IBM System Storage SAN Volume Controller

# Models 2145-8F2 and 2145-8F4 Hardware Installation Guide

*Version 4.3.1*

GC27-2221-00

IBM System Storage SAN Volume Controller

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*Version 4.3.1*

GC27-2221-00

**Note:**
Before using this information and the product it supports, read the information in **Safety and environmental notices** and **Notices**.

This edition applies to the IBM System Storage SAN Volume Controller Models 2145-8F2 and 2145-8F4 running version 4, release 3, modification 1 of IBM System Storage SAN Volume Controller software and to all subsequent releases and modifications until otherwise indicated in new editions. The information in this guide was formerly provided in GC27-2132-02.

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# Safety and environmental notices

Review the multilingual safety notices for the IBM® System Storage™ SAN Volume Controller, redundant ac-power switch, and the uninterruptible power supply before you install and use the product.

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

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 *IBM Systems Safety Notices* with the user publications that were provided with the SAN Volume Controller hardware.
3. Find the matching identification number in the *IBM Systems Safety Notices*. Then review the topics concerning the safety notices to ensure that you are in compliance.
4. Optionally, read the multilingual safety instructions on the SAN Volume Controller Web site. Go to www.ibm.com/storage/support/2145, click the current product documentation link, and then click **Multi-language**.

## Inspecting the SAN Volume Controller for unsafe conditions

Use caution when 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 start the safety inspection, make sure the power is off, and the power cord is disconnected.

Each machine has required safety items installed to protect users and IBM service personnel from injury. This guide addresses only those items.

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

If any unsafe conditions are present, you must determine how serious the apparent hazard could 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.

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**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.

Perform the following steps to inspect each SAN Volume Controller node for unsafe conditions. If necessary, see any suitable safety publications.

1. Turn off the SAN Volume Controller and disconnect the power cord.
2. Check the frame for damage (loose, broken, or sharp edges).
3. Check the power cables 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 machine. Use good judgment about the safety of any such changes.
5. Check inside the SAN Volume Controller 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 have not been removed or disturbed.
9. Before connecting the SAN Volume Controller to the storage area network (SAN), check the grounding.

## External machine check

Ensure that you perform an external machine check before you install the SAN Volume Controller.

Perform the following steps to conduct an external machine check:

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. If the SAN Volume Controller is not installed in a rack cabinet, check for loose or broken feet.
4. Check the power cord for damage.
5. Check the external signal cable for damage.
6. Check the cover for sharp edges, damage, or alterations that expose the internal parts of the device.
7. Correct any problems that you find.

## Internal machine checks

Ensure that you perform an internal machine check before you install the SAN Volume Controller.

Perform the following steps to conduct the internal machine check:

1. Check for any non-IBM changes that might have been made to the machine. If any are present, obtain the "Non-IBM Alteration Attachment Survey," form number R009, from the IBM branch office. Complete the form and return it to the branch office.
2. Check the condition of the inside of the machine 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.

## Checking the grounding of a SAN Volume Controller, the uninterruptible power supply, and the redundant ac-power switch

Ensure that you understand how to check the grounding of a SAN Volume Controller, the uninterruptible power supply, and the optional redundant ac power feature.

Ensure that you understand how to check the grounding of a SAN Volume Controller, the uninterruptible power supply, and the optional redundant ac-power switch.

Perform the following steps to test the grounding of a SAN Volume Controller node. Before you start, confirm that you know the SAN Volume Controller model type and whether you are using redundant ac power. Note the location of the signal cables that are attached to the SAN Volume Controller.

When you are asked to test the grounding continuity, use your local procedures to perform the test. The test is successful if the measured resistance is 0.1 ohm or less.

**Attention:** Some electrical circuits can be damaged if the external signal cables are present at the SAN Volume Controller while it is undergoing a grounding test.

1. Ensure that the SAN Volume Controller node is powered off. See "MAP 5350: Powering off a SAN Volume Controller node" in the *IBM System Storage SAN Volume Controller Service Guide*.
2. Disconnect all signal cables from the SAN Volume Controller node, which includes the following cables:
   - The fibre-channel cables
   - The Ethernet cable
   - The serial cable that is connected to the uninterruptible power supply.
3. Disconnect all signal cables from the uninterruptible power supply.
4. If redundant ac power is not used, disconnect the uninterruptible power supply power cable from the site power distribution unit.
5. If redundant ac power is used, turn off any SAN Volume Controller that is being supplied from the redundant ac-power switch, and remove the power cable to this system from the redundant ac-power switch.
6. If redundant ac power is used, disconnect ***both*** input power leads from the site power distribution units.
7. If redundant ac power is not used, test the grounding continuity between a conductive area on the SAN Volume Controller frame and the ground pin on the plug of the uninterruptible power supply input-power cable.
8. If redundant ac power is used, test the grounding continuity between a conductive area on the SAN Volume Controller frame and the ground pin on

the plug of the main power cable of the redundant ac-power switch. If the test is successful, test the grounding continuity between a conductive area on the SAN Volume Controller frame and the ground pin on the plug of the backup power cable of the redundant ac-power switch. Both tests must be successful.

9. After you have completed testing the grounding continuity, perform one of the following procedures, depending on the outcome of the test.
   - If the test is successful, reconnect any cables that were removed, and power on any uninterruptible power supply units and SAN Volume Controller nodes that were powered off.
   - If the test was not successful, ensure that all cables are securely connected. If the test still fails, test the individual system components. Before you test the individual components, remove all cables from the components. If any component test fails, replace the component. After each component has been tested and the failing ones have been replaced, repeat the complete system test by returning to step 1 on page ix.

     Test the components in the following order:

     a. The SAN Volume Controller node, from the frame to the ground pin of the input power receptacle.
     b. The uninterruptible power supply from the ground pin of the input power receptacle to the ground conductor of the output power receptacle.
     c. If used, the redundant ac-power switch from the ground pin of the main input power receptacle to the ground conductor of the output power receptacle, and from the ground pin of the backup input power receptacle to the ground conductor of the output power receptacle.
     d. The SAN Volume Controller node to uninterruptible power supply power cable assembly, between the two ground conductors of the power cable.
     e. The uninterruptible power supply input-power cable, between the two ground conductors of the power cable.
     f. If used, the redundant ac-power switch main input-power cable, between the two ground conductors of the cable.
     g. If used, the redundant ac-power switch backup input-power cable, between the two ground conductors of the cable.

## Inspecting the uninterruptible power supply for unsafe conditions

Ensure that you take the time to inspect the uninterruptible power supply for unsafe conditions.

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 bulging capacitor can cause serious injury.

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

Use caution when working in a potential safety hazard 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.

Using the following inspection checklist as a guide, inspect the uninterruptible power supply for unsafe conditions. If necessary, see any suitable safety publications.

1. If any equipment has been damaged during the shipment, keep the shipping cartons and packing materials.
2. Perform the following steps to file a claim for the shipping damage:
   a. File with the carrier within fifteen days of receipt of the equipment.
   b. Send a copy of the damage claim within fifteen days to your service support representative.

## Checking the labels on the SAN Volume Controller

Before you install, use, or service the SAN Volume Controller, you must ensure that you understand the safety labels.

1. Locate the following labels for the SAN Volume Controller:
   - **Agency/ratings label for the SAN Volume Controller 2145-8F2**


   - **Agency/ratings label for the SAN Volume Controller 2145-8F4**


   - **No user access label**

   - **Class 1 laser label**


This product contains a registered/certified Class I laser device that complies with the FDA radiation performance standards and is in compliance with the ICE/EN60825-1 standards.

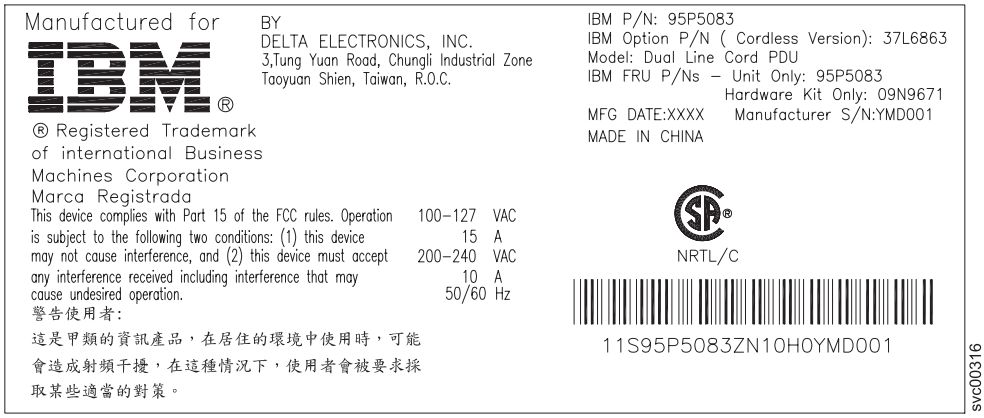
2. Before you continue, ensure that you understand each of these labels.

## Checking the labels on the redundant ac-power switch

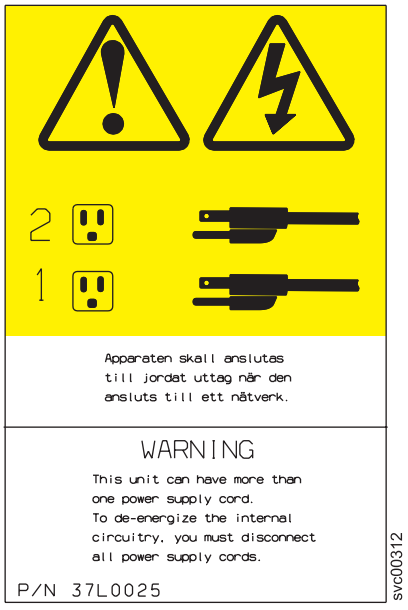
Before you install, use, or service the redundant ac-power switch, you must ensure that you understand the safety labels.

Locate the following labels on the redundant ac-power switch.

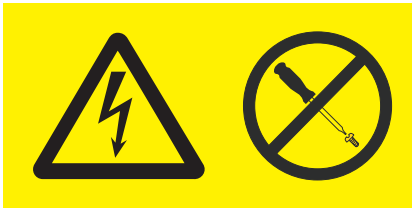
- **Agency label**



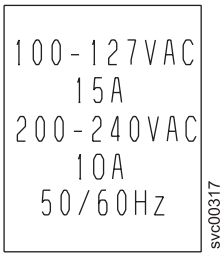

- **Dual power cord warning label**



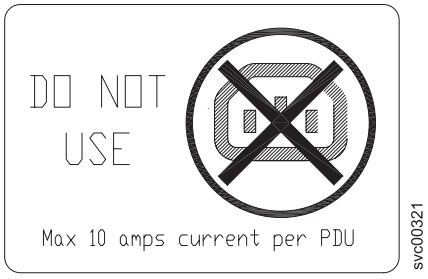
- **No user access label**




- **Input ratings label**




- **Output port warning label**



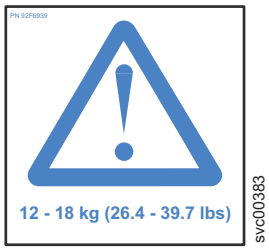

## Checking the labels on the 2145 UPS-1U

Before you install, use, or service the uninterruptible power supply, you must ensure that you understand the safety labels.

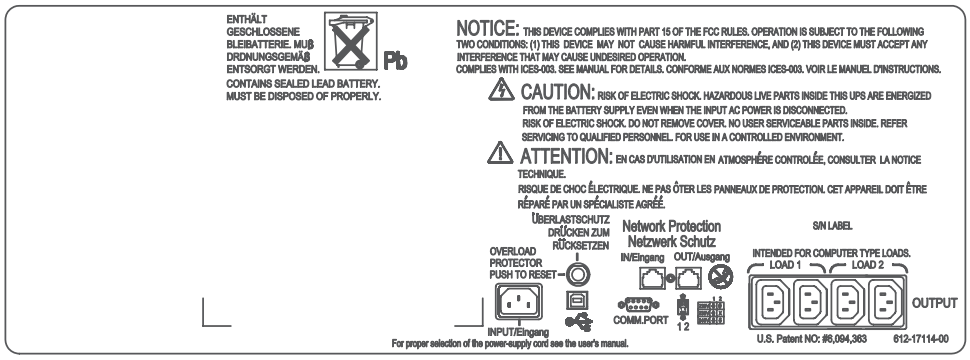
### Labels on the outside of the 2145 UPS-1U

Ensure that you locate and understand each of the following 2145 UPS-1U labels:

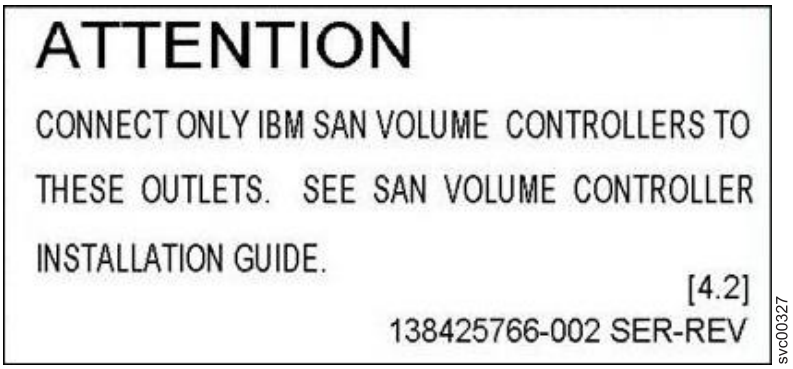
- **Weight caution label**



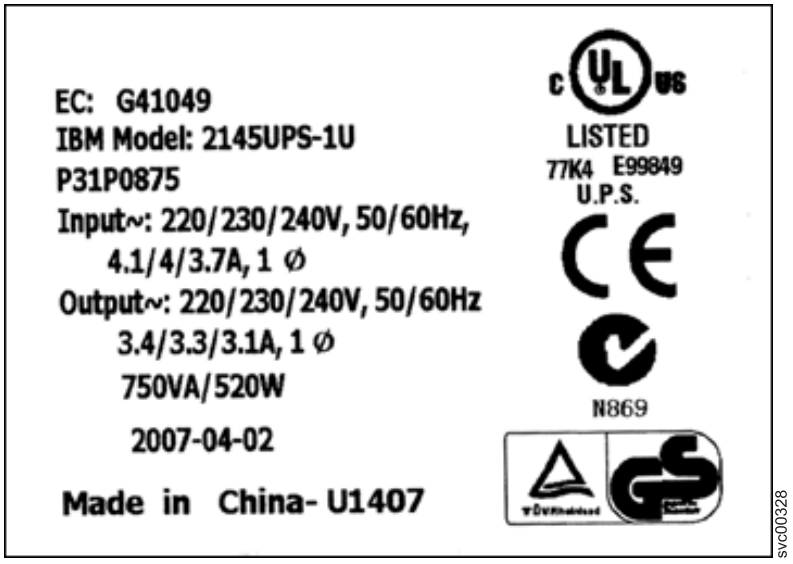

- **Safety label**




- **Power output warning label**




- **Agency label**




- **People's Republic of China Electronic Information Products (EIP) mark - 20 years**


- **Taiwan agency label**


- **IT compatible label**

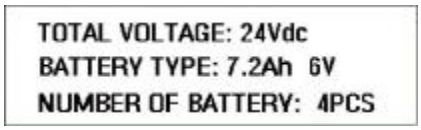

- **Do not discard the 2145 UPS-1U or the 2145 UPS-1U batteries in the trash label**

  **Note:** The 2145 UPS-1U can contain sealed, lead-acid batteries, which must be recycled.

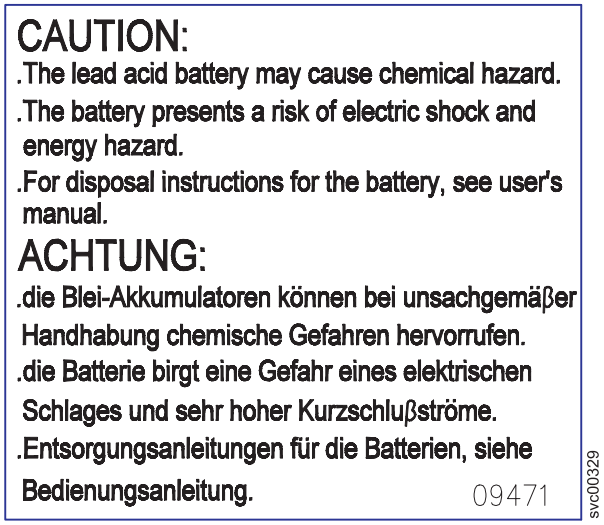

## Battery labels on the 2145 UPS-1U

Ensure that you locate and understand the battery labels on the 2145 UPS-1U.

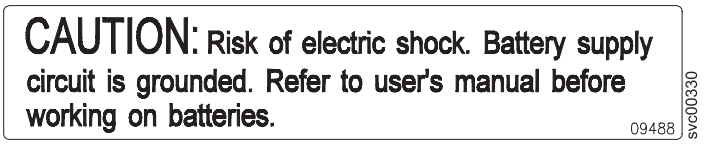
- Battery rating label




- Battery safety label



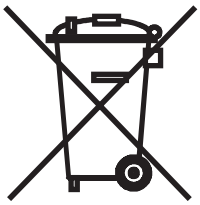

- Electric shock hazard




- **People's Republic of China Electronic Information Products (EIP) mark - 5 years**


- **Do not discard the 2145 UPS-1U or the 2145 UPS-1U batteries in the trash label**

  **Note:** The 2145 UPS-1U can contain sealed, lead-acid batteries, which must be recycled.



- **Recycling label**

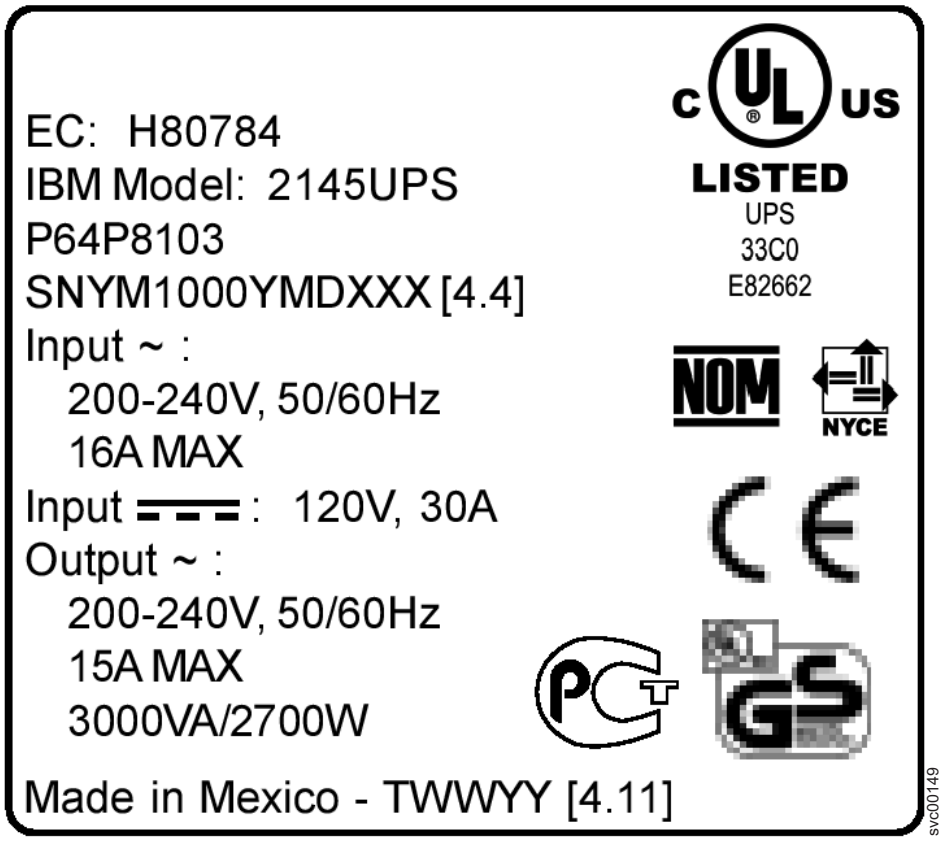

## Checking the labels on the 2145 UPS

Before you install, use, or service the 2145 UPS, you must ensure that you understand the safety labels.

### Labels on the outside of the 2145 UPS

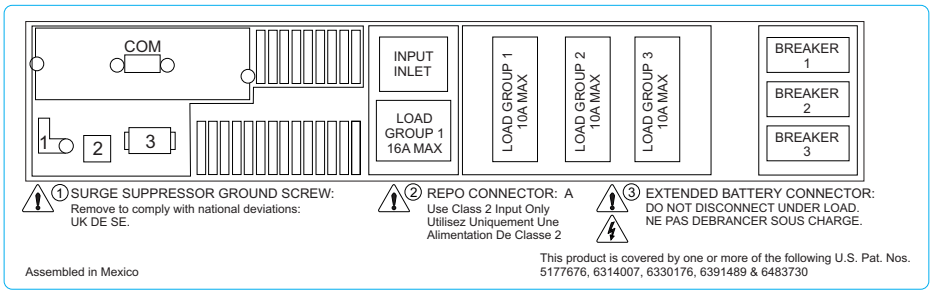
Ensure that you locate and understand each of the following 2145 UPS labels:

- **Agency label**




- **Rear panel configuration label**

**Note:** This label is installed on the cover of the power supply of the SAN Volume Controller.

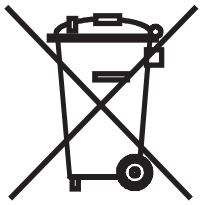



- **Do not discard the 2145 UPS or the 2145 UPS batteries in the trash label**

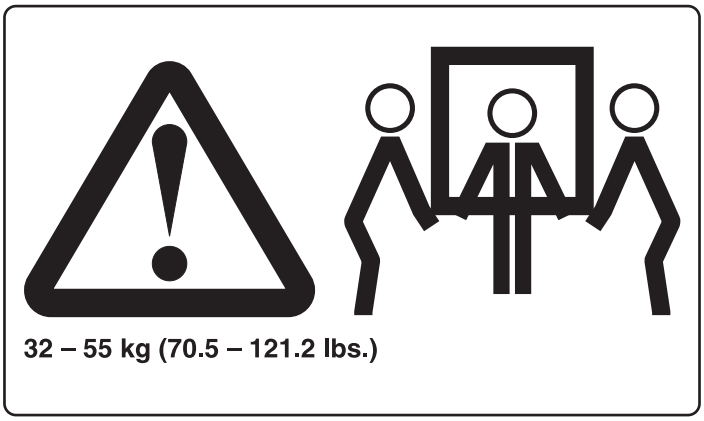
  **Notes:**

  – The 2145 UPS can contain sealed, lead-acid batteries, which must be recycled.

  – If you have a 2145 UPS unit that is already installed, you might not have this label affixed to the outside of the 2145 UPS due to changing labeling requirements.

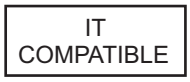


- **Three-person lift label**

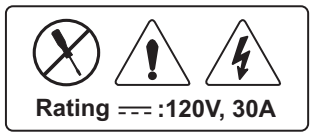



- **Weight caution label**


- **IT compatible label**



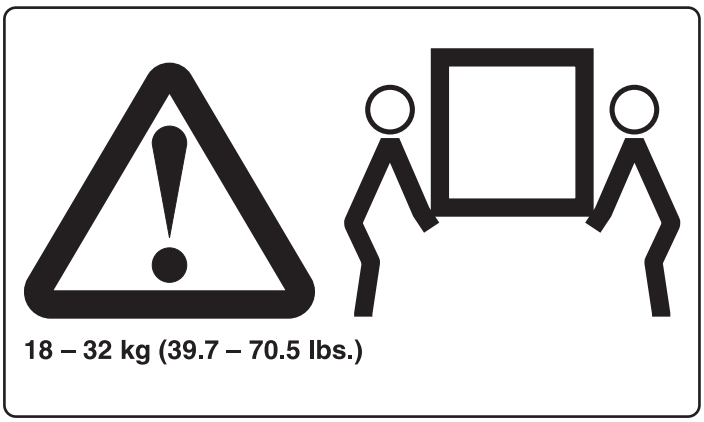

- **Power ratings and no user access label**




## Battery labels on the 2145 UPS

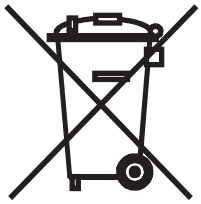
Ensure that you locate and understand the battery labels on the 2145 UPS.

- **Two-man lift label**




- **Do not discard the 2145 UPS or the 2145 UPS batteries in the trash label**

  **Note:** The 2145 UPS can contain sealed, lead-acid batteries, which must be recycled.



- **Recycling label**


- **Weight label**


- **Power ratings and no user access label**


- **Battery faceplate label**

  **Note:** You must remove the front panel to see the faceplate.


## 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 anti-static 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 SAN Volume Controller, 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 SAN Volume Controller or onto a metal table.
- Take additional care when you handle devices during cold weather because heating reduces indoor humidity and increases static electricity.

