

PAC Storage PS 3000/4000 Gen2 Series Hardware Manual v1.2



Version 1.2
August 2020

Table of Contents

Safety Precaution	V
About this Manual	vi
Revision History	vii
Hardware Specifications	viii
Package Contents.....	x
 Chapter 1: Product Introduction	
1.1 Overview	1-1
1.1.1 Major Components	1-3
1.2 Chassis.....	1-4
1.2.1 Front Panel.....	1-4
1.2.2 Rear Panel	1-6
1.2.3 Internal Backplane	1-8
1.3 Front Panel Components	1-9
1.3.1 LEDs and Button Panel	1-9
1.3.2 Drive Tray Bezel	1-10
1.4 Rear Panel Components	1-11
1.4.1 Controller Module Interface	1-11
1.4.2 Controller Module Interfaces of the JBOD Models	1-13
1.4.3 PSUs/Cooling Modules	1-15
1.4.4 Super Capacitor and Flash Backup Module	1-18
1.5 System Monitoring Features	1-19
1.5.1 Expansion Enclosure Support	1-19
1.5.2 Audible Alarms	1-20
1.6 Hot-swappable Components	1-20
 Chapter 2: Hardware installation	
2.1 Installation Prerequisites	2-1
2.2 Installation Procedures	2-2
2.2.1 Unpacking the System	2-2
2.2.2 Installing the Rackmount Kit.....	2-3
2.2.3 Installing the Hard Drives	2-18
2.2.4 Installing the Host Board	2-32
2.3 Connections.....	2-36
2.3.1 General Considerations in Connecting Devices	2-36
2.3.2 Fiber-Host Connections	2-38
2.3.3 SAS-Host Connections	2-45
2.3.4 Ethernet-Host Connections	2-49
2.3.5 Hybrid Host Connections.....	2-55
2.3.6 Expansion Connections	2-57
2.3.7 Management Console Connections	2-64
2.3.8 Power Connection	2-65
2.3.9 Turning Off the System.....	2-69

Chapter3: System monitoring	
3.1 Monitoring Features	3-1
3.1.1 LEDs	3-2
3.1.2 Alarms and I ² C Bus	3-15
Chapter4: System maintenance	
4.1 Replaceable Components	4-1
4.1.1 Replacing the PSU/Cooling Module	4-2
Replacing the PS 3060L/4060L Gen2 cooling module	4-6
4.1.2 Replacing the Controller Module	4-8
4.1.3 Replacing the Memory Module.....	4-13
4.1.4 Replacing the Host Board.....	4-15
4.1.5 Replacing the CBM (Cache Backup Module) Components	4-17
4.1.6 Replacing the Hard Drive	4-21
4.2 Restoring Default System Settings	4-27
Appendices	
Certifications	A-1
User Warning.....	A-2
UL Caution, Safety, and Warning MarkinPS	A-2
Declaration of the Presence Condition of the Restricted Substance Marking.....	A-3
Contact Information	A-4

Safety Precaution

Read these instructions carefully before you install, operate, or transport the PAC Storage storage systems and expansion systems.

Energy Hazards Precaution

This equipment is intended to be used in a restricted access location, like a computer room. Only allow access to SERVICE PERSONS or users who have been instructed about the metal chassis of the equipment, which may have hazardous energy that service persons must pay attention or take special protection before touching it. Also, the access is through the use of a key or security identity system. Only the authorized and well-trained personnel can access the restricted access location.

Installation and Operation

- Install the rack cabinet and the associated equipment at a site where the ambient temperature (special room cooling equipment may be required) stays lower than 35°C.
- Install the power source socket outlet near the enclosure where it is easily accessible and ground the rack cabinet.
- Secure airflow clearance inside and around the rack cabinet.
 - Secure an 18 to 20 cm clearance on the rear side.
 - Do not cover the enclosure openings.
 - Route the cables inside the rack cabinet.
 - Do not leave drive bays empty as it will affect airflow efficiency.
- Secure each enclosure module using its retention screws.
- Place power cords and other cables away from foot traffic. Do not place items on top of power cords and ensure they do not rest against data cables.
- Install all modules to the enclosure before turning on the systems.
- Ensure that the correct power range is tested before turning on.
- DO NOT remove the covers or replaceable modules if they are not faulty.
- If the system is not used for a long period of time, disconnect it from the power outlet to avoid transient over-voltage.
- For power source redundancy, please make sure that the two PSUs are plugged into two different power sources (i.e. different circuit breakers).

Service and Maintenance

- Keep the faulty module in place until you have a replacement unit; an empty module greatly affects the airflow efficiency within the enclosure.
- During service operation, place the enclosure on a soft and clean surface to prevent exterior damage. Do not place tools or other items on top.
- When transporting the enclosure, repackage all disk drives separately in the original package foam blocks. Replaceable modules can stay in the enclosure if you are using the original package; if not, repackage them separately as well.
- Disconnect the power cords before servicing or cleaning the enclosure.

- Use a slightly moistened paper sheet or cloth for cleaning. Avoid using liquid or sprayed detergent.
- When replacing components, insert them as gently as possible while assuring full engagement. Vibration and shock can easily damage hard drives.
- Only qualified service personnel should open the enclosure.
- Contact service personnel if any of the following situations occurs:
 - The power cord or plug is damaged.
 - The enclosure has been exposed to moisture.
 - The system has not been working properly.
 - The enclosure was dropped against a hard surface.
 - The enclosure shows obvious signs of breakage.
- To move the enclosure, more than one person might be necessary due to its weight. Drives should be removed from the enclosure beforehand.
- If there are any removal/insert/change of type of host board, the system will reset to default system and NAS settings to prevent previous settings from creating unexpected behavior with the new hardware change. Therefore, please export the NVRAM before making any changes.

Important Notice

The use of PAC Storage certified components is strongly recommended to ensure compatibility, quality, and normal operation with your PAC Storage products. Please contact your distributor for a list of PAC Storage certified components (e.g. SFP, SFP+, HBACard, iSCSI cable, FC cable, memory module, etc.).

ESD Precautions

- Handle the modules by their retention screws, ejector levers, or the module's metal frame/faceplate only. Avoid touching the PCB boards or connector pins.
- Use a grounded wrist strap and an anti-static work pad to discharge static electricity when installing or operating the enclosure.
- Avoid dust, debris, carpets, plastic, vinyl, and Styrofoam in your work area.
- Do not remove any module or component from its anti-static bag before installation takes place.
- Drives must not be stacked on top of each other without their protective drive trays. Even when drives are fixed in the drive trays, contacting the exposed PCB or rear-side interface may damage the drives.

About this Manual

The manual introduces hardware components of PAC Storage PS 3000/4000 Gen2 Series storage system and expansion enclosures. It also describes how to install, monitor, and maintain them.

- For non-serviceable components, please contact our support sites.
- GUI software: Consult the GUI User Manual on the CD-ROM.

Revision History

Version	Date	Description
1.0	September 2019	Initial release
1.1	February 2020	Added PS 3060L/4060L Gen2 products information Added host board options: 4 x 32Gb/s FC ports and 2 x 40GbE ports (QSFP+) Modified baud rate to 115200
1.2	August 2020	Enhanced front panel LED descriptions

Hardware Specifications

Specification Summary

Form Factor	2U 12-bay PAC Storage PS 3012/4012 Gen2 2U 25-bay PAC Storage PS 3025B/4025B Gen2 3U 16-bay PAC Storage PS 3016/4016 Gen2 4U 24-bay PAC Storage PS 3024/4024 Gen2 4U 60-bay PAC Storage PS 3060L/4060L Gen2
CPU	PS 3000 Gen2 Series: - Intel® Xeon® D4-Core PS 4000 Gen2 Series: - Intel® Xeon® D8-Core
Controller	Dual-redundant/ Single upgradable to redundant
Onboard iSCSI Ports (per Controller)	4 x 10GbE ports (SFP+)
Onboard SAS Expansion Ports (per Controller)	2 x 12Gb/s SAS wide ports
Host Board Options	- 4 x 16Gb/s FC ports - 2 x 32Gb/s FC ports - 4 x 32Gb/s FC ports - 2 x 10GbE ports (SFP+) - 2 x 10GbE ports (RJ-45) - 2 x 25GbE ports (SFP28) - 2 x 40GbE ports (QSFP+) - 2 x 12Gb/s SAS ports NOTES: 1. The two controllers must have identical slot settings. 2. Fiber channel supports point-to-point and switch mode.
Cache Memory (per Controller)	Default DDR4 8GB; upgradable to 16, 32, 64, 128, 256GB
Cache Backup Technique	Super capacitor + Flash module
Maximum Number of Drives	896 (with expansion board)
Drive Connectivity	12Gb/s SAS
Drive Advanced Features	S.M.A.R.T. support/ Automatic bad-sector reassignment/ Dedicated bandwidth to each connected drive
Supported Drives	2.5-inch SAS/SATA SSD 2.5-inch 10,000/15,000 RPM SAS HDD 3.5-inch 7,200 RPM Nearline SAS/SATA HDD NOTES: 1. MUX board is required when using SATA drives for dual controllers. 2. For the latest compatibility details, please refer to Compatibility Matrix.
Expansion Enclosure Supported Models	JB 3012A JB 3025BA JB 3016A JB 3060 JB 3060L

(See next page)

Specification Summary

Green Design	<ul style="list-style-type: none"> - 80 PLUS-certified power supplies delivering more than 80% energy efficiency - Intelligent multi-level drive spin-down
Power	Power supplies: Redundant/hot-swappable <ul style="list-style-type: none"> - PS 3060L/4060L Gen2: 1200W x 2 - Other form factors: 530W x 2 AC voltage with PFC (auto-switching): <ul style="list-style-type: none"> - PS 3060L/4060L Gen2: 100-127VAC@12.47A, 200-240VAC@7.08A - Other form factors: 100VAC@10A to 240VAC@5A Frequency: 47-63Hz
Environment	Temperature: <ul style="list-style-type: none"> - Operating: 0 to 40°C without BBU or CBM, 0 to 35°C with BBU or CBM - Non-operating: -40 to 60°C Altitude: <ul style="list-style-type: none"> - Operating: sea level to 3,048m (10,000ft.) - Non-operating: sea level to 12,192m (40,000ft.) Relative humidity: <ul style="list-style-type: none"> - 5 to 95% non-condensing, operating and non-operating
Regulatory	Safety: UL, BSMI, CB Electromagnetic compatibility: CE, BSMI, FCC
Dimension	PS 3012/4012 Gen2 <ul style="list-style-type: none"> - 447mm (W) x 88mm (H) x 500mm (D) PS 3025B/4025B Gen2 <ul style="list-style-type: none"> - 447mm (W) x 88mm (H) x 500mm (D) PS 3016/4016 Gen2 <ul style="list-style-type: none"> - 447mm (W) x 130mm (H) x 500mm (D) PS 3024/4024 Gen2 <ul style="list-style-type: none"> - 447mm (W) x 175mm (H) x 500mm (D) PS 3060L/4060L Gen2 <ul style="list-style-type: none"> - 448mm (W) x 176mm (H) x 840mm (D) NOTE: The dimensions do not include chassis ears/protrusions.
Package Dimension	PS 3012/4012 Gen2 <ul style="list-style-type: none"> - 780mm (W) x 379mm (H) x 588mm (D) PS 3025B/4025B Gen2 <ul style="list-style-type: none"> - 780mm (W) x 340mm (H) x 588mm (D) PS 3016/4016 Gen2 <ul style="list-style-type: none"> - 780mm (W) x 423mm (H) x 588mm (D) PS 3024/4024 Gen2 <ul style="list-style-type: none"> - 780mm (W) x 465mm (H) x 588mm (D) PS 3060L/4060L Gen2 <ul style="list-style-type: none"> - 620mm (W) x 460mm (H) x 1140mm (D)

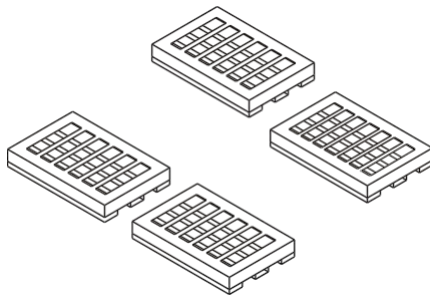
Package Contents

Check the **Unpacking List** for the complete list of contents and exact quantity of the components of your system.

NOTE: The contents and quantity may vary depending on the system model and order requests.

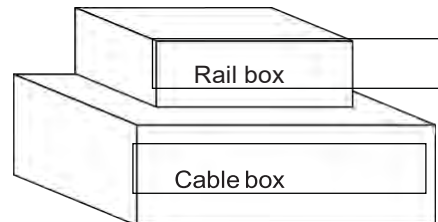
System Package

Unpacking list and compliance
documentation

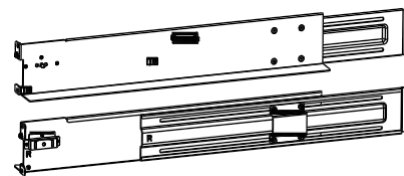


Tray EPE

(for PS3012/4012/3016/4016/3024/4024/3025B/
4025B Gen2)



Cable management arm and rail boxes
(for PS 3060L/4060L Gen2)

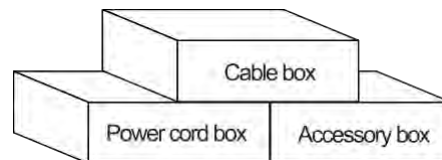


Rackmount kit

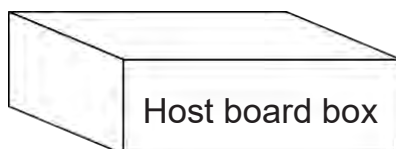


Tray box

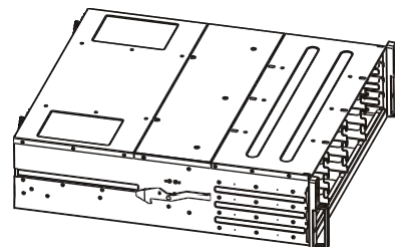
(for PS 3060L/4060L Gen2)



Powercord, cable, and
accessory boxes

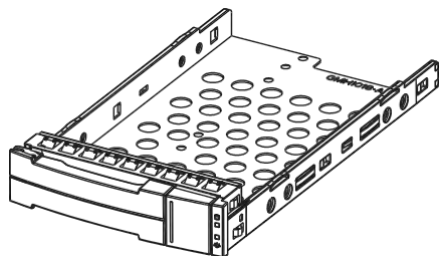


Host board box (optional)

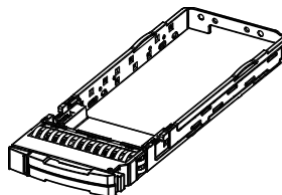


Enclosure chassis

Tray EPE Content (for PS 3012/4012/3016/4016/3024/4024/3025B/4025B Gen2)

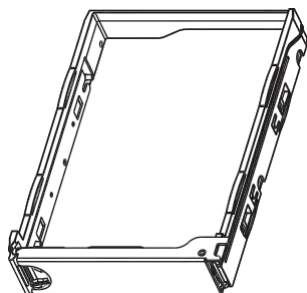


2.5"/3.5" HDD Tray (for PS 3012/4012/3016/4016/3024/4024 Gen2)



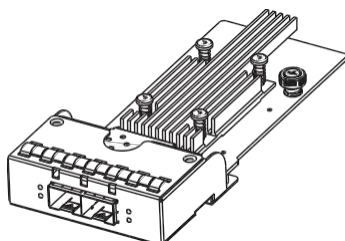
**2.5" Screwless SSD Tray
(for PS 3025B/4025B Gen2)**

Tray Box Content (for PS 3060L/4060L Gen2)



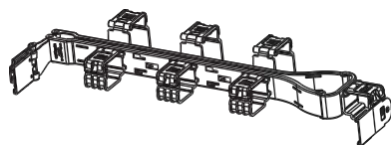
3.5" Screwless HDD Tray

Host Board Box (Optional)

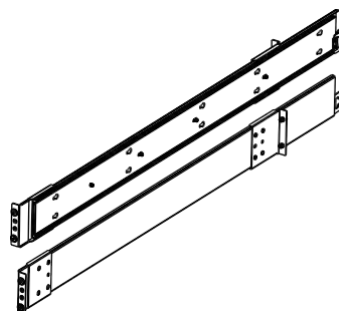


Host board (optional)

Cable Management Arm (CMA) and Rail Boxes (for PS 3060L/4060L Gen2)



Cable management arm



Rack slide rails
(left and right)



M5 cage nut



M4 6mm screw



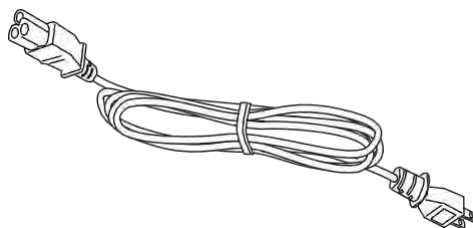
Ø5.1mm washer



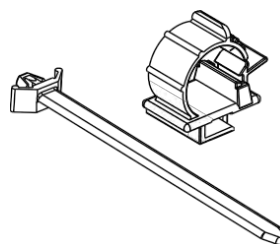
M5 10mm screw

Mounting enclosure screws,
washers, and nuts

Power Cord, Cable, and Accessory Boxes



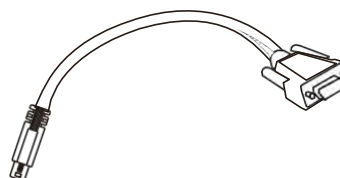
Power cord



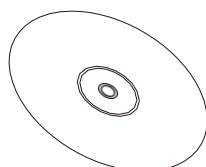
Power cord clamp set



Quick installation guide



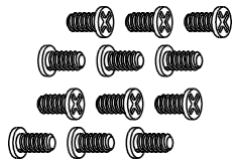
RS-232C serial cable
(mini USB to DB9)



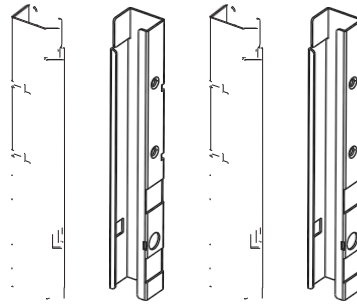
GUI CD



Mounting enclosure screws and nuts (for PS 3012/4012/3016/4016/3024/4024/3025B/4025B Gen2)



2.5"/3.5" HDD screws (for PS 3012/4012/3016/4016/3024/4024 Gen2)

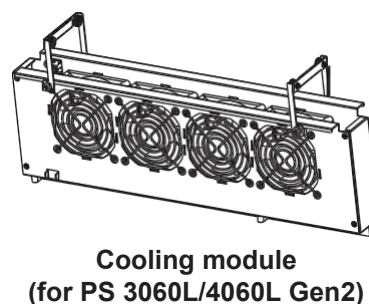
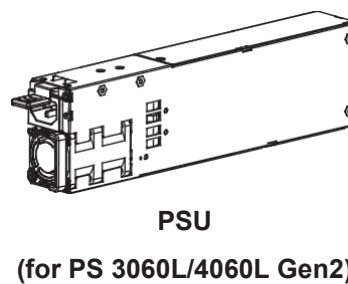
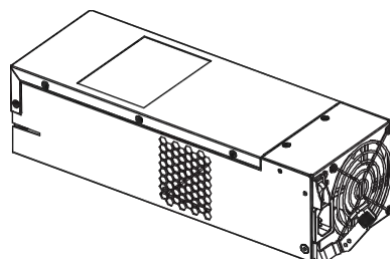
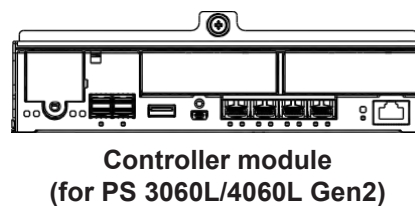
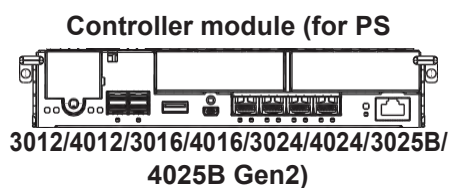


**Adjuster pillars
(for PS 3060L/4060L Gen2)**

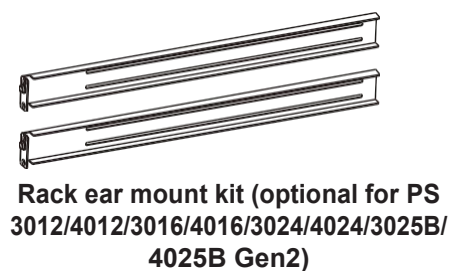
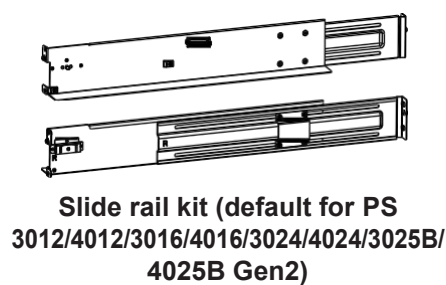


**Screws and cage nuts for pillars
(for PS 3060L/4060L Gen2)**

Pre-installed Components in the Enclosure Chassis



Rackmount Kit



NOTE: See section 2.2.2 **Installing the Rackmount Kit** for the types of mounting kit and the exact package contents.

Product Introduction

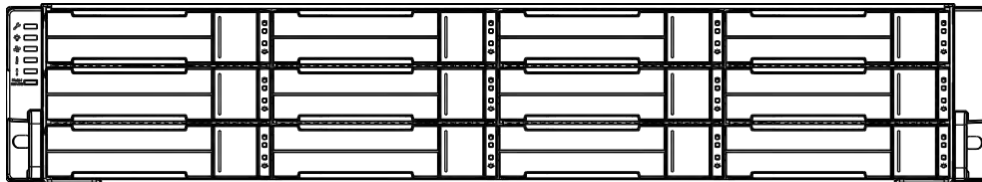
1

This chapter introduces the look and feel of PAC Storage PS 3000/4000 Gen2 Series systems, features, and the supported components.

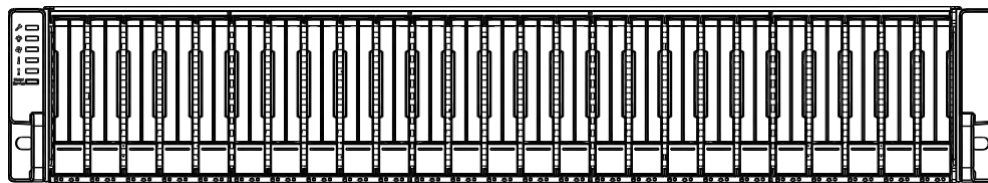
1.1 Overview

This manual introduces PAC Storage PS 3000/4000 Gen2 systems that support 3Gb/s, 6Gb/s, and 12Gb/s SAS and Nearline SAS, SATA hard drives and SSDs. These systems are designed to utilize 2.5-inch and 3.5-inch hard drives. Drive capacity can be expanded by attaching expansion hard drive enclosures.

2U systems

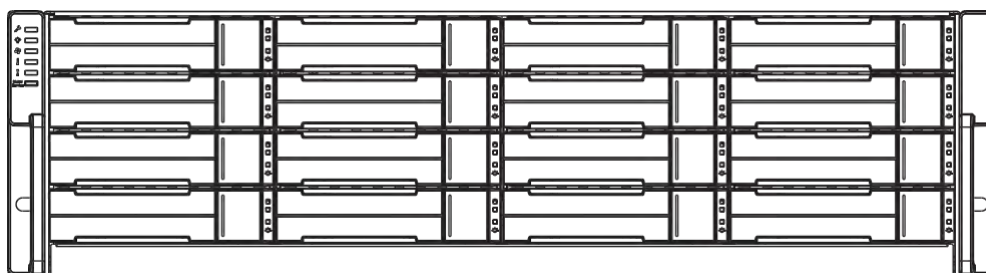


PAC Storage PS 3012/4012 Gen2



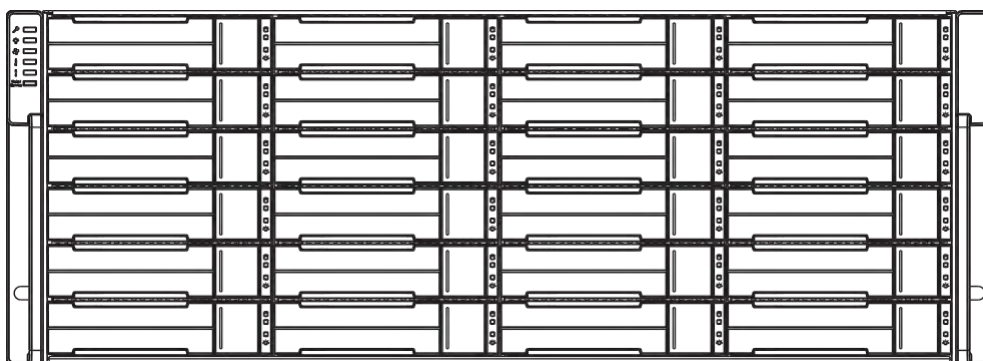
PAC Storage PS 3025B/4025B Gen2

3U system

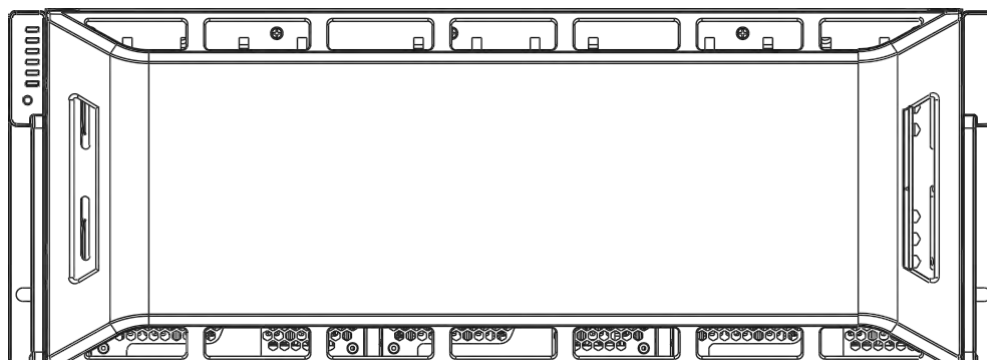


PAC Storage PS 3016/4016 Gen2

4U systems



PAC Storage PS 3024/4024 Gen2



PAC Storage PS 3060L/4060L Gen2

1.1.1 Major Components

NOTE: Upon receiving the system, check the package contents and compare them to the **Unpacking List**. If one or more of the modules are missing, please contact your system vendor.

Controller and Interface

Each system has controllers, and each controller comes with pre-installed DIMM modules. It also has a CBM (cache backup module), a module that has a super capacitor and an FBM (flash backup module). With the CBM, the cached data is quickly distributed to the FBM to save the data permanently with the support of the super capacitor if power outage occurs. With the super capacitor's fast-charging feature, it can distribute a fair supply of power to the controller, so the controller can save cached data to the FBM immediately and permanently.

Also, the embedded firmware features earth-friendly and smart algorithms that you can use to customize your system's hardware settings such as power-saving modes, variable fan speeds, and exiled drive handling.

Expansion Controller and Interface

The expansion enclosure is managed by expander controllers that distribute data flow to individual disk drives and report operating status through a proprietary enclosure service via in-band protocols. The enclosure, along with other expansion systems, connects to a SAN system and serves as a building block of a scalable configuration.

For supported protocols, the firmware supports communications with enclosure devices, SAS/SATA disk drives, and SAN system that features SAS expansion ports.

For physical connection, the SAS interface provides easy cabling routes via mini-SAS connectors. With the backplane-adapting SAS or SATA drives, the system can support enterprise-class SAS, Nearline SAS, and cost-effective SATA-II or SATA-III hard drives or SSDs. This connection is ideal for adding large capacity storages to a storage pool.

Power Supply Unit/Cooling Module

There are two PSUs in the system. Each PSU is hot-swappable and is built with a fan to protect the system from overheating while providing constant power. The modular architecture of the system and easy accessibility to all major components provide you an easy maintenance.

For PS 3060L/4060L Gen2 system, there are two types of cooling modules:

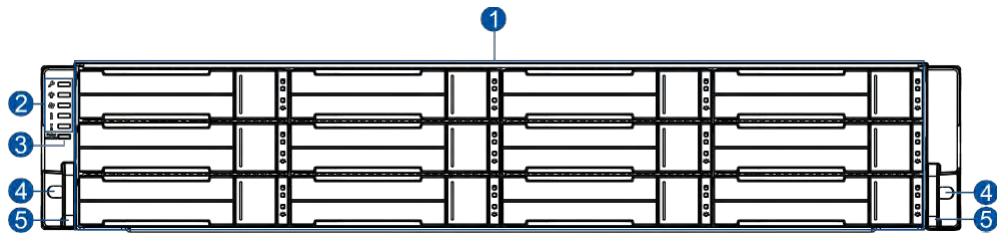
- The cooling type located at the center of the enclosure, which independently ventilates the system and keeps the operating temperatures under optimal condition.
- The cooling type which is built with the PSU to help with the PSU's temperature.

1.2 Chassis

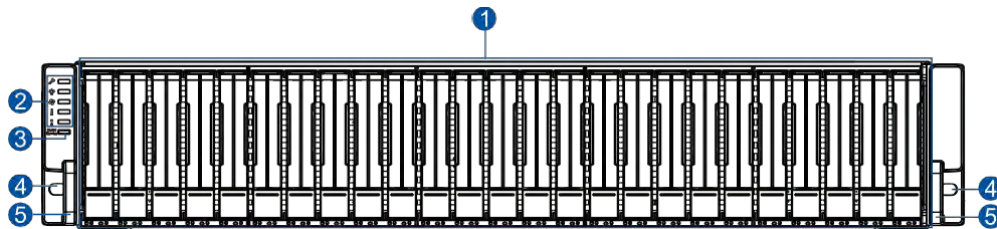
This section describes the front and rear panels of PAC Storage PS 3000/4000 Gen2 Series' rugged storage chassis. The chassis are designed to allow installation to the rack or a cabinet.

1.2.1 Front Panel

2U systems

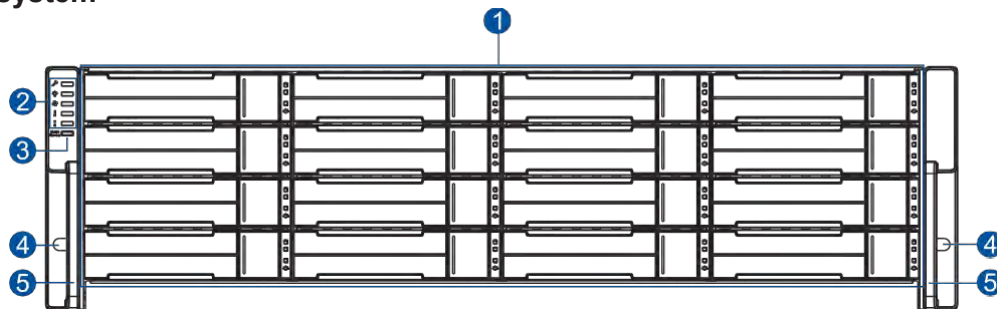


PAC Storage PS 3012/4012 Gen2



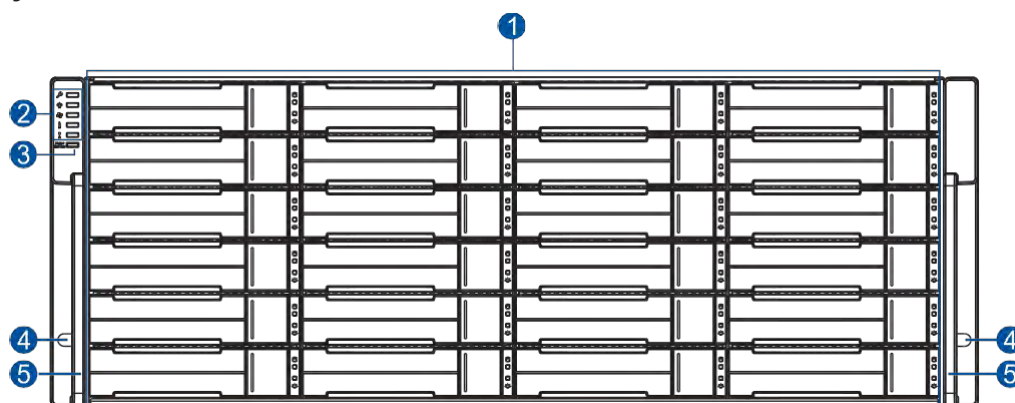
PAC Storage PS 3025B/4025B Gen2

3U system

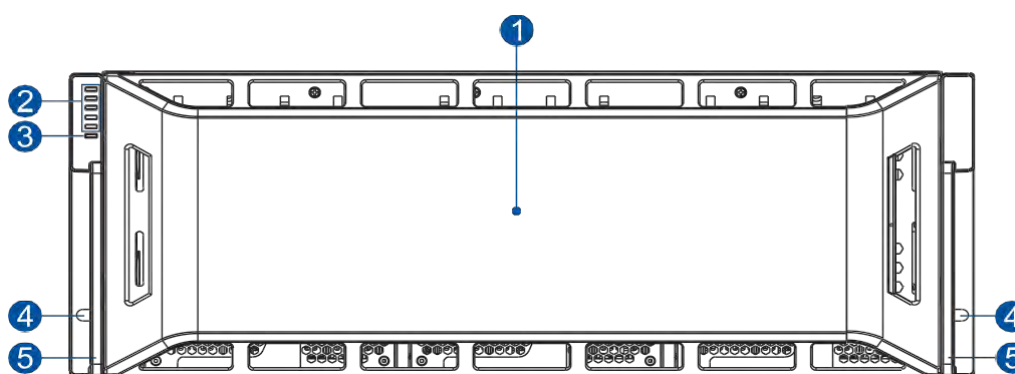


PAC Storage PS 3016/4016 Gen2

4U systems



PAC Storage PS 3024/4024 Gen2

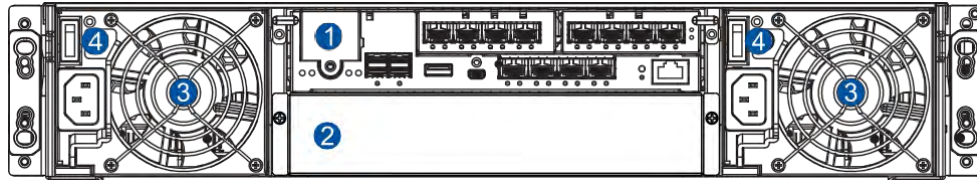


PAC Storage PS 3060L/4060L Gen2

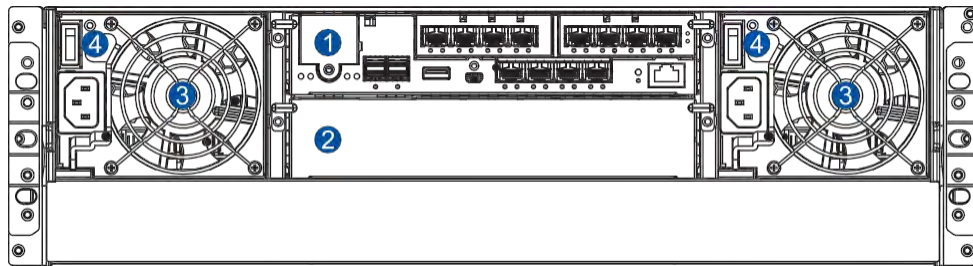
Number	Part	Description
①	Drive Trays	Each drive tray is hot-swappable and holds a 2.5-inch or 3.5-inch hard drive.
	System Cover	This cover hides the components of the system.
②	LED Panel	LED panel has service, power, cooling module, temperature, and system fault LEDs.
③	Mute Button/ Service LED	This button mutes the alarm while the embedded Service LED notifies you that the system requires service.
④	Rackmount Holes	These holes secure the enclosure to the rackmount system with the mounting screws.
⑤	Handles	These handles allow you to push/pull the enclosure to/from the cabinet installed in the rackmount system.

1.2.2 Rear Panel

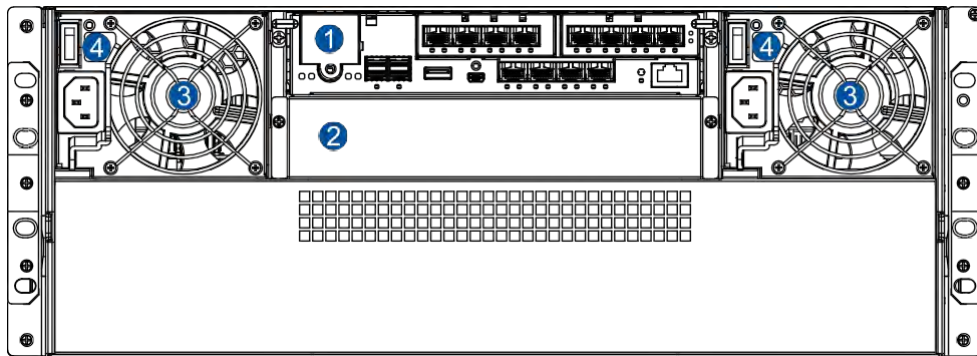
Single controller systems



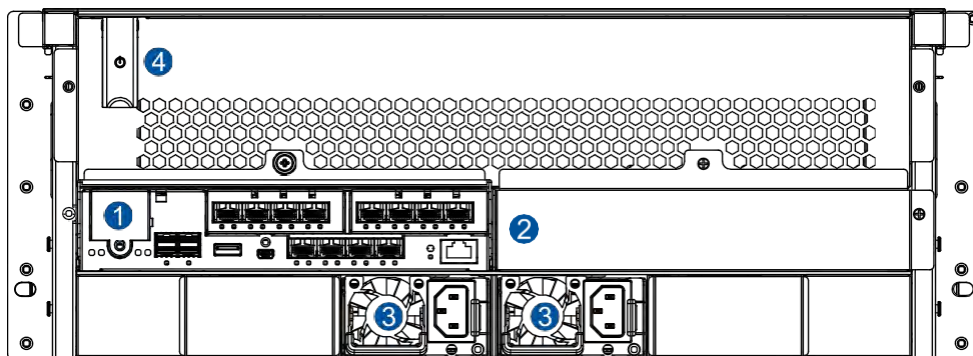
2U systems (PS 3012/4012/3025B/4025B Gen2)



3U system (PS 3016/4016 Gen2)

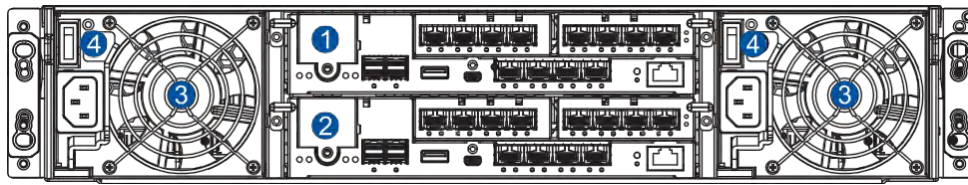


4U system (PS 3024/4024 Gen2)

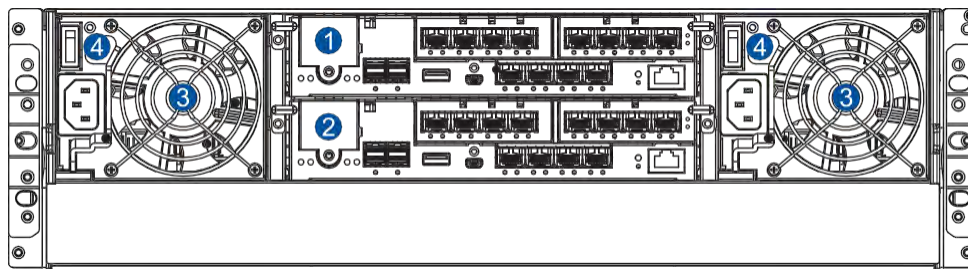


4U system (PS 3060L/4060L Gen2)

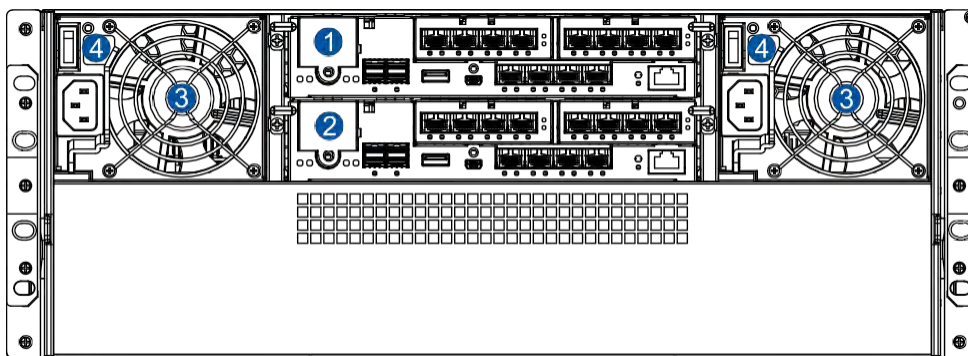
Dual controller systems



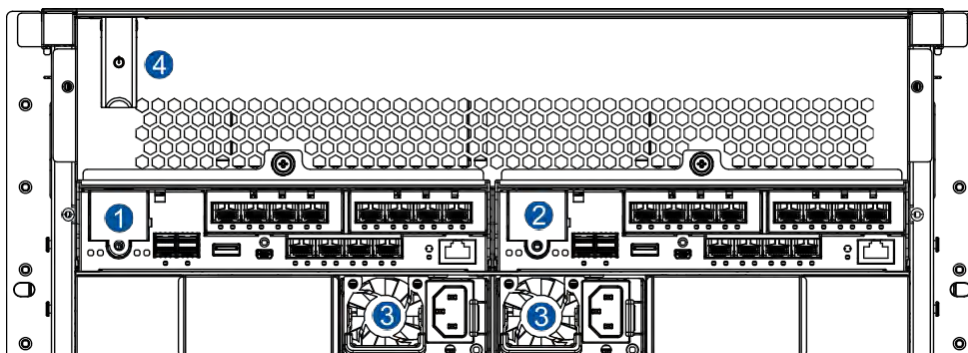
2U systems (PS 3012/4012/3025B/4025B Gen2)



3U system (PS 3016/4016 Gen2)



4U system (PS 3024/4024 Gen2)



4U system (PS 3060L/4060L Gen2)

Number	Part	Description
①	Controller A	This controller module contains the SAS expansion board which distributes I/O functions to and from the managing RAID system. This also handles the status of the components via the SAS links with the RAID system.
②	Controller B or Dummy Cage	This part contains the second controller, also called the redundant controller. This controller takes over the system functions when Controller A fails to process. For single controller system, this contains a dummy cage.
③	PSUs/Cooling Modules	These hot-swappable PSUs provide power to the storage system and each PSU has a cooling module.
④	Power Buttons	These buttons allow you to turn ON/OFF your storage system.

