

## Power Systems

*SAS subsystem for the 5105-22E,  
9008-22L, 9009-22A, 9009-22G,  
9009-41A, 9009-41G, 9009-42A,  
9009-42G, 9223-22H, 9223-22S,  
9223-42H, or 9223-42S*



**Note**

Before using this information and the product it supports, read the information in [“Safety notices” on page v](#), [“Notices” on page 11](#), 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 POWER9™ processor and to all associated models.

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# Contents

- Safety notices.....V**
  
- SAS subsystem.....1**
  - SAS subsystem configuration details..... 1
  - SAS architecture.....7
  - SAS subsystem storage configurations..... 8
    - SAS subsystem base function storage configuration..... 8
    - SAS subsystem base function storage configuration with the split-disk feature..... 9
    - SAS subsystem expanded function configuration..... 9
  - SAS subsystem service considerations.....10
  - Problem determination and recovery.....10
  
- Notices.....11**
  - Accessibility features for IBM Power Systems servers..... 12
  - Privacy policy considerations ..... 13
  - Trademarks..... 13
  - Electronic emission notices.....13
    - Class A Notices.....13
    - Class B Notices.....17
  - Terms and conditions.....19



# Safety notices

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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.
- When performing a machine inspection: 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 attempt to switch power to the machine until all possible unsafe conditions are corrected. 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.
- 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 if provided, unless the earthquake option is to be installed.
- 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).



- Stability hazard:
  - The rack may tip over causing serious personal injury.
  - Before extending the rack to the installation position, read the installation instructions.
  - Do not put any load on the slide-rail mounted equipment mounted in the installation position.
  - Do not leave the slide-rail mounted equipment in the installation position.
- 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 1 of 2)

**(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 or if the rack is not bolted to the floor. 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 part 2 of 2)



**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 little-to-no empty U-levels between devices installed in the rack cabinet below the 32U 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 2083 mm (30 x 82 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 or in an earthquake environment bolt the rack to the floor.
  - 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. 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). Stability hazard:

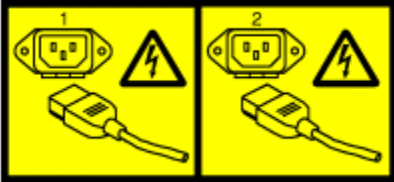
- The rack may tip over causing serious personal injury.
- Before extending the rack to the installation position, read the installation instructions.



- Do not put any load on the slide-rail mounted equipment mounted in the installation position.
- Do not leave the slide-rail mounted equipment in the installation position.

(L002)

(L003)



or



or

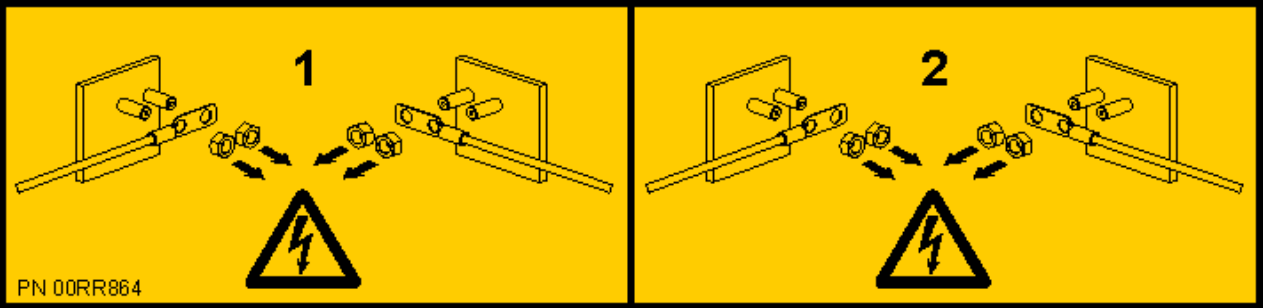



or



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)

(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 degrees C (212 degrees 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 raise, lower or slide platform load shelf unless stabilizer (brake pedal jack) is fully engaged. Keep stabilizer brake engaged when not in use or motion.
- 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 platforms, tilt riser, angled unit install wedge or other such accessory options. Secure such platforms -- riser tilt, wedge, etc options to main lift shelf or forks in all four (4x or all other provisioned mounting) 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 [adjustable angling platform] option flat at all times except for final minor angle 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 (unless the specific allowance is provided for one following qualified procedures for working at elevations with this 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.
- This TOOL must be maintained correctly for IBM Service personnel to use it. IBM shall inspect condition and verify maintenance history before operation. Personnel reserve the right not to use TOOL if inadequate. (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 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.

