Intel Virtual RAID On CPU (VROC) Storage Configurator

Lenovo ThinkStation PX, P7, P5



Lenovo

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Overview

The ThinkStation PX, P7, and P5 workstations offer an enterprise RAID solution through Intel's Virtual RAID On CPU (VROC) hardware upgrade key. The Intel VROC solution supports multiple Volume Management Devices (VMDs) to be able to RAID a vast number of PCIe NVMe solid state drives as well as SATA drives. The following document provides detailed guidance for users to optimally configure their onboard Intel RAID storage options in the ThinkStation PX, P7, and P5 platforms.

Section 1 – Intel Virtual RAID On CPU (VROC)

There are two types of Intel VROC modules supported on the Lenovo ThinkStation PX, P7, and P5 platforms. Table 1 below shows the available Intel VROC options that can be utilized on each of these ThinkStation platforms.

Intel Virtual RAID on CPU (VROC)	Picture	RAID Types Supported
Basic (FRU: 00FC973) (Lenovo Option: N/A)	VROCSTANMOD VROCSTANMOD TABLE	RAID 0, 1, and 10
Premium (FRU: 00FC974) (Lenovo Option: 4XH0Q89603)		RAID 0, 1, 5, and 10

Table 1 - Intel VROC Options

Note: Only one Intel VROC module can be installed per system.

ThinkStation PX – VROC Header Location

The figure below shows the Intel VROC header location on the ThinkStation PX motherboard. The VROC module should latch into the header when fully inserted.



Figure 1 – PX motherboard showing VROC header location

Front of System





ThinkStation P7 – VROC Header Location

The figure below shows the Intel VROC header location on the ThinkStation P7 motherboard. Note, removing the power supply is suggested for easy access to the VROC header on the motherboard. The VROC module should latch into the header when fully inserted.

Figure 2 - P7 motherboard showing VROC header location



Front of System





ThinkStation P5 – VROC Header Location

The figure below shows the Intel VROC header location on the ThinkStation P5 motherboard. Note, the memory duct and rear memory duct fans need to be removed to access the VROC header on the motherboard. The VROC module should latch into the header when fully inserted.

Figure 3 - P5 motherboard showing VROC header location



Front of System





Section 2 – Levels of Support

The ThinkStation PX, P7, and P5 platforms all support Intel VROC 8.0 or later. The below table highlights supported features for the Intel VROC controller.

Figure 4 - Levels of Support

Features	Support
BIOS Version	PX: S09KT0CA or later P7: S0DKT0BA or later P5: S0CKT0BA or later
Prerequisites	VROC Key Header required on motherboard
Drive Types	NVMe M.2 / E1.S / U.2 / U.3 / E3.S NVMe PCIe Add-in card SATA
Maximum Number of VMDs	Refer to VMD Mapping below for each platform
Maximum Number of drives per VMD	4
RAID 0/RAID 5	≥ 2 drives
RAID 10	4 drives
RAID 1	2 drives
Bootable Support	Yes, across a single VMD
Data-only Support	Yes, can span across multiple VMDs
UEFI Support	Yes (Legacy support not available)
Spanning VMDs across CPUs (PX only)	Yes, though could result in performance degradation
Linux Support	RHEL 9.2 Ubuntu 22.04 LTS
Toolless VROC Installation	Yes

Notes:

1. Levels of support vary based on platform.

2. Mixing different drive types and capacities is <u>not</u> recommended.

3. Please be sure to backup all data before proceeding! Switching between PCIe versus VMD mode or AHCI versus RAID mode may lead to data loss on the drives (including the operating system).

Section 3 – VMD Mapping

Here is a general overview of the Intel Volume Management Device (VMD) mappings for the ThinkStation PX, P7, and P5 workstations.

ThinkStation PX – VMD Mapping Implementation			
	CPU2	<u>CPU1</u>	
VMD0	PCIe Slot 1	VMD0	PCIe Slot 7
VMD1	MCIO1 Slot 1 (Front Storage Bay 2)	VMD1	PCIe Slot 6
	MCIO1 Slot 2 (Front Storage Bay 2)	VMD2	PCIe Slot 8
	MCIO2 Slot 1 (Front Storage Bay 3)	VMD3	PCIe Slot 9
	MCIO2 Slot 2 (Front Storage Bay 3)	VMD4	Onboard M.2 Slot 1
VMD2	PCIe Slot 4		Onboard M.2 Slot 2
VMD3 PCIe Slot 3			Onboard M.2 Slot 3
VMD4	PCIe Slot 2		
VMD5	PCIe Slot 5		

Note: MCIO slots are located under the motherboard.



ThinkStation D7 _ VMD Ma	nning Im	nlamontation
r = r = r = r		

<u>CPU</u>		
	PCIe Slot 7	
	MCIO (Front Storage Bay or Internal NVMe Storage Trays)	
	Onboard M.2 Slot 1	
VMD1	Onboard M.2 Slot 2	
	Onboard M.2 Slot 3 (Vertical)	
VMD2	PCIe Slot 3	
VMD3	PCIe Slot 1	
VMD4	PCIe Slot 6	
VMD5	PCIe Slot 5	
	PCIe Slot 4	
	PCIe Slot 2	

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ThinkStation P5 – \	/MD Mapping Implementation	१
	<u>CPU</u>	6
VMD0	PCIe Slot 3	Ċ
VMD1	PCIe Slot 1	
	PCIe Slot 5	
VMD2	Onboard M.2 Slot 1	
	Onboard M.2 Slot 2	
VMD3	MCIO (Front Storage Bay)	



Section 3 – How to Enable NVMe RAID

In order to setup and configure NVMe RAID, BIOS must be set to VMD mode first. Refer to the steps below on how to configure BIOS in VMD mode.

