

Power Systems

*SAS subsystem for the 5148-21L,  
5148-22L, 8247-21L, 8247-22L,  
8247-42L, 8284-21A, 8284-22A,  
8286-41A, or 8286-42A*

**IBM**



Power Systems

*SAS subsystem for the 5148-21L,  
5148-22L, 8247-21L, 8247-22L,  
8247-42L, 8284-21A, 8284-22A,  
8286-41A, or 8286-42A*

**IBM**

**Note**

Before using this information and the product it supports, read the information in “Safety notices” on page v, “Notices” on page 13, 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 POWER8® 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:

- If IBM supplied the power cord(s), 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.
  - For AC power, disconnect all power cords from their AC power source.
  - For racks with a DC power distribution panel (PDP), disconnect the customer's DC power source to the PDP.
- When connecting power to the product ensure all power cables are properly connected.

- For racks with AC power, 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.
- For racks with a DC power distribution panel (PDP), connect the customer's DC power source to the PDP. Ensure that the proper polarity is used when attaching the DC power and DC power return wiring.
- 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.
- Do not attempt to switch on power to the machine until all possible unsafe conditions are corrected.
- Assume that an electrical safety hazard is present. Perform all continuity, grounding, and power checks specified during the subsystem installation procedures to ensure that the machine meets safety requirements.
- Do not continue with the inspection if any unsafe conditions are present.
- Before you open the device covers, unless instructed otherwise in the installation and configuration procedures: Disconnect the attached AC power cords, turn off the applicable circuit breakers located in the rack power distribution panel (PDP), and disconnect any telecommunications systems, networks, and modems.

**DANGER:**

- 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. For AC power, remove the power cords from the outlets.
3. For racks with a DC power distribution panel (PDP), turn off the circuit breakers located in the PDP and remove the power from the Customer's DC power source.
4. Remove the signal cables from the connectors.
5. 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. For AC power, attach the power cords to the outlets.
5. For racks with a DC power distribution panel (PDP), restore the power from the Customer's DC power source and turn on the circuit breakers located in the PDP.
6. Turn on the devices.

Sharp edges, corners and joints may be present in and around the system. Use care when handling equipment to avoid cuts, scrapes and pinching. (D005)

**(R001 part 1 of 2):**

**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. In addition, do not lean on rack mounted devices and do not use them to stabilize your body position (for example, when working from a ladder).



- Each rack cabinet might have more than one power cord.
  - For AC powered racks, be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.
  - For racks with a DC power distribution panel (PDP), turn off the circuit breaker that controls the power to the system unit(s), or disconnect the customer's DC power source, 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.

**(R001 part 2 of 2):**

**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.

**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 (compliance ID RACK-001 or 22U (compliance ID RR001) and above.
  - Ensure that the heaviest devices are installed in the bottom of the rack cabinet.
  - Ensure that there are little-to-no empty U-levels between devices installed in the rack cabinet below the 32U (compliance ID RACK-001 or 22U (compliance ID RR001) level, unless the received configuration specifically allowed it.
- If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.
- If the rack cabinet you are relocating was supplied with removable outriggers they must be reinstalled before the cabinet is relocated.
- 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)



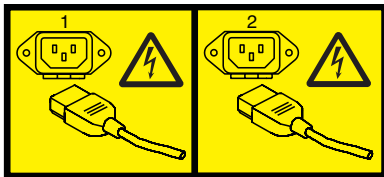
**DANGER:** Hazardous voltage, current, or energy levels are present inside any component that has this label attached. Do not open any cover or barrier that contains this label. (L001)

(L002)

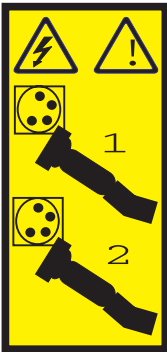


**DANGER:** Rack-mounted devices are not to be used as shelves or work spaces. (L002)

(L003)



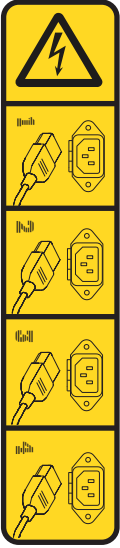
or



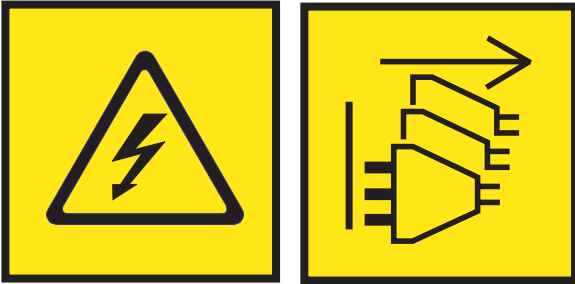
or



or



or



**DANGER:** Multiple power cords. The product might be equipped with multiple AC power cords or multiple DC power cables. To remove all hazardous voltages, disconnect all power cords and power cables. (L003)

(L007)



**CAUTION:** A hot surface nearby. (L007)

(L008)





**CAUTION:** Hazardous moving parts nearby. (L008)

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. Although shining light into one end and looking into the other end of a disconnected optical fiber to verify the continuity of optic fibers may not injure the eye, this procedure is potentially dangerous. Therefore, verifying the continuity of optical fibers by shining light into one end and looking at the other end is not recommended. To verify continuity of a fiber optic cable, use an optical light source and power meter. (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)

## CAUTION:

Regarding IBM provided VENDOR LIFT TOOL:

