

Power Systems

*SAS subsystem for the 8412-EAD,
9117-MMB, 9117-MMC, 9117-MMD,
9179-MHB, 9179-MHC, or 9179-MHD*

IBM

Power Systems

*SAS subsystem for the 8412-EAD,
9117-MMB, 9117-MMC, 9117-MMD,
9179-MHB, 9179-MHC, or 9179-MHD*

IBM

Note

Before using this information and the product it supports, read the information in “Safety notices” on page v, “Notices” on page 17, the *IBM Systems Safety Notices* manual, G229-9054, and the *IBM Environmental Notices and User Guide*, Z125-5823.

This edition applies to IBM Power Systems™ servers that contain the POWER7 processor and to all associated models.

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Safety notices

Safety notices may be printed throughout this guide:

- **DANGER** notices call attention to a situation that is potentially lethal or extremely hazardous to people.
- **CAUTION** notices call attention to a situation that is potentially hazardous to people because of some existing condition.
- **Attention** notices call attention to the possibility of damage to a program, device, system, or data.

World Trade safety information

Several countries require the safety information contained in product publications to be presented in their national languages. If this requirement applies to your country, safety information documentation is included in the publications package (such as in printed documentation, on DVD, or as part of the product) shipped with the product. The documentation contains the safety information in your national language with references to the U.S. English source. Before using a U.S. English publication to install, operate, or service this product, you must first become familiar with the related safety information documentation. You should also refer to the safety information documentation any time you do not clearly understand any safety information in the U.S. English publications.

Replacement or additional copies of safety information documentation can be obtained by calling the IBM Hotline at 1-800-300-8751.

German safety information

Das Produkt ist nicht für den Einsatz an Bildschirmarbeitsplätzen im Sinne § 2 der Bildschirmarbeitsverordnung geeignet.

Laser safety information

IBM® servers can use I/O cards or features that are fiber-optic based and that utilize lasers or LEDs.

Laser compliance

IBM servers may be installed inside or outside of an IT equipment rack.

DANGER

When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard:

- Connect power to this unit only with the IBM provided power cord. Do not use the IBM provided power cord for any other product.
- Do not open or service any power supply assembly.
- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords.
- Connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- Connect any equipment that will be attached to this product to properly wired outlets.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.
- Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.

To Disconnect:

1. Turn off everything (unless instructed otherwise).
2. Remove the power cords from the outlets.
3. Remove the signal cables from the connectors.
4. Remove all cables from the devices.

To Connect:

1. Turn off everything (unless instructed otherwise).
2. Attach all cables to the devices.
3. Attach the signal cables to the connectors.
4. Attach the power cords to the outlets.
5. Turn on the devices.

(D005)

DANGER

Observe the following precautions when working on or around your IT rack system:

- Heavy equipment—personal injury or equipment damage might result if mishandled.
- Always lower the leveling pads on the rack cabinet.
- Always install stabilizer brackets on the rack cabinet.
- To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.
- Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices.



- Each rack cabinet might have more than one power cord. Be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.
- Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.
- An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock.

CAUTION

- Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.
- Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit used for air flow through the unit.
- Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection. To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.
- *(For sliding drawers.)* Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack. Do not pull out more than one drawer at a time. The rack might become unstable if you pull out more than one drawer at a time.
- *(For fixed drawers.)* This drawer is a fixed drawer and must not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or completely out of the rack might cause the rack to become unstable or cause the drawer to fall out of the rack.

(R001)

CAUTION:

Removing components from the upper positions in the rack cabinet improves rack stability during relocation. Follow these general guidelines whenever you relocate a populated rack cabinet within a room or building:

- Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must observe the following precautions:
 - Remove all devices in the 32U position and above.
 - Ensure that the heaviest devices are installed in the bottom of the rack cabinet.
 - Ensure that there are no empty U-levels between devices installed in the rack cabinet below the 32U level.
- If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.
- Inspect the route that you plan to take to eliminate potential hazards.
- Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that comes with your rack cabinet for the weight of a loaded rack cabinet.
- Verify that all door openings are at least 760 x 230 mm (30 x 80 in.).
- Ensure that all devices, shelves, drawers, doors, and cables are secure.
- Ensure that the four leveling pads are raised to their highest position.
- Ensure that there is no stabilizer bracket installed on the rack cabinet during movement.
- Do not use a ramp inclined at more than 10 degrees.
- When the rack cabinet is in the new location, complete the following steps:
 - Lower the four leveling pads.
 - Install stabilizer brackets on the rack cabinet.
 - If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.
- If a long-distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also lower the leveling pads to raise the casters off of the pallet and bolt the rack cabinet to the pallet.

(R002)

(L001)



(L002)



(L003)



or



All lasers are certified in the U.S. to conform to the requirements of DHHS 21 CFR Subchapter J for class 1 laser products. Outside the U.S., they are certified to be in compliance with IEC 60825 as a class 1 laser product. Consult the label on each part for laser certification numbers and approval information.

CAUTION:

This product might contain one or more of the following devices: CD-ROM drive, DVD-ROM drive, DVD-RAM drive, or laser module, which are Class 1 laser products. Note the following information:

- Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.
- Use of the controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

(C026)

CAUTION:

Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. (C027)

CAUTION:

This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)

CAUTION:

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following information: laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam. (C030)

CAUTION:

The battery contains lithium. To avoid possible explosion, do not burn or charge the battery.