1. Power on the system and press the function F1 key at the Lenovo splash screen to enter BIOS setup.



ThinkStation

> System Summary
 > System Time & Date

		> BIOS Event log			
Sta	rt Menu				
	and the second second	Machine Type and Model		30EUCTO1WW	
G	Main	System Brand ID		ThinkStation PX	
谷	Devices	System Serial Number		MJ0D1234	
*	Advanced	Asset Tag			
Φ	Power	System UUID		4D07D780-1B2A-11E	E-9CC1-3B54BC194200
~	. oner	1G Ethernet MAC Address		F4-6B-8C-D1-E1-FF	
æ	Security	10G Ethernet MAC Address	43	F4-6B-8C-D1-E2-00	
200	Startup	ME Firmware Version		15.20.10.1735	
⊳	Exit	Embedded Controller Version		S09EC4FA	
		BIOS Revision Level		S09KT0CA	
		Boot Block Revision Level		1.0C	
		BIOS Date (MM/DD/YYYY)		06/19/2023	
Le	suovo"	Preinstalled OS License		Not Defined	
		0401: //10			
F1 H	Help 1	♥ Select Item +/-	Change V	alues F9	Setup Defaults
ESC E	Exit 🗧	Select Menu Enter	Select > S	ub-Menu F10	Save and Exit
		Version 2.22.0057. C	Copyright (C)	2023 AMI	

2. From within the BIOS setup screen, select the "Devices" menu option from the left-side menu options and 'Storage Setup' from the middle menu options.



3. Navigate toward the bottom of the list and select "Intel® VMD Technology".

Note: If this option does not show up here, please check the system BIOS version and consider upgrading to the latest available BIOS.

ThinkStation	Select whether to enable or disable MCIO Drive 1-2. MCIO Drive 2-1 Select whether to enable or disable MCIO Drive 2-1. MCIO Drive 2-2	Enabled	~
Start Menu	Select whether to enable or disable MCIO Drive 2-2.	Enabled	~
Main ☆ Devices ☆ Advanced ♥ Power ♠ Security ▲ Startup ➡ Exit	Configure SATA as Select AHCI/RAID Mode. NOTE: Device driver support is required for AHCI or RAID. Depending on how the hard disk image was installed, changing this setting may prevent the system from booting. Hard Disk Pre-delay Adds a delay before the first access of a hard disk by the system software. Some hard disks hang if accessed before they have initialized themselves. This delay ensures the hard disk has initialized after power up, prior to being accessed.	AHCI	~
Lenovo	> Intel(R) VMD Technology Enable the VMD(Volume Management Device) technology to support configure PCIe storages to VROC(Virtual RAID on CPU) feature.		Ű
F1 Help ESC Exit	↑↓ Select Item +/- Change Values ★→ Select Menu Enter Select > Sub-Menu Version 2.22.0057. Copyright (C) 2023 AMI	F9 Setup Defaults F10 Save and Exit	

- Lenovo
- 4. Under the "Intel® VMD Technology" menu, select the appropriate drives to RAID across and switch the drop-down menu from "PCIe" to "VMD".

ThinkStation.	~	Î
	Intel(R) VMD Technology	
Start Menu		
Main	M.2 Slot1 Enable/Disable Intel(R) Volume Management Device Technology on M.2 Slot1.	PCIe 🗸
☆ Devices☆ Advanced	M.2 Slot2 Enable/Disable Intel(R) Volume Management Device Technology on M.2 Slot2.	PCIe
PowerSecurity	M.2 Slot3 Enable/Disable Intel(R) Volume Management Device Technology on M.2 Slot3.	PCIe 🗸
📩 Startup		
⊟ Exit	PCIe Slot8 Enable/Disable Intel(R) Volume Management Device Technology on PCIe Slot8.	PCIe 🗸
	MCIO Slot1-1 Enable/Disable Intel(R) Volume Management Device Technology on MCIO Slot1-1.	PCIe 🗸
Lenovo	MCIO Slot1-2 Fnable/Disable Intel(R) Volume Management Device	PCIe 🗸
F1 Help ESC Exit	↑↓ Select Item +/- Change Values ★→ Select Menu Enter Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit

In the ThinkStation PX, here is a brief description of what each of these line items mean within the "Intel® VMD Technology" menu. The ThinkStation P5 and P7 have the same concept but with reduced complexity.

Figure 5 below shows how to enable "VMD" across the onboard M.2 slots.



Figure 5 - Onboard M.2 Slots

Figure 6 below shows how to enable "VMD" across the front accessible M.2 drives.

Figure 6 - Front NVMe Drives

MCIO Slot1-1 Enable/Disable Intel(R) Volume Management Device Technology on MCIO Slot1-1.	PCIe	~
MCIO Slot1-2 Enable/Disable Intel(R) Volume Management Device Technology on MCIO Slot1-2.	PCIe	~
MCIO Slot2-1 Enable/Disable Intel(R) Volume Management Device Technology on MCIO Slot2-1.	PCIe	~
MCIO Slot2-2 Enable/Disable Intel(R) Volume Management Device Technology on MCIO Slot2-2.	PCIe	~

Table 2 below shows the representation for the front accessible M.2 drives across the different platforms.

