OceanStor Dorado 8000, Dorado 18000 V700R001

Product Description

Issue   03

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About This Document

This document describes the positioning, highlights, architecture, specifications, environmental requirements, standards compliance, and granted certifications of the OceanStor Dorado 8000 and Dorado 18000 storage systems.

The following table lists the product models to which this document is applicable.

Product Model	Supported Version
OceanStor Dorado 8000	V700R001C10
OceanStor Dorado 18000	V700R001C20

Intended Audience

This document is intended for:

- Technical support engineers
- Maintenance engineers

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
⚠ DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

Symbol	Description
NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Issue 03 (2025-12-30)

This issue is the third official release.

Issue 02 (2025-09-30)

This issue is the second official release.

Issue 01 (2025-06-30)

This issue is the first official release.

Contents

1 Product Positioning

OceanStor Dorado 8000 and Dorado 18000 are Huawei's brand-new all-flash storage systems designed for medium- and large-size enterprise storage environments. The storage systems focus on the core services of enterprise data centers, virtual data centers, and cloud data centers to meet their requirements for robust reliability, excellent performance, and high efficiency.

OceanStor Dorado storage systems leverage a SmartMatrix full-mesh architecture, which guarantees service continuity in the event that one out of two controller enclosures fails or seven out of eight controllers fail, meeting the reliability requirements of enterprises' core services. In addition, OceanStor Dorado storage systems incorporate AI chips, meeting the requirements of various service applications such as online transaction processing (OLTP), online analytical processing (OLAP), high-performance computing (HPC), digital media, Internet operations, centralized storage, backup, disaster recovery, and data migration.

OceanStor Dorado storage systems provide high-performance storage services for data centers, as well as comprehensive data backup and disaster recovery solutions to ensure the smooth and secure running of data services. In addition, OceanStor Dorado storage systems offer various methods for easy management and convenient local/remote maintenance, remarkably reducing management and maintenance costs.

2 Product Highlights

OceanStor Dorado storage systems combine a brand-new hardware structure, SmartMatrix full-mesh architecture, and an all-flash software design with advanced data application and protection technologies, meeting medium- and large-sized enterprises' storage requirements for excellent performance, flexible scalability, proven reliability, and high availability. In addition, the OceanStor Dorado storage systems integrate both SAN and NAS on one set of hardware and software without using independent NAS gateways. The systems support protocols such as NFS, CIFS, S3, HTTP, FTP, FC (SCSI-port-based FC-SCSI protocol or NVMe-port-based FC-NVMe protocol), iSCSI, and NVMe-oF. Both SAN and NAS can scale out to multiple controllers. Hosts can access any LUN or file system from a front-end port on any controller.

> **NOTE**
>
> All Fibre Channel interface modules support the FC-NVMe protocol.

SmartMatrix Full-mesh Architecture

OceanStor Dorado storage systems use the SmartMatrix full-mesh architecture, which leverages a high-speed, fully interconnected passive backplane to connect to multiple controllers. Interface modules (Fibre Channel and back-end expansion) are shared by all controllers over the backplane, allowing hosts to access any controller through any port. The SmartMatrix architecture allows close coordination between controllers, simplifies software models, and achieves active-active fine-grained balancing, high efficiency, and low latency.

Figure 2-1 Full-mesh architecture
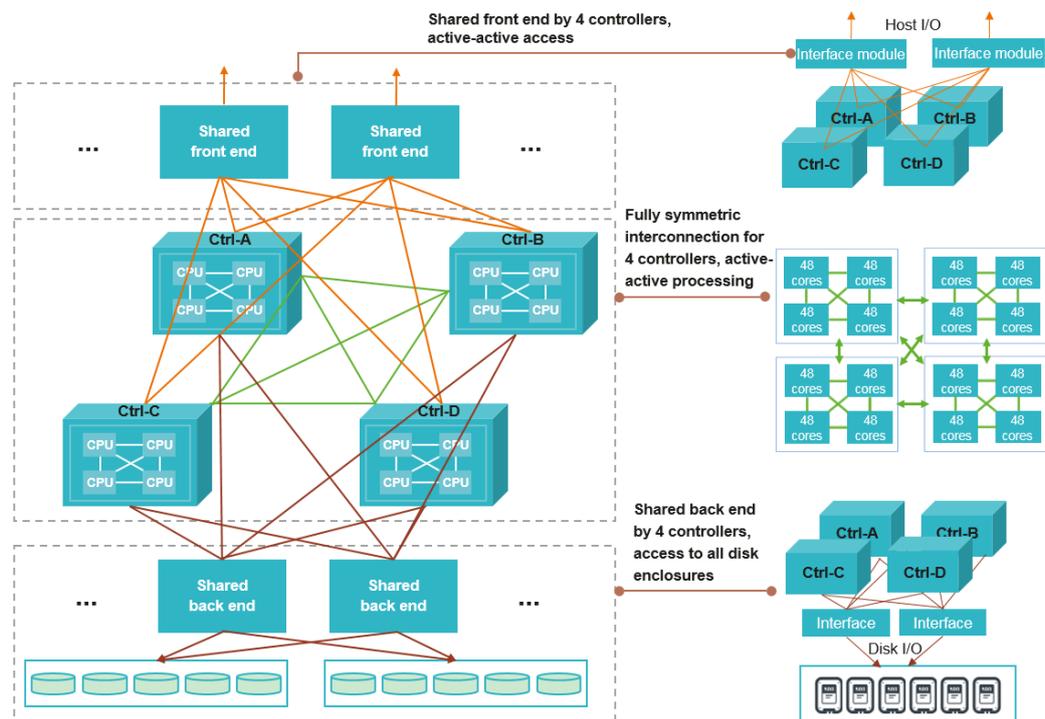
FlashLink®

OceanStor Dorado storage systems take the advantage of the flash-dedicated FlashLink® technique to serve million-level input/output operations per second (IOPS) while maintaining a consistent low latency.

FlashLink® employs a series of optimizations for flash media. It associates controller CPUs with SSD CPUs to coordinate SSD algorithms between these CPUs, thereby achieving high system performance and reliability. The key technologies of FlashLink® include:

- Intelligent many-core technology

  OceanStor Dorado storage systems use Huawei-developed CPUs, providing the industry's most CPUs and cores in a storage controller. The intelligent many-core technology allows storage performance to increase linearly with the number of CPUs and cores.

- Efficient RAID

  OceanStor Dorado storage systems use the redirect-on-write (ROW) full-stripe write design, which writes all new data to new blocks instead of overwriting existing blocks. This greatly reduces the overhead on controller CPUs and read/write loads on SSDs in a write process, improving system performance in various RAID levels.

- Hot and cold data separation

  OceanStor Dorado storage systems can identify and separate hot and cold data to improve garbage collection performance, reduce the program/erase (P/E) cycles on SSDs, and extend the service life of SSDs.

- Low latency guarantee

OceanStor Dorado storage systems use the latest generation of Huawei-developed SSDs and a faster protocol to optimize I/O processing and maintain a low I/O latency.

- Smart disk enclosure

  OceanStor Dorado storage systems support the Huawei-developed smart disk enclosure. The smart disk enclosure is equipped with CPU and memory resources, and can offload tasks, such as data reconstruction upon a disk failure, from controllers to reduce the workload on the controllers and eliminate the impact of such tasks on service performance.

- Efficient time point technology

  OceanStor Dorado storage systems implement data protection by using distributed time points. Read and write I/Os from user hosts carry the time point information to quickly locate metadata, thereby improving access performance.

Distributed File System

OceanStor Dorado storage systems use distributed file systems, which means the file systems are not owned by any specific controller. Directories and files in a file system are evenly distributed to all controllers by a balancing algorithm. Read and write requests received by any controller are equally distributed on each controller so that one file system can fully utilize the resources of the entire storage cluster. Customers can use the file system in one namespace or multiple file systems based on their service plans. The distributed file systems apply to file sharing scenarios with coexisting mass volumes of small and large files. Data in each directory is evenly distributed to each controller for load balancing. The same controller processes the I/Os of a directory and its files to eliminate forwarding across controllers and improve performance for directory traversal, attribute traversal, and batch attribute configuration. When large files are written to a storage pool, RAID 2.0+ globally distributes their data blocks to all SSDs in the storage pool for improved write bandwidth.

Flexible Scalability

OceanStor Dorado storage systems support both scale-up and scale-out, achieving flexible scalability while maintaining high performance.

- Scale-up

  Increases storage capacity and improves processing capabilities of existing controllers.

- Scale-out

  Enables performance to increase linearly with the number of controllers.

High Reliability

OceanStor Dorado storage systems offer advanced data protection technologies to minimize risks of disk failures and data loss, and protect data against catastrophic disasters, ensuring continuous system running.

- Component failure protection

  Storage system components are in 1+1 redundancy and work in active-active mode. Normally, the two redundant components are working simultaneously

and share loads. If one component fails or is offline, the other one takes over all loads without affecting ongoing services.

- RAID 2.0+

  The RAID 2.0+ underlying virtualization technology is used to automatically balance loads across disks. If a disk encounters a fault, all the other disks in the same disk domain help reconstruct the faulty disk's service data, achieving a 20-fold faster reconstruction speed than traditional RAID and significantly reducing the possibility of multi-disk failure. RAID 2.0+ supports dynamic RAID and flexible data layout, accelerating SSD reconstruction.

- Power failure protection

  Built-in backup battery units (BBUs) supply power to controller enclosures in the event of unexpected power failures. This enables the storage system to write cache data to built-in disks of controllers to prevent data loss.

- Global wear leveling and anti-wear leveling

  - Global wear leveling: If data is unevenly distributed to SSDs, certain SSDs may be used more frequently and wear faster than others. As a result, such SSDs will fail much earlier than expected, increasing the maintenance costs. OceanStor Dorado storage systems address this problem by using global wear leveling that levels the wear degree among all SSDs, improving SSD reliability.

  - Global anti-wear leveling: When the wear degree of multiple SSDs is reaching the threshold, the system preferentially writes data to specific SSDs. In this way, these SSDs wear faster than the others. This prevents multiple SSDs from failing at a time.

- Disk data pre-copy

  The disk data pre-copy technology enables the storage system to routinely check hardware status and migrate data from any failing disk to minimize the risks of data loss.

- Advanced data protection

  - HyperSnap supports writable snapshots. Snapshot creation and activation have no impact on performance.

  - HyperReplication backs up local data to a remote storage system for disaster recovery.

  - HyperClone creates physical backup copies for source LUNs in real time. It supports incremental synchronization, reverse synchronization, and consistency groups, and allows data copy between different controller enclosures or disk domains, ensuring local data availability.

  - HyperCDP achieves continuous data protection at an interval of several seconds, generating more intensive recovery points on storage devices.

  - HyperMetro enables real-time data synchronization and access between two storage systems. If data access fails in either storage system, HyperMetro implements seamless service switchover to ensure data security and service continuity.

  - The storage system supports multiple cache copies, which means that two or three copies can be created for the write cache. The three-copy mode ensures data integrity in the write cache and service continuity in the event that two controllers of the storage system fail simultaneously. For a storage system with two controller enclosures that house eight

controllers, three cache copies are distributed to both controller enclosures to protect data integrity in the write cache and service continuity in the event that either controller enclosure becomes faulty.

– HyperMetro-Inner takes the advantage of continuous mirroring, back-end global sharing, and three cache copies to tolerate successive failure of seven out of eight controllers, simultaneous failure of two controllers, and failure of one controller enclosure on an eight-controller network.

– HyperDetect is a data protection technology deployed in storage system containers. It provides ransomware detection capabilities, including ransomware file interception, real-time ransomware detection, and intelligent ransomware detection.

– HyperLock, also called write once read many (WORM), protects the integrity, confidentiality, and accessibility of original data, meeting the increasing requirements on secure data storage.

– CloudBackup uses the data protection technique deployed in storage system containers to back up file system data from a storage system to the object storage either in an on-premises data center or on the cloud, without the need for extra backup servers. A backup copy at a specified point in time can be used to restore the data.

High Availability (HA)

OceanStor Dorado storage systems use TurboModule, online capacity expansion, and disk roaming to ensure service continuity during routine maintenance.

- TurboModule enables hot swap of controllers, power modules, interface modules, BBUs, fan modules, and disks.

- Online capacity expansion allows you to add disks to the system online with ease.

- Disk roaming enables the storage system to automatically identify relocated disks and resume their services.

OceanStor Dorado storage systems use multiple resource application technologies to flexibly manage resources and maximize customers' return on investment (ROI).

- SmartVirtualization allows a local storage system to centrally manage resources of third-party storage systems, simplifying management and reducing maintenance costs.

- SmartMigration migrates LUNs or files between storage systems, adjusting and allocating resources along with business development.