Do Not:

- ___ Throw or immerse into water
- ___ Heat to more than 100°C (212°F)
- ___ Repair or disassemble

Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (C003)

Power and cabling information for NEBS (Network Equipment-Building System) GR-1089-CORE

The following comments apply to the IBM servers that have been designated as conforming to NEBS (Network Equipment-Building System) GR-1089-CORE:

The equipment is suitable for installation in the following:

- Network telecommunications facilities
- Locations where the NEC (National Electrical Code) applies

The intrabuilding ports of this equipment are suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding ports of this equipment *must not* be metallically connected to the interfaces that connect to the OSP (outside plant) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE) and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection to connect these interfaces metallically to OSP wiring.

Note: All Ethernet cables must be shielded and grounded at both ends.

The ac-powered system does not require the use of an external surge protection device (SPD).

The dc-powered system employs an isolated DC return (DC-I) design. The DC battery return terminal *shall not* be connected to the chassis or frame ground.

SAS subsystem for the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD

Review the SAS subsystem features, configurations, and limitations for the IBM Power[®] ESE (8412-EAD), the IBM Power 770 (9117-MMB, 9117-MMC, or 9117-MMD), and the IBM Power 780 (9179-MHB, 9179-MHC, or 9179-MHD) systems.

SAS architecture

Serial-attached SCSI (SAS) architecture describes a serial device interconnection and transportation protocol that defines the rules for information exchange between devices.

SAS is an evolution of the parallel SCSI device interface into a serial point-to-point interface. SAS physical links are a set of four wires used as two differential signal pairs. One differential signal transmits in one direction, while the other differential signal transmits in the opposite direction. Data can be transmitted in both directions simultaneously. Physical links are contained in SAS ports, which contain one or more physical links. If there is more than one physical link in the port, the port is a wide port. If there is only one physical link in the port, it is a narrow port. A port is identified by a unique SAS worldwide name (also called SAS address).

A *SAS adapter* contains one or more SAS ports. A *path* is a logical point-to-point link between a SAS initiator port in the adapter and a SAS target port in the I/O device (for example, a disk). A *connection* is a temporary association between an adapter and an I/O device through a path. A connection enables communication to a device. The adapter can communicate to the I/O device over this connection by using either the SCSI command set or the Advanced Technology Attachment (ATA) and Advanced Technology Attachment Packet Interface (ATAPI) command set depending on the device type.

A *SAS expander* enables connections between an adapter port and multiple I/O device ports by routing connections between the expander ports. Only a single connection through an expander can exist at a time. Using expanders creates more nodes in the path from the adapter to the I/O device. If an I/O device supports multiple ports, more than one path to the device can exist when there are expander devices included in the path.

A *SAS fabric* refers to the summation of all paths between all SAS adapter ports and all I/O device ports in the SAS subsystem including cables, enclosures, and expanders.

SAS subsystem overview

This overview of the SAS subsystem provides the features and locations for the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD system.

Use this information in conjunction with your specific system unit and operating system documentation. General information is intended for all users of this product. Service information is intended for a service representative specifically trained on the system unit and subsystem being serviced.

Feature locations

Review the supported SAS features and their system locations.

