IBM SAN Volume Controller SV2 and SA2

Hardware guide

Note

Before using this information and the product it supports, read the information in Chapter 2, “Notices ,” on page 3.

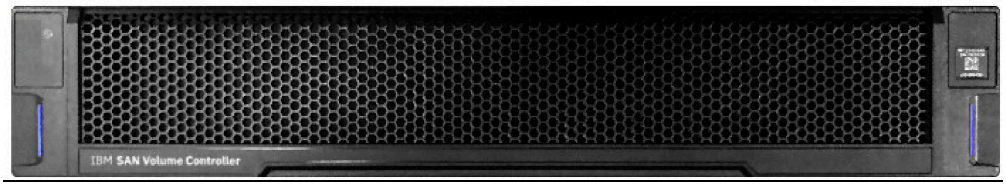
This edition applies to version 8, release 7, modification x, and to all subsequent modifications until otherwise indicated in new editions.

Contents

Figures

Tables

Chapter 1. SAN Volume Controller SV2 and SA2



Welcome to the SAN Volume Controller SV2 and SA2 documentation, where you can find information about how to install, maintain, and use the IBM Storage SAN Volume Controller SV2 and SA2 .

Chapter 2. Notices

This information was developed for products and services offered in the US. This material might be available from IBM in other languages. However, you may be required to own a copy of the product or product version in that language in order to access it.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not grant you any license to these patents. You can send license inquiries, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A.

For license inquiries regarding double-byte character set (DBCS) information, contact the IBM Intellectual Property Department in your country or send inquiries, in writing, to:

Intellectual Property Licensing
Legal and Intellectual Property Law
IBM Japan, Ltd.
19-21, Nihonbashi-Hakozakicho, Chuo-ku
Tokyo 103-8510, Japan

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some jurisdictions do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM websites are provided for convenience only and do not in any manner serve as an endorsement of those websites. The materials at those websites are not part of the materials for this IBM product and use of those websites is at your own risk.

IBM may use or distribute any of the information you provide in any way it believes appropriate without incurring any obligation to you.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact:

IBM Director of Licensing
IBM Corporation
North Castle Drive, MD-NC119
Armonk, NY 10504-1785
US

Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The licensed program described in this document and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement or any equivalent agreement between us.

The performance data discussed herein is presented as derived under specific operating conditions. Actual results may vary.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

Statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

All IBM prices shown are IBM's suggested retail prices, are current and are subject to change without notice. Dealer prices may vary.

This information is for planning purposes only. The information herein is subject to change before the products described become available.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs. The sample programs are provided "AS IS", without warranty of any kind. IBM shall not be liable for any damages arising out of your use of the sample programs.

If you are viewing this information softcopy, the photographs and color illustrations may not appear.

Trademarks

IBM, the IBM logo, and ibm.com® are trademarks or registered trademarks of International Business Machines Corp., registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the web at Copyright and trademark information at www.ibm.com/legal/copytrade.shtml.

Adobe, the Adobe logo, PostScript, and the PostScript logo are either registered trademarks or trademarks of Adobe Systems Incorporated in the United States, and/or other countries.

Intel and Intel Xeon are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

Java™ and all Java-based trademarks and logos are trademarks or registered trademarks of Oracle and/or its affiliates.

Linux® and the Linux logo is a registered trademark of Linus Torvalds in the United States, other countries, or both.

Microsoft, Windows, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Other product and service names might be trademarks of IBM or other companies.

Product support statement

If you have an operating system, Hypervisor, platform or host attachment card in your environment, check the IBM System Storage Interoperation Center (SSIC) to confirm the support status for this product.

SSIC can be found at http://www-03.ibm.com/systems/support/storage/ssic/interoperability.wss.

Homologation statement

This product may not be certified in your country for connection by any means whatsoever to interfaces of public telecommunications networks. Further certification may be required by law prior to making any such connection. Contact an IBM representative or reseller for any questions.

Safety and environmental notices

Review all safety notices, environmental notices, and electronic emission notices before you install and use the product.

Suitability for telecommunication environment: This product is not intended to connect directly or indirectly by any means whatsoever to interfaces of public telecommunications networks.

To find the converted text for a caution or danger notice, complete the following steps.

1. Look for the identification number at the end of each caution notice or each danger notice. In the following examples, the numbers (C001) and (D002) are the identification numbers.

   CAUTION: A caution notice indicates the presence of a hazard that has the potential of causing moderate or minor personal injury. (C001)

   DANGER: A danger notice indicates the presence of a hazard that has the potential of causing death or serious personal injury. (D002)
2. Locate the *IBM Systems Safety Notices* document with the user publications that were provided with your system hardware.
3. Find the matching identification number in *IBM Systems Safety Notices*. Then, review the topics about the safety notices to ensure that you are in compliance.
4. (Optional) Read the multilingual safety instructions on the system website.
   a. Go to www.ibm.com/support
   b. Enter the name of your system in the Search field (for example, "IBM Storage FlashSystem 5300").
   c. Click the documentation link.

For more information on Safety and environmental notices, see Environmental and safety notices.

For more details on different notices, see the following pages:

Safety notices and labels

Review the safety notices and safety information labels before you use this product.

To view a PDF file, you need Adobe Acrobat Reader. You can download it at no charge from the Adobe website:

www.adobe.com/support/downloads/main.html

IBM Systems Safety Notices

This publication contains the safety notices for the IBM Systems products in English and other languages. Anyone who plans, installs, operates, or services the system must be familiar with and understand the safety notices. Read the related safety notices before you begin work.

Note: The *IBM System Safety Notices* document is organized into two sections. The danger and caution notices without labels are organized alphabetically by language in the "Danger and caution notices by language" section. The danger and caution notices that are accompanied with a label are organized by label reference number in the "Labels" section. You can download the most current version of *IBM System Safety Notices* at the following site: *Environmental and safety notices*.

The following notices and statements are used in IBM documents. They are listed in order of decreasing severity of potential hazards.

Danger notice definition
A special note that emphasizes a situation that is potentially lethal or extremely hazardous to people.

Caution notice definition
A special note that emphasizes a situation that is potentially hazardous to people because of some existing condition, or to a potentially dangerous situation that might develop because of some unsafe practice.

Note: In addition to these notices, labels might be attached to the product to warn of potential hazards.

Finding translated notices

Each safety notice contains an identification number. You can use this identification number to check the safety notice in each language.

To find the translated text for a caution or danger notice:

1. In the product documentation, look for the identification number at the end of each caution notice or each danger notice. In the following examples, the numbers (D002) and (C001) are the identification numbers.

   DANGER: A danger notice indicates the presence of a hazard that has the potential of causing death or serious personal injury. (D002)

   CAUTION: A caution notice indicates the presence of a hazard that has the potential of causing moderate or minor personal injury. (C001)
2. After you download the *IBM System Safety Notices* document, open it.
3. Under the language, find the matching identification number. Review the topics about the safety notices to ensure that you are in compliance.

Caution notices for the system

Ensure that you understand the caution notices for the system.

Use the reference numbers in parentheses at the end of each notice (for example, D005) to find the matching translated notice in *IBM Systems Safety Notices*.

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. (C003)

CAUTION:

≥ 18 kg (39.7 lb) ≥ 33.6 kg (74 lb) ≥ 46.3 kg (102 lb)

The weight of this part or unit is between 32 and 55 kg (70.5 and 121.2 lb). It takes three persons to safely lift this part or unit. (C010)

CAUTION: To avoid personal injury, before lifting this unit, remove all appropriate subassemblies per instructions to reduce the system weight. (C012)

CAUTION: 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.
- 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 website.
- 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 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)

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

- Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must observe the following precautions.
  - Remove all devices in the 32U position and above.
  - Ensure that the heaviest devices are installed in the bottom of the rack cabinet.
  - Ensure that there are no empty U-levels between devices installed in the rack cabinet below the 32U level.
- If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.
- 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 the pallet and bolt the rack cabinet to the pallet. (R002)

Danger notices for the system

Ensure that you are familiar with the danger notices for your system.

Use the reference numbers in parentheses at the end of each notice (for example, D005) to find the matching translated notice in *IBM Systems Safety Notices*.

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 all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- Connect any equipment that will be attached to this product to properly wired outlets.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- 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 ontinuity, 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.
- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.
- Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.

  To disconnect:

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

  To connect:

  1. Turn off everything (unless instructed otherwise).

2. Attach all cables to the devices.
3. Attach the signal cables to the connectors.
4. Attach the power cords to the outlets.
5. Turn on the devices.

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

DANGER: Heavy equipment–personal injury or equipment damage might result if mishandled. (D006)

DANGER: Serious injury or death can occur if loaded lift tool falls over or if a heavy load falls off the lift tool. Always completely lower the lift tool load plate and properly secure the load on the lift tool before moving or using the lift tool to lift or move an object. (D010)

DANGER: Racks with a total weight of > 227 kg (500 lb.), Use Only Professional Movers! (R003)

DANGER: Do not transport the rack via fork truck unless it is properly packaged, secured on top of the supplied pallet. (R004)

DANGER:

Main Protective Earth (Ground):

This symbol is marked on the frame of the rack.

The PROTECTIVE EARTHING CONDUCTORS should be terminated at that point. A recognized or certified closed loop connector (ring terminal) should be used and secured to the frame with a lock washer using a bolt or stud. The connector should be properly sized to be suitable for the bolt or stud, the locking washer, the rating for the conducting wire used, and the considered rating of the breaker. The intent is to ensure the frame is electrically bonded to the PROTECTIVE EARTHING CONDUCTORS. The hole that the bolt or stud goes into where the terminal conductor and the lock washer contact should be free of any non-conductive material to allow for metal to metal contact. All PROTECTIVE EARTHING CONDUCTORS should terminate at this main protective earthing terminal or at points marked with . (R010)

Special caution and safety notices

This information describes special safety notices that apply to the system.

These notices are in addition to the standard safety notices that are supplied; they address specific issues that are relevant to the equipment provided.

General safety

When you service the IBM Storage FlashSystem 5300, follow general safety guidelines.

CAUTION: The weight of the enclosure exceeds 18kgs, lift the enclosure after referring label

Use the following general rules to ensure safety to yourself and others.

- Observe good housekeeping in the area where the devices are kept during and after maintenance.
- Follow the guidelines when lifting any heavy object:

1. Ensure that you can stand safely without slipping.
2. Distribute the weight of the object equally between your feet.
3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.
4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any objects that weigh more than 18 kg (40 lb) or objects that you think are too heavy for you.*

- Do not perform any action that causes a hazard or makes the equipment unsafe.
- Before you start the device, ensure that other personnel are not in a hazardous position.
- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the unit.
- Keep your tool case away from walk areas so that other people cannot trip over it.
- Do not wear loose clothing that can be trapped in the moving parts of a device. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.
- Insert the ends of your necktie or scarf inside clothing or fasten it with a nonconducting clip, approximately 8 cm (3 in.) from the end.
- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing.

  Remember: Metal objects are good electrical conductors.
- Wear safety glasses when you are hammering, drilling, soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.
- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.
- Reinstall all covers correctly after you have finished servicing the unit.

Inspecting the system for unsafe conditions

Use caution when you are working in any potential safety hazardous situation that is not covered in the safety checks. If unsafe conditions are present, determine how serious the hazards are and whether you can continue before you correct the problem.

Before you begin

Before you start the safety inspection, make sure that the power is off, and that the power cord is disconnected.

About this task

Each device has the required safety items that are installed to protect users and support personnel from injury. Only those items are addressed.

Important: Good judgment must also be used to identify potential safety hazards due to the attachment of non-IBM features or options that are not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard might be and whether you can continue without first correcting the problem. For example, consider the following conditions and their potential safety hazards:

Electrical hazards (especially primary power)
Primary voltage on the frame can cause serious or lethal electrical shock.

Explosive hazards
A damaged CRT face or a bulging capacitor can cause serious injury.

Mechanical hazards
Loose or missing items (for example, nuts and screws) can cause serious injury.

To inspect each node for unsafe conditions, use the following steps. If necessary, see any suitable safety publications.

Procedure

1. Turn off the system and disconnect the power cord.
2. Check the frame for damage (loose, broken, or sharp edges).
3. Check the power cables by using the following steps:
   a) Ensure that the third-wire ground connector is in good condition. Use a meter to check that the third-wire ground continuity is 0.1 ohm or less between the external ground pin and the frame ground.
   b) Ensure that the power cord is the appropriate type, as specified in the parts listings.
   c) Ensure that the insulation is not worn or damaged.
4. Check for any obvious nonstandard changes, both inside and outside the unit. Use good judgment about the safety of any such changes.
5. Check inside the node for any obvious unsafe conditions, such as metal particles, contamination, water or other fluids, or marks of overheating, fire, or smoke damage.
6. Check for worn, damaged, or pinched cables.
7. Ensure that the voltage that is specified on the product-information label matches the specified voltage of the electrical power outlet. If necessary, verify the voltage.
8. Inspect the power-supply assemblies and check that the fasteners (screws or rivets) in the cover of the power-supply unit are not removed or disturbed.
9. Check the grounding of the network switch before you connect the system to the storage area network (SAN).

Checking external devices

Ensure that you complete an external device check before you install or service the system.

Procedure

To conduct an external device check, complete the following steps.

1. Verify that all external covers are present and are not damaged.
2. Ensure that all latches and hinges are in the correct operating condition.
3. Check the power cords for damage.
4. Check the external signal cables for damage.
5. Check the cover for sharp edges, damage, or alterations that expose the internal parts of the device.
6. Correct any problems that you find.

Checking internal devices

Ensure that you complete an internal device check before you install or service your system.

About this task

To conduct the internal device check, use the following steps.

Procedure

1. Check for any non-IBM changes that were made to the device.
2. Check the condition of the inside of the device for any metal or other contaminants, or any indications of water, other fluid, fire, or smoke damage.
3. Check for any obvious mechanical problems, such as loose components.
4. Check any exposed cables and connectors for wear, cracks, or pinching.

Handling static-sensitive devices

Ensure that you understand how to handle devices that are sensitive to static electricity.

Attention: Static electricity can damage electronic devices and your system. To avoid damage, keep static-sensitive devices in their static-protective bags until you are ready to install them.

To reduce the possibility of electrostatic discharge, observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its antistatic bag, touch it to an unpainted metal part of the system unit for at least 2 seconds. (This action removes static electricity from the package and from your body).
- Remove the device from its package and install it directly into your system, without putting it down. If it is necessary to put the device down, place it onto its static-protective bag. (If your device is an adapter, place it component-side up.) Do not place the device onto the cover of the system or onto a metal table.
- Take additional care when you handle devices during cold weather. Indoor humidity tends to decrease in cold weather, causing an increase in static electricity.

Sound pressure

Attention: Depending on local conditions, the sound pressure can exceed 85 dB(A) during service operations. In such cases, wear appropriate hearing protection.

Environmental notices

This information contains all the required environmental notices for IBM Systems products in English and other languages.

The *IBM Systems Environmental Notices* information includes statements on limitations, product information, product recycling and disposal, battery information, flat panel display, refrigeration and water-cooling systems, external power supplies, and safety data sheets.

Electromagnetic compatibility Class A notices

The following Class A statements apply to IBM products and their features unless designated as electromagnetic compatibility (EMC) Class B in the feature information.

When attaching a monitor to the equipment, you must use the designated monitor cable and any interference suppression devices that are supplied with the monitor.

Canada Notice

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

European Community and Morocco Notice

This product is in conformity with the protection requirements of Directive 2014/30/EU of the European Parliament and of the Council on the harmonization 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.

This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Warning: This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.

Germany Notice

Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse A 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-Mitgliedsstaatenund hält die Grenzwerte der EN 55032 Klasse A 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.

EN 55032 Klasse A Geräte müssen mit folgendem Warnhinweis versehen werden:
"Warnung: Dieses ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funk-Störungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen zu ergreifen und dafür aufzukommen."

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 A

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:

IBM Deutschland GmbH
Technical Relations Europe, Abteilung M456
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 800 225 5426
e-mail: Halloibm@de.ibm.com

Generelle Informationen:

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

Japan Electronics and Information Technology Industries Association (JEITA) Notice

（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：IBM Documentationの各製品の仕様ページ参照

This statement applies to 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 applies to 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 applies to 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

Japan Voluntary Control Council for Interference (VCCI) Notice

この装置は、クラスＡ機器です。この装置を住宅環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

VCCI ー A

Korea Notice

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

People's Republic of China Notice

警告:在居住环境中,运行此设备可能会造成无线电干扰。

Russia Notice

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

Saudi Arabia Notice

قد يتسبب هذا المنتج في حدوث تداخل إذا تم استخدامه في المناطق السكنية.

ويجب تجنب هذا الاستخدام ما لم يتخذ المستخدم تدابير خاصة لتقليل الانبعاثات الكهرومغناطيسية لمنع التداخل مع استقبال البث الإذاعي والتلفزيوني.

تحذير: هذا الجهاز متوافق مع الفئة أ من SASO CISPR 32

في البيئة السكنية، قد يتسبب هذا الجهاز في حدوث تداخل لاسلكي.

Taiwan Notice

CNS 13438

警告使用者：
此為甲類資訊技術設備，
於居住環境中使用時，可
能會造成射頻擾動，在此
種情況下，使用者會被要
求採取某些適當的對策。

CNS 15936

警告：為避免電磁干擾，本產品不應安裝或使用於住宅環境。

IBM Taiwan Contact Information:

United Kingdom Notice

This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

United States Federal Communications Commission (FCC) Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than

recommended cables and connectors, or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device might not cause harmful interference, and (2) this device must accept any interference received, including interference that might cause undesired operation.

Responsible Party:
International Business Machines Corporation
New Orchard Road
Armonk, NY 10504
Contact for FCC compliance information only: fccinfo@us.ibm.com

Electromagnetic compatibility Class B notices

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

When attaching a monitor to the equipment, you must use the designated monitor cable and any interference suppression devices supplied with the monitor.

Canada Notice

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

European Community and Morocco Notice

This product is in conformity with the protection requirements of Directive 2014/30/EU of the European Parliament and of the Council on the harmonization 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.

Germany Notice

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-Mitgliedsstaatenund 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:
IBM Deutschland GmbH
Technical Relations Europe, Abteilung M456
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 (0) 800 225 5426
email: HalloIBM@de.ibm.com

Generelle Informationen:

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

Japan Electronics and Information Technology Industries Association (JEITA) Notice

（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：IBM Documentationの各製品の仕様ページ参照

This statement applies to 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

These statements apply to 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 applies to 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

Japan Voluntary Control Council for Interference (VCCI) Notice

この装置は、クラスB機器です。この装置は、住宅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 ー B

Taiwan Notice

IBM Taiwan Contact Information:

United States Federal Communications Commission (FCC) Notice

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 using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

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

Responsible Party:
International Business Machines Corporation
New Orchard Road
Armonk, NY 10504
Contact for FCC compliance information only: fccinfo@us.ibm.com

Chapter 3. System overview

IBM SAN Volume Controller is an enterprise-class storage virtualization solution. It helps organizations achieve better data economics by supporting the large scale workloads that are critical to success.

Built with IBM Storage Virtualize software - part of the IBM Spectrum Storage family, IBM SAN Volume Controller delivers the performance and scalability needed to gain insights from the latest analytics technologies.

IBM SAN Volume Controller operates as a clustered system of individual nodes, where a node is an individual hardware appliance. The nodes are always installed in pairs; a minimum of one pair and a maximum of four pairs of nodes constitute a system. Each pair of nodes is known as an I/O group.

I/O groups take the storage that is presented to the Storage Area Network (SAN) by the backend storage systems and transforms the storage into logical disks (volumes) that are used by applications on the hosts. A node is in only one I/O group and provides access to the volumes in that I/O group.

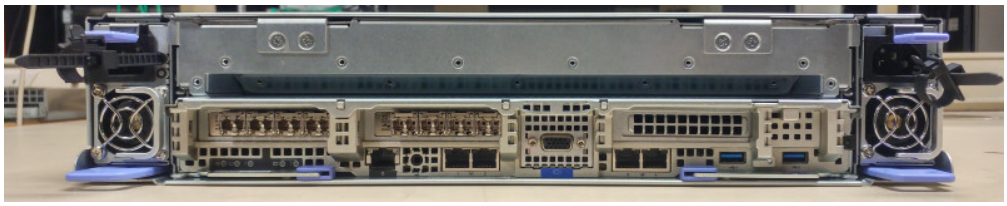


Figure 1. Rear view of the control enclosure

Table 1. IBM SAN Volume Controller SV2/SA2 Models

Machine Type - Model	Description	Minimum Software Level
2145-SV2	IBM SAN Volume Controller model SV2 with one-year warranty	8.3.1
2147-SV2	IBM SAN Volume Controller model SV2 with three-year warranty	8.3.1
2145-SA2	IBM SAN Volume Controller model SA2 with one-year warranty	8.3.1
2147-SA2	IBM SAN Volume Controller model SA2 with three-year warranty	8.3.1

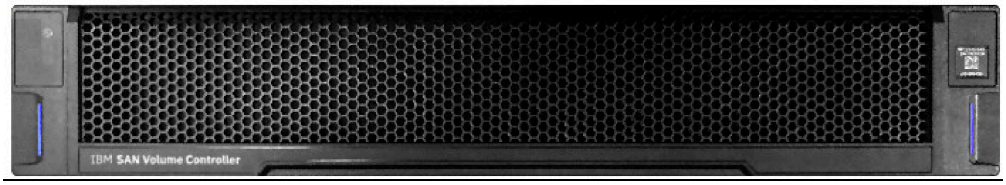


Figure 2. Front view of the control enclosure

IBM Storage Virtualize software

IBM SAN Volume Controller runs IBM Storage Virtualize which provides the following functions for the host systems that attach to the system:

- A single pool of storage
- Logical unit virtualization
- Management of logical volumes

The software also provides the following functions:

- Replication:
  - Simplify data management by automating configuration tasks.
  - Ensure seamless continuity while maintaining high throughput and low latency to applications.
- Data reduction:
  - Thin-provisioned logical volumes
  - Data reduction pool with deduplication and compression
- Ransomware threat detection
- Safeguarded snapshots
- Large scalable cache
- Easy to use management and automation that is consistent across the Storage Virtualize portfolio, including RestAPI, Ansible Playbooks, CSI integration, VMWare integration, and a modern Graphical User Interface (GUI).

For more information on IBM Storage Virtualize software, see the relevant IBM Documentation.

Control Enclosure

IBM SAN Volume Controller comprises a 2U Rack-Unit (2U) Control enclosure, which contains:

- One Node Canister
- Power Supplies.

Highly Available Architecture

IBM SAN Volume Controller implements an Active-Active architecture, with two independent nodes forming a redundant I/O Group. Because data volumes are served by both nodes, the volume remains available if one node fails or is taken offline.

Each node contains a removable Node canister which contains the systems CPUs, memory, backup batteries, and Network Attachment adapters.

Flexible Network Attachment

IBM SAN Volume Controller supports a range of Network Attachment adapter features.

The following adapter types are supported by the system:

Table 2. Adapter types

Adapter Type	Protocols supported	Minimum or maximum per node	Minimum software level
Quad-port 16 Gbps Fibre Channel	SCSI, FC-NVMe	0 - 3	8.3.1
Quad-port 32 Gbps Fibre Channel	SCSI, FC-NVMe	0 - 3	8.3.1
Dual-port 25 Gbps Ethernet (iWARP)	iSCSI, iWARP (Replication/High availability)	0 - 3	8.3.1

Table 2. Adapter types (continued)			
Adapter Type	**Protocols supported**	**Minimum or maximum per node**	**Minimum software level**
Dual-port 25 Gbps Ethernet (RoCE)	iSCSI, RoCE, NVMe/TCP	0 - 3	8.3.1

In addition, each canister has two on-board 1 Gbps Ethernet ports that are used for system management.

Power Supplies and Battery Backup

IBM SAN Volume Controller has redundant Power Supplies per node.

Each node contains a Battery that allows a canister to save its cache and metadata in an unscheduled power-down event.

For more details on different components of the SAN Volume Controller system, see the following pages:

Node canisters

A *node canister* provides host interfaces, management interfaces, and interfaces. Each IBM SAN Volume Controller enclosure contains a node canister.

A node canister has cache memory, internal drives to store software and logs, and the processing power to run the system's virtualizing and management software. A node canister also contains batteries that help to protect the system against data loss if a power outage occurs.

The nodes in a system combine to form a cluster, presenting as a single redundant system with a single point of control for system management and service. System management and error reporting are provided through an Ethernet interface to one of the nodes in the system, which is called the *configuration node*. The configuration node runs a web server and provides a command-line interface (CLI). The configuration node is a role that any node can take. If the current configuration node fails, a new configuration node is selected from the remaining nodes. Each node also provides a command-line interface and web interface to enable some hardware service actions.

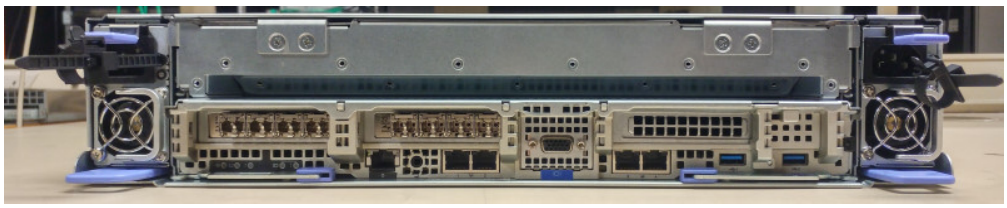


Figure 3. Rear view of the control enclosure

Information about the canister can be found in the management GUI.

Boot drive and TPM

Each node canister has an internal boot drive, which holds the system software and associated logs and diagnostics. The boot drive is also used to save the system state and cache data if there is an unexpected power-loss to the system or canister.

Each node canister also has a Trusted Platform Module, which is used as part of the chain of secrets for data at rest encryption as well as a source of entropy for keys.

Batteries

The node canister contains a battery, which provides power to the canister if there is an unexpected power loss. This allows the canister to safely save system state and cached data.