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



# SAS subsystem for the 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-22H, 9223-22S, 9223-42H, or 9223-42S

Review the Serial-attached SCSI (SAS) subsystem features, configurations, and limitations for the 5105-22E, IBM Power® System L922 (9008-22L), IBM Power System S922 (9009-22A and 9009-22G), IBM Power System H922 (9223-22H), IBM Power System H922S (9223-22S), IBM Power System S914 (9009-41A and 9009-41G), IBM Power System S924 (9009-42A and 9009-42G), IBM Power System H924 (9223-42H), or IBM Power System H924S (9223-42S) servers.

## SAS subsystem configuration details

Learn about the features and locations of the SAS subsystem parts in the 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-22H, 9223-22S, 9223-42H, or 9223-42S 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

Figure 1 on page 1 and Table 1 on page 2 provide information about the supported SAS features and the part locations in 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, or 9223-22S systems.

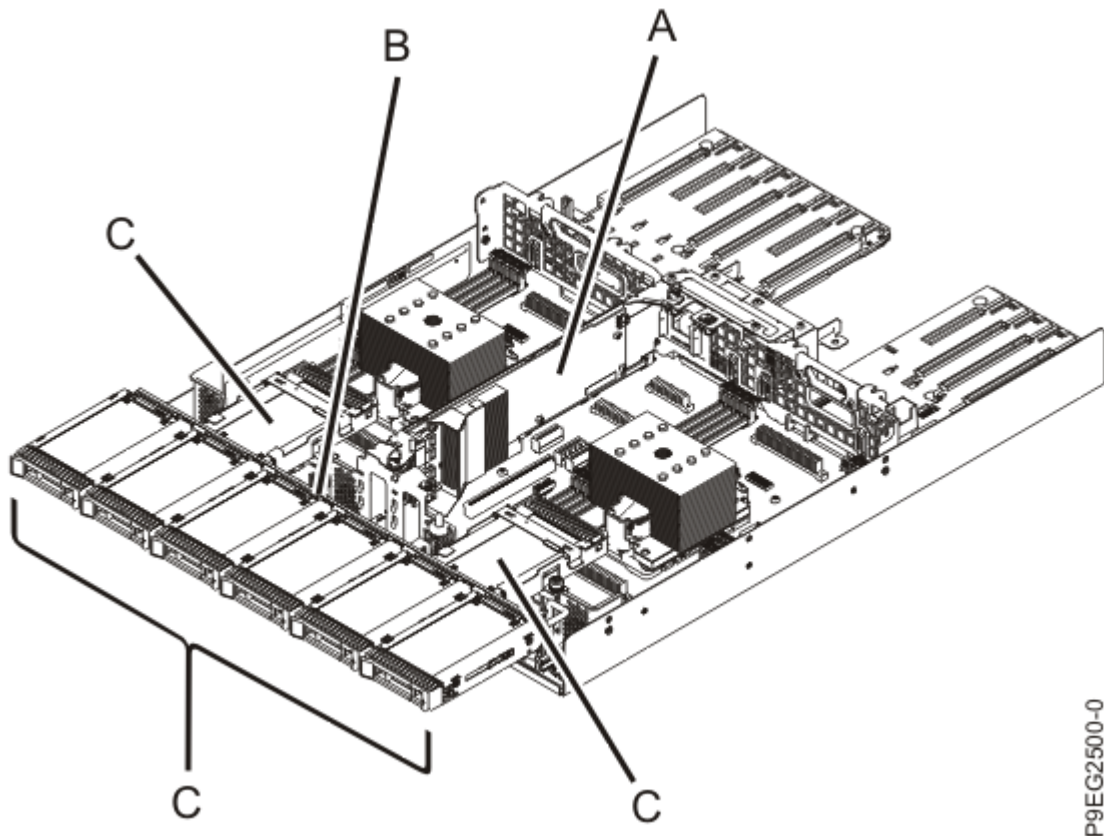


Figure 1. SAS subsystem parts in the base function storage configuration in 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, or 9223-22S systems

