# Using HighPoint NVMe RAID AICs
# with the 2019 Intel Mac Pro Workstation

**V1.01-Sept, 26,2023**

## Table of Contents

# 1. 2019 Intel Mac Pro Workstation introduction

This document provides guidelines and procedures for installing HighPoint NVMe AICs into the 2019 Intel Mac Pro 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 Processor

3.5GHz 8 core Intel Xeon W
3.3GHz 12 core Intel Xeon W
3.2GHz 16 core Intel Xeon W
2.7GHz 24 core Intel Xeon W
2.5GHz 28 core Intel Xeon W

## 1.2 Memory

Configure up to 1.5TB of DDR4 ECC memory in 12 user-accessible DIMM slots

## 1.3 PCIe slots

| Slot | Height | Length | Width | Linkwidth | Linkspeed |
|------|--------|--------|-------|-----------|-----------|
| Slot1 | Full Height | Full Length | double-wide | X16 | Gen3 |
| Slot2 | Full Height | Full Length | double-wide | X8 | Gen3 |
| Slot3 | Full Height | Full Length | double-wide | X16 | Gen3 |
| Slot4 | Full Height | Full Length | double-wide | X16 | Gen3 |
| Slot5 | Full Height | Full Length | single-wide | X16 | Gen3 |
| Slot6 | Full Height | Full Length | single-wide | X8 | Gen3 |
| Slot7 | Full Height | Full Length | single-wide | X8 | Gen3 |
| Slot8 | Full Height | Half Length | single-wide | X4 | Gen3 |

**Note1: Single-wide** indicates that this slot accepts the PCIe card with one standard expansion slot width.
**Note 2: Double-wide** indicates that this slot accepts the PCIe card with two standard expansion slot widths.

## 1.4 PCIe bandwidth

The Intel Xeon processor provides the system with 64 lanes of PCIe Gen3 bandwidth.
- Slot1 and Slot3 are directly connected to dedicated x16 root ports on the Xeon processor and are allocated 16 lanes of PCIe Gen3 bandwidth each.
- the Intel Xeon processor connects to the PCIe slots via a PCIe switch and provides 32 lanes of PCIe Gen 3 bandwidth.
  Pool A provides up to 16 lanes of PCIe Gen3 bandwidth;
  Pool B provides up to 16 lanes of PCIe Gen3 bandwidth.

*Note: HighPoint NVMe RAID AICs must be installed into either Slot3 or Slot5. If Slot3 is connected to a GPU card, you must allocate Slot5 to Pool A and ensure that the percentage of Pool A allocation is less than or equal to 100%. If the Pool A allocation percentage is more than 100%, we recommend that other devices be allocated to Pool B.*

## 1.5 Use Expansion Slot Utility

When installing or removing PCIe cards, 2019 Intel Mac Pro Workstation detects the PCIe cards in each slot. You can view and change how cards are assigned through the Expansion Slot Utility.

*Note: Slot1 and Slot3 connect directly to dedicated x16 root ports on the Xeon processor. They do not need to use Expansion Slot Utility for bandwidth allocation.*

### 1.5.1 Automatic Bandwidth Configuration

By default, PCIe bandwidth is allocated between the two pools (Pool A and Pool B) using automatic bandwidth configuration to maximize throughput.

## 1.5.2 Manual bandwidth configuration

To manually allocate PCIe bandwidth, turn off the Automatic Bandwidth Configuration and then select a pool (Pool A or Pool B) for each card to change. Changes will not take effect until you save the changes and restart your Mac.
*Note: Changes will not take effect until you save the changes and restart your Mac.*

## 1.5.3 PCIe pools

There are two PCIe pools; Pool A and Pool B.
Pool A provides up to 16 lanes of PCIe Gen3 bandwidth; Pool B provides up to 16 lanes of PCIe Gen3 bandwidth.