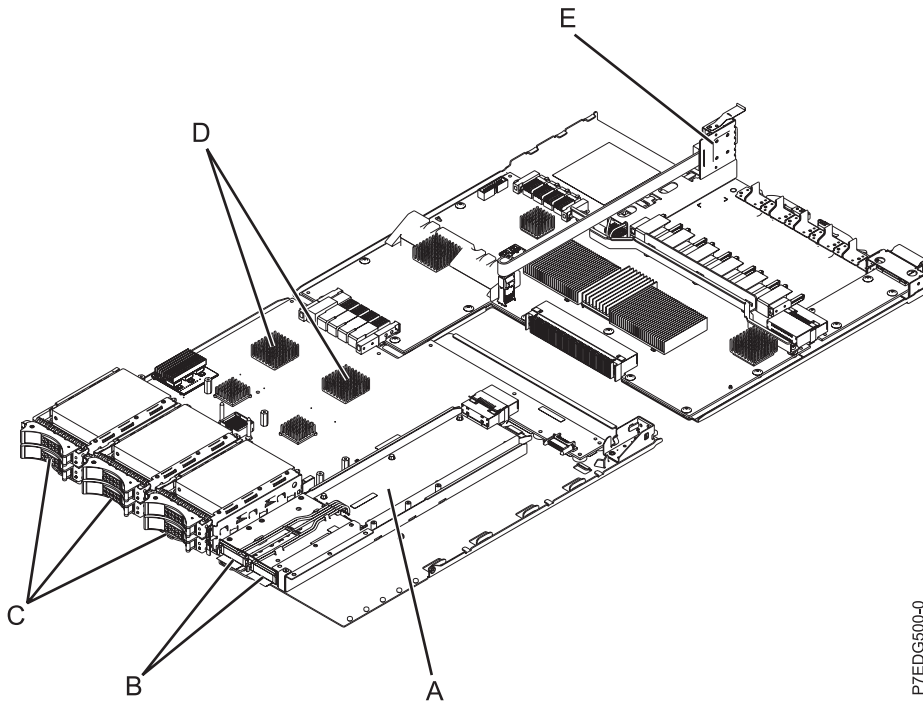


Figure 1. SAS subsystem overview

Table 1. SAS subsystem parts

Diagram location	Part name	Feature code (FC)	Customer card identification numbers (CCINs)	Physical location codes
A	175 MB Cache RAID – Dual IOA enablement card	5662	Card CCIN 2BC2 Note: If FC 5662 is installed, the embedded SAS adapters report CCIN 57CF and operate as dual RAID adapters with write cache capability.	P2-C9-C1
B	Cache battery packs			P2-C9-C1-E1 and P2-C9-C1-E2
C	Disk bays (6 SFF drive disk bays)			P2-C9-C1-D1 through P2-C9-C1-D6
D	Main SAS subsystem card with two embedded SAS adapters		Card CCIN 2BBE Notes: <ul style="list-style-type: none"> If FC 5662 is not installed, the embedded SAS adapters report CCIN 57C7 and operate as two independent adapters. If FC 5662 is installed, the embedded SAS adapters report CCIN 57CF and operate as dual RAID adapters with write cache capability. 	P2-C9

Table 1. SAS subsystem parts (continued)

Diagram location	Part name	Feature code (FC)	Customer card identification numbers (CCINs)	Physical location codes
E	Optional internal SAS cables: <ul style="list-style-type: none"> • Three-way split disk or media backplane configuration (cable FC 1815) • RAID configuration with external drives connected (cable FC 1819) 	1815 or 1819 Notes: <ul style="list-style-type: none"> • 1815 when FC 5662 is not installed ¹ • 1819 when FC 5662 is installed ¹ 		P2-T2
	Optional rack-mounted media drawer with SAS tape and DVD bays ²	5720 Notes: <ul style="list-style-type: none"> • Uses SAS PCIX 2.0 Controller (FC 5900 or 5912) with I/O drawer (FC 5797, 5798, or 5791) • Uses SAS Dual-x4 Controller (FC 5901) with I/O drawer (FC 5803) 		P2-C9-D7

¹ For detailed configuration information, see “SAS storage configurations” on page 4.
² The rack-mounted media drawer with SAS tape and DVD bays is an optional part, and hence is not shown in the figure.

Feature details

SAS RAID adapters

The SAS RAID adapters have the following features:

- PCI Express (PCIe) system interface
- Physical link (phy) speed of 3 Gbps SAS supporting transfer rates of 300 MB per second
- Optimized for SAS disk configurations that use dual paths through dual expanders for redundancy and reliability
- Adapter managed path redundancy and path switching for multiported SAS devices
- Embedded PowerPC RISC processor, hardware XOR DMA Engine, and hardware Finite Field Multiplier (FFM) DMA Engine (for Redundant Array of Independent Disks (RAID) 6)
- Support for RAID 0 and 10 disk arrays
- Additional features when the 175 MB Cache RAID – Dual IOA enablement card is installed:
 - Adapters support nonvolatile write cache
 - Support for RAID 5 and 6 disk arrays
 - Adapters configured in dual storage IOA or high availability (HA) RAID mode for best reliability and availability
- RAID disk arrays supported as a boot device
- Advanced RAID features:
 - Hot spares for RAID 5, 6, and 10 disk arrays
 - Ability to increase the capacity of an existing RAID 5 or 6 disk array by adding disks
 - Background parity checking

- Background data scrubbing
- Disks formatted to 528 bytes per sector, providing cyclical redundancy checking (CRC) and logically bad block checking
- Optimized hardware for RAID 5 and 6 sequential write workloads
- Optimized skip read/write disk support for transaction workloads

175 MB cache RAID – Dual IOA enablement card

This feature is used to enable write cache on the two embedded SAS RAID adapters of the disk or media backplane by providing the necessary rechargeable batteries for memory backup. It also enables the two embedded SAS RAID adapters to work as dual storage IOAs, that is, high availability (HA) RAID mode. This feature plugs in to the disk or media backplane and enables a 175 MB write cache on each of the two embedded RAID adapters by providing two rechargeable batteries with associated charger circuitry. The write cache can provide additional I/O performance for attached disk or solid-state drives, particularly for RAID 5 and RAID 6. The write cache contents are mirrored for redundancy between the two RAID adapters resulting in an effective write cache size of 175 MB. The batteries provide power to maintain both copies of write-cache information in the event power is lost.

Related information:

 [Serial-attached SCSI cable planning](#)

SAS storage configurations

Several SAS subsystem configurations are supported on the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD systems.

The configuration you use depends on the combination of SAS features that you have installed on your system. The following table provides an overview of the features and related configurations.

Table 2. SAS subsystem configurations

SAS subsystem configuration	175 MB Cache RAID - Dual IOA enablement card (FC 5662)	External SAS components	SAS port cables	SAS cables	Limitations
Two-way split backplane	No Note: The two embedded SAS adapters report as CCIN 57C7.	None	None	Not applicable	<ul style="list-style-type: none"> • IBM i is not supported. • Connecting to an external disk enclosure is not supported. • Each set of three drives can be HDDs or SSDs.
Three-way split backplane	No Note: The two embedded SAS adapters report as CCIN 57C7.	Dual-x4 SAS adapter (FC 5901: CCIN 57B3)	Internal SAS port (FC 1815): SAS cable for three-way split backplane	AI cable (FC 3679): Adapter to internal drive 1 meter	<ul style="list-style-type: none"> • IBM i is not supported. • An I/O adapter can be located in another enclosure of the system. • Each set of two drives can be HDDs or SSDs.