Table 2 - MCIO

РХ	P7	P5
Front M.2 Bay 1	Front M.2 Bay 1 or 3 rd Onboard M.2	Front M.2 Bay 1
→ MCIO Slot 1-1 → MCIO Slot 1-2	→ MCIO Slot 1-1	→ MCIO Slot 1-1
Front M.2 Bay 2 → MCIO Slot 2-1 → MCIO Slot 2-2	M.2 drives installed in internal 3.5" bays → MCIO Slot 1-1 → MCIO Slot 1-2	

Figure 7 below shows how to enable "VMD" across PCIe add-in adapters.

Figure 7 - PCIe NVMe Add-in Adapters

PCIe Slot8	PCIe	~
Enable/Disable Intel(R) Volume Management Device		
Technology on PCIe Slot8		

Note: Depending on the number of PCIe NVMe Add-in Adapters installed in the system will depend on how many of these items show up here.

PCIe Slot $\underline{X} \rightarrow$ correlates to the PCIe slot to where the PCIe add-in adapter is installed.

5. Select the function key F10 to 'Save and Exit' BIOS setup.



Section 4 – How to Create NVMe RAID

Refer to the steps below on how to create an NVMe RAID array. Please be sure to have the Intel VROC module installed per 'Section 1' above.

1. Power on the system and press the function F1 key at the Lenovo splash screen to enter BIOS setup.

Lenovo		
ThinkStation.	 > System Summary > System Time & Date > BIOS Event log 	
Start Menu Main Powices ₩ Advanced Ower Escurity Estit	Machine Type and Model System Brand ID System Serial Number Asset Tag System UUID 1G Ethernet MAC Address 10G Ethernet MAC Address ME Firmware Version Embedded Controller Version	30EUCTO1WW ThinkStation PX MJ0D1234 4D07D780-1B2A-11EE-9CC1-3B54BC194200 F4-6B-8C-D1-E1-FF F4-6B-8C-D1-E2-00 15.20.10.1735 S09EC4FA

2. From within the BIOS setup screen, select the "Advanced" menu option from the left-side menu options and "Intel® Virtual RAID on CPU" from the middle menu options.

Note: If this option does not show up here, please check the system BIOS version and consider upgrading to the latest available BIOS.

ThinkStation.	Configure the memory configuration RAS Configuration Contains RAS features.	^
Start Menu	Displays and provides option to change the Common RefCode Settings.	
슈 Main 슈 Devices	 Intel(R) Manageability Contains Intel vPro features. 	
Power	 Intel(R) Total Memory Encryption Contains Intel(R) Total Memory Encryption features. PIOS Solf-heading 	[]
📩 Startup	[Enabled] Enable BIOS Self-healing feature. [Disabled] Disable BIOS Self-healing feature.	Enabled
E Exit	Odometer [Enabled] Enable BIOS Odometer feature [Disabled] Disable BIOS Odometer feature	Enabled 🗸
Lenovo	 Intel(R) Virtual RAID on CPU This formset allows the user to manage Intel(R) Virtual RAID on CPU 	
F1 Help ESC Exit	T↓ Select Item +/- Change Values ←> Select Menu Enter Select > Sub-Menu Enter	F9 Setup Defaults F10 Save and Exit

3. Select "All Intel VMD Controllers".

Note: "Upgrade key" underlined below will either read "Premium" or "Basic" depending on what is installed in the system.

ThinkStation	←
	Intel(R) Virtual RAID on CPU
Start Menu Main	Intel(R) VROC 8.0.0.4006 VMD Driver Upgrade key: Premium No RAID volumes on the system No RAID volumes were found on the system.
 Power Security Startup Exit 	Intel VROC Managed Controllers: List of all Intel VROC Managed Controllers > All Intel VMD Controllers Select to see more information about the Intel VMD Controllers
Lenovo.	◆ Select Item +/- Change Values F9 Setup Defaults
ESC Exit	Select Menu Enter Select > Sub-Menu F10 Save and Exit
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Note: If the system does not detect a VROC module installed, then the "Upgrade key" will show up as "VROC in pass-thru mode".



4. Select "Create RAID Volume".



Note: If the system does not detect a VROC module, there will be no option to create a RAID volume.

ThinkStation.	← Î
	Intel VROC Managed VMD
Start Menu	All Intel VMD Controllers
🞧 Main	
A Devices	
🔆 Advanced	Non-RAID Physical Disks:
Power	List of physical disks on the system that are not part of a recognized RAID Volume
ት Security	> KXG8AZN84T09 LA KIOXIA SN:42LZZ03BEH65, 3815.45GB
A. Startup	Select to see more information about the disk
	Port 4:0, Slot 10, CPU0, VMD4, BDF 81:00.0
L→ EXIT	Select to see more information about the disk
	XXG8AZN84T09 LA KIOXIA SN:42LZZ038EH65, 3815.45GB
	Select to see more information about the disk
	Port 4: 1, Slot 11, CPU0, VMD4, BDF 82:00.0
Lenovo	XXG847N84T0914 KIOXIA SN:42177036EH65 381545GB
	V RAGAZIO DI LA RIOXIA SIL 42220502105, 5015.4500
F1 Help	↑ Select Item +/- Change Values F9 Setup Defaults
ESC Exit	Control EnterSelect > Sub-MenuF10Save and Exit
	Version 2.22.0057. Copyright (C) 2023 AMI

