IBM Cloud Object Storage System
Version 3.14.12

Medium/Large J11/J12 Disk Enclosure Hardware Installation and Maintenance Manual
4957-J11/4958-J11, 4957-J12/4958-J12

IBM

Note

Before using this information and the product it supports, read the following information:

- The general information in *Notices*
- The information in *Safety and environmental notices*
- The information in the *IBM Environmental Notices and User Guide* (provided on a DVD)

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Intended purpose and audience

This manual contains the instructions for installing and maintaining this appliance. The audience for this guide consists of those individuals responsible for installing IBM Cloud Object Storage System™ appliances and enclosures.

Note:

- The equipment and device described for installation herein are sophisticated and relatively complex to install. The party or parties installing the equipment must be familiar with installations of computer hardware and disk drives prior to attempting this installation. Only personnel proficient in working with computer hardware and disk drives should attempt to install this appliance/enclosure.
- After all appliances have been installed in the rack, refer to the *Appliance Configuration Guide* to configure the appliance settings required prior to setting up the system.
- After these appliances are configured, refer to the *System Manager Administration Guide* for information about how to configure, operate, and maintain your system.
- Both the *Appliance Configuration Guide* and the *System Manager Administration Guide* assume that all necessary appliances for the system are installed in the rack.

Safety and environmental notices

Review the safety notices, environmental notices, and electronic emission notices for IBM® Cloud Object Storage System before you install and use the product.

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

Examples of a caution and a danger notice. Numbers in parentheses refer to message numbers in the *IBM Safety Notices* publication G229-9054, which is included with your product.

⚠ **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)

Safety notices

Safety notices for this product.

Familiarize yourself with the *IBM Safety Notices* publication G229-9054, which is included with your product.

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

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

- If IBM supplied the power cord(s), connect power to this unit only with the IBM provided power cord. Do not use the IBM provided power cord for any other product.
- Do not open or service any power supply assembly.
- Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.
- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords.
  - For AC power, disconnect all power cords from their AC power source.
  - For racks with a DC power distribution panel (PDP), disconnect the customer's DC power source to the PDP.
- When connecting power to the product ensure all power cables are properly connected.
  - For racks with AC power, connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
  - For racks with a DC power distribution panel (PDP), connect the customer's DC power source to the PDP. Ensure that the proper polarity is used when attaching the DC power and DC power return wiring.
- Connect any equipment that will be attached to this product to properly wired outlets.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- Do not attempt to switch on power to the machine until all possible unsafe conditions are corrected.
- Assume that an electrical safety hazard is present. Perform all continuity, grounding, and power checks specified during the subsystem installation procedures to ensure that the machine meets safety requirements.

- Do not continue with the inspection if any unsafe conditions are present.
- Before you open the device covers, unless instructed otherwise in the installation and configuration procedures: Disconnect the attached AC power cords, turn off the applicable circuit breakers located in the rack power distribution panel (PDP), and disconnect any telecommunications systems, networks, and modems.
- Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.

  To disconnect:

  1. Turn off everything (unless instructed otherwise).
  2. For AC power, remove the power cords from the outlets.
  3. For racks with a DC power distribution panel (PDP), turn off the circuit breakers located in the PDP and remove the power from the Customer's DC power source.
  4. Remove the signal cables from the connectors.
  5. Remove all cables from the devices.

  To connect:

  1. Turn off everything (unless instructed otherwise).
  2. Attach all cables to the devices.
  3. Attach the signal cables to the connectors.
  4. For AC power, attach the power cords to the outlets.
  5. For racks with a DC power distribution panel (PDP), restore the power from the Customer's DC power source and turn on the circuit breakers located in the PDP.
  6. Turn on the devices.

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

DANGER: If the receptacle has a metal shell, do not touch the shell until you have completed the voltage and grounding checks. Improper wiring or grounding could place dangerous voltage on the metal shell. If any of the conditions are not as described, STOP. Ensure the improper voltage or impedance conditions are corrected before proceeding. (D003)

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

- Heavy equipment-personal injury or equipment damage might result if mishandled.
- Always lower the leveling pads on the rack cabinet.
- Always install stabilizer brackets on the rack cabinet unless the earthquake option is to be installed.
- To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.
- Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices. In addition, do not lean on rack mounted devices and do not use them to stabilize your body position (for example, when working from a ladder).

- Each rack cabinet might have more than one power cord.

  – For AC powered racks, be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.

– For racks with a DC power distribution panel (PDP), turn off the circuit breaker that controls the power to the system unit(s), or disconnect the customer's DC power source, when directed to disconnect power during servicing.

- Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.

- An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (R00l part 1 of 2)

CAUTION:

- Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.

- Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit used for air flow through the unit.

- Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection. To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.

- (For sliding drawers.) Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack or if the rack is not bolted to the floor. Do not pull out more than one drawer at a time. The rack might become unstable if you pull out more than one drawer at a time.

- (For fixed drawers.) This drawer is a fixed drawer and must not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or completely out of the rack might cause the rack to become unstable or cause the drawer to fall out of the rack. (R001 part 2 of 2)

DANGER: Multiple power cords. The product might be equipped with multiple AC power cords or multiple DC power cables. To remove all hazardous voltages, disconnect all power cords and power cables. (L003)
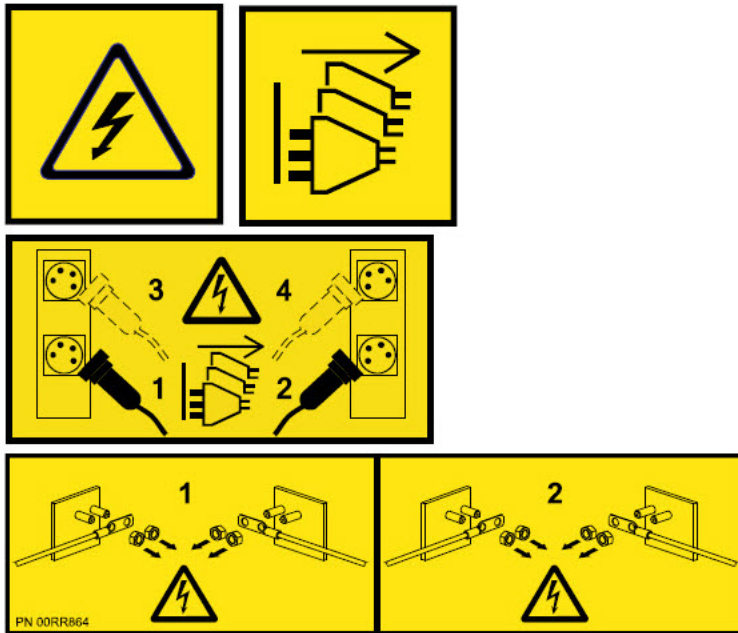
CAUTION: The weight of this part or unit is more than 55 kg (121.2 lb). It takes specially trained persons, a lifting device, or both to safely lift this part or unit. (C011)

Environmental notices

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

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

Electromagnetic Compatibility Notices

Class A Notices

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

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

Canada Notice

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

European Community and Morocco Notice

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

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

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

Germany Notice

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

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

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

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

Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

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

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

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

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:
International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:
IBM Deutschland GmbH
Technical Relations Europe, Abteilung M456
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 (0) 800 225 5426
email: HalloIBM@de.ibm.com

Generelle Informationen:

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

Japan Electronics and Information Technology Industries Association (JEITA) Notice

（一社）電子情報技術産業協会　高調波電流抑制対策実施

要領に基づく定格入力電力値：　Knowledge Center の各製品の

仕様ページ参照

This statement applies to products less than or equal to 20 A per phase.

高調波電流規格　JIS C 61000-3-2 適合品

This statement applies to products greater than 20 A, single phase.

高調波電流規格　JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象

機器（高調波発生機器）です。

- 回路分類　：6（単相、ＰＦＣ回路付）
- 換算係数　：0

This statement applies to products greater than 20 A per phase, three-phase.

高調波電流規格　JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象

機器（高調波発生機器）です。

- 回路分類　：5（3相、ＰＦＣ回路付）
- 換算係数　：0

Japan Voluntary Control Council for Interference (VCCI) Notice

この装置は、クラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨
害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求さ
れることがあります。　　　　　　　　　　　　　　　　　ＶＣＣＩ－Ａ

Korea Notice

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

People's Republic of China Notice

声　明

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在这种情况下，可能需要用户对其
干扰采取切实可行的措施。

Russia Notice

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

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這是甲類的資訊產品，在
居住的環境中使用時，可
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種情況下，使用者會被要
求採取某些適當的對策。

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

United States Federal Communications Commission (FCC) Notice

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

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

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

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

Declared noise emissions

Declared noise emissions in accordance with ISO 9296[1-5]

Table 1. Declared noise emissions in accordance with ISO 9296[1-5]						
Product description **Models: A10, C10, M10, J10, J11 & J12**	**Declared A-weighted sound power level,** $L_{WA,m}$**(B)**		**Declared A-Weighted Sound Pressure Level,** $L_{pA,m}$ **(dB)**		**Statistical adder for verification** K_v **(B)**	
	Operating	**Idling**	**Operating**	**Idling**	**Operating**	**Idling**
Typical Configuration: 23 ± 2 degrees C, 500m	7.1[6]	7.1[6]	60	60	0.3	0.3
Maximum configuration: 27 degrees C, 500m	7.3[6]	7.3[6]	60	60	0.3	0.3

Table 1. Declared noise emissions in accordance with ISO 9296 [1-5] (continued)						
Product description **Models: A10, C10, M10, J10, J11 & J12**	**Declared A-weighted sound power level,** $L_{WA,m}$**(B)**		**Declared A-Weighted** **Sound Pressure Level,** $L_{pA,m}$ **(dB)**		**Statistical adder for verification** K_v **(B)**	
	Operating	**Idling**	**Operating**	**Idling**	**Operating**	**Idling**
Maximum configuration: Worst-case ambient Fan failure	8.7[6]	8.7[6]	74	74	0.3	0.3

Notes:

1. Declared level $L_{WA,m}$ is the upper-limit A-weighted sound power level; Declared level $L_{pA,m}$ is the mean A-weighted sound pressure level measured at the 1-meter bystander positions.

2. The statistical adder for verification, K_v, is a quantity to be added to the declared mean A-weighted sound power level, $L_{WA,m}$ such that there will be a 95% probability of acceptance, when using the verification procedures of ISO 9296, if no more than 6.5% of the batch of new equipment has A-weighted sound power levels greater than (LWA,m + Kv).

3. The quantity L_{WAc} (formerly called L_{WAd}), can be computed from the sum of $L_{WA,m}$ and K_v.

4. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.

5. B, dB, abbreviations for bels and decibels, respectively. 1 B = 10 dB.

6. **Notice:** Government regulations (such as those prescribed by OSHA or European Community Directives) may govern noise level exposure in the workplace and may apply to you and your server installation. The actual sound pressure levels in your installation depend upon a variety of factors, including the number of racks in the installation; the size, materials, and configuration of the room where you designate the racks to be installed; the noise levels from other equipment; the room ambient temperature, and employees' location in relation to the equipment. Further, compliance with such government regulations also depends upon a variety of additional factors, including the duration of employees' exposure and whether employees wear hearing protection. IBM recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.

Support information

Technical support contacts.

For more information on the product or help with troubleshooting, contact IBM Support at ibm.com/mysupport or visit the Directory of worldwide contacts.

Chapter 1. Appliance safety precautions

Observe physical, electrical, and electronic component safety precautions.

DANGER: An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (D004)

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

Physical

Ensure that your equipment rack is placed in a dust-free, well-ventilated area close to an uninterruptible power supply (UPS). Leave enough room behind and around the rack for services and sufficient airflow.

- Keep the area around the appliance clean and free of clutter.
- Place the appliance top cover and any appliance components that were removed away from the appliance or on a table so that they do not accidentally get damaged.
- While you are working on the appliance, do not wear loose clothing such as neckties and unbuttoned shirt sleeves. They can retain a charge even if you are wearing a wrist strap, or could be pulled into a fan.
- After you access the inside of the appliance, close the appliance and secure it to the rack unit with the retention screws after you ensure that all connections are made.
- Close the rack's front door and all panels and components on the appliances when not servicing to maintain proper cooling.

Electrical

Basic electrical safety precautions must be followed to protect yourself and the appliance:

- Do not work alone with high-voltage components.
- Be aware of the locations of the power switch on the appliance and the room's emergency power-off switch, disconnection switch, or electrical outlet. If an electrical accident occurs, quickly remove power from the system.

  DANGER: A danger of explosion exists if the Onboard battery is installed upside down, which reverses its polarities. This battery must be replaced only with the same or an equivalent type that is recommended by the manufacturer. Dispose of used batteries according to the battery manufacturer's instructions.

Electronic components

Electrostatic discharge (ESD) is generated by two objects with different electrical charges when they come into contact with each other. An ESD neutralizes this difference, which can damage electronic components and printed circuit boards (PCBs). In general, the following measures are sufficient to neutralize this difference before contact is made to protect equipment from ESD:

- Use a grounded wrist strap that is designed to prevent ESDs.
- Keep all components in their antistatic containers until ready for installation.
- Touch a grounded metal object before you remove any board from its antistatic container.

- Remove any jewelry or metal objects from your body. They are excellent metal conductors that can create short circuits and harm you if they come into contact with printed circuit boards or areas where power is present.

Chapter 2. Safety guidelines

Safe handling

⚠️ **CAUTION:** Use this equipment in a manner specified by the manufacturer: failure to do this may cancel the protection provided by the equipment.

- For new enclosures, prepare the site for installation per "Installation checklist" on page 25, and follow safe-handling instructions provided in "Unpacking the Disk Enclosure" on page 27

- Permanently unplug the enclosure before you move it, or if you think that it has become damaged in any way.

- A safe lifting height is 20U.

- To minimize weight for an unpacked or rack-mounted enclosure, you can optionally remove the rear panel CRU modules and the top-loaded CRU modules (accessed from beneath the enclosure's top lids) before moving the enclosure once it is unpacked. However; CRU removal is not required. If you remove an item—reinstall it into the same module slot from which it was removed—after moving the enclosure. The Disk Enclosure ships with CRUs installed; however, the disks must be installed as part of the system setup, *after* the enclosure is securely mounted in the rack.

  – Before installing the enclosure into a rack, see the Installing Disk Enclosure warning

  – After installing the enclosure, and *before* installing the disks, see "ESD precautions" on page 55.

  – To install disk drive modules into a rack-mounted enclosure, face the front panel, and pull the enclosure outward on its rails. Remove the top lid(s) to provide access to the disk module slots. See Figure 9 on page 11 for removable lids, see Figure 10 on page 11 and Figure 11 on page 12 for disk slots and CRU module slot indexing.

- Belt straps and optional lift handles are designed to support the weight of the enclosure as shipped. They are not designed to support a fully populated enclosure. See also "Unpacking the Disk Enclosure" on page 27

⚠️ **CAUTION:** Use a suitable mechanical lift for hoisting the enclosure for installation into the rack:

- Fully configured COS Medium / Large Disk Enclosures can weigh up to 145.6 kg (321 lb). Do not install disks until after the enclosure is secured into the rack.

- When positioning the enclosure into its rack space, use the optional enclosure lift handles (two handles per side). See also "Requirements for rackmount installation" on page 29 for addition information.

- Observe the lifting hazard label affixed to the storage enclosure.

- Avoid use of a vacuum lift because it can potentially damage the Disk Enclosure.

Operation

Important: Operation of the enclosure with any CRU modules missing will disrupt the airflow, and the enclosure will not receive sufficient cooling. It is essential that all CRU slots hold modules before the enclosure system is used.

- Observe the module bay caution label affixed to the module being replaced.

- Replace a defective CRU with a fully operational CRU as soon as possible. Do not remove a defective CRU module unless you have a replacement model of the correct type ready for insertion.

- Before removal/replacement of a PSU, disconnect supply power from the PSU to be replaced. Refer to "Replacing a PSU module" on page 56

- Observe the hazardous voltage warning label affixed to power supply modules.

Electrical safety

- The enclosure must only be operated from a power supply input voltage range of 200–240 VAC, 50/60Hz.
- Provide a suitable power source with electrical overload protection to meet the requirements in the technical specification.
- The power cord must have a safe electrical earth connection. Check the connection to earth of the enclosure before you switch on the power supply.
- The system requires voltages within minimum fluctuation. The customer-supplied facilities' voltage must maintain a voltage with not more than ± 5 percent fluctuation. The customer facilities must also provide suitable surge protection.

Important:

- The plug on the power supply cord is used as the main disconnect device. Ensure that the socket outlets are located near the equipment and are easily accessible.
- Disk Enclosures are intended to operate with two PSUs and four system fans accessed from the rear panel. Two controller channel fan modules accessed from the top of the enclosure provide additional cooling.
- Observe the power-supply disconnection caution label affixed to PSU modules.

⚠️ **CAUTION:** Do not remove covers from the PSU or any other CRU module. There is a danger of electric shock inside. Return the plug-in module to your supplier for repair.

Important: The RJ-45 socket on IOMs is not currently supported and must not be connected to a telecommunications network.

- IBM COS Medium and Large Disk Enclosures are suitable for connection to intra-building or non-exposed wiring or cabling only.
- IBM COS Medium and Large Disk Enclosures are suitable for installation in locations where the NEC (National Electrical Code) applies. These enclosures are not suitable for Outside Plant (OSP) installations.

Rack system safety precautions

- Before installing a Disk Enclosure into the rack, see the Safe handling CAUTION and the Installing the Disk Enclosure WARNING.
- The rack construction must be capable of supporting the total weight of the installed enclosures. The design should incorporate stabilizing features suitable to prevent the rack from tipping or being pushed over during installation or in normal use.
- When loading a rack with enclosures, fill the rack from the bottom up. Empty the rack from the top down. Heavier enclosures should be located beneath lighter enclosures for optimal stability.
- Do not try to lift the enclosure by yourself.

Chapter 3. System overview

IBM COS Medium and Large Disk Enclosure, and front, top, and rear panels are described.

Enclosure chassis

An overview of the Disk Enclosure.

The Disk Enclosure consists of a sheet metal enclosure with integrated boards and a module runner system. The enclosure contains a drive channel and a controller channel, and features removable top cover lids. Enclosure top and rear panels provide access to plug-in modules known as customer-replaceable units (CRUs). Each enclosure is made of sheet steel that is bonded together using rivets, welding, and other forced contact methods. The metal surfaces are free from non-conductive coatings and paint.

- The chassis has a 1.2 m rack mounting that enables it to be installed onto standard 1.2 m racks, and uses four EIA units of rack space (7 inches) for a 4U enclosure. Optional lift handles on the chassis side walls facilitate hoisting and installation. See .
- The Cable Management Arm (CMA) routes cables from the controller channel and external connections, and secures them for in-rack servicing of the installed enclosure. The rails slide outward from the installed position.
- An internal high-speed harness ensures routing of cables controlled to specification; protects the interfaces between cables and connectors; and provides a connector system designed for positive (latched) mating.
- The drive channel bus-bar distributes power from the power mid-plane to 24 hard disk drive base-planes.
- Four 24 hard disk drive base-plane boards support 96 disk drive connections in the drive channel.
- A ten hard disk drive base-plane board supports 10 disk drive connections in the controller channel.
- The enclosure top panel provides access to LFF (with adapter) disks, held vertically. Each drive slot holds a plug-in drive carrier module. The top panel also provides access to the HS expander and controller fan CRUs.

  Note: Top panel enclosure lids **A** and **B** slide out, and can be temporarily removed for a servicing event. See .

- Four removable HS expanders connect to 24 hard disk drive base-planes via expander link cards, providing high availability.
- Within the controller channel compartment, channel fans provide additional cooling the IOM.
- Within the rear panel, the chassis assembly is populated with two PSUs, four system fans, are an IOM, and the flattened cable coils held by the bracket assembly on the CMA shelf (atop system fan sheet metal).

Enclosure configuration

Medium and Large Disk Enclosure are described.

The IBM COS Medium and Large Disk Enclosures support a 4U (rack space) chassis – see the two figures below. The large Disk Enclosures holds up to 106 low profile (1-inch high) 3.5 inch form factor disk drive modules in a vertical orientation and the medium Disk Enclosure holds 53 disks in the same orientation. Alternatively, disk slots can hold a low profile (5/8-inch high) 2.5 inch form factor disk with an adapter within the large form factor carrier.

Each individual disk drive is hot pluggable and replaceable on site. Drive modules must be installed during system setup.

Note: Throughout this guide, and in the management interface documents used with this guide, I/O module (IOM) is a general term denoting a controller module.

The enclosure configurations, including chassis and CRUs, are described on the following pages. See the section for details about various enclosure options.
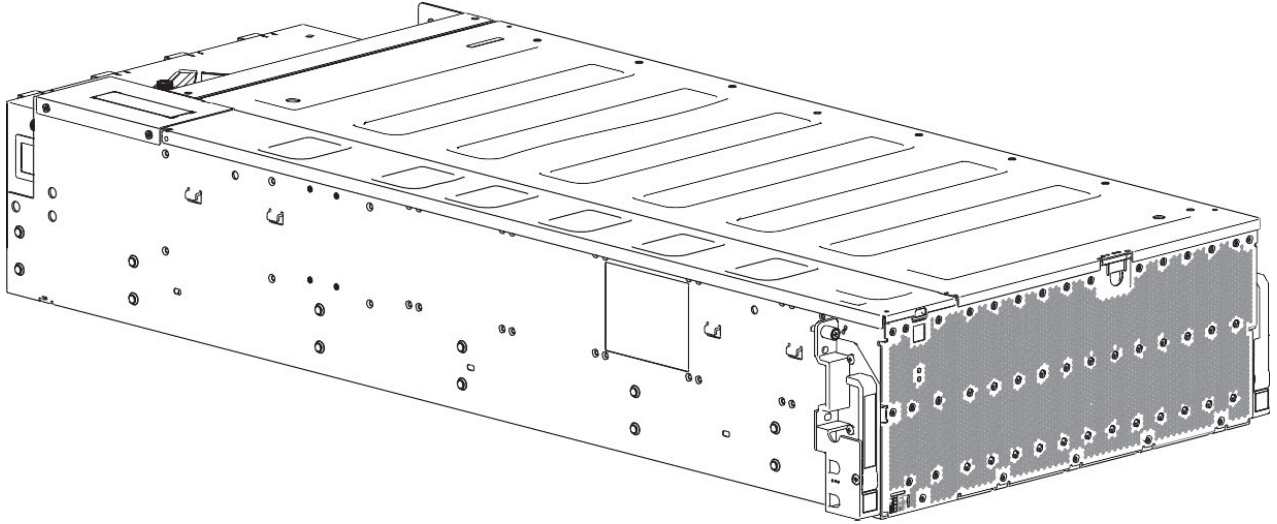
Figure 1. IBM COS Medium and Large Disk Enclosure - dimetric front orientation

fig
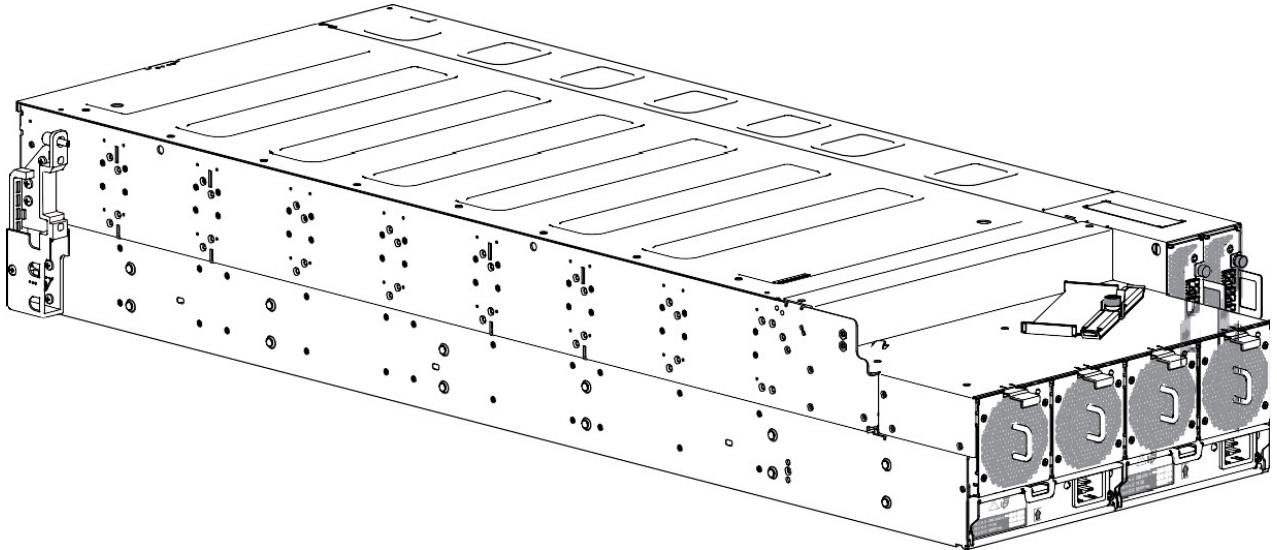
Figure 2. IBM COS Medium and Large Disk Enclosure - dimetric rear orientation

Enclosure variants

Medium and Large Disk Enclosure variants are described.

The IBM COS Medium and Large Disk Enclosure is configured as an expansion enclosure, as shown in the table below. The enclosure supports 106 qualified disk drive modules installed via the top panel.

- Hot-swappable expanders support 96 disks attached to four 24 hard disk drive base planes (12 disks x 8 rows)

  If an expander is removed for replacement, the 24 hard disk drive base plane will continue to operate while the high-availability card is replaced.

