Using HighPoint NVMe RAID AICs
with the 2023 M2 Ultra Mac Pro Workstation

V1.03- Nov 8, 2023

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1. 2023 M2 Ultra Mac Pro Workstation introduction

This document provides guidelines and procedures for installing HighPoint NVMe AICs into the 2023 M2 Ultra 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 Chipset

Apple M2 Ultra chip

- 24-core CPU with 16 performance cores and 8 efficiency cores
- 60-core GPU
- 32-core Neural Engine
- 800GB/s memory bandwidth
- Media engine
  - Hardware-accelerated H.264, HEVC, ProRes, and ProRes RAW
  - Two video decode engines
  - Four video encode engines
  - Four ProRes encode and decode engines
- Configurable to:
  - M2 Ultra with 24-core CPU, 76-core GPU, and 32-core Neural Engine

1.2 Memory

- 64GB unified memory
  Configurable to 128GB or 192GB

1.3 PCIe slots

Slot	Height	Length	Width	Linkwidth	Linkspeed
Slot1	Full Height	Full Length	double-wide	x16	Gen4
Slot2	Full Height	Full Length	double-wide	x16	Gen4
Slot3	Full Height	Full Length	double-wide	x8	Gen4
Slot4	Full Height	Full Length	double-wide	x8	Gen4
Slot5	Full Height	Full Length	single-wide	x8	Gen4
Slot6	Full Height	Full Length	single-wide	x8	Gen4
Slot7	Full Height	Half Length	single-wide	x4	Gen3

Notes:

Single-wide *indicates that this slot accepts the PCIe card with one standard expansion slot width.*

Double-wide *indicates that this slot accepts the PCIe card with two standard expansion slot widths.*

1.4 PCIe bandwidth

The M2 Ultra chip provides the system with 32 lanes of PCIe Gen4 bandwidth.
- 8 of which are dedicated to the internal SSDs.
- the M2 Ultra chip connects to the PCIe slots via a PCIe switch and provides 24 lanes of PCIe gen 4.

  Pool A provides up to 16 lanes of PCIe Gen4 bandwidth;

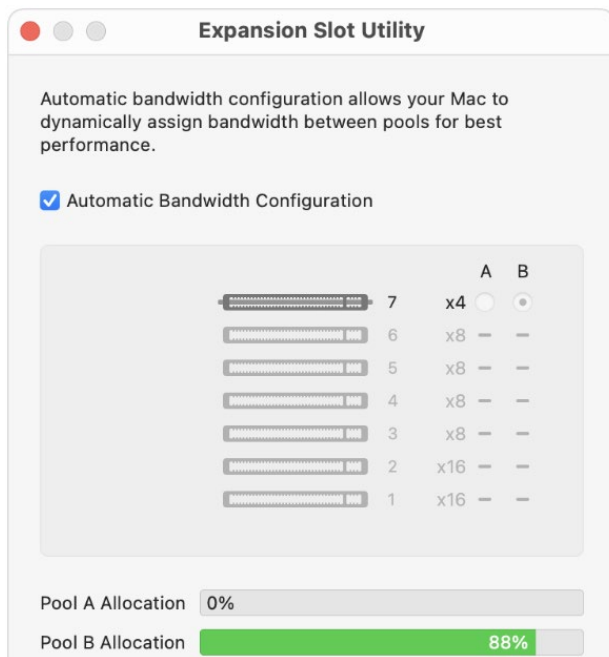 Pool B provides up to 8 lanes of PCIe Gen4 bandwidth.

Note: HighPoint NVMe RAID AIC must be allocated to Pool A and ensure that the percentage of Pool A Allocation is less than or equal to 100%. If the percentage of Pool A Allocation 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, 2023 M2 Ultra Mac Pro Workstation detects the PCIe cards in each slot. You can view and change how cards are assigned through the Expansion Slot Utility.

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. *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 Gen4 bandwidth; Pool B provides up to 8 lanes of PCIe Gen4 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: If the percentage of Pool A Allocation is more than 100%, we recommend that other devices be allocated to Pool B.