## Environmental notices and statements

You must become familiar with the environmental notices and statements.

The following topics describe the environmental notices and statements that are applicable to this product.

### 1089CORE

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

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

The equipment is suitable for installation in the following:

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

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

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

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

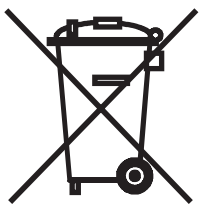
The dc-powered system employs an isolated DC return (DC-I) design. The DC battery return terminal *shall not* be connected to the chassis or frame ground.

## Product recycling and disposal

Ensure that you are aware of the materials that must be recycled.

This unit must be recycled or discarded according to applicable local and national regulations. IBM encourages owners of information technology (IT) equipment to responsibly recycle their equipment when it is no longer needed. IBM offers a variety of product return programs and services in several countries to assist equipment owners in recycling their IT products. Information on IBM product recycling offerings can be found on IBM's Internet sites at: www.ibm.com/ibm/recycle/us/index.shtml or www.ibm.com/ibm/environment/products/index.shtml.

Esta unidad debe reciclarse o desecharse de acuerdo con lo establecido en la normativa nacional o local aplicable. IBM recomienda a los propietarios de equipos de tecnología de la información (TI) que reciclen responsablemente sus equipos cuando éstos ya no les sean útiles. IBM dispone de una serie de programas y servicios de devolución de productos en varios países, a fin de ayudar a los propietarios de equipos a reciclar sus productos de TI. Se puede encontrar información sobre las ofertas de reciclado de productos de IBM en el sitio web de IBM: www.ibm.com/ibm/recycle/us/index.shtml or www.ibm.com/ibm/environment/products/index.shtml



**Note:**

This mark applies only to countries within the European Union (EU) and Norway.

Appliances are labeled in accordance with European Directive 2002/96/EC concerning waste electrical and electronic equipment (WEEE). The Directive determines the framework for the return and recycling of used appliances as applicable throughout the European Union. This label is applied to various products to indicate that the product is not to be thrown away, but rather reclaimed upon end of life per this Directive.

Remarque : Cette marque s'applique uniquement aux pays de l'Union Européenne et à la Norvège.

L'étiquette du système respecte la Directive européenne 2002/96/EC en matière de Déchets des Equipements Electriques et Electroniques (DEEE), qui détermine les dispositions de retour et de recyclage applicables aux systèmes utilisés à travers l'Union européenne. Conformément à la directive, ladite étiquette précise que le produit sur lequel elle est apposée ne doit pas être jeté mais être récupéré en fin de vie.

注意：このマークは EU 諸国およびノルウェーにおいてのみ適用されます。

この機器には、EU 諸国に対する廃電気電子機器指令 2002/96/EC(WEEE) のラベルが貼られています。この指令は、EU 諸国に適用する使用済み機器の回収とリサイクルの骨子を定めています。このラベルは、使用済みになった時に指令に従って適正な処理をする必要があることを知らせるために種々の製品に貼られています。

In accordance with the European WEEE Directive, electrical and electronic equipment (EEE) is to be collected separately and to be reused, recycled, or recovered at end of life. Users of EEE with the WEEE marking per Annex IV of the WEEE Directive, as shown previously, must not dispose of end of life EEE as unsorted municipal waste, but use the collection framework available to customers for the return, recycling, and recovery of WEEE. Customer participation is important to minimize any potential affects of EEE on the environment and human health due to the potential presence of hazardous substances in EEE. For proper collection and treatment, contact your local IBM representative.

## Battery return program

This product may contain sealed lead acid, nickel cadmium, nickel metal hydride, lithium, or lithium ion batteries. Consult your user manual or service manual for specific battery information. The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. For information on disposal of batteries outside the United States, contact your local waste disposal facility or go to the following Web site:

www.ibm.com/ibm/environment/products/index.shtml

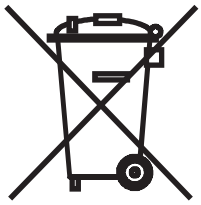
In the United States, IBM has established a return process for reuse, recycling, or proper disposal of used IBM sealed lead acid, nickel cadmium, nickel metal hydride, and other battery packs from IBM Equipment. For information on proper disposal of these batteries, contact IBM at 1-800-426-4333. Please have the IBM part number listed on the battery available prior to your call.

For Taiwan:

Please recycle batteries

廢電池請回收

For the European Union:



**Note:** This mark applies only to countries within the European Union (EU).

Batteries or packaging for batteries are labeled in accordance with European Directive 2006/66/EC concerning batteries and accumulators and waste batteries and accumulators. The Directive determines the framework for the return and recycling of used batteries and accumulators as applicable throughout the European Union. This label is applied to various batteries to indicate that the battery is not to be thrown away, but rather reclaimed upon end of life per this Directive.

Les batteries ou emballages pour batteries sont étiquetés conformément aux directives européennes 2006/66/EC, norme relative aux batteries et accumulateurs en usage et aux batteries et accumulateurs usés. Les directives déterminent la marche à suivre en vigueur dans l'Union Européenne pour le retour et le recyclage des batteries et accumulateurs usés. Cette étiquette est appliquée sur diverses batteries pour indiquer que la batterie ne doit pas être mise au rebut mais plutôt récupérée en fin de cycle de vie selon cette norme.

バッテリーあるいはバッテリー用のパッケージには、EU 諸国に対する廃電気電子機器指令 2006/66/EC のラベルが貼られています。この指令は、バッテリーと蓄電池、および廃棄バッテリーと蓄電池に関するものです。この指令は、使用済みバッテリーと蓄電池の回収とリサイクルの骨子を定めているもので、EU 諸国にわたって適用されます。このラベルは、使用済みになったときに指令に従って適正な処理をする必要があることを知らせるために種々のバッテリーに貼られています。

In accordance with the European Directive 2006/66/EC, batteries and accumulators are labeled to indicate that they are to be collected separately and recycled at end of life. The label on the battery may also include a chemical symbol for the metal concerned in the battery (Pb for lead, Hg for mercury and Cd for cadmium). Users of batteries and accumulators must not dispose of batteries and accumulators as unsorted municipal waste, but use the collection framework available to customers for the return, recycling, and treatment of batteries and accumulators. Customer participation is important to minimize any potential effects of batteries and accumulators on the environment and human health due to the potential presence of hazardous substances. For proper collection and treatment, contact your local IBM representative.

**Spain:**

This notice is provided in accordance with Royal Decree 106/2008 of Spain: The retail price of batteries, accumulators and power cells includes the cost of the environmental management of their waste.

**California:**

Perchlorate Material - special handling may apply. See www.dtsc.ca.gov/hazardouswaste/perchlorate.

The foregoing notice is provided in accordance with California Code of Regulations Title 22, Division 4.5, Chapter 33. Best Management Practices for Perchlorate Materials. This product, part, or both may include a lithium manganese dioxide battery which contains a perchlorate substance.

## Flat panel display

The fluorescent lamp or lamps in the liquid crystal display contain mercury. Dispose of it as required by local ordinances and regulations.

## Monitors and workstations

**New Jersey** – For information about recycling covered electronic devices in the state of New Jersey, go to the New Jersey Department of Environmental Protection web site at www.state.nj.us/dep/dshw/recycle/Electronic_Waste/index.html

**Oregon** - For information about recycling covered electronic devices in the state of Oregon, go to the Oregon Department of Environmental Quality site at www.deq.state.or.us/lq/electronics.htm.

**Washington** - For information about recycling covered electronic devices in the State of Washington, contact the Washington Department of Ecology at 1-800Recycle or go to the Department of Ecology Web site at fortress.wa.gov/ecy/recycle/.

# About this guide

This guide provides an overview of the IBM System Storage SAN Volume Controller and detailed installation instructions.

Use this guide to perform the following tasks:

- Install a new SAN Volume Controller system or extend an existing system.
- Install one or more SAN Volume Controller nodes and related hardware components, such as uninterruptible power supply units or an optional redundant ac-power switch.
- Connect SAN Volume Controller components to a SAN.
- Manage connections to an Ethernet network.
- Verify the completeness of a SAN Volume Controller installation.

The topics within this book provide conceptual, planning, and installation information for the SAN Volume Controller hardware model that was ordered.

## Who should use this guide?

The intended audience for this guide is the IBM service representative.

This guide should be read by the IBM service representative who is responsible for the initial installation of the SAN Volume Controller hardware, including the redundant ac-power switch and the uninterruptible power supply.

After the IBM service representative has installed the SAN Volume Controller hardware, the customers must use the *IBM System Storage SAN Volume Controller Software Installation and Configuration Guide* to install any additional software and to configure the SAN Volume Controller.

## Emphasis

Different typefaces are used in this guide to show emphasis.

The following typefaces are used to show emphasis:

| | |
|---|---|
| **Boldface** | Text in **boldface** represents menu items and command names. |
| *Italics* | Text in *italics* is used to emphasize a word. In command syntax, it is used for variables for which you supply actual values, such as a default directory or the name of a cluster. |
| `Monospace` | Text in `monospace` identifies the data or commands that you type, samples of command output, examples of program code or messages from the system, or names of command flags, parameters, arguments, and name-value pairs. |

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## SAN Volume Controller library and related publications

A list of other publications that are related to this product are provided to you for your reference.

The tables in this section list and describe the following publications:

- The publications that make up the library for the IBM System Storage SAN Volume Controller
- Other IBM publications that relate to the SAN Volume Controller

### SAN Volume Controller library

The following table lists and describes the publications that make up the SAN Volume Controller library. Unless otherwise noted, these publications are available in Adobe® portable document format (PDF) from the following Web site:

www.ibm.com/storage/support/2145

| Title | Description | Order number |
|---|---|---|
| *IBM System Storage SAN Volume Controller Planning Guide* | This guide introduces the SAN Volume Controller and lists the features you can order. It also provides guidelines for planning the installation and configuration of the SAN Volume Controller. | GA32-0551 |
| *IBM System Storage SAN Volume Controller Model 2145-8A4 Hardware Installation Guide* | This guide provides the instructions that the IBM service representative uses to install the hardware for SAN Volume Controller model 2145-8A4. | GC27-2219 |
| *IBM System Storage SAN Volume Controller Model 2145-8G4 Hardware Installation Guide* | This guide provides the instructions that the IBM service representative uses to install the hardware for SAN Volume Controller model 2145-8G4. | GC27-2220 |
| *IBM System Storage SAN Volume Controller Software Installation and Configuration Guide* | This guide provides guidelines for configuring your SAN Volume Controller. Instructions for backing up and restoring the cluster configuration, using and upgrading the SAN Volume Controller Console, using the CLI, upgrading the SAN Volume Controller software, and replacing or adding nodes to a cluster are included. | SC23-6628 |

| Title | Description | Order number |
| --- | --- | --- |
| *IBM System Storage SAN Volume Controller CIM Agent Developer's Guide* | This guide describes the concepts of the Common Information Model (CIM) environment. Steps about using the CIM agent object class instances to complete basic storage configuration tasks, establishing new Copy Services relationships, and performing CIM agent maintenance and diagnostic tasks are included. | SC23-6665 |
| *IBM System Storage SAN Volume Controller Command-Line Interface User's Guide* | This guide describes the commands that you can use from the SAN Volume Controller command-line interface (CLI). | SC26-7903 |
| *IBM System Storage SAN Volume Controller Host Attachment Guide* | This guide provides guidelines for attaching the SAN Volume Controller to your host system. | SC26-7905 |
| *IBM System Storage SAN Volume Controller Troubleshooting Guide* | This guide describes the features of each SAN Volume Controller model, explains how to use the front panel, and provides maintenance analysis procedures to help you diagnose and solve problems with the SAN Volume Controller. | GC27-2227 |
| *IBM System Storage SAN Volume Controller Hardware Maintenance Guide* | This guide provides the instructions that the IBM service representative uses to service the SAN Volume Controller hardware, including the removal and replacement of parts. | GC27-2226 |
| *IBM System Storage SAN Volume Controller Models 2145-8F2 and 2145-8F4 Hardware Installation Guide* | This guide provides the instructions that the IBM service representative uses to install the hardware for SAN Volume Controller models 2145-8F2 and 2145-8F4. | GC27-2221 |
| *IBM System Storage SAN Volume Controller Model 2145-4F2 Hardware Installation Guide* | This guide provides the instructions that the IBM service representative uses to install the hardware for SAN Volume Controller model 2145-4F2. | GC27-2222 |
| *IBM System Storage SAN Volume Controller Master Console Guide* | This guide describes how to install, maintain, and service the master console. | GC27-2223 |

| Title | Description | Order number |
| --- | --- | --- |
| *IBM Systems Safety Notices* | This guide contains translated caution and danger statements. Each caution and danger statement in the SAN Volume Controller documentation has a number that you can use to locate the corresponding statement in your language in the *IBM Systems Safety Notices* document. | G229-9054 |

## Other IBM publications

The following table lists and describes other IBM publications that contain additional information that is related to the SAN Volume Controller.

You can download IBM eServer™ IBM xSeries® and IBM System x™ publications from the following Web site:

www.ibm.com/jct01004c/systems/support/

| Title | Description | Order number |
| --- | --- | --- |
| *IBM System Storage Productivity Center Introduction and Planning Guide* | This guide introduces the IBM System Storage Productivity Center hardware and software. | SC23-8824 |
| *Read This First: Installing the IBM System Storage Productivity Center* | This guide describes how to install the IBM System Storage Productivity Center hardware. | GI11-8938 |
| *IBM System Storage Productivity Center User's Guide* | This guide describes how to configure the IBM System Storage Productivity Center software. | SC27-2336 |
| *IBM System Storage Multipath Subsystem Device Driver User's Guide* | This guide describes the IBM System Storage Multipath Subsystem Device Driver for IBM System Storage products and how to use it with the SAN Volume Controller. | GC52-1309 |
| *IBM System Storage DS Storage Manager Version 10.30 Installation and Host Support Guide* | This guide provides information about how to plan, install, configure, and work with IBM System Storage DS™ Storage Manager. | GC53-1135 |

| Title | Description | Order number |
|---|---|---|
| *IBM System Storage DS Storage Manager Version 10.30 Copy Services Guide* | This guide provides information about setting up, installing, configuring, and working with the three IBM System Storage DS Storage Manager premium features that assist with copy services: FlashCopy®, VolumeCopy, and the Enhanced Remote Mirroring Option. | GC53-1136 |
| *IBM System Storage DS4000/DS5000 Fibre Channel and Serial ATA Intermix Premium Feature Installation Overview* | This overview describes how to install the IBM System Storage DS4000/DS5000 Fibre Channel and Serial ATA Intermix Premium Feature. | GC53-1137 |
| *IBM System Storage DS5100 and DS5300 Installation, User's and Maintenance Guide* | This guide describes how to install and configure the IBM System Storage DS5100 and DS5300. | GC53-1140 |
| *IBM System Storage EXP5000 Storage Expansion Enclosure Installation, User's, and Maintenance Guide* | This guide describes how to install and configure the IBM System Storage EXP5000 Storage Expansion Enclosure. | GC53-1141 |
| *IBM System Storage DS Storage Manager Command-line Programming Guide* | This guide describes the commands that you can use from the IBM System Storage DS Storage Manager command-line interface. | GC52-1275 |
| *IBM System Storage DS5000 Quick Start Guide: Quick Reference for the DS5100, DS5300 and EXP5000* | This guide provides information about setting up and installing the DS5100, DS5300 and EXP5000. | GC53-1134 |
| *IBM TotalStorage DS4300 Fibre Channel Storage Subsystem Installation, User's, and Maintenance Guide* | This guide describes how to install and configure the IBM TotalStorage® DS4300 Fibre-Channel Storage Subsystem. | GC26-7722 |
| *IBM eServer xSeries 306m (Types 8849 and 8491) Installation Guide* | This guide describes how to install the IBM eServer xSeries 306m, which is the hardware delivered for some versions of the hardware master console. | MIGR-61615 |
| *IBM xSeries 306m (Types 8849 and 8491) User's Guide* | This guide describes how to use the IBM eServer xSeries 306m, which is the hardware delivered for some versions of the hardware master console. | MIGR-61901 |

| Title | Description | Order number |
| --- | --- | --- |
| *IBM xSeries 306m (Types 8849 and 8491) Problem Determination and Service Guide* | This guide can help you troubleshoot and resolve problems with the IBM eServer xSeries 306m, which is the hardware delivered for some versions of the hardware master console. | MIGR-62594 |
| *IBM eServer xSeries 306 (Type 8836) Installation Guide* | This guide describes how to install the IBM eServer xSeries 306, which is the hardware delivered for some versions of the hardware master console. | MIGR-55080 |
| *IBM eServer xSeries 306 (Type 8836) User's Guide* | This guide describes how to use the IBM eServer xSeries 306, which is the hardware delivered for some versions of the hardware master console. | MIGR-55079 |
| *IBM eServer xSeries 306 (Types 1878, 8489 and 8836) Hardware Maintenance Manual and Troubleshooting Guide* | This guide can help you troubleshoot problems and maintain the IBM eServer xSeries 306, which is the hardware delivered for some versions of the hardware master console. | MIGR-54820 |
| *IBM eServer xSeries 305 (Type 8673) Installation Guide* | This guide describes how to install the IBM eServer xSeries 305, which is the hardware delivered for some versions of the hardware master console. | MIGR-44200 |
| *IBM eServer xSeries 305 (Type 8673) User's Guide* | This guide describes how to use the IBM eServer xSeries 305, which is the hardware delivered for some versions of the hardware master console. | MIGR-44199 |
| *IBM eServer xSeries 305 (Type 8673) Hardware Maintenance Manual and Troubleshooting Guide* | This guide can help you troubleshoot problems and maintain the IBM eServer xSeries 305, which is the hardware delivered for some versions of the hardware master console. | MIGR-44094 |
| *IBM TotalStorage 3534 Model F08 SAN Fibre Channel Switch User's Guide* | This guide introduces the IBM TotalStorage SAN Switch 3534 Model F08. | GC26-7454 |
| *IBM System x3250 (Types 4364 and 4365) Installation Guide* | This guide describes how to install the IBM System x3250, which is the hardware delivered for some versions of the hardware master console. | MIGR-5069761 |

| Title | Description | Order number |
| --- | --- | --- |
| *IBM System x3250 (Types 4364 and 4365) User's Guide* | This guide describes how to use the IBM System x3250, which is the hardware delivered for some versions of the hardware master console. | MIGR-66373 |
| *IBM System x3250 (Types 4364 and 4365) Problem Determination and Service Guide* | This guide can help you troubleshoot and resolve problems with the IBM System x3250, which is the hardware delivered for some versions of the hardware master console. | MIGR-66374 |
| *IBM TotalStorage SAN Switch 2109 Model F16 User's Guide* | This guide introduces the IBM TotalStorage SAN Switch 2109 Model F16. | GC26-7439 |
| *IBM TotalStorage SAN Switch 2109 Model F32 User's Guide* | This guide introduces the IBM TotalStorage SAN Switch 2109 Model F32. It also describes the features of the switch and tells you where to find more information about those features. | GC26-7517 |

Some related publications are available from the following SAN Volume Controller support Web site:

www.ibm.com/storage/support/2145

## Related Web sites

The following Web sites provide information about the SAN Volume Controller or related products or technologies:

| Type of information | Web site |
| --- | --- |
| SAN Volume Controller support | www.ibm.com/storage/support/2145 |
| Technical support for IBM storage products | www.ibm.com/storage/support/ |

## How to order IBM publications

The IBM Publications Center is a worldwide central repository for IBM product publications and marketing material.

The IBM Publications Center offers customized search functions to help you find the publications that you need. Some publications are available for you to view or download at no charge. You can also order publications. The publications center displays prices in your local currency. You can access the IBM Publications Center through the following Web site:

www.ibm.com/shop/publications/order/

## How to send your comments

Your feedback is important to help us provide the highest quality information. If you have any comments about this book or any other documentation, you can submit them in one of the following ways:

- E-mail

  Submit your comments electronically to the following e-mail address:

  starpubs@us.ibm.com

  Be sure to include the name and order number of the book and, if applicable, the specific location of the text you are commenting on, such as a page number or table number.

- Mail

  Fill out the Readers' Comments form (RCF) at the back of this book. If the RCF has been removed, you can address your comments to:

  International Business Machines Corporation
  RCF Processing Department
  Department 61C
  9032 South Rita Road
  Tucson, Arizona 85775-4401
  U.S.A.

# SAN Volume Controller installation and configuration overview

The installation and configuration of a SAN Volume Controller cluster requires the completion of various tasks, some of which are normally completed by an IBM service representative.

Additional publications are included with some of the hardware components; however, use the installation and configuration procedures in the documents that are listed here.

When you plan or perform the installation and configuration tasks, have the following SAN Volume Controller publications available:

- *IBM System Storage SAN Volume Controller Planning Guide*
- *IBM System Storage SAN Volume Controller Hardware Installation Guide* for the model that was ordered.
- *IBM System Storage SAN Volume Controller Software Installation and Configuration Guide*

To access the SAN Volume Controller publications, click the product documentation link, and then click your language from the following Web site:

www.ibm.com/storage/support/2145

The IBM System Storage Productivity Center (SSPC) is the management environment for SAN Volume Controller clusters. For SSPC planning, installation, and configuration information, see the following publications:

- *IBM System Storage Productivity Center Introduction and Planning Guide*, SC23-8824
- *Read This First: Installing the IBM System Storage Productivity Center*, GI11-8938
- *IBM System Storage Productivity Center User's Guide*, SC27-2336

To access the SSPC publications, go to the **Printable PDFs** section and click the **IBM System Storage Productivity Center** link from the following Web site:

publib.boulder.ibm.com/infocenter/tivihelp/v4r1/index.jsp

**Note:** An existing master console can be upgraded to support clusters that are running the latest SAN Volume Controller software. See the *IBM System Storage SAN Volume Controller Master Console Guide* at the following Web site:

www.ibm.com/storage/support/2145

## Planning tasks to complete before installing the SAN Volume Controller

Before you install the SAN Volume Controller, you must complete the following planning tasks or have them completed by an IBM service representative or IBM Business Partner:

1. **Verify that all the SAN Volume Controller installation requirements have been met.**

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Review Chapter 2 of the *IBM System Storage SAN Volume Controller Planning Guide* to make sure that space and power requirements have been met before you begin the installation. SAN Volume Controller nodes and uninterruptible power supply units are installed in pairs.

2. **Review SAN fabric and zoning guidelines and develop your SAN Volume Controller cluster, host systems, and storage controllers plan.**

   This task helps to assure a seamless configuration. For more information, see Chapters 3 and 4 of the *IBM System Storage SAN Volume Controller Planning Guide*.

3. **Complete all physical planning charts.**

   Chapter 2 of the *IBM System Storage SAN Volume Controller Planning Guide* provides instructions for accessing and completing the following charts and tables:

   - Hardware location chart
   - Cable connection table
   - Configuration data table
   - Redundant ac-power connection chart

   The SAN Volume Controller charts and tables are available at the following Web site:

   www.ibm.com/storage/support/2145

   You can save, edit, and share the charts and tables between members of the installation team.

   For the SSPC, complete the planning worksheet in the Appendix of the *IBM System Storage Productivity Center Introduction and Planning Guide*.

## Hardware installation tasks that an IBM service representative performs

To install the SAN Volume Controller hardware, an IBM service representative must complete the following tasks:

1. **Verify that you have all of the required parts for the installation.**

   Chapter 2 of the *IBM System Storage SAN Volume Controller Hardware Installation Guide* provides a list of all the parts that are required for an installation. The list includes the SAN Volume Controller nodes, uninterruptible power supply units, optional redundant ac-power switches, and associated parts.

2. **Install the SAN Volume Controller hardware.**

   Chapter 2 of the *IBM System Storage SAN Volume Controller Hardware Installation Guide* describes the procedures for installing the uninterruptible power supply units, SAN Volume Controller nodes, and the optional redundant ac-power switches.

3. **Install the SSPC server.**

   *Read This First: Installing the IBM System Storage Productivity Center* describes how to install the SSPC server.

## Configuration tasks

To configure a SAN Volume Controller cluster, you must complete the following tasks or have them completed by an IBM service representative or IBM Business Partner:

1. **Register your product.**

To receive product support notifications from IBM, you must register your product. To register your product, click **Register** at the following Web site:

www.ibm.com/systems/support/supportsite.wss/brandmain?brandind=5345868

2. **Optionally, check for an updated version of the SAN Volume Controller CIM agent and GUI software.**

   For the latest information, click **Install/use**, and then click the link for the appropriate recommended software level from the following Web site:

   www.ibm.com/storage/support/2145

   Additionally, preinstalled software on the SSPC console might need to be updated to fully support the latest level of SAN Volume Controller. For the latest information, go to the following Web site:

   www.ibm.com/systems/support/storage/software/sspc

3. **Configure the IBM System Storage Productivity Center.**

   In the *IBM System Storage Productivity Center User's Guide*, the chapter about configuring the SSPC for the SAN Volume Controller describes the procedures for configuring the server and accessing the SAN Volume Controller Console and command-line interface (CLI). This chapter also describes how to use the PuTTY client to generate secure shell (SSH) key pairs that secure data flow between the SAN Volume Controller cluster configuration node and a client.