- The 10 hard disk drive base plane PCBA supports 10 disks (2 disks x 5 rows).

Table 2. IBM COS Medium and Large Disk Enclosure variants						
Description of configuration	PSUs[1]	System fans[2]	IOMs[3]	IOM fans[2]	Disks	HS expanders
12 Gb/s direct dock LFF	2	4	1	2	106	4
Enclosure location of CRU variant	Rear	Rear	Rear	Top	Top	Top

[1] Redundant PSUs must be compatible modules of the same type (both AC).

[2] For adequate cooling, four rear-panel system fans are required, and two IOM fans provide cooling for the IOMs (accessed via the top panel).

[3] Hot-swappable expanders support 12 disk drive slots per disk bay (8 bays total).

Enclosure core product

The Medium and Large Disk Enclosure design concept is described.

The design concept is based on an enclosure subsystem together with a set of plug-in modules. A typical enclosure system, as supplied, includes the following:

- An enclosure chassis equipped with several boards, including a mid plane, side plane, and base plane boards, and a cluster of integral enclosure status LED indicators located at the lower left area of the enclosure front panel, near the left ear.
- Two 2,000W 200–240V AC power supply unit modules.
- Fan module (system): four system fan modules for enclosure cooling.
- Two interface slots, one of which holds an IOM with four mini-SAS hard disk (SFF-8644) ports, and a serial port. The other slot contains a blank.
- Fan module (controller): two controller channel fan modules for IOM cooling
- Either 53 or 106 LFF disk drive modules
- One removable HS expander per two rows.
- A rail kit for rack mounting.
- A cable management arm (CMA) for managing cables, and enabling in-rack servicing of the enclosure.

Note: Regarding enclosure modules:

- The disk modules are not installed when the enclosure ships. Do not insert disks into the enclosure until after it has been secured in the rack. See the section, "Populating disk drive slots" on page 12.
- Unless otherwise noted within a passage pertaining to a particular CRU, the replacement procedure should be completed within three minutes of the removal of a defective module.
- Before rack-mounting enclosures, see the first **CAUTION** in the "Safe handling" on page 3 section and the Installing the Disk Enclosure WARNING.

Enclosure front panel

The Disk Enclosure front panel is described.

The following enclosure front panel diagram intentionally omits the lift handles that attach to the enclosure sides.
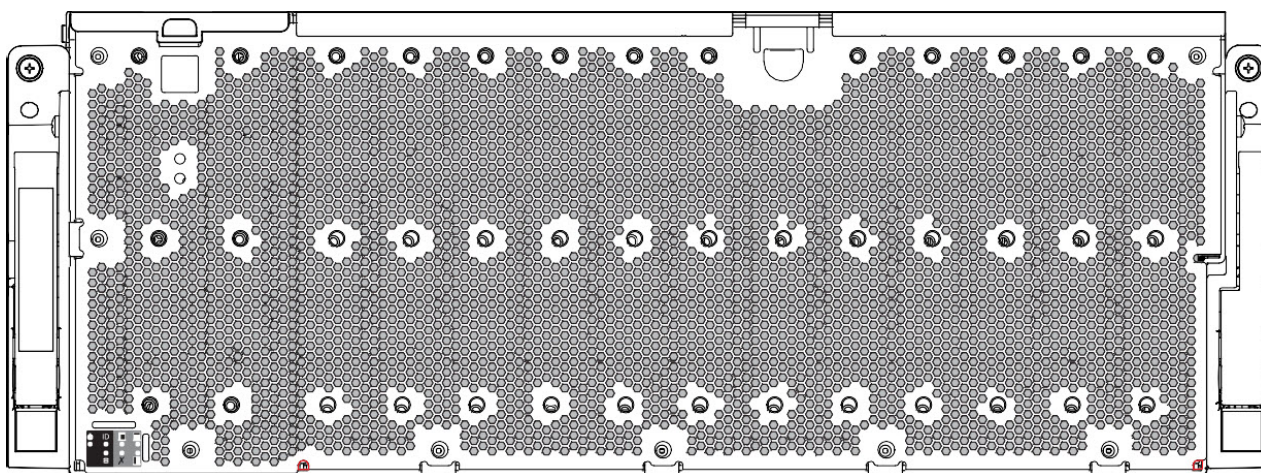
Figure 3. IBM COS Medium and Large Disk Enclosure - front panel components

The enclosure front panel provides access to the seven (7) main enclosure system LEDs, located in the lower left corner. See also the section, "Front panel LEDs" on page 14. The front panel also provides access to the left and right enclosure pull handles used to slide the enclosure forward for in-rack servicing tasks.

Enclosure rear panel

The Disk Enclosure rear panel components are described.

Concept

The following enclosure rear panel diagram intentionally omits the lift handles that attach to the enclosure sides. For clarity, it also omits the rail kit components that are used when installing the enclosure into the rack.
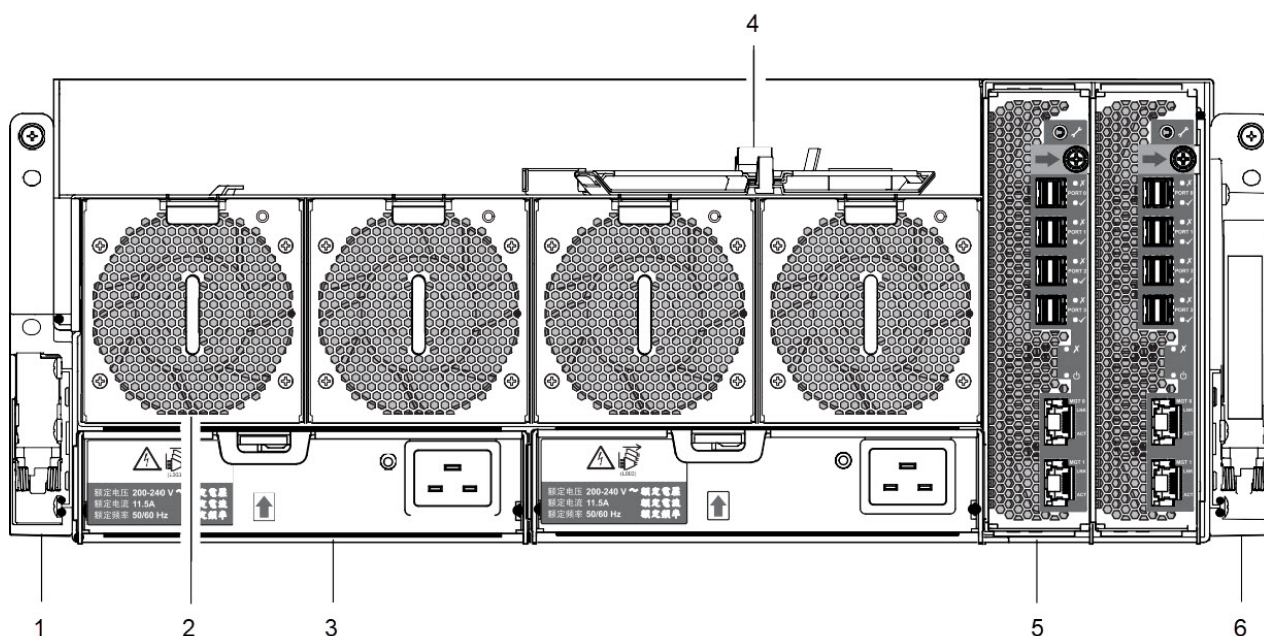
Figure 4. IBM COS Medium and Large Disk Enclosure - rear panel components

Table 3. IBM COS Medium and Large Disk Enclosure - rear panel components			
No.	**Description**	**No.**	**Description**
1	Right ear assembly (as viewed from back)	4	Cable shelf and CMA bracket for coiled cables
2	System fan module (quantity: 4)	5	Expansion module (quantity: 1)
3	Power supply unit (quantity: 2)	6	Left ear assembly (as viewed from back)

The following figure shows a conceptual diagram showing module slot-indexing as viewed from the rear panel.
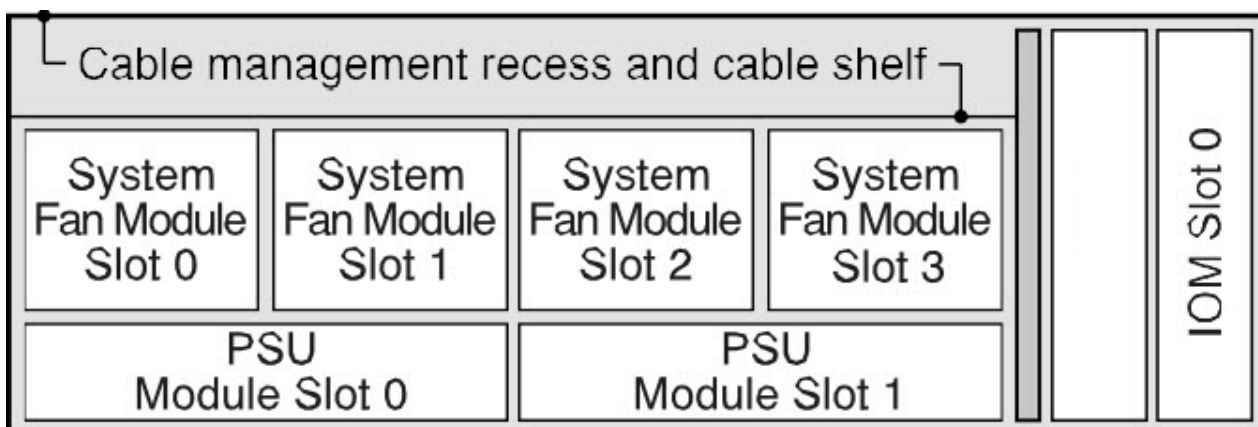
Figure 5. IBM COS Medium and Large Disk Enclosure - rear panel module slot index diagram

Expansion module

The following figure shows the expansion module used in either IOM slot located on the enclosure rear panel. The module is shown resting on its base. To install the module into one of the IOM slots located on the enclosure rear panel, revolve the module by 90° along its longitudinal axis, before inserting it into the slot, as shown in .
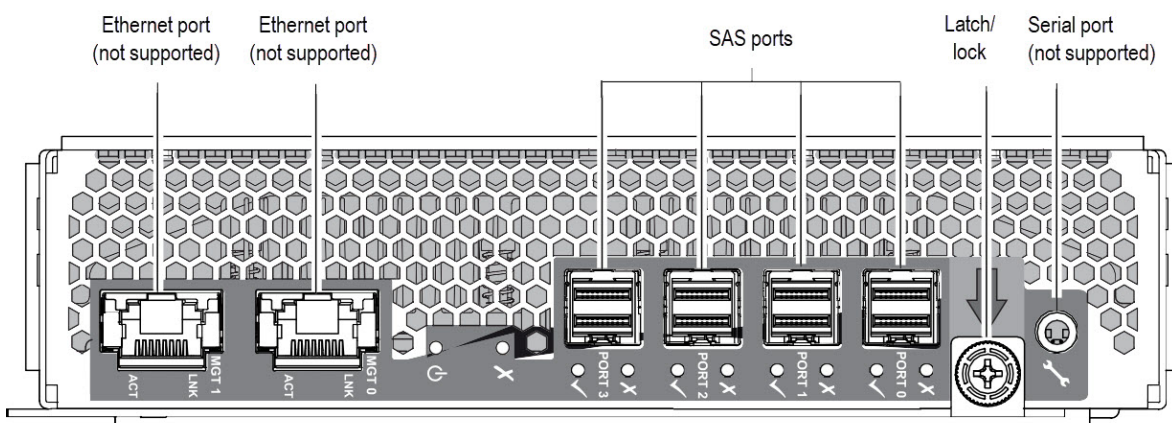
Figure 6. Expansion unit detail

Power supply unit (PSU)

The following figure shows the PSU used in a the Disk Enclosure. The example shows a PSU oriented for use in either PSU slot located on the enclosure rear panel.
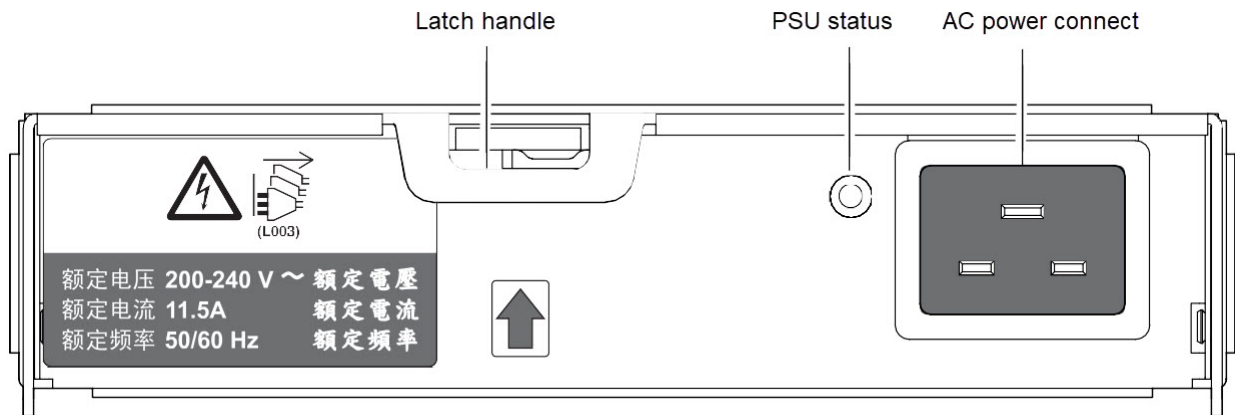
Figure 7. Power supply unit (PSU) module detail

System fan module

The following figure shows a system fan used in a the Disk Enclosure. The example shows a system fan module oriented for use in any of the system fan slots located on the enclosure rear panel.
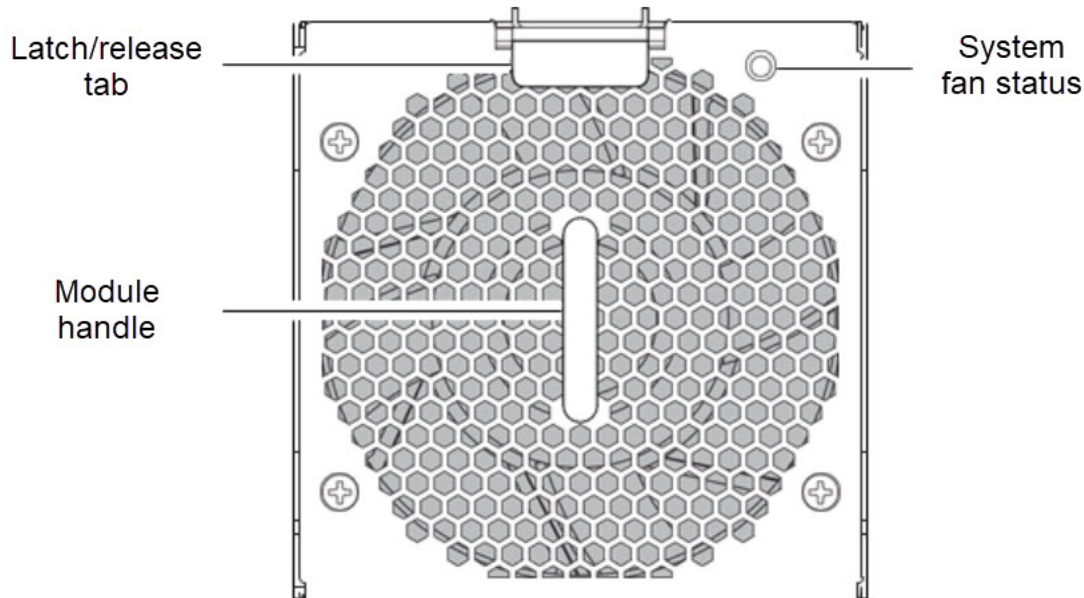
Figure 8. System fan module detail

Enclosure top panel

The Disk Enclosure top panel is described.

Overview

The following figure shows a top view of the Disk Enclosure with simplified covers. The figure is oriented such that the front of the enclosure is on left, and the rear of the enclosure is on the right. The rail kit and most of the cable management arm geometry are omitted for clarity. The enclosure top panel has three different covers, labeled A, B, and C. Two of the covers can be removed to provide access to internal components.
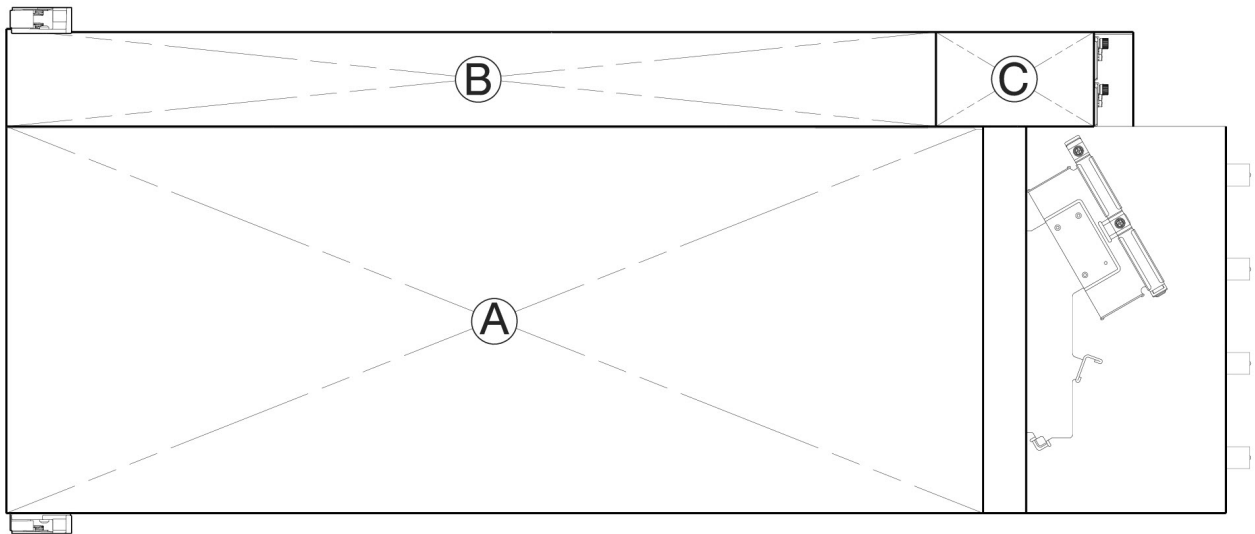
Figure 9. Top panel with covers installed

Table 4. Enclosure top panel	
Item	**Description**
A	Removable lid provides access to HS expanders and disk modules.
B	Removable lid provides access to disk modules, IOM fan modules, and limited access to IOMs.
C	Fixed cover does not remove. It provides protection for the IOMs.
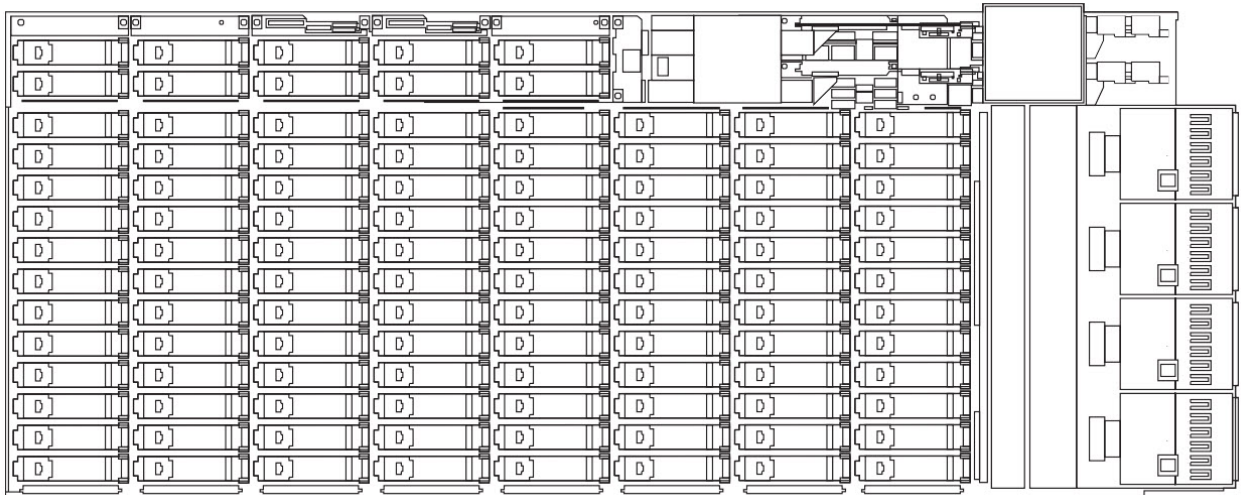
Figure 10. Top panel with covers not shown

The following figure provides a conceptual diagram of module slot-index numbering as viewed from the top of the enclosure with all covers removed. To view the arrangement of PSU module slots, beneath the system fan slots, see .

| Disk 96 | Disk 98 | Disk 100 | Disk 102 | Disk 104 | IOM Fan Module 4/5 | | IOM 0 |
| Disk 97 | Disk 99 | Disk 101 | Disk 103 | Disk 105 | | | |

Disk 0	Disk 12	Disk 24	Disk 36	Disk 48	Disk 60	Disk 72	Disk 84	Fan Module 3
Disk 1	Disk 13	Disk 25	Disk 37	Disk 49	Disk 61	Disk 73	Disk 85	
Disk 2	Disk 14	Disk 26	Disk 38	Disk 50	Disk 62	Disk 74	Disk 86	
Disk 3	Disk 15	Disk 27	Disk 39	Disk 51	Disk 63	Disk 75	Disk 87	Fan Module 2
Disk 4	Disk 16	Disk 28	Disk 40	Disk 52	Disk 64	Disk 76	Disk 88	
Disk 5	Disk 17	Disk 29	Disk 41	Disk 53	Disk 65	Disk 77	Disk 89	
Disk 6	Disk 18	Disk 30	Disk 42	Disk 54	Disk 66	Disk 78	Disk 90	
Disk 7	Disk 19	Disk 31	Disk 43	Disk 55	Disk 67	Disk 79	Disk 91	Fan Module 1
Disk 8	Disk 20	Disk 32	Disk 44	Disk 56	Disk 68	Disk 80	Disk 92	
Disk 9	Disk 21	Disk 33	Disk 45	Disk 57	Disk 69	Disk 81	Disk 93	
Disk 10	Disk 22	Disk 34	Disk 46	Disk 58	Disk 70	Disk 82	Disk 94	Fan Module 0
Disk 11	Disk 23	Disk 35	Disk 47	Disk 59	Disk 71	Disk 83	Disk 95	
Empty	Sideplane 1	Empty	Sideplane 3	Empty	Sideplane 5	Empty	Sideplane 7	

(Enclosure Front)

Figure 11. Top panel module slot index diagram with J11 disk slots highlighted

Populating disk drive slots

The IBM COS Medium and Large Disk Enclosure does not ship with pre-installed disk drive modules. When installing disk drive modules, be mindful of the slot numbering shown in the figure above. Follow this rule when populating the Disk Enclosure with disks possessing 12 watts maximum drive power per slot:

- All disks must have the same capacity.
- When adding disks, all disks must have the same capacity as those that are presently installed in the enclosure.
- When rack-mounting a Disk Enclosure, install the disks after the enclosure is installed in the rack.
- When installing disks in a Medium (J11) Disk Enclosure configuration, use slots 0-23, 48-71, 96, 98, 100, 102, and 104, as highlighted in the figure above.
- When installing disks in a Large (J12) Disk Enclosure configuration, use all slots.

Partially populated Medium Disk Enclosure (J11) disk drive slots

The IBM COS Medium J11 Disk Enclosure provides support for up to 53 disk drive modules. It can be partially populated to allow use with fewer than 53 disk drive modules. To ensure proper thermal and vibrational characteristics are maintained, the disk population must be increased in fixed increments and installed in specific slot locations. These disks can be installed while the enclosure is in use, or when it is powered down. When installing disks, but while the disk enclosure is powered on, no more than 14 disks should be added at time. After adding these disks, the operator should ensure that these disks have been successfully brought online prior to adding additional disks.

The Medium J11 Disk Enclosure supports four different disk populations. The following table describes those four configurations.

