Onboard/Integrated Intel Storage Configuration

Lenovo ThinkStation P920, P720, P520, P520c



Lenovo

Table of Contents

Overview	3
Section 1 – ThinkStation P920	4
Section 2 – ThinkStation P720	6
Section 3 – ThinkStation P520	9
Section 4 – ThinkStation P520c	11
Section 5 – Configuring RAID Arrays	13
Section 6 – Deleting RAID Arrays	20
Section 7 - Glossary	23
Section 8 – Document Revision History	

Overview

The purpose of this document is to provide guidance for users on how to configure their SATA storage options using the onboard integrated Intel SATA controller in the ThinkStation P520c, P520, P720, and P920. These ThinkStation systems are capable of supporting up to six SATA HDDs/SSDs at Gen3 (6Gb/s) maximum theoretical throughput. It is important to note that only SATA devices are supported with the onboard integrated Intel SATA controller.

Some users may find a different naming for the SATA controller, depending on BIOS level. Refer to the chart below to for guidance. <u>The steps for creating and deleting SATA RAID are the same regardless of which version is displayed.</u>

ThinkStation Platform	BIOS Level with "Intel® VROC SATA Controller"	BIOS Level with "Intel® RSTe SATA Controller"
P520 / P520c	S03KT30A & newer	S03KT29A & earlier
P720	S04KT40A & newer	S04KT38A & earlier
P920	S05KT40A & newer	S05KT38A & earlier

Section 1 – ThinkStation P920

Level of Support Summary

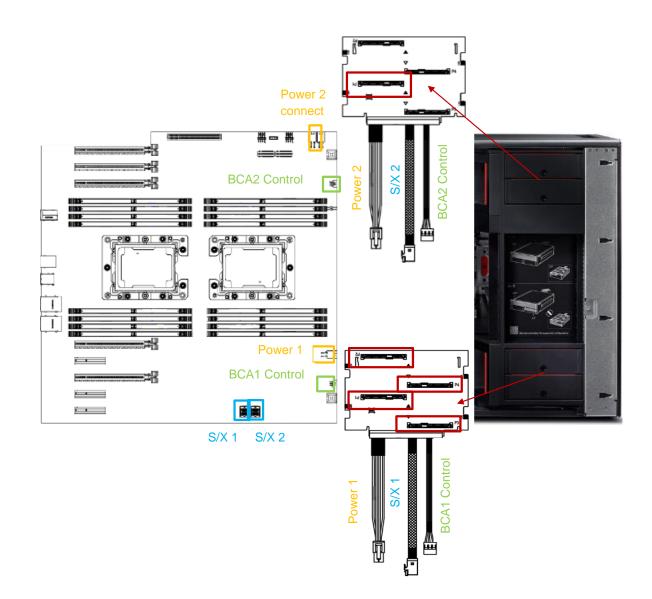
Maximum Number of Drives	6
Connection Method	Tool-less FLEX tray blind-mounted to a backplane (BCA). BCA is standard.
Drive Locations	Drives install into HDD Bays via FLEX Tray.
Hardware Required	BCA-S ¹ or BCA-P Blind HDD FLEX Tray Assembly
Drive Type Supported (6Gb/s)	3.5" SATA HDD (7200rpm) 2.5" SATA SSD
RAID Level Support	RAID 0 RAID 1 RAID 5 RAID 10
Drive Data Rate	Maximum drive data rate is 6Gb/s.
Drive Bay Configuration	0,1,2 drive bays used \rightarrow single BCA-S with dual blind connect FLEX Trays 3,4 drive bays used \rightarrow dual BCA-S with 4 blind connect FLEX trays.

¹ BCA-S comes standard in P920.

How to Utilize the Onboard Intel SATA Controller

In the P920 system, drives are always connected through a backplane called Blind Connect Assembly (BCA). When using the onboard Intel SATA controller, up to four drives can be connected to the first (bottom) BCA and up to two drives can be connected to the second (top) BCA. This gives the P920 support for up to 6 drives with the onboard Intel SATA controller via two BCA's.

The red boxes in the diagram below show the active SATA ports that are available with the onboard Intel SATA controller.