4. **Create a SAN Volume Controller cluster.**

   Chapter 4 of the *IBM System Storage SAN Volume Controller Software Installation and Configuration Guide* describes this procedure, which is completed in two phases:

   a. Use the Create Cluster option on the front panel of one of the SAN Volume Controller nodes that you have installed to create the cluster.

      This procedure is usually performed by an IBM representative or IBM Business Partner using information that the customer provides.

   b. Use the Add a Cluster function from the SAN Volume Controller Console.

5. **Complete the initial SAN Volume Controller configuration.**

   After you create the SAN Volume Controller cluster, you must perform the configuration procedures that are needed to meet your requirements. You can perform these procedures in stages; for example, add nodes to a cluster, set cluster date and time, and set license features immediately. Later, after your applications are tested and migrated to SAN Volume Controller, create host definitions, assign managed disks (MDisks) to MDisk groups, and set up virtual disks (VDisks) and assign them to hosts.

   You can also set up error and event notifications, including Call Home e-mails, to immediately notify you and the IBM Support Center if critical problems occur.

   The following chapters include procedures for these tasks:

   - Chapter 5 of the *IBM System Storage SAN Volume Controller Software Installation and Configuration Guide* describes how to perform these steps using the SAN Volume Controller Console.
   - Chapter 6 of the *IBM System Storage SAN Volume Controller Software Installation and Configuration Guide* describes how to perform these steps using the CLI.

# Chapter 1. SAN Volume Controller overview

The SAN Volume Controller combines software and hardware into a comprehensive, modular appliance that uses symmetric virtualization.

Symmetric virtualization is achieved by creating a pool of managed disks (MDisks) from the attached storage systems. Those storage systems are then mapped to a set of virtual disks (VDisks) for use by attached host systems. System administrators can view and access a common pool of storage on the storage area network (SAN). This functionality helps administrators to use storage resources more efficiently and provides a common base for advanced functions.

Each SAN Volume Controller node is an individual server in a SAN Volume Controller cluster on which the SAN Volume Controller software runs.

The nodes are always installed in pairs, with a minimum of one and a maximum of four pairs of nodes constituting a *cluster*. Each pair of nodes is known as an *I/O group*. All I/O operations that are managed by the nodes in an I/O group are cached on both nodes.

## Operating environment for the SAN Volume Controller 2145-8F4 and SAN Volume Controller 2145-8F2

To use the SAN Volume Controller, you must meet the minimum hardware and software requirements and ensure that other operating environment criteria are met.

### Minimum requirements

You must set up your SAN Volume Controller operating environment according to the following requirements:

- Minimum of one pair of SAN Volume Controller nodes
- Minimum of two uninterruptible power supply units
- One IBM System Storage Productivity Center or one master console per SAN installation for configuration

### Features of a SAN Volume Controller 2145-8F4 node

The SAN Volume Controller 2145-8F4 node has the following features:

- A 19-inch rack-mounted enclosure
- One 4-port 4 Gbps fibre-channel adapter (four fibre-channel ports)
- 8 GB cache memory

### Features of a SAN Volume Controller 2145-8F2 node

The SAN Volume Controller 2145-8F2 node has the following features:

- A 19-inch rack-mounted enclosure
- Two 2 Gbps 2-port fibre-channel adapters (four fibre-channel ports)
- 8 GB cache memory

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# SAN Volume Controller 2145-8F4 and SAN Volume Controller 2145-8F2 environment requirements

Before the SAN Volume Controller 2145-8F4 or SAN Volume Controller 2145-8F2 is installed, the physical environment must meet certain requirements. This includes verifying that adequate space is available and that requirements for power and environmental conditions are met.

## Input-voltage requirements

Ensure that your environment meets the following voltage requirements.

| Voltage | Frequency |
|---|---|
| 200 to 240 V single phase ac | 50 or 60 Hz |

## Power requirements for each node

Ensure that your environment meets the following power requirements.

The power that is required depends on the node type, the uninterruptible power supply type, and whether the redundant ac power feature is used.

| Components | Power requirements |
|---|---|
| SAN Volume Controller 2145-8F4 and 2145 UPS-1U | 520 W |
| SAN Volume Controller 2145-8F2 and 2145 UPS-1U | 520 W |

For each redundant ac-power switch, add 20 W to the power requirements.

## Circuit breaker requirements

The 2145 UPS-1U has an integrated circuit breaker and does not require additional protection.

## Environment requirements without redundant ac power

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

| Environment | Temperature | Altitude | Relative humidity | Maximum wet bulb temperature |
|---|---|---|---|---|
| Operating in lower altitudes | 10°C to 35°C (50°F to 95°F) | 0 to 914.4 m (0 to 3000 ft) | 8% to 80% noncondensing | 23°C (74°F) |
| Operating in higher altitudes | 10°C to 32°C (50°F to 88°F) | 914.4 to 2133.6 m (3000 to 7000 ft) | 8% to 80% noncondensing | 23°C (74°F) |
| Turned off | 10°C to 43°C (50°F to 110°F) | 0 to 2133.6 m (3000 to 7000 ft) | 8% to 80% noncondensing | 27°C (81°F) |
| Storing | 1°C to 60°C (34°F to 140°F) | 0 to 2133.6 m (0 to 7000 ft) | 5% to 80% noncondensing | 29°C (84°F) |

| Environment | Temperature | Altitude | Relative humidity | Maximum wet bulb temperature |
|---|---|---|---|---|
| Shipping | -20°C to 60°C (-4°F to 140°F) | 0 to 10668 m (0 to 34991 ft) | 5% to 100% condensing, but no precipitation | 29°C (84°F) |

## Environment requirements with redundant ac power

Ensure that your environment falls within the following ranges if you are using redundant ac power.

| Environment | Temperature | Altitude | Relative humidity | Maximum wet bulb temperature |
|---|---|---|---|---|
| Operating in lower altitudes | 15°C to 32°C (59°F to 89°F) | 0 to 914.4 m (0 to 3000 ft) | 20% to 80% noncondensing | 23°C (74°F) |
| Operating in higher altitudes | 15°C to 32°C (50°F to 88°F) | 914.4 to 2133.6 m (3000 to 7000 ft) | 20% to 80% noncondensing | 23°C (74°F) |
| Turned off | 10°C to 43°C (50°F to 110°F) | 0 to 2133.6 m (0 to 7000 ft) | 20% to 80% noncondensing | 27°C (81°F) |
| Storing | 1°C to 60°C (34°F to 140°F) | 0 to 2133.6 m (0 to 7000 ft) | 5% to 80% noncondensing | 29°C (84°F) |
| Shipping | -20°C to 60°C (-4°F to 140°F) | 0 to 10668 m (0 to 34991 ft) | 5% to 100% condensing, but no precipitation | 29°C (84°F) |

## Preparing your environment

The following tables list the physical characteristics of the SAN Volume Controller 2145-8F4 and SAN Volume Controller 2145-8F2 nodes.

## Dimensions and weight

Ensure that space is available in a rack that is capable of supporting the node.

| Height | Width | Depth | Maximum weight |
|---|---|---|---|
| 43 mm (1.69 in.) | 440 mm (17.32 in.) | 686 mm (27 in.) | 12.7 kg (28 lb) |

## Additional space requirements

Ensure that space is also available in the rack for the following additional space requirements around the node.

| Location | Additional space requirements | Reason |
|---|---|---|
| Left and right sides | 50 mm (2 in.) | Cooling air flow |
| Back | Minimum: 100 mm (4 in.) | Cable exit |

### Heat output of each SAN Volume Controller 2145-8F4 or SAN Volume Controller 2145-8F2 node

The nodes dissipate the following maximum heat output.

| Model | Heat output per node |
|---|---|
| SAN Volume Controller 2145-8F4 | 450 W (1540 Btu per hour) |
| SAN Volume Controller 2145-8F2 | 450 W (1540 Btu per hour) |

## SAN Volume Controller 2145-8F4 and SAN Volume Controller 2145-8F2 controls and indicators

The controls and indicators are used for power and navigation and to indicate information, such as system activity, service and configuration options, service controller failures, and node identification.

Figure 1 shows the controls and indicators on the front panel of the SAN Volume Controller 2145-8F4 and SAN Volume Controller 2145-8F2.

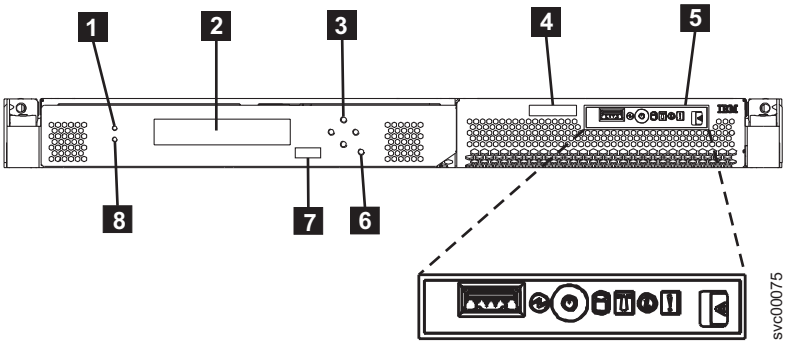


*Figure 1. SAN Volume Controller 2145-8F2 and SAN Volume Controller 2145-8F4 front-panel assembly*

1. Cache LED
2. Front-panel display
3. Navigation buttons
4. Serial number label
5. Operator-information panel
6. Select button
7. Node identification label
8. Error LED

### Cache LED

System activity is indicated through the green, cache LED.

The cache LED provides the following system activity indicators:

**Off** The node is not operating as a member of a cluster.

**On** The node is operating as a member of a cluster.

**Flashing**

The node is dumping cache and state data to the local disk in anticipation of a system reboot (from a pending power-off action or other controlled restart sequence). Do not remove the power cable or force a power-off action while this LED is flashing.

## Front-panel display

The front-panel display shows service, configuration, and navigation information.

You can select the language that is displayed on the front panel. The display can show both alphanumeric information and graphical information (progress bars).

The front-panel display shows configuration and service information about the SAN Volume Controller node and the SAN Volume Controller cluster, including the following items:

- Boot progress indicator
- Boot failed
- Charging
- Hardware boot
- Node rescue request
- Power failure
- Powering off
- Recovering
- Restarting
- Shutting down
- Error codes
- Validate WWNN?

## Navigation buttons

You can use the navigation buttons to move through menus.

There are four navigational buttons that you can use to move throughout a menu: up, down, right, and left.

Each button corresponds to the direction that you can move in a menu. For example, to move right in a menu, press the navigation button that is located on the right side. If you want to move down in a menu, press the navigation button that is located on the bottom.

**Note:** The select button is used in tandem with the navigation buttons.

## Product serial number

The node contains a SAN Volume Controller product serial number that is written to the system board hardware. The product serial number is also printed on the serial number label on the right side of the front panel.

This number is used for warranty and service entitlement checking and is included in the data sent with error reports. It is essential that this number is *not* changed during the life of the product. If the system board is replaced, you must follow the system board replacement instructions carefully and rewrite the serial number on the system board.

## SAN Volume Controller 2145-8F4 and SAN Volume Controller 2145-8F2 operator information panel

The operator-information panel contains buttons and indicators, such as the release latch for the light path diagnostics panel, the power-control button, and LEDs that indicate information, such as system-board errors, hard-drive activity, and power status.

Figure 2 shows the operator-information panel that is used by the SAN Volume Controller 2145-8F4 and the SAN Volume Controller 2145-8F2 models.

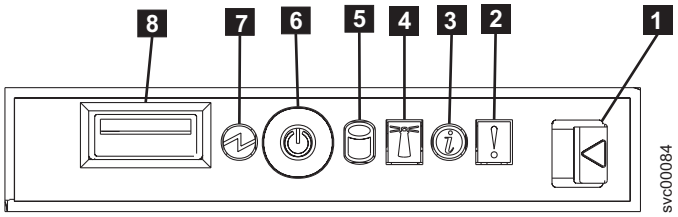


*Figure 2. SAN Volume Controller 2145-8F2 and SAN Volume Controller 2145-8F4 operator-information panel*

1. Release latch for light path diagnostics panel
2. System-error LED (amber)
3. Information LED (amber)
4. Location LED (blue)
5. Hard disk drive activity LED (green)
6. Power control button
7. Power LED (green)
8. USB connector

### Release latch

The release latch on the SAN Volume Controller 2145-8F4 and 2145-8F2 give you access to the light path diagnostics panel, which provides a method for determining the location of a problem.

After pressing the release latch on the operator-information panel, you can slide the light path diagnostics panel out to view the lit LEDs. The LEDs indicate the type of error that has occurred. See MAP 5800: Light path for more detail.

To retract the panel, push it back into the node and snap it into place.

### System-error LED

When it is lit, the system-error LED indicates that a system-board error has occurred.

This amber LED lights up if the SAN Volume Controller hardware detects a fatal error that requires a new field replaceable unit (FRU).

**Note:** See MAP 5800: Light path to help you isolate the faulty FRU.

A system-error LED is also at the rear of the node.

## Information-Error LED

When the information-error LED is lit, a noncritical event has occurred.

Check the light path diagnostics panel and the error log. Light path diagnostics are described in more detail in the light path maintenance analysis procedure (MAP).

## Location LED

The SAN Volume Controller does not use the location LED.

## Hard disk drive activity LED

When it is lit, the green hard disk drive activity LED indicates that the hard disk drive is in use.

Hard disk drive activity is shown on the hard disk drive activity LED. For the SAN Volume Controller 2145-8F2, hard disk drive activity is also shown on the hard disk drive itself.

## Power control button

The power control button turns on or turns off the main power to the SAN Volume Controller.

To turn on the power, press and release the power control button. You must have a pointed device, such as a pen, to press the button.

To turn off the power, press and release the power control button. For more information about how to turn off the SAN Volume Controller node, see "MAP 5350: Powering off a SAN Volume Controller node" in the *IBM System Storage SAN Volume Controller Troubleshooting Guide*.

**Notes:**

1. When the node is operational and you press and immediately release the power control button, the SAN Volume Controller indicates on its front panel that it is turning off and writes its control data to its internal disk. This can take up to five minutes. If you press the power control button but do not release it, the node turns off immediately without the SAN Volume Controller control data being written to disk. Service actions are then required to make the SAN Volume Controller operational again. Therefore, during a power-off operation, do not press and hold the power control button for more than two seconds.
2. The 2145 UPS-1U does not turn off when the SAN Volume Controller is shut down from the power control button.

## Power LED

The green power LED indicates the power status of the SAN Volume Controller.

The power LED has the following properties:

**Off** One or more of the following are true:

- No power is present at the power supply input.
- The power supply has failed.
- The LED has failed.

**On** The SAN Volume Controller node is turned on.

**Flashing**
The SAN Volume Controller node is turned off, but is still connected to a power source.

**Note:** A power LED is also at the rear of the node.

## Select button

You can use the select button to select an item from a menu.

The select button and navigation buttons help you to navigate and select menu and boot options, and start a service panel test.

The select button is located on the front panel of the SAN Volume Controller, near the navigation buttons.

## Node identification label

The node identification label on the front panel displays a six-digit node identification number. Sometimes this number is called the panel name or front panel ID.

The node identification label is the six-digit number that is used in the **svctask addnode** command. It is readable by system software and is used by configuration and service software as a node identifier. The node identification number can also be displayed on the front-panel display when `node` is selected from the menu.

If the service controller assembly front panel is replaced, the configuration and service software displays the number that is printed on the front of the replacement panel. Future error reports contain the new number. No cluster reconfiguration is necessary when the front panel is replaced.

## Error LED

Critical faults on the service controller are indicated through the amber, error LED.

The error LED has the following two states:

**OFF** The service controller is functioning correctly.

**ON** A critical service-controller failure was detected and you must replace the service controller.

# SAN Volume Controller 2145-8F4 and SAN Volume Controller 2145-8F2 rear panel indicators

The rear-panel indicators consist of LEDs that indicate the status of the fibre-channel ports, Ethernet connection and activity, power, electrical current, and system-board errors.

## SAN Volume Controller 2145-8F4 rear panel indicators

The rear panel indicators are located on the back panel assembly.

Figure 3 on page 9 shows the rear panel indicators on the SAN Volume Controller 2145-8F4 back panel assembly.

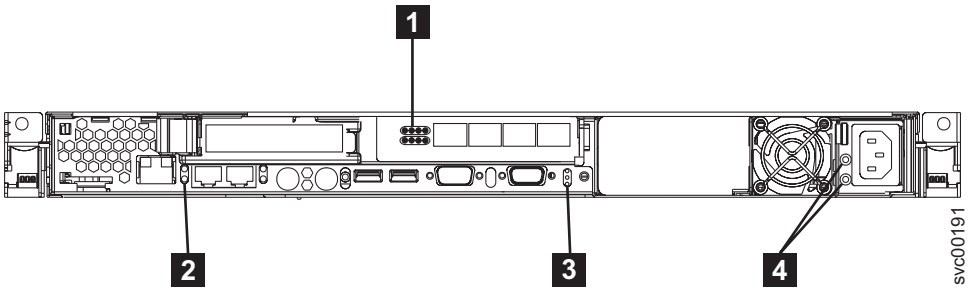


*Figure 3. SAN Volume Controller 2145-8F4 rear-panel indicators*

1. Fibre-channel LEDs
2. Ethernet link LED
3. Power, location, and system error LEDs
4. Ac and dc LEDs

## SAN Volume Controller 2145-8F2 rear panel indicators

The rear panel indicators are located on the back panel assembly.

Figure 4 shows the rear panel indicators on the SAN Volume Controller 2145-8F2 back panel assembly.

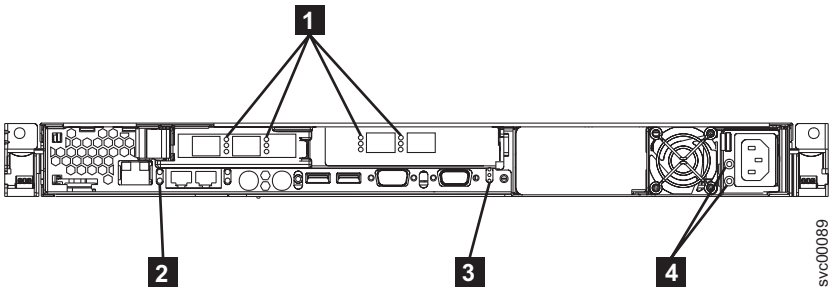


*Figure 4. SAN Volume Controller 2145-8F2 rear-panel indicators*

1. Fibre-channel LEDs
2. Ethernet link LED
3. Power, location, and system error LEDs
4. Ac and dc LEDs

## Fibre-channel LEDs

The fibre-channel LEDs indicate the status of the fibre-channel ports on the SAN Volume Controller 2145-8F4 node.

The SAN Volume Controller 2145-8F4 uses two fibre-channel LEDs per fibre-channel port, which are arranged one above the other.The LEDs are arranged in the same order as the ports.

The fibre-channel LEDs indicate the following link status.

| Top row (link speed) | Bottom row (link activity) | Link status |
|---|---|---|
| Off | Off | Inactive |
| Off | On / Blinking | Active 1 Gbps |
| Blinking | On / Blinking | Active 2 Gbps |
| On | On / Blinking | Active 4 Gbps |
| **Note:** Blinking indicates I/O activity. | | |

Figure 5 shows the fibre-channel LEDs on the SAN Volume Controller 2145-8F4.

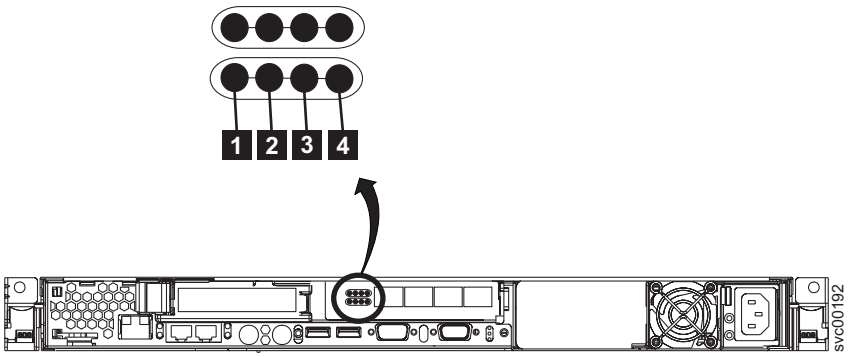


*Figure 5. SAN Volume Controller 2145-8F4 fibre-channel LEDs*

The fibre-channel LEDs are not used by the SAN Volume Controller 2145-8F2.

## Ethernet link LED

The Ethernet link LED indicates that there is an active connection on the Ethernet port.

The Ethernet link LED is located on each Ethernet port; however, only Ethernet port 1 is used during normal operation.

## Power, location, and system error LEDs

The power, location, and system error LEDs are housed together on the rear of the SAN Volume Controller next to the monitor port.

The following terms describe the power, location, and system error LEDs:

**Power LED**

This is the top of the three LEDs and indicates the following states:

**Off** One or more of the following are true:

- No power is present at the power supply input
- The power supply has failed
- The LED has failed

**On** The SAN Volume Controller is powered on.

**Flashing**

The SAN Volume Controller is turned off but is still connected to a power source.

**Location LED**

This is the middle of the three LEDs and is not used by the SAN Volume Controller.

**System-error LED**

This is the bottom of the three LEDs that indicates that a system board error has occurred. The light path diagnostics provide more information.

### Ac and dc LEDs

The ac and dc LEDs indicate whether the node is receiving electrical current.

**Ac LED**

The upper LED **1** next to the power supply, indicates that ac current is present on the node.

**Dc LED**

The lower LED **2** next to the power supply, indicates that dc current is present on the node.

**Ac and dc LEDs on the SAN Volume Controller 2145-8F4 and the SAN Volume Controller 2145-8F2:**

The ac LED and dc LED are located on the rear of the SAN Volume Controller 2145-8F4 and the SAN Volume Controller 2145-8F2.

Figure 6 shows the location of the ac and dc LEDs.

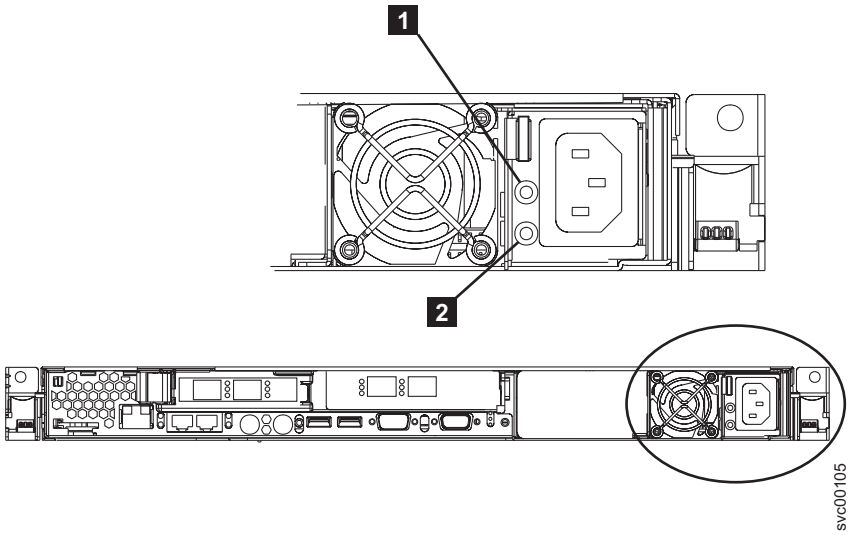


*Figure 6. SAN Volume Controller 2145-8F4 and SAN Volume Controller 2145-8F2 ac and dc LEDs*

## External connectors on the SAN Volume Controller 2145-8F4 and the SAN Volume Controller 2145-8F2

The external connectors consist of PCI slots, fibre-channel, Ethernet, and serial ports, and the power supply.

### SAN Volume Controller 2145-8F4 connectors

The external connectors consist of Ethernet, serial, and fibre-channel ports, and the power supply.

Figure 7 shows the external connectors on the SAN Volume Controller 2145-8F4 back panel assembly.

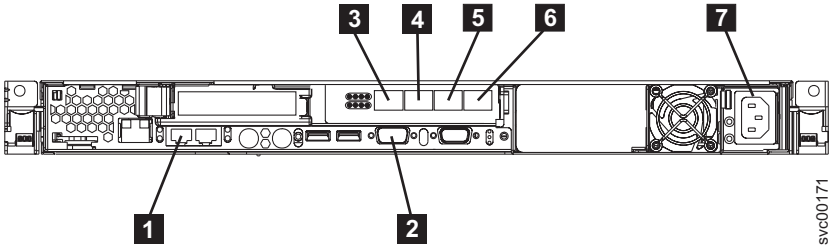


*Figure 7. SAN Volume Controller 2145-8F4 external connectors*

1. Ethernet port 1
2. Serial connection
3. Fibre-channel port 1
4. Fibre-channel port 2
5. Fibre-channel port 3
6. Fibre-channel port 4
7. Power supply

Figure 8 shows the type of connector that is located on the power supply assembly. The connector enables you to connect the SAN Volume Controller 2145-8F4 to the power source from the uninterruptible power supply.