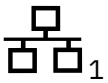
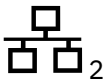
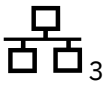
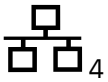
Node indicators

A node has several LED indicators, which convey information about the current state of the node.

Node canister ports

Each node canister has the following on-board ports:

Table 3. Node canister ports

Port Marking	Logical port name	Connection and Speed	Function
	Ethernet port 1	RJ45 copper, 10 Gbps	Primary Management IP Service IP Host I/O (iSCSI) Ethernet Replication (using TCP)
	Ethernet port 2	RJ45 copper, 10 Gbps	Secondary Management IP (optional) Host I/O (iSCSI) Ethernet Replication (using TCP)
	Ethernet port 3	RJ45 copper, 10 Gbps	Host I/O (iSCSI) Ethernet Replication (using TCP)
	Ethernet port 4	RJ45 copper, 10 Gbps	Host I/O (iSCSI) Ethernet Replication (using TCP)
	Technician port	RJ45 copper, 1 Gbps	DCHP port direct service management
	USB port 1	USB type A	Encryption key storage, Diagnostics collection May be disabled
	USB port 2	USB type A	Encryption key storage, Diagnostics collection May be disabled

Technician port

The technician port is a designated 1 Gbps Ethernet port on the back panel of the node canister that is used to initialize a system or configure the node canister. The technician port can also access the management GUI and CLI if the other access methods are not available.

Adapter cards

The canister contains three slots for network adapter cards. Each card fits into a cage assembly that contains an interposer to allow the card to be connected to the canister main board. In the system software, adapter card slots are numbered from 1 to 3, left to right.

Each node canister supports the following combinations of network adapters:

Table 4. Adapters and supported protocols

Valid cards per slot	**Supported protocols/uses**
Adapter Slot 1	
Empty	-
Quad-port 16 Gbps Fibre Channel	Host I/O that uses FC or FC-NVMe Replication Communication between systems
Quad-port 32 Gbps Fibre Channel	Host I/O that uses FC or FC-NVMe Replication Communication between systems
Dual-port 25 Gbps Ethernet (iWARP)	Host I/O that uses iSCSI Replication Communication between systems
Dual-port 25 Gbps Ethernet (RoCE)	Host I/O that uses iSCSI, NVMe/RDMA (RoCEv2), or NVMe/TCP
Adapter Slot 2	
Empty	-
Quad-port 16 Gbps Fibre Channel	Host I/O that uses FC or FC-NVMe Replication Communication between systems
Quad-port 32 Gbps Fibre Channel	Host I/O that uses FC or FC-NVMe Replication Communication between systems
Dual-port 25 Gbps Ethernet (iWARP)	Host I/O that uses iSCSI Replication Communication between systems
Dual-port 25 Gbps Ethernet (RoCE)	Host I/O that uses iSCSI, NVMe/RDMA (RoCEv2), or NVMe/TCP
Adapter Slot 3	
Empty	-

Table 4. Adapters and supported protocols (continued)	
Valid cards per slot	**Supported protocols/uses**
Quad-port 16 Gbps Fibre Channel	Host I/O that uses FC or FC-NVMe Replication Communication between systems
Quad-port 32 Gbps Fibre Channel	Host I/O that uses FC or FC-NVMe Replication Communication between systems
Dual-port 25 Gbps Ethernet (iWARP)	Host I/O that uses iSCSI Replication Communication between systems
Dual-port 25 Gbps Ethernet (RoCE)	Host I/O that uses iSCSI, NVMe/RDMA (RoCEv2), or NVMe/TCP

Port Numbering

For each adapter card, ports are numbered from left to right, and from adapter 1 to adapter 3. Fibre Channel ports are numbered from 1 as the leftmost port on the first adapter and continue sequentially across any additional adapters. Ethernet port numbering starts with the on-board ports (1 - 4) and then progresses incrementally across any installed adapter cards, starting with the leftmost slot and numbering across each adapter in turn.

Memory configurations

IBM SAN Volume Controller supports up to twenty-four 64 GB DIMMs per node, with three memory configurations supported.

Table 5. Memory configuration				
Configuration	**Feature code**	**DIMMs per node**	**Memory per node**	**Best practice recommendation**
Base	-	4	128 GB	Base config, ideal for < 12 drives and 1 network adapter with modest IOPS requirements
Upgrade 1	ACH1	12	384 GB	Recommended for best IOPs/ latency and >12 drives with >1 adapter and/or DRP/Deduplication workloads
Upgrade 2	ACH2	24	768 GB	Recommended for cache-heavy I/O Workloads and DRP/Deduplication workloads

For more details on the adapters, see the following pages:

Quad-port 32 Gbps Fibre Channel adapter

The quad-port 32 Gbps Fibre Channel adapter provides four Fibre Channel port connections capable of running at 32 Gbps.

The ports can also auto-negotiate to 16 Gbps or 8 Gbps for compatibility with slower networks.

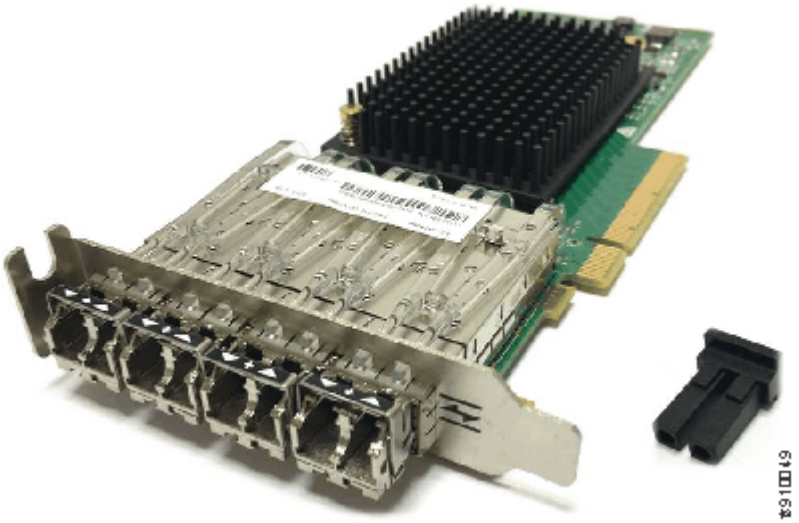


Figure 4. Quad-port 32 Gbps Fibre Channel adapter

32 Gbps Fibre Channel ports can be used for:

- Host connections by using standard Fibre Chanel (SCSI) or FC-NVMe
- Replication links
- Communications between control enclosures.

Connections can be made via a Fibre Channel switch, or as a direct connection to a host or other FlashSystem controller.

Fibre Channel ports are numbered from 1 to 4, starting from the left (horizontal placement) or top (vertical placement). Figure 2 shows ports and their indicators.

Each port has a Short-wave SFP transceiver that is installed as standard and can be connected with an LC-to-LC Fibre Channel cable. Long-wave SFP transceivers are available as an option for implementation of long-distance links.

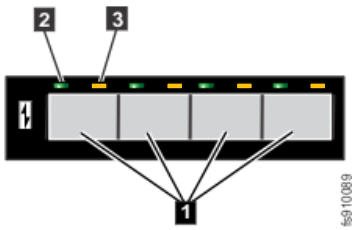


Figure 5. Fibre Channel ports and indicators

1 Fibre Channel port (4-port card)
2 Link-state LED (one for each port)
3 Speed-state LED (one for each port)

For more information, see “Fibre Channel port indicators” on page 101.

Dual-port 25 Gbps Ethernet (RoCE) host interface adapter

The dual-port 25 Gbps Ethernet (RoCE) adapter provides two Ethernet port connections capable of running at 25 Gbps.

The ports can also work at 10 Gbps when a 10 Gbps transceiver module is fitted. The ports can auto-negotiate to 10 Gbps only when non-optical transceiver modules are used.

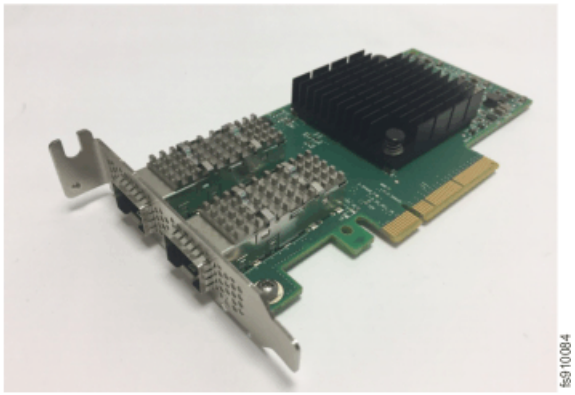


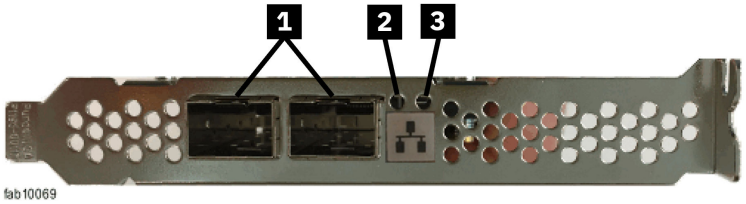
Figure 6. Dual-port 25 Gbps Ethernet (RoCE) host interface adapter

25 Gbps Ethernet ports can be used for:

- Host connections by using iSCSI, NVMe/TCP, or NVMe-RoCE
- IP Replication links

Connections can be made via a Ethernet switch, or as a direct connection to a host or other FlashSystem controller. Use of the NVMe-RoCE protocol requires RoCE-compatible Ethernet switches.

Ethernet ports are numbered from 1 to 4, starting from the left (horizontal placement) or top (vertical placement). Figure 2 shows ports and their indicators.



1 Ethernet port (2-port card)
2 Status LED (port 1)
3 Status LED (port 2)

Figure 7. Ethernet ports and indicators

Each port has an SFP+ receptacle, and a number of physical connection types supported:

Connection type	Supply method	Part number (examples for customer-supplied parts)
Optical Shortwave SFP28 Module - 25 Gb	IBM Orderable Feature	78P5153

Connection type	Supply method	Part number (examples for customer-supplied parts)
Optical Shortwave SFP+ Module – 10 Gb	IBM Orderable Feature	78P1661
Copper 10BASE-T RJ45 Module - 10 Gb	IBM Orderable Feature	45W2412
25 Gbps DAC passive copper cable	Customer supplied	Mellanox MCP2M00-A003
QSFP28 to SFP28 passive Twinax copper cable (100 Gbps to 25 Gb)	Customer supplied	Cisco QSFP-4SFP25G-CU3MMellanox - MCP7F00-A002R
10 Gbps DAC passive copper cable	Customer supplied	Cisco SFP-H10GB-CU3m
QSFP+ to SFP+ splitter cable (40 Gbps to 10 Gb)	Customer supplied	Mellanox MC2609125-005

For more information, see “Dual-port 25 Gbps Ethernet host interface adapter ports and indicators” on page 101.

Dual-port 25 Gbps Ethernet (iWARP) host interface adapter

The dual-port 25 Gb Ethernet (iWARP) adapter provides two Ethernet port connections capable of running at 25 Gbps.

The ports can also work at 10 Gbps when a 10 Gbps transceiver module is fitted. The ports can auto-negotiate to 10 Gbps only when non-optical transceiver modules are used.

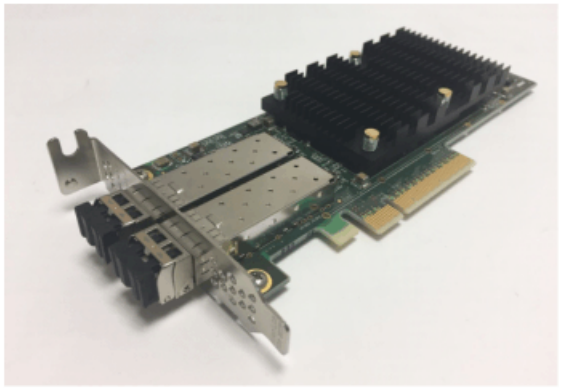


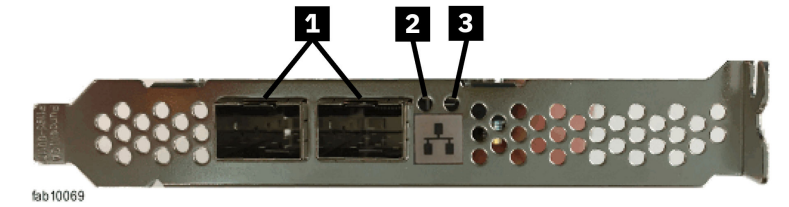
Figure 8. Dual-port 25 Gb Ethernet (iWARP) host interface adapter

25 Gb Ethernet ports can be used for:

- Host connections by using iSCSI
- IP Replication links
- Communications between control enclosures.

Connections can be made via a Ethernet switch, or as a direct connection to a host or other FlashSystem controller.

Ethernet ports are numbered from 1 to 2, starting from the left (horizontal placement) or top (vertical placement). Figure 2 shows ports and their indicators.



1 Ethernet port (2-port card)
2 Status LED (port 1)
3 Status LED (port 2)

Figure 9. Ethernet ports and indicators

Each port has an SFP+ receptacle, and a number of physical connection types supported:

Connection type	Supply method	Part number (examples for customer-supplied parts)
Optical Shortwave SFP28 Module - 25 Gb	IBM Orderable Feature	78P5153
Optical Shortwave SFP+ Module – 10 Gb	IBM Orderable Feature	78P1661
Copper 10BASE-T RJ45 Module - 10 Gb	IBM Orderable Feature	45W2412
25 Gb DAC passive copper cable	Customer supplied	Mellanox MCP2M00-A003
QSFP28 to SFP28 passive Twinax copper cable (100 Gb to 25 Gb)	Customer supplied	Cisco QSFP-4SFP25G-CU3MMellanox - MCP7F00-A002R
10 Gb DAC passive copper cable	Customer supplied	Cisco SFP-H10GB-CU3m
QSFP+ to SFP+ splitter cable (40 Gb to 10 Gb)	Customer supplied	Mellanox MC2609125-005

For more information, see “Dual-port 25 Gbps Ethernet host interface adapter ports and indicators” on page 101.

Quad-port 16 Gbps Fibre Channel adapter

The quad-port 16 Gbps Fibre Channel adapter provides four Fibre Channel port connections capable of running at 16 Gbps.

The ports can also auto-negotiate to 8 Gbps for compatibility with slower networks.

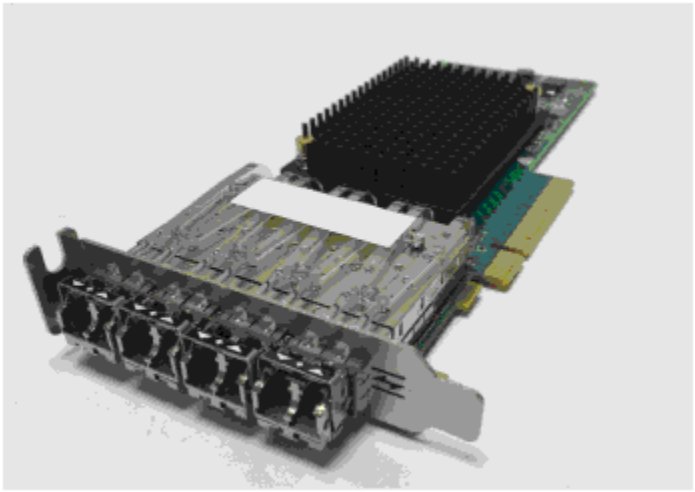


Figure 10. Quad-port 16 Gbps Fibre Channel adapter

16 Gbps Fibre Channel ports can be used for:

- Host connections by using standard Fibre Chanel (SCSI) or FC-NVMe
- Replication links
- Communications between control enclosures.

FC-NVMe is not supported on FlashSystem 5015, 5035 or 5045.

Connections can be made via a Fibre Channel switch, or as a direct connection to a host or other FlashSystem controller.

Fibre Channel ports are numbered from 1 to 4, starting from the left (horizontal placement) or top (vertical placement). Figure 2 shows ports and their indicators.

Each port has a Short-wave SFP transceiver that is installed as standard and can be connected with an LC-to-LC Fibre Channel cable. Long-wave SFP transceivers are available as an option for implementation of long-distance links.

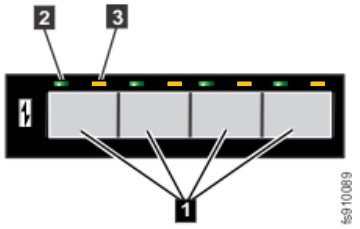


Figure 11. Fibre Channel ports and indicators

1 Fibre Channel port (4-port card)
2 Link-state LED (one for each port)
3 Speed-state LED (one for each port)

For more information, see “Fibre Channel port indicators” on page 101.

Batteries

Each node caches critical data and holds state information in volatile memory.

If power to a node fails, the node canister uses an internal battery to provide power to destage cache and state data to its boot drive, before performing an orderly shutdown.

The battery has enough charge capacity to handle two back-to-back power failures. This means that normally the node can restart I/O operations immediately after repowering without waiting to recharge the battery, or requiring any operator intervention. If several power events occur in close succession, such as battery does not have enough charge for node to save its internal state, the node remains in service until the batteries are charged sufficiently.

The battery subsystem supports a five-second ride-through capability to handle a brief AC power outage. During this time, the batteries power the node that continues to run normally servicing host I/O requests. If AC power is restored within the ride-through period, the node continues to run and does not shut down. If AC power does not return within the ride-through period, then the node stops servicing I/O and proceeds to save state data and shut down. When started, the shutdown operations run to completion even if the system power is restored during this time.

Note: Expansion canisters do not cache volume data or store state information in volatile memory. Therefore, expansion canisters do not require battery power. If AC power to both power supplies in an expansion enclosure fails, the enclosure powers off. When AC power is restored to at least one power supply, the enclosure restarts without operator intervention.

Important: Although the system is resilient to power failures and brown outs, always install the enclosures in an environment that has reliable, consistent, and required AC power. Consider uninterruptible power supply units to avoid extended interruptions to data access.

Battery management

As a battery ages, it loses capacity. The battery in the node canister lasts at least five years before it cannot hold enough charge to support a successful node shutdown.

The batteries automatically perform conditioning cycles to ensure accurate determination of their state of health. A reconditioning cycle is automatically scheduled to occur approximately once every three months, but reconditioning is rescheduled or canceled if the system loses redundancy.

When the battery capacity starts to degrade, the system posts an “EOL Warning” event. At this point, the battery subsystem still has enough capacity to be able to support an unscheduled system power-down. If a battery reports an "EOL Warning" event, replace it within approximately six months post the event.

When a battery no longer has capacity to protect against a power loss event, it reports the “EOL Fatal” event. If a battery reports an "EOL Fatal" event, the node goes offline and the battery needs replacing to allow the node to exit from Service state and come online.

If a node canister’s battery fails, that canister goes offline and reports a node error. The remaining node in the I/O group destages its cache and runs the I/O group in “write-through” mode until its partner node is repaired and online.

The battery is contained within the node canister, which must be removed from the system to replace the battery.

The node canister has a battery status LED, which is described in Node canister indicators.

To access information about the battery in the management GUI, select **Monitoring** > **System**. On the **System - Overview** page, click the directional arrow next to the enclosure that contains the battery module. Select **Battery Module** under **Internal Components** to display information about the battery module. To display information about the battery in the command-line interface, use the **`lsnodebattery`** command.

Power supply units

Power supply units (PSUs) are subcomponents of enclosures. A PSU takes electrical power from the rack Power Distribution Units (PDUs) and provides the power to the components in the enclosure.

For redundancy, the IBM SAN Volume Controller enclosure has two 2000 W PSUs that provide power to the system. If either PSU fails, the system can still run without any interruptions. The PSUs must be connected to a 240 VAC (high-line) AC supplies.

Power supplies in the IBM SAN Volume Controller enclosure are 80Plus certified as “Titanium” efficiency.

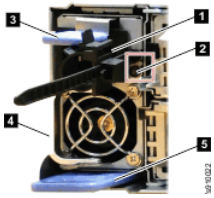
For optimum power redundancy, connect each power supply to a different power source.

The information about the health of the PSUs can be found in the management GUI.

Figure 12 on page 33 shows the rear view of a control enclosure and identifies the location of the power supply units and its indicators. The power supply has no power switch. A power supply is active when a power cord is connected to the power connector and to a power source.

Figure 12. Locate Power Supply Units

When viewed from the rear, PSU 1 is on the left side of the control enclosure and PSU 2 is on the right side.



1. Cable retention clip
2. LED indicator
3. Power supply release tab
4. Power supply handle
5. Power interposer release tab

Figure 13. Power supply details

The power supply indicators provide a summary of the status of the power supply.

Software feature limits

IBM SAN Volume Controller runs the IBM Storage Virtualize software stack to provide its rich storage functionality. There are no software feature limits on this product.

Chapter 4. Planning for hardware

This information is intended to help prepare the physical site for the installation of a SAN Volume Controller .

About this task

Certain physical site specifications must be met before the system can be set up. This activity includes verifying that adequate space is available, and that requirements for power and environmental conditions are met.

Procedure

1. Review all the guidelines in the planning topics to understand where the system can be installed and identify all prerequisites, such as building structure, equipment rack, environmental controls, power supply, and accessibility.
2. Complete the “Planning worksheets” on page 43 to record the information for the initial system creation.

What to do next

For more details on the planning for hardware, see the following pages:

SAN Volume Controller node environment requirements

Before the node is installed, the physical environment must meet certain requirements. These requirements include verifying that adequate space is available and power and environmental conditions are met.

Input-voltage requirements

Ensure that your environment meets the voltage requirements that are shown in Table 6 on page 35.

Table 6. Input-voltage requirements

Voltage	Frequency
200-240 V AC	50 Hz or 60 Hz

Power requirements for each node

Ensure that your environment meets the typical power requirement as shown in Table 7 on page 35.

Table 7. Power consumption

Component	Power requirements
SAN Volume Controller 2145-SV2	530 W in typical configuration (384 GB of memory and three 4 port 32 Gbps FC adapters) (200 - 240V AC, 50/60 Hz)
SAN Volume Controller 2145-SA2	326 W in typical configuration (384 GB of memory and three 4 port 32 Gbps FC adapters) (200 - 240V AC, 50/60 Hz)

Environment requirements without redundant AC power

Ensure that your environment falls within the following ranges if you are not using redundant AC power.

If you are not using redundant ac power, ensure that your environment falls within the ranges that are shown in Table 8 on page 36.

Table 8. Physical specifications

Environment	Temperature	Altitude	Relative humidity	Maximum dew point
Operating in lower altitudes	5°C to 40°C (41°F to 104°F)	0 - 950 m (0 ft to 3,117 ft)	8% to 85%	24°C (75°F)
Operating in higher altitudes	5°C to 28°C (41°F to 82°F)	951 m to 3,050 m (3,118 ft to 10,000 ft)		
Turned off (with standby power)	5°C to 45°C (41°F to 113°F)	0 m to 3,050 m (0 ft to 10,000 ft)	8% to 85%	27°C (80.6°F)
Storing	1°C to 60°C (33.8°F to 140.0°F)	0 m to 3,050 m (0 ft to 10,000 ft)	5% to 80%	29°C (84.2°F)
Shipping	-40°C to 60°C (-40°F to 140.0°F)	0 m to 10,700 m (0 ft to 34,991 ft)	5% to 100%	29°C (84.2°F)

Note: Decrease the maximum system temperature by 1°C for every 175 m increase in altitude. For above 950 m, decrease in maximum air temperature by 1°C for every 300 m.

Preparing your environment

The following tables list the physical characteristics of a SAN Volume Controller node.

Dimensions and weight

Use the parameters that are shown in Table 9 on page 36 to ensure that space is available in a rack capable of supporting the node.

Table 9. Dimensions and weight

Height	Width	Depth	Maximum weight
87 mm (3.4 in.)	447 mm (17.6 in)	746 mm (30.1 in)	25 kg (55 lb) to 30 kg (65 lb) depending on configuration

Additional space requirements

Ensure that space is available in the rack for the additional space requirements around the node, as shown in Table 10 on page 36.

Table 10. Additional space requirements

Location	Additional space requirements	Reason
Left side and right side	Minimum: 50 mm (2 in.)	Cooling air flow
Back	Minimum: 100 mm (4 in.) If the cable-management arm is used, allow 177 mm (7 in.)	Cable exit

Maximum heat output of each SAN Volume Controller node

The node dissipates the maximum heat output that is given in Table 11 on page 37.

Table 11. Maximum heat output

Model	Heat output per node
SAN Volume Controller 2145-SV2	Typical configuration: 1808 BTU per hour (530 watts)
SAN Volume Controller 2145-SA2	Typical configuration: 1112 BTU per hour (326 watts)

Acoustical declaration with noise hazard notice

CAUTION:

High levels of acoustical noise are (or could be under certain circumstances) present.