Table 1. SAS subsystem parts in 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, or 9223-22S systems with the base function storage 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	EJ1F	57D7	P1-C49
B, C	Base function disk drive backplane with 8 SFF bays	EJ1F	2D36	P2-D1 through P2-D8

Table 2 on page 2 and Figure 2 on page 2 provide information about the supported SAS features and the part locations in 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, or 9223-42S systems.

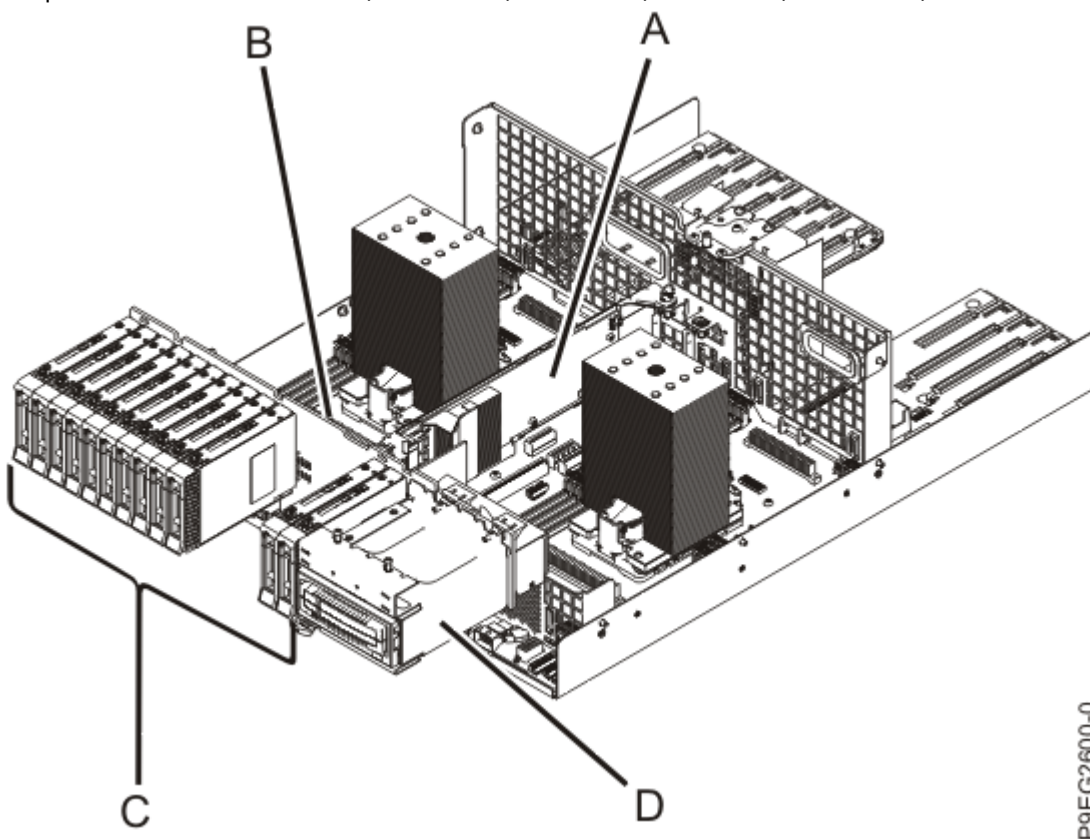


Figure 2. SAS subsystem parts in the base function storage configuration in 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, or 9223-42S systems

Table 2. SAS subsystem parts in 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, or 9223-42S systems with the base function storage 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	EJ1C	57D7	P1-C49
B, C	Base function disk drive backplane with 12 SFF bays	EJ1C	2D34	P2-D1 through P2-D12 for disk bays
D	One RDX bay	EU00		P3-D1

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

Figure 3 on page 3 and Table 3 on page 3 provide information about the supported SAS features and the part locations in 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, or 9223-22S systems.