Table 5. Medium Disk Enclosure partially populated configuration	
Disk count	**Populated slots**
14	0-11, 96, 98
28	0-23, 96, 98, 100, 102

Table 5. Medium Disk Enclosure partially populated configuration (continued)	
Disk count	**Populated slots**
41	0-23, 48-59, 96, 98, 100, 102, 104
53	0-23, 48-71, 96, 98, 100, 102, 104
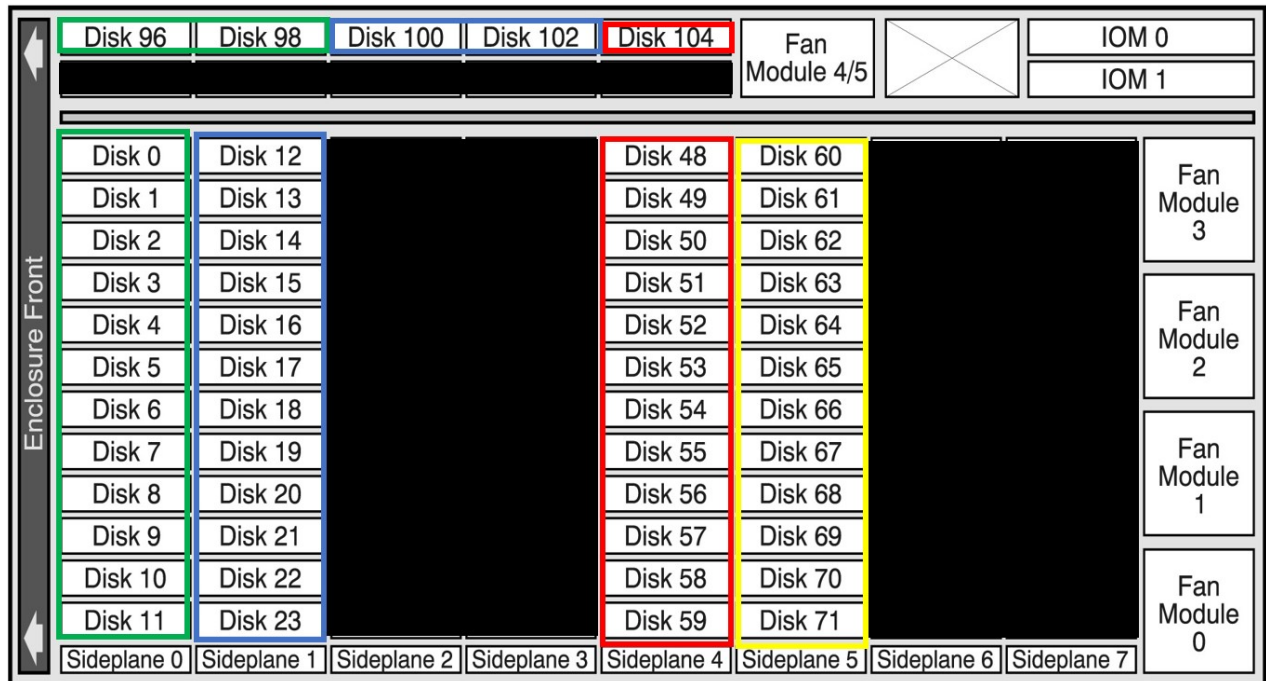
Figure 12. The following highlights illustrate the slots to be populated in order from left to right as disks are added for the four configurations noted in the above table.

Note: Note that even though there are more disk bays available, the J11 disk enclosure cannot be populated to use more than 53 disks.

After adding additional disks to the enclosure, the available system capacity increases. If the disk enclosure is part of a storage pool with multiple sets, the Manager interface may present the user with an option to resize the storage pool to take advantage of the additional capacity. To make this resize operation more efficient, this should not be done until all disk enclosures have been updated with new disks to avoid the need to resize the pool multiple times. For more information, see the *Resizing a storage pool* section in the Manager Administration Guide.

Partially populated Large Disk Enclosure (J12) disk drive slots

The IBM COS Large J12 Disk Enclosure provides support for up to 106 disk drive modules. It can be partially populated to allow use with fewer than 106 disk drive modules. To ensure proper thermal and vibrational characteristics are maintained, the disk population must be increased in fixed increments and installed in specific slot locations. These disks can be installed while the enclosure is in use, or when it is powered down. When installing disks, but while the disk enclosure is powered on, no more than 14 disks should be added at time. After adding these disks, the operator should ensure that these disks have been successfully brought online prior to adding additional disks.

The Large J12 Disk Enclosure supports four different disk populations. The following table describes those four configurations.

| Table 6. Medium Disk Enclosure partially populated configuration	
Disk count	**Populated slots**
64	0-59, 96-99
78	0-71, 96-101
92	0-83, 96-103
106	0-105
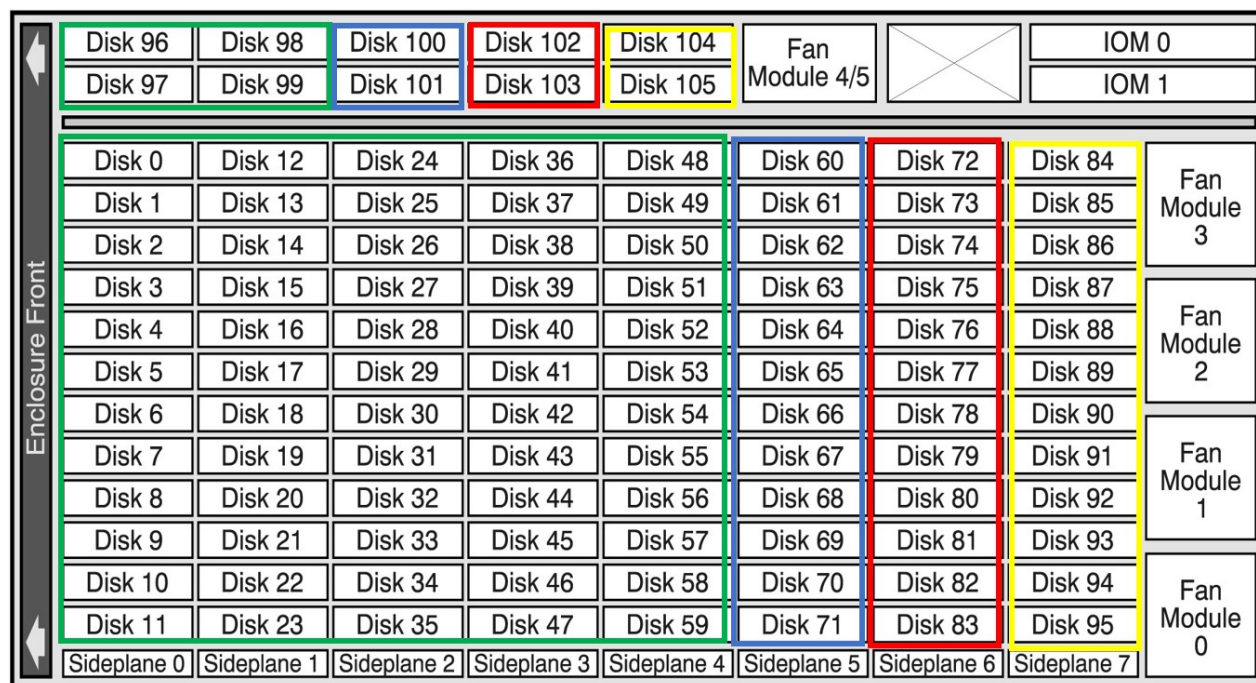
Figure 13. The following highlights illustrate the slots to be populated in order from left to right as disks are added for the four configurations noted in the above table.

After adding additional disks to the enclosure, the available system capacity increases. If the disk enclosure is part of a storage pool with multiple sets, the Manager interface may present the user with an option to resize the storage pool to take advantage of the additional capacity. To make this resize operation more efficient, this should not be done until all disk enclosures have been updated with new disks to avoid the need to resize the pool multiple times. For more information, see the *Resizing a storage pool* section in the Manager Administration Guide.

Front panel LEDs

Overview

The enclosure front panel displays several LEDs. The front panel displays the functions shown in the illustration below and listed in the table. See also Figure 3 on page 8
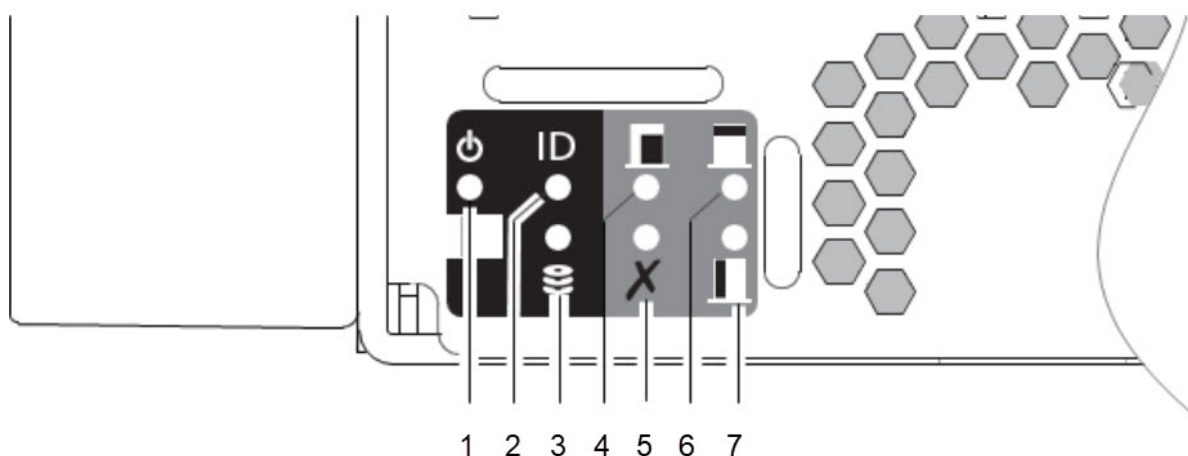
Figure 14. panel - lower left corner (partial view)

Table 7. LEDs: enclosure front panel			
LED	**Front panel functions (lower left corner of panel)**	**LED**	**Front panel functions (lower left corner of panel)**
1	System Power LED (green)	5	Firmware Fault LED (amber)
2	ID LED (blue)	6	Module Fault LED – rear (amber)
3	Drive Activity LED (blinking green)	7	Fault LED – Top lid left (amber)
4	Fault LED – Top lid (amber)		

System power on/standby LED (green)

The LED illuminates green when system power is available. If the LED is off, either the system is powered off, or there is a power failure in the system. Troubleshooting to identify the root cause is necessary.

ID LED (blue)

When activated, the ID LED is blue, and is used to identify the storage system among others installed in the rack. This LED is normally off, and illuminates only during the identification process.

Drive activity LED (green)

The LED illuminates blinking-green to indicate disk drive activity. If the enclosure is in operation and the LED is not blinking, there is a possibility of a disk drive fault. This LED can be used together with other Fault LEDs to determine whether a drive fault condition exists.

Pull the chassis forward from its installed position within the rack. Remove the top lid and look for an amber LED on any of the disk drive modules or HS expander modules on the side-plane. Replace the faulty module per the applicable CRU replacement procedure.

Fault LED - top lid (amber)

The LED illuminates amber when experiencing a system hardware fault with a component accessible via the enclosure top panel. Amber display indicates that the top lid should be removed to locate the faulty

component within the drive channel. This LED is normally off, and illuminates only when a fault occurs with a component beneath the top lid.

Pull the chassis forward from its installed position within the rack. Remove the top lid and look for an amber LED on any of the disk drive modules or HS expander modules on the side-plane. Replace the faulty module per the applicable CRU replacement procedure.

Firmware fault LED

The LED illuminates amber when experiencing a firmware application fault such as a firmware upgrade failure or memory corruption. This LED is normally off, and illuminates only when a firmware-related fault occurs. See troubleshooting procedures if this fault displays.

Fault LED - rear panel (amber)

The LED illuminates amber when experiencing a system hardware fault with a component accessible via the enclosure rear panel (IOMs, PSUs, system fans). This LED is normally off, and illuminates only when a fault occurs with a component installed in the enclosure rear panel.

Observe the enclosure rear panel, and look for a fault indicator on the modules installed.

Fault LED - top lid left (amber)

The LED illuminates amber when experiencing a system hardware fault with a component accessible via the enclosure top panel. Amber display indicates that the top lid on the left should be removed to locate the faulty component within the controller channel. This LED is normally off, and illuminates only when a fault occurs with a component beneath the top lid on the left.

Pull the chassis forward from its installed position within the rack. Remove the top left lid and look for an amber LED on any of the disk drive modules or controller channel fans. Replace the faulty module per the applicable CRU replacement procedure.

Rear panel LEDs

The Disk Enclosure rear panel LEDs are described.

Power supply unit

AC-DC power is provided by up to two auto-ranging power supply modules (PSUs). Cooling is provided by four separate cooling fans and two controller module fans. The IOM provides power and LED control. Also see the "System airflow" on page 18 section for optimal cooling within the enclosure(s).

2,000W PSU

The 2,000W PSU voltage operating range is nominally 200V–240V AC, and operates at 50–60 Hz input frequency. In the figure below, the dimetric rear orientation shows the PSU aligned for insertion into either PSU slot located on the enclosure rear panel.
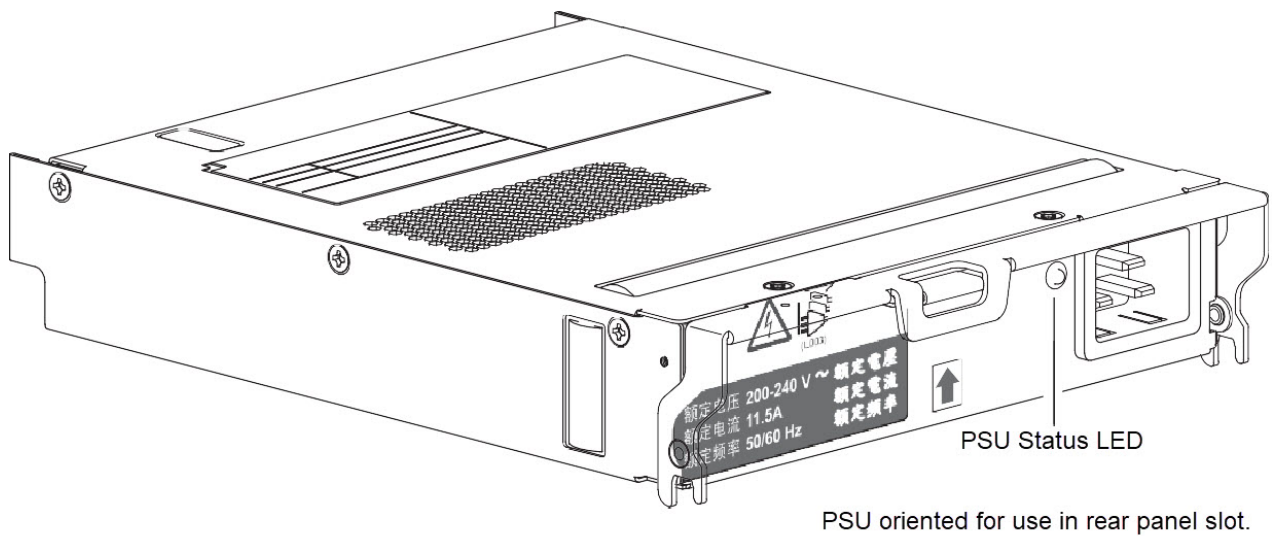
Figure 15. LEDs - 2000W PSU - rear panel

Table 8. LEDs - 2000W PSU - rear panel			
Module LED	**LED behavior states**		
PSU Status LED (Bitonal)	PCM OK (Green)	PSU fault/failure (Amber/blinking amber)	Power off (Off)

Multiple power supply unit modules

The 4U storage system includes two PSUs which provide redundant power control for the system so that if one module fails, the other maintains the power supply, and enclosure operation is not affected while you replace the faulty module.

PSUs are hot-pluggable, and replacement should only take a few seconds to do. Replacement must be completed as soon as possible after the removal of the defective PSU to avoid a thermal exception. The replacement procedure should be completed within an absolute maximum of three minutes.

Important:

Operation of the enclosure with any modules missing will disrupt the airflow, and the disks will not receive sufficient cooling. It is essential that all slots are fitted with PSUs prior to powering on the enclosure.

System fan module

Enclosure cooling is provided by four system fan modules used in combination with two controller channel fan modules. The IOM provides fan and LED control. This section describes system fan modules. See also the "Controller channel fan module" on page 22 section.

System fan status LED

System fan oriented for use in rear panel slot
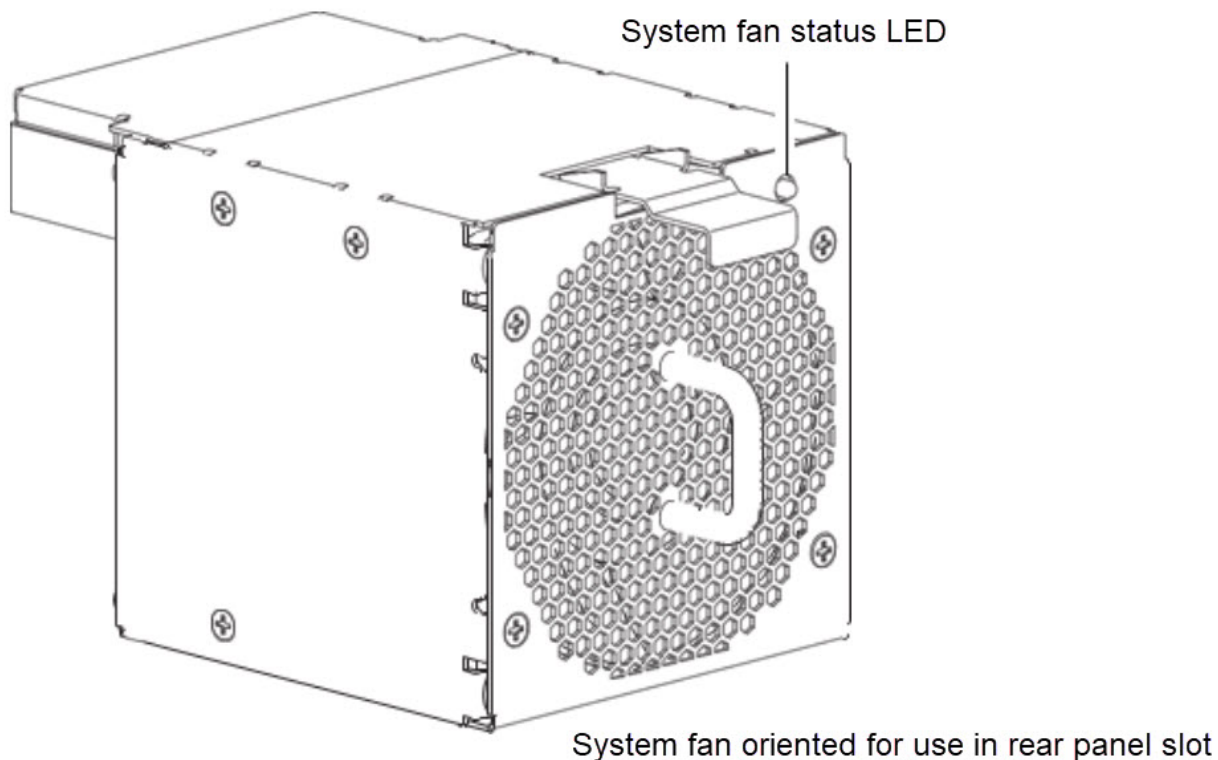
Figure 16. LEDs - system fan module - rear panel

Table 9. LEDs - system fan module - rear panel			
Module LED	**LED behavior states**		
System Fan Status LED	System Fan OK (Off)	Fan fault/ID (amber/ blinking amber)	Power off (Off)

Multiple system fan modules

The Disk Enclosure includes four system fan CRUs which provide redundant cooling for the system, so that if one module fails, the others maintain airflow circulation, and enclosure operation is not affected while you replace the faulty module. Within this CRU module, if one of the two internal rotors fails, then a fault occurs, indicating module failure. A dual rotor failure is reported as a dual-fault.

System fans are hot-pluggable, and replacement should only take a few seconds. Replacement must be completed as soon as possible after the removal of the defective system fan to avoid a thermal exception. The replacement procedure should be completed within an absolute maximum of 2 minutes for this CRU module.

Important:

Operation of the enclosure with any modules missing will disrupt the airflow, and the disks will not receive sufficient cooling. It is essential that all slots are fitted with system fans prior to powering on the enclosure.

System airflow

The system must be operated with low pressure rear exhaust installation. Back pressure created by rack doors and obstaclesis not to exceed 5 pascals (0.5mm water gauge). The cooling system provides sufficient capacity to ensure that maximum temperatures are not exceeded.

Important:

The environment in which the enclosure operates must be dust-free to ensure adequate airflow.

Expansion module

IOMs are used in IBM COS Medium and Large Disk Enclosures 12Gb/s storage enclosures.

The figure below is a dimetric rear orientation that shows a pictorial view of an expansion module. You would revolve the module by 90º along its longitudinal axis, before inserting it into the IOM slot, as shown in Figure 4 on page 8 and the figure in the section "Removing the IOM" on page 67.
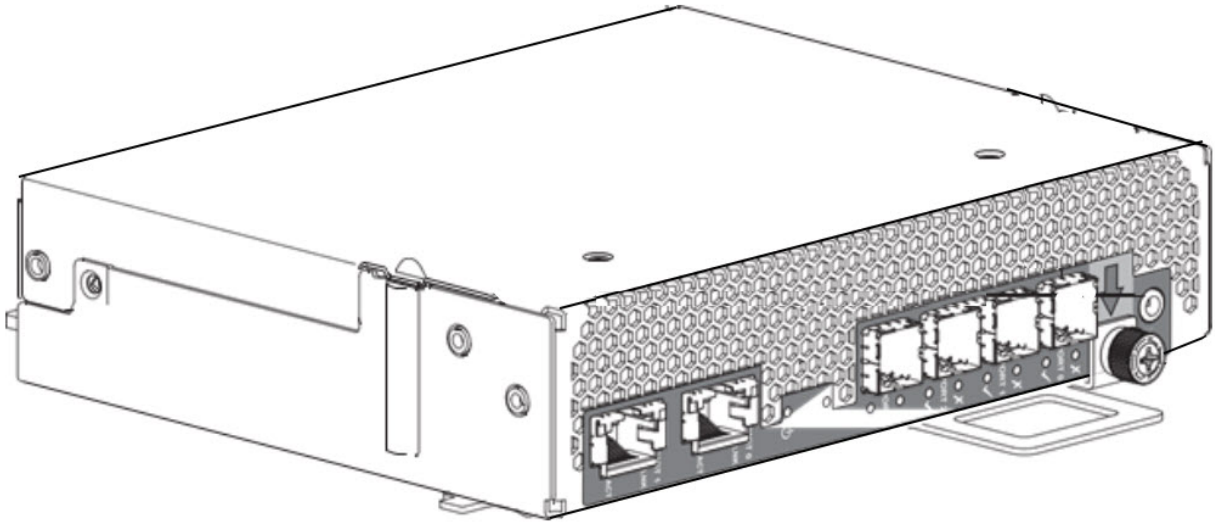
Figure 17. Expansion module - dimetric rear orientation

Each controller module maintains VPD (Vital Product Data) in EEPROM devices, and are interconnected by I2C buses on the mid-plane. In this way, the modules can discover the type and capabilities of the partner module(s), and vice versa, within the enclosure. An enclosure system fault occurs when incompatible configurations are detected. The replacement procedure should be completed within an absolute maximum of three minutes.

Important:

For a description of EBOD canister LEDs, see Figure 18 on page 20.

12Gb/s expansion module LEDs

The figure and table below provide a description of the expansion module that installs into the rear panel of an COS Medium/Large JBOD expansion enclosure. The module is shown resting on its base. To install the module into one of the IOM slots located on the enclosure rear panel, you would first revolve the module by 90º along its longitudinal axis, before inserting it into a slot as shown in Figure 4 on page 8. Showing expansion modules separately from the enclosure enables improved clarity in identifying the component items called out in the diagrams and described in the companion tables within the figure/table ensembles.
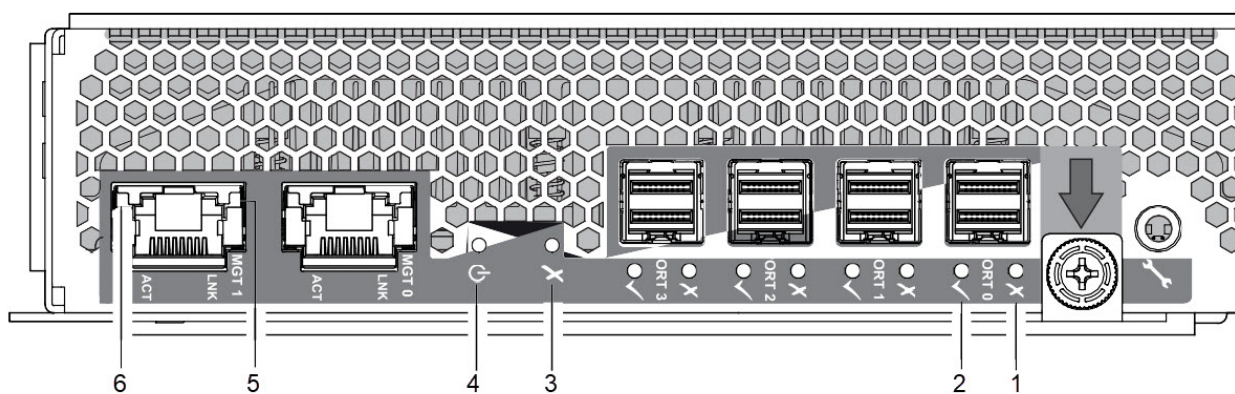
Figure 18. LEDs: 12Gb/s Expansions module - rear panel

Table 10. LEDs: Expansion module - rear panel		
LED	**Description**	**Definition**
1	12Gb SAS Fault[1]	Off - No fault detected. Amber - A fault has been detected on the port.
2	12Gb SAS Link Status and Activity[1]	Off - No link detected. Green - The port is connected and the link is up. Blinking green - The link has I/O activity.
3	Fault	Off - The expansion module is operating normally. Amber - A fault has been detected or a service action is required.
4	Power OK	Green - The expansion module is operating normally. Blinking green - System is booting. Off - The expansion module is powered off.
5	Ethernet Port Link Speed[2]	Ethernet managing is not supported at this time
6	Ethernet Port Link/Active Status[2]	Ethernet managing is not supported at this time

[1] This LED description applies to all 12Gb SAS ports (Port 0 through 3).
[2] This LED description applies to both management ports (Port 0 and Port 1).

