Lenovo

Lenovo Storage D1212/D1224/D3284 Hardware Installation and Maintenance Guide

Machine Types: 4587 and 6413

Eighth Edition (December 2022)

Contents

About this Guide

This guide provides information about initial hardware setup, removal, and installation of customer-replaceable units (CRUs) for the Lenovo Storage D1212/D1224/D3284 enclosures.

Intended audience

This guide is intended for system administrators and storage administrators.

Qualified Personnel

The personnel referred to within this document are defined as follows:

- Service Person: A person having appropriate technical training and experience necessary to be aware of hazards to which that person may be exposed in performing a task and of measures to minimize the risks to that person or other persons.
- User/Operator: Any person other than a service person.

Related Documentation

- Lenovo Storage D1212/D1224 Getting Started
- Lenovo Storage D3284 Getting Started

Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 Safety Information
(安全信息)。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας
(safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

ཐོན་རྫས་འདི་བདེ་སྒྲིད་མ་བྱས་གོང་། ·སྐོར་གྱི་ཡིད་གཟབ་
བྱ་འདྲ་མིན་ཡོད་པའི་འོད་སྣེར་བལྟ་དགོས།

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się
z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по
технике безопасности.

Pred inštaláciou tohto zariadenia si pečítaje Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

Bu ürünü kurmadan önce güvenlik bilgilerini okuyun.

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Youq mwngz yungh canjbinj neix gaxgonq, itdingh aeu doeg aen
canjbinj soengq cungj vahgangj ancien siusik.

Safety statements

These statements provide the caution and danger information that is used in this documentation.

Important: Each caution and danger statement in this documentation is labeled with a number. This number is used to cross reference an English-language caution or danger statement with translated versions of the caution or danger statement in the *Safety Information* document.

For example, if a caution statement is labeled `Statement 1`, translations for that caution statement are in the *Safety Information* document under `Statement 1`.

Be sure to read all caution and danger statements in this documentation before you perform the procedures. Read any additional safety information that comes with your system or optional device before you install the device.

Statement 1

DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached to this product.**
- **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.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To Connect:	**To Disconnect:**
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlet.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

Statement 2

CAUTION:
When replacing the lithium battery, use only Part Number 33F8354 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- **Throw or immerse into water**

- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

Statement 3

CAUTION:
When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

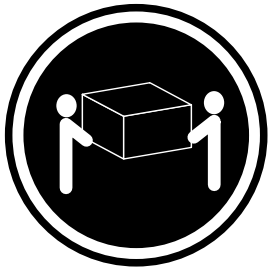
 **DANGER**

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following. Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

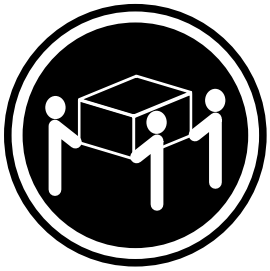
Class 1 Laser Product
Laser Klasse 1
Laser Klass 1
Luokan 1 Laserlaite
Appareil À Laser de Classe 1

Statement 4

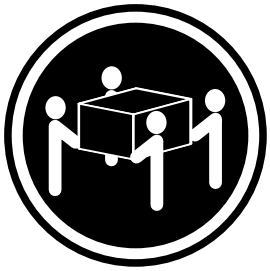
CAUTION: Use safe practices when lifting.



≥ 18 kg (39.7 lb)



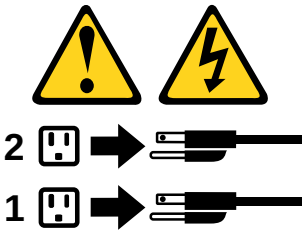
≥ 32 kg (70.5 lb)



≥ 55 kg (121.2 lb)

Statement 5

CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.

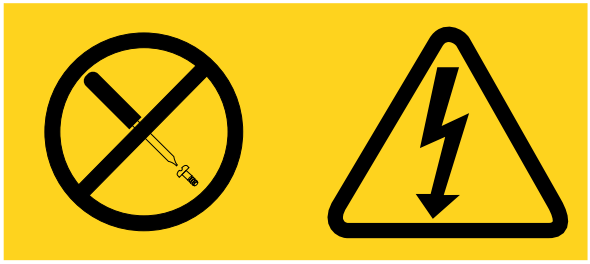


Statement 6

CAUTION:
If you install a strain-relief bracket option over the end of the power cord that is connected to the device, you must connect the other end of the power cord to an easily accessible power source.

Statement 8

CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.



Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Statement 12

CAUTION:
The following label indicates a hot surface nearby.

Statement 26

CAUTION:
Do not place any object on top of rack-mounted devices.

Statement 27

CAUTION:
Hazardous moving parts are nearby.

Rack Safety Information, Statement 2

DANGER

- **Always lower the leveling pads on the rack cabinet.**
- **Always install stabilizer brackets on the rack cabinet.**
- **Always install servers and optional devices starting from the bottom of the rack cabinet.**
- **Always install the heaviest devices in the bottom of the rack cabinet.**

Chapter 1. Safety Guidelines

This chapter contains following items:

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.

- **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.**
- **Always remove the Power Cooling Modules (PCMs) to minimize weight before you move the enclosure.**
- **Do not lift the enclosure by the handles on the PCMs – they are not designed to take the weight.**
- **For 5U enclosures, it is recommended that a minimum of three people lift the enclosure using the lifting straps supplied with the enclosure. Remove all DDIC modules from both drawers and make sure the drawers are closed firmly and locked shut.**

Fully configured 2U12 enclosures can weigh up to 28 kg (62 lb).

Fully configured 2U24 enclosures can weigh up to 25 kg (55 lb).

Do not try to lift the enclosure by yourself.

Operation

Important: Operation of the enclosure with ANY drive carrier modules missing disrupts the airflow and the drives could not receive sufficient cooling. It is ESSENTIAL that all apertures hold drives before the enclosure system is used. Empty drive bays must hold dummy drive carrier modules.

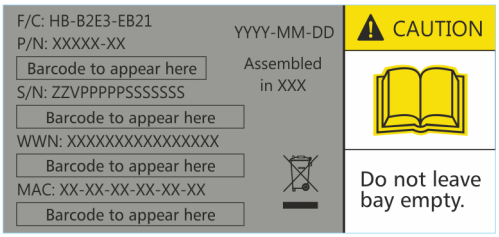


Figure 1. Module Bay Caution Label (1)

2U Enclosures Only

- Replace a defective PCM with a fully operational PCM within 24 hours. Refer to “Environment” on page 117. Do not remove a defective PCM unless you have a replacement model of the correct type ready for insertion.
- Before removal/replacement of a PCM disconnect supply power from the PCM to be replaced. Refer to “Replacing a Cooling Module” on page 89

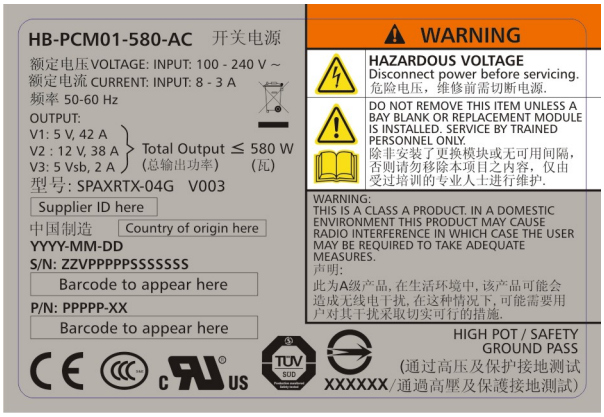


Figure 2. PCM Warning Label

5U Enclosures Only

CAUTION:
To prevent overturning, drawer interlocks stop users from opening both drawers at the same time. Do not attempt to force open a drawer when the other drawer in the enclosure is already open. In a rack containing more than one enclosure, do not open more than one drawer per rack at a time.

Important: All rear modules are part of the fire enclosure and must only be removed when a replacement can be immediately inserted.

Important: The enclosure could not receive sufficient airflow or cooling if it is operated with any of the rear modules missing. It is essential that every module bay is filled either with a module or a blank module.

Figure 3. Module Bay Caution Label (2)

Replace any defective module with a fully operational unit as soon as possible. Do not remove cooling modules, PSUs, or ESMs unless you have a replacement model of the correct type ready for insertion.

CAUTION:
To prevent overturning, drawer interlocks stop users from opening both drawers at the same time. Do not attempt to force open a drawer when the other drawer in the enclosure is already open. In a rack containing more than one enclosure, do not open more than one drawer per rack at a time.

CAUTION:

Operating temperatures inside the enclosure drawers can reach up to 60°C. Take care when opening drawers and removing drive carriers.

Figure 4. Hot Surface Warning Label

CAUTION:
Due to product acoustics, it is recommended that users wear ear protection for any prolonged exposure.

Figure 5. PSU Warning Label

Before removing a module, disconnect all power cords and cables.

Open drawers must not be used to support any other equipment.

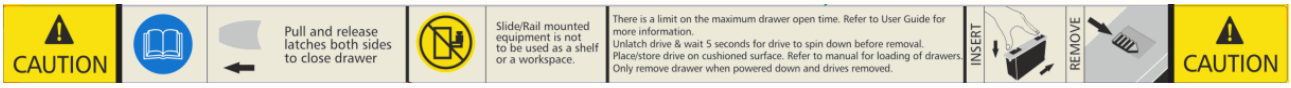


Figure 6. Drawer Caution Label

Electrical Safety

- The enclosure must only be operated from a power supply input voltage range of 200 VAC to 240 VAC, 50 Hz to 60 Hz.
- Provide a suitable power source with electrical overload protection to meet the requirements in the technical specification.
- The power supply cord must have a safe electrical earth connection. Check the connection to earth of the enclosure before you switch on the power supply.

  Important: The enclosure must be grounded before applying power.
- 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.

Do not remove covers from the PCM, PSU, or cooling modules– there is a danger of electric shock inside. Return the PCM, PSU, or cooling modules to your supplier for repair.

Important: The RJ45 socket on the ESM is for Ethernet connection only and must not be connected to a telecommunications network.

2U Enclosures Only

2U enclosures are intended to operate with two PCMs.

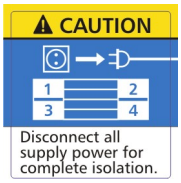


Figure 7. Power Cooling Module Warning Label

When bifurcated power cords ("Y" leads) are used, these cords must only be connected to a supply range of 200-240 VAC.

5U Enclosures Only

5U enclosures are intended to operate with two PSUs and five cooling modules.

When powered by multiple AC sources, disconnect all supply power for complete isolation.

Do not remove covers from the enclosure or any of the modules – there is a danger of electric shock inside. Do not attempt to disassemble the rear sub-chassis from the enclosure. Return any damaged components to your supplier for repair.

CAUTION:
The PSUs contain double pole/neutral fusing. Ensure that your electrical installation can support this.

Rack System Safety Precautions

The following safety requirements must be considered when the enclosure is mounted in a rack:

- 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 and empty from the top down.
- Do not try to lift the enclosure by yourself.

  To avoid danger of the rack falling over, under no circumstances should more than one enclosure be moved out of the cabinet at any one time.
- The system must be operated with low-pressure rear exhaust installation. (Back pressure created by rack doors and obstacles not to exceed 5 pascals [0.5 mm water gauge]).
- The rack design should consider the maximum operating ambient temperature for the enclosure, which is 40°C for 2U enclosures and 5U enclosures.
- The rack should have a safe electrical distribution system. It must provide overcurrent protection for the enclosure and must not be overloaded by the total number of enclosures installed in the rack. When addressing these concerns consideration should be given to the electrical power consumption rating shown on the nameplate.

- The electrical distribution system must provide a reliable earth connection for each enclosure and the rack.
- The rack, when configured with the enclosures, must meet the safety requirements of UL 60950-1 and IEC 60950-1.

2U Enclosures Only

Always remove all PCMs to minimize weight, before loading the enclosure into a rack.

Each PCM in each enclosure has an earth leakage current of 1.0 mA. The design of the electrical distribution system must consider the total earth leakage current from all the PCMs in all the enclosures. The rack requires labeling with “HIGH LEAKAGE CURRENT. Earth connection essential before connecting supply”.

5U Enclosures Only

The enclosure must only be mounted into a rack using the supplied rail kit. Due to its weight and length, the enclosure must not be flange mounted.

Before mounting the enclosure, remove all DDIC modules from both drawers and make sure that the drawers are closed firmly and locked shut. Do not try to lift the enclosure by yourself (see “Safe Handling” on page 1).

The minimum open area for the rack doors is 70%.

Each PSU in each enclosure has a ground leakage current of 1.6 mA. The design of the electrical distribution system must consider the total ground leakage current from all the PSUs in all the enclosures. The rack must be labeled with the words: "HIGH LEAKAGE CURRENT. Ground connection essential before connecting supply."

Chapter 2. System Overview

This chapter contains the following items:

Enclosure Introduction

You can connect Storage D1212/D1224/D3284 enclosures directly to the host. You also can optionally connect Storage D3284 enclosure to a Lenovo Storage DS-series as the expansion enclosure. For more information about the operation of Storage DS-series, refer to *ThinkSystem DS6200/DS4200/DS2200/DS EXP Storage Manager Guide.*

Enclosure Configurations

The storage system is available in three enclosure configurations:

- 2U (rack space) disk drive enclosure (see Figure 8 “2U12 Enclosure System – front view ” on page 8 and Figure 9 “2U12 Enclosure System – rear view ” on page 8): holds up to 12 low profile (1 inch high), 3.5 inch form factor drives in a horizontal orientation.
- 2U (rack space) disk drive enclosure (see Figure 10 “2U24 Enclosure System – front view ” on page 9 and Figure 11 “2U24 Enclosure System – rear view ” on page 9): holds up to 24 low profile (5/8 inch high), 2.5 inch form factor drives in a vertical orientation.
- 5U (rack space) disk drive enclosure (see Figure 12 “5U84 Enclosure System – front view ” on page 10 and Figure 13 “5U84 Enclosure System – rear view ” on page 11) contains two drawers of 42 drives each (84 drives in total). 2.5" drives require 3.5" adapters.

The following product information is displayed on the HBA/ RAID adapter:

- Product ID "2U12ENC" for D1212, "2U24ENC" for D1224, "5U84ENC or D3284" for D3284 is displayed on the host RAID adapter

Each individual drive assembly is hot pluggable and replaceable on site.

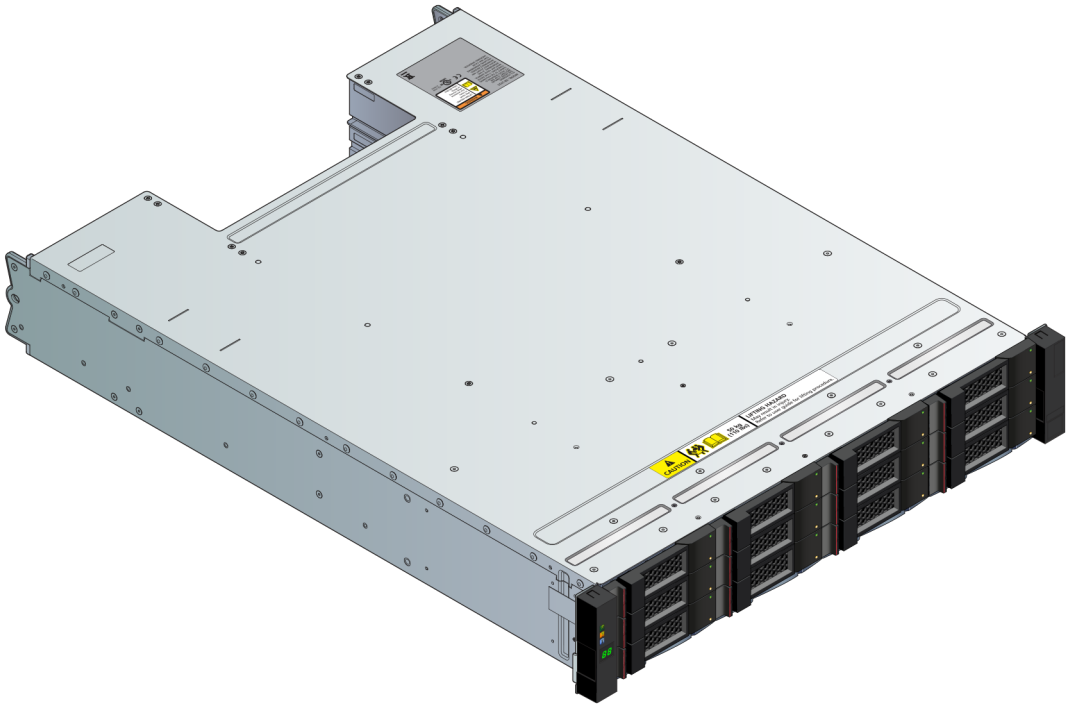


Figure 8. 2U12 Enclosure System – front view

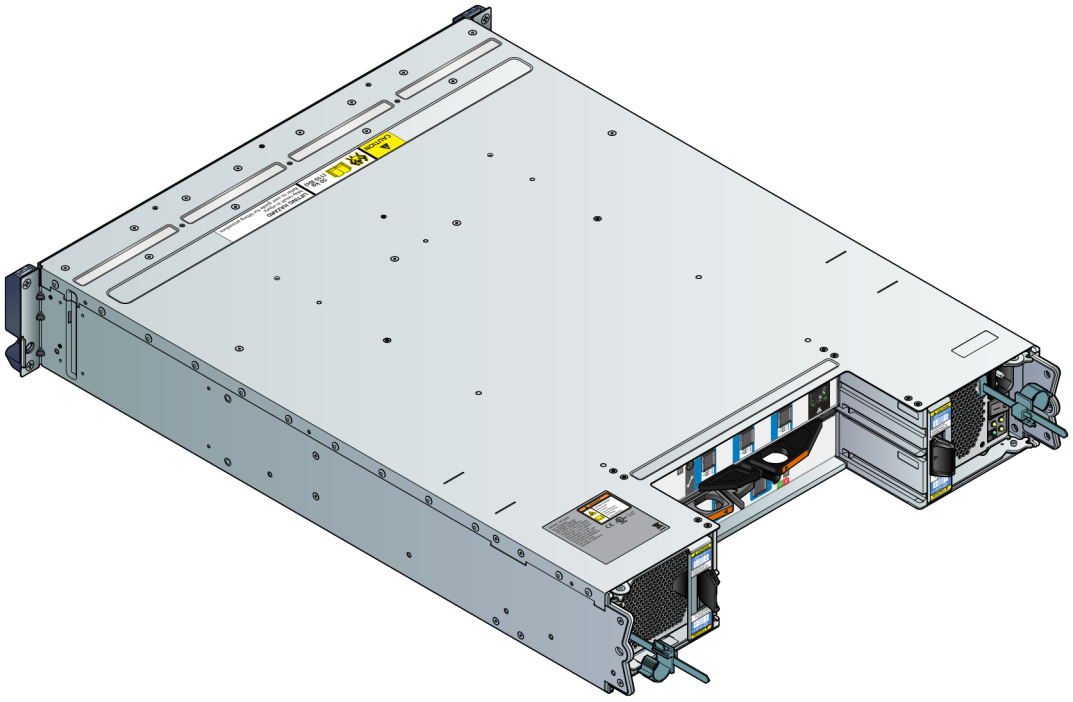


Figure 9. 2U12 Enclosure System – rear view

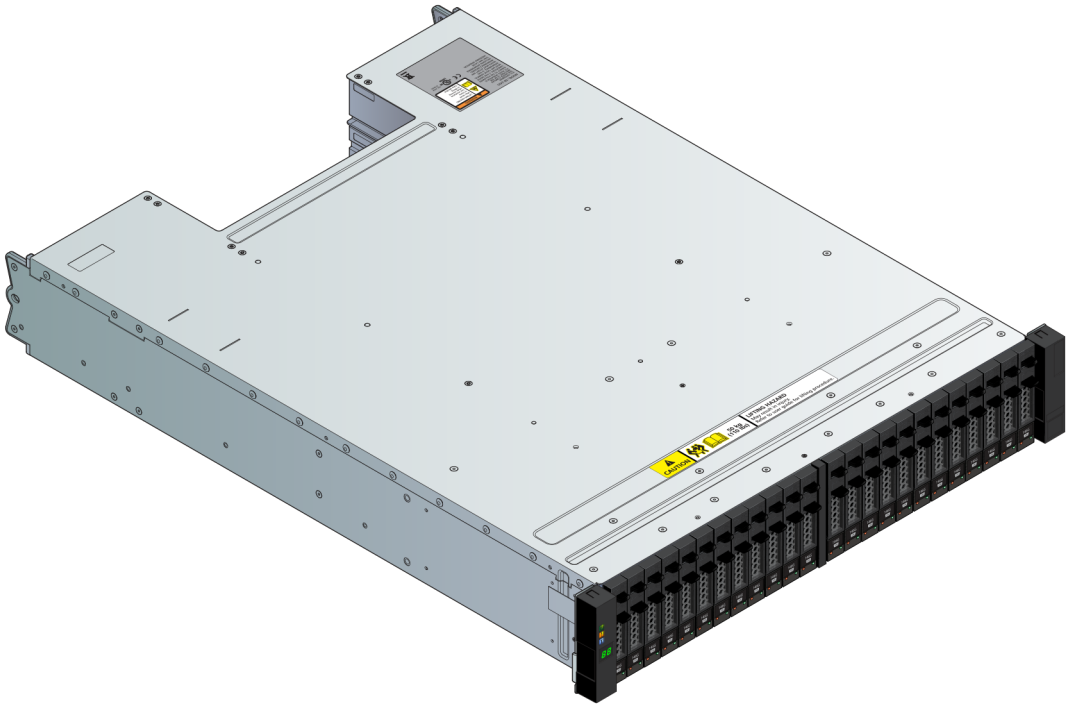


Figure 10. 2U24 Enclosure System – front view

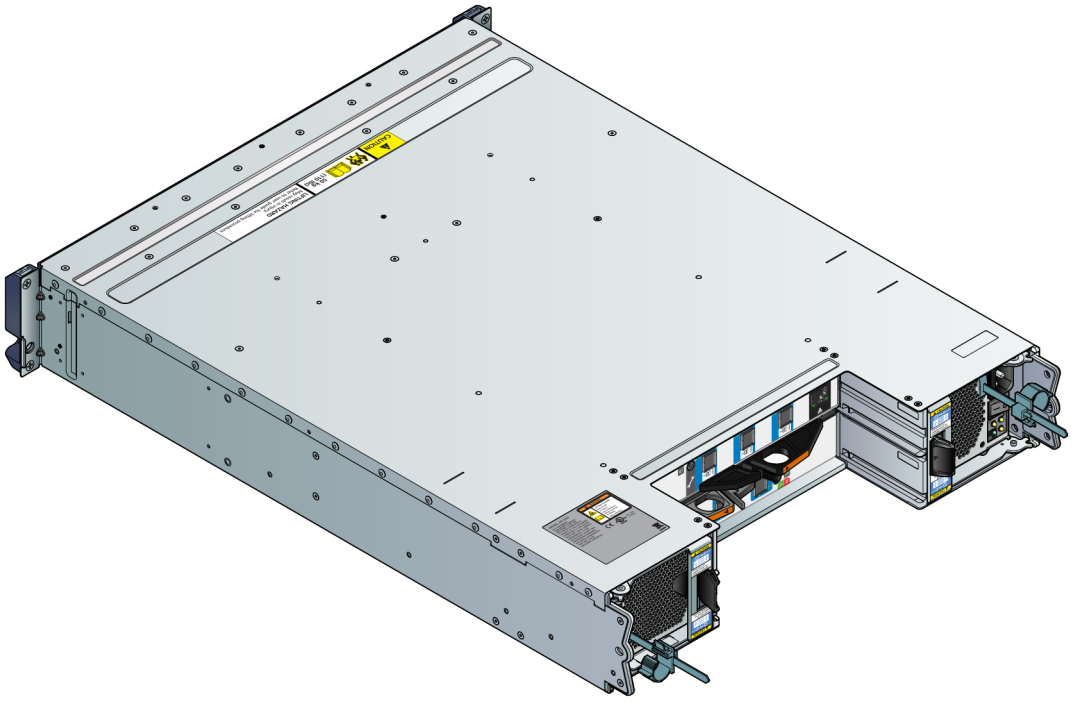


Figure 11. 2U24 Enclosure System – rear view

Figure 12. 5U84 Enclosure System – front view

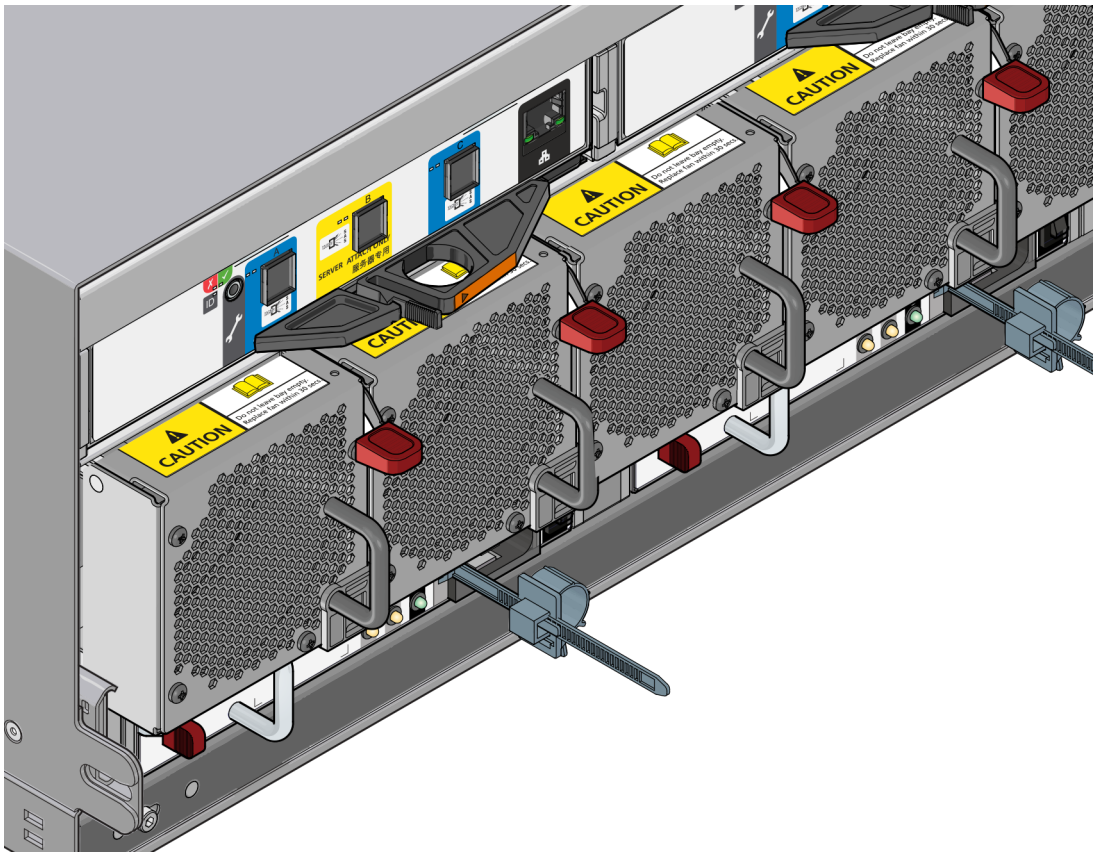


Figure 13. 5U84 Enclosure System – rear view

Enclosure Variants

The following enclosure configurations are possible.

2U12

12 x LFF (Large Form Factor) and 12 x HFF (Hybrid Form Factor) drives.

Table 1. 2U12 Enclosure Variants

Product	Configuration	PCMs	ESMs
D1212	12 Gb/s direct dock LFF SAS	2	2

2U24

24 x SFF (Small Form Factor) drives.

Table 2. 2U24 Enclosure Variants

Product	Configuration	PCMs	ESMs
D1224	12 Gb/s direct dock LFF SAS	2	2

5U84

84 x LFF or SFF (not interchangeable) drives.

Table 3. 5U84 Enclosure Variants

Product	Configuration	PSUs	ESMs	Cooling Modules
D3284	12Gb/s direct dock LFF SAS	2	2	5

The 2U Enclosure Core Product

The design concept is based on an enclosure subsystem together with a set of plug-in modules. A typical enclosure system (as supplied) comprises:

- An enclosure chassis comprising:
  - A midplane PCB.
  - An integral, front flange-mounted operator's (Ops) panel.
- Up to two 580 W, 100-240 V AC power cooling modules (PCMs). See Figure 23 "580W Power Cooling Module " on page 21.
- Up to two ESMs: two SBB (Storage Bridge Bay) compliant interface bays.
- Up to 24 drive carrier modules with drives installed. Where appropriate, drive carriers include an interposer card (refer to Figure 12 "5U84 Enclosure System – front view " on page 10).

  Note: Dummy drive carrier modules must be put in all empty drive bays.
- A rail kit for rack mounting.

Note: The module quantities quoted above are the maximum that a 2U24 enclosure can hold. Figure 14 "Module Locations (2U12)" on page 12 and Figure 15 "Module Locations (2U24)" on page 13 show the module and major component locations of the 2U enclosures.

Important: To ensure correct airflow and cooling, all PSU bays and cooling module bays must contain a functioning unit. If the enclosure is run with a single ESM, the other ESM bay must be filled with a blank module.

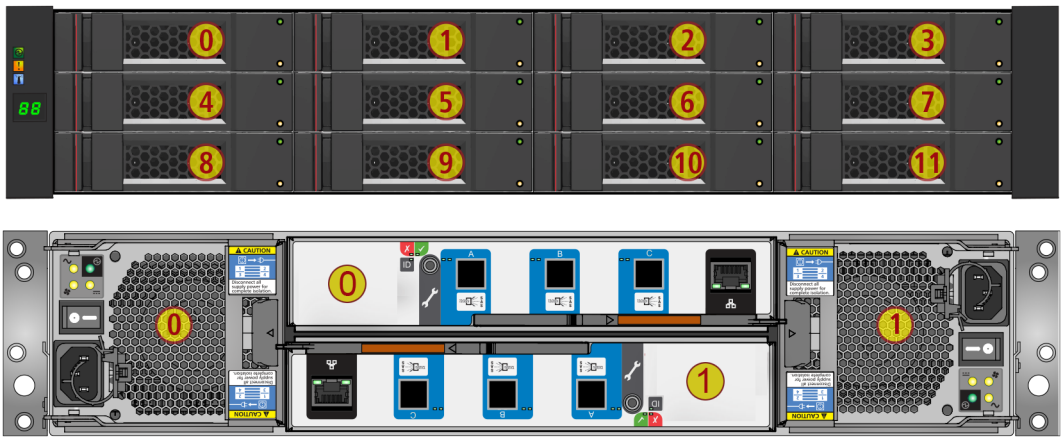


Figure 14. Module Locations (2U12)

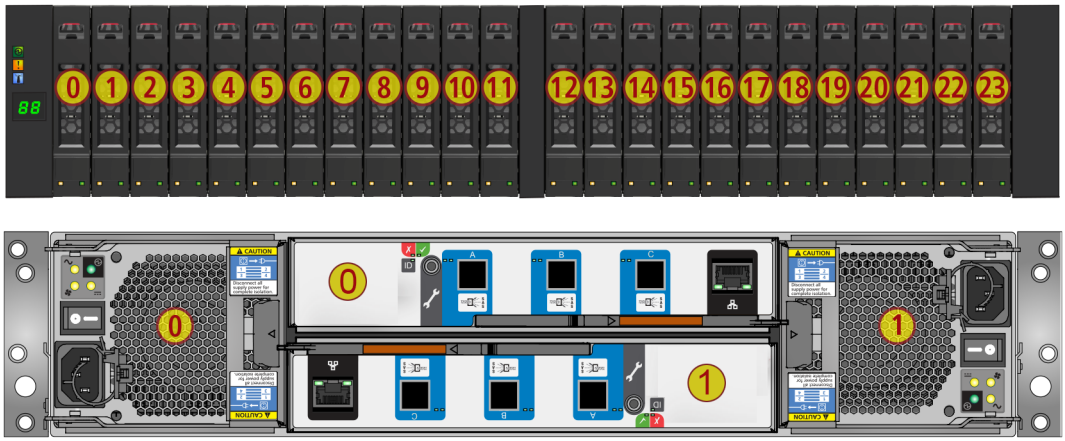


Figure 15. Module Locations (2U24)

Enclosure Chassis

The chassis (Figure 16 “Enclosure Chassis (2U12) ” on page 14) consists of a sheet metal enclosure assembly with an integrated midplane PCB and module runner system.

- The chassis has a 19 inch rack mounting that enables it to be installed on to standard 19 inch racks and uses two EIA units of rack space (3.5 inch) for a 2U enclosure.
- The midplane PCB can have up to 24 drive connections (see “Enclosure Variants” on page 11 for details).
- There are up to 24 drive bays at the front of the enclosure, in horizontal or vertical orientation as defined by the enclosure variant, see Figure 14 “Module Locations (2U12)” on page 12 and Figure 15 “Module Locations (2U24)” on page 13. Each drive bay holds a plug-in drive carrier module that can hold these drive types, dependent on the enclosure type:
  - 2U12 enclosure: 12 Low Profile (1 inch high) 3.5 inch form factor drives, held horizontally.
  - 2U24 enclosure: 24 Low Profile (5/8 inch high) 2.5 inch form factor drives, held vertically.
- At the rear, the chassis assembly can hold a maximum of two PCMs and two SBB ESMs.

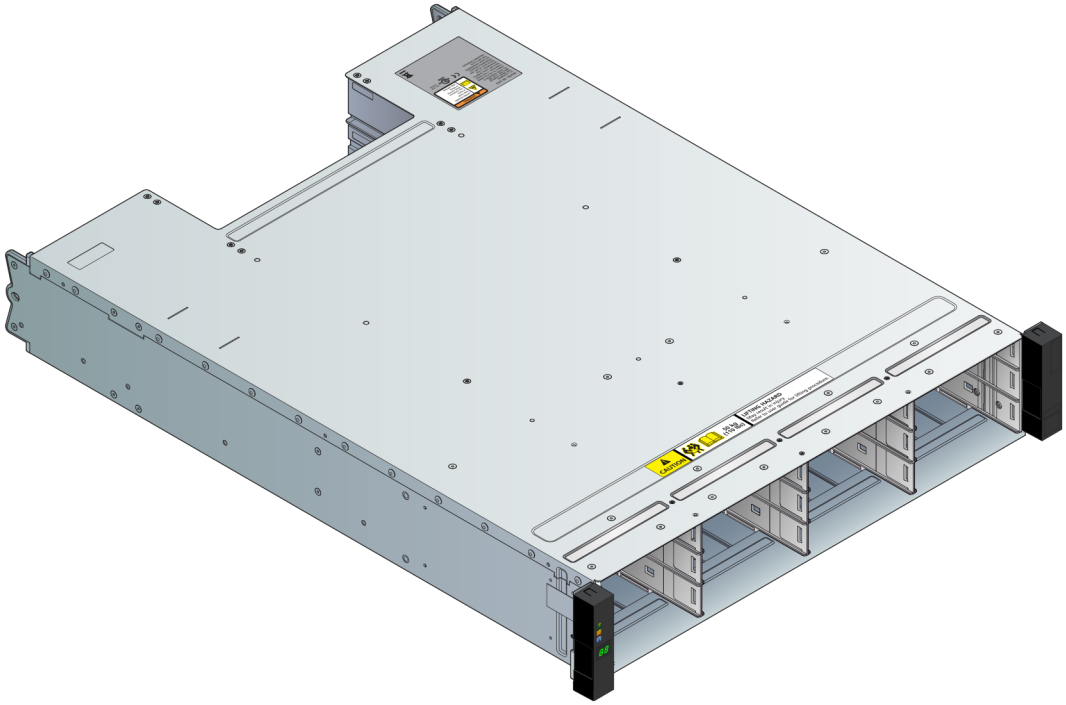


Figure 16. Enclosure Chassis (2U12)

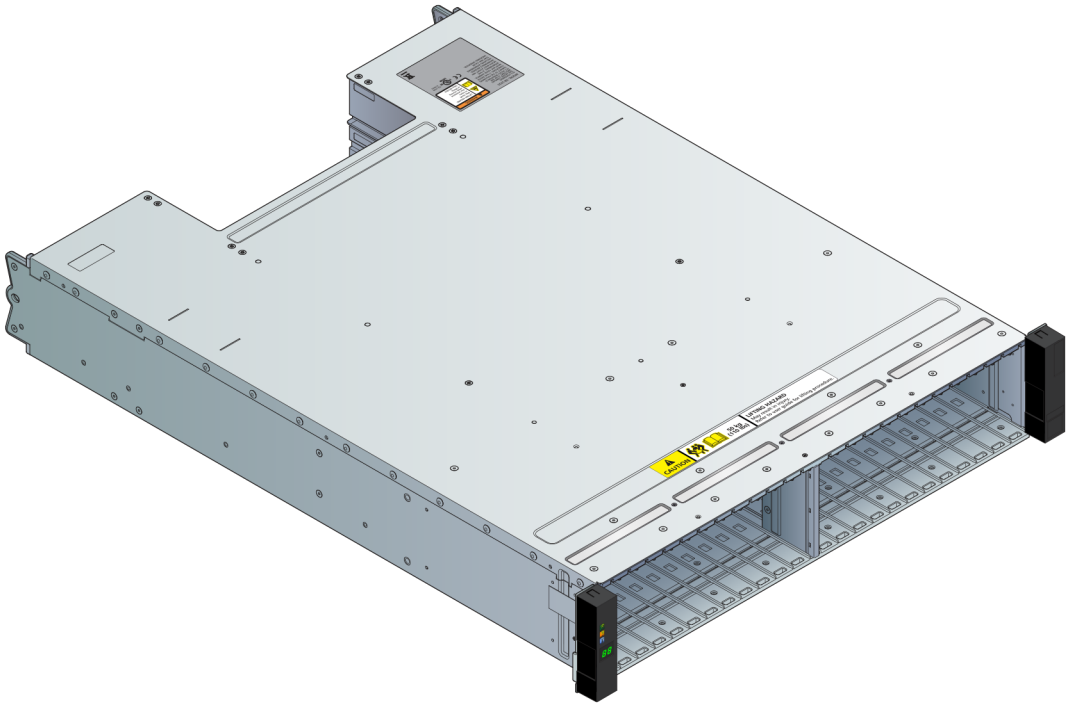


Figure 17. Enclosure Chassis (2U24)

The 5U Enclosure Core Product

The OneStor design concept is based on an enclosure subsystem together with a set of plug-in modules. A typical enclosure system (as supplied) comprises:

- An enclosure chassis comprising:

  - Two sliding drawers containing Disk Drive In Carrier (DDIC) modules.
  - An operator's (Ops) panel.
  - A front bezel.
  - A midplane PCB into which other components connect.
  - Four sideplanes and six baseplanes for front end components connectivity.
- Two Power Supply Units (PSUs).
- Five cooling modules.
- Two ESMs.
- Up to 84 Disk Drive In Carrier (DDIC) modules.
- A rail kit for rack mounting.
- A T20H screwdriver for anti-tamper lock.