- Operation of LIFT TOOL by authorized personnel only.
- LIFT TOOL intended for use to assist, lift, install, remove units (load) up into rack elevations. It is not to be used loaded transporting over major ramps nor as a replacement for such designated tools like pallet jacks, walkies, fork trucks and such related relocation practices. When this is not practicable, specially trained persons or services must be used (for instance, riggers or movers).
- Read and completely understand the contents of LIFT TOOL operator's manual before using. Failure to read, understand, obey safety rules, and follow instructions may result in property damage and/or personal injury. If there are questions, contact the vendor's service and support. Local paper manual must remain with machine in provided storage sleeve area. Latest revision manual available on vendor's web site.
- Test verify stabilizer brake function before each use. Do not over-force moving or rolling the LIFT TOOL with stabilizer brake engaged.
- Do not move LIFT TOOL while platform is raised, except for minor positioning.
- Do not exceed rated load capacity. See LOAD CAPACITY CHART regarding maximum loads at center versus edge of extended platform.
- Only raise load if properly centered on platform. Do not place more than 200 lb (91 kg) on edge of sliding platform shelf also considering the load's center of mass/gravity (CoG).
- Do not corner load the platform tilt riser accessory option. Secure platform riser tilt option to main shelf in all four (4x) locations with provided hardware only, prior to use. Load objects are designed to slide on/off smooth platforms without appreciable force, so take care not to push or lean. Keep riser tilt option flat at all times except for final minor adjustment when needed.
- Do not stand under overhanging load.
- Do not use on uneven surface, incline or decline (major ramps).
- Do not stack loads.
- Do not operate while under the influence of drugs or alcohol.
- Do not support ladder against LIFT TOOL.
- Tipping hazard. Do not push or lean against load with raised platform.
- Do not use as a personnel lifting platform or step. No riders.
- Do not stand on any part of lift. Not a step.
- Do not climb on mast.
- Do not operate a damaged or malfunctioning LIFT TOOL machine.
- Crush and pinch point hazard below platform. Only lower load in areas clear of personnel and obstructions. Keep hands and feet clear during operation.
- No Forks. Never lift or move bare LIFT TOOL MACHINE with pallet truck, jack or fork lift.
- Mast extends higher than platform. Be aware of ceiling height, cable trays, sprinklers, lights, and other overhead objects.
- Do not leave LIFT TOOL machine unattended with an elevated load.
- Watch and keep hands, fingers, and clothing clear when equipment is in motion.
- Turn Winch with hand power only. If winch handle cannot be cranked easily with one hand, it is probably over-loaded. Do not continue to turn winch past top or bottom of platform travel. Excessive unwinding will detach handle and damage cable. Always hold handle when lowering, unwinding. Always assure self that winch is holding load before releasing winch handle.
- A winch accident could cause serious injury. Not for moving humans. Make certain clicking sound is heard as the equipment is being raised. Be sure winch is locked in position before releasing handle. Read instruction page before operating this winch. Never allow winch to unwind freely. Freewheeling will cause uneven cable wrapping around winch drum, damage cable, and may cause serious injury. (C048)

## 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 metalically 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 metalically 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.

The dc-powered system is intended to be installed in a common bonding network (CBN) as described in GR-1089-CORE.



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## **SAS subsystem for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, or 8286-42A**

Review the Serial-attached SCSI (SAS) subsystem features, configurations, and limitations for the IBM Elastic Storage Server Management Server (5148-21L), IBM Elastic Storage Server Data Server (5148-22L), IBM Power® System S812L (8247-21L), IBM Power System S822L (8247-22L), IBM Power System S824L (8247-42L), IBM Power System S812 (8284-21A), IBM Power System S822 (8284-22A), IBM Power System S814 (8286-41A), and the IBM Power System S824 (8286-42A) servers.

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## **What's new in SAS subsystem for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, or 8286-42A**

Read about new or significantly changed information in SAS subsystem for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, or 8286-42A.

### **February 2017**

Added information for the IBM Power System S812 (8284-21A) servers.

### **December 2016**

Added information for the IBM Elastic Storage Server Management Server (5148-21L) and IBM Elastic Storage Server Data Server (5148-22L) servers.

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## **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 Small Computer System Interface (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

Learn about the features and locations of the SAS subsystem parts in the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, or 8286-42A system.

Use this information in conjunction with your specific system and operating system documentation.

### Feature locations for the SAS subsystem parts in the base function storage configuration systems

Figure 1 provides information about the supported SAS features and their system locations in systems that have the base function storage configuration.

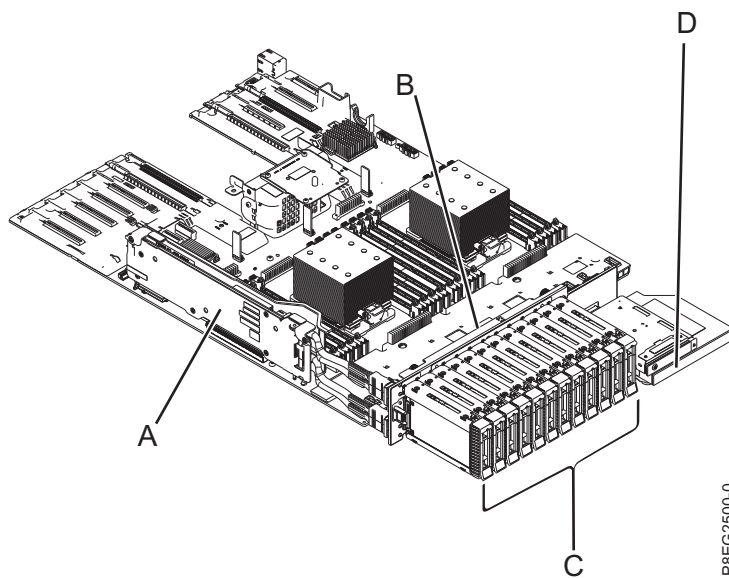


Figure 1. SAS subsystem parts in the base function storage configuration systems

Use Table 1 with Figure 1 for a list of parts and their locations.

Table 1. SAS subsystem parts in a base function storage configuration system

Diagram location	Part name	Feature code (FC)	Customer card identification numbers (CCINs)	Physical location codes
A	PCIe x8 SAS RAID internal adapter 6 Gb	EJ0S for 8247-42L, 8286-41A, or 8286-42A systems  EJ0V for 8284-21A and 8284-22A systems  EL3V for 8247-21L and 8247-22L systems	57D7	P1-C14, P1-C15
B, C	Base function disk drive backplane with 12 SFF bays	EJ0N for 8247-42L, 8286-41A, or 8286-42A systems  EJ0T for the 8284-21A and 8284-22A systems  EL3T for 5148-21L, 8247-21L, and 8247-22L systems	2B09	P2 for base function disk drive backplane  P2-D1 through P2-D12 for diskbays
D	One Slimline DVD bay	5771		P2-D27 for systems that are 4U high  P2-D15 for systems that are 2U high

## Feature locations for the SAS subsystem parts in the base function storage configuration with the split disk configuration

Figure 2 provides information about the supported SAS features and their system locations in systems that have the base function storage configuration with the split disk configuration.