Table 2. SAS subsystem configurations (continued)

SAS subsystem configuration	175 MB Cache RAID - Dual IOA enablement card (FC 5662)	External SAS components	SAS port cables	SAS cables	Limitations
Dual storage IOA configuration using internal disk drives	Yes Note: The internal dual RAID IOA adapters report as CCIN 57CF.	None	None	Not applicable	<ul style="list-style-type: none"> Internal cable (FC 1815) cannot be used with the dual storage IOA or high availability (HA) RAID configuration. The six drives can be HDDs or SSDs.
Dual storage IOA configuration using internal disk drives and external disk enclosure	Yes Note: The internal dual RAID IOA adapters report as CCIN 57CF.	Requires an external disk enclosure (FC 5886 or FC 5887)	Internal SAS port (FC 1819): SAS cable assembly for connecting to an external SAS drive enclosure	<ul style="list-style-type: none"> YI cable (FC 3686): System to SAS disk enclosure, Single adapter with Dual path 1.5 meter YI cable (FC 3687): System to SAS disk enclosure, Single adapter with Dual path 3 meter 	Only HDDs are supported.

- Each node in a system can have a different SAS subsystem configuration.
- Using the SAS drive assembly on nodes 3 and 4 is optional.

Related concepts:

“SAS subsystem service considerations” on page 12

There are several considerations to review before servicing features within the SAS subsystem for the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD system.

“Service considerations for the internal SAS cable for a three-way split backplane” on page 12

To prevent data loss, follow proper procedures before replacing the internal SAS cable for a three-way split backplane.

“Service considerations for the 175 MB cache RAID - dual IOA enablement card” on page 13

To prevent data loss, follow proper procedures before replacing the 175 MB cache RAID – dual IOA enablement card.

“Service considerations for the cache battery pack” on page 14

To prevent data loss, follow proper procedures before replacing the cache battery pack on the 175 MB cache RAID – dual IOA enablement card.

Related information:

 [Serial-attached SCSI cable planning](#)

 [175MB Cache RAID - Dual IOA Enablement Card \(FC 5662\)](#)

SAS subsystem configuration that uses a two-way split backplane

This topic provides rules and examples of a configuration that uses a two-way split backplane.

The following rules apply to this configuration:

- Each SAS adapter can recognize only three of the disk drives and cannot function in dual storage I/O adapter (IOA) or high availability (HA) RAID mode. One SAS adapter connects to D1, D2, and D3. The other SAS adapter connects to D4, D5, and D6.
- The SAS adapters can be assigned to separate partitions for boot devices.
- This configuration supports disks without RAID (referred to as JBOD) or RAID drives. However, RAID drives are limited to three drives and no write cache.
- RAID 10 with two drives is limited. A RAID 10 array with two drives is equivalent to RAID 1 (mirrored drives). A RAID 0 disk array with one drive is similar to JBOD support. A RAID 10 array with one or three drives is not allowed.
- Solid-state drives (SSDs) and hard disk drives (HDDs) can be used, but they can never be mixed in the same disk enclosure.
- SSD and HDD can both be present in a split backplane if each side of the split backplane has only SSD or HDD.

Example: Two-way split backplane

This example shows a two-way split backplane configuration. Each embedded SAS adapter controls three disk drives.

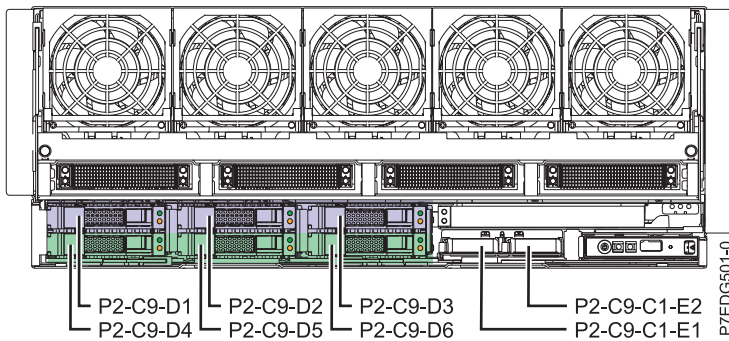


Figure 2. Disk bays controlled by each embedded SAS adapter in a two-way split backplane

The following table lists the details of the two-way split backplane configuration.

Table 3. Configuration details

Embedded SAS adapter	Configuration details
Embedded SAS adapter A	<ul style="list-style-type: none"> • The SAS adapter connects to disk drive D1, D2, and D3. • Physical connections to the SAS cable are disabled. If the external SAS port is installed, it is not functional. • The SAS adapter reports CCIN 57C7.
Embedded SAS adapter B	<ul style="list-style-type: none"> • The SAS adapter connects to disk drive D4, D5, and D6. • Physical connections to the SAS cable are disabled. If the external SAS port is installed, it is not functional. • The SAS adapter reports CCIN 57C7.

SAS subsystem configuration that uses a three-way split backplane

This topic provides rules and examples of a configuration that uses a three-way split backplane.