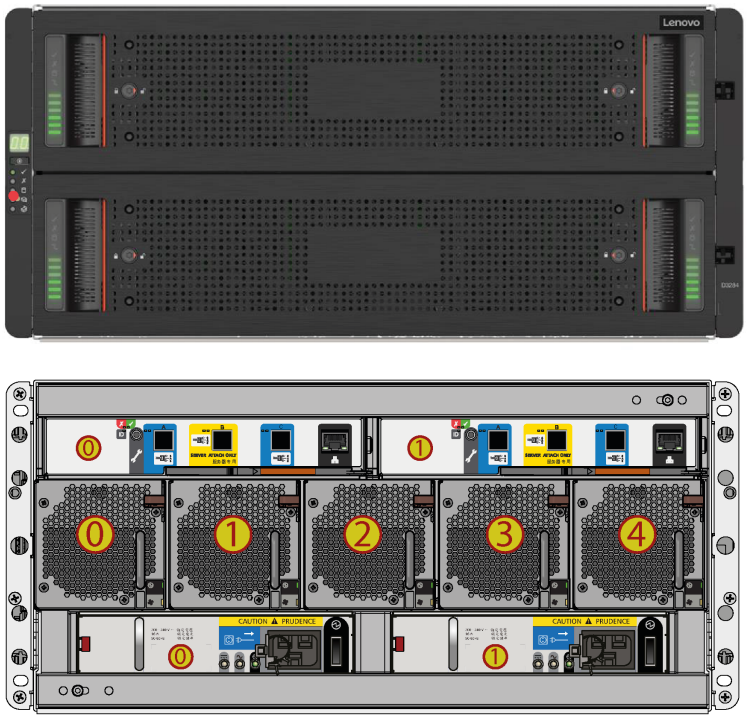


Figure 18. Module Locations

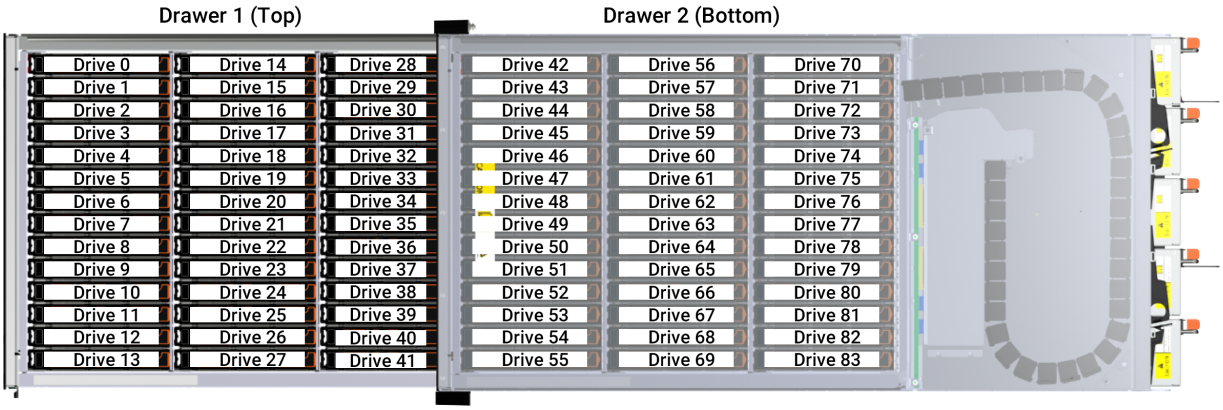


Figure 19. Drive Location

Enclosure Chassis

The chassis consists of a sheet metal enclosure assembly with an integrated midplane PCB, module runner system, and two drawers for drive modules.

The chassis has a 19 inch rack mounting that enables it to be installed on to standard 19 inch racks and uses 5 EIA units of rack space (8.75 inches; 222 mm).

Each drawer contains 42 bays for Disk Drives in Carriers (DDICs). DDICs are top-mounted into the drawers.

At the rear, the chassis assembly can accept two PSUs, two ESMs and five cooling modules.

Drawers

Note: An operation related to open a drawer needs to be finished in 5 minutes.

Each drawer contains 42 bays, each of which accepts a single DDIC containing a 3.5" drive or a 2.5" drive with an adapter.

Opening a drawer does not interrupt the functioning of the system, and DDICs can be hot-swapped while the enclosure continues to operate. However, drawers must not be left open for longer than two minutes, otherwise airflow and cooling will be compromised.

The drawer is designed to support its own weight, plus the weight of any drives, when fully open.

Safety features:

- To reduce the possibility of toppling, only one drawer can be open at any one time.
- The drawer locks into place when opened all the way. To reduce pinching hazards, two latches must be released before the drawer can be pushed back in.

Power and data are sent by three baseplanes and two sideplanes. The sideplanes ensure redundant power and signal paths to each drive.

Each drawer can be locked shut by turning both anti-tamper locks clockwise using a screwdriver with a Torx T20 bit (see Figure 18 “Module Locations” on page 15). Each side of each drawer has a series of status LEDs, shown in the following figure..

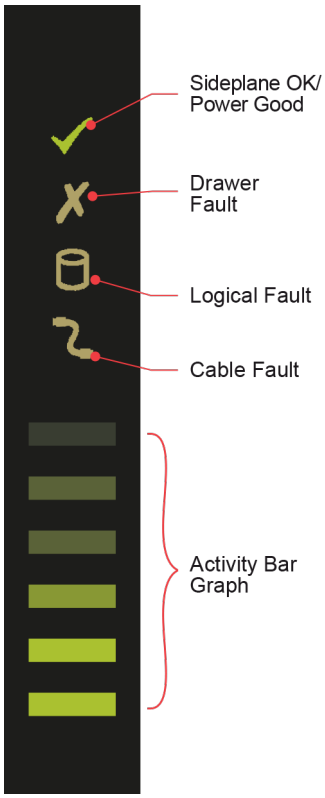


Figure 20. Drawer LEDs

Important: During normal operation, drawers must be kept shut to ensure correct airflow and cooling.

Operator's (Ops) Panel (2U Enclosures)

The enclosure front panel has an operator's (Ops) panel (shown in Figure 21 "Enclosure Front Operator's Panel " on page 18) on the left hand mounting flange: a flexible cable connects the Ops panel to the midplane. The Ops panel is a passive component: the midplane controls the panel and the ESMs control all the panel's functions. An integral part of the enclosure chassis, it is not replaceable on site. The Ops Panel has these functions:

- System power LED (Green/Amber)
- Module fault LED (Amber)
- Location LED (Blue) (not used)
- Unit identification LED display
- Thermal sensor (behind panel)

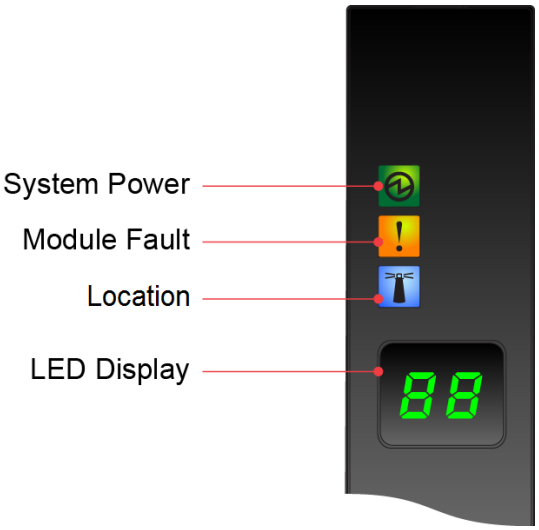


Figure 21. Enclosure Front Operator's Panel

For details of any fault indication, refer to following table.

Table 4. Ops Panel LEDs

LED	Status
System Power	Constant green: good or positive indication Constant amber: fault present
Module Fault	Constant or flashing amber: fault present
Location	Not used in this configuration

System Power On/Standby LED (Green/Amber)

Shows amber when only standby power is available. Shows green when system power is available.

Module Fault LED (Amber)

Shows amber when there is a system hardware fault. Additionally, an LED may be lit on a PCM, drawer, DDIC, cooling module or ESM that helps you identify which component is at fault.

Location LED (Blue)

When activated, the Identify LED blinks at a rate of 1 second on, 1 second off to easily locate the chassis within a data center. The locate function may be enabled/disabled through SES or by using the `hid_set_ident` CLI command.

Note: This LED is not activated for this configuration.

Unit Identification Display

A dual seven segment display that can be used to provide feedback to the user. Its primary function is to display an enclosure unit identification number to assist users in setting up and maintaining multiple enclosure systems.

Use a VPD (Vital Product Data) option to configure the unit identification display. The display will be on by default, and display a value of 0. See section.

Thermal Sensor

This thermal sensor is located outside the enclosure and sends input to the enclosure about its external operating ambient temperature.

Operator's (Ops) Panel (5U Enclosures)

The front of the enclosure features an operator's (ops) panel (shown in Figure 22 "Enclosure Operator's Panel " on page 19) on the left-hand side which contains the following:

- Unit Identification Display.
- Input button.
- Power On/Standby LED (green/amber).
- Module Fault LED (amber).
- Logical Status LED (amber)
- Drawer 1 Fault LED (amber).
- Drawer 2 Fault LED (amber).

The ops panel is an integral part of the chassis, and is not replaceable on site.

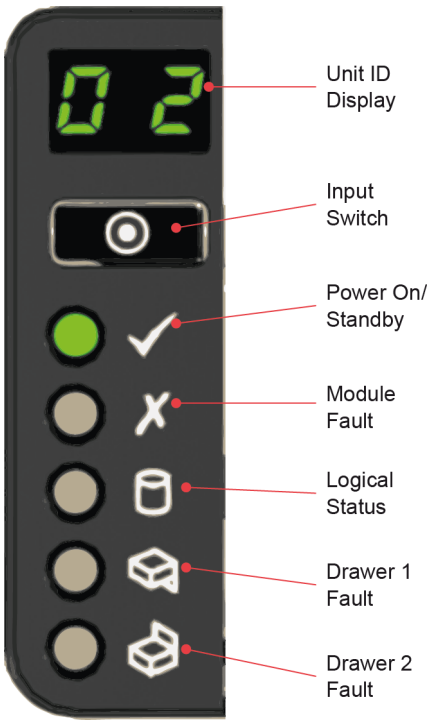


Figure 22. Enclosure Operator's Panel

For details of any fault indication, refer to the following table.

Table 5. Ops Panel LEDs

LED	Status
Power On/Standby	Constant green: power is on Constant amber: system is in standby (not operational)
Module Fault	Constant or flashing amber: fault

Table 5. Ops Panel LEDs (continued)

LED	Status
Logical Status	Constant or flashing amber: fault
Drawer 1/2 Fault	Constant amber: fault in drive, cable, or sideplane for specified drawer

Unit Identification Display

A numerical display whose primary function is to display the enclosure unit identification number.It can be helpful when setting up and maintaining multiple enclosure systems.

However, a VPD (Vital Product Data) option allows the unit identification display to be configured for other purposes. The display will be on by default, and display a value of 0. See “Unit Identification Number” on page 53.

Input Switch

Used to set the unit identification display (see “How To Set the Unit Identification Number” on page 53).

Power On/Standby LED (Green/Amber)

Shows amber when the system is in standby (not operational). Shows green when the system is on (operational).

Module Fault LED (Amber)

Shows amber when there is a system hardware fault. Additionally, an LED may be lit on a PSU, drawer, DDIC, cooling module or ESM that helps you identify which component is at fault.

Logical Status LED (Amber)

Indicates a change of status or fault from something other than the enclosure management (EM) system. This may be from an internal or external RAID controller or HBA. It is associated with a disk drive and LEDs at each disk drive position help you identify the drive affected.

Drawer Fault LEDs (Amber)

Indicates a drive, cable, or sideplane fault in the drawer indicated.

Disk Drive LEDs

Each drive carrier module incorporates two LEDs, green and amber.

Disk Drive LEDs (2U Enclosures)

LEDs in each drive carrier module are shown in Figure 60 “3.5" Drive Carrier LEDs ” on page 56 and Figure 61 “2.5" Drive Carrier LEDs ” on page 57.

- In normal operation the green LED is on and flickers as the drive operates.
- In normal operation the amber LED state is:
  - Off if there is no drive present.
  - Off as the drive operates.
  - On if there is a drive fault.

Disk Drive LEDs (5U Enclosures)

LEDs in each drive carrier module are shown in Figure 66 “Drive Fault LED” on page 63.

- In normal operation the amber LED state is:
  - Off as the drive operates.
  - On if there is a drive fault.

Power Cooling Modules (PCM)

Note: 2U Enclosures only.

AC-DC power is provided by up to 3 auto-ranging power cooling modules (PCMs) with integrated axial cooling fans. The ESMs control the fan speed. Refer to “System Airflow” on page 22 about the system airflow.

580W PCM

A 580W PCM voltage operating range is nominally 100V - 240V AC.

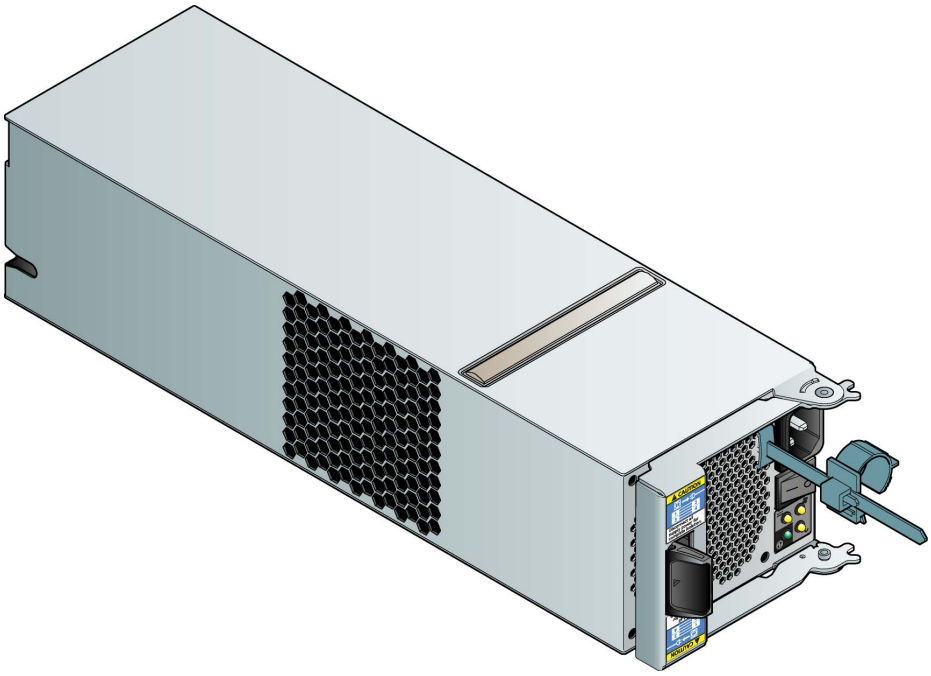


Figure 23. 580W Power Cooling Module

580W PCM LEDs

The PCM has these LEDs:

PCM OK	Green
AC Input Fail	Amber
Fan Fail	Amber
DC Output Fail	Amber

If all LEDs are amber, it indicates a communications failure.

If all LEDs are amber and flashing, it indicates that a PCM firmware update is in progress.

If the DC Output Fail is On, it indicates that a PCM detected DC output fail or firmware detected fault.

PCM LEDs are shown in the following figure.

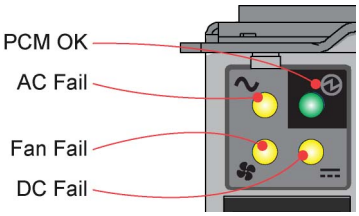


Figure 24. 580W PCM LEDs

Multiple PCMs

The 2U system includes two PCMs which provide redundant power control for the system so that if one PCM fails the other maintains the power supply and enclosure operation is not affected while you replace the faulty module.

PCMs 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 PCM to avoid a thermal exception, and within an absolute maximum of 2 minutes.

Important: Operation of the enclosure with ANY modules missing disrupts the airflow and the drives could not receive sufficient cooling. It is ESSENTIAL that all bays are fitted with PCMs or PCM blanks prior to switching on the enclosure.

System Airflow

The system must be operated with low-pressure rear exhaust installation. Back pressure created by rack doors and obstacles is not to exceed 5 pascals (0.5 mm 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.

Power Supply Unit (PSU)

Note: 5U Enclosures only.

Power is provided by two 2214W PSUs, as shown in Figure 25 “2214W PSU” on page 23. It requires an input of 200VAC to 240VAC at 50 Hz to 60 Hz.

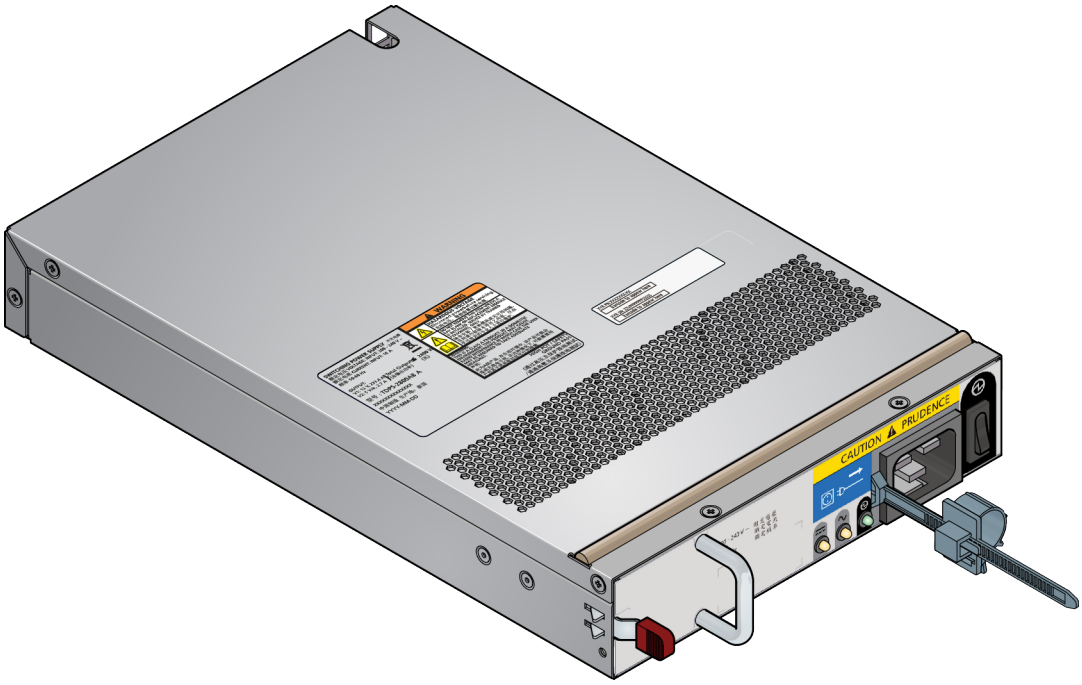


Figure 25. 2214W PSU

Dual PSUs provide redundant power for the system: if one PSU fails, the other keeps the system running while you replace the faulty module. The PSUs are hot-swappable. Replacement of a PSU can be performed while the enclosure is running, but the procedure must be completed within two minutes of the removal of the defective PSU. Ensure that you have a replacement PSU before you remove the defective PSU.

The enclosure chassis is keyed to prevent PSUs from being inserted upside down.

The back of the PSU has a power switch, three status LEDs, and a socket for the power cord (see Figure 26 “PSU LEDs” on page 23).

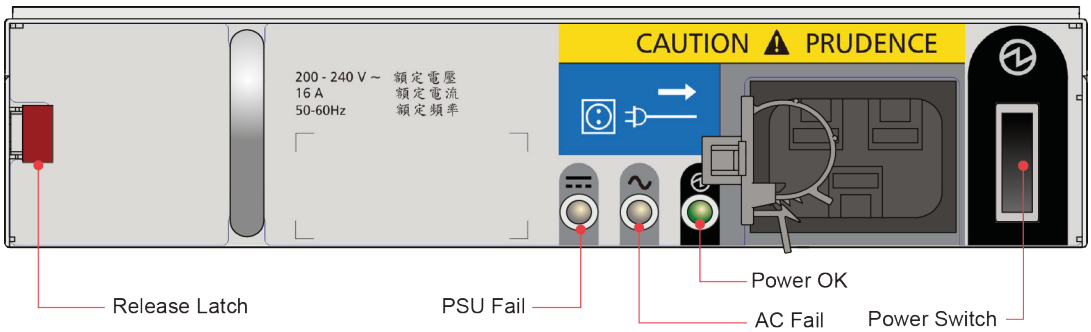


Figure 26. PSU LEDs

Cooling Module

Note: 5U Enclosures only.

The five cooling modules at the rear of the enclosure maintain all system components below their maximum temperature, assuming the ambient temperature is below 35°C.

The speed of the fans in the cooling modules is controlled by the ESM. Refer to “System Airflow” on page 24.

Cooling modules can be hot-swapped while the enclosure is still running, assuming that only one module is removed at a time and the swap takes no longer than two minutes. Ensure that you have a replacement cooling module before you remove the defective cooling module.

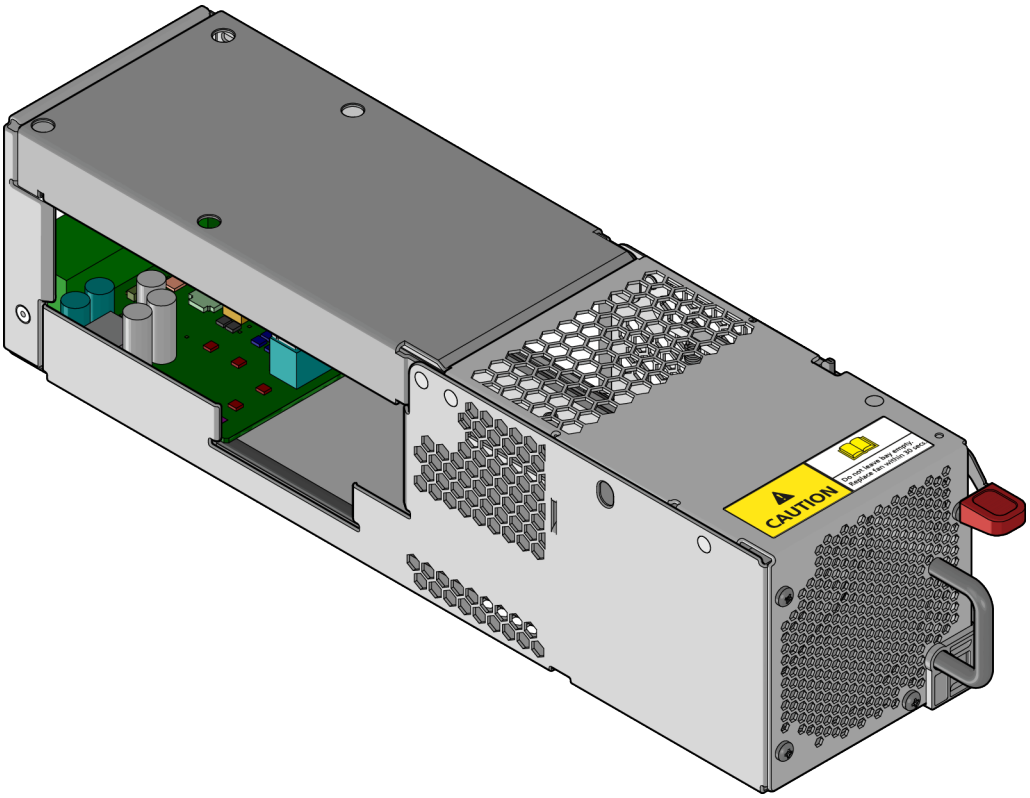


Figure 27. Cooling Module

System Airflow

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

The minimum open area for the rack doors is 70%.

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

Environmental Service Module (ESM)

This user guide describes the 12Gb/s JBOD ESMs. The ESMs are mechanically and electrically compliant to the latest SBB V2.1 specification.

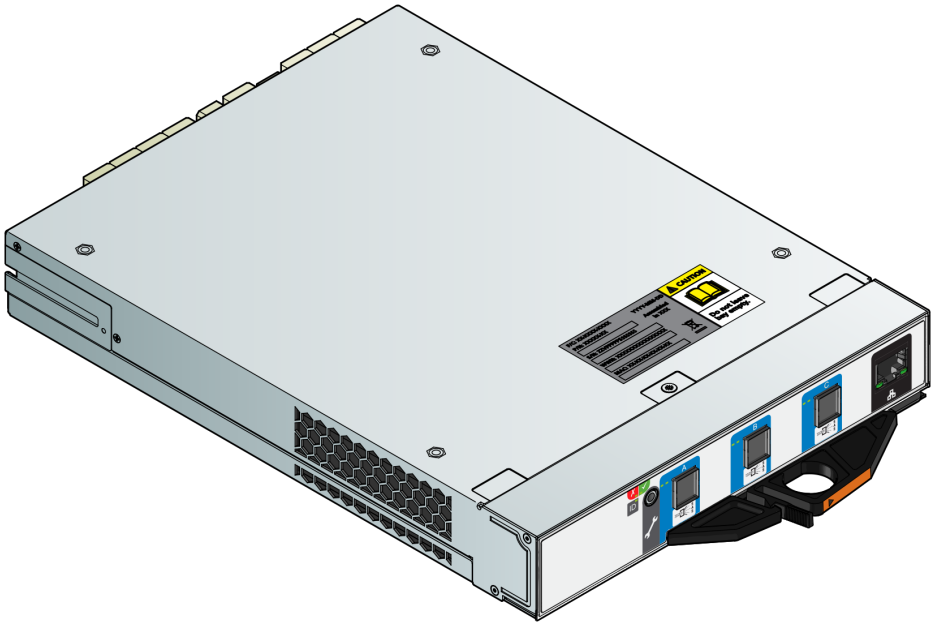


Figure 28. 12 Gb/s SAS JBOD Module (2U Enclosures)

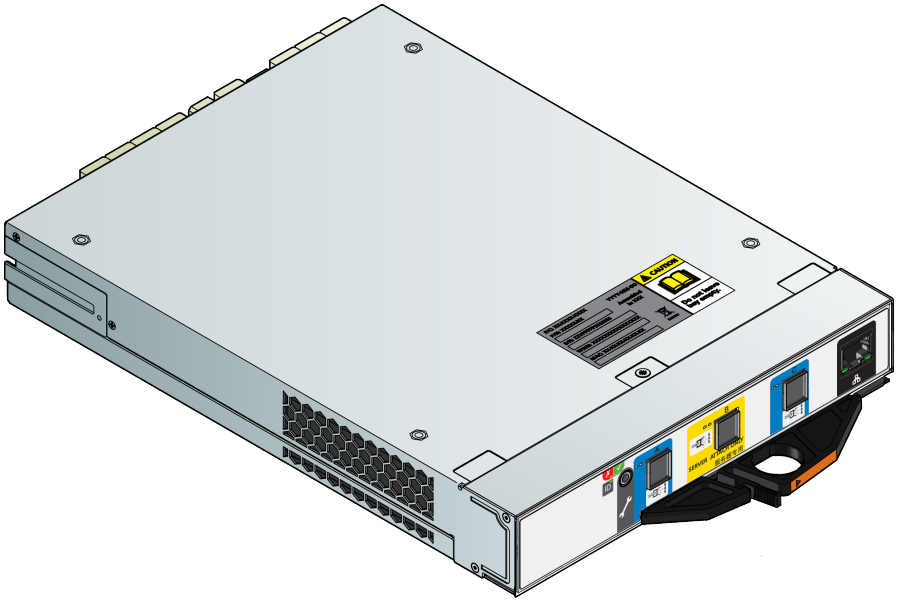


Figure 29. 12 Gb/s SAS JBOD Module (5U Enclosures)

Each ESM maintains VPD in EEPROM devices, and is interconnected by SBB defined I^2C buses on the midplane. In this way, the SBB modules can discover the type and capabilities of the partner SBB modules and vice versa within the enclosure. An enclosure system alarm occurs when incompatible configurations are detected.

12 Gb/s JBOD Module LEDs

Table 6. SAS Activity LEDs

Condition	Activity LED (green)	Fault LED (amber)
No Cable Present	Off	Off
Cable Present All links up, no activity.	On	Off
Cable Present All links up	Flash with aggregate port activity	Off
Critical Fault Any fault which causes operation of the cable to cease or fail to start, e.g. over current trip.	Off	On
Non-Critical Fault Any fault which does not cause the connection to cease operation, e.g. not all links established, overtemperature.	Flash with aggregate port activity	Flashing - 1 second on 1 second off

Table 7. Module Status LEDS

LED	State	Description
Module Fault (amber)	On	A fault condition.
	Off	Module is operating normally.
Power (green)	On	Module powered
	Off	No power
ID (blue)	On	ESM being identified.

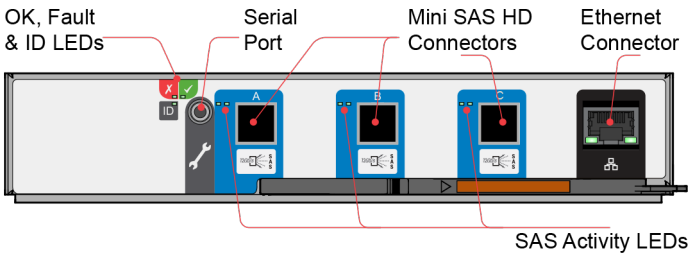


Figure 30. 12 Gb/s SAS JBOD Module Connectors and Indicators (2U enclosures) (viewed from rear of enclosure)

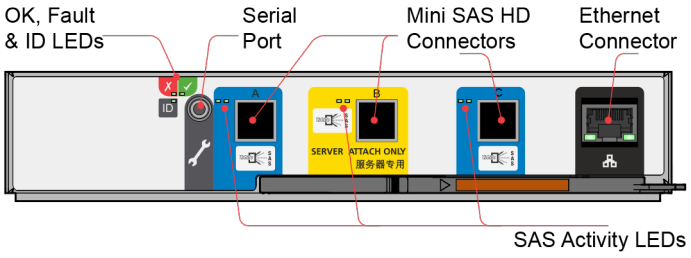


Figure 31. 12 Gb/s SAS JBOD Module Connectors and Indicators (5U enclosures) (viewed from rear of enclosure)

Table 8. Ethernet connector LEDs

Link/Activity LED (Left)	State
Off	No Link
On	Link
Blinking	Activity

Table 9. Ethernet connector LEDs

Speed LED (Right)	State
Off	10-Base-T
On	100-Base-TX

SAS Connections

The ESM has three mini-SAS-HD (SFF-8644) connector receptacles. By default each is configured as an SAS-3 universal port. They may be connected to other universal ports or end devices (for example, HBAs).

Drive Carrier Module (2U Enclosures)

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

- Each 2U12 drive bay holds a single low profile 1.0 inch high, 3.5 inch form factor disk drive in its carrier. Drives are horizontal.
  - 2.5" to 3.5" carrier adapter available to accommodate 2.5" drives.
- Each 2U24 drive bay holds a single low profile 5.8 inch high, 2.5 inch form factor disk drive in its carrier. Drives are vertical.

The carriers have mounting locations for direct dock SAS drives.

A sheet steel carrier holds each disk drive: which provides thermal conduction, radio frequency and electromagnetic induction protection and physically protects the drive.

The front cap also has an ergonomic handle which gives the following functions:

- Secure location of the carrier into and out of drive bays.
- Positive ‘spring loading’ of the drive/midplane connector.

The carrier can use these interfaces:

- Dual path direct dock Serial Attached SCSI.

Figure 32. 3.5" SAS Drive

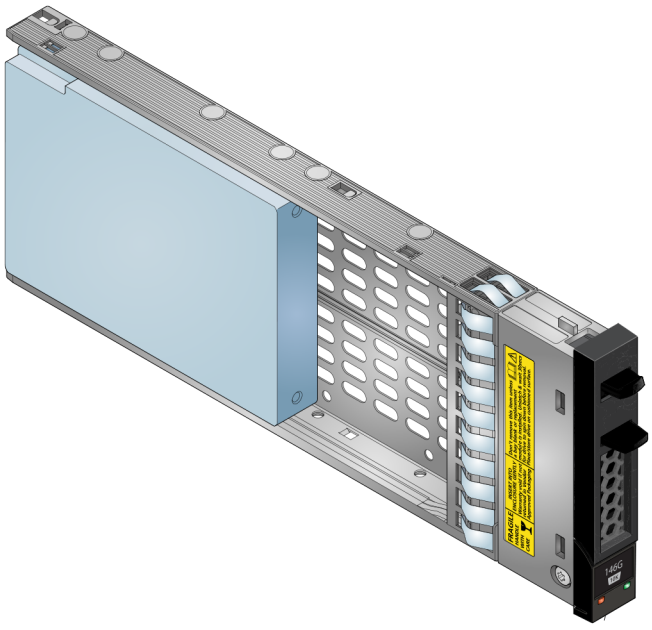


Figure 33. 2.5" Drive Carrier Module with no Interposer Card

Note: For information about the LEDs of 2.5" drive carrier module, refer to Figure 61 “2.5" Drive Carrier LEDs ” on page 57

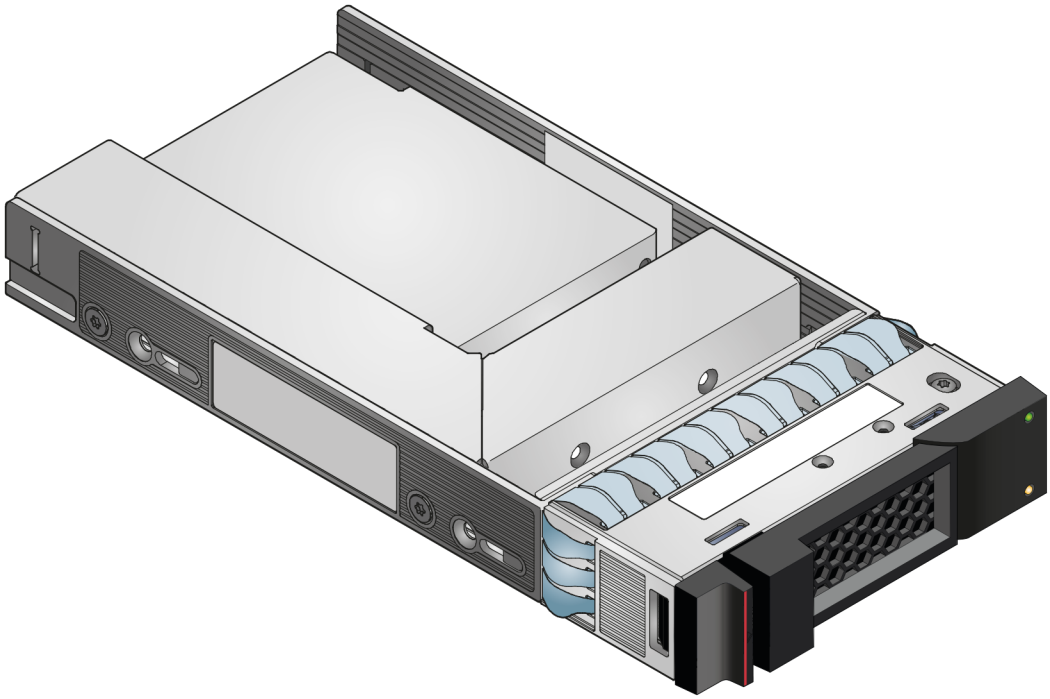


Figure 34. 2.5" to 3.5" Cabrio Drive Carrier Adapter

Note: For information about the LEDs of 3.5" drive carrier module, refer to Figure 60 “3.5" Drive Carrier LEDs ” on page 56

Drive Status Indicators

Green and amber LEDs on the front of each drive carrier module indicate disk drive status; shown in Figure 35 “Dummy Drive Carrier Module ” on page 29. The SEP (Storage Enclosure Processor) controls these LEDs. Refer to “Drive Carrier Module LEDs” on page 56 about these LEDs’ states.