WARNING!

- DO NOT remove the redundant components.
 - DO NOT replace the redundant components without a replacement on hand.
-

1.2.3 Internal Backplane

The internal backplane is a circuit board that separates the front and rear parts of the chassis. This board provides logic level signals and low voltage power paths. The thermal sensors and I²C devices are embedded to detect system temperatures and PSU operating status. This board is comprised of non user-serviceable components.

WARNING!

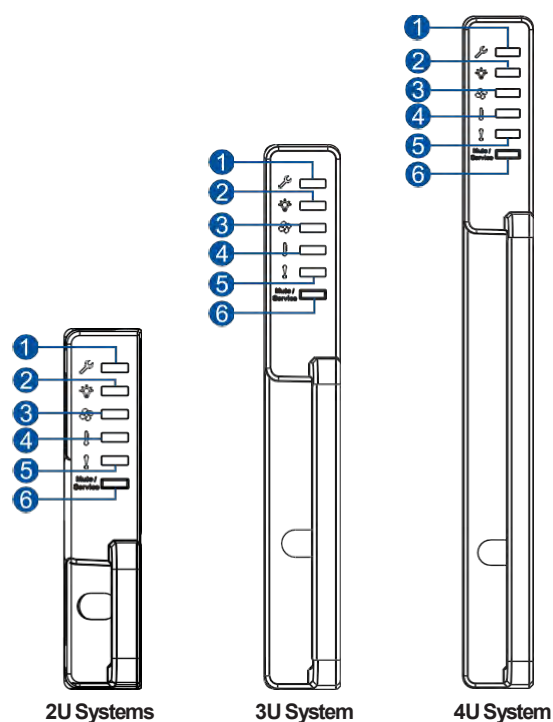
- Accessing the backplane board may lead to serious damage to the system.
 - Physical contact with the backplane board may cause electrocution.
-

1.3 Front Panel Components

This section describes the front panel components of PS 3000/4000 Gen2 Series systems.

1.3.1 LEDs and Button Panel

The LEDs on the panels allow you to know your system's current status when turned on, while the buttons have a specific function that you can set.



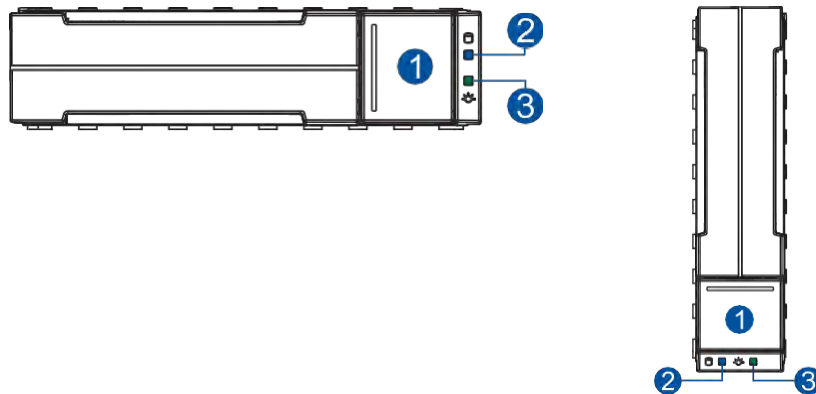
Number	Part	Description
①	Service LED	This LED provides the status when the system requires service or currently in service.
②	Power LED	This LED provides the status of the system's power.
③	Cooling Module LED	This LED provides the cooling module's status.
④	Temperature LED	This LED provides the system's temperature status.
⑤	System Fault LED	This LED provides the system's operation status.
⑥	Mute Button/Service LED	This button mutes the alarm while the embedded Service LED notifies you that the system requires service.

NOTE: For more details regarding the LEDs and their respective status, refer to **3.1.1 LEDs**.

WARNING! If critical faults are indicated on the LED panel, verify the cause of the problem as soon as possible and contact your system vendor for a module replacement.

1.3.2 Drive Tray Bezel

The drive tray bezel is designed to accommodate both SAS and SATA-interfaced hard disk drives. Get familiarized of the components of your system's drive tray bezel.



Number	Part	Description
①	Release Button	This button unlocks the drive tray from the drive tray slot.
②	Drive Busy LED	This LED provides the status of the hard disk drive.
③	Power Status LED	This LED provides the power status of the hard disk drive.

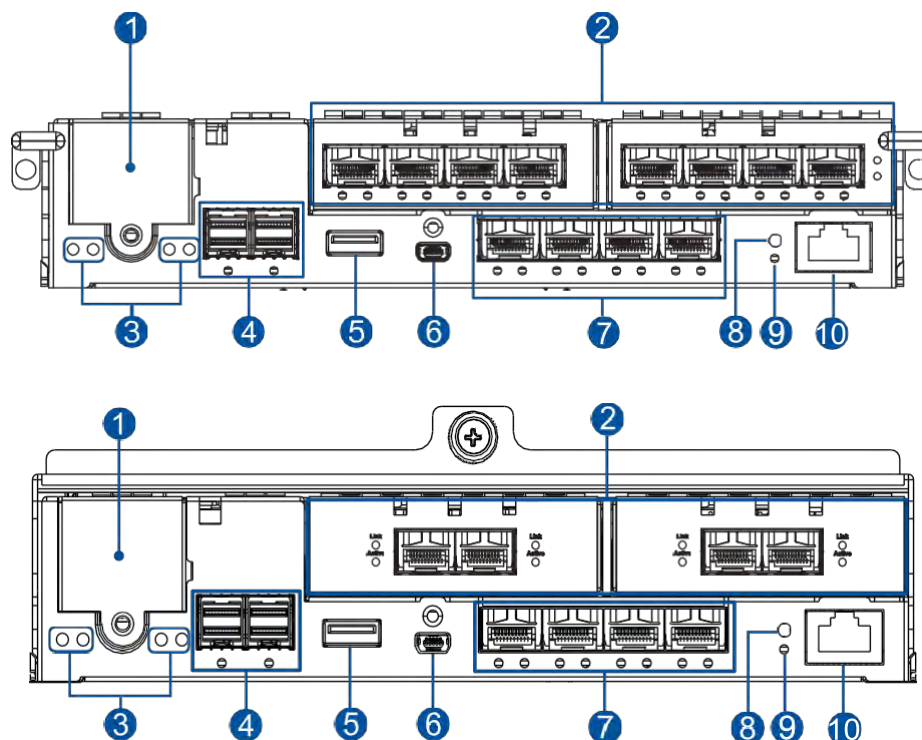
WARNING! Be careful not to drop or put heavy objects on the drive tray, as these may cause to bend or deform the drive tray's structure. If the drive tray is deformed, it may not fit into the system's drive bay.

1.4 Rear Panel Components

This section describes the rear panel components of PS 3000/4000 Gen2 Series systems.

1.4.1 Controller Module Interface

The I/O interfaces of the controller module allow you to connect to other devices and the LEDs allow you to know the status of your controller.



Number	Part	Number	Part
①	CBM (Cache Backup Module)	⑥	Mini USB Connector (Console)
②	Host Board Ports (Optional)	⑦	Onboard Host Ports
③	Controller Status LEDs	⑧	Restore Default Button
④	SAS Expansion Ports	⑨	Restore Default LED
⑤	USB 3.0 Port	⑩	Ethernet Management Port

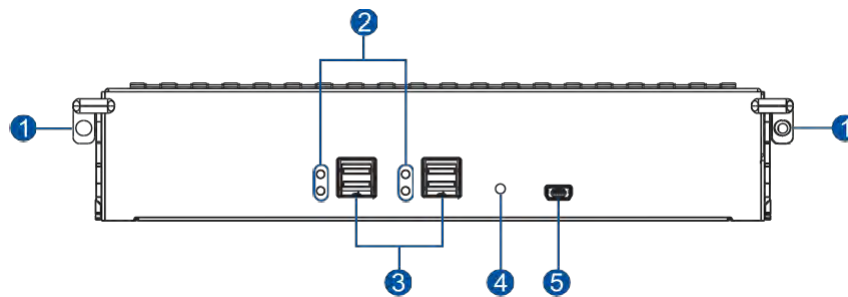
WARNING! The PAC Storage controller module is built of sensitive and non-replaceable components. You can only replace the controller module when you already have the replacement. Unnecessary tampering may damage the controller.

NOTES:

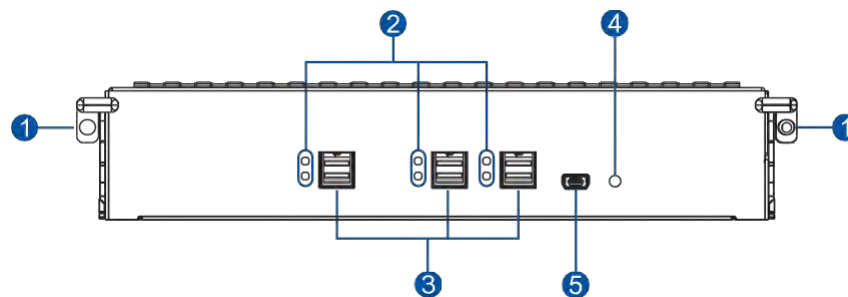
- The host boards are add-on components. If you install only one host board, use the left host board slot.
 - The Ethernet management port supports 100Mb/s and 1Gb/s speeds.
 - Whenever a onboard host port cable is not plugged in, insert the dust cap bundled in the package.
 - For more information about CBM, see section **1.4.4 Super Capacitor and Flash Backup Module**.
-

1.4.2 Controller Module Interfaces of the JBOD Models

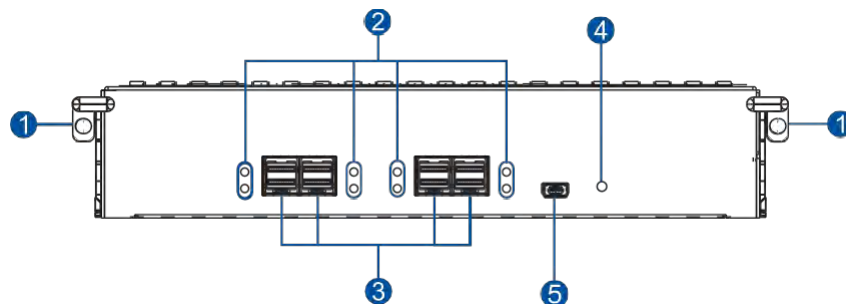
The expansion controller contains a circuit board within a metal canister, integrated with the hot-swap docking connectors at the backend. The SAS wide ports on the interface faceplate connect to a managing PS system or other expansion systems.



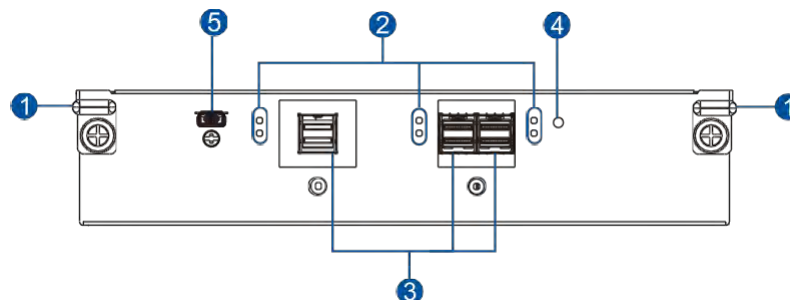
JB 3012A/3016A



JB 3060L



JB 3025BA



JB 3060

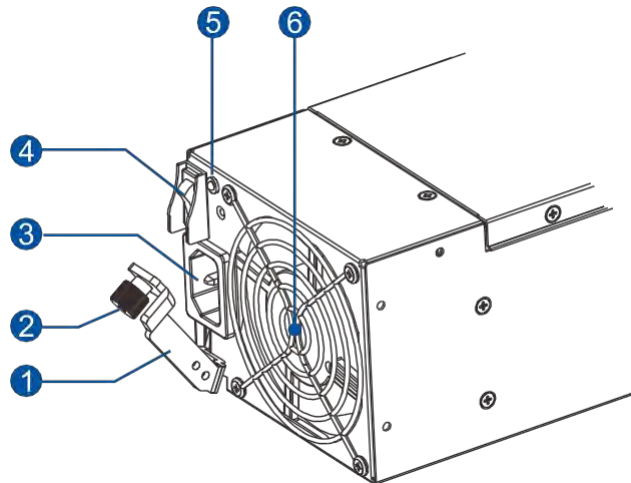
Number	Part
①	Extraction Levers/Screw Holes
②	SAS Expansion Port Status LEDs
③	SAS Expansion Ports
④	Controller Status LED
⑤	Mini USB Service Port

WARNING! You can only remove the controller when you already have the replacement. The JBOD (expansion) controller is built of sensitive components. Unnecessary tampering may damage the controller.

1.4.3 PSUs/Cooling Modules

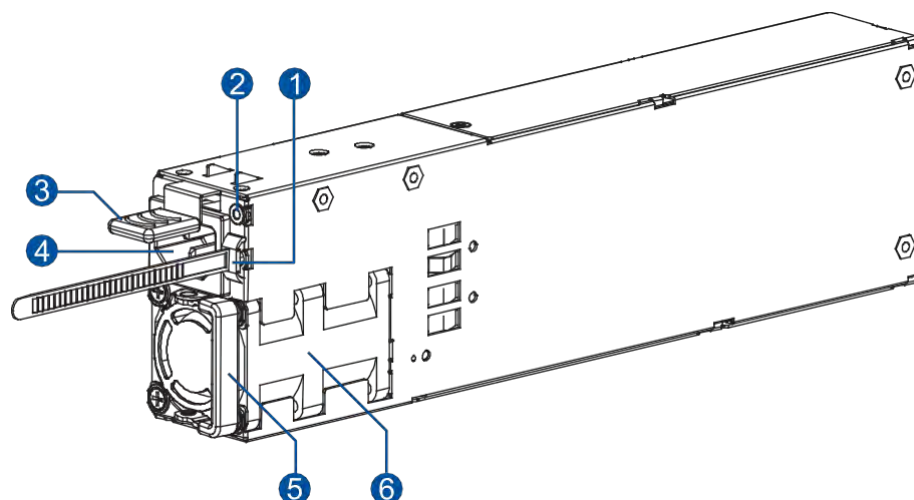
The PS 3000/4000 Gen2 Series system has two redundant, hot-swappable PSUs that provide power and built with a cooling fan that helps with the airflow, providing an efficient ventilation.

PSU/Cooling module for PS 3012/4012/3025B/4025B/3016/4016/3024/4024 Gen2



Number	Part
①	Extraction Lever
②	Retention Screw
③	Power Socket
④	Power Switch
⑤	PSU Status LED
⑥	Fan

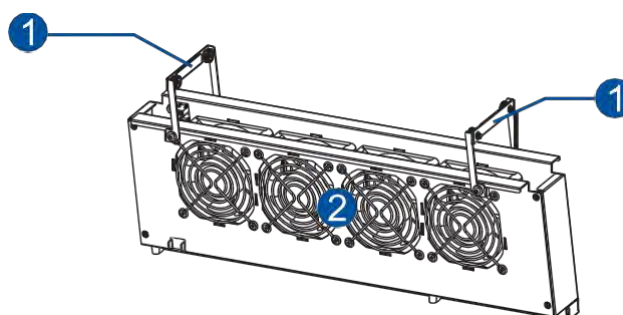
PSU for PS 3060L/4060L Gen2



Number	Part
①	Mounting Hole (with a Mounted Cable Tie)
②	PSU Status LED
③	Retention Lever
④	Power Socket
⑤	Extraction Handle
⑥	Fan

Cooling module for PS 3060L/4060L Gen2

The cooling module has four fans that help with the ventilation inside the chassis.



Number	Part
①	Extraction Handles
②	Cooling Fans

When the cooling modules operate under normal conditions, the cooling fans run at a low speed. The cooling fans raise their rotation speed to increase the airflow under the following conditions:

- Component failure: if the cooling module, PSU, or a temperature sensor failed.
- Elevated temperature: if the temperature breaches the upper threshold set for any of the interior temperature sensors.
- During the initialization stage, the cooling fans operate at a high speed. The speed is lowered when the initialization is completed and no errors are detected.

NOTE: There are two upper temperature thresholds: one for event notification and the other for triggering high fan rotation speed. You can change the preset values for event notification using the firmware-embedded configuration utility. Refer to the firmware operation manual for details.

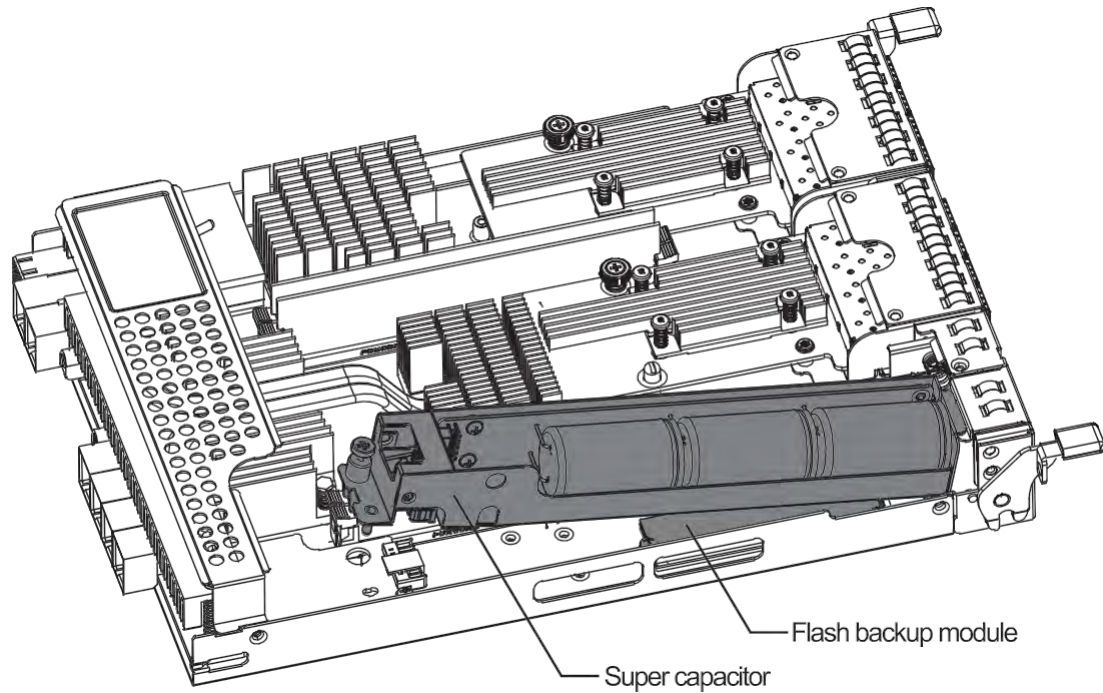
WARNING!

- If any of the LEDs lights up in amber, contact your local vendor to request for a replacement immediately.
 - When removing the system PSU/cooling module, pull the module for about 3 inches then wait for at least 10 seconds before removing the whole module from the enclosure.
 - DO NOT run the system with faulty PSU/cooling module(s) as it may cause disruption of the airflow resulting in overheating.
-

CAUTION! Keep your body away from the moving parts of the system.

1.4.4 Super Capacitor and Flash Backup Module

PS 3000/4000 Gen2 Series system has a CBM (Cache Backup Module), which is comprised of a super capacitor and flash backup module, installed in the controller. The super capacitor provides power, allowing the system to store cached data to the flash backup module permanently in case of power interruption or outage.



NOTES:

- The super capacitor is partially charged when shipped. When you turn ON the system, the super capacitor will charge to its full capacity for a few minutes. If it is not charging, there may be a problem. Contact your system vendor immediately. You can also check the status of the super capacitor via GUI or the firmware. Refer to the manuals for more details.
 - The flash backup module is located under the super capacitor.
-

1.5 System Monitoring Features

This section describes the different types of system monitoring features that provide the operating status of each component.

1.5.1 Expansion Enclosure Support

Monitoring System

A managing PS system is aware of the status of connected expansion system's components such as:

- Expander controller (presence, voltage, and thermal readings)
- PSU/Cooling module
- Enclosure thermal sensor
- Service (the Service LED signals the specific enclosure)
- Hard disk drives

Expansion System Identifier

The managing system sets off the alarm and delivers the warning messages if there is a conflict between the expansion systems.

If more than one expansion system is connected to the managing PS system, each needs a unique enclosure ID set using the rotary switch on the LED panel. For example, the firmware automatically disconnects the second expansion system if it is connected online and comes with an ID identical to the first expansion system.

NOTE: The expansion system IDs are numbers 1 to 15. For more details, see section **2.3.6 Expansion Connections**.

Cooling Module Speed Adjustment

If any of the detected temperature readings breaches the temperature threshold, the firmware running on the managing PS system automatically increases the rotation speed of all cooling fans.

Expansion Enclosure Status Monitoring

The system connecting with expansion systems (JBOD) can acquire the component status with other enclosures via a proprietary enclosure monitoring service using the in-band connectivity. No additional management connection is required.

I²C Bus

The detection circuitry and temperature sensors are interfaced via a non-user-serviceable I²C bus. When the expansion systems are connected to PS controllers, the component status is reported through in-band protocols over expansion links, which is managed by a proprietary enclosure service.

Firmware (FW) and GUI

- **Firmware (FW):** The firmware is preloaded and is used to configure the system. Access the FW via a terminal emulation program running on a management computer connected to the system's serial port.

- **GUI:** GUI is another browser-based GUI (graphical user interface) software that you can install into a local or remote computer and access via the network. The managing system communicates with the array via connection of the existing host links or the Ethernet link to the array's Ethernet port.

1.5.2 Audible Alarms

The system comes with audible alarms that are triggered when certain active components fail or when specific controller or system thresholds exceed. Whenever you hear an audible alarm, you must determine the cause and solve the problem immediately.

Event notification messages indicate the completion or status of array configuration tasks and are always accompanied by two or three successive and prolonged beeps. You can turn off the alarm using the mute button on the front panel.

WARNING! Failure to respond when an audible alarm is set off can lead to permanent damage to the system. When you hear an audible alarm, solve the problem immediately.

1.6 Hot-swappable Components

The system has a number of hot-swappable parts that you can change while the system is still online without affecting its operational integrity.

These hot-swappable components are user-maintained:

- Controller module
- PSU/cooling module
- Hard disk drive

IMPORTANT! Only remove these hot-swappable components when replacement is needed.

NOTE: A normal airflow ensures sufficient cooling of the system and this can only be attained when all components are properly installed. Remember to only remove the failed component if there is a replacement on hand. For more information on replacing hot-swappable components, see **Chapter 4 System Maintenance**.

Hardware Installation 2

This chapter describes installing the modular components such as hard drives, cards, and other optional installation or connections such as expansions and rackmount.

2.1 Installation Prerequisites

Take note of the following installation prerequisites before you start with the installation:

- **Static-free installation environment**
Install the system in a static-free environment to minimize the possibility of ESD (electrostatic discharge) damage.
- **Component check**
Before the installation, ensure that you received all required components by verifying the package contents with the **Unpacking List** document. This document is included in the package. If there are items missing and/or damaged, contact your vendor for a replacement.
- **Hard drives**
The SAS/SATA drives are purchased separately and must be available before the system installation.
- **Cables**
All cables that connect the system to the hosts are purchased separately. Contact your vendor for the list of compatible cables.
- **Memory modules**
If you want to change the pre-installed DIMM modules, ensure that they are compatible and purchased from a qualified vendor. Contact your vendor for the list of compatible DIMMs.
- **Rackmount equipment**
The rack slide rails are optional accessories. If you need to install it, see section **2.2.2 Installing the Rackmount Kit**.

IMPORTANT! Install the system first to the rack or cabinet before installing the hard drives into the system.

Ensure that you are familiar with the exact position of each plug-in module and interface connector. Also, ensure to handle the cables with care when connecting between systems installed in the rack with a correct routing paths carefully planned. DO NOT bend or twist the cables as this may cause emission interference and accidental cable disconnection.

2.2 Installation Procedures

This section details the installation procedures of the system, its components, and connections between equipment. The installation procedures in this section are in order, so it is strongly recommended that you follow the said order to reduce the time consumed during installation and prevent installation mistakes, technical mishaps, or physical injuries.

2.2.1 Unpacking the System

When your system package has arrived, check and confirm if the contents of your package are complete by referring to the **Unpacking List** document, which is bundled with your package.

Accessory Box Contents

This box contains the following:

- Serial port cable
- Screws
- Quick installation guide
- Support CD (GUI Management software and manual, firmware operation manual)
- Power cord clamp set
- Dust caps

Pre-Installed Components

Below are the components that are pre-installed in the system:

- Controllers
- LED front panels
- DIMM modules
- CBM (cache backup module)
- PSUs including the cooling modules

Components that Need User Installation

You must do the following installation:

- Assembling of the system to the rack/cabinet
- Assembling the hard drives to the hard drive tray
- Installing the host boards
- Cabling in between systems

NOTE: To install the system to the rack/cabinet, see section **2.2.2 Installing the Rackmount Kit**.

2.2.2 Installing the Rackmount Kit

This section details the overview of the rackmount kit, its assembly, and installation with the storage system.

IMPORTANT! Please contact our technical support team if you need further help in installing your system/enclosure to the rack.

NOTE: You can also watch this [YouTube video](#) on assembling the rackmount kit and installing the system to the rackmount.

Preparing the User-Provided Tools

Before assembling the rackmount kit, you must prepare the following tools:

- 1 x Medium-sized Phillips screwdriver
- 1 x Small-sized flat blade screwdriver
- Anti-static wrist wrap
- Host link cables

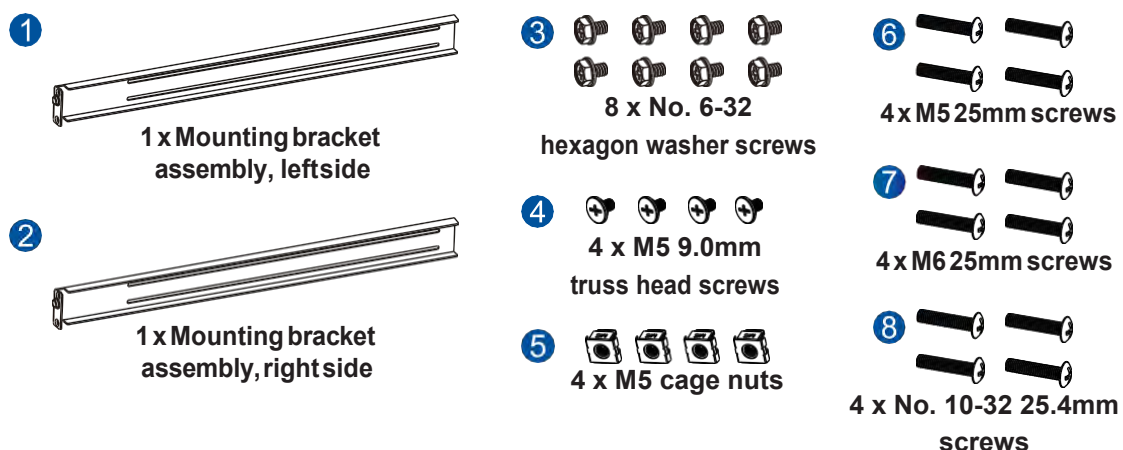
Types of Rackmount Kit

There are two types of rackmount kit depending on the systems:

- Rack ear mount kit (optional for PS 3012/4012/3016/4016/3024/4024/3025B/4025B Gen2)
- Slide rail kit (by default for PS 3012/4012/3016/4016/3024/4024/3025B/4025B Gen2)
- Rackmount slide kit and adjuster pillars (for PS 3060L/4060L Gen2)

Rack Ear Mount Kit Contents (Optional for PS 3012/4012/3016/4016/3024/4024/3025B/4025B Gen2)

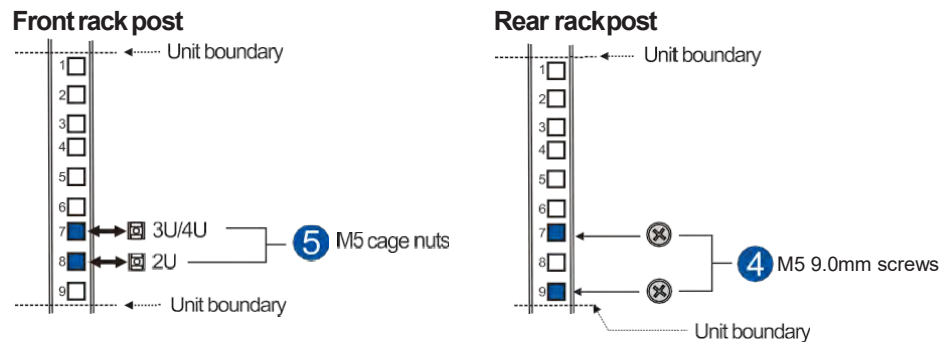
Check your rack ear mount kit for the following contents.



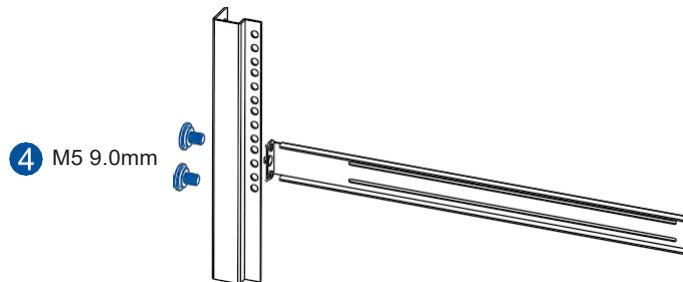
Assembling the Rack Ear Mount Kit

To assemble the rack ear mount kit:

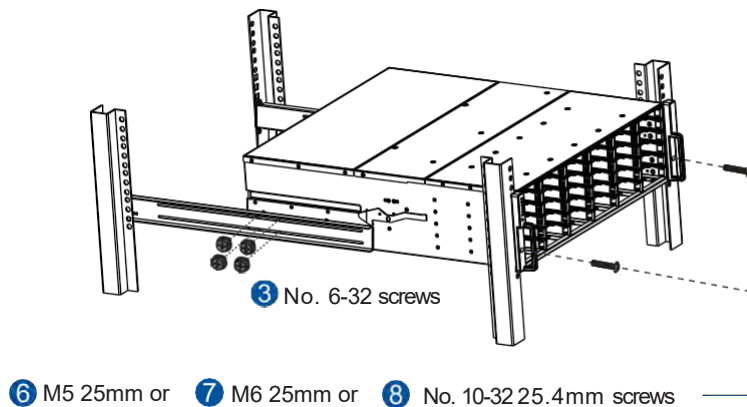
1. Determine the position where the enclosure will be installed to the front and rear rack posts, then insert the cage nuts into the designated holes on the front rack posts.



2. Install the fixed rails to the rear rack posts using the truss head screws.

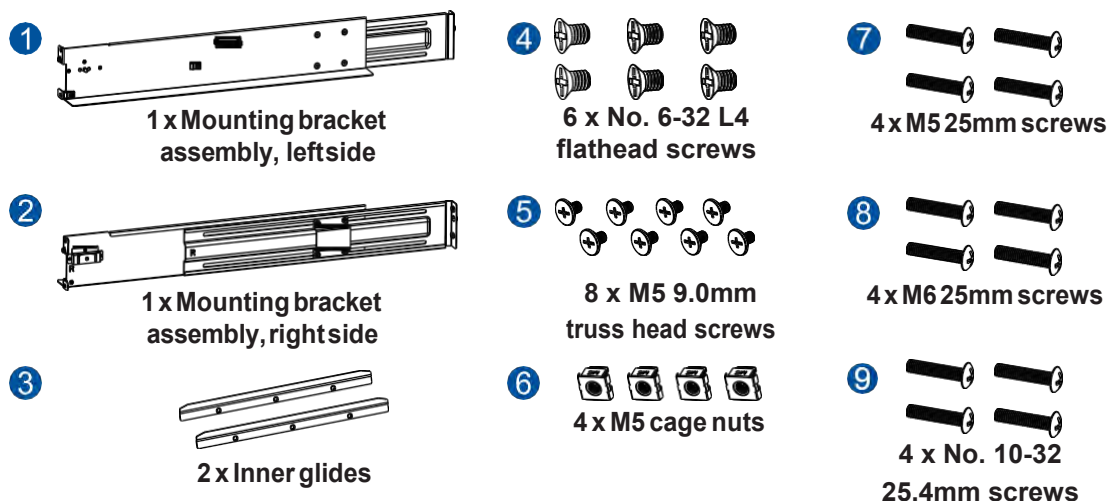


3. To install the enclosure to the rack ear mount, this requires an assistance of another person. While one person holds the enclosure at the installation height, the other person secures the enclosure using two M5 25mm or M6 25mm or no. 10-32 25.4mm screws at the front and eight no. 6-32 screws on the side panels, four on each side.



Slide Rail Kit Contents (by default for PS 3012/4012/3016/4016/3024/4024/3025B/4025B Gen2)

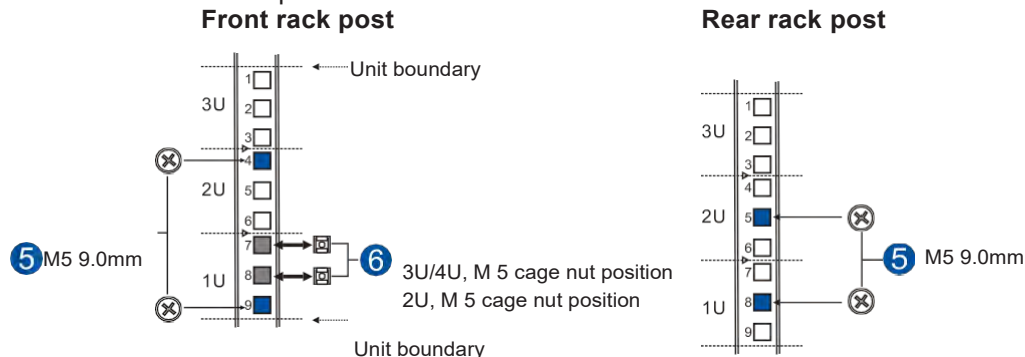
Check your slide rail kit for the following contents.



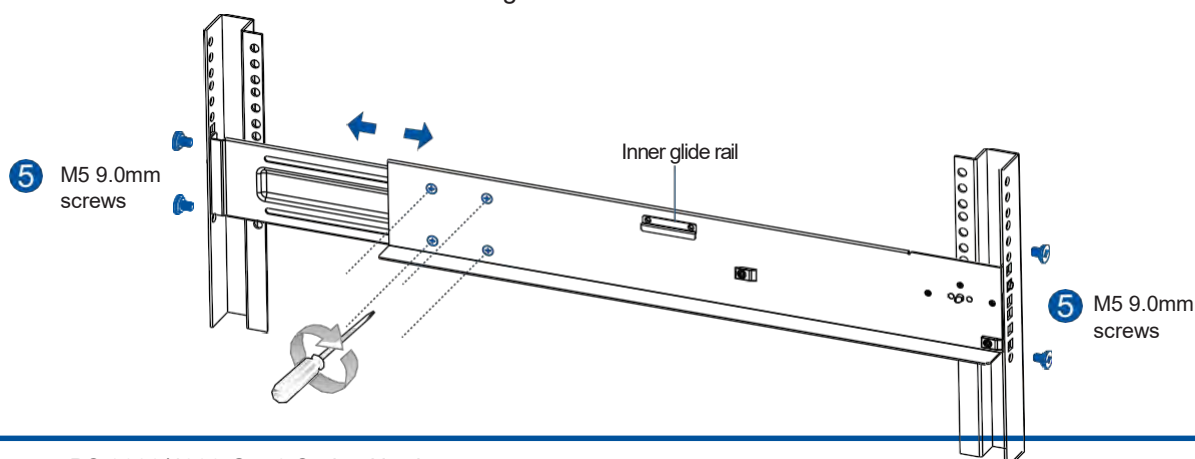
Assembling the Slide Rail Kit

To assemble the slide rail kit:

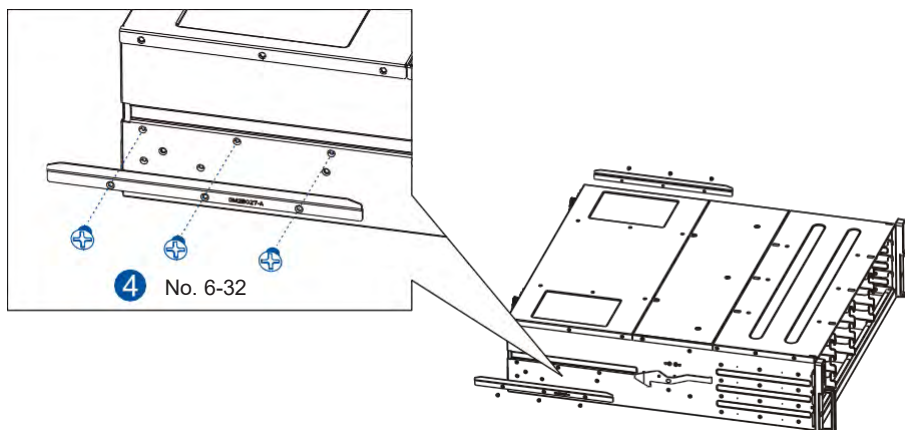
- Determine the position where the enclosure will be installed to the front and rear rack posts, then insert the cage nuts into the designated holes on the front rack posts and the truss head screws on the front and rear rack posts.



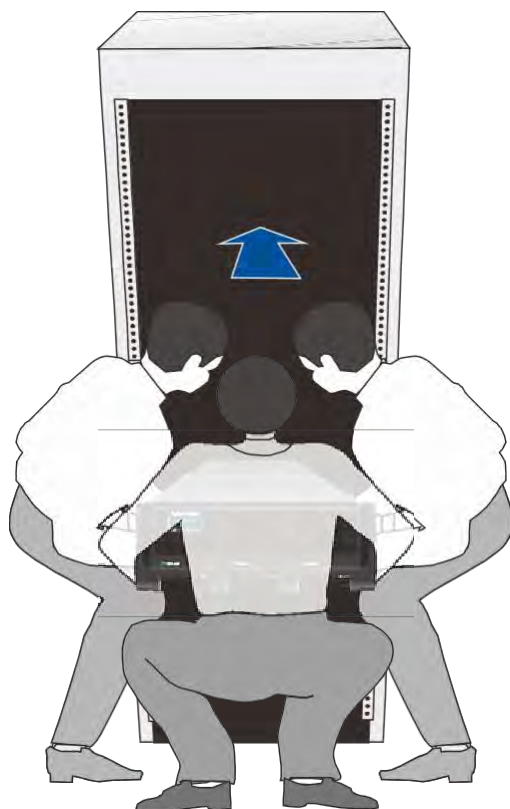
- Loosen the four screws on the slide rail to adjust the length. After the length adjustment, secure the slide rails to the front and rear rack posts with the M5 9.0mm truss head screws. Tighten the four screws on the slide rail to fix the length.



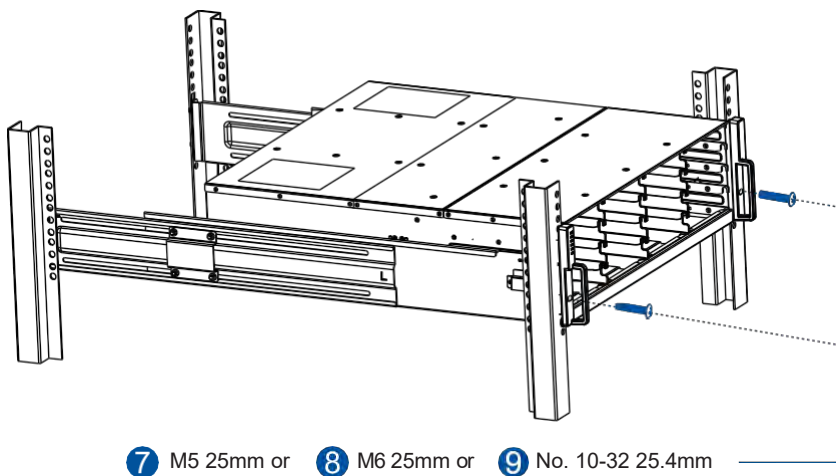
3. Attach the inner glides to both sides of the enclosure using the no. 6-32 flathead screws.



4. With the assistance of other two persons, lift and insert the enclosure onto the slide rails. Ensure that the inner glides on both sides of the enclosure meet the inner glide rails.