The following rules apply to this configuration:

- A three-way split backplane uses three sets of two drives and cannot function in dual storage I/O adapter (IOA) or high availability (HA) RAID mode. One SAS adapter connects to D1 and D4. The other SAS adapter connects to D2 and D5. An external SAS adapter connects to D3 and D6.
- The SAS adapters can be assigned to separate partitions for boot devices.
- This configuration supports disks without RAID (referred to as JBOD) or RAID drives. However, RAID drives are limited to two drives and no write cache.
- RAID 10 with two drives is limited. A RAID 10 array with two drives is equivalent to RAID 1 (mirrored drives). A RAID 0 disk array with one drive is similar to JBOD support. A RAID 10 array with one drive is not allowed.
- Solid-state drives (SSDs) and hard disk drives (HDDs) can never be mixed in the same disk enclosure.
- SSD and HDD can both be present in a split backplane if each side of the split backplane has only SSD or HDD.

Example: Three-way split backplane

This example shows a three-way split backplane configuration. Each embedded SAS adapter controls two disk drives, and the SAS adapter that is connected to the internal cable controls two disk drives.

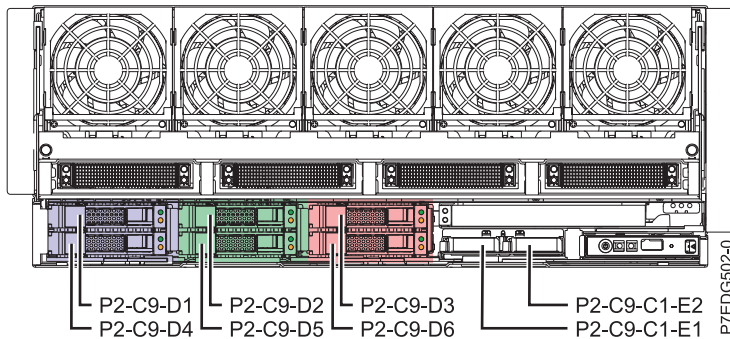


Figure 3. Disk bays controlled by each embedded SAS adapter in a three-way split backplane

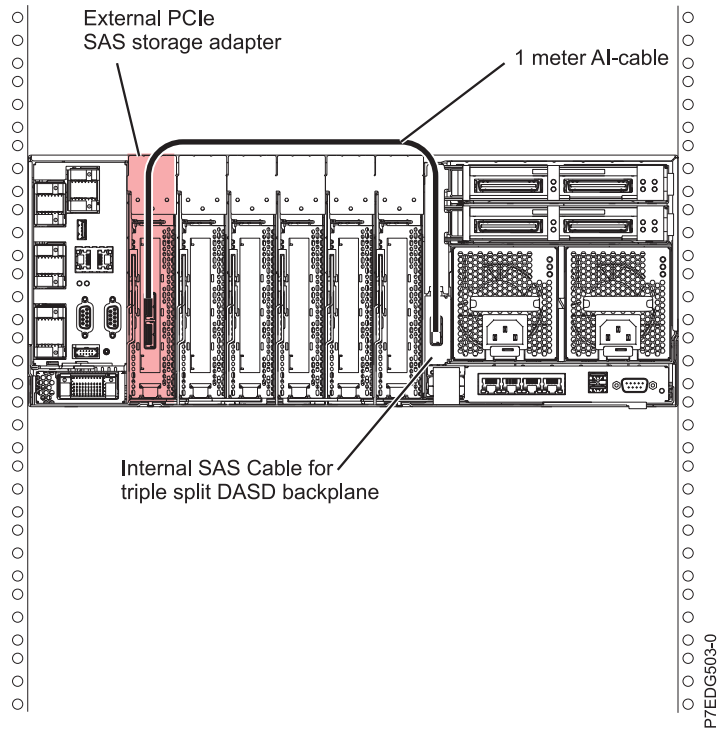


Figure 4. Physical connection to internal SAS adapter

The following table lists the details of the three-way split backplane configuration.

Table 4. Configuration details

Embedded SAS adapter	Configuration details
Embedded SAS adapter A	<ul style="list-style-type: none"> The SAS adapter connects to disk drive D1 and D4. The SAS adapter reports CCIN 57C7.
Embedded SAS adapter B	<ul style="list-style-type: none"> The SAS adapter connects to disk drive D2 and D5. The SAS adapter reports CCIN 57C7.
SAS adapter (FC 5901)	<ul style="list-style-type: none"> The physical connections to the internal SAS cable are enabled. The SAS adapter that is connected to this cable connects to disk drive D3 and D6. The SAS adapter reports CCIN 57B3.

Related concepts:

“SAS subsystem service considerations” on page 12

There are several considerations to review before servicing features within the SAS subsystem for the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD system.

“Service considerations for the internal SAS cable for a three-way split backplane” on page 12

To prevent data loss, follow proper procedures before replacing the internal SAS cable for a three-way split backplane.

SAS subsystem configuration that uses a dual storage IOA with internal drives

This configuration uses dual storage I/O adapter (IOA) or high availability (HA) RAID mode with internal disk drives.

This configuration increases availability by using dual storage IOA or high availability (HA) to connect multiple adapters to a common set of internal disk drives. It also increases the performance of RAID arrays. The following rules apply to this configuration:

- This configuration uses the 175 MB Cache RAID – Dual IOA enablement card.
- Using the dual IOA enablement card, the two embedded adapters can connect to each other and all six disk drives.
- The disk drives are required to be in RAID arrays.
- No separate SAS cables are required to connect the two embedded SAS RAID adapters to each other. The connection is contained within the backplane.
- RAID 0, 10, 5, and 6 support up to six drives.
- Solid-state drives (SSDs) and hard disk drives (HDDs) can be used, but they can never be mixed in the same disk enclosure.