1. **Pool A**
To ensure optimal performance of the HighPoint NVMe RAID AIC, we need to allocate the 16 lanes to Pool A.
*Note: You must allocate Slot5 to Pool A and ensure that the percentage of Pool A allocation is less than or equal to 100%. If the Pool A allocation percentage is more than 100%, we recommend that other devices be allocated to Pool B.*

2. **Pool B**
Built-in components are connected to the system through a PCIe switch and allocated to Pool B.
*Note: This means that the system will always show a percentage allocated to Pool B, even if no PCIe cards are installed.*

## 2. HighPoint NVMe RAID AIC compatibility in 2019 Intel Mac Pro Workstation

| HighPoint NVMe RAID AICs | Slot1 PCIe 3.0 x16 | Slot2 PCIe 3.0 x8 | Slot3 PCIe 3.0 x16 | Slot4 PCIe 3.0 x16 | Slot5 PCIe 3.0 x16 | Slot6 PCIe 3.0 x8 | Slot7 PCIe 3.0 x8 | Slot8 PCIe 3.0 x4 |
|---|---|---|---|---|---|---|---|---|
| Gen3 AICs | | | | | | | | |
| SSD7101A-1 | N/A | N/A | √ | X | √ | N/A | N/A | N/A |
| SSD7104 | N/A | N/A | √ | X | √ | N/A | N/A | N/A |
| SSD7105 | N/A | N/A | √ | X | √ | N/A | N/A | N/A |
| SSD7202 | N/A | √ | √ | X | √ | √ | √ | N/A |
| SSD7204 | N/A | √ | √ | X | √ | √ | √ | N/A |
| SSD7140A | N/A | N/A | √ | X | √ | N/A | N/A | N/A |
| RocketAIC 7105HM | N/A | N/A | √ | X | √ | N/A | N/A | N/A |
| RocketAIC 7202HM | N/A | √ | √ | X | √ | √ | √ | N/A |
| RocketAIC 7204HM | N/A | √ | √ | X | √ | √ | √ | N/A |
| RocketAIC 7140AM | N/A | N/A | √ | X | √ | N/A | N/A | N/A |
| Gen4 AICs | | | | | | | | |
| SSD7502 | N/A | N/A | √ | X | √ | N/A | N/A | N/A |
| SSD7505 | N/A | N/A | √ | X | √ | N/A | N/A | N/A |
| SSD7540 | N/A | N/A | √ | X | √ | N/A | N/A | N/A |
| SSD7749E | N/A | N/A | √[1] | X | N/A | N/A | N/A | N/A |
| RocketAIC 7505HM | N/A | N/A | √ | X | √ | N/A | N/A | N/A |
| RocketAIC 7540HM | N/A | N/A | √ | X | √ | N/A | N/A | N/A |
| RocketAIC 7749EM | N/A | N/A | √[1] | X | N/A | N/A | N/A | N/A |

*Note1: √ means that the HighPoint NVMe RAID AIC can be used normally in this slot.*
*Note2: X means that the HighPoint NVMe RAID AIC is not compatible with this slot. Using this slot may cause the system or application to crash.*
*Note3: N/A means that it is an untested slot and HighPoint NVMe RAID AIC using this slot will not deliver optimal performance.*
*Note4: slot1 is designated as the default slot for GPU.*
*Note5: slot8 is designated as the default slot for Apple I/O cards.*
*Note6: √[1] means if there is no GPU2, you can use this slot normally.*

## 3. Installing HighPoint NVMe RAID AIC into 2019 Intel Mac Pro Workstation

### 3.1 Install hardware

a. Shut down the 2019 Intel Mac Pro Workstation.
b. Wait a few minutes for the 2019 Intel Mac Pro Workstation to cool down.
c. Then unplug all cables from the 2019 Intel Mac Pro Workstation.
d. Flip the top latch of the 2019 Intel Mac Pro Workstation upward, then twist it to the left to unlock the housing.



e. Lift the housing vertically upward to detach it from the 2019 Intel Mac Pro Workstation.



*Note: The 2019 Intel Mac Pro Workstation won't power up when its cover is removed.*

f.  Use a Phillips-head screwdriver to disassemble and remove the side bracket and slot cover from the slot where the card is to be installed.



g.  Slide lock to unlocked position.



h.  Install the HighPoint NVMe RAID AIC into the appropriate PCIe slot. Slide lock to locked position and install the previously removed slot cover, then tighten the screws on the slot cover.



*Note: Do not touch the gold connector on the HighPoint NVMe RAID AIC.*

i. Place the housing back onto the 2019 Intel Mac Pro Workstation. And twist the top latch right and flip it down to lock it.



j. Connect the power cord, display, and any other peripherals.