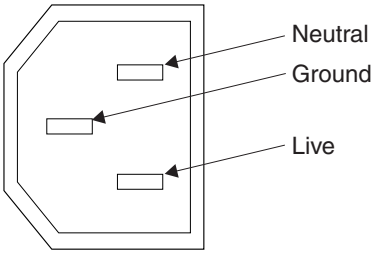


*Figure 8. Power connector*

## SAN Volume Controller 2145-8F4 ports used during service procedures

The SAN Volume Controller 2145-8F4 contains three service ports: Ethernet port 2, the keyboard port, and the monitor port. These ports are used only during service procedures. Figure 9 on page 13 provides the locations of the service ports.

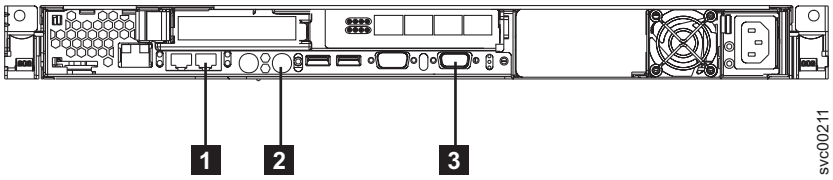


*Figure 9. Service ports of the SAN Volume Controller 2145-8F4*

1. Ethernet port 2
2. Keyboard port
3. Monitor port

### SAN Volume Controller 2145-8F4 ports not used during normal operation

The SAN Volume Controller 2145-8F4 is equipped with several ports that are not used by the SAN Volume Controller during normal operation. Figure 10 and Figure 10 show the ports that are not used by the SAN Volume Controller.

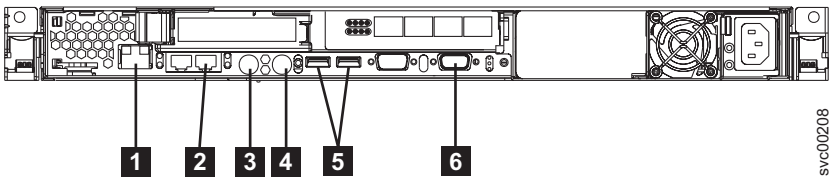


*Figure 10. Ports not used during normal operation by the SAN Volume Controller 2145-8F4*

1. System management port
2. Ethernet port 2
3. Mouse port
4. Keyboard port
5. USB ports
6. Monitor port

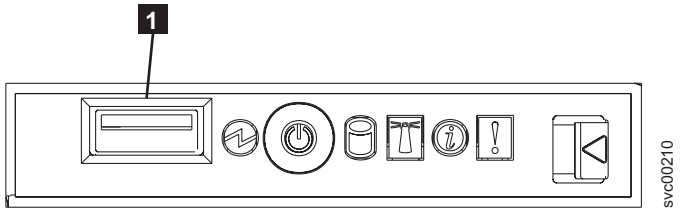


*Figure 11. Ports not used on the front panel of the SAN Volume Controller 2145-8F4*

1. USB port

## SAN Volume Controller 2145-8F2 connectors

The external connectors consist of the power supply and Ethernet, fibre-channel, and serial ports.

Figure 12 shows the external connectors on the SAN Volume Controller 2145-8F2 back panel assembly.

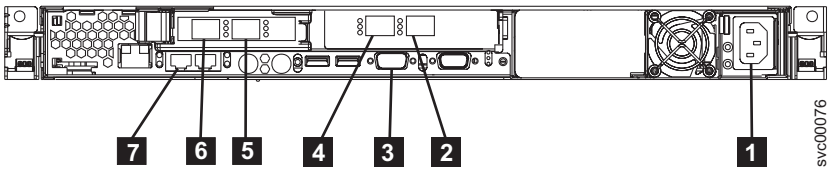


*Figure 12. SAN Volume Controller 2145-8F2 external connectors*

1. Power supply
2. Fibre-channel port 4
3. Serial connection
4. Fibre-channel port 3
5. Fibre-channel port 2
6. Fibre-channel port 1
7. Ethernet port 1

Figure 12 shows the type of connector that is located on the power supply assembly. The connector enables you to connect the SAN Volume Controller 2145-8F2 to the power source from the uninterruptible power supply.

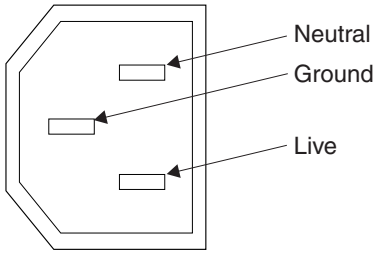


*Figure 13. Power connector*

## SAN Volume Controller 2145-8F4 and SAN Volume Controller 2145-8F2 fibre-channel port numbers and worldwide port names

The SAN Volume Controller 2145-8F4 and SAN Volume Controller 2145-8F2 fibre-channel ports are identified by their physical port number and by a worldwide port name (WWPN).

Figure 14 on page 15 provides a view of the rear of the SAN Volume Controller 2145-8F4.

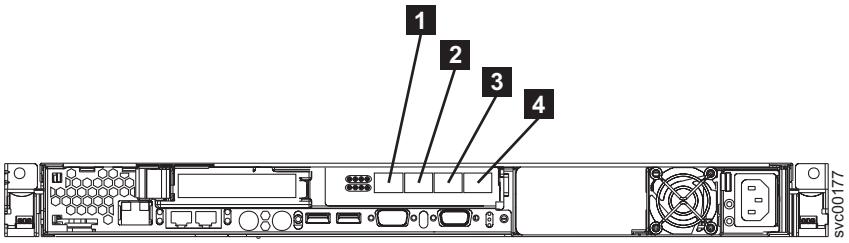


*Figure 14. The physical port numbers for the SAN Volume Controller 2145-8F4*

Figure 15 provides a view of the rear of the SAN Volume Controller 2145-8F2.

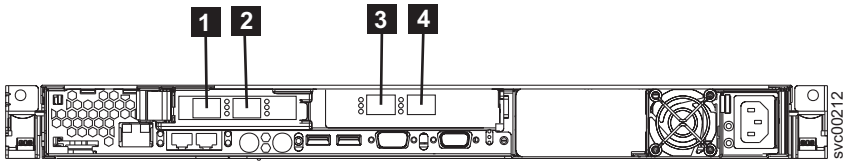


*Figure 15. The physical port numbers for the SAN Volume Controller 2145-8F2*

The physical port numbers identify fibre-channel cards and cable connections when you perform service tasks. The WWPNs are used for tasks such as fibre-channel switch configuration and to uniquely identify the devices on the SAN.

The WWPNs are derived from the worldwide node name (WWNN) of the SAN Volume Controller node in which the card is installed.

The WWNN is in the form 50050768010*XXXXX*, where *XXXXX* is initially derived from the unit and is specific to a SAN Volume Controller node. You can change the *XXXXX* value by using the front panel to facilitate service controller concurrent replacement and to enable some concurrent upgrade operations.

The WWPNs are in the form 5005076801*QXXXXX*, where *XXXXX* is as previously stated and *Q* is related to the port number as follows:

| **Port** | **Value of Q** |
|---|---|
| 1 | 4 |
| 2 | 3 |
| 3 | 1 |
| 4 | 2 |

# Chapter 2. Redundant ac-power switch

The redundant ac-power switch is an optional feature that makes the SAN Volume Controller nodes resilient to the failure of a single power circuit. The redundant ac-power switch is not a replacement for an uninterruptible power supply. You must still use a uninterruptible power supply for each node.

You must connect the redundant ac-power switch to two independent power circuits. One power circuit connects to the main power input port and the other power circuit connects to the backup power input port. If the main power to the SAN Volume Controller node fails for any reason, the redundant ac-power switch automatically uses the backup power source. When power is restored, the redundant ac-power switch automatically changes back to using the main power source.

Place the redundant ac-power switch in the same rack as the SAN Volume Controller node. The redundant ac-power switch logically sits between the rack power distribution unit and the 2145 UPS-1U.

You can use a single redundant ac-power switch to power one or two SAN Volume Controller nodes. If you use the redundant ac-power switch to power two nodes, the nodes must be in different I/O groups. In the event that the redundant ac-power switch fails or requires maintenance, both nodes power off. Because the nodes are in two different I/O groups, the hosts do not lose access to the back-end disk data.

For maximum resilience to failure, use one redundant ac-power switch to power each SAN Volume Controller node.

The following graphic shows a redundant ac-power switch.


## Redundant ac power environment requirements

Ensure that your physical site meets the installation requirements for the redundant ac-power switch.

The redundant ac-power switch requires two independent power sources that are provided through two rack-mounted power distribution units (PDUs). The PDUs must have IEC320-C13 outlets.

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The redundant ac-power switch comes with two IEC 320-C19 to C14 power cables to connect to rack PDUs. There are no country-specific cables for the redundant ac-power switch.

The power cable between the redundant ac-power switch and the 2145 UPS-1U is rated at 10 A.

### Redundant ac-power switch specifications

The following tables list the physical characteristics of the redundant ac-power switch.

#### Dimensions and weight

Ensure that space is available in a rack that is capable of supporting the redundant ac-power switch.

| Height | Width | Depth | Maximum weight |
|---|---|---|---|
| 43 mm (1.69 in.) | 192 mm (7.56 in.) | 240 mm | 2.6 kg (5.72 lb) |

#### Additional space requirements

Ensure that space is also available in the rack for the side mounting plates on either side of the redundant ac-power switch.

| Location | Width | Reason |
|---|---|---|
| Left side | 124 mm (4.89 in.) | Side mounting plate |
| Right side | 124 mm (4.89 in.) | Side mounting plate |

### Heat output (maximum)

The maximum heat output that is dissipated inside the redundant ac-power switch is approximately 20 watts (70 Btu per hour).

## Cabling of redundant ac-power switch (example)

You must properly cable the redundant ac-power switch units in your environment.

**Note:** While this topic provides an example of the cable connections, it does not indicate a preferred physical location for the components.

Figure 16 on page 19 shows an example of the main wiring for a SAN Volume Controller cluster with the redundant ac-power switch feature. The four-node cluster consists of two I/O groups:

- I/O group 0 contains nodes A and B
- I/O group 1 contains nodes C and D


*Figure 16. A four-node SAN Volume Controller cluster with the redundant ac-power switch feature*

1. I/O group 0
2. SAN Volume Controller node A
3. 2145 UPS-1U A
4. SAN Volume Controller node B
5. 2145 UPS-1U B
6. I/O group 1
7. SAN Volume Controller node C
8. 2145 UPS-1U C
9. SAN Volume Controller node D
10. 2145 UPS-1U D
11. Redundant ac-power switch 1
12. Redundant ac-power switch 2

13 Site PDU X (C13 outlets)

14 Site PDU Y (C13 outlets)

The site PDUs X and Y (13 and 14) are powered from two independent power sources.

In this example, only two redundant ac-power switch units are used, and each power switch powers one node in each I/O group. However, for maximum redundancy, use one redundant ac-power switch to power each node in the cluster.

# Chapter 3. Uninterruptible power supply

The uninterruptible power supply protects a SAN Volume Controller node against blackouts, brownouts, and power surges. The uninterruptible power supply contains a power sensor to monitor the supply and a battery to provide power until an orderly shutdown of the system can be performed.

SAN Volume Controller 2145-8F4 and SAN Volume Controller 2145-8F2 use the 2145 UPS-1U.

## 2145 UPS-1U

A 2145 UPS-1U is used exclusively to maintain data that is held in the SAN Volume Controller dynamic random access memory (DRAM) in the event of an unexpected loss of external power. This use differs from the traditional uninterruptible power supply that enables continued operation of the device that it supplies when power is lost.

With a 2145 UPS-1U, data is saved to the internal disk of the SAN Volume Controller node. The uninterruptible power supply units are required to power the SAN Volume Controller nodes even when the input power source is considered uninterruptible.

**Note:** The uninterruptible power supply maintains continuous SAN Volume Controller-specific communications with its attached SAN Volume Controller nodes. A SAN Volume Controller node cannot operate without the uninterruptible power supply. The uninterruptible power supply must be used in accordance with documented guidelines and procedures and must not power any equipment other than a SAN Volume Controller node.

## 2145 UPS-1U configuration

A 2145 UPS-1U powers one SAN Volume Controller node.

To make the SAN Volume Controller cluster more resilient against power failure, the 2145 UPS-1U units can be connected to the redundant ac-power switch.

If a redundant ac-power switch is not used, the two uninterruptible power supply units that power an I/O group can be connected to different, independent electrical power sources. In this case, if a single power source fails, only one node in the I/O group stops and the SAN Volume Controller cluster can continue to operate although with reduced performance.

Each uninterruptible power supply must be in the same rack as the node that it powers.

Each 2145 UPS-1U includes one power cord that connects the uninterruptible power supply to a redundant ac-power switch, if one exists, or to a rack power distribution unit (PDU), if one exists. The 2145 UPS-1U also includes an alternative power cable to connect to an external power source that is specific to your geography.

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Each 2145 UPS-1U is connected to a SAN Volume Controller node with a power cable and a signal cable. To avoid the possibility of power and signal cables being connected to different uninterruptible power supply units, these cables are wrapped together and supplied as a single field replaceable unit. The signal cable enables the SAN Volume Controller node to read status and identification information from the uninterruptible power supply.

## 2145 UPS-1U controls and indicators

All controls and indicators for the 2145 UPS-1U are located on the front-panel assembly.

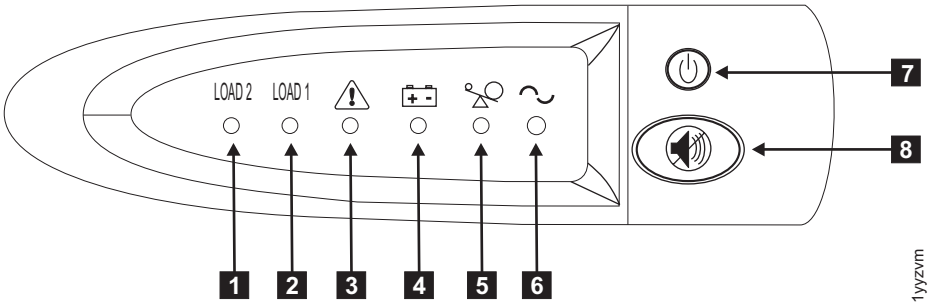



*Figure 17. 2145 UPS-1U front-panel assembly*

1. Load segment 2 indicator
2. Load segment 1 indicator
3. Alarm or Service indicator
4. On-battery indicator
5. Overload indicator
6. Power-on indicator
7. On/off button
8. Test and alarm reset button

Table 1 identifies which status and error LEDs that display on the 2145 UPS-1U front-panel assembly relate to the specified error conditions. It also lists the uninterruptible power supply alert-buzzer behavior.

*Table 1. 2145 UPS-1U error indicators*

| [1] Load2 | [2] Load1 | [3] Alarm | [4] Battery | [5] Overload | [6] Power-on | Buzzer | Error condition |
|---|---|---|---|---|---|---|---|
| Green (see Note 1) | | | | | Green | (see Note 3) | No errors; the 2145 UPS-1U was configured by the SAN Volume Controller |
| Green | Amber (see Note 2) | | | | Green | | No errors; the 2145 UPS-1U is not yet configured by the SAN Volume Controller |

*Table 1. 2145 UPS-1U error indicators (continued)*

| [1] Load2 | [2] Load1 | [3] Alarm | [4] Battery | [5] Overload | [6] Power-on | Buzzer | Error condition |
|---|---|---|---|---|---|---|---|
| Green | Either on or off | | Amber | | Green | Beeps for two seconds and then stops | The ac power is over or under limit. The uninterruptible power supply has switched to battery mode. |
| | | Flashing red | Flashing amber | Flashing red | Flashing green | Three beeps every ten seconds | Battery undervoltage |
| Green | Either on or off | Flashing red | | | Flashing green | Solid on | Battery overvoltage |
| | | Flashing red | Flashing amber | | Flashing green | Solid on | Output wave is abnormal when the charger is open, on battery mode |
| | | Flashing red | Flashing amber | | | Solid on | The ac-power output wave is under low limit or above high limit on battery mode |
| Green | Either on or off | | Amber | | | Beeps for four seconds and then stops | On battery (no ac power) |
| Green | Either on or off | | Flashing amber | | | Beeps for two seconds and then stops | Low battery (no ac power) |
| Green | Either on or off | | | Red | Green | Beeps for one second and then stops | Overload while on line |
| | | | Amber | Red | | Beeps for one second and then stops | Overload while on battery |
| Either on or off | Either on or off | Flashing red | | | Green | Solid on | Fan failure |
| Either on or off | Either on or off | Flashing red | Amber | | | Solid on | Battery test fail |
| | | Flashing red | | Red | | Solid on | Overload timeout |
| | | Flashing red | Amber | | Green | Solid on | Over temperature |
| | | Flashing red | Amber | Red | Green | | Output short circuit |

*Table 1. 2145 UPS-1U error indicators (continued)*

| [1] Load2 | [2] Load1 | [3] Alarm | [4] Battery | [5] Overload | [6] Power-on | Buzzer | Error condition |
|---|---|---|---|---|---|---|---|
| **Notes:**<br>1. The green Load2 LED ([1]) indicates that power is being supplied to the right pair of ac-power outlets as seen from the rear of the 2145 UPS-1U.<br>2. The amber Load1 LED ([2]) indicates that power is being supplied to the left pair of ac-power outlets as seen from the rear of the 2145 UPS-1U. These outlets are not used by the SAN Volume Controller.<br>This LED might be illuminated during power-on sequences, but it is typically extinguished by the SAN Volume Controller node that is attached to the 2145 UPS-1U.<br>3. A blank cell indicates that the light or buzzer is off. | | | | | | | |

## Load segment 2 indicator

The load segment 2 indicator on the 2145 UPS-1U is lit (green) when power is available to load segment 2.

When the load segment 2 indicator is green, the 2145 UPS-1U is running normally and power is available to this segment.

## Load segment 1 indicator

The load segment 1 indicator on the 2145 UPS-1U is not currently used by the SAN Volume Controller.

**Note:** When the 2145 UPS-1U is configured by the SAN Volume Controller, this load segment is disabled. During normal operation, the load segment 1 indicator is off. A “Do not use” label covers the receptacles.

## Alarm

If the alarm on the 2145 UPS-1U is flashing red, maintenance is required.

If the alarm is on, go to the 2145 UPS-1U MAP to resolve the problem.

## On-battery indicator

The amber on-battery indicator is on when the 2145 UPS-1U is powered by the battery. This indicates that the main power source has failed.

If the on-battery indicator is on, go to the 2145 UPS-1U MAP to resolve the problem.

## Overload indicator

The overload indicator lights up when the capacity of the 2145 UPS-1U is exceeded.

If the overload indicator is on, go to MAP 5250: 2145 UPS-1U repair verification to resolve the problem.

## Power-on indicator

The power-on indicator is displayed when the 2145 UPS-1U is functioning.

When the power-on indicator is a steady green, the 2145 UPS-1U is active.

## On/off button

The on/off button turns the power on or turns the power off to the 2145 UPS-1U.

### Turning on the 2145 UPS-1U

After you connect the 2145 UPS-1U to the outlet, it remains in *standby* mode until you turn it on. Press and hold the on/off button until the power-on indicator is illuminated (approximately five seconds). On some versions of the 2145 UPS-1U, you might need a pointed device, such as a screwdriver, to press the on/off button. A self-test is initiated that takes approximately 10 seconds, during which time the indicators are turned on and off several times. The 2145 UPS-1U then enters *normal* mode.

### Turning off the 2145 UPS-1U

Press and hold the on/off button until the power-on light is extinguished (approximately five seconds). On some versions of the 2145 UPS-1U, you might need a pointed device, such as a screwdriver, to press the on/off button. This places the 2145 UPS-1U in *standby* mode. You must then unplug the 2145 UPS-1U to turn off the unit.

**Attention:** Do not turn off the uninterruptible power supply before you shut down the SAN Volume Controller node that it is connected to. Always follow the instructions that are provided in MAP 5350 to perform an orderly shutdown of a SAN Volume Controller node.

## Test and alarm reset button

Use the test and alarm reset button to start the self-test.

To start the self-test, press and hold the test and alarm reset button for three seconds. This button also resets the alarm.

# 2145 UPS-1U connectors and switches

The 2145 UPS-1U has external connectors and dip switches.

### Locations for the 2145 UPS-1U connectors and switches

Figure 18 shows the location of the connectors and switches on the 2145 UPS-1U:

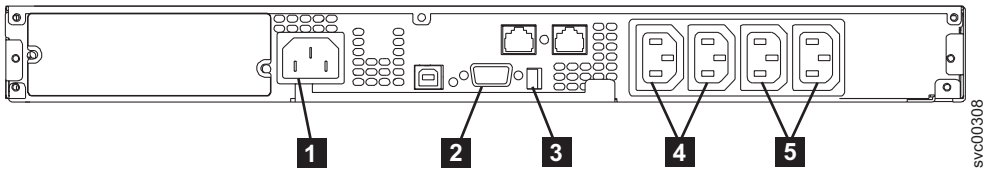



*Figure 18. 2145 UPS-1U connectors and switches*

1. Main power connector
2. Communication port
3. Dip switches
4. Load segment 1 receptacles

5 Load segment 2 receptacles

## 2145 UPS-1U dip switches

Figure 19 shows the dip switches, which can be used to configure the input and output voltage ranges. Because this function is performed by the SAN Volume Controller software, both switches must be left in the OFF position.

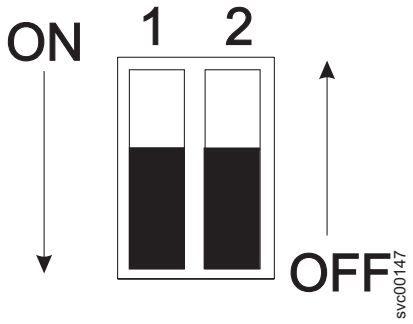



*Figure 19. 2145 UPS-1U dip switches*

## 2145 UPS-1U ports not used

The 2145 UPS-1U is equipped with ports that are not used by the SAN Volume Controller and have not been tested. Use of these ports, in conjunction with the SAN Volume Controller or any other application that might be used with the SAN Volume Controller, is not supported. Figure 20 shows the 2145 UPS-1U ports that are not used.

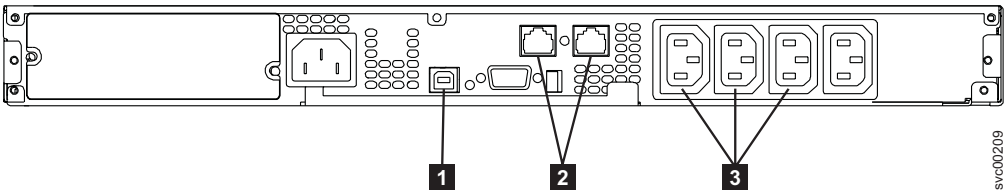



*Figure 20. Ports not used by the 2145 UPS-1U*

1 USB interface port

2 Network ports

3 Load segment receptacles

## 2145 UPS-1U power connector

Figure 21 on page 27 shows the power connector for the 2145 UPS-1U.

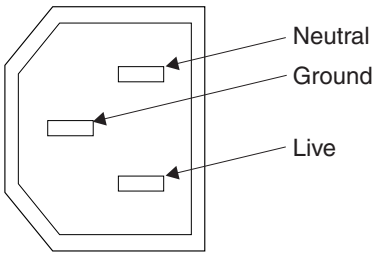



*Figure 21. Power connector*

# Uninterruptible power-supply environment requirements

An uninterruptible power-supply environment requires that certain specifications for the physical site of the SAN Volume Controller must be met.

## 2145 UPS-1U environment

All SAN Volume Controller models are supported with the 2145 UPS-1U.

### 2145 UPS-1U specifications

The following tables describe the physical characteristics of the 2145 UPS-1U.

**2145 UPS-1U dimensions and weight**

Ensure that space is available in a rack that is capable of supporting the 2145 UPS-1U.

| Height | Width | Depth | Maximum weight |
|---|---|---|---|
| 44 mm (1.73 in.) | 439 mm (17.3 in.) | 579 mm (22.8 in.) | 16 kg (35.3 lb) |
| **Note:** The 2145 UPS-1U package, which includes support rails, weighs 18.8 kg (41.4 lb). | | | |

### Heat output

The 2145 UPS-1U unit produces the following approximate heat output.

| Model | Heat output during normal operation | Heat output during battery operation |
|---|---|---|
| 2145 UPS-1U | 10 W (34 Btu per hour) | 150 W (512 Btu per hour) |

# Power cables for the 2145 UPS-1U

If you do not connect the 2145 UPS-1U to a rack power distribution unit (PDU) or redundant ac-power switch, you must follow your country or region's power requirements to choose the appropriate power cable for the 2145 UPS-1U.