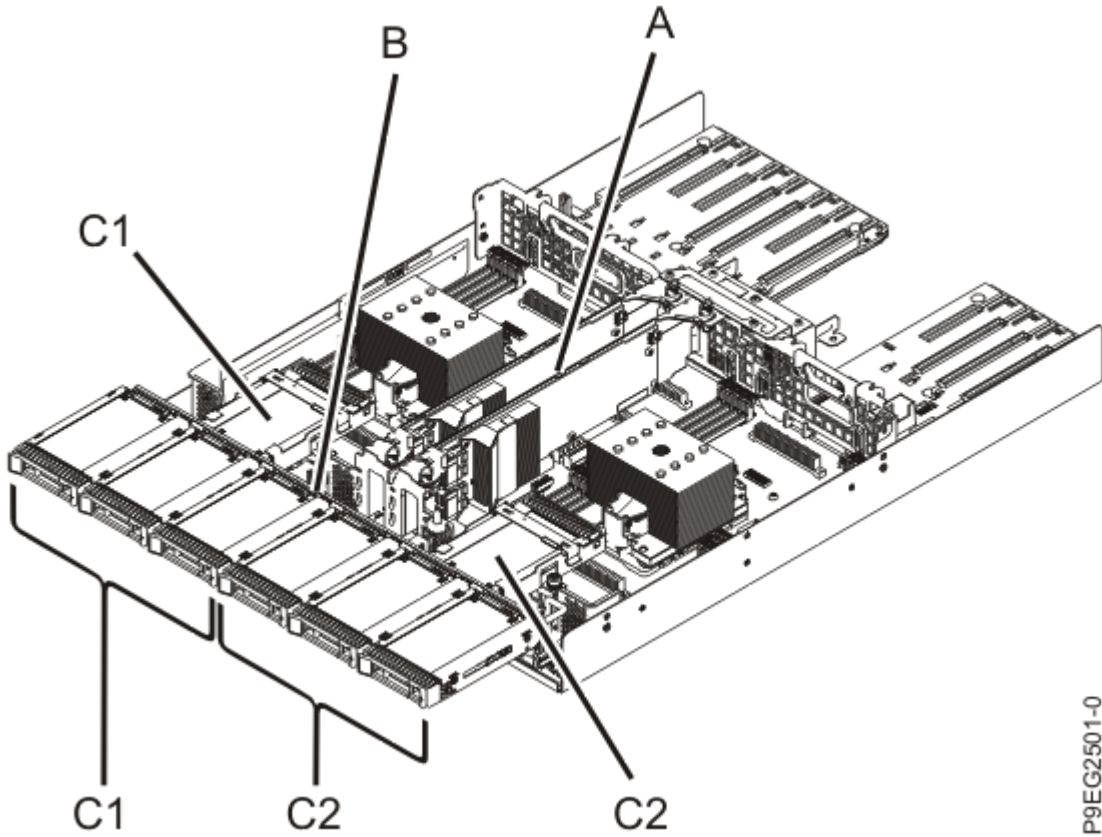


Figure 3. SAS subsystem parts in the base function storage configuration with the split-disk feature in 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, or 9223-22S system

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)	EJ1H	57D7	P1-C49, P1-C50
B, C1, C2	Base function disk drive backplane with 8 SFF bays that are split into two groups of 4 disk bays (C1 and C2)	EJ1H	2D36	P2-D1 through P2-D8

Table 4 on page 4 and Figure 4 on page 4 provide information about the supported SAS features and the part locations in 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, or 9223-42S systems.