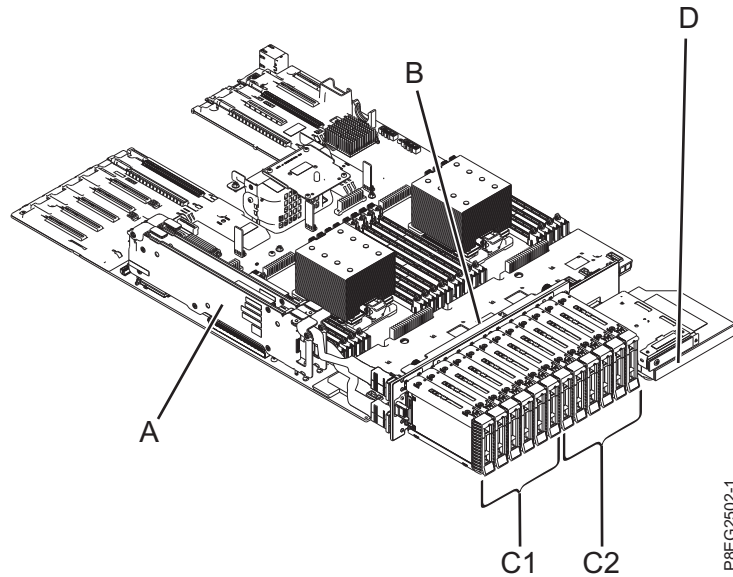


Figure 2. SAS subsystem parts in the base function storage configuration with the split disk configuration

Use Table 2 with Figure 2 for a list of parts and their locations.

Table 2. SAS subsystem parts in a base function storage configuration system with the split disk configuration

Diagram location	Part name	Feature code (FC)	Customer card identification numbers (CCINs)	Physical location codes
A	PCIe3 x8 SAS RAID internal adapter 6 Gb (quantity 2)	EJ0S for 8247-42L, 8286-41A, or 8286-42A systems  EJ0V for 8284-21A and 8284-22A systems  EL3V for 8247-21L and 8247-22L systems	57D7	P1-C14, P1-C15
B, C1, C2	Base function disk drive backplane with 12 SFF bays split into two groups of 6 disk bays (C1, C2)	EJ0N for 8247-42L, 8286-41A, or 8286-42A systems  EJ0T for 8284-21A and 8284-22A systems  EL3T for 8247-21L and 8247-22L systems	2B09	P2 for base function disk drive backplane  P2-D1 through P2-D12 for diskbays
D	One Slimline DVD bay	5771		P2-D27 for systems that are 4U high  P2-D15 for systems that are 2U high

## Feature locations for the SAS subsystem parts in the expanded function storage configuration

Figure 3 on page 4 provides information about the supported SAS features and their system locations in systems that have the expanded function storage configuration.

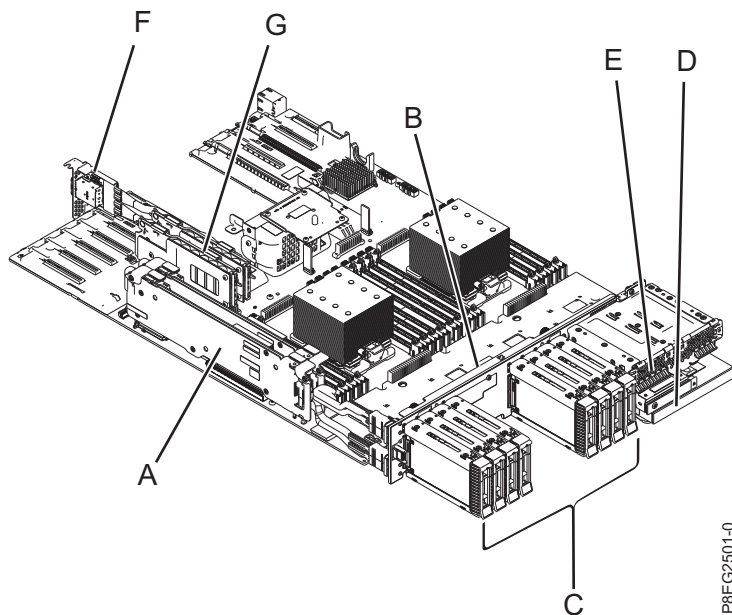


Figure 3. SAS subsystem parts in a system with the expanded function storage configuration

Use Figure 3 with Table 3 for a list of parts and their locations.

Table 3. SAS subsystem parts in a system with the expanded function storage configuration

Diagram location	Part name	Feature code (FC)	Customer card identification numbers (CCINs)	Physical location codes
A	PCIe3 x8 cache SAS RAID internal adapter 6 Gb (quantity 2)	EJ0P for 8247-42L, 8286-41A, or 8286-42A systems  EJ0U for 8284-21A and 8284-22A systems  EL3U for 8247-21L and 8247-22L systems	57D8	P1-C14, P1-C15
B, C	Expanded function disk drive backplane which supports one of the following options: <ul style="list-style-type: none"> <li>18 SFF bays (C) and 8 SSD bays (E) in the 8247-42L, 8286-41A, or 8286-42A systems</li> <li>8 SFF bays (C) and 6 SSD bays (E) in the 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A systems</li> </ul>	EL3W for 5148-22L server  EJ0P for the 8247-42L, 8286-41A, or 8286-42A systems  EJ0U for 8284-21A and 8284-22A system  EL3U for the 8247-21L and 8247-22L systems	2B0F for the 8247-42L, 8286-41A, or 8286-42A systems  2B5A for the 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A systems	P2 for expanded function disk drive backplane  P2-D1 through P2-D8 for diskbays in 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A systems  P2-D1 through P2-D9 and P2-D18 through P2-D26 for SSDs in 8247-42L, 8286-41A, or 8286-42A systems  P2-D9 through P2-D14 for expanded function disk drive backplane
E	SSD bays			P2-D9 through P2-D14 in 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A systems  P2-D10 through P2-D17 in 8247-42L, 8286-41A, or 8286-42A systems
D	One Slimline DVD bay	5771		P2-D27 for 8247-42L, 8286-41A, or 8286-42A systems  P2-D15 for 5148-22L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A systems
F	External SAS port cable assembly			
G	Backup power module cards (one for each SAS RAID internal adapter)			P1-C14-C1 and P1-C15-C2