5. Secure the enclosure using the M5, M6, or no. 10-32 screws from the front.

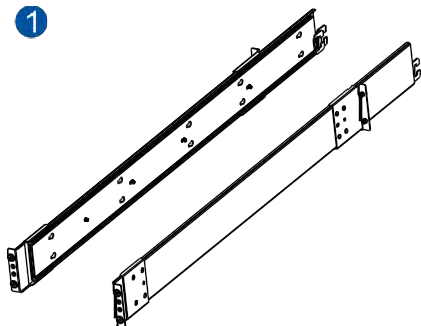


When the enclosure is already assembled to the cabinet, you can proceed to the next installation procedures of other components.

Rackmount Slide Kit Contents (for PS 3060L/4060L Gen2)

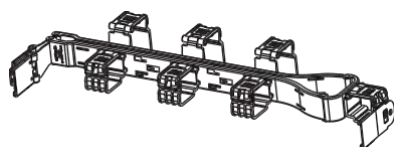
Check your rackmount slide kit for the following contents.

1



2 x Rack slide rails (left and right)

2



Cable management arm

3



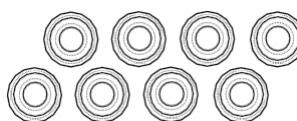
6 x M4 6mm screws

4



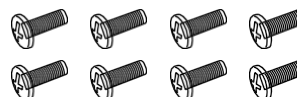
2 x M5 cage nuts

5



8 x Ø5.1mm washers

6



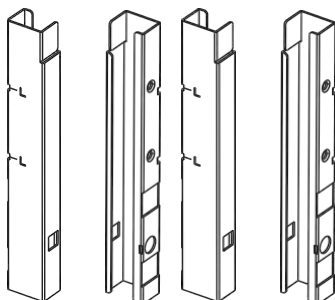
8 x M5 10mm screws

NOTE: The rack slide rails are assembled together with the enclosure slide rails.

Adjuster Pillars

Check your adjuster pillars kit for the following contents.

1



2 x 25mm and 2 x 50mm
adjuster pillars (left and
right)

2



8 x screws

3



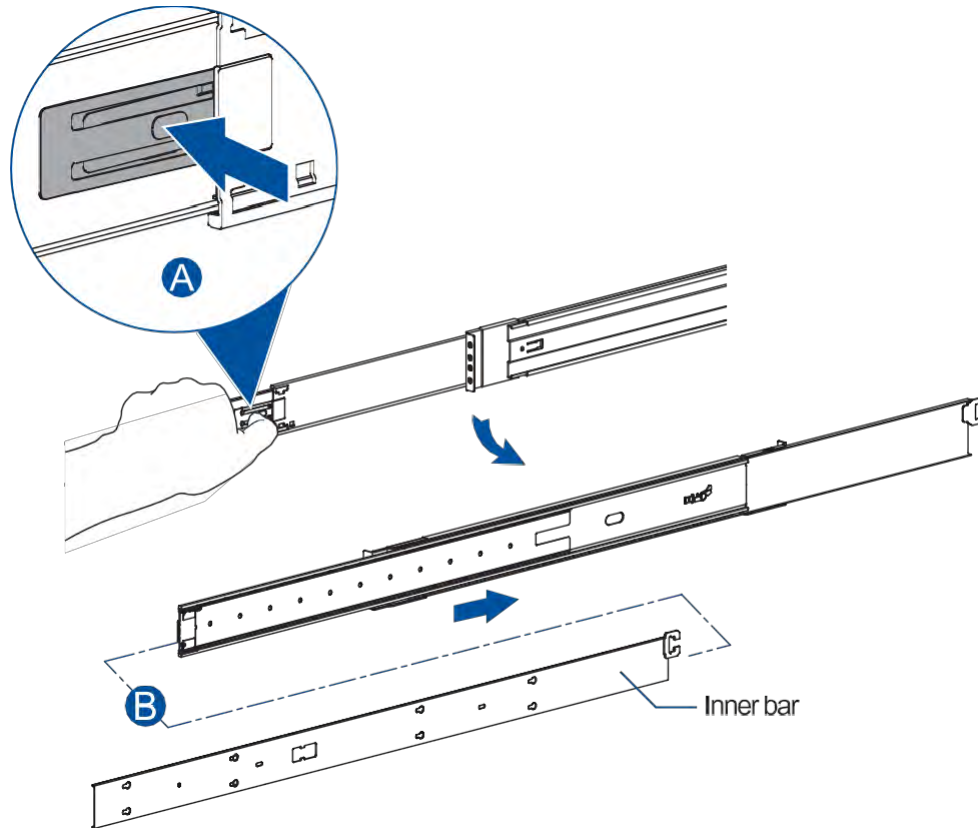
2 x M5 cage nuts

NOTE: The adjuster pillar kit is only needed if the rear end of your system protrudes at the rear end of the cabinet.

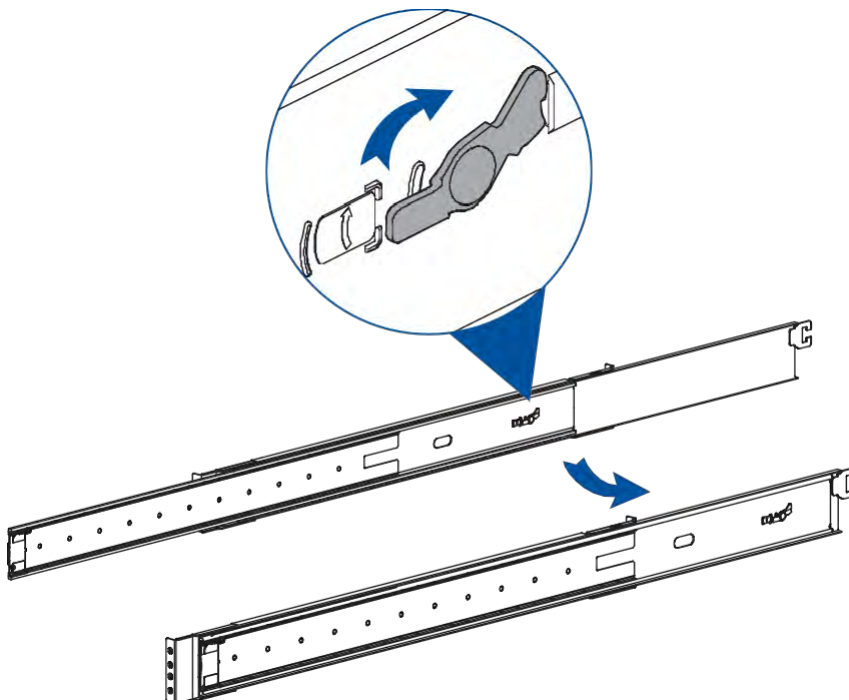
Assembling the Rackmount Slide Kit

To assemble the rackmount slide kit:

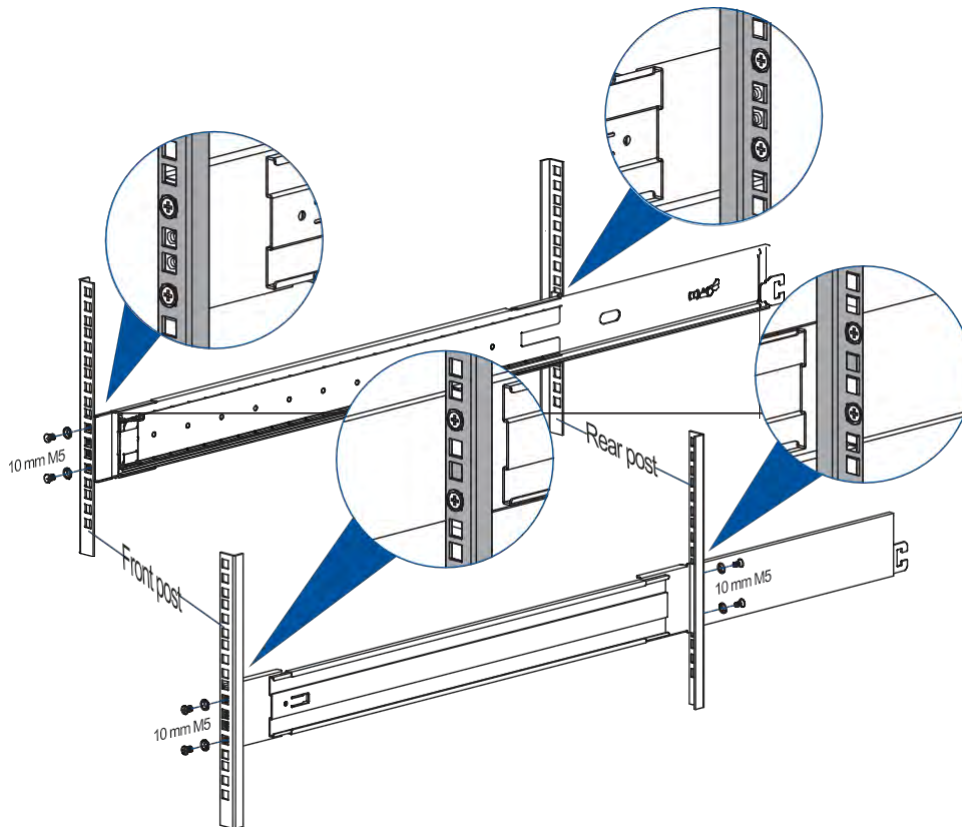
1. Press the release button (A) then remove the inner bar (B) from the slide rail.



2. Move the lever to the right side (follow the direction of the engraved arrow), then compress the remaining bars of the slide rail.



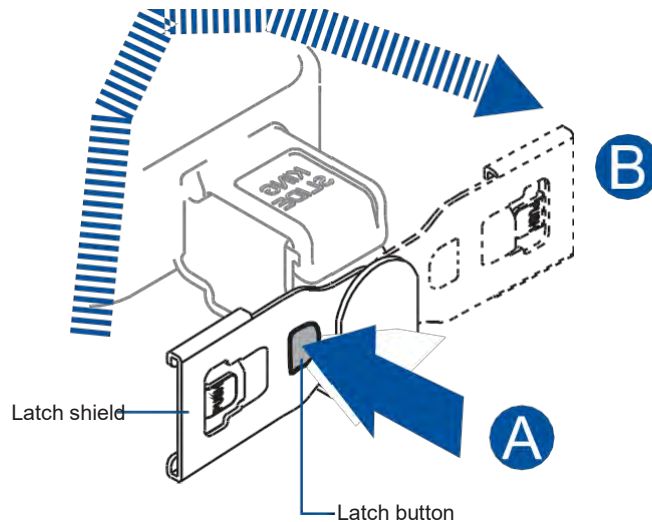
3. Determine the location where you want to install the slide rails to the rack posts.
4. Attach the slide rails to the rack posts using eight M5 10mm screws and washers, four for front posts and the other four for rear posts.



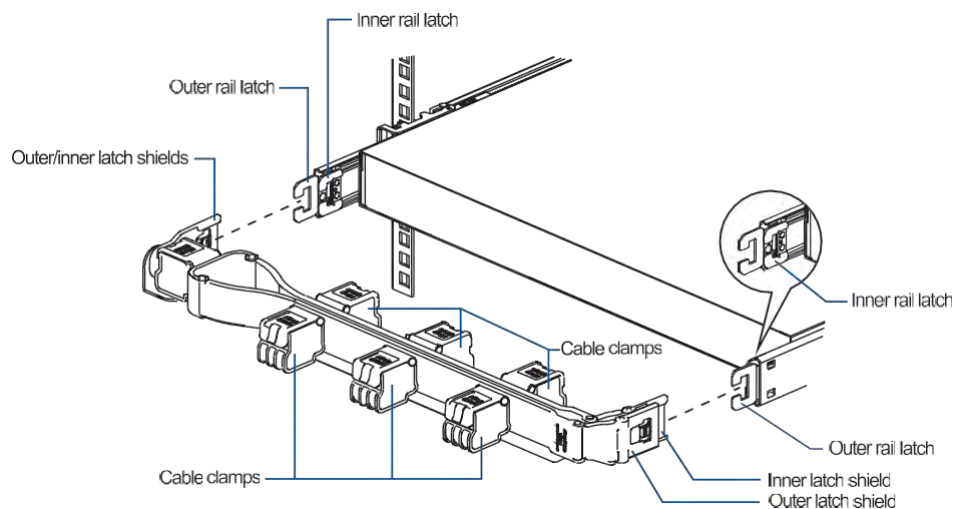
Installing the Cable Management Arm to the Rackmount

The cable management arm allows you to keep the cables in place for a clutter-free rackmount system. To install the cable management bar:

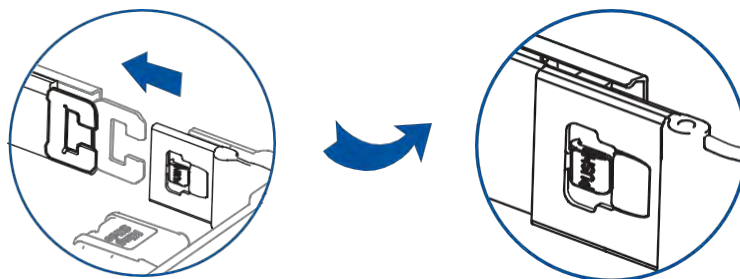
1. From the cable management arm, push the button near the latch at each end of the arm (A), then rotate the latch shield in a 180° angle (B).



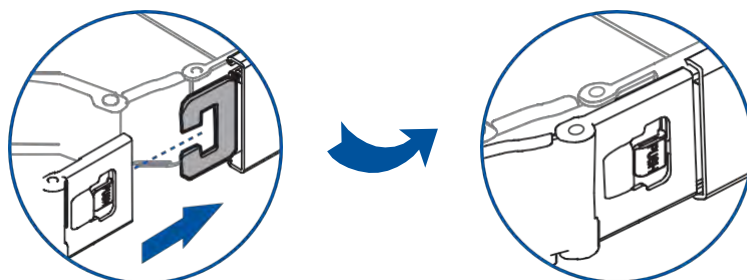
2. Connect the latches of the cable management arm to the latches of the slide rails.



- a. Connect the inner latch shield of the cable management arm to the inner latch of the inner slide rail. Do this on both sides of the arm and rails.

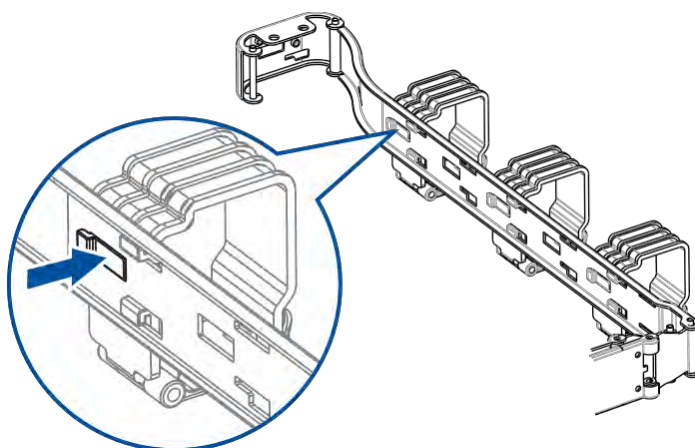


- b. Connect the outer latch shield of the cable management arm to the outer latch of the outer slide rail. Do this on both sides of the arm and rails.

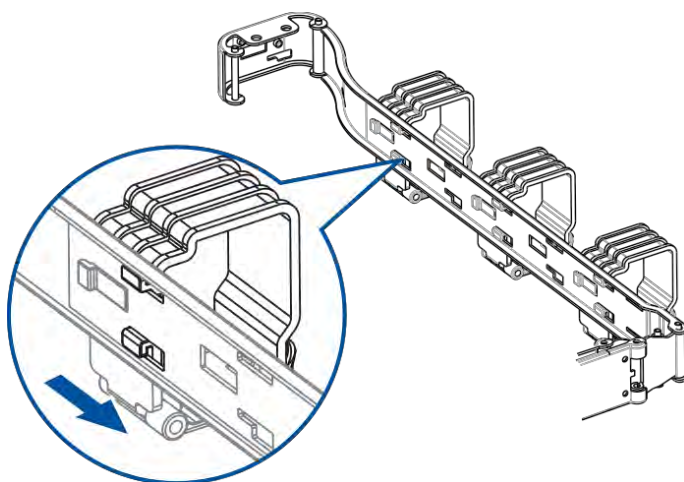


If you need to move the cable clamp to another position, do the following steps:

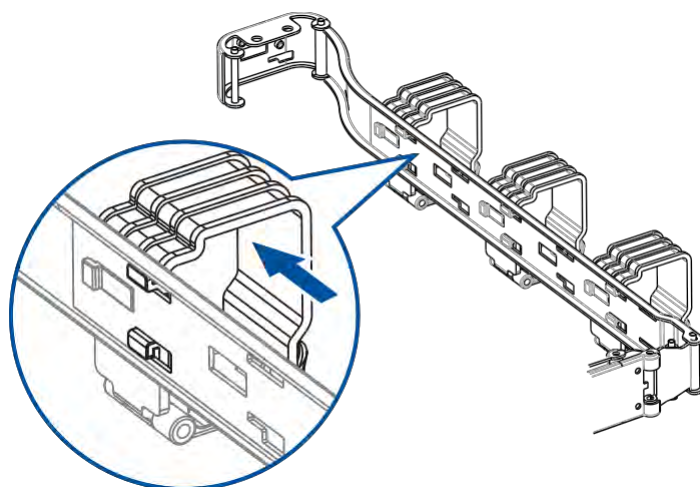
1. Push the latch to release the cable clamp from the cable management arm.



2. Move the clamp to the bigger hole of the notch, then pull to remove it from the locking holes.



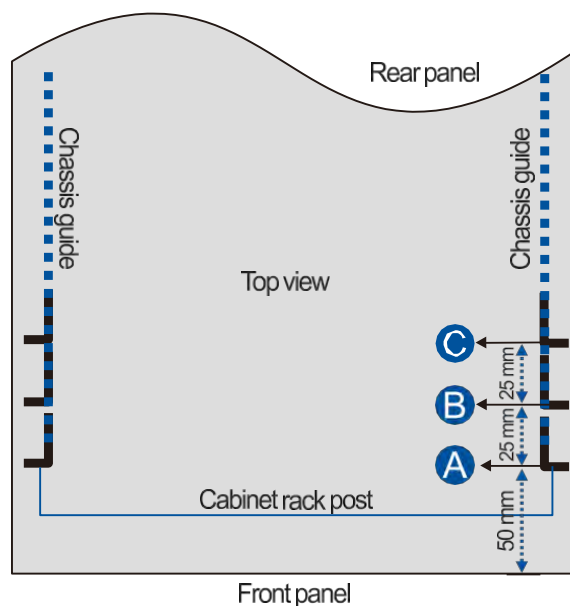
- Align the clamp's latches to the notches of the cable management arm, then slide the clamp to the narrow hole of the notch until it snaps in place.



Installing the Adjuster Pillars

Due to the measurement of PS 3060L/4060L Gen2's enclosure and the selected position where to secure the front rack posts on the chassis guide, you may be required to install the adjuster pillars so that the rear end of the enclosure will not protrude on the rear end of the cabinet.

Cabinet structure



Rack post position		A	B	C
Adjuster pillar type	25 mm Adjuster pillar	✗	✓	✗
	50 mm Adjuster pillar	✗	✗	✓

The illustration and the table above show the generic structure of the cabinet and the position of the adjuster pillars according to its measurement. Refer to the above information when installing the adjuster pillars to the rack posts.

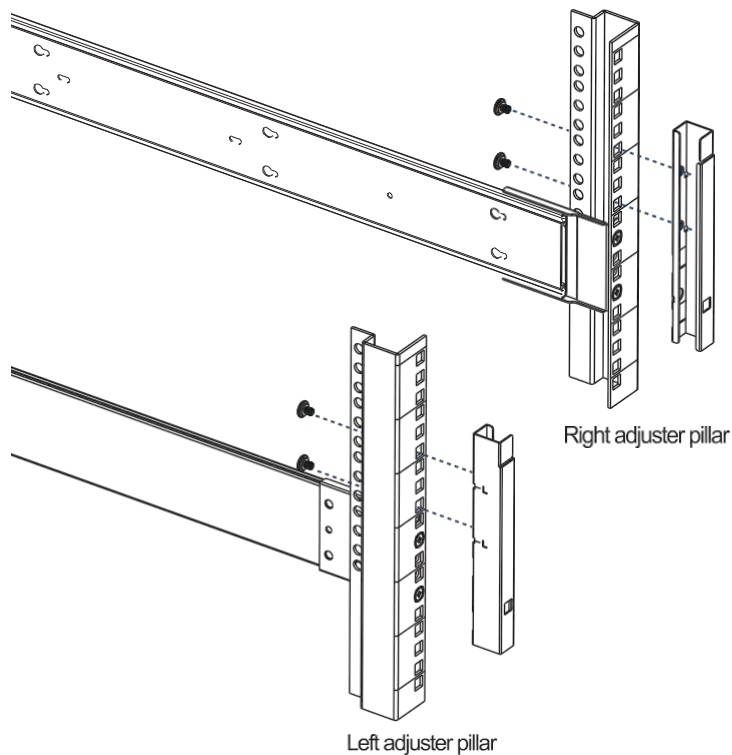
Take note of the following table information:

- Position **A** : No need to install the adjuster pillars.
- Position **B** : Install the 25 mm adjuster pillars.
- Position **C** : Install the 50 mm adjuster pillars.

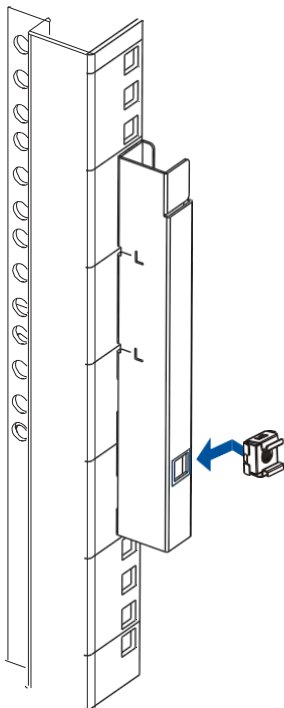
NOTE: The rackmount installation positions follows the rackmount service chassis standards of SSI (Server System Infrastructure).

To install the adjuster pillars:

1. Check the unit boundary on the front rack posts. Orient the left and right adjuster pillars at 2U/3U position on the rack posts, then secure them with the bundled screws.



2. Insert the two bundled cage nuts into the cage nut holes on the adjuster pillars.

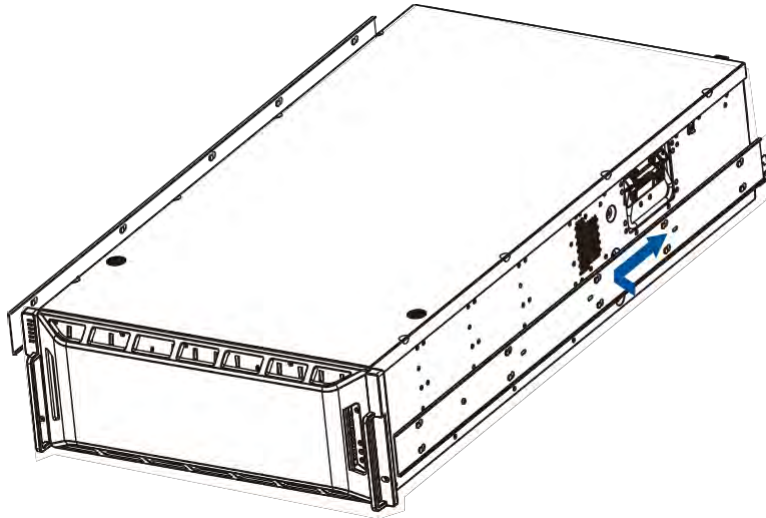


When the enclosure is already assembled to the cabinet, you can proceed to the next installation procedures of other components.

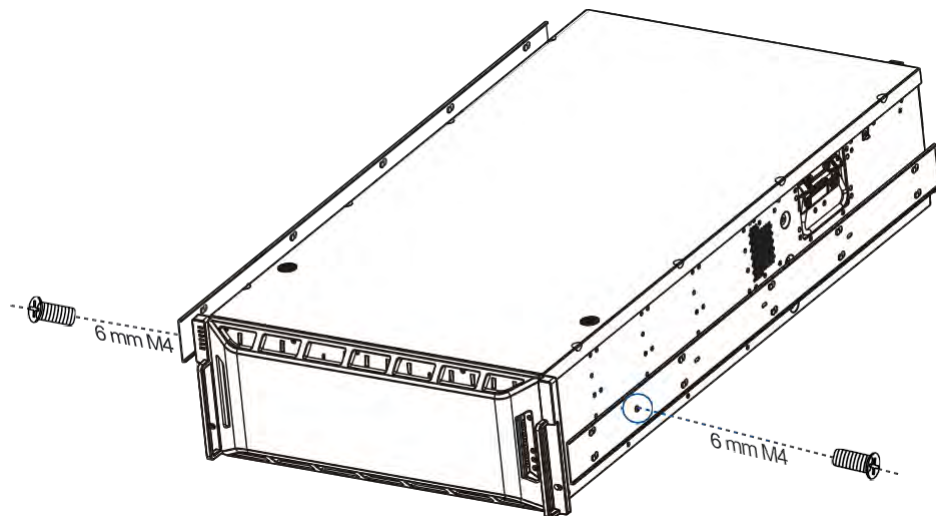
Installing the Chassis to the Assembled Rackmount

To install the chassis to the assembled rackmount:

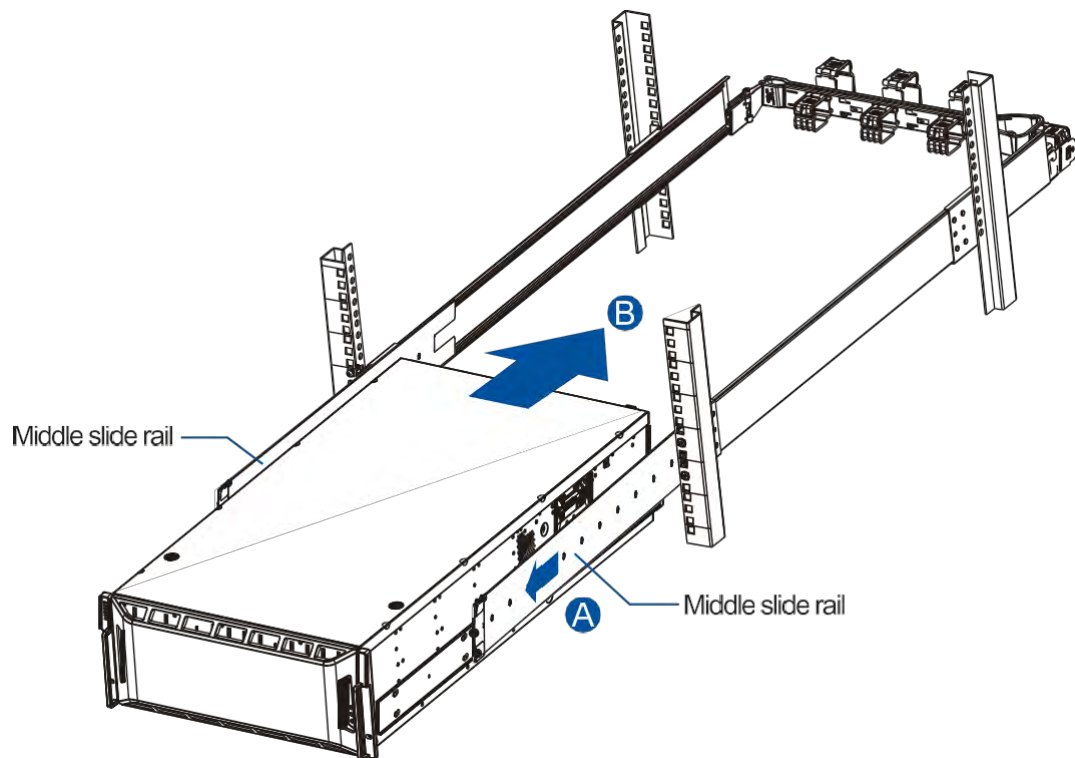
1. For the inner bars that you removed from the slide rails, install them to the sides of the enclosure:
 - a. Align and fit the inner bar's sockets to the four hinges of the enclosure, then slide it to the back of the enclosure. Do the same for the other side.



- b. Use two M4 6mm screws to secure the inner bars to the sides of the enclosure.

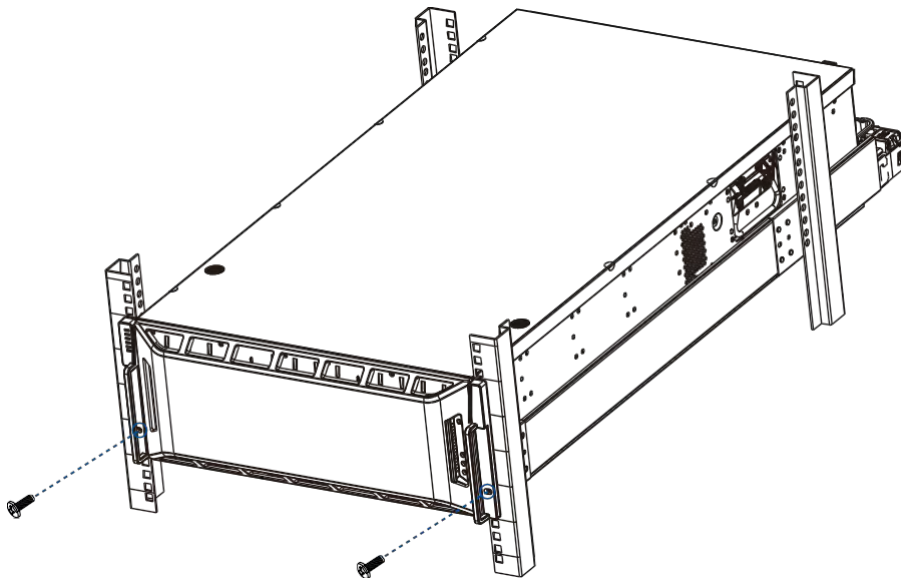


2. Extend the middle slide rails (A), then align them to the installed inner bars and insert the whole enclosure to the rack (B).



IMPORTANT! Due to the weight of the enclosure, we recommend you to ask assistance from at least 3 persons to install the enclosure to the rack.

3. Use two M5 20mm screws to fasten the enclosure to the front rack posts.



NOTE: If the rack posts have unthreaded mounting holes, insert two M5 cage nuts to the said holes then use the M5 screws to secure the enclosure to the rack.

2.2.3 Installing the Hard Drives

This section gives you an overview of the hard drive requirements, installation, and important notices that you must take note.

NOTE: The hard drives are purchased separately.

IMPORTANT!

- Ensure to install the enclosure to the rack first before installing the hard drives to the enclosure's drive bay.
 - You must install at least four hard drives for RAID 5 configuration or five hard drives for RAID 6 configuration to create an initial volume.
-

Hard Drive Installation Prerequisites

When purchasing hard drives, ensure to consider the following factors:

- **Capacity (Mb/Gb)**

Purchase the hard drives that have the same capacity. This SAN storage uses the *least common denominator* approach, which means that the maximum capacity used in each drive to create a RAID array is the maximum capacity of the smallest drive. We strongly suggest to use large storage capacity hard drives.

IMPORTANT!

- The hard drives may carry different block numbers, which means that the capacity may not be the same even if they are of the same model with the same rate capacity made by the same manufacturer.
 - When configuring the hard drives into a RAID array, you can use a smaller capacity as the *maximum disk capacity* in every hard drive. For configuration options, refer to the interface-specific firmware manual that came with your enclosure.
-

- **Profile**

The drive trays and bays of the system are designed for 2.5-inch or 3.5-inch hard drives.

- **Drive type**

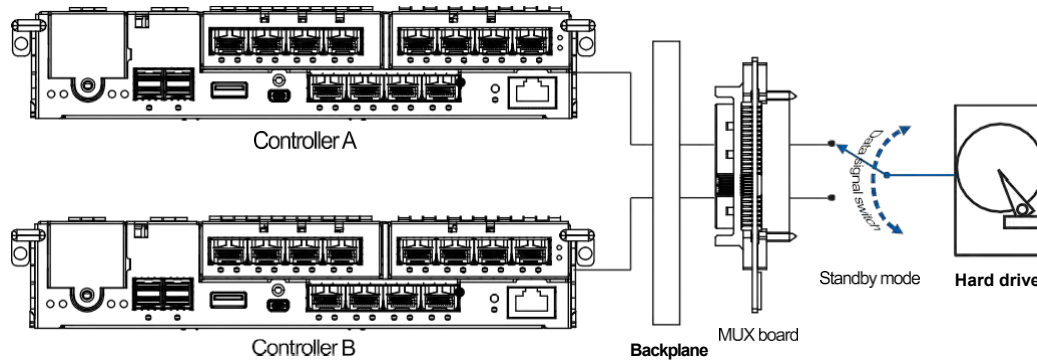
The system uses 3Gb/s SAS, 6Gb/s SAS, 12Gb/s SAS, and nearline SAS and SATA 3G/6G 2.5-inch and 3.5-inch hard drives.

IMPORTANT!

- Ensure that you purchase the correct hard drives.
 - If you prefer using SATA hard drives in the attached expansions, ensure that you purchase MUX kits.
-

Understanding the MUX Kit's Port Mechanism

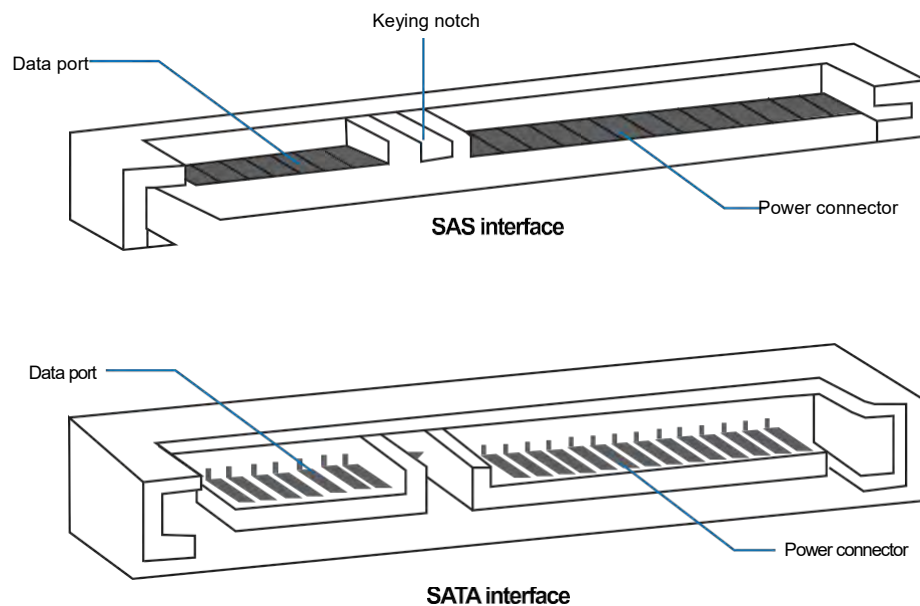
If you install a SATA hard drive in a dual-controller system, this may require an MUX board. The MUX board is paired with a hard drive in order to switch data signals between controllers A and B's signal ports.



Under normal circumstances, the controller B's signal ports are in standby mode.

SAS and SATA Interfaces

The SAS interface features a dual-ported connectivity with pins on both sides of its connector while the SATA drives have only one port. In a redundant-controller system, the MUX-supported drive trays must be separately purchased and applied. The single-controller expansion systems do not require an MUX kit.

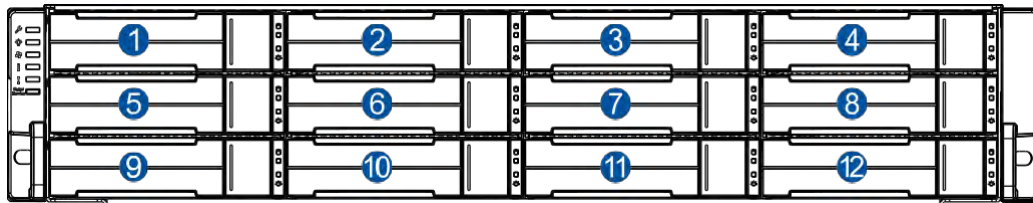


IMPORTANT!

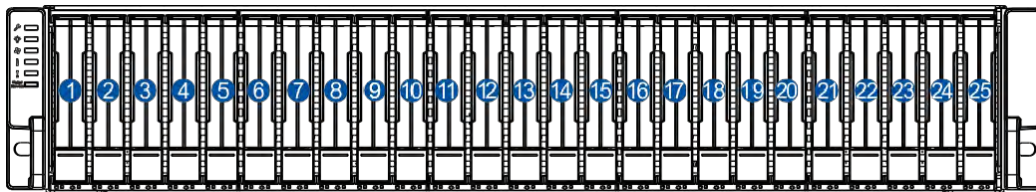
- ONLY install the drive trays to the system if the system is already mounted to the rack. If the hard drives are installed to the system before mounting to the rack, the system will be heavy to mount and possible impact during installation may damage the hard drives.
- Handle the disk drives with extreme care and observe all ESD prevention procedures when installing the hard drives.
- ONLY use the screws that are bundled in the system package. Securing the drives with longer screws may damage them.

Hard Drive Designation

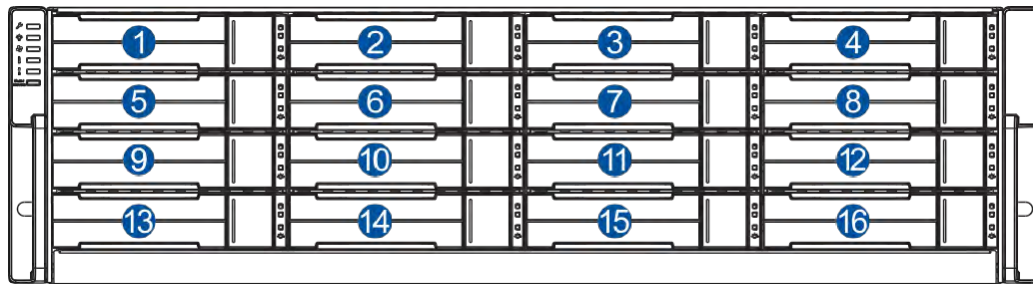
Get to know the exact order of the hard drives to avoid removing the wrong drives out of the enclosure.



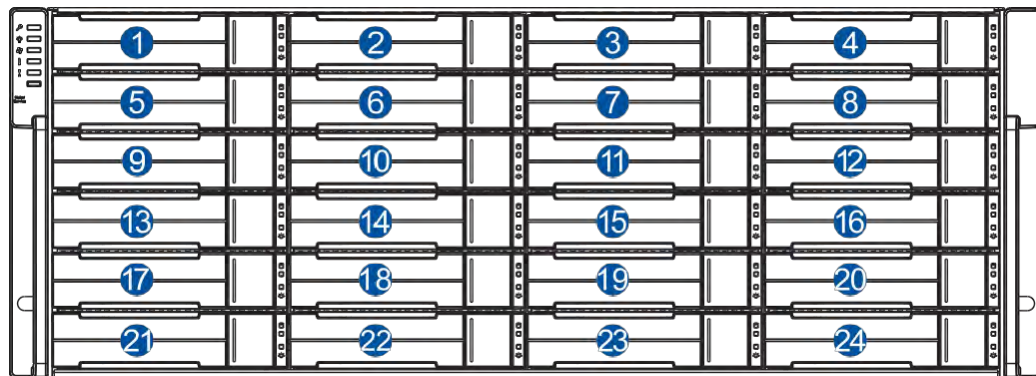
PS 3012/4012 Gen2



PS 3025B/4025B Gen2



PS 3016/4016 Gen2

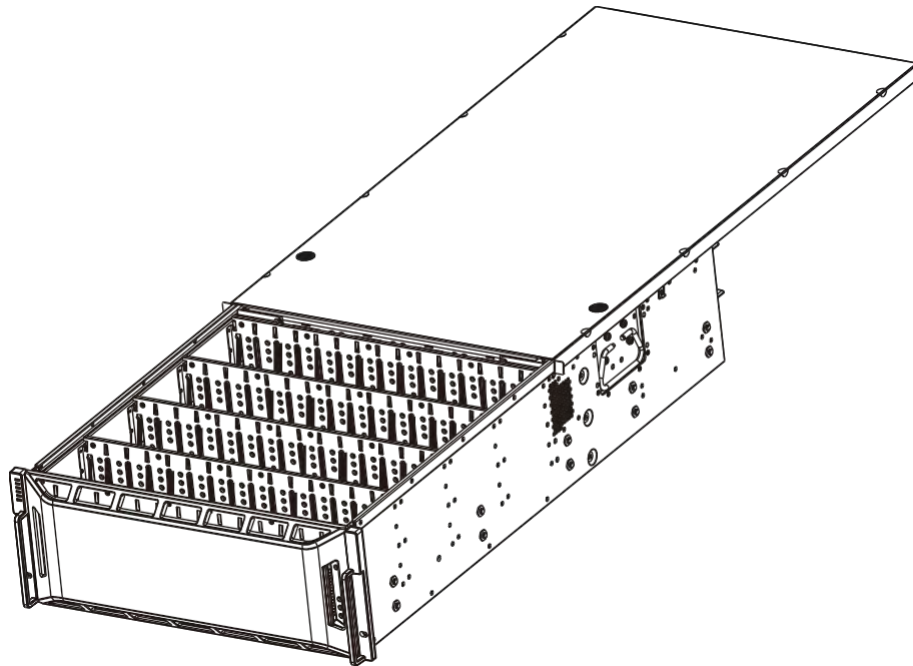


PS 3024/4024 Gen2

IMPORTANT! Install at least four hard drives for RAID 5 and five hard drives for RAID 6 to create an initial volume.