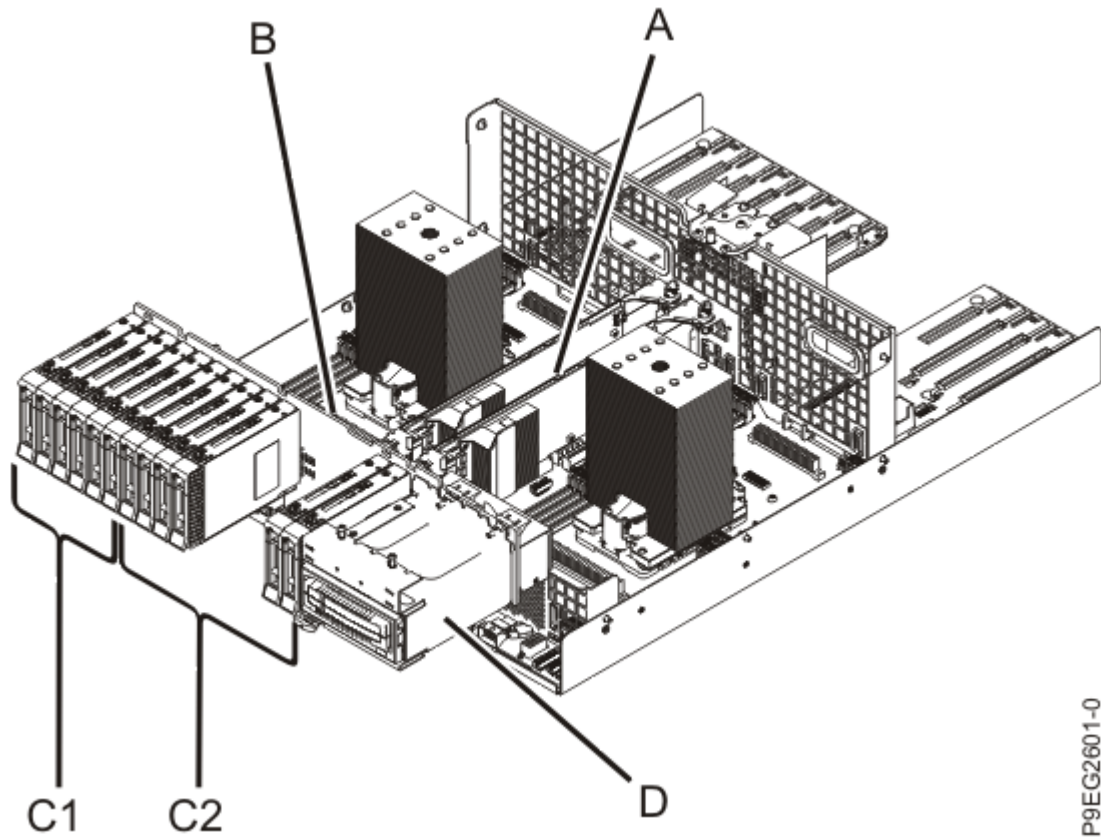
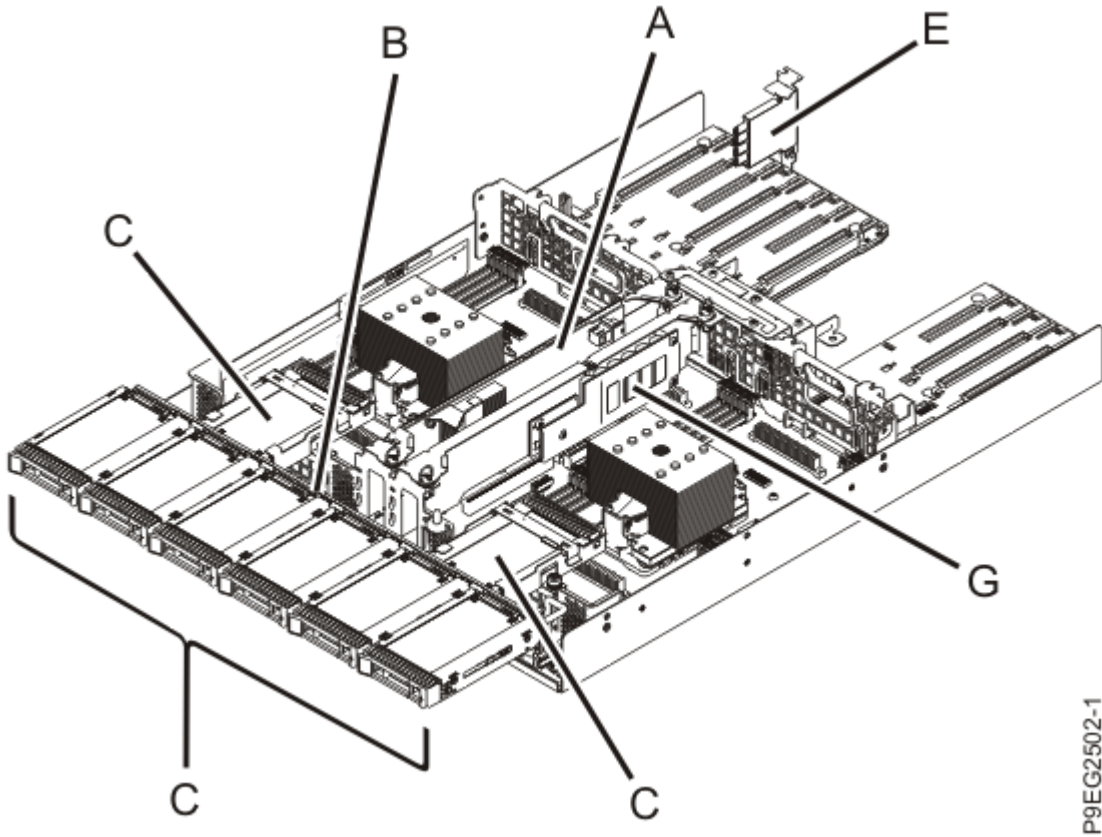