## Feature details

### SAS RAID adapters

The SAS RAID adapters have the following features:

- PCI Express (PCIe3) system interface
- Physical link (phy) speed of 6 Gbps SAS
- 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 processor, hardware XOR DMA Engine, and hardware Finite Field Multiplier (FFM) DMA Engine (for Redundant Array of Independent Disks (RAID))
- Support for RAID 0, 5, 6, and 10 disk arrays
- Additional features when the PCIe3 x8 cache SAS RAID internal adapter 6 Gb card is installed:
  - Adapters support nonvolatile write cache
  - Support for RAID 5T2, 6T2, and 10T2 tiered disk arrays (depending on the Operating System support)
  - 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, 10, 5T2, 6T2, and 10T2 disk arrays
  - Background parity checking
  - Background data scrubbing
  - Disks formatted to 528 bytes per sector, providing cyclical redundancy checking (CRC) and logically bad block checking (T10 Data Integrity Fields)
  - Optimized hardware for RAID 5 and 6 sequential write workloads
  - Optimized skip read/write disk support for transaction workloads

### Related information:

[Serial-attached SCSI cable planning](#)

[Serial-attached SCSI cable planning](#)

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## SAS subsystem storage configurations

Several SAS subsystem storage configurations are supported on the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, or 8286-42A 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 4. SAS subsystem storage configurations*

SAS subsystem configuration	Supported SAS RAID adapter	External SAS components	SAS port cables	SAS cables	Limitations
Base function storage configuration	PCIe3 x8 SAS RAID internal adapter 6 Gb 6 Gb (CCIN 57D7)	None	None	Internal mini SAS HD cables	
Base function storage configuration with the split disk feature	Two PCIe3 x8 SAS RAID internal adapters 6 Gb (CCIN 57D7)	None	None	Internal mini SAS HD cables	

Table 4. SAS subsystem storage configurations (continued)



SAS subsystem configuration	Supported SAS RAID adapter	External SAS components	SAS port cables	SAS cables	Limitations
Expanded function storage configuration	Two PCIe3 x8 cache SAS RAID internal adapters 6 Gb (CCIN 57D8)	Two external SAS 4x ports that are used for expansion to external SAS drawer FC 5887	Yes	Internal mini SAS HD cables	Only one external SAS drawer FC 5887 is supported from the external SAS ports.

**Related concepts:**

“SAS subsystem service considerations” on page 11

There are several considerations to review before servicing features within the SAS subsystem for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, or 8286-42A system.

**Related information:**

-  Serial-attached SCSI cable planning
-  Serial-attached SCSI cable planning

**SAS subsystem base function storage configuration for the 5148-21L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, or 8286-42A**

This configuration uses the base function disk drive backplane.

The base function storage configuration includes:

- One PCIe3 x8 SAS RAID internal adapter 6 Gb, with RAID 0,10,5,6
- One base function disk drive backplane that supports 12x SFF (2.5") bays
- One Slimline DVD bay
- Two mini SAS HD cables