Dummy Drive Carrier Modules

Dummy drive carrier modules are provided and must be put in all empty drive bays to create a balanced airflow.

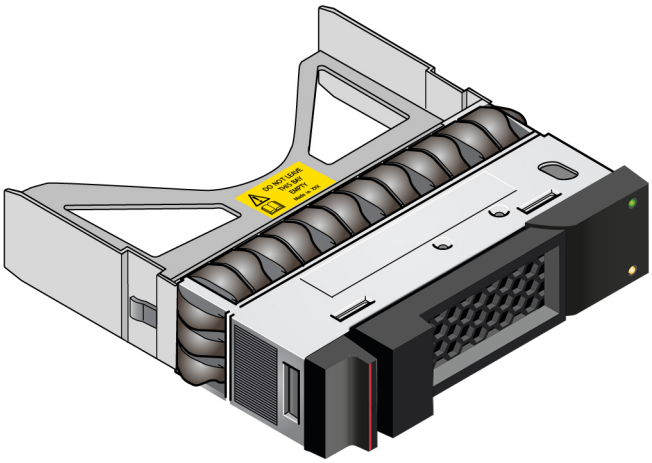


Figure 35. Dummy Drive Carrier Module

Disk Drives in Carriers (DDICs) (5U Enclosures)

Each drive is housed in a carrier (see Figure 36 “A Disk Drive In Carrier (DDIC)” on page 31) that enables secure insertion of the drive into the drawer and contains the appropriate transition card:

- SAS carrier transition card.

DDIC Population Rules

- The minimum number of drives that a chassis can support is 14.
- Drives must be added in rows (14 drives at a time).
- Install drives successively by number and alternately between the top drawer and the bottom drawer. Namely install first at slots 0 to 13 in the top drawer and then at slots 42 to 55 in the bottom drawer. After that, install at slots 14 to 27, and so on. For DDIC slot numbers, seeFigure 19 “Drive Location” on page 16.
  - The number of rows must not differ by more than one row between the top and bottom drawers.
  - Population of rows should start from the front of the enclosure.
- Always install solid-state drives (SSD) firstly.
- Hard disk drives (HDD) and SSDs can be mixed in the same drawer.
- Drives in the same row should be the same form factor (2.5 inch or 3.5 inch).

  Note: When mixing SSDs and HDDs in the top front row (slot 0 - slot 13), up to four SSDs can be installed in the first four slots (slot 0 - slot 3).
- HDDs in the same row must have the same rotational speed.

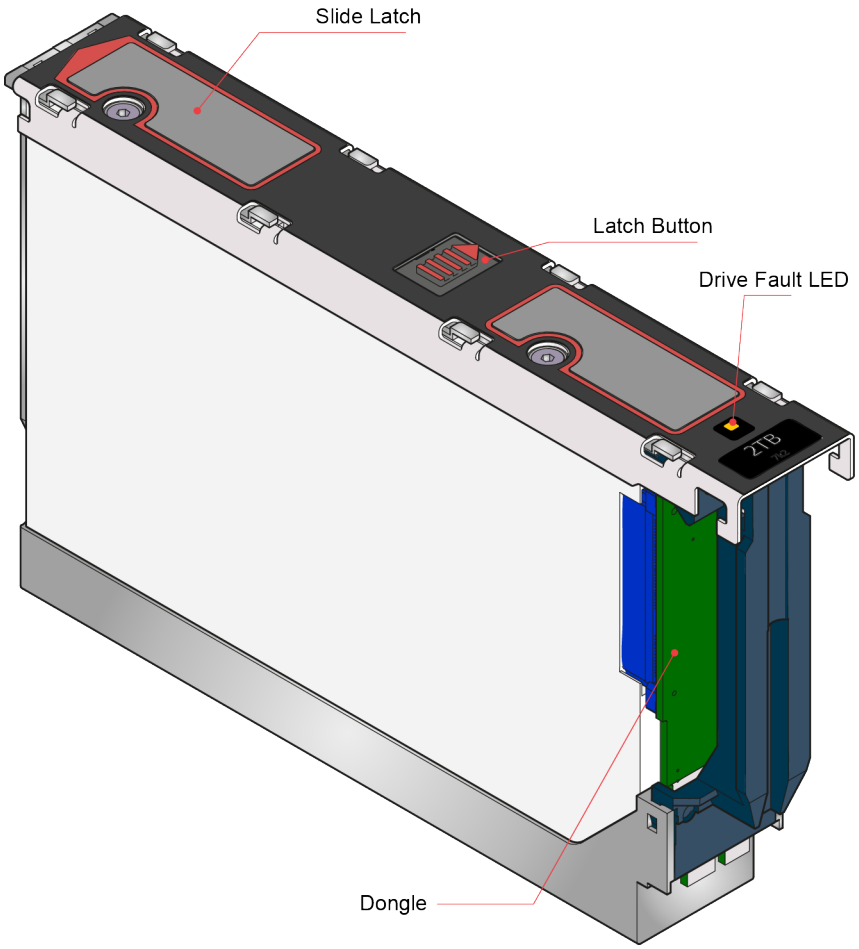


Figure 36. A Disk Drive In Carrier (DDIC)

The 2.5" SAS solid-state drive with 3.5" adapter is supported.

The drive carrier has a single amber LED which is lit when the drive has a fault.

Enclosure Management

SBB ESMs 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 the modules fails, the other module continues to operate.

Refer to a module's specification or the SES interface specification for definitions of the module's functions and its SES control.

Management of the enclosure is also performed by GEM firmware through the Ethernet port (10/100Base-TX) of each ESM. The GEM firmware provides a built-in command line interface (CLI) for interacting with the enclosure. See "Overview of GEM" on page 101 for more information.

Chapter 3. Installation

This chapter contains the following items:

Introduction

This chapter shows how to plan and install your enclosure system into an industry standard 19 inch rack cabinet.

CAUTION:
To install the system, use only the power cords supplied or cords that match the specification quoted in “AC Power Cords” on page 122.

How to Plan Your Installation

You must be familiar with the configuration requirements of your system before you start installation. For the correct locations of each of the plug-in modules, see following figures:

- 2U12: Figure 14 “Module Locations (2U12)” on page 12.
- 2U24: Figure 15 “Module Locations (2U24)” on page 13.
- 5U84: Figure 18 “Module Locations” on page 15.

Important: Read this *Hardware Installation and Maintenance Guide* and prepare appropriate tool before your installation.

Table 10. Configuration

Module	Location
Drive Carrier Modules	2U enclosures only. ALL drive bays must hold either a drive carrier or dummy drive carrier module. No bay should be empty. At least one drive must be installed.
DDICs	5U enclosures only. 84 drives are located in the drawers.
Power Cooling Modules (PCMs)	2U enclosures only. Two PCMs provide full power redundancy – this lets the system continue to operate while a faulty PCM is replaced.
Power Supply Units (PSUs)	5U enclosures only. Power is provided by two 2214W PSUs.

Table 10. Configuration (continued)

Module	Location
Cooling Modules	5U enclosures only. Five cooling modules at the rear of the enclosure maintain all system components below their maximum temperature.
ESM	A maximum of two ESMs can be installed.

Prepare for Enclosure Installation

Note: 2U enclosures are delivered with all dummy drive carrier modules installed.

The enclosure together with all its component parts is too heavy for one person to easily install into a rack cabinet.

CAUTION:
Make sure that you wear an effective anti-static wrist or ankle strap and obey all conventional ESD precautions when you touch modules and components. Do not touch midplane, motherboard and module connectors, etc.

This section gives important preparation requirements and good handling procedures. We encourage you to use these procedures for a successful installation.

How to Prepare the Site and Host Server

Before you start, make sure that the site where you install and use your storage system has:

- A standard AC power supply from an independent source or a rack power distribution unit with an UPS (uninterruptible power supply).
- A host computer with the correct software, BIOS, and drives. Before make a call to Lenovo phone service, check the correct software and hardware configurations at http://support.lenovo.com.

Before you install your enclosure make sure that you have a:

- SAS HBA or RAID adapter.
- MiniSAS HD to MiniSAS HD host cable or MiniSAS HD to MiniSAS host cable.
- Power cord.
- Rail kit (for a rack installation).

For a list of qualified accessories for use with the enclosure, refer to http://support.lenovo.com. The accessories box contains the power cords and other accessories.

How to Unpack the Enclosure System

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 packaging before you open it: this is for possible future reference.
2. Figure 37 “Unpacking the 2U12 and 2U24 Enclosure Systems ” on page 35 shows the unpacking sequence.

   Note: Keep the package.

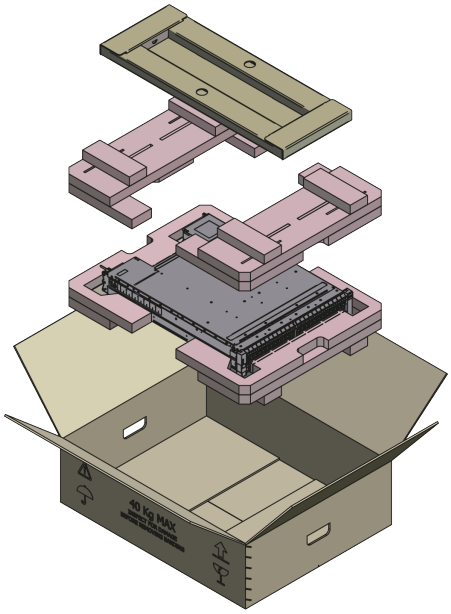


Figure 37. Unpacking the 2U12 and 2U24 Enclosure Systems

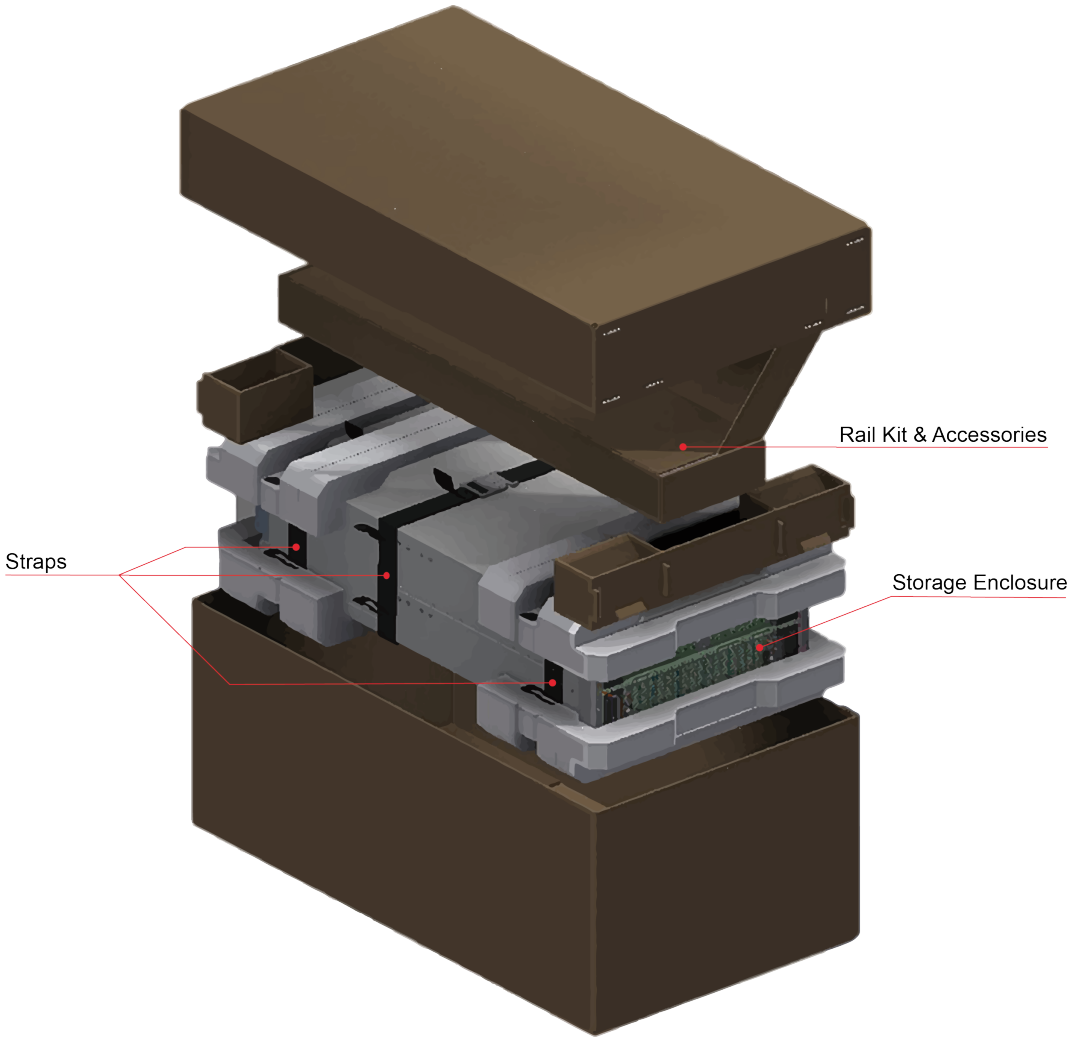


Figure 38. Unpacking the 5U84 Enclosure System

How to Plan and Configure Your Installation

You should become familiar with the configuration requirements of your enclosure system before you begin installation. Refer to "How to Plan Your Installation" on page 33 for information on system configurations.

Tools Required

To install your enclosure system into an industry standard 19 inch rack cabinet, you need a flat blade screwdriver.

Requirements for Installation of Racks

You can install the enclosure in an industry standard 19 inch cabinet capable of holding such enclosures:

- Minimum depth: 933 mm (36.73 inches) from rack posts to maximum extremity of enclosure (excludes rear cabling).
- Weight: up to 50 kg (110 lb), dependent upon configuration, per enclosure.
- The rack should cause a maximum back pressure of 5 pascals (0.5 mm water gauge).

Rack Mounting Rail Kit

Various sets of rack mounting rails are available for use in 19 inch rack cabinets. These rails have been designed and tested for the maximum enclosure weight and to make sure that multiple enclosures may be installed without loss of space within the rack. Use of other mounting hardware may cause some loss of rack space.

Contact your supplier to make sure that suitable mounting rails are available for the rack you are to use.

2U12 and 2U24 Enclosures

1. Remove the rack mounting rail kit from the accessories box and examine for damage.
2. Use the procedure given below to attach the rack brackets to the rack posts (see Figure 39 “Securing Brackets to Rail ” on page 37):
   a. Set the location pin at the rear of the rail into a rear rack post hole. Attach the bracket to the rear rack post: use the washers and screws supplied. Leave the screws loose.
   b. Extend the rail to fit between the front and rear rack posts.
   c. Attach the bracket to the front rack post using the washers and screws supplied. Leave the screws loose.
   d. Tighten the two clamping screws located along the inside of the rear section of the rack bracket.
   e. Repeat the steps for the other side rail.

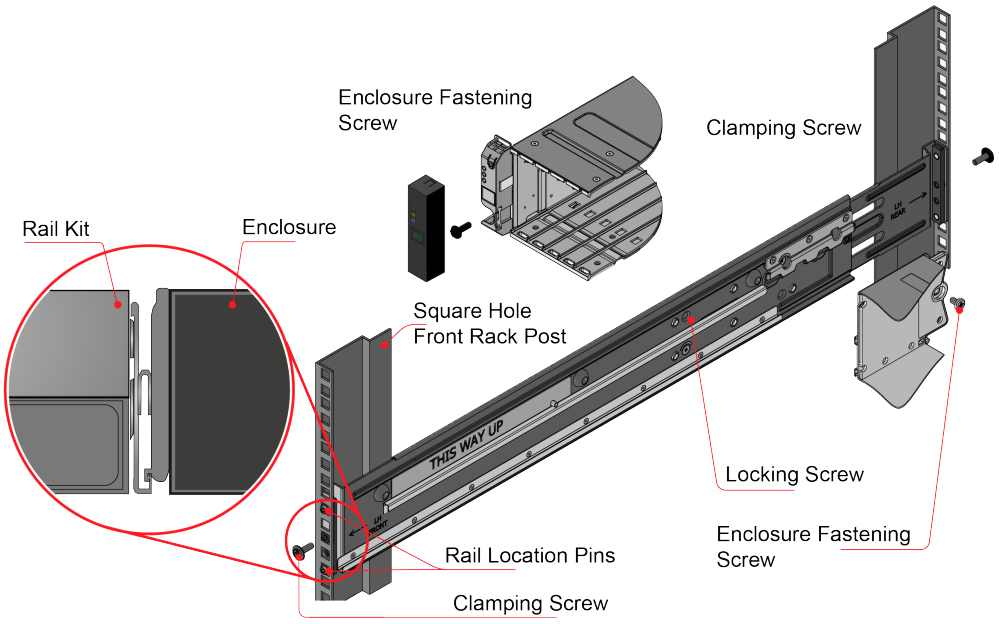


Figure 39. Securing Brackets to Rail

3. Install the enclosure into the rack as follows:
   a. Lift the enclosure and align it with the rack rails.
   b. Carefully insert the chassis slides into the rack rails.

      Note: Ensure that the groove is hooked with the chassis on both side as shown in the above figure.
   c. Push the chassis fully in.

d. Tighten the mounting screws in the rear rack bracket.

e. Secure the enclosure into the rack by installing one Phillips screw (provided) through each flange, left and right.

f. Install the flange caps by pressing them into position. They snap into place.

5U84 Enclosures

CAUTION:
An unpopulated enclosure can weigh up to 46 kg (101 lb). Do not try to lift it by yourself.

CAUTION:
There are three straps tight on the system delivery as shown in Figure 38 “Unpacking the 5U84 Enclosure System ” on page 36. Each strap can weigh up to 55 kg. Hold the straps evenly and lift the system out of the box with four persons.

CAUTION:
To avoid personal injury, dispose of the lifting straps once the enclosure is installed in the rack. Due to the weight and size of the enclosure, the lifting straps cannot be reused to remove the enclosure once it is installed in the rack.

Due to the weight of the enclosure, install it without DDIC installed. It is recommended that remove all modules in the back to reduce the weight.

The adjustment range of the rail kit, from the inside of the front post to the inside of the rear post is 660 mm - 840 mm. This suits a one metre deep rack within Rack Specification IEC 60297.

1. To facilitate access, remove the door from the rack.
2. Ensure that the pre-assembled rails are at their shortest length.
3. Locate the rail location pins inside the front of the rack and extend the length of the rail assembly to enable the rear location pins to locate. Ensure that the pins are fully located in the square or round holes in the rack posts (see Figure 40 “Mounting the System into a Rack (left-hand rail only shown for clarity)” on page 39).

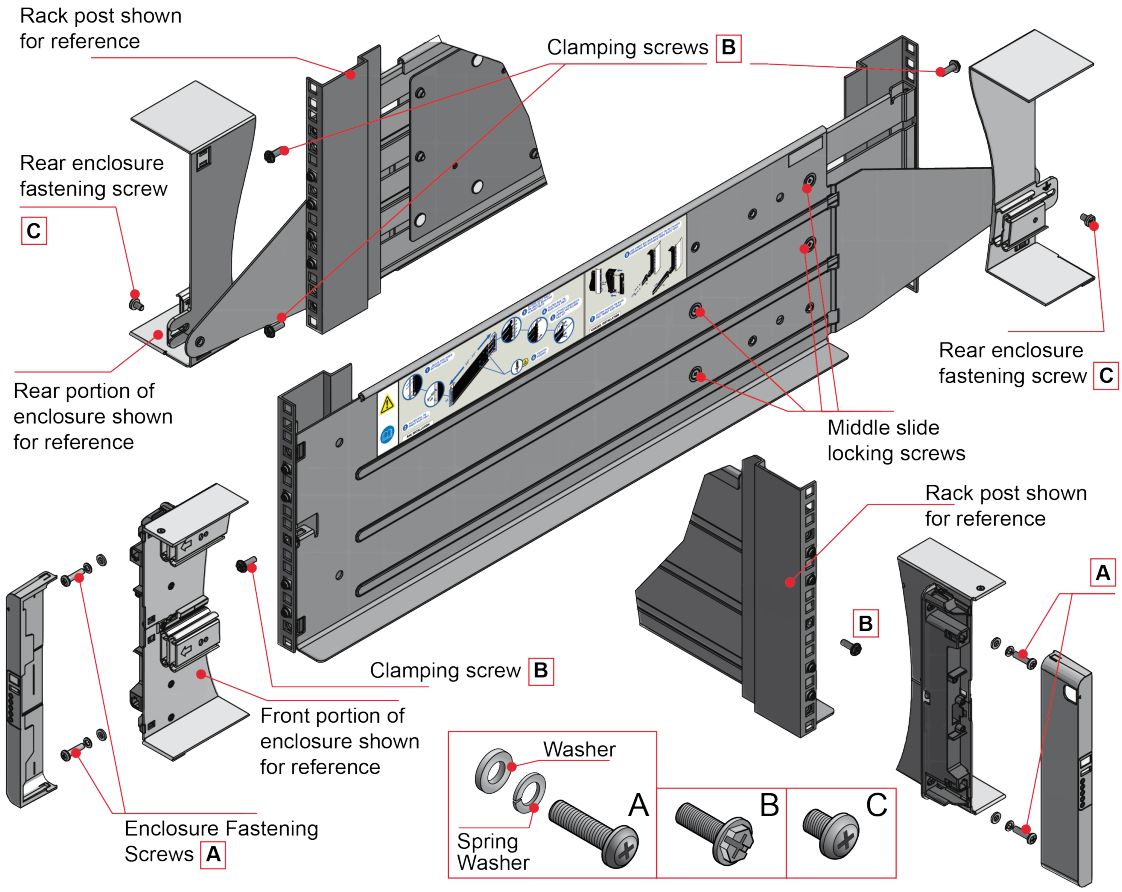


Figure 40. Mounting the System into a Rack (left-hand rail only shown for clarity)

4. Fully tighten all clamping screws and middle slide locking screws.
5. Ensure the rear spacer clips (x4) are fitted tight to the edge of the rack post.
6. Slide the enclosure fully home on its rails.
7. Fasten the front of the enclosure using the enclosure fastening screws (x4) as shown in Figure 40 “Mounting the System into a Rack (left-hand rail only shown for clarity)” on page 39.
8. Fix the rear of the enclosure to the hold down bracket with the rear enclosure fixing screws (x2).

Note: Use the long or short hold down bracket depending on the distance from the rack post to the enclosure hold down bay. Ensure that the sliding nut is at the rear of the bay prior to fitting the bracket to the post, then slide the nut along the bay to enable the rear enclosure fastening screw to be fitted.

Notes: For rack depths where the rack posts are behind the enclosure hold down bays:

1. Swap the left and right hold down brackets.
2. Insert the long flange between the rack post and chassis side (see Figure 41 “Rear Enclosure Mounting” on page 40).
3. The sliding nut head must always face away from the enclosure, whichever configuration is used.

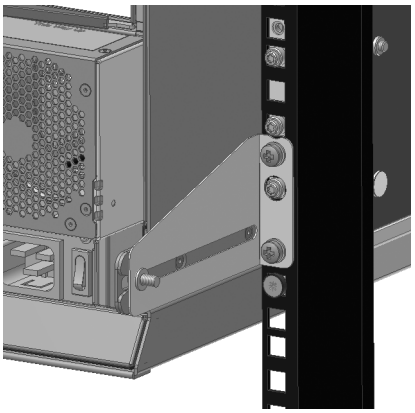


Figure 41. Rear Enclosure Mounting

CAUTION:
Use only the power cords supplied or cords that match the specification in section "AC Power Cords" on page 122.

Once the enclosure is installed in the rack, dispose of the lifting straps. Due to the difficulty in attaching the straps once the enclosure is installed in the rack, the straps are not suitable for removing the enclosure from the rack.

Module Installation

Enclosures are supplied with the midplane PCB and all plug-in modules installed. For information on removal and replacement of plug-in modules, refer to Chapter 6 "Module Removal and Replacement" on page 75.

Dummy Drive Carrier Modules

Note: 2U enclosures only.

To create a balanced airflow, all unused drive bays must hold dummy drive carrier modules.

Power Cord Connection

Connect the power cord(s) to the power distribution unit(s) (PDUs). For more information, refer to the following figures.

Important: When more than one PCM is fitted, all power cords must be connected to at least two separate and independent supplies to guarantee redundancy.

Important: When more than one PSU is fitted, connect each PSU to separate and independent supplies to guarantee redundancy.

Figure 42. Typical AC Power Cable Connections to PCMs

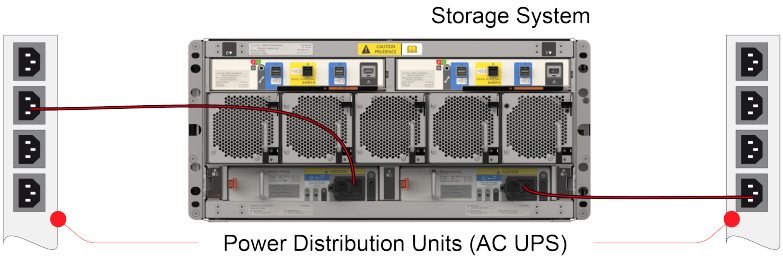


Figure 43. Typical AC Power Cable Connections to PSUs

CAUTION:
Always remove the power connections before you remove the PCM or PSU from the enclosure.

When bifurcated power cords ("Y" leads) are used, these cords must only be connected to a supply range of 200-240 VAC.

Grounding Checks

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

If more than one enclosure goes in a rack, the importance of the earth connection to the rack increases, because the rack has a larger "EARTH LEAKAGE CURRENT" ("TOUCH CURRENT").

Examine the earth connection to the rack before the switch-on: an electrical engineer who is qualified to the appropriate local and national standards must do the examination.

System Configurations

If you connect the enclosure to a host, ensure that you have the following items:

- SAS HBA
- MiniSAS HD to MiniSAS HD cable or MiniSAS HD to MiniSAS cable
- Power cord
- Rack kit

If you connect the enclosure to a Lenovo Storage DS-series as the expansion enclosure, ensure that you have the following items:

- Lenovo Storage DS-series
- MiniSAS HD to MiniSAS HD cable
- Power cord
- Rack kit

For Option Compatibility Matrix (OCM) for use with the enclosure, refer to http://support.lenovo.com.

System Cabling

Note: Configuration details in this section are for a typical enclosure.

Note: The maximum number of SAS devices depends on the number of HBA or RAID adapters in use or maximum SAS device supported for a single HBA or RAID adapter. For detailed information, refer to the HBA or RAID adapter specification and the Interoperability Matrix for the specific model Storage enclosure.

When you set up your enclosure, read the following rules:

- Only 12 Gb enclosures are allowed in a SAS chain.
- In a single SAS chain, the configuration of ESM, cooling unit, PCM, and PSU should be the same.
- Mixed types of enclosures are allowed in configuration.
- Set up enclosures by reverse cabling. For more information, refer to Figure 49 “Single host with two host adapters- Multiple 5U Enclosures” on page 45.
- The maximum configuration differs between different types of enclosures:
  - 2U enclosures only: supports up to a maximum of 8 enclosures or 192 drives.
  - 5U enclosures only: supports up to a maximum of 4 enclosures or 336 drives.
  - Mixed enclosures: supports up to a maximum of two 5U enclosures and two 2U12 enclosures, a maximum of two 5U enclosures and one 2U24 enclosures or a maximum of 192 drives.
- It is recommended to connect each cable to different adapter when there two or more adapters in the host, to prevent the adapter failure.

One of the basic configurations is multiple enclosures connected to single or dual host adapters shown as below.

Notes: When the cabling allows multiple hosts to access the same group of drives, read the following rules:

- One host can access the drives in the JBOD ESMs at any time. See Figure 44 “Single host with one host adapter- Multiple 2U Enclosures” on page 42 and Figure 45 “Single host with two host adapters- Multiple 2U Enclosures” on page 43.
- One or more RAID adapters in the host can access the drives in the JBOD ESMs. Clustering is not supported in this condition.
- One or more non-RAID adapter (HBA) in the host can access the drives in the JBOD ESMs. Clustering is supported in this condition. See Figure 45 “Single host with two host adapters- Multiple 2U Enclosures” on page 43.

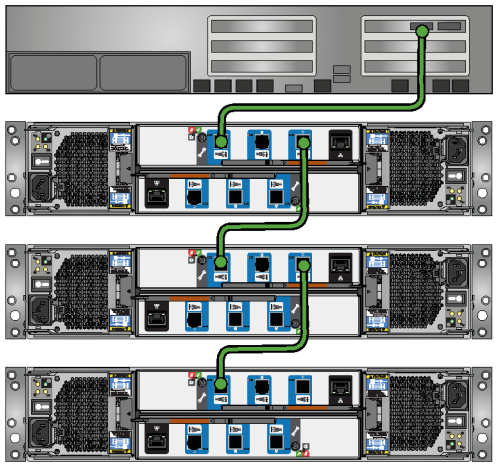


Figure 44. Single host with one host adapter- Multiple 2U Enclosures

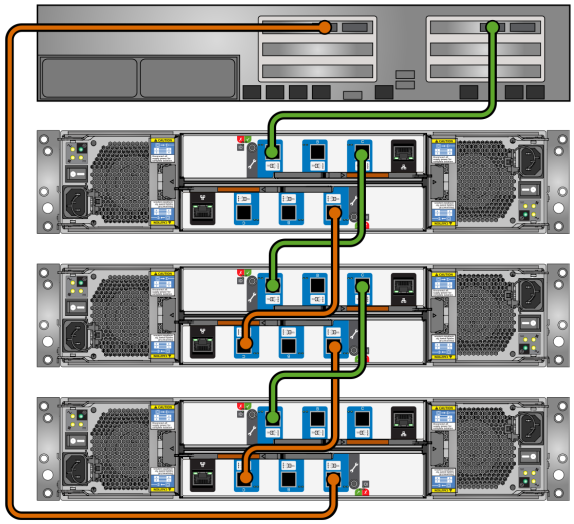


Figure 45. Single host with two host adapters- Multiple 2U Enclosures

Multiple enclosures may be connected together using SAS patch cables, up to a maximum of 192 SFF/96 LFF drives or 8 enclosures. An example configuration is shown as below.

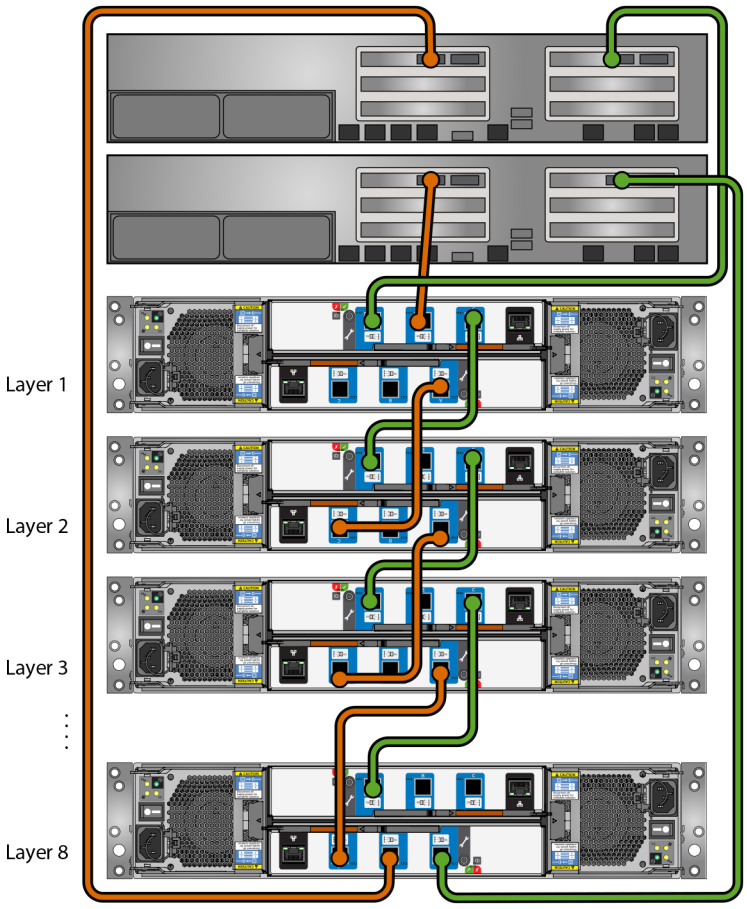


Figure 46. Dual Host – Multiple 12G 2U Enclosures

Multiple enclosures may be connected together using SAS Y-cables, up to a maximum of 192 SFF/96 LFF drives or 8 enclosures. An example configuration is shown as below.

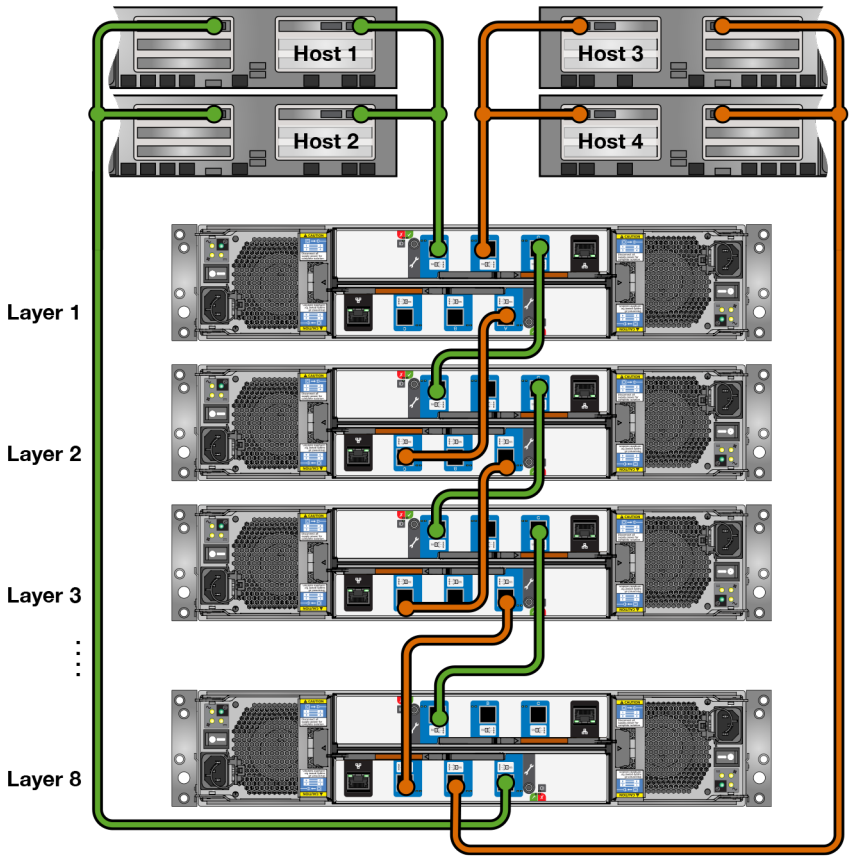


Figure 47. Multiple 12G Enclosures with Y-cable

One of the basic configurations is multiple enclosures connected to single or dual host adapters shown as below.

Notes: The SAS zoning profile in Storage D3284 firmware (version 5.0.0.17) is not supported and the following rules need to be considered:

- One host can access the drives in the JBOD ESMs at any time. See Figure 48 “Single host with one host adapter- Multiple 5U Enclosures” on page 45 and Figure 49 “Single host with two host adapters- Multiple 5U Enclosures” on page 45.
- One or more RAID adapters in the host can access the drives in the JBOD ESMs. Clustering is not supported in this condition.
- One or more non-RAID adapter (HBA) in the host can access the drives in the JBOD ESMs. Clustering is supported in this condition. See Figure 49 “Single host with two host adapters- Multiple 5U Enclosures” on page 45 and Figure 50 “Dual Host – Multiple 12G 5U Enclosures” on page 46.