5. Within the "Create RAID Volume" menu, select a unique name for the RAID volume.

ThinkStation.	~	
	Create RAID Volume	
Start Menu	Create RAID Volume	
에 Main 谷 Devices	Name: Enter a unique volume name that does not contain space at the beginning or backslash and is 16 characters or less.	Volume0
Power	RAID Level: Select RAID Level	RAID0(Stripe) 🗸
A Security	Enable RAID Spanned over VMD Controllers: Enable RAID Spanned over VMD Controllers: For Data RAID only, boot not supported.	~
L⇒ Exit	Select Disks: Select Disks:	
	KXG8AZN84T09 LA KIOXIA SN:92EFA01BFIMK, 3815.45GB Port 2:0 CPU0 VMD2	~
Lenovo.	x - to select Disk KXG8AZN84T09 LA KIOXIA SN:42LZZ03GEH65,	✓
F1 Help ESC Exit	↑↓ Select Item +/- Change Values ← Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit

6. Select a RAID Level from the drop-down menu.

Note: Only available RAID options depending on the type of VROC module and number of NVMe drives detected will show up here.



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7. Select whether to enable RAID to be spanned across multiple VMD controllers. Only applies to ThinkStation PX with dual CPUs.

Note: Bootable RAID arrays cannot be spanned across multiple VMDs.

ThinkStation	+	
	Create RAID Volume	
Start Menu	Create RAID Volume	
☆ Main 谷 Devices ※ Advanced	Name: Enter a unique volume name that does not contain space at the beginning or backslash and is 16 characters or less. RAID Level:	RAIDO(Stripe)
O Power	Select RAID Level	KAIDO(Stripe)
A Security	Enable RAID Spanned over VMD Controllers:	~
🙇 Startup	RAID only, boot not supported.	
Exit		<u>^</u>
	Select Disks: Select Disks:	
	KXG8AZN84T09 LA KIOXIA SN:92EFA01BFIMK, 3815.45GB Port 2:0 CPU0 VMD2	~
Lenovo.	X - to Select Disk	
	KXG8AZN84T09 LA KIOXIA SN:42LZZ03GEH65,	~
F1 Help	↑↓ Select Item +/- Change Values	F9 Setup Defaults
ESC Exit	←→ Select Menu Enter Select > Sub-Menu	F10 Save and Exit

8. Select the drives to use in the RAID array by selecting the "X" from each drop-down menu.

ThinkStation.	<i>←</i>	
	Create RAID Volume	
Start Menu	Create RAID Volume	
 Main ☆ Devices ★ Advanced ○ Power ☆ Security ☆ Startup 	Name: Enter a unique volume name that does not contain space at the beginning or backslash and is 16 characters or less. RAID Level: Select RAID Level Enable RAID Spanned over VMD Controllers: Enable RAID Spanned over VMD Controllers: For Data RAID only, boot not supported.	Volume0 RAID0(Stripe)
Lenovo.	Select Disks: Select Disks: KXG8AZN84T09 LA KIOXIA SN:92EFA01BFIMK, 3815.45GB Port 2:0 CPU0 VMD2 X - to Select Disk KXG8AZN84T09 LA KIOXIA SN:42LZZ03GEH65,	×
F1 Help ESC Exit	↓ Select Item +/- Change Values ←→ Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit

9. The "Strip Size" and "Capacity" will automatically populate values here depending on the RAID type and drives selected.



10. Select "Create Volume".

ThinkStation.	KXG8AZN84T09 LA KIOXIA SN:92EFA031FIMK, 3815.45GB Port 2:3 CPU0 VMD2 X - to Select Disk KXG8AZN84T09 LA KIOXIA SN:42LZZ03BEH65,	× ^
Start Menu Main A Devices Advanced Power Security Security E Startup F Exit	3815.45GB Port 4:0 CPU0 VMD4 X - to Select Disk KXG8AZN84T09 LA KIOXIA SN:42LZZ038EH65, 3815.45GB Port 4:1 CPU0 VMD4 X - to Select Disk KXG8AZN84T09 LA KIOXIA SN:42LZZ036EH65, 3815.45GB Port 4:2 CPU0 VMD4 X - to Select Disk Strip Size: Strip Size: Strip size help Capacity (GB): Capacity is an approximation in GB. Enter desired volume size. 0 will be treated as Maximum Size. Approximate Maximum size=11446.33. Default Capacity is approximately 95% of Maximum size.	X ✓ X ✓ 128КВ ✓ 10874.01
F1 Help ESC Exit	Create a volume with the settings specified above * Select Item * Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit

11. Select "Yes" to confirm creating the RAID volume.

Note: All data on the select drives will be lost.

hinkStation	\leftarrow
	Create Volume
tart Menu	Create Volume
 Main P Devices Advanced P ower Security Startup Evit 	Are you really sure you want to create volume? WARNING: All data on the selected drives will be lost.
Lenovo.	Yes Create Volume No
1 Help C Exit	Select Item +/- Change Values F9 Setup Defaults Select Menu Enter Select > Sub-Menu F10 Save and Exit
Lenovo.	N₂ Select Item +/- Change Values F9 Setup Defaults Select Menu Enter Select > Sub-Menu F10 Save and Exit Version 2.22.0057. Copyright (C) 2023 AMI