Top panel LEDs

Overview

To view LEDs of components that are accessible from the top panel, you must first remove the lid for the compartment in which the component is installed. The enclosure top panel is shown in .

Drive carrier module

The drive carrier module comprises a hard disk held by a carrier.

- Each drive slot can hold a single low profile (1.0-inch) 3.5-inch form factor disk drive in its carrier.
- The disk drive modules are inserted into vertically aligned slots that are accessible from the top of the enclosure. While facing the front of the enclosure, properly orient the disk drive module for insertion into the slot:
  - Hold the module so that the front is facing you (latch tab on left, and disk PCB facing up).
  - Revolve the module -90º about the horizontal axis (latch is facing up, module is standing on end)
  - Revolve the module 90º about the vertical axis (latch is facing up, disk PCB is facing left).

A plastic casing holds and provides protection for each disk. The disk with protective casing is known as a drive module. The front cap also has an ergonomic handle which gives the following functions:

- Secure location of the carrier into and out of drive slots.
- Positive spring-loading of the drive/mid-plane connector.

The carrier can use this interface:

- Dual path direct dock Serial Attached SCSI.

Note: Pictorial views of the supported DDIC with LFF disk drive are provided below. Modules are shown oriented for insertion into disk drive slots located on the enclosure top panel.
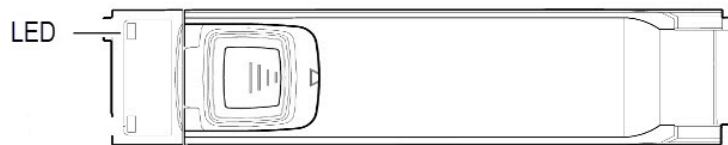
Top view of LFF disk drive module
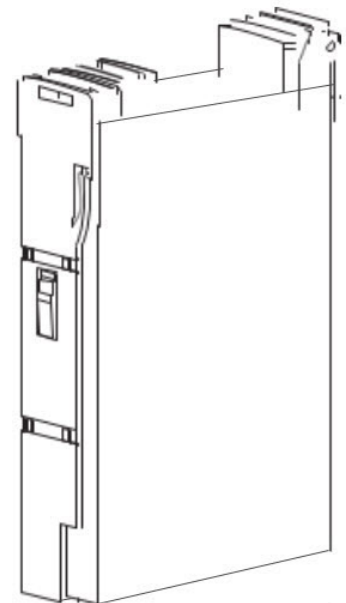
DDIC aligned to module slot

Figure 19. LED: Dual path LFF 3.5" disk drive carrier modules - top panel

Table 11. LED - Dual path LFF disk drive carrier modules - top panel	
State (Amber)	**Status**
Off	Normal
Short blink (1 sec)	Identify
On	Fault - A fault has been detected or a service action is required.
Long blink (3 secs)	Rebuild

The replacement procedure should be completed within an absolute maximum of 3 minutes. For additional information about LFF disk LED behavior, see the "Disk drive carrier module LED" on page 48 section.

Controller channel fan module

The controller channel fan module supplements the system fans by circulating airflow within the enclosure controller channel, and providing cooling for the IOMs. The replacement procedure should be completed within an absolute maximum of three minutes.
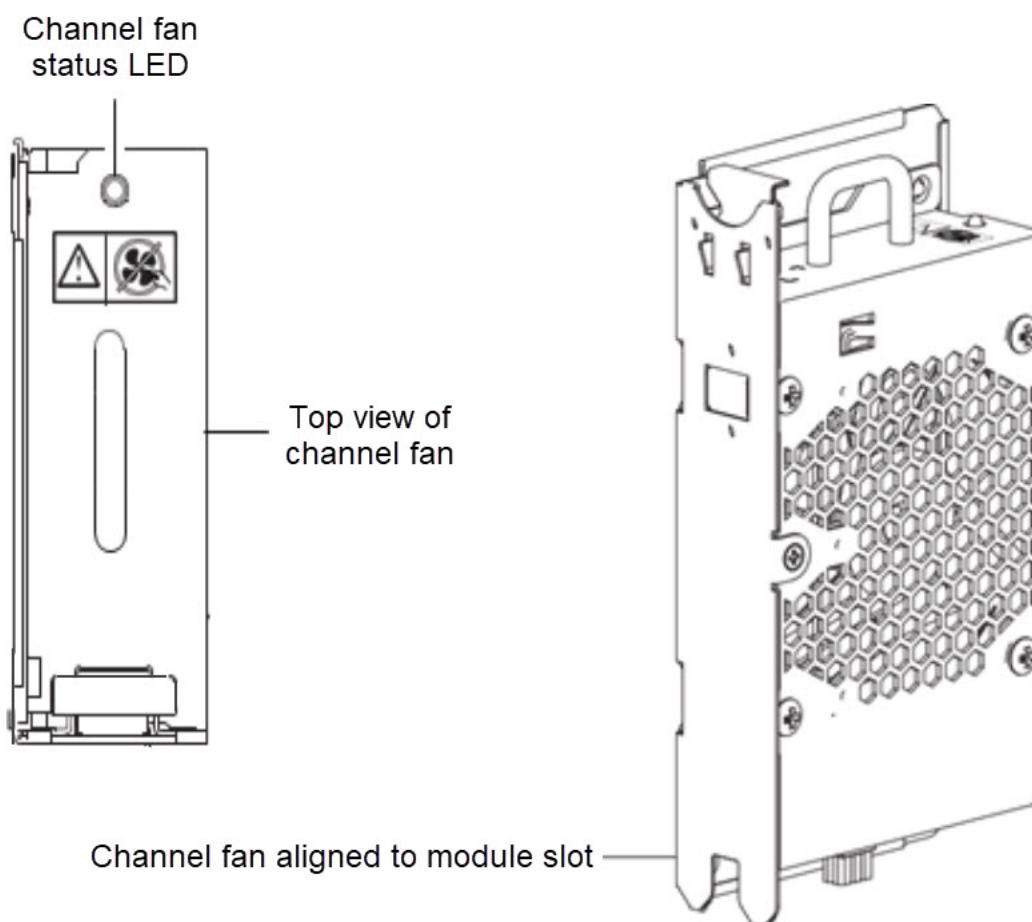
Figure 20. LEDs: Controller channel fan module - top panel

Table 12. LEDs: Controller channel fan module - top panel			
Module LED	**LED behavior states**		
Channel Fan Status LED	Channel Fan OK (Off)	Fan fault ID (amber/ blinking amber)	Power off (Off)

HS Expander module

The replacement procedure should be completed within an absolute maximum of 3 minutes.
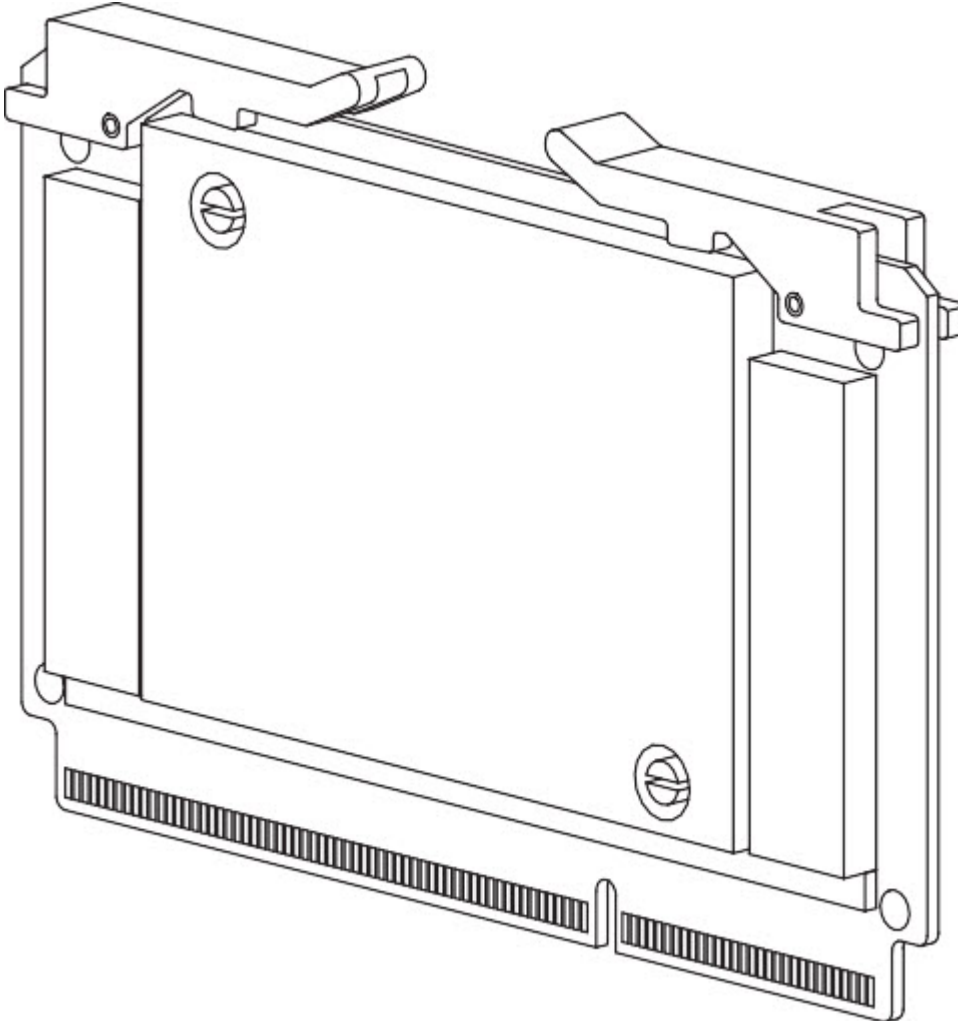
Figure 21. HS expander module - top panel

Table 13. HS expander module LEDs			
Module LED	**LED behavior states**		
HS Expander Status LED	Expander OK (Off)	Expander fault ID (amber/blinking amber)	Power off (Off)

Enclosure management

IOMs actively manage the enclosure. Each module has a SAS expander with its own storage enclosure processor (SEP) that provides a SES target for a host to interface to through the ANSI SES Standard. If one of these modules fails, the other module will continue to operate.

Chapter 4. Installation

Installation checklist

Plan and successfully install your enclosure system into an industry standard 1.2 m rack cabinet.

⚠️ **CAUTION:** To install the system, use only the power cords supplied.

The following table outlines the steps required to install the enclosure. To ensure successful installation, perform the tasks in the order presented. For rackmount installation, temporarily place all disk drive modules in a static-protected area, and then install them after the Disk Enclosure is installed in the rack.

Table 14. Installation checklist

Step	Task	Where to find procedure
1	Unpack the enclosure	See "Unpacking the Disk Enclosure" on page 27
2	Plan and prepare for installing the Disk Enclosure into the rack[1]	See "Required tools" on page 29 See "Requirements for rackmount installation" on page 29
3	For rackmount installation, defer installing disks until the Disk Enclosure is rack-mounted[2]	See "Populating disk drive slots" on page 12 See "ESD precautions" on page 55
4	Install the Disk Enclosure into the rack space	See "Installing the Disk Enclosure" on page 30
5	Cable the Disk Enclosure to IBM COS Medium and Large Disk Enclosures	See "Routing cables using the CMA" on page 38 and "Power cord connection" on page 42
6	Connect power cords	See "Power cord connection" on page 42
7	Test enclosure connectivity	See "Testing enclosure connections" on page 42

[1]The environment in which the enclosure operates must be dust-free to ensure adequate airflow.

[2]Locate the disk modules and temporarily place them in a static-protected environment for population of the disk bays once the enclosure is installed and secured into the rack.

[3]Removing CRUs before rack-mounting is not necessary, but can be done to lighten the enclosure. See removal and installation steps for individual CRUs. If you temporarily remove the CRUs, label them and place CRUs and disk modules in a static-protected environment.

Planning for installation

Before beginning the enclosure installation, familiarize yourself with the system configuration requirements. The figures listed below show the locations for each plug-in module:

- Disk Enclosure front panel: see Figure 3 on page 8.
- Disk Enclosure rear panel: see Figure 4 on page 8.
- Disk Enclosure top panel: see Figure 9 on page 11, Figure 10 on page 11, and Figure 11 on page 12.

Important: Installation work should be performed by qualified service personnel.

Table 15. Storage system configuration		
Module type	**Location**	**Description**
Power supply unit	Rear panel	Two PSUs provide full power redundancy, allowing the system to continue to operate while a faulty PSU is replaced.
System fan	Rear panel	Four system fans provide cooling, allowing the system to continue to operate while a faulty system fan is replaced.
I/O module	Rear panel	TheIOM must be installed in IOM slot No.0 and an IOM blank must be installed in IOM slot No.1.
Disk drive module	Top panel	See "Populating disk drive slots" on page 12.
Channel fan	Top panel	Two channel fan modules of the same model type are supported.
HS Expander	Top panel	Four removable hot swap expanders are supported: one per 12-drive bay.

Preparing the site and host server

Before beginning the enclosure installation, verify that the site where you will install your storage system has the following:

- A mechanical lift that can safely hoist a 280 lb high-density enclosure for installation into a 1.2 m rack.
- A proper redundant AC power source or a rack power distribution unit (PDU) with an Uninterruptible Power Supply (UPS).
- A host computer configured with the appropriate software, BIOS, and drives. Contact your supplier for the correct software configurations.
- A static-protected environment for temporarily storing disk drive modules if the enclosure is intended for rack-mount use. See the Chapter 2, "Safety guidelines," on page 3 before unpacking the enclosure and installing it in the rack.

Before installing the enclosure, verify the existence of the following:

- SAS HBA
- Qualified cable options for host connection and EBOD cascades
- One suitable C20 to C19 power cord per PSU
- Rail kit and Cable Management Arm (for rack installation)
- Disk drive modules for use in populating the disk slots after the enclosure is secured into the rack.

Contact IBM support for a list of qualified accessories for use with the enclosure. The accessories box contains the power cords and other accessories.

Preparing for installation

There are important preparation requirements and handling procedures for use during product installation.

Overview

⚠️ **CAUTION:**

The Disk Enclosure - together will all its component parts - is too heavy to manually lift and install into the rack cabinet. A minimum of three people and a suitable mechanical lift are required to hoist the Disk Enclosure and install it into the rail kit assembly within the rack.

Make sure you wear an effective anti-static wrist or ankle strap and obey conventional ESD precautions when touching modules and components. Do not touch mid-plane, motherboard, or module connectors. See also the section, "ESD precautions" on page 55.

Unpacking the Disk Enclosure

Before unpacking the Disk Enclosure, familiarize yourself with the exploded view of packaging components that pertain to your enclosure product. See also Chapter 9, "Enclosure packaging," on page 75.

1. Examine the packaging for crushes, cuts, water damage, or any other evidence of mishandling during transit.

   If you suspect that damage has happened, photograph the package before opening, for possible future reference. Retain original packaging materials for use with returns.

2. The unpacking sequence pertaining to 4U enclosures is shown in the following figures.

   ⚠️ **CAUTION:** The Disk Enclosure does not ship with disk drive modules installed, but all rear panel CRU modules are installed. This partially populated Disk Enclosure is quite heavy: 64 kg (142 lb).

   You can remove the Disk Enclosure from its shipping box using the standard belt-style lifting straps. If available, you can remove the enclosure from its box using the optional lift handles instead of the straps.

   • Default method: remove the Disk Enclosure from its box using the straps. See the figure below, and the **CAUTION** above and below the figure. The figure shows buckled belt-straps secured longitudinally on the Disk Enclosure. Only the straps and plastic bag are shown. They are isolated from the remainder of the packaging. As a visual aid for this unpacking task, see Chapter 9, "Enclosure packaging," on page 75 for more information about the packaging materials.

   ⚠️ **CAUTION:** Verify that each belt strap is securely wrapped and buckled before performing the lift.

Buckled belts-straps (3 per enclosure)
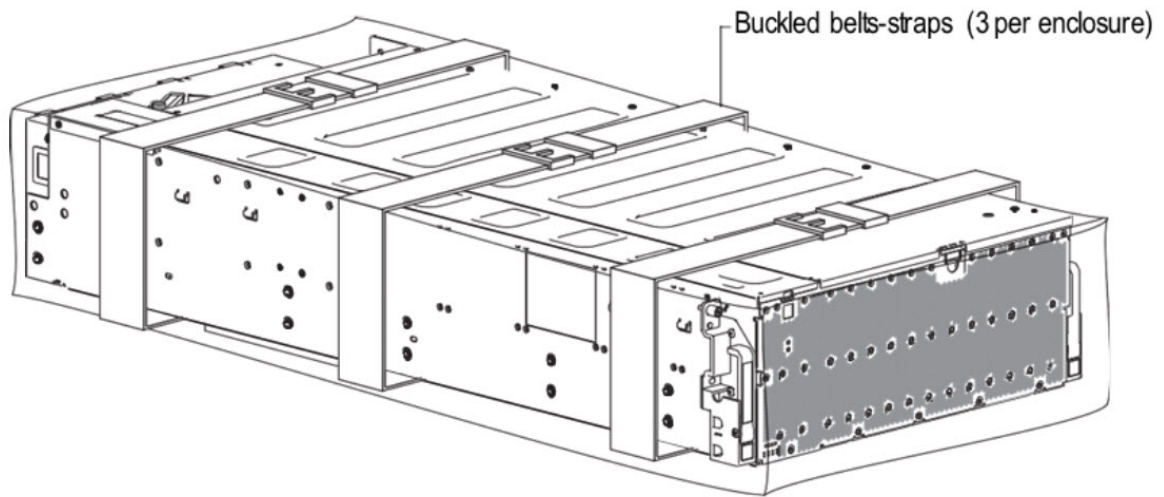
Figure 22. Unpacking the Disk Enclosure using straps

⚠️ **CAUTION:** With three persons - positioned one at each corner rear corner, and one at the front of the enclosure - grip the straps securely by the loops, and lift the enclosure out of the box using appropriate lifting technique. Place the enclosure in a static-protected area.

Except for the disk drive modules, enclosures are supplied with all integrated PCBs and all plug-in modules installed. For information about plug-in module replacement, see the section Chapter 7, "Module removal and installation," on page 55. Disk drive modules are installed separately *after* the enclosure is mounted in the rack.

- Alternative method: remove the enclosure from its box using the optional lift handles.

See the figure below and the **CAUTION** above and below the illustration. Only the straps and plastic bag are shown. They are isolated from the remainder of the packaging. As a visual aid for this unpacking task, see Chapter 9, "Enclosure packaging," on page 75 for more information about the packaging materials. The illustration shows two steel lift handles installed on the left side of the chassis just below the enclosure lid. Two additional steel lift handles are symmetrically attached on the right side of the enclosure (hidden in this view).

⚠️ **CAUTION:** Verify that each of the four lift handles is securely fastened to the enclosure sheet metal *before* performing the lift. Optional lift handles are attached to the enclosure side wall using the spring-loaded push-pull attachment pin located on the attachment flange of each lift handle. These handles are designed to support the weight of a partially populated enclosure: chassis and CRUs only (as shipped). The handles are not designed to hold the weight of a fully populated enclosure that also includes the disk drives.
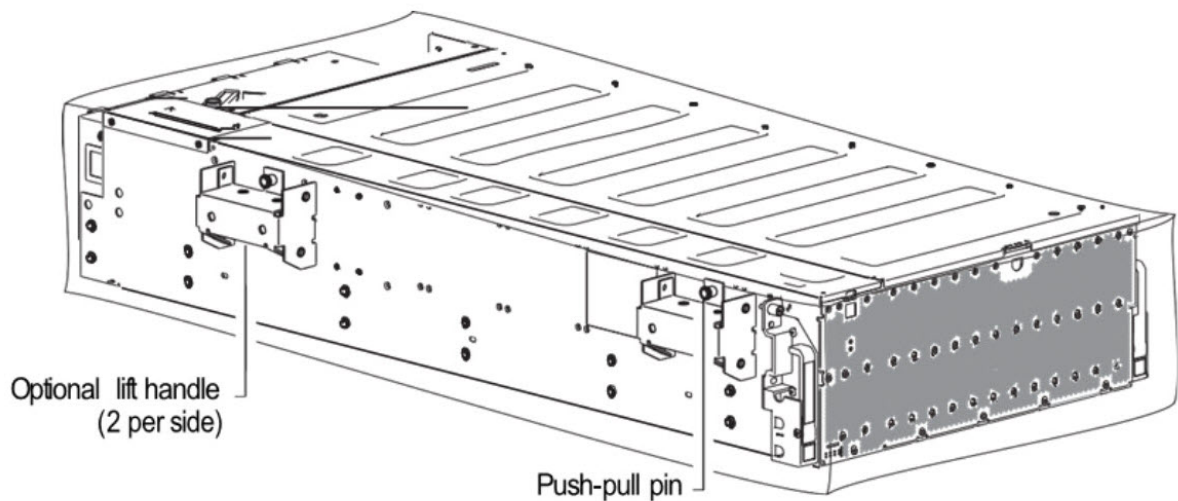
Figure 23. Unpacking the Disk Enclosure using lift handles

⚠️ **CAUTION:**

With two persons - positioned one on each side of the enclosure - grip the handles securely, and lift the enclosure out of the box using appropriate lifting technique. Place the enclosure in a static-protected area.

Except for the disk drive modules, enclosures are supplied with all integrated PCBs and all plug-in modules installed. For information about plug-in module replacement, see Chapter 7, "Module removal and installation," on page 55. Disk drive modules are installed separately *after* the enclosure is mounted in the rack.

3. Prepare to install and set up the enclosure.

   a. Before installing the enclosure into a rack, see Chapter 2, "Safety guidelines," on page 3, and the Installing the Disk Enclosure WARNING.

   b. For rackmount installation, do not install the disk drive modules until after the enclosure is mounted in the rack.

Required tools

#2 Phillips screwdriver

Requirements for rackmount installation

You can install the enclosure in an industry standard 1.2 m cabinet capable of holding 4U form factors.

- Minimum depth: 1,206.5 mm (47.5") from rack posts to maximum extremity of enclosure (includes rear panel cabling and cable bend radii).
- Weight: Up to 145.6 kg (321 lb), dependent upon configuration, per Disk Enclosure.
- The rack should cause a maximum back pressure of 5 pascals (0.5 mm water gauge).
- Before you begin, ensure that you have adequate clearance in front of the rack for installing the rails and the CMA.
- Follow the sequence of tasks provided in the "Installation checklist" on page 25

⚠️ **CAUTION:**

- The mechanical lift and the rack must be level in all planes, and with respect to each other. Failure to comply could result in mechanical failure of the rail kit.

- Use a "spotter" to observe installation from the rear of the rack. The spotter should ensure the inner rail is fully mated with the middle rail track throughout installation.

Rackmount rail kit

Rackmounting rails are developed for use with the Disk Enclosure that installs into 1.2 m rack cabinets. These rails have been designed and tested for the maximum enclosure weight, and to ensure that multiple enclosures may be installed without loss of space within the rack. Use the rail kit and mounting hardware provided by IBM.

Installing the Disk Enclosure

About this task

Enclosure installation involves interrelated steps and product-kit sub-assemblies. The rail kit comprises left and right rail sub-assemblies that attach to the Disk Enclosure and the rack. The cable management arm (CMA) comprises sub-assemblies that attach to the Disk Enclosure, rails, and rack.

⚠️ **Warning:** Do not attempt to install the enclosure into the rack with disks preloaded into drive slots. Unload disks (if installed) to a static-protected area and label them. Failure to heed this Warning and the following guidelines could result in serious injury. Although you can further lighten the enclosure by removing CRUs, It is not necessary to do so.

This procedure describes adjustment and installation of left and right rail sub-assemblies, followed by installing the Disk Enclosure into the rack.

Procedure

1. Measure the rail-span depth distance from rear rack post to front rack post, and record this dimension.

2. Take the left outer rail subassembly in hand; then rotate the middle slide release, and fully extend the middle slide.

Middle slide - fully extended
(Slide release latch identified above)

Middle slide release detail

3. Unscrew and remove the quantity-4 rail kit rear-mounting bracket screws to adjust the rack post-to-post distance for the left rail subassembly.

Adjust the rail for the rack post-to-post distance.

Attachment holes for Step 3 are identified above.

4. Relocate the left rail mounting bracket to approximately match the rack post-to-post distance recorded in Step 1, above.

This bracket has one inch of available adjustment after the screws are secured. After torquing the quantity-4 screws removed in Step 3, verify that the bracket can be adjusted to the exact rack post-to-post distance determined in Step 1. Torque to 1.36 N-m (12 lbf-in)

5. Repeat Step 1 through Step 4 for the right outer rail subassembly.
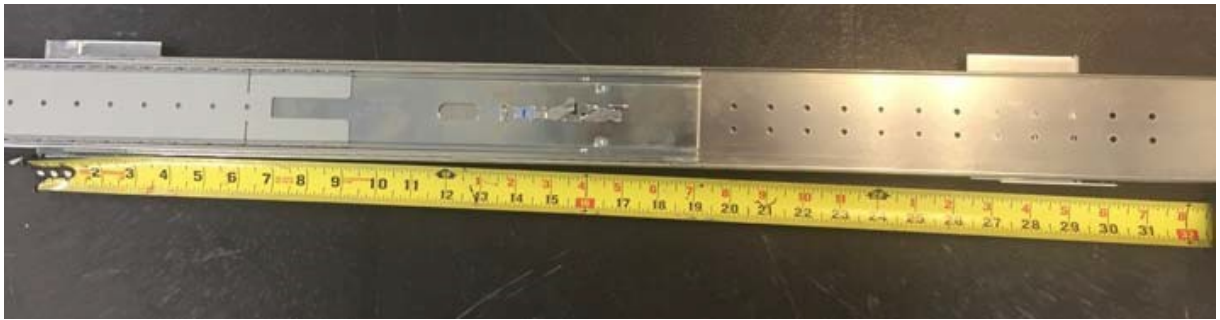
6. Take the right outer rail subassembly in hand, and flip it over (rotate it 180° along its longitudinal axis).