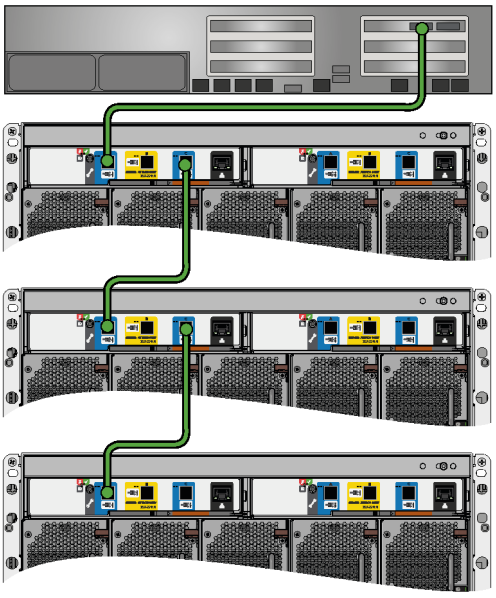


Figure 48. Single host with one host adapter- Multiple 5U Enclosures

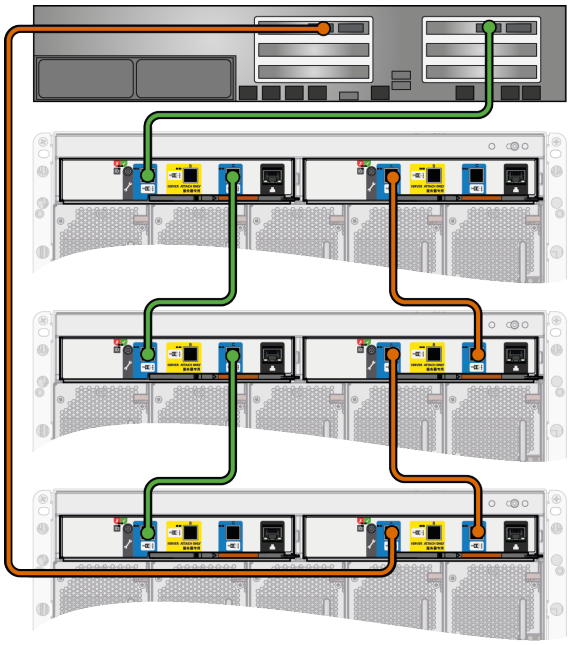


Figure 49. Single host with two host adapters- Multiple 5U Enclosures

Multiple enclosures may be connected together using SAS patch cables, up to a maximum of 336 DDICs or 4 enclosures. An example configuration is shown as below.

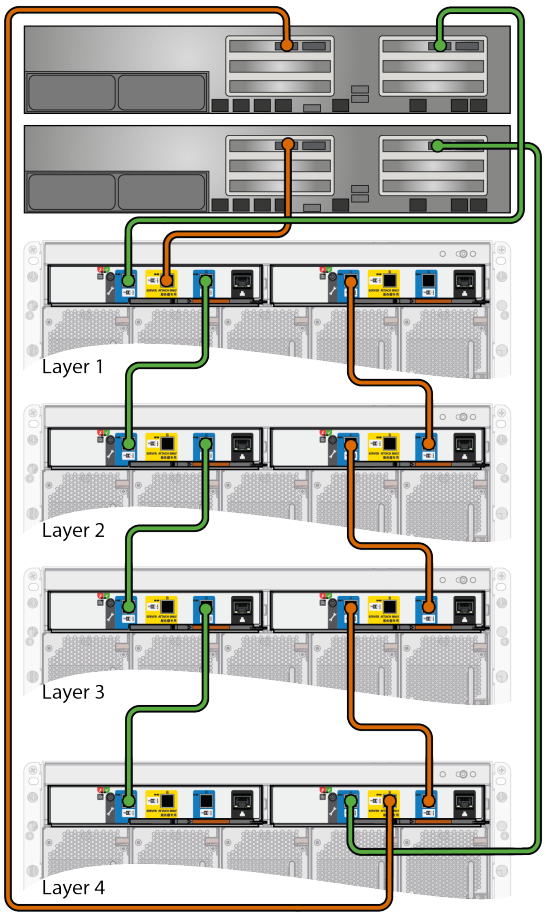


Figure 50. Dual Host – Multiple 12G 5U Enclosures

Multiple enclosures may be connected together using SAS patch cables, up to a maximum of two 5U enclosures and two 2U12 enclosures, a maximum of two 5U enclosures and one 2U24 enclosures or a maximum of 192 drives. An example configuration is shown as below.

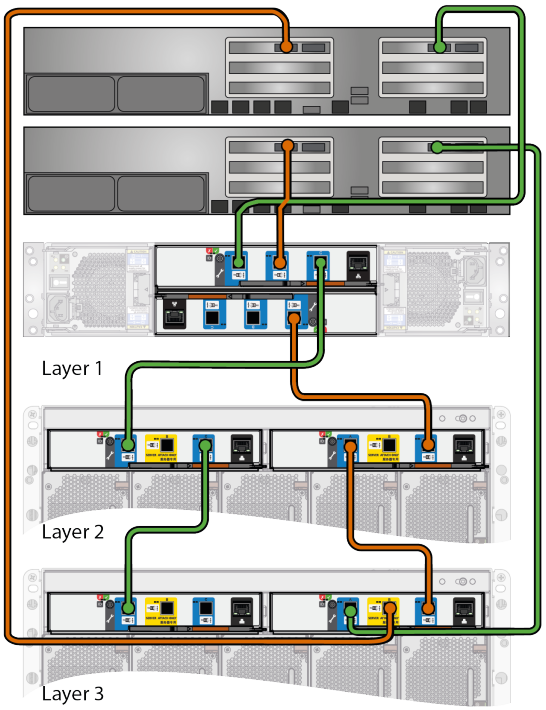


Figure 51. Dual Host – Mixed 12G 2U and 5U Enclosures

Note: When two servers are connected, the dual host must be supported by application.

Multiple enclosures may be connected together using SAS patch cables, up to a maximum of two 5U enclosures and two 2U12 enclosures, a maximum of two 5U enclosures and one 2U24 enclosures or a maximum of 192 drives. An example configuration is shown as below.

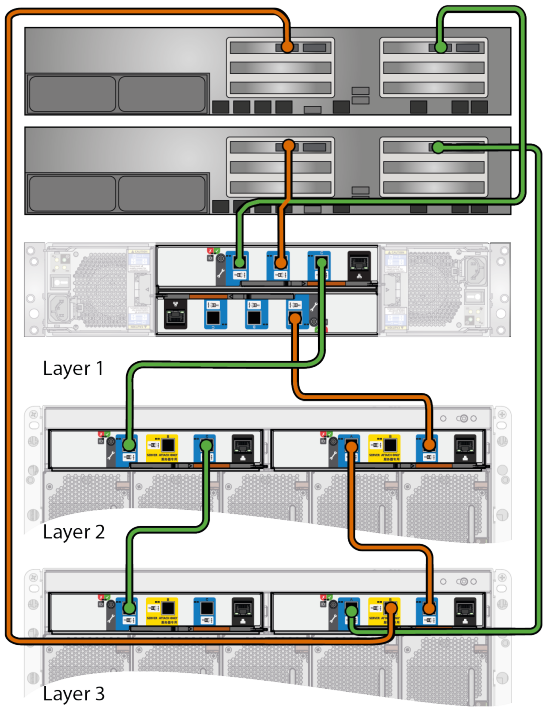


Figure 52. Dual Host – Mixed 12G 2U and 5U Enclosures

Note: When two servers are connected, the dual host must be supported by application.

Multiple enclosures may be connected together using SAS patch cables, up to a maximum of two 5U enclosures and two 2U12 enclosures, a maximum of two 5U enclosures and one 2U24 enclosures or a maximum of 192 drives. An example configuration is shown as below.

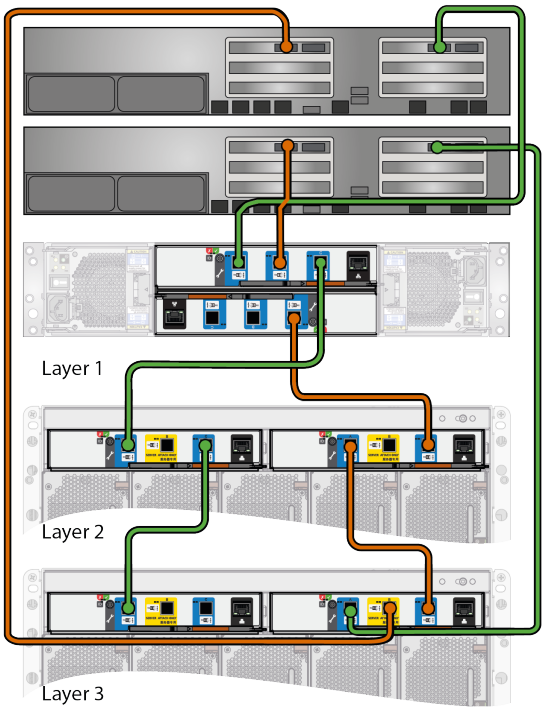


Figure 53. Dual Host – Mixed 12G 2U and 5U Enclosures

Note: When two servers are connected, the dual host must be supported by application.

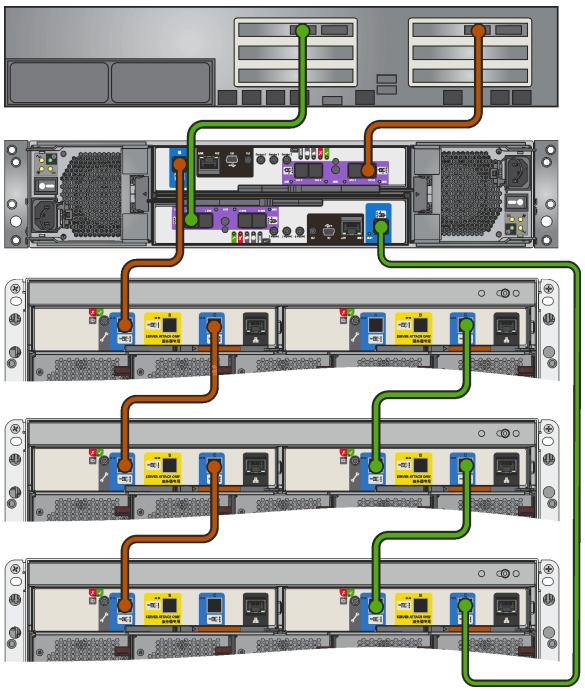


Figure 54. Single host – multiple 5U enclosure as expansion enclosures for Storage DS-series

Adding new enclosures

This section provides the instructions to add new enclosures to a existing enclosures.

Note: Before adding new enclosures, ensure that the multi-path communication is enabled on your host to avoid the I/O disconnection.

To add the new enclosures, do the following:

1. Go to https://datacentersupport.lenovo.com/, and then download and install the LSA or StorCLI utility for storage management.
2. Save the existing RAID configuration (if any).
3. Backup all user data in case of any failure (if any).
4. Shutdown and power off the server (optional).
5. Power off all the enclosures (optional).
6. Add new enclosures to the SAS chain. For the cabling of adding new enclosures, see “For single host with one adapter” on page 50 and “For single host with two adapters” on page 51.
7. Power on all the enclosures.
8. Power on the server (if applicable).
9. Check all drives and enclosures are discovered by using LSA or StorCLI.
10. Go to https://datacentersupport.lenovo.com/, and then download and run the latest firmware update package for your D-series enclosures. Ensure that the firmware levels on all the enclosures are consistency.

For single host with one adapter

Note: The color of the cable in the following figures is for indication only, and the physical color of the cable is black.

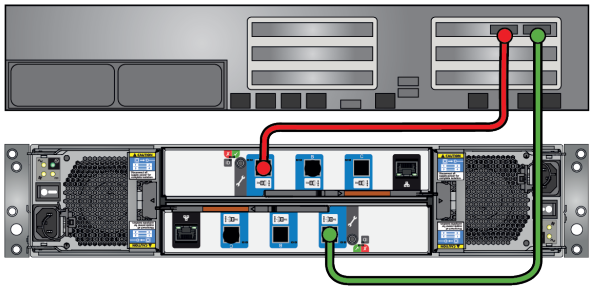


Figure 55. Single enclosure cabling for single host with one adapter

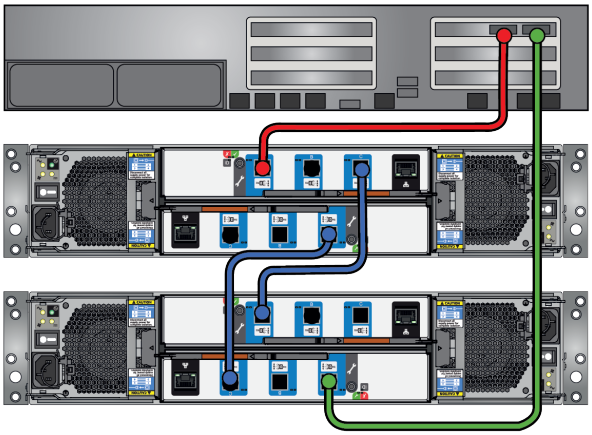


Figure 56. Two enclosures cabling for single host with one adapter

To add new enclosures with dual paths to the host with one adapter, do the following:

1. Keep the red cable connected (which will preserve the action paths from the adapter to the existing enclosure, no I/O missing to the drives). Move the green cable to the ESM 1 port A in the new enclosure.

   Note: If more than one enclosure is added, move the green cable to ESM 1 port A in the last adding enclosure.

2. Connect two blue cables:
   - from ESM 0 port C in the existing enclosure to the ESM 0 port A in the new enclosure.
   - from ESM 1 port A in the existing enclosure to the ESM 1 port C in the new enclosure.
3. If more than one enclosure is added, repeat step 2 for all the adding enclosures.

To add a new enclosure with single path to the host with one adapter, you only need to connect the cable between ESM 0 port C of the existing enclosure and the ESM 0 port A of the new enclosure.

For single host with two adapters

Note: The color of the cable in the following figures is for indication only, and the physical color of the cable is black.

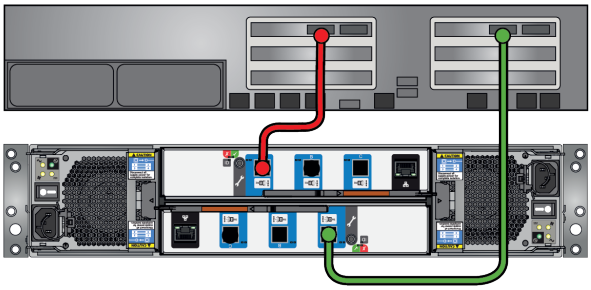


Figure 57. Single enclosure cabling for single host with two adapters

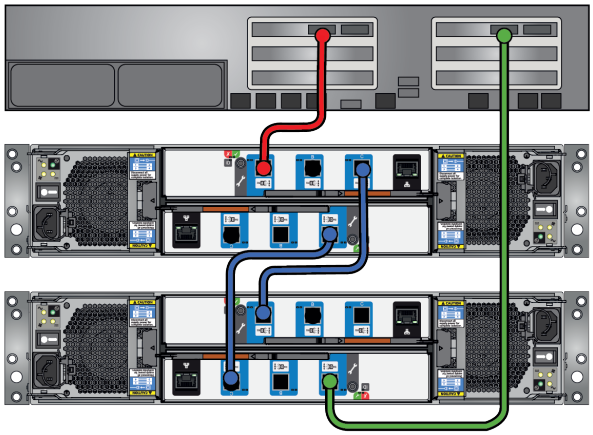


Figure 58. Two enclosures cabling for single host with two adapters

To add new enclosures with dual paths to the host with two adapters, do the following:

1. Keep the red cable connected. Move the green cable to the ESM 1 port A in the new enclosure.

   Note: If more than one enclosure is added, move the green cable to ESM 1 port A in the last adding enclosure.

2. Connect two blue cables:
   - from ESM 0 port C in the existing enclosure to the ESM 0 port A in the new enclosure.
   - from ESM 1 port A in the existing enclosure to the ESM 1 port C in the new enclosure.
3. If more than one enclosure is added, repeat step 2 for all the adding enclosures.

Chapter 4. Operation

This chapter contains the following items:

Note: Before you power up the enclosure make sure that all the modules are firmly seated in their correct bays.

Power On

CAUTION:
Do not operate the enclosure system until the ambient temperature is within the specified operating range (see “Environment” on page 117). If the drives have been recently installed, make sure that they have had time to adjust to the environmental conditions before they operate.

1. Power on the system by connecting the power cables to the PCM or to the PSU switch to the "on" position for 5U enclosure.
2. The system power LED on the Ops panel should be lit green when the enclosure power is activated (and the disk drive motors should start).

Important: If mains power is lost for any reason, on restoration of power the system re-starts automatically.

Notes:

- For details of the Ops panel LEDs for 2U enclosures and related fault conditions, refer to “Operator’s (Ops) Panel (2U Enclosures)” on page 17.
- For details of the Ops panel LEDs for 5U enclosures and related fault conditions, refer to “Operator’s (Ops) Panel (5U Enclosures)” on page 19.
- For details of the disk drive LEDs for 2U enclosures, refer to “Disk Drive LEDs (2U Enclosures)” on page 20.
- For details of the disk drive LEDs for 5U enclosures, refer to “Disk Drive LEDs (5U Enclosures)” on page 21.

Unit Identification Number

The Unit Identification Display is a dual seven segment display that can be used to provide feedback to the user. Its primary usage is to display an Enclosure Unit Identification Number to assist users in setting up and maintaining multiple enclosure systems.

The Unit Identification Number is permanently stored in the enclosure VPD.

The Unit Identification Display has the electrical capability of driving all seven of the segments, plus the dot/decimal point in each character of the display.

How To Set the Unit Identification Number

Note: 5U enclosures only.

The unit identification number is not set before the first system power on. The display is set to “00” (flashing). The enclosure continues to power up even if the unit identification number is not set.

To set the unit identification number:

1. Press and hold the Input switch on the ops panel for a period of five seconds. The left-hand digit flashes.
2. Press and release the Input switch to increment the number until the required digit is reached.
3. Press and hold the Input switch for a period of five seconds. The right-hand digit flashes.
4. Press and release the Input switch to increment the number until the required digit is reached.
5. Press and hold the Input switch for a period of five seconds to finish setting the number. Values of "01" to "99" are valid.

Once a unit identification number is set, it is stored in the midplane VPD by the Enclosure Management software and will appear when the enclosure is next powered on. In a situation where the VPD cannot be read, or where there is no enclosure management (no ESMs, or a single module with management failure) the enclosure will display "00".

Software/SES

The Enclosure Unit Identification Number may be read and set through CLI and SES.

For both 2U and 5U enclosures, Unit Identification Number can set up. For detailed information, refer to “set_encl_id” on page 112.

Power Down

To power the enclosure system down, switch off the PCMs or PSUs. Installed in the enclosure by removing power cords on PCMs or moving the PSU switch to the "Off" position. For PCM, see “Power Cooling Modules (PCM)” on page 21. For PSU, see “Power Supply Unit (PSU)” on page 22.

Chapter 5. Troubleshooting and Problem Solving

The enclosure system includes a Storage Enclosure Processor (SEP) and associated monitoring and control logic to enable it to diagnose problems within the enclosure's power, cooling and drive systems.

This chapter contains the following items:

Initial Start-Up Problems

Faulty Cords

First check that you have wired up the enclosure system correctly. Contact Lenovo service or representative for replacements if:

- Cords are missing or damaged.
- Plugs are incorrect.
- Cords are too short.

Computer Does Not Recognize Enclosure System

1. Check that the interface cables from the enclosure to the host computer are fitted correctly.
2. Check that the LEDs on all installed drive carrier modules are on (green).
3. Check that drive assemblies modules have been correctly installed.
4. Check any visible SAS indicators (JBOD and/or server adapters).
5. Check server adapter setup utilities for SAS target visibility.
6. Verify that the operating system driver has been installed correctly.

LEDs

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

- Green - good or positive indication.
- Flashing green/amber - non-critical condition.
- Amber - critical fault.

580W PCM LEDs

Note: 2U enclosures only.

Under normal conditions the PCM OK LEDs (refer to the following figure) are constant green.

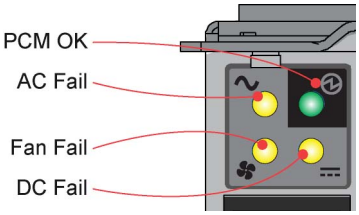


Figure 59. 580W PCM LEDs

When a fault occurs, the colors of the LEDs are as shown in Table 11 “PCM LED States” on page 56.

Table 11. PCM LED States

PCM OK (Green)	Fan Fail (Amber)	AC Fail (Amber)	DC Fail (Amber)	Status
Off	Off	Off	Off	No AC on any PCM
Off	Off	On	On	No AC on this PCM only
On	Off	Off	Off	AC present; PCM working correctly
On	Off	Off	On	PCM fan speed is outside acceptable limits
Off	On	Off	Off	PCM fan has failed
Off	On	On	On	PCM fault (over temperature, over voltage, over current)
Flashing	Off	Off	Off	Standby mode
Off	Flashing	Flashing	Flashing	PCM firmware download in progress

Drive Carrier Module LEDs

Note: 2U enclosures only.

Disk drive status is monitored by a green LED and an amber LED mounted on the front of each drive carrier module, shown in Figure 60 “3.5" Drive Carrier LEDs ” on page 56 and Figure 61 “2.5" Drive Carrier LEDs ” on page 57. The LED conditions are defined in Table 12 “Drive LED States ” on page 57.

- In normal operation the green LED is on and flickers as the drive operates.
- In normal operation the amber LED state is:
  - Off if there is no drive present.
  - Off as the drive operates.
  - On if there is a drive fault.

Figure 60. 3.5" Drive Carrier LEDs

Figure 61. 2.5" Drive Carrier LEDs

Table 12. Drive LED States

Green Drive LED	Amber Drive LED	Status
Off	Off	No drive installed
On/Flashing	Off	Drive installed and operational
On	Flashing: 1 second on / 1 second off	SES device identity set
On	On	SES device fault bit set
Off	On	Power control circuit failure
On	Flashing: 1 second on / 1 second off	RAID array status The events in which the RAID controller can set this notification are: • Array rebuild in progress • Array consistency check • Do not remove device • Disk in failed Array • Aborted array rebuild

Operator's Panel LEDs (2U Enclosures)

The Ops panel ("Operator's (Ops) Panel (2U Enclosures)" on page 17) displays the aggregated status of all the modules. The Ops panel LEDs are defined in the following table.

Table 13. Ops Panel LED States

System Power (Green/Amber)	Module Fault (Amber)	Location (Blue) (not used)	LED Dis-play	Associated LEDs/ Alarms	Status
On	Off	X			5V standby power present, overall power failed or switched off
On	On	X	On		Ops panel power on (blinks 3 times), test state

Table 13. Ops Panel LED States (continued)

System Power (Green/Amber)	Module Fault (Amber)	Location (Blue) (not used)	LED Dis-play	Associated LEDs/ Alarms	Status
On	Off	X			Power on, all functions good
On	On	X		PCM fault LEDs, fan fault LEDs	Any PCM fault, fan fault, over or under temperature
On	On	X		SBB module LEDs	Any SBB module fault
On	On	X		No module LEDs	Enclosure logical fault
On	Flash	X		Module status LED on SBB module	Unknown (invalid or mixed) SBB module type installed, I2C bus failure (inter-SBB communications), JBOD VPD configuration error
On	Flash	X		PCM fault LEDs, fan fault LEDs	Unknown (invalid or mixed) PCM type installed or I2C bus failure (PCM comms)
On		X		Array in failed or degraded state	Drive failure has occurred causing loss of availability or redundancy
On		X		Array in impacted state	Arrays operating background function
On	Flash	X		SES state S1	Enclosure ID setting different from "start of day" setting
		X	Flash		Enclosure identification or invalid ID selected

Operator's Panel LEDs (5U Enclosures)

The operator's (ops) panel (see Figure 62 "Ops Panel LEDs " on page 59) displays the aggregated status of all the modules.

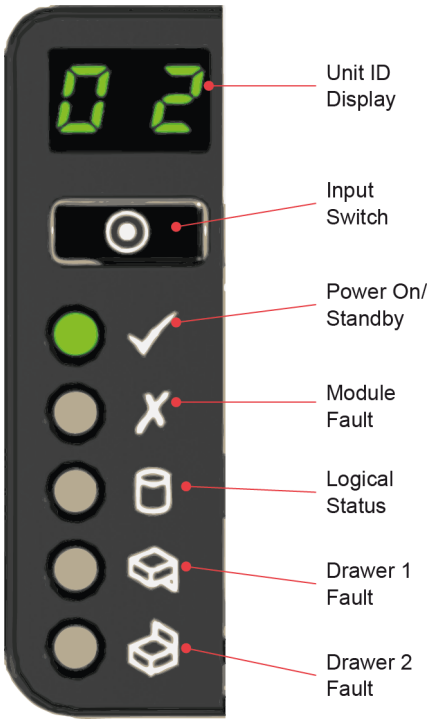


Figure 62. Ops Panel LEDs

Table 14. Ops Panel LED Descriptions

Display/LED	Description
Unit Identification Display	Usually shows the identification number for the enclosure, but can be used for other purposes.
Power On/Standby LED	Amber if the system is in standby. Green if the system has full power.
Module Fault LED	Amber indicates a fault in a PSU, cooling module or ESM. Check the drawer LEDs to see if a drive fault is indicated (see “Drawer LEDs” on page 61).
Logical Status LED	Amber indicates a fault from something other than GEM (usually a disk drive fault, or an HBA, or an internal or external RAID controller). Check the drawer LEDs to see if a drive fault is indicated (see “Drawer LEDs” on page 61).
Drawer 1 Fault LED	Amber if there is a drive, cable or sideplane fault in drawer 1. Open the drawer and check the disk drive LEDs for faults.
Drawer 2 Fault LED	Amber if there is a drive, cable or sideplane fault in drawer 2. Open the drawer and check the disk drive LEDs for faults

PSU LEDs

Note: 5U Enclosures only.

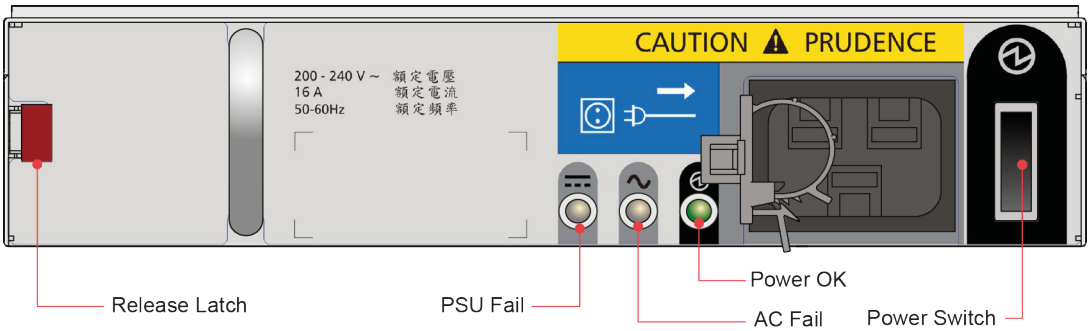


Figure 63. PSU LEDs

Table 15. PSU LED States

PSU Fail (Amber)	AC Missing (Amber)	Power (Green)	Status
Off	Off	Off	No AC power to either PSU.
On	On	Off	PSU present, but not supplying power *or* PSU alert state (usually due to critical temperature).
Off	Off	On	Mains AC present, switch on. This PSU is providing power.
Off	Off	Flashing	AC power present, PSU in standby (other PSU is providing power).
Flashing	Flashing	Off	PSU firmware download.
Off	On	Off	AC power missing, PSU in standby (other PSU is providing power).
On	On	On	GEM software has lost communication with the PSU.
On	–	Off	PSU has failed. Follow the procedure in "Removing a PSU" on page 91.

Cooling Module LEDs

Note: 5U enclosures only.

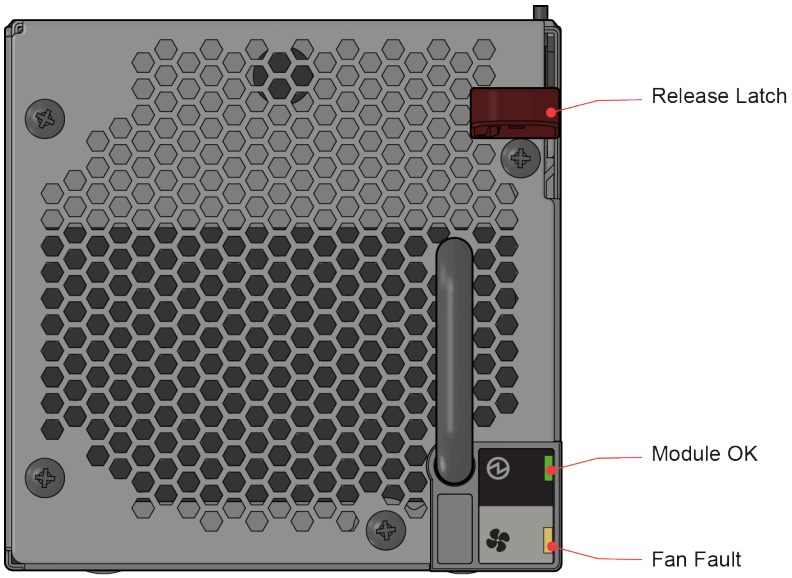


Figure 64. Cooling Module LEDs

Table 16. Cooling Module LED Descriptions

LED	Description
Module OK	Constant green indicates that the fan is working correctly. Off means the fan has failed. Follow the procedure in “Replacing a Cooling Module” on page 89.
Fan Fault	Amber indicates that a fan has failed. Follow the procedure in “Replacing a Cooling Module” on page 89.

Drawer LEDs

Note: 5U enclosures only.

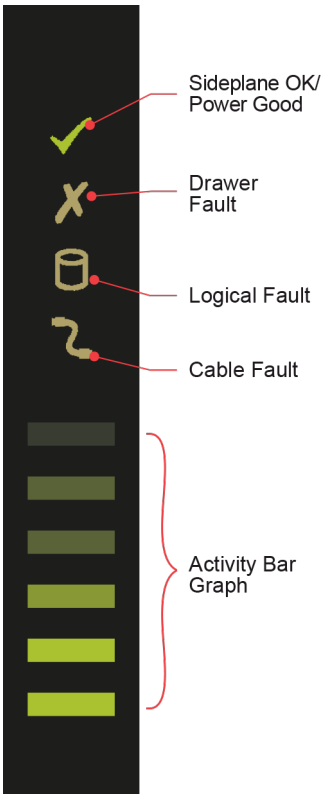


Figure 65. Drawer LEDs

Table 17. Drawer LED Descriptions

LED	Description
Sideplane OK/Power Good	Green if the sideplane card is working and there are no power problems.
Drawer Fault	Amber if a drawer component has failed. If it is a drive that has failed, an amber LED will be lit on the failed drive and you should follow the procedure in "Replacing a Disk Drive in Carrier (DDIC)" on page 86, to replace the drive. If the drives are OK, contact your storage supplier to identify the failure.
Logical Fault	Amber if there is a drive fault. Flashes amber if one or more arrays are in an impacted state.
Cable Fault	Amber if the cabling between the drawer and the back of the enclosure has failed. Contact your storage supplier to resolve the problem.
Activity Bar Graph	Shows the amount of data I/O from zero segments lit (no I/O) to all six segments lit (maximum I/O).

Disk Drive in Carrier (DDIC) LED

Note: 5U enclosures only.

Each disk drive has a single amber drive fault LED as shown in Figure 66 "Drive Fault LED" on page 63. When lit, this indicates a drive failure – the drive should be replaced as soon as possible using the procedure described in "Replacing a Disk Drive in Carrier (DDIC)" on page 86.

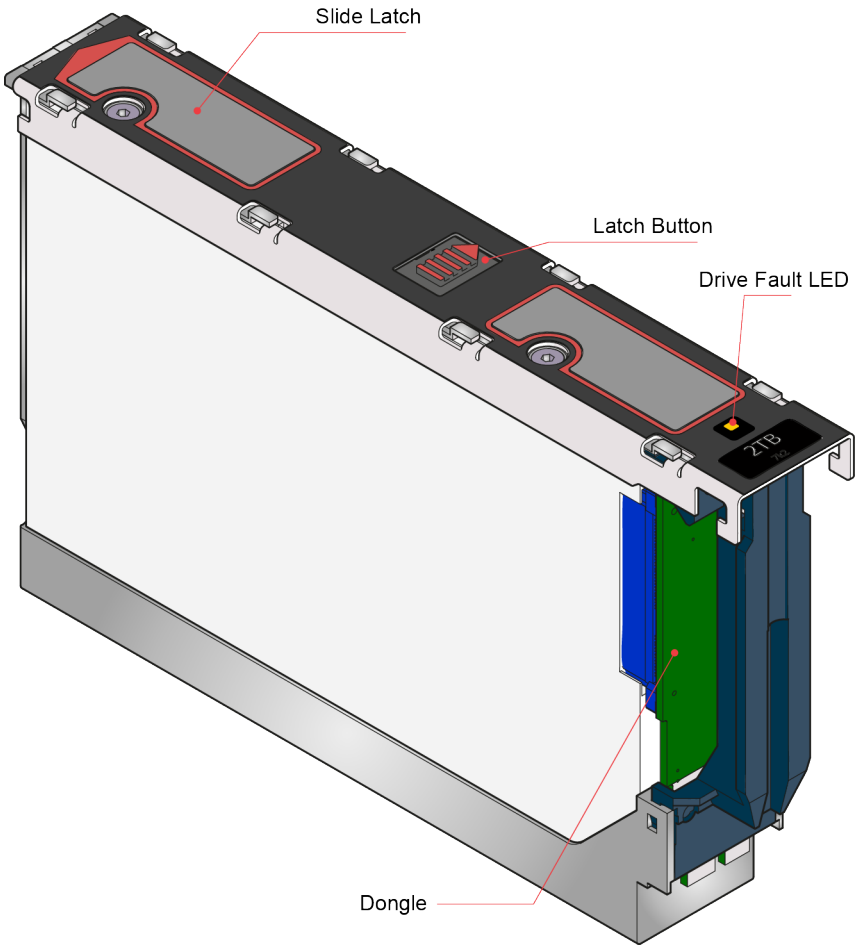


Figure 66. Drive Fault LED

ESM LEDs

ESM LED are shown as below.

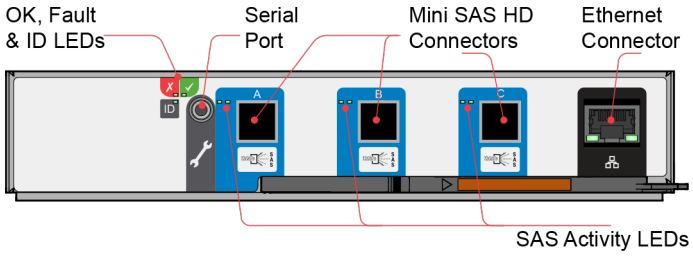


Figure 67. 12Gb/s SAS JBOD Module Connectors and Indicators (2U enclosures) (viewed from rear of enclosure)

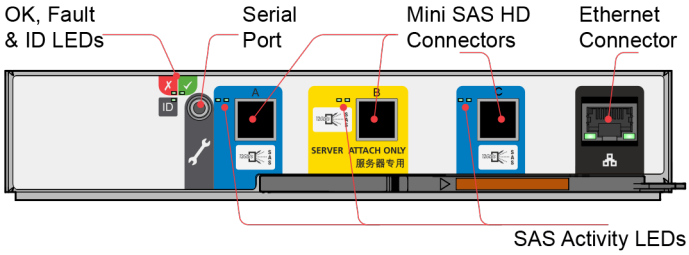


Figure 68. 12Gb/s SAS JBOD Module Connectors and Indicators (5U enclosures) (viewed from rear of enclosure)

For the detailed information of ESM LEDs status, refer to the following table.

Table 18. ESM LED Status

ESM OK (Green)	ESM Fault (Amber)	External Host Port Activity (Green)	Status
On	Off		ESM OK
Off	On		ESM fault. For replacement procedure see “Replacing ESMs” on page 92.
		Off	No external host port connection
		On	External host port connection - no activity
		Flashing	External host port connection - activity
Flashing			ESM VPD error

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.