- SmartQoS categorizes service data based on its characteristics (each category represents a type of application) and sets a priority and performance objective for each category. In this way, resources can be preferentially allocated to services with high priorities to guarantee their performance.

- SmartQuota is a file system quota technology. It controls the storage resources for directories, users, and user groups to prevent overuse of storage resources by specific users.

- SmartMobility is to store the hot and cold data of file systems into different tiers. Hot data is stored on local high-performance storage devices while cold data is stored on remote storage devices. Files that have been migrated to

remote storage devices can be read and written in real time and recalled in the background, allowing transparent user access and achieving a balance between space and performance.

- SmartMulti-Tenant creates multiple virtual storage systems (vStores) in a physical storage system to implement flexible, easy-to-manage, and cost-effective storage sharing among multiple vStores without affecting data security and privacy of each vStore.

- SmartMove migrates the source file system to a specified storage pool or storage array without interrupting host services. In this way, service data can be properly allocated and service performance can be improved.

- SmartCache improves the efficiency of access to hot data. It is applicable to I/O-intensive scenarios where most operations are read operations.

- SmartTier helps improve the storage system performance and lower the total cost of ownership (TCO) by storing user data at different tiers.

High System Security

- Storage network security
  - Secure management channel

    All management operations from physical ports are controlled by the access authentication mechanism of the storage system, and only authorized users are allowed to manage the storage system.

  - Secure protocols and ports

    The storage system provides only necessary external connections for system operations and maintenance (O&M). All the ports used are listed in *OceanStor Dorado 6.x.x & V700R001 Communication Matrix*. Dynamic listening ports are functioning in a proper scope, and no undisclosed ports exist.

  - Isolation between service and management ports

    The access control list (ACL) is used to isolate Ethernet ports from internal heartbeat network ports, management network ports, and maintenance ports.

  📖 **NOTE**

  Internal heartbeat links exist between the controllers in a storage system and are used to check the operating status of the controllers. No additional links are required.

- Storage management security

  Management permissions are controlled by enabling or disabling users. All management operations are logged.

Virtualization, Intelligence, and Efficiency

OceanStor Dorado storage systems adopt cutting-edge storage designs in terms of virtualization, intelligence, and efficiency. Compared with traditional storage systems, OceanStor Dorado storage systems use the following technologies to provide higher storage space utilization, faster data reconstruction, smarter performance allocation, and finer service quality control:

- RAID 2.0+ underlying virtualization

Divides disk storage space into small-sized data blocks and uses the blocks to create RAID groups for fine-grained resource management. This technology enables automatic load balancing, higher storage performance, better storage space utilization, faster disk reconstruction, and delicate storage space management, serving as a basis for a number of other advanced storage technologies.

- Intelligent thin provisioning (SmartThin)

  SmartThin allocates storage space on demand rather than pre-allocating all storage space at the initial stage. It is a cost-effective solution because customers can start business operations with minimal disks and add disks based on onsite requirements. In this way, the initial purchase cost and Total Cost of Ownership (TCO) are reduced.

- Deduplication and compression (SmartDedupe and SmartCompression)

  OceanStor Dorado storage systems use SmartDedupe and SmartCompression to deduplicate and compress data to save storage space and reduce read and write operations on SSDs. This helps prolong the service life of SSDs and reduce the investment costs as well as the O&M costs.

Cost-Effectiveness and Ease-of-Use

OceanStor Dorado storage systems employ delicate fan speed control, SmartDedupe, and SmartCompression to drive down costs. They also provide a collection of management and maintenance tools to simplify operation and maintenance.

- Cost-effectiveness

  Delicate fan speed control

  Dynamically adjusts the fan speed based on storage system temperature, lowering the noise and power consumption while saving device operation costs.

- Ease-of-use

  - DeviceManager

    A tool that is developed based on HTML5 and provides the graphical user interface (GUI) for storage management. It helps you easily manage storage systems through wizard-instructed operations.

  - Integrated management

    Supports VMware vCenter Plug-in and Hyper-V System Center for management. In addition, the storage system supports VMware vStorage APIs for Storage Awareness (VASA), vStorage APIs for Array Integration (VAAI), and Volume Shadow Copy Service (VSS) Provider to facilitate management.

  - Tablet management

    Supports flexible storage system management on a tablet.

  - Various alarm notification methods

    Supports alarm notification by sound, indicator, short message service (SMS), and email. Critical information is sent to users in a timely manner.

  - One-click upgrade tool

    Provides one-click online upgrade for controllers. This upgrade is easy and services remain online and operational during the upgrade process.

Intelligent O&M

The DME IQ cloud intelligent management system (formerly named eService) improves user O&M capabilities and takes planned maintenance actions to prevent potential risks.

Being authorized by customers, DME IQ monitors device alarms in 24/7 mode. Whenever an alarm is detected, it automatically notifies Huawei technical support center and creates service requests. Huawei service engineers will help customers solve problems in a timely manner.

- DME IQ provides a self-service O&M system for customers, aiming for precise information services.
- Based on Huawei Cloud, the DME IQ cloud system drives O&M activities through big data analytics and artificial intelligence (AI) to identify faults in advance, reduce O&M difficulties, and improve O&M efficiency.
- Data is encrypted for secure transmission. DME IQ can access the customer's system only after being authorized by the customer.
- 24/7 secure, reliable, and proactive O&M services are provided. SRs can be automatically created.
- Customers can use any PC to access DME IQ at any time and place to check device information.

DME IQ enables the client to work with the cloud system.

- The client is deployed on the customer side. It collects alarms on the customer devices and sends them to the cloud system for remote maintenance such as remote inspection and log collection.
- The cloud system is deployed in Huawei technical support center. It receives device alarms from the client 24/7 and automatically notifies Huawei technical support personnel of the alarms. It also supports automatic inspection and log collection on the customer devices.

For details, see the *DME IQ Intelligent Cloud O&M Platform User Guide* or access DME IQ at **https://support.eservice.huawei.com/**.

3 Hardware Architecture

3.1 3D Interactive Hardware Demonstration

The 3D Experience Center provides new 3D hardware simulation for interactive experience, which supports all-round demonstration of hardware components and manual disassembly, providing details on the internal structure. You can access the demonstration as follows:

Step 1 Visit Huawei Data Storage Infocenter (**https://info.support.huawei.com/storage/#/home**).

Step 2 In the **Top Tools** area, click **3D Experience Center**.

Step 3 Select **OceanStor Dorado**.

Step 4 Select the desired product model.

Step 5 Select the component you want to view.

----End

3.2 Bay

This section describes the overall structure and internal layout of a bay.

📖 **NOTE**

- By default, OceanStor Dorado 8000 is not delivered as bay. The bay is optional.
- By default, OceanStor Dorado 18000 is delivered by bay.

Overall Structure

Figure 3-1 Cabinet
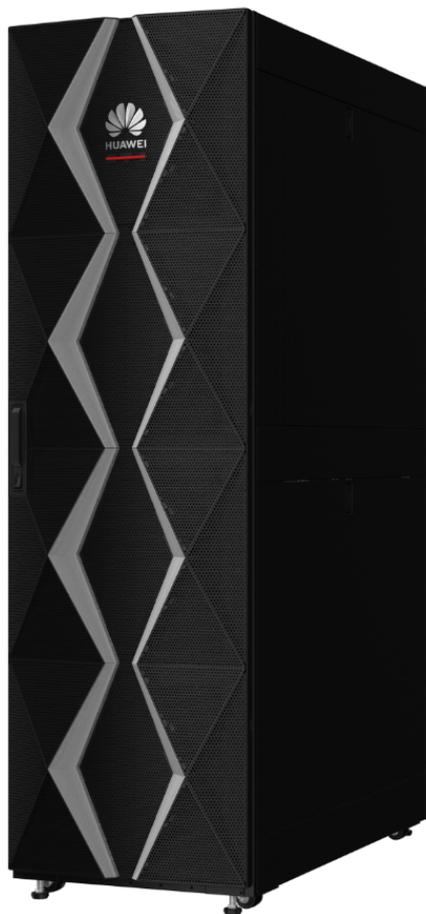
Hardware Specifications

Table 3-1 lists the dimensions, weight, and power specifications of the bay. For more specifications, refer to **Specifications Query**.

Table 3-1 Hardware specifications

Item	Specifications
Dimensions (H x W x D)	1200mm*600mm*2000mm
Unloaded bay weight	200 kg
Power distribution unit (PDU)	220 V single-phase AC: 200 V to 240 V AC±10% 380 V three-phase AC: 346 V to 415 V AC ±10% 240 V high-voltage DC: 240 V DC ±20%

Internal Layout

The storage system consists of both system bays and disk bays.

- A system bay has a controller enclosure, disk enclosures, and cable trays inside the bay.
- A disk bay has only disk enclosures.

Figure 3-2 shows the front views of bays with 2 U SAS disk enclosures.

Figure 3-2 Front views of bays with 2 U SAS disk enclosures

Figure 3-3 shows the front views of bays with 2 U smart disk enclosures.

Figure 3-3 Front views of bays with 2 U smart NVMe disk enclosures
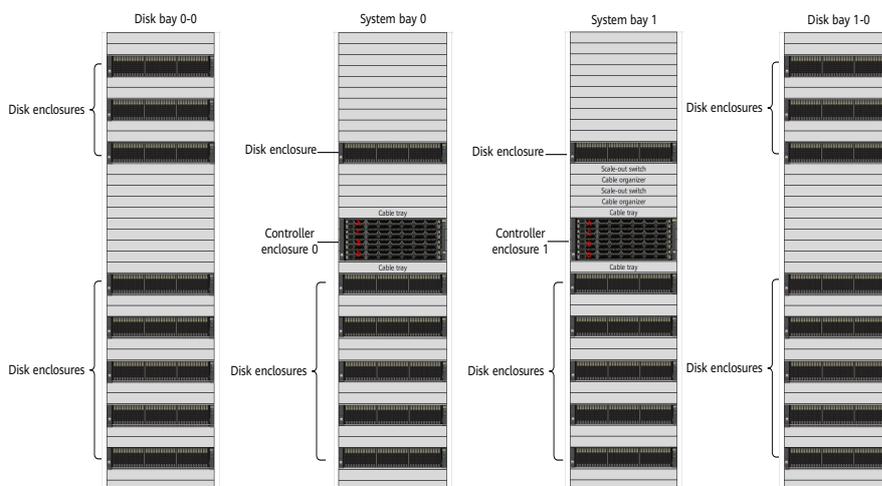
3.3 4 U Controller Enclosure for OceanStor Dorado 8000 (SAS) and Dorado 18000 (SAS)

This section describes the hardware structure, component functions, front and rear views, and indicators of a controller enclosure.

3.3.1 Overview

The controller enclosure uses a modular design and consists of a system subrack, controllers, BBUs, power modules, management modules, and interface modules.

Each controller enclosure houses two or four controllers that have CPUs, physical memory, front-end ports, and expansion ports.

NOTE

4 U controller enclosures using DC power modules do not support delivery as bay. That is, if a 4 U controller enclosure is delivered as bay, it can only use AC power modules. If a 4 U controller enclosure is not delivered as bay, it can use AC or DC power modules.

Overall Structure

Figure 3-4 shows the overall structure of a controller enclosure.

Figure 3-4 Overall structure of a controller enclosure
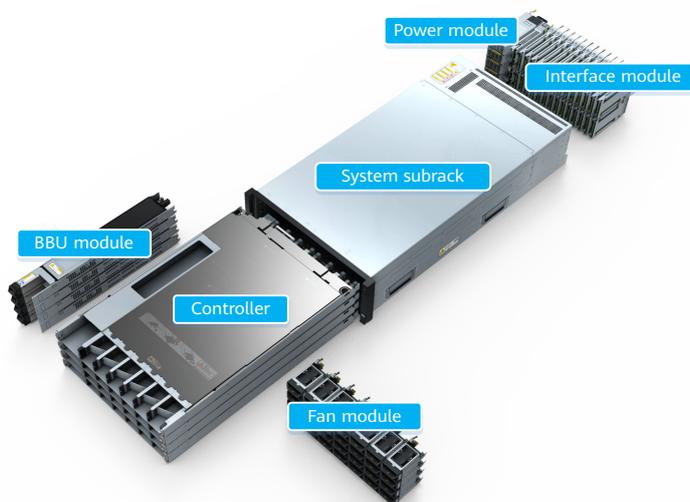
◻ NOTE

- When a controller enclosure is equipped with two controllers, the controllers are installed in the first and third slots from top to bottom, and assistant cooling modules are installed in the second and fourth slots. Controllers communicate with each other using internal heartbeat links, which do not need cable connections.
- Slots are used to accommodate and secure disks, interface modules, controllers, fan modules, and power modules.

Front View

Figure 3-5 shows the front view of a controller enclosure.

Figure 3-5 Front view of a controller enclosure
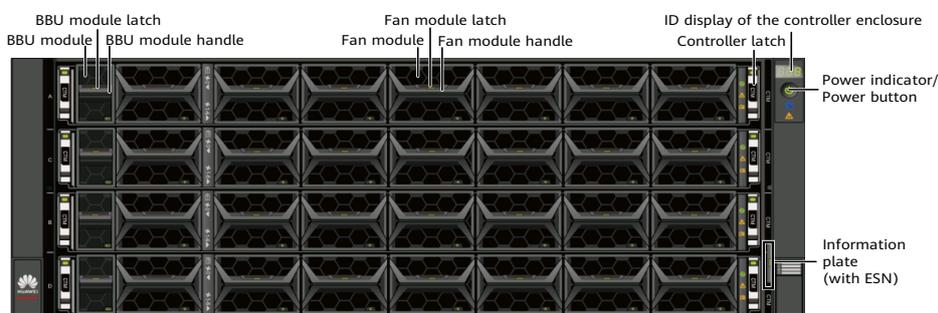
☐☐ NOTE

- Each controller has seven fan modules.
- The controllers are A, C, B, D in a top-down sequence.
- The information plate is used to record device information. You can pull out the information plate near the mounting ear of the device to view the device model.

Rear View

Figure 3-6 and **Figure 3-7** show the rear views of controller enclosures equipped with AC power modules.

Figure 3-6 Rear view of a controller enclosure (with 12 Gbit/s SAS expansion modules, using the AC power module as an example)
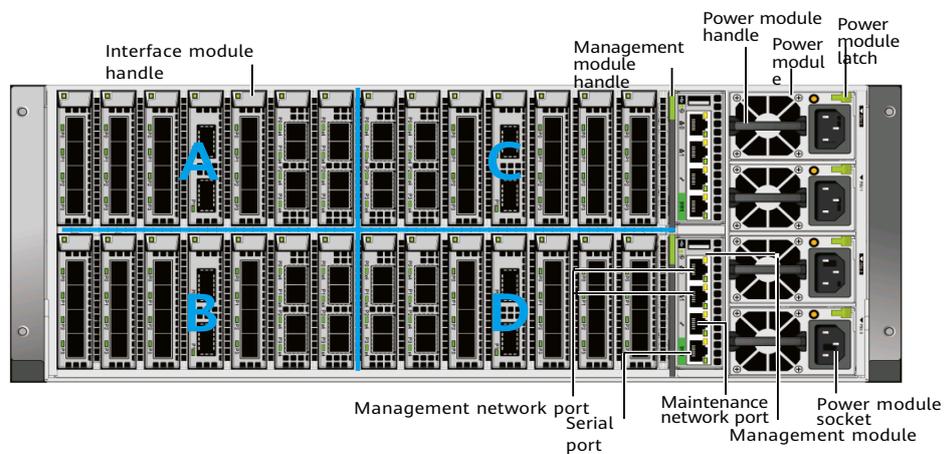
Figure 3-7 Rear view of a controller enclosure (with 100 Gbit/s RDMA back-end interface modules, using the AC power module as an example)

NOTICE

- The maintenance port is used for special management and maintenance only by Huawei technical support engineers in emergency. Do not connect the management network port and maintenance network port to the same LAN or switch to prevent network loops. The initial IP address of the maintenance port is 172.31.128.101 or 172.31.128.102. The default subnet mask is 255.255.0.0. You are advised to connect only the management port to the network.

- Only serial cables can be inserted into serial ports. Do not insert network cables into serial ports.

The management modules are mandatory for a 4 U controller enclosure. They are used for management and maintenance and their slot numbers are SMM 0 and SMM 1 from top to bottom.

As shown in **Figure 3-8**, slots of interface modules in a 4 U controller enclosure are numbered from left to right and from top to bottom as follows:

- The upper slots are IOM H0, IOM H1, IOM H2, IOM H3, IOM H4, IOM H5, IOM H6, IOM H7, IOM H8, IOM H9, IOM H10, IOM H11, IOM H12, and IOM H13.

- The lower slots are IOM L0, IOM L1, IOM L2, IOM L3, IOM L4, IOM L5, IOM L6, IOM L7, IOM L8, IOM L9, IOM L10, IOM L11, IOM L12, and IOM L13.

Figure 3-8 Slot numbers of interface modules
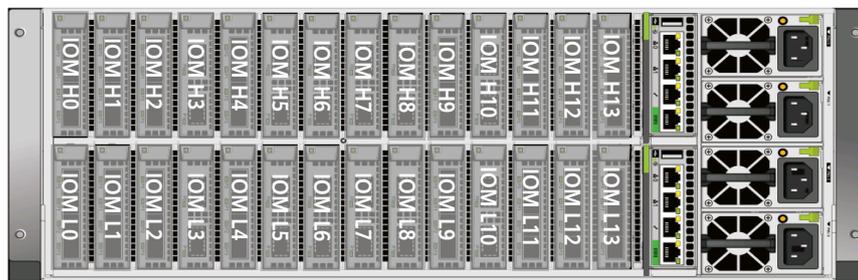
The rules for installing interface modules on a controller enclosure are as follows:

1. For reliability purposes, it is recommended that interface modules should be installed in pairs. That is, the same interface module should be installed in the upper slot and corresponding lower slot separately.

2. The scale-out interface modules are installed and configured in the following sequence: IOM H3/L3 > IOM H10/L10.

3. Install back-end interface modules first and then front-end interface modules.

4. Configuration rules for back-end interface modules:

   – For controller enclosures that can only be connected to SAS disk enclosures (configured with only 12 Gbit/s SAS interface modules): 12 Gbit/s SAS interface modules can only be installed in slots IOM H5, IOM H6, IOM H7, IOM H8, IOM L5, IOM L6, IOM L7, and IOM L8 in the following sequence: IOM H6/L6 > IOM H7/L7 > IOM H5/L5 > IOM H8/L8.

- For controller enclosures that can only be connected to smart NVMe disk enclosures (configured with only 100 Gbit/s RDMA interface modules): 100 Gbit/s RDMA interface modules for back-end connection must be installed in the following sequence: IOM H6/L6 > IOM H7/L7 > IOM H5/L5 > IOM H8/L8 > IOM H4/L4 > IOM H9/L9 > IOM H2/L2 > IOM H11/L11 > IOM H1/L1 > IOM H12/L12 > IOM H3/L3 > IOM H10/L10.

☐ NOTE

The SO 100 Gbit/s RDMA interface module used for adding controller enclosures can be installed only in slots IOM H3/L3 and IOM H10/L10. When connecting disk enclosures, do not use these slots unless other slots are not enough for disk enclosure connection.

5. Configuration rules for front-end interface modules:

- When the Fibre Channel (FC) front-end interconnect I/O module is used, you only need to configure one module in an upper slot and one in a lower slot.

- When an interface module other than the FC front-end interconnect I/O module is used, you must configure one module in each of the A, B, C, and D quadrants.

- For FC networking:

  i. For controller enclosures that can only be connected to SAS disk enclosures (configured with only 12 Gbit/s SAS interface modules), the priority of slots that can be used for installing front-end interface modules is as follows: IOM H0/L0 > IOM H13/L13 > IOM H1/L1 > IOM H12/L12 > IOM H2/L2 > IOM H11/L11 > IOM H4/L4 > IOM H9/L9 > IOM H3/L3 > IOM H10/L10.

  ii. For controller enclosures that can only be connected to smart NVMe disk enclosures (configured with only 100 Gbit/s RDMA interface modules), the priority of slots that can be used for installing front-end interface modules is as follows: IOM H0/L0 > IOM H13/L13 > IOM H1/L1 > IOM H12/L12 > IOM H2/L2 > IOM H11/L11 > IOM H4/L4 > IOM H9/L9 > IOM H5/L5 > IOM H8/L8 > IOM H3/L3 > IOM H10/L10 > IOM H7/L7.

- For non-FC networking:

  i. For controller enclosures that can only be connected to SAS disk enclosures (configured with only 12 Gbit/s SAS interface modules):

    ○ In a two-controller system, the priority of slots that can be used for installing front-end interface modules is as follows: IOM H0/L0 > IOM H1/L1 > IOM H2/L2 > IOM H4/L4 > IOM H3/L3.

    ○ In a four-controller system, the priority of slots that can be used for installing front-end interface modules is as follows: IOM H0/L0 > IOM H13/L13 > IOM H1/L1 > IOM H12/L12 > IOM H2/L2 > IOM H11/L11 > IOM H4/L4 > IOM H9/L9 > IOM H3/L3 > IOM H10/L10.

  ii. For controller enclosures that can only be connected to smart NVMe disk enclosures (configured with only 100 Gbit/s RDMA interface modules):

    ○ In a two-controller system, the priority of slots that can be used for installing front-end interface modules is as follows: IOM

H0/L0 > IOM H1/L1 > IOM H2/L2 > IOM H4/L4 > IOM H5/L5 > IOM H3/L3.

○ In a four-controller system, the priority of slots that can be used for installing front-end interface modules is as follows: IOM H0/L0 > IOM H13/L13 > IOM H1/L1 > IOM H12/L12 > IOM H2/L2 > IOM H11/L11 > IOM H4/L4 > IOM H9/L9 > IOM H5/L5 > IOM H8/L8 > IOM H3/L3 > IOM H10/L10 > IOM H7/L7.

6. The installation sequence of interface modules used for replication services is the same as that of front-end interface modules.

7. Interface modules of the same type must be installed in sequence.

8. Install different types of front-end interface modules in a sequence of Ethernet > RoCE > FC. Place interface modules in ascending order of their port rates.

9. The rules for installing SCM cards on a controller enclosure are as follows:

📖 NOTE

- When SmartCache is used, SCM cards must be installed on the controller enclosure. Each controller supports a maximum of two SCM cards.
- In a dual-controller system, a controller enclosure can have a maximum of four SCM cards, which must be installed symmetrically in the upper and lower slots.
- In a four-controller system, a controller enclosure can have a maximum of eight SCM cards, which must be installed symmetrically in the A, B, C, and D quadrants.

– If 12 Gbit/s SAS interface modules are used:

■ In a dual-controller system, follow this order when installing SCM cards into slots: IOM H2/L2 > IOM H4/L4 > IOM H0/L0 > IOM H1/L1 > IOM H3/L3.

■ In a four-controller system, follow this order when installing SCM cards into slots: IOM H2/L2/H11/L11> IOM H4/L4/H9/L9 > IOM H0/L0/H13/L13 > IOM H1/L1/H12/L12> IOM H3/L3/H10/L10.

– If BE 100 Gbit/s RDMA interface modules are used:

■ In a dual-controller system, follow this order when installing SCM cards into slots: IOM H2/L2 > IOM H4/L4 > IOM H0/L0 > IOM H1/L1 > IOM H5/L5 > IOM H3/L3.

■ In a four-controller system, follow this order when installing SCM cards into slots: IOM H2/L2/H11/L11 > IOM H4/L4/H9/L9 > IOM H0/L0/H13/L13 > IOM H1/L1/H12/L12 > IOM H5/L5/H8/L8 > IOM H3/L3/H10/L10.

10. SmartDedupe and SmartCompression acceleration module:

📖 NOTE

Each controller can be configured with a maximum of three SmartDedupe and SmartCompression acceleration modules.

- In a dual-controller system, a controller enclosure can house a maximum of six SmartDedupe and SmartCompression acceleration modules, and the modules must be installed in symmetrical slots.
- In a four-controller system, a controller enclosure can house a maximum of 12 SmartDedupe and SmartCompression acceleration modules, and the modules must be installed in symmetrical slots.

- – If 12 Gbit/s SAS interface modules are used:

  - In a dual-controller system, follow this order when installing SmartDedupe and SmartCompression acceleration modules into slots: IOM H0/L0 > IOM H1/L1 > IOM H2/L2 > IOM H4/L4 > IOM H3/L3 > IOM H5/L5 > IOM H6/L6.

  - In a four-controller system, follow this order when installing SmartDedupe and SmartCompression acceleration modules into slots: IOM H0/L0 > IOM H13/L13 > IOM H1/L1 > IOM H12/L12 > IOM H2/L2 > IOM H11/L11 > IOM H4/L4 > IOM H9/L9 > IOM H3/L3 > IOM H10/L10 > IOM H5/L5 > IOM H8/L8 > IOM H6/L6 > IOM H7/L7.

- – If BE 100 Gbit/s RDMA interface modules are used:

  - In a dual-controller system, follow this order when installing SmartDedupe and SmartCompression acceleration modules into slots: IOM H0/L0 > IOM H1/L1 > IOM H2/L2 > IOM H4/L4 > IOM H5/L5 > IOM H3/L3 > IOM H6/L6.

  - In a four-controller system, follow this order when installing SmartDedupe and SmartCompression acceleration modules into slots: IOM H0/L0 > IOM H13/L13 > IOM H1/L1 > IOM H12/L12 > IOM H2/L2 > IOM H11/L11 > IOM H4/L4 > IOM H9/L9 > IOM H5/L5 > IOM H8/L8 > IOM H3/L3 > IOM H10/L10 > IOM H6/L6 > IOM H7/L7.

Hardware Specifications

Table 3-2 lists the dimensions, weight, and power specifications of the controller enclosure. For more specifications, refer to **Specifications Query**.

Table 3-2 Hardware specifications

Item	Specifications
Dimensions (H x W x D)	175 mm x 447 mm x 865 mm
Weight (excluding auxiliary materials such as guide rails and cables)	● 71.9 kg (two controllers) ● 88.2 kg (four controllers)
AC power voltage and rated current	2000 W AC power supply (supporting 110 V dual-live-wire input (2W+PE)), 200 V to 240 V AC ±10%, 10 A, single-phase, 50/60 Hz
High-voltage DC	2000 W power supply (240 V DC input), 192 V to 288 V DC, 10 A
Low-voltage DC	2000 W power supply (supporting –48 V/–60 V DC input), –40 V to –72 V DC, 50 A

3.3.2 Component Description

This section provides the detailed illustration and description for each component.

3.3.2.1 System Subrack

The system subrack houses a midplane that provides reliable connections for interface modules and distributes power and signals to inner modules.

Appearance

Figure 3-9 shows the appearance of a system subrack.

Figure 3-9 System subrack

3.3.2.2 Controller

A controller is the core component of a storage system. It processes storage services, receives configuration management commands, saves configuration data, connects to disks, and saves critical data to system disks.

> 📖 **NOTE**
>
> Each controller has two built-in disks to store system data. If a power failure occurs, these disks also store cache data. The built-in disks on different controllers are redundant for each other.

Appearance

Figure 3-10 shows the front view of a controller.

Figure 3-10 Front view of a controller
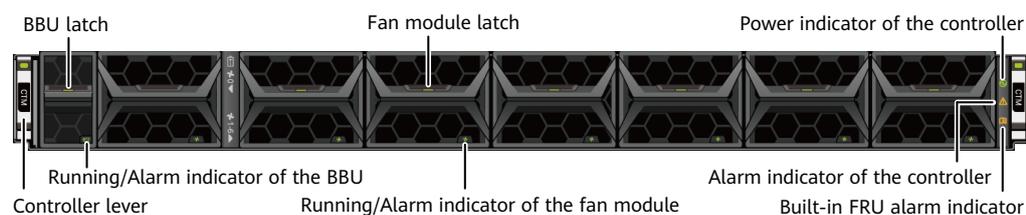
BBU latch   Fan module latch   Power indicator of the controller

Running/Alarm indicator of the BBU   Alarm indicator of the controller

Controller lever   Running/Alarm indicator of the fan module   Built-in FRU alarm indicator

Indicators

For the states and meanings of the indicators on a controller, see **Indicators on the Front Panel**.

3.3.2.3 Assistant Cooling Module

When a controller enclosure is configured with two controllers, assistant cooling modules are installed in the two slots of controllers C and D to help the controller enclosure dissipate heat. Each assistant cooling module has four fans and three fan filler panels.

Appearance

Figure 3-11 shows the appearance of an assistant cooling module.

Figure 3-11 Assistant cooling module

Figure 3-12 Front view of an assistant cooling module

Power indicator of the assistant cooling module

Running/Alarm indicator of the fan module   Alarm indicator of the assistant cooling module

Table 3-3 describes indicators on an assistant cooling module.

Table 3-3 Indicators on an assistant cooling module

Indicator	Status and Description
Running/Alarm indicator of the fan module	• Steady green: The fan module is working properly. • Steady yellow: The fan module is faulty. • Off: The fan module is powered off.
Alarm indicator of the assistant cooling module	• Steady yellow: An alarm is generated on the assistant cooling module. • Off: The assistant cooling module is working correctly.

Indicator	Status and Description
Power indicator of the assistant cooling module	• Steady green: The assistant cooling module is powered on. • Off: The assistant cooling module is absent or powered off.

3.3.2.4 Fan Module

Fan modules dissipate heat from the system, allowing the controller enclosure to operate normally at maximum power.

Appearance

Figure 3-13 and **Figure 3-14** show the appearance and front view of a fan module.

Figure 3-13 Fan module

Figure 3-14 Front view of a fan module
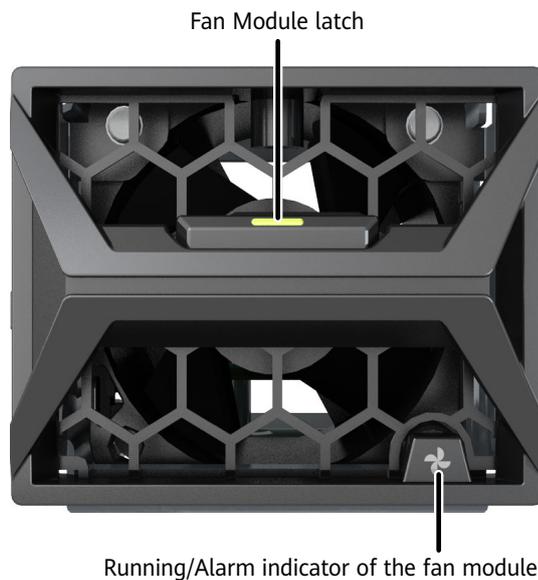
Fan Module latch

Running/Alarm indicator of the fan module

Indicators

For the indicators on a fan module after the storage system is powered on, see **Indicators on the Front Panel**.

3.3.2.5 BBU

BBUs supply power to the storage system in the event of an external power supply failure to protect data in the storage system. When the external power supplies are normal, the BBUs are standing by. If a BBU is faulty, it can be isolated without affecting the normal running of the storage system. If a power failure occurs, BBUs ensure that the storage system writes cached data to the built-in disks of the controllers, preventing data loss. After the external power supply resumes, the driver reads data from the built-in disks of the controllers to the cache.

◫ NOTE

- In a system using the lithium batteries, the battery capacity is updated and detected by charging and discharging the batteries. This helps detect battery attenuation (because batteries are not used for a long time) in advance and prevent backup failures due to insufficient battery power, improving the reliability of data protection upon system power failures.

- The capacity of BBUs is designed to implement one-time power failure protection. If the storage system experiences two or more power failures in succession, the BBU battery level is low. That is, upon the second power failure, the BBUs may fail to supply enough power for writing cached data into built-in disks of the controllers. To ensure data reliability, the system enters the protection mode upon the second power failure and does not allow the controllers to be powered on. In this case, engineers need to manually handle the problem.

Appearance

Figure 3-15 and **Figure 3-16** show the appearance and front view of a BBU.

Figure 3-15 Appearance of a BBU

Figure 3-16 Front view of a BBU
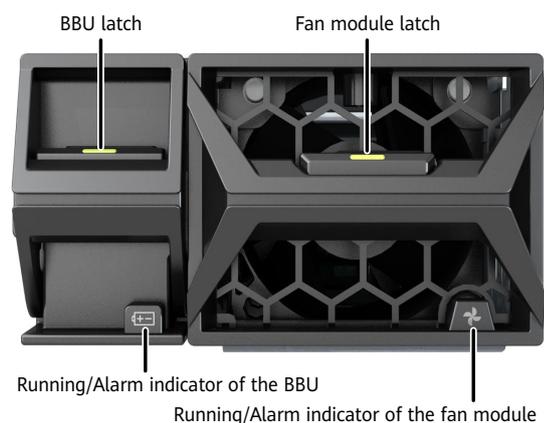
Indicator

For the indicators on a BBU after the storage system is powered on, see **Indicators on the Rear Panel**.

3.3.2.6 Management Module

A management module provides two management network ports, a maintenance network port, and a serial port.

Ports

Figure 3-17 shows the ports on a management module.

Figure 3-17 Management module
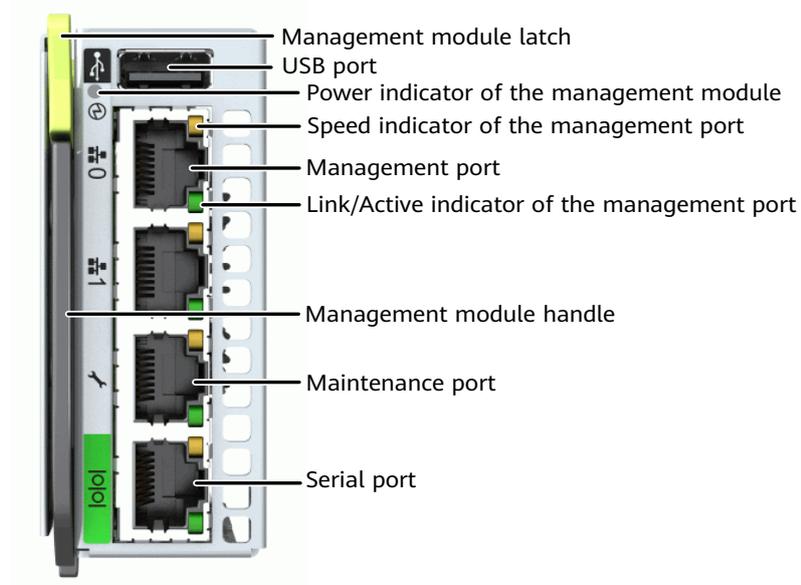
> **NOTICE**
>
> Only serial cables can be inserted into serial ports. Do not insert network cables into serial ports.

> **NOTE**
>
> Management network port 1 is reserved and not used.

Indicators

For the states and meanings of the indicators on a management module, see **Indicators on the Rear Panel**.

3.3.2.7 Power Module

The storage system supports AC and DC power modules. They allow the controller enclosure to work properly at maximum power.

Each 4 U controller enclosure has four power modules (PSU 0, PSU 1, PSU 2, and PSU 3 from upside down). PSU 0 and PSU 1 form a power plane to supply power to controllers A and C, and are redundant of each other. PSU 2 and PSU 3 form the other power plane to supply power to controllers B and D, and are redundant of each other. For reliability purposes, it is recommended that you connect PSU 0 and PSU 2 to one PDU, and PSU 1 and PSU 3 to another power distribution unit (PDU).

Appearance

Figure 3-18, **Figure 3-19**, **Figure 3-20**, and **Figure 3-22** show the appearance and front view of the power module.

Figure 3-18 Appearance of the power module (using the AC power module as an example)

Figure 3-19 Front view of an AC power module (C13 socket)

Running/Alarm indicator of the power module

Power module handle

Power module latch

94%

02312AHK

Power module socket
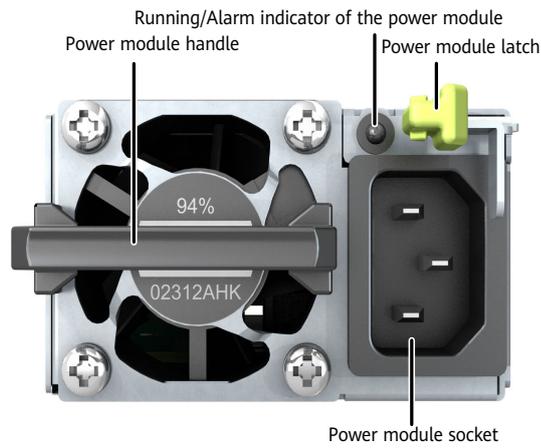
Figure 3-20 (Optional) Front view of an AC power module (C13 socket)

Handle

Latch

Power module socket

Running/Alarm indicator of the power module
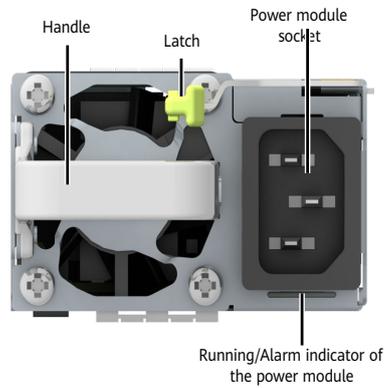
Figure 3-21 Front view of an AC power module (C19 socket)

Handle

Latch

Power module socket

BBU

Running/Alarm indicator of a BBU

Running/Alarm indicator of a power module
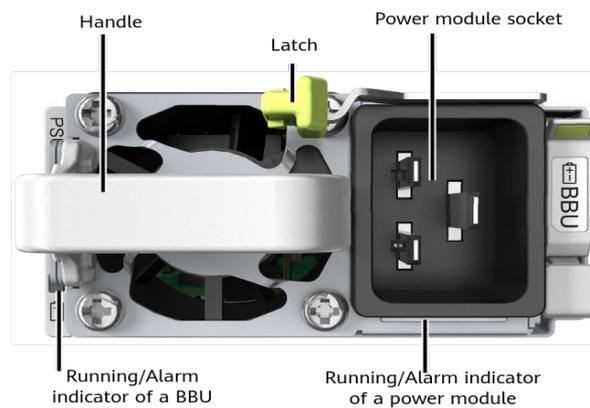
Figure 3-22 Front view of a DC power module
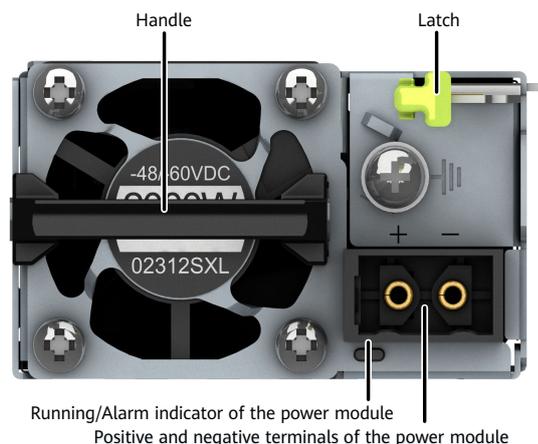
Indicators

For the states and meanings of the indicator on a power module, see **Indicators on the Rear Panel**.

3.3.3 Indicator Description

After a controller enclosure is powered on, you can check the current operating status of the controller enclosure by observing its indicators.

Indicators on the Front Panel

Figure 3-23 shows the indicators on the front panel.

Figure 3-23 Indicators on the front panel of a controller enclosure
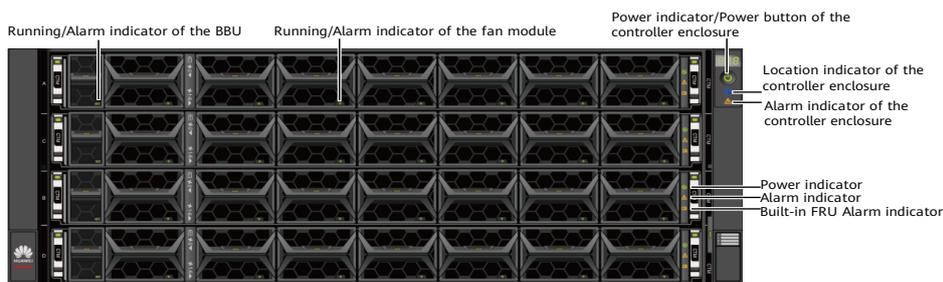
Table 3-4 describes meanings of the indicators on the front panel of a controller enclosure.

Table 3-4 Meanings of the indicators on the front panel

Module	Indicator	Status and Description
BBU	Running/Alarm indicator of the BBU	• Steady green: The BBU is fully charged. • Blinking green (1 Hz): The BBU is being charged. • Blinking green (4 Hz): The BBU is being discharged. • Steady yellow: The BBU is faulty. • Off: The module is powered off or hot swappable.
Controller	Running/Alarm indicator of the fan module	• Steady green: The fan module is working properly. • Steady yellow: The fan module is faulty. • Off: The fan module is powered off.
	Power indicator of the controller	• Steady green: The controller is on. • Blinking green (0.5 Hz): The controller is being powered on and booting the BIOS. • Blinking green (2 Hz): The controller is booting the operating system or being powered off. • Off: The controller is absent or powered off.
	Alarm indicator of the controller	• Steady yellow: The controller is faulty. • Off: The controller is working properly.
	Built-in FRU Alarm indicator	• Steady yellow: A built-in FRU of the controller is faulty. • Off: The built-in FRUs of the controller are normal.

Module	Indicator	Status and Description
System subrack	Power indicator/Power button of the controller enclosure	• Steady green: The controller enclosure is on. • Blinking green (0.5 Hz): The controller enclosure is being powered on. • Blinking green (1 Hz): The controller enclosure is in the burn-in state. • Blinking green (2 Hz): The controller enclosure is booting the operating system or being powered off. • Off: The controller enclosure is off or powered by the BBUs.
	Alarm indicator of the controller enclosure	• Steady yellow: A major or critical alarm is reported on the storage system. • Off: The storage system is running properly.
	Location indicator of the controller enclosure	• Blinking blue: The controller enclosure is being located. • Off: The controller enclosure is not located.

Indicators on the Rear Panel

Figure 3-24 shows the indicators on the rear panel of a controller enclosure.

Figure 3-24 Indicators on the rear panel of a controller enclosure (using the AC power module as an example)
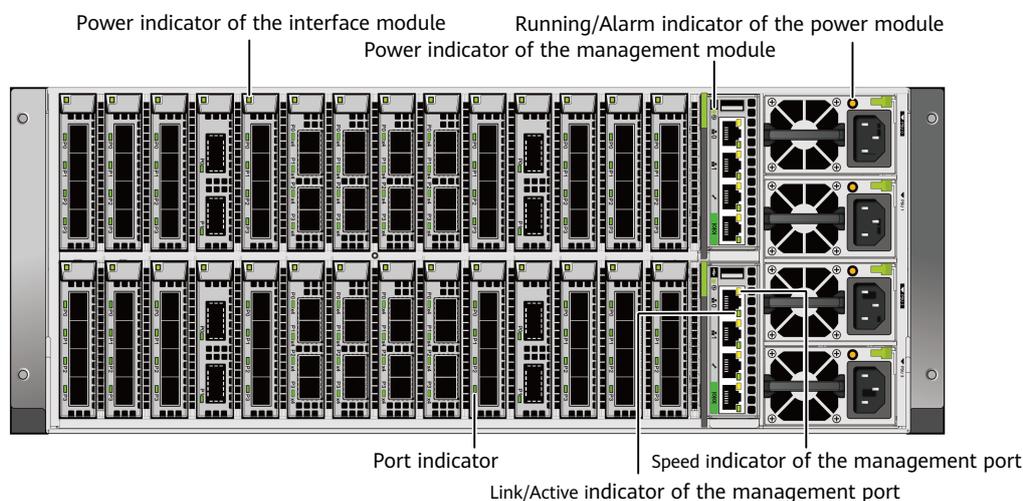
Table 3-5 describes meanings of the indicators on the rear panel of a controller enclosure.

Table 3-5 Meanings of the indicators on the rear panel

Module	Indicator	Status and Description
Interface module	Power indicator of the interface module	For the states and meanings of the indicators on the interface modules supported by the storage system, see **3.5 Interface Module**.
	Port indicator	
Power module	Running/Alarm indicator of the power module	• Steady green: The power input is normal. • Blinking green (1 Hz): The power input is normal but the device is powered off. • Blinking green (4 Hz): The power module is being upgraded online. • Steady yellow: The power module is faulty. • Off: There is no external power input.
Management module	Power indicator of the management module	• Steady green: The module is working properly. • Blinking green: The module is being powered on. • Steady yellow: The module is faulty. • Off: The module is powered off or hot swappable.
	Speed indicator of the management (maintenance) network port	• Steady yellow: Data is being transmitted at the highest speed. • Off: The speed is not the highest.
	Link/Active indicator of the management (maintenance) network port	• Steady green: The port is connected properly. • Blinking green: Data is being transmitted. • Off: The connection is abnormal.

3.4 4 U Controller Enclosure for OceanStor Dorado 8000 (NVMe) and Dorado 18000 (NVMe)

This section describes the hardware structure, component functions, front and rear views, and indicators of a controller enclosure.

3.4.1 Overview

The controller enclosure uses a modular design and consists of a system subrack, controllers, BBUs, power modules, management modules, and interface modules.

Each controller enclosure houses two or four controllers that have CPUs, physical memory, front-end ports, and expansion ports.

📖 **NOTE**

4 U controller enclosures using DC power modules do not support delivery as bay. That is, if a 4 U controller enclosure is delivered as bay, it can only use AC power modules. If a 4 U controller enclosure is not delivered as bay, it can use AC or DC power modules.

Overall Structure

Figure 3-25 shows the overall structure of a controller enclosure.

Figure 3-25 Overall structure of a controller enclosure
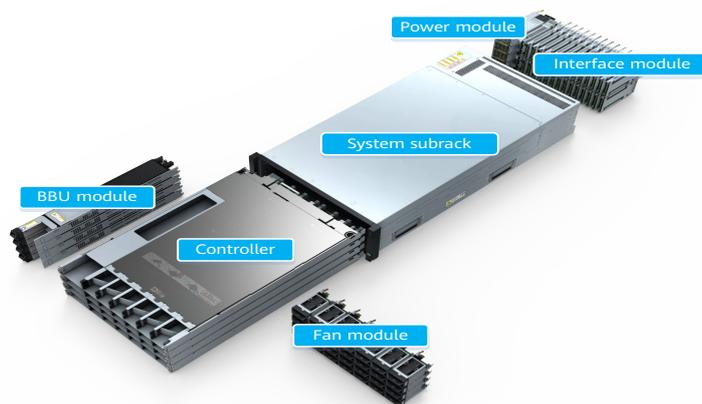
Front View

Figure 3-26 shows the front view of a controller enclosure.

Figure 3-26 Front view of a controller enclosure
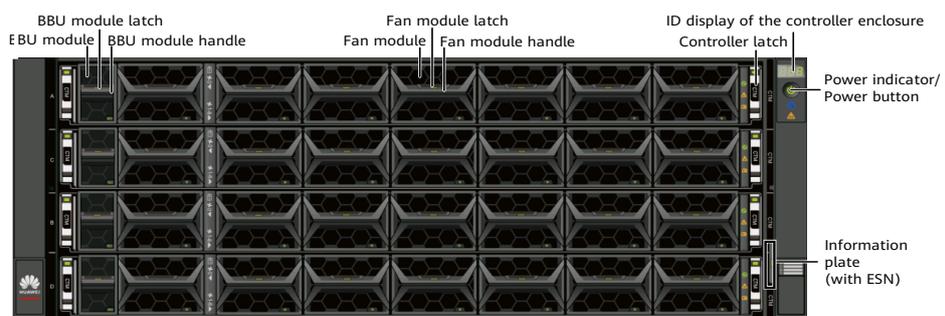
📖 **NOTE**

- Each controller has seven fan modules.
- The controllers are A, C, B, D in a top-down sequence.
- The information plate is used to record device information. You can pull out the information plate near the mounting ear of the device to view the device model.

Rear View

Figure 3-27 shows the rear view of a controller enclosure equipped with AC power modules.

Figure 3-27 Rear view of a controller enclosure (using the AC power module as an example)

NOTICE

- The maintenance port is used for special management and maintenance only by Huawei technical support engineers in emergency. Do not connect the management network port and maintenance network port to the same LAN or switch to prevent network loops. The initial IP address of the maintenance port is 172.31.128.101 or 172.31.128.102. The default subnet mask is 255.255.0.0. You are advised to connect only the management port to the network.
- Only serial cables can be inserted into serial ports. Do not insert network cables into serial ports.

The management modules are mandatory for a 4 U controller enclosure. They are used for management and maintenance and their slot numbers are SMM 0 and SMM 1 from top to bottom.

As shown in **Figure 3-28**, slots of interface modules in a 4 U controller enclosure are numbered from left to right and from top to bottom as follows:

- The upper slots are IOM H0, IOM H1, IOM H2, IOM H3, IOM H4, IOM H5, IOM H6, IOM H7, IOM H8, IOM H9, IOM H10, IOM H11, IOM H12, and IOM H13.

- The lower slots are IOM L0, IOM L1, IOM L2, IOM L3, IOM L4, IOM L5, IOM L6, IOM L7, IOM L8, IOM L9, IOM L10, IOM L11, IOM L12, and IOM L13.

Figure 3-28 Slot numbers of interface modules
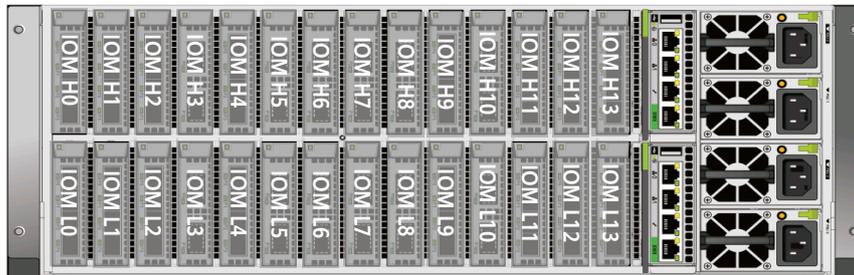
The rules for installing interface modules on a controller enclosure are as follows:

1. For reliability purposes, it is recommended that interface modules should be installed in pairs. That is, the same interface module should be installed in the upper slot and corresponding lower slot separately.

2. The scale-out interface modules are installed and configured in the following sequence: IOM H3/L3 > IOM H10/L10.

3. Install back-end interface modules first and then front-end interface modules.

4. Configuration rules for back-end interface modules (only 100 Gbit/s RDMA interface modules for back-end expansion):

    The back-end interface modules are installed in the following sequence: IOM H6/L6 > IOM H7/L7 > IOM H5/L5 > IOM H8/L8 > IOM H4/L4 > IOM H9/L9 > IOM H2/L2 > IOM H11/L11.

5. Configuration rules for front-end interface modules:

    – When the Fibre Channel front-end interconnect I/O module is used, you only need to configure one module in an upper slot and one in a lower slot.

    – When the iSCSI interface module is used, you must configure one module in each of the A, B, C, and D quadrants, as shown in the preceding figure.

    – In the event of Fibre Channel networking, follow this order when installing front-end interface modules into slots: IOM H0/L0 > IOM H13/L13 > IOM H1/L1 > IOM H12/L12 > IOM H2/L2 > IOM H11/L11 > IOM H4/L4 > IOM H9/L9 > IOM H5/L5 > IOM H8/L8 > IOM H3/L3 > IOM H10/L10 > IOM H7/L7.

    – In the event of iSCSI, NVMe over RoCE, and NAS networking:

        i. In a dual-controller system, install the front-end interface modules in the following sequence: IOM H0/L0 > IOM H1/L1 > IOM H2/L2 > IOM H4/L4 > IOM H5/L5 > IOM H3/L3.

        ii. In a four-controller system, install the front-end interface modules in the following sequence: IOM H0/L0 > IOM H13/L13 > IOM H1/L1 > IOM H12/L12 > IOM H2/L2 > IOM H11/L11 > IOM H4/L4 > IOM H9/L9 > IOM H5/L5 > IOM H8/L8 > IOM H3/L3 > IOM H10/L10 > IOM H7/L7.

      iii. Interface modules of the same type must be installed in sequence.

      iv. Install different types of front-end interface modules in a sequence of Ethernet > RoCE > FC. Place interface modules in ascending order of their port rates.

6. The installation sequence of interface modules used for replication services is the same as that of front-end interface modules.

7. Interface modules of the same type must be installed in sequence.

8. Install different types of front-end interface modules in a sequence of Ethernet > RoCE > FC. Place interface modules in ascending order of their port rates.

9. The rules for installing SCM cards on a controller enclosure are as follows:

    📖 **NOTE**

- When SmartCache is used, SCM cards must be installed on the controller enclosure. Each controller supports a maximum of two SCM cards.
- In a dual-controller system, a controller enclosure can have a maximum of four SCM cards, which must be installed symmetrically in the upper and lower slots.
- In a four-controller system, a controller enclosure can have a maximum of eight SCM cards, which must be installed symmetrically in the A, B, C, and D quadrants.

  – In a dual-controller system, follow this order when installing SCM cards into slots: IOM H2/L2 > IOM H4/L4 > IOM H0/L0 > IOM H1/L1 > IOM H5/L5 > IOM H3/L3.

  – In a four-controller system, follow this order when installing SCM cards into slots: IOM H2/L2/H11/L11 > IOM H4/L4/H9/L9 > IOM H0/L0/H13/L13 > IOM H1/L1/H12/L12 > IOM H5/L5/H8/L8 > IOM H3/L3/H10/L10.

10. SmartDedupe and SmartCompression acceleration module:

    📖 **NOTE**

Each controller can be configured with a maximum of three SmartDedupe and SmartCompression acceleration modules.

- In a dual-controller system, a controller enclosure can house a maximum of six SmartDedupe and SmartCompression acceleration modules, and the modules must be installed in symmetrical slots.
- In a four-controller system, a controller enclosure can house a maximum of 12 SmartDedupe and SmartCompression acceleration modules, and the modules must be installed in symmetrical slots.

  – If 12 Gbit/s SAS interface modules are used:

    ▪ In a dual-controller system, follow this order when installing SmartDedupe and SmartCompression acceleration modules into slots: IOM H0/L0 > IOM H1/L1 > IOM H2/L2 > IOM H4/L4 > IOM H3/L3 > IOM H5/L5 > IOM H6/L6.

    ▪ In a four-controller system, follow this order when installing SmartDedupe and SmartCompression acceleration modules into slots: IOM H0/L0 > IOM H13/L13 > IOM H1/L1 > IOM H12/L12 > IOM H2/L2 > IOM H11/L11 > IOM H4/L4 > IOM H9/L9 > IOM H3/L3 > IOM H10/L10 > IOM H5/L5 > IOM H8/L8 > IOM H6/L6 > IOM H7/L7.

- – If BE 100 Gbit/s RDMA interface modules are used:

  - ▪ In a dual-controller system, follow this order when installing SmartDedupe and SmartCompression acceleration modules into slots: IOM H0/L0 > IOM H1/L1 > IOM H2/L2 > IOM H4/L4 > IOM H5/L5 > IOM H3/L3 > IOM H6/L6.

  - ▪ In a four-controller system, follow this order when installing SmartDedupe and SmartCompression acceleration modules into slots: IOM H0/L0 > IOM H13/L13 > IOM H1/L1 > IOM H12/L12 > IOM H2/L2 > IOM H11/L11 > IOM H4/L4 > IOM H9/L9 > IOM H5/L5 > IOM H8/L8 > IOM H3/L3 > IOM H10/L10 > IOM H6/L6 > IOM H7/L7.

Hardware Specifications

Table 3-6 lists the dimensions, weight, and power specifications of the controller enclosure. For more specifications, refer to **Specifications Query**.

Table 3-6 Hardware specifications

Item	Specifications
Dimensions (H x W x D)	175 mm x 447 mm x 865 mm
Weight (excluding auxiliary materials such as guide rails and cables)	71.9 kg (two controllers) 88.2 kg (four controllers)
AC power voltage and rated current	2000 W AC power supply (supporting 110 V dual-live-wire input (2W+PE)), 200 V to 240 V AC ±10%, 10 A, single-phase, 50/60 Hz
High-voltage DC	2000 W power supply (240 V DC input), 192 V to 288 V DC, 10 A
Low-voltage DC	2000 W power supply (supporting –48 V/– 60 V DC input), –40 V to –72 V DC, 50 A

3.4.2 Component Description

This section provides the detailed illustration and description for each component.

3.4.2.1 System Subrack

The system subrack houses a midplane that provides reliable connections for interface modules and distributes power and signals to inner modules.

Appearance

Figure 3-29 shows the appearance of a system subrack.

Figure 3-29 System subrack

3.4.2.2 Controller

A controller is the core component of a storage system. It processes storage services, receives configuration management commands, saves configuration data, connects to disks, and saves critical data to system disks.

📖 **NOTE**

Each controller has one or more built-in disks to store system data. If a power failure occurs, this disk also stores cache data. The built-in disks on different controllers are redundant for each other.

Appearance

Figure 3-30 shows the front view of a controller.

Figure 3-30 Front view of a controller
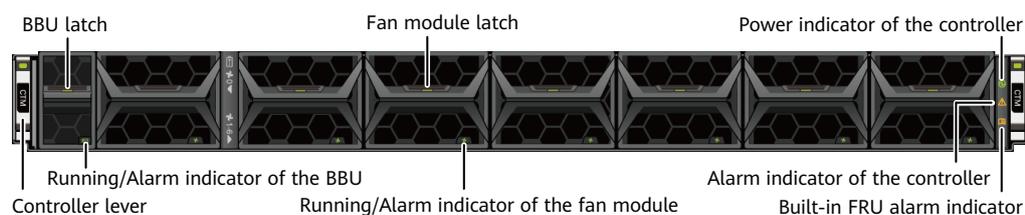
Indicators

For the states and meanings of the indicators on a controller, see **Indicators on the Front Panel**.

3.4.2.3 Assistant Cooling Module

When a controller enclosure is configured with two controllers, assistant cooling modules are installed in the two slots of controllers C and D to help the controller enclosure dissipate heat. Each assistant cooling module has four fans and three fan filler panels.

Appearance

Figure 3-31 shows the appearance of an assistant cooling module.

Figure 3-31 Assistant cooling module

Figure 3-32 Front view of an assistant cooling module

Power indicator of the assistant cooling module

Running/Alarm indicator of the fan module

Alarm indicator of the assistant cooling module

Table 3-7 describes indicators on an assistant cooling module.

Table 3-7 Indicators on an assistant cooling module

Indicator	Status and Description
Running/Alarm indicator of the fan module	• Steady green: The fan module is working properly. • Steady yellow: The fan module is faulty. • Off: The fan module is powered off.
Alarm indicator of the assistant cooling module	• Steady yellow: An alarm is generated on the assistant cooling module. • Off: The assistant cooling module is working correctly.
Power indicator of the assistant cooling module	• Steady green: The assistant cooling module is powered on. • Off: The assistant cooling module is absent or powered off.

3.4.2.4 Fan Module

Fan modules dissipate heat from the system, allowing the controller enclosure to operate normally at maximum power.

Appearance

Figure 3-33 and **Figure 3-34** show the appearance and front view of a fan module.

Figure 3-33 Fan module

Figure 3-34 Front view of a fan module
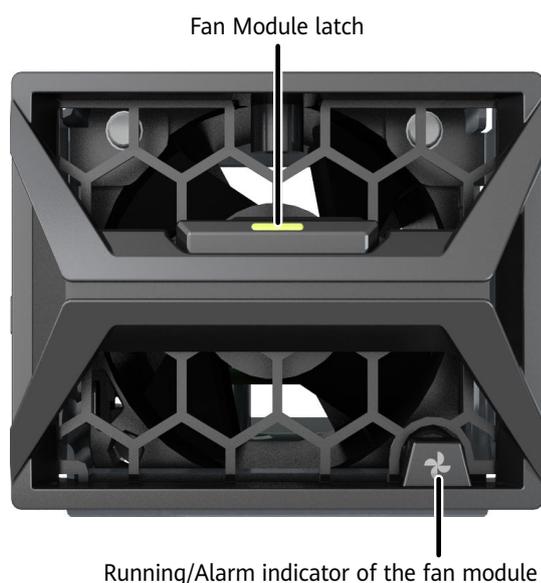
Fan Module latch

Running/Alarm indicator of the fan module

Indicators

For the indicators on a fan module after the storage system is powered on, see **Indicators on the Front Panel**.

3.4.2.5 BBU

BBUs supply power to the storage system in the event of an external power supply failure to protect data in the storage system. When the external power supplies are normal, the BBUs are standing by. If a BBU is faulty, it can be isolated without affecting the normal running of the storage system. If a power failure occurs, BBUs ensure that the storage system writes cached data to the built-in disks of the

controllers, preventing data loss. After the external power supply resumes, the driver reads data from the built-in disks of the controllers to the cache.

◻ **NOTE**

- In a system using the lithium batteries, the battery capacity is updated and detected by charging and discharging the batteries. This helps detect battery attenuation (because batteries are not used for a long time) in advance and prevent backup failures due to insufficient battery power, improving the reliability of data protection upon system power failures.

- The capacity of BBUs is designed to implement one-time power failure protection. If the storage system experiences two or more power failures in succession, the BBU battery level is low. That is, upon the second power failure, the BBUs may fail to supply enough power for writing cached data into built-in disks of the controllers. To ensure data reliability, the system enters the protection mode upon the second power failure and does not allow the controllers to be powered on. In this case, engineers need to manually handle the problem.

Appearance

Figure 3-35 and **Figure 3-36** show the appearance and front view of a BBU.

Figure 3-35 Appearance of a BBU

Figure 3-36 Front view of a BBU
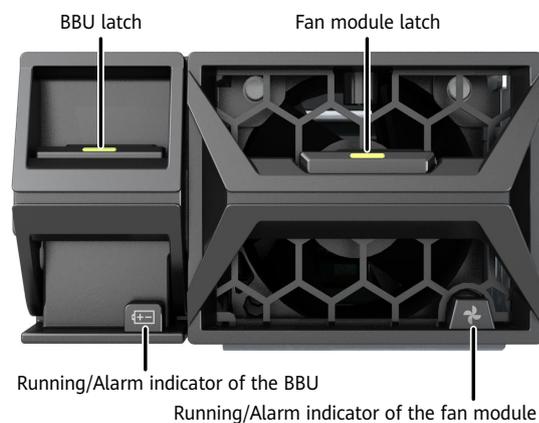
Indicators

For the indicators on a BBU after the storage system is powered on, see **Indicators on the Front Panel**.

3.4.2.6 Management Module

A management module provides two management network ports, a maintenance network port, and a serial port.

Ports

Figure 3-37 shows the ports on a management module.

Figure 3-37 Management module
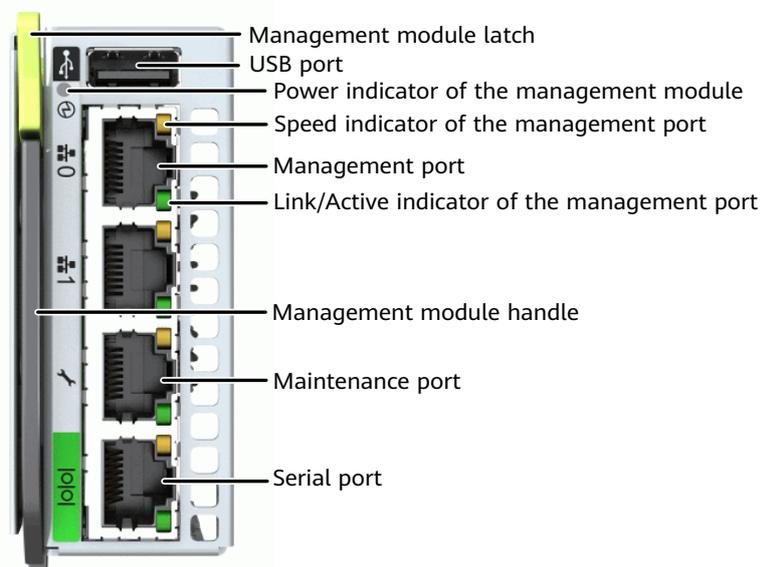
NOTICE

Only serial cables can be inserted into serial ports. Do not insert network cables into serial ports.

NOTE

- The USB port is used to light the indicator on the bay.
- Management network port 1 is reserved and not used.

Indicators

For the states and meanings of the indicators on a management module, see **Indicators on the Rear Panel**.

3.4.2.7 Power Module

The storage system supports AC and DC power modules. They allow the controller enclosure to work properly at maximum power.

Each 4 U controller enclosure has four power modules (PSU 0, PSU 1, PSU 2, and PSU 3 from upside down). PSU 0 and PSU 1 form a power plane to supply power to controllers A and C, and are redundant of each other. PSU 2 and PSU 3 form the other power plane to supply power to controllers B and D, and are redundant of each other. For reliability purposes, it is recommended that you connect PSU 0 and PSU 2 to one PDU, and PSU 1 and PSU 3 to another power distribution unit (PDU).

Appearance

Figure 3-38, **Figure 3-39**, **Figure 3-40**, and **Figure 3-42** show the appearance and front view of the power module.

Figure 3-38 Appearance of the power module (using the AC power module as an example)

Figure 3-39 Front view of an AC power module (C13 socket)
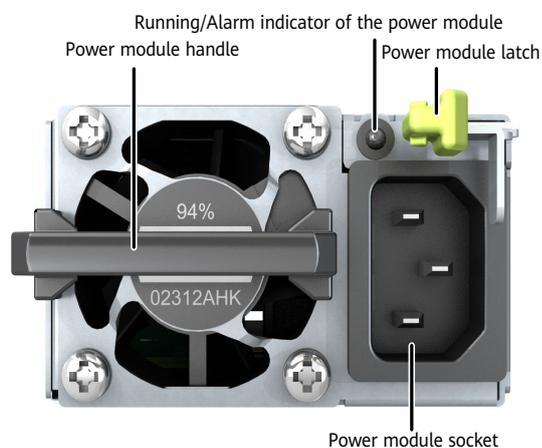
Figure 3-40 (Optional) Front view of an AC power module (C13 socket)
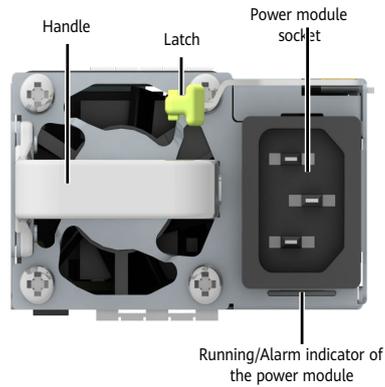
Figure 3-41 Front view of an AC power module (C19 socket)
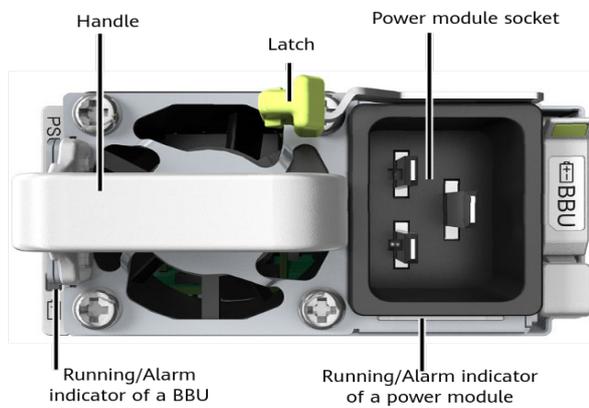
Figure 3-42 Front view of a DC power module
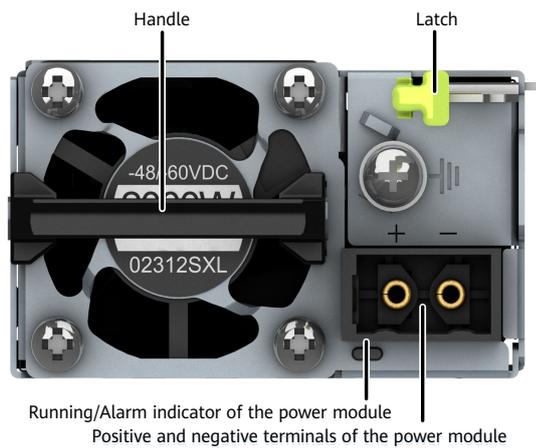
Indicators

For the states and meanings of the indicator on a power module, see **Indicators on the Rear Panel**.

3.4.3 Indicator Description

After a controller enclosure is powered on, you can check the current operating status of the controller enclosure by observing its indicators.

Indicators on the Front Panel

Figure 3-43 shows the indicators on the front panel.

Figure 3-43 Indicators on the front panel of a controller enclosure
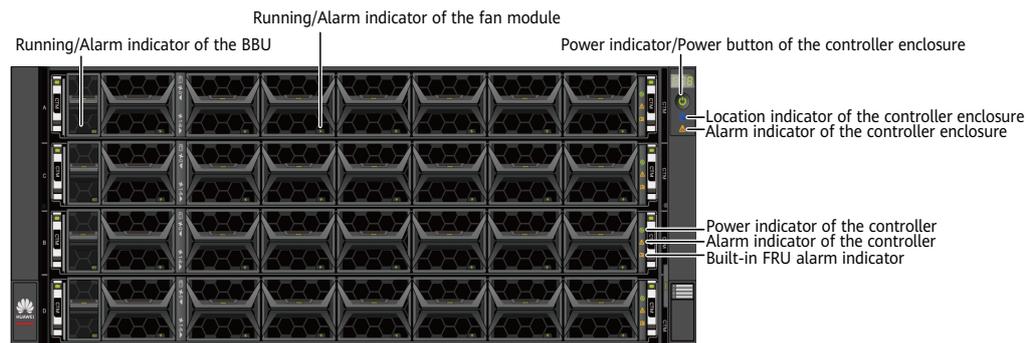
Table 3-8 describes meanings of the indicators on the front panel of a controller enclosure.

Table 3-8 Meanings of the indicators on the front panel

Module	Indicator	Status and Description
BBU	Running/Alarm indicator of the BBU	• Steady green: The BBU is fully charged. • Blinking green (1 Hz): The BBU is being charged. • Blinking green (4 Hz): The BBU is being discharged. • Steady yellow: The BBU is faulty. • Off: The module is powered off or hot swappable.
Controller	Running/Alarm indicator of the fan module	• Steady green: The fan module is working properly. • Steady yellow: The fan module is faulty. • Off: The fan module is powered off.

Module	Indicator	Status and Description
	Power indicator of the controller	- Steady green: The controller is on. - Blinking green (0.5 Hz): The controller is being powered on and booting the BIOS. - Blinking green (2 Hz): The controller is booting the operating system or being powered off. - Off: The controller is absent or powered off.
	Alarm indicator of the controller	- Steady yellow: The controller is faulty. - Off: The controller is working properly.
	Built-in FRU Alarm indicator	- Steady yellow: A built-in FRU of the controller is faulty. - Off: The built-in FRUs of the controller are normal.
System subrack	Power indicator/Power button of the controller enclosure	- Steady green: The controller enclosure is on. - Blinking green (0.5 Hz): The controller enclosure is being powered on and booting the BIOS. - Blinking green (1 Hz): The controller enclosure is in the burn-in state. - Blinking green (2 Hz): The controller enclosure is booting the operating system or being powered off. - Off: The controller enclosure is off or powered by the BBUs.
	Alarm indicator of the controller enclosure	- Steady yellow: A major or critical alarm is reported on the storage system. - Off: The storage system is running properly.
	Location indicator of the controller enclosure	- Blinking blue: The controller enclosure is being located. - Off: The controller enclosure is not located.

Indicators on the Rear Panel

Figure 3-44 shows the indicators on the rear panel of a controller enclosure.

Figure 3-44 Indicators on the rear panel of a controller enclosure (using the AC power module as an example)
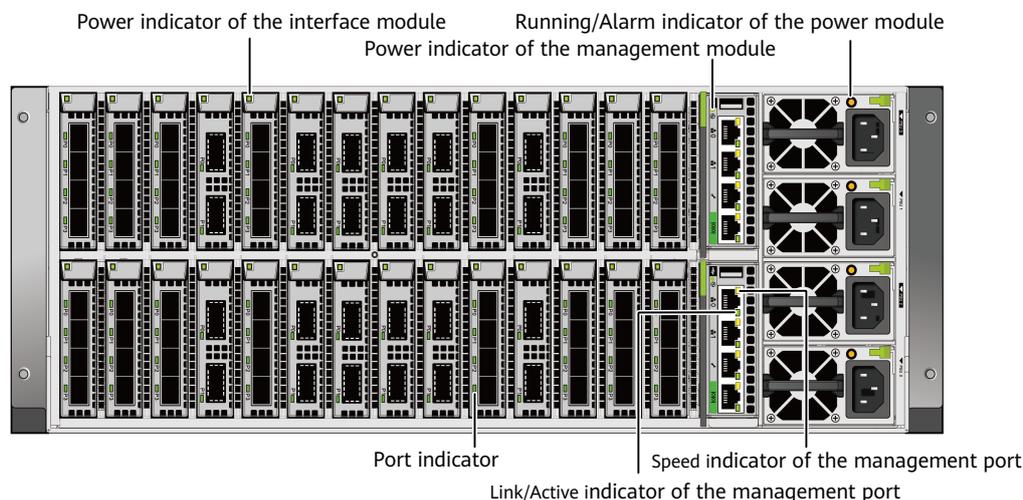
Table 3-9 describes meanings of the indicators on the rear panel of a controller enclosure.

Table 3-9 Meanings of the indicators on the rear panel

Module	Indicator	Status and Description
Interface module	Power indicator of the interface module	For the states and meanings of the indicators on the interface modules supported by the storage system, see **3.5 Interface Module**.
	Port indicator	
Power module	Running/Alarm indicator of the power module	• Steady green: The power input is normal. • Blinking green (1 Hz): The power input is normal but the device is powered off. • Blinking green (4 Hz): The power module is being upgraded online. • Steady yellow: The power module is faulty. • Off: There is no external power input.

Module	Indicator	Status and Description
Managem ent module	Power indicator of the management module	• Steady green: The module is working properly. • Blinking green: The module is being powered on. • Steady yellow: The module is faulty. • Off: The module is powered off or hot swappable.
	Speed indicator of the management (maintenance) network port	• Steady yellow: Data is being transmitted at the highest speed. • Off: The speed is not the highest.
	Link/Active indicator of the management (maintenance) network port	• Steady green: The port is connected properly. • Blinking green: Data is being transmitted. • Off: The connection is abnormal.

3.5 Interface Module

This section describes the functions, appearance, and indicator status of interface modules.

For details about the hot-swappable interface module types supported by each product model and version, see **Specifications Query**.

3.5.1 GE Electrical Interface Module

GE electrical interface modules are used for front-end services between storage devices and application servers, for HyperMetro quorum links, or for replication links between storage devices (except for HyperMetro replication links and inter-array SmartMove replication links). Select such interface modules based on service bandwidth requirements.

Function

A GE electrical interface module provides four 1 Gbit/s electrical ports.

📖 NOTE

The GE electrical interface module does not support auto-negotiation of rates.

Ports

Figure 3-45 shows the appearance of a GE electrical interface module. FE stands for front-end.