Section 2 – ThinkStation P720

Level of Support Summary

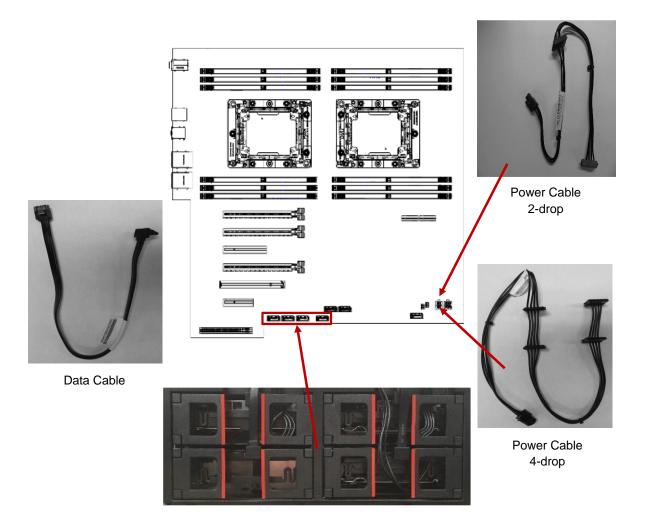
"Default" - Manual HDD Conne	ct Option
Maximum Number of Drives	4
Connection Method	Manual plug for data and power using standard cabling methods.
Drive Locations	Drives install into HDD Bays via FLEX Tray.
Hardware Required	SATA HDD cable(s) HDD Power cable Manual HDD FLEX Tray Assembly
Drive Type Supported (6Gb/s)	3.5" SATA HDD (7200rpm) 2.5" SATA SSD
RAID Level Support	RAID 0 RAID 1 RAID 5 RAID 10
Drive Data Rate	Maximum drive data rate is 6Gb/s.
Drive Bay Configuration	$0,1 \text{ drives} \rightarrow 1 \text{ SATA} + 1 \text{ dual drop power}$ $2 \text{ drives} \rightarrow 2 \text{ SATA} + 1 \text{ dual drop power}$ $3 \text{ drives} \rightarrow 3 \text{ SATA} + 1 \text{ quad drop power} + 2 \text{ manual}$ FLEX trays $4 \text{ drives} \rightarrow 4 \text{ SATA} + 1 \text{ quad drop power} + 2 \text{ manual}$ FLEX trays

"Optional" – Blind Connect Assembly (BCA) using the integrated Intel Controller		
Maximum Number of Drives	4	
Connection Method	Tool-less via BCA. BCA is optional.	
Drive Locations	Drives install into HDD Bays via FLEX Tray.	
Hardware Required	Up to two BCA-S or one BCA-S + BCA-P. Blind HDD FLEX Tray Handle Assembly.	
Drive Type Supported (6Gb/s)	3.5" SATA HDD (7200rpm) 2.5" SATA SSD	
RAID Level Support	RAID 0 RAID 1 RAID 5 RAID 10	
Drive Data Rate	Maximum drive data rate is 6Gb/s.	
Drive Bay Configuration	0,1,2,3,4 drives \rightarrow 2 BCA's + 4 FLEX trays	

How to Utilize the Onboard Intel SATA Controller

In the P720 system, SATA drives are connected to the onboard Intel SATA controller via a manual plug method. This consists of manually cabling both power and data to each drive individually. The P720 system can support up to 4 drives using the onboard Intel SATA controller.

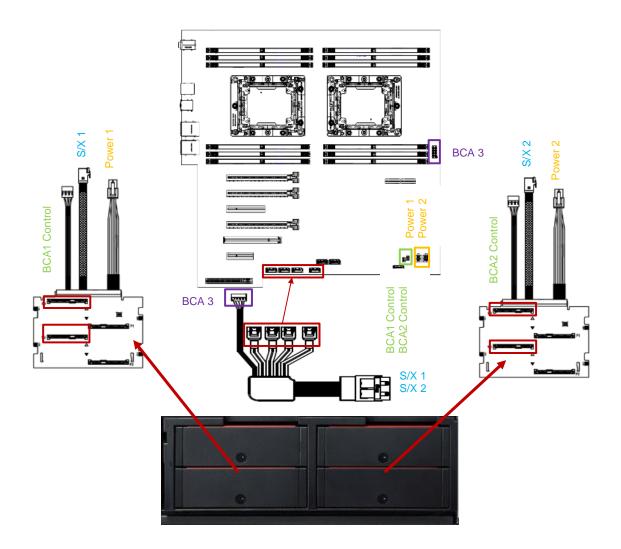
HDD/SSD Manual Connect Option



Optionally, in the P720 system, SATA drives can be connected to the onboard Intel SATA controller via BCA's. This consists of the Blind Connect to SATA cable and dual BCA-S. The P720 system can support up to 4 drives using the onboard Intel SATA controller.

The red boxes in the diagram below show the active SATA ports that are available with the onboard Intel SATA controller.

Blind Connect Assembly (BCA) Option



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Section 3 – ThinkStation P520

Level of Support Summary

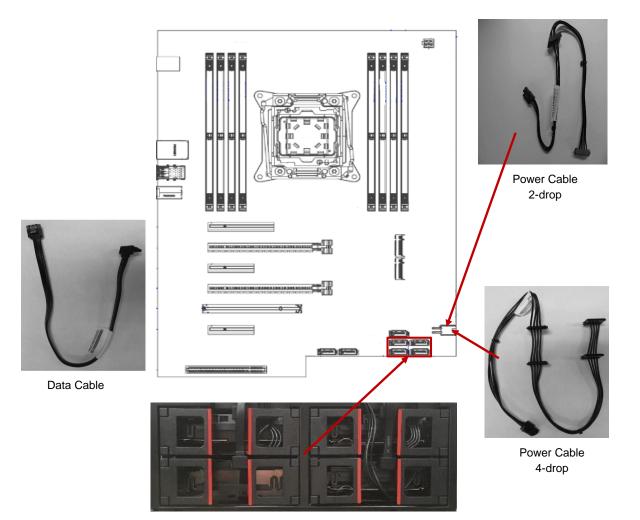
Maximum Number of Drives	4
Connection Method	Manual plug for data and power using standard cabling methods. BCA is not supported.
Drive Locations	4 Drives install into HDD Bays via FLEX Tray.
Hardware Required	SATA HDD cable(s) ² SATA HDD Power cable(s) ³ SATA HDD Power cable(s) ⁴
Drive Type Supported (6Gb/s)	3.5" SATA HDD (7200rpm) 2.5" SATA SSD
RAID Level Support	RAID 0 RAID 1 RAID 5 RAID 10
Drive Data Rate	Maximum drive data rate is 6Gb/s.
Drive Bay Configuration	0,1 drives → 1 SATA + 1 dual drop power 2 drives → 2 SATA + 1 dual drop power 3 drives → 3 SATA + 1 quad drop power + 1 cage/tray kit 4 drives → 4 SATA + 1 quad drop power + 1 cage/tray kit

² SATA HDD cable(s) should equal the quantity of HDD's/SSD's in the HDD bays and FLEX bays.

 ³ 2-drop HDD Power cable for the HDD's/SSD's in the HDD bays comes standard.
 ⁴ 4-drop HDD Power cable for the HDD's/SSD's in the HDD bays gets derived when more than two drives are selected.

How to Utilize the Onboard Intel SATA Controller

In the P520 system, SATA drives are connected to the onboard Intel SATA controller via a manual plug method. This consists of manually cabling both power and data to each drive individually. The P520 system supports up to 4 drives using the onboard Intel SATA controller.



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Section 4 – ThinkStation P520c

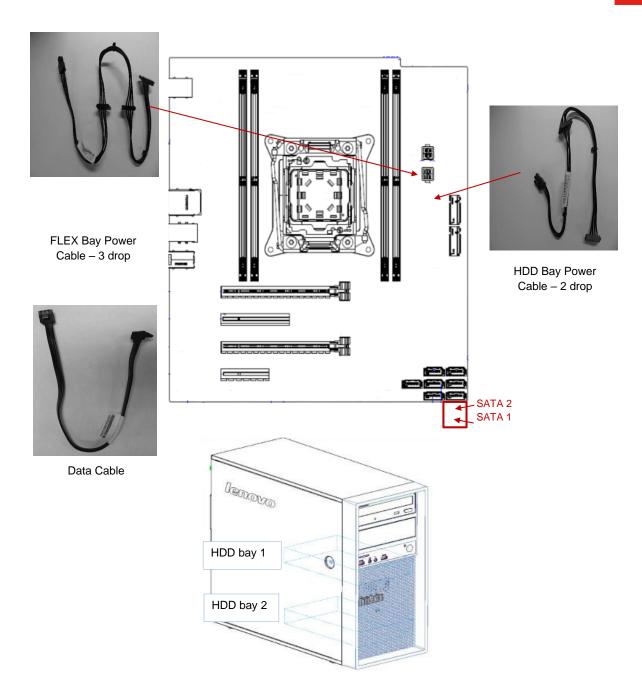
Level of Support Summary

Maximum Number of Drives	2
Connection Method	Manual plug for data and power using standard cabling methods. BCA is not supported.
Drive Locations	2 Drives install into HDD Bays via FLEX Tray.
Hardware Required	SATA HDD cable(s) ⁵ HDD Power cable(s) ⁶
Drive Type Supported (6Gb/s)	3.5" SATA HDD (7200rpm) 2.5" SATA SSD
RAID Level Support	RAID 0 RAID 1
Drive Data Rate	Maximum drive data rate is 6Gb/s.

 ⁵ SATA HDD cable(s) should equal the quantity of HDD's/SSD's in the HDD bays and FLEX bays.
 ⁶ 2-drop HDD Power cable for the HDD's/SSD's in the HDD bays.

How to Utilize the Onboard Intel SATA Controller

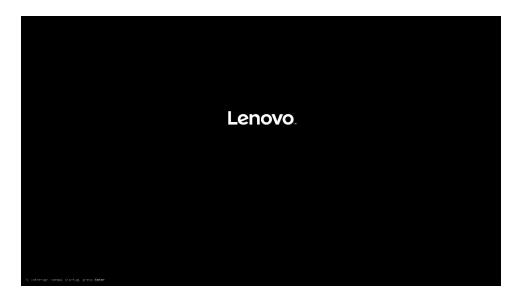
In the P520c system, SATA drives are connected to the onboard Intel SATA controller via a manual plug method. This consists of manually cabling both power and data to each drive individually. The onboard Intel SATA controller supports up to 4 drives (2 drives in the HDD bays and 2 drives in the FLEX bays).



Section 5 – Configuring RAID Arrays

Follow the instructions below to create a basic RAID array using the onboard Intel SATA controller.

- 1. Install the drives for the RAID array into the system. See the above sections to determine the correct hardware and placement of the storage devices.
- 2. Power on the system and press the 'F1' function key at the 'Lenovo' splash screen indicated below to enter BIOS.



Th	inkStation	System Language		English	~
	minotution.	> System Summary			
		> System Time & Date			
Sta	rt Menu	Setup mode select		Graphic	~
ଲ	Main	Setup Content		Advanced	~
49	Devices				
*	Advanced	Machine Type and Model		30BE0059US	
Ο	Power	System Brand ID		ThinkStation P520	
A	Security	System Serial Number	\square	MJ06001	
a.	Startup	Asset Tag		Default string	
⊡.	Exit	System UUID		2A989E80-5623-11E9	-939A-325FA54FE40F
Ŀ	EXIT	Ethernet MAC Address			
		BIOS Revision Level		S03KT59A	
		Boot Block Revision Level		S0359A	
	enovo.	BIOS Date (MM/DD/YYYY)		04/14/2023	
		Preinstalled OS License		Not Defined	
F1	Help	↑↓ Select Item	+/-	Change Values	F9 Setup Defaults
ESC	Exit	Select Menu	Enter	Select > Sub-Menu	F10 Save and Exit

3. Select the "Devices" menu along the left column and "PCH SATA Configuration" menu along the right column at the screen indicated below.

ThinkStation	Audio Setup Select this option to configure yo Video Setup			
Start Menu G Main 쭌 Devices	Select this option to configure yo > Network Setup Select this option to configure yo > USB Configuration Select this option to configure yo	ur system's network.		
 Advanced Power Accurity ▲ Startup Exit 	PCH SATA Configuration Select this option to configure yo Intel(R) Thunderbolt Select this option to configure yo			
Lenovo.	♣ Select Item ♦ Select Menu	+/- Change Values Enter: Select - Sub-Menu	F9 Setup Defaults F10 Save and Exit	

4. Select the "Configure SATA as" menu option drop-down menu box and select "RAID" as indicated below.

ThinkStation.	← PCH SATA Configur	ation		
itart Menu	SATA Controller Enable or Disable SATA Controller		Enabled	~
Main Constant Main Constant Main Advanced O Power	Configure SATA as Select AHCI/RAID Mode. NOTE: Device driver support is required fo	age was installed, changing this setting	AHCI AHCI RAID	~
🕂 Security 🍰 Startup	Port 1 Enable or Disable SATA port		Enabled	~
→ Exit	Port 2 Enable or Disable SATA port		Enabled	~
	Port 3 Enable or Disable SATA port		Enabled	~
Lenovo.	Port 4 Enable or Disable SATA port		Enabled	~
F1 Help ISC Exit	Select Item ↔ Select Menu	+/- Change Values Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit	

Lenovo

5. Select F10 key to "Save and Exit" the BIOS setup menu.

Menu		Enabled	~
	Configure Select we b Save & reset	RAID	~
vanced	Save & reset Save & configuration and reset?		
curity artup	Port 1 Coole or Dr	Enabled	~
it	Port 2 Yes No	Enabled	~
	Port 3 Enable or Disable SATA peri	Enabled	~
novo.		Enabled	~
	Example of Di- Port 3 Example so Diazole SoTA pers Port 4	Enabled	

6. As the system reboots, reenter BIOS using the same method as before. Select the "Advanced" menu along the left column and select the "Intel® VROC SATA Controller" menu along the right column at the screen indicated below.

ThinkStation	Enables or disable Windows Hardware Error Architecture. CPU Configuration Memory RAS Configuration
Start Menu Main Devices Advanced Power Security Setartup 	Contains Memory features. Common RefCode Configuration Displays and provides option to change the Common RefCode Settings Intel TXT (LT-SX) Configuration Lettel TXT (LT-SX) Configuration AMT Configuration AMT Configuration Intel(R) VMD technology
Exit	Intel(R) VROC SATA Controller This formset allows the user to manage RAID volumes on the Intel(R) RAID Controller Intel(R) Virtual RAID on CPU This formset allows the user to manage Intel(R) Virtual RAID on CPU Driver Health Ve Change Values P3 Setup Defaults
ESC Exit	♦ Select Menu Enter Select > Sub-Menu F10 Save and Exit Version 2.00.004. Copyright (5) (302) Anomical Programma International LLC.

On older BIOS versions, this option may display as "Intel® RSTe SATA Controller". For more information, please see <u>this table</u> in the Overview section. The process for creating SATA RAID is identical, so continue following along the next steps.

 Contrigure the diagnostic function (estU) configuration. Peter/PCI Settings WHEA Configuration Devices Advanced Power Startup Startup Exit Common RefCode Configuration Displays and provides option to change the Common RefCode Settings Intel TXT (LT-SX) Configuration Intel TXT (LT-SX) Configuration Intel TXT (LT-SX) Configuration Mathematical Configuration Intel TXT (LT-SX) Configuration Intel TXT (LT-SX) Configuration Intel TXT (LT-SX) Configuration Intel (R) VMD technology Intel (R) STE SATA Controller This formset allows the user to manage RAID volumes on the Intel(R) RAID Controller Driver Health Version 2.19.0045. Copyright (C) 2019 American Megatrends, Inc. 		fff Previous Values(F Optimize Defaults((Back (Back (Back (F10))
--	--	---

7. Select the "Create RAID Volume" menu option.

ThinkStation.	← Intel(R) VROC SATA Controller Intel(R) VROC 7.5.11.1002 SATA Driver	
슈 Main 俗 Devices	Create RAID Volume This page allows you to create a RAID volume	
Advanced ① Power ☆ Security ▲ Startup ⊡ Exit	Non-RAID Physical Disks: List of physical disks on the system that are not part of a recognized RAID Volume	
Lenovo.		
ESC Exit	← Select Menu Enter Select > Sub-Menu F10 Save and Exit	

8. Select the "RAID Level" drop-down menu box and select the RAID type.

ThinkStation	← Create RAID Volume	
tart Menu	Create RAID Volume	
유 Main 쮸 Devices	Name: Enter a unique volume name that does not contain space at the beginning or backslash and is 16 characters or less.	Volume0
Advanced	RAID Level: Select RAID Level	RAID0(Stripe)
丹 Security ▲ Startup → Exit	Select Disks: Select Disks:	RAID1(Mirror) RAID5(Parity) RAID10(RAID0+1)
-	Port 0, Micron MTFDDAK256TBN SN:171817128481, 238.47GB X - to Select Disk	
Lenovo.	Port 1, Micron MTFDDAK256TBN SN:17181712845E, 238.47GB X - to Select Disk	· · · · · · · · · · · · · · · · · · ·
	Port 3, Micron MTFDDAK256TBN SN:1650164B0C2F, 238.47GB	×
F1 Help SC Exit	↑↓ Select Item +/- Change Values ◆ → Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit

9. Select the disks to use in the RAID array by selecting the drop-down box next to each disk and select 'X' to select the disk to use in the RAID array creation.

\leftarrow	
Create RAID Volume	
Create RAID Volume	
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 RAID10(RAID0+1)
Select Disks: Select Disks: Port 0, Micron MTFDDAK256TBN SN:171817128481, 238.47GB	×1
X - to Select Disk Port 1, Micron MTFDDAK256TBN SN:17181712845E, 238.47GB X - to Select Disk Port 3, Micron MTFDDAK256TBN SN:1650164B0C2F, 238.47GB	×
1↓ Select Item +/- Change Values ◆ Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit
	Create RAID Volume name that does not contain space at the beginning of the submatched of the s

10. Scroll down to the bottom of the window and select "Create Volume".

ThinkStation	Port 1, Micron MTFDDAK256TBN SN:17181712845E, 238.47GB X - to Select Disk	X 🗸	
	Port 3, Micron MTFDDAK256TBN SN:1650164B0C2F, 238.47GB X - to Select Disk	x 🗸	
Start Menu	Port 5, Micron MTFDDAK256TBN SN:171817128463, 238.47GB X - to Select Disk	x 🗸	
🛱 Main			
🖞 Devices	Strip Size:	64KB	
* Advanced	Strip size help	64KB 🗸	
D Power	Capacity (GB):	453.09	
🔒 Security	Capacity is an approximation in G8. Enter desired volume size. 0 will be treated as Maximum Size. Approximate Maximum size=476.94. Default Capacity is approximately 95% of Maximum size.		
💪 Startup	сарасту із арролінатегу ээж ог нахініції size.		
→ Exit			
	> Create Volume		
Lenovo	Create a volume with the settings specified above		
F1 Help	↑↓ Select Item +/- Change Values	F9 Setup Defaults	

11. The RAID array will then show up under the "RAID Volumes:" section as indicated in the screenshot below.

ThinkStation	← Intel(R) VROC SAT		
Start Menu	Intel(R) VROC 7.5.11.1002 SA	ATA Driver	
G Main 谷 Devices 梁 Advanced	 Create RAID Volume This page allows you to create a R 	AID volume	
PowerSecurity	RAID Volumes: List of recognized RAID Volumes of	on the system	
💁 Startup [→ Exit	 Volume0, RAID10(RAID0+1), Select to see more information ab 		
Lenovo			
F1 Help ESC Exit	↑↓ Select Item ♦ Select Menu	+/- Change Values Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit
	Version 2.20.0349.	Copyright (C) 2023 American Megatrends International LLC.	

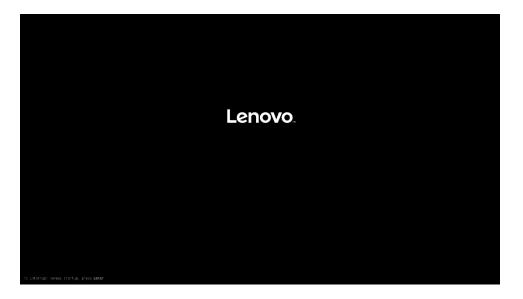
12. Once finished with creating the RAID array(s), press 'F10' to 'Save and 'Exit' BIOS.

Start Menu Image: Constraint of the second	← Intel(R) VROC SATA Controller Intel(R) VROC 7.5.11 1002 SATA Driver Create IRA: This page of Save & reset (⑦) Save configuration and reset? RAID Volu	
Security Startup Exit Lenovo.	VolumeO, Select to ser Yes No ** Select Item ** Select Item ** ** Select Item **	

Section 6 – Deleting RAID Arrays

Follow the instructions below to delete an existing RAID array using the onboard Intel SATA controller.

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



2. Select the "Setup" menu option at the screen indicated below.

ThinkStation	System Language		English		~	Î
I IIIIINULULIUII.	> System Summary					
	> System Time & Date					
Start Menu	Setup mode select		Graphic		~	
🞧 Main	Setup Content		Advanced		~	
P Devices						
* Advanced	Machine Type and Model		30BE0059US			
Power	System Brand ID		ThinkStation P520			
A Security	System Serial Number	\square	MJ06001			
Startup	Asset Tag		Default string			
Exit	System UUID		2A989E80-5623-11E9	-939A-325FA5	4FE40F	
L→ Exit	Ethernet MAC Address					
	BIOS Revision Level		S03KT59A			
	Boot Block Revision Level		S0359A			
Lenovo	BIOS Date (MM/DD/YYYY)		04/14/2023			
LCHOVO.	Preinstalled OS License		Not Defined			
F1 Help	↑↓ Select Item	+/-	Change Values	F9		
ESC Exit	Select Menu	Enter	Select > Sub-Menu	F10	Save and Exit	

3. Select the "Advanced" menu along the left column and select the "Intel® VROC SATA Controller" menu along the right column at the screen indicated below. On older BIOS versions, this option may display as "Intel® RSTe SATA Controller".

ThinkStation	Enables or disable Windows Hardware Error Architecture. CPU Configuration Memory RAS Configuration
Adam Main Poevices ✓ Advanced O Power Accurity ▲ Startup	Contains Memory features. Common RefCode Configuration Displays and provides option to change the Common RefCode Settings Intel TXT (LT-SX) Configuration Intel TXT (LT-SX) Configuration AMT Configuration MIT Configuration Intel(R) VMD technology
E Exit Lenovo.	Intel(R) VROC SATA Controller This formset allows the user to manage RAID volumes on the Intel(R) RAID Controller Intel(R) Virtual RAID on CPU This formset allows the user to manage Intel(R) Virtual RAID on CPU Driver Health
F1 Help ESC Exit	1 Select Item +/- Change Values F9 Setup Defaults +> Select Menu Enter Select > Sub-Menu F10 Save and Exit

4. To delete the RAID volume, select the RAID volume and select "Delete".

ThinkStation	←	Î
ΠΠΠΛΟΙΔΙΙΟΠ.	RAID VOLUME INFO	
	RAID VOLUME INFO	
Start Menu		
에 Main 삼 Devices	Volume Actions List of actions available for RAID Volume	
🐙 Advanced	> Delete	
Power		
🕂 Security		
🚣 Startup	Name: Volume name	Volume0
i⇒ Exit	RAID Level: RAID Level (type)	RAID10(RAID0+1)
Lenovo	Strip Size: Indicates the strip size of the RAID volume	64KB
Lenovo.	Size: Size(capacity) in GB or TB	453.09GB
F1 Help ESC Exit	↑↓ Select Item +/- Change Values ↔ Select Menu Enter Select > Sub-Menu	F9 Setup Defaults F10 Save and Exit
	Version 2.20.0049. Copyright (C) 2023 American Megatrends International LLC.	

5. Select "Yes" to confirm deletion. <u>This step will permanently wipe all data</u> <u>on the drive</u>.

ThinkStation	4
i iiiinotativii.	Delete
	Delete
Start Menu	
Main A Devices	Delete the RAID volume?
* Advanced	ALL DATA ON VOLUME WILL BE LOST!
D Power	
🔒 Security	
💪 Startup	
Exit	> Yes Deleting a volume will reset the disks to non-RAID.
Lenovo	> No
F1 Help ESC Exit	1↓ Select Item (/- Change Values F9 Setup Defaults ↔ Select Menu Enter Select > Sub-Menu F10 Save and Exit
	Version 2.20.0349. Copyright (C) 2023 American Megatrends International LLC.

6. Once finished, press F10 to save changes and exit BIOS.

ThinkStation.	← Intel(R) VROC SATA Controller	
Start Menu		
(元) Main 谷 Devices 梁 Advanced	Sicreate RA This rage a	
Power Security	Save configuration and reset?	
💪 Startup ⊖ Exit	Non-RAID Dat of stype Volume Yes No	
	Port 0, Mide Select to see internation about the disk	
Lenovo		
E1 Help ESC Exit	No Select Item ⊕ Change Values ↔ Select Menu Enter Select > Sub-Menu	

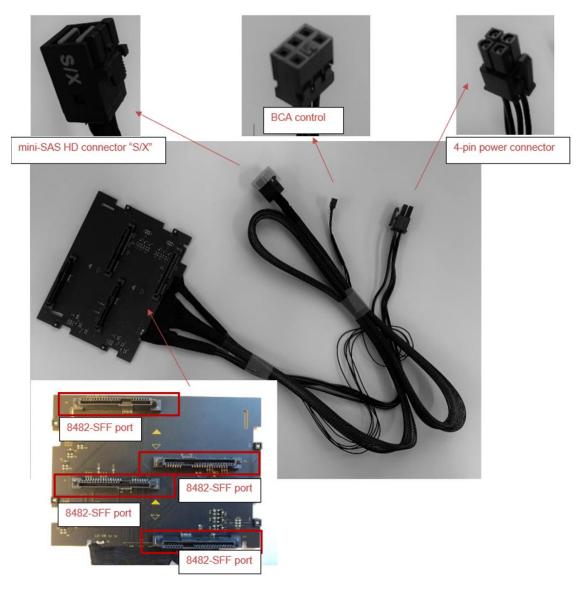
Lenovo

Section 7 - Glossary

Blind Connect Assembly (BCA)

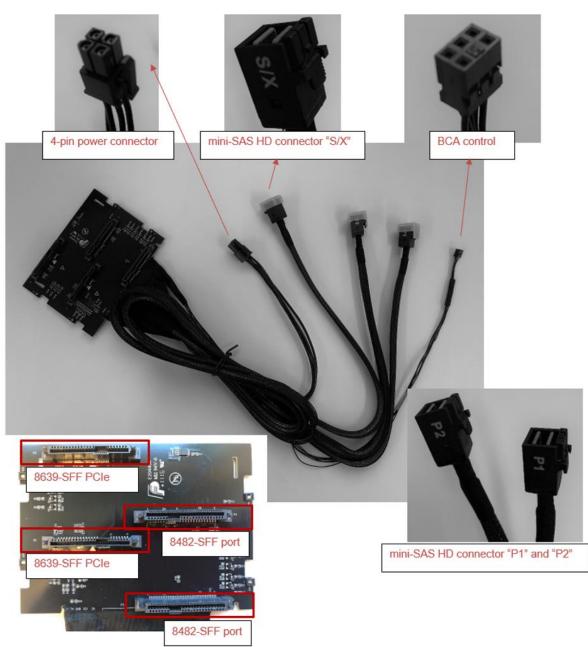
BCA-S: Blind Connect Assembly consisting of four 8482-SFF ports (supporting SAS and SATA drives). The assembly also contains the following cable connections:

- One 4-pin power connector that connects to the motherboard.
- One mini-SAS HD connector labeled "S/X" that connects to either the onboard Intel controller or the Broadcom controller



<u>BCA-P</u>: Blind Connect Assembly consisting of two 8639-SFF (U.2) ports (supporting PCIe, SAS, or SATA drives) and two 8482-SFF ports (supporting SAS or SATA drives). The assembly also contains the following cable connections:

- One 4-pin power connector that connects to the motherboard.
- Two mini-SAS HD connectors that connect to the Broadcom adapter (for PCIe connections).
- One mini-SAS HD connector labeled "S/X" that connects to either the onboard Intel controller or the Broadcom controller.



Connector Type	Drives Supported
	SATA
8639-SFF (U.2) PCIe port	SAS (only with Broadcom controller)
	NVMe (U.2 only)
9492 SEE port	SATA
8482-SFF port	SAS (only with Broadcom controller)

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FLEX Tray



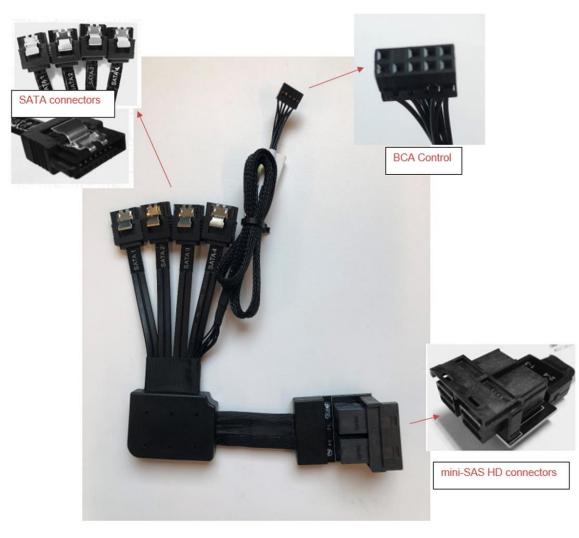
Blind Connect FLEX Tray : Tool-less tray that can hold up to two drives and utilizes a "pull-bar" style handle to connect drive(s) to the BCA



Manual Connect FLEX Tray : Tool-less tray that can hold up to two drives. These trays utilize hinged pulls that open and allow for cable access and manual cable connections.

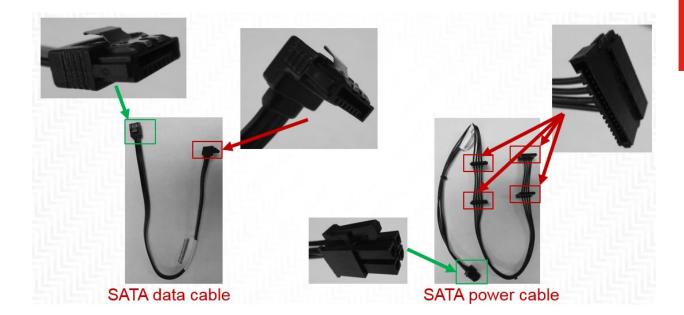
Blind Connect to SATA cable

Blind Connect to SATA cable used to support SATA drives on Intel Onboard Controller via BCA-S for P720.



Manual HDD Connect Cables

Manual HDD connect cables are used to support SATA drives using Intel onboard SATA controller.



Section 8 – Document Revision History

Version	Date	Author	Changes/Updates
1.4	7/26/2023	Chris C.	Updated information and visuals
1.3	10/25/2018	Jason Moebs	Updated Blind Connect to SATA cable in
			Glossary Section.
1.2	10/24/2018	Jason Moebs	Update Glossary Section.
1.1	10/10/2018	Jason Moebs	Updates throughout.
1.0	10/10/2018	Jason Moebs	Initial launch release.