Troubleshooting (2U Enclosures)

The following sections describe common problems which can occur with your enclosure system and some possible solutions. For all of the problems listed in Table 19 “Alarm Conditions ” on page 64, the module fault LED on the Ops panel (Figure 24 “580W PCM LEDs ” on page 22) will light amber to indicate a fault.

Table 19. Alarm Conditions

Status	Severity	OPs Panel LED
PCM alert - loss of DC power from a single PCM	Fault - no loss of redundancy	Module Fault
PCM alert - loss of DC power from a single PCM	Fault - loss of redundancy	Module Fault
PCM fan fall	Fault - loss of redundancy	Module Fault
ESM detected PCM fault	Fault	Module Fault
PCM removed	Configuration error	Module Fault

Table 19. Alarm Conditions (continued)

Status	Severity	OPs Panel LED
Enclosure configuration error (VPD)	Fault - critical	Module Fault
Low warning temperature alert	Warning	Module Fault
High warning temperature alert	Warning	Module Fault
Over-temperature alarm	Fault - critical	Module Fault
I^2C bus failure	Fault - loss of redundancy	Module Fault
Ops panel communication error (I^2C)	Critical fault	Module Fault
RAID error	Fault - critical	Module Fault
SBB interface module fault- no functionning modules remaining	Fault - critical	Module Fault
SBB interface module removed	Warning	Module Fault
Drive power control fault	Warning - no loss of drive power	Module Fault
Drive power control fault	Fault - critical - loss of drive power	Module Fault
Drive removed	Warining	Module Fault
Insufficient power available	Warning	Module Fault

For details on how to remove and replace a module see Chapter 6 “Module Removal and Replacement” on page 75.

Power Cooling Module Faults

Symptom	Cause	Action
Ops panel module fault LED amber	Any power fault.	Check that AC mains connections to PCM are live.
Fan fail LED is illuminated on PCM	A fan failure	Replace PCM.

Thermal Monitoring and Control

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

Symptom	Cause	Action
If the ambient air is below 25 °C 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 drives and power supplies fitted.	1. Check the installation for any airflow restrictions at either the front or rear of the enclosure. A minimum gap of 25 mm at the front and 50 mm at the rear is recommended. 2. Check for restrictions due to dust buildup. Clean as appropriate. 3. Check for excessive recirculation of heated air from rear to the front. Use of the enclosure in a fully enclosed rack is not recommended. 4. Check that all blank modules are in place. 5. Reduce the ambient temperature.

Thermal Alarm

Symptom	Cause	Action
1. Ops panel module fault LED is amber. 2. Fan fail LED is lit on one or more PCMs.	The internal temperature has exceeded a pre-set threshold.	1. Check that the local ambient environment temperature is below the specification (see “Environment” on page 117). 2. Check the installation for any airflow restrictions at either the front or rear of the enclosure. A minimum gap of 25 mm at the front and 50 mm at the rear is recommended. 3. Check for restrictions due to dust buildup. Clean as appropriate. 4. Check for excessive recirculation of heated air from rear to the 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.

Troubleshooting (5U Enclosures)

The following sections describe common problems which can occur with your enclosure system and some possible solutions. For all of the problems listed in Table 20 “Alarm Conditions ” on page 66, the module fault LED on the Ops panel (Figure 26 “PSU LEDs” on page 23) will light amber to indicate a fault. All alarms will also report via SES.

Table 20. Alarm Conditions

Status	Severity
PSU alert – loss of DC power from a single PSU	Fault – loss of redundancy
Cooling module fan failure	Fault – loss of redundancy
ESM detected PSU fault	Fault
PSU removed	Configuration error
Enclosure configuration error (VPD)	Fault – critical
Low warning temperature alert	Warning
High warning temperature alert	Warning

Table 20. Alarm Conditions (continued)

Status	Severity
Over-temperature alarm	Fault – critical
Under-temperature alarm	Fault – critical
I^2C bus failure	Fault – loss of redundancy
Ops panel communication error (I^2C)	Fault – critical
RAID error	Fault – critical
ESM fault	Fault – critical
ESM removed	Warning
Drive power control fault	Warning – no loss of drive power
Drive power control fault	Fault – critical: loss of drive power
Insufficient power available	Warning

For details on how to remove and replace a module see Chapter 6 “Module Removal and Replacement” on page 75.

Thermal Monitoring and Control

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

Symptom	Cause	Action
If the ambient air is below 25 °C 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 drives and power supplies fitted.	1. Check the installation for any airflow restrictions at either the front or rear of the enclosure. A minimum gap of 25 mm at the front and 50 mm at the rear is recommended. 2. Check for restrictions due to dust buildup. Clean as appropriate. 3. Check for excessive recirculation of heated air from rear to the front. Use of the enclosure in a fully enclosed rack is not recommended. 4. Check that all blank modules are in place. 5. Reduce the ambient temperature.

Thermal Alarm

Symptom	Cause	Action
1. Ops panel module fault LED is amber.	The internal temperature has exceeded a pre-set threshold.	1. Check that the local ambient environment temperature is below the specification (see "Environment" on page 117). 2. Check the installation for any airflow restrictions at either the front or rear of the enclosure. A minimum gap of 25 mm at the front and 50 mm at the rear is recommended. 3. Check for restrictions due to dust buildup. Clean as appropriate. 4. Check for excessive recirculation of heated air from rear to the 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.

Dealing with Hardware Faults

Ensure that you have obtained a replacement module of the same type before removing any faulty module.

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 can overheat, causing power failure and data loss. Such action will invalidate the warranty.

Important: Observe all conventional ESD precautions when handling modules and components. Avoid contact with midplane components and module connectors, etc.

Continuous Operation During Replacement

Your hardware or software enclosure management application determines the capability of replacing a failed disk without loss of access to any file system on the enclosure. Enclosure access and use during this period is uninterrupted when appropriate I/O or management connectivity set up prior.

If an enclosure contains two or more PCMs or PSUs, they can maintain power to the system while a faulty PCM or a faulty PSU is replaced.

Firmware Updates

Periodically, firmware updates to ESMs, PCMs, PSUs, FANs and midplanes may be necessary. This is accomplished through a combined update software package.

PCM or PSU Firmware Programming Failure

If a PCM's or PSU's firmware is being programmed and the download fails, the PCM fans or PSU fans go to full speed and the PCM LEDs or PSU LEDs flash.

Important: In this situation (where PCM or PSU programming has failed) the PCM or PSU can be reprogrammed but it must not be moved between bays. If the PCM or PSU is moved, it must be returned to the original bay before reprogramming can occur.

DDIC Pop-up Troubleshooting

If a DDIC pops up, the top drawer cannot be fully opened or closed. To solve the problem, perform the corresponding procedure based on the symptom listed in the following table.

Note: You can still fully open or close the bottom drawer even though a DDIC pops up.

Symptom	Cause	Action
The top drawer opens no more than 50 mm (1.97 inches) and stops.	A DDIC pops up in the front row of the top drawer.	Procedure A
The top drawer opens no more than the front row of the DDIC and stops.	A DDIC pops up in the middle row of the top drawer.	
The top drawer opens no more than the middle row of the DDIC and stops.	A DDIC pops up in the back row of the top drawer.	
The top drawer only closes about 50 mm (1.97 inches) and stops.	A DDIC pops up in the front row of the bottom drawer.	Procedure B
The top drawer only closes at the front row of the DDIC and then stops.	A DDIC pops up in the middle row of the bottom drawer.	
The top drawer only closes at the middle row of the DDIC and then stops.	A DDIC pops up in the back row of the bottom drawer.	

Procedure A

Tools required:

- A metal or plastic strip with a maximum thickness of 1.6 mm (0.06 inches), such as a 300 mm (11.8 inches) steel or plastic ruler

To fully open the top drawer, do the following:

1. Turn off the system and then disconnect the power cord from the electrical outlet.
2. Open the top drawer as most as you can; then, push it inward about 25 mm (0.98 inches). For instructions on opening the top drawer, see “Opening a Drawer ” on page 84.

3. Insert a metal or plastic strip between the chassis lid and the top drawer in a length of 50-60 mm (1.97-2.36 inches). Then, move the strip from left to right until the pop-up DDIC is detected.

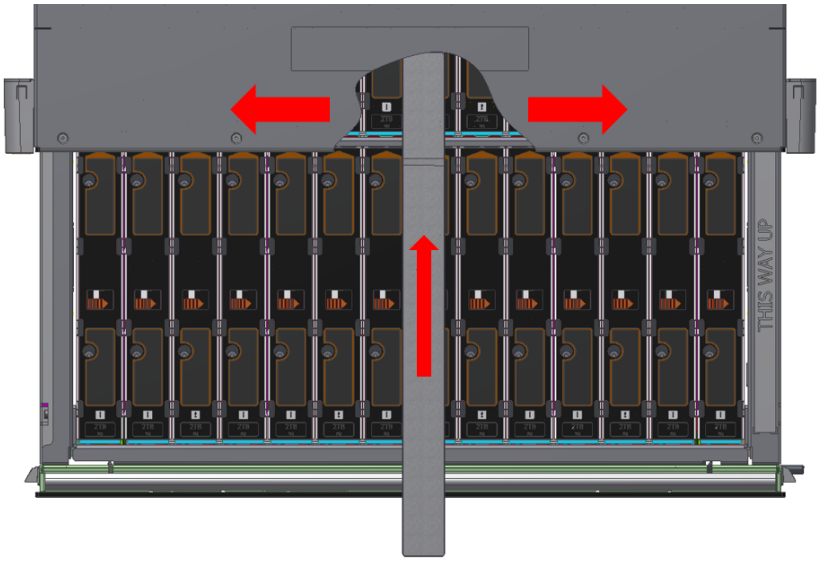


Figure 69. Inserting and moving the strip

Note: After the pop-up DDIC is detected, keep the strip contacting with the side of the pop-up DDIC at an angle of about 30 degrees.

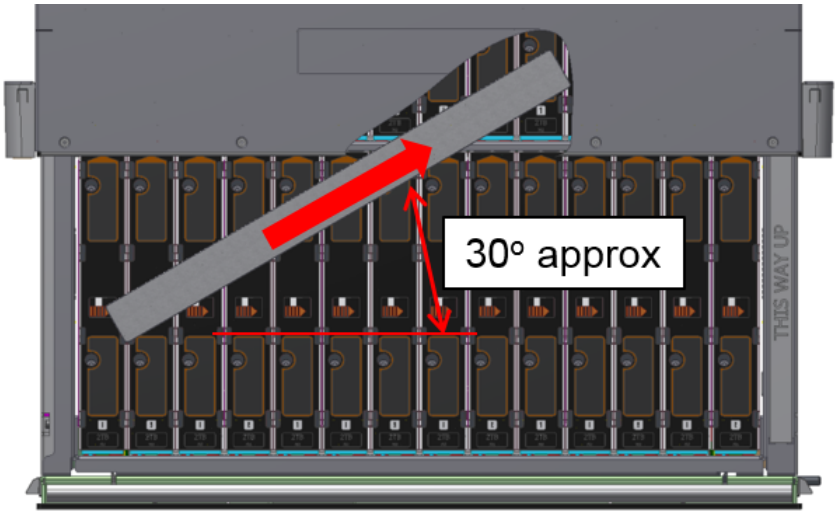


Figure 70. Keeping the strip contacting with the pop-up DDIC

4. Move and place the strip between the chassis lid and the pop-up DDIC. Then, rotate the strip directly on the top of the pop-up DDIC and fully open the top drawer at the same time.

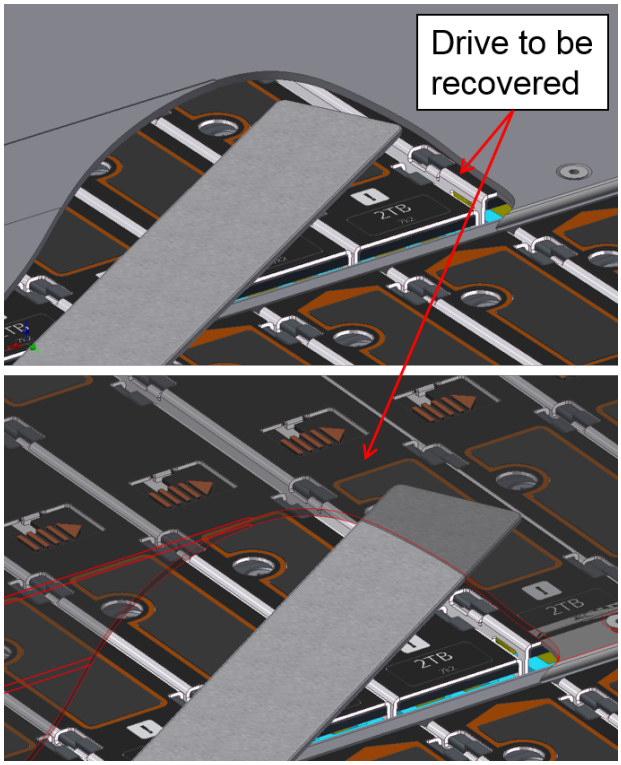


Figure 71. Moving and placing the strip between the chassis lid and the pop-up DDIC

Figure 72. Rotating the strip

5. Remove the pop-up DDIC using the instructions in “Removing a DDIC ” on page 86.
6. Reinsert the DDIC into the drawer using the instructions in “Inserting a DDIC” on page 87.

Procedure B

Tools required:

- A flat head screwdriver (if needed)

To fully close the top drawer, do the following:

1. Turn off the system and then disconnect the power cord from the electrical outlet.
2. Fully open the top drawer fully using the instructions in “Opening a Drawer ” on page 84.
3. Remove all 42 drives on the top drawer, while leaving the bottom drawer closed.
4. Press and hold the latches of the top drawer, and then pull out the top drawer slightly. For the location of the drawer latches, refer to Figure 89 “Drawer Latches” on page 86.

   Note: Ensure that the top drawer is pulled out about 25-30 mm (0.98-1.18 inches) and the rear of the top drawer is exposed.
5. Release the cable chain from the rear of the top drawer by lifting the retaining latch and sliding out the bracket.

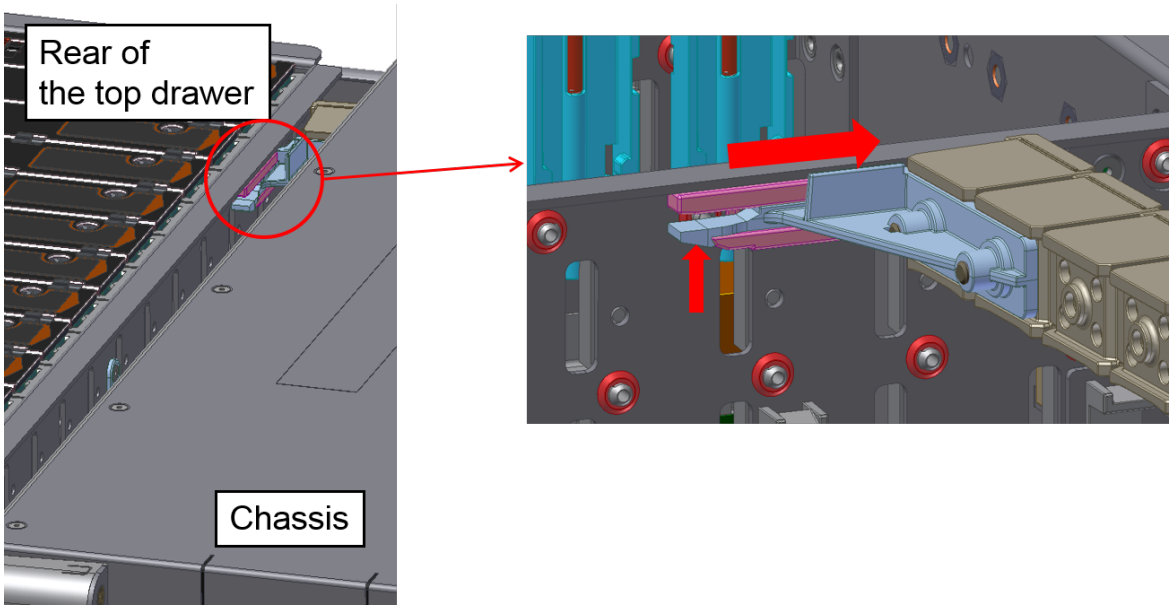


Figure 73. Releasing the cable chain

6. Further pull out the top drawer about 30-40 mm (1.18-1.57 inches).
7. Identify which DDIC has popped up in the bottom drawer.
8. Reach the pop-up DDIC by reaching out a hand behind the top drawer.

   If you still cannot reach the pop-up DDIC, do the following:

   a. Remove the front bezel from the right side of the chassis.

b. Insert a flat head screwdriver into the slot nearby the bottom drawer and push the retaining arm up.

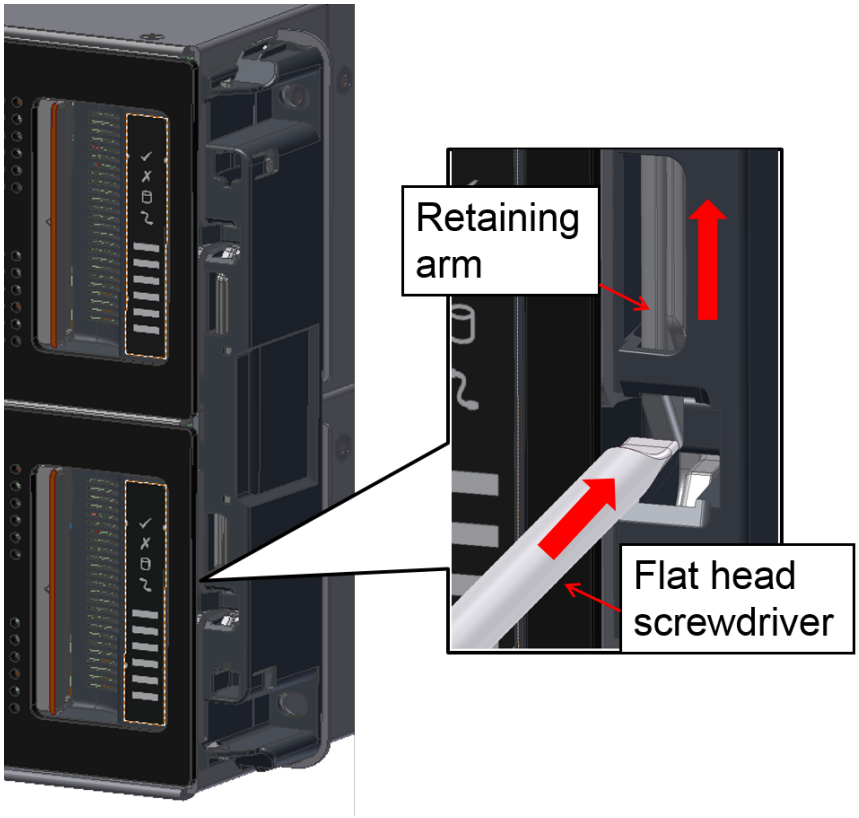


Figure 74. Pushing the retaining arm up

c. Open the bottom drawer until you can reach the pop-up DDIC.

CAUTION:
When the top and bottom drawers (with drives installed) open at the same time, ensure that the rear of chassis is suitably fastened on the workbench. Otherwise, the chassis might fall down.

9. Remove the pop-up DDIC from the bottom drawer using the instructions in “Removing a DDIC ” on page 86.
10. Reinsert the removed DDIC into the bottom drawer using the instructions in “Inserting a DDIC” on page 87.
11. Close the bottom drawer if you have opened it.
12. Reinsert the cable chain into the holder, and then close all cable clamps that have been opened.

    Note: Ensure that the bundles of the cables are in the correct position and not pinched or trapped.
13. Push the top drawer inward until you hear a click and see the rear row DDIC slot aligning with the chassis front.
14. Reinstall the 42 drives that you removed, and then close the top drawer fully.

Parts list (2U and 5U enclosures)

Use the parts list to identify each of the components that are available for your storage.

For more information about the compatible parts list, go to https://datacentersupport.lenovo.com.

Chapter 6. Module Removal and Replacement

This chapter contains the following items:

Overview

Important:

- Always have available a replacement or blank module before removing the old module. When you replace a module, you must never leave an empty bay in the rear of the enclosure.
- For 2U enclosures, after replacing any of the following FRUs or CRUs, update the firmware for all of the following FRUs or CRUs to the latest version. To download the latest firmware, go to the Lenovo Support Web site.
  - Chassis
  - ESM
  - PCM
- For 5U enclosures, after replacing any of the following FRUs or CRUs, update the firmware for all of the following FRUs or CRUs to the latest version. To download the latest firmware, go to the Lenovo Support Web site.
  - Chassis
  - Cooling module
  - ESM
  - Left and right sideplanes
  - PSU

ESD Precautions

Important: It is recommended that you fit and check a suitable anti-static wrist or ankle strap and observe all conventional ESD precautions when handling plug-in modules and components. Avoid contact with midplane components and module connectors.

Replacing Power Cooling Modules

Note: 2U enclosures only.

The power cooling module (PCM) is hot-swappable and therefore removal/replacement may be performed by the user.

Do not remove covers from the PCM. Danger of electric shock inside. Return the PCM to your supplier for repair.

Removing a Power Cooling Module

Important: Operation of the enclosure with any modules missing will disrupt the airflow and the drives will not receive sufficient cooling. It is essential that all apertures are filled before operating the enclosure system.

Important: Prior to removing the PCM, disconnect the power from the PCM, by either the mains switch (where present) or by physically removing the power source in order to ensure that your system has warning of an imminent power shutdown. A faulty PCM must be replaced by a fully operational PCM within 24 hours.

1. Ensure that you identify the faulty PCM correctly.
2. Switch off and disconnect the power supply cord.
3. Grasp the latch and the side of the PCM handle between thumb and forefinger, squeeze together and open the handle to cam the PCM out of the enclosure (see Figure 75 “Removing a PCM (1) ” on page 76).

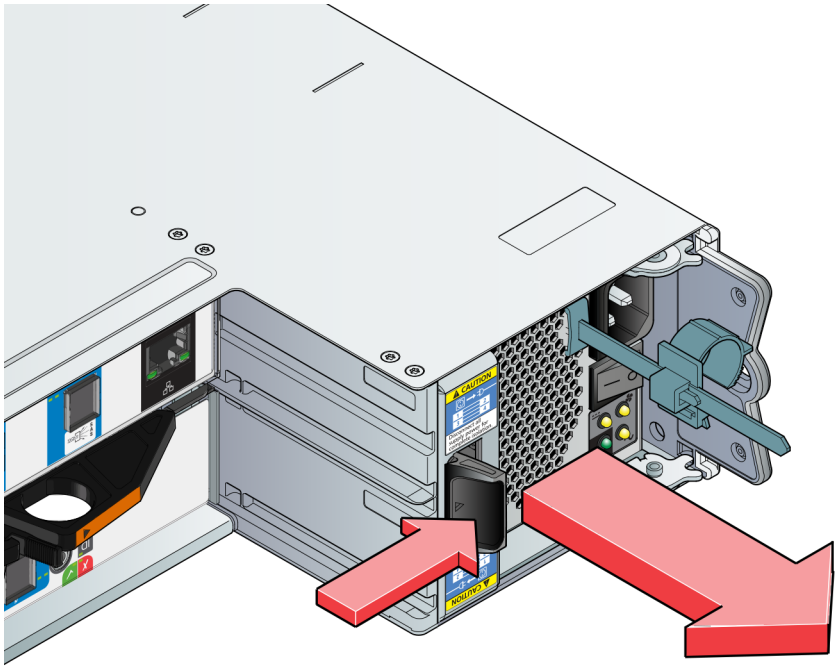


Figure 75. Removing a PCM (1)

4. Grip the handle and withdraw the PCM, taking care to support the base of the module with both hands, as you remove it from the enclosure. (See Figure 76 “Removing a PCM (2) ” on page 77).

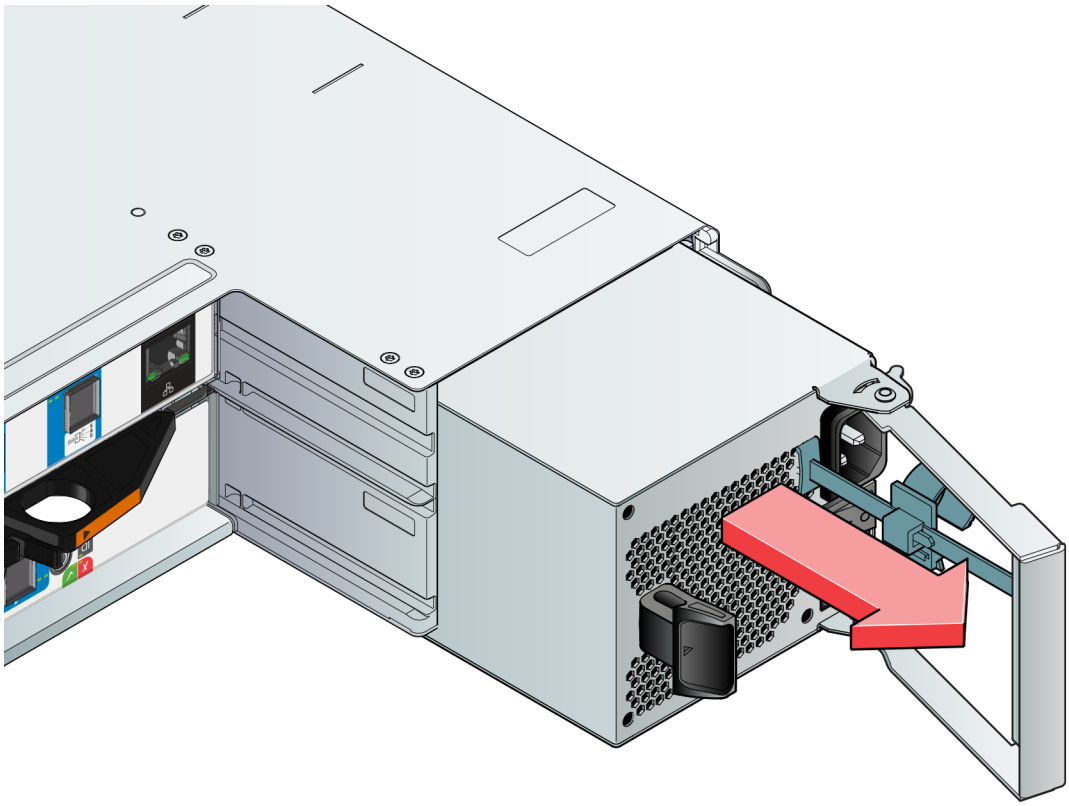


Figure 76. Removing a PCM (2)

Installing a Power Cooling Module

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

1. Check for damage, especially to all connectors.
2. With the PCM 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. Cam the module home by manually closing the PCM handle. A click should be heard as the handle latch engages.
4. Connect the power cables to the power source and to the PCM.
5. Secure the strain relief bales.

Replacing Drive Carrier Modules

Note: 2U enclosures only.

Important: Observe all conventional ESD precautions when handling modules and components. Avoid contact with midplane components and module connectors, etc.

Removing a 3.5-inch Drive Carrier Module

Important: Damage can occur to a drive if it is removed while it still spins. If possible use the operating system to spin down the drives prior to removal. If this is not possible we recommend that you perform all steps of the following procedure to make sure that the drive has stopped prior to removal.

To remove a 3.5-inch drive carrier module, do the following:

1. Press the latch in the handle towards the handle hinge as shown in Figure 77 “Removing a Drive Carrier Module (1)” on page 78) to release the carrier handle.

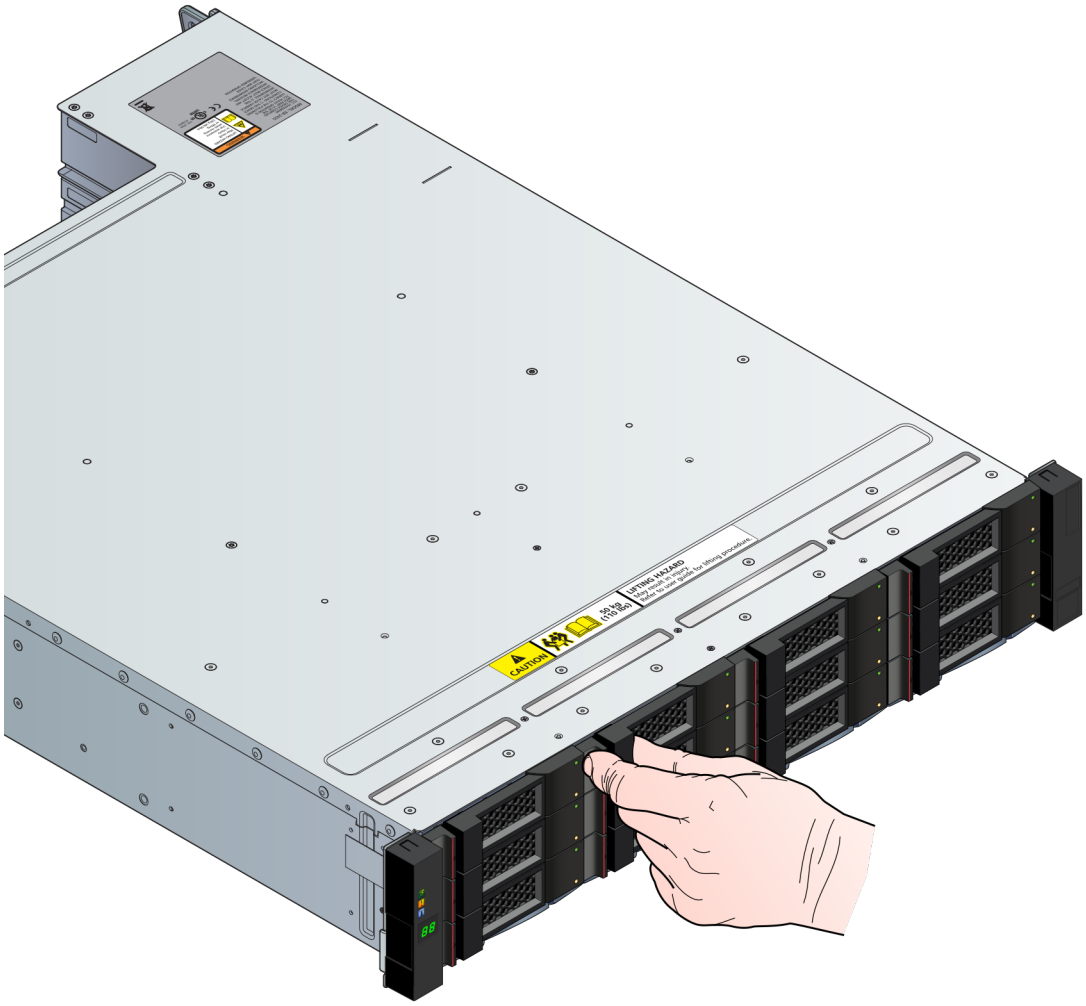


Figure 77. Removing a Drive Carrier Module (1)

2. Gently remove the drive carrier module approximately 1 inch (25mm), then wait 30 seconds (see Figure 78 “Removing a Drive Carrier Module (2)” on page 79).

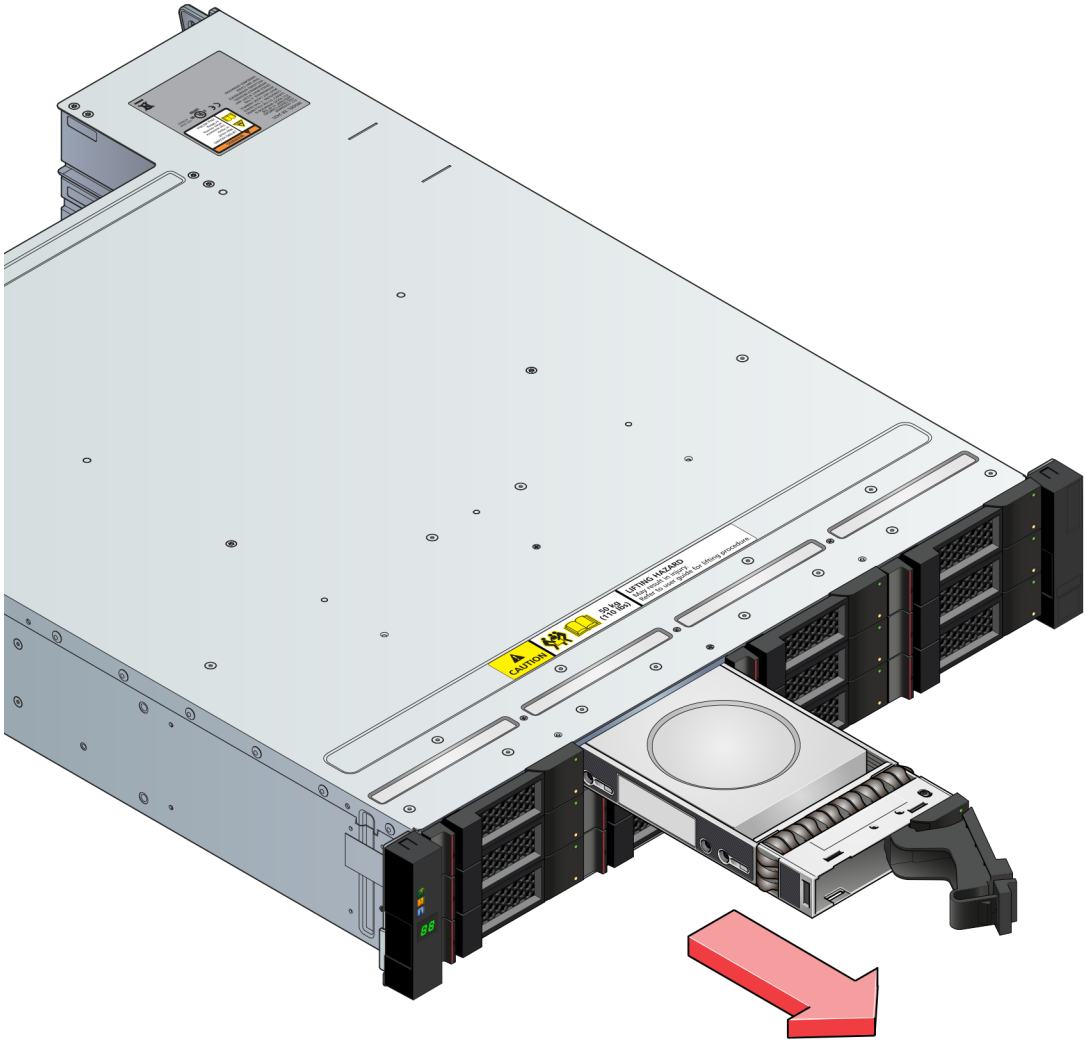


Figure 78. Removing a Drive Carrier Module (2)

3. Remove the module fully from the drive bay.

CAUTION:
Dummy drive carrier modules MUST be fitted to ALL unused drive bays. There will be inadequate drive cooling if any are left open.

Installing a 3.5-inch Drive Carrier Module

To install a 3.5-inch drive carrier module, do the following:

1. Release the drive carrier handle, by depressing the latch in the handle (see Figure 79 “Installing a Drive Carrier Module (1)” on page 80).

Figure 79. Installing a Drive Carrier Module (1)

2. Put the drive carrier module into the enclosure (see Figure 80 “Installing a Drive Carrier Module (2)” on page 80). Make sure that the drive carrier is in a position so that the drive points up and the handle opens from the left.

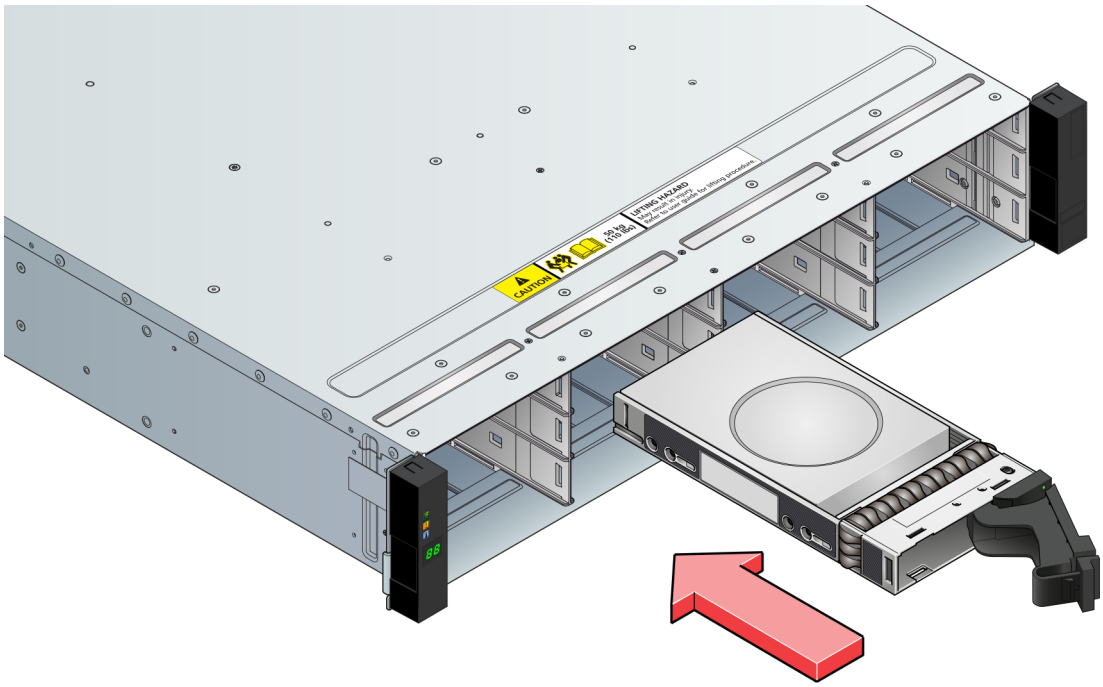


Figure 80. Installing a Drive Carrier Module (2)

3. Slide the drive carrier fully into the enclosure.
4. Cam the drive carrier home. The camming foot on the carrier engages into a bay in the enclosure. Continue to push firmly until the handle fully engages. A click should be heard as the latch engages and holds the handle closed.