**Example: Base function disk drive backplane for 5148-21L, 8247-21L, 8247-22L, 8284-21A, or 8284-22A**

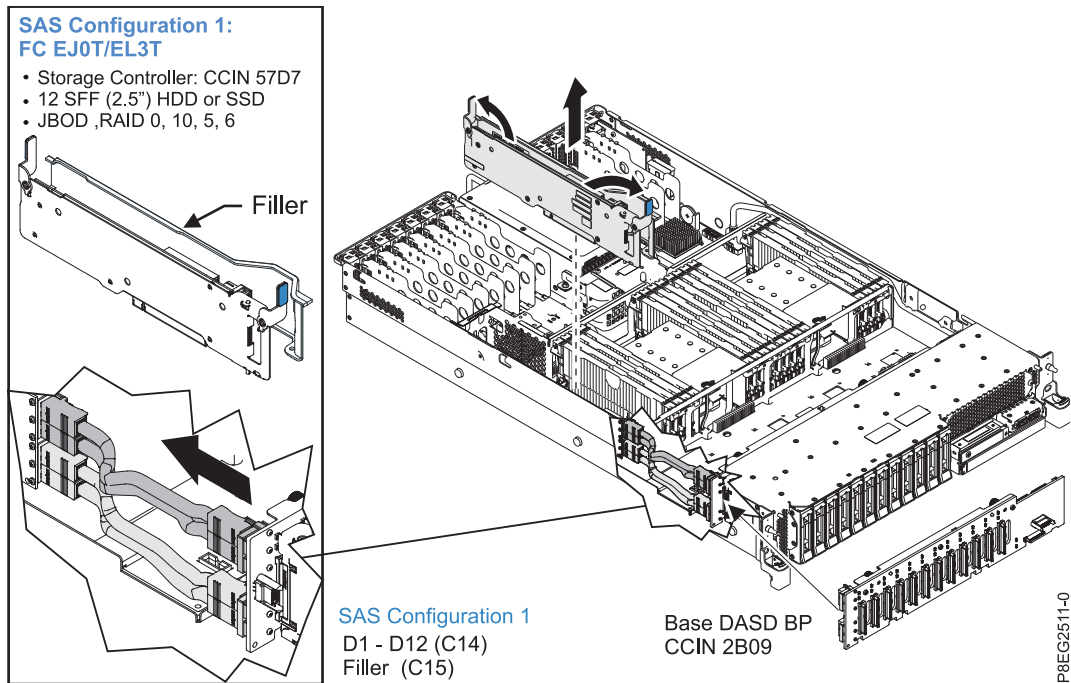


Figure 4. Disk bays controlled by base function disk drive backplane

**Example: Base function disk drive backplane for 8247-42L, 8286-41A, or 8286-42A**

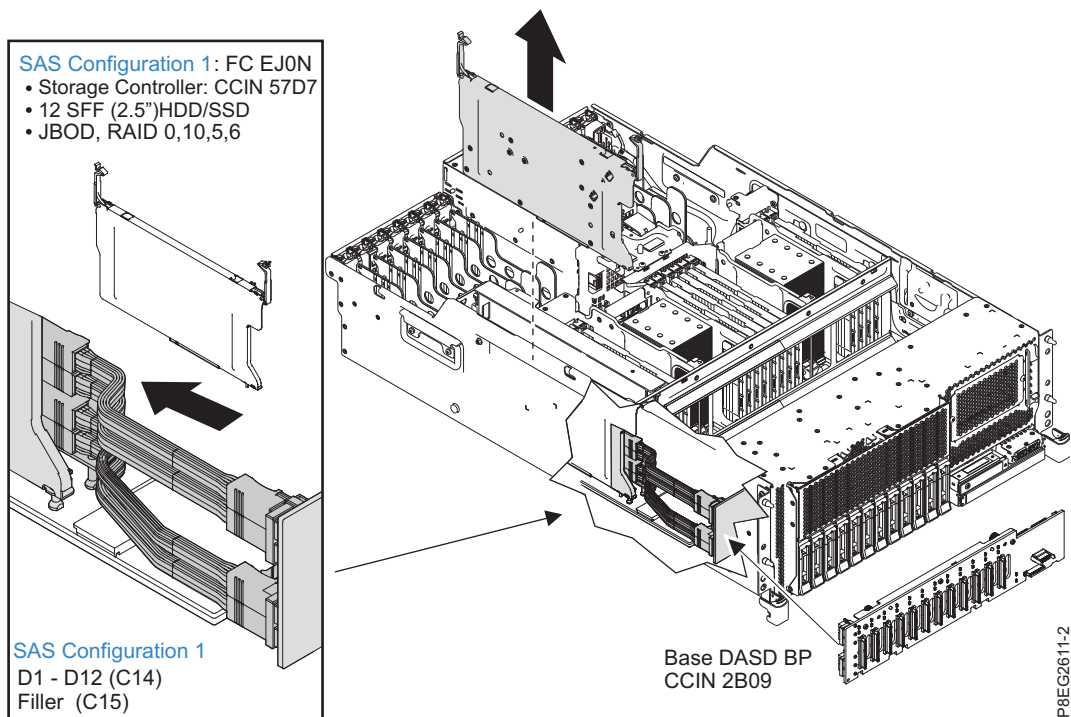


Figure 5. Disk bays controlled by base function disk drive backplane

On the base function disk drive backplane, the DVD drive and the disks are directly attached to the SAS adapter, and uses VSES for controlling the LED and power.

## SAS subsystem base function storage configuration with the split disk feature for the 8247-21L, 8247-22L, 8284-22A, 8286-41A, or 8286-42A

This configuration uses the base function disk drive backplane with the split-disk feature, with disks split as 6+6.

The base function storage configuration includes:

- Two PCIe3 x8 SAS RAID internal adapters 6 Gb, with RAID 0,10,5,6
- One base function disk drive backplane that supports 12x SFF (2.5") bays
- One Slimline DVD bay
- Two mini SAS HD cables

### Example: Base function disk drive backplane with split disk configuration for 8247-21L, 8247-22L, 8284-21A, or 8284-22A

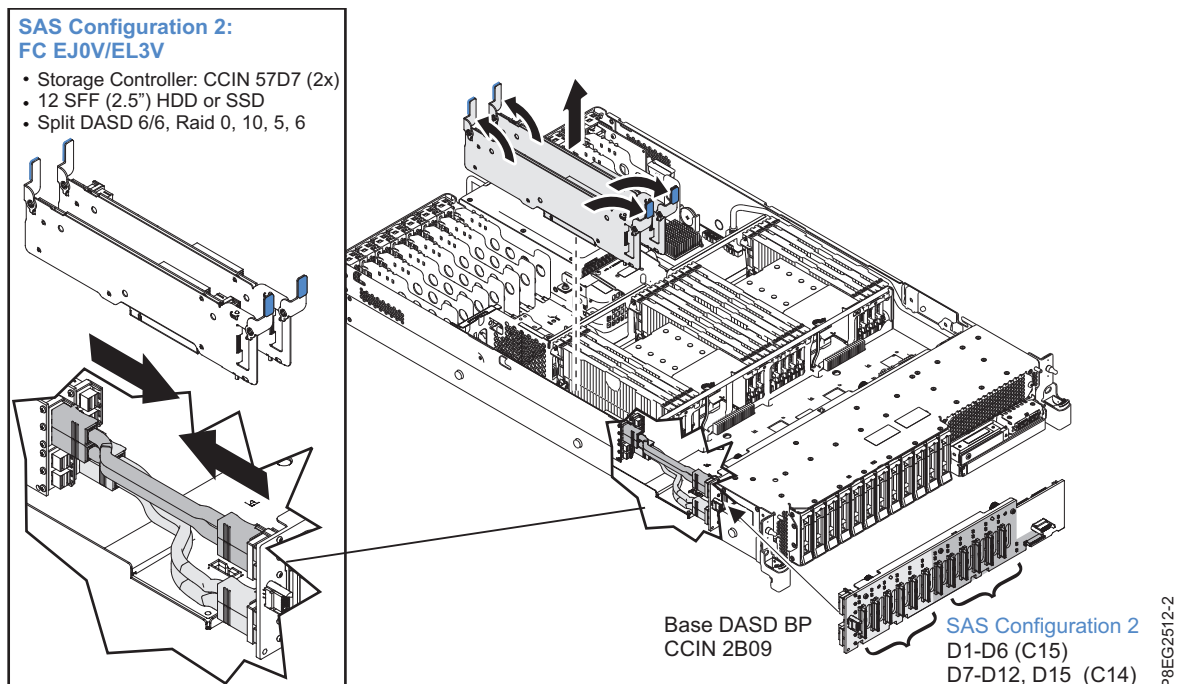


Figure 6. Disk bays controlled by the base function disk drive backplane, with the split disk feature