2. **Pool B**

The following built-in components are connected to the system through the PCIe switch and allocated to Pool B:
- SATA controller
- 10Gb Ethernet controllers
- Wireless (Wi-Fi, Bluetooth) controller
- USB-A port
- PCIe Slot 7 (Apple I/O card)

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 2023 M2 Ultra Mac Pro Workstation

HighPointNVMe RAID AICs	Slot1 PCIe 4.0 x16	Slot2 PCIe 4.0 x16	Slot3 PCIe 4.0 x8	Slot4 PCIe 4.0 x8	Slot5 PCIe 4.0 x8	Slot6 PCIe 4.0 x8	Slot7 PCIe 3.0 x4
Gen3 AICs							
SSD7101A-1	X	√	N/A	N/A	N/A	N/A	N/A
SSD7104	√	√	N/A	N/A	N/A	N/A	N/A
SSD7105	√	√	N/A	N/A	N/A	N/A	N/A
SSD7202	√	√	√	√	√	√	N/A
SSD7204	√	√	√	√	√	√	N/A
SSD7140A	√	√	N/A	N/A	N/A	N/A	N/A
RocketAIC 7105HM	√	√	N/A	N/A	N/A	N/A	N/A
RocketAIC 7202HM	√	√	√	√	√	√	N/A
RocketAIC 7204HM	√	√	√	√	√	√	N/A
RocketAIC 7140AM	√	√	N/A	N/A	N/A	N/A	N/A
Gen4 AICs							
SSD7502	√	√	N/A	N/A	N/A	N/A	N/A
SSD7505	√	√	N/A	N/A	N/A	N/A	N/A
SSD7540	√	√	N/A	N/A	N/A	N/A	N/A
SSD7749E	√	√	N/A	N/A	N/A	N/A	N/A
RocketAIC 7505HM	√	√	N/A	N/A	N/A	N/A	N/A
RocketAIC 7540HM	√	√	N/A	N/A	N/A	N/A	N/A
RocketAIC 7749EM	√	√	N/A	N/A	N/A	N/A	N/A

Notes:

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

X means that the HighPoint NVMe RAID AIC is not compatible with this slot.

N/A means that this slot is not recommended. This slot does not have enough electrical channels to work properly with the HighPoint NVMe RAID AIC.

Slot7 is designated as the default slot for Apple I/O cards.

3. Installing HighPoint NVMe RAID AIC into 2023 M2 Ultra Mac Pro Workstation

3.1 Install hardware

a. Shut down the 2023 M2 Ultra Mac Pro Workstation.
b. Wait a few minutes for the 2023 M2 Ultra Mac Pro Workstation to cool down.
c. Then unplug all cables from the 2023 M2 Ultra Mac Pro Workstation.
d. Flip the top latch of the 2023 M2 Ultra 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 2023 M2 Ultra Mac Pro Workstation.

Note: The 2023 M2 Ultra 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. If you are using the SSD7140A, SSD7540, SSD7749E, RocketAIC 7140AM, RocketAIC 7540HM, or RocketAIC 7749EM, you will need to purchase the Belkin AUX Power Cable Kit from the Apple Store. The kit includes seven AUX power cables; four 8-pin to 6+2 pin cables, two 6-pin to 6-pin cables, and a single 8-pin to dual 6-pin cable.