12. The created RAID arrays will show up under the root menu for "Intel VROC Managed VMD".



13. To view the RAID volume information, select the RAID volume from the previous step.

ThinkStation	> Delete	
Start Menu	Name: Volume name RAID Level:	test RAID0(Stripe)
슈 Main 伦 Devices	RAID Level (type) Strip Size: Indicates the strip size of the RAID volume	128КВ
 Advanced Power Security 	Size: Size(capacity) in GB or TB Status:	10874.01GB Normal
💑 Startup [→ Exit	Bootable: Indicates whether the volume will be available for I/o access	Yes
	Block size: Block size in bytes	512
Lenovo	RAID Member Disks: Member Disks of the RAID Volume. Select disk to see more info.	
F1 Help T ESC Exit C	 Select Item +/- Change Values Select Menu Enter Select > Sub-Menu 	F9 Setup Defaults F10 Save and Exit

Scrolling down the "RAID Volume Info" screen will show the drives associated with the RAID volume.

ThinkStation.	Bootable: Yes Indicates whether the volume will be available for I/o access Block size: 512	Ŷ
Start Menu	block size in bytes	-
Main ☆ Devices ★ Advanced ○ Power ☆ Security ☆ Startup ► Exit	RAID Member Disks: Member Disks of the RAID Volume. Select disk to see more info. KXG8AZN84T09 LA KIOXIA SN:42LZZ03BEH65, 3815.45GB Port 4:0, Slot 10, CPU0, VMD4, BDF 81:00.0 KXG8AZN84T09 LA KIOXIA SN:42LZZ038EH65, 3815.45GB	
Lenovo.	Fort 4:1, Slot 11, CPU0, VMD4, BDF 82:00.0 KXG8AZN84T09 LA KIOXIA SN:42LZZ036EH65, 3815.45GB Port 4:2, Slot 12, CPU0, VMD4, BDF 83:00.0 Select Item +/- Change Values F9 Setup Defaults Select Menu Enter Select > Sub-Menu F10 Save and Exit	v

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14. To delete the RAID, select the RAID volume from the previous step.

Note: This is destructive and will not be able to recover the RAID array and all data stored on the drives.

ThinkStation	\leftarrow	Î
	Intel VROC Managed VMD	
Start Menu	All Intel VMD Controllers	
에 Main 谷 Devices	 Create RAID Volume This page allows you to create a RAID volume 	
 ※ Advanced ① Power ☆ Security ☆ Startup ▷ Evit 	RAID Volumes: List of recognized RAID Volumes on the Intel VMD controllers > test, RAID0(Stripe), 10874.01GB, Normal Select to see more information about the RAID Volume	
Lenovo	Non-RAID Physical Disks: List of physical disks on the system that are not part of a recognized RAID Volume KXG8AZN84T09 LA KIOXIA SN:92EFA01BFIMK, 3815.45GB Select to see more information about the disk	
F1 Help ESC Exit	N Select Item +/- Change Values F9 Setup Defaults ↔ Select Menu Enter Select > Sub-Menu F10 Save and Exit	

15. Select "Delete".

ThinkStation	<i>←</i>	î
	RAID VOLUME INFO	
Start Menu	RAID VOLUME INFO	
 Main ☆ Devices ※ Advanced ↔ Power 	Volume Actions List of actions available for RAID Volume > Delete	
 Gecurity ▲ Startup → Exit 	Name: Volume name RAID Level: RAID Level (type)	test RAID0(Stripe)
Lenovo.	Strip Size: Indicates the strip size of the RAID volume Size: Size(capacity) in GB or TB Status: Status	128KB 10874.01GB Normal
F1 Help ESC Exit	N Select Item +/- Change Values ↔ Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit

16. Select "Yes".

ThinkStation	<i>←</i>
	Delete
Start Menu	Delete
Main	Delete the RAID volume?
谷 Devices 米 Advanced	ALL DATA ON VOLUME WILL BE LOST!
Power	
음 Security	
🙇 Startup	> Yes
Exit	Deleting a volume will reset the disks to non-RAID.
	> No
Lenovo.	
F1 Help	New Select Item +/- Change Values F9 Setup Defaults
ESC Exit	Select Menu Enter Select > Sub-Menu F10 Save and Exit

Section 5 – How to Enable SATA RAID

In order to setup and configure SATA RAID, BIOS must be set to RAID mode first. Refer to the steps below on how to configure BIOS in RAID mode.

1. Power on the system and press the function F1 key at the Lenovo splash screen to enter BIOS setup.



ThinkStation

> System Summary
 > System Time & Date

		y Bros Evene log			
Sta	rt Menu				
		Machine Type and Model		30EUCTO1WW	
ഹ	Main	System Brand ID		ThinkStation PX	
42	Devices	System Serial Number		MJ0D1234	
*	Advanced	Asset Tag			
Φ	Power	System UUID		4D07D780-1B2A-12	LEE-9CC1-3B54BC194200
0	Fower	1G Ethernet MAC Address	N	F4-6B-8C-D1-E1-FF	
æ	Security	10G Ethernet MAC Address	13	F4-6B-8C-D1-E2-00	
200	Startup	ME Firmware Version		15.20.10.1735	
⊳	Exit	Embedded Controller Version		S09EC4FA	
		BIOS Revision Level		S09KTOCA	
		Boot Block Revision Level		1.0C	
		BIOS Date (MM/DD/YYYY)		06/19/2023	
Le	SUOAO"	Preinstalled OS License		Not Defined	
		0421: VTD		NODDY	
F1 H	Help	↑↓ Select Item +/-	Change \	/alues	F9 Setup Defaults
ESC E	Exit	↔ Select Menu Enter	Select > S	Sub-Menu F	10 Save and Exit

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2. From within the BIOS setup screen, select the "Devices" menu option from the left-side menu options and "Storage Setup" from the middle menu options.