Example: Dual storage IOA using internal drives

This example provides an overview of the dual storage configuration that uses internal disk drives.

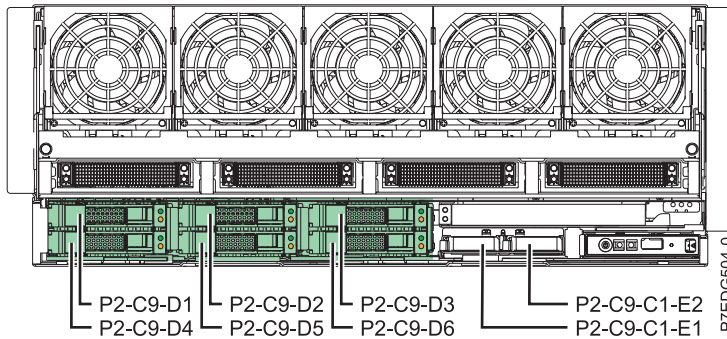


Figure 5. Disk bays controlled by both embedded SAS adapters that have dual storage IOA with internal drives

The following table lists the configuration details.

Table 5. Configuration details

Embedded SAS adapters	Configuration details
Two embedded SAS adapters	<ul style="list-style-type: none"> • RAID mode is required for this configuration. • The SAS adapters connect to all six disk drives. • Physical connections to the SAS cable are disabled. • The two embedded adapters report CCIN 57CF.

Related concepts:

“SAS subsystem service considerations” on page 12

There are several considerations to review before servicing features within the SAS subsystem for the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD system.

“Service considerations for the 175 MB cache RAID - dual IOA enablement card” on page 13

To prevent data loss, follow proper procedures before replacing the 175 MB cache RAID – dual IOA enablement card.

“Service considerations for the cache battery pack” on page 14

To prevent data loss, follow proper procedures before replacing the cache battery pack on the 175 MB cache RAID – dual IOA enablement card.

SAS subsystem configuration that uses a dual storage IOA with external drives

This configuration uses dual storage I/O adapter (IOA) or high availability (HA) RAID mode with internal and external disk drives.

You can increase availability by using high availability to connect multiple adapters to a common set of internal disk drives and external disk enclosures. The following rules apply to this configuration:

- This configuration uses the 175 MB Cache RAID – Dual IOA enablement card.
- The two SAS adapters with write cache can connect to each other, connect to the six internal disk drives, and connect to the 12 disk drives in an external disk drive enclosure by using the dual IOA enablement card and the external SAS port.
- Only hard disk drives (HDDs) are supported in this configuration. You cannot use solid-state drives (SSDs).
- The disk drives are required to be in RAID arrays.
- RAID 0, 10, 5, and 6 are supported.
- No separate SAS cables are required to connect the two embedded SAS RAID adapters to each other. The connection is contained within the backplane.
- The 5886 disk drive enclosure provides external storage in this configuration.

Example: Dual storage IOA using external drives

This example provides an overview of the dual storage IOA configuration that uses external disk drives.

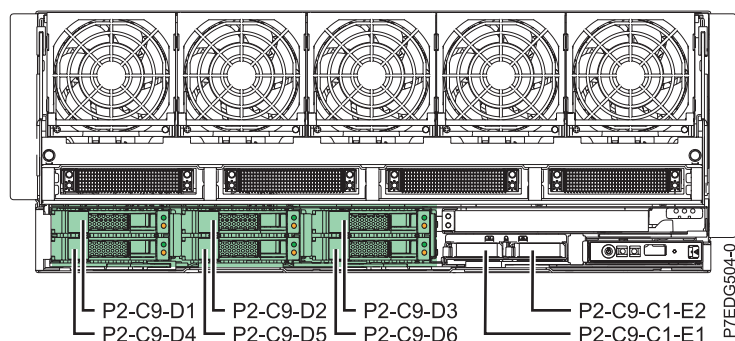


Figure 6. Disk bays controlled by both embedded SAS adapters when using dual storage IOA with internal and external drives

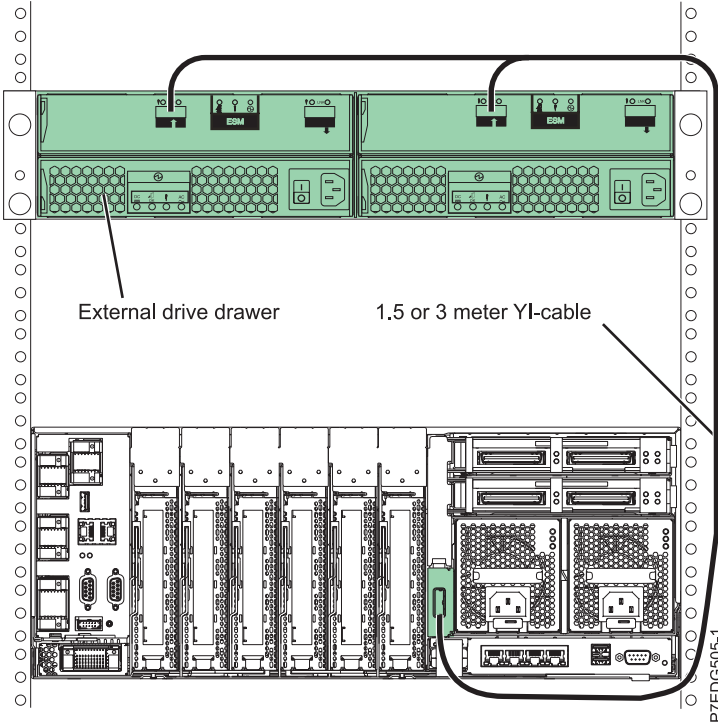


Figure 7. Physical connection to attach external disk enclosures

The following table lists the configuration details.