Use approved hearing protection and/or provide mitigation or limit. (L018)

Table 12. Declared noise emission values in accordance with ISO 9296 (1-6)

Product description	Declared A-weighted sound power level, $L_{WA,m}$ (B)		Declared A-weighted emission sound pressure level, $L_{pA,m}$ (dB)		Statistical adder for verification, K_v (B)	
	Operating	Idling	Operating	Idling	Operating	Idling
Principal configuration: Single 2U enclosure in a rack; MTM 2145-SV2 and 2147-SV2 MTM 2145-SA2 and 2147-SA2; 25 degrees C	7.8	7.8	-	-	0.3	0.3
Maximum configuration: Single 2U enclosure in a rack; MTM 2145-SV2 and 2147-SV2 MTM 2145-SA2 and 2147-SA2; 27 degrees C	8.1	8.1	-	-	0.3	0.3

Table 12. Declared noise emission values in accordance with ISO 9296 [(1-6)] (continued)

Product description	Declared A-weighted sound power level, $L_{WA,m}$ (B)		Declared A-weighted emission sound pressure level, $L_{pA,m}$ (dB)		Statistical adder for verification, K_v (B)	
	Operating	Idling	Operating	Idling	Operating	Idling
Maximum configuration: Single 2U enclosure in a rack; MTM 2145-SV2 and 2147-SV2 MTM 2145-SA2 and 2147-SA2; Maximum fan speeds	9.0	9.0	-	-	0.3	0.3
Maximum configuration: Single 2U enclosure in a rack; MTM 2145-SV2 and 2147-SV2 MTM 2145-SA2 and 2147-SA2; Maximum fan speeds, Service Position	-	-	87 [(7)]	87 [(7)]	0.3	0.3

Notes:

1. Declared level $L_{WA,m}$ is the upper-limit A-weighted sound power level. Declared level $L_{pA,m}$ is the mean A-weighted sound pressure level measured at the 1-meter bystander positions.
2. The statistical adder for verification, K_v, is a quantity to be added to the declared mean A-weighted sound power level, $L_{WA,m}$ such that there will be a 95% probability of acceptance, when using the verification procedures of ISO 9296, if no more than 6.5% of the batch of new equipment has A-weighted sound power levels greater than ($L_{WA,m}$ + K_v).
3. The quantity $L_{WA,c}$ (formerly called L_{WAd}), can be computed from the sum of $L_{WA,m}$ and K_v.
4. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.
5. B, dB, abbreviations for bels and decibels, respectively. 1 B = 10 dB.
6. **Notice:** Government regulations (such as those prescribed by OSHA or European Community Directives) may govern noise level exposure in the workplace and may apply to you and your server installation. The actual sound pressure levels in your installation depend upon a variety of factors, including the number of racks in the installation; the size, materials, and configuration of the room where you designate the racks to be installed; the noise levels from other equipment; the room ambient temperature, and employees' location in relation to the equipment. Further, compliance with such government regulations also depends upon a variety of additional factors, including the duration of employees' exposure and whether employees wear hearing protection. IBM recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.
7. Sound Pressure Level given is greater value of front and rear measurements.

Enclosure location guidelines

Use these guidelines to plan the location of a control enclosure and any expansion enclosures that attach to it.

Each control enclosure contains two node canisters, forming an I/O group. The guidelines apply on an I/O group by I/O group basis.

Note: A mounting rail kit is provided with each control enclosure and expansion enclosure. Each rail can expand to accommodate a range of rack depths, which are measured between the front and rear mounting posts of the rack. However, because there are differences between some types of mounting rails, be sure to use the specific rail kit that is supplied with each control or expansion enclosure.

Plan for one of the following types of installation.

- Control enclosure only
- Control enclosure and one or more expansion enclosures
  - Position the control enclosure in the center of the rack to have shorter cabling runs. Balance the number of expansion enclosures above and below the control enclosure.
  - Position the enclosures together. Avoid adding other equipment between enclosures.
  - Position the enclosures in the rack so that you can easily view them and access them for servicing. This action also allows the rack to remain stable and allows two or more people to install and remove the enclosures.

Planning management connections

The cable-connection tables provide an easy to read method of recording the locations of current and planned cable connections for each control enclosure in the system.

Management Ethernet connections

Each node canister in a control enclosure connects over an Ethernet cable from Ethernet port 1 of the canister to an enabled port on your Ethernet switch or router. Ethernet port 1 is for accessing the management GUI, the service assistant GUI for the node canister, and iSCSI host attachment.

Note:

- For 100 Gbps Ethernet connectivity, you may use third-party 100GBASE-BIDI QSFP optical transceiver that meets the minimum standards specifications. However, during troubleshooting, IBM support may ask customers to install IBM approved transceivers if the third-party transceivers are determined to cause the issue.

IP address allocation and usage

As you plan your installation, you must consider IP address requirements and service access for the system.

Use Table 13 on page 39 to consider the TCP/IP address requirements of the system and the requirements to access other services. You must also plan for the IP address allocation, and for the configuration of the Ethernet router, gateway and firewall.

Table 13. Summary of TCP/IP ports and services

Service	Traffic direction	Protocol	Port	Service type
Email (SMTP) notification and inventory reports	Outbound	TCP	25	Optional
SNMP event notification	Outbound	UDP	162	Optional

Table 13. Summary of TCP/IP ports and services (continued)

Service	Traffic direction	Protocol	Port	Service type
Syslog event notification	Outbound	TCP UDP	6514 (TCP) 514 (UDP)	Optional
IPv4 DHCP (Node service address)	Outbound	UDP	68	Optional
IPv6 DHCP (Node service address)	Outbound	UDP	547	Optional
Network time server (NTP)	Outbound	UDP	123	Optional
SSH for command line interface (CLI) access	Inbound	TCP	22	Mandatory
Remote support assistance	Outbound	TCP	22	Optional
HTTPS for GUI access	Inbound	TCP	443	Mandatory
Uploading support packages to IBM	Outbound	TCP	443	Optional
Remote support assistance for HTTPS GUI access	Outbound	TCP	443	Optional
Remote user authentication service - HTTP	Outbound	TCP	16310	Optional
Remote user authentication service - HTTPS	Outbound	TCP	16311	Optional
Remote user authentication service - Lightweight Directory Access Protocol (LDAP)	Outbound	TCP	389	Optional
iSCSI	Inbound	TCP	3260	Optional
iSCSI iSNS	Outbound	TCP	3260	Optional
IP-based RDMA replication/high availability	Inbound and Outbound	TCP	4791, 21451, 21452, and 21455	Optional
IP-based RDMA replication/high availability	Inbound and Outbound	UDP	4791, 21451, 21452, and 21455	Optional
IP Partnership management IP communication	Inbound and Outbound	TCP	3260	Optional
IP Partnership data path connections[1]	Inbound and Outbound	TCP	3265	Optional
REST API access and replication management	Inbound	TCP	7443	Optional
NVMe over RDMA	Inbound and Outbound	UDP over RoCEv2	4420	Optional
NVMe over TCP	Inbound and Outbound	TCP	4420	Optional
IP quorum application	Inbound and Outbound	TCP	1260	Optional

[1]Ports must be open for IP addresses that are configured for replication and not the system IP address.

For configuration and management, you must allocate an IP address to the system; this IP address is referred to as the *management IP address*. For extra fault tolerance, you can also configure a second IP address for the second Ethernet port on the node. The addresses must be fixed addresses. If IPv4 and IPv6 are operating concurrently, you must provide an address for each protocol.

Attention: The address for a management IP cannot be the same address that is used for the service IP. Using the same IP address causes communication problems.

Name servers are not used to locate other devices. You must supply the numeric IP address of the device. To locate a device, the device must have a fixed IP address.

Planning for I/O connections

Plan to install the appropriate adapters for your FlashSystem control enclosure so that it is compatible with your networking topology and provides the appropriate connection capability.

The control enclosure contains two node canisters. Each node canister has three PCIe interface slots for adapters. Additionally, each node canister has four Onboard Ethernet ports for management, host I/O, and replication.

Important: Both nodes in an I/O group must be configured with the same adapters.

Table 14 on page 41 provides examples of the connection types and the alternative connection methods if alternative connection methods are available.

Table 14. Communications types

Functionality	Network speeds supported	On-board or Adapter	Host I/O	System to system	Storage virtualization
Fibre Channel SAN (SCSI)	32 Gb, 16 Gb	Adapter: 4-port	yes	yes	yes
Fibre Channel SAN (FC-NVMe)	32 Gb, 16 Gb	Adapter: 4-port	yes	no	no
Ethernet (iSCSI)	25 Gb	Adapter: 2-port	yes	yes	yes
	10 Gb	On-board: 4-port	yes	yes	no
Ethernet (NVMe/TCP and NVMe/RDMA)	25 Gb	Adapter: 2-port	yes	yes	no

Note: 2 port adapter with port speed 25 Gb or 10 Gb depends on transceiver installation. For more information on the adapter, see “Cable reference” on page 41.

Cable reference

The cable standard tables specify cable types and standards for customer-supplied cables for use with the system.

Table 15 on page 42 provides a list of Ethernet cable standards. Ethernet cables are not supplied as part of your order. Ensure the cables that are used meet the minimum standards for the Ethernet port type.

Table 15. Ethernet cable standards

Ethernet adapter type	Ethernet port type	Connector	Cable type	Minimum standard	Remark
On-board Ethernet ports	1 Gbps Ethernet port	RJ45	Unshielded twisted pair (UTP)	Cat 5e or Cat 6 (up to 100 meters)	
On-board Ethernet ports	10 Gbps Ethernet port	RJ45	Unshielded twisted pair (UTP)	Cat 6a or Cat 7 (up to 100 meters)	
2 Port 25 Gbps RoCE Adapter Card or 2 Port 25 Gbps iWARP Adapter Card	25 Gbps Ethernet port	LC-SFP28 Transceiver (IBM feature)	Optical fibre	• OM3 (up to 70 m) • OM4 (up to 100 m)	
2 Port 25 Gbps RoCE Adapter Card or 2 Port 25 Gbps iWARP Adapter Card	25 Gbps Ethernet port	QSFP28 to SFP28	Passive Twinax DAC Cable (up to 2 m)	• SFF-8432 transceiver specification • IEC60825-1 product safety specification • Operational temperature should be 0 deg C - 70 deg C. However, in some cases the temperature can reach to 85 deg C.	
2 Port 25 Gbps RoCE Adapter Card or 2 Port 25 Gbps iWARP Adapter Card	10 Gbps Ethernet port	RJ45 SFP+ connector (IBM feature)	Unshielded twisted pair (UTP)	• Cat 6a or Cat 7 (up to 100 meters	The 25 Gbps Adapter card runs as a 10 Gbps port when using the RJ45 SFP+ connector.
2 Port 25 Gbps RoCE Adapter Card or 2 Port 25 Gbps iWARP Adapter Card	10 Gbps Ethernet port	LC - SFP+ Transceiver (IBM feature)	Optical fiber	• OM2 (up to 60 meters) or OM3 (60 - 150 meters)	The 25 Gbps Adapter card runs as a 10 Gbps port when using the LC - SFP+ Transceiver connector.

Table 15. Ethernet cable standards (continued)					
Ethernet adapter type	**Ethernet port type**	**Connector**	**Cable type**	**Minimum standard**	**Remark**
2 Port 25 Gbps RoCE Adapter Card or 2 Port 25 Gbps iWARP Adapter Card	25 Gbps Ethernet port	DAC (Direct Attached Copper)	DAC: Twin-ax copper cable (up to 2 m)	• SFF-8432 transceiver specification • IEC60825-1 product safety specification • Operational temperature should be 0 deg C - 70 deg C. However, in some cases the temperature can reach 85 deg C.	The 25 Gbps adapter ports can work with 10 Gbps and 25 Gbps DAC cables.

Planning worksheets

Planning worksheets can help identify important information that is needed when the system is installed and configured. Complete the relevant sections to help with installation planning.

The planning worksheet is available for download in the following languages:

SAN Volume Controller SV2

- English
- Brazilian Portuguese
- French
- Italian
- German
- Spanish
- Simplified Chinese
- Japanese
- Korean

SAN Volume Controller SA2

- English
- Brazilian Portuguese
- French
- Italian
- German
- Spanish
- Simplified Chinese
- Japanese
- Korean

Chapter 5. Installing

This information covers the system hardware installation and initial setup.

After you verify that the power and environmental requirements of the system are met, and planning the location of the enclosure, you are ready to begin installing the hardware components. The installation activity follows the plan that is used in the planning section.

For more details on the installation, see the following pages:

Unpacking the node

Before you unpack the node, ensure that you review and follow all related instructions.

Before you begin

The node and related parts are shipped in a single box, containing the following:

- Node with the following components preinstalled:
  - Node canister with adapters, SFPs, and memory feature codes preinstalled
  - Two power supplies and two power interposers
  - Bezel
- Rail kit including left and right rails, securing screws, and locating pins
- Two power cables
- Optional OM3 fiber cables
- Fibre Channel cables

Note: You will need a box knife to unpack the node.

About this task

CAUTION: Lifting the enclosure requires two persons or a suitable mechanical lift. If there are less than two persons or a lifting equipment is not available, reduce the weight of the enclosure temporarily by removing the two PSUs and the node canister.

Procedure

1. Cut the box tape and open the lid of the shipping carton.
2. Remove the rail kit box and set it aside in a safe location.
3. Lift the front and rear foam packing pieces from the carton.
4. Remove the four corner reinforcement pieces from the carton.
5. Using the box knife, carefully cut the four corners of the carton from top to bottom.
6. Fold the sides and back of the carton down to uncover the rear of the node.
   If necessary, carefully cut along the lower fold line of the sides and remove them.
7. Carefully cut the raised section of the foam packing away from the rear of the enclosure.
8. Lift the enclosure from the shipping carton.
9. Carefully cut open the bag covering the rear of the enclosure.
10. If you do not have two persons or mechanical lift available, then remove the power supply units (PSU) from the enclosure
11. Record the last six digits of the serial number on the back of the each power supply, and then set the power supply aside.

12. Remove the node canister from the enclosure only if you do not have two persons or mechanical lift available.
13. Record the serial number on the canister release handle, and then set the canister aside.

Installing support rails for the node

Before you install the node, you must first install the support rails for it.

Procedure

To install the support rails for the node, complete the following steps.

1. Locate the node rails.

   The rail assembly consists of two rails that must be installed in the rack cabinet.

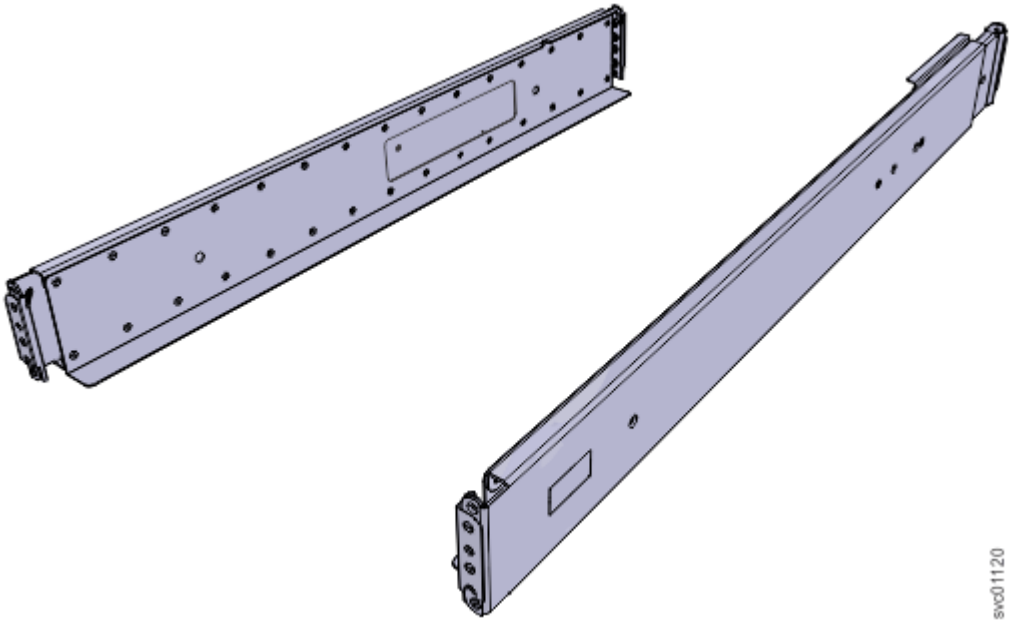


Figure 14. Node support rails

2. Working at the front of the rack cabinet, identify the two standard rack units (2U) of space in the rack into which you want to install the support rails.

   The following figure shows two rack units with the front mounting holes identified.

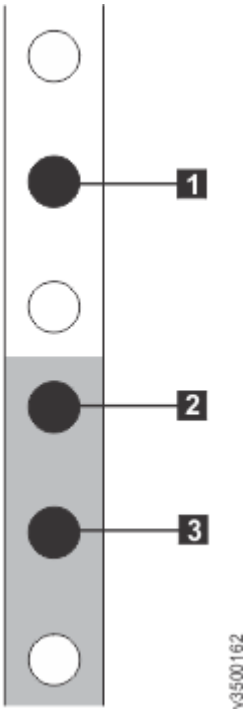


Figure 15. Hole locations in the front of the rack

- 1 Upper rail-mounting bracket pin
- 2 Lower rail-mounting bracket pin
- 3 Rack mounting screw hole

3. Ensure that the appropriate bracket pins are installed in the front and rear bracket of each rail.

   Each rail comes with four medium pins preinstalled (two in the front bracket and two in the rear bracket). Large pins are provided separately. Use the pins that are appropriate for the mounting holes in your rack (see the following table).

Table 16. Selecting bracket pins for your rack

Mounting holes	**Bracket pins**
Round, unthreaded	Use the preinstalled medium pins.
Square	Unscrew the medium pins and replace with the large pins that are supplied with the rails.

4. At each end of the rail, grasp the tab 1 and pull *firmly* to open the hinge bracket.

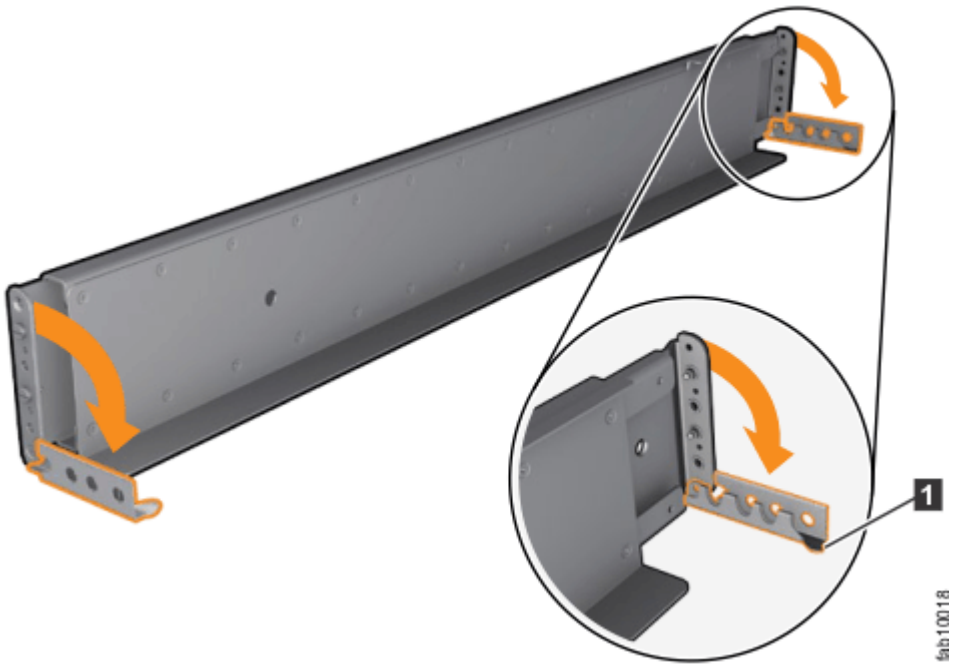


Figure 16. Opening the hinge brackets

5. Align the holes in the rail bracket with the holes on the front and rear rack cabinet flanges. Ensure that the rails are aligned on the inside of the rack cabinet.
6. On the rear of the rail, press the two bracket pins into the holes in the rack flanges.
7. Close the rear hinge bracket to secure the rail to the rack cabinet flange.

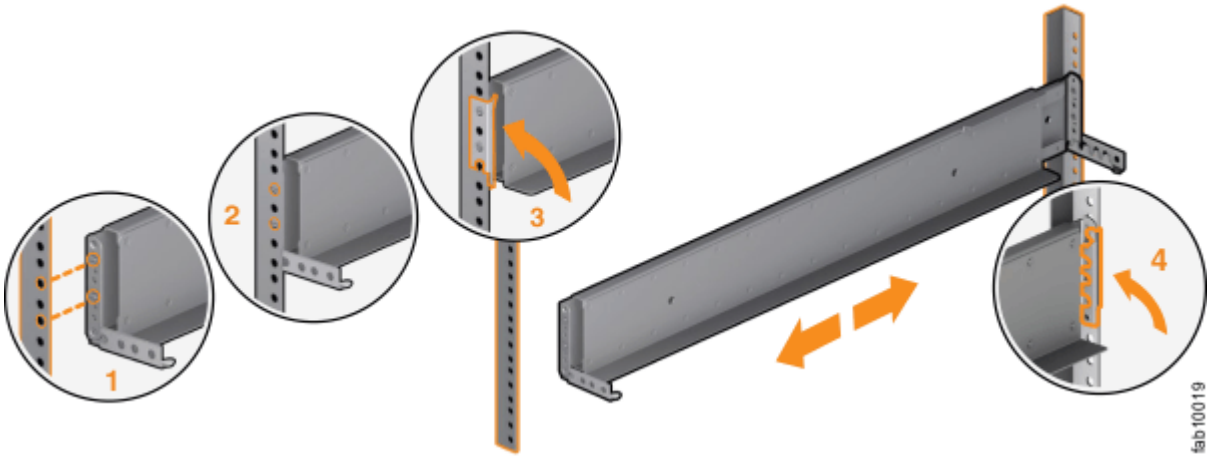


Figure 17. Closing the hinge brackets

8. On the front of the rail, press the two bracket pins into the holes in the rack flanges.
9. Close the front hinge bracket to secure the rail to the rack cabinet flange.
10. Secure the rear of the rail to the rear rack flange with two black M5 screws.
11. Repeat the steps to secure the opposite rail to the rack cabinet.

Installing the node

Following your node location plan, install the node.

About this task

CAUTION:

- To lift a node requires at least two people.
- Install a node only onto the rails supplied with the node.
- Load the rack from the bottom up to ensure rack stability. Empty the rack from the top down.

Procedure

To install an node, complete the following steps.

1. To remove the fascia from the node, grasp the fascia by the left and right blue touch points.
2. Pull the fascia straight out from the node, so that the left and the right ends of the fascia release at the same time.
3. Align the node with the front of the rack cabinet.
4. Slide the node into the rack along the rails until the node is fully inserted, as shown in the following figure.

   Note: The rails are not designed to hold an node that is partially inserted. The node must always be in a fully inserted position.

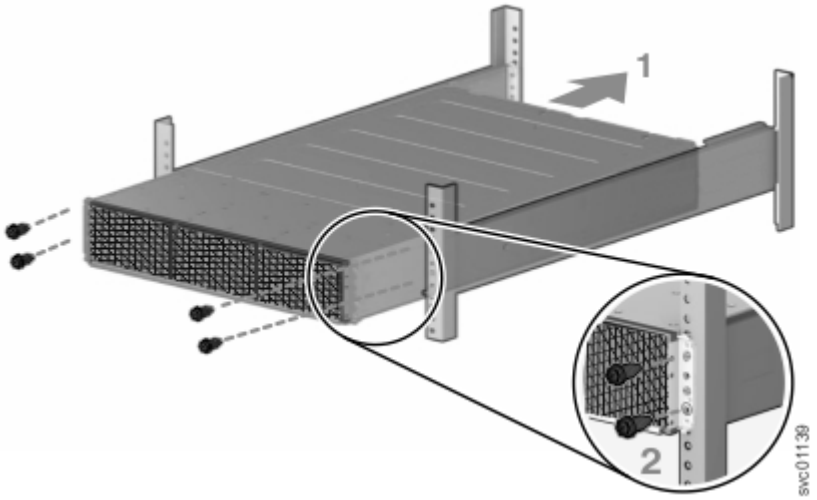


Figure 18. Inserting the node

5. Secure the node with four M5 screws in the holes in the rack mounting flanges on either side of the enclosure.

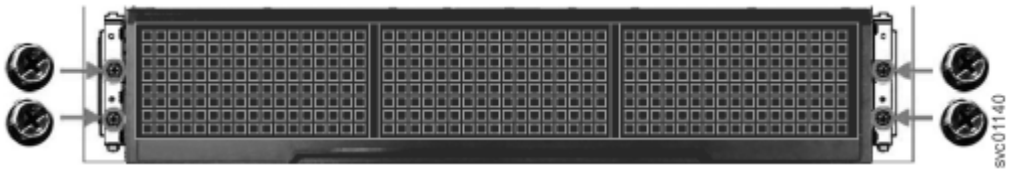


Figure 19. Securing the front of the node

6. To replace the fascia, complete the following steps:
   a) Hold the fascia by the blue touch points on each end and align the fascia with the front of the node so the clips on the rear of the fascia align with the four mounting posts on the node flanges.
   b) Press the ends of the fascia so that the clips engage with the mounting posts and the back of the fascia is flush against the front panel of the node.

What to do next

If you removed components from the node to lift it, reinstall the components into their original locations in the node.

Connecting Ethernet cables to the node

To provide system management connectivity for your system, you must connect an Ethernet cables to Ethernet port 1 of the node canister in the node.

Procedure

To install the Ethernet cable, complete the following steps.

1. Connect Ethernet port 1 of the node to the IP network that provides connection to the system management interfaces, as shown in the following figure.

   This port can also be used for iSCSI connectivity to the system by hosts on the network. Where more than one node is present in the system, ensure port 1 of every node is connected to the same network to provide access if the configuration node fails.

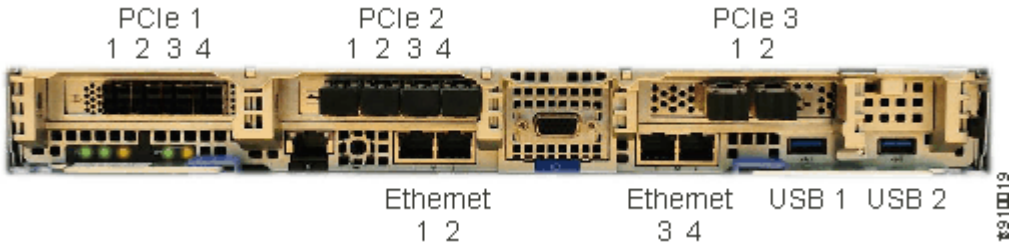


   Figure 20. Ethernet ports on the node

2. Optionally, connect Ethernet port 2 of the node to a second IP network that provides redundant connection to the system management interfaces.

   If there is more than one node in the system, ensure that port 2 of every node is connected to the same network to provide access if the configuration node fails.

Connecting Fibre Channel cables to a Fibre Channel adapter in the node

Your system may have one or more 4-port Fibre Channel adapters installed. You must use Fibre Channel cables to connect the node to the switches in the Fibre Channel SAN.

Before you begin

Obtain the “Planning worksheets” on page 43 completed by the customer to determine the number of required cables and their intended port locations.