The 2145 UPS-1U is supplied with an IEC 320-C13 to C14 jumper to connect it to a rack PDU. You can also use this cable to connect the 2145 UPS-1U to the redundant ac-power switch.

The following table lists the power cable options for your country or region.

| Country or region | Length | Connection type (attached plug designed for 200 - 240 V ac input) | Part number |
|---|---|---|---|
| United States of America (Chicago), Canada, Mexico | 1.8 m (6 ft) | NEMA L6-15P | 39M5115 |
| Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Korea (South), Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Suriname, Taiwan, Trinidad (West Indies), United States of America, Venezuela | 2.8 m (9 ft) | NEMA L6-15P | 39M5116 |
| Afghanistan, Algeria, Andorra, Angola, Austria, Belgium, Benin, Bulgaria, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Czech Republic, Egypt, Finland, France, French Guiana, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Iran, Ivory Coast, Jordan, Lebanon, Luxembourg, Macao S.A.R. of China, Malagasy, Mali, Martinique, Mauritania, Mauritius, Monaco, Morocco, Mozambique, Netherlands, New Caledonia, Niger, Norway, Poland, Portugal, Romania, Senegal, Slovakia, Spain, Sudan, Sweden, Syria, Togo, Tunisia, Turkey, former USSR, Vietnam, former Yugoslavia, Zaire, Zimbabwe | 2.8 m (9 ft) | CEE 7-VII | 39M5123 |
| Antigua, Bahrain, Brunei, Channel Islands, Hong Kong S.A.R. of China, Cyprus, Dubai, Fiji, Ghana, India, Iraq, Ireland, Kenya, Kuwait, Malawi, Malaysia, Malta, Nepal, Nigeria, Polynesia, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Kingdom, Yemen, Zambia | 2.8 m (9 ft) | BS 1363/A | 39M5151 |
| Argentina | 2.8 m (9 ft) | IRAM 2073 | 39M5068 |
| Argentina, Australia, New Zealand, Papua New Guinea, Paraguay, Uruguay, Western Samoa | 2.8 m (9 ft) | AS/NZS 3112/2000 | 39M5102 |
| Bangladesh, Burma, Pakistan, South Africa, Sri Lanka | 2.8 m (9 ft) | SABS 164 | 39M5144 |
| Chile, Ethiopia, Italy, Libya, Somalia | 2.8 m (9 ft) | CEI 23-16 | 39M5165 |
| People's Republic of China | 2.8 m (9 ft) | GB 2099.1 | 39M5206 |

| Country or region | Length | Connection type (attached plug designed for 200 - 240 V ac input) | Part number |
|---|---|---|---|
| Denmark | 2.8 m (9 ft) | DK2-5a | 39M5130 |
| Israel | 2.8 m (9 ft) | SI 32 | 39M5172 |
| Liechtenstein, Switzerland | 2.8 m (9 ft) | IEC 60884 Stnd. Sheet 416534?2 (CH Type 12) | 39M5158 |
| Thailand | 2.8 m (9 ft) | NEMA 6-15P | 39M5095 |

# Chapter 4. Installing the SAN Volume Controller 2145-8F4 or the SAN Volume Controller 2145-8F2 hardware

There are several steps that you must perform to prepare and then install the SAN Volume Controller 2145-8F4 or the SAN Volume Controller 2145-8F2 hardware.

The following topics describe the SAN Volume Controller 2145-8F4 or the SAN Volume Controller 2145-8F2 hardware installation tasks in the order that they should be performed.

**Note:** If you are adding a new I/O group to an existing SAN Volume Controller cluster, there is no need to turn off the existing, operating cluster nodes.

1. Prepare for the SAN Volume Controller hardware installation by confirming that you have all the planning information and parts that you require.
2. Optionally, install and verify the redundant ac-power switch, if it is to be used and is not already being used for a node.
3. Install the uninterruptible power supply.
4. Install the node.
5. Connect the fibre-channel and Ethernet cables to the node.
6. Connect the node to the uninterruptible power supply.
7. Verify the node.
8. Install and verify the master console, unless it is already installed. Optionally, this step can be performed first.

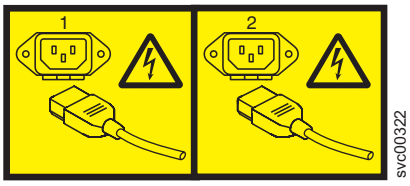
After you finish these steps, the hardware installation is complete.

## Optionally installing the redundant ac-power switch

Use the redundant ac-power switch to make the SAN Volume Controller cluster more resilient to power failure.

**DANGER**

**Multiple power cords: The product is equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords. (L003)**




or

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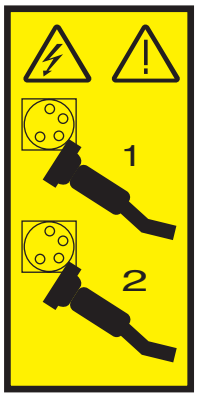


The following topics describe the redundant ac-power switch installation tasks in the order that they must be performed:

1. Attach the mounting plates to the redundant ac-power switch.
2. Label the cables.
3. Connect the power input cables to the redundant ac-power switch.
4. Install the redundant ac-power switch in the rack.
5. Connect the redundant ac-power switch to the site power.
6. Test the redundant ac-power switch to ensure that it automatically switches power supplies when the main power source fails or is restored.

## Attaching the mounting plates to the redundant ac-power switch

Attach the mounting plates to the redundant ac-power switch before you label the cables.

Perform the following steps to attach the mounting plates to the redundant ac-power switch:

Attach each of the two mounting plates to the redundant ac-power switch using three M3 Torx T8 head screws. Position the mounting face on the side of the redundant ac-power switch containing the output power sockets. See Figure 22.


*Figure 22. Attaching the mounting plates*

## Labeling the cables

You must label each end of the two redundant ac-power switch input-power cables before you connect the input-power cables to the redundant ac-power switch.

Perform the following steps to label each end of the two redundant ac-power switch input-power cables:

1. Label the rack power-distribution end “Power source <name>, outlet <id> to redundant ac-power switch <location> <MAIN | BACKUP> input.” For example, “Power source D2, outlet 4 to redundant ac-power switch pos 7 MAIN input.” One cable is labeled “MAIN;” the other is labeled “BACKUP.”
2. Label the redundant ac-power switch end “redundant ac-power switch <location> <MAIN | BACKUP> input from Power source <name>, outlet <id>.” One cable is labeled “MAIN;” the other is labeled “BACKUP.”

## Connecting the input-power cables to the redundant ac-power switch

You will find it easier to connect the input-power cables to the redundant ac-power switch before you install the redundant ac-power switch in the rack.

Perform the following steps to connect the input-power cables to the redundant ac-power switch:

1. Connect the main input-power cable to the redundant ac-power switch.
2. Connect the backup input-power cable to the redundant ac-power switch.
3. Secure both the redundant ac-power switch input-power cables using the clips of the redundant ac-power switch. See Figure 23.


*Figure 23. Power cable clips*

## Installing the redundant ac-power switch in the rack

You must install the redundant ac-power switch in the rear of the rack before you connect the redundant ac-power switch to the site power.

Perform the following steps to install the redundant ac-power switch in the rack:

1. Use the hardware location chart to determine where to install the redundant ac-power switch in the rack. The redundant ac-power switch can be installed horizontally in a rack slot or vertically in one of the side slots of the rack.
2. Position the four “C” clips in the rack’s mounting bar, as shown in Figure 24 on page 34.

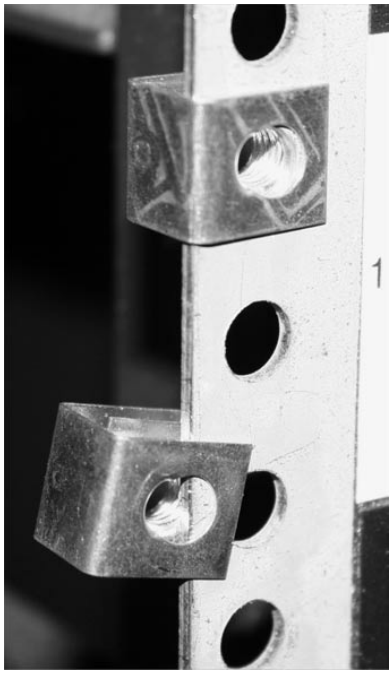


*Figure 24. Positioning the clips*

3. Position the redundant ac-power switch in the rack first, pushing the cables through to the front of the rack. Mount in place, as shown in Figure 25, using the four M6 screws.


*Figure 25. Positioned in rack*

## Connecting the redundant ac-power switch to the site power

You must connect the redundant ac-power switch to the site power before you test the redundant ac-power switch.

Perform the following steps to connect the redundant ac-power switch to the site power:

1. Determine a suitable cable route from the redundant ac-power switch to the power distribution units.
2. Route the main input-power cable of the redundant ac-power switch to the specified power distribution unit, and connect it.
3. Route the backup input-power cable of the redundant ac-power switch to the specified power distribution unit, and connect it.
4. Verify that the redundant ac-power switch power cables are tidy. Ensure that they do not obstruct other equipment and that they are tied in place where necessary.

## Testing the redundant ac-power switch

You can test the redundant ac-power switch before you continue installing other SAN Volume Controller components. You can test the redundant ac-power switch later if a suitable test device is not available.

You can test whether the redundant ac-power switch correctly switches between power inputs when the main input power fails or is restored. You can either use a volt meter to measure for voltage at the output or attach a work light, or similar device with a C14 plug, to the redundant ac-power switch output and verify that it remains powered when a failure is simulated on either of the inputs.

**Notes:**

- If you do not have a separate device to verify that there is power on the output port of the redundant ac-power switch, you can delay this test until you connect the redundant ac-power switch to the uninterruptible power supply. In that case, turn on the uninterruptible power supply (not the SAN Volume Controller node) and see if it changes to battery power. The test fails if the uninterruptible power supply switches to battery power for more than five seconds.
- Any transient indications of battery power can be ignored.

When the instructions say to "remove power," you can either turn the power off if the site power-distribution unit (PDU) has outputs that are individually switched or remove the specified redundant ac-power switch power cable from the outlet of the site PDU.

**Note:** If at any time there is no power on the output socket, ensure that the power distribution sockets of the power source are turned on. If they are, recheck all of the connections and decide if the redundant ac-power switch assembly, which includes the input-power cables, is defective.

Perform the following steps to test the redundant ac-power switch:

1. Confirm that there is power at redundant ac-power switch output socket 2.
2. Confirm that there is power at redundant ac-power switch output socket 1.
3. Remove power from the main power cable to the redundant ac-power switch and confirm that there is power at the redundant ac-power switch output 1.
4. Reconnect the main power cable.
5. Remove power from the backup power cable to the redundant ac-power switch and confirm that there is power at the redundant ac-power switch output 1.
6. Reconnect the backup power cable and remove the monitoring device.

   **Note:** After any failure, repeat the test phase from the start until all the tests succeed.

# Installing the 2145 UPS-1U

Before you can use the SAN Volume Controller, you need to install the uninterruptible power supply.

Complete the following steps to install the 2145 UPS-1U:

1. Install the support rails for the 2145 UPS-1U.
2. Install the 2145 UPS-1U in the rack.
3. Install the 2145 UPS-1U cable-retention bracket.

## Installing the support rails for the 2145 UPS-1U

You must install the support rails in the rack before installing the 2145 UPS-1U.

Complete the following prerequisites before installing the support rails:

1. Use the customer's hardware-location chart to determine where in the rack that the 2145 UPS-1U is to be installed.
2. At the back of the rack, observe the Electronic Industries Alliance (EIA) positions and determine where you are going to install the 2145 UPS-1U. Because of its weight, position the 2145 UPS-1U where it is easy to handle in one of the lower positions in the rack.

Perform the following steps to install the support rails for the 2145 UPS-1U:

1. Open the top of the 2145 UPS-1U shipping carton. Grip the flaps on either side of the 2145 UPS-1U.
2. Lift the 2145 UPS-1U clear of the shipping carton and place it on a flat, stable surface with the front facing you.
3. Attach the long side of a mounting bracket **1** to each side of the 2145 UPS-1U using four M3 × 6 screws **2** for each bracket, as shown in Figure 26.

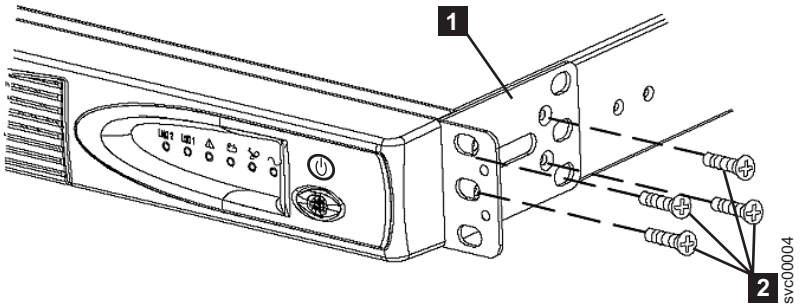


*Figure 26. Installing the support rails for a 2145 UPS-1U into the rack*

4. Loosen the assembly wing nuts (**1** in Figure 27) on both rail assemblies and adjust the rail size to the depth of your rack.

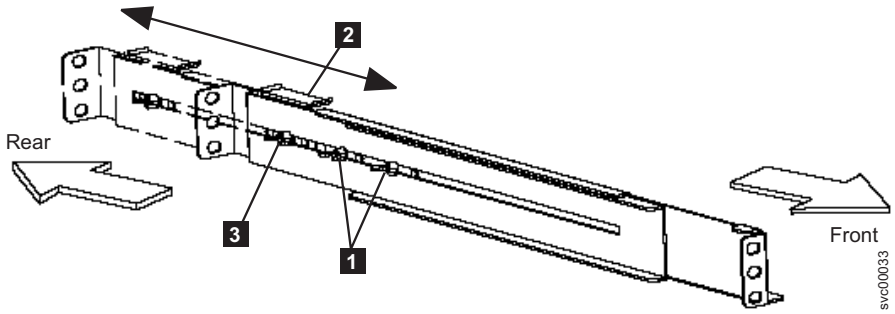


*Figure 27. Adjusting the rail depth on the 2145 UPS-1U*

**1** Assembly wing nuts

2 Hold-down bracket

3 Wing nut

5. Position the rear, hold-down bracket (2 in Figure 27 on page 36) towards the end of the rail assemblies and tighten the wing nut (3 in Figure 27 on page 36).
6. Select the holes in the rail where you want to position the 2145 UPS-1U.

   **Note:** The bottom flange of the support rail must align with the EIA mark on the rack.
7. Using two M6 × 10 screws (1 in Figure 28) and two clip nuts 2, attach the rail to the rear of the rack. The customer's rack might be different than the one shown here, and if so, might require different clip nuts or fasteners.

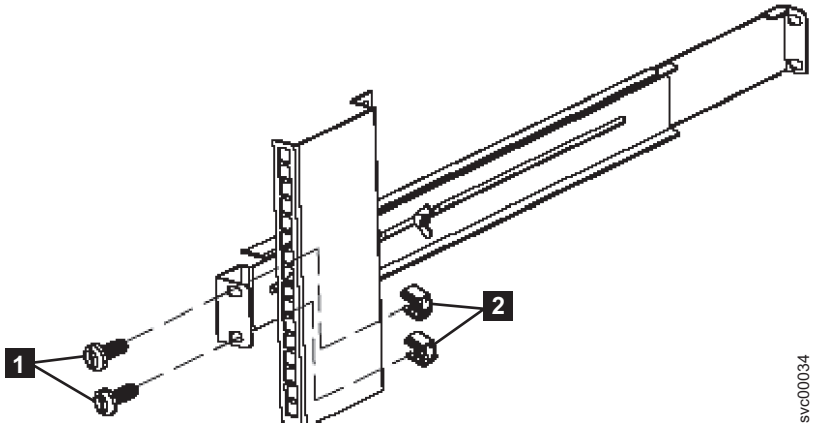


*Figure 28. Securing the rear rail on the 2145 UPS-1U*

8. Attach only the bottom hole of the rail to the front of the rack with one M6 × 10 screw and one clip nut (1 in Figure 29 on page 38).

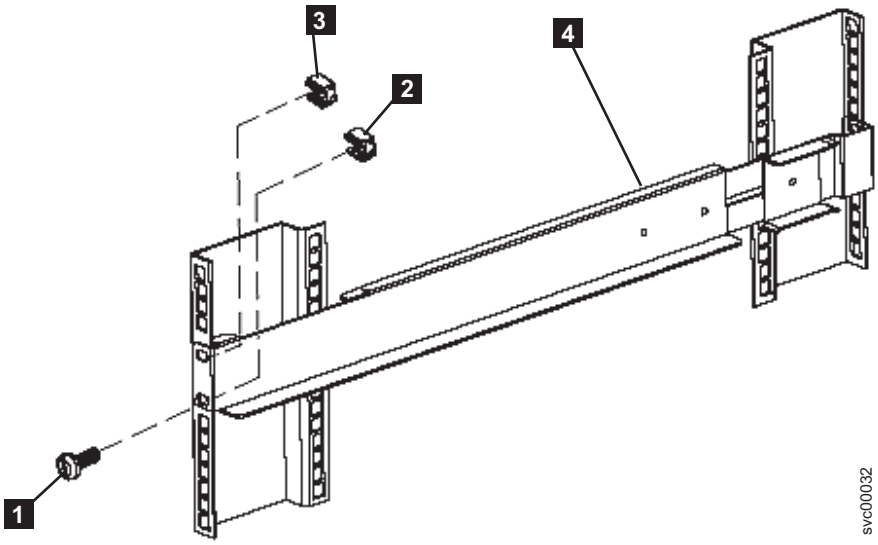


*Figure 29. Securing the front rail on the 2145 UPS-1U*

9. Install a clip nut in the top hole of the rail **3** .
10. Repeat step 7 on page 37 through step 9 for the other rail.
11. Tighten the assembly wing nuts on both rail assemblies.

## Installing the 2145 UPS-1U in the rack

After you have completed the preparation procedures, you are ready to install the 2145 UPS-1U in the rack.

**Attention:** See "Safety and environmental notices" on page vii before you start the installation process. Use the reference numbers in parentheses at the end of each safety notice to find the matching translated notice. For the translation of the danger, caution, and attention notices, see the *IBM Systems Safety Notices*.

**CAUTION:**
**The uninterruptible power supply contains its own energy source (sealed, lead-acid batteries). The output receptacles might carry live voltage, even when the uninterruptible power supply is not connected to an ac supply. (11)**

**CAUTION:**
**Do not remove or unplug the input cord when the uninterruptible power supply is turned on. Unplugging the input cord removes the safety ground from the uninterruptible power supply and the equipment connected to the uninterruptible power supply. (12)**

**CAUTION:**
**To reduce the risk of fire or electric shock, install the uninterruptible power supply in a temperature- and humidity-controlled indoor environment, free of conductive contaminants. Ambient temperature must not exceed 40°C (104°F). Do not operate near water or excessive humidity (95% maximum). (13)**

**CAUTION:**
**To avoid any hazard from the rack tipping forward when devices are installed, observe all safety precautions for the rack into which you are installing the device.**

Perform the following steps to install the 2145 UPS-1U in the rack.

**Note:** You might have already completed steps 3 through 6 on page 41 if you used the *Read Me First* pamphlet, which is included with the 2145 UPS-1U.

1. Stand at the front of the rack and place the back of the 2145 UPS-1U onto the support rails, and then slide the 2145 UPS-1U into the rack.

   **CAUTION:**
   **The 2145 UPS-1U weighs 16 kg (35.3 lb). If you feel unsure about lifting the uninterruptible power supply to its location in the rack, seek assistance or remove the battery to reduce its weight.**

2. At the front of the 2145 UPS-1U, install the two mounting screws (**1** in Figure 30).

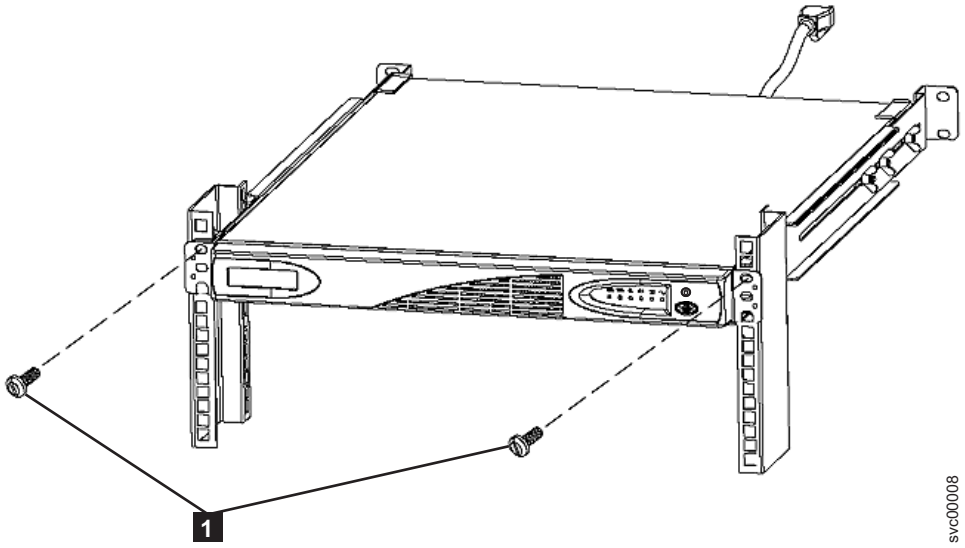


*Figure 30. Mounting screws for the 2145 UPS-1U*

3. If you have not already connected the internal battery connector, remove the 2145 UPS-1U front panel, as shown in Figure 31 on page 40.

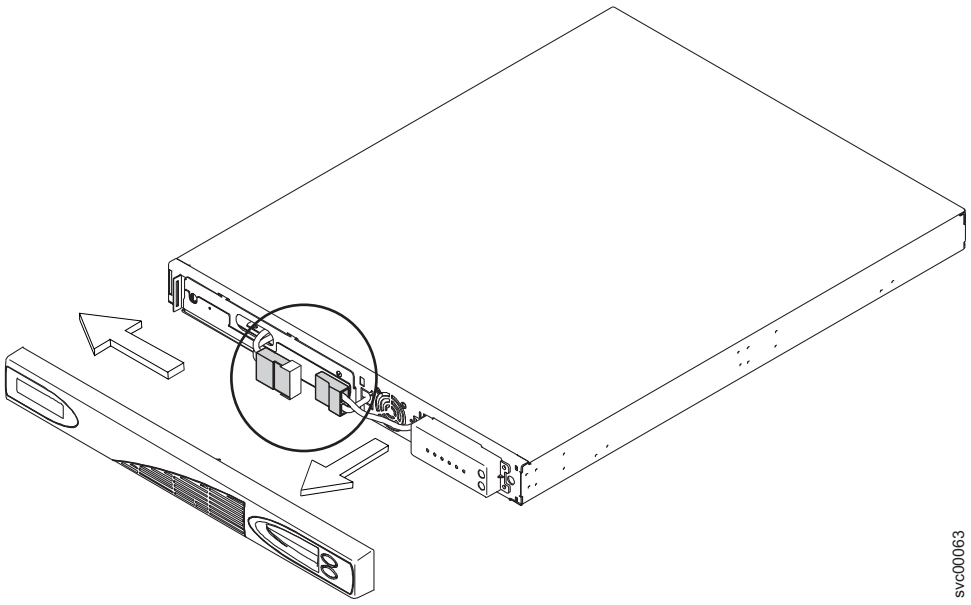


*Figure 31. Removing the 2145 UPS-1U front panel*

4. Remove the protective label from the internal battery connector (shown in Figure 32).

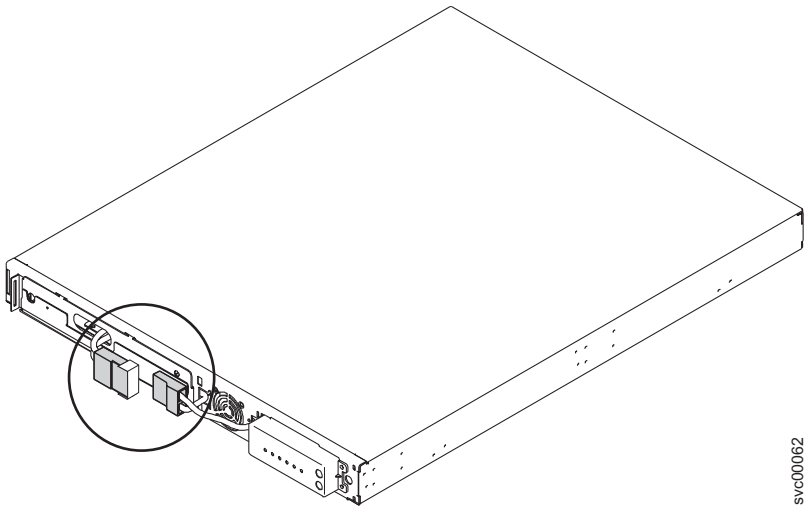


*Figure 32. The 2145 UPS-1U internal battery connector with protective tape*

5. Connect the internal battery connector (shown in Figure 33 on page 41). Each end of the keyed connector has two wires: one red (+) and one black (–). Align the connector so that the two red wires are joined together and the two black wires are joined together.