Table 6. Configuration details

Embedded SAS adapters	Configuration details
Two embedded SAS adapters	<ul style="list-style-type: none"> • RAID mode is required for this configuration. • SAS adapters connect to all six disk drives and to any drives that are attached by the external cable. • Physical connections to the SAS cable are enabled to attach to another SAS port expander in an external disk enclosure. The SAS external port card, YI cable, or expansion enclosure might be present. • The two embedded adapters report as CCIN 57CF.

Related concepts:

“SAS subsystem service considerations”

There are several considerations to review before servicing features within the SAS subsystem for the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD system.

“Service considerations for the 175 MB cache RAID - dual IOA enablement card” on page 13

To prevent data loss, follow proper procedures before replacing the 175 MB cache RAID – dual IOA enablement card.

“Service considerations for the cache battery pack” on page 14

To prevent data loss, follow proper procedures before replacing the cache battery pack on the 175 MB cache RAID – dual IOA enablement card.

Related information:

 [5886 disk drive enclosure](#)

SAS subsystem service considerations

There are several considerations to review before servicing features within the SAS subsystem for the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD system.

Before servicing any features, review the I/O configurations for each logical partition on your system. It is important to understand the differences between the various configurations and the resulting service considerations. In addition, consider possible impacts to the following areas:

- Logical partitions and their I/O adapter assignments
- RAID array configurations
- Physical disk locations
- Path to your boot device

Related information:

 [Logical partitioning](#)

 [SAS RAID controllers for Linux](#)

 [SAS RAID controllers for AIX](#)

 [SAS RAID controllers for IBM i](#)

Service considerations for the internal SAS cable for a three-way split backplane

To prevent data loss, follow proper procedures before replacing the internal SAS cable for a three-way split backplane.

Attention: To maintain system availability and to prevent possible data loss, it is important to understand that these features have implications on the SAS configuration and data accessibility of the system.

Review the SAS subsystem configuration that uses a two-way split backplane example. This configuration consists of two independent embedded SAS adapters, each controlling three of the six disk bays. In the following figure, the highlighted disk bays represent the disk bays that are controlled by each embedded storage adapter (D1 - D3 and D4 - D6).

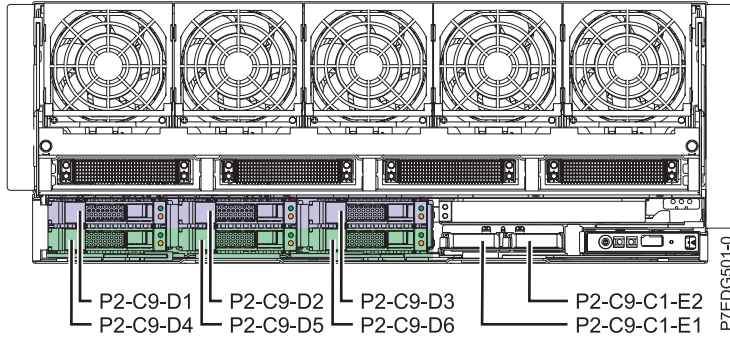


Figure 8. Disk bays controlled by each embedded SAS adapter in a two-way split backplane

Review the SAS subsystem configuration that uses a three-way split backplane example. If you add the optional internal SAS cable for a three-way split backplane (FC 1815), the disk bay configuration changes. The six disk bays are split into three groups of two. Each of the two embedded SAS adapters controls two disk bays and a third external PCIe SAS storage adapter controls the remaining two bays. In the following figure, the highlighted disk bays represent the disk bays that are controlled by each of the embedded storage adapters (D1, D4, and D2, D5) and the third external PCIe adapter (D3, D6). Each of the SAS storage adapters now controls different disk bays than in the previous configuration without the internal SAS cable feature.

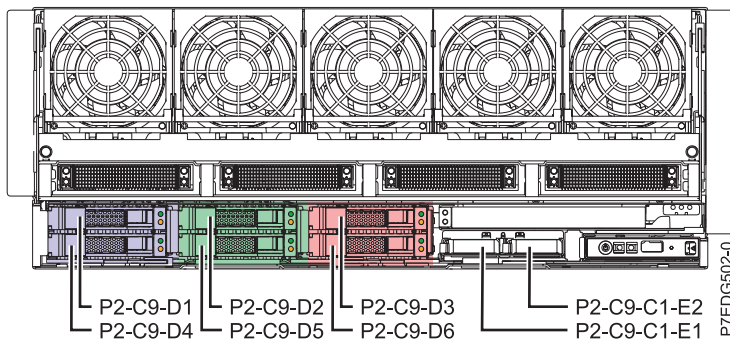


Figure 9. Disk bays controlled by adapters in a three-way split backplane

Attention: You must do proper planning and follow proper procedures before adding or removing the internal SAS cable for a three-way split backplane (FC 1815) to maintain system availability and to prevent possible data loss.