Procedure

To install the cables, complete the following steps.

1. Review the “Planning worksheets” on page 43.
2. Connect the required number of Fibre Channel cables to the node, and the switches in the Fibre Channel SAN.

   The following figure shows the location and port numbers of the Fibre Channel adapter in adapter slot 1 of the node. (The system might also have an optional Fibre Channel adapter installed in slot 2 and slot 3 of the node.)

   Figure 21. Fibre Channel adapter in adapter slot 1

Powering on the system

After you install all hardware components, you must power on the system and check its status.

About this task

Note: Each power supply unit includes a cable retainer to secure the power cable.

Use the cable retainers to secure the power cables from being accidentally pulled out of the node. The cable retainer, which is on the back of each PSU, has a curved opening that faces the rear of the PSU. After you plug the power cables in to the PSU, slip the power cable behind the retainer. Then, pull the cable back into the retainer opening to secure the cable.

Each cable must be routed through the retainer, as shown in the following figure. For PSU 1, hook the power cable underneath the cable retainer so the cable can extend to the left. For PSU 2, make a loop to secure the cable under the retainer and extend the power cable to the right side of the node.

To remove the power cable, push the cable forward to unhook it from the cable retainer. Then, unplug the cable from the PSU.

Procedure

To power on the system, complete the following steps.

1. Power on the node. Use the supplied power cords to connect both power supply units of the node to their power sources.

   If the power sources have circuit breakers or switches, ensure that they are turned on. The enclosure does not have power switches.

   Notes:

   - Each node has two power supply units. To provide power failure redundancy, connect the two power cords to separate power circuits.
   - Ensure that each power cable is secured to each PSU on the back of the node.

2. From the rear of the node, check the LEDs on the node canister.

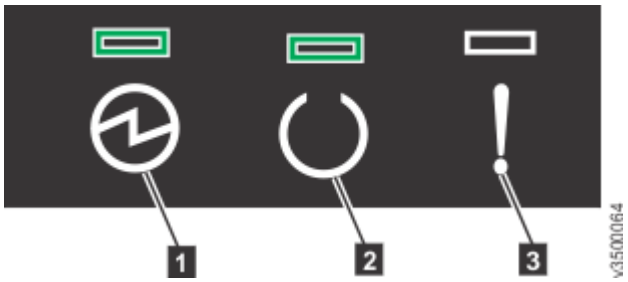


Figure 22. Node canister LEDs

1 Power
2 Status
3 Fault

The canister is ready for initialization with no critical errors when **Power** is illuminated, **Status** is flashing, and **Fault** is off.

What to do next

Next, you will connect an Ethernet cable to the technician port on the node, and initialize the system.

Installing optional features

Optional hardware features can be installed in an enclosure. For example, drives, network adapters, and more memory modules.

The optional features that an enclosure supports are shown in the sales manual within the IBM Documentation. To find the relevant IBM Sales Manual, search “in all of IBM Sales manuals” for the machine type or the product name of the enclosure.

If an optional feature was ordered with the enclosure order, it is fitted at IBM manufacturing.

Drives can be added to a control enclosure or an expansion enclosure without powering off the enclosure. The IBM Storage Virtualize software discovers the drives. Use the management GUI to add the drives to an existing array or use them to make a new array.

Pluggable network port modules (for example SFP) can be added or changed without powering off the node canister.

A node canister must be logically removed from the system (by using the **rmnode** command) and power off before adding memory modules to it. When putting the node canister back in to the enclosure, it is automatically added back into the system if there are no unrecoverable node errors. Ensure that hosts can access volumes via this node canister before logically removing the other node canister from the system (by using the **rmnode** command) and power it off to add memory modules to it.

A node canister must be logically removed from the system (by using the **rmnode** command) and powered off before adding or changing any network adapter to it.

When a node canister comes online with new adapters in it, the addresses of the ports might move. Some reconfiguration might be needed to restore all communication links before proceeding to update the next node canister. If portmasks or portsets are being used, they might need to be changed.

Always check that hosts, other Storage Virtualize nodes, and any back-end storage controllers can access the partner node canister before powering off a node canister.

Note: Wait for the power LED to start flashing (standby mode) before removing the node canister from the enclosure.

Use the management GUI to check that access to volumes is not lost if a node is offline. Host administrators can check that there are still paths to volumes if a node is offline.

If there are partnerships with other IBM Storage Virtualize systems, use the management GUI to check that communication with the partner system is not lost when a node is offline.

Use the management GUI to power off or remove a node canister from the system. However, if the node is logically removed from the system, use the service assistant tool or CLI to power it off.

Use the management GUI to make any port configuration changes that might be needed to a node with new or different network adapters.

See the page appropriate to the product for the specific information about how and where to fit adapters in the node canister type.

Related concepts

“Removing and replacing control enclosure parts” on page 56
Parts can be removed and replaced in the control enclosures to perform service procedures or during the initial installation process.

Related information

Troubleshooting

Adding a node to a system

You can add a node to the system by using the CLI or management GUI. A node can be added to the system if the node previously failed and is being replaced with a new node or if a repair action causes the node to be unrecognizable by the system. When you add nodes, ensure that they are added in pairs to

create a full I/O group. Adding a node to the system typically increases the capacity of the entire system. Adding spare nodes to a system does not increase the capacity of the system.

You can use either the management GUI or the command-line interface to add a node to the system. Some models might require you to use the front panel to verify that the new node was added correctly.

Before you add a node to a system, you must make sure that the switch zoning is configured such that the node that is being added is in the same zone as all other nodes in the system. If you are replacing a node and the switch is zoned by worldwide port name (WWPN) rather than by switch port, make sure that the switch is configured such that the node that is being added is in the same VSAN or zone.

Note: Use a consistent method (either only the management GUI, or only the CLI) when you add, remove, and re-add nodes. If a node is added by using the CLI and later re-added by using the GUI, it might get a different node name than it originally had.

You can use either the **addnode** command or the **Add Node** wizard in the management GUI. To access the **Add Node** wizard, select **Monitoring** > **System**. On the **System -- Overview** page, select **Add Node** to start the wizard. Complete the wizard and verify the new node. If **Add Node** is not displayed, it indicates a potential cabling issue. Check the installation information to ensure that your node was cabled correctly.

To add a node to a system by using the command-line interface, complete these steps:

1. Enter this command to verify that the node is detected on the network:

   ```
   svcinfo lsnodecandidate
   ```

   If the node is detected on the system the results display information identifying the new node in the system, like the serial number and machine signature. The **id** parameter displays the WWNN for the node. If the node is not detected, verify cabling to the node.
2. Enter this command to determine the I/O group where the node must be added:

   ```
   lsiogrp
   ```
3. Record the name or ID of the first I/O group that has a node count of zero. You need the name or ID for the next step.

   Note: You must do this step for the first node that is added. Do not perform this step for the second node of the pair because it uses the same I/O group number.
4. Enter this command to add the node to the system:

   ```
   addnode -wwnodename WWNN -iogrp iogrp_name -name new_name_arg -site site_name
   ```

   Where **WWNN** is the WWNN of the node, **iogrp_name** is the name of the I/O group that you want to add the node to and `new_name_arg` is the name that you want to assign to the node. If you do not specify a new node name, a default name is assigned. Typically, you specify a meaningful node name. The `site_name` specifies the name of the site location of the new node. This parameter is only required if the topology is a HyperSwap or stretched system.

   Note: Adding the node might take a considerable amount of time.
5. Record this information for future reference:
   - Serial number.
   - Worldwide node name.
   - All of the worldwide port names.
   - The name or ID of the I/O group

Chapter 6. Hardware Servicing

The following topics contain information about service procedures for control and expansion enclosures.

This section describes removing and replacing field-replaceable units (FRUs) from the nodes and expansion enclosures.

Each part has its own removal procedure. Sometimes a step within a procedure refers you to a different remove or replace procedure. Complete the new procedure before you continue with the first procedure that you started.

Note: Do not use FRUs from containers with broken seals or try to transfer FRUs between systems. If you open a FRU container but do not use the part, do not re-seal the container; instead, send the FRU back for reconditioning per the Certified Service Parts (CSP) process.

For more details on the service procedures, see the following pages:

Resolving a problem with failure to boot: 2145-SV2 and 2145-SA2

An IBM Service Support Representative (SSR) can use this procedure if a node canister fails to boot when powered on.

Before you begin

If the Storage Virtualize software is not running, then the node canister status and battery status LEDs are off. The service interfaces such as the service IP, technician port, and satask.txt on a USB flash drive do not work.

Note: If the canister services software on the PCIe switch chip finds that the microprocessors might not start, the node canister fault LED might be on with the node canister status LED off.

If the Storage Virtualize software is running, then the node canister fault LED might be on, and the node canister status LED might blink. The node canister error code and error data can be seen in the Service Assistant GUI, by connecting to the technician port, or by using the other service interfaces. Look up the error code in the SAN Volume Controller IBM Documentation to find out what the error data means and what to do about it.

About this task

Complete the following steps if the Storage Virtualize software is not running on a node canister.

Procedure

1. Connect a monitor to the VGA port and a keyboard to a USB port of the node canister. Consider any error messages on the monitor.
   For example, was it unable to find a good device from which to boot (such as device: `/dev/sda [SAT]`, 1 offline uncorrectable sector)? If the system is booting to a UEFI Shell prompt, review the boot order configured on the canister.
2. If no useful messages display on the monitor, complete the following steps.
   a) Power off the node canister by pulling it a little way out of the enclosure.
   b) Wait for 1 minute.
   c) Push the node canister back in to the enclosure and close the release latches.
      The node canister attempts to power on.
   d) If the power LED comes on green, then watch the VGA monitor for any useful messages.
   e) If the VGA monitor does not show any useful messages, try the next step.

3. Attempt to access the UEFI setup utility on the VGA monitor by pulling out and pushing back in the node canister and holding down the **ESC** or **Delete** key on the keyboard.
   If the **Setup Utility** displays on the monitor, complete the following steps.
   a) If the node canister fault LED is flashing, access the **Bmc self test log** from the **Server Mgmt** tab to look for a cause.
   b) Access the **System Event Log** from the **Server Mgmt** tab.
   Events in this log might help to pinpoint the problem.
4. If by using the setup utility you are unable to pinpoint a broken component, or if the setup utility does not start, complete the following steps.
   It is best to initially investigate a fault with the adapters and DIMMs.
   a) Power off the node canister by pulling the node canister out of the enclosure.
   b) Remove the node canister from the enclosure.
   Place it on a workbench where you can remove the cover.
   c) Replace the cover, push the node canister back in to the enclosure, and close the release latches.
   The node canister attempts to power on.
   d) If the Storage Virtualize software now boots and the node canister fault LED comes on with the canister status LED blinking, then the adapter that you removed might be broken. Repeat the steps with a different adapter until you find the broken adapter.
5. If the Storage Virtualize software does not load with all of the adapters that are removed, complete the following steps.
   a) Power off the node canister by pulling out the node canister from the enclosure.
   b) Remove the node canister from the enclosure.
   Place it on a workbench where you can remove the cover.
   c) Remove the DIMMs, but leave in one DIMM per microprocessor (CPU).
   For example, leave the DIMM in the A0 DIMM slot of each CPU. See “Removing and replacing a memory module” on page 77.
   d) Replace the cover, push the node canister back in to the enclosure, and close the release latches.
   The node canister attempts to power on.
   e) If the Storage Virtualize software boot and the node canister fault LED come on with the canister status LED blinking, then one of the DIMMs that you removed might be broken. Repeat the steps with a different set of DIMMs in slot A0 until you find the broken DIMM.
6. If you did not find any evidence of a broken DIMM or adapter, replace the node canister because a CPU or the system board might be broken.

Removing and replacing control enclosure parts

Parts can be removed and replaced in the control enclosures to perform service procedures or during the initial installation process.

Important: Read the safety precautions in the IBM Systems Safety Notices. These guidelines help you safely work with the system.

Procedure: Identifying which enclosure or canister to service

Use this procedure to identify which enclosure or canister must be serviced.

About this task

To prevent data access loss or data loss when servicing the system, identify the correct enclosure or canister when you complete a service action.

- Labels on the enclosure front and rear indicate the enclosure model and serial number.

- The node canister can be identified by the enclosure it is in, and the serial number of the node canister. The label on the release handles of the canister displays the serial number.

A canister can also be located by the enclosure that contains it and its slot location. This ID is shown as *E-C* or *E*|*C*, where *E* is the enclosure ID and *C* is the canister slot location. On the service assistant, the ID is known as the Panel.

Note: When a node canister is added to a system as a node, it is given a node name and a node ID. The default node name is *nodeN*, where *N* is the node ID. The node ID does not represent the slot location of the node.

To display the node name and canister location in the management GUI, complete the following steps:

1. Select **Monitoring** > **System Hardware**.
2. On the **System Hardware - Overview** page, select the directional arrow next to the enclosure that contains the node canister that you want to display.
3. On the **Enclosure Details** page, click **Node Canister** to highlight the node canister in the graphic and display details for the node canister.

The service assistant home-page also shows both the node name and the canister location. If you have only the node name, use these panels to determine the node canister location. Use this procedure to identify which enclosure or canister must be serviced, as completing a service action on the wrong canister can lead to data access loss or data loss.

To control the identify LED of an enclosure or online canister, use the management GUI:

1. Select **Monitoring** > **System Hardware** .
2. On the **System Hardware - Overview** page, select the directional arrow next to the enclosure that contains the node canister that you want to identify.
3. On the **Enclosure Details** page, right-click the node canister in the graphic and select **Identify** from the **Actions** menu.

Alternatively, if a node canister is not online to the system, use the service assistant to control the identified LED.

1. Log in to the service assistant of the node canister to be identified.
2. Click **Identify** at the upper left of the page to control the identified LEDs.

Procedure: Understanding system volume dependencies

If one component in a redundant pair is offline or powered off, host access to volumes can be disrupted. Before you remove or power off a node canister or enclosure, verify whether any volumes depend on those components.

The following examples describe scenarios where the system or node status can impact if a volume is available to a host.

- If a control enclosure has only one node canister online, access to a volume depends on the online node canister. For example, a host might lose access to a volume that is stored partially or wholly on an array that uses drives in the offline node or its expansion enclosures.
- If one expansion canister in an expansion enclosure is powered off, further expansion canisters to that down side chain get isolated from the control canister of the side chain. In this case, host access to volumes depends on the online canister if the volume uses drives in an isolated enclosure or the enclosure with the offline canister.
- If an entire expansion enclosure is powered off, both sides of the SAS chain are broken. In this case, host access to some volumes can be considered to depend on the entire expansion enclosure.

The impact that a service procedure might have on host access to data can be understood by using the management GUI. To do so, use the following procedure:

1. In the management GUI, select **Monitoring** > **System** .

2. On the **System -- Overview** page, use the directional arrow near the enclosure that contains the node canister to open the **Enclosure Details** page.
3. Under **Rear View** of the system, right-click the canister and select **Dependent Volumes** from the **Actions** menu to display all volumes that become disabled to hosts if the canister is powered off.

During a maintenance procedure, if the **Dependent Volumes** action identifies dependent volumes, you may choose to stop the procedure. Then, investigate whether it is possible to reinstate the redundancy in the system to carry out the procedure without loss of access to data. For example, first complete procedures to ensure that both canisters in the enclosure are online. Then, complete any procedure that powers off the only online canister in the enclosure.

Procedure: Powering off the system

Sometimes, it is necessary to power down all node canisters in a system. For example, you might need to shut down the system before you do the maintenance actions in your data center.

Before you begin

Notes:

- It is not necessary to shut down the entire system (all node canisters) when you complete service actions.
- Service actions upon a node canister require only one node canister in the control enclosure to be shut down. If one node canister of an I/O group is online and communicating with hosts and other nodes, volumes that depend on resources of the I/O group can remain online.
- Service actions upon a control enclosure might require the control enclosure to be shut down. In this case, the I/O group that is provided by the control enclosure goes offline. All volumes that depend on that I/O group become disabled. However, other I/O groups in the system can continue to operate.

Procedure

1. Stop all host I/O to volumes on the system.
2. Shut down the system by using the management GUI. Click **Monitoring** > **System**. From the **System Actions** menu, select **Power Off System**.
3. Disconnect the power cords.
   a) If you are servicing the control enclosure only, disconnect the power cords from both power supply units (PSUs) in the control enclosure.

      Note: You do not need to power off the expansion enclosures.

   b) If you are preparing for site maintenance, disconnect the power cords from both power supplies in each expansion enclosure in the control enclosure's SAS chains.

      Note: The 2U and 5U expansion enclosures do not have a power button. Each expansion enclosure has two PSUs.
4. When you are ready to restore power to the control enclosure and any expansion enclosures, follow the Powering on the control enclosures procedure for system configuration.

Procedure: Powering off a node

To complete some service tasks, you must ensure that the node canister is powered off safely.

About this task

Attention: If your system is powered on and doing I/O operations, the system must power off correctly to ensure that no data is lost. If possible, always use the fix procedures that are presented by the management GUI to manage and maintain your system. The fix procedures ensure that the canister is powered off safely.

While a node canister is powered off, some volumes can become inaccessible. Refer to “Procedure: Understanding system volume dependencies” on page 57 to determine whether it is appropriate to continue this procedure.

Procedure

To power off a node canister, complete the following steps:

1. Determine the volume dependencies for the node canister that you are shutting down. For more information, see “Procedure: Understanding system volume dependencies” on page 57.
2. Go to the service assistant for the node with the canister to shut down.
3. On the home page, select the node canister to shut down.
4. If you are working on a maintenance procedure, complete the following steps to ensure that the correct node canister is identified.
   a) Go to the **Node Details** panel in the service assistant.
   b) Select the **Node** tab. Then, make a note of the last 6 digits that appear in the **Part Identity** field.
   c) Select the **Hardware** tab. Then, take note of the values in the **Canister Location** (slot), **Machine Type and Model**, and **Serial Number** fields.
   Table 17 on page 59 summarizes the information that can help you identify the correct node canister.

Table 17. Information to identify a node canister

Tab	Field name	Node canister value
Node	Part Identify	
Hardware	Canister Location (slot)	
	Machine Type and Model	
	Serial Number	

   d) To activate the identified indication on the node canister, you can also click the **Identify** button. The fault LED indicator on the node canister blinks so that you can confirm its location.
5. Use the **Power off** action to power off the canister.
6. After the node is powered off, the service assistant shows that the node status is offline. The status LED indicators on the canister show that the node is powered off.

Removing and replacing the enclosure end caps

You can remove and replace the enclosure end caps during some service procedures.

About this task

shows the end caps on the front of the control enclosure. Each end cap provides information to identify the enclosure (machine type and model and serial number). LED indicators also provide information about the status of the enclosure.

Notes:

- The information on the end cap must always match the information that is printed on the rear of the enclosure. It must also match the information that is stored on the enclosure midplane.
- No tools are required to complete this task. Do not remove or loosen any screws.

Procedure

1. If the enclosure is on a table or other flat surface, elevate the enclosure front slightly or carefully extend the front over the table edge.

2. Grasp the end cap by the blue touch point and pull it until the bottom edge of the end cap is clear of the bottom tab on the chassis flange.

   shows an example of the left end cap. The touch point is located below the LED indicators.
3. Lift the end cap off the chassis flange.

   shows how to lift the end cap of chassis flange.
4. Fit the slot on the top of the new end cap over the tab on the top of the chassis flange.
5. Rotate the end cap down until it snaps into place.

Removing and replacing the node support rails: 2145-SV2 and 2145-SA2

You can replace faulty support rails with new rails that are received from stock.

About this task

As part of this procedure, the node must be removed from the rack. Two persons are required to remove and replace the node. Follow all safety precautions when you complete this procedure.

Procedure

1. Remove the node from the rack.

   Follow the steps in “Removing and reseating a node” on page 75.
2. Locate the left support rail.

   Record the shelf number of the support rail so that the replacement rails can be installed into the same position.
3. At the rear of the rack, remove the black M5 screws from the rear bracket of the rail. Two screws are attached to each bracket. Then, open the rear hinge bracket, as shown in the following figure.

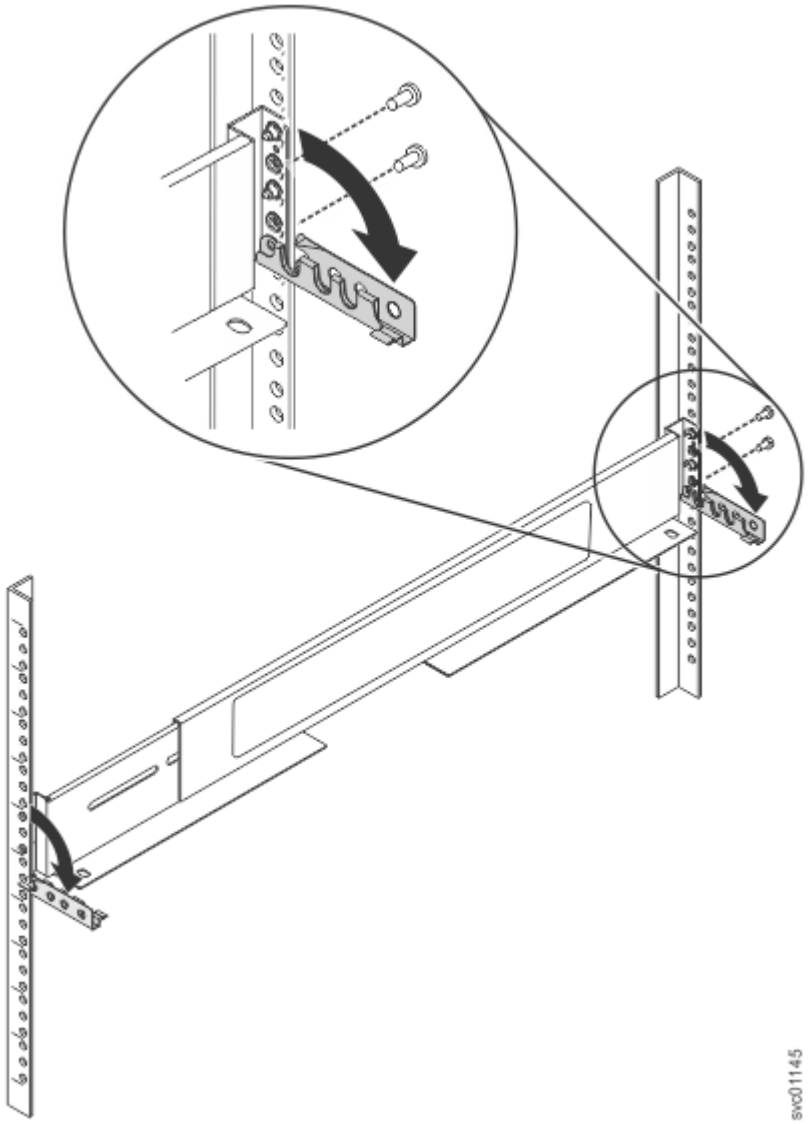


Figure 23. Opening the rear hinge bracket of the mounting rail

4. At the front of the rack, hold on to the rail and open the front hinge bracket.
5. Compress the rail to shorten it. Then, hold onto the rail and open the rear hinge bracket, as show in the following figure.

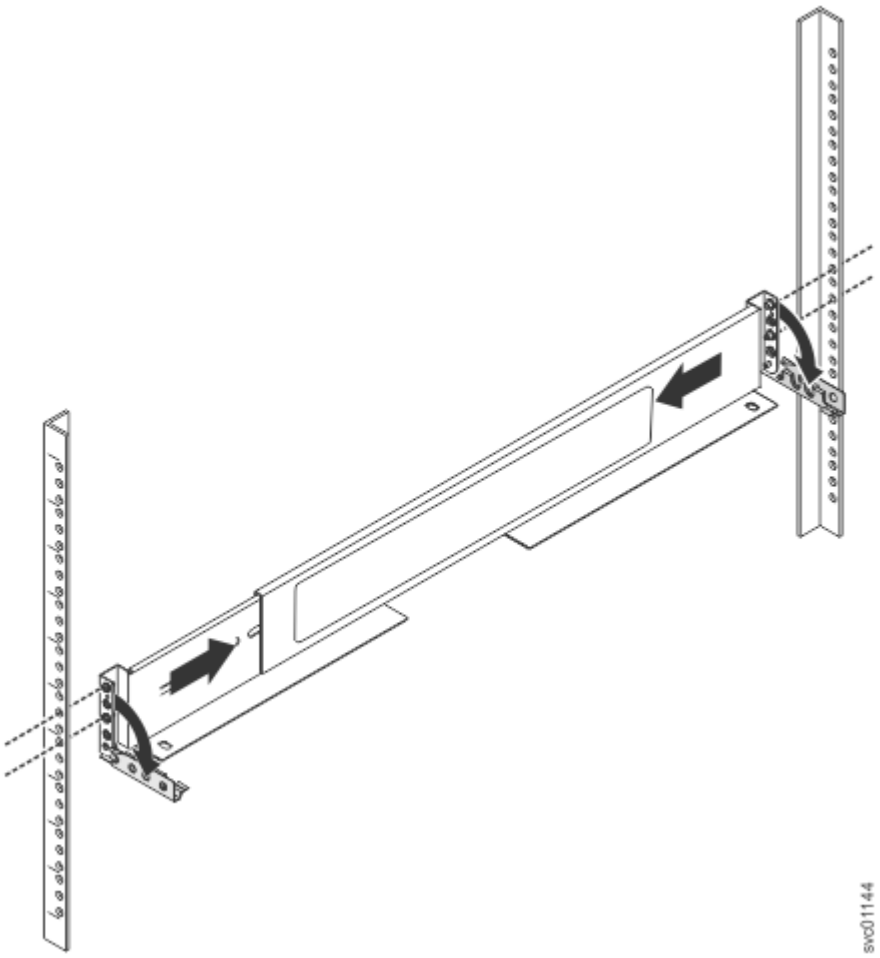


Figure 24. Compressing the rail for removal from rack

6. Repeat steps “3” on page 60 to “5” on page 61 for the right support rail.
7. Install the new support rails at the rack position that is recorded at step “2” on page 60. Follow the procedure described in Installing support rails for the node.
8. Replace the node in the rack.