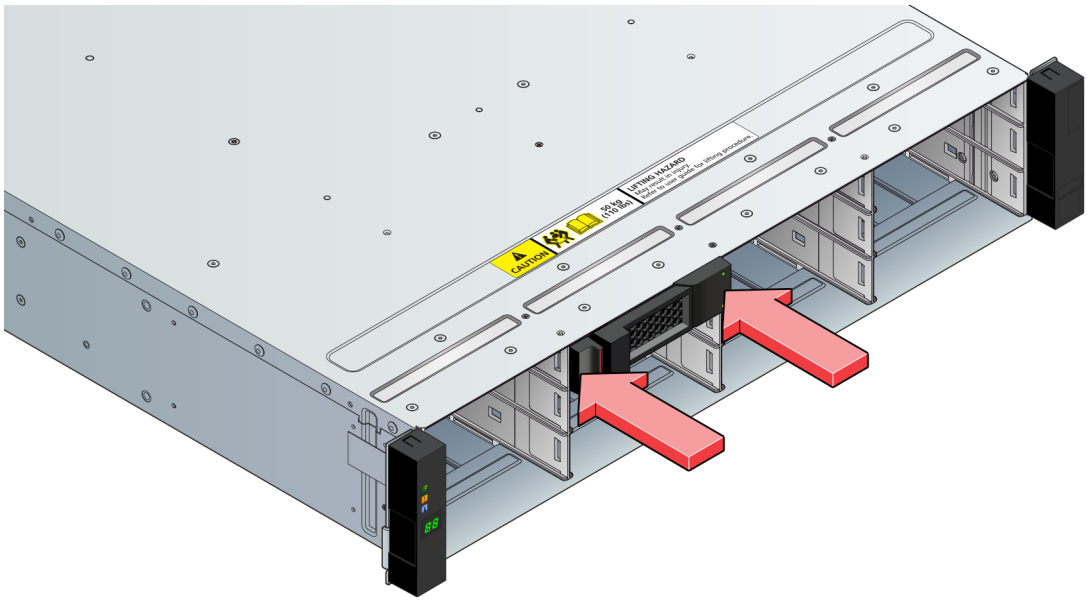


Figure 81. Engaging a Drive Carrier Module in an Enclosure

Removing/Replacing 2.5-inch Drive Carrier Modules

The removal/replacement procedure for 2.5” drive carrier modules is basically the same as for 3.5” drive carriers, except that the 2.5” drive carriers are mounted vertically.

To remove/replace 2.5-inch drive carrier modules, do the following:

1. Release the carrier handle, by pressing the latch in the handle downwards and insert the carrier into the enclosure in the vertical position.

   Important: Make sure that the carrier is positioned so that the drive is on the left side and the handle opens from the top (see Figure 82 “2.5” Drive Carrier Module in Open Position” on page 82).

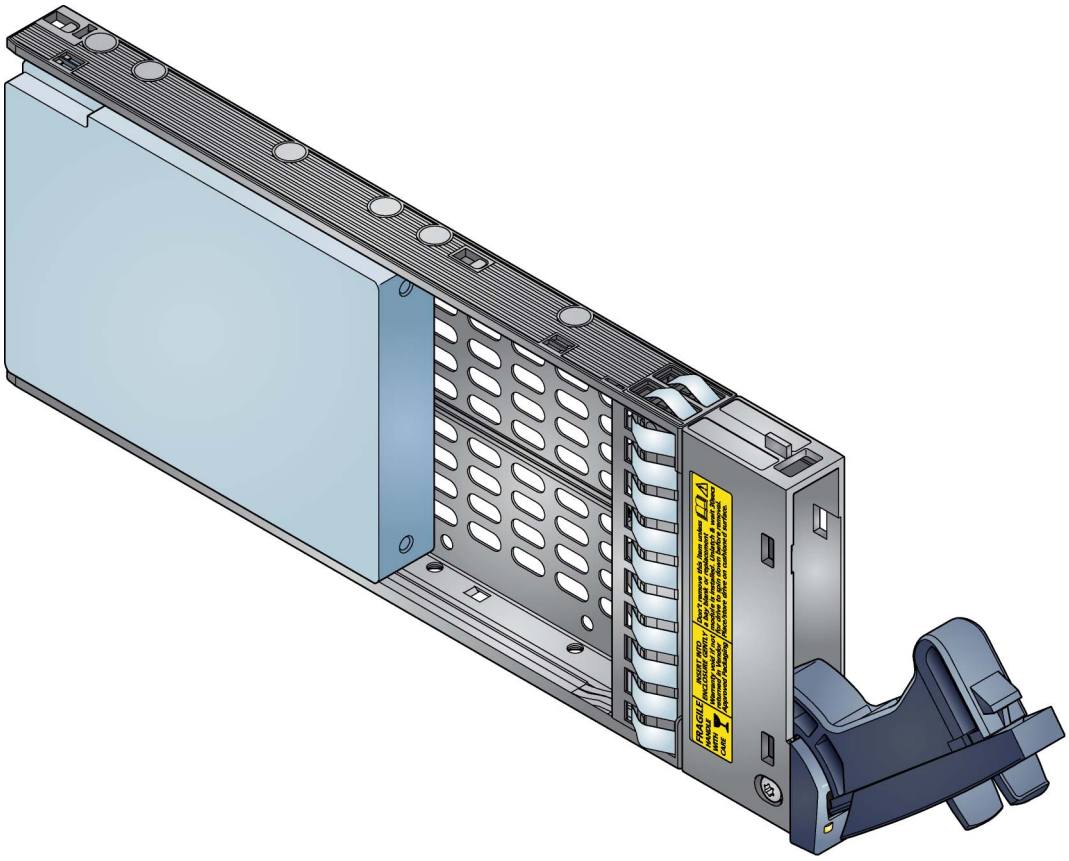


Figure 82. 2.5” Drive Carrier Module in Open Position

2. Slide the carrier fully into the enclosure until it is stopped by the camming lever on the bottom of the carrier (see Figure 83 “Installing a 2.5” Drive Carrier Module (1)” on page 82).

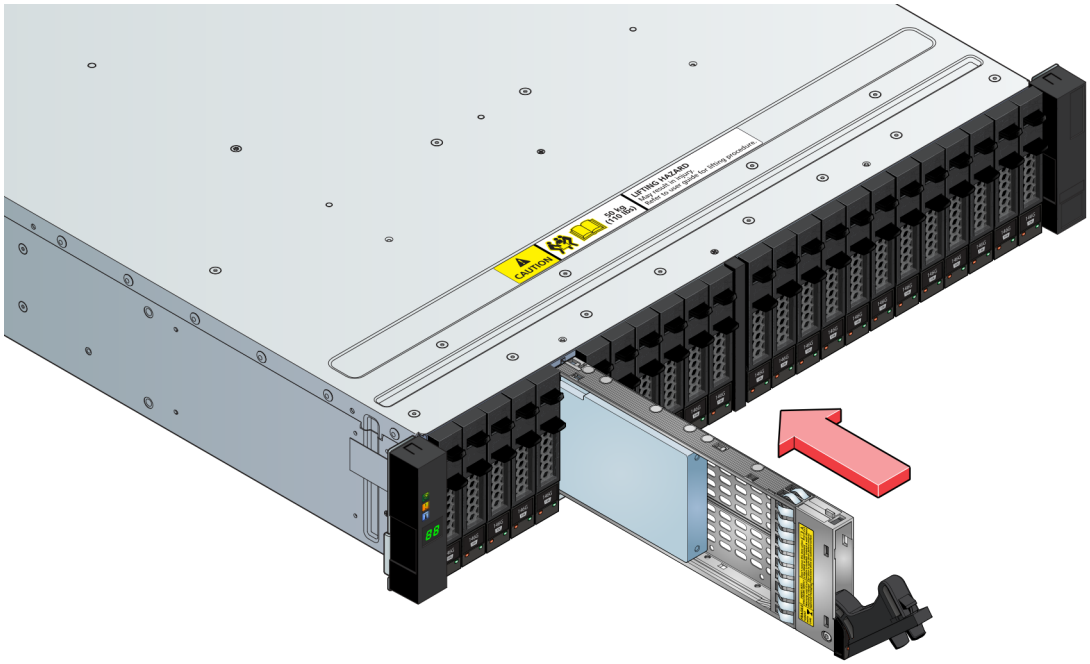


Figure 83. Installing a 2.5” Drive Carrier Module (1)

3. Cam the carrier home. The camming lever on the carrier will engage into a bay in the enclosure. Continue to push firmly until the handle fully engages. A click should be heard as the latch engages and holds the handle closed (see Figure 84 “Installing a 2.5” Drive Carrier Module (2)” on page 83).

   Important: Make sure that the handle always opens from the top.

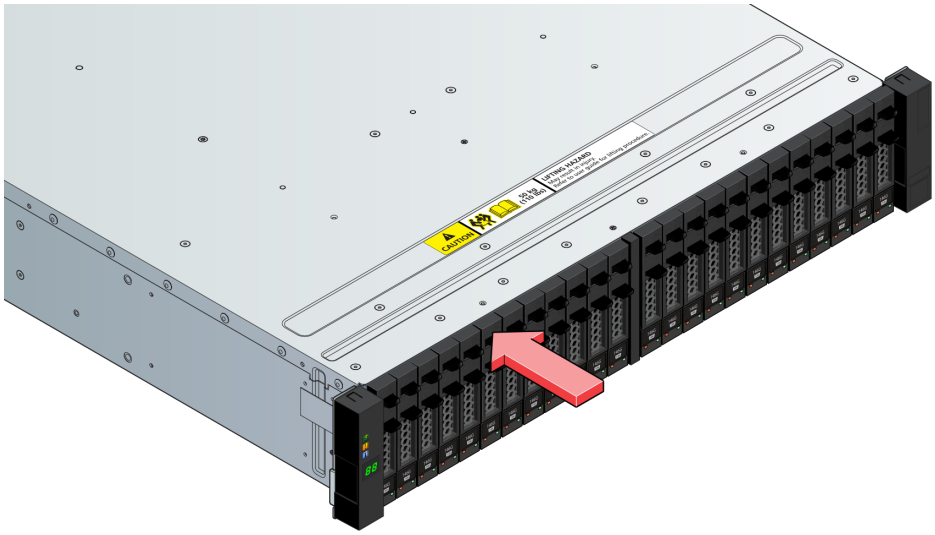


Figure 84. Installing a 2.5” Drive Carrier Module (2)

Note: Removal is the reverse of this procedure (press on the latch to release the handle). Please refer to Figure 85 “Removing a 2.5” Drive Carrier Module (1)” on page 83 and Figure 86 “Removing a 2.5” Drive Carrier Module (2)” on page 84.

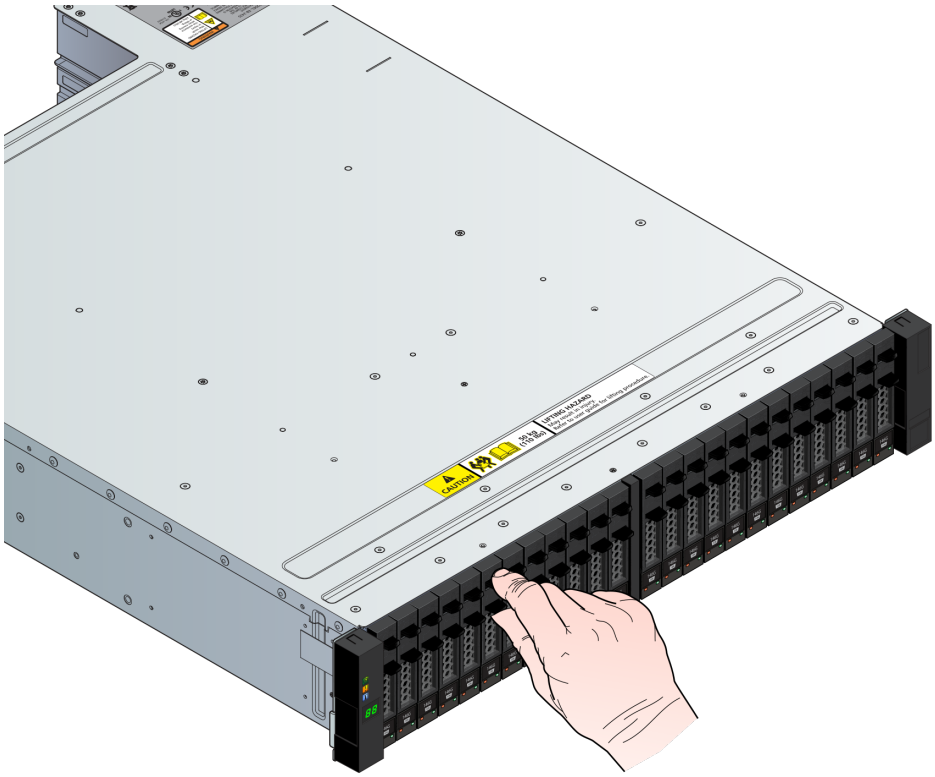


Figure 85. Removing a 2.5” Drive Carrier Module (1)

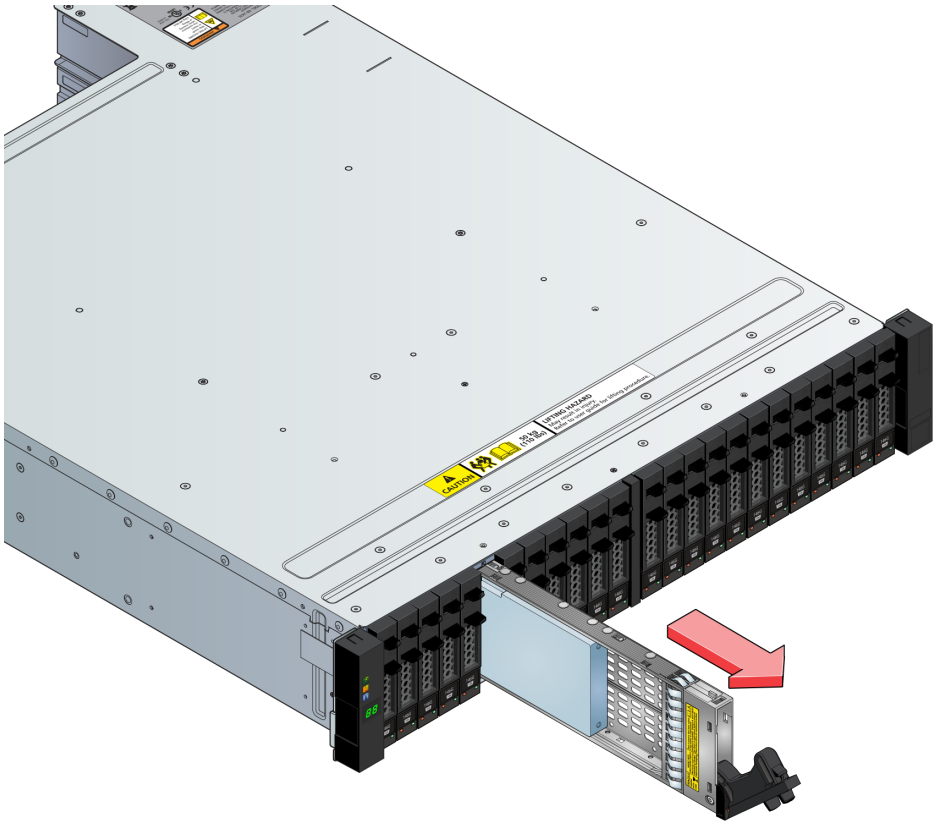


Figure 86. Removing a 2.5” Drive Carrier Module (2)

Dummy Carrier Module Removal/Replacement

Dummy drive carrier modules are removed and replaced in the enclosure simply by pulling the module out of the enclosure or pushing it into place.

Opening a Drawer

Note: 5U enclosures only.

1. Make sure the anti-tamper locks are not engaged. The red arrows on the locks point inwards if the locks are disengaged (see Figure 87 “Anti-tamper Locks (shown disengaged)” on page 84). Unlock them if necessary by rotating them counterclockwise using a screwdriver with a torx T20 bit.

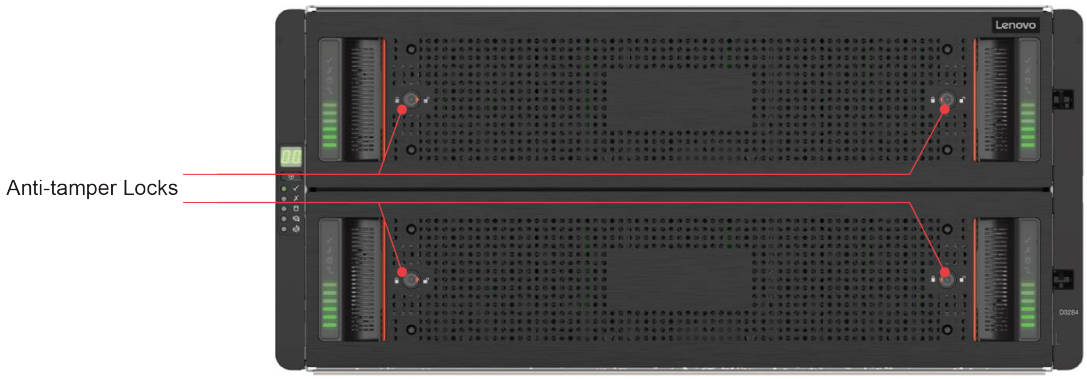


Figure 87. Anti-tamper Locks (shown disengaged)

2. Push the drawer latches inward and hold them. (See Figure 88 “Opening the Bottom Drawer” on page 85
3. Pull out the drawer until it locks open.

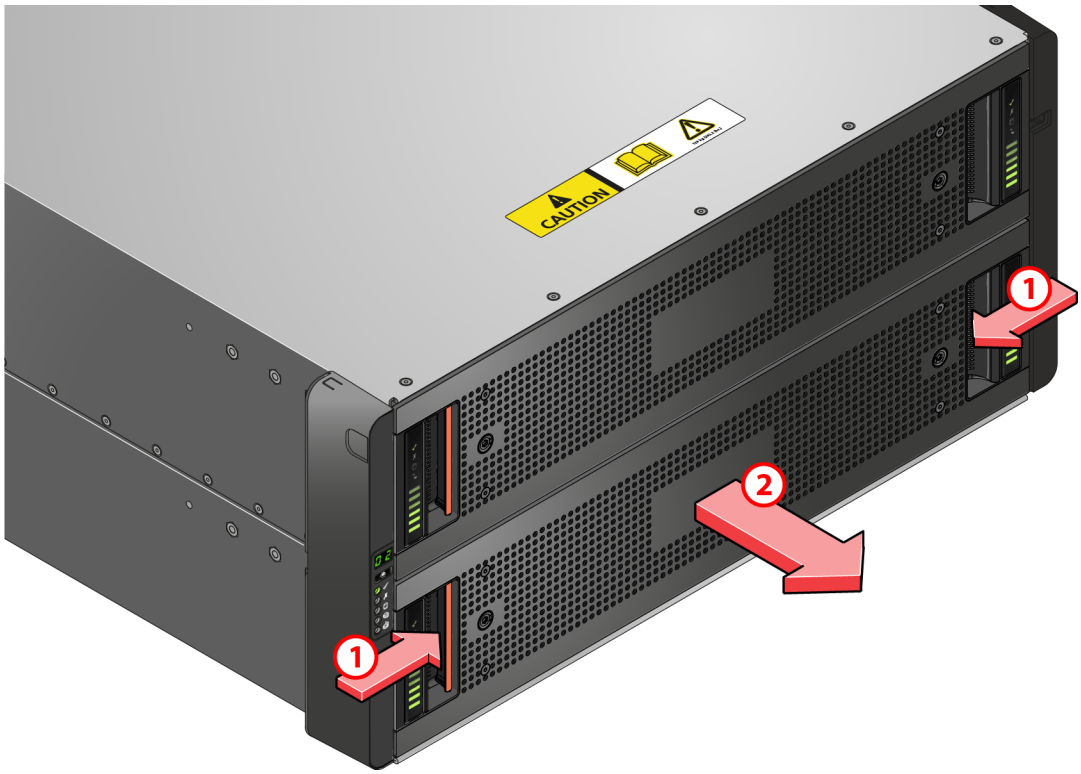


Figure 88. Opening the Bottom Drawer

Important: The drawer must not be left open for more than two minutes while the enclosure is powered.

Closing a Drawer

Note: 5U enclosures only.

1. Press and hold both of the black latches on the sides of the drawer (see Figure 89 “Drawer Latches” on page 86).
2. Push the drawer in slightly.
3. Release the black latches.
4. Push the drawer all the way back into the enclosure, making sure it clicks home.

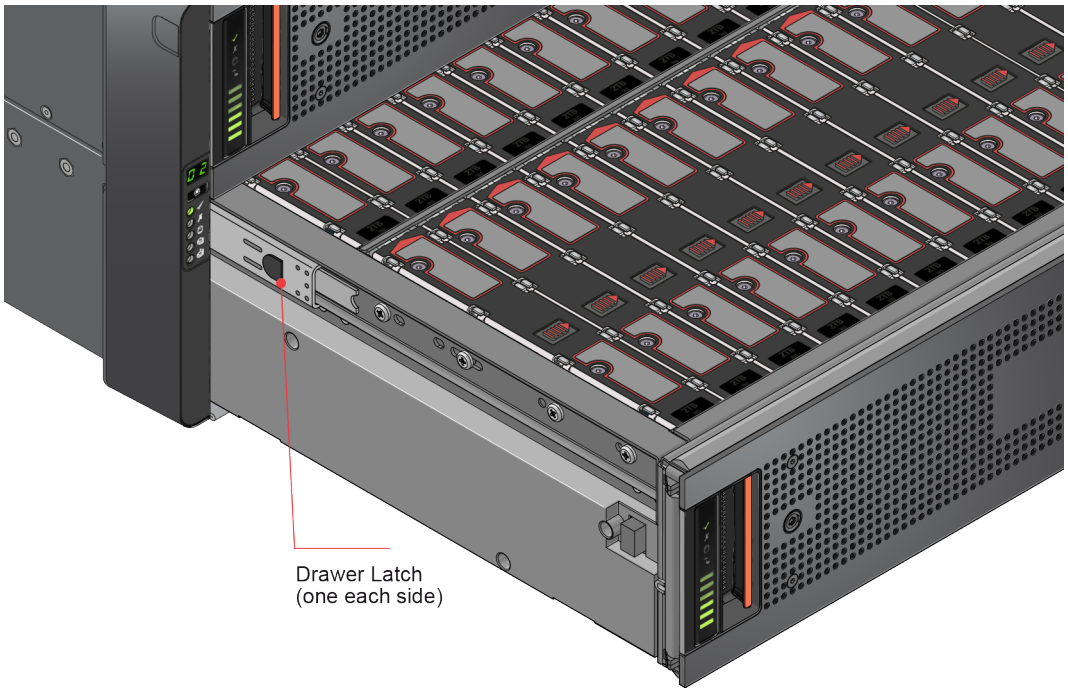


Figure 89. Drawer Latches

Replacing a Disk Drive in Carrier (DDIC)

Note: 5U enclosures only

This topic provides instructions on how to remove and insert the disk drive in carrier.

Removing a DDIC

1. Identify which drawer contains the drive to be replaced. If the drive number is known, the plan in Figure 90 “Drive Location” on page 86 can be used. If the drive has failed, the drive fault LED is lit amber on the relevant drawer.

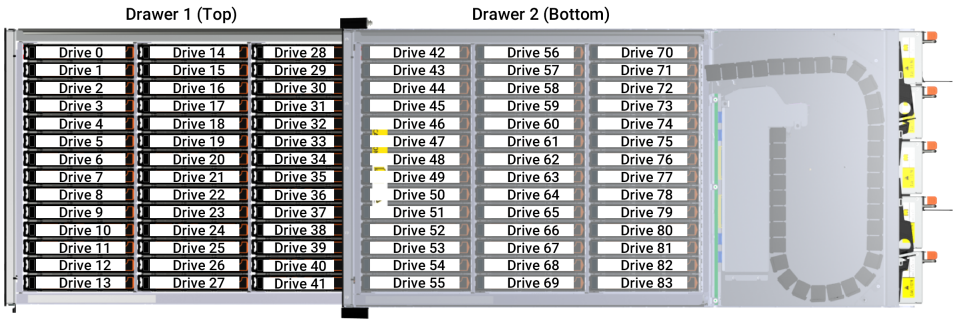


Figure 90. Drive Location

2. Open the relevant drawer using the instructions in “Opening a Drawer ” on page 84.
3. Locate the drive to be replaced, either by using the drive plan (see Figure 90 “Drive Location” on page 86) or by looking for the amber LED on the drive that indicates a fault.
4. Slide the release button, as shown in the following figure.
5. Slide the top surface in the direction of the arrow until the latch releases, as shown in the following figure. The DDIC should pop up slightly from the slot.

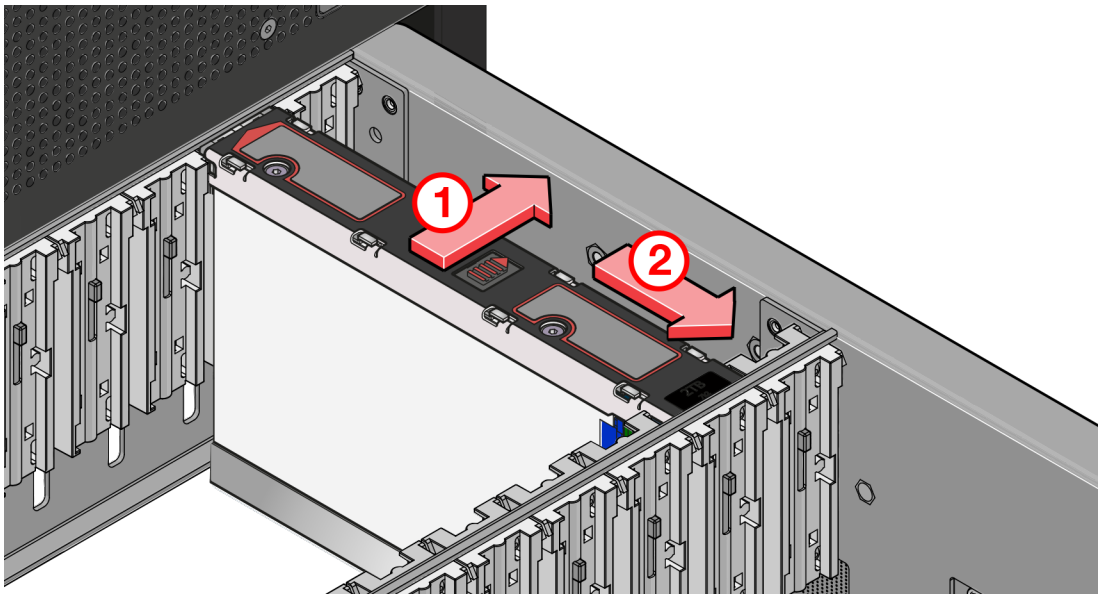


Figure 91. Removing a DDIC

6. If the DDIC does not pop up, perform steps 1 and 2 simultaneously in above figure. The DDIC will pop up slightly from the slot.
7. Lift the DDIC out of the slot, as shown in the following figure.

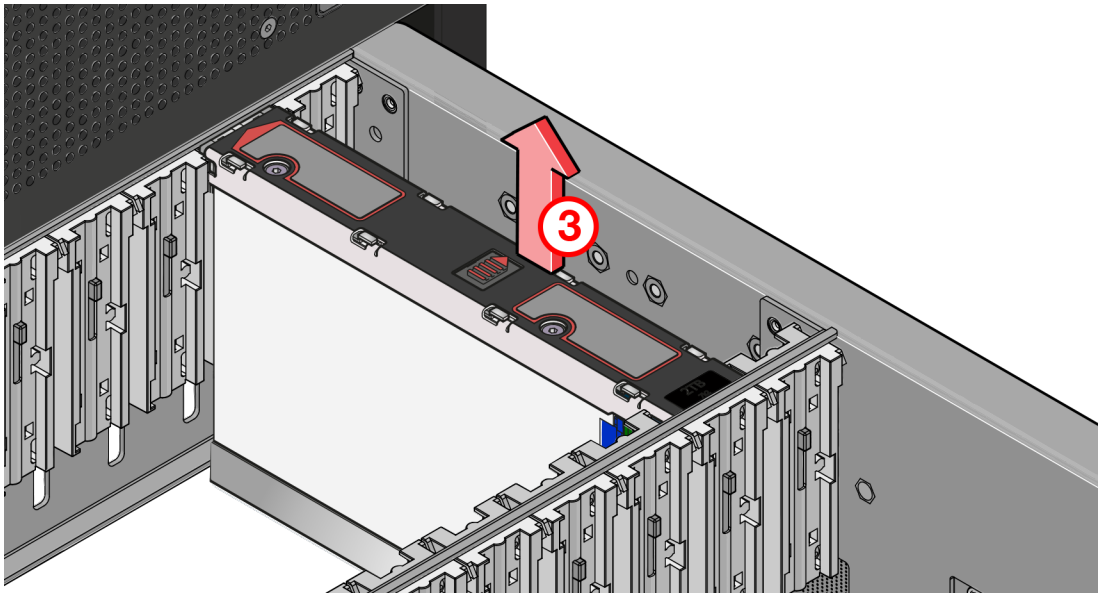


Figure 92. Removing a DDIC

Important: If you are not going to replace the drive immediately, close the drawer (see "Closing a Drawer" on page 85) so that correct airflow and cooling are maintained in the enclosure.

Inserting a DDIC

Important: Failed drives must be replaced with approved drives. Contact your storage supplier for details.

1. If the relevant drawer is not already open, open it using the instructions in "Opening a Drawer " on page 84.

2. Lower the DDIC into the bay, with the drive capacity label facing toward you, as shown in Figure 93 “Installing a DDIC Drive” on page 88
3. Push the DDIC downwards and hold it down while sliding the drive carrier plate to the end in the direction shown in Figure 93 “Installing a DDIC Drive” on page 88. This locks the drive in place.

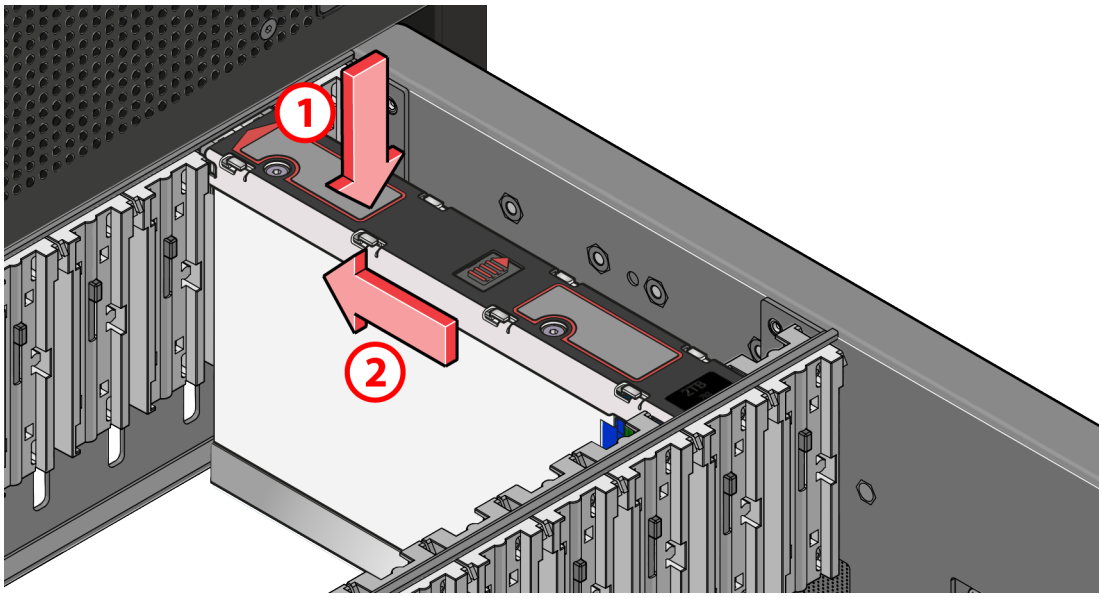


Figure 93. Installing a DDIC Drive

4. Check that the release latch has returned to its locked position, as shown in Figure 94 “Latch Position of a Correctly Inserted Drive” on page 88.

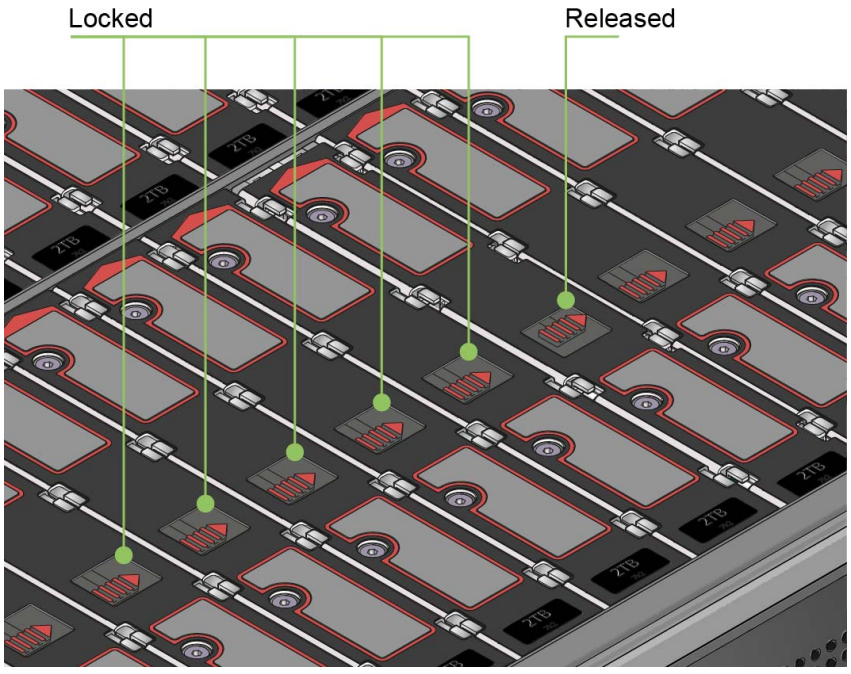


Figure 94. Latch Position of a Correctly Inserted Drive

5. Close the drawer using the instructions in “Closing a Drawer” on page 85.

Note: The drawers must be populated with drives in whole rows at a time (there are 3 rows of 14 drives per drawer). The minimum number of drives in an enclosure is 14, the number of rows must not differ by more than 1 between top and bottom drawers and the rows should be populated from the front to the rear of the enclosure.

Replacing a Cooling Module

Note: 5U enclosures only.

This topic provides instructions on how to remove and insert the cooling module.

Removing a Cooling Module

Important: Before removing a module, make sure that you have a replacement module to insert.

1. Identify the cooling module to be removed. If the module has failed, the fan fault LED will be lit amber (see Figure 95 “Cooling Module LEDs” on page 89).