   **Note:** A small amount of arcing might occur when connecting the batteries. This is normal and does not damage the unit or present any safety concerns.

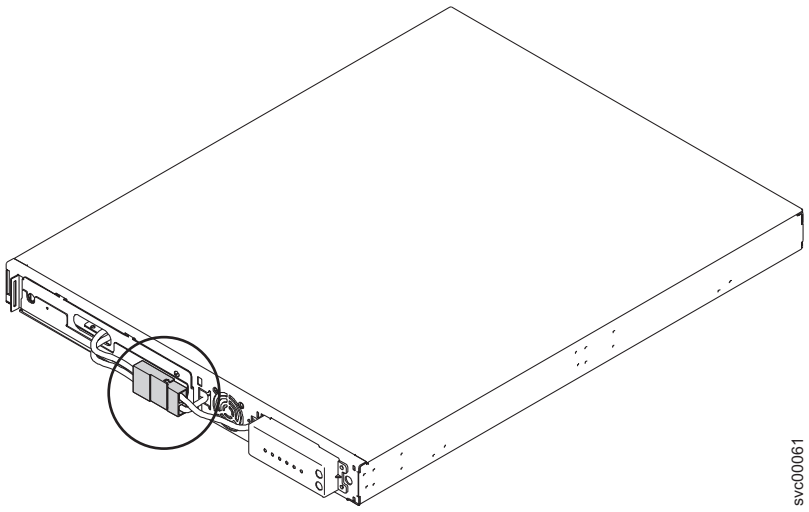


*Figure 33. The 2145 UPS-1U internal-battery connector*

6. Reinstall the front panel. You might first need to move the sliding section on the front of the 2145 UPS-1U to the closed position.
7. At the back of the 2145 UPS-1U, plug the 2145 UPS-1U main-power connector into the power socket (**1** in Figure 34). The 2145 UPS-1U is in standby mode, so all indicators are off.

   It is recommended that each 2145 UPS-1U for an I/O group is connected to a different power source.

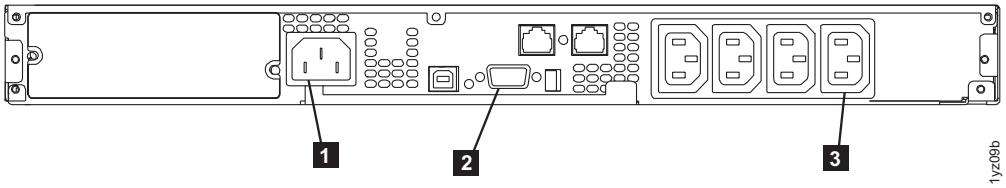


*Figure 34. 2145 UPS-1U (rear view)*

**1** Main power connector

**2** Communication port

**3** Load segment 2 receptacle

**Attention:** Ensure that you comply with the following requirements:

- The voltage supplied to the 2145 UPS-1U must be 200 - 240 V single phase.
- The frequency supplied must be 50 or 60 Hz.

**Notes:**

a. The 2145 UPS-1U has an integrated circuit breaker and does not require external protection.

b. The 2145 UPS-1U is intended to maintain power on SAN Volume Controller nodes until data can be saved to the local hard-disk drive. Only SAN Volume Controller nodes can be plugged into the 2145 UPS-1U or the SAN Volume Controller cluster malfunctions.

8. Press and hold the on/off button (7 in Figure 35) for approximately five seconds. You might need a pointed device, such as a screwdriver, to press the on/off button. The front panel indicators cycle through a startup sequence while the 2145 UPS-1U conducts a self-test.

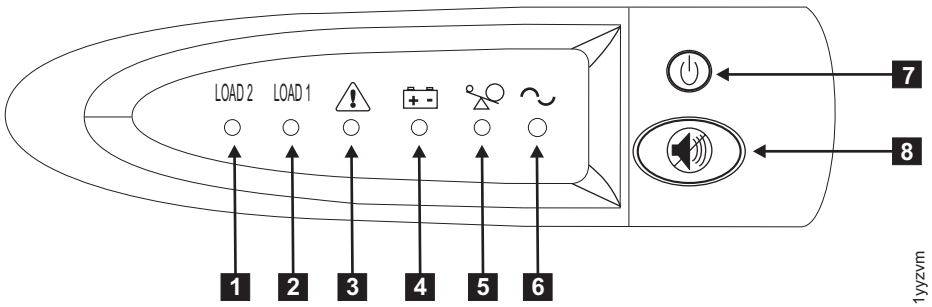


*Figure 35. 2145 UPS-1U front-panel assembly*

When the self-test is complete, the power-on indicator 6 and the load indicators (1 and 2) illuminate to indicate that power is being supplied by the 2145 UPS-1U. The 2145 UPS-1U is now in normal mode, and is charging its battery. If the battery indicator 4 is on and the alarm is sounding, the voltage range setting might not be correct. When a SAN Volume Controller is connected to the 2145 UPS-1U, the SAN Volume Controller automatically adjusts the voltage range setting. Take no action for this alarm condition unless it persists for more than five minutes after a SAN Volume Controller has been connected to this 2145 UPS-1U and turned on.

9. Repeat all of these steps to install additional 2145 UPS-1U units.

## Installing the 2145 UPS-1U cable-retention bracket

The 2145 UPS-1U cable-retention bracket ensures that the power cable connection between the 2145 UPS-1U and the SAN Volume Controller node is stable.

Install the bracket after you install the power cable that connects the 2145 UPS-1U and the SAN Volume Controller node.

You can attach the bracket by performing the following steps:

1. Install the power cable into the rightmost power outlet on the rear of the 2145 UPS-1U.
2. Remove the bracket and the two screws (shown in Figure 36 on page 43) from the packaging.

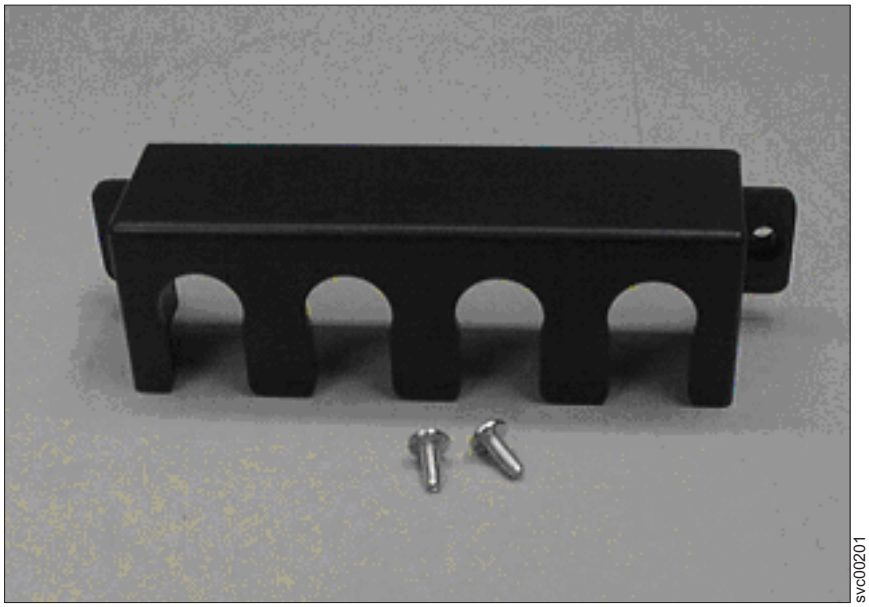


*Figure 36. 2145 UPS-1U power cable-retention bracket hardware*

3. Place the bracket over the power outlets on the right rear of the 2145 UPS-1U, so that the two screw holes line up.
4. Position the bracket with the power cable protruding through the rightmost slot in the bracket.
5. Secure the bracket in place with one screw on each side, as shown in Figure 37.


*Figure 37. 2145 UPS-1U power cable-retention bracket*

## Installing the SAN Volume Controller 2145-8F2 or the SAN Volume Controller 2145-8F4

There are several steps that you must perform to install the SAN Volume Controller 2145-8F2 or the SAN Volume Controller 2145-8F4 nodes.

Installing the SAN Volume Controller 2145-8F2 or the SAN Volume Controller 2145-8F4 consists of the following tasks:

1. Installing the support rails in the rack cabinet.
2. Installing the SAN Volume Controller 2145-8F2 or the SAN Volume Controller 2145-8F4.
3. Connecting the SAN Volume Controller 2145-8F2 or the SAN Volume Controller 2145-8F4 to the uninterruptible power supply.

4. Installing the cable retention bracket on the SAN Volume Controller 2145-8F4.

## Installing the support rails for the SAN Volume Controller 2145-8F4 or the SAN Volume Controller 2145-8F2

You must install the support rails that hold the SAN Volume Controller 2145-8F4 or the SAN Volume Controller 2145-8F2.

When you are ready to install the support rails, perform the following tasks:

- Refer to the Hardware Location Chart to determine where the SAN Volume Controller is to be installed in the rack.
- Refer to the Electronic Industries Alliance (EIA) markings on the rack and decide where you are going to install the support rails.

Perform the following steps to install the support rails:

1. Check the labels on the support rails. Each rail has a label that indicates which is the front end of the rail and whether the rail is for the left or right side of the rack. Perform this procedure for both rails.
2. Put your index finger against the side of the latch-lever, **1** in Figure 38, and put your thumb against the front of the latch-lock **2**.

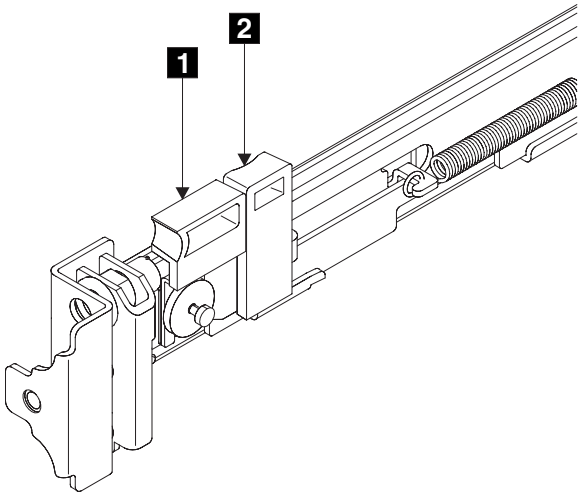


*Figure 38. Retracting the latch lock carrier*

**1** Latch-lever

**2** Latch-lock

3. Gently push the latch lock **2** away from the rail as you move the latch lever **1** toward the far end of the rail (Figure 39 on page 45). The latch-lock carrier assembly slides against the spring tension.

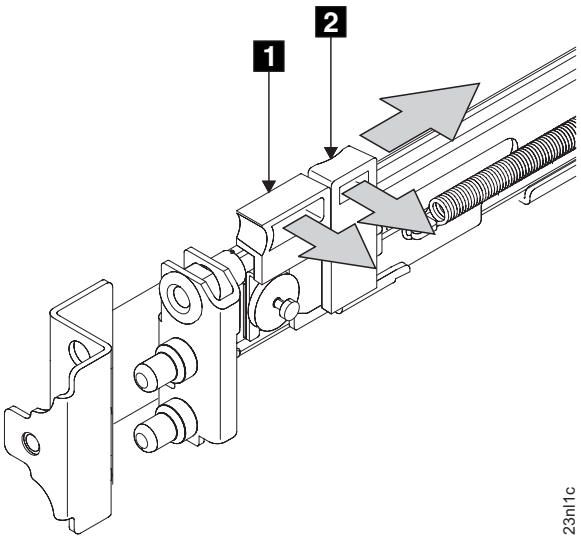


*Figure 39. Opening the front latch-lock carrier assembly*

1 Latch-lever

2 Latch-lock

4. Continue to slide the latch-lock carrier for approximately 13 mm (0.5 in). The latch-lever engages a hole in the back bracket assembly and holds the latch-lock carrier in the retracted position.
5. Push the back rail bracket 1 (Figure 40) toward the front of the rail until it stops. The rail is now at its shortest adjustment.

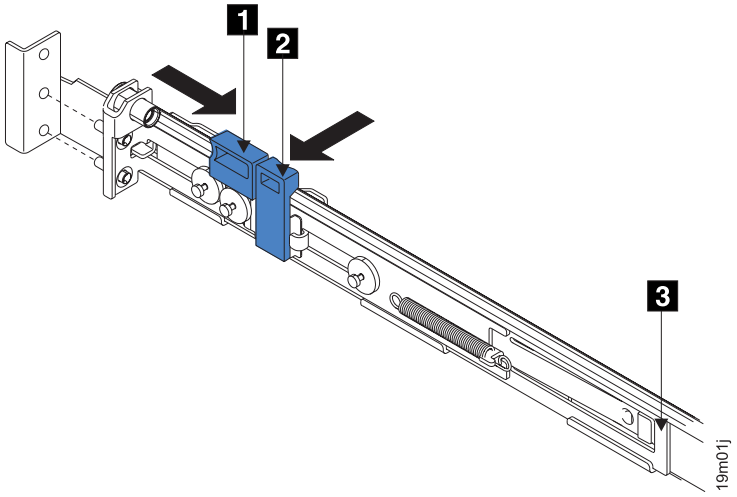


*Figure 40. Opening the back latch-lock carrier assembly*

1 Latch-lever

2 Latch-lock

3 Back rail bracket

6. Place the front end of the left rail in the rack cabinet. Align the top of the front bracket 1 (Figure 41 on page 46) with the required EIA marking that is

on the rack.

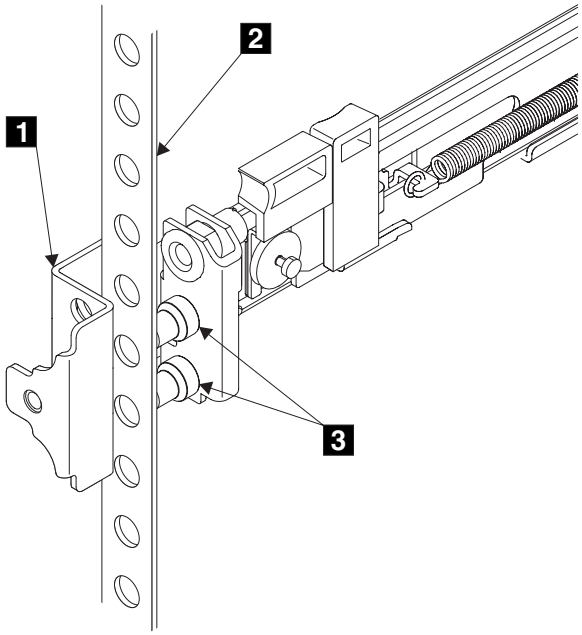


*Figure 41. Installing the front end of the rail*

1 Front bracket

2 Rack-mounting flange

3 Locating pins

7. Align the locating pins 3 with the holes that are in the rack-mounting flange.
8. Push the latch lock 2 (Figure 42 on page 47) away from the rail to release the carrier. The latch-lock carrier slides toward the front of the rack and the locating pins project through the holes that are in the front flange and in the front rail bracket.

   **Important:** Ensure that the locating pins are fully extended through the front rail bracket.

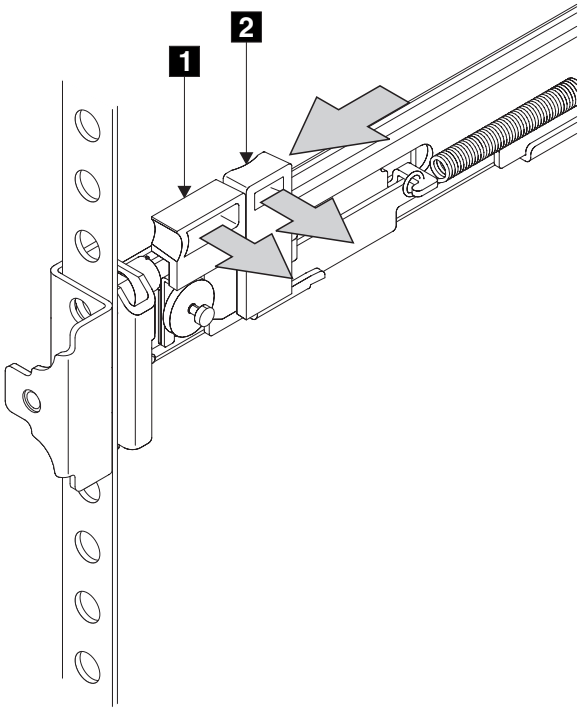


*Figure 42. Closing the latch-lock carrier assembly*

**1** Latch-lever

**2** Latch-lock

9. Push the back rail bracket toward the rear of the rack and align the locating pins with the rack-mounting flange.
10. Push the latch lock **2** away from the rail to release the carrier. The latch-lock carrier slides toward the rear of the rack, and the locating pins project through the holes that are in the rear flange and in the rear rail bracket.

    **Important:** Ensure that the locating pins are fully extended through the rear rail bracket.
11. On the rear of each rail, press the blue release tab and slide the shipping bracket off the slide rail. Store the shipping bracket for further use.

## Installing the SAN Volume Controller in a rack

After installing the support rails, you can install the SAN Volume Controller in a rack.

### Installing the SAN Volume Controller 2145-8F2 or the SAN Volume Controller 2145-8F4 in a rack

After installing the support rails, you can install the SAN Volume Controller 2145-8F4 or the SAN Volume Controller 2145-8F2 in the rack.

**CAUTION:**
**To avoid any hazard from the rack tipping forward when devices are installed, observe all safety precautions for the rack into which you are installing the device.**

Perform the following steps to install the SAN Volume Controller 2145-8F2 or the SAN Volume Controller 2145-8F4 node in the rack:

1. Stand at the front of the rack and place the back of the node onto the support rails, as low in the rack as possible.
2. Slide the node fully into the rack.

   The node snaps into place.
3. Repeat this procedure for each node that needs to be installed.

   **Tip:** If you have available space, leave a 1U space between each node to improve the air circulation in the rack.

## Connecting the SAN Volume Controller 2145-8F2 or the SAN Volume Controller 2145-8F4 to the 2145 UPS-1U

Connect the SAN Volume Controller to the 2145 UPS-1U to protect your data in the event of an unexpected loss of external power.

**Note:** To make the SAN Volume Controller cluster more resilient to power failure, the 2145 UPS-1U units can be connected to the redundant ac-power switch. If a redundant ac-power switch is not used, you can connect the two uninterruptible power supply units that are powering an I/O group to different, independent electrical power sources. If a single power source fails, the SAN Volume Controller cluster can then continue to operate with reduced performance.

Before you begin this task, see the completed customer's cable-connection table, which is described in the *IBM System Storage SAN Volume Controller Planning Guide* and can be downloaded from www.ibm.com/storage/support/2145.

Use the information in this table to identify the 2145 UPS-1U unit to which this node is to be connected.

Perform the following steps to connect the SAN Volume Controller to the 2145 UPS-1U:

1. At the back of the SAN Volume Controller 2145-8F2 or the SAN Volume Controller 2145-8F4, plug the combined power and serial cable into the power connector **2**. See Figure 43 on page 49.

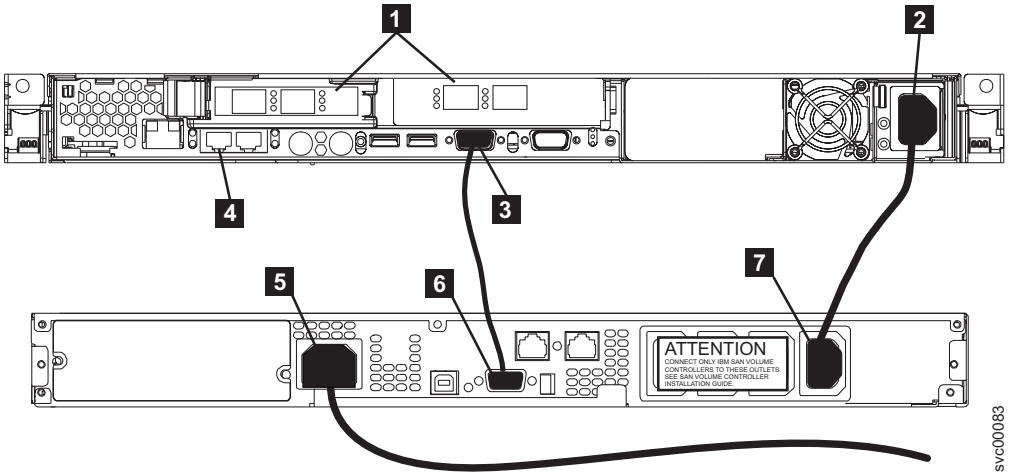


*Figure 43. Connecting the SAN Volume Controller 2145-8F2 power cable to the 2145 UPS-1U*

1. Fibre-channel ports
2. Power connector
3. Serial connector
4. Ethernet ports
5. Main power connector
6. Communication port
7. Load segment 2 receptacle

2. Place the other end of the power cable into the rightmost load segment 2 receptacle 7 on the 2145 UPS-1U.

   **DANGER**

   **You have already switched on the 2145 UPS-1U. The output sockets of the 2145 UPS-1U are live.**

3. Plug the signal cable into the serial connector 3 located on the SAN Volume Controller 2145-8F4 or the SAN Volume Controller 2145-8F2.
4. Place the other end of the signal cable into the communication port 6 on the 2145 UPS-1U.

The SAN Volume Controller power is now connected to the 2145 UPS-1U.

## Installing the SAN Volume Controller 2145-8F4 cable retention bracket

The cable retention bracket ensures that the SAN Volume Controller 2145-8F4 node does not mistakenly become unplugged from the uninterruptible power supply.

Install the SAN Volume Controller 2145-8F4 cable retention bracket after you install the node in the rack.

To attach the bracket to the support rail, perform the following steps:

1. Install the power cable into the power supply.

2. Insert the bracket onto the power cable so that the power cable is held by the slot on the end of the bracket. Figure 44 provides a view of how to align the cable retention bracket with the cable.


*Figure 44. Attaching the cable retention bracket to the SAN Volume Controller 2145-8F4 power cable*

3. Position the cable retention bracket against the support rail and attach the bracket onto the slot in the rear of the rail. Figure 45 provides a view of the cable retention bracket that is attached to the SAN Volume Controller 2145-8F4.

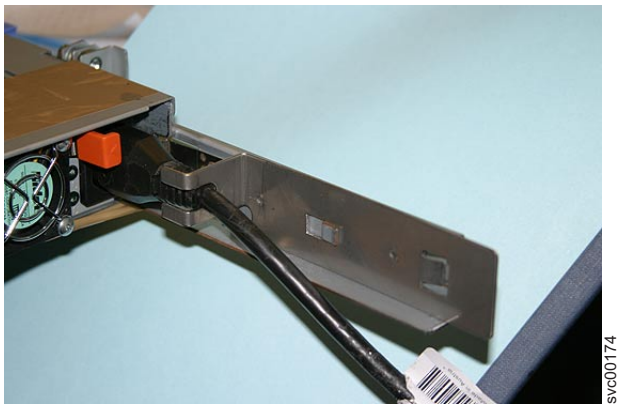


*Figure 45. SAN Volume Controller 2145-8F4 with cable retention bracket attached*

## Connecting the SAN Volume Controller 2145-8F4 or the SAN Volume Controller 2145-8F2 to the SAN and to the Ethernet network

Before you connect the SAN Volume Controller 2145-8F4 or the SAN Volume Controller 2145-8F2 to the SAN, you must connect the Ethernet and fibre-channel cables.

Before you begin this task, refer to the user's cable connection table to find out where to connect the Ethernet and fibre-channel cables.

To connect the SAN Volume Controller 2145-8F4 or the SAN Volume Controller 2145-8F2 to the SAN and to the Ethernet network, perform the following steps:

1. Connect the Ethernet cable to Ethernet port 1 **5** in Figure 46 on page 51 or Figure 47 on page 51.

**Attention:** You must use only Ethernet port 1 on the SAN Volume Controller. The software is configured only for Ethernet port 1.