### Example: Base function disk drive backplane with split disk configuration for 8247-42L, 8286-41A, or 8286-42A

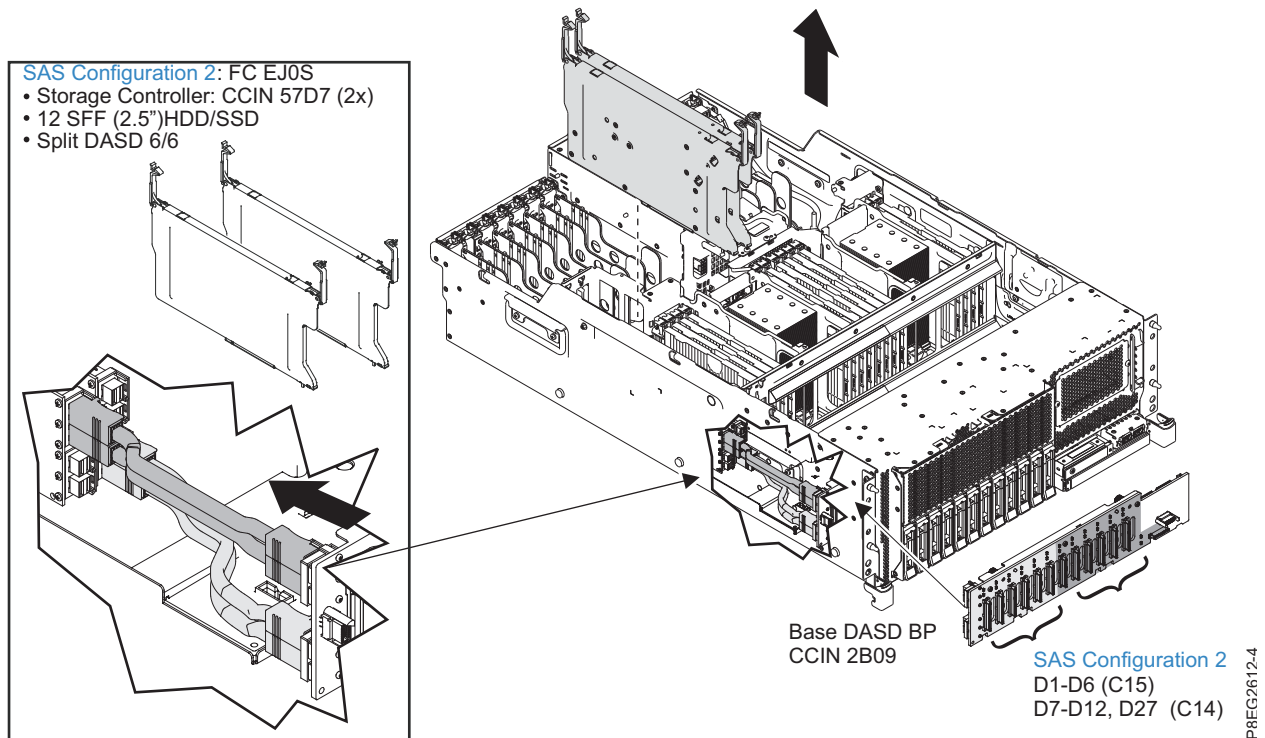


Figure 7. Disk bays controlled by the base function disk drive backplane, with the split disk feature

On the base function disk drive backplane, the DVD drive and the disks are directly attached to the SAS adapter, and uses VSES for controlling the LED and power.

## SAS subsystem expanded function configuration for the 5148-22L, 8247-21L, 8247-22L, 8284-22A, 8286-41A, or 8286-42A

This configuration uses the expanded function disk drive backplane.

The expanded function storage feature includes:

- Two expanded function PCIe3 x8 Cache SAS RAID Internal adapters 6 Gb, with RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2.

**Note:** RAID 5T2, 6T2, and 10T2 are not supported for IBM i operating system.

- One expanded function disk drive backplane which supports 18 SFF (2.5'') bays, 8 1.8" SSD bays

**Note:** For 8247-21L, 8247-22L, 8284-21A, or 8284-22A systems, the storage feature includes one expanded function disk drive backplane which supports 8x SFF (2.5'') bays, 6x 1.8" SSD bays, and one Slimline DVD bay.

- One Slimline DVD bay
- Two mini SAS HD cables

Two external SAS 4x ports are supported with the expanded function storage configuration. The SAS port connectors are located on the rear bulk head. The external SAS ports are used for expansion to external SAS drawer such as FC 5887. Only one FC 5887 disk drive enclosure is supported from the external SAS ports. Additional FC 5887 disk drive enclosures can be supported via PCIe SAS adapters.

## Examples: Expanded function disk drive backplane

This example shows an expanded function storage configuration in the 5148-22L, 8247-21L, and 8247-22L systems.