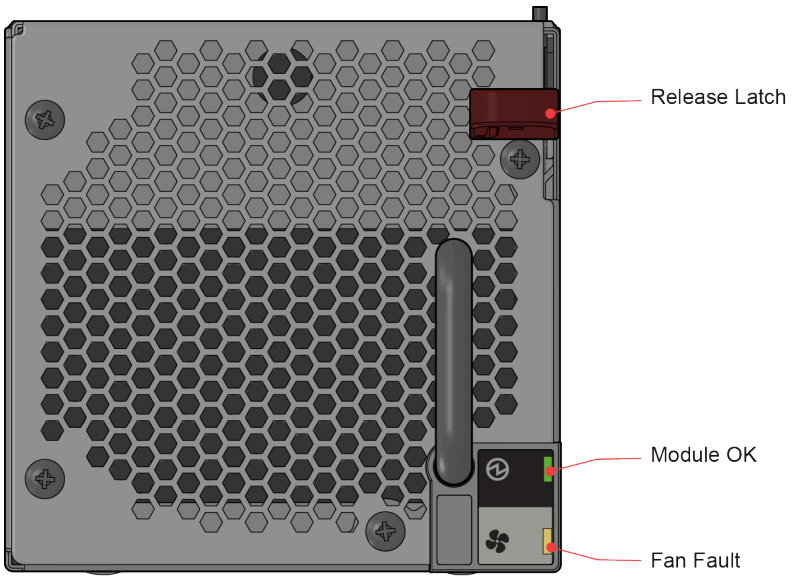


Figure 95. Cooling Module LEDs

2. As shown in Figure 96 “Removing a Cooling Module (1)” on page 90 and Figure 97 “Removing a Cooling Module (2)” on page 90, push down and hold the black release latch (1) and pull out the module by its handle (2).

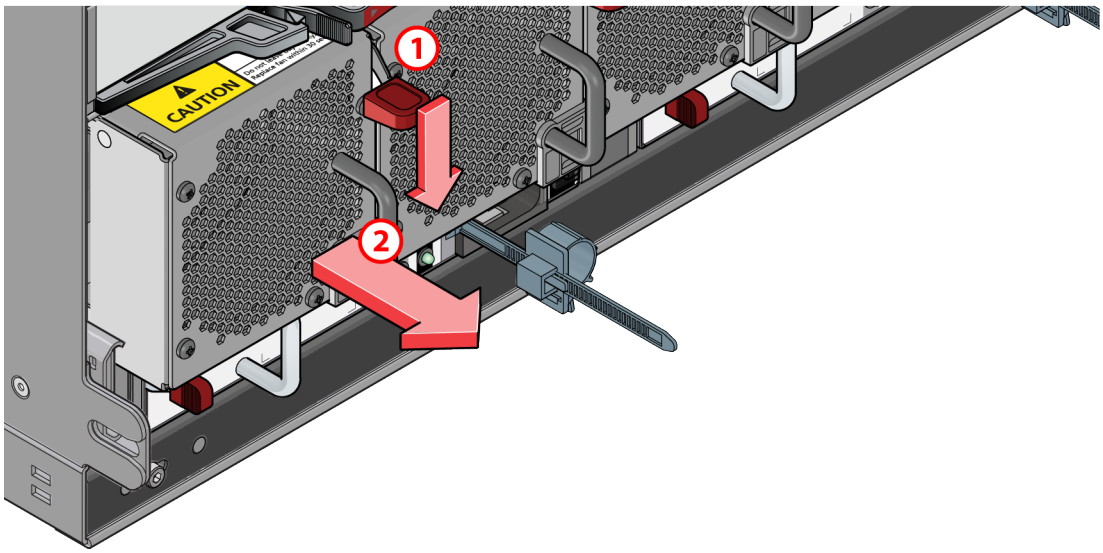


Figure 96. Removing a Cooling Module (1)

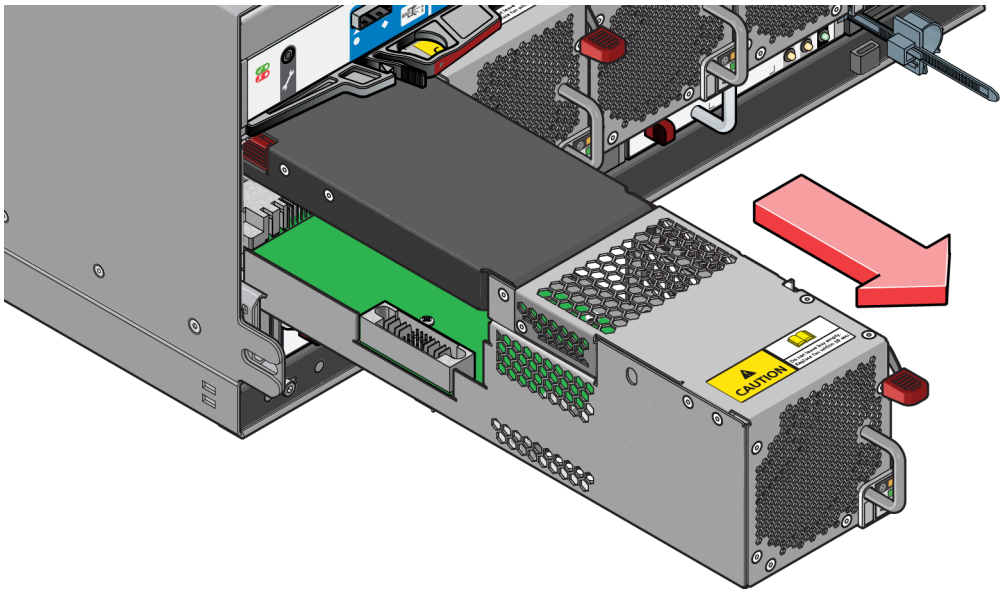


Figure 97. Removing a Cooling Module (2)

Important: The cooling module bay must not be empty for more than two minutes while the enclosure is powered.

Inserting a Cooling Module

1. Rotate the cooling module so that the black release latch and handle are on the right-hand side.
2. Slide the cooling module into its bay until the latch clicks home. The enclosure automatically detects and makes use of the new unit.

Replacing a Power Supply Unit (PSU)

Note: 5U enclosures only.

This topic provides instructions on how to remove and insert the PSU.

Removing a PSU

Important: Before removing a PSU, make sure that you have a replacement module to insert.

1. Identify the PSU to be removed using appropriate fault reporting software.
2. As shown in Figure 98 “Removing a PSU Module (1) ” on page 91 and Figure 99 “Removing a PSU Module (2) ” on page 91, push the red release latch to the right and hold it (1), then pull out the module by its handle (2).

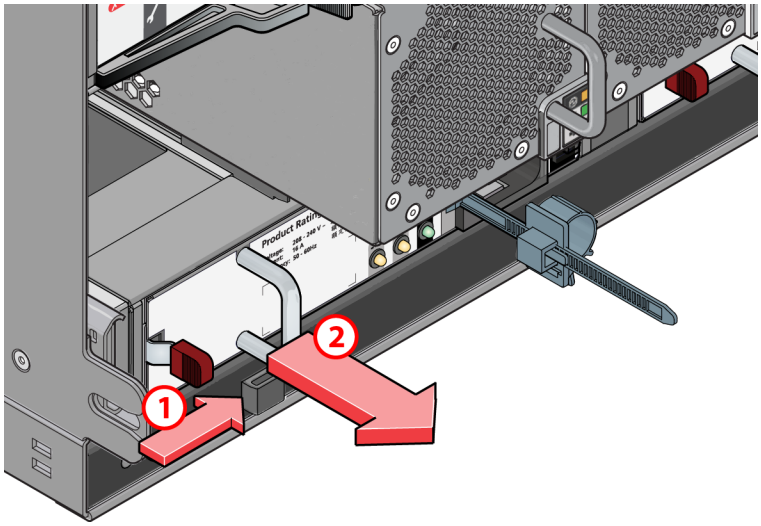


Figure 98. Removing a PSU Module (1)

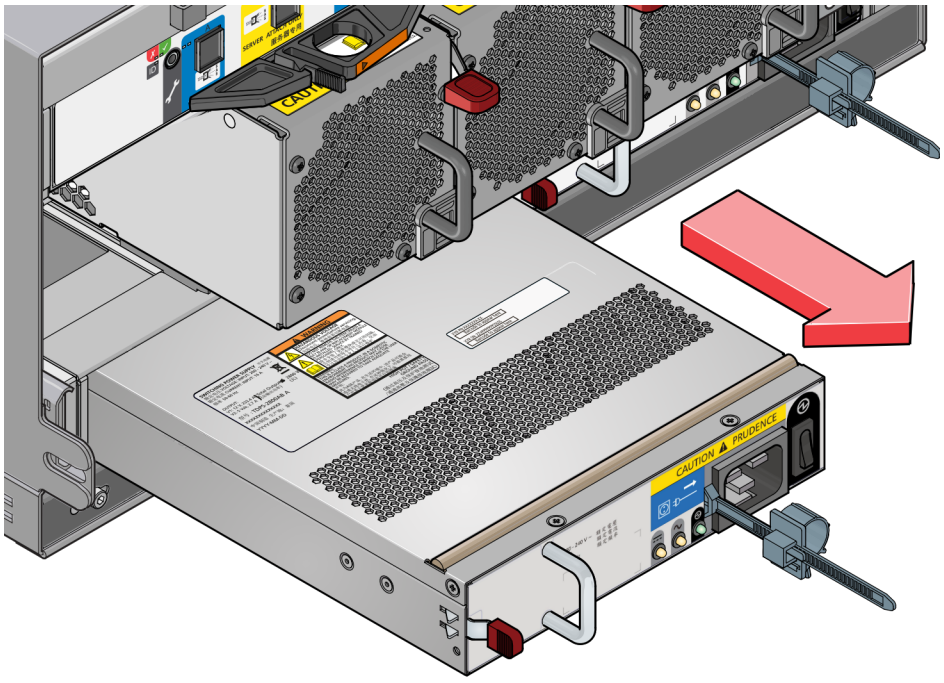


Figure 99. Removing a PSU Module (2)

Important: The PSU module bay must not be empty for more than two minutes while the enclosure is powered.

Inserting a PSU

1. Rotate the PSU so that the red release latch and handle are on the left-hand side.
2. Slide the PSU into its bay until the latch clicks home. The enclosure automatically detects the new unit.

Replacing ESMs

The ESM is hot-swappable and therefore removal or replacement may be done by the user while the power supply is on.

Important:

- Before removing an ESM, make sure that you have a replacement module to insert.
- After installing a new ESM, DHCP is enabled by default. If necessary, configure the static IP address using the JBOD Configure Utility. You can download the utility from the Lenovo Support Web site.

Removing an ESM (2U Enclosures)

Important: Do not remove this module unless a replacement can be immediately added. The system must not be operated without all modules in place.

1. Grasp the module latch between the thumb and forefinger and squeeze them together to release the latch.
2. Pull the latch out to release the module from the enclosure (Figure 100 “ESM Latch Operation ” on page 92).

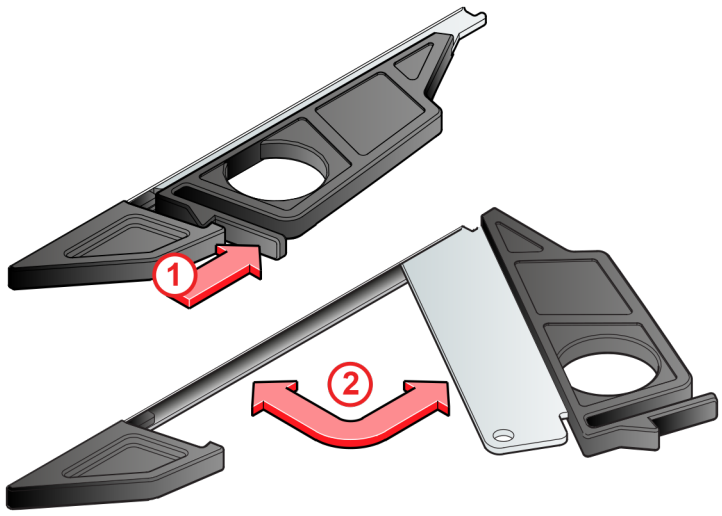


Figure 100. ESM Latch Operation

3. Grip the latch handles and remove the module (Figure 101 “Removing an ESM” on page 93).

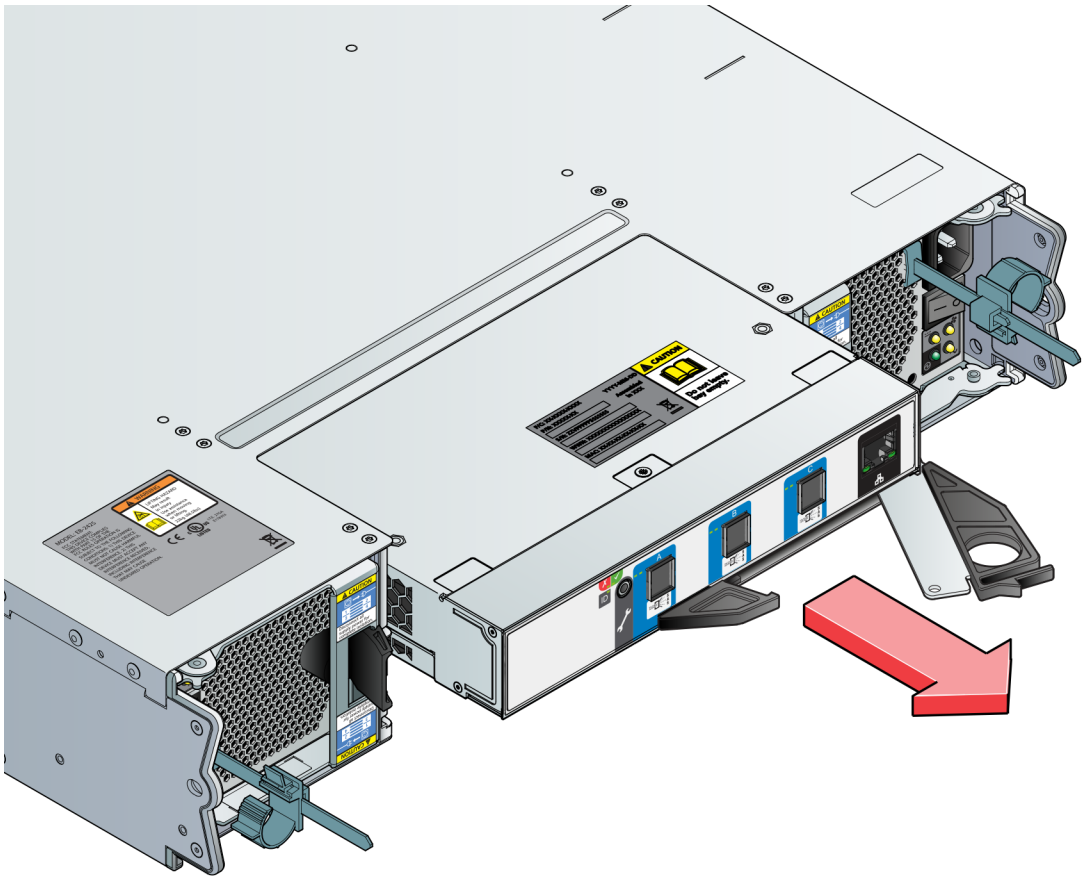


Figure 101. Removing an ESM

Installing an ESM (2U Enclosures)

Note: EMC (Electromagnetic Compatibility) precautions: if passive copper cables are connected, the cable must not have a connection to a common ground/earth point.

1. Examine for damage, closely inspect the interface connector. Do not install it if the pins are bent.
2. With the latches in the open position (see Figure 102 “Installing an ESM ” on page 94), slide the module into the enclosure until the latches engage.

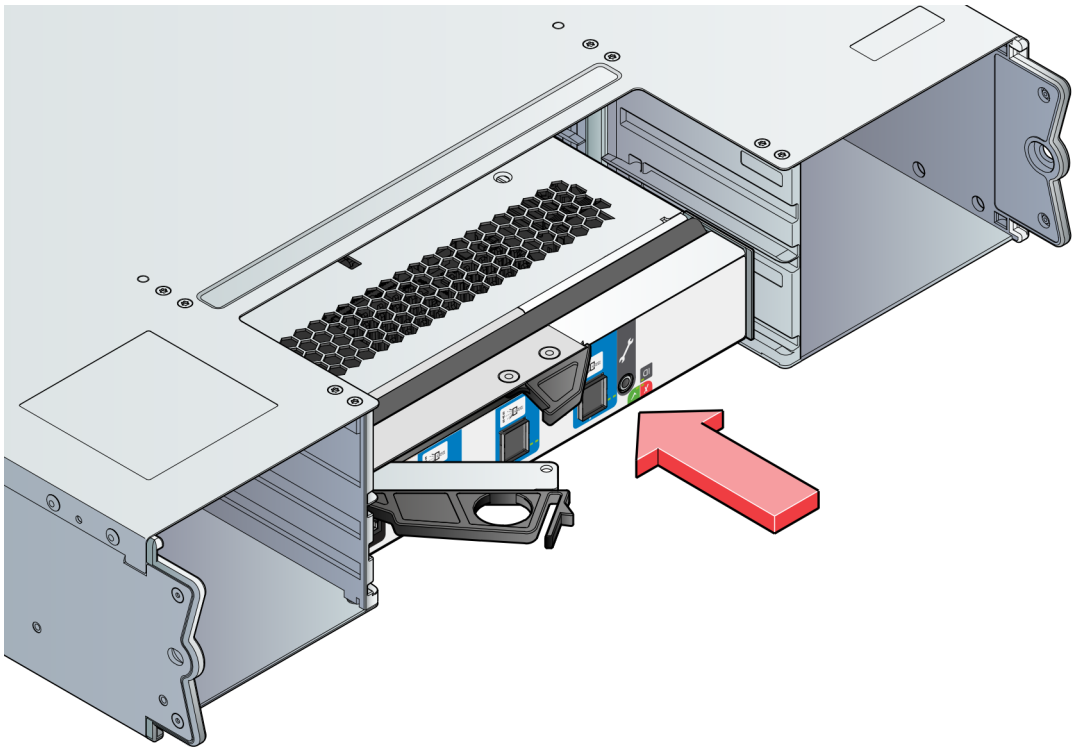


Figure 102. Installing an ESM

3. Set the module in position by manually closing the latches. A click should be heard as the latches engage.

Note: The ESM may take up to one minute to re-initialize after the cables are inserted.

Note: Secondary ESM is upside down.

Removing an ESM (5U Enclosures)

1. Identify the ESM to be removed. If the module has failed, the fault LED will be lit amber (see Figure 103 “ESM LEDs ” on page 94).
2. Make a note of the locations of the cables before removing them from the ESM

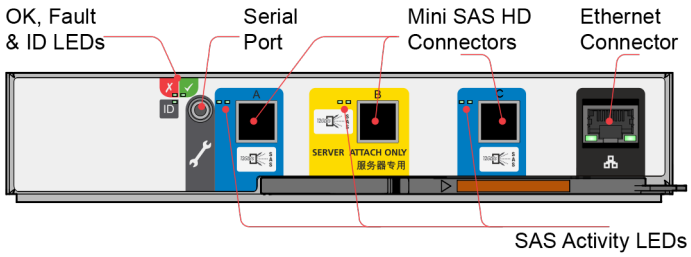


Figure 103. ESM LEDs

3. As shown in Figure 104 “Removing an ESM (1)” on page 95 and Figure 105 “Removing an ESM (2)” on page 95, pinch the latch on the module and pull the handle toward you (1). This will lever the module out of its connector on the midplane.
4. Pull the module out of the enclosure (2).

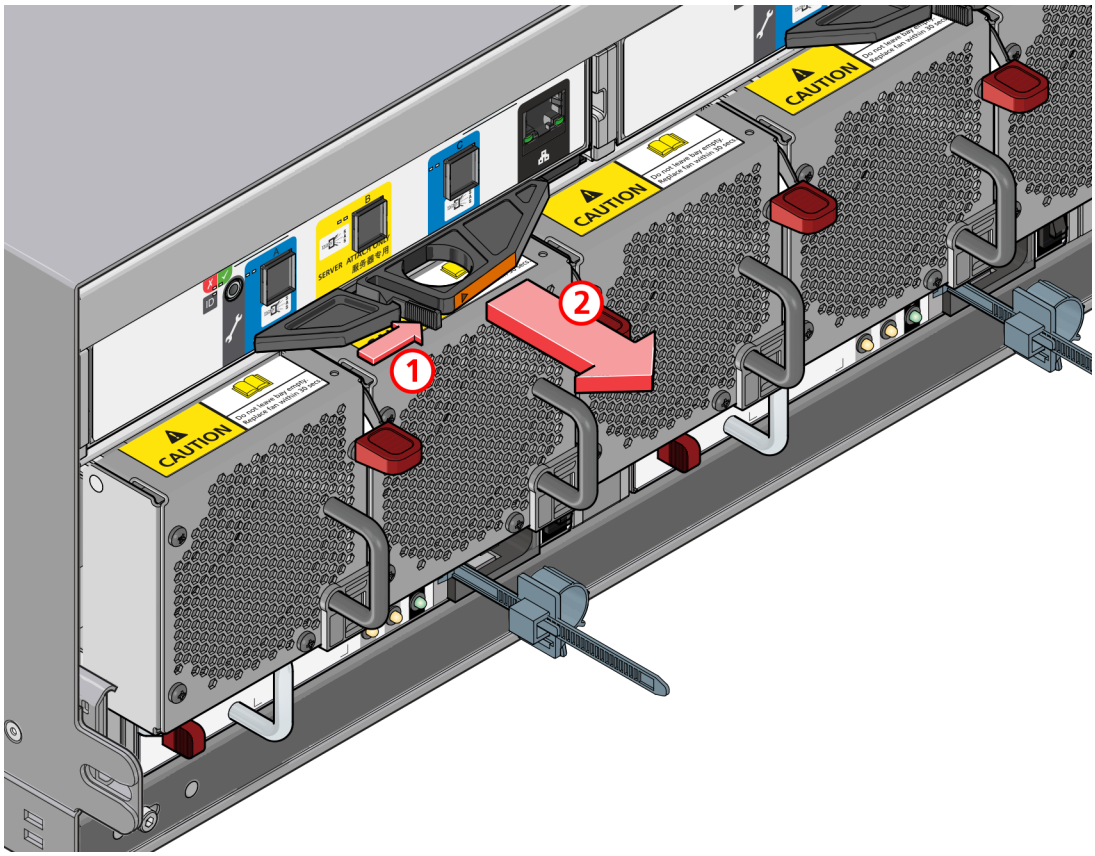


Figure 104. Removing an ESM (1)

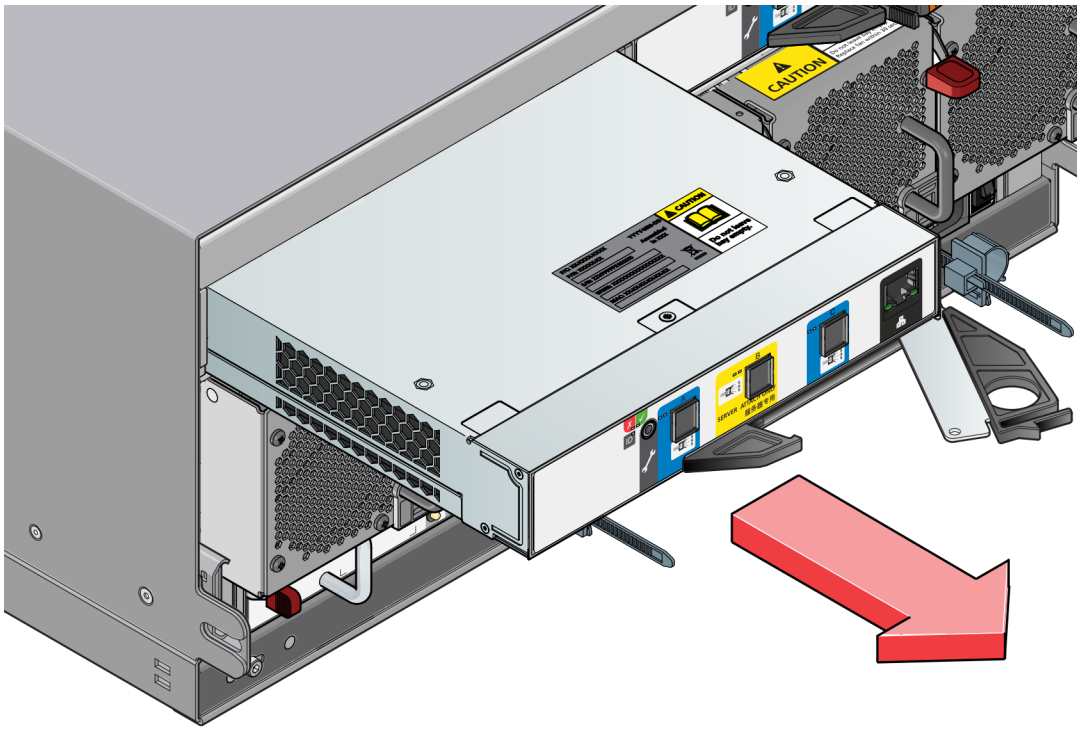


Figure 105. Removing an ESM (2)

Important: The ESM bay must not be empty for more than two minutes while the enclosure is powered.

Inserting an ESM (5U Enclosures)

1. Rotate the ESM so that the release latch is at the bottom.
2. Open the release latch and rotate it to its most open position (as shown in “Removing an ESM (5U Enclosures)” on page 94).
3. Slide the ESM into its bay until it goes no further and the handle has started to close.
4. Close the latch until it clicks home. This levers the module home into its connector on the midplane. The enclosure automatically detects the new unit.
5. Connect the cables to the new module (if necessary, refer to the note you made before you removed the cables from the defective ESM).

Replacing an enclosure chassis

Notes:

- 2U enclosures only.
- Do not attempt to replace an enclosure chassis for 5U enclosure by yourself. Contact Lenovo service or representative if you want a replacement for 5U enclosure chassis.

This topic provides instructions on how to remove and install an 2U enclosure chassis.

Whether your storage enclosure product is a 2U12 or 2U24 model, a fully functional replacement chassis requires the successful removal, labeling, and installation of the following components:

- All power and data cables
- All disk drive modules
- Two power cooling modules (both AC)
- Two IOMs of the same model type

Before you begin

Important: Do not remove the enclosure until you have received the replacement enclosure.

Before you replace the enclosure, do the following:

1. Schedule down time that will allow for shutdown.
2. Verify the existence of a known/good backup of the system.
3. Record system settings for future use and label all cables.
4. Prepare a suitable static-protected work environment to accommodate chassis replacement tasks.

Verifying component failure

The enclosure FRU includes the enclosure’s metal housing, the module runner system, the integrated Ops panel, and the assembled/installed midplane PCB that connects ESMs, disk drive modules, and power cooling modules. This FRU replaces an enclosure that has been damaged, or whose midplane has been damaged. Often, a damaged midplane will appear as though a ESM has failed. If you replace a ESM and it does not remedy the fault, you may need to replace the enclosure chassis.

Observe enclosure health (front panel and rear panel) using management interfaces or JBOD configuration tool to verify enclosure failure or enclosure operation.

Replacement procedure

Before replacing a damaged enclosure chassis, ensure that you do the following:

1. Schedule the down time of the connected hosts.
2. Power off the storage enclosure.

Note: If there is any hardware or software RAID/application in using, ensure that you shutdown the service or hosts before powering off the storage enclosures.

Attention: Within the new enclosure chassis, reinstall each disk drive or disk drive blank into the same disk slot from which it was removed from the damaged enclosure chassis. To ensure optimal cooling throughout the enclosure, dummy drive carriers must be fitted to all unused drive slots.

To replace an enclosure chassis, do the following:

1. Facing the front of the storage enclosure, remove the cosmetic bezel and drive carrier modules from the damaged chassis and place them in a static-protected work area nearby.

   Note: If you temporarily stack the disks before installing them, insert static dissipative foam between the drive modules.

   For more information about removing and installing the drive carrier module, see

   - “Removing a 3.5-inch Drive Carrier Module” on page 77
   - “Installing a 3.5-inch Drive Carrier Module” on page 79
   - “Removing/Replacing 2.5-inch Drive Carrier Modules” on page 81
2. Facing the rear of the storage enclosure, remove the power cables and data cables between devices as needed..
   - Between the cascaded enclosures.
   - Between the ESMs and the hosts.

   Note: Label the cables to facilitate reconnection of the storage devices.
3. Remove the damaged enclosure chassis from the rack and place it in the static-protected location.
   a. Remove the retaining screws that secure the front and rear of the enclosure chassis to the rack and rails.

      Note: Do not retain the cosmetic bezels from the damaged enclosure chassis: integrated cosmetic bezels are provided with the new enclosure chassis.

   b. Maintaining a level position, carefully pull the enclosure chassis out of the rack.

   c. Place the enclosure chassis on a static-protected work surface near the newt enclosure chassis, with the removed disk drive modules, cables, and screws.
4. Install the new enclosure chassis into the rack.

   Important: Install the enclosure chassis into the rack before re-inserting the disk drive modules.
5. Remove the two Power Cooling Modules (PCMs) from the damaged enclosure chassis rear panel, and install them in the new enclosure chassis. See “Removing a Power Cooling Module” on page 76 and “Installing a Power Cooling Module” on page 77.
6. Remove the two ESMs from the damaged enclosure chassis rear panel, and install them in the replacement chassis. See “Removing an ESM (2U Enclosures)” on page 92 and “Installing an ESM (2U Enclosures)” on page 93.

   Note: Within the new enclosure chassis, each CRU must be reinstalled into the same CRU slot from which it was extracted from the damaged enclosure chassis.

7. Facing the front of the enclosure chassis, install disk drive modules and cosmetic bezel into the new enclosure chassis.
8. Complete the enclosure chassis replacement process.
   a. Reconnect data cables between devices, as needed, to return to the original cabling configuration:
      - Between cascaded storage enclosures.
      - Between the ESMs and the hosts.
   b. Reconnect power cables to the storage enclosures.

Verifying component operation

1. Restart system devices by moving the power switch on the power supply to the **On** position in the following sequence:
   a. All JBOD enclosures first.
   b. Data host last (if powered down for maintenance purposes).

   Allow time for each device to complete its Power On Self Tests (POST) before proceeding.
2. Check all the RAID/application service health status from the hosts.

Using LEDs

View LEDs on the enclosure front and rear panels.

Verify front panel LEDs

Front panel LEDs reside on the Ops panel located on the left ear flange. Disk LEDs are located on the carrier modules.

- Verify that the System Power On/Standby LED is illuminated green, and that the Module Fault LED is not illuminated.
- Verify that the enclosure ID LED located on the left ear is illuminated green.
- Verify that the disk module's Green LED is illuminated green or blinking green, and that the disk module's Amber LED is not illuminated.

For 5U84 enclosures, status LEDs located on the Ops panel or drawer bezel will illuminate amber if there is a disk fault. Alternatively, you can open a drawer to confirm that the Drive Fault LED is not illuminated amber on any disk.

Verify rear panel LEDs

Rear panel LEDs reside on plug-in module face plates.

- Verify that each power cooling module's PCM OK LED is illuminated green (2U enclosures).
- Verify that each PSU Power OK LED is illuminated green, and neither fail LED is amber (5U enclosure).
- Verifythat each cooling module OK LED is illuminated green (5U enclosure)

For ESMs, verify that the OK LED is illuminated green, indicating that the module has completed initializing, and is online.

Using management interfaces

In addition to viewing LEDs as described above, you can use management interfaces to monitor the health status of the system and its components, provided you have configured and provisioned the system, and enabled event notification.

Select from the following methods to verify component operation:

- Use the Telnet to check the health status. Log in the GEM CLI via Telnet session and command report_ faults for the enclosure status overview.
- Use the JBOD configration tool. Run the configration tool on the host for the desired enclosure target. Enter the command `report_faults` for enclosure status overview.

Chapter 7. GEM CLI Commands

Overview of GEM

GEM (Generic Enclosure Management) is the firmware responsible for actively managing the ESM and enclosure electronics. Additional software is required for other components in the system. GEM resides in flash memory.

In an enclosure with two ESMs, GEM runs on both of them in an active-active redundant configuration. This allows for the collection of consistent enclosure status from either channel as well as providing dual path control capabilities. As there are two instances of GEM, enclosure operation can be maintained in the event that an ESM fails.

The enclosure management tasks performed by GEM include:

- Thermal management – Monitoring and control of temperatures and enclosure cooling.
- Power management – Intelligent power and fault tracking to ensure that the enclosure power supplies are never oversubscribed. GEM allows you to power cycle individual ESMs as well as the enclosure as whole.
- Drive management – Spinning up drives using input from power management.
- SAS expander management – Control of access to the drives through SAS and providing of status information about link quality and device mapping within the enclosure.
- High availability – Ensuring the management environment for both ESMs is synchronized and detecting and managing of scenarios where an ESM has failed (dual ESM systems only).
- Battery management – Management of the battery system so that enclosures can flush their data caches to non-volatile storage if AC power fails.
- Fault reporting – Collection of fault information gathered from the enclosure and its display on the various fault indicators as well as the electronic interfaces provided.

Overview of the GEM CLI

The GEM firmware provides a built in command line interface (CLI) for interacting with the enclosure. This is not intended as a general means of controlling the system (like SES or IPMI) and is most often used for gathering data when a fault has occurred and for setting the SAS zoning profile.

The CLI is under continuing development and its behavior is subject to change.

As well as native CLI commands, the CLI can be used as a wrapper to send certain SES and IPMI commands.

In the CLI commands listed in the following sections, these conventions are used:

- Parameters are given between angle brackets (<>). These must be substituted with a suitable argument. The options available are described for each command. Parameters without angle brackets are literal text, for example ‘all’ is sometimes used to specify all available options.
- Parameters in square brackets ([]) are optional.
- The vertical bar (|) is used to mean as a logical OR, meaning that one option or the other can be chosen.

Example:

```
help [all] | [<cmd>]
```

This means that the help command can be invoked with the all parameter or the name of a command:

```
help all
help ddump
```

Numeric parameters can be specified in decimal, hexadecimal, or octal:

- Decimal – Use the numerical value, for example: “14”.
- Octal – Use a leading zero, for example: “016”.
- Hexadecimal – Use a leading zero and “x”, for example: “0xE”

String parameters must be enclosed in quotes if the parameter includes spaces or tabs, or if the case must be preserved (by default strings are converted to lower case).

To send a command to the partner ESM, precede the command with a minus sign (“-”). For example, `ver` gives software versions numbers for the current ESM, while `-ver` gives the same information for the partner ESM.

A single command cannot exceed 120 characters in length.

Connecting to the GEM CLI

Set up the Ethernet connection before you power on the enclosure. Ensure that the network is configured to use DHCP and check that the DHCP server is assigned to correct IP addresses.

DHCP is enabled by default when your system meets the following requirements:

System	EC number on the label of ESM	Firmware version
D1212/D1224	N34768	5.0.0.15
D3284	N34764	5.0.0.17

Notes:

- Do not connect the Ethernet port to the public network. It is recommended that all the ESM Ethernet ports are in the local area network.
- If the EC number on the label of ESM is 019609 or later, the firmware installed on the ESM has newer version and the static IP addresses on each Ethernet port are as follows:
  - ESM 0: 192.168.0.101
  - ESM 1: 192.168.0.102
- When the Storage D3284 is used as the expansion enclosure of Storage DS-series, the Ethernet connector on each ESM is disabled.

GEM CLI via Telnet

GEM CLI can be accessed via Telnet by connecting to the Ethernet port of a controller and using the command

```
Telnet <ESM IP>
```

The default account and password are:

- User name: cliuser
- Password: L@12sT12 (case sensitive)

Note: After replacing the chassis, the password will be restored to the default value. Reset the password as needed.

GEM CLI General Commands

The CLI commands in the following section are for general use, and can be issued without any possibility of causing data loss or other serious problems.

change_password

Changes the password for the currently logged in user. The password is changed at the enclosure level, so all ESMs use the updated login credentials on completion.

The command is interactive and the current password must be specified before a new password can be specified.

Syntax:

```
change_password
```

Example:

```
0+02:58:35.445 MO GEM> change_password
Enter Old Password:********
Enter New Password:*******
Reenter New Password:*******
password change success
0+02:58:55.822 MO GEM>
```

cleardriveindicator

Stops displaying a drive location indication on the specified drive bay. The drive location indication is used to aid in locating a drive bay for servicing.

Syntax:

```
cleardriveindicator <drive>

 drive                   The 0-based ID of the drive bay for which the locate indication is to be halted
```

Example:

```
0+03:03:11.579 MO GEM> cleardriveindicator 0
0+03:05:17.297 MO GEM>
```

ddump

Displays all enclosure diagnostic information. The information from this command must be provided for both ESMs when submitting problem reports.

Syntax:

```
ddump
```

Example:

```
0+03:18:10.897 MO GEM> ddump
------------------------------------------------------------------------
batt_dump_regs
Diagnostic dump of the battery registers
Battery 1 - Not Present
Battery 2 - Not Present
Battery 3 - Not Present
Battery 4 - Not Present
...
255 | 0000000000000000 | 0000000000000000 | 0000000000000000 |
0+03:10:32.272 MO GEM>
```

ddumpo

This command is similar to the ddump command except that the ddumpo command captures more useful information first with less useful information at the end. ddump invokes the commands in alphabetical order whereas ddumpo lists by category.