2. Connect the other end of the Ethernet cable to the proper connector on the Ethernet hub or switch.

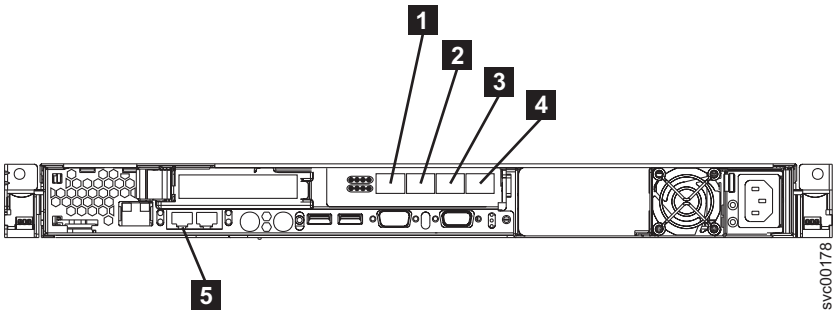


*Figure 46. Connectors at the back of the SAN Volume Controller 2145-8F4*

**1** Fibre-channel port 1

**2** Fibre-channel port 2

**3** Fibre-channel port 3

**4** Fibre-channel port 4

**5** Ethernet port 1

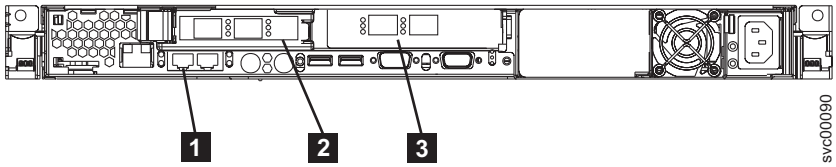


*Figure 47. Connectors at the back of the SAN Volume Controller 2145-8F2*

**1** Ethernet port 1

**2** Low-profile, dual-port fibre-channel host bus adapter (HBA) with ports 1 and 2 (left to right)

**3** Full-height, dual-port fibre-channel HBA with ports 3 and 4 (left to right)

**Attention:** When routing the fibre-channel cables, do not tighten the cable straps or bend the cables to a radius smaller than 76 mm (3 in.).

3. Connect the fibre-channel cables to the fibre-channel ports as required by the user's configuration.
4. Connect the other ends of the fibre-channel cables to the proper connectors of the fibre-channel switches.

## Verifying the SAN Volume Controller 2145-8F2 or the SAN Volume Controller 2145-8F4 installation

You must verify the SAN Volume Controller installation after the installation has completed.

This task shows you how to verify the installation after you install the SAN Volume Controller in the rack and connect it to the uninterruptible power supply, the storage area network (SAN), and the Ethernet.

**Note:** If at any point the SAN Volume Controller does not operate as described, see "MAP 5000" in the *IBM System Storage SAN Volume Controller Troubleshooting Guide*, unless a different maintenance analysis procedure (MAP) is specified.

Perform the following steps to verify installation:

1. Press the SAN Volume Controller power-control button. Because the button is recessed, you might need a pointed device, such as a screwdriver, to press the power-control button. Verify that the green power LED is lit. If the LED is not illuminated, see "MAP 5000: Start" in the *IBM System Storage SAN Volume Controller Troubleshooting Guide* to repair the problem.

   **Note:** You do not need to install any software. The node boots automatically.

   Verify that the node is booting without error. If it boots without error, either the `Charging`, `Recovering`, or the `Cluster:` message is displayed in the first line of the front-panel display.
2. Press and hold the select button for five seconds. The check light comes on and a display test is performed. Check that all display cells light and that a bar scrolls horizontally and vertically across the display. When the display test is complete, the check light goes off and a button test is started.
3. Press the up, down, left, and right buttons to verify that they are working. Figure 48 shows four examples of what the front panel should display when you press the buttons. After you finish testing the buttons, press and hold the select button for five seconds to exit the test.

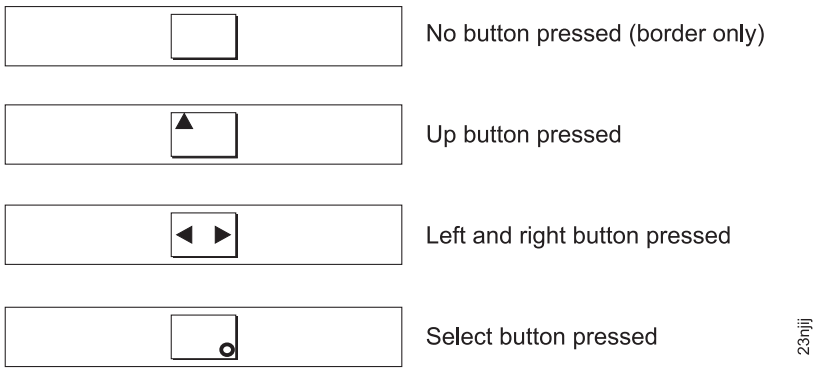


*Figure 48. Front-panel display when push buttons are pressed*

4. If the `Charging` or `Recovering` message is displayed on the front-panel display, press the select button to switch to the menu. The menu continues to be displayed while you press the buttons on the front panel. If you do not press any buttons within 60 seconds, the menu changes to display the charging progress. You can switch the front-panel display to the menu at any time by pressing the select button again.
5. Press and release the up button or down button until the `Node:` option is displayed on the first line of the front-panel display.
6. Verify that the node number that is displayed on the second line of the front-panel display is the same as the node number that is printed on the front panel of the node. Figure 49 on page 53 shows how the node number is

displayed on the front panel. If the node number is not the same, contact the IBM Support Center.


*Figure 49. Node number*

7. Press and release the up button or down button until the `Node:` option is displayed on the first line of the front-panel display. The second line of the front-panel display in Figure 50 shows the message `Inactive`. This message indicates that, although an Ethernet connection is available, it cannot yet be used.


*Figure 50. Ethernet mode*

8. Press and release the up button or down button until the `FC Port-1` option shows in the display.
9. Check whether the second line of the front-panel display shows the message `Active`. If `Active` is not shown on the second line, go to "MAP 5600: Fibre channel" in the *IBM System Storage SAN Volume Controller Service Guide* to repair the fault.
10. If you are installing a SAN Volume Controller 2145-8F2 node, go to step 16. If you are installing a SAN Volume Controller 2145-8F4 node, go to step 11.
11. Press and hold the down button.
12. Press and release the select button.
13. Release the down button. The operational speed of the fibre-channel link is displayed. Use the cable connection table that is provided by the customer to verify that the fibre-channel link is operating at the expected speed. If the operational speed does not match the expected speed, go to "MAP 5600: Fibre channel" in the *IBM System Storage SAN Volume Controller Troubleshooting Guide* to repair the fault.
14. Press the select button to return to the fibre-channel status display.
15. Press the right button to display each port in turn and ensure that the port is active and the speed is correct. Go to step 18 on page 54
16. Press and release the left or right button to display the other port options. Check whether for each port, the second line of the front-panel display shows the message `Active`. If `Active` is not shown for any port, go to "MAP 5600: Fibre channel" in the *IBM System Storage SAN Volume Controller Service Guide* to repair the fault.
17. If the configuration data table provided by the user indicates that the SAN Volume Controller nodes are to be operated at 1 Gbps, follow these steps:
    a. Press and hold the down button.
    b. Press and release the select button.
    c. Release the down button.

The second line of the front-panel display shows the current fibre-channel speed setting of the node. Press the up or down button until `1 Gbps` is displayed and then press the select button. This changes the fibre-channel speed for all ports on this node to 1 Gbps.

18. If you want to select a language other than English, perform the following steps:
    a. Press the up or down button until `Select Language?` is displayed.
    b. Press the select button.
    c. Press the left or right button until the required language is displayed.
    d. Press the select button.

    If the battery needed to be charged, the `Charging` or `Recovering` message is replaced by the `Cluster:` message when the battery is fully charged. The progress bar no longer displays. The installation of the SAN Volume Controller hardware is now complete. No software installation is required. Continue with the instructions in the *IBM System Storage SAN Volume Controller Software Installation and Configuration Guide* to create, if necessary, a new SAN Volume Controller cluster and to add the nodes into a SAN Volume Controller cluster.

# Accessibility

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully.

## Features

These are the major accessibility features in the SAN Volume Controller Console:

- You can use screen-reader software and a digital speech synthesizer to hear what is displayed on the screen. The following screen reader has been tested: Window-Eyes v6.1.
- You can operate all features using the keyboard instead of the mouse.
- You can change the initial delay and repeat rate of the up and down buttons to two seconds when you use the front panel of the SAN Volume Controller to set or change an IPv4 address. This feature is documented in the applicable sections of the SAN Volume Controller publications.

## Navigating by keyboard

You can use keys or key combinations to perform operations and initiate many menu actions that can also be done through mouse actions. You can navigate the SAN Volume Controller Console and help system from the keyboard by using the following key combinations:

- To traverse to the next link, button, or topic, press Tab inside a frame (page).
- To expand or collapse a tree node, press → or ←, respectively.
- To move to the next topic node, press V or Tab.
- To move to the previous topic node, press ^ or Shift+Tab.
- To scroll all the way up or down, press Home or End, respectively.
- To go back, press Alt+←.
- To go forward, press Alt+→.
- To go to the next frame, press Ctrl+Tab.
- To move to the previous frame, press Shift+Ctrl+Tab.
- To print the current page or active frame, press Ctrl+P.
- To select, press Enter.

## Accessing the publications

You can view the publications for the SAN Volume Controller in Adobe Portable Document Format (PDF) using the Adobe Acrobat Reader. The PDFs are provided at the following Web site:

www.ibm.com/storage/support/2145

**Related reference**

"SAN Volume Controller library and related publications" on page xxviii
A list of other publications that are related to this product are provided to you for your reference.

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# Glossary

This glossary includes terms for the IBM System Storage SAN Volume Controller.

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The following cross-references are used in this glossary:

**See** Refers the reader to one of two kinds of related information:

- A term that is the expanded form of an abbreviation or acronym. This expanded form of the term contains the full definition.
- A synonym or more preferred term.

**See also**
Refers the reader to one or more related terms.

**Contrast with**
Refers the reader to a term that has an opposite or substantively different meaning.

## Numerics

**2145** A hardware machine type for the IBM System Storage SAN Volume Controller. Models of the SAN Volume Controller are expressed as the number 2145 followed by "-xxx", such as 2145-8G4. Hardware models for the 2145 include 2145-4F2, 2145-8F2, 2145-8F4, 2145-8G4, and 2145-8A4.

## A

**access mode**
One of three different modes in which a logical unit (LU) in a disk controller system can operate. See also *image mode*, *managed space mode*, and *unconfigured mode*.

**Address Resolution Protocol (ARP)**
A protocol that dynamically maps an IP address to a network adapter address in a local area network.

**agent code**
An open-systems standard that interprets Common Information Model (CIM) requests and responses as they transfer between the client application and the device.

**application server**
A host that is attached to the storage area network (SAN) and that runs applications.

**ARP** See *Address Resolution Protocol*.

**array** An ordered collection, or group, of physical storage devices that are used to define logical volumes or devices.

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**association**
A class that contains two references that define a relationship between two referenced objects.

**asymmetric virtualization**
A virtualization technique in which the virtualization engine is outside the data path and performs a metadata-style service. The metadata server contains all the mapping and locking tables while the storage devices contain only data. See also *symmetric virtualization*.

**auxiliary virtual disk**
The virtual disk that contains a backup copy of the data and that is used in disaster recovery scenarios. See also *master virtual disk*.

**availability**
The ability of a system to continue working, with perhaps a decrease in performance, after individual components fail.

## B

**bandwidth**
The range of frequencies an electronic system can transmit or receive. The greater the bandwidth of a system, the more information the system can transfer in a given period of time.

**bitmap**
A coded representation in which each bit, or group of bits, represents or corresponds to an item; for example, a configuration of bits in main storage in which each bit indicates whether a peripheral device or a storage block is available or in which each group of bits corresponds to one pixel of a display image.

**blade** One component in a system that is designed to accept some number of components (blades). Blades could be individual servers that plug into a multiprocessing system or individual port cards that add connectivity to a switch. A blade is typically a hot-swappable hardware device.

**block** A unit of data storage on a disk drive.

**block virtualization**
The act of applying virtualization to one or more block-based (storage) services for the purpose of providing a new aggregated, higher-level, richer, simpler, or secure block service to clients. Block virtualization functions can be nested. A disk drive, RAID system, or volume manager all perform some form of block-address to (different) block-address mapping or aggregation. See also *virtualization*.

**Boolean**
Pertaining to the processes used in the algebra formulated by George Boole.

## C

**cache** A high-speed memory or storage device used to reduce the effective time required to read data from or write data to lower-speed memory or a device. Read cache holds data in anticipation that it will be requested by a client. Write cache holds data written by a client until it can be safely stored on more permanent storage media such as disk or tape.

**Call Home**
In SAN Volume Controller, a communication service that sends data and

event notifications to a service provider. The machine can use this link to place a call to IBM or to another service provider when service is required.

**capacity licensing**
A type of licensing that grants you the use of a number of terabytes (TB) for virtualization, a number of terabytes for Metro Mirror and Global Mirror relationships, and a number of terabytes for FlashCopy® mappings.

**cascading**
The process of connecting two or more fibre-channel hubs or switches together to increase the number of ports or extend distances.

**CIM** See *Common Information Model*.

**CIM object manager (CIMOM)**
The common conceptual framework for data management that receives, validates, and authenticates the CIM requests from the client application. It then directs the requests to the appropriate component or service provider.

**CIMOM**
See *CIM object manager*.

**class** The definition of an object within a specific hierarchy. A class can have properties and methods and can serve as the target of an association.

**CLI** See *command line interface*.

**client** A computer system or process that requests a service of another computer system or process that is typically referred to as a server. Multiple clients can share access to a common server.

**client application**
A storage management program that initiates Common Information Model (CIM) requests to the CIM agent for the device.

**cluster**
In SAN Volume Controller, up to four pairs of nodes that provide a single configuration and service interface.

**command line-interface (CLI)**
A type of computer interface in which the input command is a string of text characters.

**Common Information Model (CIM)**
A set of standards developed by the Distributed Management Task Force (DMTF). CIM provides a conceptual framework for storage management and an open approach to the design and implementation of storage systems, applications, databases, networks, and devices.

**concurrent maintenance**
Service that is performed on a unit while it is operational.

In SAN Volume Controller, the ability for one node in the cluster to be turned off for maintenance without interrupting access to the VDisk data provided by the cluster.

**configuration node**
A node that acts as the focal point for configuration commands and manages the data that describes the cluster configuration.

**connected**
In a Global Mirror relationship, pertaining to the status condition that occurs when two clusters can communicate.

**consistency group**
A group of copy relationships between virtual disks that are managed as a single entity.

**consistent copy**
In a Metro or Global Mirror relationship, a copy of a secondary virtual disk (VDisk) that is identical to the primary VDisk from the viewpoint of a host system, even if a power failure occurred while I/O activity was in progress.

**consistent-stopped**
In a Global Mirror relationship, the state that occurs when the secondary virtual disk (VDisk) contains a consistent image, but the image might be out-of-date with respect to the primary VDisk. This state can happen when a relationship was in the consistent-synchronized state when an error occurred that forced a freeze of the consistency group. This state can also happen when a relationship is created with the create-consistent flag set to `TRUE`.

**consistent-synchronized**
In a Global Mirror relationship, the status condition that occurs when the primary virtual disk (VDisk) is accessible for read and write I/O operations. The secondary VDisk is accessible for read-only I/O operations. See also *primary virtual disk* and *secondary virtual disk*.

**container**
A data storage location; for example, a file, directory, or device.

A software object that holds or organizes other software objects or entities.

**contingency capacity**
Initially, a fixed amount of unused real capacity that is maintained on a space-efficient virtual disk that is configured to automatically expand its real capacity. It is also the difference between the used capacity and the new real capacity when the real capacity is changed manually.

**copied**
In a FlashCopy mapping, a state that indicates that a copy has been started after the copy relationship was created. The copy process is complete and the target disk has no further dependence on the source disk.

**copying**
A status condition that describes the state of a pair of virtual disks (VDisks) that have a copy relationship. The copy process has been started but the two virtual disks are not yet synchronized.

**Copy Services**
The services that enable you to copy virtual disks (VDisks): FlashCopy, Metro, and Global Mirror.

**counterpart SAN**
A nonredundant portion of a redundant storage area network (SAN). A counterpart SAN provides all the connectivity of the redundant SAN but without the redundancy. Each counterpart SANs provides an alternate path for each SAN-attached device. See also *redundant SAN*.

**cross-volume consistency**
In SAN Volume Controller, a consistency group property that guarantees consistency between virtual disks when an application issues dependent write operations that span multiple virtual disks.

## D

**data migration**
The movement of data from one physical location to another without disrupting I/O operations.

**degraded**
Pertaining to a valid configuration that has suffered a failure but continues to be supported and legal. Typically, a repair action can be performed on a degraded configuration to restore it to a valid configuration.

**dense wavelength division multiplexing (DWDM)**
A technology that places many optical signals onto one single-mode fiber using slightly different optical frequencies. DWDM enables many data streams to be transferred in parallel.

**dependent write operations**
A set of write operations that must be applied in the correct order to maintain cross-volume consistency.

**destage**
A write command initiated by the cache to flush data to disk storage.

**device** In the CIM Agent, the storage server that processes and hosts client application requests.

IBM definition: A piece of equipment that is used with the computer and does not generally interact directly with the system, but is controlled by a controller.

HP definition: In its physical form, a magnetic disk that can be attached to a SCSI bus. The term is also used to indicate a physical device that has been made part of a controller configuration; that is, a physical device that is known to the controller. Units (virtual disks) can be created from devices after the devices have been made known to the controller.

**device provider**
A device-specific handler that serves as a plug-in for the Common Information Model (CIM); that is, the CIM object manager (CIMOM) uses the handler to interface with the device.

**directed maintenance procedures**
The set of maintenance procedures that can be run for a cluster. These procedures are run from within the SAN Volume Controller application and are documented in the *IBM System Storage SAN Volume Controller Troubleshooting Guide*.

**disconnected**
In a Metro or Global Mirror relationship, pertains to two clusters when they cannot communicate.

**discovery**
The automatic detection of a network topology change, for example, new and deleted nodes or links.

**disk controller**
A device that coordinates and controls the operation of one or more disk drives and synchronizes the operation of the drives with the operation of the system as a whole. Disk controllers provide the storage that the cluster detects as managed disks (MDisks).

**disk drive**
A disk-based, nonvolatile, storage medium.

**disk zone**
A zone defined in the storage area network (SAN) fabric in which the SAN Volume Controller can detect and address the logical units that the disk controllers present.

**Distributed Management Task Force (DMTF)**
An organization that defines standards for the management of distributed systems. See also *Common Information Model*.

**DMP** See *directed maintenance procedures*.

**DMTF**
See *Distributed Management Task Force*.

**domain name server**
In the Internet suite of protocols, a server program that supplies name-to-address conversion by mapping domain names to IP addresses.

**DRAM**
See *dynamic random access memory*.

**DWDM**
See *dense wavelength division multiplexing*.

**dynamic random access memory (DRAM)**
A storage in which the cells require repetitive application of control signals to retain stored data.

## E

**EC** See *engineering change.*

**EIA** See *Electronic Industries Alliance*.

**Electronic Industries Alliance (EIA)**
An alliance of four trade associations: The Electronic Components, Assemblies & Materials Association (ECA); the Government Electronics and Information Technology Association (GEIA); the JEDEC Solid State Technology Association (JEDEC); and the Telecommunications Industry Association (TIA). Prior to 1998, EIA was the Electronic Industries Association and the group dates back to 1924.

**empty** In a Global Mirror relationship, a status condition that exists when the consistency group contains no relationships.

**engineering change (EC)**
A correction for a defect of hardware or software that is applied to a product.

**error code**
A value that identifies an error condition.

**ESS** See *IBM TotalStorage Enterprise Storage Server®*.

**exclude**
To remove a managed disk (MDisk) from a cluster because of certain error conditions.

**excluded**
In SAN Volume Controller, the status of a managed disk that the cluster has removed from use after repeated access errors.

**extent** A unit of data that manages the mapping of data between managed disks and virtual disks.

## F

**fabric** In fibre-channel technology, a routing structure, such as a switch, that receives addressed information and routes it to the appropriate destination. A fabric can consist of more than one switch. When multiple fibre-channel switches are interconnected, they are described as cascading. See also *cascading*.

**fabric port (F_port)**
A port that is part of a fibre-channel fabric. An F_port on a fibre-channel fabric connects to the node port (N_port) on a node.

**failover**
In SAN Volume Controller, the function that occurs when one redundant part of the system takes over the workload of another part of the system that has failed.

**FCIP** See *Fibre Channel over IP*.

**fibre channel**
A technology for transmitting data between computer devices at a data rate of up to 4 Gbps. It is especially suited for attaching computer servers to shared storage devices and for interconnecting storage controllers and drives.

**fibre-channel extender**
A device that extends a fibre-channel link over a greater distance than is supported by the standard, usually a number of miles or kilometers. Devices must be deployed in pairs at each end of a link.

**Fibre Channel over IP (FCIP)**
A network storage technology that combines the features of the Fibre Channel Protocol and the Internet Protocol (IP) to connect distributed SANs over large distances.

**Fibre Channel Protocol (FCP)**
A protocol that is used in fibre-channel communications with five layers that define how fibre-channel ports interact through their physical links to communicate with other ports.

**field replaceable unit (FRU)**
An assembly that is replaced in its entirety when any one of its components fails. An IBM service representative performs the replacement. In some cases, a field replaceable unit might contain other field replaceable units.

**FlashCopy mapping**
A relationship between two virtual disks.

**FlashCopy relationship**
See *FlashCopy mapping*.

**FlashCopy service**
In SAN Volume Controller, a copy service that duplicates the contents of a source virtual disk (VDisk) to a target VDisk. In the process, the original contents of the target VDisk are lost. See also *point-in-time copy.*

**F_port** See *fabric port*.

**FRU** See *field replaceable unit*.

## G

**gateway**
An entity that operates above the link layer and translates, when required, the interface and protocol used by one network into those used by another distinct network.

**GB** See *gigabyte*.

**GBIC** See *gigabit interface converter*.

**gigabit interface converter (GBIC)**
An interface module that converts the light stream from a fibre-channel cable into electronic signals for use by the network interface card.

**gigabyte (GB)**
In decimal notation, 1 073 741 824 bytes.

**Global Mirror**
An asynchronous copy service that enables host data on a particular source virtual disk (VDisk) to be copied to the target VDisk that is designated in the relationship.

**grain** In a FlashCopy bitmap, the unit of data represented by a single bit.

**graphical user interface (GUI)**
A type of computer interface that presents a visual metaphor of a real-world scene, often of a desktop, by combining high-resolution graphics, pointing devices, menu bars and other menus, overlapping windows, icons and the object-action relationship.

**GUI** See *graphical user interface*.

## H

**hardcoded**
Pertaining to software instructions that are statically encoded and not intended to be altered.

**HBA** See *host bus adapter*.

**HLUN**
See *virtual disk*.

**hop** One segment of a transmission path between adjacent nodes in a routed network.

**host** An open-systems computer that is connected to the SAN Volume Controller through a fibre-channel interface.

**host bus adapter (HBA)**
In SAN Volume Controller, an interface card that connects a host bus, such as a peripheral component interconnect (PCI) bus, to the storage area network.

**host ID**
In SAN Volume Controller, a numeric identifier assigned to a group of host fibre-channel ports for the purpose of logical unit number (LUN) mapping. For each host ID, there is a separate mapping of Small Computer System Interface (SCSI) IDs to virtual disks (VDisks).

**host zone**
A zone defined in the storage area network (SAN) fabric in which the hosts can address the SAN Volume Controllers.

**hub** A fibre-channel device that connects nodes into a logical loop by using a physical star topology. Hubs will automatically recognize an active node and insert the node into the loop. A node that fails or is powered off is automatically removed from the loop.

A communications infrastructure device to which nodes on a multi-point bus or loop are physically connected. Commonly used in Ethernet and fibre-channel networks to improve the manageability of physical cables. Hubs maintain the logical loop topology of the network of which they are a part, while creating a "hub and spoke" physical star layout. Unlike switches, hubs do not aggregate bandwidth. Hubs typically support the addition or removal of nodes from the bus while it is operating. (S) Contrast with *switch*.

## I

**IBM System Storage Productivity Center (SSPC)**
An integrated hardware and software solution that provides a single point of entry for managing SAN Volume Controller clusters, IBM System Storage DS8000™ systems, and other components of a data storage infrastructure.

**IBM TotalStorage Enterprise Storage Server (ESS)**
An IBM product that provides an intelligent disk-storage system across an enterprise.

**ID** See *identifier*.

**identifier (ID)**
A sequence of bits or characters that identifies a user, program device, or system to another user, program device, or system.

**idle** In a FlashCopy mapping, the state that occurs when the source and target virtual disks (VDisks) act as independent VDisks even if a mapping exists between the two. Read and write caching is enabled for both the source and the target.

**idling** The status of a pair of virtual disks (VDisks) that have a defined copy relationship for which no copy activity has yet been started.

In a Metro or Global Mirror relationship, the state that indicates that the master virtual disks (VDisks) and auxiliary VDisks are operating in the primary role. Consequently, both VDisks are accessible for write I/O operations.