Attachment holes for Step 7 are identified above

7. Using the quantity-4 panhead screws provided with the CMA kit, attach the CMA attachment bracket to the rear end of the outer slide, on its outside surface. The images below show the progression of steps from left to right.

CMA attachment bracket

CMA attachment bracket aligned with outer slide

Pan head screws

CMA attachment bracket installed on outer side

8. Insert the right rail subassembly into the rack. Attach the adjustable rear mounting bracket to the rail first, ensuring that the rail subassembly occupies the lower 2U portion of the allotted 4U space. The rear mounting bracket spring will clip onto the rail. Ensure that the quantity-2 all-in-one rail kit mounting hardware fully seats into the rack post mounting hole.
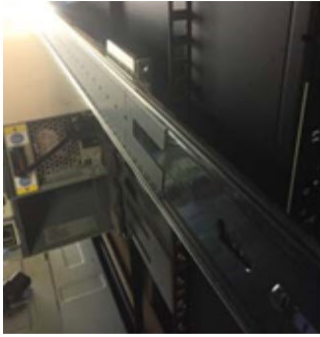
| Location detail | Fastener detail | Attachment spring detail |

9. Attach the front mounting bracket to the rack post, ensuring that the rail subassembly occupies the lower 2U portion of the allotted 4U space. The front mounting bracket spring will clip onto the post. Ensure that the quantity-2 all-in-one rail kit mounting hardware fully seats into the rack post mounting hole.

Front rack post attachment details

10. Secure the front and back rail kit mounting brackets with the three 10-32 panhead screws provided,on the top and bottom PEM locations on the back mounting bracket, and the bottom PEM location on the front mounting bracket (total quantity-3). Torque to 3.95 N-m (35 lbf-in).

11. Repeat Steps 7 through 10 for the left rail subassembly

12. Insert the quantity-4 (quantity-2 per side) cage nuts provided into the rack in the second-to-top and third-to-top square holes in the 4U space (mates to thumbscrew and panhead screw in Step 21)

Rack post square hole location detail

13. While heeding the following safe handling precautions, ensure the middle slide ball bearing track is fully seated to the front of the middle slide. This step is critical for proper rail sequencing and full engagement of the inner rail on the middle rail. In the example on the left (below), the ball bearing track is not fully seated to the front of the middle slide.
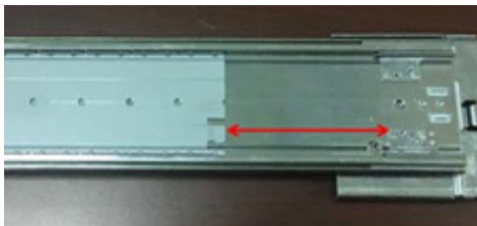
Incorrect - example

Correct - example

⚠️ **Warning:** Safe handling precautions:

- Do not drop or lift the chassis using a mechanical lift while inner rails are engaged with middle rails. The middle and inner rails should be properly aligned before engagement, so they glide smoothly during the entire insertion

- The Disk Enclosure must be entirely supported by the mechanical lift until the rails are locked in the service position. Failure to do so can cause mechanical failure and serious personal injury.

- Do not push the chassis into the rack using the mechanical lift. The insertion force must be manual, and unassisted by mechanical force or additional mass. Using the lift for this purpose could damage rails.

- Do not bend the middle rail in order to force alignment with the inner rail. Alignment should be adequately established with the lift.

- If fine-tuning of alignment adjustments are required, do not adjust using the mechanical lift. Adjustments should be made by shifting the chassis itself; not the lift, and not the middle rail.

- Lower the lift only after the service position is reached, and the rail is locked in place. Lower the lift by no more than 2"– 3" while the chassis is inserted from the service position into the rack.

- The inner rails/chassis and the middle rails must be kept level, straight, and fully parallel during the entire installation. Failure to comply can cause inadequate rail engagement, and possible damage to the rails.
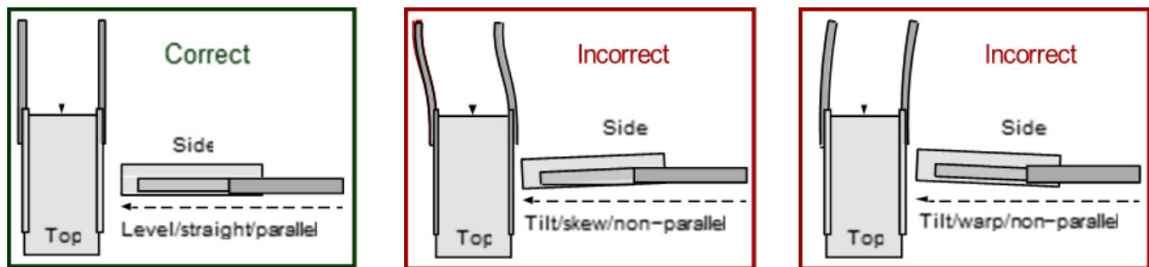
Safe-handling thumbnails: inserting the chassis with rails into the rack

14. Extend the middle rail of both the left and right rail kit sub-assemblies roughly three inches beyond the face of the rack.

15. Position the chassis with the lift such that the inner rails are lined-up perfectly with the middle rails. The end of both inner rails should be equidistant from the rack face. To make adjustments to the alignment, shift the chassis on the left until alignment of both sides is adequate.
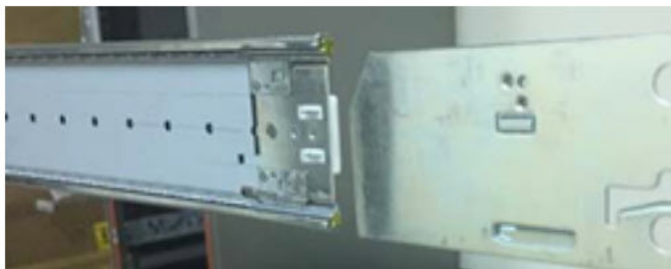
Rail slide alignment detail

16. Keeping the chassis stationary, pull the middle rails forward onto the inner rails, ensuring full engagement of the inner rails onto the middle slide track. Middle slides should slide freely and smoothly onto inner rails. Difficult middle slide movement during this step typically indicates misalignment.

17. Middle-rails will eventually "click" into place as the service position locks engage. Ensure both sides engage at the same time, and both inner rails are fully engaged on their respective middle slide tracks.

18. Carefully and slowly lower the mechanical lift two to three inches so that the weight of the chassis now fully rests on the rail kit. Keep the lift elevation two to three inches below the chassis elevation until the enclosure is fully installed in the rack. This is a safety measure in case the rails are not seated properly, or another mechanical/integration failure occurs.

19. Locate the inner slide lock springs on both the left and right rail kits, and depress both to disengage the service protection lock. Continue depressing springs while inserting the chassis far enough to bypass the locks on both sides.

Rail slide assembly details

Inner view - example

Outer view - example

20. Continue inserting the chassis all the way into the rack, ensuring the chassis ears are coincident with the rack mounting flanges.

21. Secure the 4U chassis ears to the rack/rail kit with embedded thumbscrews (quantity-2, 1perside). For shipping and transport, secure the 10-32 panhead screws provided, and torque to 3.96 N-m (35 lbf-in) (quantity-4, 2 per side).
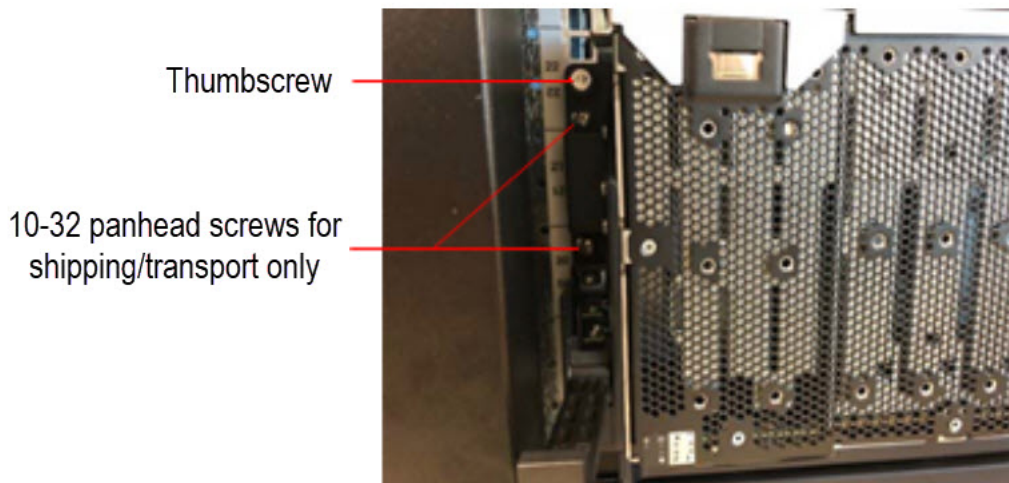
22. Using the quantity-2 panhead screws provided, attach the CMA chassis attachment bracket to the chassis above the CMA shelf, on its inner surface. Torque screws to 1.36 N-m (12 lbf-in). The images below show the progression of steps from left to right.

CMA attachment bracket   Panhead screws   Installed on 4U chassis

23. Clip the CMA "B" bracket onto the right rail subassembly CMA attachment bracket (from Step 7). Ensure that the blue spring clips onto the C-shaped CMA attachment bracket securely, and the arrow next to the "B" mark on the CMA arm is pointed upward. The "B" bracket should reside outside of the CMA ramp "lip" (see middle photo).

CMA "B" bracket   CMA ramp "lip"   CMA "A" bracket

24. Clip the CMA "A" bracket onto the chassis CMA attachment bracket (from Step 22). Ensure that the blue spring clips onto the C-shaped CMA attachment bracket securely. The "A" bracket should reside inside the CMA ramp "lip" as shown above

25. Install the crossbar.

Crossbar with blue thumbscrews stabilizes the two rails at the rear of the chassis

26. Install the shipping screws (optional step required only for preventing non-operating transportation shock/vibration)

The figure above identifies an installed shipping screw using a red arrow. A shipping screw installs above each of the crossbar thumbscrews as shown in the enclosure rear panel view included above this step.

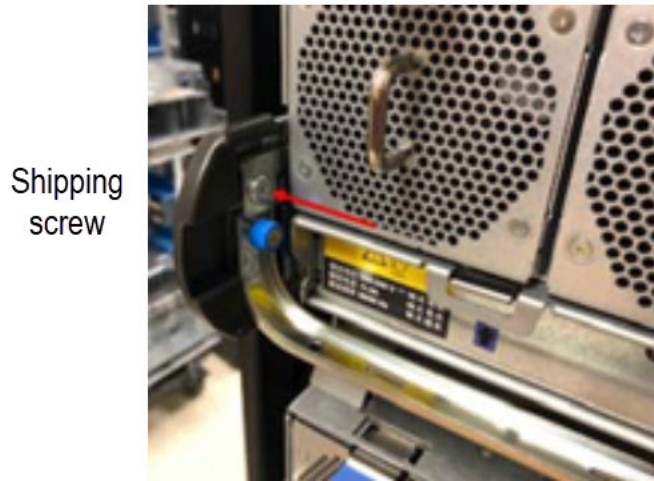**Note:** After the enclosure is secured in the rack, install the disks.

Routing cables using the CMA

About this task

Routing of power and data cables for the JBOD is integral to successful rail kit installation and rackmount installation of the enclosure. Cables must be correctly installed and routed to facilitate efficient operation and in-rack servicing of the enclosure.

This procedure describes the routing of cables through the CMA, including using the CMA baskets and the CMA storage shelf located at the rear of the enclosure.

Procedure

1. Install the data cables and route them through the CMA brackets.
    a) Rotate the CMA cable capture arms so they are out of the way of the data cable routing.
    b) Route data cables 1–5 onto the CMA shelf and through the CMA brackets in the order and configuration shown below.
    c) Secure the routed cables with one hand, while installing additional cables until data cables 1–5 are installed.
    d) Rotate the outer cable capture arm close over data cables 1–5, ensuring it seats in the C-flange in between the two cable capture arms.

    Note: This model of the Disk Enclosure does not contain an IOM in slot 1. Thus, disregard the red cables in the figures below.

Rear view
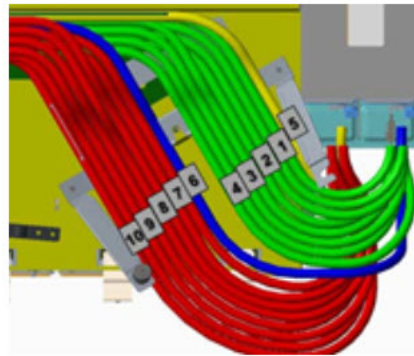
Top view
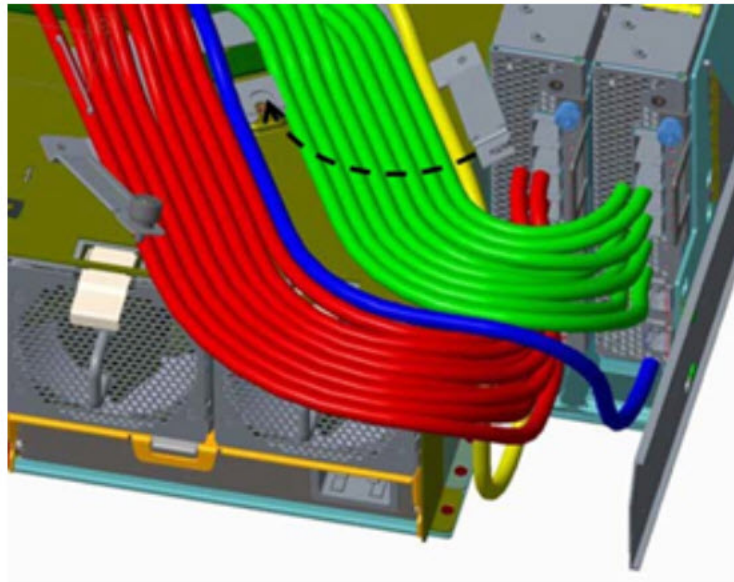
Trimetric projection relative to enclosure rear panel

2. Rotate the inner CMA cable capture arm into the C-bracket to secure the rest of the data cables. The outer CMA cable capture arm may need to be pushed down in the C-bracket to allow the inner cable capture arm to seat properly. The CMA bracket may need to be shifted slightly in order for the thumbscrew to find the PEM thread in the CMA shelf. Secure the thumbscrew.

Note: This model of the Disk Enclosure does not contain an IOM in slot 1. Thus, disregard the red cables in the figure below.
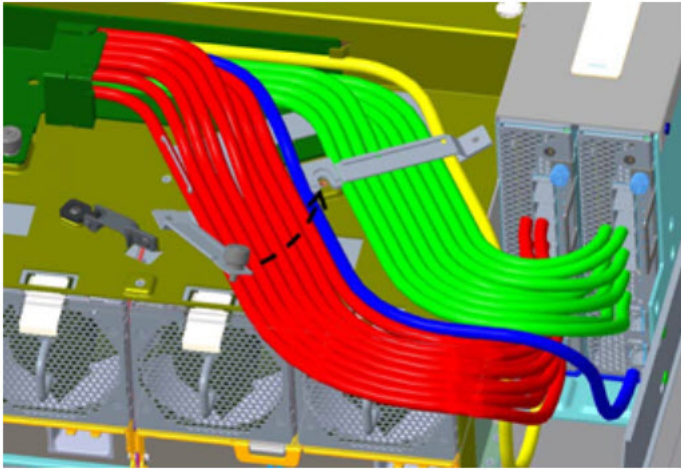
Securing cables with the CMA bracket

3. Install the PSU cables.

   Refer to the details provided beneath the sub-steps, noting that the top view details represent the CMA shelf.

   a) Remove the M3 panhead screw from the PSU cable clip assembly, and set it aside for re-installation.

   b) Install the right-angle C19 connectors into the PSUs.

   c) Route the cables as shown, ensuring they lay flat on the CMA shelf and through the PSU cable-clip assembly.

   d) Reinstall the M3 panhead screw from Step 3a, while torquing the screw to 0.56 N-m (5 lbf-in).

   Note: This model of the Disk Enclosure does not contain an IOM in slot 1. Thus, disregard the red cables in the figure below.
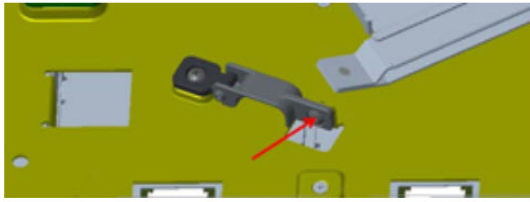
PSU cable clip M3 panhead screw
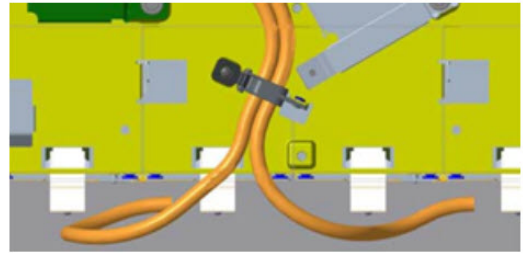
CMA shelf detail - top view
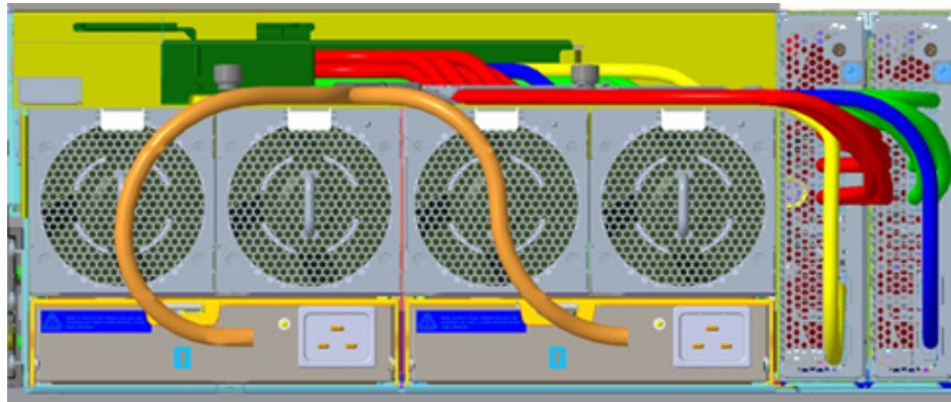
JBOD enclosure rear panel

4. Route cables through CMA baskets.

   a) Route cables through the first two baskets, ensuring minimal cable crossover to maximize space

   b) Use all available space on the CMA shelf to make the first 180º bend into the first CMA basket.

   c) Keep pairs of dual SAS cables parallel and close together.

   d) After all cables (including PSU cables) are routed through the first two CMA baskets, route them around a 180º bend into the remaining four CMA baskets.

Power cord connection

Overview

Connect a power cord from each PSU on the enclosure rear panel to the PDU (power distribution unit) as shown in the figure below.

Expansion Enclosure

Power Distribution Units (AC UPS shown)
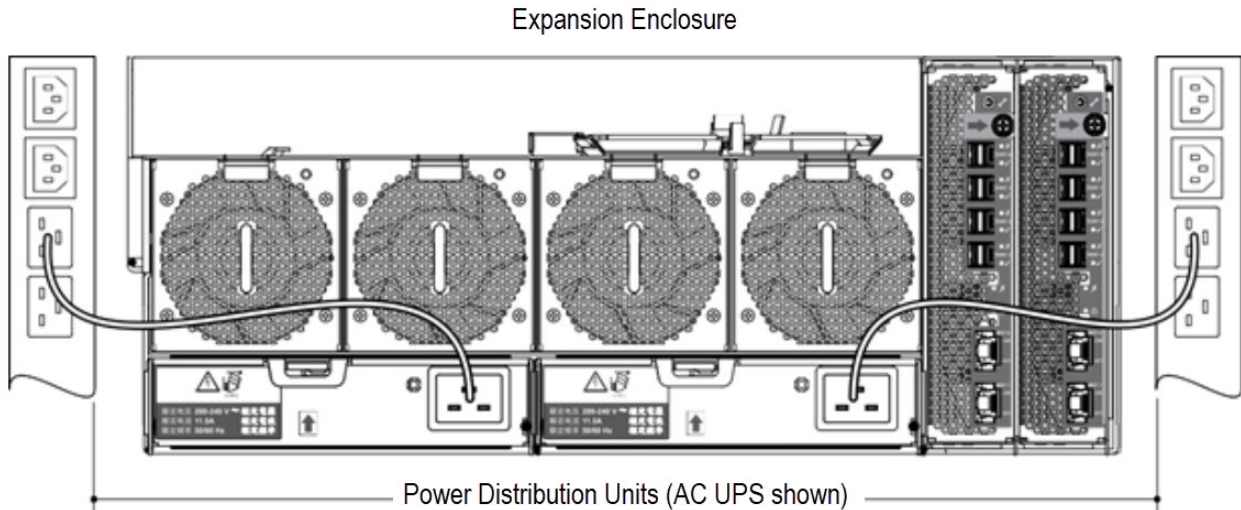
Figure 24. Typical AC power cord connection from PDU to PSU

Important: The Disk Enclosure is fitted with two redundant PSUs. All power cords must be connected to at least two separate and independent power supplies to ensure redundancy.

- The figure above shows the power connection from a single-core PSU to a PDU using C19 connectors.
- The C20 plug on the PSU connects to the C19 receptacle of the power cord. The C20 plug on the power cord connects to the C19 receptacle in the PDU.

> ⚠️ **CAUTION:** Power connection concerns:
> - Never connect the power cord to the PSU before installing the PSU in the system.
> - Always remove the power connections *before* you remove the PSU from the enclosure.
> - Whether standard (single-lead) or bifurcated (Y-lead), power cords must only be connected to a supply range of 200–240V AC as indicated on each PSU's hazardous voltage warning label.

Testing enclosure connections

See the section "Powering on/powering off" on page 45. Once the power-on sequence succeeds, the storage system is ready to be connected.

Grounding checks

The product must only be connected to a power source that has a safety electrical earth connection.

> ⚠️ **CAUTION:** If more than one enclosure goes in a rack, the importance of the earth connection to the rack increases because the rack will have a larger Earth Leakage Current (Touch Current).

Examine the earth connection to the rack before power on. An electrical engineer who is qualified to the appropriate local and national standards must do the examination.

SAS cable connections

The following figure and steps describe how to connect the SAS cables from a single IBM COS Medium or Large Disk Enclosure connected to a single IBM COS Controller Node, and when to power the unit on.
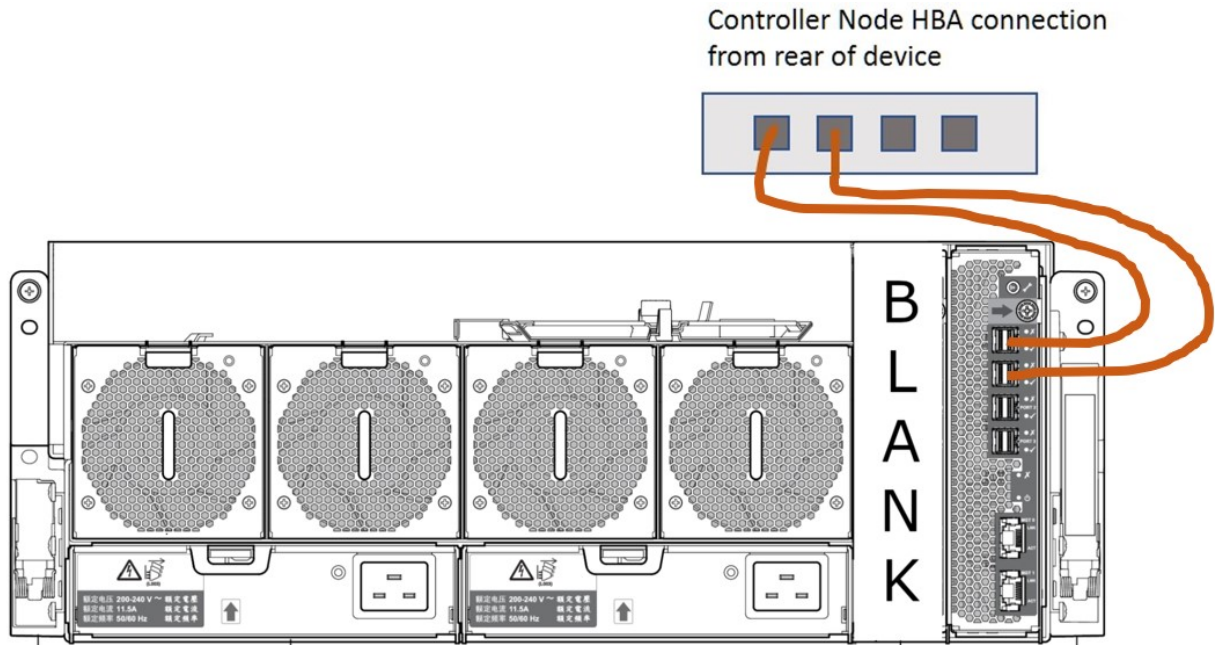
Figure 25. SAS cable connections

1. **Important:** The COS Controller Node and the COS Medium or Large Disk Enclosure must be powered off before attaching the first of the two supplied Mini-SAS HD cables.