# 3.2 System Setting

## 3.2.1 No Security Policy for Apple T2 Platform

Customers working with Mac platforms manufactured in 2018 or later that feature an Apple T2 security chip, will need to disable the Secure Boot in order to load drivers for third party devices. HighPoint NVMe AICs affected by this requirement.
Mac computers with Apple T2 security chip, please visit the following website:
[Mac computers with the Apple T2 Security Chip - Apple Support](#)

### 3.2.1.1 No Security Policy

To disable this feature, select "**No Security**" from the Startup Security Utility interface. You can access this menu by pressing the **Command (⌘)-R** keys after the Apple logo first appears during the boot-up process.
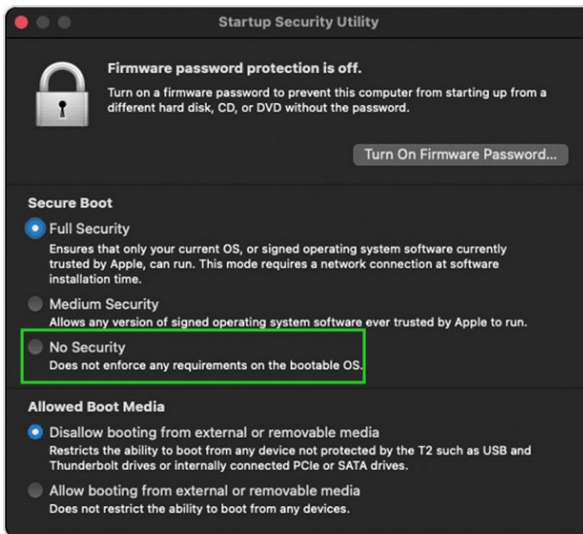
## 3.3 Install software

## 3.3.1 Installing HighPoint NVMe RAID AICs into the 2019 Intel Mac Pro 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 Mac Driver & Management Software

Please refer to the Data RAID Installation Guide (Mac) to install the HighPoint NVMe RAID AIC Driver and RAID Management Software.

# 4. Test HighPoint NVMe RAID AIC

## 4.1 Performance Testing

- **HighPoint NVMe RAID AICs:**

| Gen3 HighPoint NVMe RAID AICs | SSD7101A-1 |
| --- | --- |
| | SSD7104 |
| | SSD7105 |
| | SSD7140A |
| | SSD7202 |
| | SSD7204 |
| **Gen4 HighPoint NVMe RAID AICs** | SSD7502 |
| | SSD7505 |
| | SSD7540 |

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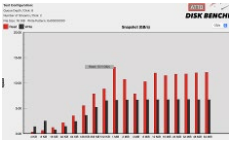  Samsung 980 Pro 2TB
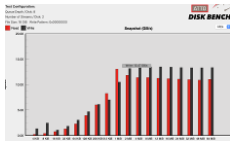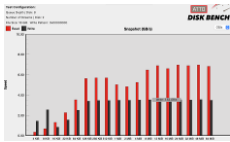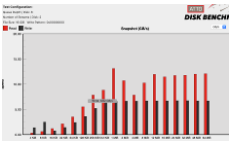  *Note: Samsung 980 Pro 2TB Disk spec.*
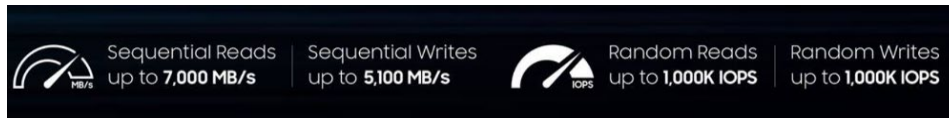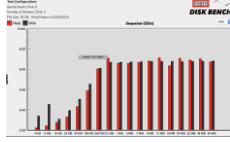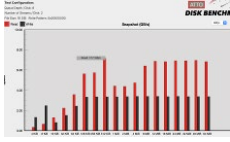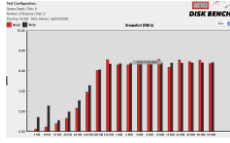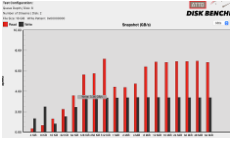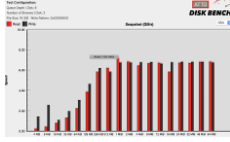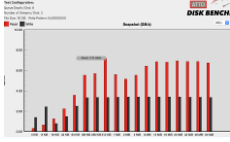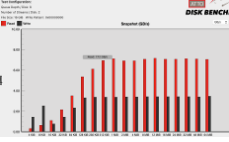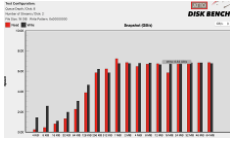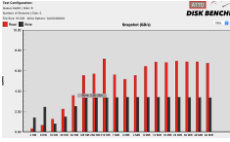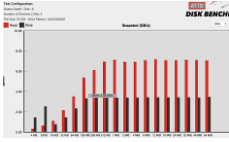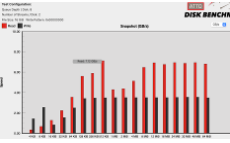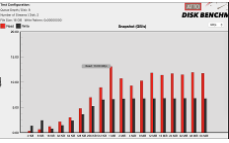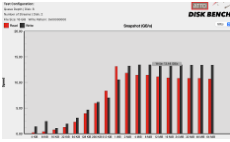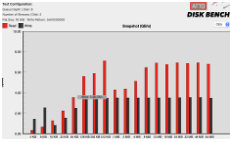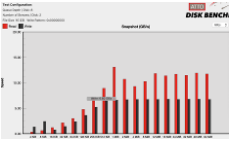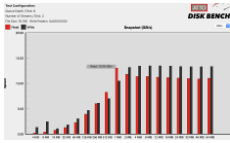


