User Guide

4U60 Storage Enclosure G460-J-12

February 2017

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Revision 1.7

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Revision History

Date	Revision	Comment
October 2015	Revision 1.0	Initial version
December 2015	Revision 1.1	Updates to content
December 2015	Revision 1.2	Addition of 4TB and 6TB as qualified hard disk drives
February 2016	Revision 1.3	• Updates to content • Edits to content • Initial version of the Firmware Release Notes
May 2016	Revision 1.4	• Added 8TB SATA and 10TB SAS drives • Edits to content
August 2016	Revision 1.5	• Updated Linux upgrade instructions • Added Windows upgrade instructions • Removed 2.1.0 information • Updated document design
September 2016	Revision 1.6	• Updated firmware upgrade information for ESMs • Removed 4.2.1 information
February 2017	Revision 1.7	• Added the **Interoperability Notes** section in the Release Notes • Added the Serial Console Upgrade section in the Release Notes • Updated the SSD drive capacity section

Note: Revision histories in the documentation set for the 4U60 Storage Enclosure refer to the docset as a whole, not just this document.

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1   Document Summary

The following document provides information of the agency, compliance, and certifications for countries that allow the use and operation of the 4U60 Storage Enclosure.

1.1   Introduction

The 4U60 Storage Enclosure is a 4U, high-density drive enclosure. The enclosure is designed to house up to a full configuration of 60 drives and to maximize the performance of these drives under all operating conditions. For a list of compatible drives consult the HGST 4U60 Hardware User Guide.

The system contains the following high level features:

Table 1: High Level Features Specifications

Hardware	Details	Number of Component
4U60 Storage Enclosure	4U rack-mounted storage enclosure with slide rail and cable management assembly	1
ESM	2U half-width SAS Expander Canister–JBOD application (12G version)	Up to 2
Drive Board	• Connects the power supplies (with integrated fans) via power interface board, drives, and ESM. • Fully compliant with SAS 3.0 specification for operation up to 12Gbps.	1
3.5-inch HDD or 2.5-inch SSD	**Full Configuration**: 60 drives contained within top accessible chassis. • Hot swappable • Two status LEDs per drive slot, Activity and Fault • Ejector handle allows for easy installation and removal of HDDs and SSDs • With carrier	60 qualified drives
Power Supply Unit (PSU)	• 2U half-width dual 1+1 redundant, 1650W AC power supplies • 200 ~ 240 VAC (1650W) input, 47Hz – 63Hz • +12V and +5V outputs with +5V standby power • 2 integrated fans powered by redundant power rail • Compliant with 80 Plus efficiency Gold level	2

Hardware	Details	Number of Component
	• +/- 5% Voltage margin control on 5V and 12V rails • Trouble history implementation • 5v and 12v DC output at 1650W	
Fans	• N+1 redundant cooling • any one fan can fail and the system will continue to operate	4 (2 in each PSU)

1.2   Specification Summary

The following table is a summary of specs relevant and represent a fully configured enclosure:

Table 2: Specification Summary

Condition (Fully Configured)	Non-operating	Operating
Temperature	-30°C to 60°C	5°C to 35°C
Temperature Gradient	5°C per hour	20°C per hour
Temperature De-rating	1°C per 300m above 3000m	1°C per 125m above 950m
Relative Humidity	8% to 80% non-condensing	8% to 80% non-condensing
Relative Humidity Gradient	30% per hour maximum	30% per hour maximum
Altitude	-300m to 12,000m -984 ft. to 39,370 ft.	-300m to 3,048m 984 ft. to 10,000 ft.
Shock	8g 6ms Trapezoidal	3.5g 6ms Pulse vertical shock
Vibration	Random 0.6 Grms 10-300Hz	Random 0.25 Grms, 5-10Hz 0.05 g sine wave sweep, 10-300Hz
Power Requirements	N/A	**Typical**: 1.0 KVA **Max**: 1.8 KVA
Weight	**Maximum Enclosure Weight (full configuration—HDD)**: 207.6 lbs./93.71 kg **Minimum Enclosure Weight (without drives)**: 99.6 lbs./45 kg	
System Dimensions	**Dimensions (Enclosure)**: 174.8mm x 424mm x 871.2mm/6.88in. x 16.69in. x 34.3in. **Dimensions (with CMAs)**: 174.8mm x 424mm x 1100mm/6.88in. x 16.69in. x 43.3in.	

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Condition (Fully Configured)	Non-operating	Operating
Required Rack Opening Dimensions	1100mm x 424mm x 174.8mm/43.3in. x 16.69in. x 6.88in. **Note:** The depth of 1100mm is required for the CMA to fit and function properly.	
Rack Units (U)	4U	

2 For More Information

The following chapter identifies the contact information for support on the 4U60 Storage Enclosure.

2.1   Points of Contact

For further assistance with an HGST product, contact HGST Data Center Solutions support. Please be prepared to provide the following information: Serial Number (S/N), product name, model number, and a brief description of the issue.

Email:
support@hgst.com

Website:
www.hgst.com/4U60

Customer Technical Support and Downloads:
support.hgst.com/4U60

For technical user documentation, from the bottom of the **Customer Technical Support and Downloads** page, select the **Resources** tab.

3   Disclaimers

The following chapter describes the Regulatory Statement of Compliance, Safety Compliance, and Electromagnetic Compatibility Agency Requirements for the 4U60 Storage Enclosure.