   Follow the steps in Installing the node.

Removing and replacing a power supply unit:2145-SV2 and 2145-SA2

You can remove and replace either of the two hot-swap redundant power supply units (PSUs) in the enclosure. These redundant power supplies operate in parallel, one continuing to power the enclosure if the other fails.

About this task

Notes:

- Do not insert a PSU if the PSU slot does not contain a power interposer.
- Do not operate an enclosure without a power interposer and PSU in a PSU slot for longer than **5 minutes**. Operating for longer than this period might cause the enclosure to shut down due to overheating.
- Remove the replacement PSU from its packaging and have it available before carrying out this procedure.
- No tools are required to complete this task. Do not remove or loosen any screws.

- Although many components are hot-swappable, their intended use is only when your system is not active (no I/O operations). If your system is powered on and processing I/O operations, go to the management GUI and follow the fix procedures. Initiating the replacement actions without the assistance of the fix procedures can result in loss of data or loss of access to data.
- Be careful when you are replacing the hardware components that are located in the back of the system. Do not inadvertently disturb or remove any cables that you are not instructed to remove.
- 

When you replace this part, you must follow recommended procedures for handling electrostatic discharge (ESD)-sensitive devices.

Procedure

1. Identify the location of the control enclosure that requires service. The Event Log contains the enclosure MTM and serial number. Looking at the back of the node, PSU 1 is on the left and PSU 2 is on the right.
2. Identify the PSU that requires service; the Event Log contains the ID of the PSU that failed.

Removing the PSU

3. Release the cable retention clip and disconnect the power cord from the power supply unit that you are replacing.

   This figure shows the location of the cable retention clip 1, LED indicator 2, PSU 1 release tab 3, PSU handle 4, and the power interposer release tab 5.

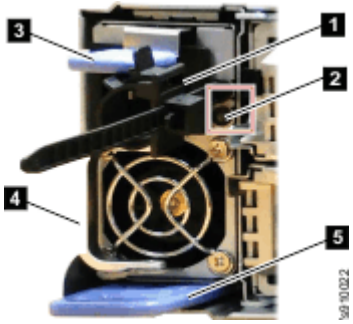


Figure 25. Features of a power supply unit

4. Fold out the handle so that it extends perpendicular to the PSU.
5. Hold the PSU handle, and press and hold the PSU release tab. Then, steadily pull the handle horizontally to slide the PSU from the enclosure, as shown in this figure.

   Support the PSU with your other hand as it is released from the enclosure.

Figure 26. Removing the power supply unit

Important: Insert the replacement PSU within 5 minutes; otherwise, the system may overheat and shut down.

Replacing the PSU

6. Fold out the handle so that it extends perpendicular to the PSU.
7. While keeping the PSU handle extended and supporting the PSU slide the power supply into the enclosure until the release tab engages with a "click".
8. Connect the power cord to the power supply and to a properly grounded electrical outlet. Secure the cable with the cable retention clip on the rear of the power supply unit.

   Note: After the power cord is connected to the electrical outlet, make sure that the PSU LED indicator 2 shown in Figure 25 on page 63, is lit.

Removing and replacing a Fibre Channel SFP transceiver: 2145-SV2 and 2145-SA2

When a failure occurs on an optical link in a control enclosure, the SFP transceiver in the port that provides the link might need to be removed and replaced.

About this task

No tools are required to complete this task. Do not remove or loosen any screws.

Although many components are hot-swappable, their intended use is only when your system is not active (no I/O operations). If your system is powered on and processing I/O operations, go to the management GUI and follow the fix procedures. Initiating the replacement actions without the assistance of the fix procedures can result in loss of data or loss of access to data.

Be careful when you are replacing the hardware components that are located in the back of the system. Do not inadvertently disturb or remove any cables that you are not instructed to remove.

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)

When you replace this part, you must follow recommended procedures for handling electrostatic discharge (ESD)-sensitive devices

Procedure

1. Carefully determine the failing physical port connection. In the Event Log, its location is identified by the following information:
   - Enclosure (MTM and serial number)
   - Canister (serial number)
   - Adapter (slot number) - if applicable
   - Port (port number).

   Important:

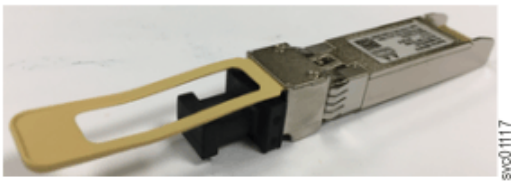
   - For correct operation, use the correct replacement SFP transceivers with each adapter. See Replaceable units for the applicable information for your system.
     - Use only the appropriate 16 Gbps SFP transceivers in the 16 Gbps Fibre Channel adapter.
     - Use only the appropriate 25 Gbps SFP transceiver in the 25 Gbps Ethernet adapters.
     - Use only the appropriate 32 Gbps SFP transceivers in the 32 Gbps Fibre Channel adapter.
   - Removing the wrong SFP transceiver might result in loss of data access.

Replacing the SFP

2. Locate the faulty SFP device. The enclosure MTM and serial number are at the rear of the enclosure. The canister serial number is at the rear of the canister. Adapter slots and canister Ethernet ports are numbered on the canister, from left to right. Ports on each adapter are numbered from left to right.
3. Record or mark the cable that is to be removed.
4. Unlatch and remove the cable from the faulty SFP device.

   As Table 18 on page 65 shows, the SFP transceiver and latching mechanism can vary per each type of host interface adapter.

Table 18. SFP transceiver example

Host interface adapter	SFP transceiver example
Quad-port 16 Gbps Fibre Channel	
Dual-port 25 Gbps Ethernet (RoCE)	
Dual-port 25 Gbps Ethernet (iWARP)	

5. Remove the faulty SFP transceiver from its aperture.
   a) Unclip the handle of the SFP transceiver.
   b) Pull on the handle of the SFP transceiver to slide it out of the slot.

Replacing the SFP

6. Install the replacement SFP transceiver into the aperture that is vacated in step “5” on page 65.
   a) Open the latch on the replacement SFP transceiver.
   b) Push the new SFP transceiver into the aperture until it stops.
   c) Close the release latch.
   d) Gently pull the SFP transceiver. If it is installed correctly, it does not move from its aperture.
7. Reconnect the optical cable.
8. Check the Event Log to confirm that the error is cleared. Mark the error as fixed or restart the node, depending on the failure indication originally noted.

Removing and replacing a network adapter

Use this procedure to remove and replace a network adapter in a system with a new one received from stock.

About this task

Notes:

- When a node canister is removed, do not operate the system for more than **16 minutes**. Operating the system for longer than this period might cause the control enclosure to shut down due to overheating.
- No tools are required to complete this task. Do not remove or loosen any screws when you remove or replace an adapter. The adapter is not attached to the PCIe riser by screws.

Procedure

1. Identify the node with the faulty adapter.
   a) Identify any dependencies on the node canister by using the management GUI. Understand the impact of any dependencies and resolve them if necessary.
   b) Locate the control enclosure that requires servicing by its MTM and serial number (S/N), which are labeled on the enclosure front left cover and also on the enclosure rear. At the rear of the enclosure, locate the node canister by finding its serial number on the release handles.
   c) Use the Event Log to identify the location of the adapter that requires replacement. Location information includes the enclosure MTM and S/N, node canister (slot number/serial number), and the adapter slot number.
2. Label each network cable connection or record all cables that are connected to the node canister. This information is used to reconnect the cables to the node canister. The orientation, slot numbers, and port numbers of node canister 1 (top canister) differ from node canister 2 (bottom canister)

   Use Table 19 on page 66 to summarize the possible adapters that are used in each PCIe slot and the port number configuration of node canister 2 (the bottom node canister).

Table 19. Node canister PCIe slots and port connections

PCIe slot 1 **Adapter type**				**PCIe slot 2** **Adapter type**				**PCIe slot 3** **Adapter type**			
Port 1	**Port 2**	**Port 3**	**Port 4**	**Port 1**	**Port 2**	**Port 3**	**Port 4**	**Port 1**	**Port 2**	**Port 3**	**Port 4**

Removing the host interface adapter

3. Remove the node canister, as described in “Removing and reseating a node” on page 75.
4. Remove the cover and set it aside, as described in “Removing and replacing the cover of a node” on page 69.
5. At the back of the node canister, locate the PCIe slot of the adapter that is to be replaced.

   When the node canister is removed, the PCIe adapter slots are numbered 1 - 3, bottom to top, as shown in Figure 27 on page 67.

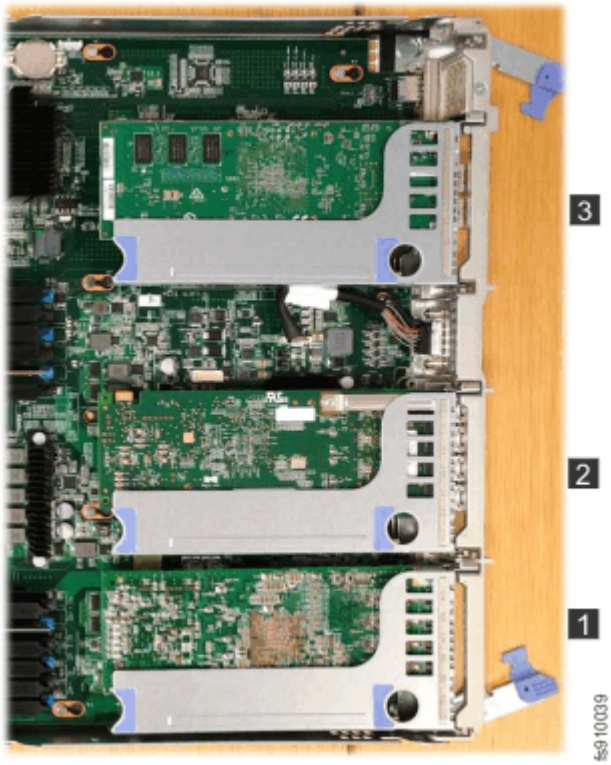


Figure 27. Locating the host interface adapter slots

6. If applicable, remove each SFP from each adapter port, as described in "Removing and replacing a Fibre Channel SFP transceiver: 2145-SV2 and 2145-SA2" on page 64.

   Record the serial number of each SFP device as you remove them from the adapter ports.
7. Lift the adapter and PCIe riser from the canister.
8. Press the adapter out of the PCIe socket of the riser.

   Important: Adapters with a large SFP cage, such as the 4-port Fibre Channel adapter, might have limited clearance between the external edge of the SFP cage and the slot of the PCIe riser. When you remove or insert an adapter, you might need to start the removal at the bracket end of the adapter, so that the adapter is removed at a slight angle.

Replacing the host interface adapter

9. Review Table 20 on page 67 to ensure that you are using the correct replacement adapter.

Table 20. Summary of network adapters and SFP devices

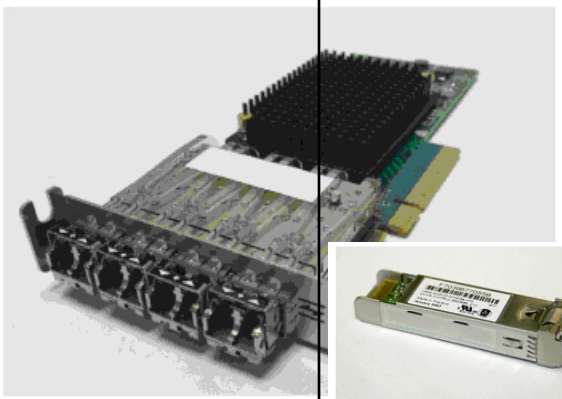
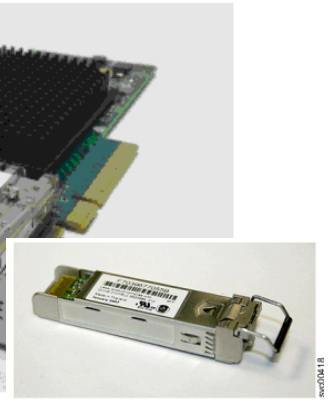
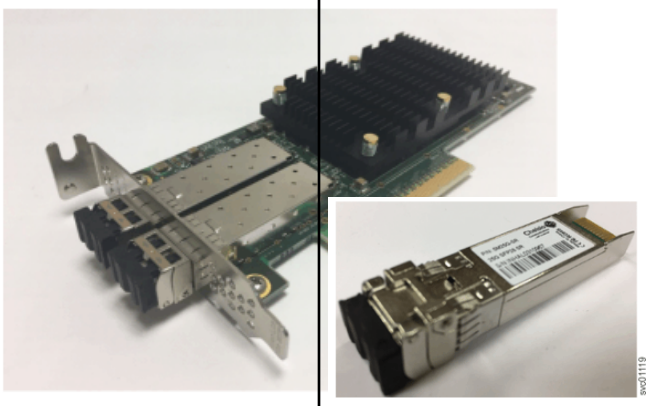
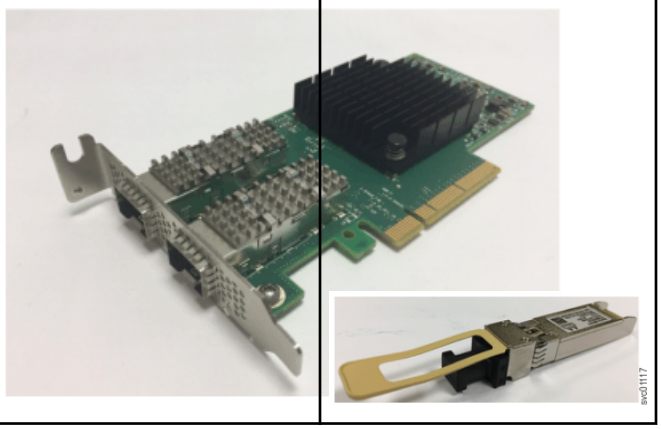
Type	Adapter	SFP device
Quad-port 16 Gbps Fibre Channel		

Table 20. Summary of network adapters and SFP devices (continued)		
Type	**Adapter**	**SFP device**
Quad-port 32 Gbps Fibre Channel		
Dual-port 25 Gbps Ethernet (iWARP)		
Dual-port 25 Gbps Ethernet (RoCE)		

10. Align the replacement adapter with the PCIe socket of the riser and press the adapter into place. Ensure that the adapter is fully seated in the riser, as shown in Figure 28 on page 69.

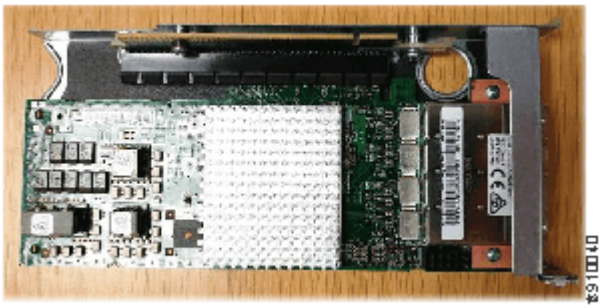
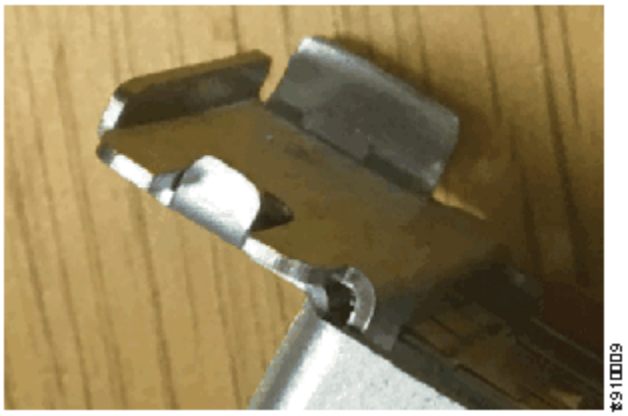


Figure 28. Alignment of the network adapter

11. Ensure the bracket of the PCIe riser is aligned correctly, as shown in Table 21 on page 69.

Table 21. Aligning the brackethost interface adapter

Correct Alignment	Incorrect alignment
	

12. Insert any SFP devices that were removed in step "6" on page 67 into the adapter. See Table 20 on page 67 to ensure that you are using the correct SFP device.
13. Align the riser so that the adapter SFPs face out of the canister and the PCIe connector of the riser faces down into the PCIe socket of the canister.
14. Carefully press the PCIe riser into place.
15. Install the canister lid, as described in "Removing and replacing the cover of a node" on page 69.
16. Reinsert the node canister, as described in "Removing and reseating a node" on page 75, and reconnect the power cables.

    If the node canister does not start, check that the canister is fully inserted into the enclosure.
17. Reconnect the network cables to the rear of the canister, by using the information that you collected at step "2" on page 66.
18. Verify that the error is cleared from the Event Log.

Removing and replacing the cover of a node

To complete a service procedure, you may need to remove and replace the cover of a node canister.

About this task

- No tools are required to complete this task. Do not remove or loosen any screws.
- The cover of a node canister can be removed only after the canister is removed from the control enclosure.

Procedure

1. Remove the node canister from the control enclosure, as described in “Removing and reseating a node” on page 75.

Removing the cover

2. Place the node canister on a flat, level work surface. The release levers should be facing you and the cover should be facing upwards.

   Note: The node canister in the upper slot (node canister 1) of the control enclosure is upside-down. To access the cover, you must turn it over after you have removed it from the control enclosure.

3. Open the cover of the node canister by depressing the recessed, blue touch points on the lid (1) and sliding the lid away from you (2), as shown in Figure 29 on page 70.

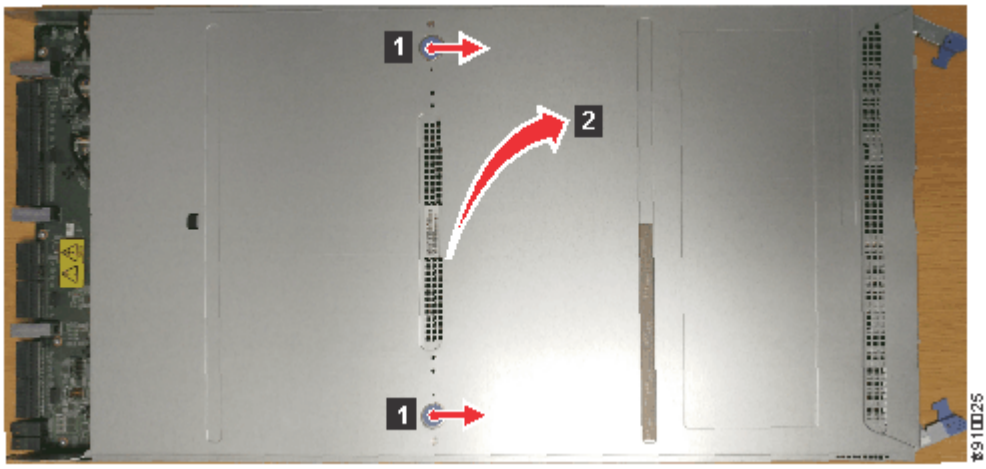


Figure 29. Removing the node canister cover

Replacing the cover

4. Slide the cover onto the node canister until the catch clicks and the lid edges are flush with the canister. Figure 30 on page 70 shows an example.

Figure 30. Replacing the node canister cover

Note: Inserting the node canister into the upper slot of the enclosure requires the node canister to be inverted, so that the lid faces downwards.

Removing and replacing the node battery

To remove and replace a faulty battery with a new one received from stock, use this procedure.

About this task

No tools are required to complete this task. Do not remove or loosen any screws.

CAUTION: The battery is a lithium ion battery. To avoid possible explosions, do not burn. Exchange only with the approved part. Recycle or discard the battery as instructed by local regulations. (C007a)

Procedure

1. Refer to the Event Log to identify the enclosure and node canister where battery replacement is required. Alternately, follow the procedure "System indicators summary" on page 96.
2. Label each network and power cable connection or otherwise record all cables that are connected to the node canister. This information is used to reconnect the node canister later.
3. Disconnect all cabling from the back of the node canister.
4. Remove the node canister, as described in "Removing and reseating a node" on page 75.
5. Remove the cover, as described in "Removing and replacing the cover of a node" on page 69.

Removing the battery

6. Lift the node battery latch up, as shown in Figure 31 on page 71.

Figure 31. Lifting the latch of the node battery

7. Slide the node battery toward the latch until it stops, as shown in Figure 32 on page 71.

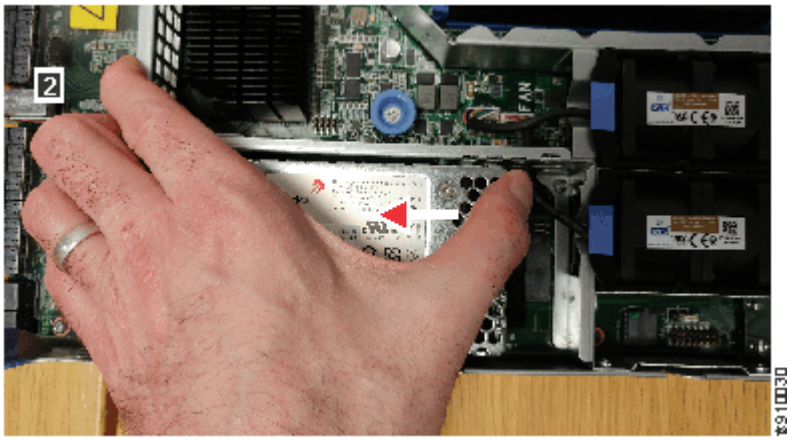


Figure 32. Sliding the node battery out of its position

8. Lift the battery straight up to remove it from the node canister, as shown in Figure 33 on page 72.

Figure 33. Removing the node battery

Replacing the battery

9. Open the battery latch.
10. Place the replacement battery into the battery slot so the pins on the board engage with the slots on the underside of the battery.

    Figure 34 on page 72 shows the battery slots.

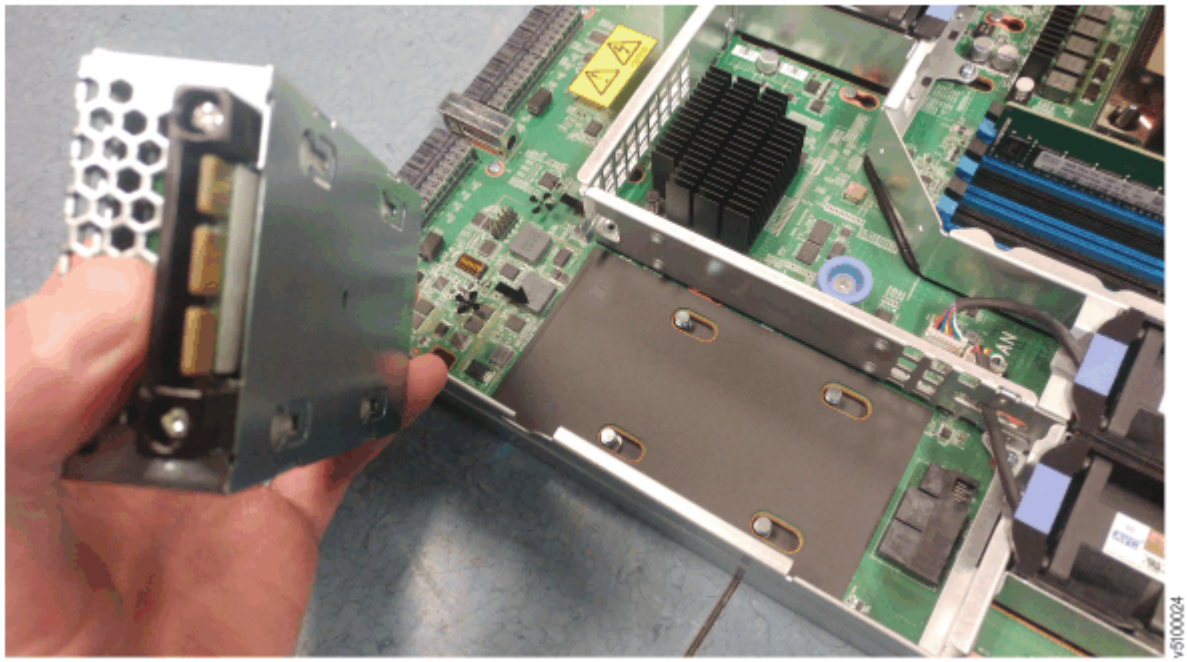


Figure 34. Locating the battery slots

11. Connect the battery by carefully sliding it towards the battery connector.

    Note: When you insert the new battery, be careful not to damage the connector cable for fan 5. As Figure 35 on page 73 shows, the fan 5 connector passes through the partition of the battery compartment.

Figure 35. Replacing the node battery

12. Rotate the node battery latch down so that it holds the battery in place.
13. Install the node canister cover, as described in “Removing and replacing the cover of a node” on page 69.
14. Reinsert the node canister, as described in “Removing and reseating a node” on page 75.
15. Reconnect the cables to the node canister, ensuring that each cable goes into the same port and power supply unit (PSU) from which it was removed.

    If the node canister does not begin to power up, check that the canister is fully inserted into the enclosure.
16. When the node canister is back online, check the Event Log for any new events that might indicate a problem with the reassembly.

    Note: A new node error or event ID in the Event Log might indicate that the new battery is functioning but requires some time to reach minimum charge. Monitor the Event Log until the battery is charged sufficiently for the node to boot.

Removing and replacing a CMOS battery

The complementary metal-oxide semiconductor (CMOS) battery is a coin-shaped power cell that is mounted inside the node canister. It is used to keep the system time when there is no power to the node canister.

About this task

- Use this procedure to remove and replace a CMOS battery in a node canister.
- The node canister must be shutdown and removed to perform this task.
- A Philips screw driver is needed to remove the canister cover.
- Recycle or discard the battery as instructed by local regulations.

Procedure

1. Remove the node canister, as described in “Removing and reseating a node” on page 75.
2. Remove the node canister cover, as described in “Removing and replacing the cover of a node” on page 69.