### 4.1.1 Test tool

Benchmark Tool: Atto disk benchmark
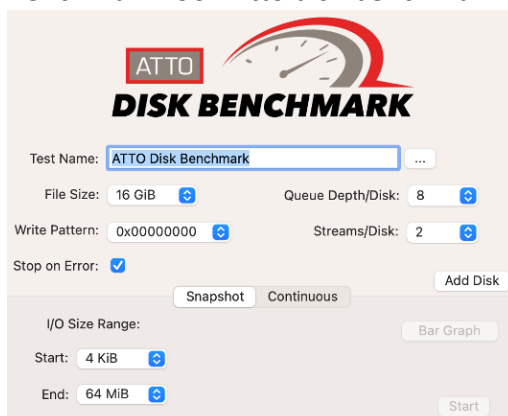
## 4.1.2 Gen3 HighPoint NVMe RAID AIC test results

| Gen3 RAID AIC | | RAID0 | RAID1 | RAID10 |
|---|---|---|---|---|
| SSD7202 | Seq-Read (GB/s) | 7.12 | 7.17 | / |
| | Seq-Write (GB/s) | 6.79 | 3.36 | / |
| SSD7204 | Seq-Read (GB/s) | 7.23 | 7.15 | 7.12 |
| | Seq-Write (GB/s) | 6.83 | 3.36 | 3.38 |
| SSD7101A-1 | Seq-Read (GB/s) | 13.10 | 7.12 | 13.09 |
| | Seq-Write (GB/s) | 13.44 | 3.48 | 6.60 |
| SSD7104 | Seq-Read (GB/s) | 13.05 | 6.96 | 13.11 |
| | Seq-Write (GB/s) | 13.47 | 3.53 | 6.62 |

| SSD7105 | Seq-Read (GB/s) | 13.15 | 7.16 | 13.25 |
| | Seq-Write (GB/s) | 13.32 | 3.46 | 6.69 |
| SSD7140A | Seq-Read (GB/s) | 13.25 | 7.13 | 13.47 |
| | Seq-Write (GB/s) | 13.48 | 3.49 | 6.77 |
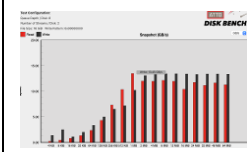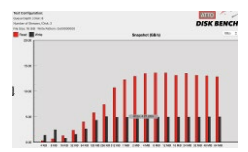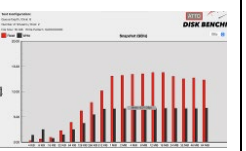
**Note:** **/** *means that this AIC does not support the creation of RAID10.*

## 4.1.3 Gen4 HighPoint NVMe RAID AIC test results

| Gen4 RAID AIC | | RAID0 | RAID1 | RAID10 |
|---|---|---|---|---|
| SSD7502 | Seq-Read (GB/s) | 13.54 | 13.60 | / |
| | Seq-Write (GB/s) | 9.79 | 4.92 | / |
| SSD7505 | Seq-Read (GB/s) | 13.49 | 13.61 | 13.80 |
| | Seq-Write (GB/s) | 13.45 | 4.97 | 6.71 |

| | | | | |
|---|---|---|---|---|
| | |  |  |  |
| SSD7540 | Seq-Read (GB/s) | 13.97 | 13.97 | 14.01 |
| | |  |  |  |
| | Seq-Write (GB/s) | 13.42 | 4.95 | 6.80 |
| | |  |  |  |