   a) Connect the 6-pin power connector of the Belkin AUX Power Cable to the 2023 M2 Ultra Mac Pro Workstation.
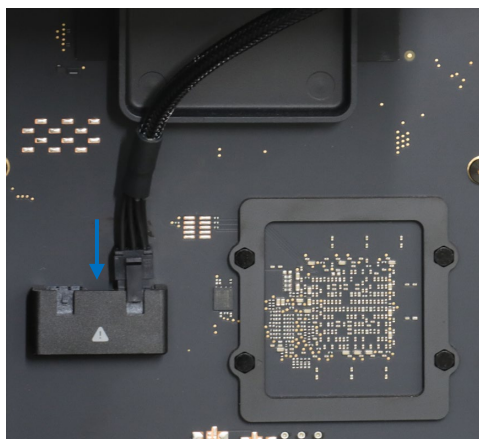
b) Connect the 6-pin power connector of the Belkin AUX Power Cable to the side of the HighPoint NVMe RAID AICs.
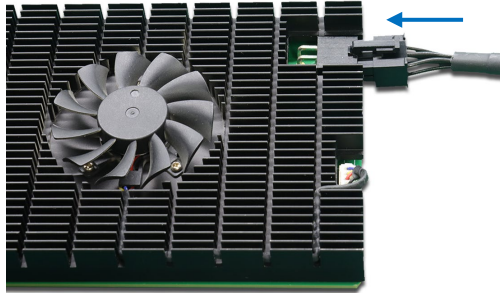
i. Install the HighPoint NVMe RAID AIC into the appropriate PCIe slot. Slide lock to locked position and install the previously removed slot cover, then tighten the screws on the slot cover.

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

j. Place the housing back onto the 2023 M2 Ultra Mac Pro workstation. And twist the top latch right and flip it down to lock it.

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

3.2 System Setting

3.2.1 Reduced Security Policy for Apple M2 Ultra Platform

Customers working with Apple M2 Ultra Platforms will need to reduce the Security Policy in order to load drivers for third party devices. HighPoint NVMe AICs affected by this requirement. Mac computers with Apple M2 Ultra chip, please visit the following website:
[Mac computers with Apple silicon - Apple Support](#)

3.2.1.1 Check Security Policy

Check the system's Security Policy settings to determine if they need to be changed. If Secure Boot is set to "**Full Security**", please change this to "**Reduced Security**":
System Information -> Hardware -> Controller -> Boot Policy
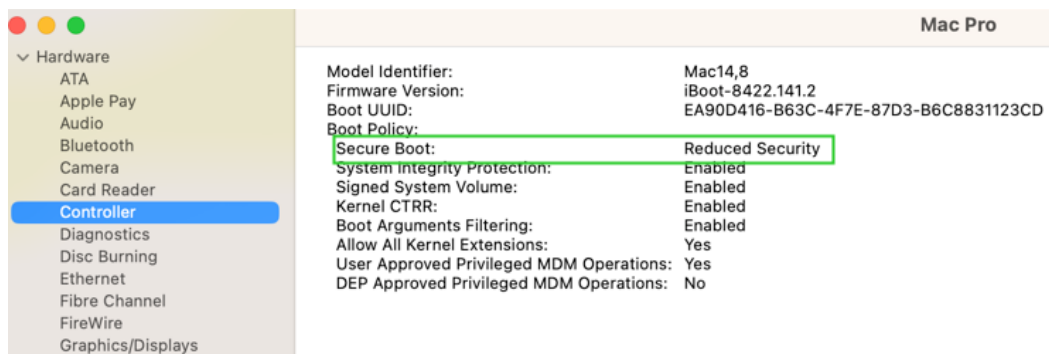
3.2.1.2 Reduced Security Policy

You can access this menu by:
Shutdown the system, **pressing and holding the Power Button** until you see **Loading Startup Options**.
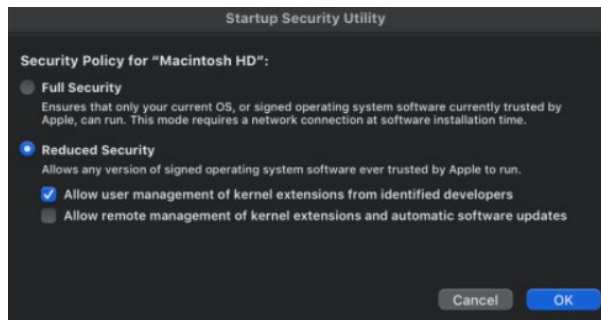
3.3 Install software