Rear of the enclosure

1	5	9	13	17	21	25	29	33	37	41	45	49	53	57
2	6	10	14	18	22	26	30	34	38	42	46	50	54	58
3	7	11	15	19	23	27	31	35	39	43	47	51	55	59
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60



PS 3060L/4060L Gen2

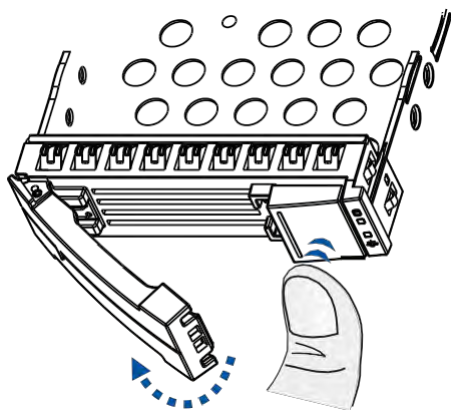
IMPORTANT!

- The hard drive slots marked in blue belong to the initial set.
- The hard drive slots marked in gray are the in-line/parallel set.
- It is strongly recommended to install at least 12 hard drives into the blue slots. To install more drives, use the in-line/parallel set (gray-marked slots) and ensure that you install in the correct drive order.

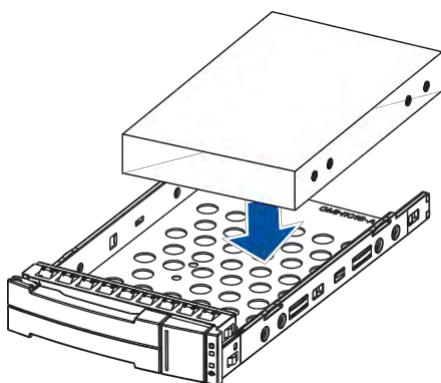
Installing the Hard Drive into the Drive Tray and Enclosure (for PS 3012/4012/3016/4016/3024/4024 Gen2)

To install the hard drive into the drive tray and enclosure, follow the steps below:

1. Press the release button to open the spring handle, then gently pull out the tray.

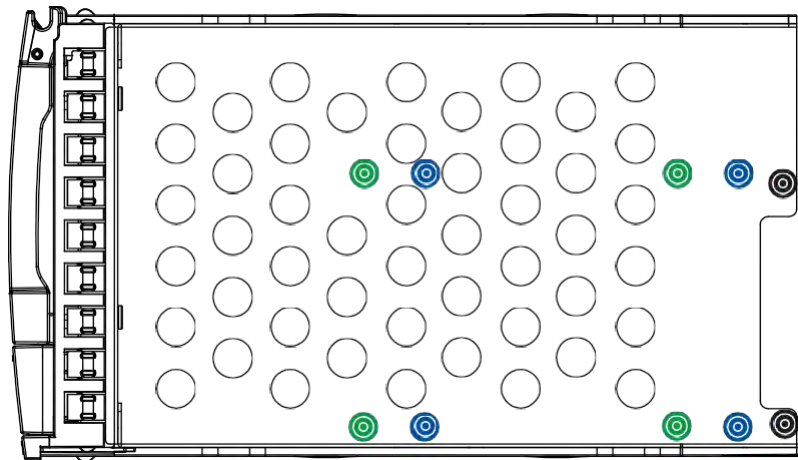


2. Orient the hard drive to the tray with the interface connectors facing the open side of the tray and the label is facing up.



3. Secure the drive to the correct holes of the tray using the four bundled screws.

Screw hole location of 2.5-inch HDD/SSD on a 3.5-inch drive tray



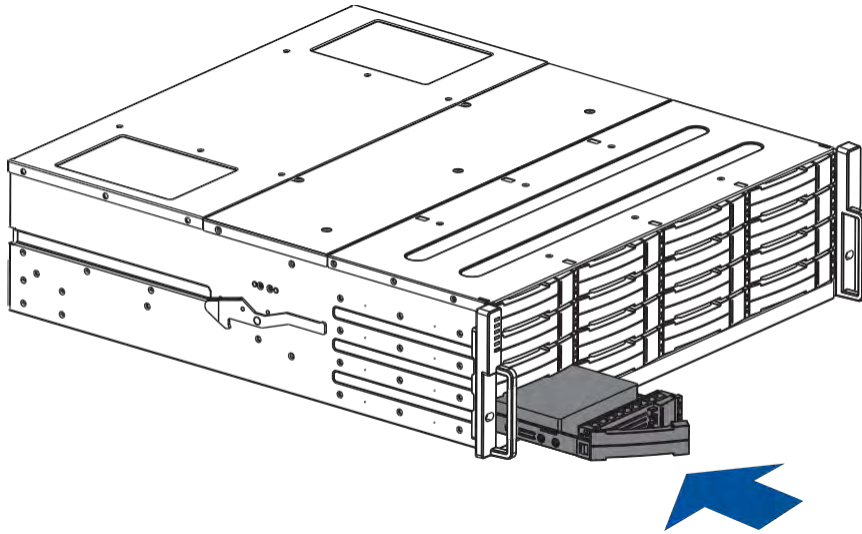
- HDD/SSD with MUX board
- HDD/SSD without MUX board
- MUX board screw holes

Screw holes of 3.5-inch SAS and SATA HDD



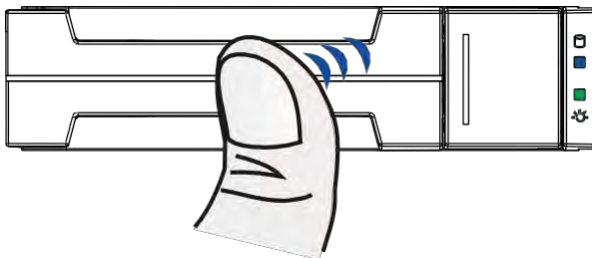
- HDD with MUX board
- HDD without MUX board

4. Insert the assembled hard drive and tray to the enclosure with the spring handle open.



WARNING! Ensure that your system has all the drive bays occupied with the drive trays even if there are no hard drives installed. Without the drive trays, the ventilation is compromised and may cause overheating.

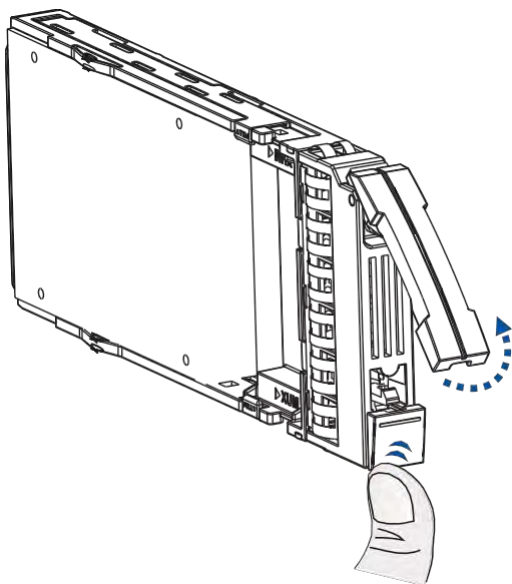
5. When the tray is fully inserted to the bay, close the spring handle.



Installing the Hard Drive into the Drive Tray and Enclosure (for PS 3025B/4025B Gen2)

To install the hard drive into the drive tray and enclosure, follow the steps below:

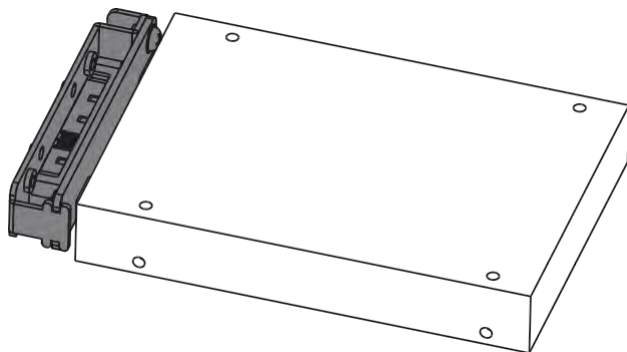
1. Press the release button to open the spring handle, then gently pull out the tray.



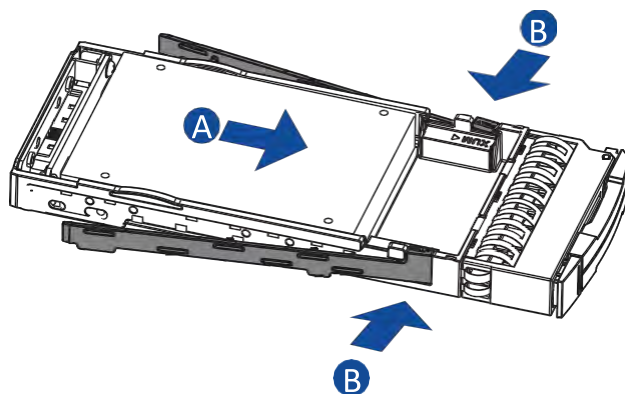
2. Place the hard drive into the tray.

With MUX Board:

- a. Attach the MUX board to the drive.

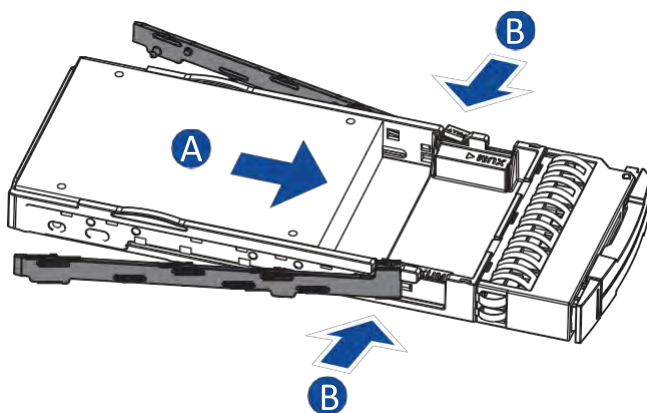


- b. Place the hard drive on the tray (A), then secure the clips to both sides of the tray (B).



Without MUX Board:

Place the hard drive on the tray (A), then secure the clips to the both sides of the tray (B).



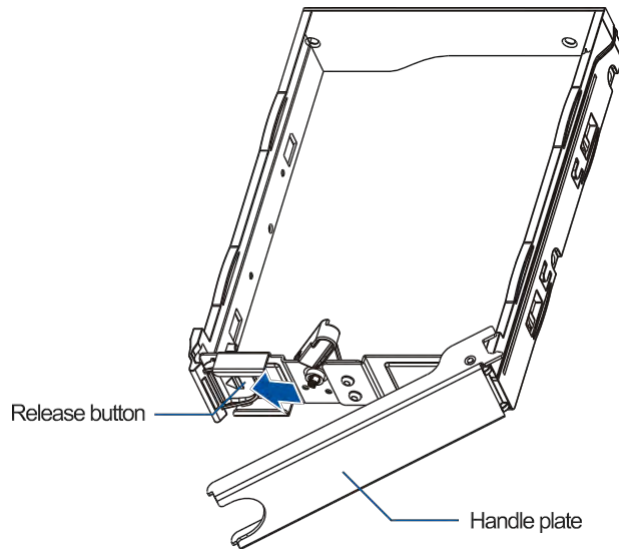
3. Insert the assembled hard drive and tray to the enclosure with the spring handle open, then close the spring handle when the drive is fully inserted to the bay.



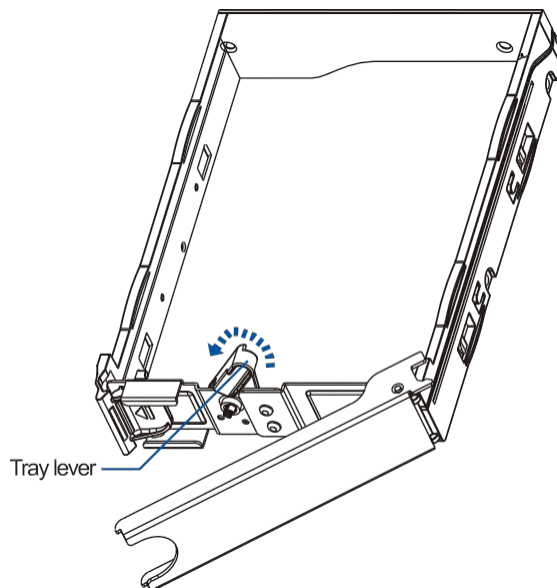
Installing the Hard Drive into the Drive Tray and Enclosure (for PS 3060L/4060L Gen2)

To install the hard drive into the drive tray and enclosure, follow the steps below.

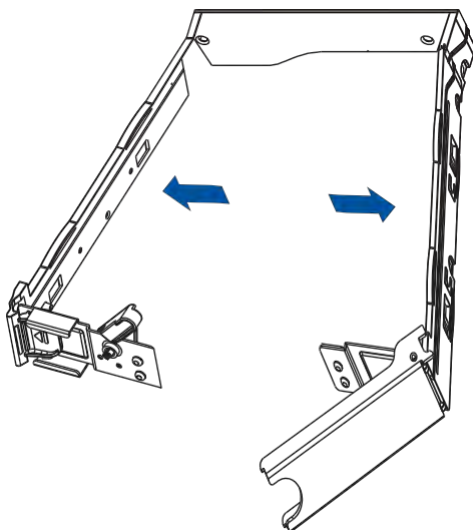
1. Push the release button to the left, then lift the drive tray with the handle plate to remove it from the enclosure.



2. Move the lever tray to the left to unlock the sides.

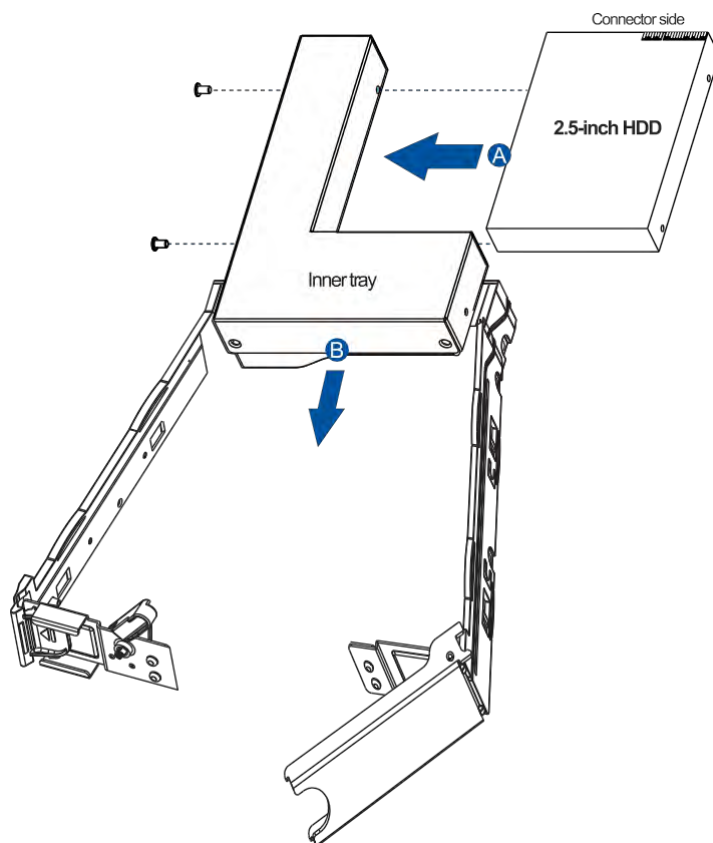


3. Pull both sides to widen the tray.

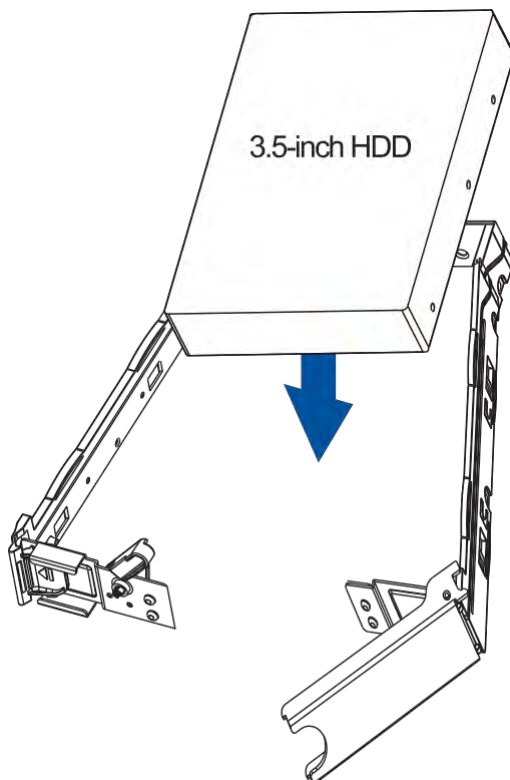


4. Insert the hard drive into the tray.

- (A) • For the 2.5-inch hard drive, secure the drive first to the inner tray using the two bundled screws, then orient the inner tray's pin holes to the main drive tray's pins on the sides (B).

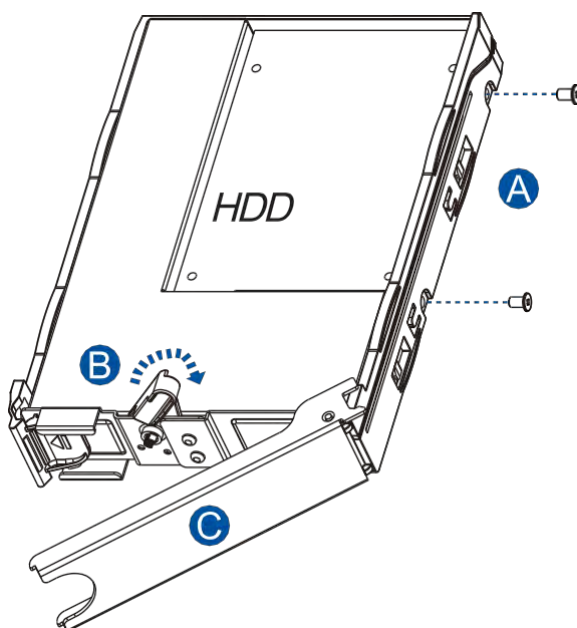


- For the 3.5-inch hard drive, orient the drive to the drive tray's two pins on its sides.

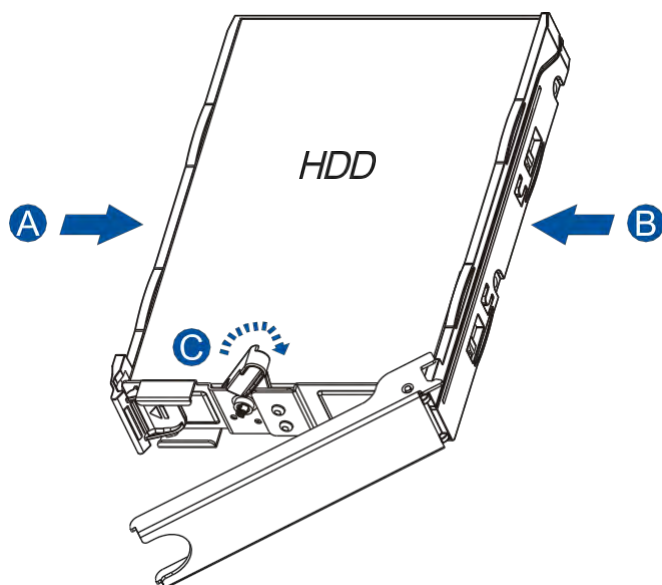


5. Snap back the sides of the tray to its original position.

- For the 2.5-inch drive, secure the hard drive and tray assembly with the bundled screws (A), then move the tray lever to the right (B). Keep the handle plate open (C).

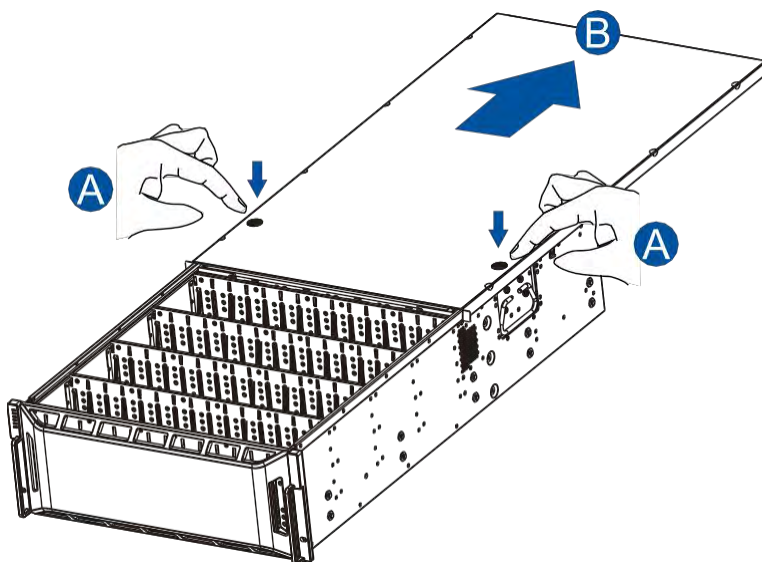


- For the 3.5-inch drive, secure the side to the hard drive with the release button first (A), then the side with the handle plate (B), and move the tray lever to the left (C). Keep the handle plate open.



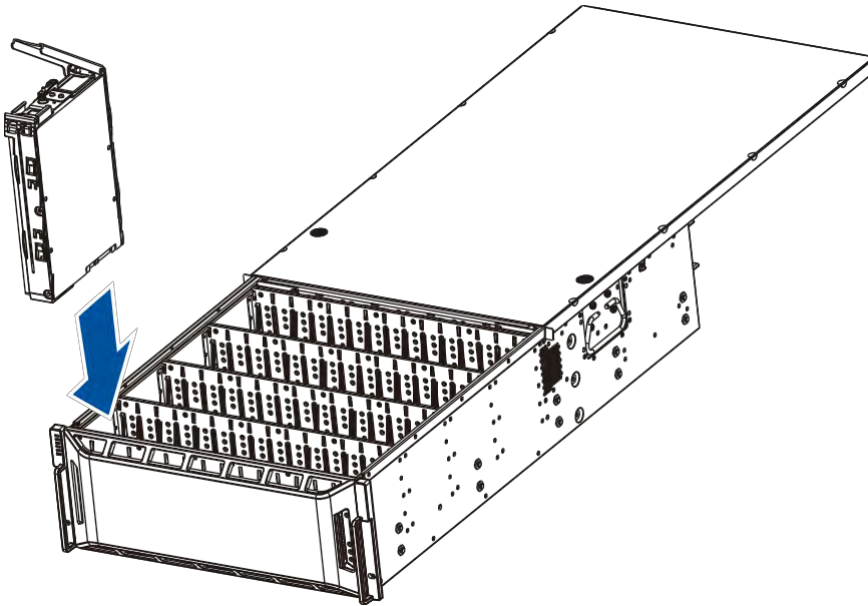
IMPORTANT! Ensure that the drives are secured to the drive trays before installing the assembly to the enclosure.

- On the enclosure, push the two release buttons (A) then gently slide the top cover backward (B).



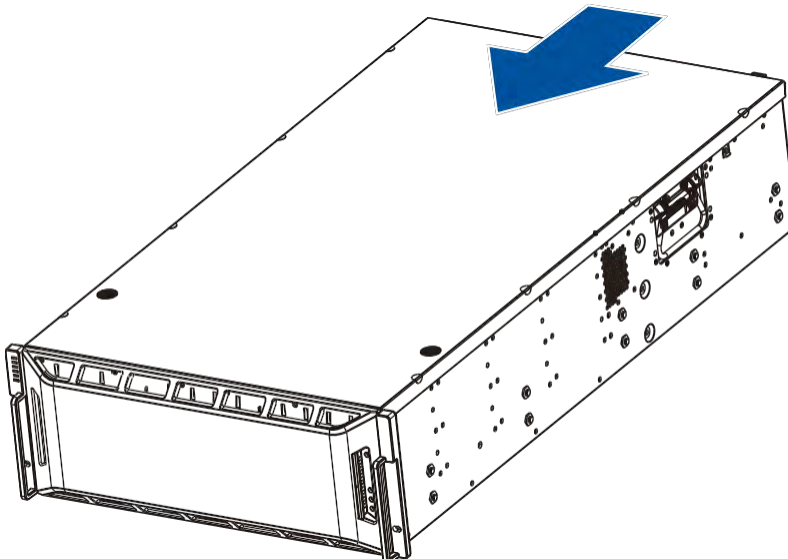
NOTE: You cannot totally remove the cover from the enclosure.

7. Install the hard drive and tray assembly to the hard drive slot of the enclosure with the handle plate open, push the hard drive to connect with the enclosure, then push the handle plate to secure the hard drive tray to the enclosure.



IMPORTANT! Ensure that the handle plate is completely clamped on the hard drive.

8. After installing the drives, slide back the top cover until it snaps with the front panel and the release buttons are in its original position when the cover is closed.



2.2.4 Installing the Host Board

NOTES:

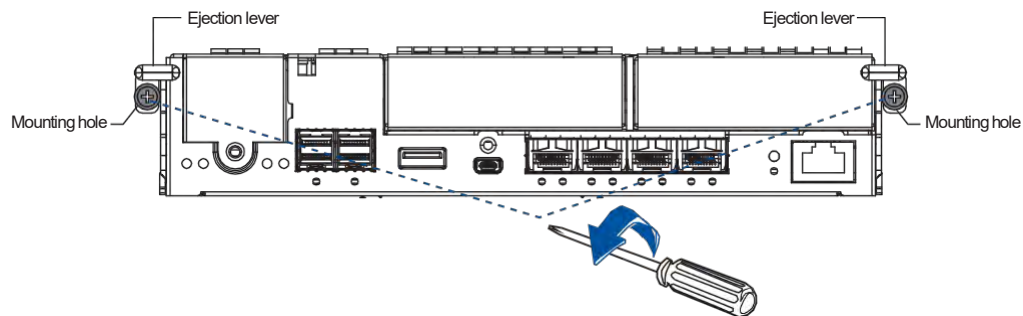
- A downtime may occur when upgrading the controller/host board.
 - If you install only one host board, install it at the left slot.
 - To add or replace a host board, the firmware automatically restores the default factory settings of your system.
-

IMPORTANT! When installing a host board in a single-controller system, ensure that you shut down the applications and the system.

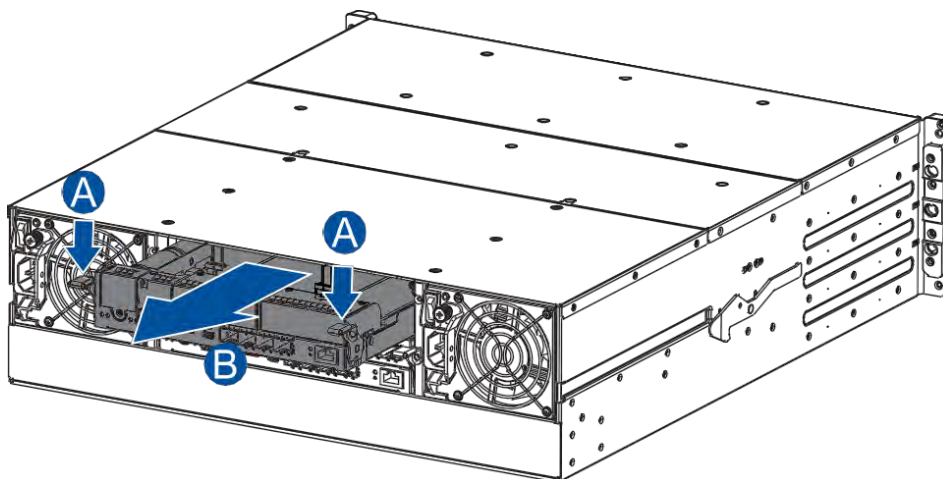
Installing the Host Board (for PS 3012/4012/3016/4016/3024/4024/3025B/4025B Gen2)

To install a host board:

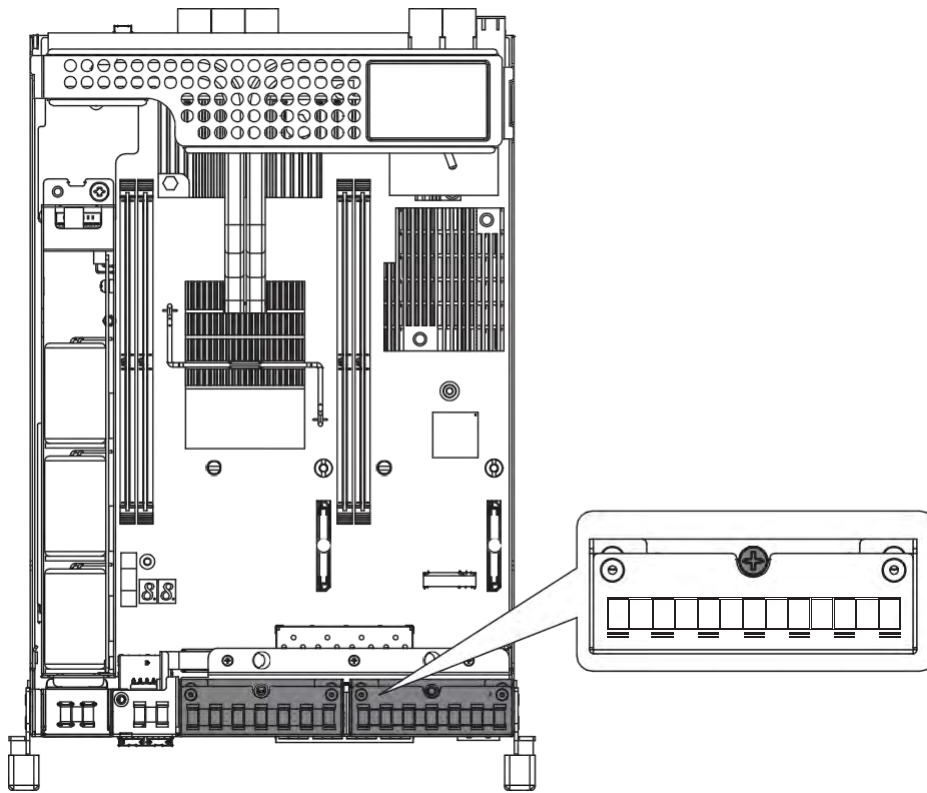
1. Disconnect all cables from the controller module that you want to be replaced.
2. Loosen the screws that secure the controller module's ejection levers to the chassis.



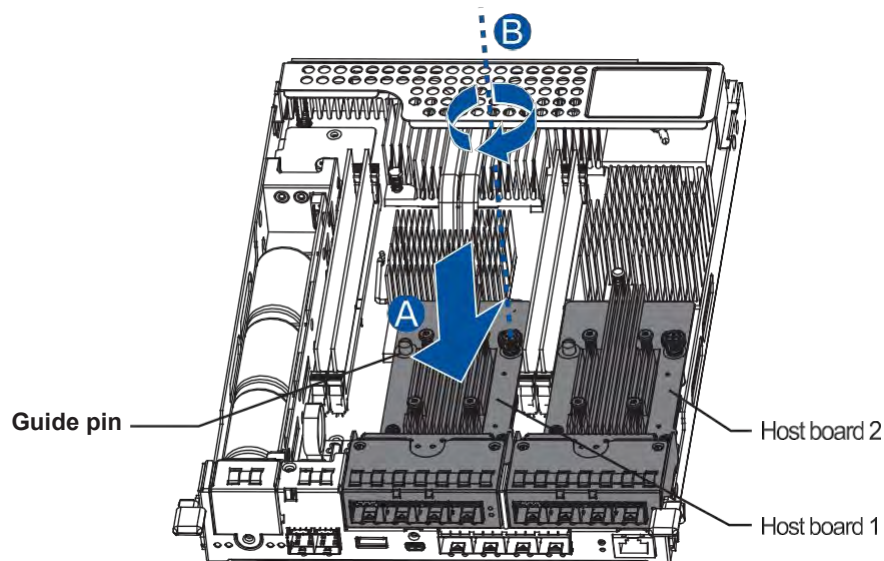
3. Push the ejection levers downwards to dislodge the controller from the system (A), then pull to remove from the enclosure (B).



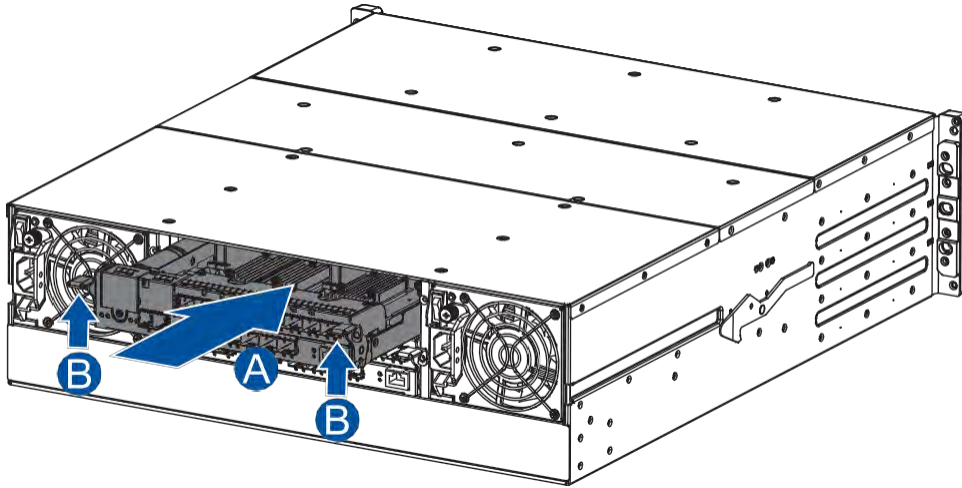
4. Loosen the screws that secure the dummy covers to the controller and remove the dummy covers.



5. Use the guide pin to position the new host board to the host board slot, place it carefully (A), then tighten the thumb screws to secure the host board in place (B).



6. Insert back the controller carefully into the module slot (A). When you feel a contact resistance, use a small but careful force and push the ejection levers upwards to secure the controller into chassis (B).

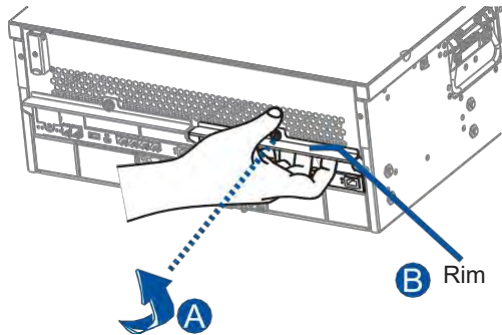


7. Secure the controller to the enclosure with the retention screws. Reconnect the cables to the controller module.

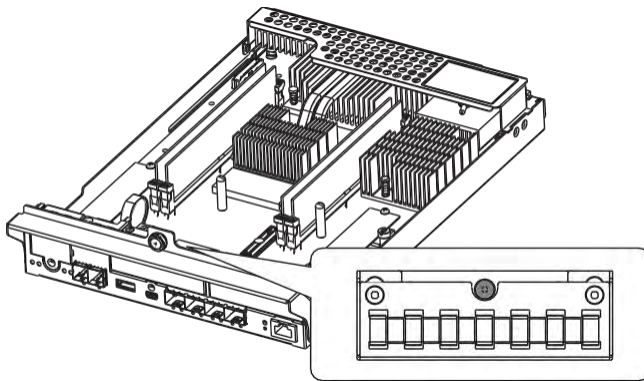
Installing the Host Board (for PS 3060L/4060L Gen2)

To install a host board:

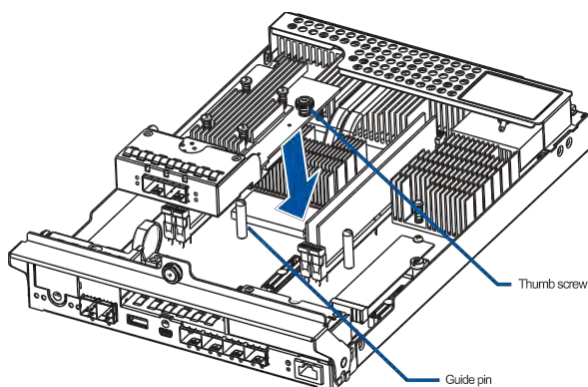
1. Unfasten the retention screw from the controller that you want to install the host board (A), and hold the rim then remove the controller from the system (B).



2. Remove the screw that secure the dummy cover to the enclosure.



3. Orient the new host board to the controller's guide pin, place it carefully, then tighten the thumb screw to secure in place.



4. Insert the controller carefully into the module slot. When you feel a contact resistance, push the controller with a small but careful force, then secure the controller to the enclosure with the retention screw.

2.3 Connections

This section details the connection procedures of PS system to the expansions, power source, connection status, topologies, and other connection configurations.

2.3.1 General Considerations in Connecting Devices

When selecting the number of hard drives to assemble a logical drive, the host channel bandwidth and the performance of each drive must be considered. It is a good practice that you calculate the performance against the host port bandwidth when designing an application topology.

For example, if eight drives are included in a logical drive and is associated with a host ID (LUN mapping), the combined performance of this logical drive must estimate the channel bandwidth. If two 6-drive logical arrays are associated with two IDs residing in a single host channel, there may be a trade-off with the performance.

If your system comes with a total of eight or more host ports, we recommend that you use more disk drives to an expansion so that you can create a host-port that corresponds to 6-member logical drives (RAID 5) or 8-member logical drives (RAID 6). These logical drives bring up the bandwidth of each host.

You must also take note of these considerations:

- A spare drive that carries no data stripes and does not contribute to disk-level performance. For performance data information of your hard drive, refer to its documentation.
- Disk drives in the same logical drive must have the same capacity, but it is preferred that all disk drives in a chassis have the same capacity. Tiered storage configuration is supported in this setup. However, you must not include both SAS and SATA drives in a logical drive.
- A spare drive must have a minimum capacity equivalent to the largest drive that needs replacement. If the capacity of the spare drive is less than the capacity of the drive to be replaced, the controller will not proceed with the failed drive rebuild.
- When connecting between devices, follow all the specifications. Pay attention to the signals and avoid electronic noise from adjacent interfaces. DO NOT put power cords on optical cables.
- When rack mounting, leave enough space for the cables. DO NOT bend them to a diameter of less than 76 mm (3 inches).
- Route the cables away from places where it can be damaged by other devices such as foot traffic or fan exhaust.
- DO NOT over-tighten, twist, or bend the cables.

Configuring the Host-Side Topologies

When configuring host-side topologies, avoid the points of failure. It is recommended that the host ports are connected to at least two HBAs (Host Bus Adapters).

NOTES:

- To manage the fault-tolerant data paths and optimize data throughput on multiple data paths, you must apply multipathing utilities such as Linux Device Mapper.
 - Host port channel designation may vary by system. Refer to the topologies of this manual to create your own connections that suit your needs.
-

Configuring the Host-Side Parameters

For the host-side parameters, we strongly recommend that you use the default settings of your system. If you need to adjust the host-side parameters, consult your on-site technical personnel or seek technical support from your vendor.

Familiarizing the Maximum Concurrent Host LUN Connection (Nexus in SCSI)

The menu option *Max Number of Concurrent Host-LUN Connection* allows you to set the maximum number of concurrent host LUN connections. This is the arrangement of the controller internal resources to use with a number of current host nexus.

For example, if you have four hosts (A, B, C, and D) and four host IDs/LUNs (IDs 0, 1, 2, and 3) in a configuration, where:

- Host A accesses ID 0 (one nexus)
- Host B accesses ID 1 (one nexus)
- Host C accesses ID 2 (one nexus)
- Host D accesses ID 3 (one nexus)

These connections are queued in the cache, which are called four nexus. If there is an I/O in the cache with these four nexus and another host I/O comes with a nexus different from the four in the cache (e.g. host A accesses ID 3), the controller returns as busy. This happens with the concurrent active nexus. If the cache is cleared, it accepts four different nexus again. Many I/O operations can be accessed via the same nexus.

Knowing the Maximum Queued I/O Count

The menu option *Maximum Queued I/O Count* allows you to configure the maximum number of I/O operations per host channel that can be accepted from the servers. The predefined range is from 1 to 1024 I/O operations per host channel. You can also choose **Auto**, which sets the automatic configuration. The default value is 256 I/O operations. The appropriate setting for this option depends on how many I/O operations the attached servers are performing. This varies according to the amount of the host memory present as well as the number of drives and their respective sizes. Usually, the optimum performance occurs from using **Auto** or **256** settings. For more information, refer to the firmware manual that came with your system.

2.3.2 Fiber-Host Connections

The FC (Fiber Channel) standard allows optical connections. The optical cables are used over long distances and have been proven to be more reliable. Due to the demands of high transfer rates, optical cables are preferred for a 4 Gbps, 8 Gbps, 16 Gbps, or 32 Gbps fiber connectivity, as they are not vulnerable to EMI.

The fiber host ports are connected to fiber channel HBAs (host bus adapters) that feature SFP interface with full duplex transfer support in a PCIe interface. For the latest certified items, please contact the vendor near you.

WARNING!

- All fiber cables are sensitive and must be handled with care. To avoid interference, the cabling path must be carefully planned without the cables getting bent.
 - Lasers are hazardous and may cause blindness or permanent eye damage. Use them with utmost caution. Never look directly when lasers are turned on or operating.
-

Detecting Auto Speed

Speed auto-detection is specified by the fiber channel standard. If a 16 Gbps port is connected to an 8 Gbps port, the speed slows down at 8 Gbps. If there are 16 Gbps ports on both ends of the link, the speed runs at 16 Gbps.