3. Navigate toward the middle of the list and select "Configure SATA as" and change the dropdown menu from "AHCI" to "RAID".

Note: If this option does not show up here, please check the system BIOS version and consider upgrading to the latest available BIOS.

Think@totion	Select whether to enable or disable SATA drive 4.	L
I IIIIINƏLƏLIUII.	M.2 Drive 1	Enabled 🗸
Start Menu	M.2 Drive 2 Select whether to enable or disable M.2 Drive 2.	Enabled 🗸
A Main	M.2 Drive 3 Select whether to enable or disable M.2 Drive 3.	Enabled 🗸
谷 Devices	MCIO Drive 1-1 Select whether to enable or disable MCIO Drive 1-1.	Enabled 🗸
☆ Advanced	MCIO Drive 1-2 Select whether to enable or disable MCIO Drive 1-2.	Enabled 🗸
A Security	MCIO Drive 2-1 Select whether to enable or disable MCIO Drive 2-1.	Enabled 🗸
📩 Startup 🕞 Exit	MCIO Drive 2-2 Select whether to enable or disable MCIO Drive 2-2.	Enabled 🗸
Lenovo.	Configure SATA as Select AHCI/RAID Mode. NOTE: Device driver support is required for AHCI or RAID. Depending on how the hard disk image was installed, changing this setting may prevent the system from booting.	AHCI V AHCI RAID
F1 Help 🔨	Select Item +/- Change Values	F9 Setup Defaults
ESC Exit ↔	Select Menu Enter Select > Sub-Menu	F10 Save and Exit

4. Select the function key F10 to "Save and Exit" BIOS setup.



Section 6 – How to Create a SATA RAID

Refer to the steps below on how to create a SATA RAID array. Note, an Intel VROC module is not necessary to complete these steps below.

> System Summary
 > System Time & Date

1. Power on the system and press the function F1 key at the Lenovo splash screen to enter BIOS setup.



ThinkStation

		>	BIOS Event log						
Sta	rt Menu					20511670110			
\sim	Main		Machine Type and Model			30EUCTO1WW			
տ	Main		System Brand ID			ThinkStation F	×		
谷	Devices		System Serial Number			MJ0D1234			
*	Advanced		Asset Tag						
0	Power		System UUID			4D07D780-1B	2A-11E	E-9CC1-3B54BC194200	
~			1G Ethernet MAC Address	s		F4-6B-8C-D1-E	1-FF		
曲	Security		10G Ethernet MAC Addres	ss	45	F4-6B-8C-D1-E	2-00		
200	Startup		ME Firmware Version			15.20.10.1735			
⊳	Exit		Embedded Controller Version			S09EC4FA			
			BIOS Revision Level			S09KTOCA			
			Boot Block Revision Level	I .		1.0C			
			BIOS Date (MM/DD/YYYY)		06/19/2023			
Le	SUOA?		Preinstalled OS License			Not Defined			
			0421:			NO DOV			
F1 F	Help	1↓	Select Item	+/-	Change	/alues	F9	Setup Defaults	
ESC E	Exit	+ >	Select Menu Er	nter	Select >	Sub-Menu	F10	Save and Exit	
			Version 2.22.00	057. C	opyright (C)	2023 AMI			

2. From within the BIOS setup screen, select the "Advanced" menu option from the left-side menu options and "Intel® VROC sSATA Controller" from the middle menu options.

Note: If this option does not show up here, please check the system BIOS version and consider upgrading to the latest available BIOS.

ThinkStation	Configure the memory configuration RAS Configuration Contains RAS features.	Ŷ
Start Menu 슈 Main 谷 Devices ※ Advanced	 Common RefCode Configuration Displays and provides option to change the Common RefCode Settings. Intel(R) Manageability Contains Intel vPro features. 	
 Power Security Startup Exit 	 Intel(R) Total Memory Encryption Contains Intel(R) Total Memory Encryption features. BIOS Self-healing [Enabled] Enable BIOS Self-healing feature. Odometer [Enabled] Enable BIOS Odometer feature [Disabled] Disable BIOS Odometer feature 	Enabled 🗸
Lenovo.	 Intel(R) VROC sSATA Controller This formset allows the user to manage RAID volumes on the Intel(R) RAID Controller 	Ţ
F1 Help ESC Exit	NJ Select Item +/- Change Values ↔ Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit

3. Select "Create RAID Volume".

ThinkStation.	← Întel(R) VROC sSATA Controller
Start Menu	Intel(R) VROC 8.0.0.4006 sSATA Driver
에 Main 谷 Devices	Create RAID Volume This page allows you to create a RAID volume
 Advanced Power Security Startup Exit 	Non-RAID Physical Disks: List of physical disks on the system that are not part of a recognized RAID Volume Port 4, ST12000NM000J 00MX141 00MX141LEN SN:ZRT02Z1J, 11176.00GB Select to see more information about the disk Port 5, ST12000NM000J 00MX141 00MX141LEN SN:ZRT02K8Z, 11176.00GB Select to see more information about the disk Port 6, ST12000NM000J 00MX141 00MX141LEN SN:ZV70413G, 11176.00GB Select to see more information about the disk Port 7, ST12000NM000J 00MX141 00MX141LEN SN:ZRT02Z5J, 11176.00GB
F1 Help 1 ESC Exit 4	Select Item +/- Change Values F9 Setup Defaults Select Menu Enter Select > Sub-Menu F10 Save and Exit

4. Within the "Create RAID Volume" menu, select a unique name for the RAID volume.

ThinkStation	←	Í
	Create RAID Volume	
Start Menu	Create RAID Volume	
슈 Main 슈 Devices	Name: Enter a unique volume name that does not contain space at the beginning or backslash and is 16 characters or less.	Volume0
 Power Security 	KAID Level: Select RAID Level	RAID0(Stripe) 🗸
📩 Startup	Select Disks: Select Disks:	
L→ Exit	Port 4, ST12000NM000J 00MX141 00MX141LEN SN:ZRT02Z1J, 11176.00GB X - to Select Disk	~
Lenovo	Port 5, ST12000NM000J 00MX141 00MX141LEN SN:ZRT02K8Z, 11176.00GB X - to Select Disk	~
	Port 6, ST12000NM000J 00MX141	
F1 Help ESC Exit	↑↓ Select Item +/- Change Values ←> Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit

5. Select a RAID level from the drop-down menu.

Note: Only available RAID options depending on the number of SATA drives detected will show up here.

ThinkStation	<i>←</i>	Í
	Create RAID Volume	
Start Menu	Create RAID Volume	
Main 谷 Devices	Name: Enter a unique volume name that does not contain space at the beginning or backslash and is 16 characters or less.	Volume0
Power	RAID Level: Select RAID Level	RAIDO(Stripe)
 A Security ▲ Startup → Exit 	Select Disks: Select Disks: Port 4, ST12000NM000J 00MX141	RAID1(Mirror) RAID5(Parity) RAID10(RAID1+0)
Lenovo	00MX141LEN SN:2RT0221J, 11176.00GB X - to Select Disk Port 5, ST12000NM000J 00MX141 00MX141LEN SN:2RT02K8Z, 11176.00GB X - to Select Disk Port 6, ST12000NM000 L 00MX141	
F1 Help ESC Exit	↑↓ Select Item +/- Change Values ←> Select Menu Enter	F9 Setup Defaults F10 Save and Exit

6. Select the drives to use in the RAID array by selecting the "X" from each drop-down menu.

ThinkStation	<i>←</i>	ĺ
	Create RAID Volume	
Start Menu	Create RAID Volume	
 ☆ Main ☆ Devices ☆ Advanced ⊙ Power ☆ Security 	Name: Enter a unique volume name that does not contain space at the beginning or backslash and is 16 characters or less. RAID Level: Select RAID Level	Volume0 RAID0(Stripe)
📩 Startup	Select Disks: Select Disks:	
⊨ Exit	Port 4, ST12000NM000J 00MX141 00MX141LEN SN:ZRT02Z1J, 11176.00GB X - to Select Disk	~
Lenovo	Port 5, ST12000NM000J 00MX141 00MX141LEN SN:ZRT02K8Z, 11176.00GB X - to Select Disk	×
	Port 6, ST12000NM000J 00MX141	✓
F1 Help ESC Exit	Select Menu Version 2.22.0057, Convright (C) 2023 AMI	F10 Save and Exit

7. The "Strip Size" and "Capacity" will automatically populate values here depending on the RAID type and drives selected.

ThinkStation	Select Disks: Select Disks:	
Start Menu	Port 4, ST12000NM000J 00MX141 00MX141LEN SN:ZRT02Z1J, 11176.00GB X - to Select Disk	x 🗸
슈 Main 谷 Devices	Port 5, ST12000NM000J 00MX141 00MX141LEN SN:ZRT02K8Z, 11176.00GB X - to Select Disk	X 🗸
Advanced Power	Port 6, ST12000NM000J 00MX141 00MX141LEN SN:ZV70413G, 11176.00GB X - to Select Disk	X 🗸
A Security	Port 7, ST12000NM000J 00MX141 00MX141LEN SN:ZRT02Z5J, 11176.00GB X - to Select Disk	x 🗸
⊖ Exit	Strip Size: Strip size help	128KB 🗸
Lenovo	Capacity (GB): Capacity is an approximation in GB. Enter desired volume size. 0 will be treated as Maximum Size. Approximate Maximum size=44703.98. Default Capacity is approximately 95% of Maximum size.	42468.78
F1 Help SC Exit	No Select Item +/- Change Values ←> Select Menu Enter Select > Sub-Menu Version 2.22.0057. Copyright (C) 2023 AMI	F9 Setup Defaults F10 Save and Exit

8. Select "Create Volume".



9. Select "Yes" to confirm creating the RAID volume.

Note: All data on the selected drives will be lost.