Syntax:

```
ddumpo
```

Example:

```
5+03:25:41.123 M1 GEM> ddumpo
---------------------------------- Version command group ----------------------------------
-------------------------------------------------------------------------------------------------------------------------------
Dumps the i2c Bus Manager device state and device access statistics
Multibus manager device information:
device:0 bus:32 deviceIndex:00:

 type: 8                address:0x4c             devType:end device              parent:N/A


 busMask:0x00000006           selection:0x00000000           selectionDone:0x00000000

Device stats:

                               read                                    write
 success                       0                                       0
 slave                         0                                       0
 arb loss                      0                                       0
 busy                          0                                       0
 NAK                           0                                       0
 error                         0                                       0
 timeout                       0                                       0
 slavedrop                     0                                       0
 no resp                       0                                       0
 total                         0                                       0
 ----------------Retry Stats------------------------
 Success after
 NoRetry                       0                                       0
 OneRetry                      0                                       0
 MultiRetry                    0                                       0
 Failure after
 MultiRetry                    0                                       0


...

 Customer VPD Region                                  10
 Total Writes                                         0
 Success                                              0
```

```
Unsuccessful                                    0
Device not ready                                0

5+03:27:47.299 M1 GEM>
```

driveinv

This command shows a quick view of all drives, such as vendor, model, serial number, firmware version, temperature, and capacity information.

Note: This command is supported on version 5.0.0.19 or later.

Syntax:
```
driveinv
```

Example:
```
2+15:08:09.151 M0 GEM> driveinv

Drive    Vendor    Model          Serial                      Rev          Temp       Size
0        LENOVO    ST1800MM0018   X  S3Z0EFWW0000M642K6YY     L59B         29 C       1800  GB
1        LENOVO    ST1800MM0018   X  S3Z0DTJB0000K6436TPH     L59B         30 C       1800  GB
2        LENOVO    ST1800MM0018   X  S3Z0DKP40000M6434UTM     L59B         30 C       1800  GB
3        LENOVO    ST1800MM0018   X  S3Z0DR270000M6431YPK     L59B         28 C       1800  GB
```

exit

Terminates the current CLI session. When run over the serial port, this returns the user to the login prompt. When run over telnet, the telnet session is terminated.

Usage:
```
exit
```

Example:
```
0+03:20:09.677 M0 GEM> exit
Login:
```

getboardid

Retrieves the identity and operating mode of the ESMs on which the command is executed.

Syntax:
```
getboardid [mode]

 mode                  When mode is set to “hex”the command output is provided as a
                       machine readable hexadecimal dump
```

Example:
```
0+03:24:40.474 M0 GEM> getboardid
Board ID: 0, Mode: master
```

getvpd

Displays inventory information for all populated enclosure FRUs.

Note: Canister is another term for ESM.

Syntax:
```
getvpd
```

Example:
```
0+03:40:34.561 MO GEM> getvpd
Battery 1: Not Present
Battery 2: Not present
Enclosure:

 Vendor                                  : LENOVO
 PID                                     : 2U24ENCJ12ESM3P
 WWN                                     : 50050CC1062296AA
 SN                                      A123B456c789dEF
 PN                                      : 4587HC2

Canister 0: Present

 Version                                : 06
 Vendor                                 : LENOVO
 PID                                    : J12ESM3P
 SN                                     : IMS0989198G06SF
 PN                                     : 0989198-06

Canister 1: Present

 Version                                 : 06
 Vendor                                  : LENOVO
 PID                                     : J12ESM3P
 SN                                      : IMS0989198G06XF
 PN                                      : 0989198-06

Midplane:

 Version                                  : 13
 PID                                      : D1224
 SN                                       : BPS0994355G19R1
 PN                                       : 0994355-04

Expander 0: Present

 SMP Target                             : 50050CC11084913F
 SSP Target                             : 50050CC11084913E

0+03:42:29.293 MO GEM>
```

help

Displays the complete list of supported CLI commands or provides usage information for a specified command.

Syntax:

```
help [[type] | [cmd]]
```

type	The command classification to list
cmd	The specific command for which the usage shall be retrieved

Example:

```
0+03:42:33.775 MO GEM> help
Supported commands:
```

change_password	To change Current User Password
cleardriveindicator	Clears the drive indicator LED
ddump	System-wide diagnostic dump
ddumpo	Ordered system-wide diagnostic dump
exit	To logout from the cli connection
getboardid	Get this board ID and mode
getvpd	List all VPD information
help	Displays command information
hid_set_ident	Set/clear enclosure identify mode
ipconfig	Set IP Configuration in VPD
logcmt	Insert comment in logdump
logdump	Display logged msgs
logdumpnv	Display Non-Vol logged msgs
poweroffdrive	Powers off a drive (includes spin-down)
powerondrive	Powers on a drive (includes spin up)
report_faults	Reports all system-wide faults
reset_saved_zone_info	Erases saved zone information from flash and resets the context with default values
set_encl_id	Set enclosure ID
set_zone_mode	Change default configuration for zoning
setcanisterindicator	Set/Clear the local canister indicator status
setdriveindicator	Set the drive indicator LED
settime	Sets unit time
ver	Version information

```
0+03:49:10.821 MO GEM>
```

hid_set_ident

Sets or clears the locate indication on the enclosure Ops panel. The locate indication is used to aid in the identification of the physical enclosure for maintenance.

Usage:

```
hid_set_ident <State>
```

state	1 = Enable locate indication on ops panel
	0 = Disable locate indication on ops panel

Example:

```
0+03:49:13.187 MO GEM> hid_set_ident 1
Enclosure identify status = set
0+03:55:43.808 MO GEM> hid_set_ident 0
Enclosure identify status = cleared
0+03:56:39.021 MO GEM>
```

ipconfig

Configures the ESM's Ethernet management port. Some changes may require a reboot of the ESM to activate. When run with no arguments, the current IP information is displayed.

Syntax:

```
ipconfig [option]
```

option

- ether <state>

  Enable or disable the management Ethernet Port. Changes must be activated by rebooting The ESM.

state	
enable	Enable the Ethernet port
disable	Disable the Ethernet port

- dhcp <state>

  Enable or disable DHCP address assignment. A valid static configuration must be present for the disable option to be success

state	
enable	Enable DHCP
disable	Disable DHCP

- Telnet <state>

  Enable or disable telnet CLI access.

state	
enable	Enable telnet CLI
disable	Disable telnet CLI

- ip <addr> <netmask> [gateway]

  Set the static IP configuration for the port. These settings will only apply if DHCP address assignment is disabled.

addr	The IPv4 address to assign to the Ethernet port
netmask	The subnet mask to assign to the Ethernet port
gateway	An optional default route to be used by the Ethernet port

- dns <dns1> [dns2]

  Set any static DNS addresses. These settings will only apply if DHC address assignment is disabled.

dns1	The IPv4 address of the primary Domain Name Server
Dns2	The IPv4 address of the optional secondary Domain Name Server

Example:

```
0+03:56:39.021 MO GEM> ipconfig

Ether:                                  Enabled
DHCP:                                   Enabled
Telnet:                                 Enabled
IP:                                     10.22.168.220
Net Mask:                               255.255.240.0
Gateway:                                10.22.160.1
DNS 1:                                  0.0.0.0
DNS 2:                                  0.0.0.0
MAC:                                    02:50:0C:C1:00:00
0+03:59:58.290 MO GEM> ipconfig ip 192.168.0.2 255.255.255.0
0+05:04:43.295 MO GEM> ipconfig dhcp disable
0+05:05:18.388 MO GEM> ipconfig
Ether:                                  Enabled
DHCP:                                   Disabled
Telnet:                                 Enabled
IP:                                     192.168.0.2
Net Mask:                               255.255.255.0
Gateway:                                0.0.0.0
DNS 1:                                  0.0.0.0
DNS 2:                                  0.0.0.0
MAC:                                    02:50:0C:C1:00:00
```

logcmt

Writes a user-defined message to the GEM error log

Syntax:

```
logcmt <message>
```

message	The message to write to the log. To retain case sensitivity and preserve spaces, enclose message in double quotes e.g. “A message”

Example:

```
0+06:41:40.097 MO GEM> logcmt "User message 1"
0+06:45:30.783 MO GEM> logdump r new 1
6+04:53:46.784; ENC_MGT; can_manager; 04; MO:User message 1
0+06:45:40.469 MO GEM>
```

logdump

Retrieves the EMS error log. Two log regions exist: volatile and non-volatile. The volatile region is printed by default.

Syntax:

```
logdump [<region> [order] [count]]

When run with no arguments the entire volatile log is output in newest first order.

 region                   'r' - Dump the volatile RAM log
                          'n' - Dump the non-volatile log

 order                    'new' - Retrieve newest messages first
                          'old' - Retrieve oldest messages first

 count                    The number of messages to retrieve
```

Example:

```
0+06:55:42.222 MO GEM> logdump
6+05:03:14.780; ENC_MGT; can_manager; 04; MO:Message 3
6+05:03:12.353; ENC_MGT; can_manager; 04; MO:Message 2
6+05:03:10.093; ENC_MGT; can_manager; 04; MO:Message 1
0+06:55:43.831 MO GEM> logdump r old
6+05:03:10.093; ENC_MGT; can_manager; 04; MO:Message 1
6+05:03:12.353; ENC_MGT; can_manager; 04; MO:Message 2
6+05:03:14.780; ENC_MGT; can_manager; 04; MO:Message 3
0+06:56:44.390 MO GEM> logdump n
6+05:03:14.780; ENC_MGT; can_manager; 04; MO:Message 3
6+05:03:12.354; ENC_MGT; can_manager; 04; MO:Message 2
6+05:03:10.094; ENC_MGT; can_manager; 04; MO:Message 1
0+06:56:45.390 MO GEM> logdump r
6+05:03:14.780; ENC_MGT; can_manager; 04; MO:Message 3
6+05:03:12.354; ENC_MGT; can_manager; 04; MO:Message 2
6+05:03:10.094; ENC_MGT; can_manager; 04; MO:Message 1
0+06:58:00.622 MO GEM> logdump r new 2
6+05:03:14.780; ENC_MGT; can_manager; 04; MO:Message 3
6+05:03:12.353; ENC_MGT; can_manager; 04; MO:Message 2
0+06:58:48.320 MO GEM>
```

logdumpnv

This command is an alias for `logdump n`.

Syntax:

```
logdumpnv [order] [count]
When run with no arguments the entire non-volatile log is output in newest first order.

 order                   'new' - Retrieve newest messages first
                         'old' - Retrieve oldest messages first

 count                   The number of messages to retrieve
```

Example:

```
0+06:55:42.222 MO GEM> logdumpnv
6+05:03:14.780; ENC_MGT; can_manager; 04; MO:Message 3
6+05:03:12.353; ENC_MGT; can_manager; 04; MO:Message 2
6+05:03:10.093; ENC_MGT; can_manager; 04; MO:Message 1
0+06:55:43.831 MO GEM> logdumpnv old
6+05:03:10.093; ENC_MGT; can_manager; 04; MO:Message 1
```

```
6+05:03:12.353; ENC_MGT; can_manager; 04; MO:Message 2
6+05:03:14.780; ENC_MGT; can_manager; 04; MO:Message 3
0+06:58:00.622 MO GEM> logdumpnv new 2
6+05:03:14.780; ENC_MGT; can_manager; 04; MO:Message 3
6+05:03:12.353; ENC_MGT; can_manager; 04; MO:Message 2
0+06:58:48.320 MO GEM>
```

poweroffdrive

Powers off the drives within the specified bays.

Syntax:

```
poweroffdrive <drives>

 drives                   Takes the form of a comma separated list of drive bays that are to be powered off. Specifying “al
```

Example:

```
0+06:55:42.222 MO GEM> poweroffdrive 0
0+06:55:43.831 MO GEM> poweroffdrive 1,2,3,4,5,6
0+06:58:00.622 MO GEM> poweroffdrive all
```

powerondrive

Powers on the drives within the specified bays.

Syntax:

```
powerondrive <drives>

 drives                   Takes the form of a comma separated list of drive bays that are to be powered on. Specifying “all”
```

Example:

```
0+06:55:42.222 MO GEM> powerondrive 0
0+06:55:43.831 MO GEM> powerondrive 1,2,3,4,5,6
0+06:58:00.622 MO GEM> powerondrive all
```

report_faults

Outputs a summary of the all the faults currently detected by the enclosure firmware.

Syntax:

```
report_faults
```

Example:

```
0+06:55:42.222 MO GEM> report_faults
------------------------------------------------------------------------
Canister Manager faults
Canister 0 Faults:
...
Power Manager faults
No faults
------------------------------------------------------------------------
0+07:11:44.029 MO GEM>
```

reset_saved_zone_info

When saved SAS zone settings are enabled, this command restores the default SAS zoning configuration for the product. If saved zone settings are not enabled, this command has no effect.

Syntax:
```
reset_saved_zone_info
```

Example:
```
0+06:55:42.222 MO GEM> reset_saved_zone_info
Restored saved zoning information to default values
0+07:11:44.029 MO GEM>
```

set_encl_id

Sets the value of the enclosure ID display on the Ops panel. When run with no arguments, the command returns the current ID. The enclosure ID value persists a reboot.

Syntax :
```
set_encl_id [id]

 id                       The ID value to display on the ops panel in the range 0-99


When run without arguments, this command returns the current ID.
```

Example:
```
0+07:23:30.932 MO GEM> set_encl_id
Valid Enclosure ID range: 1 - 99
Current Enclosure ID: 0
Hex display mode: 0
0+07:24:50.749 MO GEM> set_encl_id 10
Enclosure ID initiated to set '10'
0+07:25:05.213 MO GEM> set_encl_id
Valid Enclosure ID range: 1 - 99
Current Enclosure ID: 10
Hex display mode: 0
0+07:25:07.959 MO GEM>
```

set_zone_mode

Notes:

- The 5U enclosure supports zoning mode on version 5.0.0.39 or later. After upgrading from the version 5.0.0.17, the zoning mode will be set to zone mode 88 automatically. The zone mode 88 is the setting to retain the non-zoning group in earlier firmware version. Reset the zoning mode to other setting except the zone mode 0 as needed, otherwise, the physical PHY reset and drive disconnection may occur.
- Zoning mode 1, 2, 3, 4, and 5 are supported only when the single enclosure is in use.
- After replacing the chassis, zoning mode will be restored to zone mode 0. Reset the zoning mode as needed.

When the predefined SAS zone modes are supported by the product, this command may be used to query and change the current operational zone mode (drive partitioning scheme).

Table 1, "Zoning Modes" shows zoning schemes that can be implemented.

Table 21. Zoning Modes

Zoning mode	Description	D1212	D1224	D3284
0	Zoning disabled	Port A -> Universal Port B -> Universal	Port A -> Universal Port B -> Universal	Port A -> Universal Port B -> Universal

Table 21. Zoning Modes (continued)

Zoning mode	Description	D1212	D1224	D3284
		Port C -> Universal	Port C -> Universal	Port C -> Universal
1	Drives partitioned into 2 groups	Port A -> Drives 0-1, 4-5, 8-9 Port B -> Drives 2-3, 6-7, 10-11 Port C -> Expansion	Port A -> Drives 0-11 Port B -> Drives 12-23 Port C -> Expansion	Port A -> Drives 0-6, 14-20, 28-34, 42-48, 56-62, 70-76 Port B -> Drives 7-13, 21-27, 35-41, 49-55, 63-69, 77-83 Port C -> Expansion
2	Drives partitioned into 3 groups	Port A -> Drives 0-3 Port B -> Drives 4-7 Port C -> Drives 8-11	Port A -> Drives 0-7 Port B -> Drives 8-15 Port C -> Drives 16-23	Port A -> Drives 0-4, 14-18, 28-31, 42-46, 56-60, 70-73 Port B -> Drives 5-9, 19-22, 32-36, 47-51, 61-64, 74-78 Port C -> Drives 10-13, 23-27, 37-41, 52-55, 65-69, 79-83
3	Drives partitioned into 3 groups with y-cable	Port A.0 -> Drives 0-3 Port A.1 -> Drives 4-7 Port B.0-> Drives 8-11 Port B.1 -> Unused Port C-> Expansion	Port A.0 -> Drives 0-7 Port A.1 -> Drives 8-15 Port B.0 -> Drives 16-23 Port B.1 -> Unused Port C -> Expansion	Port A.0 -> Drives 0-4, 14-18, 28-31, 42-46, 56-60, 70-73 Port A.1 -> Drives 5-9, 19-22, 32-36, 47-51, 61-64, 71-78 Port B.0 -> Drives 10-13, 23-27, 37-41, 52-55, 65-69, 79-83 Port B.1 -> Unused Port C -> Expansion
4	Drives partitioned into 4 groups with y-cable	Port A.0 -> Drives 0, 4, 8 Port A.1 -> Drives 1, 5, 9 Port B.0-> Drives 2, 6, 10 Port B.1 -> Drives 3, 7, 11 Port C-> Expansion	Port A.0 -> Drives 0-5 Port A.1 -> Drives 6-11 Port B.0 -> Drives 12-17 Port B.1 -> Drives 18-23 Port C-> Expansion	Port A.0 -> Drives 0-3, 14-17, 28-30, 42-45, 56-58, 70-72 Port A.1 -> Drives 4-6, 18-20, 31-34, 46-48, 59-62, 73-76 Port B.0 -> Drives 7-10, 21-24, 35-37, 49-52, 63-65, 77-79 Port B.1 -> Drives 11-13, 25-27, 38-41, 53-55, 66-69, 80-83 Port C-> Expansion

Table 21. Zoning Modes (continued)

Zoning mode	Description	D1212	D1224	D3284
5	Drives partitioned into 6 groups with y-cable	N/A	Port A.0 -> Drives 0-3 Port A.1 -> Drives 4-7 Port B.0 -> Drives 8-11 Port B.1 -> Drives 12-15 Port C.0 ->Drives 16-19 Port C.1 ->Drives 20-23	Port A.0 -> Drives 0, 1, 2, 14, 15, 28, 29, 42, 43, 44, 56, 57, 70, 71 Port A.1 -> Drives 3, 4, 16, 17, 18, 30, 31, 45, 46, 58, 59, 60 Port B.0 -> Drives 5, 6, 19, 20, 32, 33, 34, 47, 48, 61, 62, 74, 75, 76 Port B.1 -> Drives 7, 8, 9, 21, 22, 35, 36, 49, 50, 51, 63, 64, 77, 78 Port C.0 ->Drives 10, 11, 23, 24, 25, 37, 38, 52, 53, 65, 66, 67, 79, 80 Port C.1 ->Drives 12, 13, 26, 27, 39, 40, 41, 54, 55, 68, 69, 81, 82, 83
Note: A '.0' or '.1' In the port name indicates the use of a y-cable to split one x4 port into two x2 ports. .0 is the first leg of the y-cable and .1 is the second leg of the cable.				

Syntax :

```
set_zone_mode [mode]

 mode                          A number between 0-254 detailing the drive partitioning scheme to be applied. Zone
                               mode 0 disables zoning permitting access to all drives from any host.

When run without arguments, this command returns the currently active zone mode.
```

Example:

```
0+07:15:06.839 MO GEM> set_zone_mode
Current Zone Mode: 0
0+07:19:51.429 MO GEM> set_zone_mode 1
0+07:19:51.429 MO GEM> set_zone_mode
Current Zone Mode: 1
0+07:20:14.436 MO GEM>
```

setcanisterindicator

Sets or clears the location indication for the ESM on which the command is executed.

Syntax:

```
setcanisterindicator <state>

 state                   1 - Enable ESM location indication
                         0 - Disable ESM location indication
```

Example:

```
0+03:03:11.579 MO GEM> setcanisterindicator 1
0+03:05:17.297 MO GEM> setcanisterindicator 0
0+07:29:06.202 MO GEM>
```

setdriveindicator

Starts displaying a drive location indication on the specified drive bay. The drive location indication is used to aid in locating a drive bay for servicing.

Syntax:
```
setdriveindicator <drive>

 drive                    The 0-based ID of the drive bay for which the locate indication is to be displayed
```

Example:
```
0+03:03:11.579 MO GEM> setdriveindicator 1
0+03:05:17.297 MO GEM>
```

settime

Sets the current log time for the enclosure. Setting the log time on one ESM synchronises it with the partner ESM, if present. An uptime (time since enclosure start) or a calendar time may be specified. The log time does not survive a power cycle and may drift if not refreshed regularly. When run without arguments, the current log time may be queried.

Syntax:
```
settime [[options] [time]]

 options
 -c                       <time> argument is calendar time in the format:<year> <mon> <day> <hr> <min> <sec>
 -u                       <time> argument is up-time in the format: <days> <hrs> <mins> <secs>

If no time format option is specified, <time> takes the uptime format .
```

Example:
```
0+07:38:26.383 MO GEM> settime 100 11 20 5
0+07:38:40.750 MO GEM> settime
Current Time: 100+11:20:13.748
0+07:38:48.755 MO GEM> settime -u 120 23 0 44
0+07:39:09.491 MO GEM> settime
Current Time: 120+23:00:46.740
0+07:39:11.745 MO GEM> settime -c 2016 6 6 19 59 0
0+07:39:42.549 MO GEM> settime
Current Time: 2016-06-06 19:59:03.163
0+07:39:45.173 MO GEM>
```

ver

Retrieves the firmware version information for the enclosure.

Syntax:
```
ver
```

Example:

```
0+07:41:18.270 MO GEM> ver
Canister firmware                          : 5.0.0.7
Canister firmware date                     : Jun 14 2016 16:15:32
Revision control hash                      : 0bb77f0a3cee571e58f07b606167c73db20c50e1
Product build type                         : sbb_sas
Canister bootloader                        : 1.01
Canister config CRC                        : 0x91B3C0F7
```

```
Canister VPD structure                  : 0x06
Canister VPD CRC                        : 0x8EB959A1
Canister CPLD                           : 0x0A.00
Canister Power CPLD                     : Not present
Canister chip                           : 0x80540002
Canister SDK                            : 4.08.02-B82
Midplane VPD structure                  : 0x0C
Midplane VPD CRC                        : 0xEAC4EEC9
Midplane CPLD                           : 0x13
PCM 1 firmware                          : 3.11
PCM 2 firmware                          : 2.09
PCM 1 VPD structure                     : 0x03
PCM 2 VPD structure                     : 0x03
PCM 1 VPD CRC                           : 0x6B58AD13
PCM 2 VPD CRC                           : 0x6B58AD13
Battery 1 firmware                      : Not present
Battery 2 firmware                      : Not present
0+07:41:26.877 M0 GEM>
```

Chapter 8. Technical Specifications

Dimensions

Enclosure (Rack)	2U Enclosures		5U Enclosures	
	Inches	millimeters	Inches	millimeters
Height (enclosure, overall)	3.46	87.9	8.75	222.3
Width across mounting flange	19.01	483	19	482.6
Width across body of enclosure	17.44	443		
Depth from front mounting flange to extremity of enclosure body	22.71	576.8		
Depth from Ops panel to furthest extremity of enclosure	24.79	629.6		
Depth from front mounting flange to furthest extremity of enclosure	23.74	602.9		
Depth from rear of front flanges to rear extremity of chassis			36	915

Weights

Component	2U12 (kg/lb.)	2U24 (kg/lb.)	5U84 (kg/lb.)
Enclosure (empty)	4.8/10.56	4.8/10.56	< 64 kg
Drive carrier	0.9/1.98	0.3/0.66	0.8/1.8
Dummy drive carrier	0.05/0.11	0.05/0.11	
PCM	3.5/7.7	3.5/7.7	
PSU			2.7/6
ESM	1.5/3.3	1.5/3.3	
Enclosure (fully populated) total weight (maximum)	28/62	25/55	130.7/297.5
Cooling module			1.4/3

Environment

Table 22. Ambient Temperature and Humidity

	2U Enclosures		5U enclosures	
	Operational	Non-Operational / Shipping	Operational	Non-Operational / Shipping
Temperature Range	5°C to 40°C	-40°C to +70°C	5°C to 35°C	-40°C to +70°C
Relative Humidity	20% to 80% non-condensing	5% to 100% non-precipitating	20% to 80% non-condensing	5% to 100% non-condensing
Max. Wet Bulb	28°C	29°C	28°C	29°C

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 H2O]).
Altitude, Operational	• 2U enclosures – 0 - 3045 m (0 - 10 000 ft)/De-rated by 5°C above 2133 m (7 000 ft.). • 5U enclosures –-30 to 3048m (-100 to 10000ft)/De-rate 5°C above 2134 m (7000 ft)
Altitude, Non-Operational	-305 to 12192 m (-1 000 to 40 000ft)
Shock, Operational	Vertical axis 5 g 10 ms 1/2 sine
Shock, Non-Operational	• 2U enclosures – 30 g 10 ms 1/2 sine • 5U enclosures – 30 g 10 ms 1/2 sine (Z-axis), 20 g 10 ms 1/2 sine (X- and Y-axes)
Vibration, Operational	0.21 g RMS 5-500 Hz random
Vibration, Non-Operational	1.04 g RMS 2-200 Hz random
Vibration, Relocation	0.3 g 2-200 Hz sine 0.4 decades per minute
Acoustics	Sound Power • 2U enclosures-Operating sound power ≤ 6.6 Bels LWad (re 1 pW) @ 23°C. • 5U enclosures- Operating sound power ≤ 8.0 Bels LWad @ 23°C.
Orientation & Mounting	19" Rack mount (2EIA Units)
• Rack Rails • Rack Characteristics	To fit 800 mm depth racks compliant with the SSI server rack specification Back pressure not exceeding 5 Pa (□0.5 mm H2O)

Power Cooling Module

Note: 2U enclosures only.

HE580W PCM

Dimensions	84.3 mm high x 104.5 mm wide x 340.8 mm long (3.32in x 4.11in x 37.03in)
Maximum Output Power	580 W
Voltage Range	100 - 240 VAC rated
Frequency	50/60 Hz
Voltage Range Selection	Auto ranging: 90 - 264 VAC, 47/63Hz
Maximum Inrush Current	20A
Power Factor Correction	≥95% @ nominal input voltage
Harmonics	Meets EN61000-3-2

Output	+5 V @: 42A, +12 V:@ 38A, +5 V standby voltage @ 2.7A
Operating Temperature	0° to 57°C
Hot Pluggable	Yes
Switches & LEDs	AC mains switch and four status indicator LEDs
Enclosure Cooling	Dual axial cooling fans with variable fan speed control

Power Supply Unit

Note: 5U enclosures only.

Output power	2214 W maximum continuous output power at high line voltage
Voltage	+12 V at 183A (2196 W) +5 V standby voltage at 2.7A
Input voltage range	200 to 240 VAC
Input frequency	50Hz to 60Hz
Power factor correction	>0.95 @ 100% load
Efficiency	82% at 10% load 90% at 20% load 94% at 50% load 91% at 100% load
Holdup time	5 ms from ACOKn high to rails out of regulation (see SBB v2 specification)
Mains inlet connector	IEC60320 C20 with cable retention
Weight	3 kg
Cooling fans	2 stacked fans: 80x80x38mm

Chapter 9. Standards and Regulations

International Standards

The enclosure system complies with the requirements of the following agencies and standards:

- CE to EN 60950-1
- CB report to IEC 60950-1
- UL & cUL to UL 60950-1 second edition

Potential for Radio Frequency Interference

USA Federal Communications Commission (FCC)

Note: 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. The supplier 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.

European Regulations

This equipment complies with European Regulations EN 55022 Class A: Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment and EN50082-1: Generic Immunity.

Safety Compliance

System Product Type Approval	UL, cUL, CE
Safety Compliance	UL 60950-1 second edition
	IEC 60950
	EN 60950

EMC Compliance

Conducted Emissions Limit Levels	CFR47 Part 15B Class A
	EN55022 Class A

	CISPR Class A
Radiated Emissions Limit Levels	CFR47 Part 15B Class A
	EN55022 Class A
	CISPR Class A
Harmonics and Flicker	EN61000-3-2/3
Immunity Limit Levels	EN55024

AC Power Cords

1. United States of America

   Must be NRTL LISTED (National Recognized Test Laboratory, e.g. UL)

	2U	**5U**
Cord type	SV or SVT, 18 AWG minimum, 3 conductor, 2.0M max length.	SJT or SVT, 12 AWG minimum, 3 conductor.
Plug (AC source)	NEMA 5-15P grounding-type attachment plug rated 120 V 10 A *or* IEC 320 C14, 250 V, 10 A.	IEC 320 C20, 250 V, 20 A *or* a suitable plug rated 250 V, 20 A.
Socket	IEC 320, C-13, 250 V, 10 A.	IEC 320 C19, 250 V, 20 A.

2. Europe & Others

   General requirements:

	2U	**5U**
Cord type	Harmonized, H05-VVF-3G1.0	Harmonized, H05-VVF-3G2.5.
Plug (AC source)		IEC 320 C20, 250 V, 16 A *or* a suitable plug rated 250 V, 16A.
Socket	IEC 320, C-13, 250 V, 10A.	IEC 320 C19, 250 V, 16A.

Important: The plug and the complete power cord assembly must meet the standards appropriate to the country, and must have safety approvals acceptable in that country.

Recycling of Waste Electrical and Electronic Equipment

At the end of the product's life, all scrap/ waste electrical and electronic equipment should be recycled in accordance with national regulations applicable to the handling of hazardous/ toxic electrical and electronic waste materials.

Please contact your supplier/Lenovo for a copy of the Recycling Procedures applicable to your product.

Important: Observe all applicable safety precautions detailed in the preceding chapters (weight restrictions, handling batteries and lasers etc.) when dismantling and disposing of this equipment.

Appendix A. Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about Lenovo products, you will find a wide variety of sources available from Lenovo to assist you.

Use this information to obtain additional information about Lenovo and Lenovo products, and determine what to do if you experience a problem with your Lenovo system or optional device.

Note: This section includes references to IBM Web sites and information about obtaining service. IBM is Lenovo's preferred service provider for the System x, Flex System, and NeXtScale System products.

Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself.

If you believe that you require warranty service for your Lenovo product, the service technicians will be able to assist you more efficiently if you prepare before you call.

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Check for updated software, firmware, and operating-system device drivers for your Lenovo product. The Lenovo Warranty terms and conditions state that you, the owner of the Lenovo product, are responsible for maintaining and updating all software and firmware for the product (unless it is covered by an additional maintenance contract). Your service technician will request that you upgrade your software and firmware if the problem has a documented solution within a software upgrade.
- If you have installed new hardware or software in your environment, check http://www.lenovo.com/serverproven/ to make sure that the hardware and software is supported by your product.
- Go to http://support.lenovo.com/ to check for information to help you solve the problem.
- Gather the following information to provide to the service technician. This data will help the service technician quickly provide a solution to your problem and ensure that you receive the level of service for which you might have contracted.
  - Hardware and Software Maintenance agreement contract numbers, if applicable
  - Machine type number (Lenovo 4-digit machine identifier)
  - Model number
  - Serial number
  - Current system UEFI and firmware levels
  - Other pertinent information such as error messages and logs
- Go to http://www.ibm.com/support/ entry/portal/Open_service_request to submit an Electronic Service Request. Submitting an Electronic Service Request will start the process of determining a solution to your problem by making the pertinent information available to the service technicians. The IBM service technicians can start working on your solution as soon as you have completed and submitted an Electronic Service Request.

You can solve many problems without outside assistance by following the troubleshooting procedures that Lenovo provides in the online help or in the Lenovo product documentation. The Lenovo product documentation also describes the diagnostic tests that you can perform. The documentation for most systems, operating systems, and programs contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

Using the documentation

Information about your Lenovo system and preinstalled software, if any, or optional device is available in the product documentation. That documentation can include printed documents, online documents, readme files, and help files.

See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. Lenovo maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to http://support.lenovo.com/.

Getting help and information from the World Wide Web

Up-to-date information about Lenovo products and support is available on the World Wide Web.

On the World Wide Web, up-to-date information about Lenovo systems, optional devices, services, and support is available at http://support.lenovo.com/. The most current version of the product documentation is available in the following Web site:http://support.lenovo.com/. Then click **Servers** and search for the storage system.

Creating a personalized support web page

You can create a personalized support web page by identifying Lenovo products that are of interest to you.

To create a personalized support web page, go to http://www.ibm.com/support/ mynotifications. From this personalized page, you can subscribe to weekly email notifications about new technical documents, search for information and downloads, and access various administrative services.

Software service and support

Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems with your Lenovo products.

For more information about Support Line and other IBM services, see http://www.ibm.com/services or see http://www.ibm.com/planetwide for support telephone numbers. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

Hardware service and support

IBM is Lenovo's preferred service provider for the System x, Flex System and NeXtScale System products.

You can receive hardware service through your Lenovo reseller or from IBM. To locate a reseller authorized by Lenovo to provide warranty service, go to http://www.ibm.com/partnerworld and click **Business Partner Locator**. For IBM support telephone numbers, see http://www.ibm.com/planetwide. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U. K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

Taiwan region product service

Use this information to contact IBM Taiwan region product service.

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

IBM Taiwan region product service contact information:

IBM Taiwan Corporation
3F, No 7, Song Ren Rd.
Taipei, Taiwan Region
Telephone: 0800-016-888

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Any performance data contained herein was determined in a controlled environment. Therefore, the result obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

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Linux is a registered trademark of Linus Torvalds.

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Important notes

Processor speed indicates the internal clock speed of the microprocessor; other factors also affect application performance.

CD or DVD drive speed is the variable read rate. Actual speeds vary and are often less than the possible maximum.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for 1 024 bytes, MB stands for 1 048 576 bytes, and GB stands for 1 073 741 824 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1 000 000 bytes, and GB stands for 1 000 000 000 bytes. Total user-accessible capacity can vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard-disk-drive bays with the largest currently supported drives that are available from Lenovo.

Maximum memory might require replacement of the standard memory with an optional memory module.

Each solid-state memory cell has an intrinsic, finite number of write cycles that the cell can incur. Therefore, a solid-state device has a maximum number of write cycles that it can be subjected to, expressed as `total bytes written` (TBW). A device that has exceeded this limit might fail to respond to system-generated commands or might be incapable of being written to. Lenovo is not responsible for replacement of a device that has exceeded its maximum guaranteed number of program/erase cycles, as documented in the Official Published Specifications for the device.

Lenovo makes no representations or warranties with respect to non-Lenovo products. Support (if any) for the non-Lenovo products is provided by the third party, not Lenovo.

Some software might differ from its retail version (if available) and might not include user manuals or all program functionality.

Recycling information

Lenovo encourages owners of information technology (IT) equipment to responsibly recycle their equipment when it is no longer needed. Lenovo offers a variety of programs and services to assist equipment owners in recycling their IT products. For information on recycling Lenovo products, go to:http://www.lenovo.com/recycling.

Particulate contamination

Attention: Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the device that is described in this document.

Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the device to malfunction or cease functioning altogether. This specification sets forth limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits, because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that are set forth in this document, you must implement practices that maintain particulate and gas levels that are consistent with the protection of human health and safety. If Lenovo determines that the levels of particulates or gases in your environment have caused damage to the device, Lenovo may condition provision of repair or replacement of devices or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 23. Limits for particulates and gases

Contaminant	Limits
Particulate	• The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2[1]. • Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282. • The deliquescent relative humidity of the particulate contamination must be more than 60%[2]. • The room must be free of conductive contamination such as zinc whiskers.
Gaseous	• Copper: Class G1 as per ANSI/ISA 71.04-1985[3] • Silver: Corrosion rate of less than 300 Å in 30 days

[1] ASHRAE 52.2-2008 - *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

[2] The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.

[3] ANSI/ISA-71.04-1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.

Telecommunication regulatory statement

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

Electronic emission notices

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

Taiwan region BSMI RoHS declaration

單元Unit	限用物質及其化學符號 Restricted substances and its chemical symbols					
	鉛Lead (Pb)	汞Mercury (Hg)	鎘Cadmium (Cd)	六價鉻 Hexavalent chromium (Cr^{+6})	多溴聯苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
機箱子組件 Chassis Subassembly	-	o	o	o	o	o
電源 Power Supply	-	o	o	o	o	o
印刷板組件 Printed Board Assemblies (PBA)	-	o	o	o	o	o
硬碟 Disk Drives	-	o	o	o	o	o

備考1.〝超出0.1 wt %〞及〝超出0.01 wt %〞係指限用物質之百分比含量超出百分比含量基準值。

Note 1:“Exceeding 0.1 wt %” and “exceeding 0.01 wt %” indicate that the percentage content of the restricted substance exceeds the reference percentage value of presence condition.

備考2.〝○〞係指該項限用物質之百分比含量未超出百分比含量基準值。

Note 2:“○” indicates that the percentage content of the restricted substance does not exceed the percentage of reference value of presence.

備考3.〝－〞係指該項限用物質為排除項目。

Note 3:The “–” indicates that the restricted substance corresponds to the exemption.

Index