Removing the CMOS battery

3. Locate the CMOS battery inside the node canister.

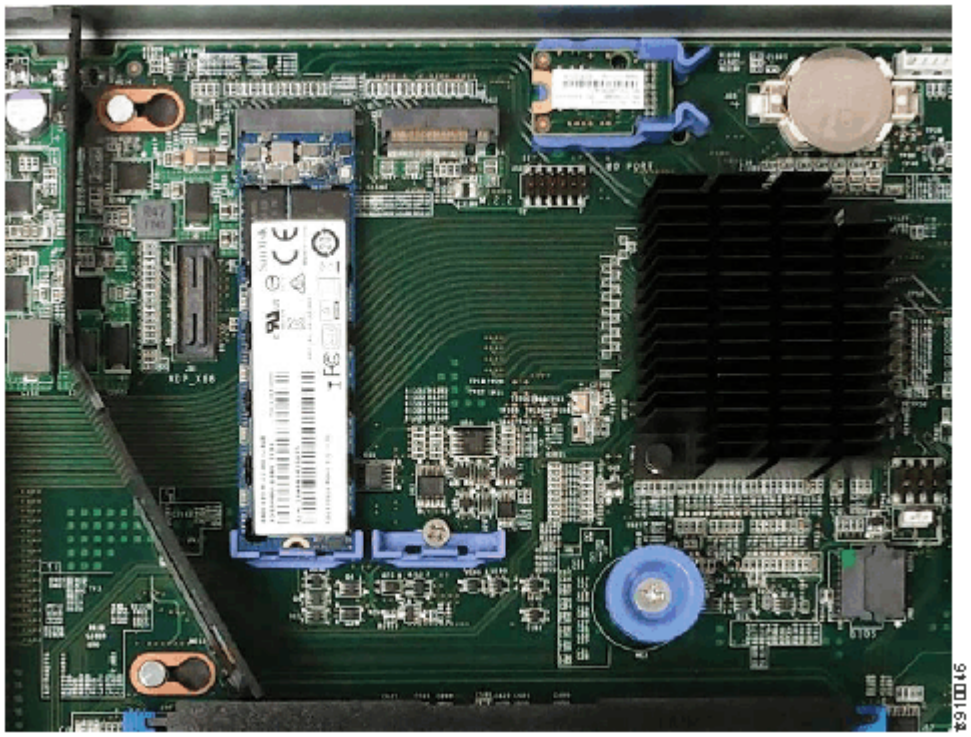


Figure 36. Locating a CMOS battery

4. Use a flat head screwdriver to gently pop the CMOS battery out of the battery holder, as shown in Figure 37 on page 74. However, do not remove or loosen any screws in the node canister.

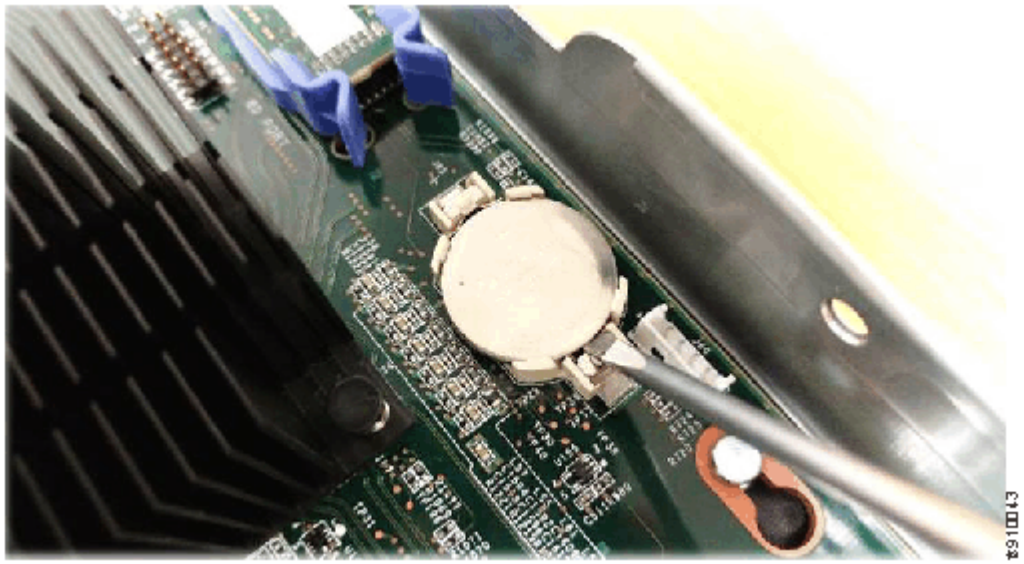


Figure 37. Replacing a CMOS battery

Replacing the CMOS battery

5. Orient the replacement coin cell with the positive side up.
6. Gently push the new coin cell down into the battery holder.
7. Install the node canister cover, as described in “Removing and replacing the cover of a node” on page 69.
8. Reinsert the node canister, as described in “Removing and reseating a node” on page 75.

   If the canister does not begin to power-up, check that it is fully inserted into the enclosure.
9. Reconnect all cables.

10. Use the management GUI to check that the time and date settings of the system are correct.
    a) If a CMOS battery error is present in the Event Log, run the fix procedure.

Removing and reseating a node

To access or replace some components during service procedures, a canister might need to be temporarily removed from, and reinserted into, the enclosure.

Before you begin

Note: This topic provides instructions for temporarily removing and replacing a canister and should be used only when instructed to do so by other service procedures. To replace a faulty node canister with one from FRU stock, follow the procedure that is described in "Removing and replacing a faulty node" on page 76.

Make a note of the following points before replacing a canister:

- No tools are required to complete this task. Do not remove or loosen any screws.
- Before removing a canister, it must be powered off or be in service state. Otherwise, it can result in loss of data or loss of access to data.
- If a canister was recently removed from the system, and then added again, ensure that the canister is online for at least 25 minutes before you remove its partner canister. This delay allows multipath drivers to fail over to the online canister when the partner canister is removed.
- Use care when you remove a canister from the enclosure. Have a flat surface ready to receive the canister after removal.
- Use care when you lift and insert the canister.

Before you start the removal procedure, make sure to transfer the following components from the faulty canister to the replacement canister:

- DIMMs
- PCIe adapters
- Backup battery

To remove and reinsert a canister in the enclosure, complete the following steps.

Procedure

1. Shut down the canister by using the service assistant. Follow the steps in "Procedure: Powering off a node" on page 58.
2. Use the LED indicators on the canister to confirm that it is safe to remove it from the enclosure, as described in "Node front and rear panel indicators: 2145-SV2 and 2145-SA2" on page 97.
3. Record which data cables are plugged into the specific ports on the rear of the canister. The cables must be inserted back into the same ports after the replacement is complete; otherwise, the system cannot function properly.
4. Disconnect the data cables that are connected to the canister.
5. If you are reinserting the canister while the enclosure is installed in the rack, disconnect the CMA arm from the adjacent side of the enclosure to allow room to slide the canister out of the enclosure.
6. Locate the left and right release levers for the canister, marked by blue touchpoints on the ends of the levers.
7. Holding the canister release levers by the blue touch points, open the two levers horizontally 90 degrees, then slide the canister out of the enclosure and place it onto an antistatic mat.
8. To reinstall the canister, ensure that both of the canister release levers are fully open (90 degrees relative to the canister), and then slide the canister into the enclosure, ensuring that both release levers engage with the canister and begin to close.

9. Press the release levers closed to lock the canister into the enclosure. Press the latch ends to ensure that the latches are engaged with the canister.
10. Reconnect the CMA to the enclosure and rack.
11. Reconnect all cables that were removed from the back of the canister.
12. If the canister does not begin to power up, check that it is fully inserted into the enclosure. If necessary, remove the power and cables; then, repeat steps “8” on page 75 through “12” on page 76.

Removing and replacing a faulty node

You can use this procedure to remove a faulty node and replace it with a new node. You can remove the parts from the faulty node and reinstall them into the new node. You can also use this procedure to allow for replacement of parts inside the node.

About this task

Notes:

- There are two different node types. Ensure the FRU part number (P/N) of the replacement part matches that of the failed node, or is an approved substitute. The FRU P/N is identified on the label of the and on the FRU packaging.
- No tools are required to complete this task. Do not remove or loosen any screws.
- Use care when you remove a node from the control enclosure. The node is long and its center of gravity is far forward. It can be helpful to have a lift or other sturdy, flat surface ready to receive the node during removal.

Procedure

1. Review the Event Log to identify the faulty node.
2. Review “Procedure: Understanding system volume dependencies” on page 57 to identify any volume dependencies on the node .
3. Follow Procedure: Powering off a node canister to verify that the hosts do not lose access to data in volumes.
4. From the rear of the control enclosure, label each cable and remove it from the node.

Removing the faulty node

5. Remove the node, as described in “Removing and reseating a node” on page 75, and place it on a flat, level surface.
6. Remove the new node from its packaging.

   Ensure that the FRU P/N of the replacement node matches that of the failed node or that the new P/N is an approved substitute. See “Replaceable units” on page 102 for more information.
7. Remove the covers from the faulty and replacement nodes and set them aside, as described in “Removing and replacing the cover of a node” on page 69.
8. Complete the following procedures to remove parts from the faulty node and install them in the replacement node.
   - “Removing and replacing a memory module” on page 77
   - Removing and replacing a fan module
   - “Removing and replacing the Trusted Platform Module” on page 86
   - “Removing and replacing the node battery” on page 70
   - “Removing and replacing a boot drive” on page 88

     Note: Transfer each boot drive one at a time. Ensure that you install the drive into the same slot in the replacement node .

Replacing the new node

9. Replace the cover on the new node, as described in, as described in “Removing and replacing the cover of a node” on page 69.
10. Install the new node into the control enclosure, as described in “Removing and reseating a node” on page 75.
11. Reconnect the cables that were removed in step “4” on page 76 to the appropriate ports in the replacement node.
12. If the node was communicating with other nodes using RDMA over Ethernet, then use the Service Assistant Tool or the **sainfo lsnodeip** command to check if the node IP configuration has been lost. Use the Service Assistant Tool or the **satask chnodeip** command to set the node IP if needed.

    Note: Step “12” on page 77 is only needed for a new node.
13. Use the management GUI or service assistant GUI to check that the node is online (or is Active) in the system.
14. Enter the service assistant command **satask chbootdrive -replacecanister** to update the drives to match the serial number of the new node.

    Note: Node error code 545 is expected. For more information, see 545.

    To help identify the node, the inside of the release levers are labeled with the serial number.
15. Review the management GUI to determine that all errors are resolved.

Removing and replacing a memory module

You can remove and replace a faulty dual inline memory module (DIMM) from a control enclosure. You can also use this procedure to add DIMMs to increase the memory capacity of the node canister.

About this task

Notes:

- 

The memory modules are sensitive to electrostatic-discharge (ESD). Take precautions to avoid damage from static electricity. When you remove or replace this part, you must follow recommended procedures for handling ESD-sensitive devices.
- A screwdriver is required to open the node canister cover.
- The hardware (for example labels on the printed circuit board) identifies the processors as CPU0 and CPU1, but the Storage Virtualize error messages identify them as CPU1 and CPU2.
- All DIMMs are 64 GB, and supported configurations can have 8, 16 or 24 installed DIMMs in specific slots.

As Figure 38 on page 78 shows, each node canister contains:

- Five fans across the top
- Two processors, which are identified as CPU 1 and CPU 2
- 24 DIMM slots numbered 1 through 24.

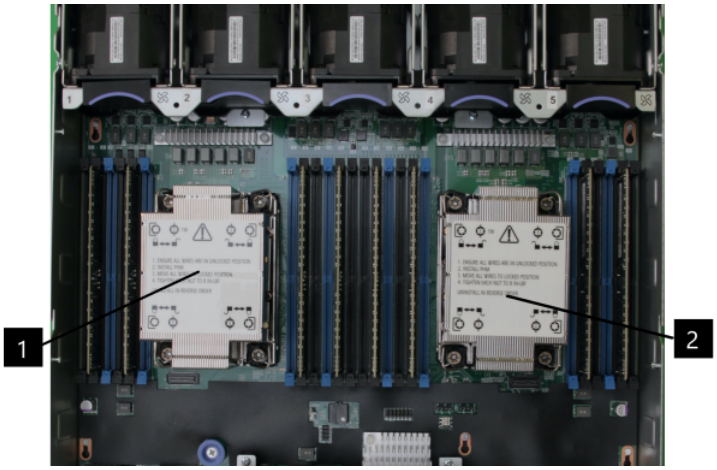


Figure 38. Location of CPUs and DIMM slots

1 CPU1 to the Storage Virtualize Software and CPU 0 to the hardware. 2 CPU 2 to the Storage Virtualize Software and CPU 1 to the hardware.

- A CPU processor can have 4, 8 or 12 DIMMs installed.
- On the system board, the DIMM slots are labeled according to their memory channel and slot. They are associated with the CPU nearest to their DIMM slots.
- You do not have to replace all memory modules at the same time. However, when you install memory modules, be sure that you follow the configurations that are described in the following table:

Table 22. Available memory configurations for a control enclosure

Total Memory per Control Enclosure	**512 GB**	**1024 GB**	**1536 GB**	**Slot label**
Features	**ACGM**	**ACGM + ACGN**	**ACGM + ACGN + ACGP**	
CH1-DIMM0	Blank	64 GB	64 GB	**1**
CH0-DIMM0	64 GB	64 GB	64 GB	**2**
CH0-DIMM1	Blank	Blank	64 GB	**3**
CH3-DIMM0	Blank	64 GB	64 GB	**4**
CH2-DIMM0	64 GB	64 GB	64 GB	**5**
CH3-DIMM1	Blank	Blank	64 GB	**6**
CPU 1				
CH6-DIMM1	Blank	Blank	64 GB	**7**
CH6-DIMM0	64 GB	64 GB	64 GB	**8**
CH7-DIMM0	Blank	64 GB	64 GB	**9**
CH4-DIMM1	Blank	Blank	64 GB	**10**
CH4-DIMM0	64 GB	64 GB	64 GB	**11**
CH5-DIMM0	Blank	64 GB	64 GB	**12**
CH1-DIMM0	Blank	64 GB	64 GB	**13**
CH0-DIMM0	64 GB	64 GB	64 GB	**14**

Table 22. Available memory configurations for a control enclosure (continued)				
Total Memory per Control Enclosure	**512 GB**	**1024 GB**	**1536 GB**	**Slot label**
CH0-DIMM1	Blank	Blank	64 GB	**15**
CH3-DIMM0	Blank	64 GB	64 GB	**16**
CH2-DIMM0	64 GB	64 GB	64 GB	**17**
CH3-DIMM1	Blank	Blank	64 GB	**18**
CPU 2				
CH6-DIMM1	Blank	Blank	64 GB	**19**
CH6-DIMM0	64 GB	64 GB	64 GB	**20**
CH7-DIMM0	Blank	64 GB	64 GB	**21**
CH4-DIMM1	Blank	Blank	64 GB	**22**
CH4-DIMM0	64 GB	64 GB	64 GB	**23**
CH5-DIMM0	Blank	64 GB	64 GB	**24**

If a node error 510 is logged (error code 1022 in the system log), the sense data includes the following information, that you can use to determine which DIMMs need to be replaced.

- Detected memory size in MB.
- Expected memory size in MB.
- A list with one entry per DIMM slot, show the size of the DIMM in GB for each slot.

Procedure

Identifying failed DIMMs

1. If you are replacing failed DIMMs, use the service assistant or the **System Event Log** in the management GUI to obtain the sense data. This data shows the detected and expected memory sizes and the size of the DIMM in each slot.
2. Identify the column in the memory configuration table that contains the expected configuration. To do so, match the expected memory size from the error sense data to the column that has the same node canister total memory.
3. Compare the size of DIMM reported in each slot in the error data with the expected DIMM size for the slot index and node canister total memory size that is shown in the memory configuration table. For each mismatch, the DIMM must be replaced with the size of DIMM that is indicated in the table. See the Replaceable units topic for the correct FRU part number for each size of DIMM.

Removing the node canister

4. Follow “Procedure: Powering off a node” on page 58 to verify that the hosts do not lose access to data in volumes.
5. Remove the node canister, as described in “Removing and reseating a node” on page 75, and place it on a flat, level surface.
6. Remove the cover, as described in “Removing and replacing the cover of a node” on page 69.

Removing the DIMM

Important: Do not start service status on the node. Power off the node to replace a DIMM or run the rmnode command to add DIMMs.

If you are upgrading memory of a node canister as a part of an enclosure upgrade, you must remove that node from the system configuration before you start the following procedure. To do so, you can use the management GUI or the CLI.

- To use the management GUI, right-click the node canister and select **Remove**.
- To use the CLI, enter the following command, where *object_id | object_name* identifies the node canister that receives the additional memory:

```
rmnode object_id | object_name
```

If you are replacing a faulty DIMM with a new one from FRU stock, you do not need to remove the node canister from the system configuration.

7. Remove the air baffle.
8. Locate the appropriate DIMM slot.

   As Figure 39 on page 80, Figure 40 on page 80, Figure 41 on page 81, and Figure 42 on page 81 shows that the DIMM locations are identified on the system board.

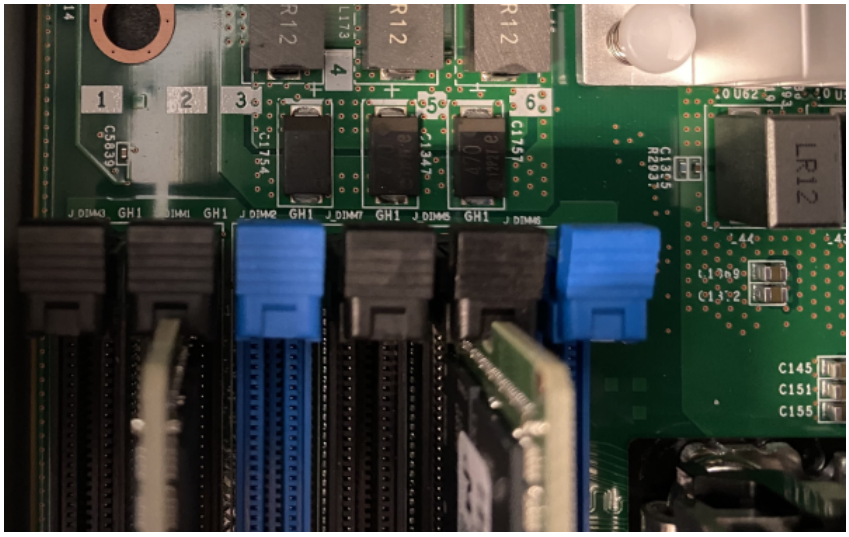


Figure 39. Identifying DIMM locations 1-6

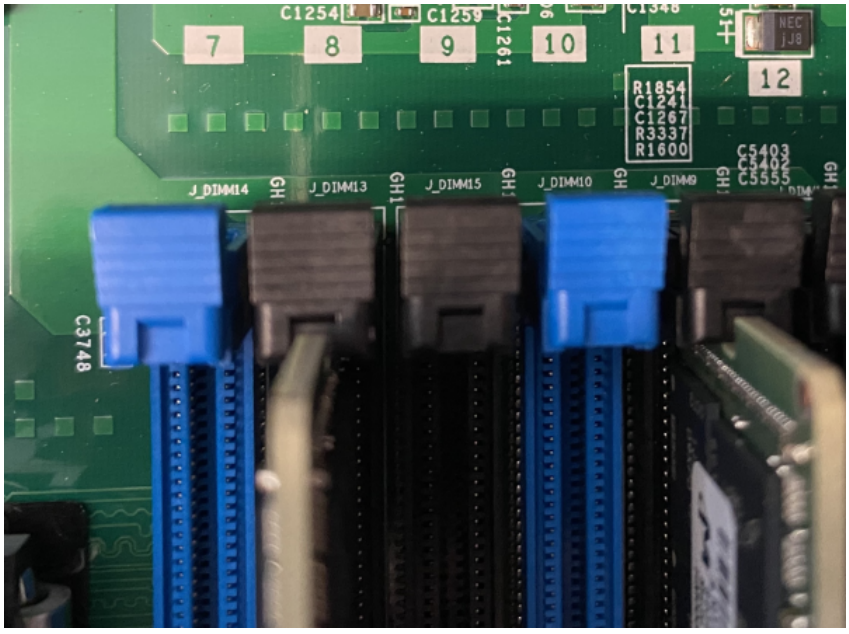


Figure 40. Identifying DIMM locations 7-12

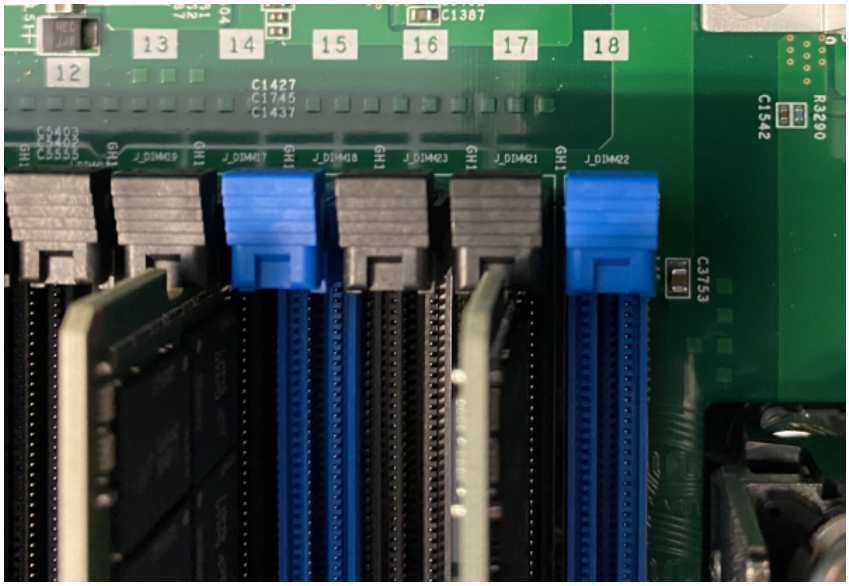


Figure 41. Identifying DIMM locations 13-18

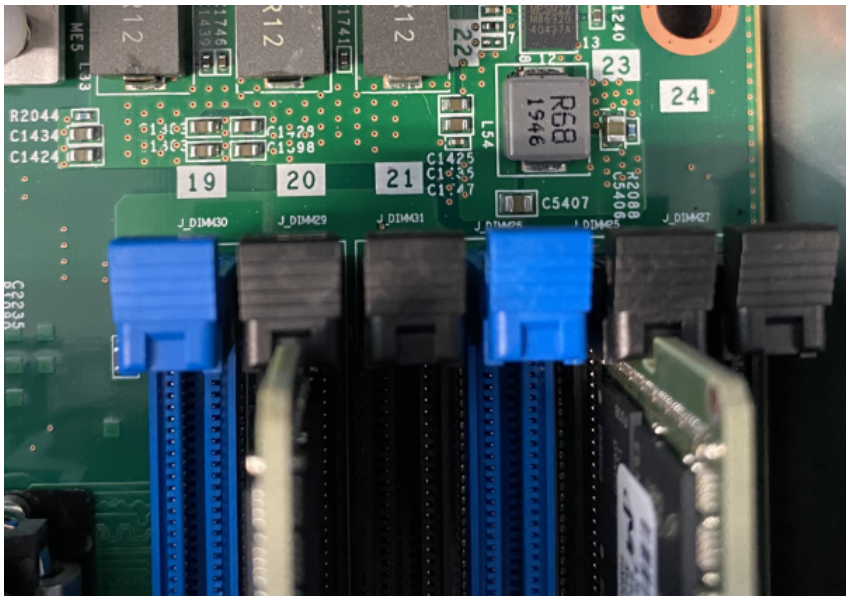


Figure 42. Identifying DIMM locations 19-24

9. Press the locking tabs on the side of the DIMM to eject it.
10. Lift the DIMM up and out of the slot.
11. If you have other tasks to complete inside the control enclosure, do those tasks now.

Replacing or adding the DIMM

Important: If you are adding memory to a node canister, you must remove that node from the system configuration before you start the following procedure. To do so, you can use the management GUI or the CLI.

- To use the management GUI, right-click the node canister and select **Remove**.
- To use the CLI, enter the following command, where *object_id | object_name* identifies the node canister that receives the additional memory:

```
rmnodecanister object_id | object_name
```

If you are replacing a faulty DIMM with a new one from FRU stock, you do not need to remove the node canister from the system configuration.

12. Touch the static-protective package that contains the new DIMM to any unpainted metal surface on the node canister. Remove the DIMM from the package.
13. Turn the DIMM so that the DIMM keys align correctly with the connector on the main board.
14. Insert the DIMM into the connector by aligning the edges of the DIMM with the slots at the ends of the DIMM connector.

    Attention: If there is a gap between the DIMM and the retaining clips, the DIMM is not correctly inserted; open the retaining clips, remove the DIMM, and then reinsert it.
15. Apply pressure on both ends of the DIMM simultaneously and firmly press the DIMM straight down into the connector. The retaining clips snap into the locked position when the DIMM is firmly seated in the connector.
16. Repeat steps "12" on page 82 through "15" on page 82 until all the new or replacement DIMMs are installed.
17. Replace the air baffle.
18. Install the cover, as described in "Removing and replacing the cover of a node" on page 69.
19. Reinsert the node canister, as described in "Removing and reseating a node" on page 75.

    If the canister does not begin to power-up, check that the canister is fully inserted into the enclosure.
20. When the node is active again, go to the management GUI and look for any unfixed events that are related to the DIMMs.

Removing and replacing a fan module:2145-SA2 and 2145-SV2

Use this procedure to replace a faulty fan module in an SAN Volume Controller node canister with a new one received from stock.

About this task

Each node canister contains five fan modules, which are accessible when the node canister is removed from the control enclosure. Each fan module contains two fans and a cable that connects the module to the system board.

Attention:

- Do not remove the node canister and faulty fan module before the replacement fan is available. After a fan module is removed, this replacement procedure must be completed within **16 minutes** to ensure that the components do not shut down due to excessive temperatures.
- 

When you replace this part, you must follow recommended procedures for handling electrostatic discharge (ESD)-sensitive devices.
- No tools are required to complete this task. Do not remove or loosen any screws.