ThinkStation.	\leftarrow				
	Create volume				
Start Menu	Create volume				
슈 Main 谷 Devices	Are you sure you want to create volume?				
 ※ Advanced ① Power 合 Security 本 Startup 	WARNING: All data on the selected drives will be lost.				
Exit	> Yes > No				
Lenovo.					
F1 Help ESC Exit	N Select Item +/- Change Values F9 Setup Defaults ↔ Select Menu Enter Select > Sub-Menu F10 Save and Exit				
Version 2.22.0057. Copyright (C) 2023 AMI					

10. The created RAID array will show up under the root menu for "Intel VROC sSATA Controller".

ThinkStation.	<i>←</i>
Start Menu	Intel(R) VROC sSATA Controller Intel(R) VROC 8.0.0.4006 sSATA Driver
에 Main 삼 Devices	Create RAID Volume This page allows you to create a RAID volume
 ৵ Advanced Power Security Startup Exit 	RAID Volumes: List of recognized RAID Volumes on the system Volume0, RAID0(Stripe), 42468.78GB, Normal Select to see more information about the RAID Volume
F1 Help ESC Exit	N Select Item +/- Change Values F9 Setup Defaults ↔ Select Menu Enter Select > Sub-Menu F10 Save and Exit

11. To view the RAID volume information, select the RAID volume from the previous step.

ThinkStation.	> Delete	
Start Menu Main Oevices ✓ Advanced ○ Power △ Security ▲ Startup Exit	Name: Volume name RAID Level: RAID Level (type) Strip Size: Indicates the strip size of the RAID volume Size: Size(capacity) in GB or TB Status: Status Bootable: Indicates whether the volume will be available for I/o access Block size: Block size in bytes	Volume0 RAID0(Stripe) 128KB 42468.78GB Normal Yes 512
Lenovo	RAID Member Disks: Member Disks of the RAID Volume. Select disk to see more info.	
F1 Help ESC Exit	↓ Select Item +/- Change Values ↔ Select Menu Enter Select > Sub-Menu Version 2.22.0057. Copyright (C) 2023 AMI	F9 Setup Defaults F10 Save and Exit

12. Scrolling down the "RAID Volume Info" screen will show the drives associated with the RAID volume.

ThinkStation.	Size: Size(capacity) in GB or TB Status: Status	42468.78GB Normal
Start Menu	Bootable: Indicates whether the volume will be available for I/o access	Yes
슈 Main 谷 Devices	Block size: Block size in bytes	512
 ★ Advanced Power ▲ Security ▲ Startup ➡ Exit 	RAID Member Disks: Member Disks of the RAID Volume. Select disk to see more info. > Port 4, ST12000NM000J 00MX141 00MX141LEN S > Port 5, ST12000NM000J 00MX141 00MX141LEN S > Port 6, ST12000NM000J 00MX141 00MX141LEN S	5N:ZRT02Z1J, 11176.00GB 5N:ZRT02K8Z, 11176.00GB 5N:ZV70413G, 11176.00GB
Lenovo	> Port 7, ST12000NM000J 00MX141 00MX141LEN 5	5N:ZRT02Z5J, 11176.00GB
F1 Help ESC Exit	Neelect Item +/- Change Values ↔ Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit

13. To delete the RAID, select the RAID volume from the previous step.

Note: This is destructive and will not be able to recover the RAID array or data on the drives.

ThinkStation	\leftarrow			
C 1 1 1	Intel(R) VROC sSATA Controller			
Start Menu	> Create RAID Volume			
A Devices	This page allows you to create a RAID volume			
 ☆ Advanced ⑦ Power ☆ Security ☆ Startup ▷ Exit 	RAID Volumes: List of recognized RAID Volumes on the system Volume0, RAID0(Stripe), 42468.78GB, Normal Select to see more information about the RAID Volume			
F1 Help ESC Exit	N Select Item +/- Change Values F9 Setup Defaults ↔ Select Menu Enter Select > Sub-Menu F10 Save and Exit			
Version 2.22.0057. Copyright (C) 2023 AMI				

14. Select "Delete".

ThinkStation	÷	Î			
	RAID VOLUME INFO				
Start Menu	art Menu RAID VOLUME INFO				
☆ Main ☆ Devices ₩ Advanced	Volume Actions List of actions available for RAID Volume > Delete				
Security	Name:	Volume0			
🚵 Startup [→ Exit	RAID Level: RAID Level (type)	RAID0(Stripe)			
	Strip Size: Indicates the strip size of the RAID volume	128KB			
	Size: Size(capacity) in GB or TB	42468.78GB			
Lenovo.	Status: Status	Normal			
F1 Help ESC Exit	↑↓ Select Item +/- Change Values ←> Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit			

15. Select "Yes".

ThinkStation.	←					
	Delete					
Start Menu	Delete					
Main	Delete the RAID volume?					
谷 Devices 梁 Advanced	ALL DATA ON VOLUME WILL BE LOST!					
O Power						
🕂 Security						
💑 Startup	> Yes					
Exit	Deleting a volume will reset the disks to non-RAID.					
	> No					
Lenovo						
F1 Help	↑↓ Select Item	+/-	Change Values	F9	Setup Defaults	
ESC Exit	← Select Menu	Enter	Select > Sub-Menu	F10	Save and Exit	

Revision History

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Version	Date	Author	Changes/Updates
1.0	9/18/2023	Jason M.	Initial draft.