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

# 5. Uninstalling a HighPoint NVMe RAID AIC from the 2019 Intel Mac Pro Workstation

## 5.1 Uninstall hardware

### 5.1.1 Uninstall the HighPoint NVMe RAID AIC

a. Shut down the 2019 Intel Mac Pro Workstation.
b. Wait a few minutes for the 2019 Intel Mac Pro Workstation to cool down.
c. Then unplug all cables from the 2019 Intel Mac Pro Workstation.
d. Flip the top latch of the 2019 Intel Mac Pro Workstation upward, then twist it to the left to unlock the housing.



e. Lift the housing straight up and off of the 2019 Intel Mac Pro Workstation. Carefully set it aside.

f.  Slide the lock to the unlocked position.



g.  Using a Phillips-head screwdriver, unscrew and remove the slot cover. Remove the HighPoint NVMe RAID AIC from the PCIe slot.



h.  Reinstall the slot cover you removed, then tighten the screws on the slot cover.

      i.     Reinstall the housing.



      j.     After the housing is fully seated, twist the top latch right and flip it down to lock it.

## 5.2 Uninstall Software

### 5.2.1 Uninstall the Driver

a. Power down the system and remove the HighPoint NVMe RAID AIC from the 2019 Intel Mac Pro Workstation.
   *Note1: Failing to remove the HighPoint NVMe RAID AIC from the motherboard during the uninstall process may result in data loss.*
   *Note2: The macOS will load the default NVMe support after the HighPoint driver has been uninstalled – this driver will only recognize the NVMe SSD's as separate disks.*
b. Power on the system.
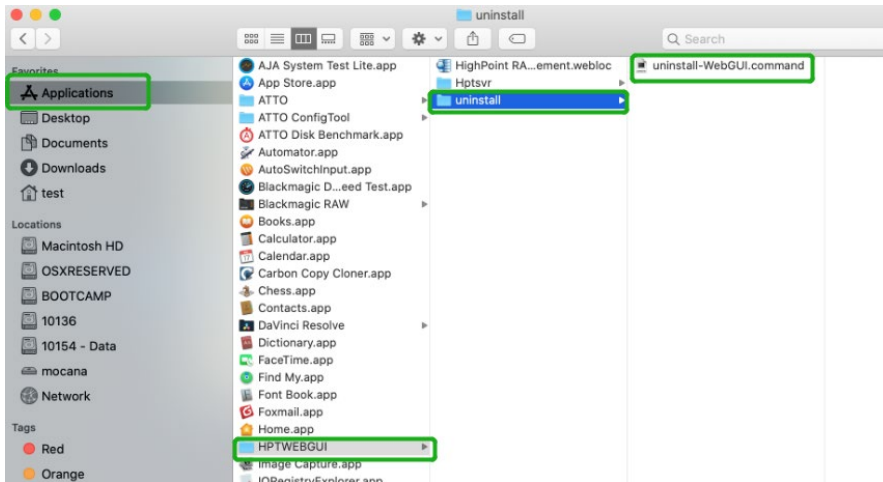c. To uninstall the NVMe driver, you will need to open the terminal window and enter the f ollowing command:
   **sudo rm -rf /Library/Extensions/HighPointNVMe.kext**
   **sudo kextcache –i /**

```
[test@testsMB01610152 ~ % sudo rm –rf /Library/Extensions/HighPointNVMe.kext
Password:
[test@testsMB01610152 ~ % sudo kextcache –i /
kextcache –i /
kextcache –arch x86_64 –local-root –all-loaded –kernel /System/Library/Kernels/k
ernel –prelinked-kernel /Library/Apple/System/Library/PrelinkedKernels/prelinked
kernel –volume-root / /Library/Extensions /AppleInternal/Library/Extensions /Lib
rary/Apple/System/Library/Extensions /System/Library/Extensions
KernelCache ID: 91AFAAB6216EDD61055A39A8E77A483C
test@testsMB01610152 ~ %
```

d. After uninstalling the driver, manually reboot the system.

## 5.2.2 Uninstall the RAID Management Software

To uninstall the RAID Management Software, access **Applications**, click on **HPTWEBGUI**, select uninstall, and double-click the **uninstall-WEBGUI.command**. The uninstall command will automatically open a terminal and uninstall the software: