Supporting PCIe Based Storage on ThinkStation P500/P510, P700/P710, and P900/P910 Platforms

Version 1.1

1. Introduction

The introduction of the new ThinkStation P500, P700, and P900 platforms brings with it several new exciting technologies to increase the performance of the system. One of these new technologies is PCIe based solid state storage. This technology offers a new type of architecture for storage that uses the extremely capable PCIe system bus instead of traditional SATA busses. With this change, users can reach even higher performance levels when it comes to storage bandwidth. This document will highlight the types of PCIe based storage that are supported on the new ThinkStation P500/P510, P700/P710, and P900/P910 systems as well as provide information about how to properly configure these systems to take advantage of this new technology.

2. Types of PCIe Based Solid State Storage

PCIe based solid state storage devices come in several different form factors that are supported by a variety of interfaces. These include the following:

- 2.5” PCIe SSDs supporting the 8639 small form factor interface

- M.2 PCIe SSDs (also shown with M.2 FLEX Adapter)

- Add-in PCIe SSDs

These form factors are all quite different from one another in physical appearance; however their main function is still the same. They are all devices consisting of an onboard controller with onboard solid state memory that use the system's PCIe bus to communicate back to the system processor or chipset.

By using the PCIe bus, these PCIe based storage devices can achieve a much higher link speed than traditional SATA based storage devices. PCIe 3.0 (x4) devices can link with a theoretical max bandwidth of 32Gb/s, which far exceeds the theoretical max bandwidth of SATA3 at 6Gb/s.

All of the above form factors are supported in the P500/P510, P700/P710, and P900/P910 ThinkStation platforms. It is important to note that the number of each type of device supported will vary by platform. Also, supporting certain form factors will require additional hardware and specific connection details as highlighted in the following sections.

3. Supporting PCIe Based Storage Devices in the ThinkStation P500 and ThinkStation P700/P710

P500/P510/P700/P710 Support for 2.5" PCIe SSDs with 8639 SFF connector

Maximum number of drives supported	1 (P500/P510) 2 (P700/P710)
Drive location	Installs in to FLEX Tray (max 1 drive per tray)
Additional hardware required*	Multi IO Port FLEX Adapter BCA-P (Blind Connect Assembly SATA/SAS/PCIe) Blind HDD FLEX Tray Handle Assembly

*Systems ordered with 2.5" PCIe SSDs will come with the required additional hardware already installed.

Installation Notes:

- The system must be equipped with one BCA-P
- The system must have the Multi IO Port FLEX Adapter installed in the FLEX Slot on the motherboard
- 2.5" PCIe SSDs install into the Blind Connect FLEX Tray (Note : Max of 1 drive per tray)
- The FLEX Tray then installs into the BCA-P in the **"UP"** position(s)
- The BCA-P power cord connects to the system motherboard
- The BCA-P P1 connector connects to the P1 port on the Multi IO Port FLEX Adapter
- The BCA-P P2 connector connects to the P2 port on the Multi IO Port FLEX Adapter
- The BCA-P S/X connector can connect to the Avago 9364-8i SATA/SAS ROC Adapter (if installed) to provide additional SATA/SAS support. If two 2.5" PCIe drives are utilized in P700/P710, then the S/X connector would remain unconnected.

P500/P510/P700/P710 Support for M.2 PCIe SSDs

Maximum number of drives supported	1 (P500/P510) 2 (P700/P710)
Bus Supported	PCIe 3.0, up to x4 lanes
Drive location	Onboard the FLEX Adapter (P500/P510 = slot 1 only)
Additional hardware required*	M.2 SSD FLEX Adapter

*Systems ordered with M.2 PCIe drives will come with the required additional hardware already installed.

Installation Notes:

- The system must have the M.2 SSD FLEX Adapter installed in the FLEX Slot on the motherboard
- For P500/P510, the M.2 PCIe SSD must be installed in slot 1 on the M.2 SSD FLEX Adapter
- For P700/P710, M.2 PCIe SSDs can be installed to either slot on the M.2 SSD FLEX Adapter

- At this time, M.2 cards of 80mm in length can secured to the M.2 SSD FLEX Adapter

P500/P510/P700/P710 Support for Add-in PCIe SSDs

Maximum number of drives supported	Depends on number of available PCIe slots
Drive location	Traditional PCIe slot (x4 or larger)
Additional hardware required	None

Installation Notes:

- The Add-in PCIe SSD installs directly to an available PCIe slot on the motherboard (generally x4 or larger).
- For P700/P710, CPU2 must be populated if PCIe Add-in cards are to be installed to slots 1 and 3.
- For PCIe Add-in SSDs that are gen3 compliant, ensure they are installed to a gen3 capable slot for optimal performance. Refer to the ThinkStation Tech Specs site (www.thinkstation-specs.com) for more information on PCIe slot bandwidth.

4. Supporting PCIe Based Storage in the ThinkStation P900/P910

P900/P910 Support for 2.5" PCIe SSDs with 8639 SFF connector

Maximum number of drives supported*	4 total (2 drives per Multi IO Port FLEX Adapter)
Drive location	Installs in to FLEX Tray (max 1 drive per tray)
Additional hardware required **1-2 drives**	1 x Multi IO Port FLEX Adapter 1 x BCA-P (Blind Connect Assembly SATA/SAS/PCIe)
Additional hardware required **3-4 drives**	2 x Multi IO Port FLEX Adapters 2 x BCA-P (Blind Connect Assembly SATA/SAS/PCIe)

*Support for 3-4 drives requires dual CPUs to be installed
**Systems ordered with 2.5" PCIe SSDs will come with the required additional hardware already installed.

Installation Notes:

- The system must be equipped with at least one BCA-P
- The system must have the Multi IO Port FLEX Adapter installed in the FLEX Slot on the motherboard
- 2.5" PCIe SSDs install into the FLEX Tray (Note : Max of one 2.5" PCIe SSD per tray).
- The FLEX Tray then installs into the BCA-P in the **"UP"** position(s)
- The BCA-P power cord connects to the system motherboard
- The BCA-P P1 connector connects to the P1 port on the Multi IO Port FLEX Adapter
- The BCA-P P2 connector connects to the P2 port on the Multi IO Port FLEX Adapter
- The BCA-P S/X connector can connect to the Avago 9364-8i SATA/SAS ROC Adapter (if installed), the Avago SAS/SATA RAID FLEX Adapter (if installed), or the onboard Intel controller.

Additional Installation Notes (3-4 drives):

- The system must be equipped with at least two BCA-P
- The system must have two Multi IO Port FLEX Adapters installed
- The BCA-P S/X connector can connect to the Avago 9364-8i SATA/SAS ROC Adapter (if installed), the Avago SAS/SATA RAID FLEX Adapter (if installed), or the onboard Intel controller.

P900/P910 Support for M.2 PCIe SSDs

Maximum number of drives supported	4*
Drive location	Onboard the FLEX Adapter
Bus Supported	PCIe 3.0, up to x4 lanes
Additional hardware required **1-2 drives**	1 x M.2 SSD FLEX Adapter
Additional hardware required **3-4 drives***	2 x M.2 SSD FLEX Adapters

*Support for 3-4 drives requires dual CPUs to be installed.
**Systems ordered with M.2 PCIe SSDs will come with the required additional hardware already installed.

Installation Notes:

- The system must have the M.2 SSD FLEX Adapter installed in the FLEX Slot on the motherboard
- M.2 PCIe SSDs can be installed to either slot 1 or slot 2.
- For 3-4 drives, a second M.2 SSD FLEX Adapter is required.
- Slot 2 on the M.2 SSD FLEX Adapter can also support M.2 SATA SSDs if available, but the M.2 SSD FLEX adapter must be installed in the black FLEX Slot on the motherboard to support this feature.
- At this time, M.2 cards of 80mm in length can secured to the M.2 SSD FLEX Adapter

P900/P910 Support for Add-in PCIe SSDs

Maximum number of drives supported	Depends on the number of available PCIe slots
Drive location	Traditional PCIe 3.0 x16 slot
Additional hardware required	None

Installation Notes:

- The Add-in PCIe SSD installs directly to an available PCIe slot on the motherboard (generally x4 or larger).
- For P900/P910, CPU2 must be populated if PCIe Add-in cards are to be installed to slots 6, 7, or 8.
- For PCIe Add-in SSDs that are gen3 compliant, ensure they are installed to a gen3 capable slot for optimal performance. Refer to the ThinkStation Tech Specs site (www.thinkstation-specs.com) for more information on PCIe slot bandwidth.

Description of Commonly Used Storage Hardware in P-Series ThinkStations

Blind Connect Assembly (BCA)

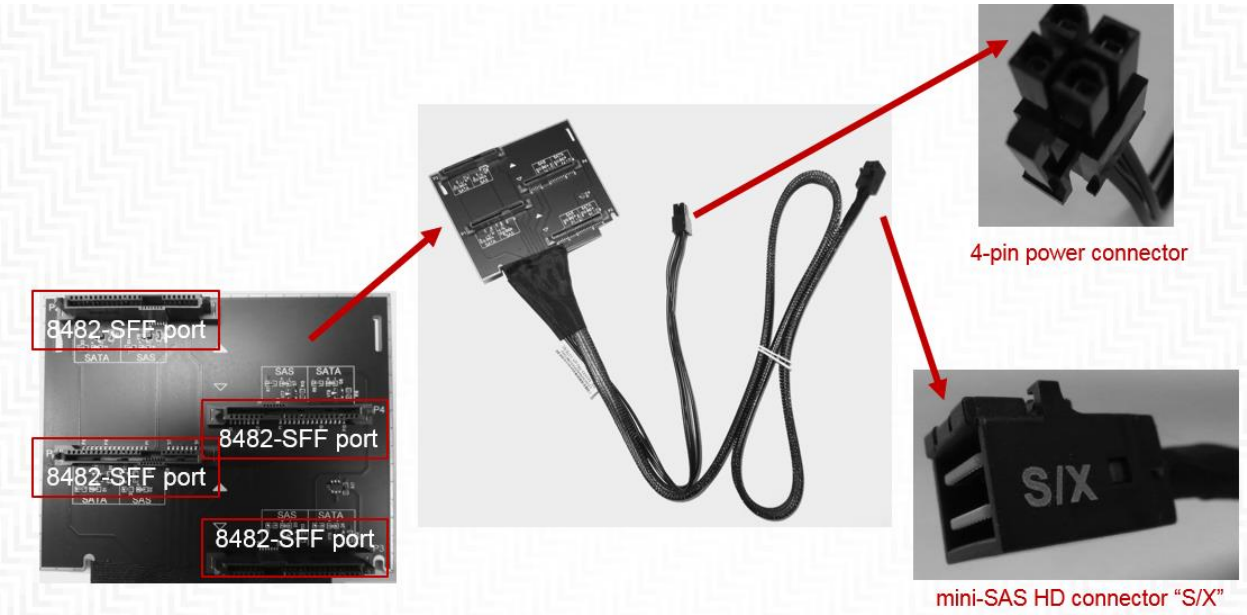
BCA-P : Blind Connect Assembly consisting of two 8639-SFF ports (supporting PCIe, SAS, or SATA drives) and two 8482-SFF ports (supporting SAS or SATA drives). The assembly also consists of the following cable connections:

- One 4-pin power connector that connect to the motherboard
- Two mini-SAS HD connectors that connect to the Multi-IO FLEX adapter (for PCIe connections) labeled “P1” and “P2”
- One mini-SAS HD connector labeled “S/X” that connect to either the onboard controller or Avago controller
- LEDs light up next to each port to show which ports on the BCA are functional and which drive types each port can support based on the controller(s) the BCA is connected to.
- When the “S/X” cable is connected to an Avago controller, all 4 ports on the BCA are active and show as supporting SAS and SATA via the LEDs.
- When the “S/X” cable is connected to the onboard Intel controller, only two of the ports on the BCA are active and show as supporting SATA via the LEDs.
- When the “P1” and “P2” cables are connected to the Multi IO FLEX Adapter, the PCIe LEDs will illuminate to show which ports are capable of supporting 2.5” PCIe drives.


8639-SFF PCIe port
8482-SFF port
8639-SFF PCIe port
8482-SFF port
P1
P2
mini-SAS HD connector "P1" and ""P2"
S/X
mini-SAS HD connector "S/X"
4-pin power connector

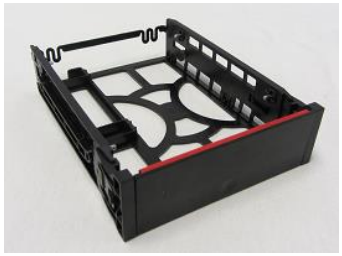
BCA-S : Blind Connect Assembly consisting of four 8482-SFF ports (supporting SAS or SATA drives). The assembly also contains the following cable connections:

- One 4-pin power connector that connect to the motherboard
- One mini-SAS HD connector labeled “S/X” that connect to either the onboard Intel controller or Avago controller
- LEDs light up next to each port to show which ports on the BCA are functional and which drive types each port can support based on the controller(s) the BCA is connected to.
- When the “S/X” cable is connected to an Avago controller, all 4 ports on the BCA are active and show as supporting SAS and SATA via the LEDs.
- When the “S/X” cable is connected to the onboard Intel controller, only two of the ports on the BCA are active and show as supporting SATA via the LEDs.

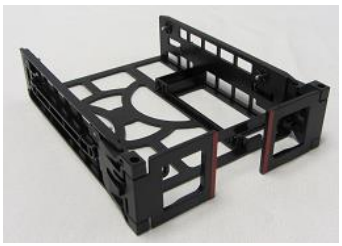


Connector Type	Drives Supported
8639-SFF PCIe port	SATA
	SAS (only with Avago controller)
	SSD
	2.5” PCIe SSDs
8482-SFF port	SATA
	SAS (only with Avago controller)
	SSD

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

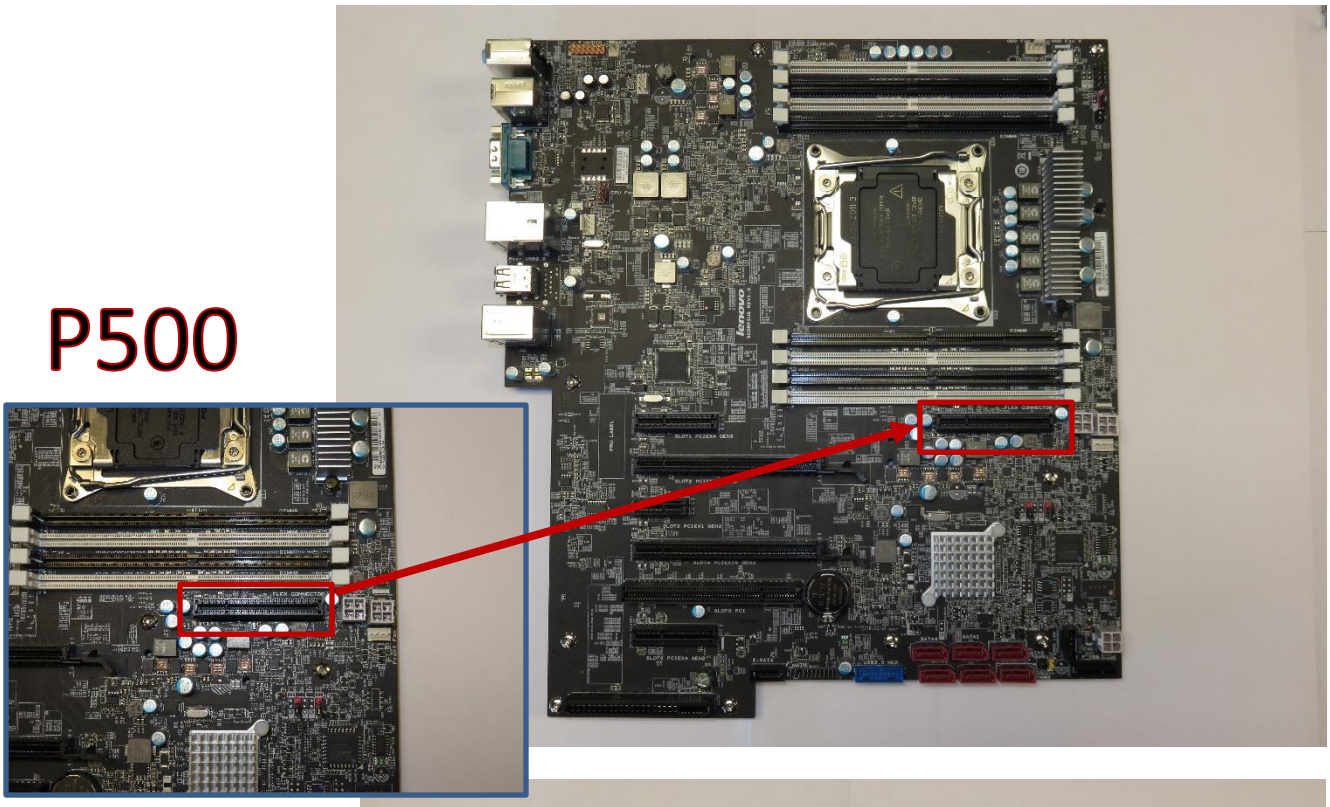


Manual Connect FLEX Tray : Tool-less tray that can hold up to two drives. These trays utilize hinged pulls that open and allow for cable access and manual cable connections.

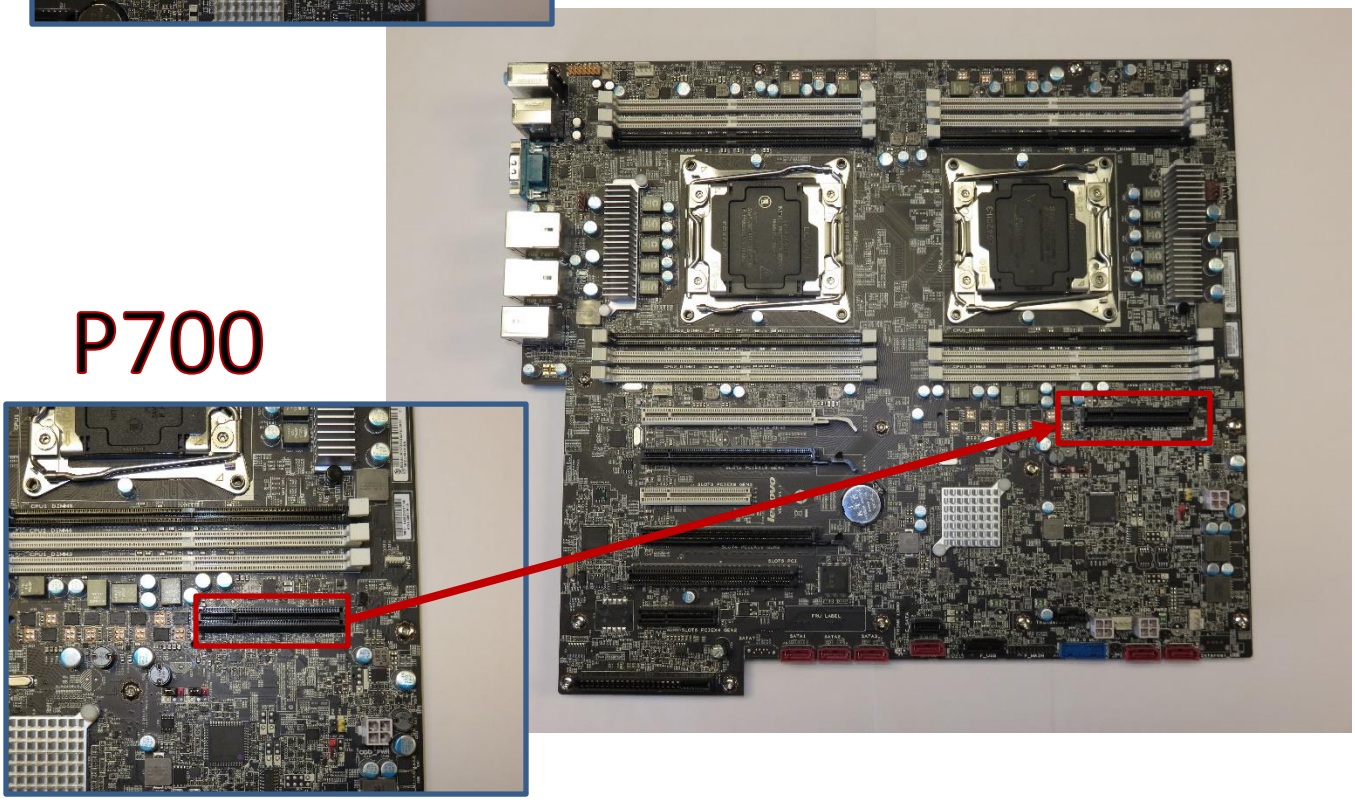
FLEX Connector

Specialized connector used to support FLEX Adapters. These connectors cannot support traditional PCIe devices. Note that the images for P500, P700, and P900 also apply to P510, P710, and P910, respectively.

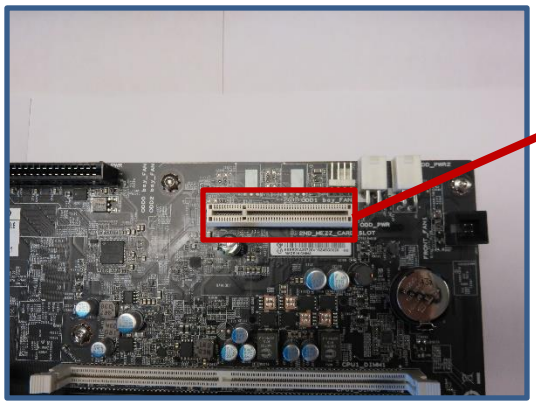
P500

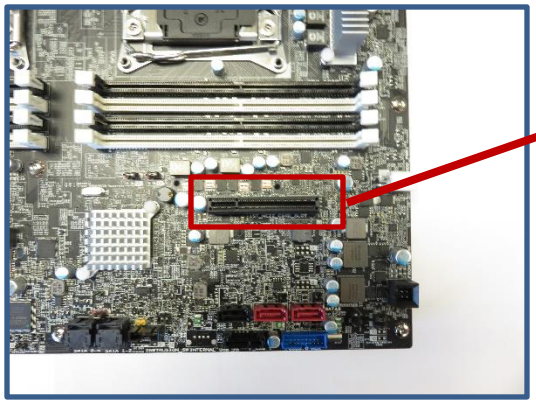


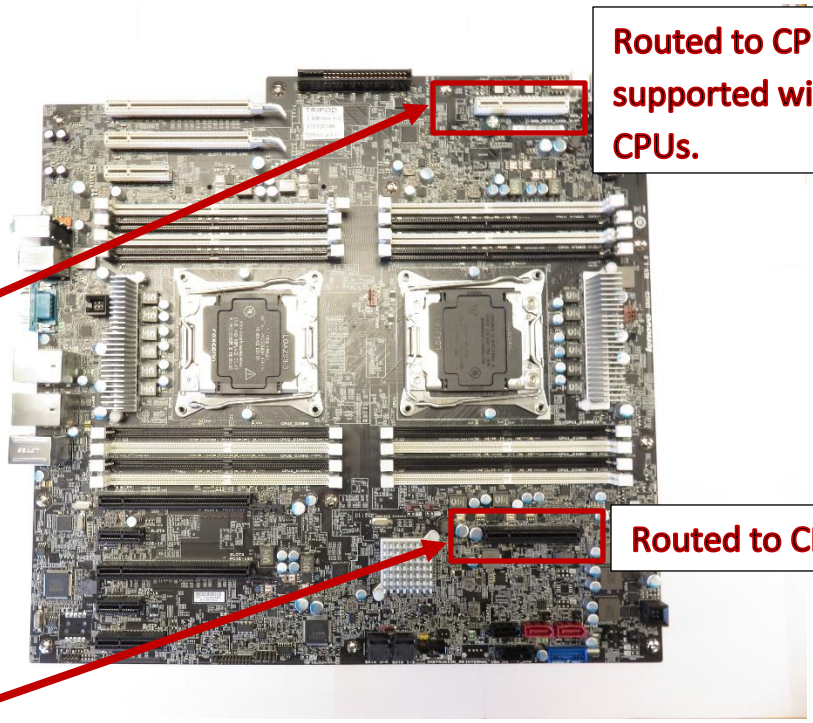
P700



P900







Routed to CPU 2. Only supported with dual CPUs.

Routed to CPU 1.

FLEX Adapters

Specialized adapter cards used to support a variety of different functions

Multi IO FLEX Adapter: FLEX adapter primarily used to support 2.5” PCIe SSD drives via BCA-P. Also consists of a SATA (AHCI) port and USB2.0 port for additional connectivity.

M.2 SSD FLEX Adapter: FLEX adapter used to support M.2 PCIe drives and/or M.2 SATA drives.

LSI SAS/SATA RAID FLEX Adapter (IOC): FLEX adapter consisting of an LSI SAS/SATA RAID controller to support drives via BCA.