Procedure

1. Follow "Procedure: Powering off a node" on page 58 to verify that the hosts will not lose access to data in volumes.
2. Remove the node canister, as described in "Removing and reseating a node" on page 75.
3. Remove the cover, as described in "Removing and replacing the cover of a node" on page 69.

Removing the fan module

4. Remove the replacement fan module from its packaging. Figure 43 on page 83 shows an example of a fan module.

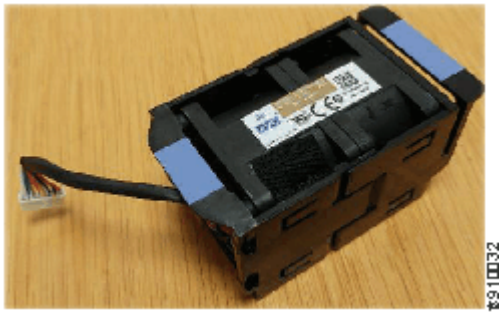


Figure 43. Replacement fan module

5. Identify the faulty fan module.

   The Event Log indicates the fan and node that are causing the error. The fix procedure in the management GUI provides the location of the node canister. As Figure 44 on page 83 shows, the fan modules are numbered 1 to 5 within the node canister.

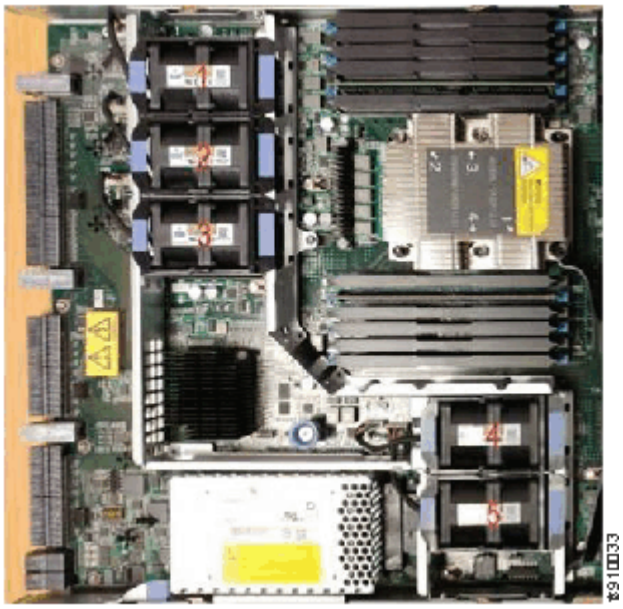


Figure 44. Location of the fans within the node canister

6. Carefully disconnect the fan cable from the system board of the node canister, as shown in Figure 45 on page 83.

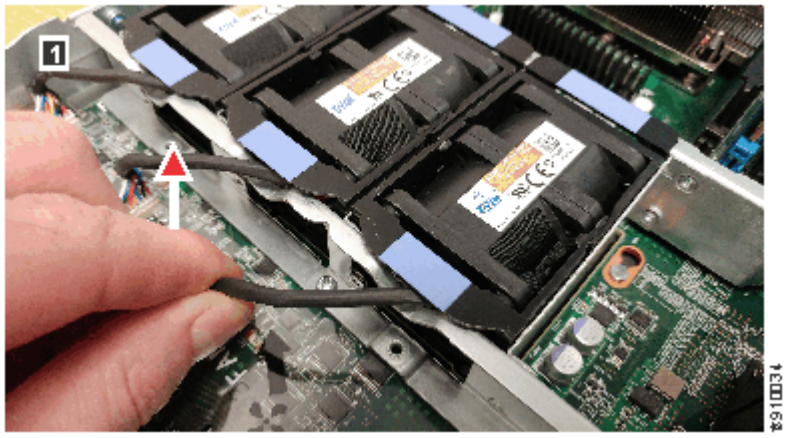


Figure 45. Removing the fan cable

7. Hold the fan module between your finger and thumb at the blue touch points. Squeeze gently and lift the fan module out of the node canister, as shows.

Replacing the fan module

8. Install the replacement fan module into the vacant fan slot. The cable must face toward the canister front. Be careful to ensure the connecting cable passes over the air dam at the V-shaped indent, as shown in Figure 46 on page 84. Ensure that the cable is not caught under the fan module.

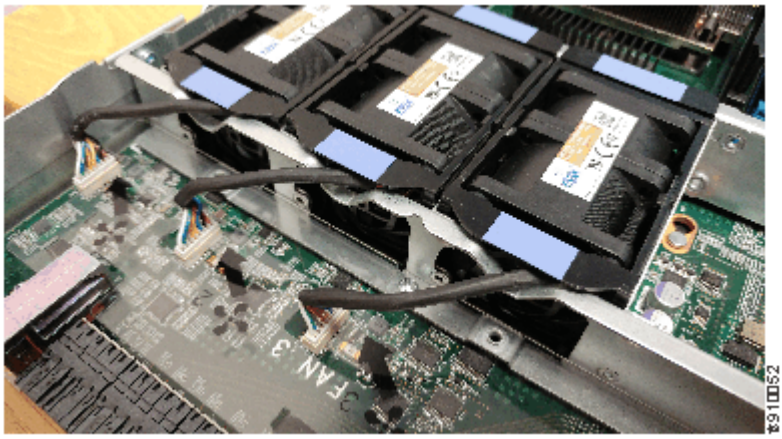


Figure 46. Aligning the cable connector

a) Check the orientation of the connector and plug the cable end into the numbered fan connector on the system board.

b) If you are installing fan module 5, carefully pass the cable through the gap in the metal divider of the battery compartment to reach the connector on the main board.

Figure 47. Aligning the cable connector for fan 5

9. Install the canister cover, as described in “Removing and replacing the cover of a node” on page 69.
10. Reinsert the node canister, as described in “Removing and reseating a node” on page 75.
11. Reconnect the power and data cables into the ports from which they were removed.
12. If the control enclosure is powered and the node canister is correctly installed, the node canister starts automatically.
    a) If the node canister is not correctly installed, remove it and repeat the installation procedure.
13. When the node canister is back online, check the Event Log for any new events that might indicate a problem with the reassembly.

Removing and replacing a power interposer

A faulty power interposer can be removed and replaced with an identical or equivalent replacement part from stock.

About this task

A power interposer forms part of each power supply unit (PSU) slot and fills the space between the PSU and the midplane. It can be removed only after its PSU is removed from the rear of the enclosure. Before you remove or replace a power interposer, review the following guidelines for this procedure:

- Ensure that you identify the correct PSU and power interposer for removal. If a PSU or a power interposer has a fault that prevents it from powering the enclosure and the functional power supply is removed, the node canisters in the control enclosure shut down.
- See "System indicators summary" on page 96 to determine when it is safe to remove the PSU and power interposer.
- Do not insert a PSU into the slot while the power interposer is removed.

  Warning: Do not operate the enclosure without a power interposer and PSU in a PSU slot for longer than **5 minutes**. Operating for longer than this period might cause the control enclosure to shut down due to overheating.
- No tools are required to complete this task. Do not remove or loosen any screws.

Procedure

1. Remove the power supply unit, as described in Removing and replacing a power supply unit.

Removing the power interposer

2. Remove the power interposer by 1 pulling on the blue handle that is located beneath the PSU slot, and then 2 sliding the power interposer out until it is clear of the node.

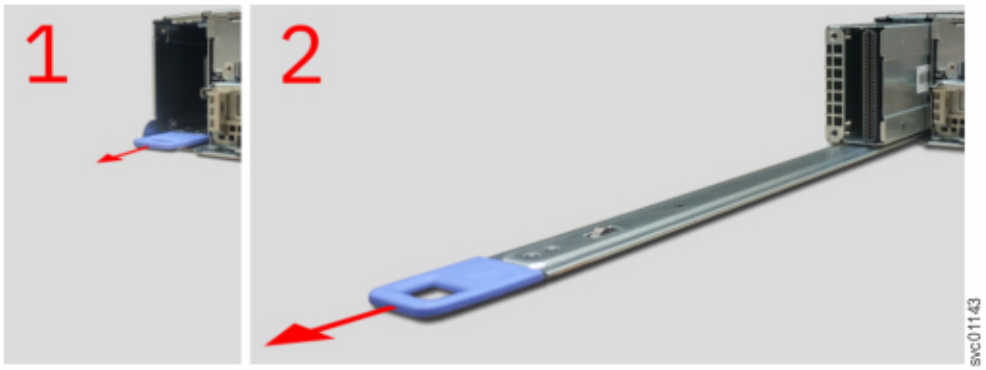


Figure 48. Removing the power interposer

3. Slide the power interposer out until it is clear of the enclosure rear, as shown in Figure 49 on page 86.

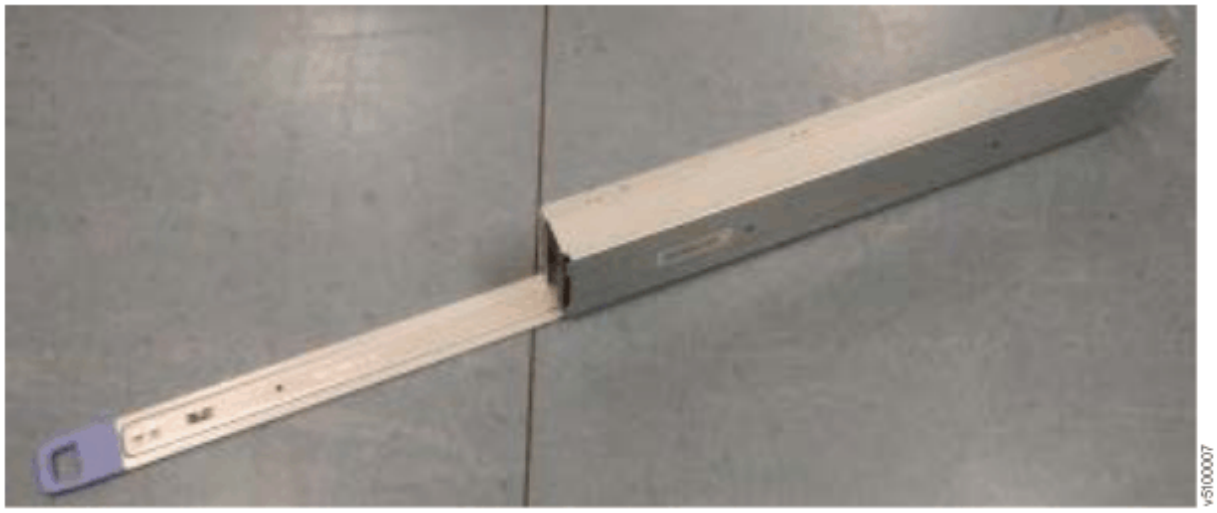


Figure 49. Removing a power interposer

Replacing the power interposer

4. Identify the correct empty power slot where the power interposer is to be installed.
5. Hold the power interposer so that the connectors are near the PSU slot, as shown in Figure 50 on page 86 (1).
6. Slide the power interposer into the PSU slot until the handle is the only part that is visible at the rear of the enclosure, as shown in Figure 50 on page 86 (2).

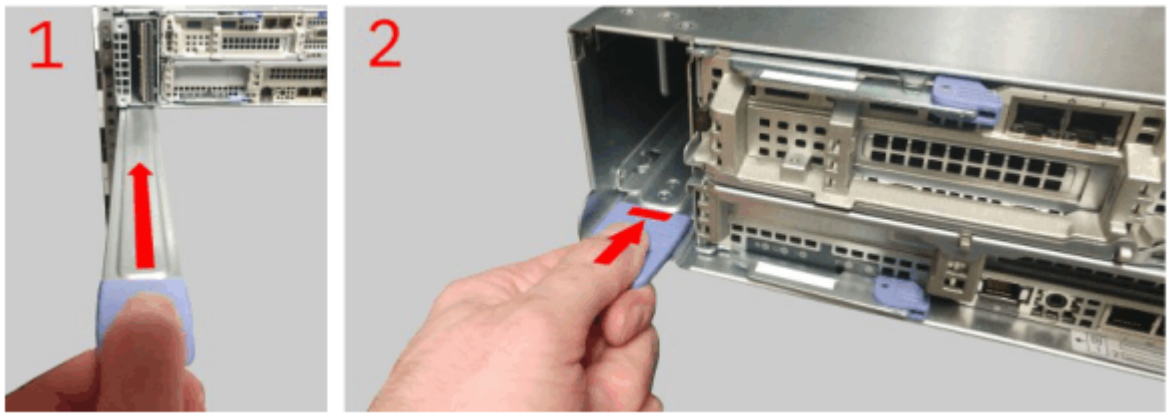


Figure 50. Inserting the new power interposer

7. Replace the PSU that was removed in step "1" on page 85. Follow the procedure that is described in Removing and replacing a power supply unit.
8. Reconnect all cables.

Removing and replacing the Trusted Platform Module

Use this procedure to remove and replace a faulty Trusted Platform Module (TPM) with a new one received from stock.

About this task

No tools are required to complete this task.

Do not remove or loosen any screws.

When you replace this part, you must follow recommended procedures for handling electrostatic discharge (ESD)-sensitive devices.

Important: If the node canister is part of a system and is the last online node, do not proceed to change the TPM in the node. Doing so prevents the node from accessing encryption keys that are stored on the node canister boot drive. Instead, complete repairs to bring another node (ideally the partner node) online in the system. The node with the replacement TPM can then obtain required encryption keys from the online node.

Procedure

1. Identify the node canister that contains the faulty TPM. Use the management GUI to identify any dependencies on the node canister. Understand the impact of any dependencies and resolve them, if necessary.

   The Event Log contains the TPM failure error. You can also locate the enclosure MTM and serial number, and the node canister serial number.
2. Label each power and cable connection or record all cables that are connected to the node canister. This information is used to reconnect the canister later.
3. Remove the cables from the node canister.
4. Follow “Removing and reseating a node” on page 75 to disconnect and remove the node canister with the faulty TPM.
5. Remove the cover of the node canister, as described in “Removing and replacing the cover of a node” on page 69.

Removing the TPM

6. Locate the TPM, which is between the boot drive and CMOS battery, as shown in Figure 51 on page 87.

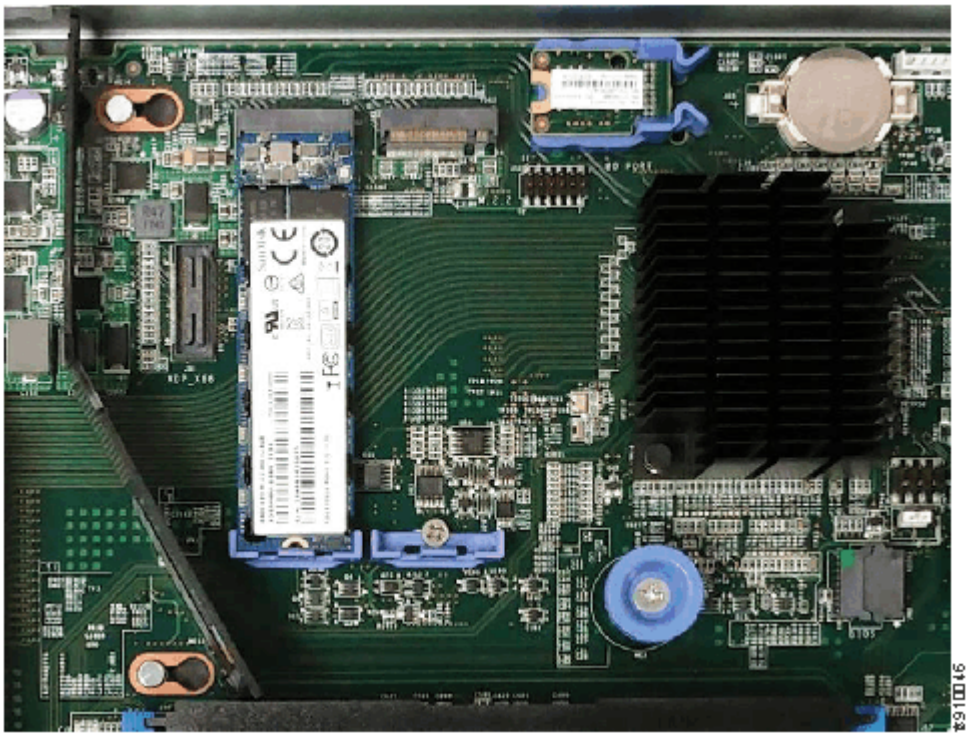


Figure 51. Locating the TPM

7. Insert your finger tip between the latches and hold the TPM between your thumb and finger, as shown in Figure 52 on page 88.

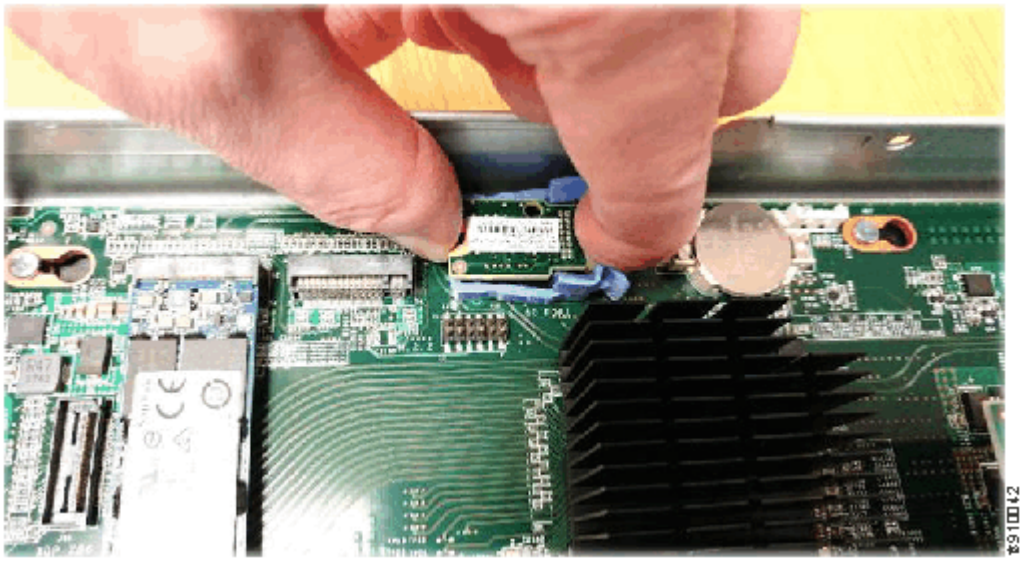


Figure 52. Removing the TPM

8. Remove the TPM by pulling it upwards from its socket.

Replacing the TPM and boot drives

9. Touch the replacement TPM packaging onto a metal area of the case; then, remove the replacement TPM from its package.
10. Align the replacement TPM over the socket and firmly press it straight down into the socket.
11. Install the node canister lid, as described in "Removing and replacing the cover of a node" on page 69.
12. Reinstall the node canister, as described in "Removing and reseating a node" on page 75.
13. Reconnect the power and networking cables to the node canister, ensuring the cables go into the same ports from which they were removed in step "4" on page 87.
14. When the node canister is back online, check the Event Log for new events, particularly events that relate to TPM and encryption failures.

Removing and replacing a boot drive

Use this procedure to remove and replace a faulty boot drive from a node canister.

About this task

The IBM Storage FlashSystem node canister has dual boot drives. The system can run if one boot drive fails. Before you remove or power off the node, verify whether any volumes depend on the enclosure.

Notes:

- If all boot drives in a node canister are replaced with new drives, then some Ethernet configuration of the node will be lost, such as the service IP and node IP. Use the Service Assistant Tool to reset the service IP and node IP if needed. (A node IP is only needed if the node must communicate with other nodes by using RDMA over Ethernet).
- No tools are required to complete this task. Do not remove or loosen any screws while you are completing this procedure.

Procedure

1. Read the safety information.

2. Review the Event Log to identify the faulty boot drive and the node canister in which it resides.
3. Record the drive number and FRU Identity value of the drive.
4. Use the management GUI to determine the status of the node canister.
5. Record which cables are plugged into the specific ports on the rear of the node canister. The cables must be inserted back into the same ports after the replacement is complete; otherwise, the system cannot function properly.
6. Disconnect the data and power cables that are connected to the node canister.

Removing the boot drive

7. Remove the node canister, as described in “Removing and reseating a node” on page 75.
8. Remove the cover, as described in “Removing and replacing the cover of a node” on page 69.
9. Locate the boot drive on the system board.

   For example, Figure 53 on page 89 shows a system with one boot drive in boot drive slot 1.

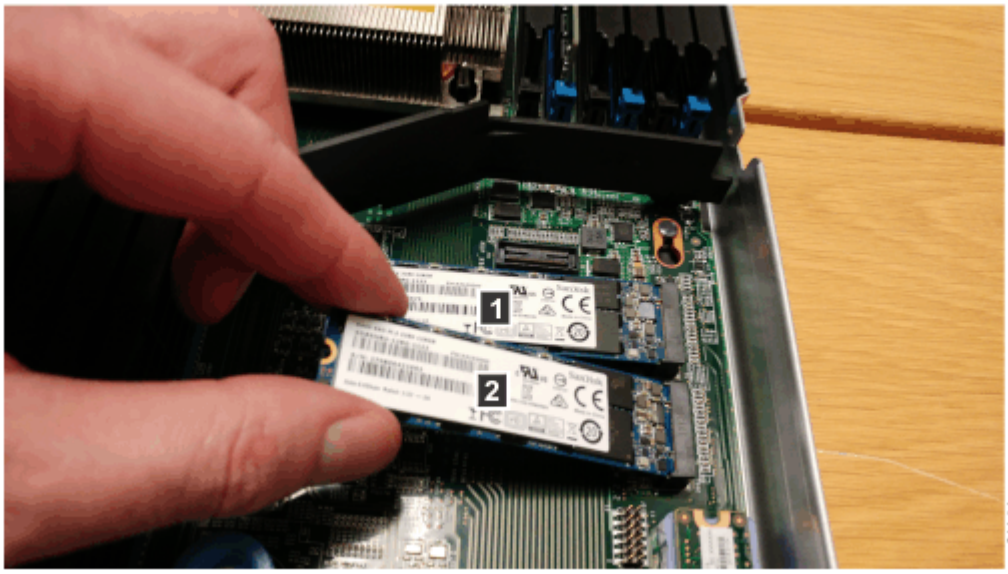


Figure 53. Location of the boot drives

10. Gently open the blue friction latch, as shown in Figure 54 on page 89. Apply gentle pressure; do not force the latch open.

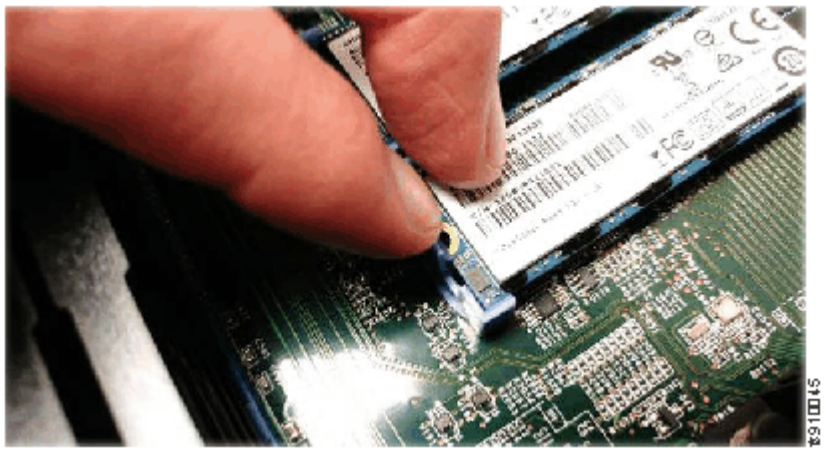


Figure 54. Removing the boot drive

When released, the boot drive pops up approximately 30 degrees. You can then carefully slide it out of connector.

Replacing the boot drive

11. Hold the new boot drive from slot 2 at a 25 degree angle, as shown in Figure 55 on page 90. Then, gently slide the drive into the connector until it stops.

Figure 55. Replacing the boot drive

The contacts on the end of the boot drive will be fully covered. The boot drive is then "hinged" at the connector at one end and pressed down behind a friction clip at the other end.

12. Install the node canister cover, as described in "Removing and replacing the cover of a node" on page 69.
13. Reinsert the node canister, as described in "Removing and reseating a node" on page 75.
14. Reconnect the power and connection cables to the node canister, ensuring that each cable goes into the same port from which it was removed.
15. Log into the service assistant GUI or use management GUI or service CLI to place the node in service state to check the status of the node canister.

Removing and replacing a midplane assembly

A trained service provider can use this procedure to replace a faulty control enclosure midplane with a new one received from stock. Ensure that your control enclosure midplane assembly is replaced only by a trained service provider.

About this task

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 all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- Connect any equipment that will be attached to this product to properly wired outlets.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- 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 ontinuity, 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.
- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.
- Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.

  To disconnect:

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

  To connect:

  1. Turn off everything (unless instructed otherwise).
  2. Attach all cables to the devices.
  3. Attach the signal cables to the connectors.
  4. Attach the power cords to the outlets.
  5. Turn on the devices.
-  Sharp edges, corners and joints might be present in and around the system. Use care when handling equipment to avoid cuts, scrapes and pinching. (D005)

Attention:

- The control enclosure midplane assembly must be replaced only by a trained service provider. Complete this procedure only if instructed to do so by a service action or the IBM Support center.
- If you have a single control enclosure, this procedure requires that you shut down your system to replace the control enclosure midplane assembly. If you have more than one control enclosure, part of the system can continue to run. However, you lose access to the volumes that are on the affected I/O group. You also lose access to any volumes that are in other I/O groups that depend on the drives that are in the affected I/O group. If the system is still doing I/O requests in all the I/O groups, schedule the replacement during a maintenance period or other time when the I/O can be stopped.
- When you replace hardware components in the back of the enclosure, ensure that you do not inadvertently disturb or remove cables that you are not instructed to remove.
- Ensure that you are aware of procedures for handling static-sensitive devices before you remove the enclosure.

Note: Remote copy services including HyperSwap, Metro Mirror, Global Mirror, and volume mobility are supported till software version 8.7.0 only. These services are replaced with policy-based high availability and policy-based replication from 8.7.1 and higher versions.