Figure 4. SAS subsystem parts in systems with base function storage configuration with the split-disk feature in 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, or 9223-42S

Table 4. SAS subsystem parts in 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, or 9223-42S systems with the base function storage configuration with split-disk feature				
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)	EJ1E	57D7	P1-C49, P1-C50
B, C1, C2	Base function disk drive backplane with 12 SFF bays that are split into two groups of 6 disk bays (C1 and C2)	EJ1E	2D34	P2-D1 through P2-D12 for disk bays
D	One RDX bay	EU00		P3-D1

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

Figure 5 on page 5 and Table 5 on page 5 provide information about the supported SAS features and the part locations in 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, or 9223-22S systems that have the expanded function storage configuration.

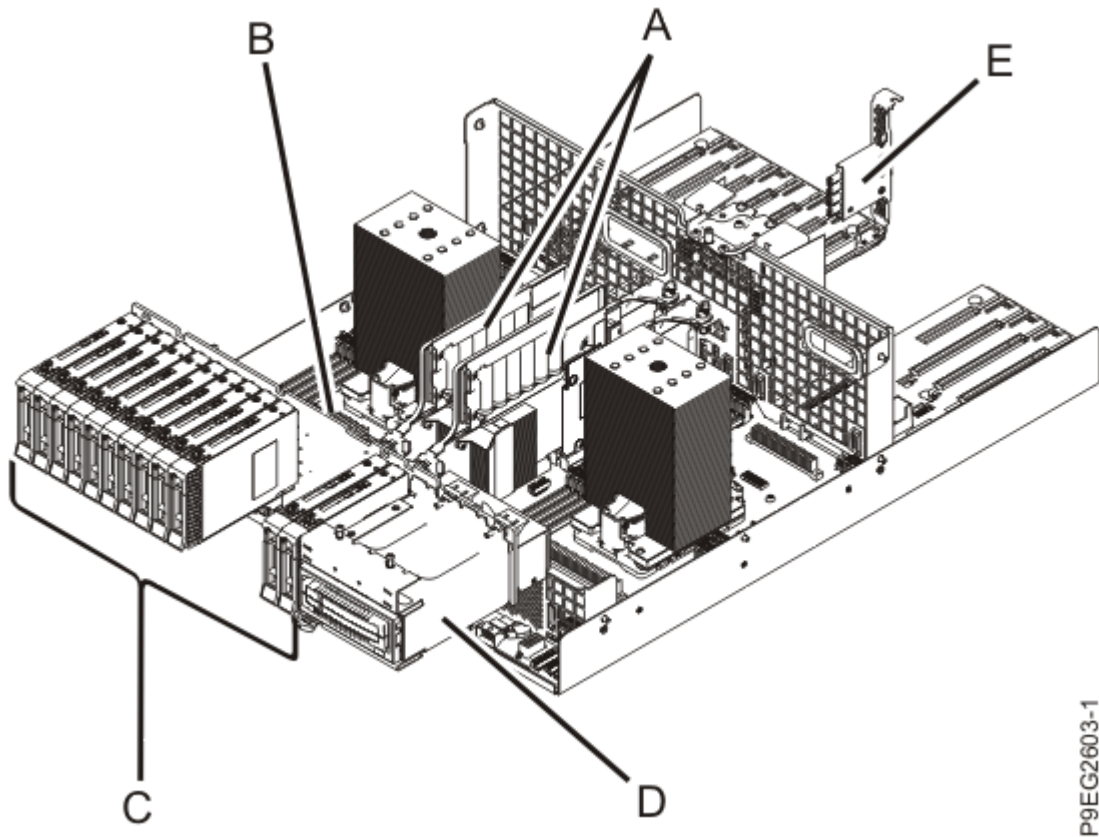


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Figure 5. SAS subsystem parts in a system with expanded function storage configuration in a 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, or 9223-22S

Table 5. SAS subsystem parts in a 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, or 9223-22S 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 1)	EJ1G	57DC	P1-C49
B, C	Expanded function disk drive backplane with 8 SFF bays	EJ1G	2D36	P2-D1 through P2-D8
E	External SAS port cable assembly			P1-C10
G	Backup power module card			P1-C49-E1

Figure 6 on page 6 and Table 6 on page 6 provide information about the supported SAS features and the part locations in 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, or 9223-42S systems.



P9EG2603-1

Figure 6. SAS subsystem parts with the expanded function storage configuration in a 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, or 9223-42S system

Table 6. SAS subsystem parts in a 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, or 9223-42S 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)	EJ1D or EJ1M	57D8	P1-C49, P1-C50
B, C	Expanded function disk drive backplane, which supports one of the following options: <ul style="list-style-type: none"> <li>• 18 SFF bays</li> <li>• 12 SFF bays</li> </ul>	<ul style="list-style-type: none"> <li>• EJ1D for 18 SFF bays</li> <li>• EJ1M for 12 SFF bays</li> </ul>	<ul style="list-style-type: none"> <li>• 2D35 for 18SFF bays</li> <li>• 6B64 for 12SFF bays</li> </ul>	P2-D1 through P2-D18 P2-D1 through P2-D12