3.3.1 Installing the Driver & RAID 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.
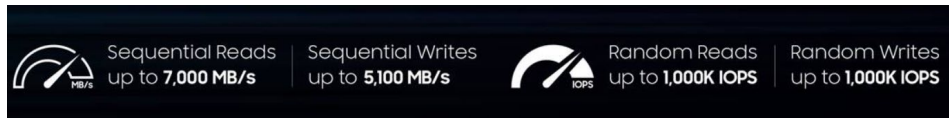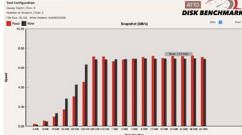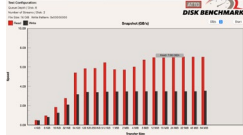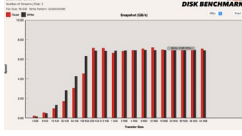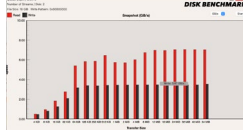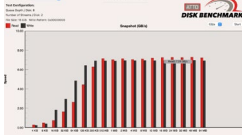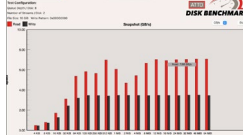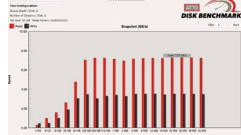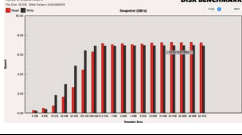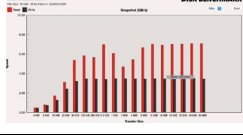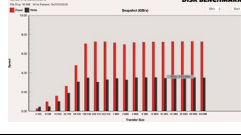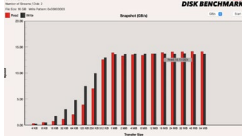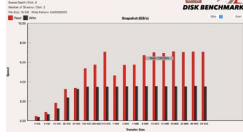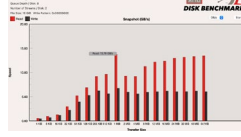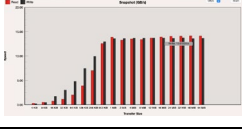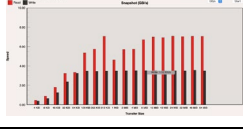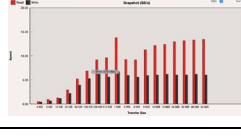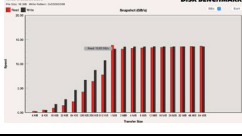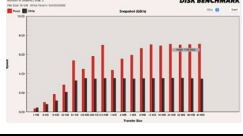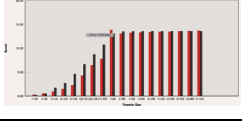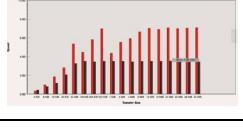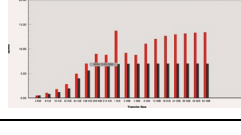
4.1.1 Test tool

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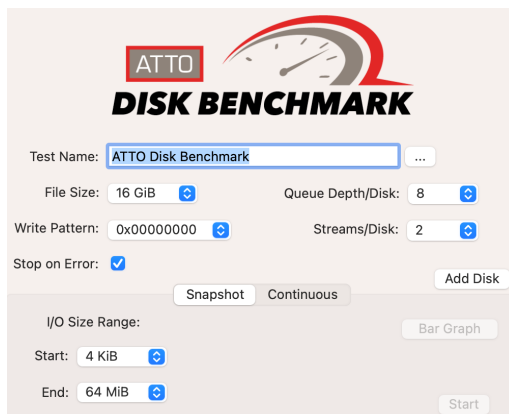
4.1.2 Gen3 HighPoint NVMe RAID AIC test results

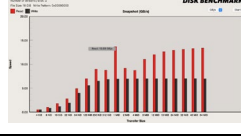| Gen3 RAID AIC		RAID0	RAID1	RAID10
SSD7202	Seq-Read (GB/s)	7.22	7.06	/
	Seq-Write (GB/s)	6.95	3.47	/
SSD7204	Seq-Read (GB/s)	7.28	7.08	7.27
	Seq-Write (GB/s)	6.97	3.51	3.50
SSD7101A-1	Seq-Read (GB/s)	14.13	7.08	13.76
	Seq-Write (GB/s)	13.61	3.52	6.75
SSD7104	Seq-Read (GB/s)	13.82	7.08	13.69
	Seq-Write (GB/s)	13.09	3.46	6.93