3.1   Regulatory Statement

Product Name: **4U60 Storage Enclosure**
Regulatory Model: **G460-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 and regulatory type 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.

3.1.1   Restricted Access Location

The HGST 4U60 Storage Enclosure 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.

3.1.2   Safety Compliance

The following table outlines how the 4U60 Storage Enclosure is designed to pass the product safety requirements:

Table 3: Product Safety Compliance

Country/Region	Authority or Mark	Standard	Status
Australia/New Zealand	CB report, CB certificate	AS/NZS 60950.1	Complete
Brazil	INMETRO	IEC 60950-1	Complete
Canada/North America	NRTL	CSA C22.22 No. 60950-1-07	Complete
Customs Union/Russia, Kazakhstan, Belarus, Armenia	EAC	TR CU 004/2011	Complete
European Union	CE	EN 60950-1	Complete

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Country/Region	Authority or Mark	Standard	Status
India	BIS	IS 13252 (Part 1):2010	Complete
International		IEC60950, CB report and Certificate to include all country national deviations	Complete
Israel	SII	IEC 60950-1	Complete
Mexico	NYCE or NOM	NOM-019-SCFI-1998	Complete
Moldova	INSM	SM SR EN60950-1	Complete
Serbia	KVALITET	SRPS EN60950:2010	Complete
South Africa	NRCS	SANS IEC 60950-1	Complete
Taiwan	BSMI	CNS14336	Complete
Ukraine	UKrTEST or equivalent	4467-1:2005	Complete
United States/North America	NRTL	UL 60950-1	Complete

3.1.3   Electromagnetic Compatibility Agency Requirements

The following table outlines how the 4U60 Storage Enclosure is being designed to comply with the Electromagnetic Compatibility agency requirements:

Table 4: Product Electromagnetic Compatibility/Immunity Compliance

Country/Region	Authority or Mark	Standard	Status
Australia/New Zealand	RCM	AS/NZS CISPR22	Complete
Canada/North America	Industry Canada	ICES-003	Complete
Customs Union/Russia, Kazakhstan, Belarus, Armenia	EAC	TR CU 020/2011	Complete
European Union	CE	EN55022, EN55024 including EN61000-3-2, EN61000-3-3	Complete
International		CISPR22, CISPR24	Complete
Japan	Compliant	V-3:2014	Complete
Korea	MSIP	KN22, KN24	Complete
Taiwan	BSMI	CNS13438	Complete
Ukraine	UKrTEST or equivalent	4467-1:2005	Complete
United States/North America	FCC	FCC Part 15	Complete

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4   Safety

The following chapter provides safety and regulatory information for the 4U60 Storage Enclosure.

4.1   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.

4.2   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.

4.3   Electrostatic Discharge

CAUTION

Electrostatic discharge can harm delicate components inside HGST 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.

4.4   Rackmountable Systems

CAUTION

Always install rack rails and storage enclosure according to 4U60 Storage Enclosure product documentation. Follow all cautions, warnings, labels, and instructions provided within the rackmount instructions.

Reliable earthing 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.

4.5   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.

4.6   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.

4.7   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 a HGST-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 4U60 Storage Enclosure.

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.

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5   Regulatory Statements

The following chapter provides regulatory statements for the 4U60 Storage Enclosure.

HGST Storage Enclosures are marked to indicate compliance to various country and regional standards.

> **Note:** *Potential equipment damage:* Operation of this equipment with cables that are not properly shielded and not correctly grounded may cause interference to other electronic equipment and result in violation of Class A legal requirements. Changes or modifications to this equipment that are not expressly approved in advance by HGST will void the warranty. In addition, changes or modifications to this equipment might cause it to create harmful interference.

5.1   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 HGST may void the authority granted to the user by the FCC to operate equipment.

5.2   FCC Verification Statement (USA)

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

- This device may not cause harmful interference, and
- 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 and can radiate radio frequency energy, and if not installed and used in accordance with the 4U60 Storage Enclosure User Guide, it may cause harmful interference to radio communications.

5.3   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.

5.4   CE Notices (European Union), Class A ITE

Marking by the symbol indicates compliance of this system to the applicable Council Directives of the European Union, including the Electromagnetic Compatibility Directive (2004/108/EC) and the Low Voltage Directive (2006/95/EC). A "Declaration of Conformity" in accordance with the applicable directives has been made and is on file at HGST Europe.

5.5   Europe (CE Declaration of Conformity)

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of the Canadian Department of Communications.

Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: "Appareils Numériques", NMB-003 édictée par le Ministre Canadian des Communications.

5.6   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.

5.7   KCC Notice (Republic of Korea Only), Class A ITE

기 종 별	사 용 자 안 내 문
A급 기기 (업무용 정보통신기기)	이 기기는 업무용으로 전자파적합등록을 한 기기이오니 판매자 또는 사용자는 이 점을 주의하시기 바라며 만약 잘못 판매 또는 구입하였을 때에는 가정용으로 교환하시기 바랍니다.

English translation:

Please note that this device has been approved for business purposes with regard to electromagnetic interference. If you find that this device is not suitable for your use, you may exchange it for a non-business device.

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6   Technical Specifications

The following chapter describes the technical specifications related to the 4U60 Storage Enclosure and the location in which it is to be installed.

6.1   Rack Requirements

The rack mount requirements are based on the 4U rack standards. Rack spaces are equipped to give the enclosure ample power and connectivity allowing them to perform as expected. They also provide effective airflow, cooling for the devices, and allow for easy access for routine maintenance.

For proper rack installation of the 4U60 Storage Enclosure, please mount the enclosure according to the following drawing:

Figure 1: Assembly in the Rack
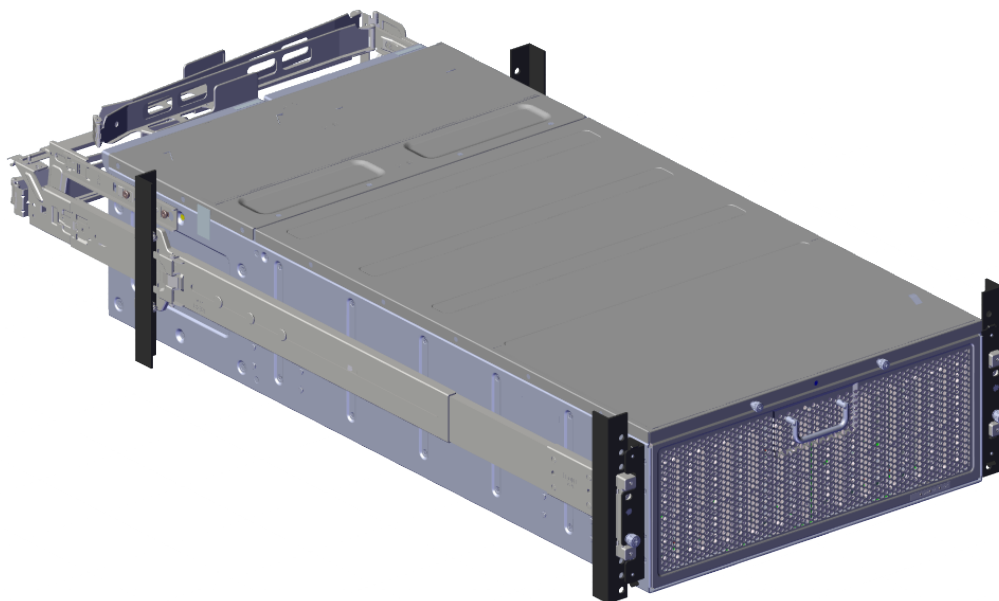
6.2   Alternating Current Input

The following table describes the A/C Input specification for the 4U60 Storage Enclosure.

Table 5: AC Power Specifications

Power	
Alternating Current (AC) Power Supply (2 per enclosure)	
Wattage (per power supply)	1650W 80 + Gold rated

Power	
Voltage (per power supply)	200–240VAC (1650W 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 **45** amps peak.

6.3   Host Connectivity

Connect the 4U60 Storage Enclosure to the host, using high quality miniSAS HD cables.

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

Table 6: Approved Power Cables

Type	Part Number	Dimension (overmold)	Length
BIZlink Technology Inc.	BC314-BC313-1.5M-UL	C13 to C14	1.5 meters
Celestica San Jose	R0893-C0011-01	C13 to C14	1.5 meters
Well Shin Technology CO LTD	0096-0011	C13 to C14	1.5 meters

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

Table 7: Approved SAS Cables

Type	Part Number	Length	Quantity
Elpeus HD Mini-SAS (SFF-8644) to QSFP+ (SFF-8436)	SAS2-44361-2	2 meters	2
Molex HD Mini-SAS (SFF-8644) to QSFP+ (SFF-8436)	1000833201	2 meters	2
Elpeus HD Mini-SAS (SFF-8644) to QSFP+ (SFF-8436)	SAS2-44361-2	3 meters	2

The following table displays the list of Expansion cables approved by HGST:

Table 8: Expansion Cables

Type	Part Number	Length	Quantity
Elpeus QSFP+(SFF-8436) to QSFP+ (SFF-8436)	CB22322-2	2 meters	2
Molex QSFP+(SFF-8436) to QSFP+ (SFF-8436)	1110402205	2 meters	2
Elpeus QSFP+(SFF-8436) to QSFP+ (SFF-8436)	CB22322-2	3 Meters	2

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6.4   Airflow Consideration

The user needs to ensure both the front and rear of the 4U60 Storage Enclosure stay clear of any materials that may block or disrupt the airflow in any way. Disrupting the airflow can cause the enclosure to run the fans at an excessive RPM.

The following rack airflow principles should be considered for best results:

- Controlled air conditioners that are located in the facility where the enclosure will be installed.
- The airflow in and out of the equipment must not be restricted.

6.4.1   Cooling the Enclosure

The 4U60 Storage Enclosure 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 for the temperature sensor 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.

6.5   Grounding the Enclosure

The enclosure is designed to ground all components to the chassis base with the use of a properly grounded receptacle. 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.

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

6.5.1   Electrostatic Discharge

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 recommend that suitable ESD precautions be observed during installation and service operations

7   SCSI Enclosure Services

The following chapter describes the overall functionality of SES within the 4U60 Storage Enclosure.

7.1   SCSI Enclosure Services

The 4U60 Storage Enclosure provides enclosure management capabilities in-band through the MiniSAS HD ports using the SCSI Enclosure Services 3 (SES-3). The management functions are performed with SCSI commands, which are targeted at the Input/Ouput controller's embedded SCSI Enclosure Processor (SEP) device. The 4U60 Storage Enclosure SES command set allows management clients to observe and control the functionality of the enclosure itself, as well as various management entities associated with the enclosure, including the embedded controller, disk drives, power supplies, fans, and connectors.

8   Enclosure Capacity

The following chapter describes defines the capacity of the enclosure and the qualified hard drives for the 4U60 Storage Enclosure.

8.1   Qualified Storage

The SEP examines the Inquiry data of all attached drives to determine if they are a supported type. If an unsupported device is attached to the 4U60 Storage Enclosure, it will not be available to access.

The enclosure uses the following qualified hard disk drives (HDDs):

Table 9: Qualified Hard Disk Drives

Capacity	Family	Format	Form Factor	Model
4TB	Ultrastar 7K6000	SAS 512e SE	3.5in.	HUS726040AL5214
4TB	Ultrastar 7K6000	SAS 512e ISE	3.5in.	HUS726040AL5210
4TB	Ultrastar 7K6000	SAS 4Kn SE	3.5in.	HUS726040AL4214
4TB	Ultrastar 7K6000	SAS 4Kn ISE	3.5in.	HUS726040AL4210
4TB	Ultrastar 7K6000	SAS 512e TCG	3.5in.	HUS726040AL5211
6TB	Ultrastar 7K6000	SAS 512e SE	3.5in.	HUS726060AL5214
6TB	Ultrastar 7K6000	SAS 512e ISE	3.5in.	HUS726060AL5210
6TB	Ultrastar 7K6000	SAS 4Kn SE	3.5in.	HUS726060AL4214
6TB	Ultrastar 7K6000	SAS 4Kn ISE	3.5in.	HUS726060AL4210
6TB	Ultrastar 7K6000	SAS 512e TCG	3.5in.	HUS726060AL5211
8TB	Ultrastar He8	SAS 512e SE	3.5in.	HUH728080AL5204
8TB	Ultrastar He8	SAS 4Kn SE	3.5in.	HUH728080AL4204
8TB	Ultrastar He8	SAS 512e ISE	3.5in.	HUH728080AL5200
8TB	Ultrastar He8	SAS 4Kn ISE	3.5in.	HUH728080AL4200
8TB	Ultrastar He8	SAS 4Kn TCG	3.5in.	HUH728080AL5201
8TB	Ultrastar He8	SATA 512e ISE	3.5in.	HUH728080ALE600
8TB	Ultrastar He8	SATA 512e SE	3.5in.	HUH728080ALE604
8TB	Ultrastar He8	SATA 512e BDE	3.5in.	HUH728080ALE601
8TB	Ultrastar He8	SATA 4Kn ISE	3.5in.	HUH728080ALN600
8TB	Ultrastar He8	SATA 4Kn SE	3.5in.	HUH728080ALN604
8TB	Ultrastar He8	SATA 4Kn BDE	3.5in.	HUH728080ALN601
10TB	Ultrastar He10	SAS 512e ISE	3.5in.	HUH721010AL5200

Capacity	Family	Format	Form Factor	Model
10TB	Ultrastar He10	SAS 512e TCG	3.5in.	HUH721010AL5201
10TB	Ultrastar He10	SAS 512e SE	3.5in.	HUH721010AL5204
10TB	Ultrastar He10	SAS 4Kn ISE	3.5in.	HUH721010AL4200
10TB	Ultrastar He10	SAS 4Kn TCG	3.5in.	HUH721010AL4201
10TB	Ultrastar He10	SAS 4Kn SE	3.5in.	HUH721010AL4204
10TB	Ultrastar He10	SATA 512e ISE	3.5in.	HUH721010ALE600
10TB	Ultrastar He10	SATA 512e SE	3.5in.	HUH721010ALE604
10TB	Ultrastar He10	SATA 512e SED (BDE + TCG)	3.5in.	HUH721010ALE601

The enclosure uses the following qualified solid state drives (SSDs):

Table 10: Qualified Solid State Disk Drives

Capacity	Family	Format	Form Factor	Model
400GB	SanDisk Lightning Ascend Gen. II	SAS ISE	2.5in.	SDLTODKM-400G-5CA1
800GB	SanDisk CloudSpeed Ultra Gen. II	SATA SE	2.5in.	SDLF1DAM-800G-1HA1

8.2   Enclosure Capacity

The following section lists the capacity options per enclosure. The HDD options for capacity consider 4TB, 6TB, 8TB, and 10TB, with up to 60 HDDs per enclosure. The SSD options for capacity consider 200GB and 400GB, with up to 12 SSDs per enclosure.

Table 11: Enclosure Capacity

Raw capacity per Enclosure	Max Drives Per Enclosure	Capacity per Hard Disk Drive	Family
240TB	60	4TB (SAS)	Ultrastar 7K6000
360TB	60	6TB (SAS)	Ultrastar 7K6000
480TB	60	8TB (SAS and SATA)	Ultrastar He8
600TB	60	10TB (SAS)	Ultrastar He10
600TB	60	10TB (SATA)	Ultrastar He10
2.4TB	12	200GB (SAS)	Ultrastar SSD800MH.B
4.8TB	12	400GB (SAS)	Ultrastar SSD1600MR

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8.3   Partial Population

The 4U60 Storage Enclosure allows for partial population of the enclosure.

SSD Partial Population Rules

The following population rules for **SSDs** must be followed for a partially populated enclosure to function properly:

- The minimum amount of drives required for the enclosure to function properly is **two** SSDs.
- Each increase in drive must be done in increments of **two**.
- Each row that is partially populated with drives (HDD and/or SSD) must have the population of that row completed with blanks.
- A combination of HDDs and SSDs are allowed, but the rule of increasing capacity must be done by two when SSDs are involved.
- The remainder of the enclosure, preceding a populated row may remain empty.
- **When SSDs are involved, the population of drive slots must be done in the order and positions displayed below.**
- Repeat the configuration for each following row.

The following diagrams display the partially populated configurations for the first row of drives:

Figure 2: Partially Populated Configurations

Power Supply						Power Supply					
48	49	50	51	52	53	54	55	56	57	58	59
36	37	38	39	40	41	42	43	44	45	46	47
24	25	26	27	28	29	30	31	32	33	34	35
12	13	14	15	16	17	18	19	20	21	22	23
00	01	02	03	04	05	06	07	08	09	10	11

Power Supply						Power Supply					
48	49	50	51	52	53	54	55	56	57	58	59
36	37	38	39	40	41	42	43	44	45	46	47
24	25	26	27	28	29	30	31	32	33	34	35
12	13	14	15	16	17	18	19	20	21	22	23
00	01	02	03	04	05	06	07	08	09	10	11

(green)	Populated with a Drive
(red)	Populated with a Blank
(hatched)	Unpopulated Drive Slot

Power Supply						Power Supply					
48	49	50	51	52	53	54	55	56	57	58	59
36	37	38	39	40	41	42	43	44	45	46	47
24	25	26	27	28	29	30	31	32	33	34	35
12	13	14	15	16	17	18	19	20	21	22	23
00	01	02	03	04	05	06	07	08	09	10	11

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Power Supply						Power Supply					
48	49	50	51	52	53	54	55	56	57	58	59
36	37	38	39	40	41	42	43	44	45	46	47
24	25	26	27	28	29	30	31	32	33	34	35
12	13	14	15	16	17	18	19	20	21	22	23
00	01	02	03	04	05	06	07	08	09	10	11

Power Supply						Power Supply					
48	49	50	51	52	53	54	55	56	57	58	59
36	37	38	39	40	41	42	43	44	45	46	47
24	25	26	27	28	29	30	31	32	33	34	35
12	13	14	15	16	17	18	19	20	21	22	23
00	01	02	03	04	05	06	07	08	09	10	11

Legend:
- Populated with a Drive
- Populated with a Blank
- Unpopulated Drive Slot

Power Supply						Power Supply					
48	49	50	51	52	53	54	55	56	57	58	59
36	37	38	39	40	41	42	43	44	45	46	47
24	25	26	27	28	29	30	31	32	33	34	35
12	13	14	15	16	17	18	19	20	21	22	23
00	01	02	03	04	05	06	07	08	09	10	11

HDD Partial Population Rules

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The following population rules for **HDDs** must be followed for a partially populated enclosure to function properly:

- The minimum amount of drives required for the enclosure to function properly is **one** HDD.
- Each row that is partially populated with drives must have the population of that row completed with blanks.

> **Note:** The position of the HDD does not matter as long as the remaining slots in that row have been populated with blanks.

- The remainder of the enclosure, preceding a populated row may remain empty.
- Repeat the configuration for each following row.

8.4   Drive On/Off Power Control

The 4U60 Storage Enclosure supports individual drive power control utilizing the T10 Pin 3 Power Disable.

The following requirements must be met in order for the power control feature to function properly:

- HDD must support T10 Pin 3 Power Disable
- 4U60 Storage Enclosure drive board model number must be R0814-G0004-03 (old) and R0814-G0004-04 (new)
- Firmware Version: 4.2.5

9   Host and Enclosure Interconnect

The following section describes the interconnect from the hosts to an enclosure or enclosures.

9.1   4U60 Storage Enclosure Interconnect

The following rules for interconnecting or daisy chaining 4U60 Storage Enclosures must be followed for a the for proper functionality:

- The maximum amount of 4U60 Storage Enclosures that can be connected together is **four**.
- The hosts must connect to the **IN** port on their respective sides.

The following figure displays the proper connection for interconnecting multiple enclosures:

Figure 3: Daisy Chain
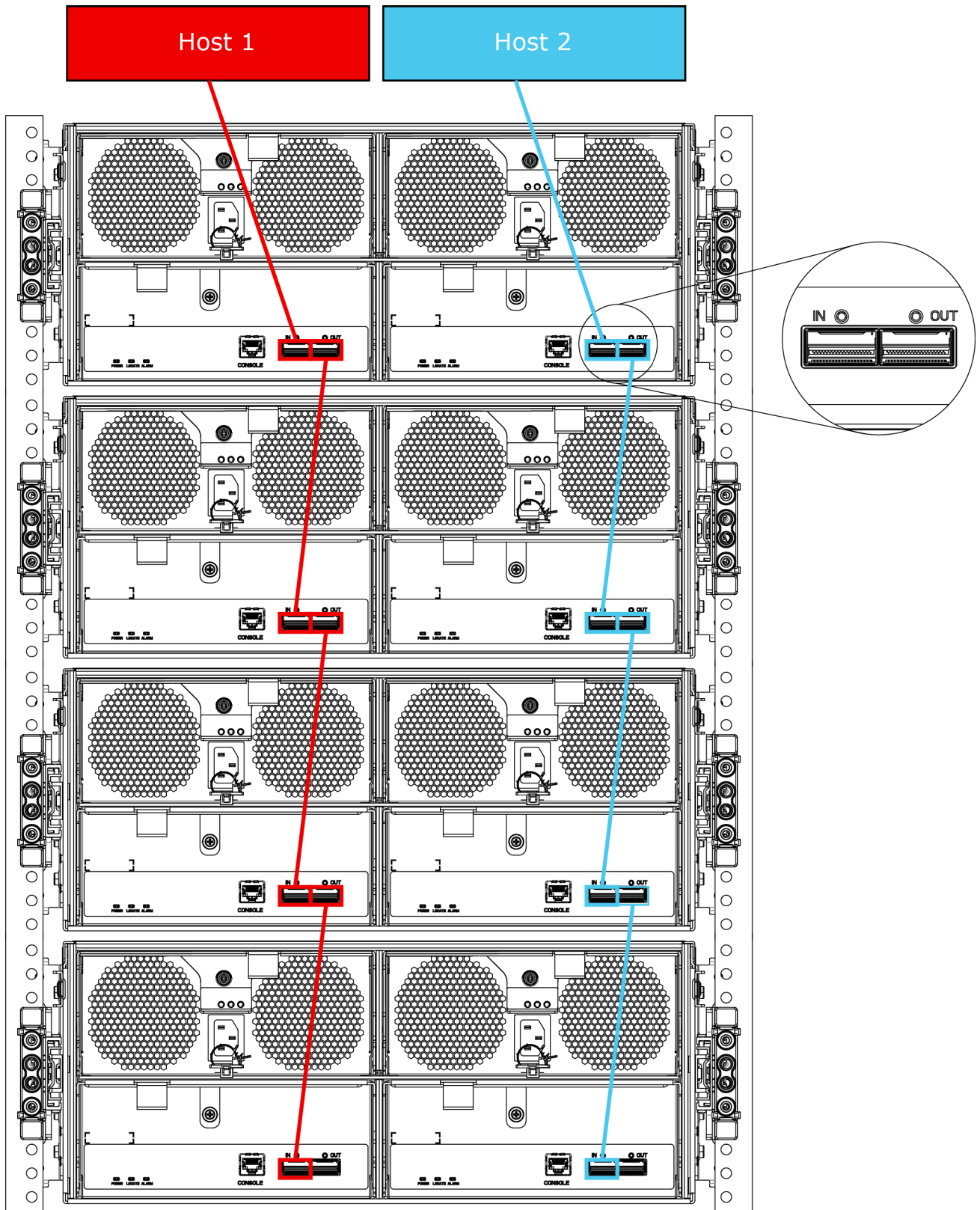
10   Customer Replaceable Units

The following chapter describes the Customer Replaceable Units for the 4U60 Storage Enclosure.

> **Note:** Refer to the Customer Replaceable Unit Guide for detailed instructions on how to replace customer replaceable units.

10.1   Power Supply Unit

The 4U60 Storage Enclosure contains two redundant power supply units (PSU).

> **Note:** The PSU is a hot swappable component.

Figure 4: Power Supply Unit
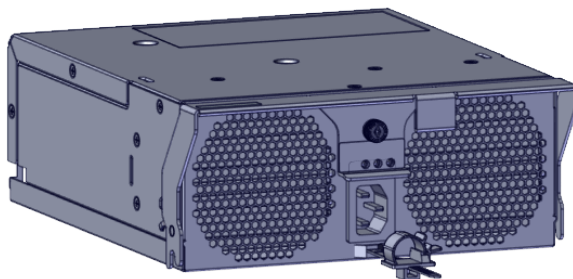
10.2   Enclosure Storage Module

The 4U60 Storage Enclosure contains two Enclosure Storage Modules (ESM) as a standard for SAS drive configurations. The 4U60 Storage Enclosure contains one ESM for SATA drive configurations. The single ESM configuration replaces one of the ESMs with a blank to ensure proper airflow within the enclosure.

Note: The ESM is a hot swappable component.

Figure 5: Enclosure Storage Module
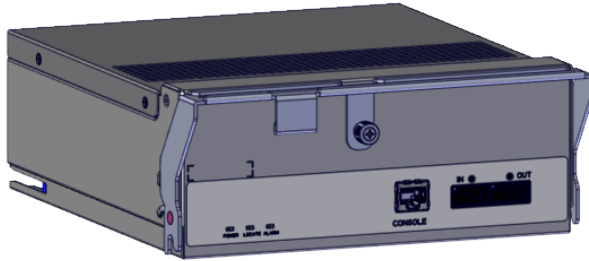
10.3   Hard Disk Drive

The full configuration of the 4U60 Storage Enclosure contains 60 qualified drives. If the enclosure is partially populated, any row that contains drives must be completed with drive slot blanks. Drive slot blanks look like a plastic version of a real drive and help keep proper airflow throughout the enclosure.

> **Note:** The HDDs are hot swappable
> components.

Figure 6: Hard Disk Drive
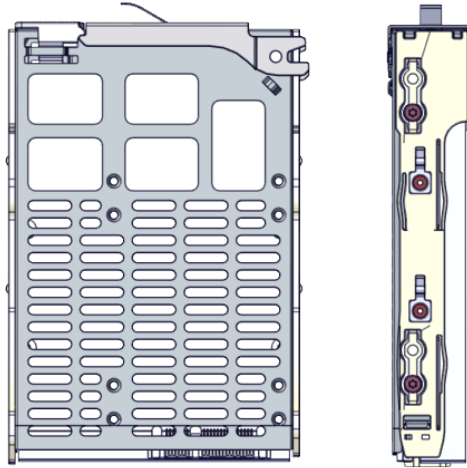
For a list of qualified hard drives, see **Qualified Storage** on page 22.

10.3.1   Drive Carrier

The 4U60 Storage Enclosure contains 60 drive carriers.

Note: The drive carriers are hot swappable
components.

Figure 7: Drive Carrier
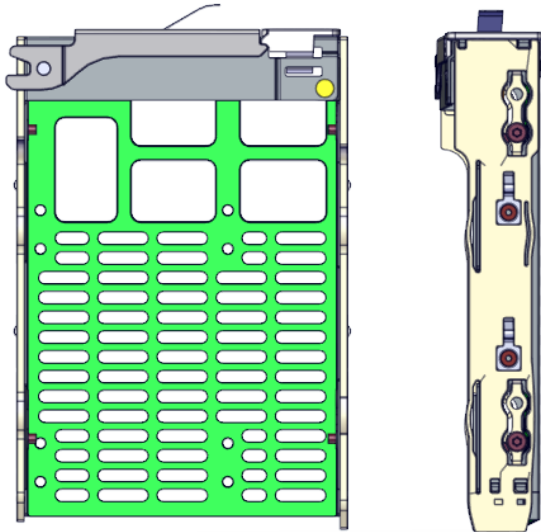
10.3.2   Drive Blank

The 4U60 Storage Enclosure is designed to accept drive blanks to complete the population of drive rows and maintain proper airflow within the enclosure.

> **Note:** The drive blanks are hot swappable components.

Figure 8: Drive Blank
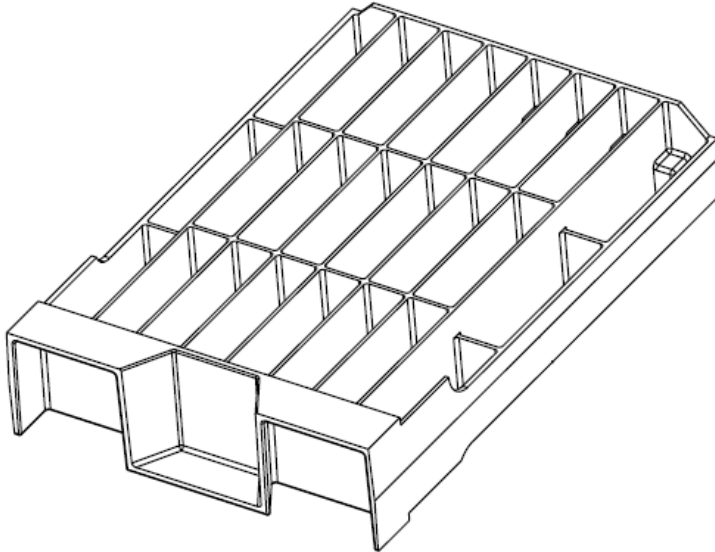
10.4   Cable Management Assembly

The 4U60 Storage Enclosure contains a cable management assembly (CMA) that includes an upper and lower arm.

> **Note:** The CMA is designed to cable the enclosure to meet the needs of your specific configuration.

Figure 9: Cable Management Assembly
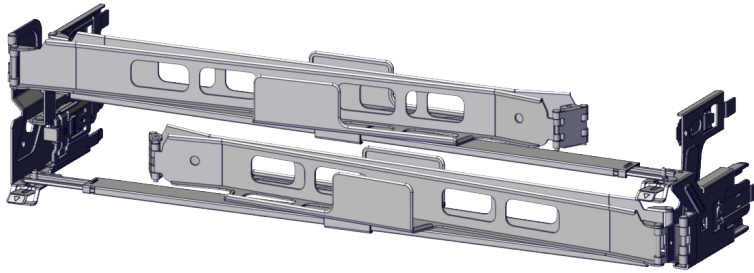
10.5   Power Cords

The 4U60 Storage Enclosure contains a power cord for each of the two PSUs.

> **Note:** It is highly recommended that you use the power cords that have been approved for this particular enclosure. For a list of approved power cords, see: **Host Connectivity** on page 19.

10.6   HD Mini-SAS Cables

The 4U60 Storage Enclosure contains an HD Mini-SAS cable for each of the two ESMs.

> **Note:** It is highly recommended that you use the HD Mini-SAS cables that have been approved for this particular enclosure. For a list of approved HD Mini-SAS cables, see: **Host Connectivity** on page 19.

10.7   Expansion Cables

The 4U60 Storage Enclosure has the option to utilize expansion cables to allow for the connection of up to **four** enclosures.

> **Note:** It is highly recommended that you use the Expansion cables that have been approved for this particular enclosure. For a list of approved expansion cables, see: **Host Connectivity** on page 19.

The **OUT** expansion port may be utilized for a additional bandwidth in the event that the 4U60 Storage Enclosures are not being connected to each other.

10.8   Chassis

The 4U60 Storage Enclosure chassis houses the all of the components that allow for the enclosure to function. During the chassis replacement, it is highly recommended that you remove and store the functioning components in a safe place.

Figure 10: Chassis
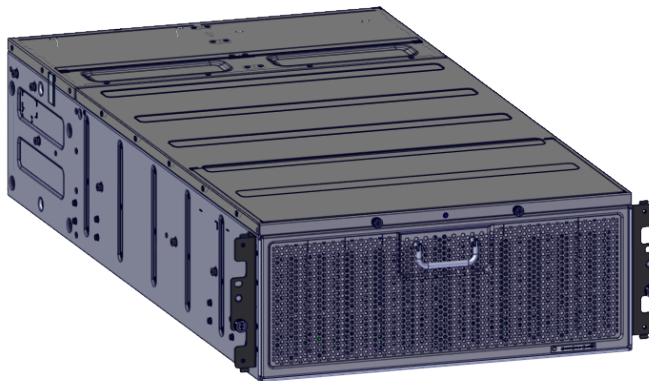
10.9   Rail Kit

The 4U60 Storage Enclosure is installed into the rack using a rail kit. The rail kit is designed to clip into the rack before attaching it with screws. This allows for ease of installation and adjustment. The chassis and all other component will need to be removed in order to replace the component.

Figure 11: Rail Kit
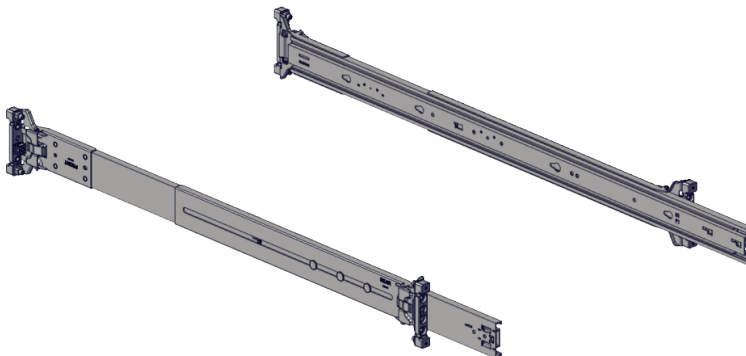
11   Operating the 4U60 Storage Enclosure

The following chapter describes the operation of the 4U60 Storage Enclosure.

11.1   Before You Begin

Ensure that you have all of proper cabling to connect to the enclosure. The enclosure is designed to be installed into a rack, not assembled on a bench top. Connect all of the cables, and turn on and boot the host or control node server. Connect the power to the 4U60 Storage Enclosure; it will come on and boot without any interaction from the user.

11.2   Power On/Off

The 4U60 Storage Enclosure does not have an external power switch, the enclosure is powered on by plugging power cords into the power supplies. Once powered on, the enclosure automatically powers up all drives.

11.3   Verifying the Drives

To verify the drives, do the following:

1. Using SG Utilities, type the following command **Sg_scan –a -s -v**.
    A list of device SCSI results appear.
2. Press **Enter**.

12   Component and Visual Indicator Identification

The following chapter describes the component and visual indicator identification.

12.1   Visual Indicator Identification

The 4U60 Storage Enclosure contains the following LEDs:

Table 12: 4U60 Storage Enclosure LED Descriptions

LED Name	LED Action
ESM	
Power	• **Green**: ESM powered on. • **Off**: ESM powered off.
Fault	• **Red**: ESM has one or more faults. • **Off**: ESM has no faults.
Locate	• **Blinking Amber**: ESM is being identified. • **Off**: ESM is not being identified.
SAS Link Up	• **Green**: SAS link has an active connection. • **Off**: SAS link does not have an active connection.
Enclosure	
Locate	• **Blinking Amber**: Enclosure is being identified. • **Off**: Enclosure is not being identified.
Power	• **Green**: Enclosure is powered on. • **Off**: Enclosure is powered off.
Ready	• **Green**: Enclosure is ready. • **Off**: Enclosure is not ready.
PSU	
Fault	• **Red**: PSU has one or more faults. • **Blinking Red**: PSU is being identified. • **Off**: PSU has no faults.
Ready	• **Green**: PSU is powered on. • **Off**: PSU is powered off.
ACIN	• **Green**: AC input OK. • **Off**: No AC input.

LED Name	LED Action
SAS Drive	
Ready	• **Green**: SAS drive is ready **Note:** Ready LED will blink during spin-up and turn solid green when complete. • **Blinking Green**: I/O Activity on drive. • **Off**: Drive not ready.
Status	• **Red**: Drive has one or more faults. • **Blinking Red (1Hz)**: Drive has been rebuilt/remapped. • **Blinking Red (4Hz)**: Drive has been identified. • **Off**: Drive has no faults.
SATA Drive	
Ready	• **Green**: SATA drive is not ready. **Note:** Ready LED might stay lit during spin-up, and will turn off when complete. • **Blinking Green**: I/O Activity on drive. • **Off**: Drive is ready.
Status	• **Red**: Drive has one or more faults. • **Blinking Red (1Hz)**: Drive has been rebuilt/remapped. • **Blinking Red (4Hz)**: Drive has been identified. • **Off**: Drive has no faults.

12.2   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, defined to cover a wide range of devices. Page 02h refers to the control and status of the enclosures PSUs, drives, ESMs, and sensors.

Note: Refer to the SCSI Enclosure Services documentation for more information on SES Page 02.

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