E	External SAS port cable assembly			P1-C6
D	One RDX bay	EU00	EU00	P3-D1

## 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 or 4224 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](#)

[SAS RAID controllers for AIX](#)

[SAS RAID controllers for IBM i](#)

[SAS RAID controllers for Linux](#)

## **SAS architecture**

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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 the expander devices are 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 storage configurations

Several SAS subsystem storage configurations are supported on the 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-22H, 9223-22S, 9223-42H, or 9223-42S systems.

The configuration you use depends on the combination of SAS features that you have installed on your system. The following tables provide an overview of the features and related configurations for the different systems.

*Table 7. SAS subsystem storage configuration for 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, and 9223-22S systems*

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 (CCIN 57D7)	None	None	Internal 8x 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	Two internal 8x mini SAS HD cables	
Expanded function storage configuration	One PCIe3 x8 cache SAS RAID internal adapters 6 Gb (CCIN 57DC)	One external SAS 4x ports that is used for expansion to external SAS storage enclosure FC5887, ESLS, or ESLL	Yes	Two internal 8x mini SAS HD cables	One external SAS storage enclosure (FC 5887, ESLS, or ESLL) is supported from the external SAS port.

*Table 8. SAS subsystem storage configuration for 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, and 9223-42S systems*

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 8x 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	Two internal mini SAS HD cables	
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 storage enclosure (FC 5887, ESLS, or ESLL)	Yes	Internal mini SAS HD cables	One external SAS storage enclosure (FC 5887, ESLS, or ESLL) is supported from the external SAS port.

### Related information

[Serial-attached SCSI cable planning](#)

[SAS subsystem service considerations](#)

## SAS subsystem base function storage configuration for the 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-22H, 9223-22S, 9223-42H, or 9223-42S

This configuration uses the base function disk drive backplane.