Procedure

1. Log in to the service assistant on one of the node canisters in the control enclosure. In the **Node Details** panel, select the **Location** tab. Note the following values for the enclosure in Table 23 on page 92. This information might be needed later.

Table 23. Recording control enclosure information

Item	Value
WWNN 1	
WWNN 2	
Machine type and model	
Serial number	

2. If the control enclosure is still active, stop host I/O, FlashCopy®, Global Mirror, or Metro Mirror activities on all the volumes that depend on the control enclosure.

   This step applies to all I/O group volumes that are managed by this control enclosure. It also applies to any volumes in other I/O groups that depend on the drives in the affected I/O group.

3. Complete "Procedure: Powering off a node" on page 58 for the node canister that requires the midplane assembly replacement.

Removing the midplane assembly

4. Disconnect both power cables from the rear of the control enclosure.
5. Write down the port and cable connections before you disconnect all cables from the ports rear of the control enclosure. Use the following tables to record the information for each node canister.

   Notes:

   a. Depending on your system configuration, some PCIe adapter ports and Ethernet ports might not be connected.

   b. The orientation, slot numbers, and port numbers of node canister 1 (top canister) differ from node canister 2 (bottom canister).

Table 24. Summary of node canister 1 PCIe slots and port connections

PCIe slot 2				PCIe slot 1			
Port 4	**Port 3**	**Port 2**	**Port 1**	**Port 4**	**Port 3**	**Port 2**	**Port 1**

Table 25 on page 92 summarizes the Ethernet ports and possible connections for node canister 1.

Table 25. Summary of node canister 1 Ethernet ports

Port 4	Port 3	Port 2	Port 1

Table 26 on page 92 summarizes the Ethernet ports and possible connections for node canister 2.

Table 26. Summary of node canister 2 Ethernet ports

Port 1	Port 2	Port 3	Port 4

6. Remove the two power supplies from the control enclosure.

7. Remove the two power interposers from the control enclosure, as described in “Removing and replacing a power interposer” on page 85.
8. Remove the node canisters from the control enclosure, as described in “Removing and reseating a node” on page 75. Label them to indicate what canister came from each canister slot.
9. Remove the end caps from the control enclosure, as described in “Removing and replacing the enclosure end caps” on page 59.
10. Remove the screws from the front of the control enclosure to free the enclosure from the rack.

    Figure 56 on page 93 shows the location of the screws. This figure shows two black M5 screws and two silver screws in the rack. However, some racks might use four black M5 screws.

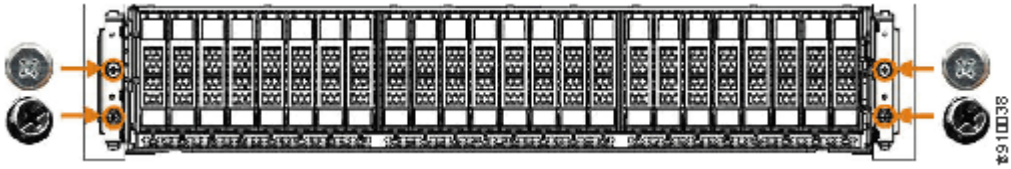


Figure 56. Location of the screws on the front of the enclosure

11. Carefully slide the control enclosure from the rack.
12. Place the control enclosure on a work surface, so that the underside of the enclosure faces upward, and the enclosure front is facing toward you.
13. Remove the nine screws from under the front of the enclosure (see Figure 57 on page 93).

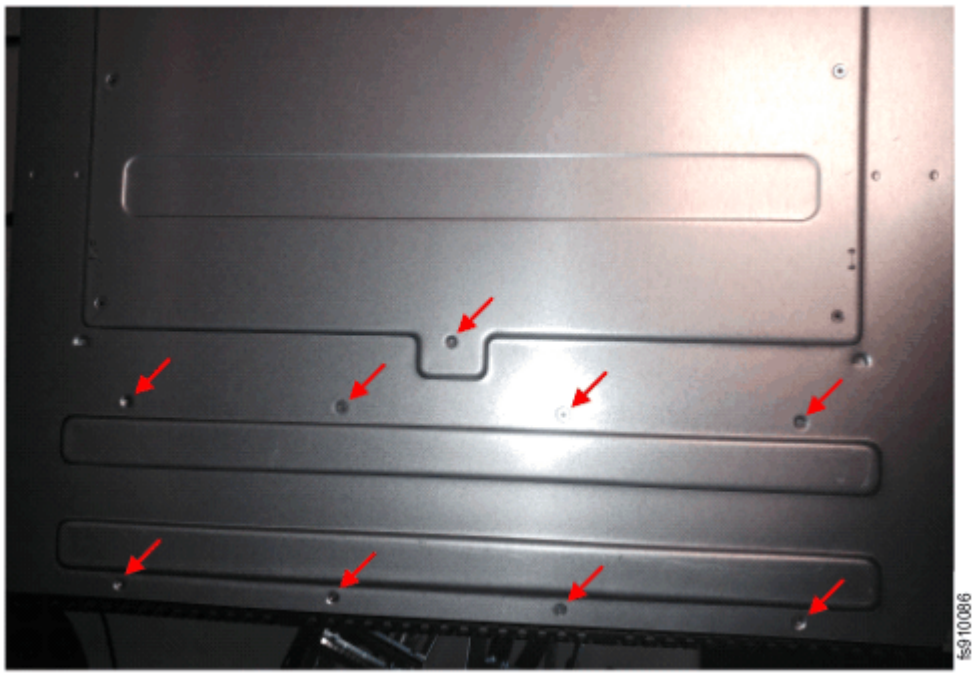


Figure 57. Location of the screws on the underside of the control enclosure

14. Turn the control enclosure over so that the top of the enclosure is facing upward, and the front is facing towards you.
15. Remove the five screws from the top of the enclosure.
16. Remove the four screws on the right side that secure the midplane assembly to the enclosure.
17. Remove the four screws on the left side that secure the midplane assembly to the enclosure.
18. Remove the midplane assembly from the chassis by rotating up the midplane assembly to about 45°. Then, withdraw the midplane assembly from the front of the enclosure.

    Figure 58 on page 94 shows the front of the enclosure with the midplane assembly removed; the screw locations are also shown.

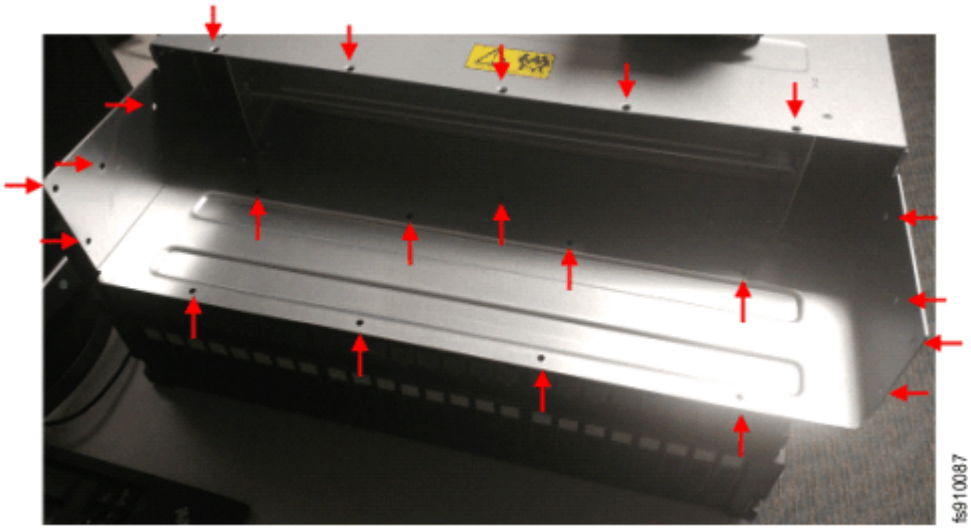


Figure 58. Midplane assembly removed from the control enclosure

Replacing the midplane assembly

19. Unpack the replacement midplane assembly. Locate the pack of replacement screws that comes in the package. The package includes 24 screws, but only 22 screws (shown in Figure 59 on page 94) are used to secure the enclosure chassis.

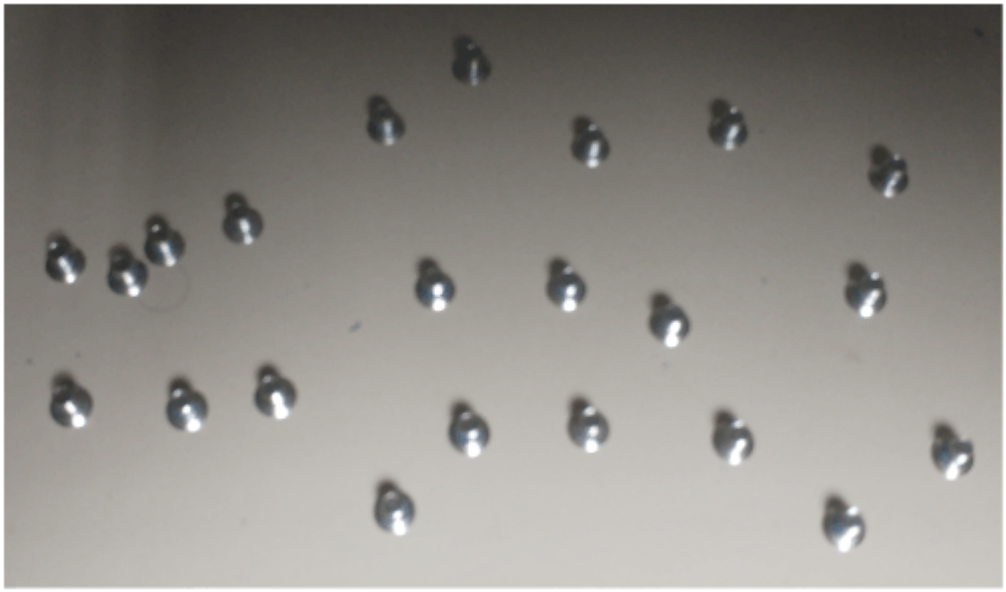


Figure 59. Midplane assembly screws

20. Hold the midplane assembly the correct way up; ensure the drive bays face toward you.
21. Insert the midplane assembly into the front of the enclosure at 45° angle. Then, rotate it down into the front of the enclosure so that the screw holes in the midplane assembly align with the screw holes in the enclosure.
22. Secure the midplane assembly to the enclosure chassis on the right and left sides by using four screws each side to replace the screws that were removed in steps “16” on page 93 and “17” on page 93.
23. Secure the five screws that were removed in step “15” on page 93 to the top of the enclosure chassis.
24. Turn over the bottom of the enclosure to face upward; then, insert the nine screws on the bottom of the enclosure that were removed in step “13” on page 93.

25. Reinstall the control enclosure in the rack cabinet, securing it with the screws that were removed at step “10” on page 93.
26. Reinstall the end caps at the front of the enclosure, as described in “Removing and replacing the enclosure end caps” on page 59.
27. Reinstall the node canisters into the same canister slots from which they were removed, as described in “Removing and reseating a node” on page 75.
28. Reinstall the power interposers, as described in “Removing and replacing a power interposer” on page 85.
29. Reinstall the two power supplies, as described in “Removing and replacing a power supply unit:2145-SV2 and 2145-SA2” on page 62.
30. Reconnect the data cables to the same connectors at the rear of the control enclosure. Use the data that you collected in step “5” on page 92.
31. Reconnect power to the control enclosure.

    The node canisters restart. The yellow fault LED indicators are on because the new enclosure was not set with the identity of the old enclosure. The node canisters log node error 504 to report that they are in the wrong location. In the system Event log, the error code is 1192.
32. Use an **ssh** client to log in as the superuser to the service IP address of either node canister. Then, access the service assistant CLI.

    Note: If you replaced a node canister, log in to the node canisfs9100_rplc_cntrl_enc_midplane/remove_drivester that was not replaced.
33. Enter the **satask chvpd -replacemidplane** command.

    If the command is successful, the node canister modifies the VPD data. You are disconnected from the CLI as both node canisters reboot.

    If the **satask chvpd -replacemidplane** command fails, complete the following steps:

    a) Connect to the Service Assistant Tool of the node canister. Go to `http://service_ip/service` or connect to the technician port of the node canister.

    If you replaced a node canister at the same time as the midplane assembly, connect to the node canister that was not replaced.

    b) In the Service Assistant tool, use the **Configure Enclosure** panel.

    c) Select to use the node copy of the data that you recorded in step “1” on page 92 (WWNN 1, WWNN 2, machine type and model, and serial number).

    If the node copy for any of the values is not available, select the **Specify** option for each missing value. Then, enter the value that you recorded at step “1” on page 92 .

    d) After you specify all values in the **Enclosure Information** panel, click **Modify**.

    The node canisters restart. When the restart finishes, the system comes online with both node canisters online.

    Important:

    - Do not reset the system ID.
    - After the replacement midplane is modified, it cannot be used as a replacement part for a different enclosure. Do **not** return a modified midplane assembly to FRU stock.
34. Wait for the green status LED of both node canisters to light and indicate that the node canisters are active in the system.

Note: Customers can complete the following tasks after the new midplane is installed and the control enclosure is operating again.

35. Use the management GUI to check the status of all volumes and physical storage to ensure that the system is operating normally.
36. Go to **Monitoring** > **Events** to check the Event Log for other events or errors.

37. Restart the host application and any FlashCopy, Global Mirror, or Metro Mirror activities that were stopped.

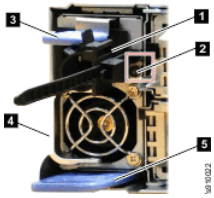
System indicators summary

An system contains several control and expansion enclosures, each of which has LED indicators for identification and fault diagnosis. The details of these indicators are covered in the following topics.

Note: For optimal usage, configure call home and event notifications rather than using the LED indicators as the primary means of fault diagnosis. As a best practice, configure call home and event notifications to precisely detect the fault and failure of the system.

Power supply indicators

IBM Storage FlashSystem power supplies have three LED indicators to convey information about the state of the supply.



1 Cable retention clip
2 LED indicator
3 Power supply release tab
4 Power supply handle
5 Power interposer release tab

Figure 60. Power supply details

Table 27 on page 96 describes the meaning of each indicator.

Table 27. Summary of LED indicators for the PSUs

Indicator	Color	Meaning
Power supply status	Green	• Off - The enclosure is not receiving AC power; ensure that the power is turned on. • On - The power supply is receiving AC power. No action is required. • Slow flash - AC is present. However, check the Event Log for errors, such as a possible fan failure. • Flashing - The power supply firmware is being updated. No actions are required; do not remove AC power.
	Amber	A fault needs to be resolved. • Slow flash - The power supply is on, but needs maintenance. Check the Event Log for errors and events where the power supply continues to operate, such as high temperature, high power, high current, or slow fan. • On - AC power is lost or the cable is unplugged, but power is still being supplied from the second power supply. There might also be a critical fault in the power supply that causes it to shut down (such as a fan failure). Check that the AC power cable is plugged and power is provided. If the amber LED persists, check the Event Log.

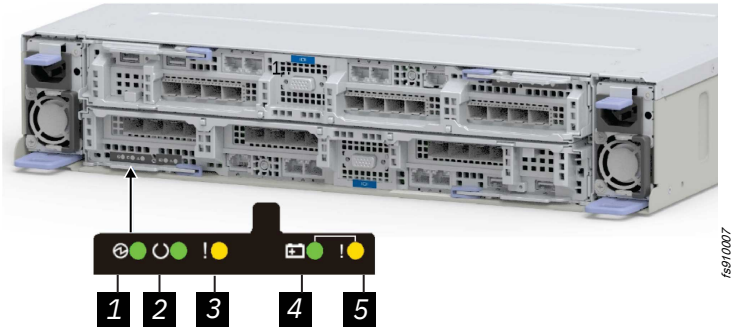
Node front and rear panel indicators: 2145-SV2 and 2145-SA2

Each node canister within the control enclosure has indicators that are visible from the back of the enclosure..

Figure 61 on page 97 shows the back of a control enclosure. Each node canister has its own set of indicators that identify the status of the node canister and its battery.

1. Node canister power LED
2. Node canister status LED
3. Node canister fault LED
4. Battery status
5. Battery fault

Figure 61. Rear view of a control enclosure



Node front panel indicators

Labels and indicators on the left end cap of the node provide information about the node status. When multiple nodes are in a rack, the serial number is used to identify the node that is being referenced.

Figure 62. Left node end cap

Table 28 on page 97 summarizes the possible meanings of each indicator.

Table 28. Summary of LED Indicators

Indicator Name	Color	Symbol	Meaning
Node operational	Green		• Off - The node isn't receiving AC power or it's running on battery. • Slow flash - The main CPU isn't running or the canister is in X86 standby mode. • On - The node is running (not in standby mode)
Identify node	Blue		• Off - Default • On - The light identifies the node. The LED can be turned on or off by the **`chenclosure`** command.

Table 28. Summary of LED Indicators (continued)			
Indicator Name	**Color**	**Symbol**	**Meaning**
Node fault	Amber	!	• Off - The node is in candidate state or active state. • On – The node is in service state, or there is an error that is preventing the software from loading. – A canister, PSU, or fan assembly has an error. – Insufficient battery power to start the system. The system will start once the battery has charged.

Node rear panel indicators

Figure 61 on page 97 shows the location of the LED indicators and Table 29 on page 98 summarizes the meaning and values of each indicator.

Table 29. Node canister status LED indicators			
Name	**Color**	**State**	**Meaning**
Power	Green	Off	No power is available or power is coming from the battery.
		Slow flash	Power is available but the main processor is not running; this state is called *standby mode*.
		Fast flash	In self-test.
		On	Power is available and the system code is running.
Status	Green	Off	The system code has not started. The system is off, in standby mode, or in self-test.
		Flash	The canister is in candidate or service state. It is not completing I/O operations. It is safe to remove the node.
		Fast flashing	The canister is dumping hardened data.
		On	The canister is active, able to complete I/O operations, or starting. The node is part of a cluster.

Table 29. Node canister status LED indicators (continued)			
Name	**Color**	**State**	**Meaning**
Node canister fault	Amber	Off	The canister can function as an active member of the system. If the node canister has a problem, it is not severe enough to stop the node canister from completing I/O operations.
		Flash	The canister is being identified. There might also be a fault condition.
		On	The node is in service state or an error might be stopping the system code from starting. The node canister cannot become active in the system until the problem is resolved. Determine the cause of the error before you replace the node canister. The error might be due to insufficient battery charge. To resolve this error, wait for the battery to charge.

Battery status LED indicators

Each node canister also has a battery and two LED indicators for the battery status. If an AC power failure occurs, the battery provides power to the node canister as it stores cache and system data to an internal drive. This process is known as a *fire hose dump*. Figure 61 on page 97 shows the location of the battery indicators and Table 30 on page 100 describes the function and possible values for each indicator.

Table 30. Battery status LED indicators			
Name	**Color**	**State**	**Meaning**
Battery status	Green	Off	The battery is not available for use. The battery might be missing or a battery fault was detected.
		Fast flash	The battery has insufficient charge to complete a "fire hose" dump.
		Flash	The battery has sufficient charge to complete one "fire hose" dump.
		On	The battery has sufficient charge to complete at least two "fire hose" dumps.
Battery fault	Amber	Off	No fault. An exception to this would be where a battery has insufficient charge to complete a single "fire hose" dump.
		On	A battery fault was detected.

Node port indicators

Each Node canister Ethernet port has a pair of green LEDs with the following meanings. Table 31 on page 100 describes the LED indicators.

Table 31. Onboard Ethernet port LEDs				
Name	**Symbol**	**Color**	**State**	**Meaning**
Link speed	None	Green	OFF	No link connection or the link is connected at less than 1 Gbps.
			ON	There is a 1 Gbps link connection to a remote device.
Activity	None	Green	OFF	No activity.
			FLASHING	Activity on link.

Network adapter port indicators

A control enclosure can support several types of optional host interface adapters. Each host interface adapter has its own Light-Emitting Diode (LED) indicators to help with status and fault diagnosis, as documented in the following sections:

Fibre Channel port indicators

The system supports dual-port and quad-port fibre channel adapters and the status is shown by the indicators.

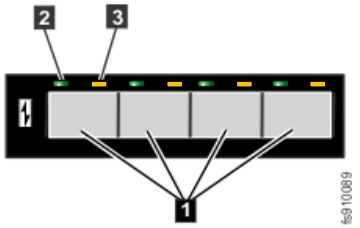


Figure 63. Fibre Channel ports and indicators

1 Fibre Channel port (4-port card)
2 Link-state LED (one for each port)
3 Speed-state LED (one for each port)

The following table lists the possible link status values for the Fibre Channel LEDs.

Table 32. Link status values for Fibre Channel adapter LEDs

Green LED	Amber LED	Meaning
Off	Off	One of the following situations is in effect: • The port is not configured. • The port is not active.
Off	On	The port is configured, but the link is not detected at the transport layer. This situation is the result of the port not being connected or of a failed link negotiation with the switch.
On	Off	The link is up and running at the expected port speed. This display does not imply logical connectivity, that is completion of FLOGI or FIP.
On	On	The link is up but running at a degraded speed.

Dual-port 25 Gbps Ethernet host interface adapter ports and indicators

Each port on the dual-port 25 Gbps Ethernet host interface adapter has one bi-color LED that indicates the status of the link and port. The location of the LEDs varies depending on the type of adapter.

Figure 64 on page 101 shows the front of a dual-port 25 Gbps Ethernet (RoCE) host interface adapter.

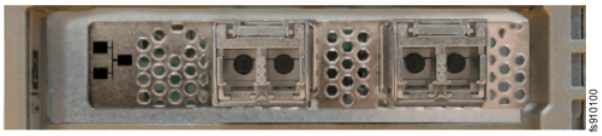


Figure 64. Dual-port 25 Gbps Ethernet host interface adapter ports and LEDs (RoCE)

The LED states and their descriptions are explained in Table 33 on page 102.

Table 33. LED indicators for dual-port 25 Gbps Ethernet host interface adapter (RoCE)		
Color	**State**	**Description**
None	Off	The port is not active.
Green	Solid	The port has a valid link with no active traffic.
Green	Blinking	The port has a valid link with active traffic.
Yellow	Blinking	The link has a problem.

Figure 65 on page 102 shows the 25 Gbps Ethernet (iWARP) host interface adapter. Each port has a single LED that indicates the status of the port and link.

Figure 65. Dual-port 25 Gbps Ethernet host interface adapter ports and LEDs (iWARP)

Table 34 on page 102 summarizes the possible values of the LEDs on the 25 Gbps Ethernet host interface adapter (iWARP).

Table 34. Table 2. LED indicators for dual-port 25 Gbps Ethernet host interface adapter (iWARP)		
Color	**State**	**Description**
Off	Off	The ports and links are not active.
Green	Solid	The ports have a valid link.

Replaceable units

Each system consists of several replaceable units, such as cables, SFP transceivers, canisters, power supply units, batteries, drives, and enclosure chassis. The part numbers vary depending on the model of the control enclosure or expansion enclosure.

Node replaceable units

All IBM SAN Volume Controller 2147-SV2 and IBM SAN Volume Controller 2147-SA2 parts are field-replaceable units (FRUs), which must be replaced by IBM® trained service technicians. There are no customer-replaceable parts (CRUs).

SAN Volume Controller 2145-SV2 and 2145-SA2 replaceable unit summarizes the replaceable unit for the system.

Table 35. SAN Volume Controller 2145-SV2 and 2145-SA2 replaceable unit	
Part Number	**Description**
00RY190	16 Gbps Fibre Channel (FC) short-wave (SW) SFP
00RY191	16 Gbps Fibre Channel (FC) long-wave (LW) SFP
00RY543	CR 2032 coin cell
01FT777	25 Gbps SFP28 (RoCE)
01LJ207	32 GB DDR4 DIMM
01NN193	25 Gbps SFP28 (iWARP)
01YM283	25 Gbps dual-port ISCSI (RoCE) adapter

Table 35. SAN Volume Controller 2145-SV2 and 2145-SA2 replaceable unit (continued)	
Part Number	**Description**
01YM285	25 Gbps dual-port ISCSI (iWARP) adapter
01YM314	Power interposer
01YM315	TPM
01YM317	Rail kit (with screws and alternative pins for square hole racks)
01YM333	Quad-port 16 Gbps FC adapter
01YM789	DIMM Filler
01YM887	BBU pack
01YM898	Quad-port 32 Gbps FC adapter
01YM902	PCIe riser card with bracket assembly
01YM942	32 Gbps FC SW SFP
02PX560	32 Gbps FC LW SFP
02YC307	Node canister for 2145-SA2 contains two 8-core Cascade Lake CPUs and CR 2032 power cell.
02YC308	Node canister for 2145-SV2 contains two 16-core Cascade Lake CPUs and CR 2032 power cell.
02YC309	EMC filler
02YC310	IBM front fascia
02YC311	Filler (dummy) canister, which is installed in the upper canister slot of the control enclosure.
02YC312	Fan module
02YC313	Fan flaps
02YC315	240 GB M.2 SSD
02YC415	2000 W AC PSU
02YJ555	Generic fascia
02YJ905	Control enclosure midplane assembly
15R8848	25 m OM3 fiber cable (LC)
39M5068	Power cord - Argentina
39M5102	Power cord - Australia / New Zealand
39M5123	Power cord - Europe / Africa
39M5130	Power cord - Denmark
39M5144	Power cord - South Africa
39M5151	Power cord - UK /EMEA
39M5158	Power cord - Switzerland
39M5165	Power cord - Chile / Italy
39M5172	Power cord - Israel

Table 35. SAN Volume Controller 2145-SV2 and 2145-SA2 replaceable unit (continued)	
Part Number	**Description**
39M5206	Power cord - China
39M5219	Power cord - Korea
39M5226	Power cord - India
39M5240	Power cord - Brazil
39M5392	Power cord - C13-I/C20
39M5508	Power cord - C13-E/C14
41V2120	10 m OM3 fiber cable (LC)
45D4773	1 m OM3 fiber cable (LC)
45D4774	5 m OM3 fiber cable (LC)