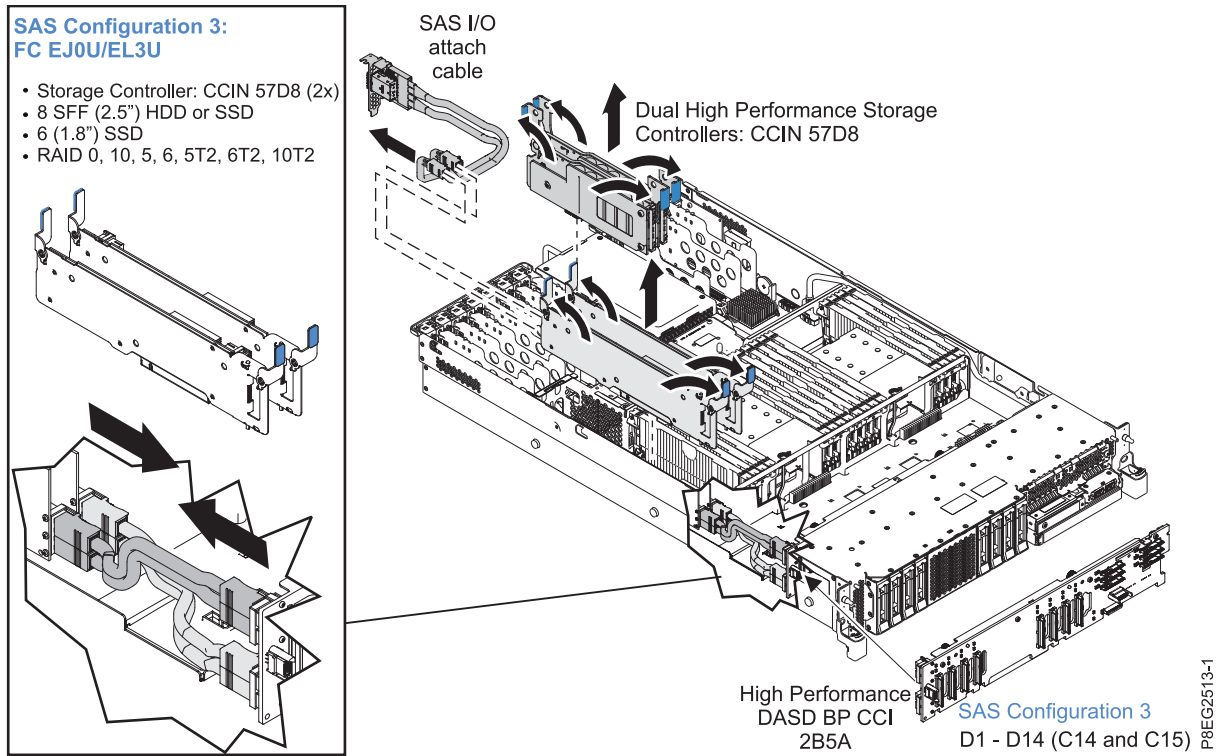


Figure 8. Disk bays controlled by the expanded function disk drive backplane in the 5148-22L, 8247-21L, 8247-22L, and 8284-22A systems

This example shows an expanded function storage configuration in the 8286-41A and 8286-42A systems.



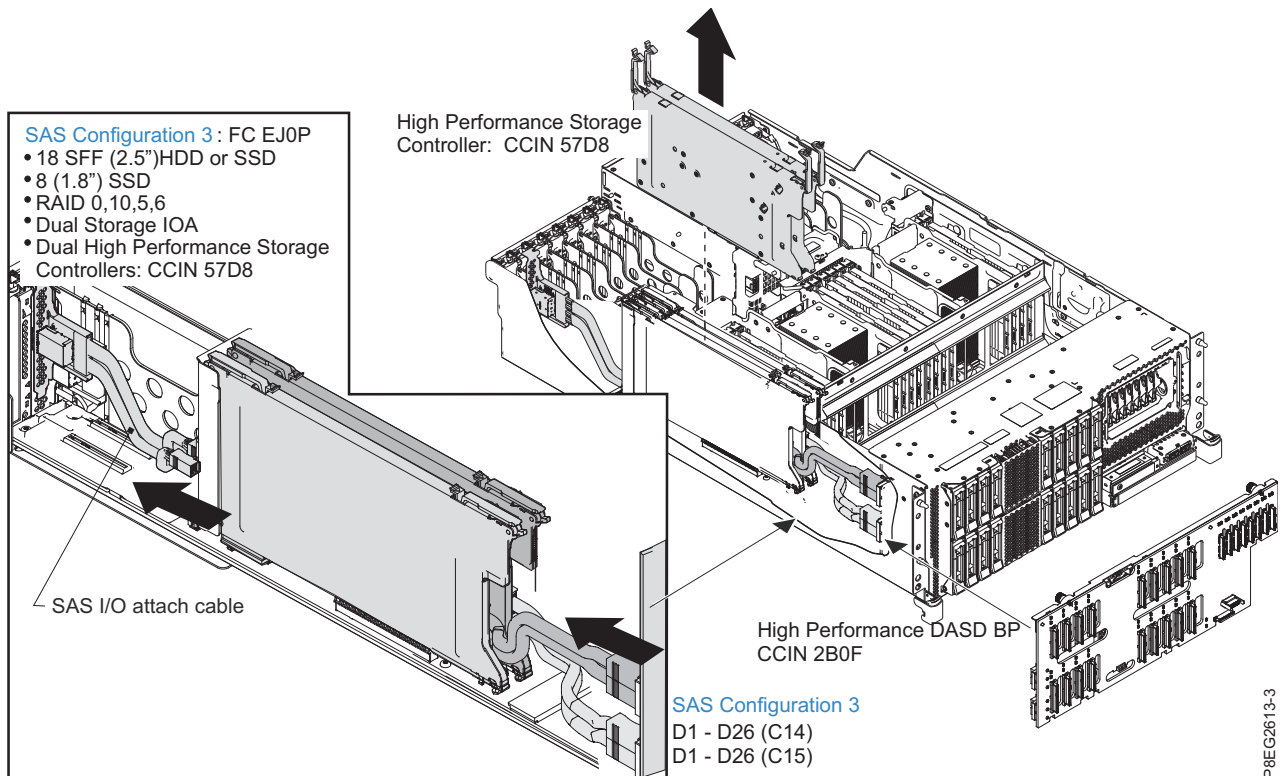


Figure 9. Disk bays controlled by the expanded function disk drive backplane in the 8286-41A and 8286-42A systems

## SAS subsystem service considerations

There are several considerations to review before servicing features within the SAS subsystem for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, or 8286-42A 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 concepts:

“SAS subsystem storage configurations” on page 5

Several SAS subsystem storage configurations are supported on the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, or 8286-42A systems.