SFP/SFP+ Transceivers

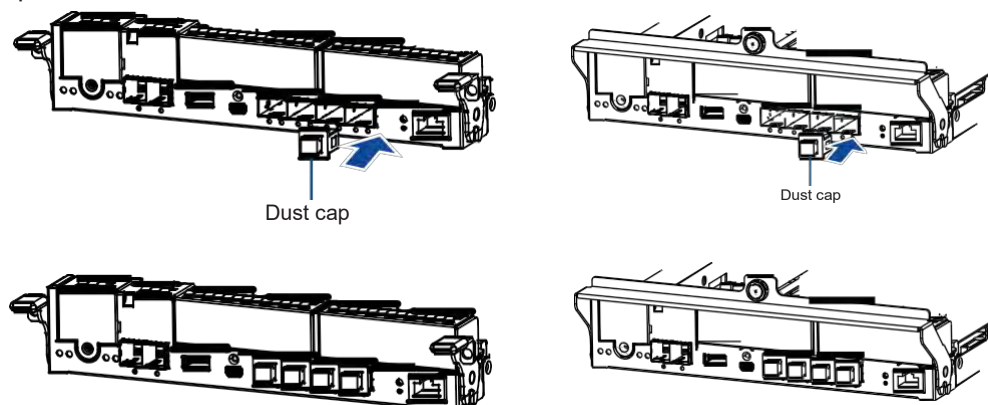
An SFP transceiver converts electrical data signals into light signals then transfers these signals transparently via the optical fiber. A transceiver provides bi-directional data links, a laser transmitter (for fiber optic cables), LC connector, and a metal enclosure to lower the EMI.

Other features of a typical SFP transceiver include a single power supply, low power dissipation, and hot-swap capability. It is also important that the transceiver you use meets the FC performance and reliability specifications.

WARNING! The SFP transceiver has a laser diode featuring a Class 1 laser. To ensure safety, DO NOT remove any covers or attempt access of the inside of the device. If problems arise or if you need technical service, contact a qualified personnel.

FC Port Dust Caps

Dust caps are bundled in the package. Whenever a onboard host port cable is not plugged in, insert the dust cap.



Fiber-Host Topologies

The fiber-host standard supports three topologies:

- **Point-to-Point Topology**

A direct connection between two fiber-channel devices. The simplest among the three topologies.

- **FC-AL (Fiber Channel Arbitrated Loop)**

The fiber-channel devices are all connected to a loop. Each device is assigned to an AL_PA (Arbitrated Loop Physical Address). FC-AL supports 124 devices in a single loop. This is the most commonly-used topology among the three.

- **Fabric Switch**

This topology can support up to 224 fiber-channel devices and allows multiple devices to communicate simultaneously. A fiber switch is required to implement this topology.

IMPORTANT! If different servers need to access your logical drive, file locking, FC switch zoning, port binding, and multipath access control configurations are necessary.

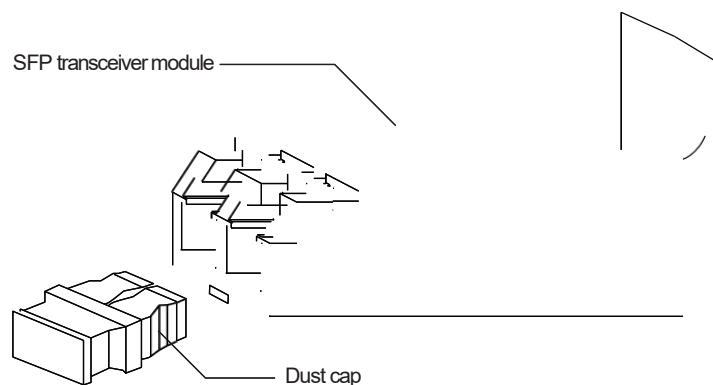
Fiber Cabling

Before you set up your fiber cabling connection, you must:

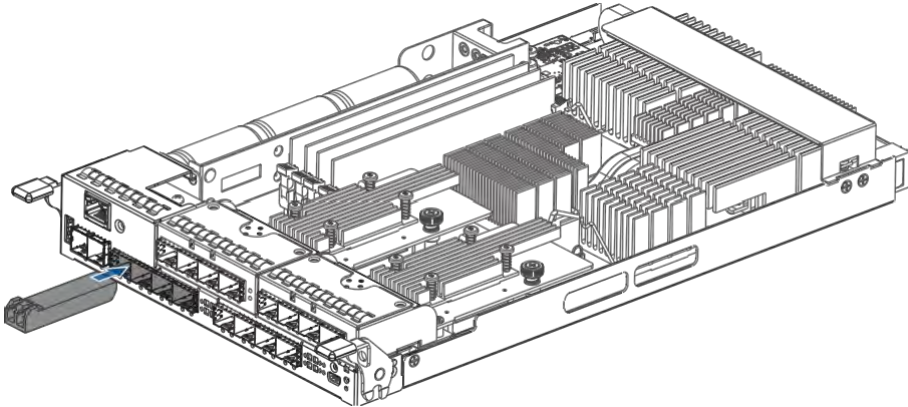
- a. Create a configuration plan. In addition to cabling topologies and the list of networking components, you must also include the firmware and software maintenance details.
- b. Confirm that your fiber-channel cable's loop measures 6 inches or longer.
- c. Ensure proper airflow and keep the cables away from ventilation outlets.

To connect devices using fiber cable:

1. Take out the SFP transceiver module from the static protective package.
2. Remove the dust cap from the SFP transceiver module.

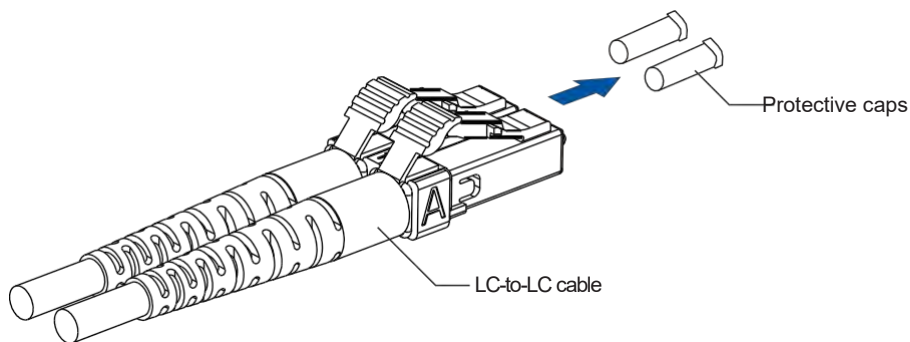


3. Insert the SFP module into one of the system host ports. The module will snap into place.

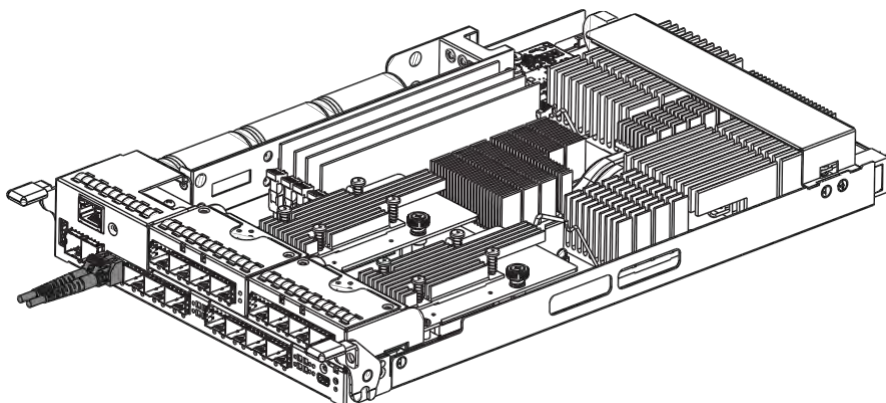


NOTE: The drawing of the controller is for reference only. Look for the actual system host ports in your PS 3000/4000 Gen2 system.

4. Remove the two protective caps from the LC-to-LC type cable. Save the protective caps for future use.



5. Insert the LC-to-LC cable to the SFP transceiver module already connected to the system. You can hear a clicking sound, securing the cable in place.

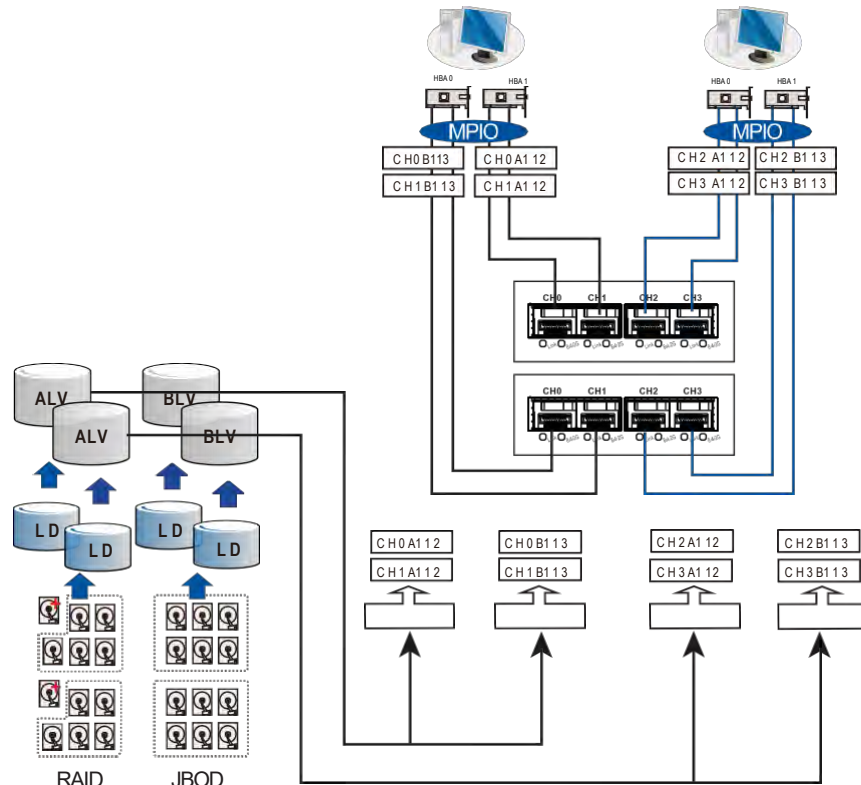


NOTE: The drawing of the controller is for reference only. Look for the actual system host ports in your PS 3000/4000 Gen2 system.

6. Remove the protective caps on the other end of the cable, then connect to an SFP transceiver module on a Fiber Channel switch port or a Fiber Channel HBA (host bus adapter) port.

Simple End-to-End Connection

This connection type shows a simple end-to-end connection, with each SFP port connected to a host adapter. Multiple logical drives, logical volumes, and logical partitions are created and each partition is mapped to a corresponding host channel ID/LUN combination.



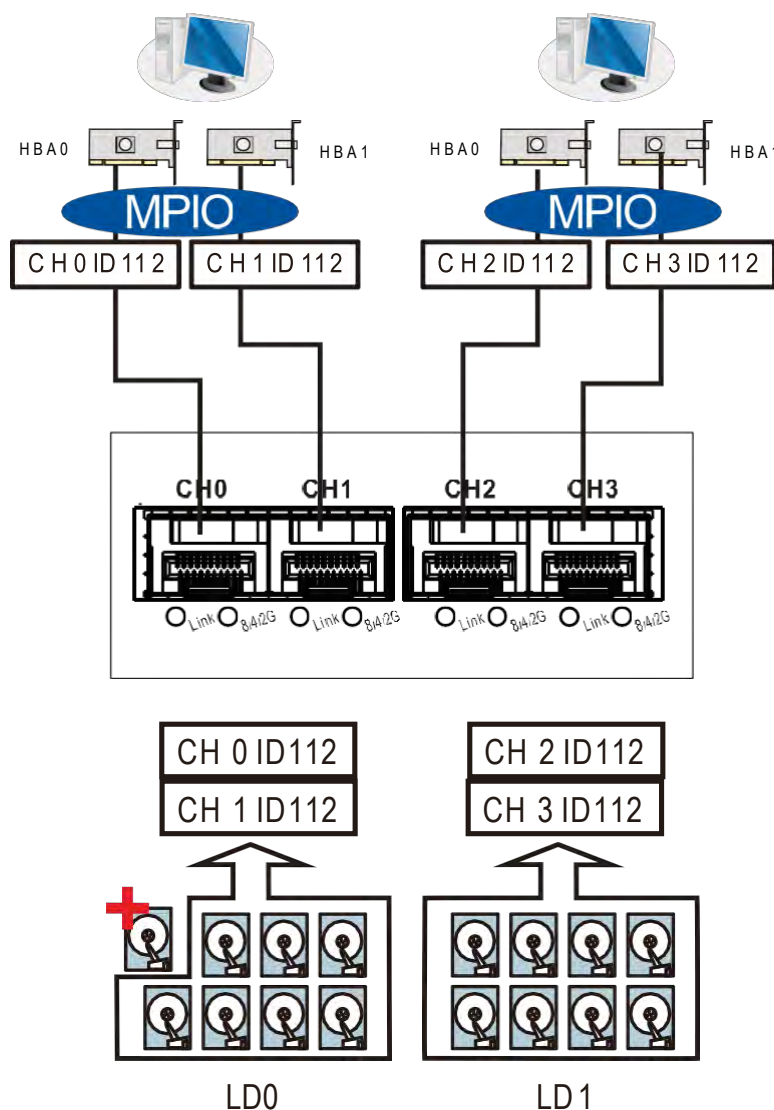
Channels	Controller A	Controller B
Host	CH0, CH1, CH2, CH3	CH0, CH1, CH2, CH3
Configuration Information		
Number of Controllers	2	
Host Servers	2	
Data Path Connection	Fault-tolerant data paths	

NOTE: You need a multipathing software such as **MPIO** or **Linux Device Mapper** to control and optimize the access to logical drives via multiple data paths.

DAS (Direct-Attached Storage) Connection

This connection has more disk drives over SAS expansion links. With this connection, you can create more logical groups of drives. These logical drives use more host channel IDs or LUN numbers.

The two logical drives in the illustration below cannot equate the full power of the system. You can attach one or two more expansion enclosures to achieve more end-to-end performance.

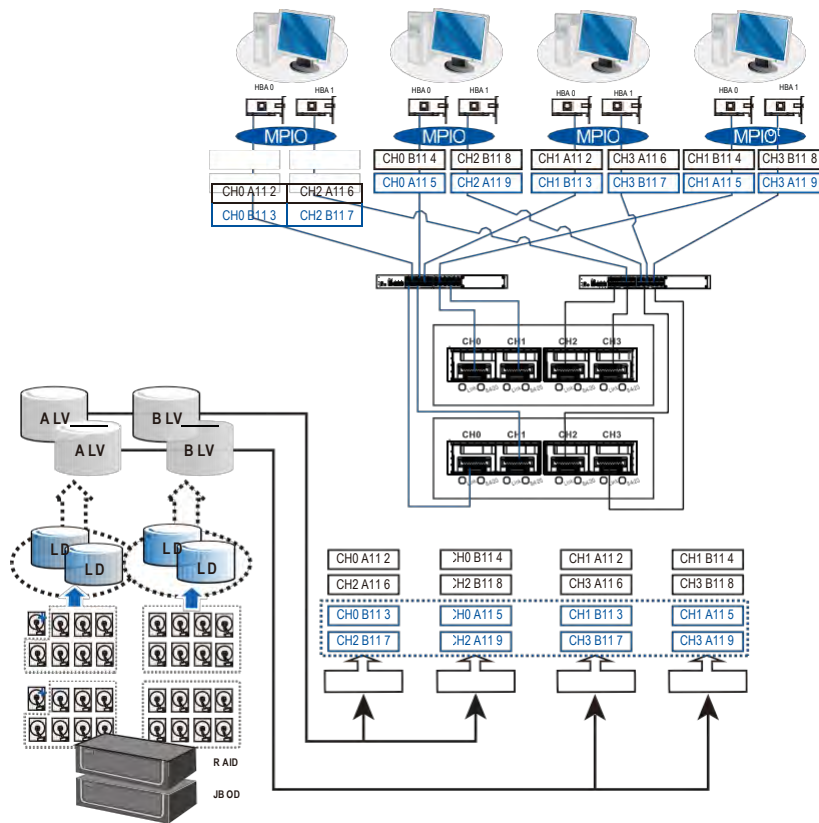


Channels	Controller A
Host	CH0, CH1, CH2, CH3
Configuration Information	
Number of Controllers	1
Host Servers	2
Data Path Connection	Simple end-to-end connections with fault-tolerant pairs

NOTE: If a server has multiple data paths to a SAN storage, a multipathing software such as MPIO, is needed.

Switched Fabric Connection in Dual Controller

In this type of connection, the channel link bypass is provided by external FC switches. Each application server shown in the illustration below is equipped with two HBAs with FC links, connecting via two FC switches to the SFP ports on individual controllers.



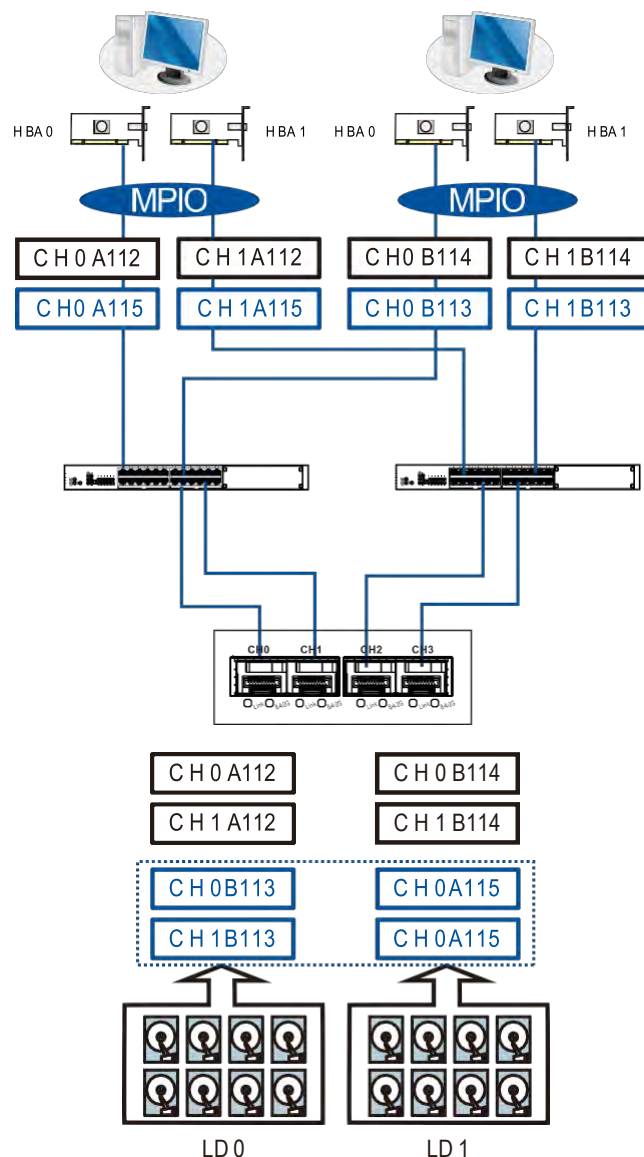
Channels	Controller A	Controller B
Host	CH0, CH1, CH2, CH3	CH0, CH1, CH2, CH3
Configuration Information		
Number of Controllers	2	
Host Servers	4 (or more via FC switches)	
FC Switches	2 (or 1 into 2 zones)	
Data Path Connection	Fault-tolerant data paths	

Each logical partition is redundantly mapped to multiple host channel IDs in an AAPP (Active-Active-Passive-Passive) configuration. Logical volumes are managed by either controller A or controller B. The passive IDs will only become functional when a single controller fails in the system.

The MPIO driver is needed on the application servers. This driver communicates with the system firmware and performs load balance and automated distribution of I/Os across the preferred paths (active IDs on data paths). TPPS (Target Port Group Service) is supported so that the I/Os are routed to the preferred paths.

Switched Fabric Connection in Single Controller

In this type of connection, each SFP port is connected to an FC switch then to the host board adapters. Each logical partition is mapped to a single host channel ID. If you prefer path redundancy, you can map a logical partition to IDs residing on two different channels.



Channels	Controller A
Host	CH0, CH1, CH2, CH3
Configuration Information	
Number of Controllers	1
Host Servers	4
Data Path Connection	The data paths are connected to one or more FC switches. The SAN management measures, such as switch zoning and port binding, must be taken to avoid multiple servers from accessing the same LUN.

If multiple servers detect a mapped volume, you have to avoid access contention using file locking software, port binding, or zoning feature of the FC switches, which limits the access from host to a specific LUN. If you have two servers in a clustered configuration, the clustering software will perform the access control.

IMPORTANT!

- We suggest you to use an enclosure-specific spare drive to prevent it from participating in the rebuild of a logical drive on another enclosure. You can refer to the ID taPS on the host links to see the related LUN mapping and cable links routing paths.
 - You need MPIO driver to manage the access via two different HBA ports. This driver communicates with the system firmware and performs load balance and automated distribution of I/O.
-

2.3.3 SAS-Host Connections

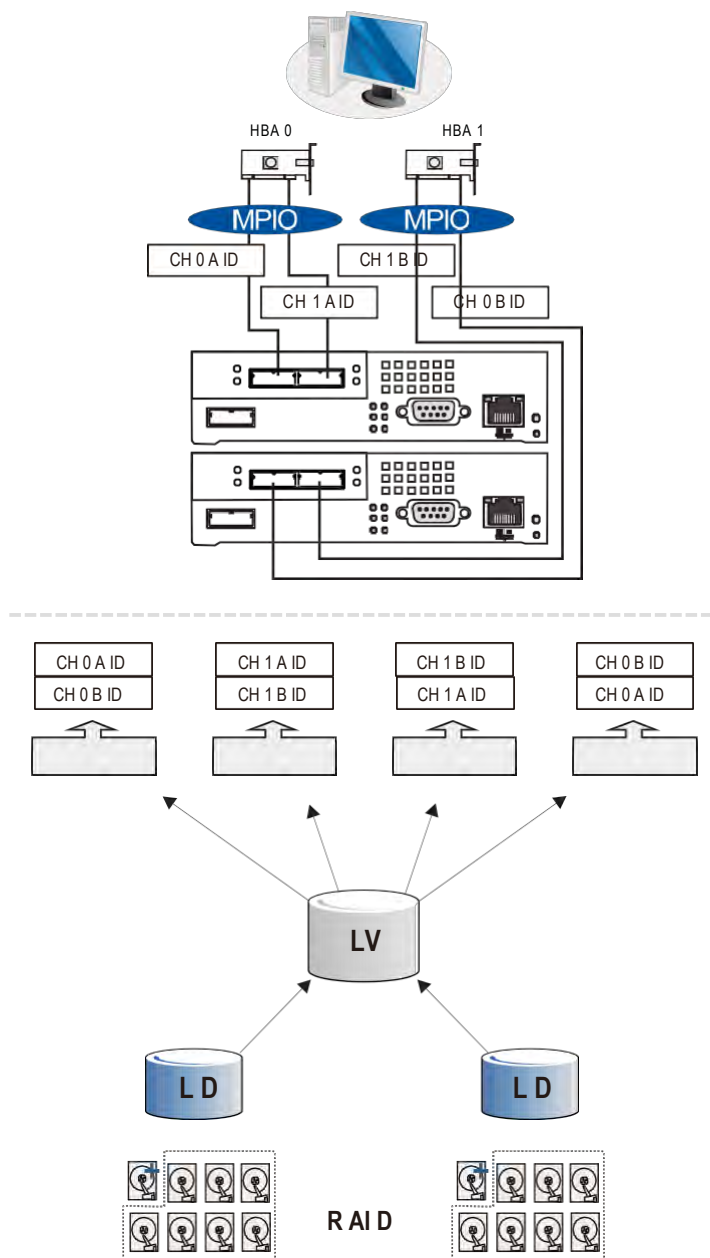
This section details about the connections between SAS and host using SAS cables. The SAS cables (8 pairs of 28 mm AWG) are characterized by the following:

- 100 Ohms
- Black color
- UL-approved, lead free, 50 cm, 120 cm, or 170 cm in length
- Connectors must be secured to the receptacle of the chassis using a latching mechanism.

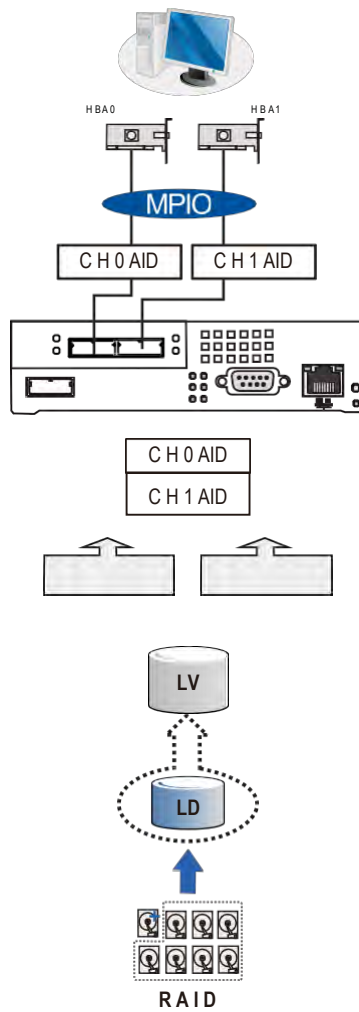
WARNING! The SAS cables are sensitive and must be handled with care. To prevent interference within the rackmount, the cable routing path must be carefully planned and the cables must not be bent.

DAS (Direct-Attached Storage) Connection with Redundant Host Path

- Dual Controller Models



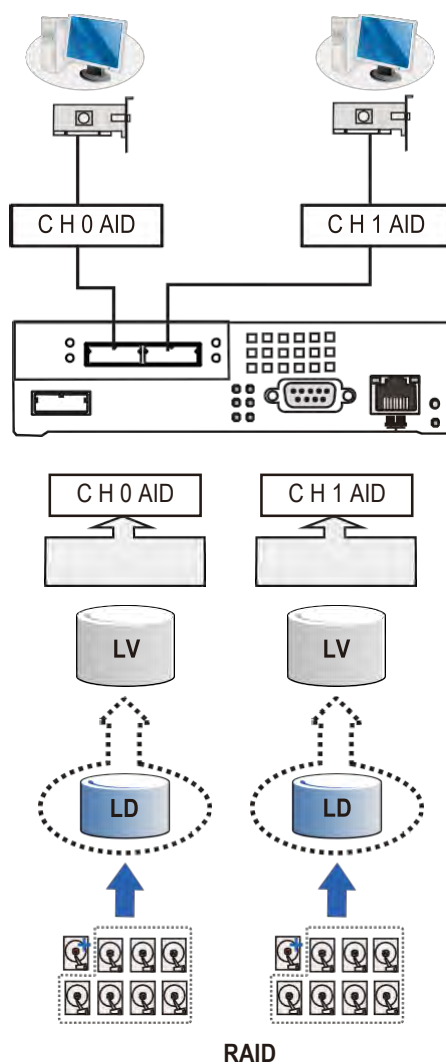
- **Single Controller Models**



NOTES:

- With more hard drives over SAS expansion links, you can create more logical groups of drives. Avail the logical partitions using more LUNs.
- If your operating system is Windows® 2003 server, you need a multipathing software such as **MPIO** or **Linux Device Mapper** to control and optimize the access to logical drives via multiple data paths.

DAS (Direct-Attached Storage) Connection to Two Servers



NOTE: If you want your LUN to be accessible by multiple hosts, use file locking or multipath access control.

2.3.4 Ethernet-Host Connections

Before performing the connections between Ethernet and host, take note of the following requirements:

- Ethernet cables are user-supplied. We recommend you to use CAT5e shielded STP type network cables or cables with better performance types (important for meeting the requirements imposed by emission standards).
- Use of straight-through Ethernet cables with RJ-45 plug.
- Use of cross-over cables. These cables are automatically detected and rerouted for a valid connection.

See below the list of connection types:

- Directly to iSCSI initiators (software or hardware) or via the Gigabit Ethernet switches.
- To servers equipped with iSCSI HBA, preferably a hardware TOE (TCP/IP Offload Engine) card, then to client stations with an Ethernet NIC or iSCSI HBA.
- The system presents its logical volumes via SCSI-like IDs and LUNs. These RAID volumes then appear as iSCSI targets via the network.

IMPORTANT! Even though the iSCSI initiator software is a cost-effective way of building an iSCSI SAN, this software initiator adds additional workload to the server CPU. We recommend you to apply iSCSI HBAs that come with TCP/IP offload engines in order to reduce overhead.

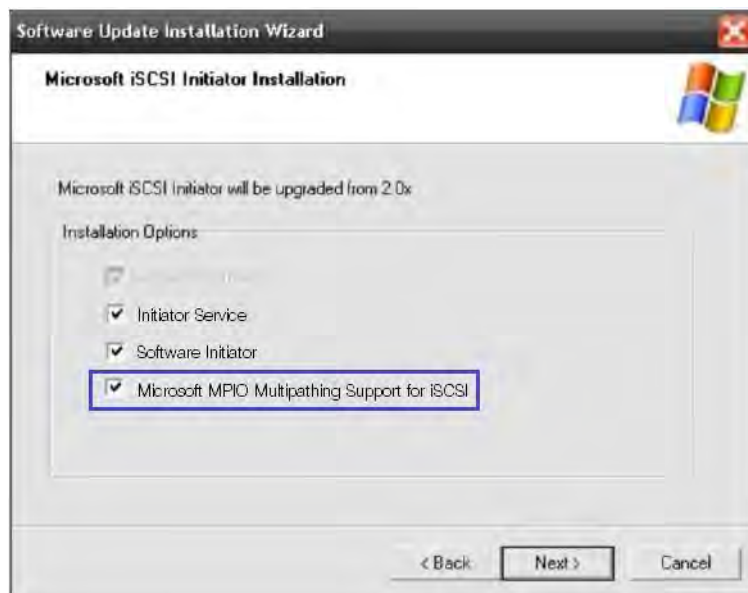
Network and Host Connection Topologies

The iSCSI host ports must be connected to Ethernet network devices and iSCSI initiators that comply with IETF iSCSI standard (RFC 3720). The network connection of the iSCSI ports is flexible. The use of network connecting devices, subnet, name servers, or iSCSI management software varies from case to case.

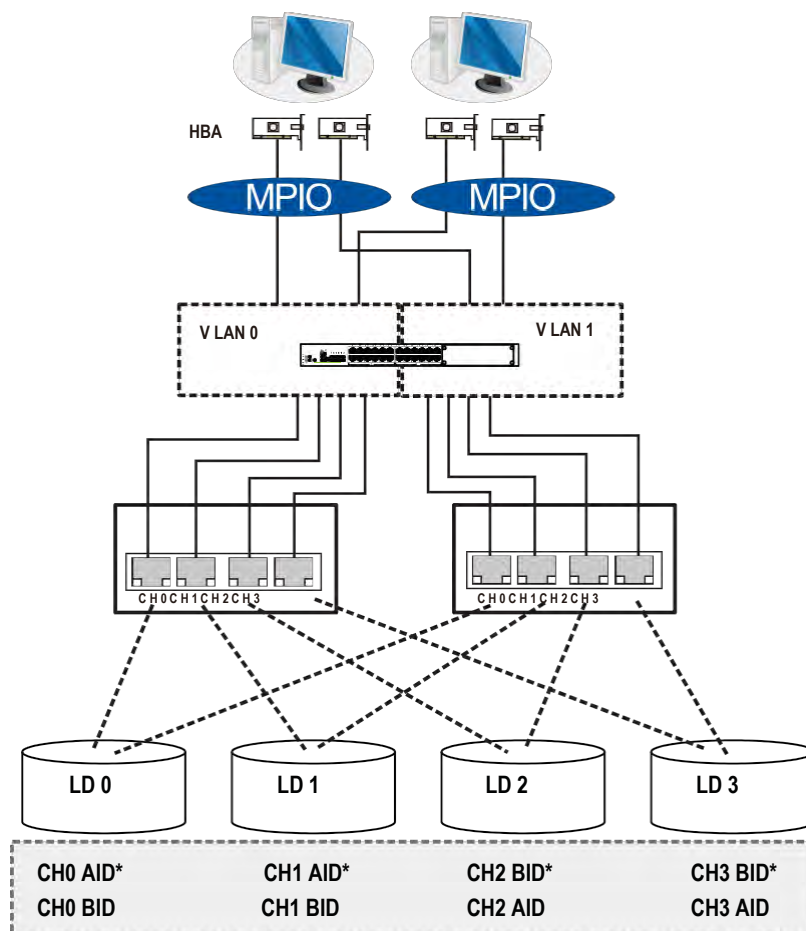
Note that the host NIC ports and the storage system's iSCSI host ports must be configured in the same subnet, and the following:

- Use the Ethernet management port for management purposes only such as GUI or telnet console. This port must not be used for I/O processes.
- Configurations such as subnet or virtual LAN can separate iSCSI host links, decrease overhead, and eliminate the impact of link failure.
- Multiple arrays or logical partitions can be created and made available separately via different IDs or LUNs on host ports. Usually, a RAID5 logical drive of 8 members sometimes brings optimal array performance.

IMPORTANT! If you are using Microsoft's software initiator, uncheck the embedded MPIO function when installing the software as the MPIO selection creates conflict with MPIO driver.



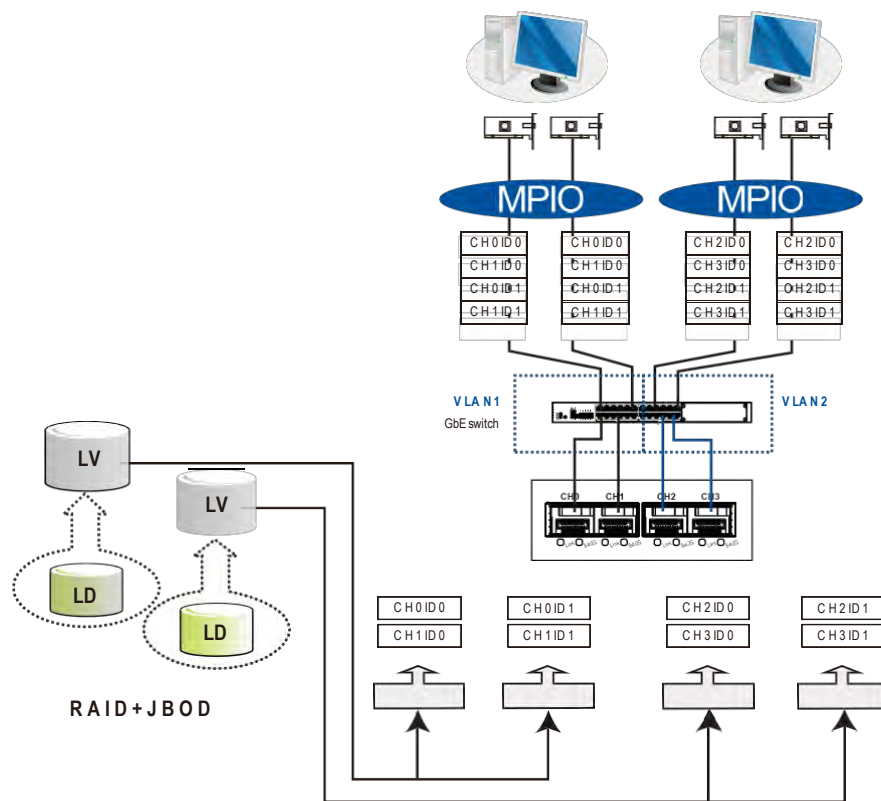
High Availability IP SAN with Redundant Controller



Component	Description
SAN Storage System	Redundant controllers with a total of 8 host ports
HBA	iSCSI initiators, preferably PCIe TOE (TCP/IP offload engine) capable cards
GbE Cables	GbE network cables
GbE Switch	Ports divided into 2 virtual LANs to separate access from host to targets
Software	MPIO to manage the fault-tolerant paths with failover/failback and load balance capabilities. Use MPIO multipathing software for the operating system to identify the alternative paths to the same logical drive.
RAID Configuration	<ul style="list-style-type: none"> • This configuration does not support remote replication functionality. To set up remote replication, refer to High Availability IP SAN (Recommended for Remote Replication) or High Availability IP SAN with Port Trunk (Remote Replication-Enabled). • Four logical drives (each logical drive has four member drives). You can include the drives from the expansion systems for better performance. • LD0 mapped to CH0 AID and CH0 BID; LD assigned to controller A • LD1 mapped to CH1 AID and CH1 BID; LD assigned to controller A • LD2 mapped to CH2 AID and CH2 BID; LD assigned to controller B • LD3 mapped to CH3 AID and CH3 BID; LD assigned to controller B
CH0 AID* CH1 AID* CH2 BID* CH3 BID*	Logical drive assignment

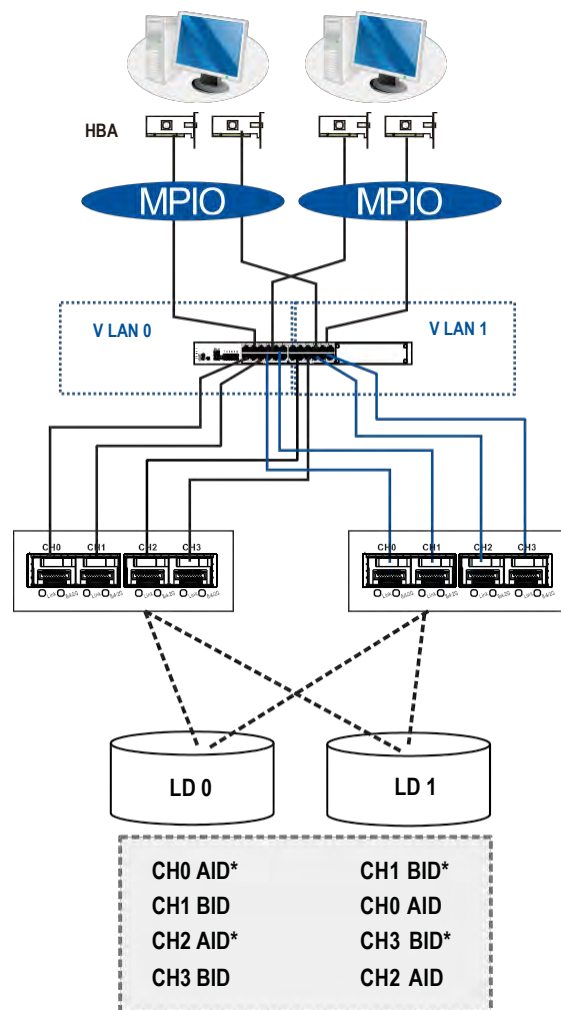
IMPORTANT! In the event of single-controller failure, a logical drive is accessed via the host IDs managed by the alternate controller. The host IDs and port IPs do not failover to the remaining controller. In this case, MPIO driver is necessary for path redundancy and controller failover.

Single Controller with Fault-Tolerant Path



Component	Description
SAN Storage System	Single controller with 4 host ports
HBA or NIC	iSCSI initiators, preferably PCIe TOE (TCP/IP offload engine) capable cards
GbE Cables	GbE network cables
Software	MPIO to manage the fault-tolerant paths with failover/failback and load balance capabilities
RAID Configuration	<ul style="list-style-type: none"> Four logical partitions (created from two logical volumes) Two logical volumes (each contains a logical drive) Two logical drives <p>NOTE: Each logical partition appears on two different host links for fault tolerance. Use MPIO software so that your operating system can identify the alternate paths to the same logical drive.</p>

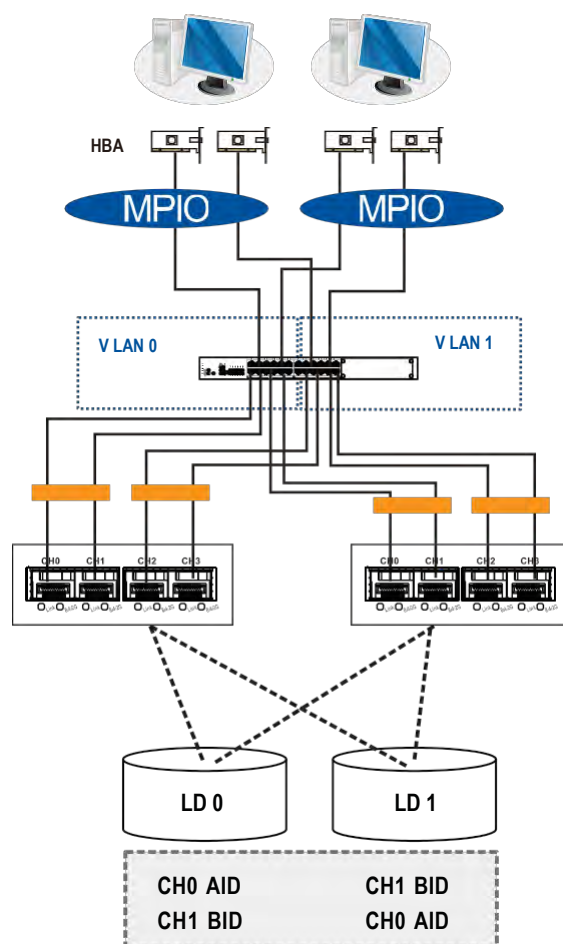
High Availability IP SAN (Recommended for Remote Replication)



Component	Description
SAN Storage System	Redundant controllers with eight host ports
HBA	iSCSI initiators, preferably PCIe TOE (TCP/IP offload engine) capable cards
GbE Cables	GbE network cables
GbE Switch	Ports divided into 2 virtual LANs. Both controllers are linked to both virtual LAN zones.
Software	MPIO to manage the fault-tolerant paths with failover/failback and load balance capabilities. Use MPIO multipathing software for the operating system to identify the alternative paths to the same logical drive.
RAID Configuration	<ul style="list-style-type: none"> Two logical drives; each has eight member drives. You can create more logical drives from the drives in the expansion systems. LD0 mapped to CH0 AID, CH1 BID, CH2 AID, and CH3 BID. LD must be assigned to controllers A and B to enable remote replication. LD1 mapped to CH1 BID, CH0 AID, CH3 BID, and CH2 AID. LD must be assigned to controllers A and B to enable remote replication.

IMPORTANT! For systems operating in Windows® 2003 server, and in the event of single-controller failure, a logical drive is accessed via the host IDs managed by the alternate controller. The host IDs and port IPs do not failover to the remaining controller. In this case, MPIO driver is necessary for path redundancy and controller failover.

High Availability IP SAN with Port Trunk (Remote Replication-Enabled)



Component	Description
SAN Storage System	Redundant controllers with eight host ports
HBA	iSCSI initiators, preferably PCIe TOE (TCP/IP offload engine) capable cards
GbE Cables	GbE network cables; port trunking marked in orange rectangles
GbE Switch	Ports divided into 2 virtual LANs. Both controllers are linked to both virtual LAN zones.
Software	MPIO to manage the fault-tolerant paths with failover/failback and load balance capabilities. Use MPIO multipathing software for the operating system to identify the alternative paths to the same logical drive.

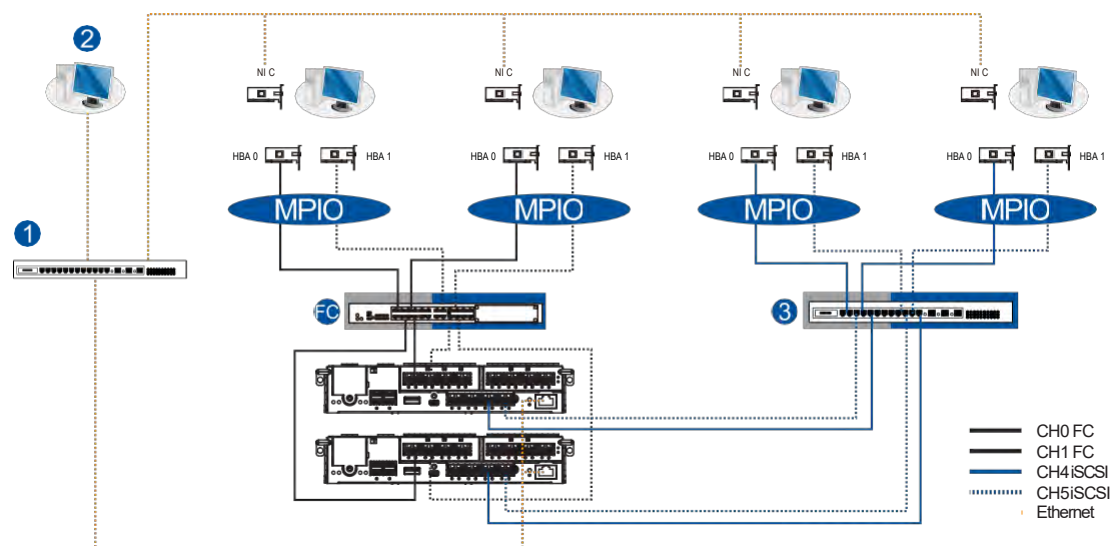
(see next page)

Component	Description
RAID Configuration	<ul style="list-style-type: none"> Two logical drives; each has eight member drives. You can create more logical drives from the drives in the expansion systems. LD0 mapped to CH0 AID and CH1 BID. LD must be assigned to controllers A and B to enable remote replication. LD1 mapped to CH1 BID and CH0 AID. LD must be assigned to controllers A and B to enable remote replication.

2.3.5 Hybrid Host Connections

For hybrid systems that feature two additional iSCSI ports, you can use these systems for remote replication or for host LUN mapping.

Single Hybrid Unit Connected to FC/iSCSI Hosts

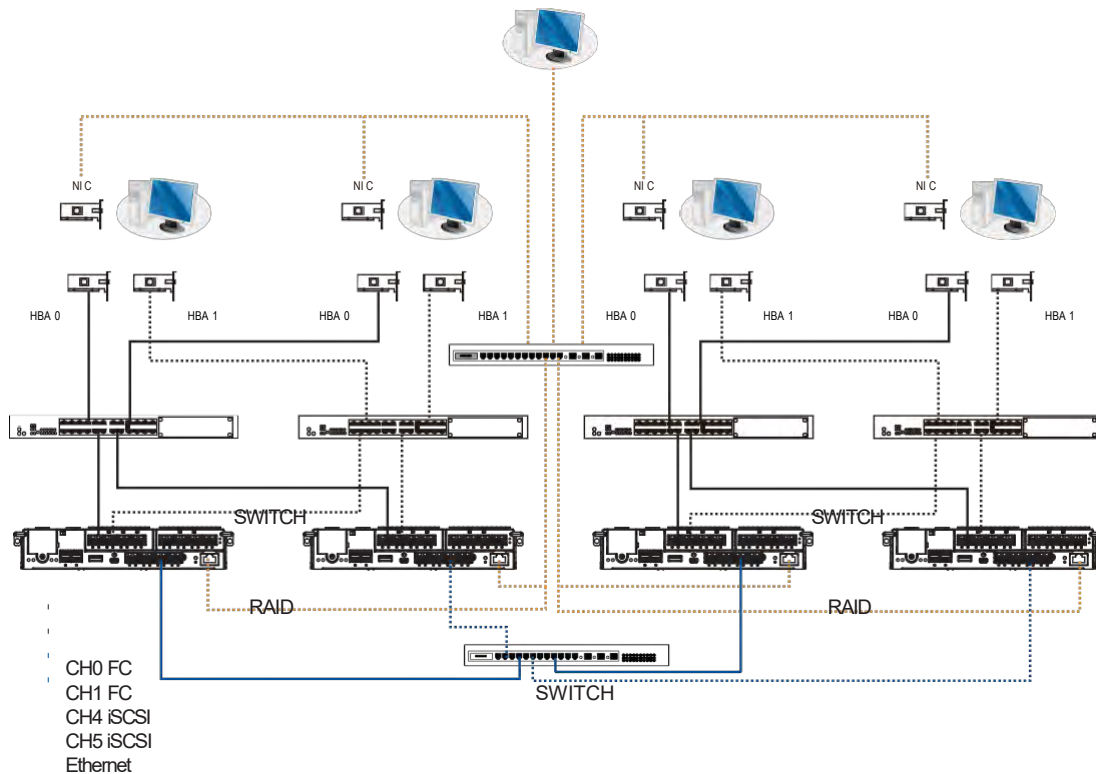


When connected to FC and iSCSI hosts, the connections are working in their respective speeds. This connection maximizes the number of connections while keeping the optimum performance gained by the high-speed FC link and FC switch.

NOTES:

- To gain optimum performance, ensure that the LAN switch **1** for the management station **2**, the LAN switch for the systems, and the iSCSI switch **3** for iSCSI host link are separated.
- If they are not separated, the host may consider that the iSCSI connection is a part of the host connection and might use it for data I/O, even if the iSCSI ports are not mapped to the host. As a result, the data transaction speed slows down to iSCSI connection's level and the fast FC connection bandwidth may be spent without use.

Utilizing Hybrid iSCSI Ports for Data Replication



The illustration above depicts the utilization of the iSCSI host ports for remote data replication.

Two hybrid systems, a source system and a target system, reside within the same virtual pool but are physically apart. You can create a volume copy/mirror pair for data protection without relying on slow management LAN cable connections. In such case, you can link the hybrid systems using iSCSI host ports. If the distances between systems are far, additional switches may be required.

2.3.6 Expansion Connections

A SAS host link cable is bundled per expansion package. If you need to purchase other cables, or if you need other cables of different lengths, contact your vendor.

Before configuring the expansions, you must take note of the following important points:

- For a cleaner and clutter-free rack system, have a carefully planned routing paths when connecting between systems.
- All SAS cables are sensitive and must be handled with care. DO NOT bend or twist the cables when connecting the systems installed to the rack.

Configuring the SAS Expansion

The SAS expansion port of the PS system connects to the expansion systems. For dual-controller systems, each expansion port connects to a controller of another expansion system, making a fault-tolerant linkage to different SAS domains.

The following principles apply to SAN storage and expansion system connections:

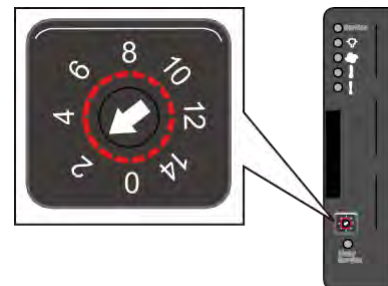
- Dual-controller SAN storage connects to a dual-controller expansion system
- Single-controller SAN storage connects to a single-controller expansion system
- A longer cable is available in making expansion links with a dual-controller configuration. If you need to connect expansion systems from two opposite directions, you may need a longer cable. Routing between two different connections can avoid loss of data links if one expansion fails to operate.

Setting the Expansion IDs

Each expansion system must have a unique ID and you can configure the ID via the rotary ID switch. To set the expansion IDs, use a small flat blade screwdriver.

You must take note of the following when setting the IDs on the expansion system:

- Set the IDs from 1 to 15. The order starts from the expansion enclosure that is closest to the managing PS enclosure.
- Ensure to set a unique ID on each expansion enclosure so that the SAS WWN addresses of the disk drives are properly assigned. The SAN storage system firmware automatically manages these addresses.



Configuration Rules

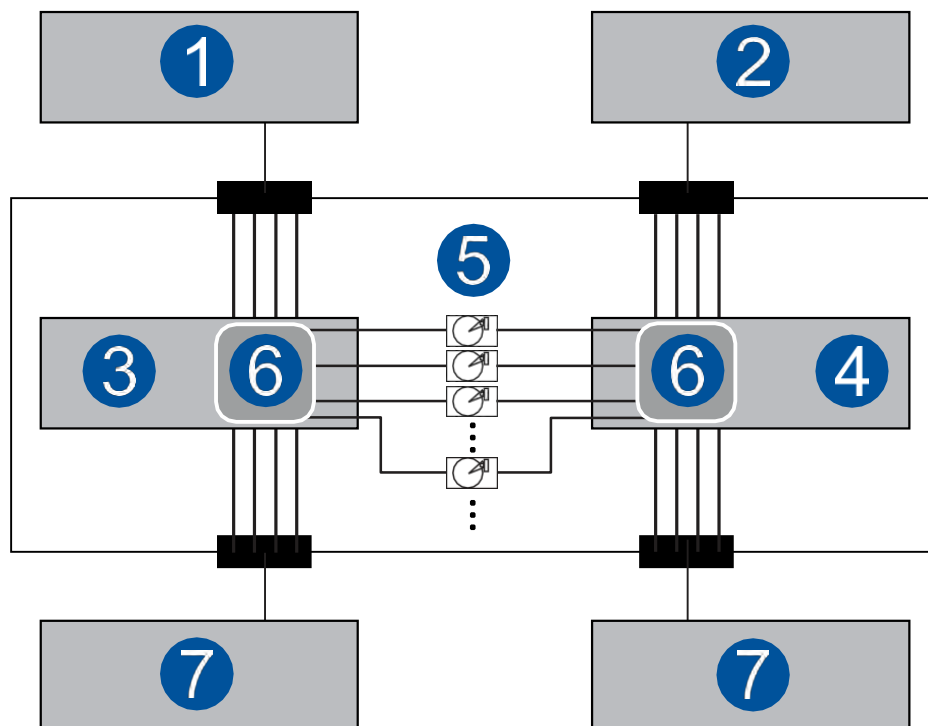
To connect the SAS interfaces across storage and expansion systems, you must take note of the following:

- **Fault-Tolerant Links in a Dual Controller Combination**

Corresponding to the dual-port interfaces of the SAS drives, two physical links are available per disk drive, routed across the backplane board, then to a SAS expander, and interfaced via a 4x wide external SAS port.

- **With Data Paths via Separate SAS Domains**

Access to disk drives can be continued in the event of a failure from a cable link or SAS expansion controller.

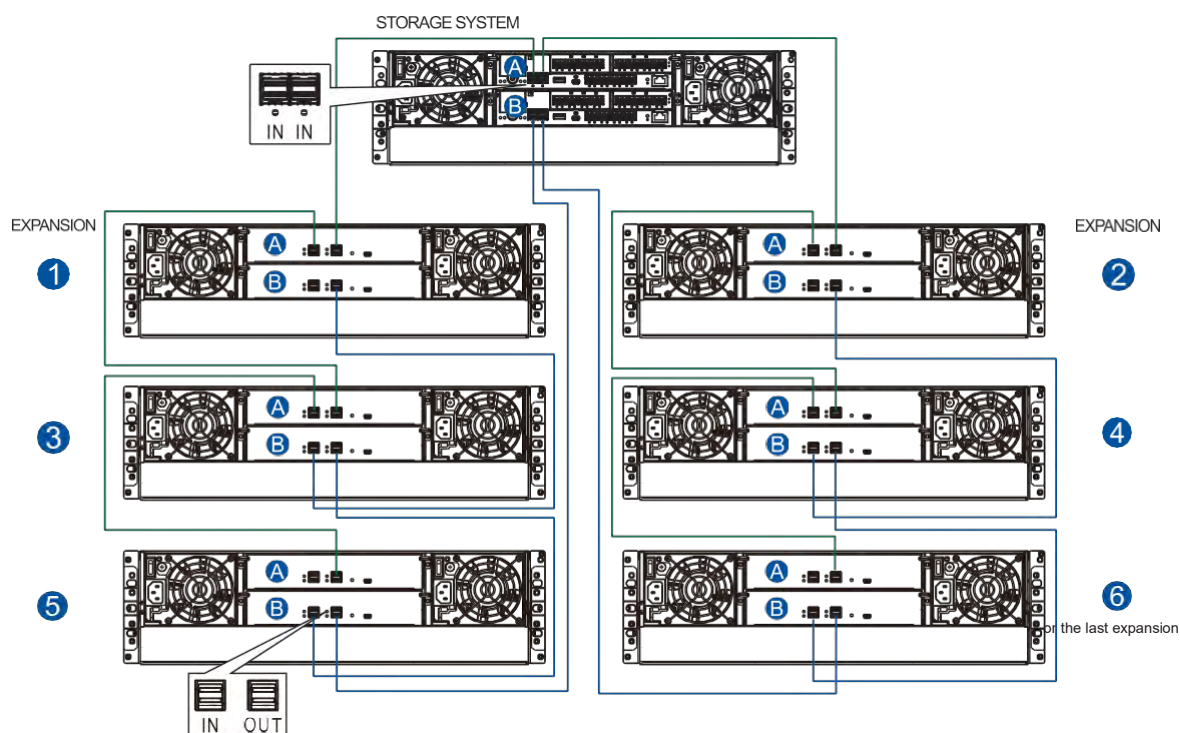


Number	Description
①	RAID controller A
②	RAID controller B
③	Expansion system controller A
④	Expansion system controller B
⑤	Dual-port SAS drives
⑥	Expander
⑦	To another expansion system

- **Fault-Tolerant Links to SAS Disk Drives**
 - The SAS expansion cables are bundled with the expansion systems. Take note that if there are many expansion systems connected, a longer SAS external cable, approximately measured 120 cm, may be needed to connect an expansion system from the opposite direction for a higher redundancy.
 - One expansion link connects the expansion system from a storage system with HBA/RAID card to the nearest expansion system, then to the most distant expansion system. Another expansion link connects to the most distant expansion system, from the opposite direction to the first expansion system from the storage system.
 - Each expander controller on the SAS expansion system controls a *SAS Domain* that connects to one of the alternative interfaces of the disk drives in the enclosure. For example, one expander unit controls Domain A while the other expander controls Domain B. In a fault-tolerant topology, the SAS external links always connect to the SAS ports of the same SAS domain.
 - Identify the SAS domains by the location of the expanders: the left controller is controller A, the right is controller B.
 - On a storage system, each controller is considered as managing a separate SAS domain. With the help of the port selector mechanism on the MUX boards, the idea of SAS domain applies even when SATA drives are used in a dual-controller expansion system.

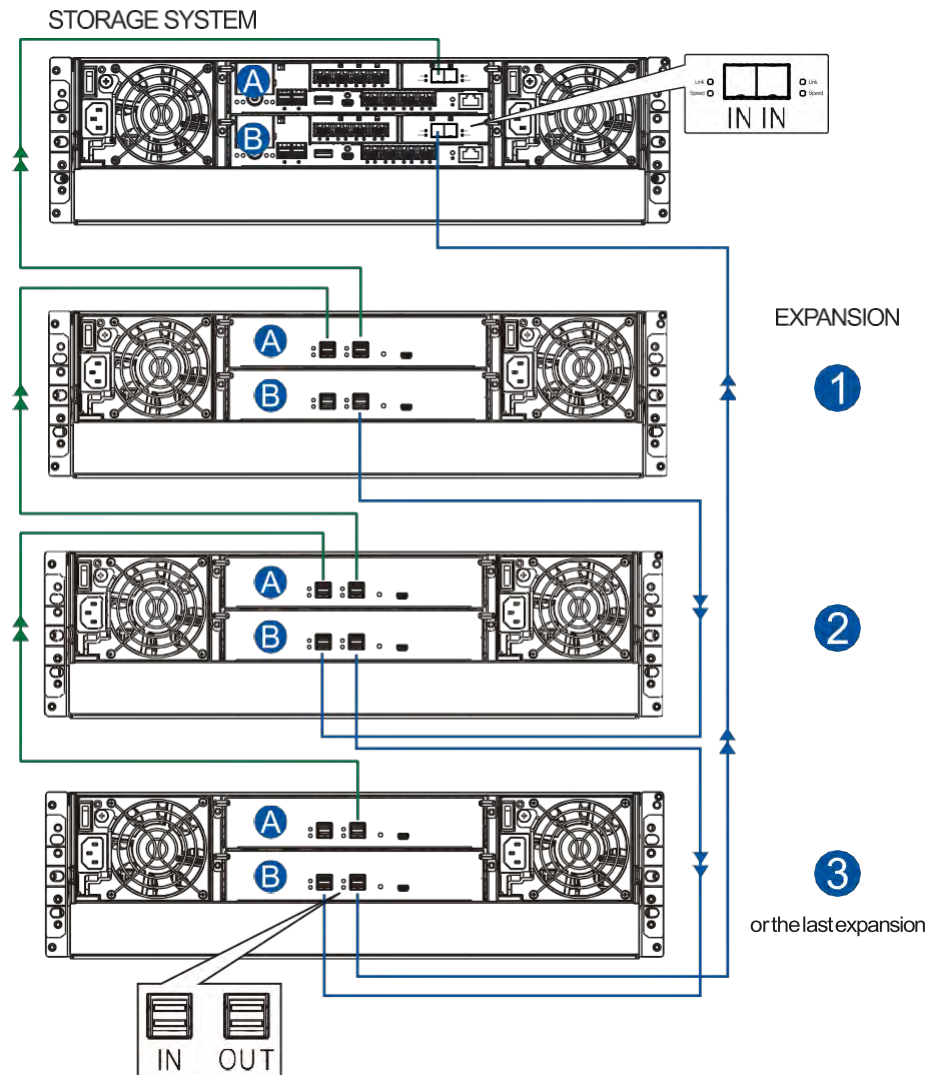
Connecting Expansion Systems

- Connecting Dual Controller Expansions Using the Onboard SAS Expansion Ports



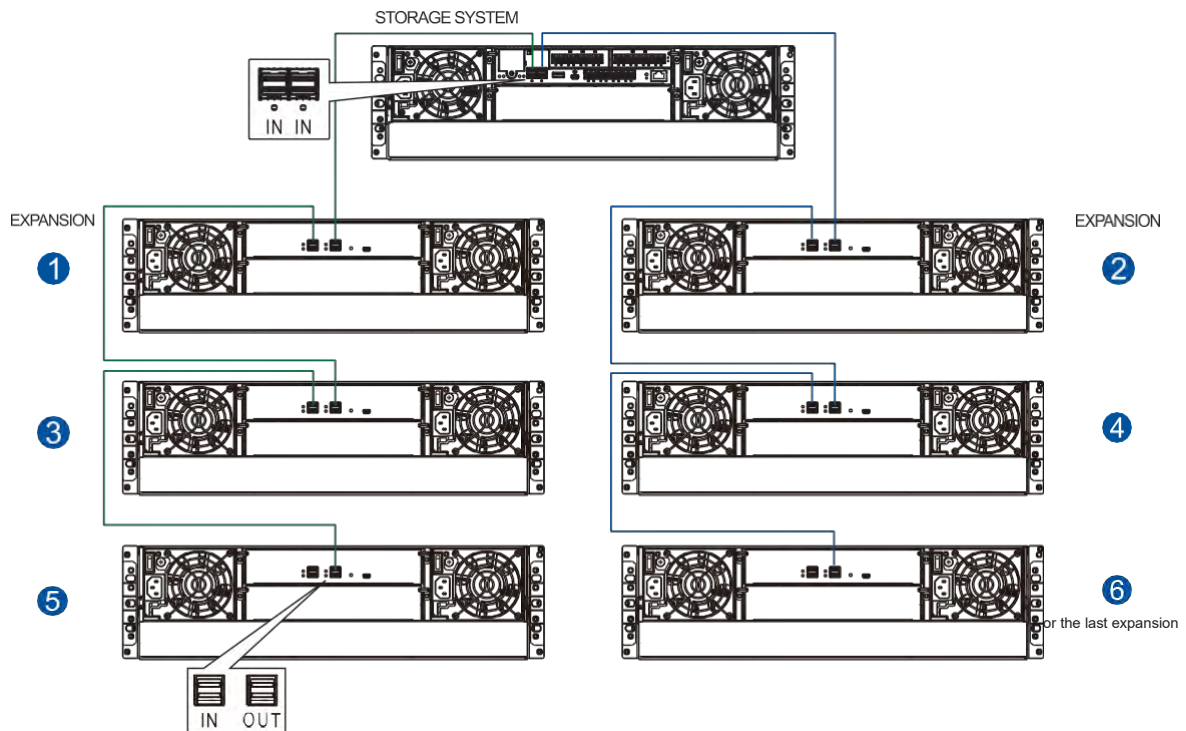
- Storage controller **A**: left SAS port **IN** → Expansion **1**, controller **A**: SAS port **OUT**
- Expansion **1**, controller **A**: SAS port **IN** → Expansion **3**, controller **A**: SAS port **OUT**
- Expansion **3**, controller **A**: SAS port **IN** → Expansion **5**, controller **A**: SAS port **OUT**
- Storage controller **A**: right SAS port **IN** → Expansion **2**, controller **A**: SAS port **OUT**
- Expansion **2**, controller **A**: SAS port **IN** → Expansion **4**, controller **A**: SAS port **OUT**
- Expansion **4**, controller **A**: SAS port **IN** → Expansion **6** or last, controller **A**: SAS port **OUT**
- Storage controller **B**: left SAS port **IN** → Expansion **5**, controller **B**: SAS port **OUT**
- Expansion **5**, controller **B**: SAS port **IN** → Expansion **3**, controller **B**: SAS port **OUT**
- Expansion **3**, controller **B**: SAS port **IN** → Expansion **1**, controller **B**: SAS port **OUT**
- Storage controller **B**: right SAS port **IN** → Expansion **6** or last, controller **B**: SAS port **OUT**
- Expansion **6** or last, controller **B**: SAS port **IN** → Expansion **4**, controller **B**: SAS port **OUT**
- Expansion **4**, controller **B**: SAS port **IN** → Expansion **2**, controller **B**: SAS port **OUT**

- Connecting Dual Controller Expansions Using the Host Board's SAS Expansion Ports



- Storage controller **A**: host board SAS port **IN** → Expansion **1**, controller **A**: SAS port **OUT**
- Expansion **1**, controller **A**: SAS port **IN** → Expansion **2**, controller **A**: SAS port **OUT**
- Expansion **2**, controller **A**: SAS port **IN** → Expansion **3** or last, controller **A**: SAS port **OUT**
- Storage controller **B**: host board SAS port **IN** → Expansion **3** or last, controller **B**: SAS port **OUT**
- Expansion **3** or last, controller **B**: SAS port **IN** → Expansion **2**, controller **B**: SAS port **OUT**
- Expansion **2**, controller **B**: SAS port **IN** → Expansion **1**, controller **B**: SAS port **OUT**

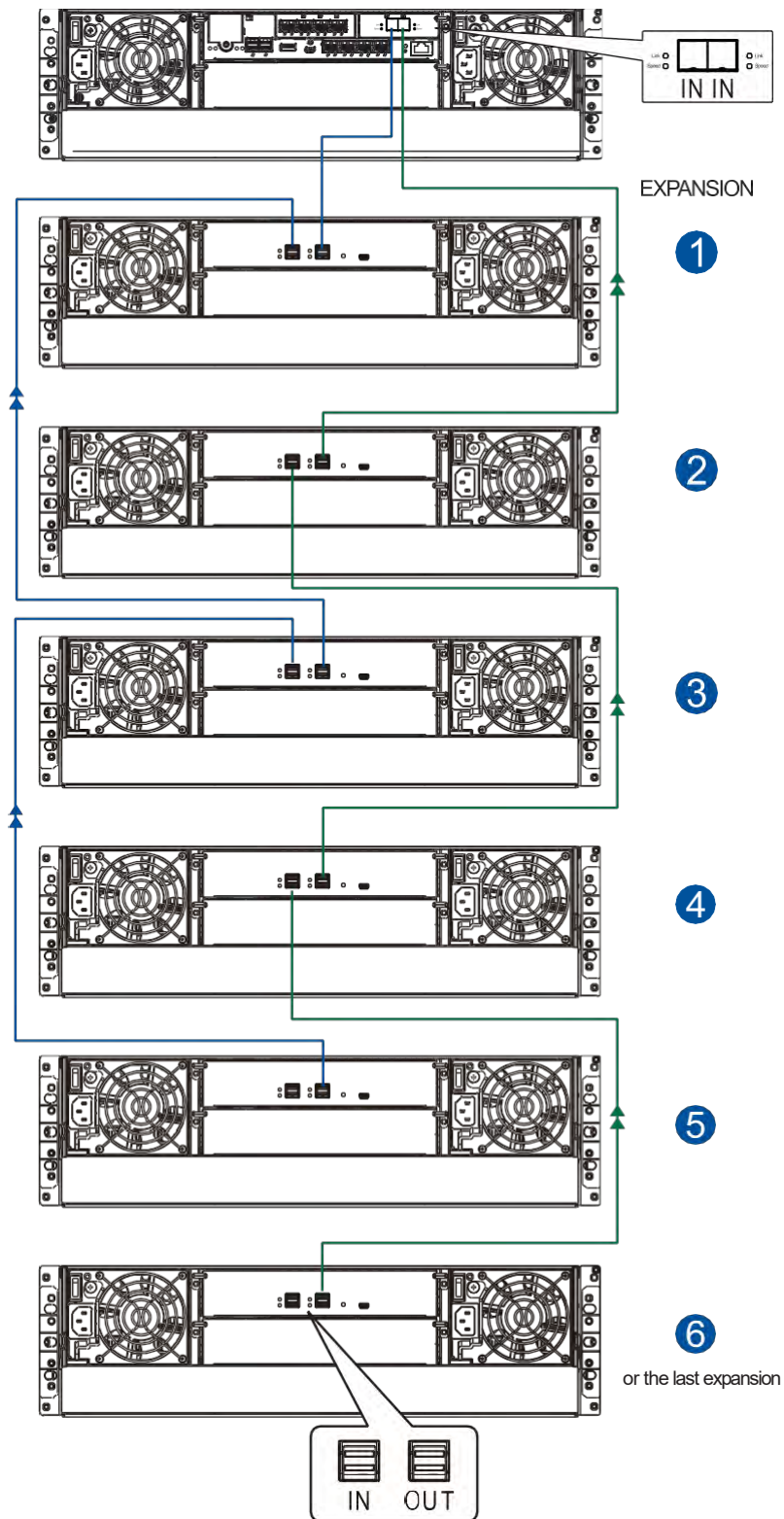
- **Connecting Single Controller Expansions Using the Onboard SAS Expansion Ports**



- Storage controller: left SAS port **IN** → Expansion **1**: SAS port **OUT**
- Expansion **1**: SAS port **IN** → Expansion **3**: SAS port **OUT**
- Expansion **3**: SAS port **IN** → Expansion **5**: SAS port **OUT**
- Storage controller: right SAS port **IN** → Expansion **2**: SAS port **OUT**
- Expansion **2**: SAS port **IN** → Expansion **4**: SAS port **OUT**
- Expansion **4**: SAS port **IN** → Expansion **6** or last: SAS port **OUT**

- Connecting Single Controller Expansions Using the Host Board's SAS Expansion Ports

STORAGE SYSTEM



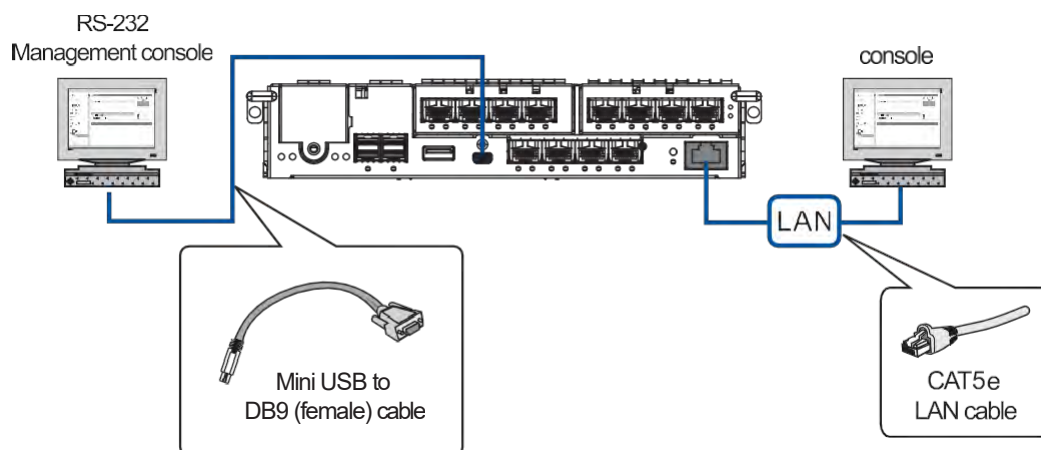
- Storage controller: host board SAS port **IN** → Expansion **1**: SAS port **OUT**
- Expansion **1**: SAS port **IN** → Expansion **3**: SAS port **OUT**
- Expansion **3**: SAS port **IN** → Expansion **5**: SAS port **OUT**
- Storage controller: host board SAS port **IN** → Expansion **2**: SAS port **OUT**
- Expansion **2**: SAS port **IN** → Expansion **4**: SAS port **OUT**
- Expansion **4**: SAS port **IN** → Expansion **6** or last: SAS port **OUT**

2.3.7 Management Console Connections

To connect your SAN storage to external consoles, you need the following:

- DB9 female to mini USB cable (bundled with the package)
- CAT5e LAN cable (user supplied)

Connecting SAN Storage to External Consoles



See below table for the list of default values of the serial port.

Baud Rate	115200
Data Bit	8
Parity	None
Stop Bit	1
Flow Control	Hardware

IMPORTANT! Always connect to the primary controller.

NOTES:

- A null modem may be required if you are using a 3rd party cable.
 - For TCP/IP connection and firewall configuration, refer to GUI, your management software's online help, or user manual. If your network is not running the DHCP server protocols, you can use the default IP **10.10.1.1** if you are accessing for the first time.
-

2.3.8 Power Connection

Before connecting to a power source, ensure that all components are properly installed and the management interfaces are properly connected.

Take a look at the list below and check the following:

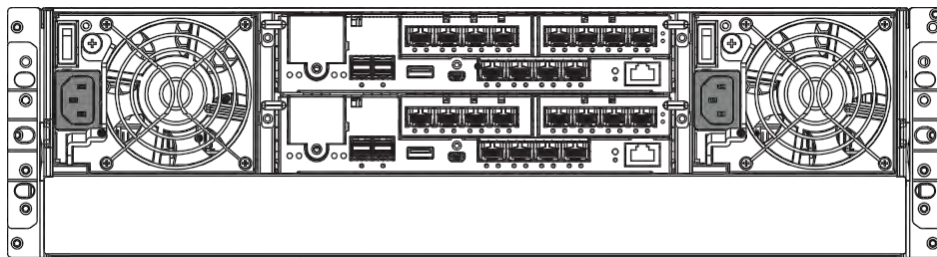
- The hard drives are correctly installed to the drive trays.
- All drive trays are installed to the system, whether or not they contain a hard drive.
- The system is connected to host computers, management computers, or external networking devices with the correct cables.

IMPORTANT! Ensure to use the power cables with at least 1.2 meters in length. **DONOT** use extension cables as the power cables are designed to connect **ONLY and DIRECTLY** to relocatable power taps (RPTs) on server cabinets.

- Ensure that the ambient temperature is not more than 35°C (with CBM).

Connecting to Power Source

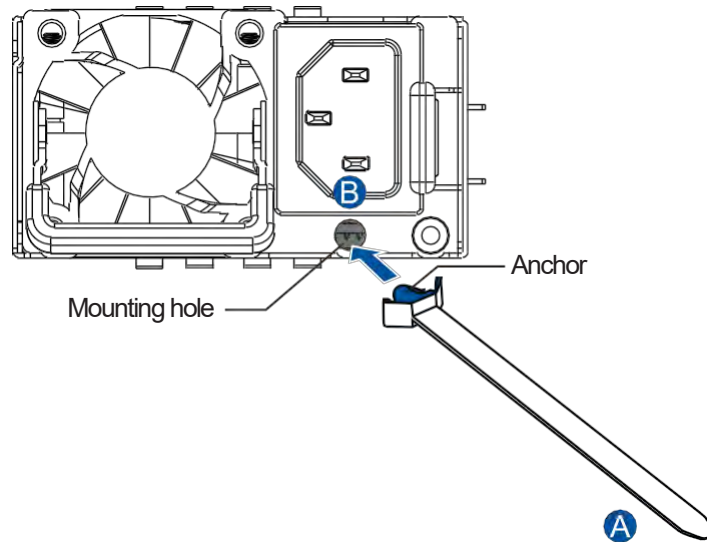
Use the bundled power cables and connect them to the power sockets for both PSUs.



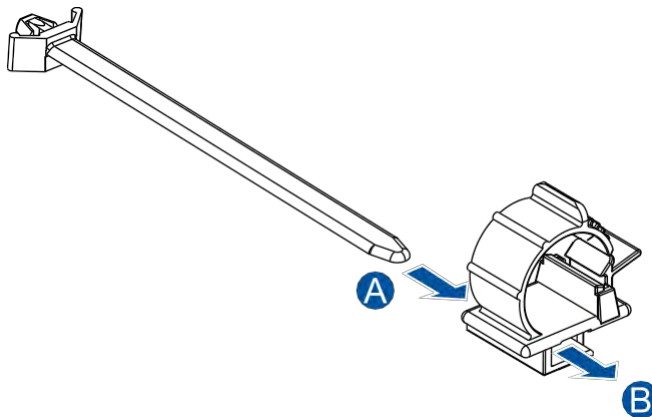
For PS 3060L/4060L Gen2 system, you need to secure the power cord to the system with a bundled cable tie before you can connect the power cord to the system.

To assemble the cable tie:

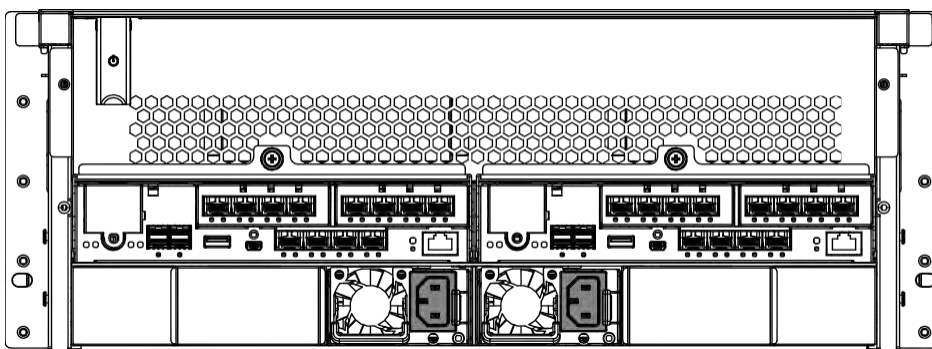
1. Insert the cable tie's anchor (A) into the mounting hole on the PSU (B).



2. Insert the cable tie (A) into the lower slot of the cable clamp (B).

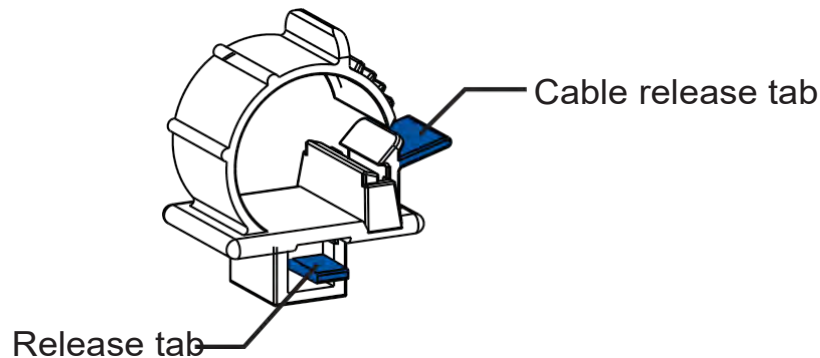


3. Connect the power cords to the PSU's power sockets.



IMPORTANT! DO NOT plug the system to the power outlet yet.

4. Use the cable release tab to open the cable clamp, insert the power cord, then press the cable clamp to close it until you hear a snap.



NOTE: To adjust the cable's position and tightness, use the cable clamp's release tab.

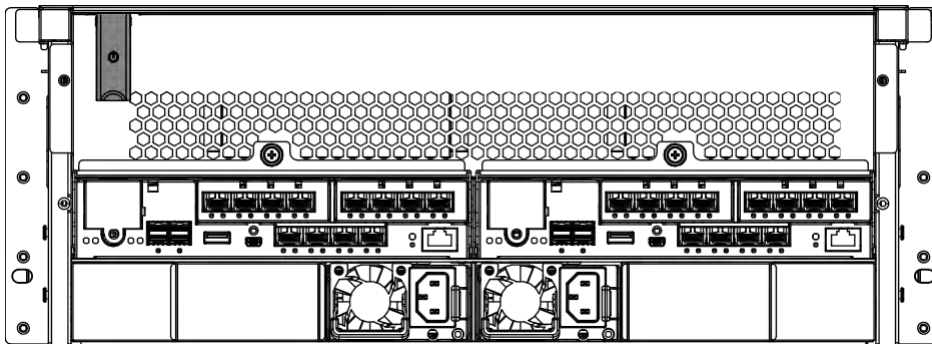
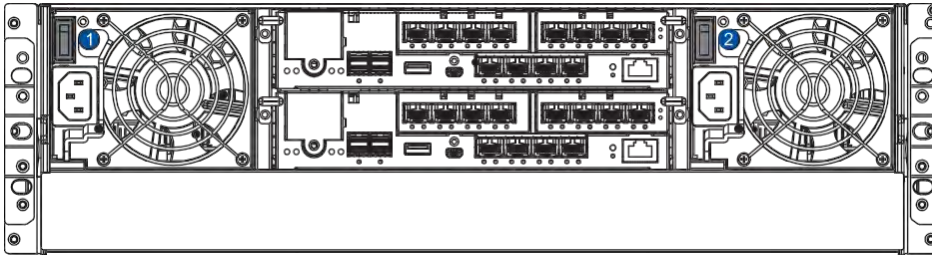
5. Connect the power cord(s) to the power outlet.

Turning On the System

Before turning on the PS system, you must turn on the expansion enclosures first if your network configuration consists of multiple arrays.

To turn on the system:

1. Turn on the networking devices.
2. Turn on the JBOD/expansion systems.
3. Press the power switches located at the PSUs, from left to right order.

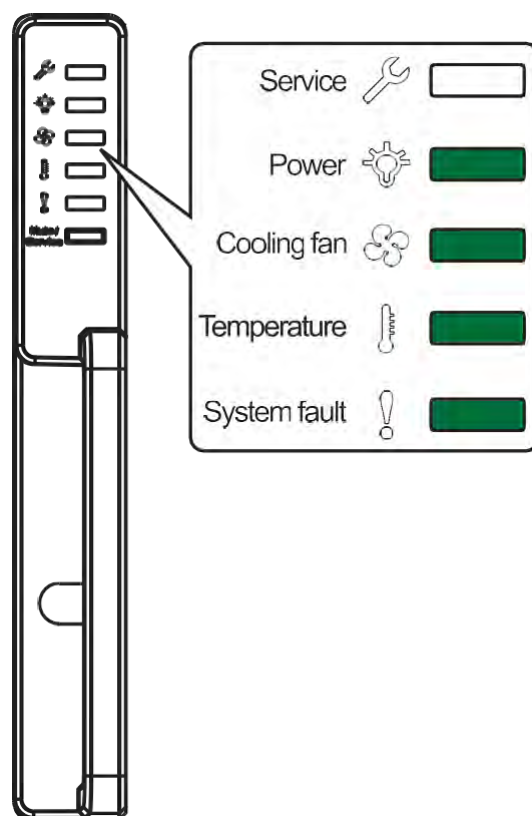


4. Turn on the application servers.

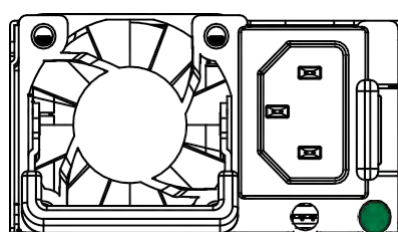
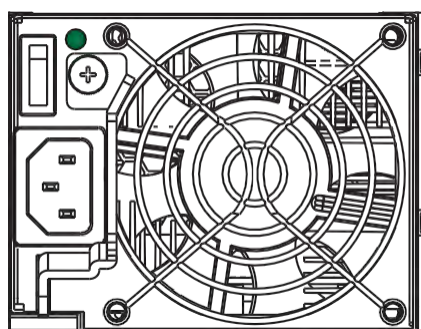
Checking the Power Status

Once the system is on, no LEDs should light up in red or amber, nor should you hear an alarm from the system. Start verifying the system status via the following interfaces:

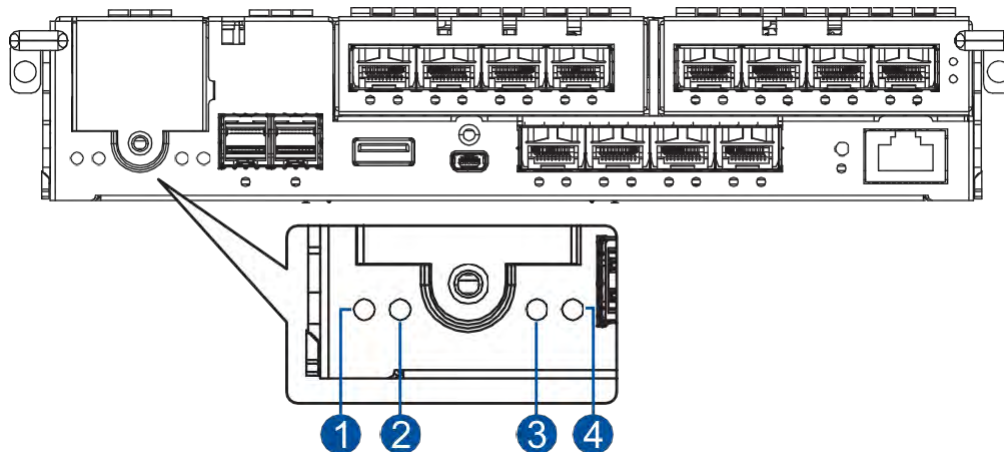
- **Front Panel LEDs**



- **PSU Status LED**



- **Controller Module LEDs**



Number	LED Name	Status
①	Control Status	ON
②	CBM Status	ON
③	Cache Dirty	OFF
④	Host Busy	OFF

NOTE: Refer to chapter **System Monitoring** for more information regarding the LED description.

2.3.9 Turning Off the System

Before turning off the system, ensure that no processes are taking place such as **Regenerate Logical Drive Parity** or **Media Scan**.

To turn off the system:

1. Close all applications to stop the I/O access to the system.
2. Flush the cache to clear the DRAM data. If the DRAM contains cached data, the Cache Dirty LED lights up in amber.
3. Flush all cached data using the controller's shutdown function to prepare the RAID system for a safe power shutdown. Refer to GUI manual for details.
4. Once the cache is flushed, switch off the system.

System Monitoring

3

This chapter details the monitoring features and the status of PAC Storage PS 3000/4000 Gen2 Series systems.

3.1 Monitoring Features

A PAC Storage PS 3000/4000 Gen2 system is equipped with self-monitoring features that help you keep track of the system's operating status.

You can monitor your system's status with the following features:

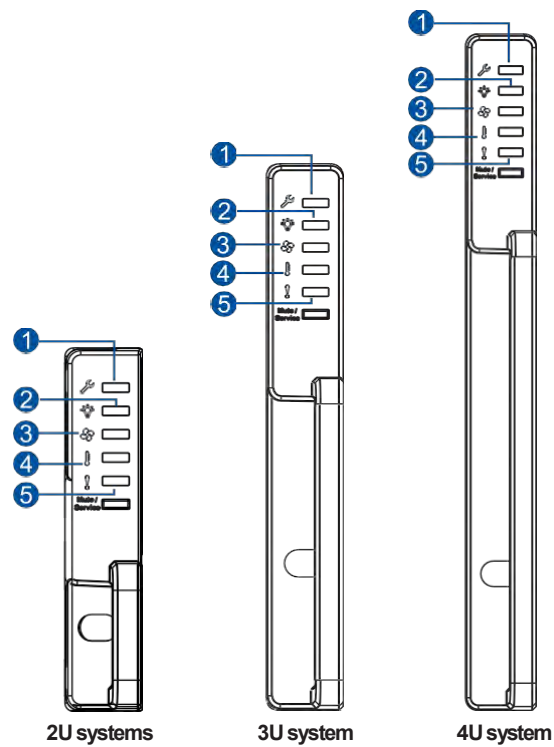
- **Firmware**
The firmware manages the controllers of the system, which is accessible in a terminal program via the serial port.
- **GUI**
GUI is a browser-based GUI (graphical user interface) software that you can install into a local or remote computer and access via the network. You can refer to GUI manual in your bundled CD for more information.
- **LEDs**
The LEDs are indicators that notify you of the system status, events, and errors or failed operations. The LEDs are located on both front and rear panels of the chassis.
- **Audible Alarms**
The audible alarms are triggered in case of system failures.

3.1.1 LEDs






This section details the system LEDs and their descriptions.




Front Panel

- Front Panel LEDs

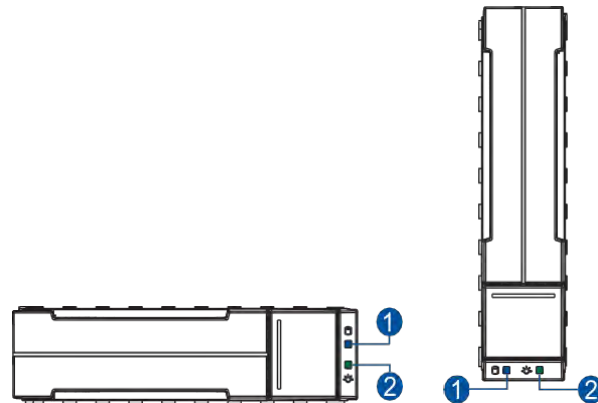


Number	LED Name	Number	LED Name
①	Service	④	Temperature
②	Power	⑤	System Fault
③	Cooling Module		





Color/Status	Description	Action
	The system is operating normally.	No action required.
	<ul style="list-style-type: none"> The controller cannot be detected. Wrong BIOS self-test. Memory is not installed. 	<ol style="list-style-type: none"> Shut down the system and remove the controller. Check if the DIMMs are properly installed. Install the controller back and power up the system. If unresolved, contact technical support.
	The system memory is not enough.	<ol style="list-style-type: none"> Shut down the system and remove the controller. Check if the memory is 64GB or above per node and properly installed. Install the controller back and power up the system. If unresolved, contact technical support.
	The system boot failure.	Contact technical support.
	The PSU is faulty	<ol style="list-style-type: none"> Check the PSU LEDs on the rear panel and find the faulty PSU. Remove and reinstall the PSU properly. If unresolved, replace the PSU. If still unresolved, contact technical support.

Color/Status	Description	Action
	<p>The cooling fan built with the PSU or the cooling fan inside the enclosure is faulty.</p>	<p>Contact technical support.</p>
	<p>The system temperature is too high.</p>	<ol style="list-style-type: none"> 1. Check if the rear openings are covered. 2. Check if the ambient temperature is too high. 3. If unresolved, contact technical support.
	<p>The cooling fan is faulty and the system temperature is too high.</p>	<p>Contact technical support.</p>

- **Drive Tray LEDs**

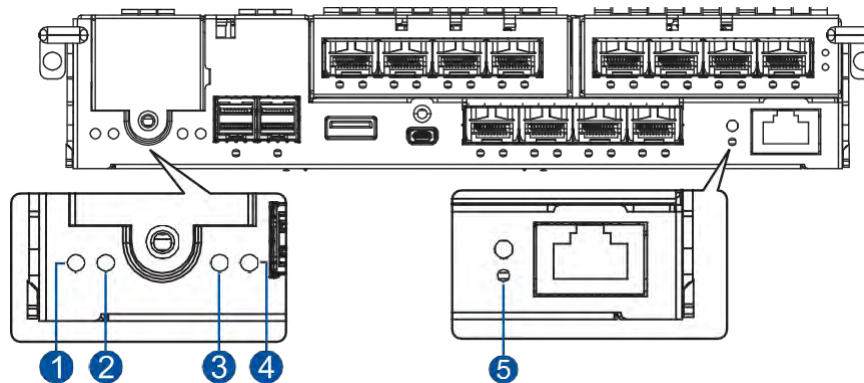


There are two LEDs on the tray that indicate the status of your drives. When you get notified by a drive failure message, you must check the drive tray LEDs to find the correct location of the failed drive.

Number	LED Name	Color	Description
1	Drive Busy		Data is being written or read from the drive. The drive is busy.
			Data is being written or read from the drive. The drive is extremely busy.
		OFF	The hard drive is plugged in but there is no activity going on.
2	Power Status		The drive bay is occupied and working normally.
			Disk drive failed or connection problem occurred.

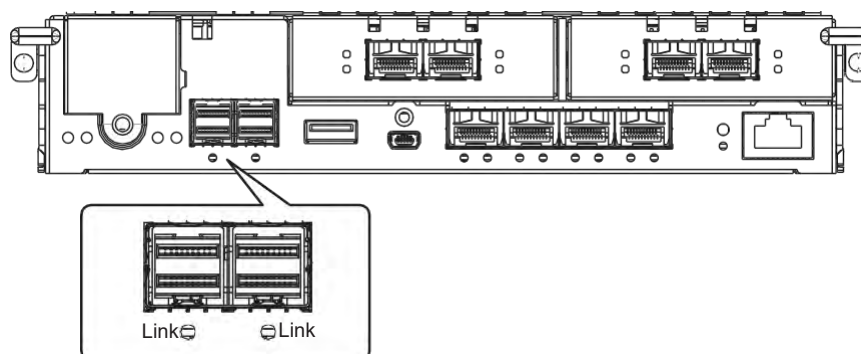
Rear Panel

• Controller Status LEDs



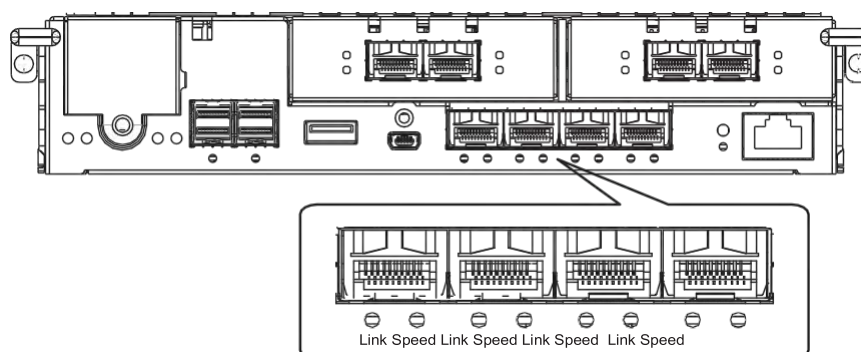
Number	LED Name	Color/Status	Description
1	Control Status		A controller is operating normally.
			<ul style="list-style-type: none"> A component has failed or inappropriate RAID configurations cause system faults. The controller is initializing.
2	CBM Status		<ul style="list-style-type: none"> Super capacitor and FBM (flash backup module) are installed in the system. The CBM is ready for operation.
			<ul style="list-style-type: none"> The CBM failed in operating, either the super capacitor or FBM. Either the super capacitor and FBM is missing.
			The super capacitor is charging.
3	Cache Dirty		<ul style="list-style-type: none"> Cache memory is dirty. Data in FBM is flushed to the cache. Errors occurred with cache memory (ECC errors). Data is flushed from FBM to drive when the power is restored. The super capacitor temperature reading is abnormal (out of 0 to 35°C range). The super capacitor is not present.
			The cached data is being transferred to the FBM after a power outage. Once the transfer is done, all LEDs will turn off. This signal is local to each controller.
		OFF	The cache is clean and the super capacitor can sustain the memory in case of power loss.
4	Host Busy		Traffic is going on the host bus.
		OFF	No traffic is going on the host bus.
5	Restore Default		Successfully reset the controller after pressing and holding the restore default button.

- **12Gb/s SAS Expansion Port LEDs**



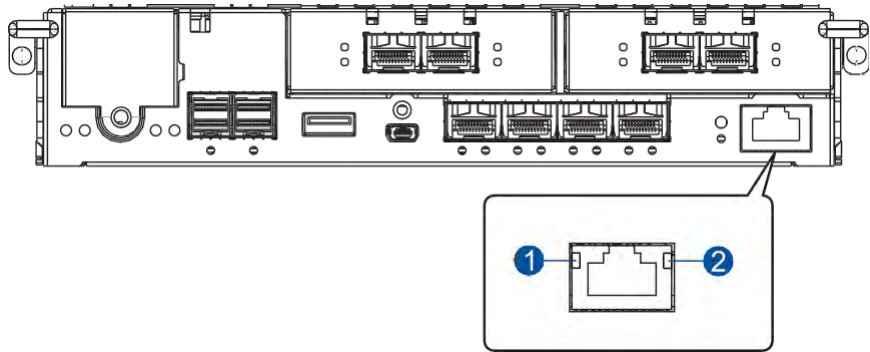
LED Name	Color/Status	Description
Link/Active		All 4 PHY links are validly linked.
		Less than 4 PHY links are connected (at least one of the PHYs has failed).
	OFF	All 4 PHY links are offline.

- **10GbE Port (SFP+) LEDs**



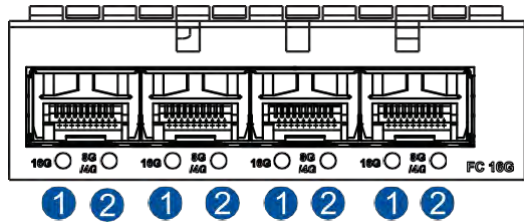
LED Name	Color/Status	Description
Link/Active		A connection is established.
		Data I/O is ongoing.
	OFF	No connection is established.
Speed		10Gb connection is established.
	OFF	1Gb connection is established.

- 1GbE Management Port (RJ-45) LEDs



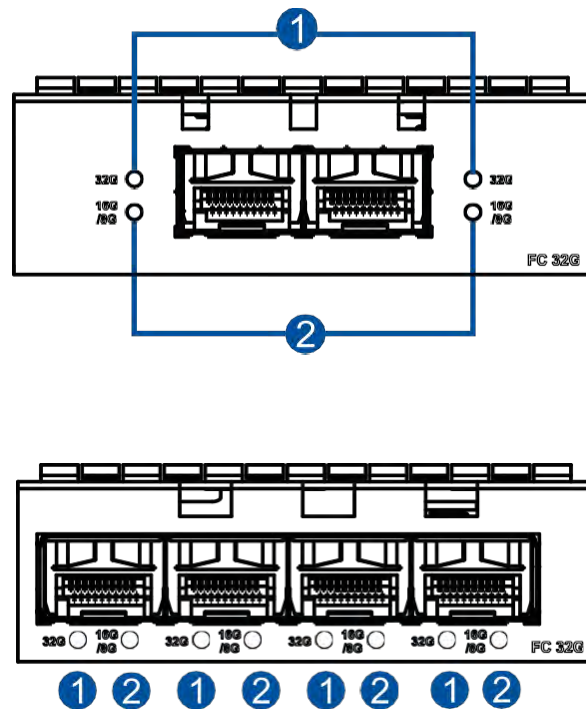
Number	LED Name	Color/Status	Description
1	Speed	●	1Gb connection is established.
		OFF	10/100Mb connection is established.
2	Link/Active	●	A connection is established.
		⚡	Data I/O is ongoing.
		OFF	No connection is established.

- Host Board 16Gb/s Fiber Channel Port LEDs



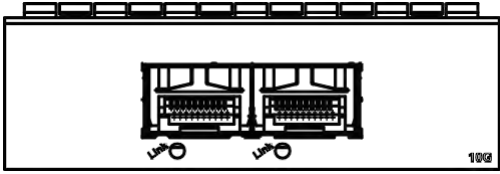
Number	LED Name	Color/Status	Description
1	16Gb/s Speed	●	A connection is established.
		⚡ (fast)	Data I/O is ongoing.
		⚡ (slow)	No link/connection is established.
2	8Gb/s Speed	●	A connection is established.
		⚡ (fast)	Data I/O is ongoing.
		⚡ (slow)	No link/connection is established.
	4Gb/s Speed	●	A connection is established.
		⚡ (fast)	Data I/O is ongoing.
		⚡ (slow)	No link/connection is established.

- Host Board 32Gb/s Fiber Channel Port LEDs



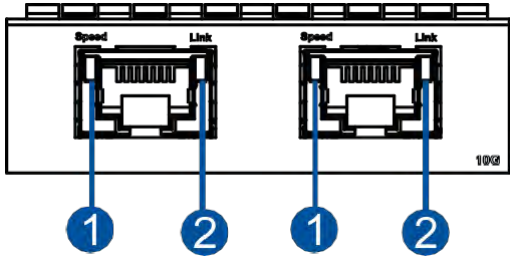
Number	LED Name	Color/ Status	Description
1	32Gb/s Speed		A connection is established.
		(fast)	Data I/O is ongoing.
		(slow)	No link/connection is established.
2	16Gb/s Speed		A connection is established.
			Data I/O is ongoing.
		OFF	No link/connection is established.
	8Gb/s Speed		A connection is established.
			Data I/O is ongoing.
		OFF	No link/connection is established.

- **Host Board 10GbE Port (SFP+) LEDs**



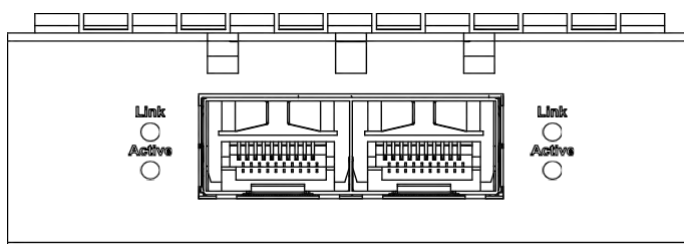
LED Name	Color/Status	Description
Link/Active		A connection is established.
		Data I/O is ongoing.
	OFF	No connection is established.



- **Host Board 10GbE Port (RJ-45) LED**



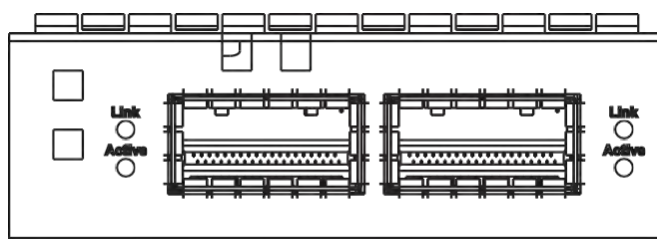
Number	LED Name	Color/Status	Description
①	Speed		10Gb connection is established.
			1Gb connection is established.
		OFF	10/100Mb connection is established.
②	Link/Active		A connection is established.
			Data I/O is ongoing.
		OFF	No connection is established.



- **Host Board 25GbE Port (SFP28) LEDs**



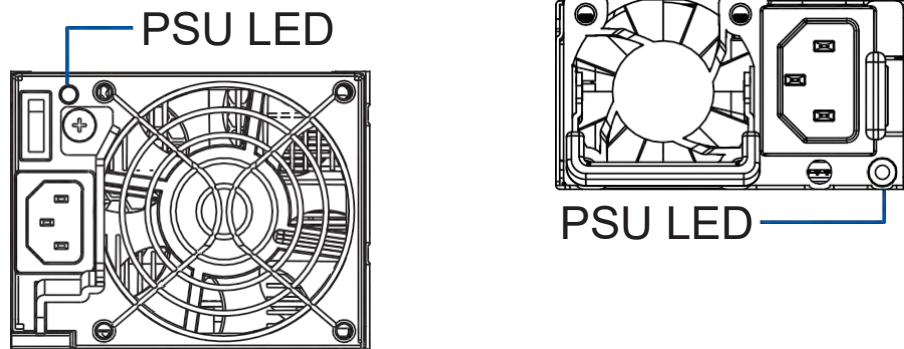
LED name	Color/Status	Description
Link		A connection is established.
	OFF	No connection is established.
Active		Data I/O is ongoing.
	OFF	No Data I/O.




- **Host Board 40GbE Port (QSFP+) LEDs**



LED Name	Color/Status	Description
Link		A connection is established.
	OFF	No connection is established.
Active		Data I/O is ongoing.
	OFF	No Data I/O.

- PSU LED



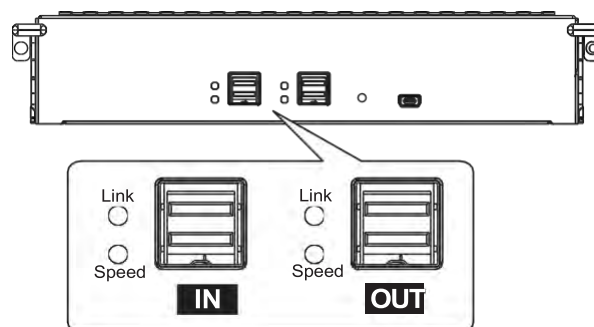
Color/Status	Description
	The system is connected to the power source but the system is not turned on.
	The PSU is operating normally.
	<ul style="list-style-type: none"> • The PSU is faulty. • Over Voltage Protection (OVP)/Over Power Protection (OPP)/Over Current Protection (OCP) is activated. • The fan built with the PSU is faulty.
OFF	The system is not connected to the power.

The PSU LED alerts you of the current status of your PSU. When this component fails, you must replace the PSU immediately.

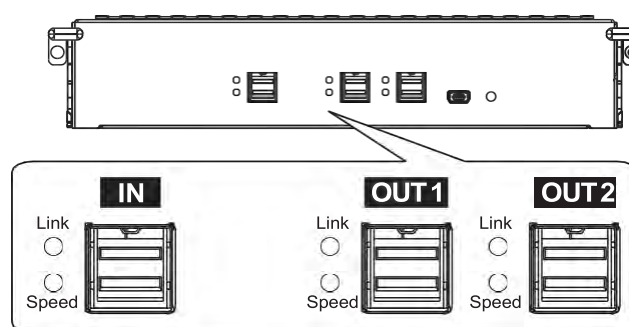
WARNING! Keep your fingers away from moving parts of the system to prevent technical mishaps and physical injuries.

NOTE: For more details, see section **4.1.1 Replacing the PSU/Cooling Module**.

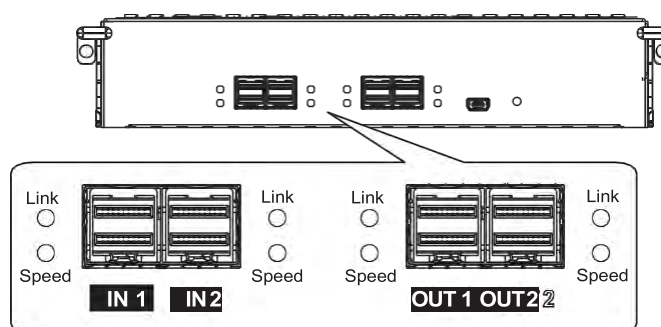
- JBOD 12Gb/s SAS Expansion Controller LEDs



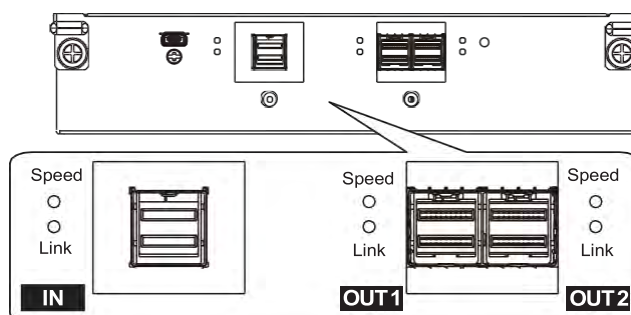
JB 3012A/3016A










JB 3060L



JB 3025BA



JB 3060

LED Name	Color/Status	Description
Link		All PHYs are validly linked.
		One of the PHYs has failed.
	OFF	All PHYs are offline.
Speed		12Gb/s link speed
		6Gb/s or 3Gb/s link speed
	OFF	No connection
		The controller is operating normally.
		<ul style="list-style-type: none"> A component failure occurred. Initialization is ongoing.

3.1.2 Alarms and I²C Bus

This section details the system alarms and I²C bus.

Audible Alarms

You will hear an audible alarm if any of the following components fails:

- Cooling modules
- PSU modules
- Hard disk drives
- Sensors or presence detection circuitries

If you hear an audible alarm, ensure to read the error message on the terminal or GUI screen to determine the cause of the alarm. Take appropriate actions to solve the problem. You can turn off the alarm using the mute button on the front panel.

NOTE: When the temperature exceeds the preset threshold, the controller's charger circuits stop charging. You will receive a messages that says *Thermal Shutdown/Enter Sleep Mode*. When the temperature falls back to normal range, the super capacitor resumes charging.

I²C bus

The operating status of the PSU and cooling modules are collected via the I²C serial bus. If either of the modules fails, the system detects the failure and you will be notified via the same methods stated in audible alarms.

System Maintenance

4

This chapter provides maintenance and replacement procedures of replaceable components of your PAC Storage PS 3000/4000 Gen2 Series systems.

4.1 Replaceable Components

Your PAC Storage PS 3000/4000 Gen2 system is comprised of replaceable components:

- PSU/cooling module
- Controller module
- Memory module
- Host board
- CBM
- Hard disk drive

WARNING!

- DO NOT remove a defective component from the system until you have the replacement on hand. Doing so may disrupt the internal airflow.
 - Consult with the qualified engineers who are familiar with the system to recommend you of the component replacements.
 - DONOT use excessive force when installing a replaceable module. Forced installation of the module can damage the connector pins of the system, the module, or the internal backplane.
-

4.1.1 Replacing the PSU/Cooling Module

Replace the defective PSU/cooling module immediately, but only if you have the replacement.

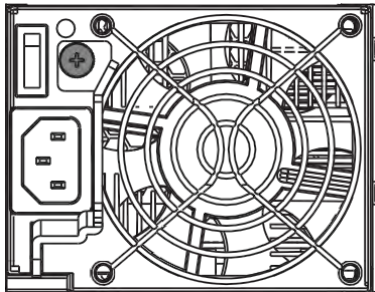
WARNING! Although the system can still operate with a defective PSU, it is not recommended to use it for an extended period of time.

IMPORTANT! For single-controller systems, you must shut down your system before replacing the PSU/cooling module.

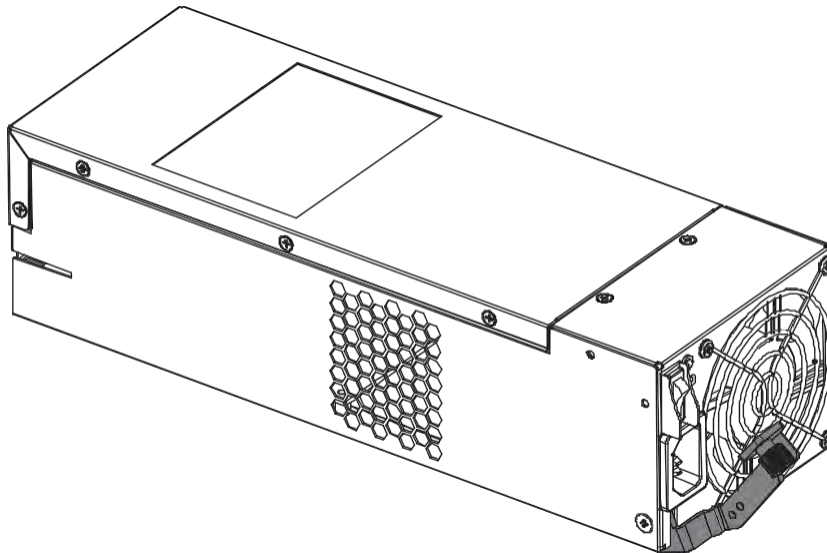
Replacing the PS 3012/4012/3025B/4025B/3016/4016/3024/4024 Gen2 PSU/cooling module

To replace the PSU/cooling module:

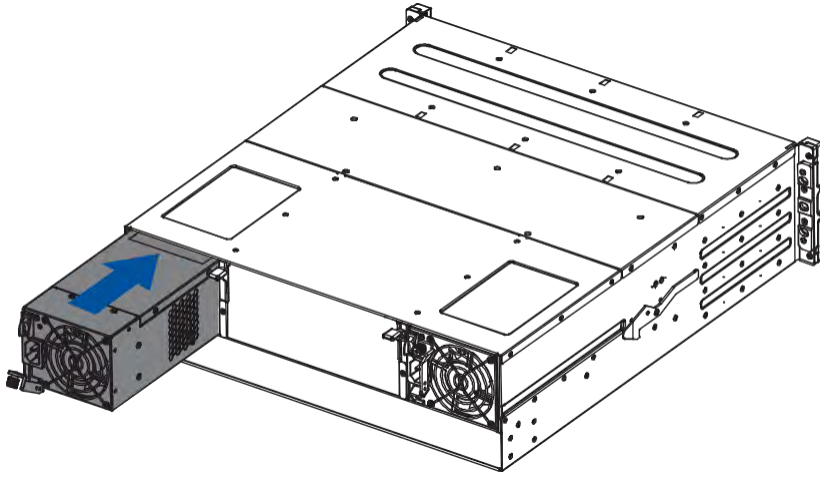
1. Shut down the system, turn off the PSU, then unplug the power cord.
2. Loosen the retention screw that secures the extraction lever to the chassis.



3. Pull down the extraction lever to dislodge the PSU/cooling module from the backplane connectors, then gently pull the PSU/cooling module from the system. If the system is mounted to the rackmount, carefully support its weight with the rack while removing the module.



4. Insert the replacement PSU/cooling module with the extraction lever pointing outwards, then push into the chassis. When you feel a resistance, push the extraction lever to lodge the PSU/cooling module to the backend connectors.



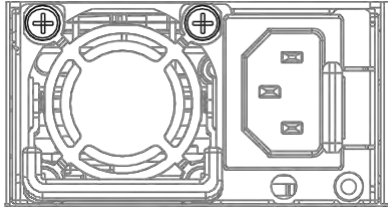
NOTE: This enclosure illustration is for reference only.

5. Fasten the retention screw.
6. Reconnect the power cord.
7. Power on the PSU module.

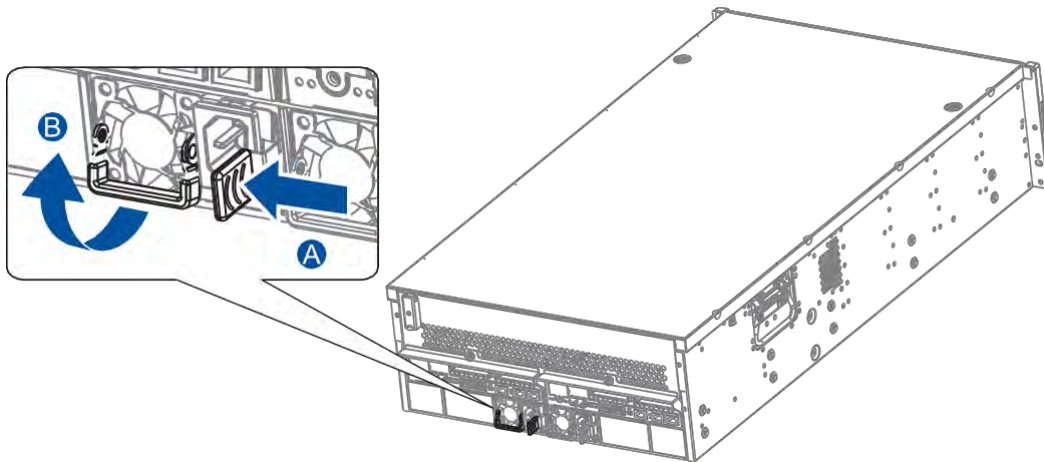
Replacing the PS 3060L/4060L Gen2 PSU

To replace the PSU:

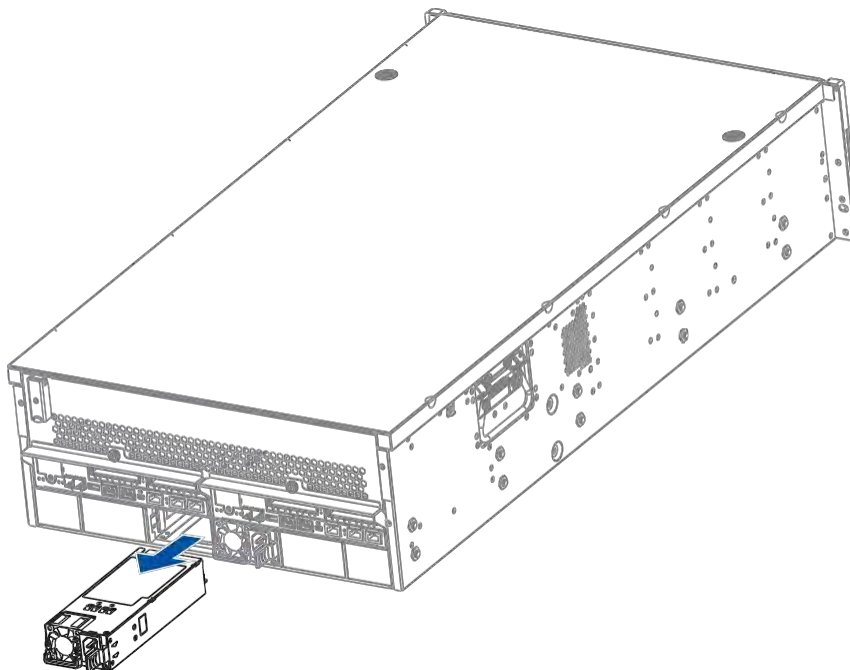
1. Shut down the system, turn off the PSU, then unplug the power cord.
2. Loosen the screws that secure the PSU to the chassis.



3. Press the retention lever to the left (A) then pull out the extraction handle (B).



4. Hold the extraction handle then pull gently to remove the PSU from the system.

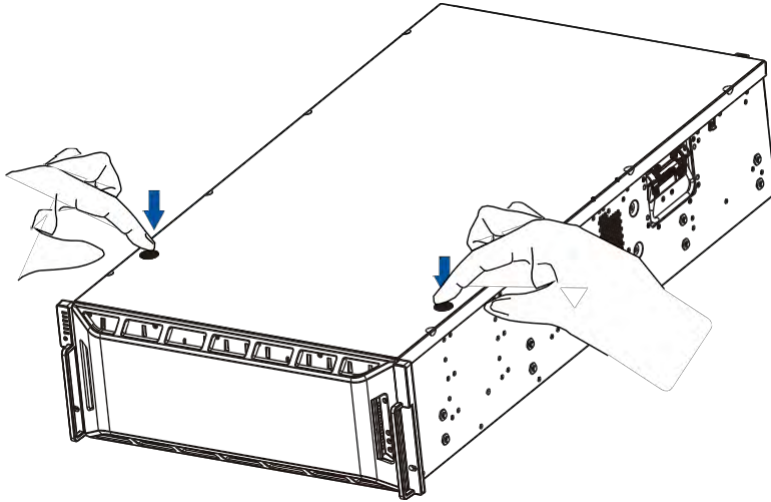


5. Insert the replacement PSU into the enclosure then push it gently. When you feel a resistance, push the module to lodge it to the backend connectors. Once lodged, the retention lever clicks back into place.
6. Fasten the PSU to the systems using the screws that you removed in step 2.
7. Connect the power cord.
8. Turn on the system.

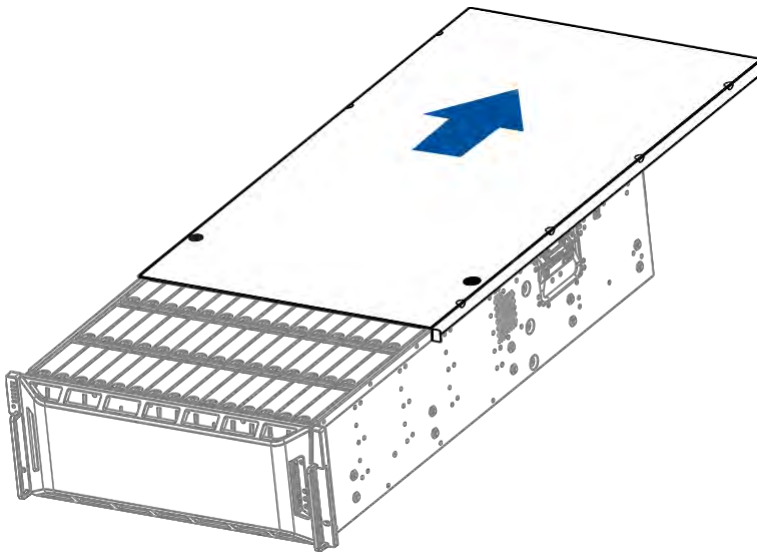
Replacing the PS 3060L/4060L Gen2 cooling module

To replace the cooling module:

1. Shut down the system, turn off the PSU, then unplug the power cord.
2. Push the two release buttons to dislodge the cover from the enclosure.

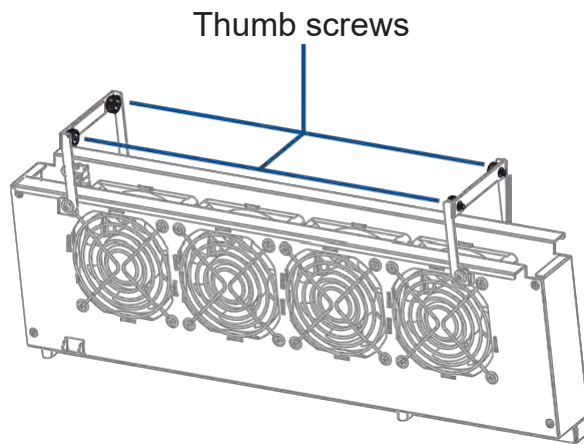


3. Gently slide the top cover backward.

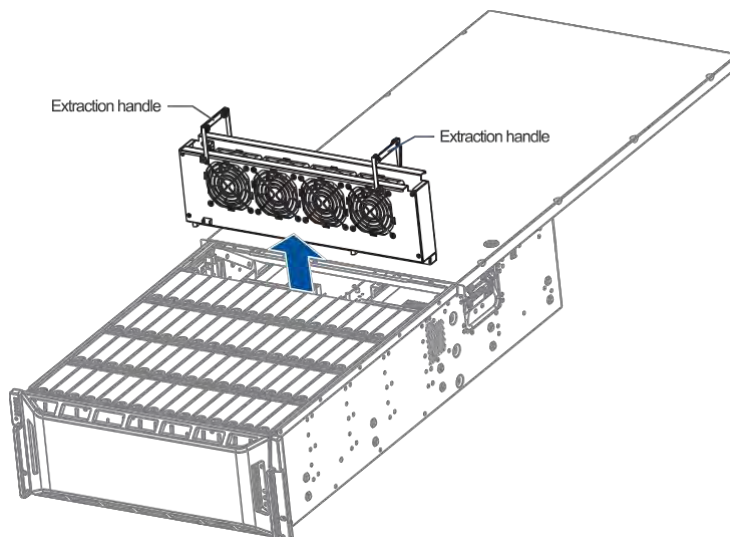


NOTE: You cannot totally remove the cover from the enclosure.

4. From inside the enclosure, loosen the thumb screws that secure the cooling module to the enclosure.



5. Use the extraction handles to pull out the cooling module from the enclosure.



6. Insert the replacement cooling module into the enclosure.
7. Tighten the thumb screws to secure the cooling module to the enclosure.
8. Close the top cover of the enclosure.
9. Connect the power cord.
10. Turn on the system.

4.1.2 Replacing the Controller Module

When replacing a controller in a dual-controller system, ensure that the replacement controller's firmware matches with the controller that you want to get replaced. The replacement provided to you has the firmware version on the label of the packaging.

Use GUI to find out the firmware version of the present controller. From GUI GUI, go to **Storage Manager > Information > Enclosure View**.

WARNING! DO NOT use the controller modules from different models. Each controller module has a unique ID which is applied to the host port names. If you insist on using other models' controller modules, you may encounter SAN problems on multiple systems.

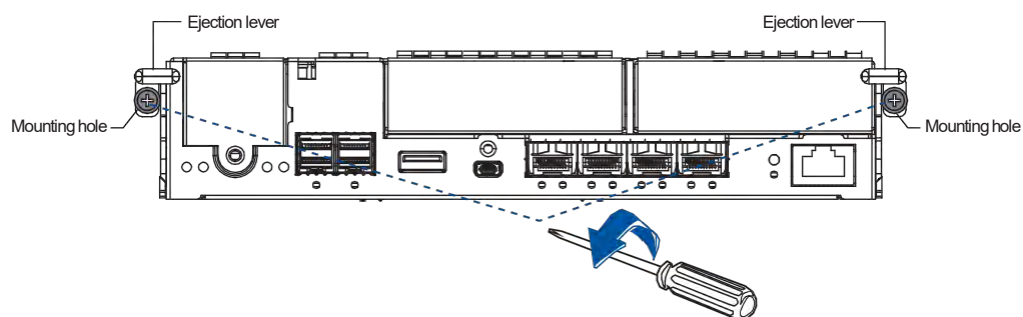
IMPORTANT! When removing/installing a controller in a single-controller system or both controllers simultaneously in a dual-controller system, ensure that you shut down the applications and the system.

NOTE: Refer to GUI user manual for more details.

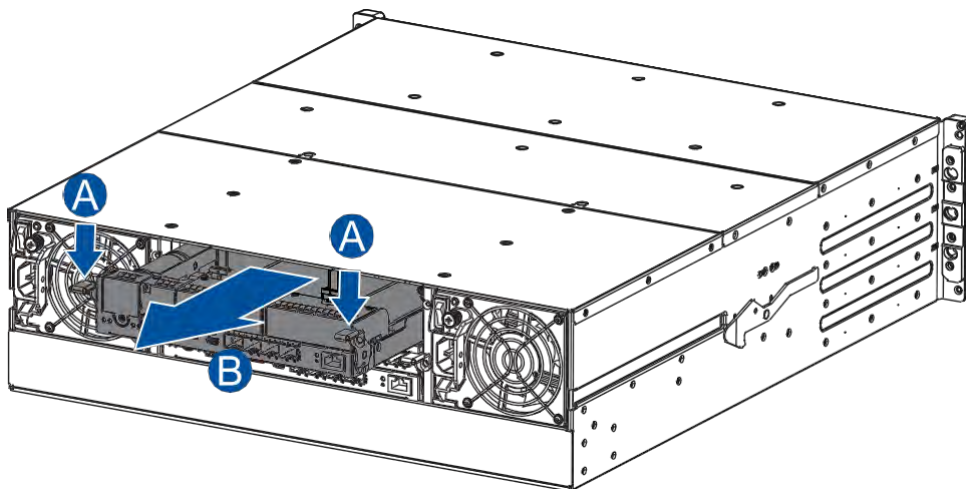
Replacing the controller in PS 3012/4012/3025B/4025B/3016/4016/3024/4024 Gen2 systems

To replace the controller:

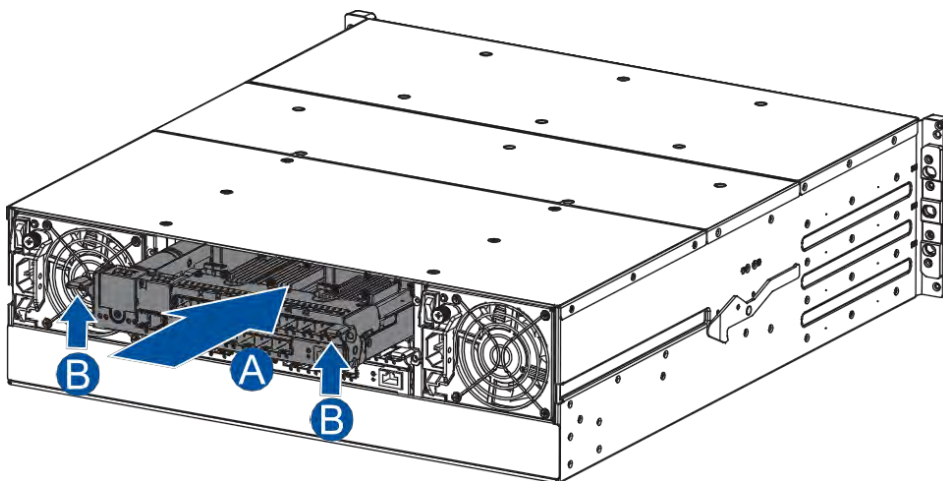
1. Prepare a clean, static-free work pad or container to place the controller.
2. For replacing a controller in a single-controller system or both controllers simultaneously in a dual-controller system, shut the system down. Stop all I/O access to the system and ensure all cached writes have been distributed to disk drives using firmware's **Main Menu > System Functions > Shutdown controller function**. Power off the system and turn off the power switches and unplug the power cords from PSUs.
3. Disconnect all cables from the controller that you want to be replaced.
4. Loosen the screws that secure the controller's ejection levers to the chassis.



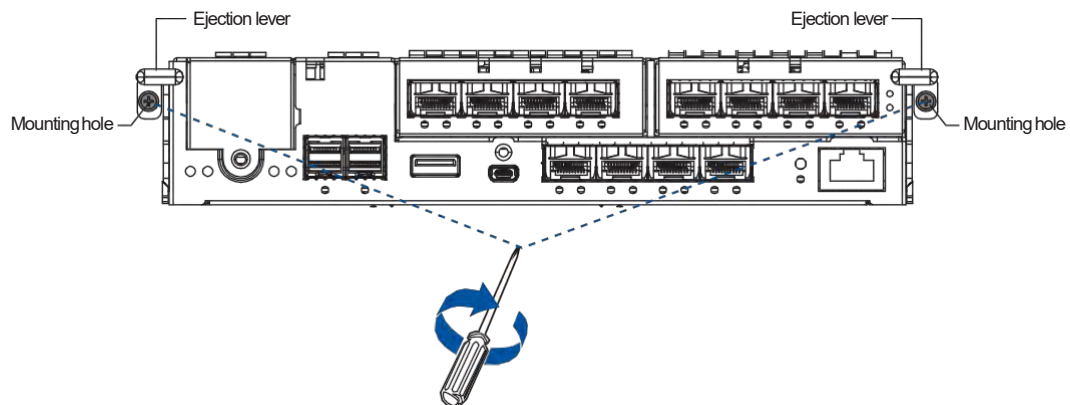
5. Push the ejection levers downwards to dislodge the controller from the system (A), then pull to remove from the enclosure (B).



6. Insert the replacement controller carefully into the controller module slot (A). When you feel a contact resistance, use a small but careful force and push the ejection levers upwards to secure the controller to the enclosure (B).



7. To secure the controller to the chassis, fasten two retention screws to the controller's mounting holes under the ejection levers.

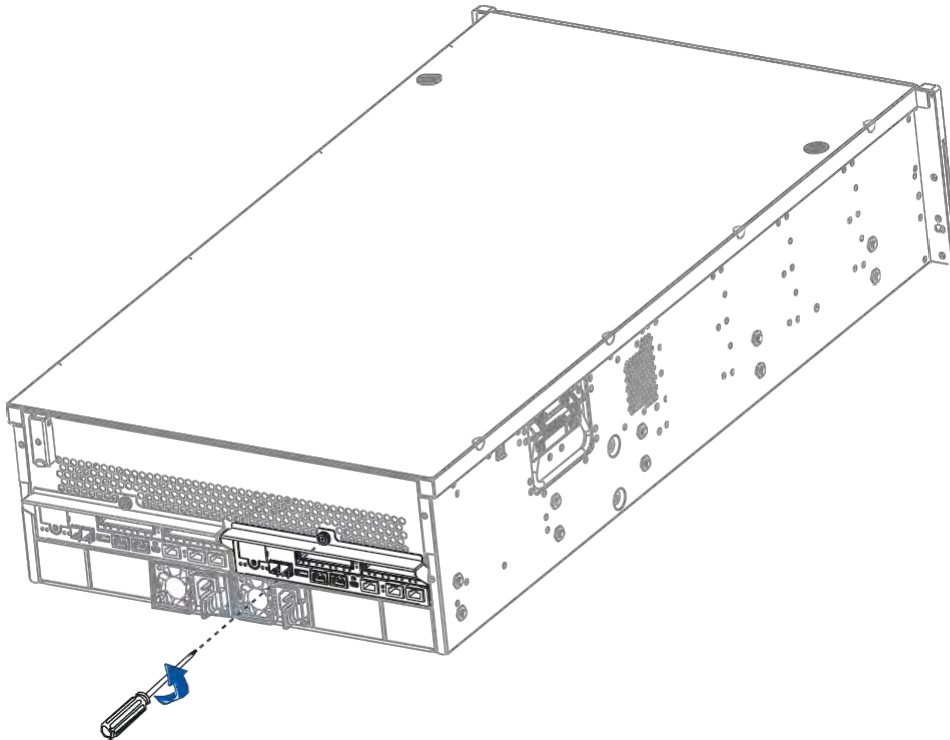


8. Reconnect the cables to the controller's ports.
9. For replacing a controller in a single-controller system or both controllers simultaneously in a dual-controller system, power up the system. Check the messages on the system's LCD panel, GUI, or firmware utility. The power LEDs turn on when the system is successfully initiated online.
10. For replacing a controller in a single-controller system or both controllers simultaneously in a dual-controller system, restore NVRAM data. From your firmware, look for **Restore NVRAM from Disks** or **Restore NVRAM from Files** to restore your previous ID/LUN mapping configuration.

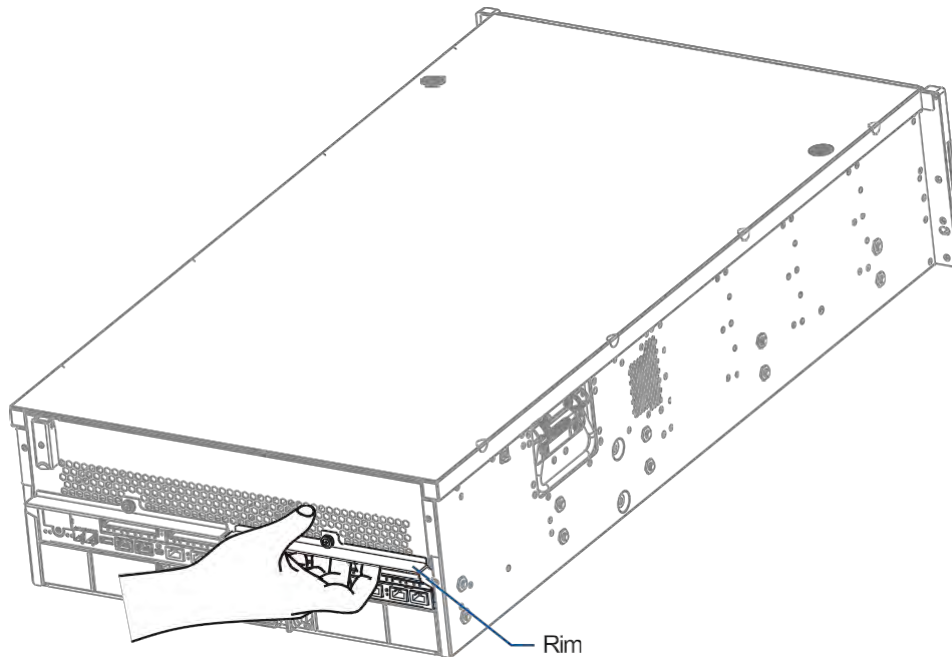
Replacing the controller in PS 3060L/4060L Gen2 system

To replace the controller:

1. From your system's software, go to **Main Menu > System Functions > Shutdown controller** function to stop all I/O access to the system and the cached data are distributed to the disk drives.
2. Shut down the system, switch off the power buttons, and unplug the power cords from the PSUs.
3. Disconnect all cables from the controller module that you want to be replaced.
4. Unfasten the retention screw of the controller module that you wish to replace.



5. Hold the rim, then pull the controller out of the enclosure.



6. Insert the replacement controller carefully into the module slot. When you feel a contact resistance, push the controller with a small but careful force, then secure the replacement controller to the enclosure with the retention screw you removed in step 4.
7. Attach the cables.
8. Turn on the system, then check the system message on GUI or the firmware utility.

NOTE: Once the replacement controller becomes active online, the Control status LED lights up in green. See section **Rear panel LEDs** for details.

9. Restore the previous ID/LUN mapping settings that you set using the following options:
 - a. Restore NVRAM from Disks
 - b. Restore NVRAM from Files

4.1.3 Replacing the Memory Module

The controller comes with a pre-installed DRAM module(s). You can upgrade or replace it when the bundled module malfunctions.

IMPORTANT!

- We strongly recommend you to NOT use the removed DRAM module from a failed controller of a different storage system.
 - Contact your system vendor to help you purchase the compatible DRAM modules.
 - When removing/installing a memory module in a single-controller system, ensure that you shut down the applications and the system.
-

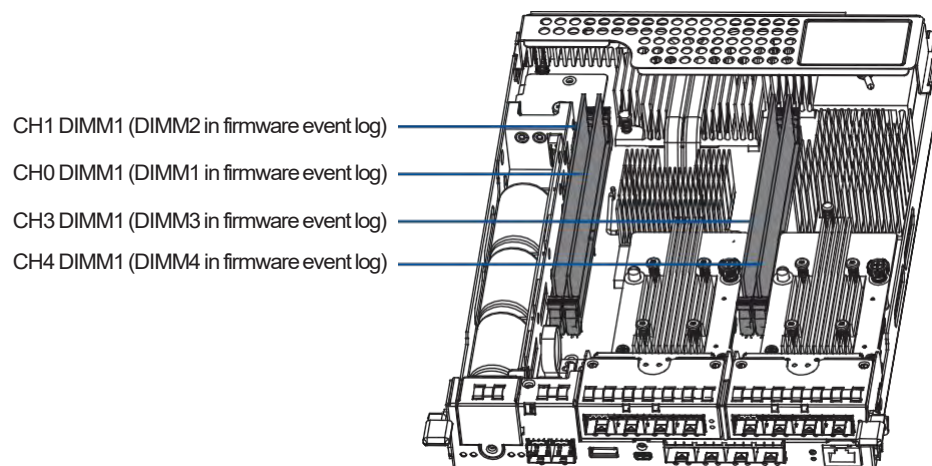
NOTE: Refer to section **ESD Precautions** for safety information.

To replace the memory module:

1. Remove the controller that contains the memory module you want to replace.

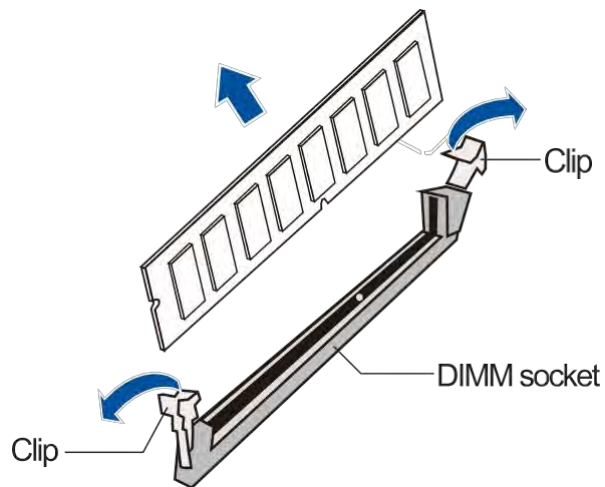
NOTE: See section **4.1.2 Replacing the Controller Module** for details.

2. Look for the DIMM slots in the controller.

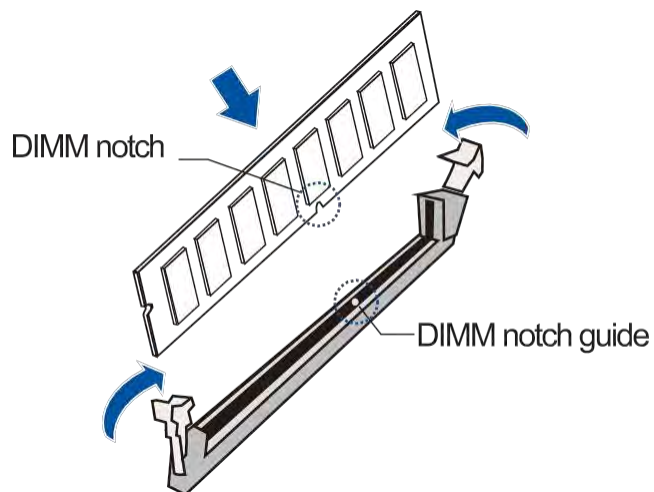


IMPORTANT! When installing memory modules, please fill CH0 DIMM1 and CH3 DIMM1 slots first.

3. Push down the clips to release the DRAM module from the DIMM socket.



4. Insert the replacement DIMM carefully into the DIMM socket, with the DIMM's notch aligned to the DIMM socket's notch guide.



5. Reinstall the controller back to the enclosure.

4.1.4 Replacing the Host Board

Before replacing the host board to the controller, you must take note of the following considerations:

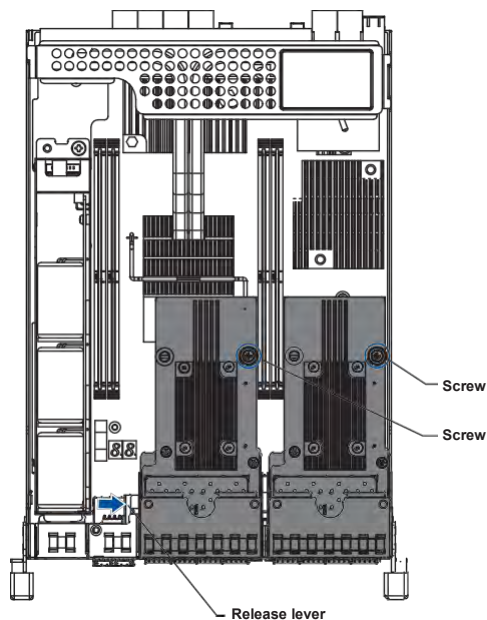
- A controller/host board downtime may occur if you replace a host board for an upgrade.
- The firmware automatically restores the system to its factory settings when adding or replacing a host board.

To replace the host board:

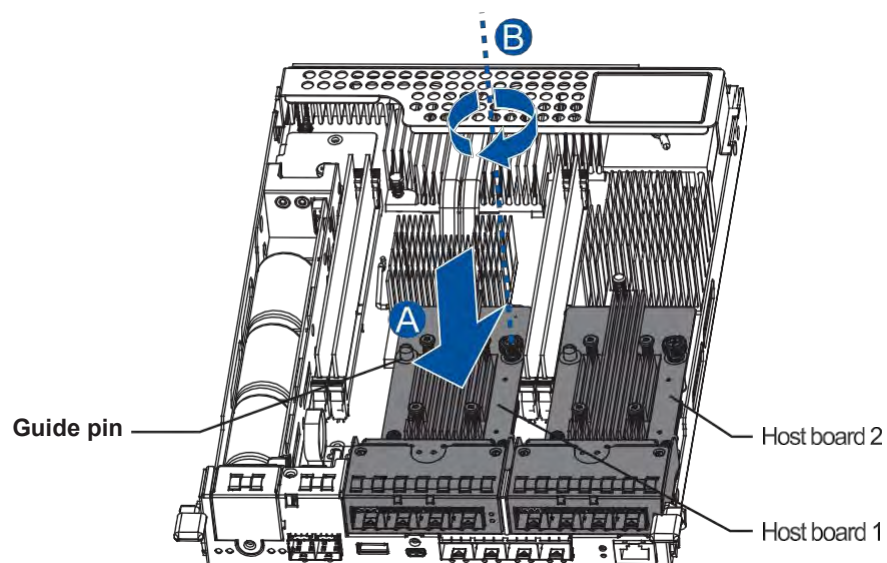
1. Remove the controller that contains the host board you want to replace.

NOTE: See section 4.1.2 Replacing the Controller Module for details.

2. Loosen the screw that secure the host board to the controller, push the release lever, then lift to remove the host board.



3. Use the guide pin to position the new host board to the host board slot, place it carefully (A), then tighten the thumb screws to secure the host board in place (B).



4. Reinstall the controller back to the enclosure.

4.1.5 Replacing the CBM (Cache Backup Module) Components

The CBM is comprised of a super capacitor and the FBM (flash backup module). The super capacitor allows your controller to provide more power during a power outage, supporting the controller to save the data to the FBM.

WARNING! Ensure that you have the replacement on hand before replacing your current CBM.

Super Capacitor Fault Conditions and Precautions

If a super capacitor leaks, gives off bad odor, generates abnormal amount of heat, becomes discolored or deformed, or appears abnormal when charging or storing, remove it from the system immediately.

These issues may be due to the following:

- The temperature sensor on the system's charger circuit reports a temperature that exceeds the preset threshold. The charger circuit enters to a low power and self-protection state.
- A super capacitor module has been charged for more than 10 minutes. When this occurs, the charger enters a timer fault state. Charging resumes automatically after you remove or reinstall the super capacitor, or after you reset the system.

When reinstalling/replacing the super capacitor, remember these precautions:

- ONLY use a replacement super capacitor supplied by an authorized distributor. Use of other capacitors voids your system's warranty.
- ONLY dispose your used/defective super capacitor at an authorized battery disposal sites.
- DO NOT place the super capacitor near a heat source.
- DO NOT immerse/submerge the super capacitor in water or other liquids.
- DO NOT disassemble or modify the super capacitor.
- DO NOT pierce, strike, throw, or exert pressure on the super capacitor.

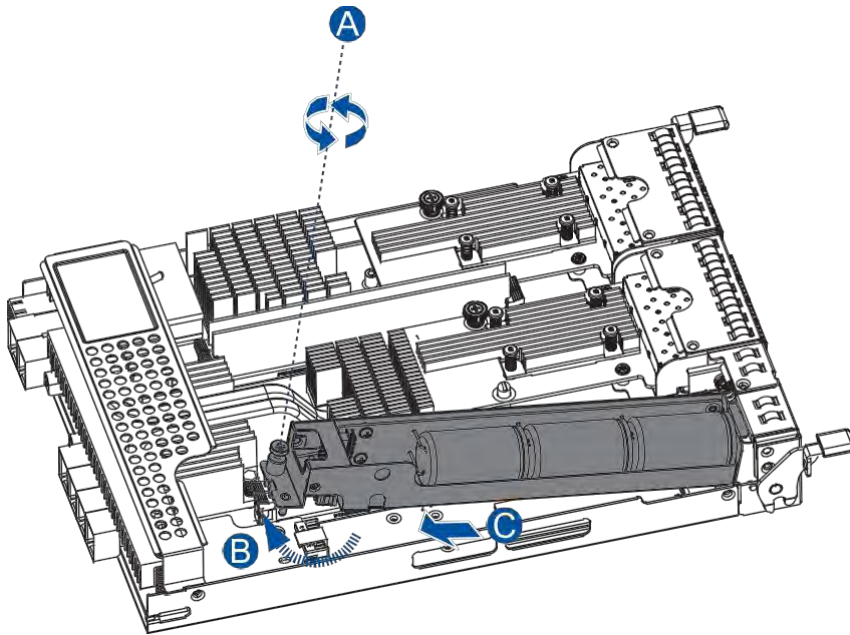
Replacing the Super Capacitor

To replace the super capacitor:

1. Remove the controller that contains the super capacitor you want to replace.

NOTE: See section **4.1.2 Replacing the Controller Module** for details.

2. Loosen the screw that secures the super capacitor to the controller (A), lift its side to a 45° angle (B), then pull to remove from the controller (C).



3. Install the replacement super capacitor to the controller, then tighten the screw to secure it in place.
4. Reinstall the controller back to the enclosure.

Replacing the FBM (Flash Backup Module)

The FBM is located underneath the super capacitor. To replace the FBM, you need to remove the super capacitor from the controller.

To replace the FBM:

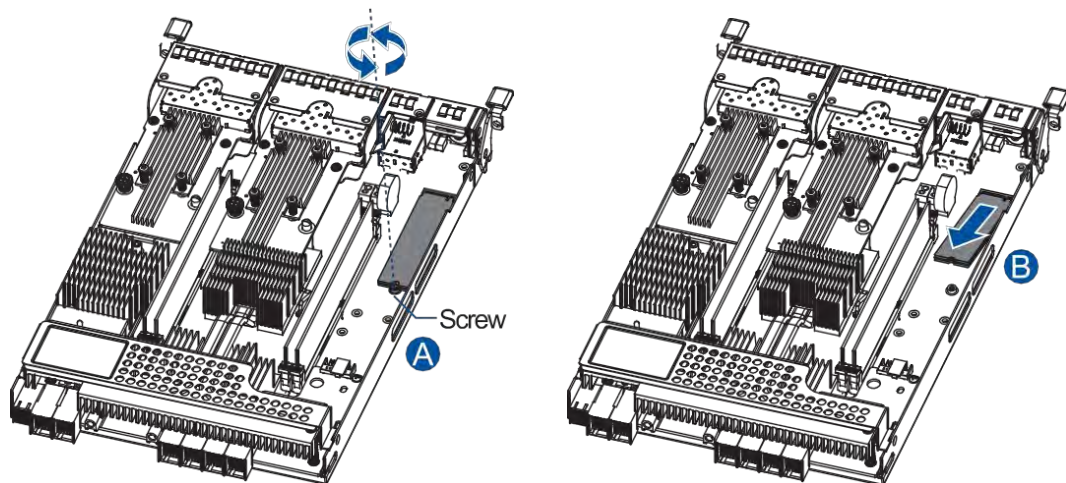
1. Remove the controller that contains the FBM you want to replace.

NOTE: See section **4.1.2 Replacing the Controller Module** for details.

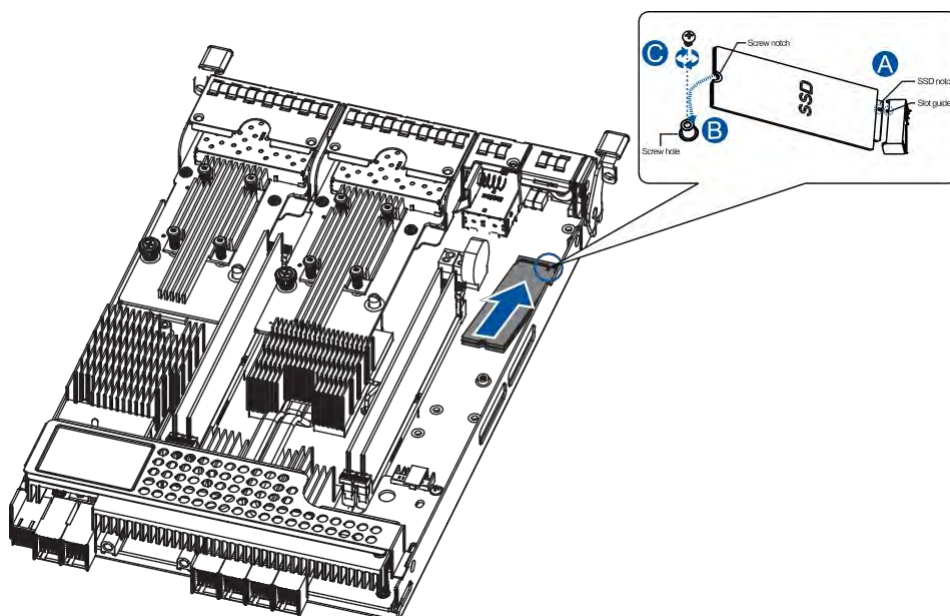
2. Remove the super capacitor from the controller.

NOTE: See section **Replacing the Super Capacitor** for details.

3. Remove the screw that secures the FBM to the controller (A), then remove the FBM from the FBM module slot (B).



4. Orient and insert the replacement FBM's notch to the module slot's guide in a 45° angle (A), orient the screw notch on the screw hole (B), then secure the FBM to the board with a screw you removed in step 3 (C).



5. Install the super capacitor back to the controller.
6. Insert the controller back to the enclosure.

4.1.6 Replacing the Hard Drive

WARNING!

- Ensure to have the replacement ready before replacing the hard drive. DO NOT leave the drive tray open for long periods to prevent disruption of internal airflow.
 - Handle the hard drives with extreme care. Hold them by the edges and avoid touching the circuits and interface connectors.
-

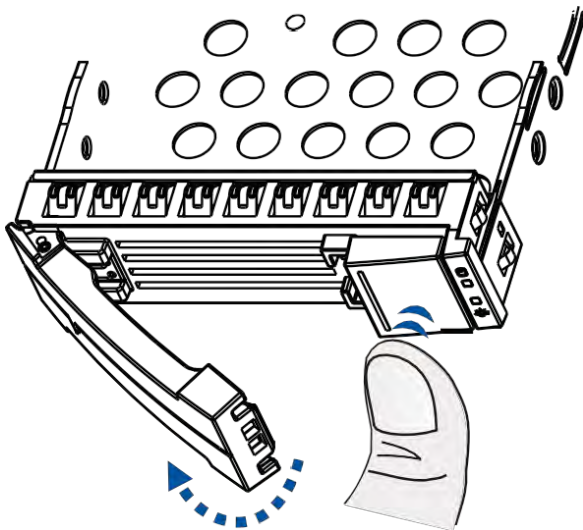
Replacing the Hard Drive into the Drive Bay and Enclosure (for PS 3012/4012/3016/4016/3024/4024 Gen2 Systems)

To replace the hard drive:

1. Identify the faulty hard drive using the GUI software.

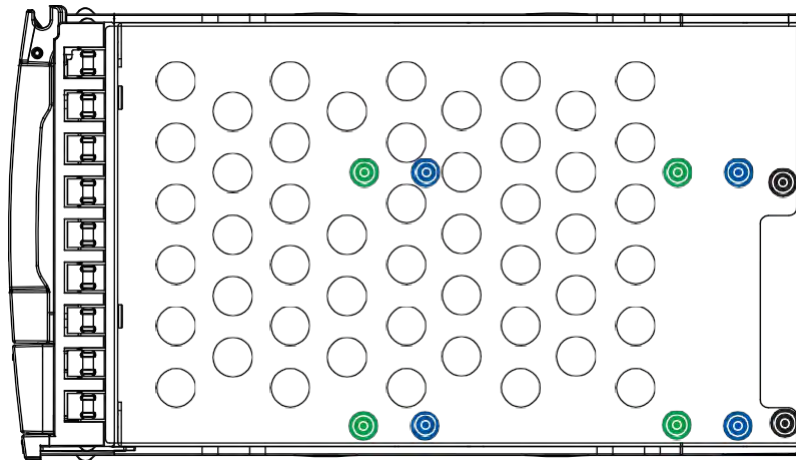
NOTE: See section **Hard Drive Designation** for the order of the drive bays.

2. When the faulty hard drive is located, push the release button to eject the drive tray, wait for 30 seconds for the drive to spin down, then pull out the tray using the spring handle.



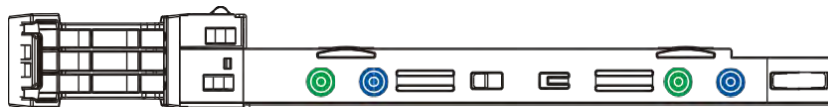
3. Remove the retention screws from the drive tray to dislodge the hard drive.

Screw hole location of 2.5-inch HDD/SSD on a 3.5-inch drive tray



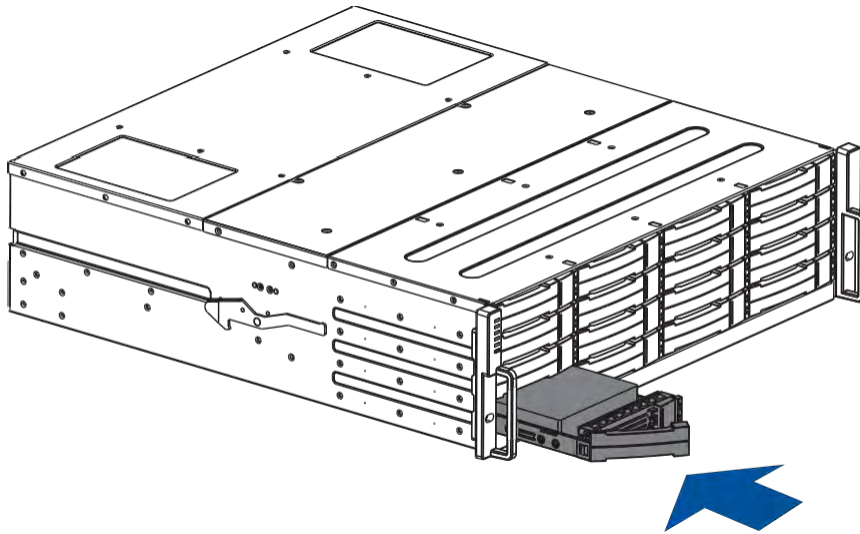
- HDD/SSD with MUX board
- HDD/SSD without MUX board
- MUX board screw holes

Screw holes of 3.5-inch SAS and SATA HDD



- HDD with MUX board
- HDD without MUX board

4. Install the replacement hard drive to the drive tray, then insert the assembled hard drive and drive tray to the bay with the spring handle open.



5. When the tray is fully inserted to the bay, close the spring handle.

IMPORTANT! Ensure that there is no more drive error reported.

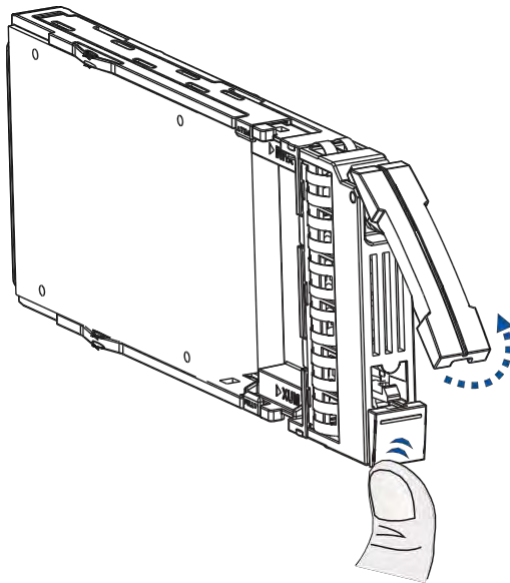
Replacing the Hard Drive into the Drive Bay and Enclosure (for PS 3025B/4025B Gen2 System only)

To replace the hard drive:

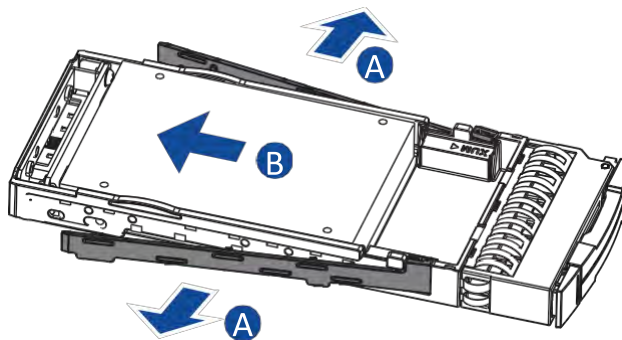
1. Identify the faulty hard drive using the GUI software.

NOTE: See section **Hard Drive Designation** for the order of the drive bays.

2. When the faulty hard drive is located, push the release button to eject the drive tray, wait for 30 seconds for the drive to spin down, then pull out the tray using the spring handle.

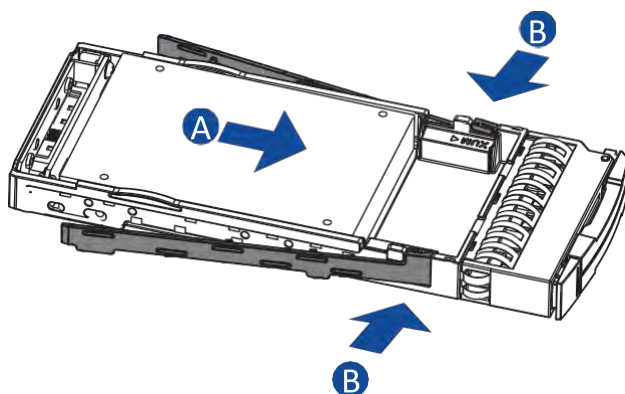


3. Remove the side clips from the tray (A) then remove the hard drive from the tray (B).



NOTE: If the installed hard drive has an MUX board, remove it from the hard drive's connectors.

4. Place the hard drive on the tray (A), then secure the clips to both sides of the tray (B).



NOTE: If the hard drive requires an MUX board, attach it to the drive.

5. Insert the assembled hard drive and tray to the enclosure with the spring handle open, then close the spring handle when the drive is fully inserted to the bay.



Replacing the Hard Drive into the Drive Tray and Enclosure (for PS 3060L/4060L Gen2 system only)

To replace the hard drive:

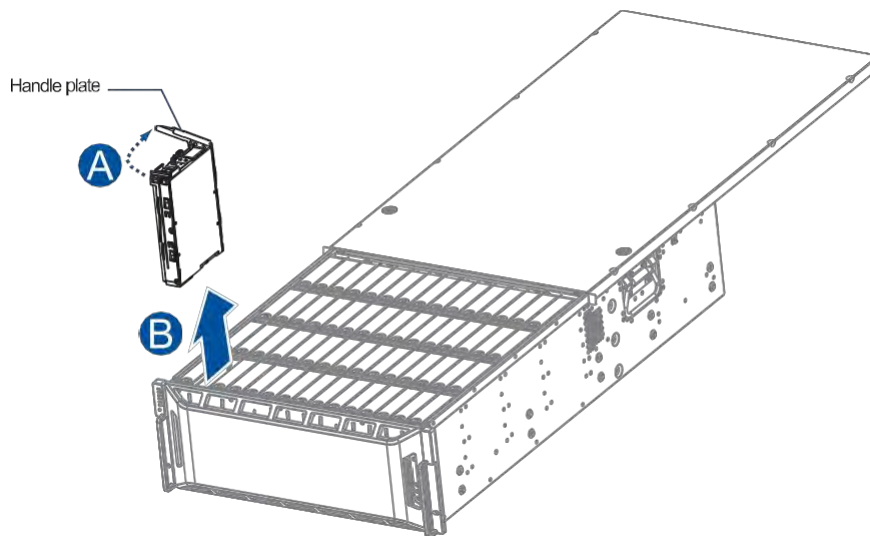
1. Identify the faulty hard drive using the GUI software.

NOTE: See section **Hard drive designation** for the order of the drive bays.

2. When the faulty hard drive is located, open the top cover of the enclosure.

NOTE: See section **4.1.2 Replacing the Cooling Module** on how to open the top cover.

3. Look for the defective hard drive, then pull up its handle plate (A) and remove the assembled drive and tray (B).



4. Take out the defective hard drive from the tray, assemble the hard drive replacement to the tray, then install the assembly back to the system.

NOTE: See section **2.2.3 Installing the Hard Drives** to complete the hard drive installation.

4.2 Restoring Default System Settings

NOTE: Restoring default settings is a last-resort function. All configurations such as parameters and host LUN mappings will be erased.

You may need to restore default settings in the following cases:

- When the firmware update procedure requires it.
- When you need to reset the password to access the storage system.

To restore the default settings, follow these steps:

1. Stop all host I/O's.
2. Save the current configuration using **Export NVRAM**.
3. You may also want to make a list of the existing ID/LUN mapping information because the default restoration will erase the ID/LUN mapping associations (i.e., which logical drive is associated with which host ID/LUN).
4. If your system is a dual-controller model, remove Controller B from the chassis. Please refer to **4.1.2 Replacing the Controller Module**.
5. Power off the storage system.
6. Insert a straightened paper clip to the Restore Default button on Controller A, then press and hold until the Restore Default LED lights up.

NOTE: During restoration, the Restore Default LED lights up in . It lights up in  after the restoration process is complete.

7. In the firmware, use **Import NVRAM from reserved space** or **Restore NVRAM from files** to restore your previous settings. ID/LUN mapping configuration is restored after applying your previous settings. The single-controller system's restore default procedure is complete. For dual-controller system, please continue with the following procedures:
8. Power off the system.
9. Replace Controller A with Controller B (Insert Controller B into Controller A's slot). While leaving Controller B's slot empty with Controller B in slot A, perform the above steps 1 to 7 to restore Controller B to default settings.
10. Put both Controller A and Controller B into their original positions and power up the system.

Appendices



Certifications

Summary

Safety	UL 60950-1 second edition BSMI CNS 14336-1:99 CB IEC 60950-1:2005 (Second Edition) + Am 1:2009 + Am 2:2013
EMC	CE EN 55032:2015+AC:2016 / EN61000-3-2:2014 EN 61000-3-3:2013 / EN 55024:2010+A1:2015 BSMI (CNS 13438) FCC (FCC Part 15, subpart B)
Others	ISO 9001/14001 RoHS

User Warning

This is Class A Information Technology product which may cause radio frequency interference when used in a residential area, in which case the user will be required to take certain appropriate measures/troubleshooting.

UL Caution, Safety, and Warning Markings

SAFETY STOP - DO NOT ALTER	DISPOSITIF DE SÛRETÉ – NE PAS MODIFIER
CAUTION: This product is combustible. A protective barrier or thermal barrier is required as specified in the appropriate building code	ATTENTION: Ce produit est combustible. Une barrière de protection ou une barrière thermique est exigée par le code du bâtiment en vigueur.
WARNING – Interconnection of more than one power supply source to a section of grid rail bus may present a fire hazard.	AVERTISSEMENT – Interconnexion de plus d'une source d'alimentation à une section de bus sur rail grille peut présenter un risque d'incendie.
DANGER – RADIATION	DANGER – RAYONNEMENT

Declaration of the Presence Condition of the Restricted Substance Marking

設備名稱：儲存器 Equipment name: Storage system		型號（型式）：PS 3000/4000 Gen2 Series Type designation (Type): PS 3000/4000 Gen2 Series				
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 Brominated biphenyls (PBB)	多溴二苯醚 Brominated diphenyl ethers (PBDE)
外殼 Case	○	○	○	○	○	○
電路板 PCB assembly	-	○	○	○	○	○
電源供應器 Power supply	-	○	○	○	○	○
硬碟 Hard disk	-	○	○	○	○	○
電源線 Power cable	○	○	○	○	○	○
風扇 Fan	○	○	○	○	○	○
<p>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.</p> <p>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.</p> <p>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.</p>						

Contact Information

PAC Storage

27141 Aliso Creek Rd. Suite 225

Aliso Viejo, CA 92656