The base function storage configuration for 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, and 9223-22S systems includes:

- One PCIe3 x8 SAS RAID internal adapter 6 Gb, with RAID 0,10,5,6
- One base function disk drive backplane that supports 8x SFF (2.5") bays

- Two 8x mini SAS HD cables

The base function storage configuration for 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, and 9223-42S systems 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 RDX bay
- Two 8x mini SAS HD cables

On the base function disk drive backplane, the disks are directly attached to the SAS adapter, and uses Virtual SCSI Enclosure Services (VSES) for controlling the light-emitting diode (LED) and system power. The RDX drive utilizes one of the USB 3.0 ports from the embedded USB 3.0 controller.

## **SAS subsystem base function storage configuration with the split-disk feature for the 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-22H, 9223-22S, 9223-42H, or 9223-42S**

This configuration uses the base function disk drive backplane with the split-disk feature.

The base function storage configuration with split-disk feature for 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, and 9223-22S systems includes:

- Two PCIe3 x8 SAS RAID internal adapters 6 Gb, with RAID 0,10,5,6
- One base function disk drive backplane that supports 8x SFF (2.5") bays, with disks split as 4+4.
- Two 8x mini SAS HD cables

The base function storage configuration with split-disk feature for 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, and 9223-42S systems includes:

- Two PCIe3 x8 SAS RAID internal adapters 6 Gb, with RAID 0,10,5,6
- One RDX bay
- One base function disk drive backplane that supports 12x SFF (2.5") bays, with disks split as 6+6.
- Two 8x mini SAS HD cables

On the base function disk drive backplane, the disks are directly attached to the SAS adapter, and uses Virtual SCSI Enclosure Services (VSES) for controlling the light-emitting diode (LED) and system power. The RDX drive utilizes one of the USB 3.0 ports from the embedded USB 3.0 controller.

## **SAS subsystem expanded function configuration for the 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-22H, 9223-22S, 9223-42H, or 9223-42S**

This configuration uses the expanded function disk drive backplane.

The expanded function storage configuration for 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9223-22H, or 9223-22S systems includes:

- One expanded function PCIe3 x8 Cache SAS RAID Internal adapters 6 Gb, with RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2
- One 2U disk drive backplane which supports 8x SFF (2.5") bays
- One 8x SAS HD cables

One external SAS 4x port is supported with the expanded function storage configuration. The SAS port connector is located on the rear bulk head. The external SAS port is used for expansion to external SAS storage drawers.

The expanded function RAID storage configuration for 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-42H, or 9223-42S systems includes:

- Two expanded function GXP PCIe3 x8 Cache SAS RAID Internal adapters 6 Gb, with RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2
- One RDX device
- One 4U 12 Gb disk drive backplane which supports 12x SFF (2.5") bays
- Two mini 8x SAS HD cables

or

- Two expanded function GXP PCIe3 x8 Cache SAS RAID Internal adapters 6 Gb, with RAID 0, 5, 6, 10, 5T2, 6T2, and 10T2
- One 4U 12 Gb disk drive backplane which supports 18x SFF (2.5") bays
- Two mini 8x 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 storage drawers.

## SAS subsystem service considerations

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There are several considerations to review before servicing features within the SAS subsystem for the 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-22H, 9223-22S, 9223-42H, or 9223-42S 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 IBM i](#)

[SAS RAID controllers for Linux](#)

[SAS RAID controllers for AIX](#)

## Problem determination and recovery

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Review information about using problem determination and recovery procedures for the 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-22H, 9223-22S, 9223-42H, or 9223-42S 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 5105-22E, 9008-22L, 9009-22A, 9009-22G, 9009-41A, 9009-41G, 9009-42A, 9009-42G, 9223-22H, 9223-22S, 9223-42H, or 9223-42S 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 for IBM Power Systems servers

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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](http://www.w3.org/TR/wai-aria/) ([www.w3.org/TR/wai-aria/](http://www.w3.org/TR/wai-aria/)), to ensure compliance with [US Section 508](http://www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-section-508-standards/section-508-standards) ([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](http://www.w3.org/TR/WCAG20/) ([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.

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### Keyboard navigation

This product uses standard navigation keys.

### 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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台北市松仁路7號3樓  
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Generelle Informationen:

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

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