SSD7105	Seq-Read (GB/s)	13.89	7.25	13.77
	Seq-Write (GB/s)	13.23	3.48	6.74
SSD7140A	Seq-Read (GB/s)	14.08	7.08	14.22
	Seq-Write (GB/s)	13.67	3.50	6.84

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)	13.51	13.58	/
	Seq-Write (GB/s)	9.76	4.81	/

16

SSD7505	Seq-Read (GB/s)	26.84	13.53	26.03
	Seq-Write (GB/s)	18.69	4.94	8.80
SSD7540	Seq-Read (GB/s)	27.20	13.44	27.01
	Seq-Write (GB/s)	27.07	4.87	12.78

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

5. Uninstalling a HighPoint NVMe RAID AIC from the 2023 M2 Ultra Mac Pro Workstation

5.1 Uninstall hardware

5.1.1 Uninstall the HighPoint NVMe RAID AIC

a. Shut down the 2023 M2 Ultra Mac Pro Workstation.
b. Wait a few minutes for the 2023 M2 Ultra Mac Pro Workstation to cool down.
c. Then unplug all cables from the 2023 M2 Ultra Mac Pro Workstation.
d. Flip the top latch of the 2023 M2 Ultra Mac Pro Workstation upward, then twist it to the left to unlock the housing.

e. Lift the housing straight up and off of the 2023 M2 Ultra 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. Disconnect the 6-pin power connector of the Belkin AUX Power Cable from the 2023 M2 Ultra Mac Pro Workstation.

i. Disconnect the 6-pin power connector of the Belkin AUX Power Cable from the HighPoint NVMe RAID AICs. (Required for the SSD7140A/ SSD7540/ SSD7749E/ RocketAIC 7140AM/ RocketAIC 7540HM/ RocketAIC 7749EM)

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

k. Reinstall the housing.

l. 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 2023 M2 Ultra Mac Pro Workstation.
   Notes:
   Failing to remove the HighPoint NVMe RAID AIC from the 2023 M2 Ultra Mac Pro Workstation during the uninstall process may result in data loss. 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.

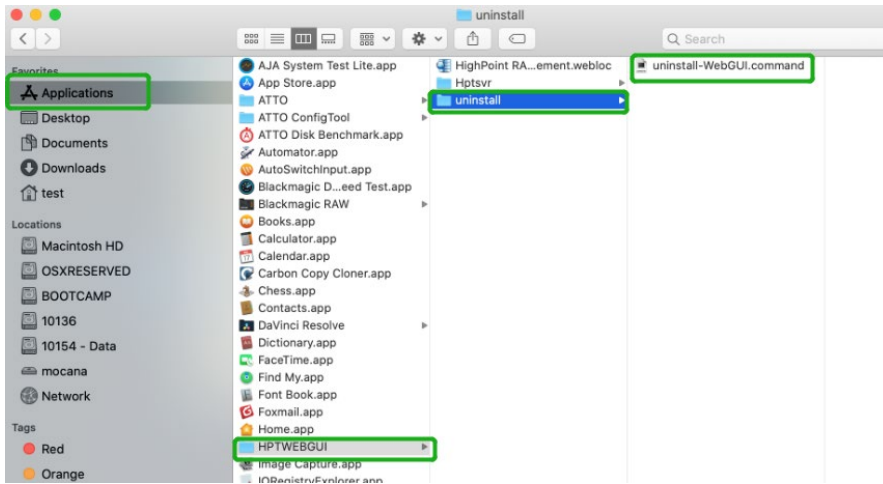c. To uninstall the driver, you will need to open the terminal window and enter the following command:
   sudo rm -rf /Library/Extensions/HighPointNVMe.kext
   sudo kextcache –i /

```
[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: