User Guide

2U24 Flash Storage Platform
Regulatory Model: G224-J-12
March 2020
Rev. 1.10
1ET0279

Western Digital.

Revision History

Date	Revision	Comment
March 2017	Revision 1.0	Initial Release
April 2017	Revision 1.1	1. Changed the chassis replacement procedure to account for Chassis replacements already containing PSUs and ESMs. See Chassis Replacement Procedure *(page 37)* 2. Added images to the PSU replacement procedures to clarify proper usage of the cable retention clip. See, PSU Replacement Procedure *(page 31)* 3. Updated the list of compatible drives to include SATA options. See List of Compatible Drives *(page 15)* 4. Added a list of available SKUs. See List of Available SKUs *(page 13)* 5. Added a section describing important differences between SAS and SATA product SKUs. See SATA Differences and Limitations *(page 14)* 6. Updated the list of replaceable components to include SATA based components. See List of Replaceable Components *(page 15)* 7. Updated the description of the ESM module to include SATA differences. See ESM Description *(page 25)* 8. Updated the behavior descriptions for the ESM LEDs. See Figure 4: ESM LED Layout *(page 21)* 9. Corrected the names of the SAS Drives. See List of Compatible Drives *(page 15)*
May 2017	Revision 1.2	Changed the product name from "2U24 All-Flash Storage Platform" to "2U24 Flash Storage Platform"
August 2017	Revision 1.3	Corrected part numbers listed in the List of Compatible Drives *(page 15)* for the two SATA SSDs.
March 2018	Revision 1.4	1. Added the Zoning procedures. See T10 Zoning *(page 46)* 2. Added the Firmware Upgrade procedures. See Firmware Upgrade *(page 59)*
May 2018	Revision 1.5	1. Updated the Zoning procedures. See T10 Zoning *(page 46)* 2. Updated the Firmware Upgrade procedures. See Firmware Upgrade *(page 59)*
June 2018	Revision 1.6	Updated the Firmware Upgrade procedures for Linux and Windows sg_ses_microcode. See Firmware Upgrade *(page 59)*
March 2019	Revision 1.7	1. Updated the Specification Summary. See 2U24 Flash Storage Platform Specification Summary *(page 12)*

Date	Revision	Comment
		2. Updated the List of Replaceable Components. See List of Replaceable Components *(page 15)*
		3. Updated the List of Compatible Drives. See List of Compatible Drives *(page 15)*
		4. Updated the Rails Description. See Rails Description *(page 28)*
March 2019	Revision 1.8	**1.** Updated the List of Replaceable Components. See List of Replaceable Components *(page 15)*
		2. Updated the List of Compatible Drives. See List of Compatible Drives *(page 15)*
April 2019	Revision 1.9	**1.** Updated the LED Visual Identifiers. See LED Visual Identifiers *(page 20)*
		2. Updated the rack depth requirement. See 2U24 Flash Storage Platform Specification Summary *(page 12)*
March 2020	Revision 1.10	**1.** Rebranded document to WD design
		2. Updated the SKU List. See List of Available SKUs *(page 13)*
		3. Updated the List of Compatible Drives. See List of Compatible Drives *(page 15)*

Points of Contact

For further assistance with a Western Digital product, contact Western Digital Datacenter Platforms technical support. Please be prepared to provide the following information: part number (P/N), serial number (S/N), product name and/or model number, and a brief description of the issue.

Email:
support@wdc.com

Website:
https://portal.wdc.com/Support/s/

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Disclaimers

Learn about the Regulatory, Safety, and Electromagnetic standards for which this product is compliant.

The following chapter describes the Regulatory Statement of Compliance, Safety Compliance, and Electromagnetic Compatibility Agency Requirements for the 2U24 Flash Storage Platform.

In This Chapter:

1.1 Regulatory Statement

Product Name: **2U24 Flash Storage Platform**
Regulatory Model: **G224-J-12**
Electromagnetic Compatibility Emissions: **Class A**

This product has been tested and evaluated as Information Technology Equipment (ITE) at accredited third-party laboratories for all safety, emissions and immunity testing required for the countries and regions where the product is marketed and sold. The product has been verified as compliant with the latest applicable standards, regulations and directives for those regions/countries. The suitability of this product for other product categories other than ITE, may require further evaluation.

The product is labeled with a unique regulatory model that is printed on the label and affixed to every unit. The label will provide traceability to the regulatory approvals listed in this document. The document applies to any product that bears the regulatory model and type names including marketing names other than those listed in this document.

1.1.1 Restricted Access Location

The 2U24 Flash Storage Platform is intended for installation in a server room or computer room where at least one of the following conditions apply:

- access can only be gained by **service persons** or by **users** who have been instructed about the restrictions applied to the location and about any precautions that shall be taken and/or
- access is through the use of a **tool** or lock and key, or other means of security, and is controlled by the authority responsible for the location.

1.1.2 Safety Compliance

The G224-J-12 complies with and conforms to the latest international Product Safety standards as applicable:

- UL60950-1 Second Edition
- CSA 60950-1-03, Second Edition
- EN 60950-1, Second Edition
- IEC 60950-1, Second Edition
- CE – Low Voltage Directive
- BSMI CNS14336
- TR CU 004/2011

1.1.3 Electromagnetic Compatibility (EMC) Class A Compliance

The G224-J-12 complies with and conforms to the latest international standards as applicable:

Emissions

- FCC CFR 47 Part 15, Subpart B
- ICES-003
- EN 55032
- CISPR 32

- CE – EMC Directive 2014/30/EU
- VCCI V-3
- BSMI CNS14338
- KN32
- AS/NZS CISPR 32
- TR CU 020/2011

Immunity

- EN 61000-3-2 Harmonic Current Emissions
- EN 61000-3-3 Voltage Fluctuations and Flicker
- EN 55024
- KN35
- EN 61000-4-2 ESD
- EN 61000-4-3 Radiated Immunity
- EN 61000-4-4 EFT
- EN 61000-4-5 Surge
- EN 61000-4-6 RF Common Mode
- EN 61000-4-8 Power Frequency Magnetic Field
- EN 61000-4-11 Voltage Dips and Interruptions

1.1.4 Country Certifications

Table 1: Country Certifications

Country/Region	Authority or Mark
North America (Canada, USA)	Nemko
European Union	CE
Japan	VCCI
Korea	MSIP
Taiwan	BSMI
Australia/New Zealand	RCM
Russia, Kazakhstan, Belarus, Armenia	CU EAC
Ukraine	Ukrsepro
Mexico	NOM
Israel	SII
South Africa	NRCS

Regulatory

In This Chapter:

2.1 FCC Class A Notice

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

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

> **Note:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Any modifications made to this device that are not approved by Western Digital may void the authority granted to the user by the FCC to operate equipment.

2.2 ICES-003 Class A Notice—Avis NMB-003, Classe A

This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numerique de la classe A est conforme à la norme NMB-003 du Canada.

2.3 Europe (CE Declaration of Conformity)

Marking by the symbol indicates compliance of this system to the applicable Council Directives of the European Union, including the Electromagnetic Compatibility Directive (2014/30/EU) and the Low Voltage Directive (2014/30/EU). A "Declaration of Conformity" in accordance with the applicable directives has been made and is on file at Western Digital Europe.

2.4 Japanese Compliance Statement, Class A ITE

The following Japanese compliance statement pertains to VCCI EMI regulations:

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

English translation:

This is a Class A product based on the Technical Requirement of the Voluntary Control Council for Interference by Information Technology (VCCI). In a domestic environment, this product may cause radio interference, in which case the user may be required to take corrective actions.
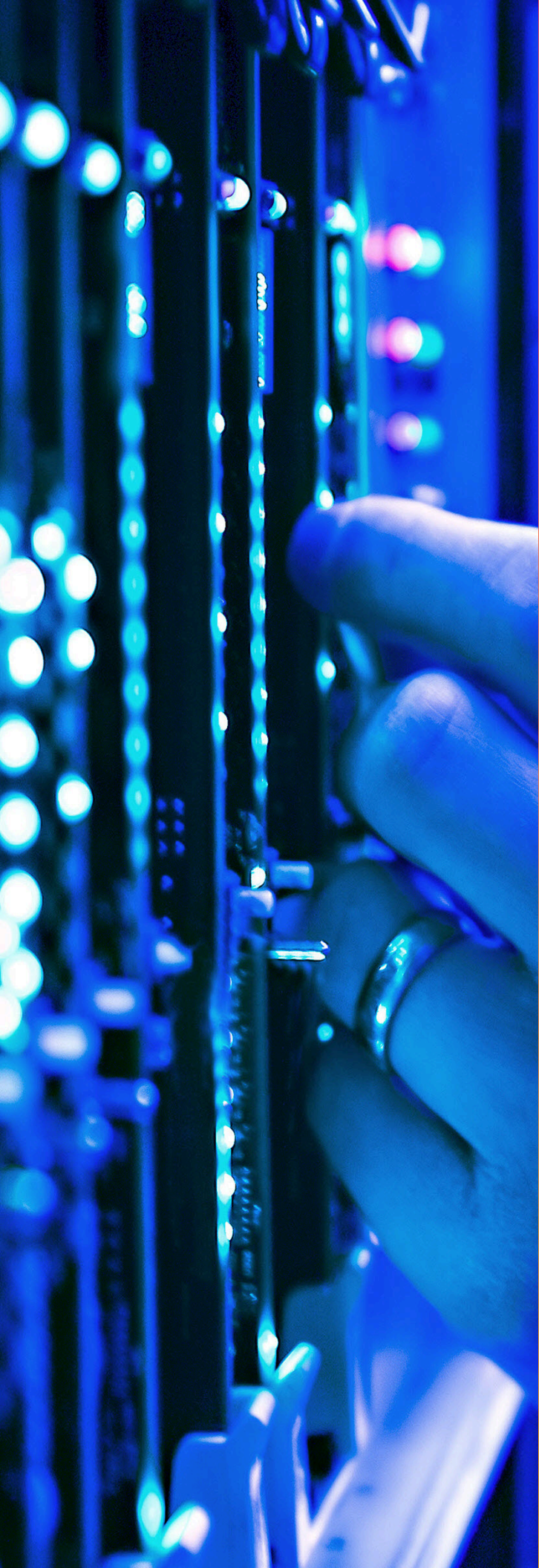
2.5 Taiwan Warning Label Statement, Class A ITE

警告使用者:

此為甲類資訊技術設備，於居住環境中使用時，

可能會造成射頻擾動，在此種情況下，使用者會

被要求採取某些適當的對策。

English translation:

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take adequate measures.

Safety

In This Chapter:

3.1 Optimizing Location

Failure to recognize the importance of optimally locating your product and failure to protect against electrostatic discharge (ESD) when handling your product can result in lowered system performance or system failure.

Do not position the unit in an environment that has extreme high temperatures or extreme low temperatures. Be aware of the proximity of the unit to heaters, radiators, and air conditioners.

Position the unit so that there is adequate space around it for proper cooling and ventilation. Consult the product documentation for spacing information.

Keep the unit away from direct strong magnetic fields, excessive dust, and electronic/electrical equipment that generate electrical noise.

3.2 Safety Warnings and Cautions

To avoid personal injury or property damage, before you begin installing the product, read, observe, and adhere to all of the following safety instructions and information. The following safety symbols may be used throughout the documentation and may be marked on the product and/or the product packaging.

CAUTION####indicates the presence of a hazard that may cause minor personal injury or property damage if the CAUTION is ignored.

WARNING###indicates the presence of a hazard that may result in serious personal injury if the WARNING is ignored.

###indicates potential hazard if indicated information is ignored.

###indicates shock hazards that result in serious injury or death if safety instructions are not followed.

###indicates do not touch fan blades, may result in injury.

###indicates disconnect all power sources before servicing.

3.3 Electrostatic Discharge

#**CAUTION**

Electrostatic discharge can harm delicate components inside Western Digital products.

Electrostatic discharge (ESD) is a discharge of stored static electricity that can damage equipment and impair electrical circuitry. It occurs when electronic components are improperly handled and can result in complete or intermittent failures.

Wear an ESD wrist strap for installation, service and maintenance to prevent damage to components in the product. Ensure the antistatic wrist strap is attached to a chassis ground (any unpainted metal surface). If possible, keep one hand on the frame when you install or remove an ESD-sensitive part.

Before moving ESD-sensitive parts place them in ESD static-protective bags until you are ready to install the part.

3.4 Rackmountable Systems

CAUTION

Always install rack rails and storage enclosure according to 2U24 Flash Storage Platform product documentation. Follow all cautions, warnings, labels, and instructions provided within the rackmount instructions.

Reliable grounding of rack-mounted equipment should be maintained.

If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (Tma) specified by the manufacturer.

Observe the maximum rated ambient temperature, which is specified in the product documentation.

For safe operation of the equipment, installation of the equipment in a rack should be such that the amount of air flow is not impeded so that the safe operation of the equipment is not compromised.

3.5 Power Connections

Be aware of the ampere limit on any power supply or extension cables being used. The total ampere rating being pulled on a circuit by all devices combined should not exceed 80% of the maximum limit for the circuit.

CAUTION####The power outlet must be easily accessible close to the unit.

⚠####Always use properly grounded, unmodified electrical outlets and cables. Ensure all outlets and cables are rated to supply the proper voltage and current.

⚡####This unit has more than one power supply connection; both power cords must be removed from the power supplies to completely remove power from the unit. There is no switch or other disconnect device.

3.6 Power Cords

⚠####Use only tested and approved power cords to connect to properly grounded power outlets or insulated sockets of the rack's internal power supply.

If an AC power cord was not provided with your product, purchase one that is approved for use in your country or region.

CAUTION####To avoid electrical shock or fire, check the power cord(s) that will be used with the product as follows:

- The power cord must have an electrical rating that is greater than that of the electrical current rating marked on the product.
- Do not attempt to modify or use the AC power cord(s) if they are not the exact type required to fit into the grounded electrical outlets.
- The power supply cord(s) must be plugged into socket-outlet(s) that is / are provided with a suitable earth ground.
- The power supply cord(s) is / are the main disconnect device to AC power. The socket outlet(s) must be near the equipment and readily accessible for disconnection.

3.7 Safety and Service

####All maintenance and service actions appropriate to the end-users are described in the product documentation. All other servicing should be referred to an Western Digital-authorized service technician.

####To avoid shock hazard, turn off power to the unit by unplugging both power cords before servicing the unit. Use extreme caution around the chassis because potentially harmful voltages are present.

####When replacing a hot-plug power supply, unplug the power cord to the power supply being replaced before removing it from the 2U24 Flash Storage Platform.

####The power supply in this product contains no user-serviceable parts. Do not open the power supply. Hazardous voltage, current and energy levels are present inside the power supply. Return to manufacturer for servicing.

####Use caution when accessing part of the product that are labeled as potential shock hazards, hazardous access to moving parts such as fan blades or caution labels.

Overview

In This Chapter:

4.1 2U24 Flash Storage Platform Description

Figure 1: 2U24 Flash Storage Platform
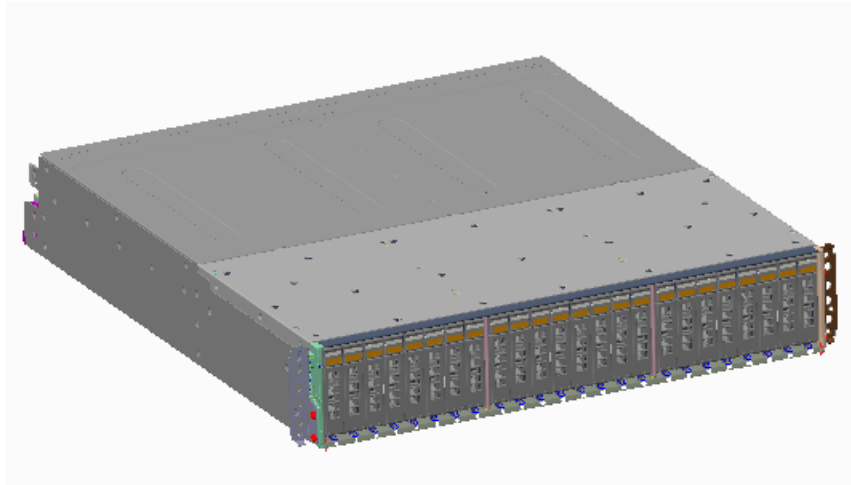
The 2U24 Flash Storage Platform is a 2U form factor, rack-mounted storage platform that is capable of hosting up to 24 SAS or SATA SSDs. The maximum data storage capacity of the platform is 180TB raw using Western Digital Ultrastar S2200 SAS SSD drives (other drive options are available, see List of Compatible Drives *(page 15)*). The platform is designed with redundant Power Supply Units (PSUs) and Expansion Storage Modules (ESMs) which allows for high availability of platform storage. These components are also hot-swappable for easy servicability.

The following list summarizes the important features about the 2U24 Flash Storage Platform:

- Provides up to 368.64TB of high speed data storage.
- Platform management using standard SCSI Enclosure Services (SES)
  - Platform health monitoring
  - Cooling control
  - System event log
  - In-Band firmware updating
- Up to 12 Gbps data transfer rates using 6 HD mini-SAS ports (3 per ESM)

4.2 2U24 Flash Storage Platform Specification Summary

Table 2: Specification Summary

Specification	Non-Operational	Operational
Temperature	-40°C to 60°C	5°C to 40°C
Temperature Gradient	N/A	10°C per hour
Temperature De-rating	N/A	1°C per 175m above 950m
Relative Humidity	5% to 90% non-condensing	5% to 85% non-condensing

Specification	Non-Operational	Operational
Relative Humidity Gradient	30% per hour maximum	30% per hour maximum
Altitude	0m to 12,000m / -0 ft. to 39,3711 ft.	0m to 914.4m / 0 ft. to 3,000 ft.
Shock	35g 6ms Trapezoidal	3.5g 3ms Pulse Vertical Shock
Vibration	1.04g 2-200Hz	Random 0.21g 5-500Hz
Power Requirements	N/A	**Typical**: 400VA **Max**: 600VA
Weight		**Operational**: 48.7 lbs **Recieving Weight**: 67.1 lbs
Dimensions		**H:** 87.4mm x **W:** 446.8mm x **D:** 536mm / **H:** 3.44in. x **W:** 17.6in. x **D:** 21.1in.
Required Rack Width		Refer to the EIA-310D spec for rack dimension requirements.
Required Rack Depth		609.6-762 mm (24in.- 30in.) of usable rack space, frame to frame with the Standard Rail Kit
		609.6-863.6 mm (24in.- 34in.) of usable rack space, frame to frame with the Extended Rail Kit
Rail Length Options		Standard Rail Kit (30in. maximum extension)
		Extended Rail Kit (34in. maximum extension)
Rack Units (U)		2U

4.3 List of Available SKUs

The following table list the available SKUs that can be purchased in 2U24 Flash Storage Platform range.

Table 3: Available SKUs

Drive Type	Encryption	# of Drives	SKU Number
Western Digital® Ultrastar® SS530 SAS 184.32TB	ISE	12	1ES1477
Western Digital® Ultrastar® SS530 SAS 184.32TB	SE	12	1ES1478
Western Digital® Ultrastar® SS530 SAS 184.32TB	TCG	12	1ES1479
Western Digital® Ultrastar® SS530 SAS 368.64TB	ISE	24	1ES1480
Western Digital® Ultrastar® SS530 SAS 368.64TB	SE	24	1ES1481
Western Digital® Ultrastar® SS530 SAS 368.64TB	TCG	24	1ES1482
Western Digital® Ultrastar® SS530 SAS 19.2TB	ISE	12	1ES1583
Western Digital® Ultrastar® SS530 SAS 19.2TB	SE	12	1ES1584

Drive Type	Encryption	# of Drives	SKU Number
Western Digital® Ultrastar® SS530 SAS 19.2TB	TCG	12	1ES1585
Western Digital® Ultrastar® SS530 SAS 38.4TB	ISE	24	1ES1586
Western Digital® Ultrastar® SS530 SAS 38.4TB	SE	24	1ES1587
Western Digital® Ultrastar® SS530 SAS 38.4TB	TCG	24	1ES1588
Western Digital® Ultrastar® SS530 SAS 23.04TB	ISE	12	1ES1589
Western Digital® Ultrastar® SS530 SAS 23.04TB	SE	12	1ES1590
Western Digital® Ultrastar® SS530 SAS 23.04TB	TCG	12	1ES1591
Western Digital® Ultrastar® SS530 SAS 46.08TB	ISE	24	1ES1592
Western Digital® Ultrastar® SS530 SAS 46.08TB	SE	24	1ES1593
Western Digital® Ultrastar® SS530 SAS 46.08TB	TCG	24	1ES1594
Western Digital® Ultrastar® SS530 SAS 38.4TB	ISE	12	1ES1595
Western Digital® Ultrastar® SS530 SAS 38.4TB	SE	12	1ES1596
Western Digital® Ultrastar® SS530 SAS 38.4TB	TCG	12	1ES1597
Western Digital® Ultrastar® SS530 SAS 76.8TB	ISE	24	1ES1598
Western Digital® Ultrastar® SS530 SAS 76.8TB	SE	24	1ES1599
Western Digital® Ultrastar® SS530 SAS 76.8TB	TCG	24	1ES1600
Western Digital® Ultrastar® SS530 SAS 46.08TB	ISE	12	1ES1601
Western Digital® Ultrastar® SS530 SAS 46.08TB	SE	12	1ES1602
Western Digital® Ultrastar® SS530 SAS 46.08TB	TCG	12	1ES1603
Western Digital® Ultrastar® SS530 SAS 92.16TB	ISE	24	1ES1604
Western Digital® Ultrastar® SS530 SAS 92.16TB	SE	24	1ES1605
Western Digital® Ultrastar® SS530 SAS 92.16TB	TCG	24	1ES1606
Western Digital® Ultrastar® SS530 SAS 76.8TB	ISE	12	1ES1607
Western Digital® Ultrastar® SS530 SAS 76.8TB	SE	12	1ES1608
Western Digital® Ultrastar® SS530 SAS 76.8TB	TCG	12	1ES1609
Western Digital® Ultrastar® SS530 SAS 153.6TB	ISE	24	1ES1610
Western Digital® Ultrastar® SS530 SAS 153.6TB	SE	24	1ES1611
Western Digital® Ultrastar® SS530 SAS 153.6TB	TCG	24	1ES1612
Western Digital® Ultrastar® SS530 SAS 92.16TB	ISE	12	1ES1613
Western Digital® Ultrastar® SS530 SAS 92.16TB	SE	12	1ES1614
Western Digital® Ultrastar® SS530 SAS 92.16TB	TCG	12	1ES1615
Western Digital® Ultrastar® SS530 SAS 184.32TB	ISE	24	1ES1616
Western Digital® Ultrastar® SS530 SAS 184.32TB	SE	24	1ES1617
Western Digital® Ultrastar® SS530 SAS 184.32TB	TCG	24	1ES1618
Western Digital® Ultrastar® SS540 SAS 368.64TB	ISE	24	1ES1950

4.4 SATA Differences and Limitations

This section describes the differences between the SAS and SATA versions of the 2U24 Flash Storage Platform.

The 2U24 Flash Storage Platform has a variety of SKUs available that can be referenced in Table 3: Available SKUs *(page 13)*. Some of the SKUs available leverage SAS based SSDs, and others reference SATA based SSDs. The following is a list of general differences of SATA to the SAS versions.

- SATA based SKUs only come with a single ESM. SAS SKUs come with redundant ESMs.
- The SAS based drives are capable of 12Gbps transfer rates, while SATA is limited to 6Gbps
- The SATA devices are limited to a single initiator when referenced by host devices.

4.4.1 SATA Single Initiator Limitation

The ATA protocol is not capable of handling multi-initiator access which means the 2U24 Flash Storage Platform only supports a single SATA affiliation to one initiator. If multiple initiators are connected to an enclosure with SATA devices installed then the initiator that first discovers the SATA device will be given the affiliation to that SATA device. This creates a scenario where it is hard to control which initiator has access to specific SATA devices within the enclosure. If multiple initiators must be used with a SATA enclosure then zone the enclosure so each host port on the ESM only has access to a specific number of SATA devices within the enclosure. This will prevent any variability in the device discovery process.

4.5 List of Replaceable Components

Table 4: Replaceable Components

Component	Part Number
ESM	1EX0333
Dummy Carrier, Drive Blank	1EX0332
PSU	1EX0334
Standard Rail Kit (30in. maximum extension) w/ mounting hardware	1EX0335
Extended Rail Kit (34in. maximum extension) w/ mounting hardware	1EX2182
Rack Ear Bezel Kit	1EX0336
Power Cable C13-C14, 18AWG, 1.5m	1EX0084
Mini-SAS HD Cable, 3m	1EX0329
Chassis with Redundant ESMs, Redundant PSUs (SAS SKUs only)	1EX0338
Chassis with Single ESM, Redundant PSUs (SATA SKUs only)	1EX0285
Replacement Drive Carrier (No Drive) w/ screws	1EX0337

4.6 List of Compatible Drives

Note: Please note that an enclosure can only have one type of drive at a time.

Table 5: Compatible Drives

Drive	Type	Interface	Drive Writes	Encryption	Volume	Part Number
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	SE	400GB	1EX1083
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	ISE	400GB	1EX1082
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	ISE	480GB	1EX1078
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	SE	480GB	1EX1079
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	ISE	800GB	1EX1074
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	SE	800GB	1EX1075
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	ISE	960GB	1EX1076
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	SE	960GB	1EX1077
Sandisk® Cloudspeed Eco II w/ 2.5 in. drive carrier	SSD	SATA 6Gb/s	1DW/D	SE	960GB	1EX0386
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	ISE	1.6TB	1EX1072
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	SE	1.6TB	1EX1073
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	SE	1.6TB	1EX2131
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	ISE	1.6TB	1EX2130
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	TCG	1.6TB	1EX2132
Sandisk® Cloudspeed Eco II w/ 2.5 in. drive carrier	SSD	SATA 6Gb/s	3DW/D	SE	1.9TB	1EX0385
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	ISE	1.92TB	1EX1080
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	SE	1.92TB	1EX1081
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	SE	1.92TB	1EX2134

Drive	Type	Interface	Drive Writes	Encryption	Volume	Part Number
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	ISE	1.92TB	1EX2133
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	TCG	1.92TB	1EX2135
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	ISE	3.2TB	1EX0187
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	ISE	3.2TB	1EX0185
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	SE	3.2TB	1EX2137
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	ISE	3.2TB	1EX2136
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	TCG	3.2TB	1EX2138
Western Digital® Ultrastar® SS200 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	ISE	3.84TB	1EX0186
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	SE	3.84TB	1EX2140
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	ISE	3.84TB	1EX2139
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	TCG	3.84TB	1EX2141
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	SE	6.4TB	1EX2143
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	ISE	6.4TB	1EX2142
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	3DW/D	TCG	6.4TB	1EX2144
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	SE	7.68TB	1EX2146
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	ISE	7.68TB	1EX2145
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	TCG	7.68TB	1EX2147
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	SE	15.36TB	1EX1805
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	ISE	15.36TB	1EX1804
Western Digital® Ultrastar® SS530 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	TCG	15.36TB	1EX1806

Drive	Type	Interface	Drive Writes	Encryption	Volume	Part Number
Western Digital® Ultrastar® SS540 w/ 2.5 in. drive carrier	SSD	SAS 12Gb/s	1DW/D	ISE	15.36TB	1EX2742

> (i) **Important:** The 2U24 Flash Storage Platform must contain drives that are list in the this compatible drives list. If a drive that **is not** on this list is installed, the enclosure will not recognize the unapproved drive.

4.7 Host Connectivity

The following table displays the list of power cables approved by Western Digital:

Table 6: Approved Power Cables

Type	Part Number	Dimension (overmold)
BIZlink Technology Inc.	BC314-BC313-1.5M-UL	C13 to C14
Well Shin Technology CO LTD	0096-0011	C13 to C14

Connect the 2U24 Flash Storage Platform to the host, using high quality miniSAS HD cables.

The following table displays the list of SAS cables approved by Western Digital:

Table 7: Approved SAS Cables

Type	Part Number
Amphenol	601760008
FCI	10117949-3030LF
Molex Inc.	1110751003

4.8 Power Requirements

The following table describes the A/C input power specification for the 2U24 Flash Storage Platform.

Table 8: AC Power Specifications

Power	
Alternating Current (AC) Power Supply (2 per enclosure)	
Wattage (per power supply)	600W 80 + Gold rated
Voltage (per power supply)	90 - 246VAC (600W max), auto-ranging, 50/60 Hz
Maximum inrush current (per power supply)	After AC power is applied to the power supply, any initial inrush current surge or spike of **10** milliseconds or less must not exceed **25** amps peak.

4.9 System Cooling

The 2U24 Flash Storage Platform has an advanced thermal algorithm that monitors all of the temperature sensors in the system. The enclosure makes adjustments to the fan speeds based upon the thermal sensors. The fan algorithm takes into account the component and the warning and critical threshold limits set by SES. If any temperature sensor gets to the warning limit, the fans speeds will increase to cool the component. If the enclosure encounters low temperatures, the system will reduce fan speed in an attempt to conserve power and not over-cool the enclosure.

This algorithm is agnostic to effects of altitude and humidity. The algorithm simply works based on temperatures within the system with emphasis on reducing power consumption.

4.10 ESD

The enclosure is designed to dissipate all electrostatic discharges to the chassis base. Ensure that there is sufficient electrical and mechanical connection from the chassis base to the rack rails, and that the rack itself is tied to earth ground. It is recommended that suitable ESD precautions be observed during installation and service operations

The unit must be grounded in accordance with all local/regional and national electrical codes.

4.11 Rack Requirements

Rack spaces should be equipped to give the enclosure ample power and connectivity to perform as expected. They must also provide effective airflow, cooling , and allow for access for routine maintenance.

For proper rack installation of the 2U24 Flash Storage Platform, mount the enclosure according to the following drawing:

Figure 2: Assembly in the Rack
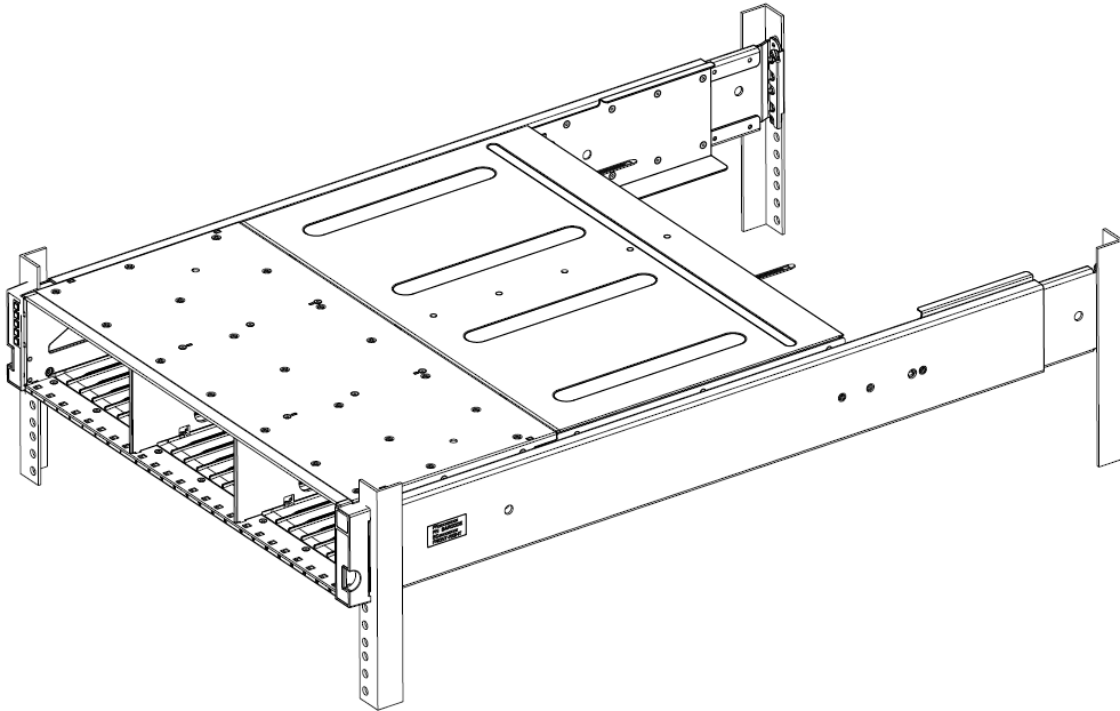
4.12 LED Visual Identifiers

The 2U24 Flash Storage Platform contains the following visial indicators.

Figure 3: Front LED Panel
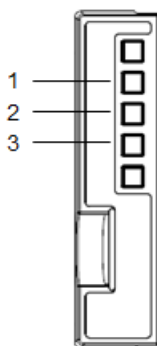
1. Green
   - On—Power on
   - Off—Power off

2. Blue

- On—Enclosure Identification
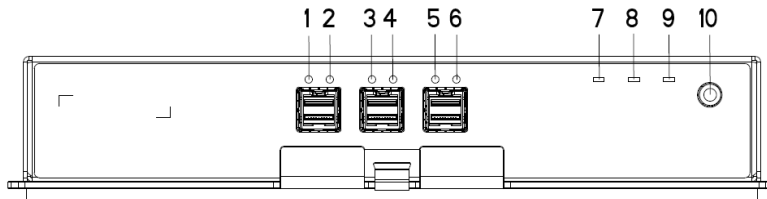- Off—Normal Operation

3. Amber

- On—Fault
- Off—Normal Operation

Figure 4: ESM LED Layout

1. T1 port link status LED—Green

- On—Link is established on any or all of the 4 channels on this port
- Off—Loss of link on all of the 4 channels on this port

2. T1 port fault LED—Amber

- On—Fault exists on this port
- Off—Normal operation

3. T2 port link status LED—Green

- On—Link is established on any or all of the 4 channels on this port
- Off—Loss of link on all of the 4 channels on this port

4. T2 port fault LED—Amber

- On—Fault exists on this port
- Off—Normal operation

5. T3 port link status LED—Green

- On—Link is established on any or all of the 4 channels on this port
- Off—Loss of link on all of the 4 channels on this port

6. T3 port fault LED—Amber

- On—Fault exists on this port
- Off—Normal operation

7. ESM Power LED—Green

- On—ESM is powered on
- Off—ESM is powered off

8. ESM Identification LED—Blue

- On—ESM has been identified
- Off—Normal operation

9. ESM Fault LED—Amber

- On—Fault exists on this port
- Off—Normal operation

10. 3.5mm Console Port

Figure 5: PSU LED Layout (one set of LEDs per PSU, 2 sets total)
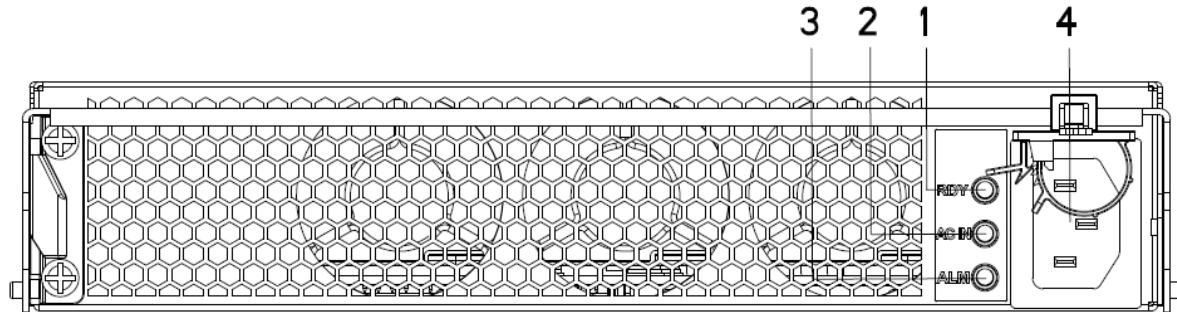
1. RDY—Green

    - On—PSU output +12V and +5V are functioning normally
    - Off—PSU output is not functioning normally

2. AC IN—Green

    - On—Input AC voltage is normal
    - Off—Input AC is not functioning normally

3. ALM—Amber

    - On—PSU has reported a fault
    - Off—Normal operation

4. Power cord receptacle w/ retention clip

Figure 6: Drive Carrier LEDs
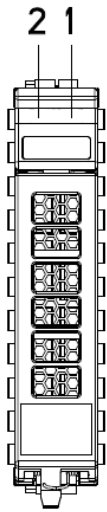
1. Green

   - On—Activity on that specific drive
   - Blink—Activity on that specific drive
   - Off—Activity on that specific drive

2. Red

   - On (1Hz blink)—A fault has occurred
   - Off—Normal operation

4.13 SCSI Enclosure Services Page 02

The SCSI `Send Diagnostic` and `Receive Diagnostic Results` commands can be addressed to a specific **SES element** in the enclosure. There are many different element codes, such as Page 02, defined to cover a wide range of devices. Page 02h refers to the control and status of the enclosures PSUs, HDDs, ESMs, and sensors.

> **Note:** Refer to the SES FIrmware Management Interface Specification for more information on SES Page 02.
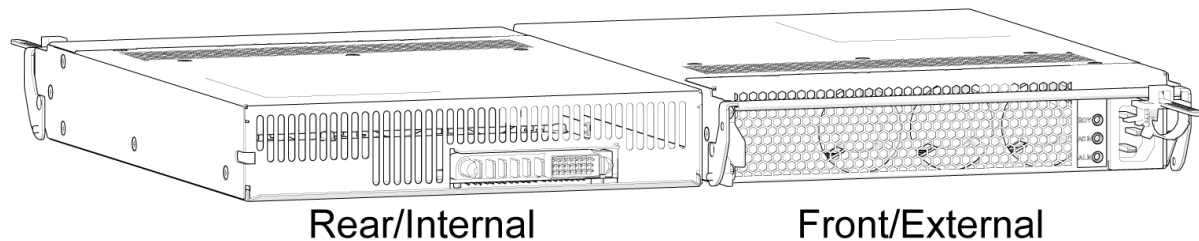
Components

In This Chapter:

5.1 PSU Description

Figure 7: PSU Front and Rear


Rear/Internal   Front/External

The 2U24 Flash Storage Platform features redundant, high-efficiency power supplies units (PSUs). There are two PSUs that are hot swappable (one at a time). The following is a list of important PSU features:

- 90-264VAC input via standard IEC grounded connector
- High efficiency, 80 Plus Gold certified Hot pluggable and N+1 redundant
- Redundant +5V 40A DC Output (supports current sharing)
- Redundant +12V 36A DC Output (supports current sharing)
- Redundant +5V 1.0A Standby DC Output
- Single Molex hot plug output connector
- Combined output power 600W continuous
- Three 40mm dual counter rotating fans per PSU for system cooling controlled by internal microcontroller

5.2 ESM Description

Figure 8: ESM Front and Rear

Front/External   Rear/Internal
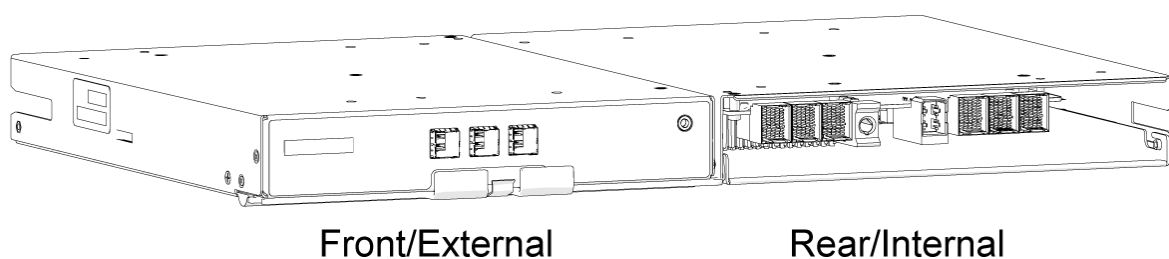
The Enclosure Storage Module (ESM) provides system data connectivity through 3 Mini-SAS HD ports located at the rear of the component. Each port supports four SAS connections per ESM, totaling 12 connections. These ports support 12Gbps, 6Gbps, and 3Gbps data transfer rates. When the 2U24 Flash Storage Platform is configured to use SAS SSDs, the enclosure will come with two ESMs installed. When it is configured to use SATA SSDs, there will only be one ESM.

The following is a list of important ESM features:

- 3 SAS ports support 4 connections each, 12 total over Mini-SAS HD cables
- Supports expansion downstream to additional enclosures
- Monitors the operational temperature of the enclosure and manages cooling
- Provides a 3.5mm console port to connect to the native management CLI and firmware interface
- Hot-Swappable

5.3 Drive Assembly Description

Figure 9: Drive Assembly
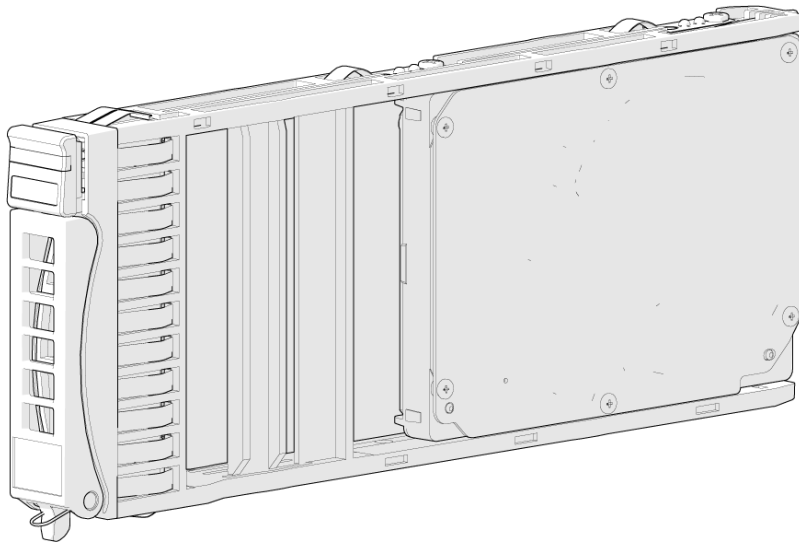
The 2U24 Flash Storage Platform drive assembly consists of two basic parts: the 2.5in. SSD and the drive carrier. The drive carrier attaches to the drive using four screws that are screwed into the side of the assembly. There is a latch that secures the drive assembly to the platform chassis and a button that is used to unlatch and release the assembly from the chassis. When the latch release is pressed, the carrier arm pops out of the assembly and can be used to remove the drive assembly from the chassis. There are two LEDs on the carrier assembly. The amber LED on the left is a Fault LED that will illuminate when there is a failure in the drive. The green LED on the right is an Activity LED that will blink when there is activity (reads and writes) occurring on that drive.

The drive assembly is oriented in the platform such that the connector faces in toward the chassis, and the drive carrier latch is at the top as shown in the following image.

Figure 10: Drive Assembly Orientation
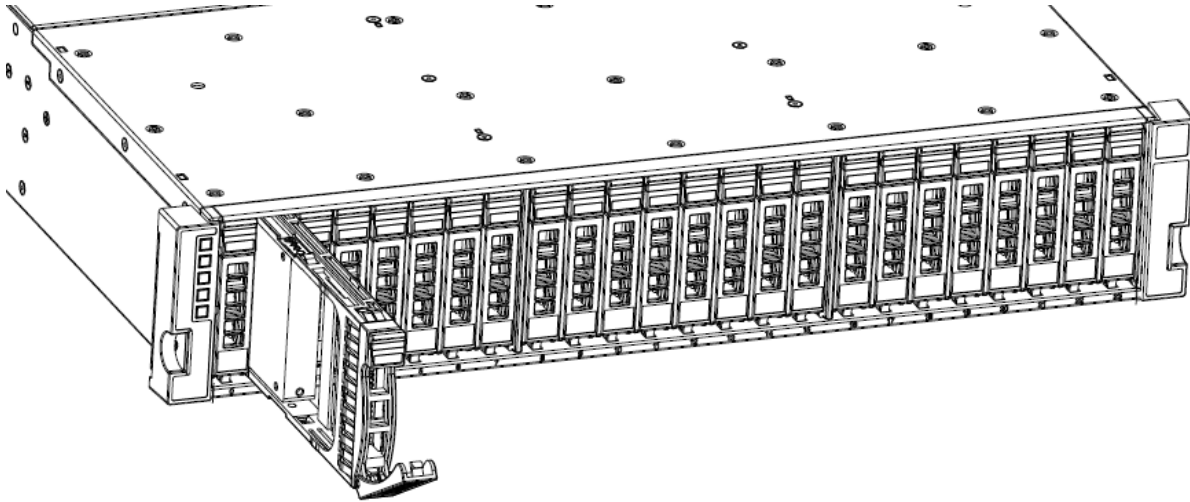
5.4 Midplane Description

Figure 11: Midplane Connectors
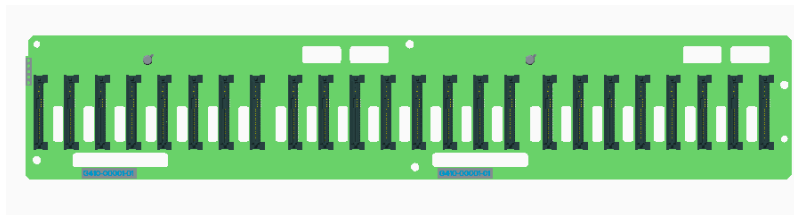
The enclosure midplane supports 24 2.5" SSD drive connections. It contains the SAS drive SFF-8680 connectors and the drive and enclosure status LEDs. These LEDs are made visible on the front of the enclosure via light pipes / fiber optics. The midplane also contains two redundant Vital Product Data (VPD) EEPROMS as required by the SBB specification. This midplane has been designed with stub elimination (back-drilling) to reduce high-speed signal losses. It is mounted to the drive cage as shown in the following image.

Figure 12: Midplane Attached to Drive Cage
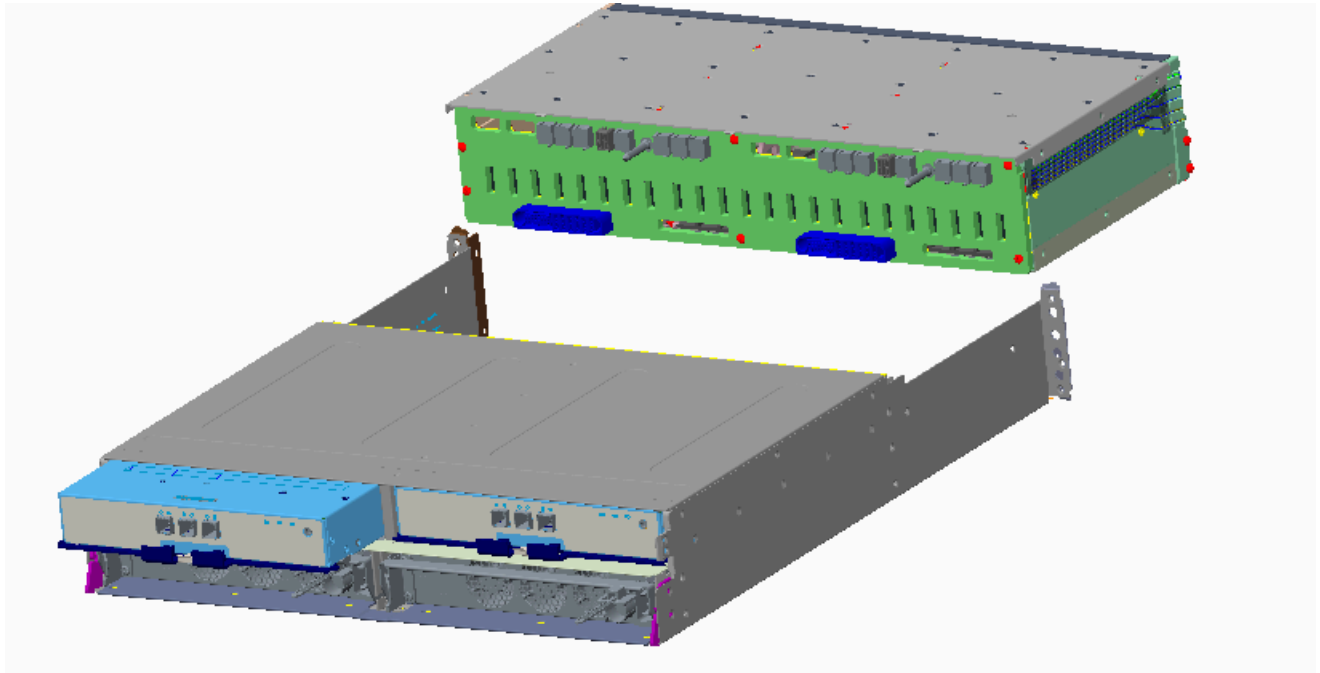
5.5 Chassis Description

Figure 13: Chassis Front and Rear

Drive Bays   PSU/ESM Bays
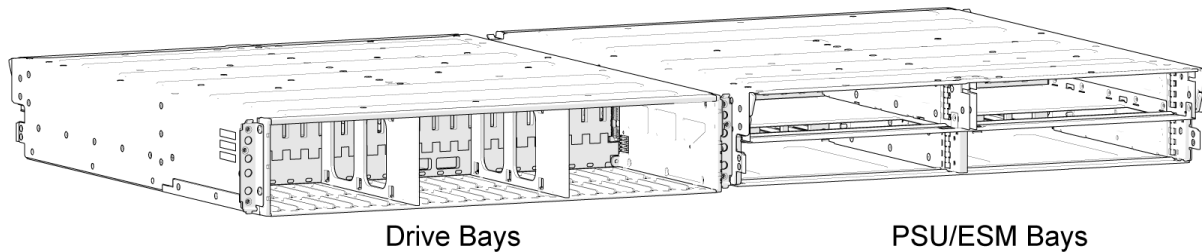
The 2U24 Flash Storage Platform chassis is a 2U, 87.4mm (H) x 446.8mm (W) x 536mm (D) steel enclosure that is SBB 2.1 compliant. The chassis is split into two compartments: the drivecage and the rear component bay that houses the ESM and PSU. It includes the platforms Midplane that attaches to the drivecage and provides the 24 connections to the SSDs.

5.6 Rails Description

Figure 14: Rails
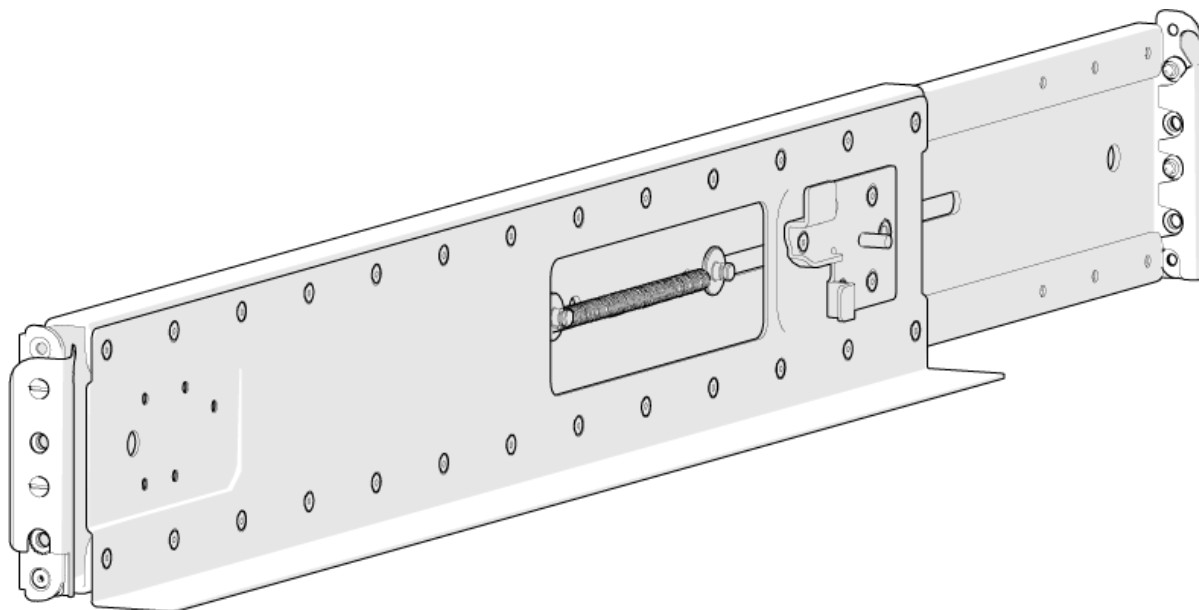
The rack rail kit that comes with the 2U24 Flash Storage Platform contains 2 toolless, 2U, shelf style rails that can extend from 24in. to 30in. A 34in. set of rails are available for racks with vertical rails that are spaced farther apart. The rails have a tensioning spring that keeps them extended but allows them to collapse to fit the rack they are installed it. They are secured to the rack using a clip that is rotated to the open position pre-installation and closed after install to enclose around the brackets on the rail and the rack posts.

Management

In This Chapter:

6.1 PSU Replacement Procedure

Table 9: Replacement Procedure Info

Required Tools	# of People Required	Time Required
None	1	10 Minutes

To replace a power supply unit (PSU), do the following:

> 📄 **Note:**
> - Ensure that you store all removed parts in a safe location while replacing the CRU.
> - The PSUs are hot-swappable. The enclosure does not need to be powered down in order to replace them.

Step 1: Remove the power cable from the PSU.

    a. From the rear of the enclosure, locate the power cable.

Figure 15: Power Cable and Handle Release
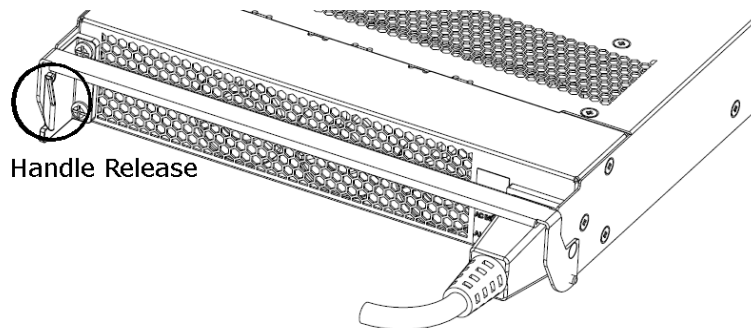
Handle Release

    b. Detach the cable retention clip from the power cord.

Figure 16: Cable Retention Mechanism
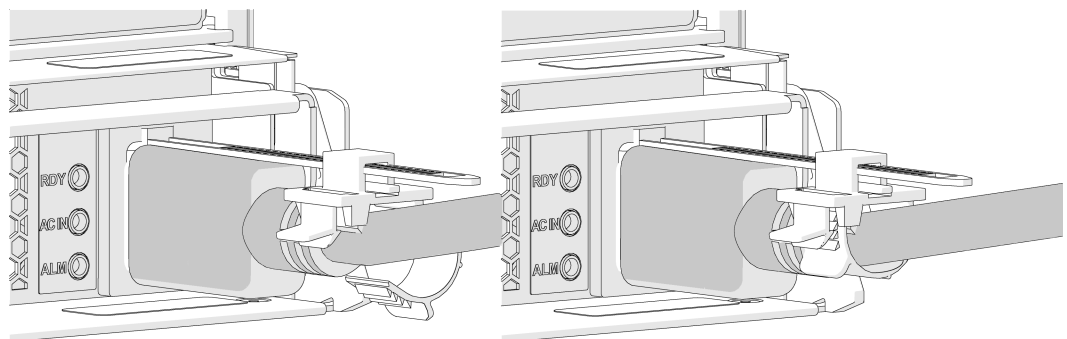
    c. Remove the power cord by pulling firmly, but do not jerk it out of the unit.

Step 2: Uninstall the PSU.

    a. Press the handle release as shown in the previous image.
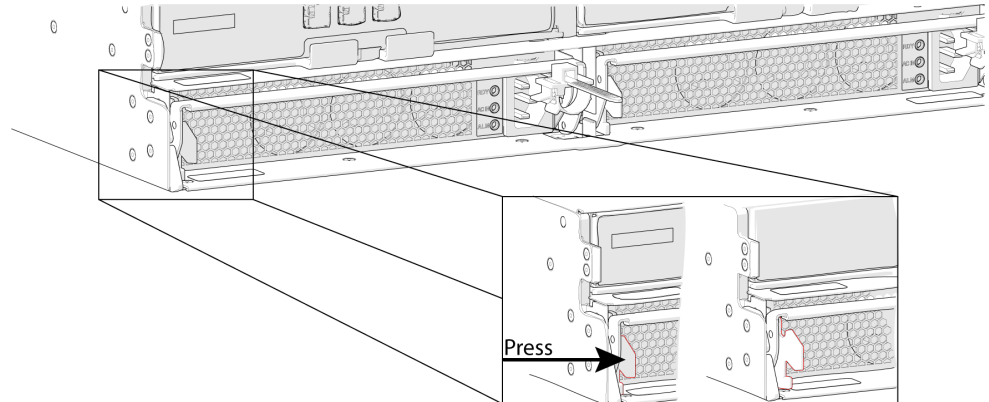
Press

    b. With the release pressed, swing the handle downward.
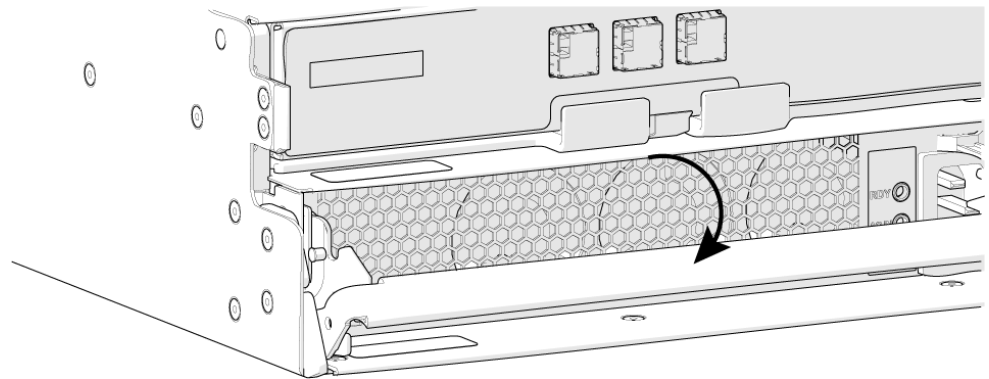
    c. Use the handle to pull with even pressure and remove the PSU.

Pull
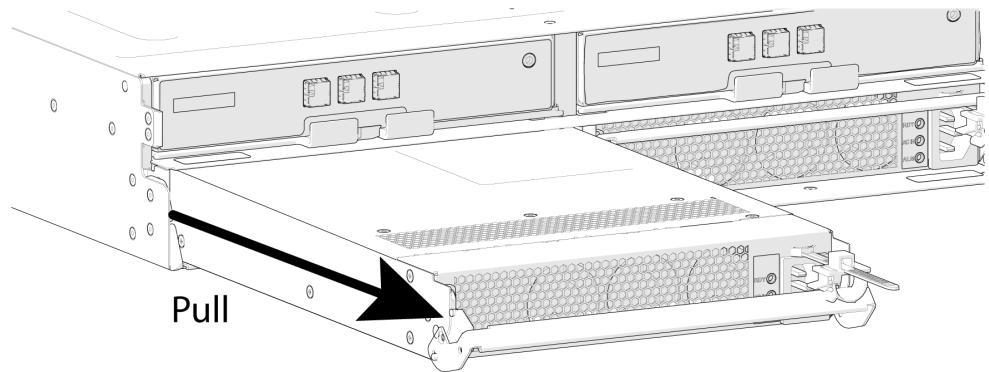
Step 3: Install the PSU.

    a. Align the PSU with the empty slot and slide it forward until it stops (don't force it).

    b. Apply light, even pressure with one hand and lift the handle with the other until the handle locks in place.

Step 4: Insert the power cables into the rear of the PSU.

    a. Plug the power cable into the receptacle at the back of the PSU.

a. Loop the retention clip around the cable and pinch it until the clip catches and locks in place.

Figure 17: Cable Retention Mechanism
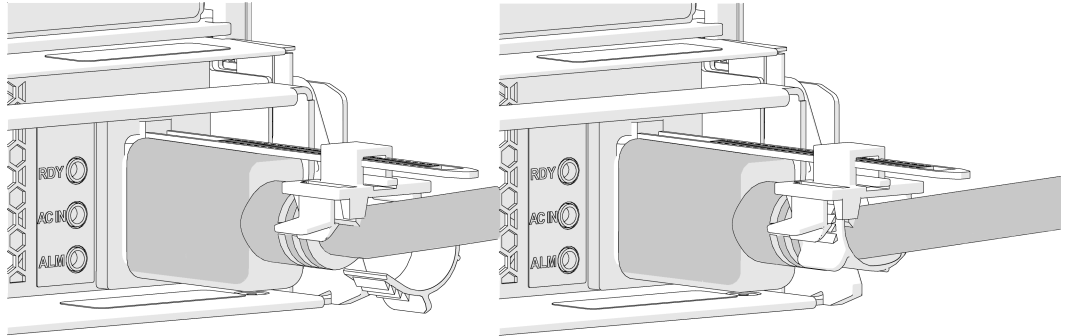
b. Slide the retention clip forward until it stops near the cable connector. Doing this will ensure that the retention clip functions properly in the event the cable is yanked on for some reason.

Figure 18: Cinching Cable Retention Clip
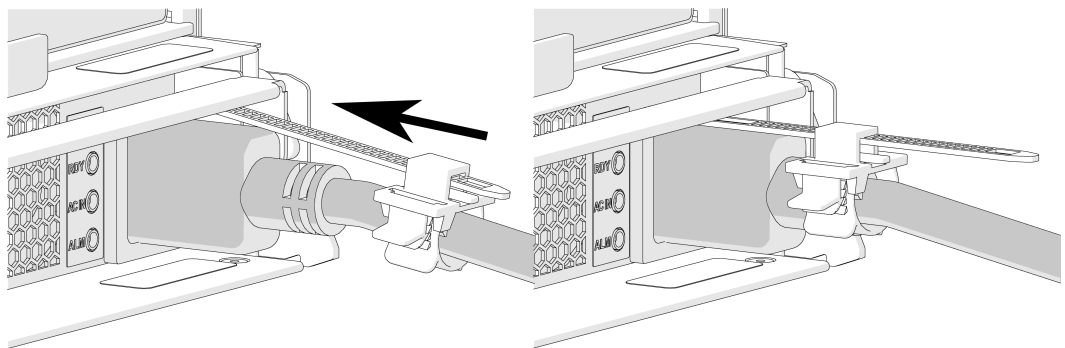
6.2 ESM Replacement Procedure

Table 10: Replacement Procedure Info

| Required Tools	# of People Required	Time Required
None	1	10 Minutes

Note:

- Ensure that you store all removed parts in a safe location while replacing the CRU.
- The PSUs are hot-swappable. The enclosure does not need to be powered down in order to replace them.

Step 1: Remove the three HD Mini-SAS cables attached to the faulty ESM.
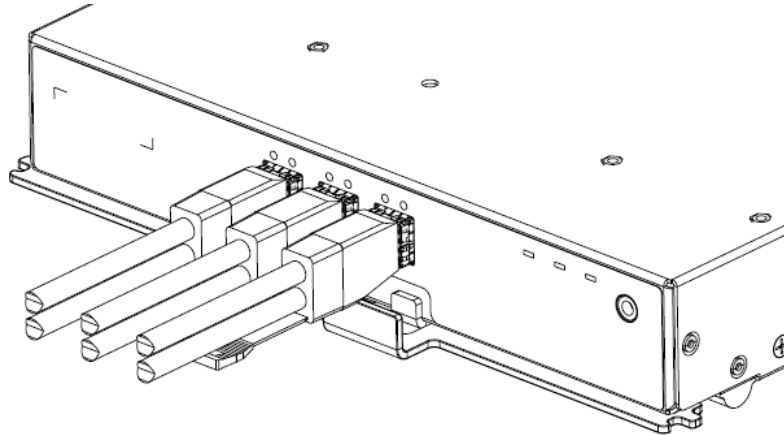

    a. To remove an HD Mini-SAS cables, pull (don't jerk) on the blue tab that is extending outward from the connector. This will free the cable from the port.

    b. Make sure the cable is labeled or label it yourself to ensure that it will be plugged back into the same location.

Step 2: Uninstall the ESM.

    a. To release the ESM from the enclosure, press up on the release lever to allow the handles to swing out.

Press Upward
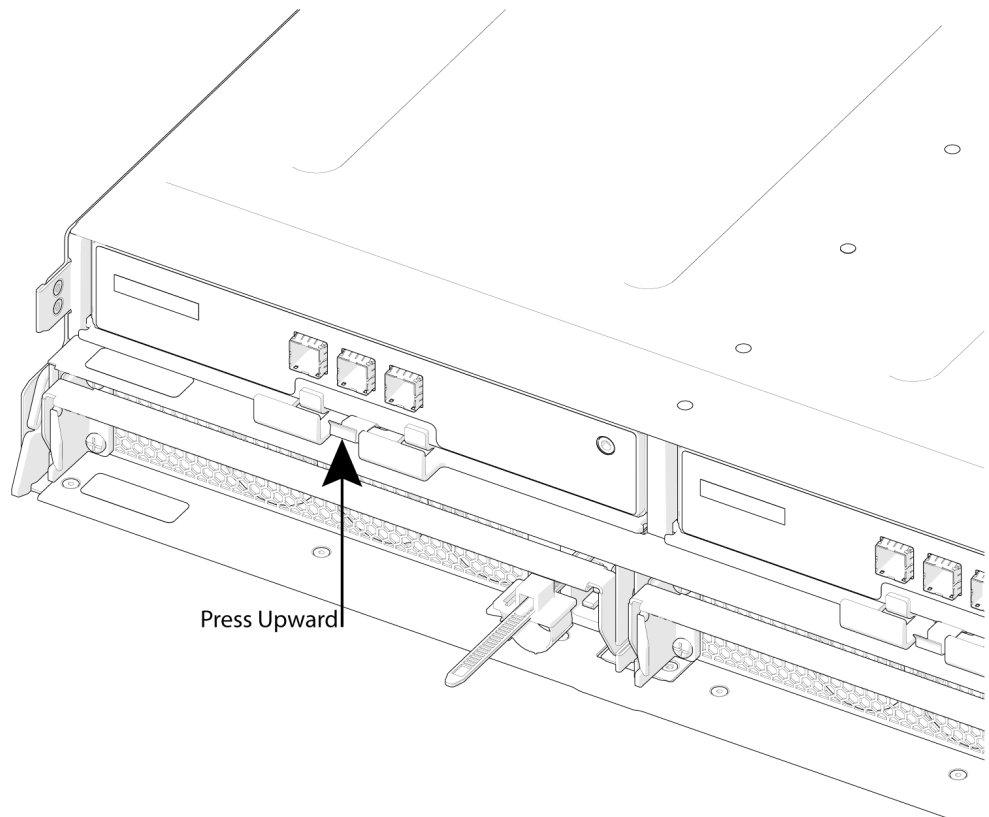
    b. The swing arm handles will swing forward.
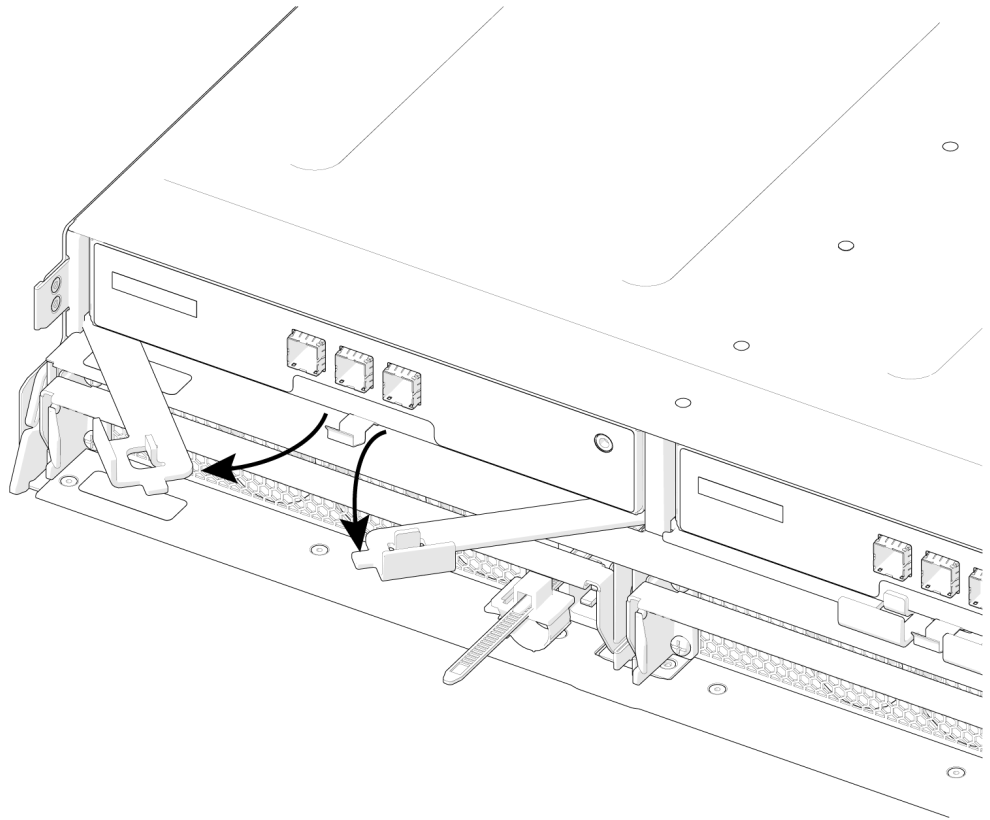
c. Grasp both handles and slide the ESM out with even pressure.
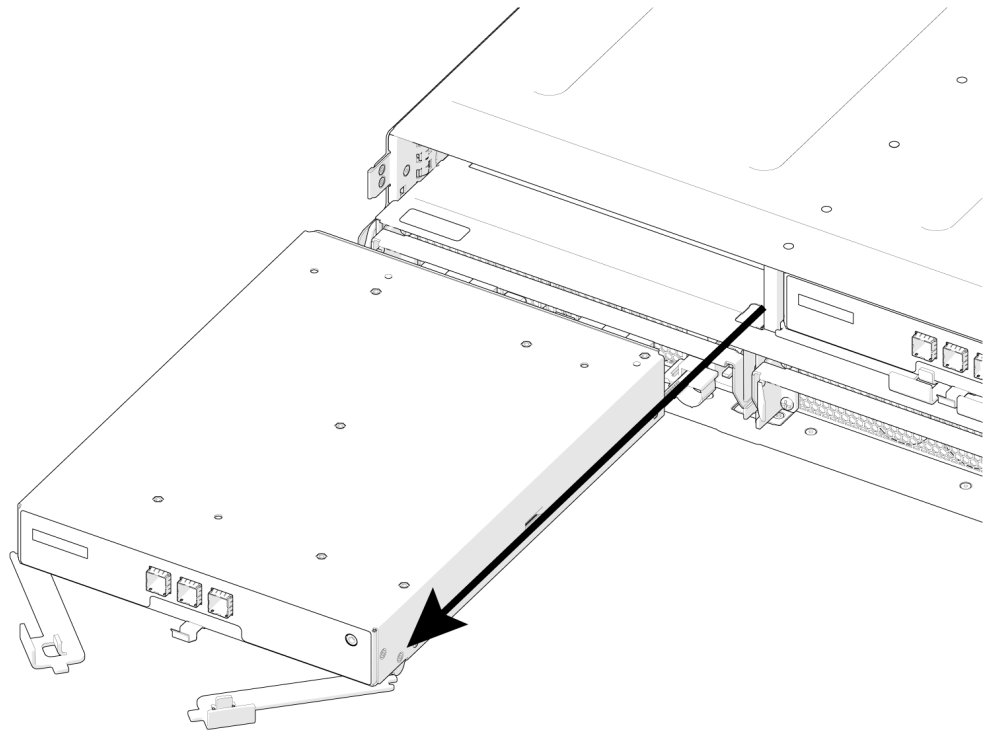
Step 3: Install the ESM.

a. Ensure the two swing arms are in the extended position before installing the ESM.

b. Insert the ESM into the empty slot and push it forward until it will not proceed further.

c. Use one hand to apply light, even pressure on the ESM, and use the other hand to fold the swing arms back in toward the ESM until they lock in place.

Step 4: Install the HD Mini-SAS cables into the rear of the ESM.

a. Read the label on each cable to ensure it is being installed in the correct port.

b. To insert the connector into the port, orient the cable so that the blue release tab is facing the ground and insert the connector into the port until it locks.
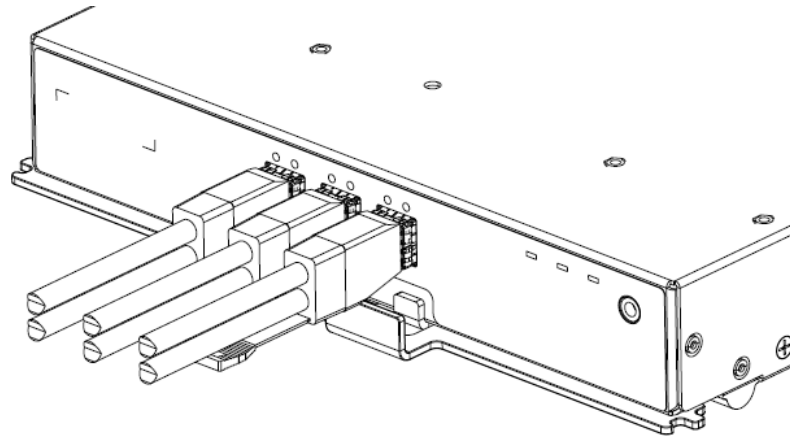
c. Complete these steps for each cable until all are installed.

d. When there is power running to the platform, the activity LED at the back of the ESM will turn on and remain solid if there is no IO to the drives. This will ensure that it is installed correctly.

6.3 Drive Assembly Replacement Procedure

Note:

- Ensure that you store all removed parts in a safe location while replacing the CRU.
- The PSUs are hot-swappable. The enclosure does not need to be powered down in order to replace them.

Table 11: Replacement Procedure Info

Required Tools	# of People Required	Time Required
None	1	2 Minutes

Step 1: Uninstall the drive assembly.

a. If the drive is faulty, locate it by the amber fault LED flashing on the drive carrier (LED #2). Otherwise, activate the ident light for the drive that will be replaced.

Figure 19: Drive Carrier Fault LED
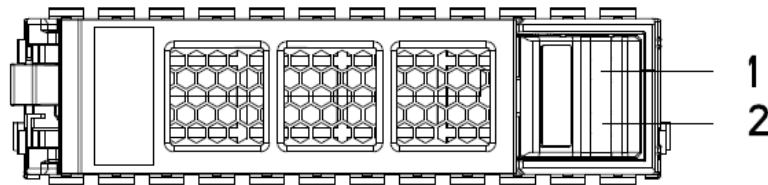
b. To remove the drive assembly, press the release button to unlatch the drive carrier from the enclosure. The carrier's handle should extend out of the enclosure.
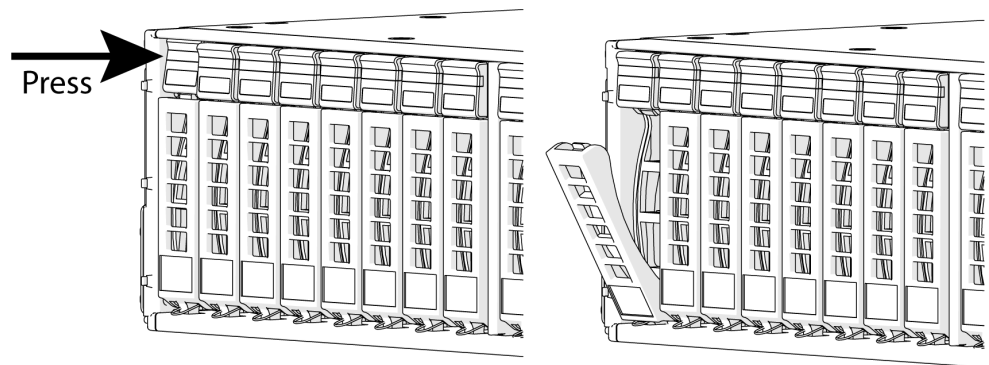
c. Grasp the handle and pull the drive out with even pressure.
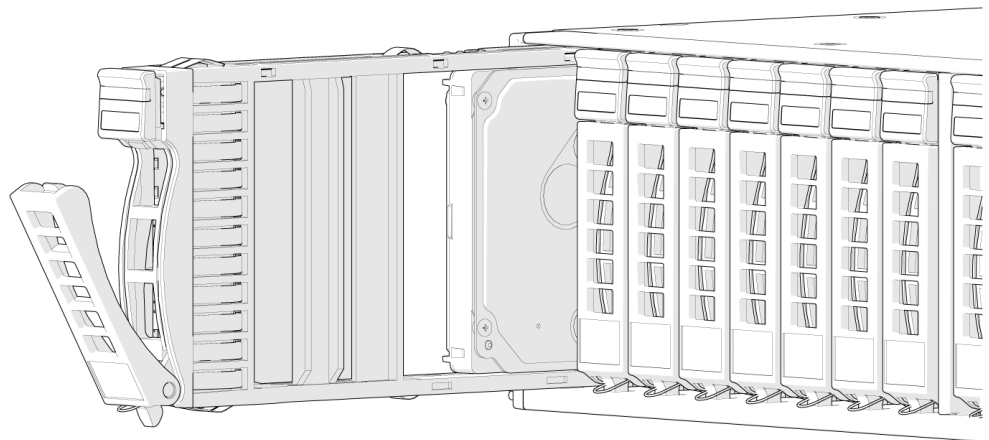
Step 2: Install the drive assembly.

    a. If the drive carrier handle is not in the open state, press the release button to unlatch the drive carrier from the enclosure. The carrier's handle should extend out.

    b. Align the drive assembly such that the release button is facing up and the handle is facing away from the enclosure, and slide the drive assembly into the empty drive bay.

    c. Press against the drive (not the handle) until it will not go in any further.

    d. Lift the drive assembly handle in toward the enclosure until it locks in place. This will secure the drive to the enclosure.

6.4 Chassis Replacement Procedure

Table 12: Replacement Procedure Info

Required Tools	# of People Required	Time Required
Philips Head Screwdriver	2 - Chassis Team Lift	45 minutes

Step 1: Remove the power cable from the PSU.

    a. From the rear of the enclosure, locate the power cable.

Figure 20: Power Cable and Handle Release

Handle Release
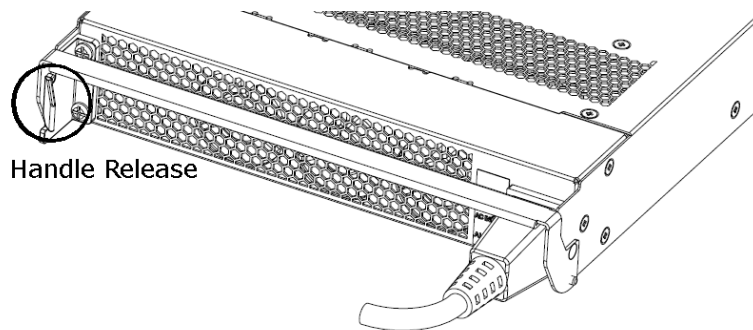
    b. Detach the cable retention clip from the power cord.

Figure 21: Cable Retention Mechanism
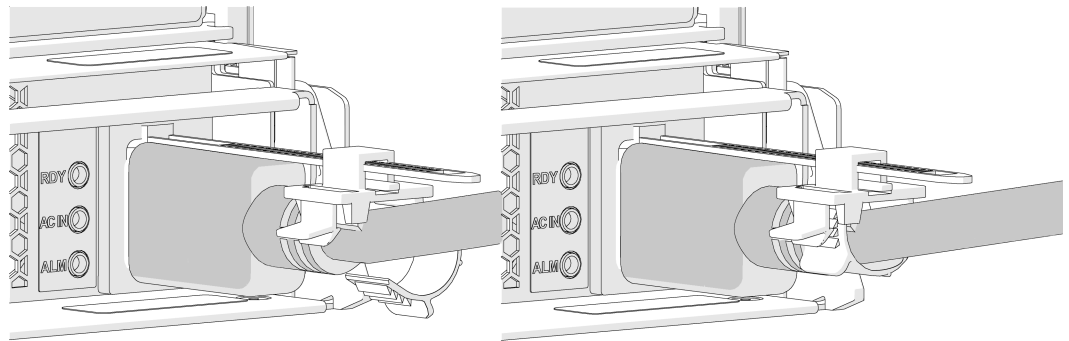
    c. Remove the power cord by pulling firmly, but do not jerk it out of the unit.

Step 2: Repeat the previous step for the power cable on the second PSU.

Step 3: Remove the three HD Mini-SAS cables attached to the faulty ESM.
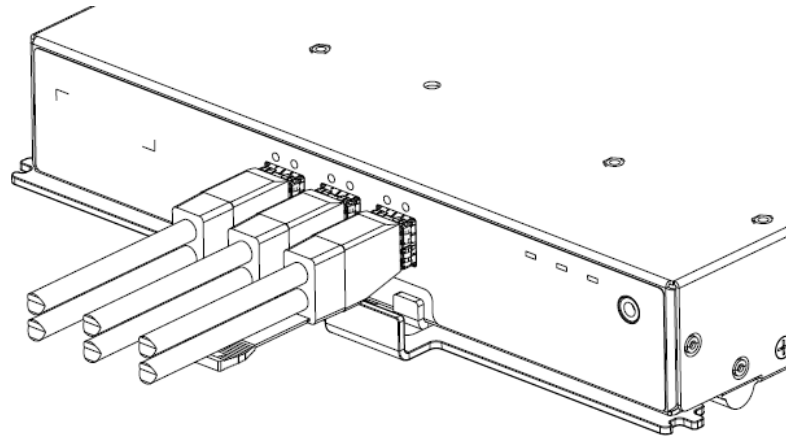
   a. To remove an HD Mini-SAS cables, pull (don't jerk) on the blue tab that is extending outward from the connector. This will free the cable from the port.

   b. Make sure the cable is labeled or label it yourself to ensure that it will be plugged back into the same location.

Step 4: Repeat the previous step for the HD Mini-SAS cables on the second ESM.

Step 5: Move to the front of the enclosure and begin removing drives, making sure that the drive is labeled as to what bay it was removed from. The drives bays are numbered from left to right starting at 0 and counting up.

Step 6: Uninstall the drive assembly.

   a. If the drive is faulty, locate it by the amber fault LED flashing on the drive carrier (LED #2). Otherwise, activate the ident light for the drive that will be replaced.

Figure 22: Drive Carrier Fault LED
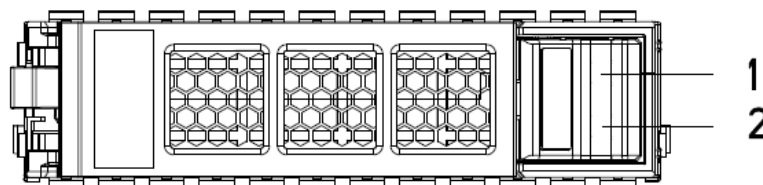
   b. To remove the drive assembly, press the release button to unlatch the drive carrier from the enclosure. The carrier's handle should extend out of the enclosure.
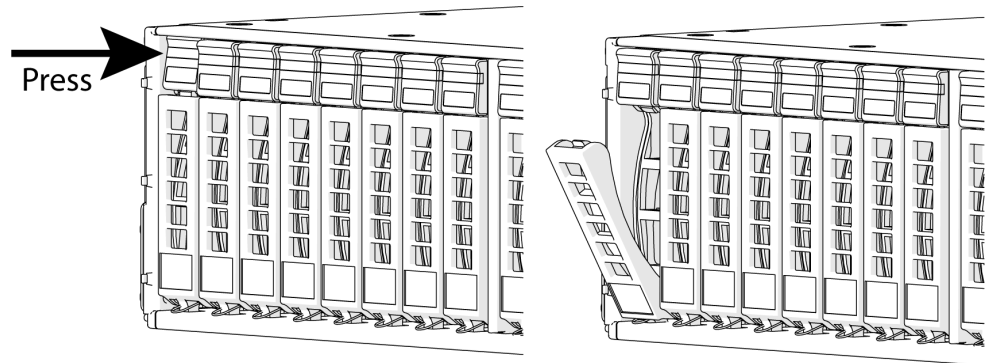
Press

c. Grasp the handle and pull the drive out with even pressure.
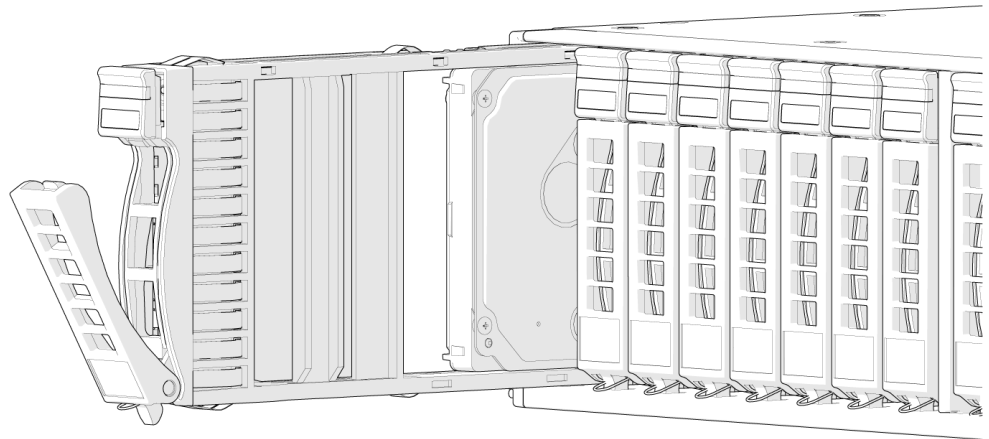
Step 7: Complete the previous step for each drive assembly and set each one aside in an ESD safe environment. Do not stack them on top of one another.

Step 8: Remove the rack ears that are covering the screws on the front of the enclosure.

Step 9: Unscrew the screws that were covered by the rack ears. These screws secure the chassis to the rack.

Step 10: Slide the enclosure out of the rack as shown in the following image.

Push
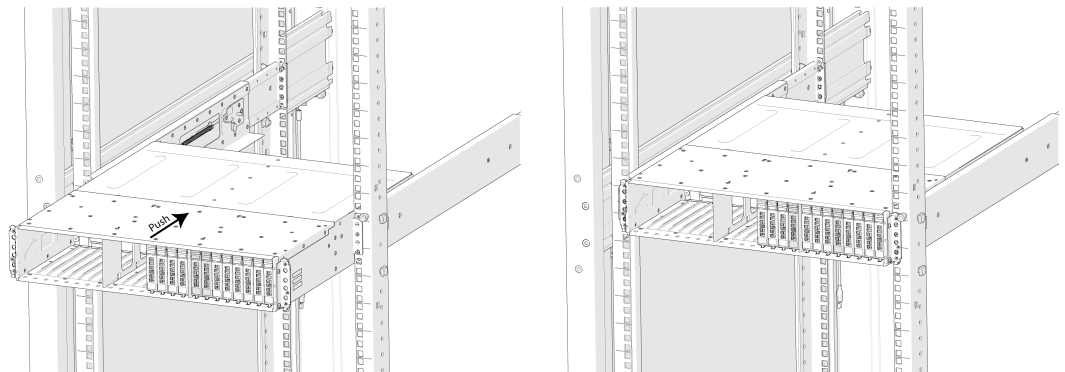
Step 11: Install the replacement chassis in the empty slot left.

Step 12: Reinstall the screws that secure the chassis to the rack, and reinstall the rack ear bezels over them.

Step 13: Install the drive assembly.

    a. If the drive carrier handle is not in the open state, press the release button to unlatch the drive carrier from the enclosure. The carrier's handle should extend out.

    b. Align the drive assembly such that the release button is facing up and the handle is facing away from the enclosure, and slide the drive assembly into the empty drive bay.

    c. Press against the drive (not the handle) until it will not go in any further.

    d. Lift the drive assembly handle in toward the enclosure until it locks in place. This will secure the drive to the enclosure.

Step 14: Complete the previous step for each drive assembly, making sure that the drive is inserted in the correct slot according to the labels that were added earlier.

Step 15: Install the HD Mini-SAS cables into the rear of the ESM.

    a. Read the label on each cable to ensure it is being installed in the correct port.

    b. To insert the connector into the port, orient the cable so that the blue release tab is facing the ground and insert the connector into the port until it locks.
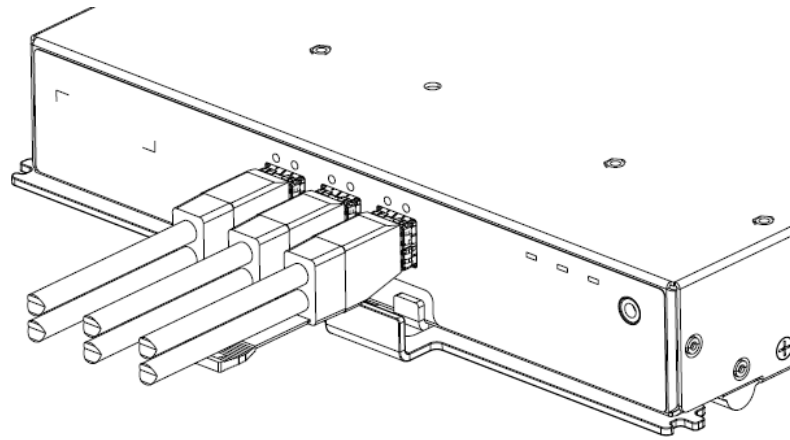
    c. Complete these steps for each cable until all are installed.

    d. When there is power running to the platform, the activity LED at the back of the ESM will turn on and remain solid if there is no IO to the drives. This will ensure that it is installed correctly.

Step 16: Insert the power cables into the rear of the PSU.

    a. Plug the power cable into the receptacle at the back of the PSU.

    a. Loop the retention clip around the cable and pinch it until the clip catches and locks in place.

Figure 23: Cable Retention Mechanism
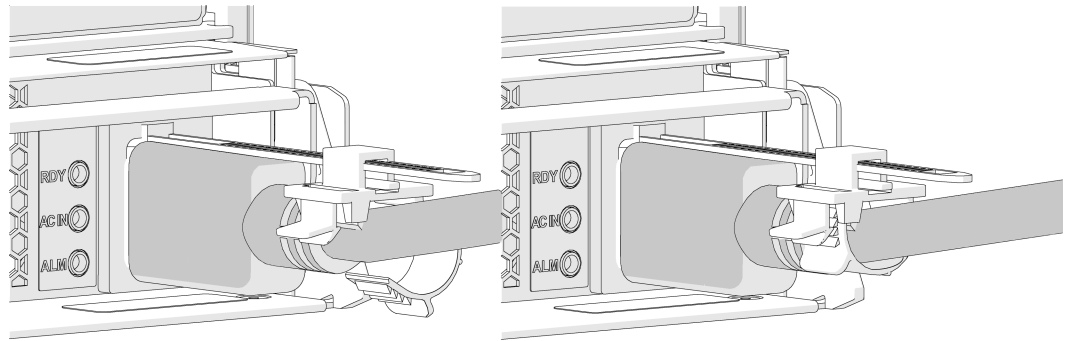
b. Slide the retention clip forward until it stops near the cable connector. Doing this will ensure that the retention clip functions properly in the event the cable is yanked on for some reason.

Figure 24: Cinching Cable Retention Clip
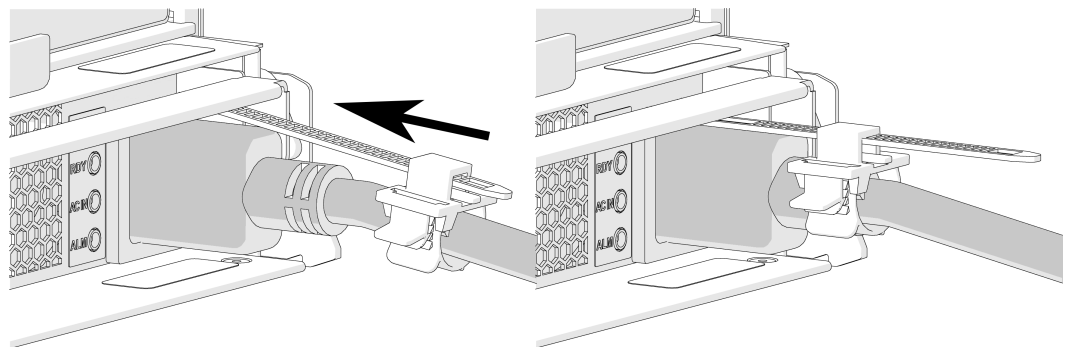
Step 17 : Complete the previous step for the power cable in the second PSU.

6.5 Rails Replacement Procedure

Table 13: Replacement Procedure Info

Required Tools	# of People Required	Time Required
None	1	25 Minutes

Step 1: Uninstall the rails from the rack.

a. From the back of the rack, rotate the metal clip that secures the rail to the rack out to free the front end of the rail from the rack.
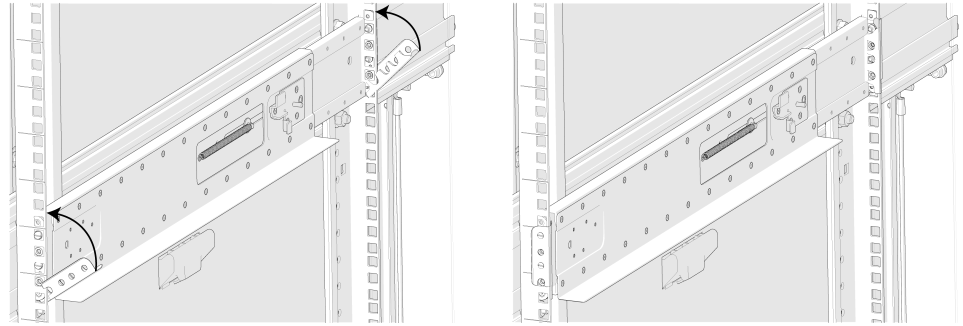
b. Move to the front of the rack, and do the same to the metal clip on that side. The rail is now not secured to the rack by anything other then tension from the tensioning spring.

c. Grasp the rail with both hands from the front of the rack and apply forward pressure. This will tension the rail and free it from the front of the rack.

d. The rail can now be removed fully.

e. Complete the same sequence to remove the other rail.

Step 2: Unpack the replacement rails and locate the tensioning springs in the box.

Step 3: Attach the tensioning springs to each rail.

a. Locate the tensioning springs in the kit's packaging. The 2U24 Flash Storage Platform rail kits come with two tensioning springs in the box that need to be attached for the rails to function properly.

b. Extend the rail fully.

c. Find the cutout in the on the inner side of the rail, the side that the shelf is on. The cutout is rectangular and there are two mushroom shaped rivets spaced about 3 inches apart inside.
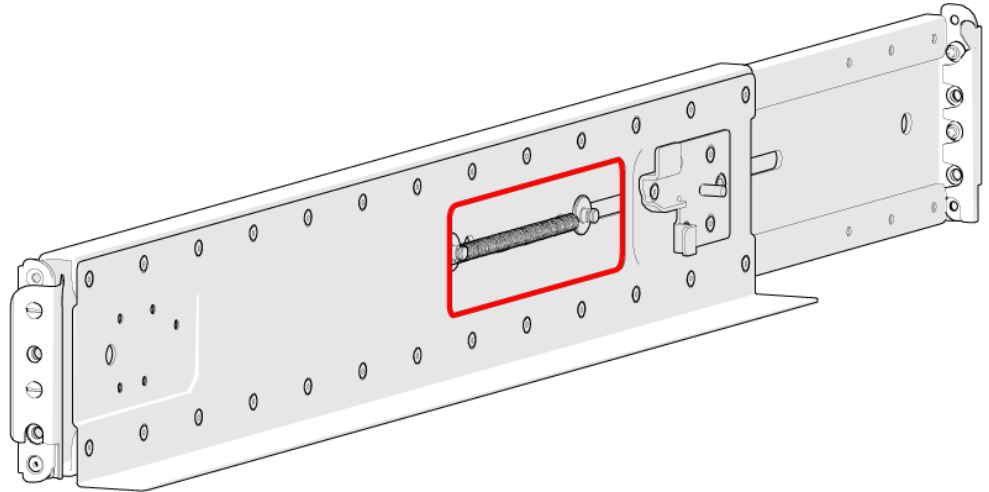
d. Attach one end of the tensioning springs to each rivet.
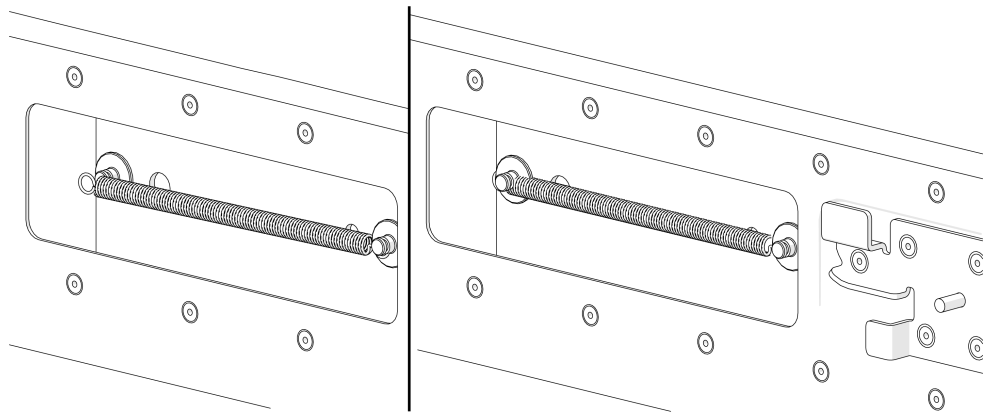
Step 4: Install the rails into the rack.

a. Rotate the clips at the front and rear ends of the rail to reveal the rail posts.
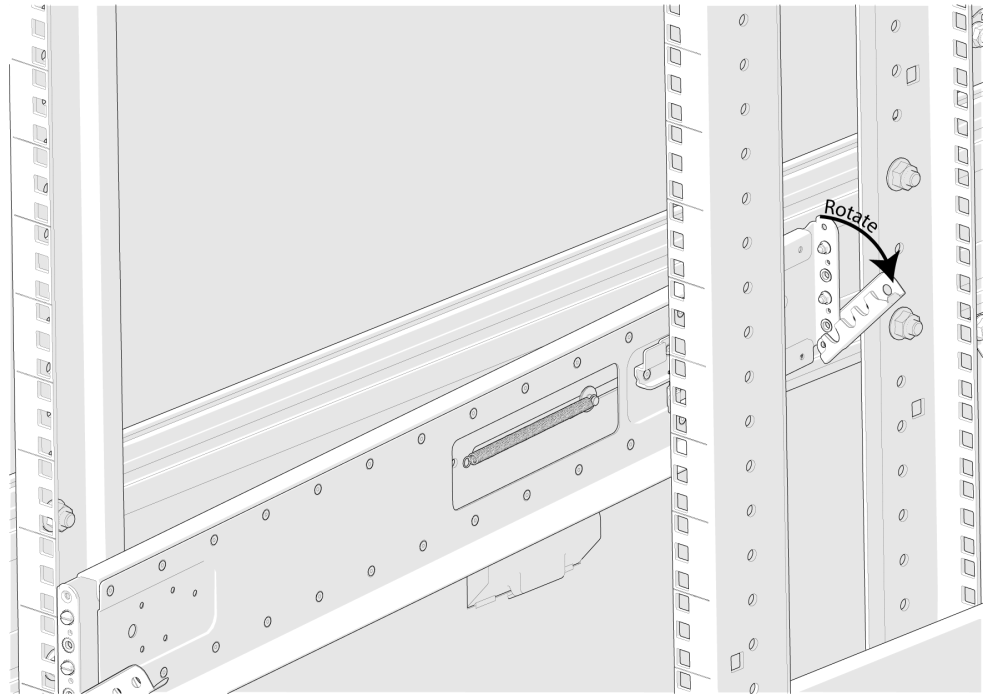
b. From the front of the rack, orient the rail so that the shelf is facing the interior of the rack, and the collabsible end is facing the rear of the rack.

c. Lead the collapsible end toward the holes on the rear of the rack, and rest the posts on the end of the rail in the holes at the desired U-height.

d. Apply light forward pressure to the rail to collapse it enough the clear the support posts at the front of the rail to the holes in the front of the rack.
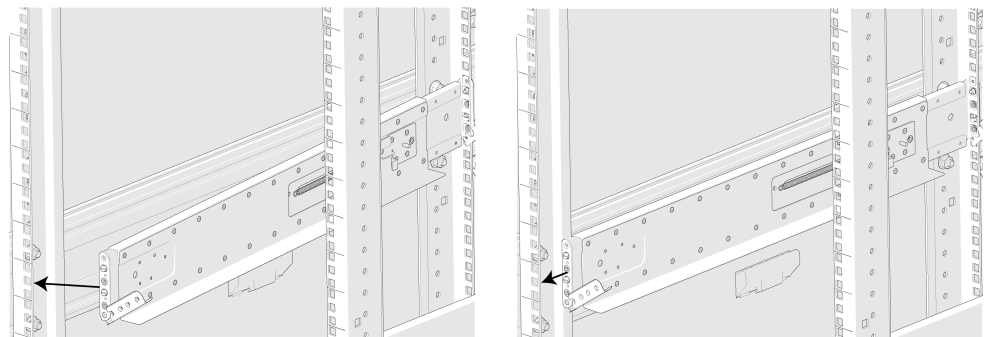
e. Align the rail with the holes on the rack at the desired u-height and insert the rail posts into the holes in the front. The rail will now be secured by tension only to the rack.

f. Close the clips on the front and rear ends of the rail to secure it to the rack.
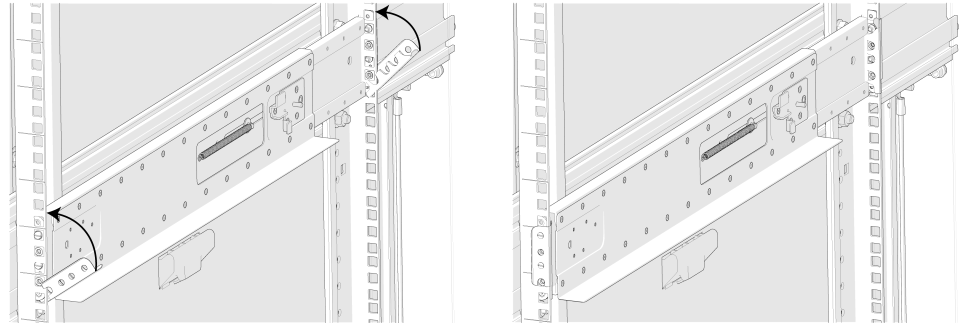
g. Complete the same sequence for the other rail.

6.6 T10 Zoning

T10 Zoning enables different hosts to access their own sets of drives on a single enclosure. The 2U24 Flash Storage Platform uses a PHY based zoning model in which a given SAS connector PHY or set of PHYs has access to a drive PHY or set of PHYs. Access to zone groups is granted based on a zone permission table and zone configuration table setup on the expanders within each ESM. The configurations listed in this section are based on a fully populated enclosure containing 24 drives of either SAS or SATA with each zone consisting of 8 drives resulting in a configuration of 8/8/8. Zoning only needs to be configured or disabled from a single host. Once zoning has been configured, each of three hosts that are connected will have access to the enclosure and only the drives that each should see.

6.6.1 Before Zoning

This section provides information on actions that should be taken before starting zoning on the 2U24 Flash Storage Platform.

Users should install all of the required downloads before beginning the zoning process.

Required Downloads:

- SMP Tools 0.98 for Linux: http://sg.danny.cz/sg/smp_utils.html
- SG3 Utils: http://sg.danny.cz/sg/sg3_utils.html
- CLI Tools: to download the latest version of CLI tools, see: Downloading Firmware from the Support Portal *(page 61)*

6.6.2 Enclosure Cabling for Zoning

Physically connect the 2U24 Flash Storage Platform to the host servers using SAS cables in the configuration displayed below.

Figure 25: SAS Cable Configuration
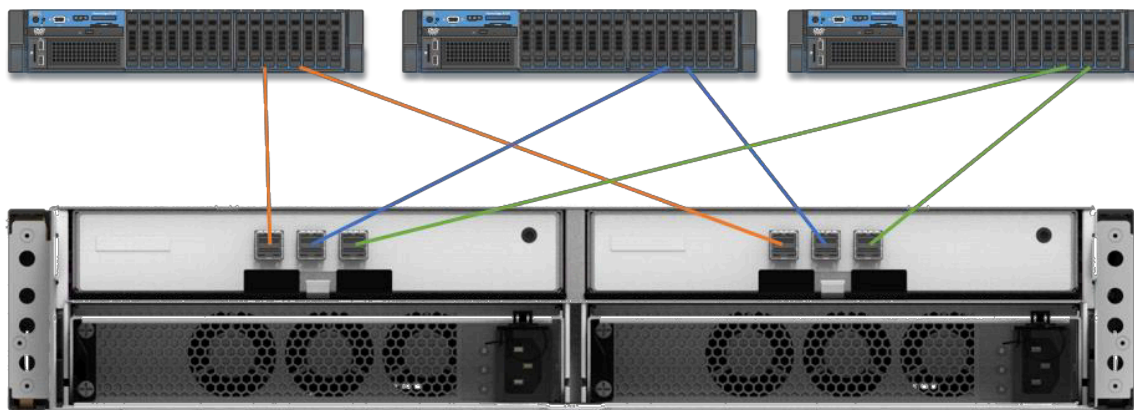
Table 14: SAS Cable Configuration

Host Connection (SAS Port)		Enclosure Connection (SAS Port)
Host 1	ESM A	Port 1
Host 1	ESM B	Port 1
Host 2	ESM A	Port 2
Host 2	ESM B	Port 2
Host 3	ESM A	Port 3
Host 3	ESM B	Port 3

6.6.3 Enabling Zoning using Linux

Step 1:

Step 2 : Enable zoning for each of the sg devices that are associated with the 2U24 Flash Storage Platform ESMs.

    a. Issue the following command to enable zoning on ESM A using the first sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "zone set 1"
```

Example of Enabling zoning on the First ESM Device Results

```
cli_cmd = zone set 1

Zoning function has been ENABLED with default THREE_MACHINES
 configuration!
```

    b. Issue the following command to enable zoning on ESM B using the second sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "zone set 1"
```

Example of Enabling zoning on the Second ESM Device Results

```
cli_cmd = zone set 1

Zoning function has been ENABLED with default THREE_MACHINES
 configuration!
```

Step 3: Verify the zoning status for each of the sg devices.

    a. Issue the following command for ESM A using the first sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "zone get"
```

Example of Identifying the Zoning Status of the First sg Device Results

```
cli_cmd = zone get
[INFO] wait for responding...
Zone Function ENABLED!
```

    b. Verify that the zone get command reports a `Zone Function ENABLED!` message and results for the sg device. The results will also display the Zone Group Info and Permission Table for that specific ESM.

    c. Issue the following command for ESM B using the second sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "zone get"
```

Example of Identifying the Zoning Status of the Second sg Device Results

```
[root@lab]# hgst_cli_tool -d /dev/<devicenumber> -c "zone get"
cli_cmd = zone get
[INFO] wait for responding...
Zone Function ENABLED!
```

    d. Verify that the zone get command reports a `Zone Function ENABLED!` message and results for the sg device. The results will also display the Zone Group Info and Permission Table for that specific ESM.

Step 4: Reset the ESMs using hgst_cli_tool.

    a. Issue the following command to reset ESM A using the first sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "reset 0"
```

Example of Resetting First sg Device Results

```
cli_cmd = reset 0
```

    b. Issue the following command to reset ESM B using the first sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "reset 0"
```

Example of Resetting Second sg Device Results

```
cli_cmd = reset 0
```

Step 5: Verify the zoning groups for each of the hosts using the smp_discover_list command.

    a. Issue the following command to locate the expander handles:

```
ls /dev/bsg
```

Example of the Expander Handles

```
0:0:0:0     1:0:110:0  1:0:119:0             end_device-1:6:6
 end_device-1:7:6
1:0:102:0  1:0:111:0  2:0:0:0               end_device-1:6:7
 end_device-1:7:7
1:0:103:0  1:0:112:0  end_device-0:0:0  end_device-1:6:8
 end_device-1:7:8
1:0:104:0  1:0:113:0  end_device-1:6:0  end_device-1:7:0
 expander-0:0
1:0:105:0  1:0:114:0  end_device-1:6:1  end_device-1:7:1
   expander-1:6
1:0:106:0  1:0:115:0  end_device-1:6:2  end_device-1:7:2
   expander-1:7
1:0:107:0  1:0:116:0  end_device-1:6:3  end_device-1:7:3  sas_host0
1:0:108:0  1:0:117:0  end_device-1:6:4  end_device-1:7:4  sas_host1
1:0:109:0  1:0:118:0  end_device-1:6:5  end_device-1:7:5
```

b. Issue the following command to access a single host's SMP Discover output:

```
smp_discover_list /dev/bsg/expander-1:6
```

Example of a Single Host smp_discover_list

```
phy   0:U:attached:[5001173100dd54ad:00  t(SSP)]  12 Gbps  ZG:8
  phy   1:U:attached:[5001173100ded8f9:00  t(SSP)]  12 Gbps  ZG:8
  phy   2:U:attached:[5001173100dd685d:00  t(SSP)]  12 Gbps  ZG:8
  phy   3:U:attached:[5001173100decaf9:00  t(SSP)]  12 Gbps  ZG:8
  phy   4:U:attached:[5001173100df8e7d:00  t(SSP)]  12 Gbps  ZG:8
  phy   5:U:attached:[5001173100dd6891:00  t(SSP)]  12 Gbps  ZG:8
  phy   6:U:attached:[5001173100ffff0d:00  t(SSP)]  12 Gbps  ZG:8
  phy   7:U:attached:[5001173100dd7fe1:00  t(SSP)]  12 Gbps  ZG:8
  phy   8: inaccessible (phy vacant)
  phy   9: inaccessible (phy vacant)
  phy  10: inaccessible (phy vacant)
  phy  11: inaccessible (phy vacant)
  phy  12: inaccessible (phy vacant)
  phy  13: inaccessible (phy vacant)
  phy  14: inaccessible (phy vacant)
  phy  15: inaccessible (phy vacant)
  phy  16: inaccessible (phy vacant)
  phy  17: inaccessible (phy vacant)
  phy  18: inaccessible (phy vacant)
  phy  19: inaccessible (phy vacant)
  phy  20: inaccessible (phy vacant)
  phy  21: inaccessible (phy vacant)
  phy  22: inaccessible (phy vacant)
  phy  23: inaccessible (phy vacant)
  phy  24: inaccessible (phy vacant)
  phy  25: inaccessible (phy vacant)
  phy  26: inaccessible (phy vacant)
  phy  27: inaccessible (phy vacant)
  phy  28: inaccessible (phy vacant)
  phy  29: inaccessible (phy vacant)
  phy  30: inaccessible (phy vacant)
  phy  31: inaccessible (phy vacant)
```

```
    phy  32: inaccessible (phy vacant)
    phy  33: inaccessible (phy vacant)
    phy  34: inaccessible (phy vacant)
    phy  35: inaccessible (phy vacant)
    phy  36:D:attached:[500e0eca0653fa3d:36  V i(SSP) t(SSP)]  12 Gbps
```

c. Zone group 8 can be identified by the `ZG:8` located at the end of each line in zone 8. The above example displays PHYs 0-7 as being in zone group 8. All other devices are labeled as `inaccessible` because the host is displaying the only devices it has access to. The step can be repeated on other hosts to see what zone group each host has access to.

d. Issue the following command to access all hosts smp_discover_list:

```
smp_discover_list --ignore /dev/bsg/expander-1:6
```

Example of All Hosts smp_discover_list

```
phy   0:U:attached:[5001173100dd54ad:00  t(SSP)]  12 Gbps  ZG:8
  phy   1:U:attached:[5001173100ded8f9:00  t(SSP)]  12 Gbps  ZG:8
  phy   2:U:attached:[5001173100dd685d:00  t(SSP)]  12 Gbps  ZG:8
  phy   3:U:attached:[5001173100decaf9:00  t(SSP)]  12 Gbps  ZG:8
  phy   4:U:attached:[5001173100df8e7d:00  t(SSP)]  12 Gbps  ZG:8
  phy   5:U:attached:[5001173100dd6891:00  t(SSP)]  12 Gbps  ZG:8
  phy   6:U:attached:[5001173100ffff0d:00  t(SSP)]  12 Gbps  ZG:8
  phy   7:U:attached:[5001173100dd7fe1:00  t(SSP)]  12 Gbps  ZG:8
  phy   8:U:attached:[5001173100d38cad:00  t(SSP)]  12 Gbps  ZG:9
  phy   9:U:attached:[5001173100aeb871:00  t(SSP)]  12 Gbps  ZG:9
  phy  10:U:attached:[5001173100ad5179:00  t(SSP)]  12 Gbps  ZG:9
  phy  11:U:attached:[5001173100ad5275:00  t(SSP)]  12 Gbps  ZG:9
  phy  12:U:attached:[5001173100a92c95:00  t(SSP)]  12 Gbps  ZG:9
  phy  13:U:attached:[5001173100a9431d:00  t(SSP)]  12 Gbps  ZG:9
  phy  14:U:attached:[5001173100d38c59:00  t(SSP)]  12 Gbps  ZG:9
  phy  15:U:attached:[5001173100dfeae5:00  t(SSP)]  12 Gbps  ZG:9
  phy  16:U:attached:[5001173100a9189d:00  t(SSP)]  12 Gbps  ZG:10
  phy  17:U:attached:[5001173100d39081:00  t(SSP)]  12 Gbps  ZG:10
  phy  18:U:attached:[5001173100df8edd:00  t(SSP)]  12 Gbps  ZG:10
  phy  19:U:attached:[5001173100df74b1:00  t(SSP)]  12 Gbps  ZG:10
  phy  20:U:attached:[5001173100df7615:00  t(SSP)]  12 Gbps  ZG:10
  phy  21:U:attached:[5001173100df81cd:00  t(SSP)]  12 Gbps  ZG:10
  phy  22:U:attached:[5001173100ded6a9:00  t(SSP)]  12 Gbps  ZG:10
  phy  23:U:attached:[5001173100df7599:00  t(SSP)]  12 Gbps  ZG:10
  phy  24:U:attached:[500605b00a6f26c0:00  i(SSP+STP+SMP)]  12 Gbps
  ZG:11
  phy  25:U:attached:[500605b00a6f26c0:01  i(SSP+STP+SMP)]  12 Gbps
  ZG:11
  phy  26:U:attached:[500605b00a6f26c0:02  i(SSP+STP+SMP)]  12 Gbps
  ZG:11
  phy  27:U:attached:[500605b00a6f26c0:03  i(SSP+STP+SMP)]  12 Gbps
  ZG:11
  phy  28:U:attached:[500605b00cf57420:07  i(SSP+STP+SMP)]  12 Gbps
  ZG:12
  phy  29:U:attached:[500605b00cf57420:06  i(SSP+STP+SMP)]  12 Gbps
  ZG:12
  phy  30:U:attached:[500605b00cf57420:05  i(SSP+STP+SMP)]  12 Gbps
  ZG:12
  phy  31:U:attached:[500605b00cf57420:04  i(SSP+STP+SMP)]  12 Gbps
  ZG:12
```

```
  phy  32:U:attached:[500605b007438ba1:04  i(SSP+STP+SMP)]  12 Gbps
ZG:13
  phy  33:U:attached:[500605b007438ba1:05  i(SSP+STP+SMP)]  12 Gbps
ZG:13
  phy  34:U:attached:[500605b007438ba1:06  i(SSP+STP+SMP)]  12 Gbps
ZG:13
  phy  35:U:attached:[500605b007438ba1:07  i(SSP+STP+SMP)]  12 Gbps
ZG:13
  phy  36:D:attached:[500e0eca0653fa3d:36  V i(SSP) t(SSP)]  12 Gbps
```

   e. Zone groups 8, 9, and 10 can be identified by the `ZG` located at the end of each group in each of their respective zones. The above example displays PHYs 0-7 as being in zone group 8, PHYs 8-15 as being in zone group 9, and PHYs 16-23 as being in zone group 10.

Step 6: Verify the zone groups for each of the hosts using sg_ses page 02.

   a. Issue the following command to access sg_ses page 02 related to the first SCSI device:

```
sg_ses /dev/sg<devicenumber> -p2
```

Example of Page 02 on Zone Group 8

```
...
        Element 7 descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: OK
        OK=1, Reserved device=0, Hot spare=0, Cons check=0
        In crit array=0, In failed array=0, Rebuild/remap=0, R/R
 abort=0
        App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc
bypass B=0
        Ready to insert=0, RMV=0, Ident=0, Report=0
        App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device
off=0
        Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed
B=0

...

        Element 8 descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: No access
allowed
        OK=0, Reserved device=0, Hot spare=0, Cons check=0
        In crit array=0, In failed array=0, Rebuild/remap=0, R/R
abort=0
        App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc
bypass B=0
        Ready to insert=0, RMV=0, Ident=0, Report=0
        App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device
off=0
        Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed
B=0

...
```

   b. The status of each sg device that appear in PHYs 0-7 display `status: OK`. All other PHYs display `status:No access allowed` due to this specific host not having access to those sg devices.

   c. To view other zone groups on other hosts, log into each host and repeat this entire step.

6.6.4 Enabling Zoning using Windows

Step 1: From the host server, identify the SCSI devices that are associated with the 2U24 Flash Storage Platform ESMs.

> **Note:** The operating system associates each SEP device as a SCSI device. The SCSI device of the SEP can be used to get status from or control elements within the enclosure.

a. Issue the following command:

```
sg_scan -s | findstr /i encl
```

b. Identify the SCSI devices from the output. The device information follows **SCSI0**. The devices appear as **SCSI0:1,62,0** and **SCSI0:1,124,0** bolded in the example below.

```
SCSI0:1,62,0    claimed=0 pdt=dh         HGST        2U24_STOR_ENCL
      0428
SCSI0:1,124,0   claimed=0 pdt=dh         HGST        2U24_STOR_ENCL

      0428
```

Step 2: Enable zoning for each of the SCSI devices that are associated with the 2U24 Flash Storage Platform ESMs.

a. Issue the following command for ESM A using the first SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "zone set 1"
```

Example of Enabling the SCSI Device Results

```
cli_cmd = zone set 1

Zoning function has been ENABLED with default THREE_MACHINES
 configuration!
```

b. Issue the following command for ESM B using the second SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "zone set 1"
```

Example of Enabling the SCSI Device Results

```
cli_cmd = zone set 1

Zoning function has been ENABLED with default THREE_MACHINES
 configuration!
```

Step 3: Verify the zoning status for each of the SCSI devices.

a. Issue the following command for ESM A using the first SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "zone get"
```

Example of Identifying the Zoning Status of the First SCSI Device Results

```
cli_cmd = zone get
[INFO] wait for responding...
Zone Function ENABLED!
```

b. Verify that the zone get command reports a `Zone Function ENABLED!` message and results for the SCSI device. The results will also display the Zone Group Info and Permission Table for that specific ESM.

c. Issue the following command for ESM B using the second SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "zone get"
```

Example of Identifying the Zoning Status of the Second SCSI Device Results

```
cli_cmd = zone get
[INFO] wait for responding...
Zone Function ENABLED!
```

Step 4: Reset the ESMs using hgst_cli_tool.

a. Issue the following command to reset ESM A using the first SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "reset 0"
```

Example of Resetting First SCSI Device Results

```
cli_cmd = reset 0
```

b. Issue the following command to reset ESM B using the first SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "reset 0"
```

Example of Resetting Second sg Device Results

```
cli_cmd = reset 0
```

Step 5: Verify the zone groups for each of the host using sg_ses page 02.

a. Issue the following command to access sg_ses page 02 related to the first SCSI device:

```
sg_ses <devicenumber> -p2
```

Example of Page 02 on Zone Group 8

```
...
        Element 7 descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: OK
        OK=1, Reserved device=0, Hot spare=0, Cons check=0
        In crit array=0, In failed array=0, Rebuild/remap=0, R/R
 abort=0
        App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc
 bypass B=0
        Ready to insert=0, RMV=0, Ident=0, Report=0
        App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device
 off=0
        Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed
 B=0

...
```

```
        Element 8 descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: No access
allowed
        OK=0, Reserved device=0, Hot spare=0, Cons check=0
        In crit array=0, In failed array=0, Rebuild/remap=0, R/R
abort=0
        App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc
bypass B=0
        Ready to insert=0, RMV=0, Ident=0, Report=0
        App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device
off=0
        Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed
B=0

...
```

b. The status of each SCSI device that appear in PHYs 0-7 display `status: OK`. All other PHYs display `status:No access allowed` due to this specific host not having access to those SCSI devices.

c. To view other zone groups on other hosts, log into each host and repeat this entire step.

6.6.5 Disabling Zoning using Linux

Important: Ensure that zoning is disabled only during a maintenance window. Disabling zoning while multiple hosts are active on the enclosure could result in data corruption if another host gains access to a set of drives that it should not have access to. All hosts will have access to all drives after zoning is disabled.

Step 1: From the host server, identify the sg devices that are associated with the 2U24 Flash Storage Platform ESMs.

> **Note:** The operating system associates each SEP device as a sg device. The sg device of the SEP can be used to get status from or control elements within the enclosure.

a. Issue the following command:

```
sg_scan -i | grep -i enc -B 1
```

b. Identify the sg devices from the output. The devices can be identified by the **/dev/sg<devicenumber>**. The devices appear as **/dev/sg10** and **/dev/sg11** bolded in the example below.

```
/dev/sg10: scsi1 channel=0 id=17 lun=0
    HGST      2U24_STOR_ENCL    0428 [rmb=0 cmdq=1 pqual=0 pdev=0xd]
/dev/sg11: scsi1 channel=0 id=43 lun=0
    HGST      2U24_STOR_ENCL    0428 [rmb=0 cmdq=1 pqual=0 pdev=0xd]
```

Step 2: Disable zoning on each of the sg devices that are associated with the 2U24 Flash Storage Platform ESMs.

a. Issue the following command to disable zoning on ESM A using the first sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "zone set 0"
```

Example of Disabling the First sg Device Results

```
cli_cmd = zone set 0

Zoning function has been DISABLED!
```

b. Issue the following command to disable zoning on ESM B using the second sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "zone set 0"
```

Example of Disabling the Second sg Device Results

```
cli_cmd = zone set 0

Zoning function has been DISABLED!
```

Step 3: Verify that zoning has been disabled.

a. Issue the following command to disable zoning on ESM A using the first sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "zone get"
```

Example of Disabled First sg Device Results

```
cli_cmd = zone get
Zoning function DISABLED!
```

b. Issue the following command to disable zoning on ESM B using the second sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "zone get"
```

Example of Disabled Second sg Device Results

```
cli_cmd = zone get
Zoning function DISABLED!
```

Step 4: Reset the ESMs using hgst_cli_tool.

a. Issue the following command to reset ESM A using the first sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "reset 0"
```

Example of Resetting First sg Device Results

```
cli_cmd = reset 0
```

b. Issue the following command to reset ESM B using the first sg device:

```
hgst_cli_tool -d /dev/sg<devicenumber> -c "reset 0"
```

Example of Resetting Second sg Device Results

```
cli_cmd = reset 0
```

Step 5: Verify the zoning groups for each of the host using the smp_discover_list command.

a. Issue the following command to locate the expander handles:

```
ls /dev/bsg
```

Example of the Expander Handles

```
0:0:0:0    1:0:110:0  1:0:119:0          end_device-1:6:6
 end_device-1:7:6
1:0:102:0  1:0:111:0  2:0:0:0            end_device-1:6:7
 end_device-1:7:7
1:0:103:0  1:0:112:0  end_device-0:0:0  end_device-1:6:8
 end_device-1:7:8
1:0:104:0  1:0:113:0  end_device-1:6:0  end_device-1:7:0
 expander-0:0
1:0:105:0  1:0:114:0  end_device-1:6:1  end_device-1:7:1
   expander-1:6
1:0:106:0  1:0:115:0  end_device-1:6:2  end_device-1:7:2
   expander-1:7
1:0:107:0  1:0:116:0  end_device-1:6:3  end_device-1:7:3  sas_host0
1:0:108:0  1:0:117:0  end_device-1:6:4  end_device-1:7:4  sas_host1
1:0:109:0  1:0:118:0  end_device-1:6:5  end_device-1:7:5
```

b. The expander handles appear in the last column of each of the expander strings. In this example, the values `expander-1:6` and `expander-1:7` will be used smp_discover_list. These number may change anytime the expander is reset.

c. Issue the following command to access a single hosts smp_discover_list:

```
smp_discover_list /dev/bsg/expander-1:6
```

Example of a Single Host smp_discover_list after Disabling Zoning

```
phy   0:U:attached:[5001173100dd54ae:01  t(SSP)]  12 Gbps
  phy   1:U:attached:[5001173100ded8fa:01  t(SSP)]  12 Gbps
  phy   2:U:attached:[5001173100dd685e:01  t(SSP)]  12 Gbps
  phy   3:U:attached:[5001173100decafa:01  t(SSP)]  12 Gbps
  phy   4:U:attached:[5001173100df8e7e:01  t(SSP)]  12 Gbps
  phy   5:U:attached:[5001173100dd6892:01  t(SSP)]  12 Gbps
  phy   6:U:attached:[5001173100ffff0e:01  t(SSP)]  12 Gbps
  phy   7:U:attached:[5001173100dd7fe2:01  t(SSP)]  12 Gbps
  phy   8:U:attached:[5001173100d38cae:01  t(SSP)]  12 Gbps
  phy   9:U:attached:[5001173100aeb872:01  t(SSP)]  12 Gbps
  phy  10:U:attached:[5001173100ad517a:01  t(SSP)]  12 Gbps
  phy  11:U:attached:[5001173100ad5276:01  t(SSP)]  12 Gbps
  phy  12:U:attached:[5001173100a92c96:01  t(SSP)]  12 Gbps
  phy  13:U:attached:[5001173100a9431e:01  t(SSP)]  12 Gbps
  phy  14:U:attached:[5001173100d38c5a:01  t(SSP)]  12 Gbps
  phy  15:U:attached:[5001173100dfeae6:01  t(SSP)]  12 Gbps
  phy  16:U:attached:[5001173100a9189e:01  t(SSP)]  12 Gbps
  phy  17:U:attached:[5001173100d39082:01  t(SSP)]  12 Gbps
  phy  18:U:attached:[5001173100df8ede:01  t(SSP)]  12 Gbps
  phy  19:U:attached:[5001173100df74b2:01  t(SSP)]  12 Gbps
  phy  20:U:attached:[5001173100df7616:01  t(SSP)]  12 Gbps
  phy  21:U:attached:[5001173100df81ce:01  t(SSP)]  12 Gbps
  phy  22:U:attached:[5001173100ded6aa:01  t(SSP)]  12 Gbps
  phy  23:U:attached:[5001173100df759a:01  t(SSP)]  12 Gbps
  phy  24:U:attached:[500605b00a6f26c1:04  i(SSP+STP+SMP)]  12 Gbps
  phy  25:U:attached:[500605b00a6f26c1:05  i(SSP+STP+SMP)]  12 Gbps
  phy  26:U:attached:[500605b00a6f26c1:06  i(SSP+STP+SMP)]  12 Gbps
```

```
phy  27:U:attached:[500605b00a6f26c1:07  i(SSP+STP+SMP)]  12 Gbps
phy  28:U:attached:[500605b00cf57421:03  i(SSP+STP+SMP)]  12 Gbps
phy  29:U:attached:[500605b00cf57421:02  i(SSP+STP+SMP)]  12 Gbps
phy  30:U:attached:[500605b00cf57421:01  i(SSP+STP+SMP)]  12 Gbps
phy  31:U:attached:[500605b00cf57421:00  i(SSP+STP+SMP)]  12 Gbps
phy  32:U:attached:[500605b007438ba0:00  i(SSP+STP+SMP)]  12 Gbps
phy  33:U:attached:[500605b007438ba0:01  i(SSP+STP+SMP)]  12 Gbps
phy  34:U:attached:[500605b007438ba0:02  i(SSP+STP+SMP)]  12 Gbps
phy  35:U:attached:[500605b007438ba0:03  i(SSP+STP+SMP)]  12 Gbps
phy  36:D:attached:[500e0eca0653fa7d:36  V i(SSP) t(SSP)]  12 Gbps
```

d. All of the PHYs in the results do not have zone group values assigned to them. The results omit the entire last column that usually identifies which zone group the sg devices were assigned to. The enclosure zoning has been successfully disabled.

6.6.6 Disabling Zoning using Windows

Important: Ensure that zoning is disabled only during a maintenance window. Disabling zoning while multiple hosts are active on the enclosure could result in data corruption if another host gains access to a set of drives that it should not have access to. All hosts will have access to all drives after zoning is disabled.

Step 1: From the host server, identify the SCSI devices that are associated with the 2U24 Flash Storage Platform ESMs.

Note: The operating system associates each SEP device as a SCSI device. The SCSI device of the SEP can be used to get status from or control elements within the enclosure.

a. Issue the following command:

```
sg_scan -s | findstr /i encl
```

b. Identify the SCSI devices from the output. The device information follows **SCSI0**. The devices appear as **SCSI0:1,62,0** and **SCSI0:1,124,0** bolded in the example below.

```
SCSI0:1,62,0    claimed=0 pdt=dh          HGST      2U24_STOR_ENCL
      0428
SCSI0:1,124,0   claimed=0 pdt=dh          HGST      2U24_STOR_ENCL

      0428
```

Step 2: Disable zoning on each of the SCSI devices that are associated with the 2U24 Flash Storage Platform ESMs.

a. Issue the following command to disable zoning on ESM A using the first SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "zone set 0"
```

Example of Disabling the First SCSI Device Results

```
cli_cmd = zone set 0
```

```
Zoning function has been DISABLED!
```

b. Issue the following command to disable zoning on ESM B using the second SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "zone set 0"
```

Example of Disabling the First SCSI Device Results

```
cli_cmd = zone set 0

Zoning function has been DISABLED!
```

c. Using the second SCSI device number, repeat the previous step to disable zoning on that device.

Step 3: Reset the ESMs using hgst_cli_tool.

a. Issue the following command to reset ESM A using the first SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "reset 0"
```

Example of Resetting First SCSI Device Results

```
cli_cmd = reset 0
```

b. Issue the following command to reset ESM B using the first SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "reset 0"
```

Example of Resetting Second SCSI Device Results

```
cli_cmd = reset 0
```

Step 4: Verify that zoning has been disabled.

a. Issue the following command to disable zoning on ESM A using the first SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "zone get"
```

Example of Disabled First SCSI Device Results

```
cli_cmd = zone get
Zoning function DISABLED!
```

b. Issue the following command to disable zoning on ESM B using the second SCSI device:

```
hgst_cli_tool.exe –d <devicenumber> -c "zone get"
```

Example of Disabled Second SCSI Device Results

```
cli_cmd = zone get
Zoning function DISABLED!
```

Step 5: Verify the zone groups for each of the host using sg_ses page 02.

a. Issue the following command to access sg_ses page 02 related to the first SCSI device:

```
sg_ses <devicenumber> -p2
```

Example of Page 02 on the First SCSI Device

```
...
Element 0 descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: OK
        OK=1, Reserved device=0, Hot spare=0, Cons check=0
        In crit array=0, In failed array=0, Rebuild/remap=0, R/R
 abort=0
        App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc
 bypass B=0
        Ready to insert=0, RMV=0, Ident=0, Report=0
        App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device
 off=0
        Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed
 B=0
...
```

b. The status of each SCSI device appears as `status: OK` after disabling zoning.

c. Issue the following command to access sg_ses page 02 related to the first SCSI device:

```
sg_ses <devicenumber>
```

Example of Page 02 on the Second SCSI Device

```
...
Element 0 descriptor:
        Predicted failure=0, Disabled=0, Swap=0, status: OK
        OK=1, Reserved device=0, Hot spare=0, Cons check=0
        In crit array=0, In failed array=0, Rebuild/remap=0, R/R
 abort=0
        App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc
 bypass B=0
        Ready to insert=0, RMV=0, Ident=0, Report=0
        App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device
 off=0
        Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed
 B=0
...
```

d. The status of each SCSI device appears as `status: OK` after disabling zoning.

6.7 Firmware Upgrade

6.7.1 Before Upgrading

This section provides information on actions that should be taken before starting a firmware upgrade on the 2U24 Flash Storage Platform.

Before upgrading enclosure firmware, review the following section to determine whether or not the enclosure should be taken offline before upgrading:

- **SAS Configuration**: If the enclosure contains SAS drives and redundant ESMs, the enclosure firmware may be upgraded while online. This is due to the SAS configuration and host being able to manage the firmware upgrade using host multi-pathing software. The storage administrator should ensure that there are always two paths to each drive before starting an upgrade on either ESM. This will ensure that at least one path to each drive is available during the reset of the ESM that is being upgraded.

  After the firmware has been downloaded to one ESM, the ESM will need to be reset and boot to the new firmware. Before proceeding with the upgrade on the second ESM, ensure that each drive has two available paths to guarantee that there is a redundant path is available to service I/O. The storage administrator should determine if the applications on the enclosure should be quiesced before the online upgrade is completed.
- **SATA Configuration**: If the enclosure contains SATA drives, the enclosure firmware should not be upgraded while online. This is due to the SATA configuration having no redundancy due to only having a single ESM. When the ESM is rebooted, the single path to the drives to service I/O will be taken down.

Devices (<dev>)

In order to initiate a firmware upgrade on the enclosure, a target must be identified. Linux targets are referred to as sg (SCSI Generic) devices and appear as sg<dev> in the Linux Firmware Upgrade procedure. Windows targets are referred to as SCSI devices and appear as SCSI<dev> in the Windows Firmware Upgrade.

Required Downloads:

- CLI Tools: to download the latest version of CLI tools, see: Downloading Firmware from the Support Portal *(page 61)*
- Firmware: to download the latest version of enclosure firmware, see: Downloading Firmware from the Support Portal *(page 61)*

> **Note:** Firmware upgrades do not affect any zoning configurations that have been enabled on the enclosure.

6.7.2 Enclosure Cabling for Firmware Update

Physically connect the 2U24 Flash Storage Platform to the host server using SAS cables in the configuration displayed below.

Figure 26: SAS Cable Configuration
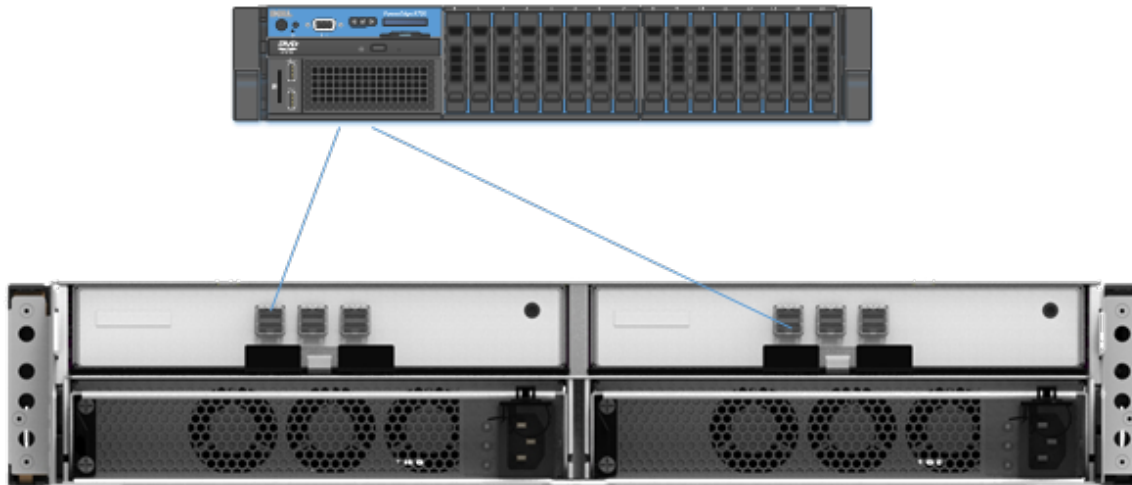
Table 15: SAS Cable Configuration

Host Connection (SAS Port)		Enclosure Connection (SAS Port)
Host 1	ESM A	Port 1
Host 1	ESM B	Port 1

6.7.3 Downloading Firmware from the Support Portal

Note: The product must be registered in order to download firmware updates.

Step 1: Open a web browser and go to: https://portal.wdc.com/Support/s/.

The Western Digital Enterprise Support Center will appear.

Step 2: Log in to the Western Digital enterprise support center using a Email and password.

You will be logged into the Western Digital Enterprise Support Center and several support options will appear on the page.

Figure 27: Logged into the Western Digital Enterprise Support Center

Step 3 : Click the **Downloads** option.

The Western Digital downloads page will appear.

Step 4 : Locate and download the firmware update for your product.

a. From the Identify Product section, select the Product, Operating System / Type, and Release Version.

Figure 28: Identify Product section

b. From the Select Files for Download section, expand the Firmware section and select the check box for the firmware file(s).

Figure 29: Select Files for Download section

c. From the Review & Download Files section, review the selected files and click DOWNLOAD FILES to download the entire file selection from that section.

Figure 30: Review & Download Files section

Figure 31: Download Files

Step 5: Extract the file by unzipping the downloaded file to the desktop.

6.7.4 Enabling MPIO for Linux

To enable MPIO for Linux, determine the version of Linux that is needed and follow one of the links below.

- **RHEL 6.x**: https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/6/html-single/dm_multipath/index
- **RHEL 7.x**: https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/7/html-single/dm_multipath/index
- **Ubuntu**: https://help.ubuntu.com/lts/serverguide/dm-multipath-chapter.html

6.7.4.1 Multipath Configurations for Linux

The following section provides information on the default multipath configurations. These configurations can vary for given Linux distributions. Refer to the specific Linux distributions DM-Multipath documentation for differences at Enabling MPIO for Linux *(page 63)*.

```
# cat /etc/multipath.conf

# This is a basic configuration file with some examples, for device mapper
# multipath.
```

```
#
# For a complete list of the default configuration values, run either# multipath -t
# or
# multipathd show config
#
# For a list of configuration options with descriptions, see the multipath.conf
# man page
```

```
## Here is an example of how to configure some standard options.
##
defaults {
#       udev_dir                /dev
        polling_interval         10
        path_selector           "round-robin 0"
        path_grouping_policy    multibus
#       uid_attribute            ID_SERIAL
#       prio                    alua
        path_checker            tur
        rr_min_io                100
        max_fds                  8192
        rr_weight                priorities
        failback                immediate
        no_path_retry            10
        user_friendly_names     yes
}
```

6.7.5 Enabling MPIO for Windows

📄 **Note:** MPIO for Windows should be installed from the Windows server prior to this procedure.

Step 1: From the host server, identify the product string for the drives that will be multipathed.

   a. Issue the following command:

```
sg_scan -s
```

   b. Locate the information for the drives that will be multipathed.

Step 2: Add the product device strings to the MPIO Properties.

   a. Launch the **MPIO Properties** from the host server.

Figure 32: MPIO Properties
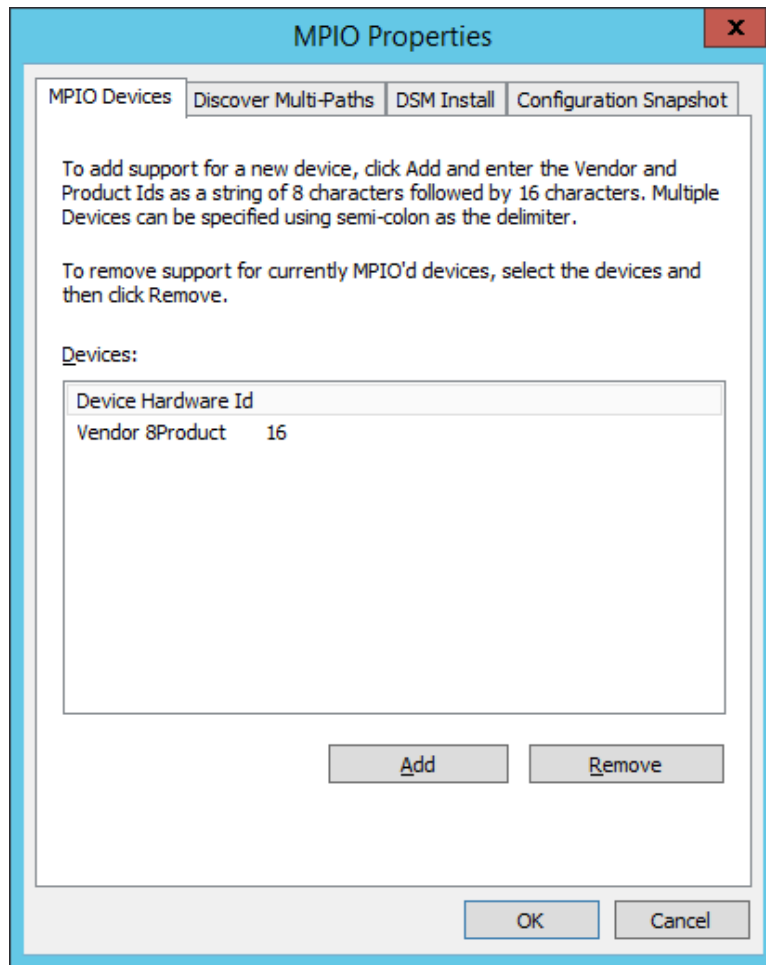
b. Under the MPIO Devices tab, click **Add**.

c. Type the product device strings into the Add MPIO Support field and click **OK**.

Figure 33: Add MPIO Support
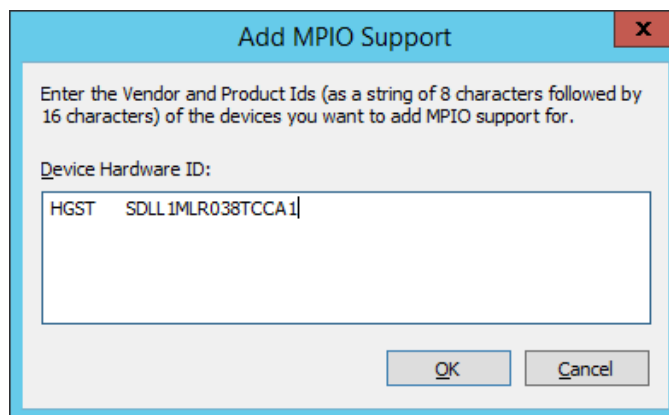
> 📄 **Note:** The vendor can take up to eight characters and the product can take up to 16 characters. For example, **Vendor 8Product16**.

d. Complete the previous substep for all devices that need to be multipathed.

> 📄 **Note:** One device of each vendor and product ID within the enclosure must be added to the MPIO properties.

e. Click **OK** at the bottom of the MPIO Properties pane.

f. Reboot the host server when prompted.

Figure 34: Reboot Required
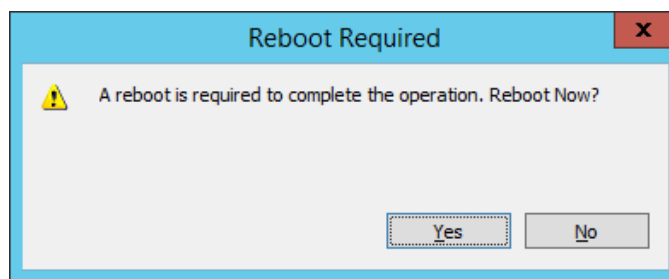
Step 3: Verify that the devices added to the MPIO properties are under control of Windows MPIO.

a. In the Computer Management window, under the host server, navigate to **Disk Drives**.

b. Verify that the list of devices contains all of the expected devices.

Figure 35: Computer Management
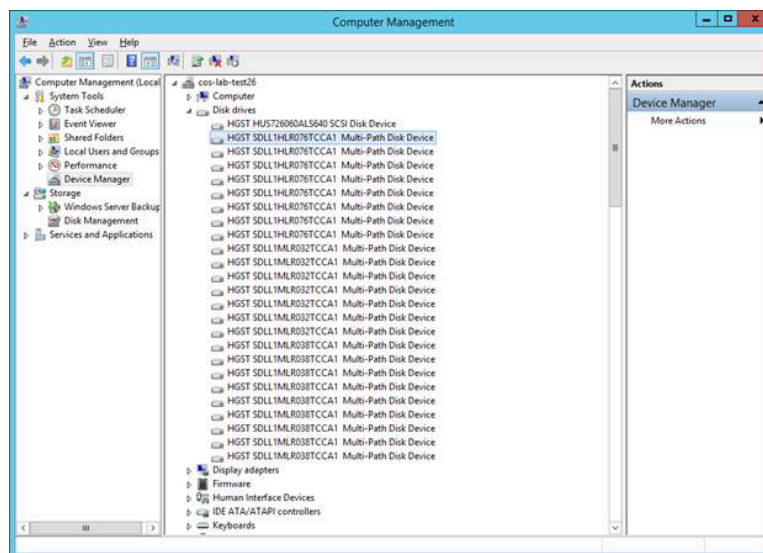
Step 4: Check the Path States of the MPIO.

a. Click on the properties of one of the Multi-Path Disk Devices and select the MPIO tab.

Figure 36: Multi-Path Disk Devices
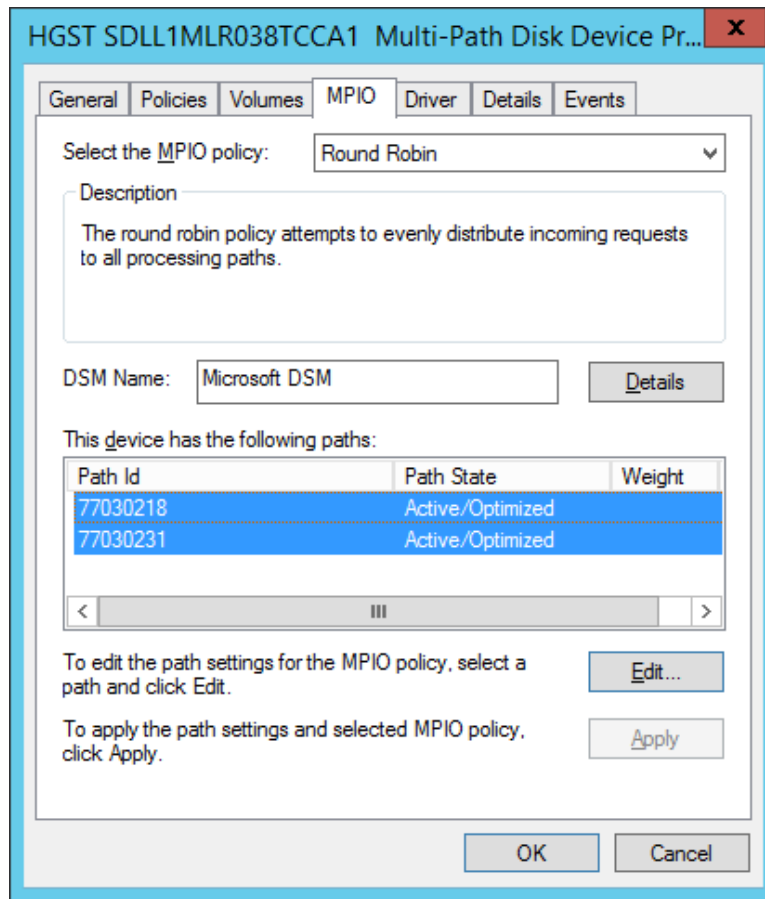
b. Review the path states of each path to ensure it displays a result of Active/Optimized.

Step 5: Identify the available paths using a single action by executing the following command:

```
mpclaim.exe -v C:\OurayMPIOOutput.txt
```

📄 **Note:** This alternative will allow for all devices to be check through one action instead of one device at a time.

```
Registered DSMs: 1
================
+------------------------------|------------------|----|----|----|---|-----
+
|DSM Name                      |     Version      |PRP | RC | RI |PVP|
 PVE |
|------------------------------|------------------|----|----|----|---|-----|
|Microsoft DSM                 |010.0000.14393.1532|0020|0003|0001|030|
False|
+------------------------------|------------------|----|----|----|---|-----
+
```

```
Microsoft DSM
=============
MPIO Disk23: 02 Paths, Round Robin, ALUA Not Supported
        SN: 5001173100DF7598

        Supported Load Balance Policies: FOO RR RRWS LQD WP LB

    Path ID            State              SCSI Address       Weight

 --------------------------------------------------------------------------------
    0000000077000051 Active/Optimized    000|000|081|000    0
        Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F: 005|000|
000)
        Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

    0000000077000038 Active/Optimized    000|000|056|000    0
        Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F: 005|000|
000)
        Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

MPIO Disk22: 02 Paths, Round Robin, ALUA Not Supported
        SN: 5001173100DED6A8

        Supported Load Balance Policies: FOO RR RRWS LQD WP LB

    Path ID            State              SCSI Address       Weight

 --------------------------------------------------------------------------------
    0000000077000050 Active/Optimized    000|000|080|000    0
        Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F: 005|000|
000)
        Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

    0000000077000037 Active/Optimized    000|000|055|000    0
        Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F: 005|000|
000)
        Controller: 46616B65436F6E74726F6C6C6572 (State: Active)
```

6.7.6 Upgrading Firmware using hgst_upg_tool for Linux

The following upgrade can be completed using a host that contains a Linux operating system installed on it.

Step 1: From the host server, identify the sg devices that are associated with the 2U24 Flash Storage Platform ESMs.

> **Note:** The operating system associates each SEP device as a sg device. The sg device of the SEP can be used to get status from or control elements within the enclosure.

a. Issue the following command:

```
sg_scan -i | grep -i enc -B 1
```

b. Identify the sg devices from the output. The devices can be identified by the **/dev/sg<devicenumber>**. The devices appear as **/dev/sg10** and **/dev/sg11** bolded in the example below.

```
/dev/sg10: scsi1 channel=0 id=17 lun=0
    HGST      2U24_STOR_ENCL     0428 [rmb=0 cmdq=1 pqual=0 pdev=0xd]
/dev/sg11: scsi1 channel=0 id=43 lun=0
    HGST      2U24_STOR_ENCL     0428 [rmb=0 cmdq=1 pqual=0 pdev=0xd]
```

Step 2: Upgrade the firmware using hgst_upg_tool.

a. The hgst_upg_tool initiates the upgrade of the firmware one ESM at a time using a specific sg device. Follow the key below to define the specific information that is needed to complete the firmware download command for hgst_upg_tool. The command will be utilized to complete the upgrade on each ESM by executing the command on the first sg device and then the second sg device.

hgst_upg_tool -d /dev/sg**<devicenumber>** -f **<firmwareimage>**.bin -m 7

- **-d** is where the specific sg device is defined. This is located using an sg_scan command that will provide two devices numbers. Insert the device number in place of **<devicenumber>**.
- **-f** is where the filename of the firmware image is defined. This is the filename of the firmware update that was downloaded from the Western Digital Support site. Insert the filename in place of **<firmwareimage>**.
- **-m** is where the download microcode mode with offsets, save, and activate is defined. For this case, the download microcode mode is predefined as mode select 7.

b. Issue the following command to upgrade ESM A using the first sg device:

```
hgst_upg_tool -d /dev/sg<devicenumber> -f <firmwareimage>.bin -m 7
```

c. Verify the status of the upgrade has completed before completing the next step.

d. Issue the following command to verify all paths to all drives are available on ESM A:

```
multipath -ll
```

📄 **Note:** This step assumes that Linux DM-Multipath software is being used.

e. Identify the available paths from the output. Do not proceed to the next step until both paths are listed as **active ready running**. The paths need to be active paths to each drive on both ESMs before moving on to the following steps.

```
mpathbv (35001173100dd54ac) dm-3 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:322:0 sdb 8:16  active ready running
  `- 1:0:325:0 sdj 8:144 active ready running
mpathbu (35001173100dd6890) dm-8 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:310:0 sdg 8:96  active ready running
  `- 1:0:330:0 sdo 8:224 active ready running
```

```
...
```

f. Issue the following command to upgrade ESM B using the second sg device:

```
hgst_upg_tool -d /dev/sg<devicenumber> -f <firmwareimage>.bin -m 7
```

g. Verify the status of the upgrade has completed before completing the next step.

h. Issue the following command to verify all paths to all drives are available on ESM A:

```
multipath -ll
```

> **Note:** This step assumes that Linux DM-Multipath software is being used.

i. Identify the available paths from the output. Do not proceed to the next step until both paths are listed as **active ready running**. The paths need to be active paths to the drives on both ESMs before moving on to the following steps.

```
mpathbv (35001173100dd54ac) dm-3 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:322:0 sdb 8:16  active ready running
  `- 1:0:325:0 sdj 8:144 active ready running
mpathbu (35001173100dd6890) dm-8 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:310:0 sdg 8:96  active ready running
  `- 1:0:330:0 sdo 8:224 active ready running
...
```

> **Note:** An ESM fault LED will illuminate after upgrading the first ESM. This is expected behavior and is due to the FW mismatch between ESMs. Once both ESMs have been upgraded the fault LEDs will turn off.

Step 3: Verify the firmware upgrade using sg_scan.

a. Issue the following command:

```
sg_scan -i | grep enc -B 1
```

b. Identify the firmware upgrade version from the output. The latest version number should match the version labeled in the firmware filename. The version number follows the vendor and product ID, **HGST 2U24_STOR_ENCL**, for each associated sg device in the output. The firmware has been upgraded to version 0441 shown in the example below.

```
/dev/sg10: scsi1 channel=0 id=17 lun=0
    HGST      2U24_STOR_ENCL    0441 [rmb=0 cmdq=1 pqual=0 pdev=0xd]
/dev/sg11: scsi1 channel=0 id=43 lun=0
    HGST      2U24_STOR_ENCL    0441 [rmb=0 cmdq=1 pqual=0 pdev=0xd]
```

c. Issue the following command to verify all paths to all drives are available:

```
hgst_upg_tool multipath -ll
```

> 📄 **Note:** This step assumes that DM-Multipath software is being used.

d. Identify the available paths from the output. The available paths appear as **|- 1:0:310:0 sdg 8:96 active ready running** and **`- 1:0:330:0 sdo 8:224 active ready running** bolded in the example below. If the paths do not appear as **active ready running**, the drives are not available to the host. The paths need to be active this ESM before moving on to the following steps.

```
mpathbv (35001173100dd54ac) dm-3 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:322:0 sdb 8:16  active ready running
  `- 1:0:325:0 sdj 8:144 active ready running
mpathbu (35001173100dd6890) dm-8 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:310:0 sdg 8:96  active ready running
  `- 1:0:330:0 sdo 8:224 active ready running
...
```

6.7.7 Upgrading Firmware using sg_ses_microcode for Linux

The following upgrade can be completed using a host that contains a Linux operating system installed on it.

Step 1: From the host server, identify the sg devices that are associated with the 2U24 Flash Storage Platform ESMs.

> 📄 **Note:** The operating system associates each SEP device as a sg device. The sg device of the SEP can be used to get status from or control elements within the enclosure.

a. Issue the following command:

```
sg_scan -i | grep -i enc -B 1
```

b. Identify the sg devices from the output. The devices can be identified by the **/dev/sg<devicenumber>**. The devices appear as **/dev/sg10** and **/dev/sg11** bolded in the example below.

```
/dev/sg10: scsi1 channel=0 id=17 lun=0
    HGST     2U24_STOR_ENCL    0428 [rmb=0 cmdq=1 pqual=0 pdev=0xd]
/dev/sg11: scsi1 channel=0 id=43 lun=0
    HGST     2U24_STOR_ENCL    0428 [rmb=0 cmdq=1 pqual=0 pdev=0xd]
```

Step 2: Upgrade the firmware using sg_ses_microcode.

a. The sg_ses_microcode initiates the upgrade of the firmware one ESM at a time using a specific sg device. Follow the key below to define the specific information that is needed to complete the firmware download command for sg_ses_microcode. The command will be utilized to complete the upgrade on each ESM by executing the command on the first sg device and then the second sg device.

sg_ses_microcode --mode=14 --bpw=4096 --in=**\<filepath\>**/**\<filename\>** /\<dev\>

b. Issue the following command to upgrade ESM A using the first sg device:

```
sg_ses_microcode -d /dev/sg<devicenumber> -f <firmwareimage>.bin -m 7
```

c. Verify the status of the upgrade has completed before completing the next step.

d. Issue the following command to verify all paths to all drives are available on ESM A:

```
multipath -ll
```

> **Note:** This step assumes that Linux DM-Multipath software is being used.

e. Identify the available paths from the output. Do not proceed to the next step until both paths are listed as **active ready running**. The paths need to be active paths to each drive on both ESMs before moving on to the following steps.

```
mpathbv (35001173100dd54ac) dm-3 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:322:0 sdb 8:16  active ready running
  `- 1:0:325:0 sdj 8:144 active ready running
mpathbu (35001173100dd6890) dm-8 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:310:0 sdg 8:96  active ready running
  `- 1:0:330:0 sdo 8:224 active ready running
...
```

f. Issue the following command to upgrade ESM B using the second sg device:

```
hgst_upg_tool -d /dev/sg<devicenumber> -f <firmwareimage>.bin -m 7
```

g. Verify the status of the upgrade has completed before completing the next step.

h. Issue the following command to verify all paths to all drives are available on ESM A:

```
multipath -ll
```

> **Note:** This step assumes that Linux DM-Multipath software is being used.

i. Identify the available paths from the output. Do not proceed to the next step until both paths are listed as **active ready running**. The paths need to be active paths to the drives on both ESMs before moving on to the following steps.

```
mpathbv (35001173100dd54ac) dm-3 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:322:0 sdb 8:16  active ready running
  `- 1:0:325:0 sdj 8:144 active ready running
mpathbu (35001173100dd6890) dm-8 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:310:0 sdg 8:96  active ready running
```

```
    `- 1:0:330:0 sdo 8:224 active ready running
...
```

> **Note:** An ESM fault LED will illuminate after upgrading the first ESM. This is expected behavior and is due to the FW mismatch between ESMs. Once both ESMs have been upgraded the fault LEDs will turn off.

Step 3: Verify the firmware upgrade using sg_scan.

    a. Issue the following command:

```
sg_scan -i | grep enc -B 1
```

    b. Identify the firmware upgrade version from the output. The latest version number should match the version labeled in the firmware filename. The version number follows the vendor and product ID, **HGST 2U24_STOR_ENCL**, for each associated sg device in the output. The firmware has been upgraded to version 0441 shown in the example below.

```
/dev/sg10: scsi1 channel=0 id=17 lun=0
    HGST      2U24_STOR_ENCL    0441 [rmb=0 cmdq=1 pqual=0 pdev=0xd]
/dev/sg11: scsi1 channel=0 id=43 lun=0
    HGST      2U24_STOR_ENCL    0441 [rmb=0 cmdq=1 pqual=0 pdev=0xd]
```

    c. Issue the following command to verify all paths to all drives are available:

```
hgst_upg_tool multipath -ll
```

> **Note:** This step assumes that DM-Multipath software is being used.

    d. Identify the available paths from the output. The available paths appear as **|- 1:0:310:0 sdg 8:96 active ready running** and **`- 1:0:330:0 sdo 8:224 active ready running** bolded in the example below. If the paths do not appear as **active ready running**, the drives are not available to the host. The paths need to be active this ESM before moving on to the following steps.

```
mpathbv (35001173100dd54ac) dm-3 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:322:0 sdb 8:16  active ready running
  `- 1:0:325:0 sdj 8:144 active ready running
mpathbu (35001173100dd6890) dm-8 HGST,SDLL1MLR038TCCA1
size=3.5T features='0' hwhandler='0' wp=rw
`-+- policy='round-robin 0' prio=1 status=active
  |- 1:0:310:0 sdg 8:96  active ready running
  `- 1:0:330:0 sdo 8:224 active ready running
...
```

6.7.8 Upgrading Firmware using hgst_upg_tool for Windows

The following upgrade can be completed using a host that contains a Windows operating system installed on it.

Step 1: From the host server, identify the SCSI devices that are associated with the 2U24 Flash Storage Platform ESMs.

> **Note:** The operating system associates each SEP device as a SCSI device. The SCSI device of the SEP can be used to get status from or control elements within the enclosure.

a. Issue the following command:

```
sg_scan -s | findstr /i encl
```

b. Identify the SCSI devices from the output. The device information follows **SCSI0**. The devices appear as **SCSI0:1,62,0** and **SCSI0:1,124,0** bolded in the example below.

```
SCSI0:1,62,0    claimed=0 pdt=dh          HGST        2U24_STOR_ENCL
      0428
SCSI0:1,124,0   claimed=0 pdt=dh          HGST        2U24_STOR_ENCL

      0428
```

Step 2: Upgrade the firmware using hgst_upg_tool.exe.

a. The hgst_upg_tool.exe initiates the upgrade of the firmware one ESM at a time using a specific SCSI device. Follow the key below to define the specific information that is needed to complete the firmware download command for hgst_upg_tool.exe. The command will be utilized to complete the upgrade on each ESM by executing the command on the first SCSI device and then the second SCSI device.

hgst_upg_tool.exe -d SCSI0:**<devicenumber>** -f **<firmwareimage>**.bin -m 7

- **-d** is where the specific SCSI device is defined. This is located using an sg_scan command that will provide two devices numbers. Insert the device number in place of **<devicenumber>**.
- **-f** is where the filename of the firmware image is defined. This is the filename of the firmware update that was downloaded from the Western Digital Support site. Insert the filename in place of **<firmwareimage>**.
- **-m** is where the download microcode mode with offsets, save, and activate is defined. For this case, the download microcode mode is predefined as mode select 7.

b. Issue the following command to upgrade ESM A using the first SCSI device:

```
hgst_upg_tool.exe -d SCSI0:<devicenumber> -f <firmwareimage>.bin -m 7
```

c. Verify the status of the upgrade has completed before completing the next step.
d. Check the Path States of the MPIO by clicking on the properties of one of the Multi-Path Disk Devices and select the MPIO tab.

Figure 37: Multi-Path Disk Devices

e. Review the path states of each path to ensure it displays a result of Active/Optimized.

f. Identify the available paths using a single action by executing the following command:

```
mpclaim.exe -v C:\OurayMPIOOutput.txt
```

```
Registered DSMs: 1
================
+--------------------|--------------------|----|----|----|---|-----+
|DSM Name            |       Version      |PRP | RC | RI |PVP| PVE |
|--------------------|--------------------|----|----|----|---|-----|
|Microsoft DSM                |010.0000.14393.1532|0020|0003|0001|030|
False|
+--------------------|--------------------|----|----|----|---|-----+


Microsoft DSM
=============
MPIO Disk23: 02 Paths, Round Robin, ALUA Not Supported
        SN: 5001173100DF7598

        Supported Load Balance Policies: FOO RR RRWS LQD WP LB

    Path ID         State              SCSI Address       Weight
```

```
      ----------------------------------------------------------------
      0000000077000051 Active/Optimized   000|000|081|000   0
           Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
      005|000|000)
           Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

      0000000077000038 Active/Optimized   000|000|056|000   0
           Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
      005|000|000)
           Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

MPIO Disk22: 02 Paths, Round Robin, ALUA Not Supported
      SN: 5001173100DED6A8

      Supported Load Balance Policies: FOO RR RRWS LQD WP LB

   Path ID          State            SCSI Address      Weight

      ----------------------------------------------------------------
      0000000077000050 Active/Optimized   000|000|080|000   0
           Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
      005|000|000)
           Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

      0000000077000037 Active/Optimized   000|000|055|000   0
           Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
      005|000|000)
           Controller: 46616B65436F6E74726F6C6C6572 (State: Active)
```

g. Issue the following command to upgrade ESM B using the second SCSI device:

```
hgst_upg_tool.exe -d SCSI0:<devicenumber> -f <firmwareimage>.bin -m 7
```

h. Verify the status of the upgrade has completed before completing the next step.

i. Check the Path States of the MPIO by clicking on the properties of one of the Multi-Path Disk Devices and select the MPIO tab.

Figure 38: Multi-Path Disk Devices

j. Review the path states of each path to ensure it displays a result of Active/Optimized.

k. Identify the available paths using a single action by executing the following command:

```
mpclaim.exe -v C:\OurayMPIOOutput.txt


Registered DSMs: 1
================
+-----------------------|-------------------|----|----|----|---|-----
+
|DSM Name               |       Version     |PRP | RC | RI |PVP| PVE
 |
|-----------------------|-------------------|----|----|----|---|-----|
|Microsoft DSM          |010.0000.14393.1532|0020|0003|0001|030|
False|
+-----------------------|-------------------|----|----|----|---|-----
+


Microsoft DSM
=============
MPIO Disk23: 02 Paths, Round Robin, ALUA Not Supported
        SN: 5001173100DF7598
```

```
            Supported Load Balance Policies: FOO RR RRWS LQD WP LB


     Path ID           State            SCSI Address      Weight


   --------------------------------------------------------------------
     0000000077000051 Active/Optimized   000|000|081|000   0
          Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
  005|000|000)
          Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

     0000000077000038 Active/Optimized   000|000|056|000   0
          Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
  005|000|000)
          Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

MPIO Disk22: 02 Paths, Round Robin, ALUA Not Supported
        SN: 5001173100DED6A8

        Supported Load Balance Policies: FOO RR RRWS LQD WP LB


     Path ID           State            SCSI Address      Weight


   --------------------------------------------------------------------
     0000000077000050 Active/Optimized   000|000|080|000   0
          Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
  005|000|000)
          Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

     0000000077000037 Active/Optimized   000|000|055|000   0
          Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
  005|000|000)
          Controller: 46616B65436F6E74726F6C6C6572 (State: Active)
```
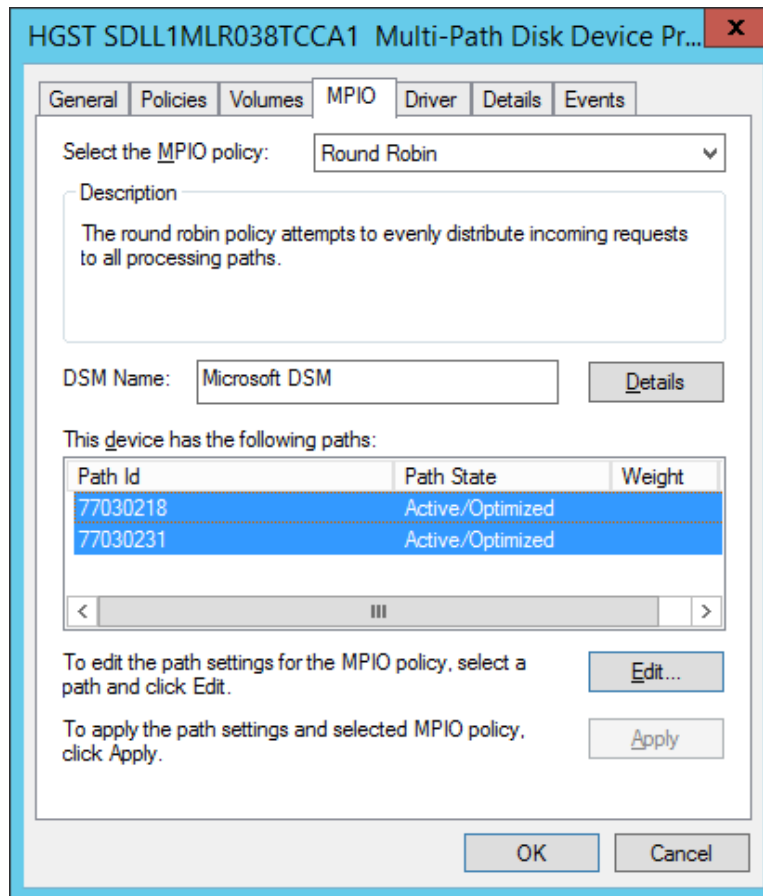
l. Verify that the MPIO results appear.

> **Note:** An ESM fault LED will illuminate after upgrading the first ESM. This is expected behavior and is due to the FW mismatch between ESMs. Once both ESMs have been upgraded the fault LEDs will turn off.

Step 3: Verify the firmware upgrade using sg_scan.

a. Issue the following command:

```
sg_scan -s | findstr /i encl
```

b. Identify the firmware upgrade version from the output. The latest version number should match the version labeled in the firmware filename. The version number follows the vendor and product ID, **HGST 2U24_STOR_ENCL**, for each associated SCSI device in the output. The firmware has been upgraded to version 0441 shown in the example below.

```
SCSI0:1,62,0   claimed=0 pdt=dh            HGST        2U24_STOR_ENCL
     0441
SCSI0:1,124,0  claimed=0 pdt=dh            HGST        2U24_STOR_ENCL

     0441
```

6.7.9 Upgrading Firmware using sg_ses_microcode for Windows

The following upgrade can be completed using a host that contains a Windows operating system installed on it.

Step 1: From the host server, identify the SCSI devices that are associated with the 2U24 Flash Storage Platform ESMs.

> **Note:** The operating system associates each SEP device as a SCSI device. The SCSI device of the SEP can be used to get status from or control elements within the enclosure.

a. Issue the following command:

```
sg_scan -s | findstr /i encl
```

b. Identify the SCSI devices from the output. The device information follows **SCSI0**. The devices appear as **SCSI0:1,62,0** and **SCSI0:1,124,0** bolded in the example below.

```
SCSI0:1,62,0    claimed=0 pdt=dh          HGST       2U24_STOR_ENCL
     0428
SCSI0:1,124,0   claimed=0 pdt=dh          HGST       2U24_STOR_ENCL

     0428
```

Step 2: Upgrade the firmware using sg_ses_microcode.exe.

a. The sg_ses_microcode.exe initiates the upgrade of the firmware one ESM at a time using a specific SCSI device. Follow the key below to define the specific information that is needed to complete the firmware download command for sg_ses_microcode.exe. The command will be utilized to complete the upgrade on each ESM by executing the command on the first SCSI device and then the second SCSI device.

sg_ses_microcode.exe --mode=14 --bpw=4096 --non --in=**<filename>**
    <dev>

- sg_ses_microcode: The sg3_util command that talks to the ESM firmware
- mode=14: Sends the firmware to the ESM
- bpw=4096: Block transfer size
- in: Path to the .bin file download

b. Issue the following command to upgrade ESM A using the first SCSI device:

```
sg_ses_microcode.exe -d SCSI0:<devicenumber> -f <firmwareimage>.bin -
m 7
```

c. Verify the status of the upgrade has completed before completing the next step.

d. Check the Path States of the MPIO by clicking on the properties of one of the Multi-Path Disk Devices and select the MPIO tab.

Figure 39: Multi-Path Disk Devices

e. Review the path states of each path to ensure it displays a result of Active/Optimized.

f. Identify the available paths using a single action by executing the following command:

```
mpclaim.exe -v C:\OurayMPIOOutput.txt


Registered DSMs: 1
================
+--------------------------|-------------------|----|----|----|---|-----
+
|DSM Name                  |       Version     |PRP | RC | RI |PVP|
 PVE |
|--------------------------|-------------------|----|----|----|---|-----|
|Microsoft DSM             |010.0000.14393.1532|0020|0003|0001|030|
False|
+--------------------------|-------------------|----|----|----|---|-----
+


Microsoft DSM
=============
MPIO Disk23: 02 Paths, Round Robin, ALUA Not Supported
        SN: 5001173100DF7598
```

```
        Supported Load Balance Policies: FOO RR RRWS LQD WP LB


    Path ID          State              SCSI Address      Weight


  ----------------------------------------------------------------------
    0000000077000051 Active/Optimized   000|000|081|000   0
        Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
005|000|000)
        Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

    0000000077000038 Active/Optimized   000|000|056|000   0
        Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
005|000|000)
        Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

MPIO Disk22: 02 Paths, Round Robin, ALUA Not Supported
        SN: 5001173100DED6A8


        Supported Load Balance Policies: FOO RR RRWS LQD WP LB


    Path ID          State              SCSI Address      Weight


  ----------------------------------------------------------------------
    0000000077000050 Active/Optimized   000|000|080|000   0
        Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
005|000|000)
        Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

    0000000077000037 Active/Optimized   000|000|055|000   0
        Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
005|000|000)
        Controller: 46616B65436F6E74726F6C6C6572 (State: Active)
```

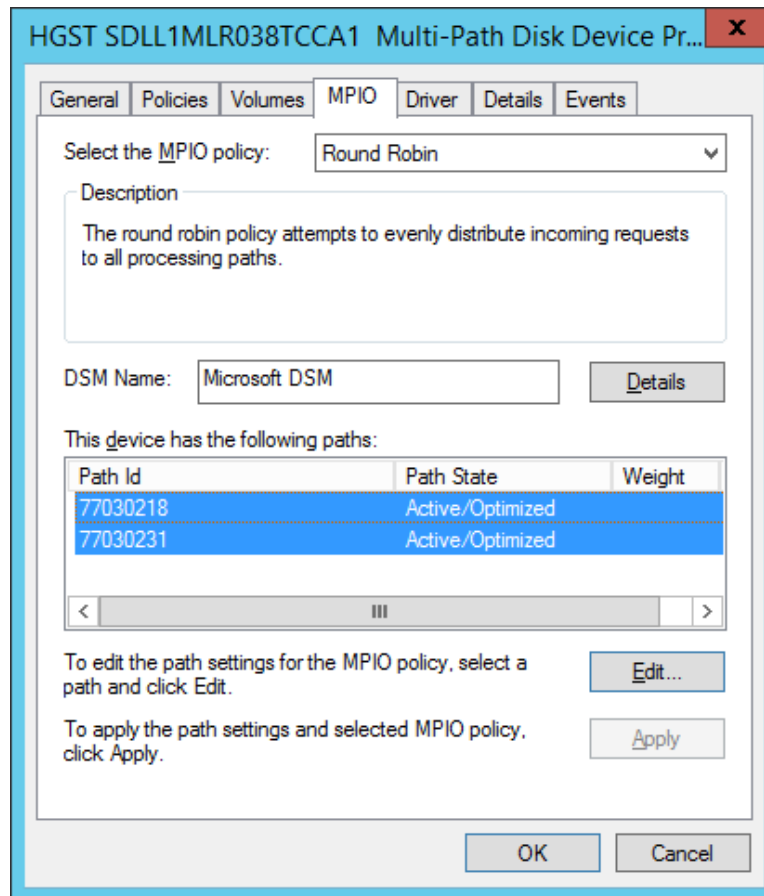**g.** Issue the following command to upgrade ESM B using the second SCSI device:

```
hgst_upg_tool.exe -d SCSI0:<devicenumber> -f <firmwareimage>.bin -m 7
```

h. Verify the status of the upgrade has completed before completing the next step.

i. Check the Path States of the MPIO by clicking on the properties of one of the Multi-Path Disk Devices and select the MPIO tab.

Figure 40: Multi-Path Disk Devices

j. Review the path states of each path to ensure it displays a result of Active/Optimized.

k. Identify the available paths using a single action by executing the following command:

```
mpclaim.exe -v C:\OurayMPIOOutput.txt


Registered DSMs: 1
================
+--------------------------|-------------------|----|----|----|---|-----
+
|DSM Name                  |      Version      |PRP | RC | RI |PVP|
 PVE |
|--------------------------|-------------------|----|----|----|---|-----|
|Microsoft DSM             |010.0000.14393.1532|0020|0003|0001|030|
False|
+--------------------------|-------------------|----|----|----|---|-----
+


Microsoft DSM
=============
MPIO Disk23: 02 Paths, Round Robin, ALUA Not Supported
        SN: 5001173100DF7598
```

```
          Supported Load Balance Policies: FOO RR RRWS LQD WP LB


     Path ID              State               SCSI Address        Weight

  -----------------------------------------------------------------------
     0000000077000051 Active/Optimized    000|000|081|000    0
          Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
  005|000|000)
          Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

     0000000077000038 Active/Optimized    000|000|056|000    0
          Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
  005|000|000)
          Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

MPIO Disk22: 02 Paths, Round Robin, ALUA Not Supported
     SN: 5001173100DED6A8


     Supported Load Balance Policies: FOO RR RRWS LQD WP LB


     Path ID              State               SCSI Address        Weight

  -----------------------------------------------------------------------
     0000000077000050 Active/Optimized    000|000|080|000    0
          Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
  005|000|000)
          Controller: 46616B65436F6E74726F6C6C6572 (State: Active)

     0000000077000037 Active/Optimized    000|000|055|000    0
          Adapter: Avago Adapter, SAS3 3008 Fury -StorPo...  (B|D|F:
  005|000|000)
          Controller: 46616B65436F6E74726F6C6C6572 (State: Active)
```

l. Verify that the MPIO results appear to be the same as the results verified in Enabling MPIO for Linux *(page 63)*.

> **Note:** An ESM fault LED will illuminate after upgrading the first ESM. This is expected behavior and is due to the FW mismatch between ESMs. Once both ESMs have been upgraded the fault LEDs will turn off.

Step 3: Verify the firmware upgrade using sg_scan.

a. Issue the following command:

```
sg_scan -s | findstr /i encl
```

b. Identify the firmware upgrade version from the output. The latest version number should match the version labeled in the firmware filename. The version number follows the vendor and product ID, **HGST 2U24_STOR_ENCL**, for each associated SCSI device in the output. The firmware has been upgraded to version 0441 shown in the example below.

```
SCSI0:1,62,0    claimed=0 pdt=dh          HGST        2U24_STOR_ENCL
     0441
SCSI0:1,124,0   claimed=0 pdt=dh          HGST        2U24_STOR_ENCL

     0441
```