   Make the first cable connection between the far-left port on the HBA as shown in the figure, and the top port on the I/O Module installed in the small disk enclosure. The second cable is connected between the second port from the left on the HBA and the second-to-top port on the I/O Module.

2. Power on the COS medium or large disk enclosure.

3. Wait 3 minutes.

4. Proceed to power on the Controller Node.

Chapter 5. Operation

Powering on/powering off

About this task

Before powering on the enclosure system, make sure that all modules are firmly seated in their correct slots. Verify that you have successfully completed the sequential instructions in the "Installation checklist" on page 25 table. Once you have completed these steps, you can access the management interfaces to complete the system setup.

⚠️ **CAUTION:** Do not operate the enclosure system until the ambient temperature is within the specified operating range described in the "Environmental requirements" on page 71 section. If the drive modules have been recently installed, make sure they have had time to adjust to the environmental conditions before they are used with production data for I/O.

Procedure

1. Power up the system by connecting the power cables from the PSU to the PDU. The System Power LED on the front panel should be lit green when the enclosure power is activated.

   See the "Power cord connection" on page 42 section.

2. Power the system down by disconnecting the power cord from the power supply module.

3. When powering up, make sure to power up the enclosures and associated data host in the following order:

   • Expansion enclosures first.

     This ensures that the disks in the drive enclosure have enough time to completely spin up before being scanned by the controller modules within the controller enclosure.

     While enclosures power up, their LEDs blink. After the LEDs stop blinking—if no LEDs on the front, back and top of the enclosure are amber—the power-on sequence is complete, and no faults have been detected.

     – See "Front panel LEDs" on page 14.
     – See "Rear panel LEDs" on page 16 and figures/tables for rear panel CRUs.
     – See "Top panel LEDs" on page 21 and figures/tables for top panel CRUs.

   • Controller enclosure next, if an RBOD is used. Not applicable to server attached Disk Enclosure configuration.

     Depending upon the number and type of disks in the system, it may take several minutes for the system to become ready.

   • Data host last (if powered down for maintenance purposes).

   Tip: When powering off, you will reverse the order of steps used for powering on.

   Important: If main power is lost for any reason, upon restoration of power, the system will restart automatically.

   Note: See "Front panel LEDs" on page 14 for details about front panel LEDs and related fault conditions.

Unit Identification Number

Software/SES

The enclosure UID number can be read and set through the management interfaces and SES.

Chapter 6. Troubleshooting and problem solving

These procedures are intended to be used only during initial configuration, for the purpose of verifying that hardware setup is successful. They are not intended to be used as troubleshooting procedures for configured systems using production data and I/O.

Overview

The enclosure system includes a Storage Enclosure Processor (SEP) and associated monitoring and control logic to enable it to diagnose problems with the enclosure's power, cooling, and drive systems. Management interfaces allow for provisioning, monitoring, and managing the storage system.

Important:

See the "Fault isolation methodology" on page 52 section when conducting system diagnostics.

Initial start-up problems

Faulty power cords

Check that you have correctly cabled the system. Contact IBM support for replacements if:

- Power cables are missing or damaged.
- Plugs are incorrect.
- Power cables are too short.

Controller Node does not recognize the enclosure system

1. Verify that the interface cables from the enclosure to the host computer are fitted correctly.
2. Verify that the LEDs on all installed drive carrier modules are on (green).
3. Verify that the drive carrier modules have been correctly installed.
4. Check any visible SAS indicators (Controller Node HBA Module, Disk Enclosure, and IOM Control Module, if applicable).
5. Check HBA BIOS for SAS target visibility.
6. Verify that ClevOS has been installed correctly.

Note: If the enclosure fails initialization, see the "If the enclosure does not initialize" on page 52 section.

LEDs

Overview

LED colors are used consistently throughout the enclosure and its components for indicating status:

Green
Good or positive indication

Blinking green/amber
Non-critical condition

Amber
Critical fault

PSU LEDs

Under normal conditions, the bi-tonal PSU Status OK LED will be a constant green. See also Figure 15 on page 17. When a fault occurs, the color of the LEDs will display as shown in the following table.

Table 16. PSU LED status		
PSU status (green)	**PSU status (amber)**	**Status**
Off	Off	No AC power on this PSU only
On	Off	AC present; PSU working correctly
Off	On	PSU fault (over temperature, over voltage, over current)
Off	Blinking	PSU firmware download is in progress

Front panel LEDs

The front panel displays the aggregated status of all the modules. The enclosure status LEDs located on the front panel are labeled in Figure 14 on page 15 and they are individually described in the narrative subsections that follow the table.

Disk drive carrier module LED

Disk drive status is monitored by an amber LED mounted on the front of each drive carrier module, as shown in the figure below. The drive module LED conditions are defined in the table following the figure below.

In normal operation the amber LED will be:

- Off if there is no drive present.
- Off as the drive operates.
- On if there is a drive fault.
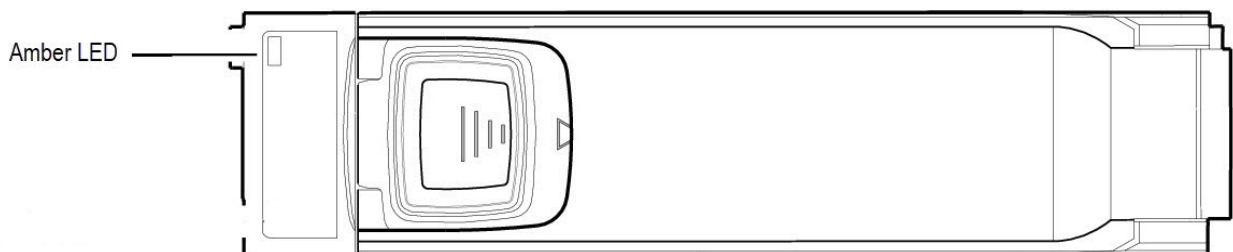
Figure 26. Drive carrier module LED

Table 17. Drive carrier module LED	
State (Amber)	**Status**
Off	Enclosure is not powered on.
Off	Disk drive module is installed and operational
Blinking: 1s on/1s off	SES device identity set
On	SES device fault bit set
On	Power control circuit failure

IOM LEDs

Expansion IOM status is monitored by the LEDs located on the face plate. See also Figure 18 on page 20. LED behaviors for expansion enclosures are described in the table below.

Table 18. Expansion module LED states			
CRU OK (green)	**CRU Fault (amber)**	**SAS port activity (green)**	**Status**
On	Off		Expansion module OK
Off	On		Expansion module fault – see the "Replacing an IOM" on page 66 section.
		Off	No external port connection
		On	HD mini-SAS port connection – no activity
		Blinking	HD mini-SAS port connection – activity
Blinking			IOM VPD error

Actions:

- If the Power OK LED is blinking, wait for the system to boot.
- If the Power OK LED is off, and the IOM is powered on, the module has failed.
  - Check that the IOM is fully inserted and latched in place, and that the enclosure is powered on.
  - Check for logs pertaining to the failure
- If the Fault LED is on, a fault condition is detected
  - Re-seat the IOM in its slot.
  - Check for logs pertaining to the failure
- If the above actions do not resolve the fault, contact IBM support for assistance.

Temperature sensors

Temperature sensors throughout the enclosure and its components monitor the thermal health of the storage system. Exceeding the limits of critical values will cause a notification to occur.

Enclosure system

Overview

The following sections describe common problems that can occur with your enclosure system, and some possible solutions. For the problems listed in the table below, the pertinent fault LEDs on the enclosure front panel will light amber to indicate a fault. See also "Front panel LEDs" on page 14.

Table 19. Alarm conditions		
Status	**Severity**	**Alarm**
PSU alert - loss of DC power from a single PSU	Fault - loss of redundancy	S1[1]

Table 19. Alarm conditions (continued)		
Status	**Severity**	**Alarm**
PSU fan fail	Fault - loss of redundancy	S1[1]
CFF module detected PSU fault	Fault	S1[1]
PSU removed	Configuration error	None[2]
Enclosure configuration error (VPD)	Fault - critical	S1[1]
Low warning temperature alert	Warning	S1[1]
High warning temperature alert	Warning	S1[1]
Over temperature alarm	Fault - critical	S4[3]
I^2C bus failure	Fault - loss of redundancy	S1[1]
Front panel communication error (I^2C)	Critical fault	S1[1]
IOM module fault	Fault - critical	S1[1, 4]
IOM module removed	Warning	None[2]
Drive power control fault	Fault - critical - loss of disk power	S1[1]
Insufficient power available	Warning	None[2]

[1] The enclosure will continue operating, requiring an administrator to take appropriate action; such as replacing a PSU or reducing the room temperature. Alarm messages will be in the COS System manager interface.

[2] An alarm is not issued for this status and severity condition.

[3] The enclosure will take action; such as shutting down in order to protect the enclosure's data content. Alarm messages are signaled by the SES pages (see "Enclosure management" on page 23).

[4] An IOM fault will prevent data from being stored within the Disk Enclosure.

PSU and system fan faults

Overview

Table 20. PSU and system fan faults		
Symptom	**Cause**	**Recommended action**
Front panel Module Fault LED is amber[1]	Any power fault	Verify AC mains connections to the PSU are live
Amber LED is illuminated on fan module[2]	Fan failure	Replace system fan module

[1] See Figure 14 on page 15 for visual reference of front panel LEDs.

[2] See Figure 15 on page 17 for visual reference of PSU LEDs. See Figure 16 on page 18 visual reference of system fan module LEDs.

Thermal monitoring and control

The storage enclosure system uses extensive thermal monitoring and takes a number of actions to ensure component temperatures are kept low, and to also minimize acoustic noise. Air flow is from the front to back of the enclosure.

Table 21. Thermal monitoring and control

Symptom	Cause	Recommended action
If the ambient air is below 25ºC (77ºF), and the fans are observed to increase in speed, then some restriction on airflow may be causing additional internal temperature rise. **Note:** This is not a fault condition.	The first stage in the thermal control process is for the fans to automatically increase in speed when a thermal threshold is reached. This may be caused by higher ambient temperatures in the local environment, and may be perfectly normal. **Note:** This threshold changes according to the number of disks.	1. Check the installation for any airflow restrictions at either the front or back of the enclosure. A minimum gap of 25 mm (1") at the front and 50 mm (2") at the rear is recommended. 2. Check for restrictions due to dust build-up. Clean as appropriate. 3. Check for excessive re-circulation of heated air from rear to front. Use of the enclosure in a fully enclosed rack is not recommended. 4. Verify that all blank modules are in place. 5. Reduce the ambient temperature.

Thermal alarm

Table 22. Thermal alarm

Symptom	Cause	Recommended action
1. Front panel Module Fault LED is amber. 2. Fan Fail LED is illuminated on one or more PSUs.	Internal temperature exceeds a preset threshold for the enclosure.	1. Verify that the local ambient environment temperature is within the acceptable range. See also the *Environmental requirements* section. 2. Check the installation for any airflow restrictions at either the front or back of the enclosure. A minimum gap of 25 mm (1") at the front and 50 mm (2") at the rear is recommended. 3. Check for restrictions due to dust build-up. Clean as appropriate. 4. Check for excessive re-circulation of heated air from rear to front. Use of the enclosure in a fully enclosed rack is not recommended. 5. If possible, shut down the enclosure and investigate the problem before continuing

Fault isolation methodology

The basic methodology used to locate faults within a storage system, and to identify the pertinent CRUs affected.

Overview

Basic steps:

- Gather fault information, including using system LEDs.
- Determine where in the system the fault is occurring.
- Review logs from the ClevOS Manager event console.
- If required, isolate the fault to a data path component or configuration as described in "Isolate the fault" on page 52.

Gather fault information

When a fault occurs, it is important to gather as much information as possible. Doing so will help you determine the correct action needed to remedy the fault.

Begin by reviewing the reported fault:

- Is the fault related to an internal data path or an external data path?
- Is the fault related to a hardware component such as a disk drive module, controller module, or power supply unit?

By isolating the fault to *one* of the components within the storage system, you will be able to determine the necessary corrective action more quickly.

Determine where the fault is occurring

When a fault occurs, the Module Fault LED - located in the lower left corner of the enclosure front panel - illuminates. See also "Front panel LEDs" on page 14. Check the status of the other front panel LEDs. Also check the LEDs on the back and top panels (must remove a lid) of the enclosure to narrow the fault to a CRU, connection, or both.

- See "Rear panel LEDs" on page 16.
- See "Top panel LEDs" on page 21.

The LEDs help you identify the location of a CRU reporting a fault.

Isolate the fault

Occasionally, it might become necessary to isolate a fault. This is particularly true with data paths, due to the number of components comprising the data path. For example, if a host-side data error occurs, it could be caused by any of the components in the data path: Controller node HBA, Cable, IOM, or Disk Enclosure.

If the enclosure does not initialize

It may take up to two minutes for all enclosures to initialize. If an enclosure does not initialize:

- Power cycle the system.
- Make sure the power cord is properly connected, and check the power source to which it is connected.
- Check the ClevOS Manager event console for errors.

Host I/O

When troubleshooting disk drive and connectivity faults, stop I/O to the affected disk groups from all hosts as a data protection precaution. See also the "Stopping I/O" on page 67 section.

Dealing with hardware faults

Ensure that you have obtained a replacement module of the same type before removing any faulty module as described in the Chapter 7, "Module removal and installation," on page 55 section.

Important: If the enclosure system is powered up and you remove any module, replace it immediately. If the system is used with any modules missing for more than a few seconds, the enclosure(s) can overheat, causing power failure and potential data loss. Such action can invalidate the product warranty.

Important: Observe applicable/conventional ESD precautions when handling modules and components, as described in the "ESD precautions" on page 55 section. Avoid contact with mid-plane components, module connectors, leads, pins, and exposed circuitry.

Continuous operation during replacement

ClevOS supports hot swapping of data disk drives. Enclosure access and use during this period is uninterrupted. If an enclosure is equipped with redundant PSUs, sufficient power is provided to the system while the faulty module is replaced.

Note: Accesser® ApplicationsIBM COS Medium / Large Disk Enclosure support hot-plug replacement of redundant expansion modules, power supplies, fan modules, and HS expanders. Hot-add replacement of expansion enclosures is also supported.

Firmware

After installing the hardware and powering on the storage system components for the first time, verify that the controller modules, expansion modules, and disk drives are using the current firmware release. Contact IBM support for additional information.

CRUs for IBM COS Medium / Large Disk Enclosure

A listing of Customer Replaceable Units for the Medium and Large Disk Enclosures.

Table 23. IBM COS Medium/Large Disk Enclosure product components for 4U 106-drive chassis

Item	Enclosure CRU and related component description	Access
1	Disk drive module: 3.5" DDIC (Disk in drive carrier)	Top
2	Chassis (sheet metal enclosure) with integrated PCBAs (included with chassis; not available separately)	Note 2
3	Power supply unit (PSU) module available as AC unit (chassis uses two PSUs of same model type)	Rear
4	Expansion module (IOM) for storage expansion Disk Enclosure Medium IOM and Disk Enclosure Large IOM are not interchangeable.	Rear
5	System fan module	Rear
6	Controller fan module	Top
7	HS Expander module (PCBA card)	Top

Table 23. IBM COS Medium/Large Disk Enclosure product components for 4U 106-drive chassis (continued)

Item	Enclosure CRU and related component description	Access
8	Rail kit (variable attachment options) 1. Rack mount kit, shelf, long (1.2 m), HW 2. Cable Management Arm (CMA) and brackets	Note 3
9	Cable kits [Cable package: standard HD mini-SAS (SFF-8644) to HD mini-SAS (SFF-8644)]	N/A
10	AC power cord compatible with AC PSU	N/a

1 - The **Access** column lists the enclosure panel from which the CRU is observed and accessed. It does not apply to other components.

2 - See "Enclosure chassis" on page 5 for a description of the chassis CRU.

3 - See "Rackmount rail kit" on page 30 and "Routing cables using the CMA" on page 38 for descriptions of the rail kit and CMA.

Tip: Enclosure panel access diagrams for locating CRUs:

- Front panel: see Figure 3 on page 8 and Table 7 on page 15.
- Rear panel: see Table 3 on page 9.
- Top panel: see Figure 9 on page 11, Figure 10 on page 11, and Figure 11 on page 12.

Tip: Enclosure dimetric pictorial views:

- Projection from enclosure front panel: see Figure 1 on page 6.
- Projection from enclosure rear panel: see Figure 2 on page 6.

Chapter 7. Module removal and installation

Overview

This chapter provides procedures for replacing CRUs (customer-replaceable units), including precautions, removal instructions, installation instructions, and verification of successful installation. Each procedure addresses a specific task.

Note: Unless otherwise noted within a passage pertaining to a particular CRU, the replacement procedure should be completed within 3 minutes of the removal of a defective module. Do not remove a faulty module unless you have the replacement module available and ready for insertion into the slot.

ESD precautions

Precautions and preventive measures when handling or installing electrostatic-sensitive parts.

Overview

Before you begin any of the procedures, consider the following precautions and preventive measures.

Preventing electrostatic discharge

To prevent electrostatic discharge (ESD) from damaging the system, be aware of the precautions to consider when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.

CAUTION: Parts can be damaged by electrostatic discharge. Follow these precautions:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-protected workstations.
- Place parts in a static-protected area before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when touching a static-sensitive component or assembly.
- Remove clutter (plastic, vinyl, foam) from the static-protected workstation.

Grounding methods to prevent electrostatic discharge

Several methods are used for grounding. Adhere to the following precautions when handling or installing electrostatic-sensitive parts.

CAUTION: Parts can be damaged by electrostatic discharge. Use proper anti-static protection:

- Keep the replacement CRU in the ESD bag until needed; and when removing a CRU from the enclosure, immediately place it in the ESD bag and anti-static packaging.
- Wear an ESD wrist strap connected by a ground cord to a grounded workstation or unpainted surface of the computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm (± 10 percent) resistance in the ground cords. To provide proper ground, wear the strap snug against the skin.
- If an ESD wrist strap is unavailable, touch an unpainted surface of the chassis before handling the component.
- Use heel straps, toe straps, or boot straps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats.

- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

Replacing a PSU module

Procedures for the removal and installation of power supply unit modules.

This section provides procedures for replacing a failed power supply unit (PSU) module. Illustrations in PSU replacement procedures show rear panel views of the enclosure, with the PSU properly oriented for insertion into the rear panel of the enclosure.

A single PSU is sufficient to maintain operation of the enclosure. You need not halt operations and completely power-off the enclosure when replacing only one PSU; however, a complete orderly shutdown is required if replacing both units simultaneously.

⚠️ **CAUTION:** Do not remove the cover from the PSU due to danger from electric shock inside. Return the PSU to your supplier for repair.

See CAUTION bullets regarding electrostatic discharge and anti-static protection in the "ESD precautions" on page 55 section.

Tip: The illustrations show PSU module replacement as you face the enclosure rear panel. See also Figure 4 on page 8 and Figure 7 on page 10.

Removing a PSU module

About this task

⚠️ **CAUTION:** Removing a power supply unit significantly disrupts the enclosure's airflow. Do not remove the PSU until you have received the replacement module. It is important that all CRU slots are filled when the enclosure is in operation.

Before removing the PSU, disconnect the power from the PSU by physically removing the power source in order to ensure your system has warning of imminent power shutdown. A faulty PSU must be replaced by a fully operational PSU as soon as possible. Ensure that you correctly identify the faulty PSU before beginning the step procedure.

Procedure

1. Stop all I/O from hosts to the enclosure. See also the Stopping I/O section.

   Tip: This step is not required for hot-swapping. However, it is required when replacing both PSUs at once.

2. Disconnect the power cable from the PSU power connector to power off the faulty PSU (it has no power switch).

   Note:

   Power cables are typically routed to the PSU from the cable management arm (CMA). Verify that the 180º power cable bends lie flat in the CMA baskets. Ensure that the cable lays flat on the CMA shelf and through the cable clip assembly. See also Figure 4 on page 8 and Step "3" on page 40 of "Routing cables using the CMA" on page 38.

3. If replacing a single PSU via hot-swap, proceed to Step "5" on page 56.

4. If replacing both PSUs, verify that the enclosure was shut down using management interfaces, and that the enclosure is powered off.

5. Verify that the power cord is disconnected.

6. Grasp the PSU handle latch between the thumb and forefinger and press the latch tab down to unlock the handle. Revolve the handle out and downward to lever the PSU out of the enclosure as shown in the figure below.
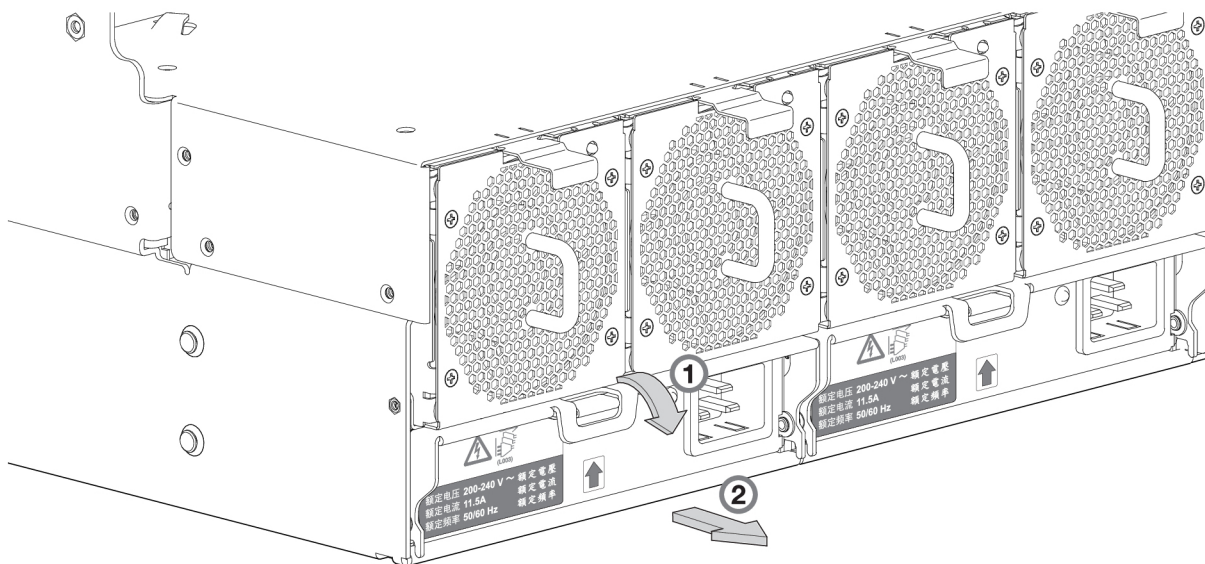
Figure 27. Removing a PSU (1 of 2)

7. Grip the handle and withdraw the PSU, taking care to support the base of the module with both hands as you remove it from the enclosure as shown in the figure below.
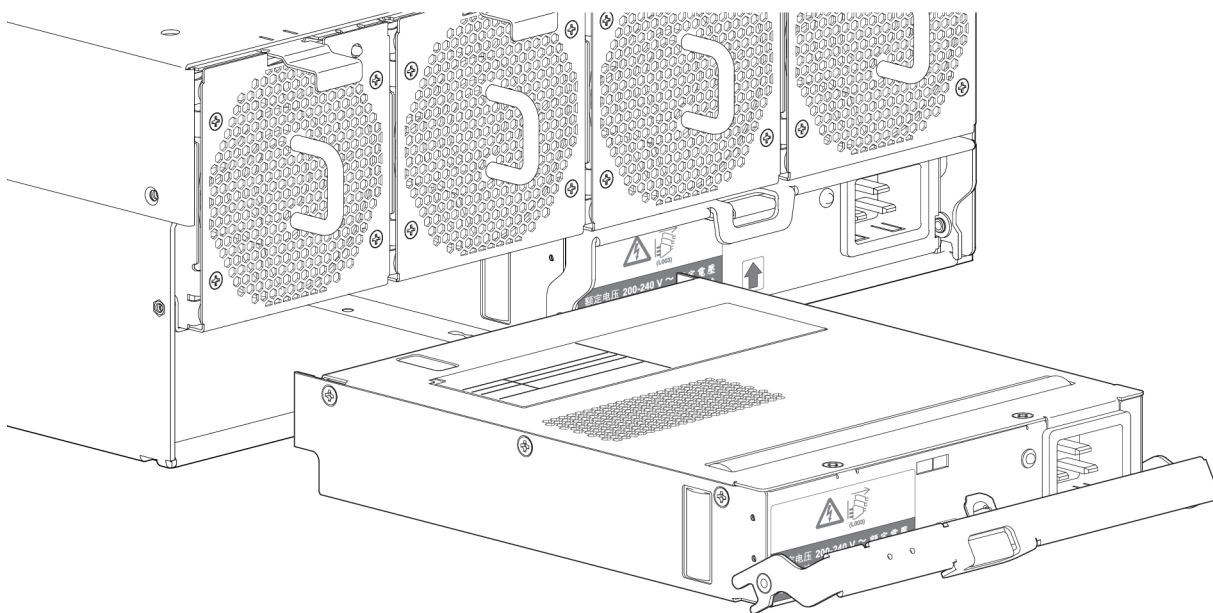

Figure 28. Removing a PSU (2 of 2)

Note: The remove PSU illustrations show a module with a single power connection. The procedure applies equally to single cord and dual cord PSU modules used in 4U enclosures.

8. If replacing two PSUs, repeat Step 5 through Step 8, being mindful of the Enclosure rear panel illustrations TIP.

Installing a PSU module

About this task

Refer to Figure 27 on page 57 and Figure 28 on page 57 when performing this procedure, but ignore the directional arrows - since you will insert the module into the slot - rather than remove it.

Important: Handle the PSU carefully, and avoid damaging the connector pins. Do not install the PSU if any pins appear to be bent.

Procedure

1. Check for damage, especially to all module connectors.
2. With the PSU handle in the open position, slide the module into the enclosure, taking care to support the base and weight of the module with both hands.
3. Lever the module home by manually closing the PSU handle. You should hear a click as the latch handle engages and secures the PSU to its connector on the back of the power mid-plane.
4. Connect the power cable to the power source and the PSU.

   Power cables are typically routed to the PSU from the cable management arm (CMA). Verify that the 180º power cable bends lie flat in the CMA baskets. Route the cables as shown in "3" on page 40 of "Routing cables using the CMA" on page 38, ensuring they lay flat on the CMA shelf and through the PSU cable clips assembly. See also "Enclosure rear panel" on page 8.
5. Verify that the bi-tonal PSU Status LED is on/green. Verify that cooling fans are spinning with no fail states. Verify that the front panel LED states show no amber module faults.
6. Repeat this procedure if replacing two PSUs. Keep in mind the Enclosure rear panel illustrations TIP

Replacing a system fan module

Procedures for the removal and installation of system fan modules.

This section provides procedures for replacing a failed system fan module. Within this CRU module, if one of the two internal rotors fails, then a fault occurs, indicating module failure. Illustrations in system fan replacement procedures show rear panel views of the enclosure, with the fan properly oriented for insertion into the rear panel of the enclosure.

If a system fan module fails, the remaining three fans are sufficient to maintain operation of the enclosure. You need not halt operations and completely power-off the enclosure when replacing only one system fan; however, a complete orderly shutdown is required if replacing multiple system fan modules simultaneously.

⚠️ **CAUTION:** Do not remove the cover from the system fan module due to danger from electric shock inside. Return the module to your supplier for repair.

See CAUTION bullets regarding electrostatic discharge and anti-static protection in the "ESD precautions" on page 55 section.

Tip: The illustrations show PSU module replacement as you face the enclosure rear panel. See also Figure 4 on page 8 and Figure 7 on page 10.

Removing a system fan module

About this task

⚠️ **CAUTION:** Removing a system fan module significantly disrupts the enclosure's airflow. Do not remove the fan until you have received the replacement module. It is important that all fan module slots are filled when the enclosure is in operation.

Procedure

1. Press down on the latch tab to release the fan from its locked position. See detail No. 1 in the figure below.
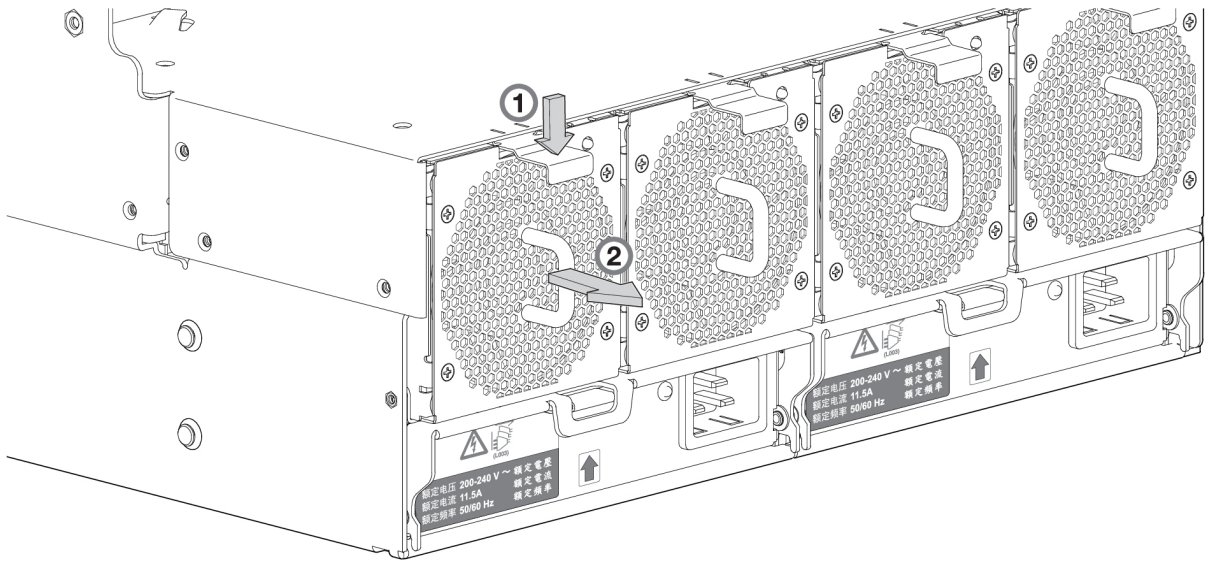

Figure 29. Removing a system fan (1 of 2)

2. Grasp the fan module handle and carefully pull the fan out of its slot. See also the detail in the figure below.

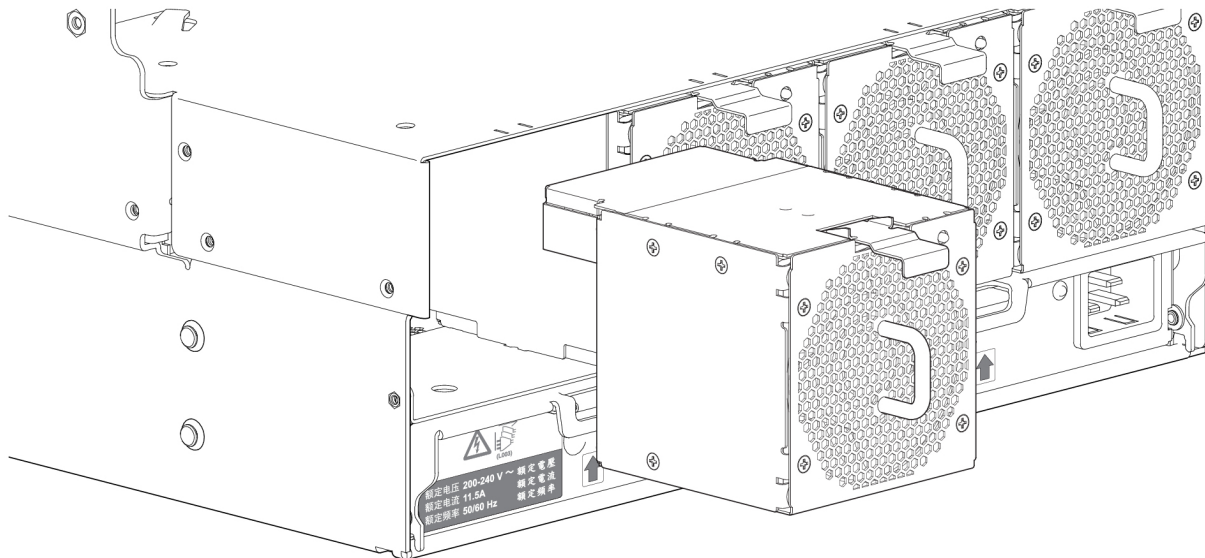*Figure 30. Removing a system fan (2 of 2)*

Installing a system fan module

About this task

Refer to Figure 29 on page 59 and Figure 30 on page 59 when performing this procedure, but ignore the directional arrow—since you will insert the module into the slot—rather than remove it.

Important: Handle the system fan carefully, and avoid damaging connectors.

Procedure

1. Check for damage, especially to all module connectors.

2. Align the system fan module for insertion into its slot, as shown in

3. Insert the system fan, and slide the module into the enclosure, taking care to support the base and weight of the module with both hands.

   Gently, but firmly, push the fan module into its fully seated position with its mating connector in the enclosure.

4. Verify that the System Fan Status LED is off. Verify that the cooling fans are spinning with no fail states. Verify that the front panel LED states show no amber module faults.

5. Repeat this procedure if replacing multiple fans. The replacement procedure should be completed within an absolute maximum of 2 minutes for this CRU module.

Replacing a controller fan module

Procedures for the removal and installation of controller fan modules.

This section provides procedures for replacing a failed controller fan module. Illustrations in controller fan replacement procedures show top panel views of the enclosure, with the fan properly oriented for insertion into the top panel of the enclosure, near the IOMs. Remove the top lid "**B**"to access the controller module fan. See . Reattach top lid "**B**"when you complete the procedure

If a system fan module fails, the remaining fan is sufficient to maintain operation of the enclosure. You need not halt operations and completely power-off the enclosure when replacing only one controller module fan.

⚠️ **CAUTION:** Do not remove the cover from the controller fan module due to danger from electric shock inside. Return the module to your supplier for repair.

See CAUTION bullets regarding electrostatic discharge and anti-static protection in the section.

Tip: The illustrations show controller fan module replacement as you face the enclosure front and view the top panel. See also and .

Removing a controller fan module

About this task

⚠️ **CAUTION:** Removing a controller fan module disrupts the enclosure's airflow. Do not remove the fan until you have received the replacement module. It is important that all CRU module slots are filled when the enclosure is in operation.
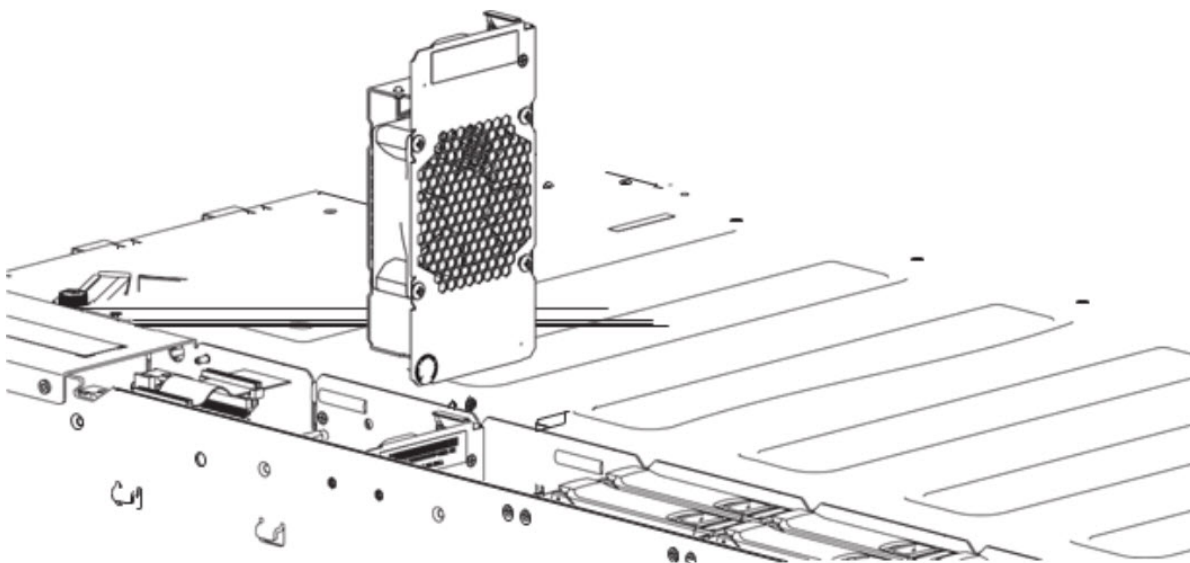
Procedure

1. Grasp the latch tab on the interior channel wall of the enclosure, and squeeze the tab against the wall to release the channel fan from its locked position as shown in the figure below.
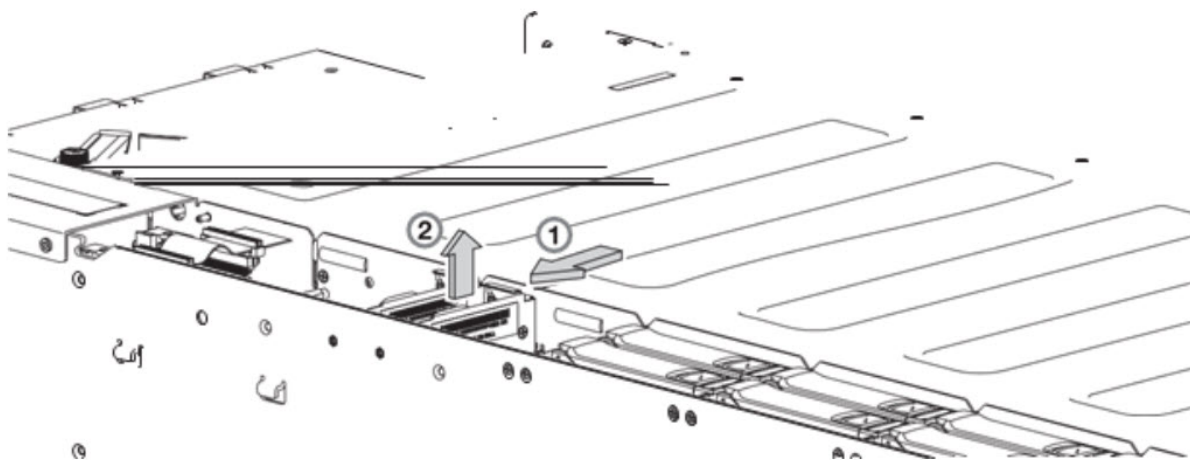
Figure 31. Removing a controller fan (1 of 2)

2. With your other hand, grasp the handle located on the top of the fan, and pull upwards to remove the fan from its slot as shown in the figure below.

Figure 32. Removing a controller fan (2 of 2)

Installing a controller fan module

About this task
Refer to Figure 31 on page 61 and Figure 32 on page 61 when performing this procedure, but ignore the directional arrow—since you will insert the module into the slot—rather than remove it.

Important: Handle the controller fan carefully, and avoid damaging connectors.

Procedure

1. Check for damage, especially to all module connectors.
2. Align the controller fan module for use in the fan slot that is accessible from the top panel.
3. Insert the controller fan module into the slot, and gently press down on the module until it seats firmly in its connector.
4. Verify that the Controller Fan Status LED is off. Verify that the front panel LED states show no amber module faults.

5. If replacing multiple fans, repeat this procedure.

Replacing an HS Expander module

Procedures for the removal and installation of HS expander modules.

This section provides procedures for replacing a failed HS Expander module. Illustrations in HS Expander replacement procedures show top panel views of the enclosure, with the module properly oriented for insertion into the top panel of the enclosure near the right wall.

If a HS Expander module fails, the remaining modules are sufficient to maintain operation of the enclosure. You need not halt operations and completely power-off the enclosure when replacing only one HS Expander module.

See CAUTION bullets regarding electrostatic discharge and anti-static protection in the "ESD precautions" on page 55 section.

Tip: The illustrations show controller fan module replacement as you face the enclosure front and view the top panel. See also Figure 11 on page 12 and Figure 9 on page 11

Removing an HS Expander module

About this task

⚠️ **CAUTION:** Removing this hot-swappable PCBA disrupts the enclosure's airflow. Do not remove the PCBA until you have received the replacement. It is important that all CRU module slots are filled when the enclosure is in operation.

Procedure

1. Remove the top lid "**A**" to access the HS Expander module. See Figure 9 on page 11
2. On the faulty HS Expander, grasp each of the two plastic swing-arms between thumb and index finger as shown in the figure below.
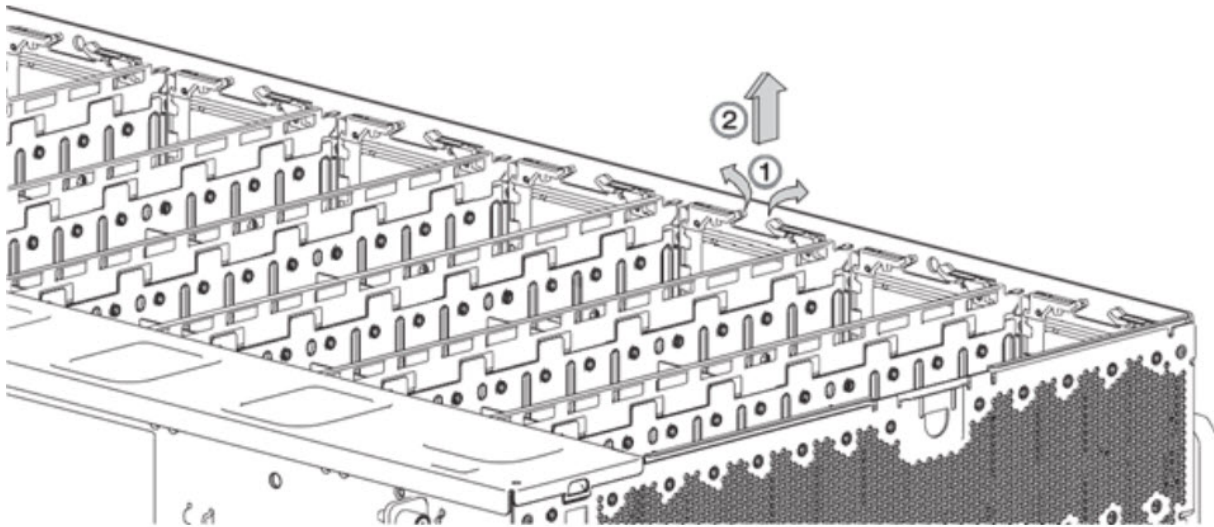
Figure 33. Removing an HS Expander (1 of 2)

3. Revolve each swing-arm upward to release the PCBA carrier from its slot as shown in the figure below.

Figure 34. Removing an HS Expander (2 of 2)

4. While grasping the swing-arm handle, pull upwards to lift the HS Expander and remove it from its slot.
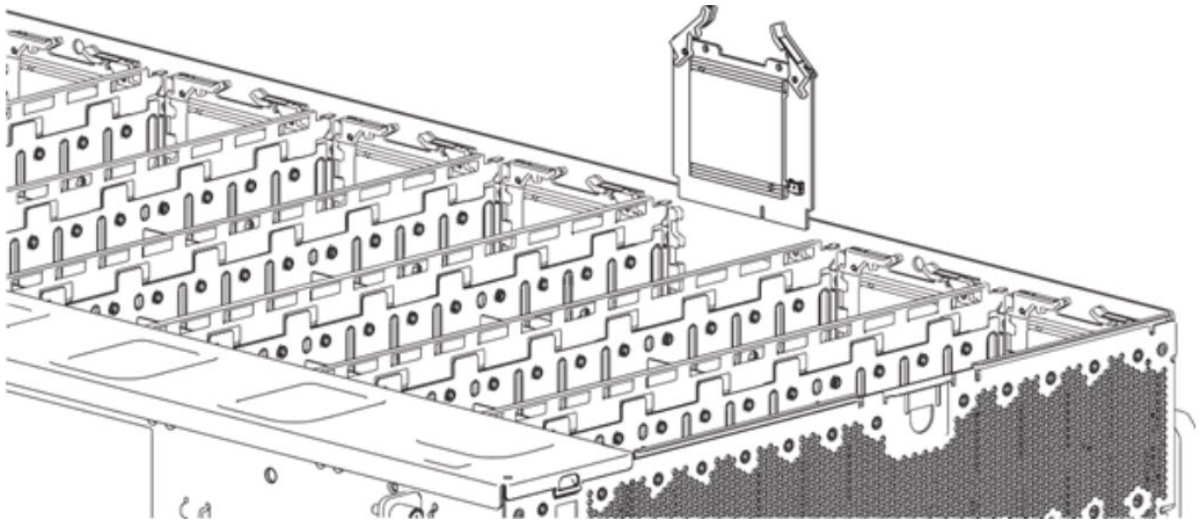
Installing an HS Expander module

About this task

Refer to Figure 33 on page 62 and Figure 34 on page 63 when performing this procedure, but ignore the directional arrow - since you will insert the module into the slot - rather than remove it.

Important: Handle the HS Expander module carefully to avoid damage to the connector and swing arms.

Procedure

1. Check for damage, especially to all module connectors.
2. Align the controller HS Expander module for use in the module slot that is accessible from the top panel along the right wall of the enclosure.
3. Insert the controller module into the slot, and gently press down on the module until it seats firmly in its connector.
4. Verify that the HS Expander Status LED is off. Verify that the front panel LED states show no amber module faults.
5. If replacing multiple HS Expanders, repeat Step 1 through Step 4
6. Reattach top lid "**A**" when you complete the procedure.

Replacing a drive carrier module

Procedures for the removal and installation of a drive carrier module.

A disk drive module consists of a disk in a carrier or sled. Disk Drive in Carrier (DDIC) modules are hot-swappable, which means they can be replaced without halting I/O to the disk groups, or powering off the enclosure. The new disk must be of the same type, and possess capacity equal to or greater than the one being replaced. Otherwise, the storage system cannot use the new disk to reconstruct the disk group. Remove the top lid "**A**" to access DDICs. See Figure 9 on page 11 for enclosure lid locations and labeling. Reattach top lid "**A**" when the procedure is completed. If accessing DDICs in disk slots 96–105, remove top lid "**B**", and reattach it when the procedure is completed. See also Figure 11 on page 12 for disk slot indexing.

⚠️ **CAUTION:** Removing a disk drive module impacts the airflow and cooling ability of the enclosure. If the internal temperature exceeds acceptable limits, the enclosure may overheat and automatically shut down or restart. To avoid potential overheating, wait 20 seconds to allow the internal disks to stop spinning, then insert the new disk drive module.

See CAUTION bullets regarding electrostatic discharge and anti-static protection in the "ESD precautions" on page 55 section.

Tip: The illustrations show disk module replacement within the drive slots as you view the enclosure top panel. See also Figure 11 on page 12 for disk drive slot numbering.

Removing a drive carrier module

Procedure

1. Press the latch in the carrier handle towards the handle hinge to release the carrier handle as shown in the figure below.
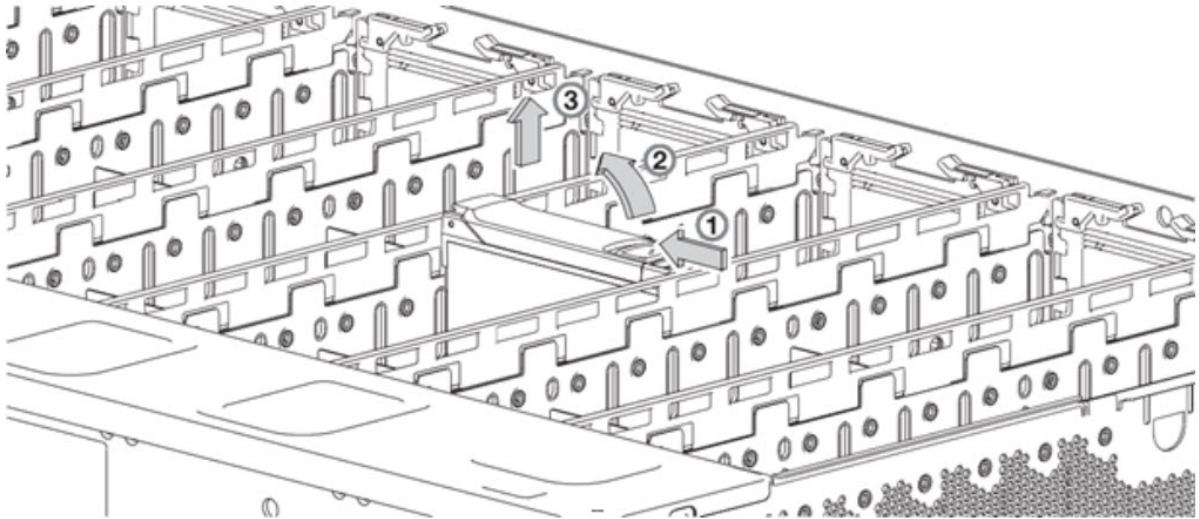
Figure 35. Removing a disk drive module (1 of 2)

2. Revolve the handle outward to lever the module out of its connector on the base-plane.

Figure 36. Removing a disk drive module (2 of 2)

3. Lift and remove the module fully from the drive slot.

Installing a drive carrier module

Procedure

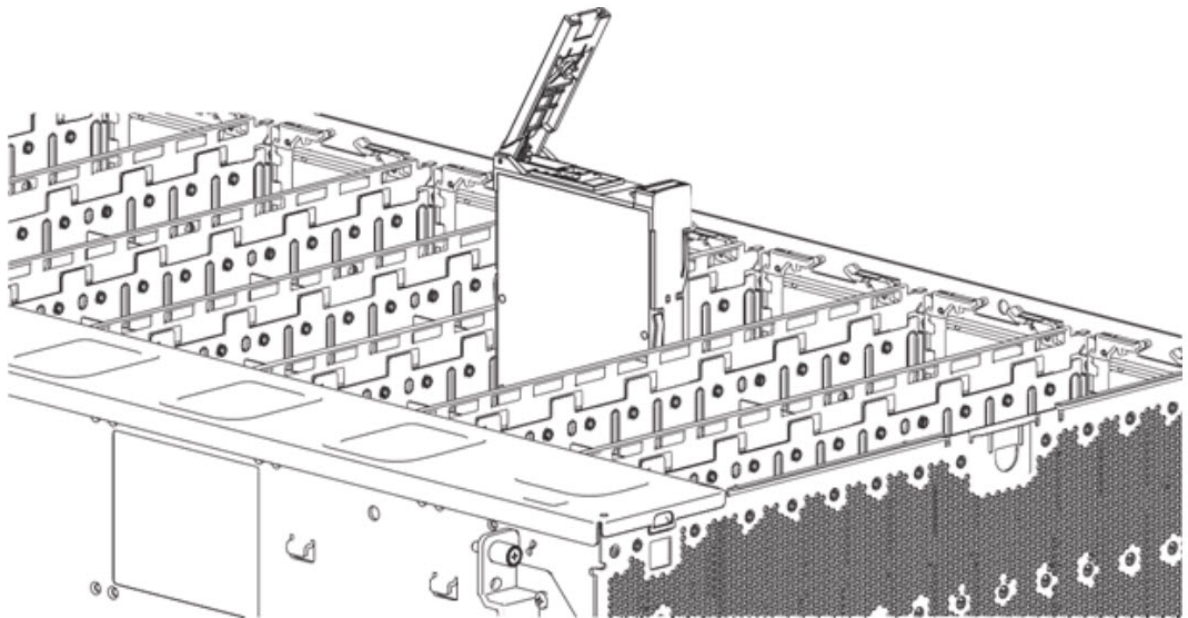1. Release the drive carrier handle by pressing the latch in the carrier handle towards the handle hinge to release the carrier handle as shown in the figure below.
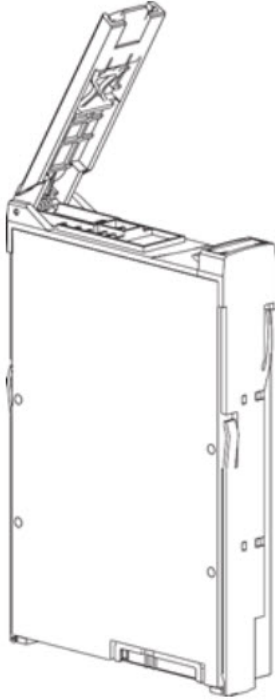
Figure 37. Drive carrier module in open position