### Related information:

- Logical partitioning
- SAS RAID controllers for IBM i
- SAS RAID controllers for Linux
- SAS RAID controllers for AIX

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## Problem determination and recovery

Review information about using problem determination and recovery procedures for the 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, or 8286-42A 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 5148-21L, 5148-22L, 8247-21L, 8247-22L, 8247-42L, 8284-21A, 8284-22A, 8286-41A, or 8286-42A system.

### Related information:

- [SAS RAID controllers for AIX](#)
- [SAS RAID controllers for IBM i](#)
- [SAS RAID controllers for Linux](#)
- [Serial-attached SCSI cable planning](#)



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Accessibility features assist users who have a disability, such as restricted mobility or limited vision, to use information technology content successfully.

### Overview

The IBM Power Systems servers include the following major accessibility features:

- Keyboard-only operation
- Operations that use a screen reader

The IBM Power Systems servers use the latest W3C Standard, WAI-ARIA 1.0 ([www.w3.org/TR/wai-aria/](http://www.w3.org/TR/wai-aria/)), to ensure compliance with US Section 508 ([www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-section-508-standards/section-508-standards](http://www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-section-508-standards/section-508-standards)) and Web Content Accessibility Guidelines (WCAG) 2.0 ([www.w3.org/TR/WCAG20/](http://www.w3.org/TR/WCAG20/)). To take advantage of accessibility features, use the latest release of your screen reader and the latest web browser that is supported by the IBM Power Systems servers.

The IBM Power Systems servers online product documentation in IBM Knowledge Center is enabled for accessibility. The accessibility features of IBM Knowledge Center are described in the Accessibility section of the IBM Knowledge Center help ([www.ibm.com/support/knowledgcenter/doc/kc\\_help.html#accessibility](http://www.ibm.com/support/knowledgcenter/doc/kc_help.html#accessibility)).

## Keyboard navigation

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## Interface information

The IBM Power Systems servers user interfaces do not have content that flashes 2 - 55 times per second.

The IBM Power Systems servers web user interface relies on cascading style sheets to render content properly and to provide a usable experience. The application provides an equivalent way for low-vision users to use system display settings, including high-contrast mode. You can control font size by using the device or web browser settings.

The IBM Power Systems servers web user interface includes WAI-ARIA navigational landmarks that you can use to quickly navigate to functional areas in the application.

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TTY service  
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This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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CAN ICES-3 (A)/NMB-3(A)

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要領に基づく定格入力電力値： Knowledge Centerの各製品の  
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台北市松仁路7號3樓  
電話：0800-016-888

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Generelle Informationen:

**Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 / EN 55032 Klasse A.**

## Electromagnetic Interference (EMI) Statement - Russia

**ВНИМАНИЕ!** Настоящее изделие относится к классу А.  
В жилых помещениях оно может создавать  
радиопомехи, для снижения которых необходимы  
дополнительные меры

### Class B Notices

The following Class B statements apply to features designated as electromagnetic compatibility (EMC) Class B in the feature installation information.

### Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an IBM-authorized dealer or service representative for help.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. Proper cables and connectors are available from IBM-authorized dealers. IBM is not responsible for any radio or television interference caused by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### Industry Canada Compliance Statement

CAN ICES-3 (B)/NMB-3(B)

### European Community Compliance Statement

This product is in conformity with the protection requirements of EU Council Directive 2014/30/EU on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.



European Community contact:  
IBM Deutschland GmbH  
Technical Regulations, Abteilung M456  
IBM-Allee 1, 71139 Ehningen, Germany  
Tel: +49 800 225 5426  
email: halloibm@de.ibm.com

## VCCI Statement - Japan

この装置は、クラスB情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。

取扱説明書に従って正しい取り扱いをして下さい。 VCCI-B

## Japan Electronics and Information Technology Industries Association Statement

This statement explains the Japan JIS C 61000-3-2 product wattage compliance.

(一社) 電子情報技術産業協会 高調波電流抑制対策実施  
要領に基づく定格入力電力値 : Knowledge Centerの各製品の  
仕様ページ参照

This statement explains the Japan Electronics and Information Technology Industries Association (JEITA) statement for products less than or equal to 20 A per phase.

高調波電流規格 JIS C 61000-3-2 適合品

This statement explains the JEITA statement for products greater than 20 A, single phase.

高調波電流規格 JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。

- 回路分類 : 6 (単相、PFC回路付)
- 換算係数 : 0

This statement explains the JEITA statement for products greater than 20 A per phase, three-phase.

## 高調波電流規格 JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。

- 回路分類 : 5 (3相、PFC回路付)
- 換算係数 : 0

### IBM Taiwan Contact Information

台灣IBM 產品服務聯絡方式：  
台灣國際商業機器股份有限公司  
台北市松仁路7號3樓  
電話：0800-016-888

### Germany Compliance Statement

#### Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse B EU-Richtlinie zur Elektromagnetischen Verträglichkeit

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2014/30/EU zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022/ EN 55032 Klasse B ein.

Um dieses sicherzustellen, sind die Geräte wie in den Handbüchern beschrieben zu installieren und zu betreiben. Des Weiteren dürfen auch nur von der IBM empfohlene Kabel angeschlossen werden. IBM übernimmt keine Verantwortung für die Einhaltung der Schutzanforderungen, wenn das Produkt ohne Zustimmung von IBM verändert bzw. wenn Erweiterungskomponenten von Fremdherstellern ohne Empfehlung von IBM gesteckt/eingebaut werden.

#### Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

Dieses Produkt entspricht dem "Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)". Dies ist die Umsetzung der EU-Richtlinie 2014/30/EU in der Bundesrepublik Deutschland.

#### Zulassungsbescheinigung laut dem Deutschen Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG) (bzw. der EMC Richtlinie 2014/30/EU) für Geräte der Klasse B

Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:  
International Business Machines Corp.  
New Orchard Road  
Armonk, New York 10504

Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:

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email: HalloIBM@de.ibm.com

Generelle Informationen:

**Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022/ EN 55032 Klasse B.**

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