Related information:

➡ Installing the external SAS port on a 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD

Service considerations for the 175 MB cache RAID - dual IOA enablement card

To prevent data loss, follow proper procedures before replacing the 175 MB cache RAID – dual IOA enablement card.

Attention: To maintain system availability and to prevent possible data loss, it is important to understand that these features have implications on the SAS configuration and data accessibility of the system.

Review the SAS subsystem configuration that uses a two-way split backplane example. This configuration consists of two independent embedded SAS adapters, each controlling three of the six disk bays. In the following figure, the highlighted disk bays represent the disk bays that are controlled by each embedded storage adapter (D1- D3 and D4 - D6).

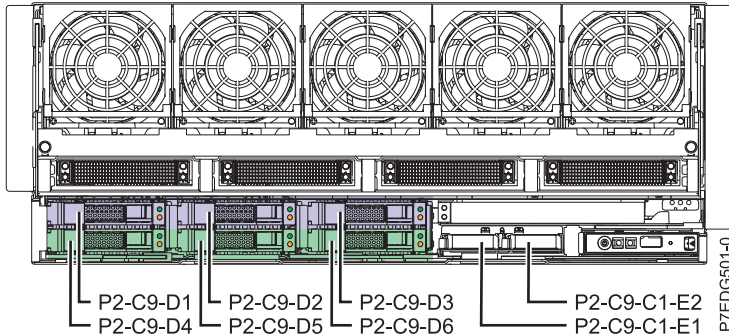


Figure 10. Disk bays controlled by each embedded SAS adapter in a two-way split backplane

Review the SAS subsystem configuration that uses a dual storage IOA with internal drives example. If you add the optional 175 MB Cache RAID – Dual IOA enablement card (FC 5662), it creates a configuration consisting of two embedded SAS adapters in a dual storage IOA or high availability (HA) RAID mode. Both adapters mutually control all of the six disk drive bays and have access to common data (see the following figure). In addition, the two rechargeable battery packs on this feature enable nonvolatile write cache of the embedded SAS storage adapters.

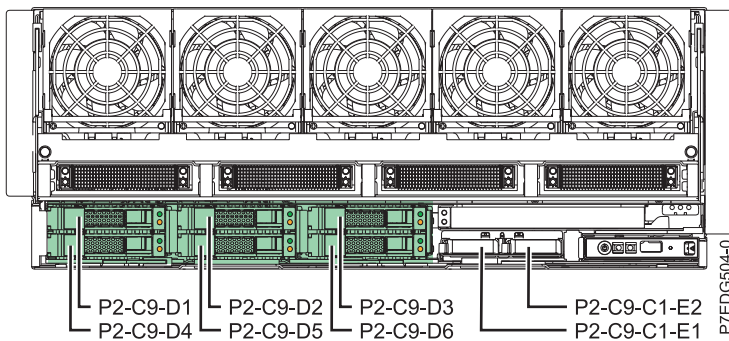


Figure 11. Disk bays controlled by both embedded SAS adapters that have dual storage IOA with internal drives

Attention: You must do proper planning and follow proper procedures before adding or removing the 175 MB Cache RAID – Dual IOA enablement card (FC 5662) to maintain system availability and to prevent possible data loss.

Related information:

- Removing the 175 MB Cache RAID – Dual IOA enablement card from the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD
- Installing the 175 MB Cache RAID – Dual IOA enablement card in the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD
- Important partitioning considerations with dual-slot and multi-adapter configurations

Service considerations for the cache battery pack


To prevent data loss, follow proper procedures before replacing the cache battery pack on the 175 MB cache RAID – dual IOA enablement card.

Attention: To maintain system availability and to prevent possible data loss, it is important to understand that these features have implications on the SAS configuration and data accessibility of the system.

The 175 MB cache Raid – dual IOA enablement card (FC 5662) contains two rechargeable battery packs and battery charger circuitry. Each battery pack provides power for the write cache of an embedded SAS storage adapter. When you replace a failing cache battery pack, be sure to replace the correct battery pack.

Attention: To prevent data loss, follow proper procedures before proceeding with battery replacement. If either of the cache battery LEDs are flashing, do not replace the cache battery pack or you might lose data.

Related information:

 [Removing and replacing the cache battery pack for the 9117-MMB, 9117-MMC, 9179-MHB, or 9179-MHC](#)

Problem determination and recovery

Review information about using problem determination and recovery procedures for the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD system.

Attention: To maintain system availability and to prevent possible data loss, contact your next level of support for any service that is related to the SAS storage subsystem on the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD system.

For more details about service, support, and feature information for the SAS storage subsystem, see the following information:


Related information:


 [SAS RAID controllers for AIX](#)


 [SAS RAID controllers for IBM i](#)


 [SAS RAID controllers for Linux](#)

 [Serial-attached SCSI cable planning](#)

 [Removing the 175 MB Cache RAID – Dual IOA enablement card from the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD](#)

 [Installing the 175 MB Cache RAID – Dual IOA enablement card in the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD](#)

 [Removing and replacing the cache battery pack for the 9117-MMB, 9117-MMC, 9179-MHB, or 9179-MHC](#)

 [Removing and installing the external SAS port on the 8412-EAD, 9117-MMB, 9117-MMC, 9117-MMD, 9179-MHB, 9179-MHC, or 9179-MHD](#)

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Technical Regulations, Department M372
IBM-Allee 1, 71139 Ehningen, Germany
Tele: +49 7032 15 2941
email: lugi@de.ibm.com

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