2. Insert the drive carrier module into the enclosure. Make sure that the drive carrier is positioned such that the front face of the disk is facing up, and the handle opens from the left as you face the enclosure top panel. The module should be revolved such that its horizontal axis is parallel to the chassis longitudinal axis, as shown in the figure below.
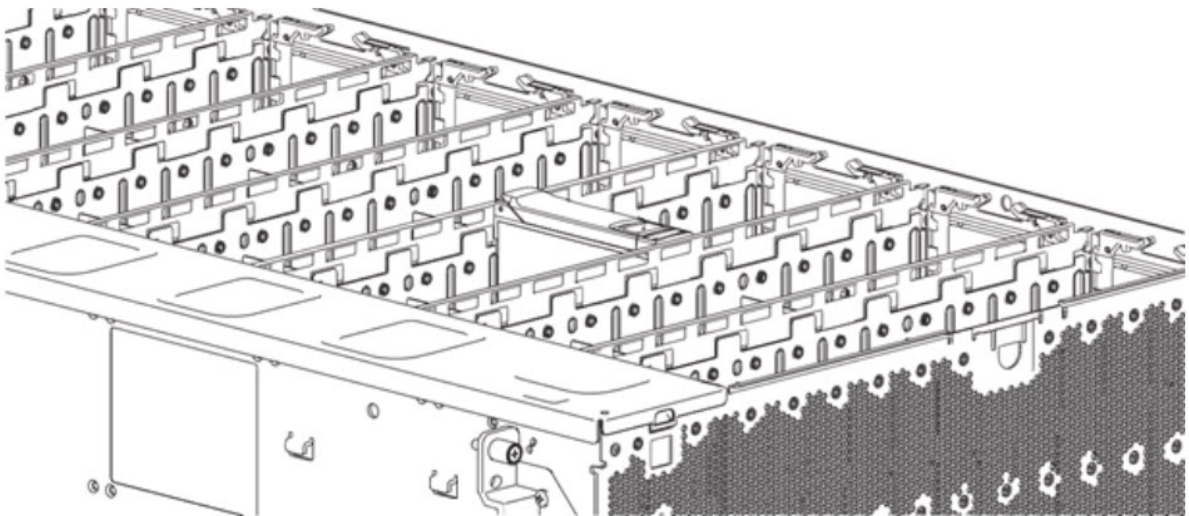
Figure 38. Installing a drive carrier module (1 of 2)

3. Slide the drive carrier fully into the disk slot within the enclosure.

4. Continue to push firmly until the handle fully engages. The camming foot on the carrier will engage into a slot in the enclosure. You should hear a click as the latch handle engages and holds the handle closed.

Figure 39. Installing a drive carrier module (2 of 2)

5. Verify that the amber Fault LED on the disk module handle is off. Verify that the front panel LED states show no amber module faults. The enclosure front panel Drive Activity blue LED will blink to show disk activity.
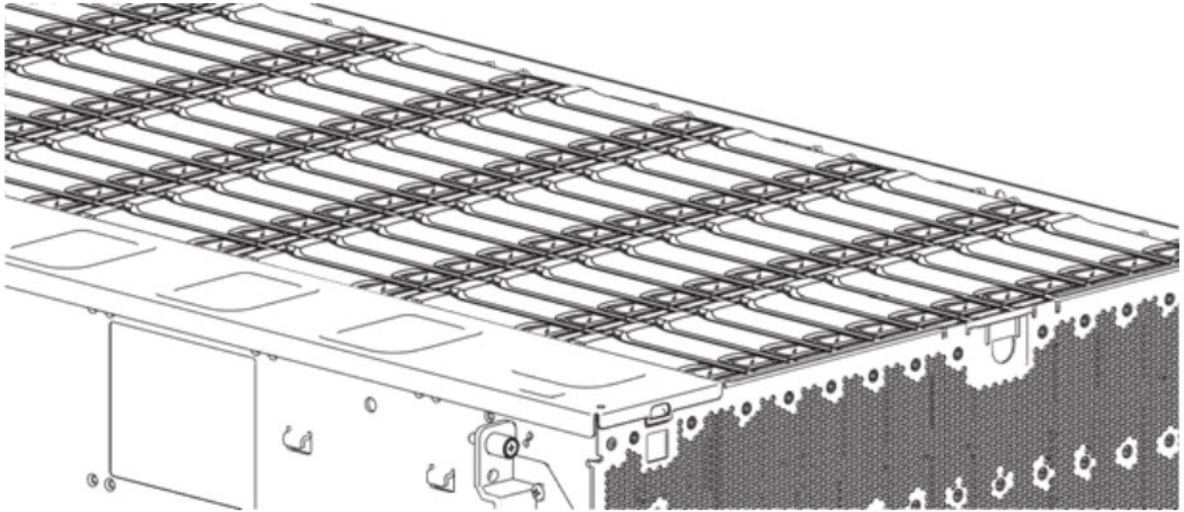
Replacing an IOM

Procedures for the removal and installation of an I/O Module.

Overview

Important: The IOM must be installed in IOM slot No.0. As you face the enclosure rear panel, this is the IOM slot located on the right. An IOM blank must be installed in the adjacent slot (Slot 1) as shown in the rear panel module slot index diagram. This configuration is required to ensure sufficient air flow through the enclosure during operation.

The I/O module (IOM) denotes a controller module.

You may need to replace an expansion module when:

- The Fault LED is illuminated.
- Logs or events in the firmware indicate a problem with the module.
- Troubleshooting indicates a problem with the module.

Before you begin

Removing an IOM or IOM blank module from an operational enclosure significantly changes air flow within the enclosure. Openings must be populated for the enclosure to cool properly. Leave modules in the enclosure until ready to install a replacement. If replacing both IOMs in a dual-canister enclosure, record configuration settings before installing the new controller modules. See "Removing the IOM" on page 67, and "Installing the IOM" on page 68 for instructions about installing an additional controller module.

Verifying component failure

- Check Module Fault LED – rear (front of enclosure): Amber = Fault condition.
- Check Fault LED (back of enclosure on IOM face plate): Amber = Fault condition.

- Check that the OK LED (back of enclosure) is off.

Stopping I/O

When troubleshooting disk drive and connectivity faults, stop I/O to the affected disk groups from all hosts as a data protection precaution. As an additional data protection precaution, it is helpful to conduct regularly scheduled backups of your data.

Important: Stopping I/O to a disk group is a host-side task, and falls outside the scope of this document.

When on-site, you can verify that there is no I/O activity by briefly monitoring the system LEDs; however, when accessing the storage system remotely, this is not possible.

Removing the IOM

About this task

Important: Consideration for removing the IOM:

- Do not remove a faulty module unless its replacement is on-hand. All CRU modules must be in place when the system is in operation.

See CAUTION bullets regarding electrostatic discharge and anti-static protection in the "ESD precautions" on page 55 section.

Illustrations in the IOM replacement procedures show rear panel views of the enclosure, and IOM is properly aligned for insertion into the rear panel of the enclosure.

Procedure

1. Locate the enclosure whose ID LED (enclosure front panel – left side) is illuminated, and within the enclosure, locate the IOM in slot 0.
2. Disconnect any cables connected to the IOM.

   Label each cable to facilitate re-connection to the replacement IOM.
3. Unlock the IOM latch handle by turning the thumbscrew counter-clockwise as shown in detail No.1 in the figure below.

   Take care not to remove the thumbscrew from the IOM latch handle.
4. Grasp the IOM latch handle between the thumb and index finger and pull. Revolve the handle out and downward to lever the IOM out of the enclosure as shown in details No. 2 and No. 3 in the figure below.
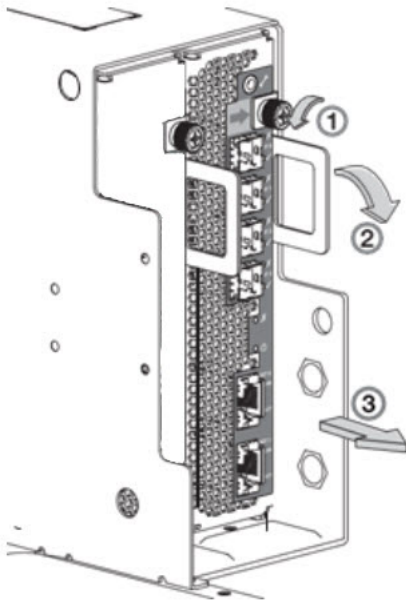
Figure 40. Removing the IOM (1 of 2)

5. Grip the latch handle and ease the IOM forward from the slot as shown within the figure below

6. Place both hands on the IOM body, and pull it straight out of the enclosure such that the IOM remains level during removal.
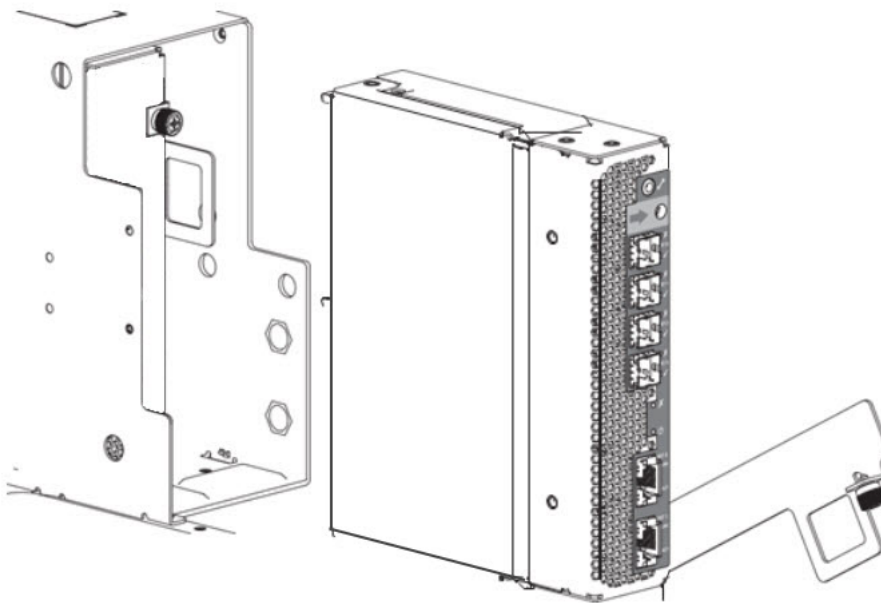
Figure 41. Removing the IOM (2 of 2)

Installing the IOM

About this task

See CAUTION bullets regarding electrostatic discharge and anti-static protection in the "ESD precautions" on page 55 section.

⚠️ **CAUTION:** If passive copper cables are connected, the cable must not have a connection to a common ground/earth point.

Note: When performing the following procedure, refer to and while ignoring the directional arrow. For installation, the IOM will travel in the opposite direction relative to the arrow shown.

Procedure

1. Examine the IOM for damage, and closely inspect the interface connector. Do not install if the pins are bent.
2. Grasp the IOM using both hands, and with the latch in the open position, orient the module and align it for insertion into IOM slot 0.
3. Ensuring the IOM is oriented as shown in the illustrations, slide it into the enclosure as far as it will go.

   An IOM that is only partially seated will prevent optimal performance of the enclosure. Verify that the module is fully seated before continuing.
4. Set the module in position by manually closing the latch

   You should hear a click as the latch handle engages and secures the IOM to its connector on the back of the mid-plane. Tighten the thumbscrew to secure the latch in place.
5. Reconnect the cables.

Verifying component operation

Module considerations during initialization.

Expansion module

If the storage system is configured with expansion enclosures, the replacement expansion module may take up to one minute to initialize after the cables are connected. Verify that there are no illuminated Fault LEDs on the enclosure front panel or the IOM faceplate.

Chapter 8. Technical specifications

Enclosure dimensions, weights, operating temperature and humidity, and power cooling.

Enclosure dimensions

Table 24. 4U enclosure dimensions		
Specification	**Metric units**	**Imperial units**
Height (including top cover)	176.4 mm	6.94 in
Width (excluding ears and rails)	441.0 mm	17.36 in
Depth (including handles, excluding cables)	1,139.0 mm	44.84 in

Enclosure weights

Table 25. Disk Enclosure weights		
CRU/component	**Metric units**	**Imperial units**
Storage enclosure (empty)	36.30 kg	80.00 lb
Disk drive module (3.5" LFF disks)	0.80 kg	1.80 lb
Power Supply Unit (PSU)	1.45 kg	3.20 lb
System fan module	0.70 kg	1.50 lb
IOM	0.80 kg	1.80 lb
IOM fan module	0.345 kg	0.80 lb
HS expander module	0.10 kg	0.20 lb
Disk Enclosure (fully populated with 106 drives: maximum weight)	145.60 kg	321.00 lb

1- Weights shown are nominal, and subject to variances. Disk drive module weights vary by type of disk used.

2 - Rail kit adds approximately 6.25 kg (14.9 lb) to the aggregate enclosure weight. The CMA adds 0.91 kg (2.0 lb) to aggregate enclosure weight.

3 - Weights may vary due to the number of disks and differing calibrations between scales.

Environmental requirements

Table 26. Ambient temperature and humidity		
Specification	**Temperature range**	**Relative humidity**
Operating	5º C to 35ºC (41º F to 95º F, de-rated by 1º C per 300m above 900m) (ASHRAE A2 2015 thermal guidelines)	-12º C DP/10 to 80% (Max) (Non-condensing)

Table 26. Ambient temperature and humidity (continued)		
Specification	**Temperature range**	**Relative humidity**
Non-operating	-40º C to +70º C (-40º F to +158º F) (Max rate of change: 20º C)	-12º C DP/5 to 100% (Max) (Non-condensing)

Specification	**Measurement/description**
Airflow	System must be operated with low pressure rear exhaust installation. Back pressure created by rack doors and obstacles not to exceed 5 Pa (0.5 mm H_2O)
Altitude, operating	-100 to 3,048 meters (0 to 10,000 feet). Maximum operating temperature is de-rated by 1º C for each 300 m above 900 m (2952.76 feet)
Altitude, non-operating	-100 to 12,192 m (-328 to 40,000 feet)
Shock, operating	3.0 g, 11 ms (per axis)
Shock, non-operating	20.0 g, 7 ms, 10 shock pulses (2 shocks per axis X, Y in positive and negative direction, and 2 shocks in positive Z axis) OR ISTA 3H (mounted in a rack, horizontal impact on all sides, 4-in drop tests)
Vibration, operating	0.18 G_{rms} 5Hz to 500 Hz, 30 min per axis
Vibration, non-operating	0.54 G_{rms} 6Hz to 200 Hz (ISTA 3E)
Vibration, relocation	ISTA3H air ride for 60 min
Acoustics	4U enclosures: Sound power operating £ 8.5 Bels LW_{Ad} @23ºC
Orientation and mounting: • Rack rails • Rack characteristics	1.2 m rack mount (4 EIA units) To fit 1.2 m depth racks compliant with the SSI server rack specification Back pressure not exceeding 5 Pa (~0.5 mm H_20)

Power supply unit specifications

Table 27. Power cooling module specifications	
Specification	**Measurement/description**
Dimensions	38.1 mm high x 169.9 mm wide x 211.1 mm long: • X-axis length: 169.9 mm (6.69 in) • Y-axis length: 38.1 mm (1.5 in) • Z-axis length: 211.1 mm (8.3 in)
Maximum output power	2000 W
Voltage range	200–240 VAC rated
Frequency	50–60 Hz
Voltage range selection	Auto-ranging: 90–264 VAC, 47–63 Hz

Table 27. Power cooling module specifications (continued)

| Specification	Measurement/description
Maximum inrush current	55A
Power conversion efficiency	³ 94% @ 230 VAC (50% load)
Harmonics	Meets EN61000-3-2 (EU), EN 31000-3-3 (EU), EN 55024 (EU), KN 24/KN 35 (S. Korea)
Output	+12V @ 164A, +12V Standby Voltage @3.5A
Hot pluggable	Yes
Switches and LEDs	AC power cable connect and one bi-tonal status indicator LED
Enclosure cooling	Four dual-impeller, counter rotating axial fans (enclosure rear-panel) Two single-impeller axial fans (controller bay)

Chapter 9. Enclosure packaging

Information about unpacking the enclosure.

Supported packaging configurations are included for reference. Identify your packaging configuration from the palletized enclosure ship kit assemblies shown below. Read the documentation provided in your ship kit *before* unpacking, disposing of, or storing packing materials. See also "Preparing for installation" on page 27
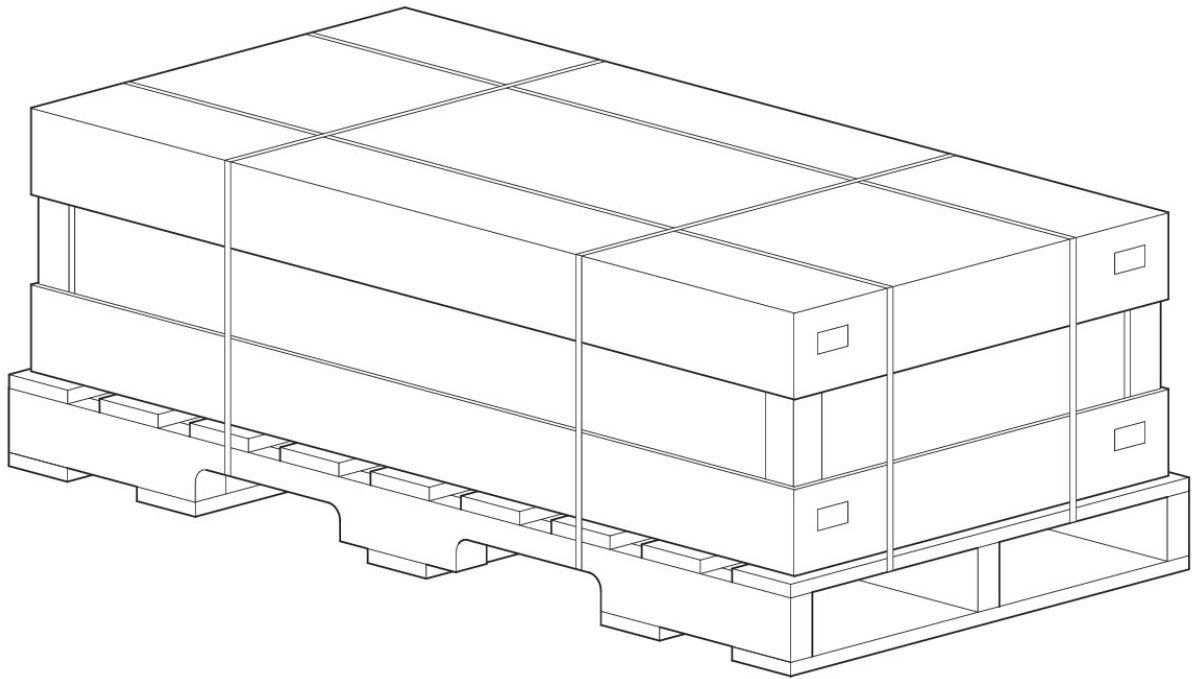
Figure 42. Unpacking the enclosure: 3-piece box with packing - assembly view

The figure below shows an illustrated parts catalog (IPC) representation of the enclosure master container to complement the assembly view shown above.

Important: Disk drives in carriers (DDICs) are packaged separately from the Disk Enclosure, and are available in different assortments (single, 12-pack, 24-pack). Do not populate disk slots with DDICs until after the enclosure has been installed in the rack using a suitable mechanical lift. See also Safe handling CAUTION and "Populating disk drive slots" on page 12.

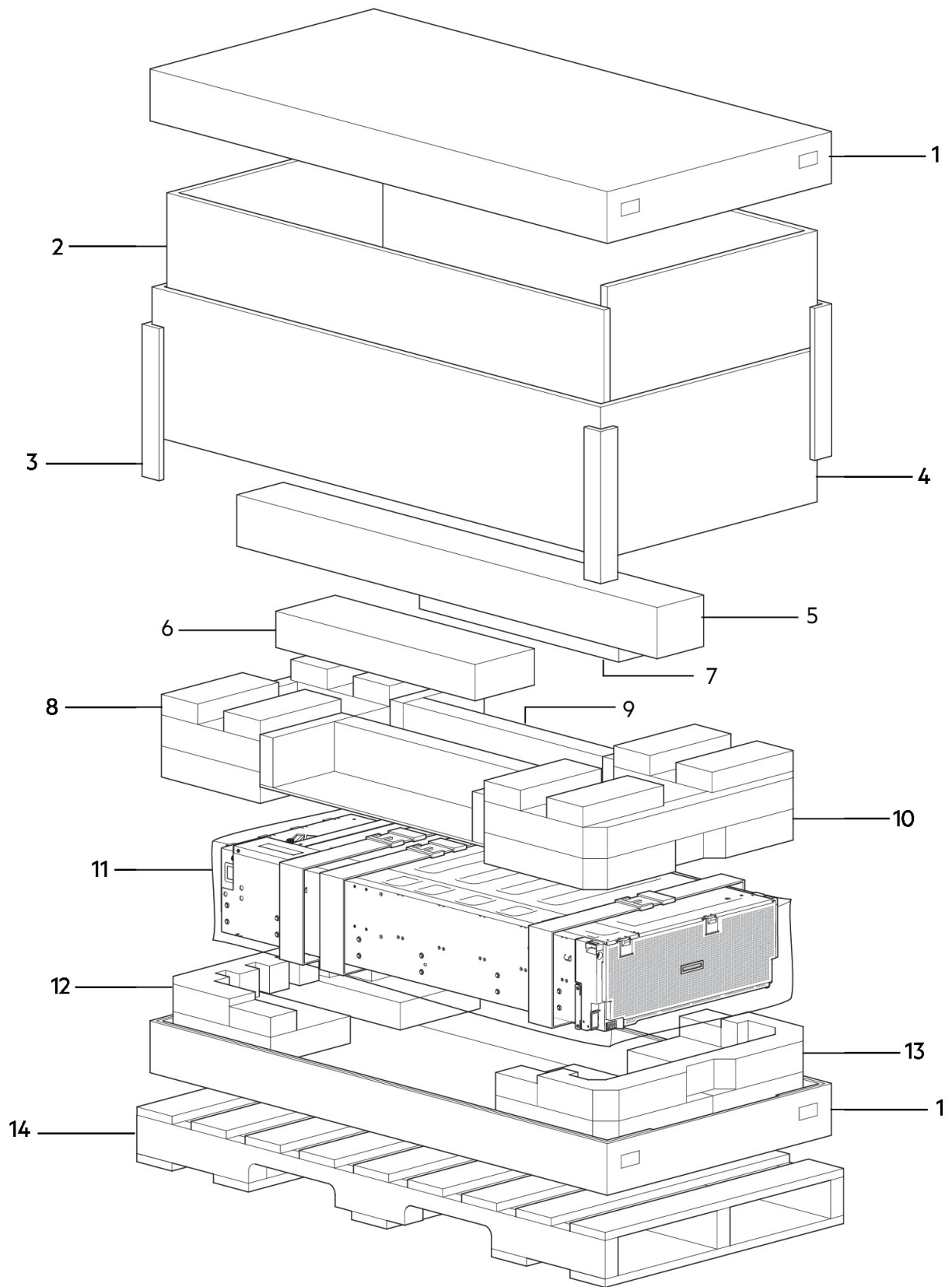*Figure 43. Unpacking the enclosure: 3-piece box with packing - master container*

No.	Component description	Qty.	No.	Component description	Qty.
	Table 28. Unpacking the enclosure: 3-piece box with packing				
1	Base/lid, cardboard	2	8	Foam, inner, drawer rear, top	1
2	Insert, strength L, cardboard	2	9	Insert, CMA holder, cardboard	2
3	Edge protector, height, each corner	4	10	Foam, inner, drawer front, top	1
4	Insert, wall, cardboard	1	11	Plastic bag (with enclosure/belt straps)	1
5	Rail kit box	1	12	Foam, inner, drawer rear, bottom	1
6	Box, accessory kit	1	13	Foam, inner, drawer front, bottom	1
7	CMA box	1	14	Custom pallet, wood	1

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