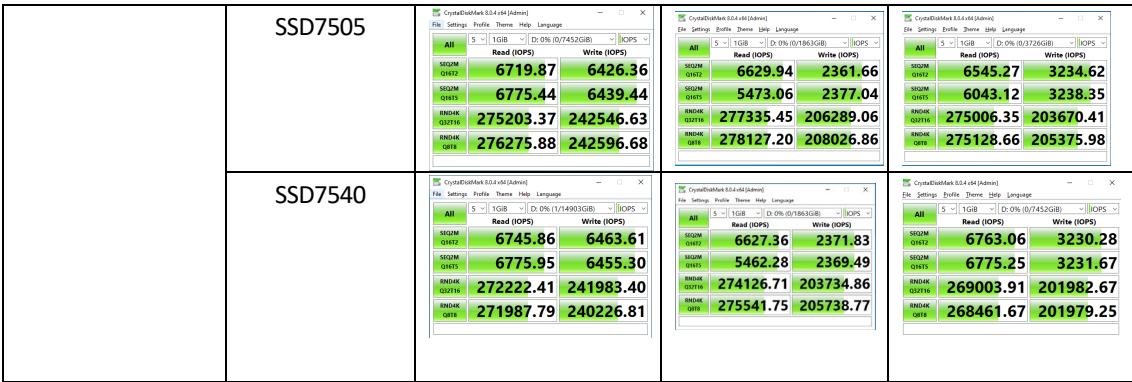
Note: / *means that this AIC does not support the creation of RAID10.*

5. Uninstalling a HighPoint NVMe RAID AIC from the Dell Precision 7920 Tower Workstation

5.1 Uninstall hardware

5.1.1 Uninstall the HighPoint NVMe RAID AIC

a. Unlock the side cover by press the latch and pull the latch upward.
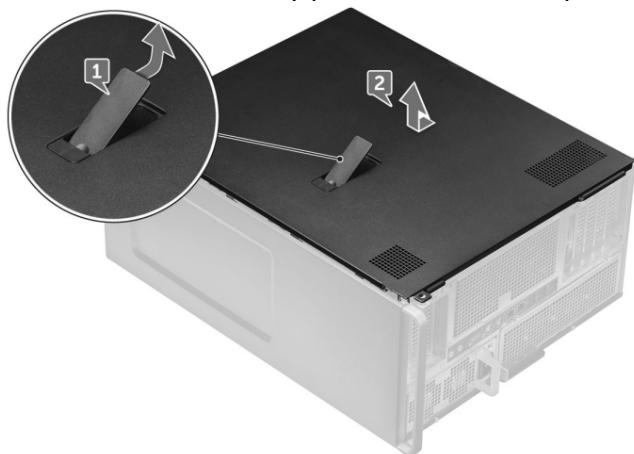
b. Disconnect the power cable from the 6-pin power supply of the HighPoint NVMe RAID AIC (only applies to the SSD7140A/7540).
c. If you are uninstalling the SSD7120, disconnect each SFF-8643 to SFF-8643 cable to the AIC and the backplane component 76W3N connector.
d. Align the side cover with the Dell Precision 7920 Tower Workstation to complete the side cover installation.

5.2 Uninstalling the HighPoint Software

## 5.2.1 Uninstall the HighPoint NVMe RAID AIC for Windows

5.2.1.1 Uninstall the driver

a. Power down the system and remove the HighPoint NVMe RAID AIC from the motherboard.
   *Note1: Failing to remove the HighPoint NVMe RAID AIC from the motherboard during the uninstall process may result in data loss.*
   Note2: Whenever the driver is uninstalled, Windows will attempt to install the default NVMe support, which may corrupt the RAID configurations and any data stored on SSD's hosted by the HighPoint NVMe RAID AIC.

b. Power on the system and boot Windows.
c. Access **Control Panel** and select **Programs**→ **Programs and Features,** and click on the **HighPoint NVMe RAID Controller Driver** entry**.**
d. Click **Uninstall/Change.**
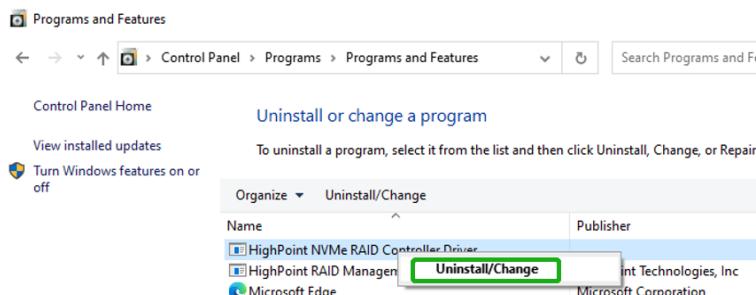
e. After uninstalling the driver, click Finish.
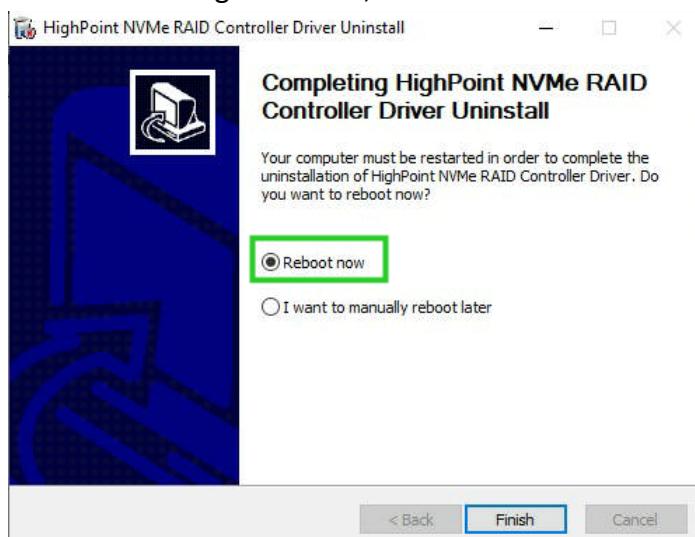
f. Reboot Windows to complete the uninstall procedure.