**idling-disconnected**
In a Global Mirror relationship, the state that occurs when the virtual disks (VDisks) in this half of the consistency group are all operating in the primary role and can accept read or write I/O operations.

**illegal configuration**
A configuration that will not operate and will generate an error code to indicate the cause of the problem.

**image mode**
An access mode that establishes a one-to-one mapping of extents in the managed disk (MDisk) with the extents in the virtual disk (VDisk). See also *managed space mode* and *unconfigured mode*.

**image VDisk**
A virtual disk (VDisk) in which there is a direct block-for-block translation from the managed disk (MDisk) to the VDisk.

**IML** See *initial microcode load*.

**inconsistent**
In a Metro or Global Mirror relationship, pertaining to a secondary virtual disk (VDisk) that is being synchronized with the primary VDisk.

**inconsistent-copying**
In a Global Mirror relationship, the state that occurs when the primary virtual disk (VDisk) is accessible for read and write input/output (I/O) operations, but the secondary VDisk is not accessible for either. This state occurs after a **start** command is issued to a consistency group that is in the inconsistent-stopped state. This state also occurs when a **start** command is issued, with the force option, to a consistency group that is in the idling or consistent-stopped state.

**inconsistent-disconnected**
In a Global Mirror relationship, a state that occurs when the virtual disks (VDisks) in the half of the consistency group that is operating in the secondary role are not accessible for either read or write I/O operations.

**inconsistent-stopped**
In a Global Mirror relationship, the state that occurs when the primary virtual disk (VDisk) is accessible for read and write input/output (I/O) operations, but the secondary VDisk is not accessible for either read or write I/O operations.

**indication**
An object representation of an event.

**initial microcode load (IML)**
In SAN Volume Controller, the process by which the run-time code and data for a node are loaded into memory and initialized.

**initiator**
The system component that originates an I/O command over an I/O bus or network. I/O adapters, network interface cards, and intelligent controller device I/O bus control ASICs are typical initiators. (S) See also *logical unit number*.

**input/output (I/O)**
Pertaining to a functional unit or communication path involved in an input process, an output process, or both, concurrently or not, and to the data involved in such a process.

**instance**
An individual object that is a member of some class. In object-oriented programming, an object is created by instantiating a class.

**integrity**
The ability of a system to either return only correct data or respond that it cannot return correct data.

**Internet Protocol (IP)**
In the Internet suite of protocols, a connectionless protocol that routes data through a network or interconnected networks and acts as an intermediary between the higher protocol layers and the physical network. IPv4 is the dominant network layer protocol on the Internet, and IPv6 is designated as its successor. IPv6 provides a much larger address space, which enables greater flexibility in assigning addresses and simplifies routing and renumbering.

**interswitch link (ISL)**
The physical connection that carries a protocol for interconnecting multiple routers and switches in a storage area network.

**I/O** See *input/output.*

**I/O group**
A collection of virtual disks (VDisks) and node relationships that present a common interface to host systems.

**I/O throttling rate**
The maximum rate at which an I/O transaction is accepted for this virtual disk (VDisk).

**IP** See *Internet Protocol*.

**IP address**
The unique 32-bit address that specifies the location of each device or workstation in the Internet. For example, 9.67.97.103 is an IP address.

**ISL** See *interswitch link*.

**ISL hop**
A hop on an interswitch link (ISL). Considering all pairs of node ports (N-ports) in a fabric and measuring distance only in terms of interswitch links (ISLs) in the fabric, the number of ISLs traversed is the number of ISL hops on the shortest route between the pair of nodes that are farthest apart in the fabric.

## J

**JBOD (just a bunch of disks)**
IBM definition: See *non-RAID*.

HP definition: A group of single-device logical units not configured into any other container type.

## L

**LBA** See *logical block address*.

**least recently used (LRU)**
An algorithm used to identify and make available the cache space that contains the least-recently used data.

**line card**
See *blade.*

**local fabric**
In SAN Volume Controller, those storage area network (SAN) components (such as switches and cables) that connect the components (nodes, hosts, switches) of the local cluster together.

**local/remote fabric interconnect**
The storage area network (SAN) components that are used to connect the local and remote fabrics together.

**logical block address (LBA)**
The block number on a disk.

**logical unit (LU)**
An entity to which Small Computer System Interface (SCSI) commands are addressed, such as a virtual disk (VDisk) or managed disk (MDisk).

**logical unit number (LUN)**
The SCSI identifier of a logical unit within a target. (S)

**longitudinal redundancy check (LRC)**
A method of error checking during data transfer that involves checking parity.

**LRC** See *longitudinal redundancy check*.

**LRU** See *least recently used*.

**LU** See *logical unit*.

**LUN** See *logical unit number*.

**LUN masking**
A process that allows or prevents I/O to the disk drives through the host-bus-adapter (HBA) device or operating-system device driver.

## M

**managed disk (MDisk)**
A Small Computer System Interface (SCSI) logical unit that a redundant array of independent disks (RAID) controller provides and a cluster manages. The MDisk is not visible to host systems on the storage area network (SAN).

**managed disk group**
A collection of managed disks (MDisks) that, as a unit, contain all the data for a specified set of virtual disks (VDisks).

**Managed Object Format (MOF)**
A language for defining Common Information Model (CIM) schemas.

**managed space mode**
An access mode that enables virtualization functions to be performed. See also *image mode* and *unconfigured mode*.

**Management Information Base (MIB)**
Simple Network Management Protocol (SNMP) units of managed information that specifically describe an aspect of a system, such as the system name, hardware number, or communications configuration. A collection of related MIB objects is defined as a MIB.

**mapping**
See *FlashCopy mapping*.

**master console**
A single point from which to manage the IBM System Storage SAN Volume Controller. For SAN Volume Controller version 4.2.1 and earlier, the master console was purchased either as software that was installed and configured on a server or as a hardware platform with preinstalled operating system and master console software. See *IBM System Storage Productivity Center*.

**master virtual disk**
The virtual disk (VDisk) that contains a production copy of the data and that an application accesses. See also *auxiliary virtual disk.*

**MB** See *megabyte*.

**MDisk**
See *managed disk*.

**megabyte (MB)**
In decimal notation, 1 048 576 bytes.

**mesh configuration**
A network that contains a number of small SAN switches configured to create a larger switched network. With this configuration, four or more switches are connected together in a loop with some of the paths short circuiting the loop. An example of this configuration is to have four switches connected together in a loop with ISLs for one of the diagonals.

**method**
A way to implement a function on a class.

**Metro Mirror**
A synchronous copy service that enables host data on a particular source virtual disk (VDisk) to be copied to the target VDisk that is designated in the relationship.

**MIB** See *Management Information Base*.

**migration**
See *data migration*.

**mirrored virtual disk**
A virtual disk (VDisk) with two VDisk copies.

**mirrorset**
IBM definition: See *RAID-1*.

HP definition: A RAID storageset of two or more physical disks that maintain a complete and independent copy of the data from the virtual disk. This type of storageset has the advantage of being highly reliable and extremely tolerant of device failure. Raid level 1 storagesets are referred to as mirrorsets.

**MOF** See *Managed Object Format (MOF)*.

## N

**namespace**
The scope within which a Common Information Model (CIM) schema applies.

**node** One SAN Volume Controller. Each node provides virtualization, cache, and Copy Services to the storage area network (SAN).

**node name**
A name identifier associated with a node. (SNIA)

**node port (N_port)**
A port that connects a node to a fabric or to another node. N_ports connect to fabric ports (F_ports) or to other N_ports of other nodes. N_ports handle creation, detection, and flow of message units to and from the connected systems. N_ports are end points in point-to-point links.

**node rescue**
In SAN Volume Controller, the process by which a node that has no valid software installed on its hard disk drive can copy the software from another node connected to the same fibre-channel fabric.

**non-RAID**
Disks that are not in a redundant array of independent disks (RAID). HP definition: See *JBOD*.

**N_port**
See *node port*.

## O

**object** In object-oriented design or programming, a concrete realization of a class that consists of data and the operations associated with that data.

**object model**
A representation, such as a diagram, of objects in a given system. Using symbols similar to standard flowchart symbols, an object model depicts the classes the objects belong to, their associations with each other, the attributes that make them unique, and the operations that the objects can perform and that can be performed on them.

**object name**
An object that consists of a namespace path and a model path. The namespace path provides access to the Common Information Model (CIM) implementation managed by the CIM Agent, and the model path provides navigation within the implementation.

**object path**
An object that consists of a namespace path and a model path. The namespace path provides access to the Common Information Model (CIM) implementation managed by the CIM Agent, and the model path provides navigation within the implementation.

**offline**
Pertaining to the operation of a functional unit or device that is not under the continual control of the system or of a host.

**online** Pertaining to the operation of a functional unit or device that is under the continual control of the system or of a host.

**operating set**
In SAN Volume Controller, the set of nodes that are operating together to deliver storage services.

**overallocated volume**
See *space-efficient virtual disk*.

**oversubscription**
The ratio of the sum of the traffic that is on the initiator N-node connections to the traffic that is on the most heavily loaded interswitch links (ISLs), where more than one ISL is connected in parallel between these switches. This definition assumes a symmetrical network and a specific workload that is applied equally from all initiators and sent equally to all targets. See also *symmetrical network*.

## P

**partition**
IBM definition: A logical division of storage on a fixed disk.

HP definition: A logical division of a container represented to the host as a logical unit.

**partner node**
The other node that is in the I/O group to which this node belongs.

**partnership**
In Metro or Global Mirror operations, the relationship between two

clusters. In a cluster partnership, one cluster is defined as the local cluster and the other cluster as the remote cluster.

**paused**
In SAN Volume Controller, the process by which the cache component quiesces all ongoing I/O activity below the cache layer.

**pend** To cause to wait for an event.

**petabyte (PB)**
In decimal notation, 1 125 899 906 842 624 bytes.

**PDU** See *power distribution unit*.

**physical disk licensing**
A type of licensing that grants you the use of a number of physical disks for virtualization. You can also license the use of the Metro Mirror and Global Mirror feature, the use of the FlashCopy feature, or both of these features.

**PLUN** See *managed disk*.

**point-in-time copy**
The instantaneous copy that the FlashCopy service makes of the source virtual disk (VDisk). In some contexts, this copy is known as a $T_0$ *copy*.

**port** The physical entity within a host, SAN Volume Controller, or disk controller system that performs the data communication (transmitting and receiving) over the fibre channel.

**port ID**
An identifier associated with a port.

**power distribution unit (PDU)**
A device that distributes electrical power to multiple devices in the rack. It typically is rack-mounted and provides circuit breakers and transient voltage suppression.

**power-on self-test**
A diagnostic test that servers or computers run when they are turned on.

**prepared**
In a Global Mirror relationship, the state that occurs when the mapping is ready to start. While in this state, the target virtual disk (VDisk) is offline.

**preparing**
In a Global Mirror relationship, the state that occurs when any changed write data for the source virtual disk (VDisk) is flushed from the cache. Any read or write data for the target VDisk is discarded from the cache.

**primary virtual disk**
In a Metro or Global Mirror relationship, the target of write operations issued by the host application.

**property**
In the Common Information Model (CIM), an attribute that is used to characterize instances of a class.

**PuTTY**
A client program that allows you to run remote sessions on your computer through specific network protocols, such as SSH, Telnet, and Rlogin.

## Q

**qualifier**
A value that provides additional information about a class, association, indication, method, method parameter, instance, property, or reference.

**quorum**
A set of nodes that operates as a cluster. Each node has a connection to every other node in the cluster. If a connection failure causes the cluster to split into two or more groups of nodes that have full connection within the group, the quorum is the group that is selected to operate as the cluster. Typically, this is the larger group of nodes, but the quorum disk serves as a tiebreaker if the groups are the same size.

**queue depth**
The number of I/O operations that can be run in parallel on a device.

**quorum disk**
A managed disk (MDisk) that contains a reserved area that is used exclusively for cluster management. The quorum disk is accessed in the event that it is necessary to determine which half of the cluster continues to read and write data.

**quorum index**
A number that can be either: 0, 1 or 2

## R

**rack** A free-standing framework that holds the devices and card enclosure.

**RAID** See *redundant array of independent disks*.

**RAID 0**
IBM definition: RAID 0 allows a number of disk drives to be combined and presented as one large disk. RAID 0 does not provide any data redundancy. If one drive fails, all data is lost.

HP definition: A RAID storageset that stripes data across an array of disk drives. A single logical disk spans multiple physical disks, allowing parallel data processing for increased I/O performance. While the performance characteristics of RAID level 0 is excellent, this RAID level is the only one that does not provide redundancy. Raid level 0 storagesets are referred to as stripesets.

**RAID 1**
SNIA dictionary definition: A form of storage array in which two or more identical copies of data are maintained on separate media. (S)

IBM definition: A form of storage array in which two or more identical copies of data are maintained on separate media. Also known as mirrorset.

HP definition: See *mirrorset*.

**RAID 5**
SNIA definition: A form of parity RAID in which the disks operate independently, the data strip size is no smaller than the exported block size, and parity check data is distributed across the array's disks. (S)

IBM definition: See the SNIA definition.

HP definition: A specially developed RAID storageset that stripes data and parity across three or more members in a disk array. A RAIDset combines the best characteristics of RAID level 3 and RAID level 5. A RAIDset is the

best choice for most applications with small to medium I/O requests, unless the application is write intensive. A RAIDset is sometimes called parity RAID. RAID level 3/5 storagesets are referred to as RAIDsets.

**RAID 10**
A type of RAID that optimizes high performance while maintaining fault tolerance for up to two failed disk drives by striping volume data across several disk drives and mirroring the first set of disk drives on an identical set.

**real capacity**
The amount of storage that is allocated to a virtual disk copy from a managed disk group.

**redundant ac-power switch**
A device that provides input power redundancy by attaching a SAN Volume Controller to two independent power sources. If the main source becomes unavailable, the redundant ac-power switch automatically provides power from a secondary (backup) source. When power is restored, the redundant ac-power switch automatically changes back to the main power source.

**redundant array of independent disks (RAID)**
A collection of two or more disk drives that present the image of a single disk drive to the system. In the event of a single device failure, the data can be read or regenerated from the other disk drives in the array.

**redundant SAN**
A storage area network (SAN) configuration in which any one single component might fail, but connectivity between the devices within the SAN is maintained, possibly with degraded performance. This configuration is normally achieved by splitting the SAN into two, independent, counterpart SANs. See also *counterpart SAN.*

**reference**
A pointer to another instance that defines the role and scope of an object in an association.

**rejected**
A status condition that describes a node that the cluster software has removed from the working set of nodes in the cluster.

**relationship**
In Metro or Global Mirror, the association between a master virtual disk (VDisk) and an auxiliary VDisk. These VDisks also have the attributes of a primary or secondary VDisk. See also *auxiliary virtual disk, master virtual disk, primary virtual disk, and secondary virtual disk.*

**reliability**
The ability of a system to continue to return data even if a component fails.

**remote fabric**
In Global Mirror, the storage area network (SAN) components (switches and cables) that connect the components (nodes, hosts, and switches) of the remote cluster.

**roles** Authorization is based on roles that map to the administrator and service roles in an installation. The switch translates these roles into SAN Volume Controller administrator and service user IDs when a connection is made to the node for the SAN Volume Controller.

## S

**SAN** See *storage area network*.

**SAN Volume Controller fibre-channel port fan in**
The number of hosts that can see any one SAN Volume Controller port.

**SATA** See *Serial Advanced Technology Attachment*.

**schema**
A group of object classes defined for and applicable to a single namespace. Within the CIM Agent, the supported schemas are the ones that are loaded through the managed object format (MOF).

**SCSI** See *Small Computer Systems Interface*.

**SCSI back-end layer**
The layer in a Small Computer Systems Interface (SCSI) network that performs the following functions: controls access to individual disk controller systems that are managed by the cluster; receives requests from the virtualization layer, processes them, and sends them to managed disks; addresses SCSI-3 commands to the disk controller systems on the storage area network (SAN).

**SCSI front-end layer**
The layer in a Small Computer Systems Interface (SCSI) network that receives I/O commands sent from hosts and provides the SCSI-3 interface to hosts. SCSI logical unit numbers (LUNs) are mapped to virtual disks (VDisks) in this layer as well. Thus, the layer converts SCSI read and write commands that are addressed to LUNs into commands that are addressed to specific VDisks.

**SDD** See *subsystem device driver (SDD)*.

**secondary virtual disk**
In Metro or Global Mirror, the virtual disk (VDisk) in a relationship that contains a copy of data written by the host application to the primary VDisk.

**Secure Shell (SSH)**
A program to log in to another computer over a network, to run commands in a remote machine, and to move files from one machine to another.

**Secure Sockets Layer (SSL)**
A security protocol that provides communication privacy. With SSL, client/server applications can communicate in a way that is designed to prevent eavesdropping, tampering, and message forgery.

**sequential VDisk**
A virtual disk that uses extents from a single managed disk.

**Serial Advanced Technology Attachment (SATA)**
The evolution of the ATA interface from a parallel bus to serial connection architecture. (S)

**Serial ATA**
See *Serial Advanced Technology Attachment*.

**server** In a network, the hardware or software that provides facilities to other stations; for example, a file server, a printer server, a mail server. The station making the request of the server is usually called the client.

**Service Location Protocol (SLP)**
In the Internet suite of protocols, a protocol that identifies and uses network hosts without having to designate a specific network host name.

**fibre-channel SFP connector**
See *small form-factor pluggable connector*.

**Simple Mail Transfer Protocol (SMTP)**
An Internet application protocol for transferring mail among users of the Internet. SMTP specifies the mail exchange sequences and message format. It assumes that the Transmission Control Protocol (TCP) is the underlying protocol.

**Simple Network Management Protocol (SNMP)**
In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application-layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB).

**SLP** See *Service Location Protocol*.

**Small Computer System Interface (SCSI)**
A standard hardware interface that enables a variety of peripheral devices to communicate with one another.

**small form-factor pluggable (SFP) connector**
A compact optical transceiver that provides the optical interface to a fibre-channel cable.

**SMI-S** See *Storage Management Initiative Specification*.

**SMTP** See *Simple Mail Transfer Protocol*.

**SNIA** See *Storage Networking Industry Association*.

**SNMP**
See *Simple Network Management Protocol*.

**space-efficient VDisk**
See *space-efficient virtual disk*.

**space-efficient virtual disk**
A virtual disk that has different virtual capacities and real capacities.

**SSH** See *Secure Shell*.

**SSPC** See *IBM System Storage Productivity Center (SSPC)*.

**SSL** See *Secure Sockets Layer*.

**stand-alone relationship**
In FlashCopy, Metro Mirror, and Global Mirror, relationships that do not belong to a consistency group and that have a null consistency group attribute.

**stop** A configuration command that is used to stop the activity for all copy relationships in a consistency group.

**stopped**
The status of a pair of virtual disks (VDisks) that have a copy relationship that the user has temporarily broken because of a problem.

**storage area network (SAN)**
A network whose primary purpose is the transfer of data between computer systems and storage elements and among storage elements. A

SAN consists of a communication infrastructure, which provides physical connections, and a management layer, which organizes the connections, storage elements, and computer systems so that data transfer is secure and robust. (S)

**Storage Management Initiative Specification (SMI-S)**
A design specification developed by the Storage Networking Industry Association (SNIA) that specifies a secure and reliable interface that allows storage management systems to identify, classify, monitor, and control physical and logical resources in a storage area network. The interface is intended as a solution that integrates the various devices to be managed in a storage area network (SAN) and the tools used to manage them.

**Storage Networking Industry Association (SNIA)**
An association of producers and consumers of storage networking products whose goal is to further storage networking technology and applications. See www.snia.org.

**striped**
Pertains to a virtual disk (VDisk) that is created from multiple managed disks (MDisks) that are in the MDisk group. Extents are allocated on the MDisks in the order specified.

**stripeset**
See *RAID 0*.

**subsystem device driver (SDD)**
An IBM pseudo device driver designed to support the multipath configuration environments in IBM products.

**superuser authority**
Can issue any command-line interface (CLI) command. A superuser can view and work with the following panels: View users, Add cluster, Remove cluster, Add users, and Modify users. Only one Superuser role is available.

**suspended**
The status of a pair of virtual disks (VDisks) that have a copy relationship that has been temporarily broken because of a problem.

**switch** A network infrastructure component to which multiple nodes attach. Unlike hubs, switches typically have internal bandwidth that is a multiple of link bandwidth, and the ability to rapidly switch node connections from one to another. A typical switch can accommodate several simultaneous full link bandwidth transmissions between different pairs of nodes. (S) Contrast with *hub*.

**symmetrical network**
A network in which all the initiators are connected at the same level and all the controllers are connected at the same level.

**symmetric virtualization**
A virtualization technique in which the physical storage in the form of Redundant Array of Independent Disks (RAID) is split into smaller chunks of storage known as *extents*. These extents are then concatenated, using various policies, to make virtual disks (VDisks). See also *asymmetric virtualization*.

**synchronized**
In Metro or Global Mirror, the status condition that exists when both virtual disks (VDisks) of a pair that has a copy relationship contain the same data.

**system**
A functional unit, consisting of one or more computers and associated software, that uses common storage for all or part of a program and also for all or part of the data necessary for the execution of the program. A computer system can be a stand-alone unit, or it can consist of multiple connected units.

## T

**terabyte**
In decimal notation, 1 099 511 628 000 bytes.

**thinly provisioned volume**
See *space-efficient virtual disk*.

**topology**
The logical layout of the components of a computer system or network and their interconnections. Topology deals with questions of what components are directly connected to other components from the standpoint of being able to communicate. It does not deal with questions of physical location of components or interconnecting cables. (S)

**trigger**
To initiate or reinitiate copying between a pair of virtual disks (VDisks) that have a copy relationship.

## U

**UID** See *unique identifier*.

**unconfigured mode**
A mode in which I/O operations cannot be performed. See also *image mode* and *managed space mode*.

**uninterruptible power supply**
A device that is connected between a computer and its power source that protects the computer against blackouts, brownouts, and power surges. The uninterruptible power supply contains a power sensor to monitor the supply and a battery to provide power until an orderly shutdown of the system can be performed.

**unique identifier (UID)**
An identifier that is assigned to storage system logical units when they are created. It is used to identify the logical unit regardless of the logical unit number (LUN), status of the logical unit, or whether alternate paths exist to the same device. Typically, a UID is only used once.

**unmanaged**
An access mode that pertains to a managed disk (MDisk) that is not used by the cluster.

## V

**valid configuration**
A configuration that is supported.

**VDisk** See *virtual disk (VDisk)*.

**VDisk copy**
See *virtual disk copy*.

**virtual capacity**
The amount of storage that is available to a server on a virtual disk (VDisk) copy. In a space-efficient virtual disk, the virtual capacity can be different from the real capacity. In a standard virtual disk, the virtual capacity and real capacity are the same.

**virtual disk copy**
A physical copy of the data that is stored on a virtual disk (VDisk). Mirrored VDisks have two such copies. Nonmirrored VDisks have one copy.

**virtual disk (VDisk)**
A device that host systems in a storage area network (SAN) recognize as a Small Computer System Interface (SCSI) disk.

**virtualization**
In the storage industry, a concept in which a pool of storage is created that contains several disk subsystems. The subsystems can be from various vendors. The pool can be split into virtual disks that are visible to the host systems that use them.

**virtualized storage**
Physical storage that has virtualization techniques applied to it by a virtualization engine.

**virtual storage area network (VSAN)**
A fabric within the SAN.

**vital product data (VPD)**
Information that uniquely defines system, hardware, software, and microcode elements of a processing system.

**VLUN** See *managed disk*.

**VPD** See *vital product data*.

**VSAN** See *virtual storage area network*.

## W

**WBEM**
See *Web-Based Enterprise Management*.

**Web-Based Enterprise Management (WBEM)**
A tiered, enterprise-management architecture that was developed by the Distributed Management Task Force (DMTF). This architecture provides the management design framework that consists of devices, device providers, the object manager, and the messaging protocol for the communication between client applications and the object manager.

**worldwide node name (WWNN)**
An identifier for an object that is globally unique. WWNNs are used by Fibre Channel and other standards.

**worldwide port name (WWPN)**
A unique 64-bit identifier that is associated with a fibre-channel adapter port. The WWPN is assigned in an implementation- and protocol-independent manner.

**WWNN**
See *worldwide node name*.

**WWPN**
See *worldwide port name*.

## Z

**zoning**
In fibre-channel environments, the grouping of multiple ports to form a virtual, private, storage network. Ports that are members of a zone can communicate with each other, but are isolated from ports in other zones.

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# Readers' Comments — We'd Like to Hear from You

**IBM System Storage SAN Volume Controller**
**Models 2145-8F2 and 2145-8F4**
**Hardware Installation Guide**
**Version 4.3.1**

**Publication No. GC27-2221-00**

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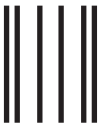

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