Using HighPoint NVMe RAID AICs with the Dell Precision 7920 Tower Workstation

5.2.1.2 Uninstall the RAID Management Software

a. Access **Control Panel and select Programs→ Programs and Features**.
b. Click on the **HighPoint RAID Management** entry.
c. Click **Uninstall/Change**.
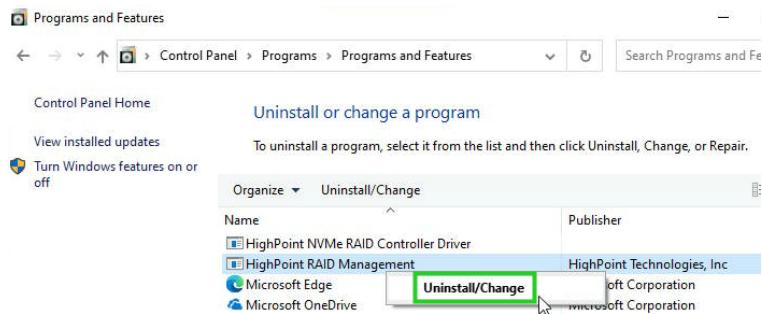
d. After uninstalling the HighPoint RAID Management, click Finish.

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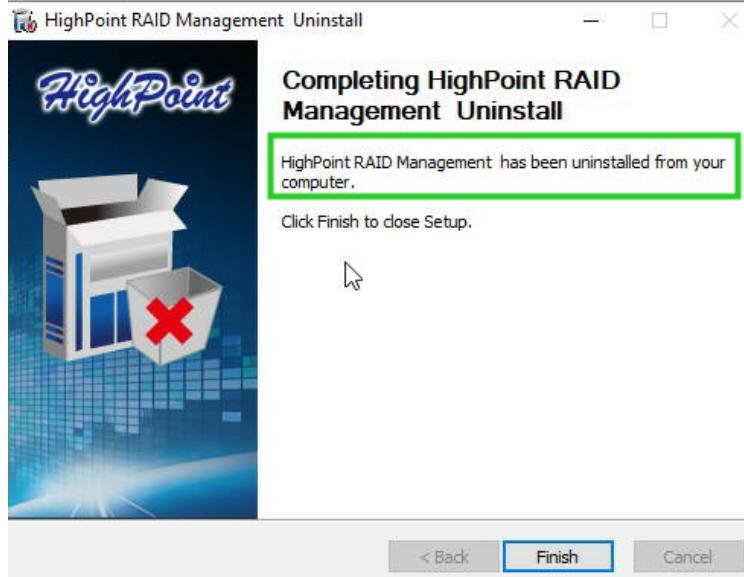
5.2.2 Uninstall the HighPoint NVMe RAID AIC for Linux

5.2.2.1 Uninstall Driver

a. Open the system terminal with root privileges.
b. Enter the following commands to uninstall the driver: **hptuninhptnvme.**
c. Press **'Y'** to confirm.

```
[root@localhost Downloads]# hptuninhptnvme
Are you sure to uninstall the driver hptnvme from system? (Y/n): y
Removed symlink /etc/systemd/system/default.target.wants/hptdrv-monitor.service.
Removed symlink /etc/systemd/system/sysinit.target.wants/systemd-hptdrv.service.
All files installed have been deleted from the system.
[root@localhost Downloads]#
```

d. After uninstalling the driver, manually reboot the system.
e. After the system has rebooted, open the system terminal with root privileges. And enter the following command to check the driver status: **lsmod |grep hptnvme**

Before uninstalling:
```
[root@localhost test]# lsmod | grep hptnvme
hptnvme                235401  0
```

After uninstalling:
```
[root@localhost test]# lsmod | grep hptnvme
[root@localhost test]#
```

f. If the system does not display information about "hptnvme", the driver has been successfully uninstalled.

5.2.2.2 Uninstall the RAID Management Software

a. Open the system terminal with root privileges.
b. Enter the following commands to uninstall the RAID Management.
   # dpkg -r hptsvr (or rpm -e hptsvr-https)
```
root@testlu-Super-Server:/home/testlu/Desktop# dpkg -r hptsvr
(Reading database ... 183888 files and directories currently installed.)
Removing hptsvr (3.1.12) ...
```
c. Enter the following command to check if the RAID Management has been removed successfully.
   #hptraidconf
   After uninstall:
```
root@testlu-Super-Server:/home/testlu/Desktop# hptraidconf
bash: /usr/bin/hptraidconf: No such file or directory
```