Figure 3-45 GE electrical interface module
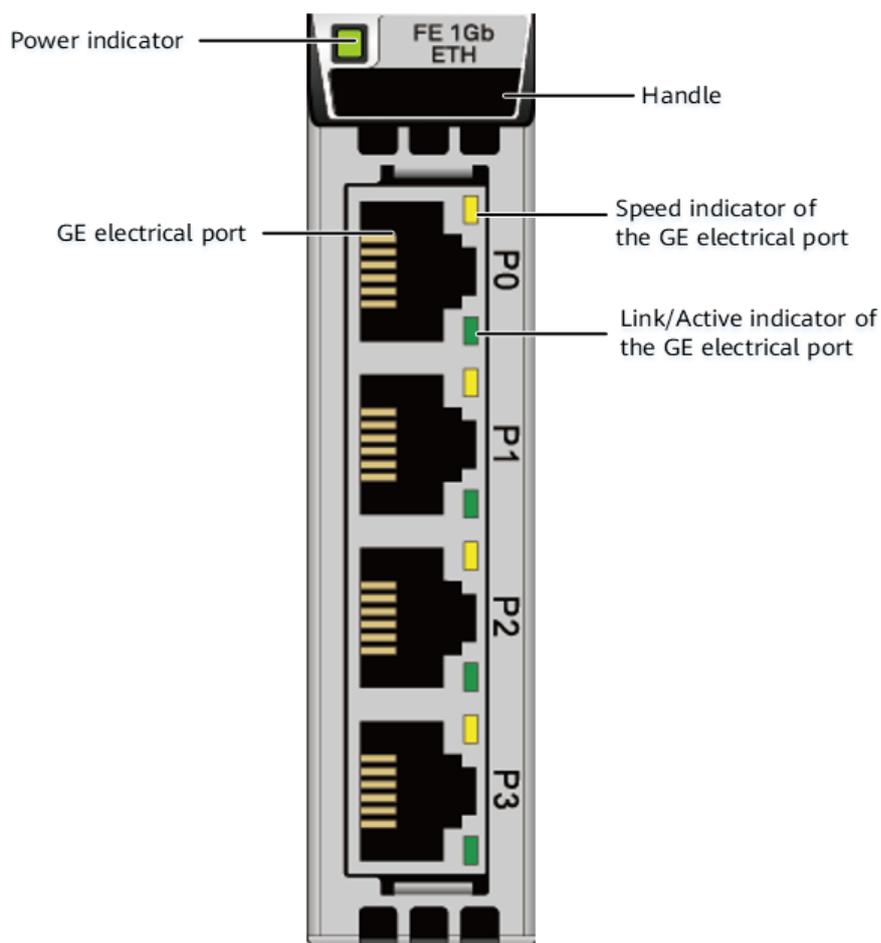
Indicators

Table 3-10 describes the indicators on a GE electrical interface module after the storage system is powered on.

Table 3-10 Indicators on a GE electrical interface module

Indicator	Status and Description
Power indicator	• Steady green: The module is working properly. • Blinking green (2 Hz): There is a hot swap request to the module. • Steady yellow: The module is faulty. • Off: The module is powered off or hot swappable.
Link/Active indicator of the GE electrical port	• Steady green: The link to the application server is normal. • Blinking green: Data is being transmitted. • Off: The link to the application server is down or no link exists.

Indicator	Status and Description
Speed indicator of the GE electrical port	● Steady yellow: The speed is the highest. ● Off: The speed is not the highest.

3.5.2 10GE electrical interface module

10GE electrical interface modules are used for front-end services between storage devices and application servers, for HyperMetro quorum links, or for replication links between storage devices. Select such interface modules based on service bandwidth requirements.

Function

A 10GE electrical interface module provides four 10 Gbit/s electrical ports. The electrical module rate must be consistent with that on the interface module label. Otherwise, the storage system reports an alarm and this port is unavailable.

Table 3-11 describes the requirements for the electrical modules on the storage system and at the peer end of the storage system.

Table 3-11 Electrical module parameters

Electrical Module Rate on the Storage System	Type	Electrical Module Rate at the Peer End
10 Gbit/s	SFP+	10 Gbit/s

☐ NOTE

● The storage system does not support electrical modules purchased by the customer elsewhere. Use electrical modules that match the interface modules of the storage system.

● A 10GE electrical interface module does not support auto-negotiation of rates.

Ports

Figure 3-46 shows the appearance of a 10GE electrical interface module. FE stands for front-end.

☐ NOTE

A 10GE electrical interface module has the same appearance as a SmartIO interface module that uses a 10 Gbit/s optical module. You can distinguish between them only by the BOM numbers on their handles. You can check the BOM number on the **Spare Parts Query** tool to determine the interface module type.

Figure 3-46 10GE electrical interface module

Power indicator

FE 10Gb
DPU-ETH

Handle

Port

P0

Link/Active/Mode
indicator of the
port

P1

P2

P3
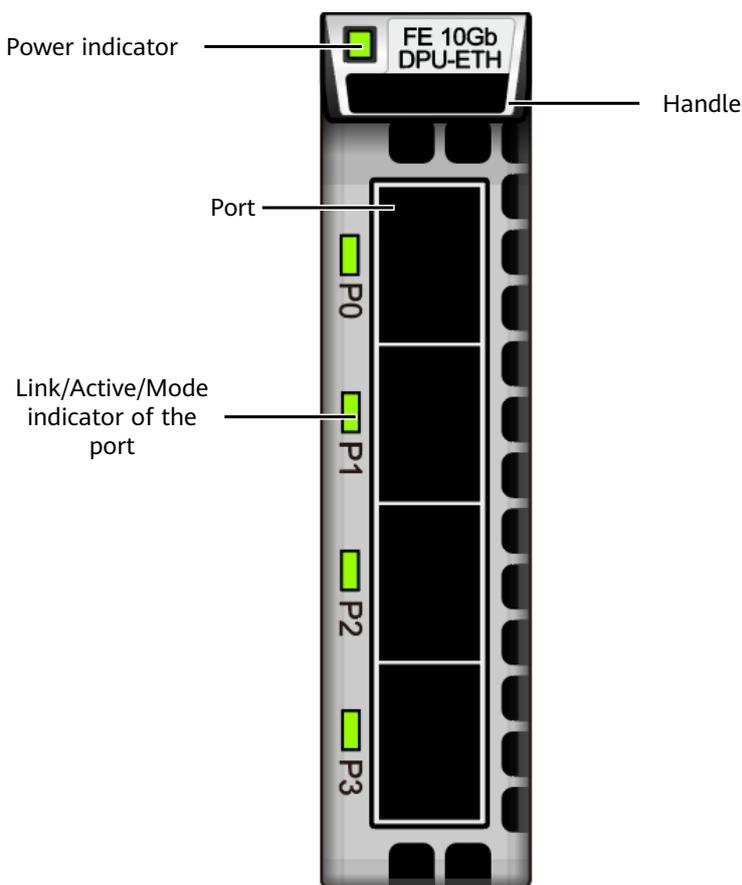
☐ **NOTE**

You must first install electrical modules before using the 10GE electrical interface module. **Figure 3-47** shows how to install an electrical module. For details about the standard cable types and length requirements for the ports, see **Specifications Query**.

Figure 3-47 Installing an electrical module
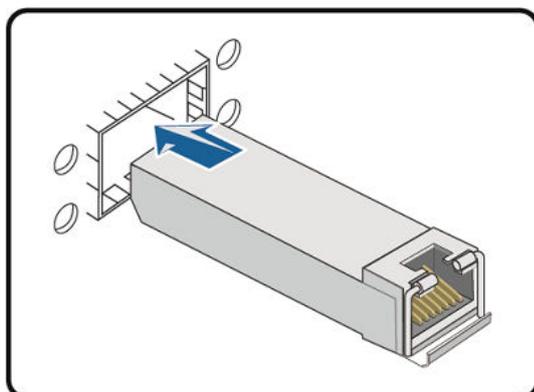
Indicators

Table 3-12 describes the indicators on a 10GE electrical interface module after the storage system is powered on.

Table 3-12 Indicators on a 10GE electrical interface module

Indicator	Status and Description
Power indicator	- Steady green: The module is working properly. - Blinking green: There is a hot swap request to the module. - Steady yellow: The module is faulty. - Off: The module is powered off or hot swappable.
Link/Active/Mode indicator of the port	- Steady green: The interface module is working in Ethernet mode and the port link is up. - Blinking green (2 Hz): The interface module is working in Ethernet mode and data is being transmitted. - Steady yellow: The electrical module is faulty or does not match the port specifications. - Off: The port is not connected.

3.5.3 25 Gbit/s RoCE Interface Module

25 Gbit/s RoCE interface modules are used for front-end services between storage devices and application servers or for replication links between storage devices. Select such interface modules based on service bandwidth requirements.

Function

A 25 Gbit/s RoCE interface module provides four 25 Gbit/s optical ports. The optical module rate must be consistent with that on the interface module label. Otherwise, the storage system reports an alarm and this port is unavailable.

Table 3-13 describes the requirements for the optical modules on the storage system and at the peer end of the storage system.

Table 3-13 Optical module parameters

Optical Module Rate on the Storage System	Type	Optical Module Rate at the Peer End	Negotiated Rate
25 Gbit/s	SFP28	25 Gbit/s	25 Gbit/s

☐ NOTE

The storage system does not support optical modules purchased by the customer elsewhere. Use optical modules that match the storage interface modules.

Ports

Figure 3-48 shows the appearance of a 25 Gbit/s RoCE interface module. FE stands for front-end.

Figure 3-48 25 Gbit/s RoCE interface module
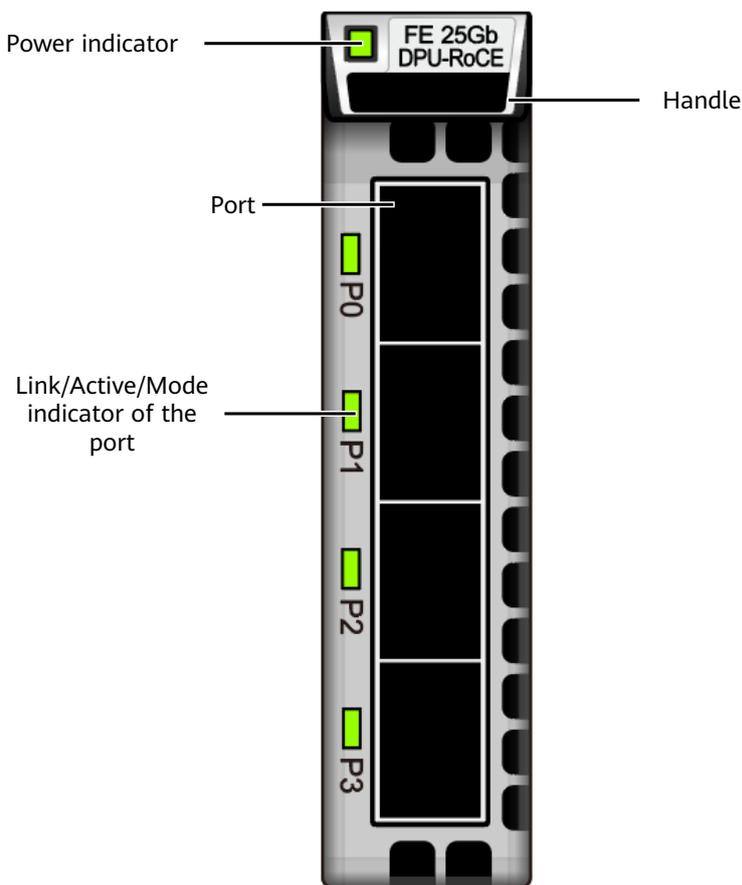
Indicators

Table 3-14 describes the indicators on a 25 Gbit/s RoCE interface module after the storage system is powered on.

Table 3-14 Indicators on a 25 Gbit/s RoCE interface module

Indicator	Status and Description
Power indicator	● Steady green: The module is working properly. ● Blinking green: There is a hot swap request to the module. ● Steady yellow: The module is faulty. ● Off: The module is powered off or hot swappable.

Indicator	Status and Description
Link/Active/Mode indicator of the port	• Steady green: The interface module is working in Ethernet mode and the port link is up. • Blinking green (2 Hz): The interface module is working in Ethernet mode and data is being transmitted. • Steady yellow: The optical module is faulty or does not match the port specifications. • Off: The port is not connected.

3.5.4 25 Gbit/s NoF Interface Module

The 25 Gbit/s NoF interface module is used for front-end services between storage devices and application servers.

Function

A 25 Gbit/s NoF interface module provides four 25 Gbit/s optical ports. The optical module rate must be consistent with that on the interface module label. Otherwise, the storage system reports an alarm and this port is unavailable.

Table 3-15 describes the requirements for the optical modules on the storage system and at the peer end of the storage system.

Table 3-15 Optical module parameters

Optical Module Rate on the Storage System	Type	Optical Module Rate at the Peer End	Negotiated Rate
25 Gbit/s	SFP28	25 Gbit/s	25 Gbit/s

◫ **NOTE**

- The storage system does not support optical modules purchased by the customer elsewhere. Use optical modules that match the storage interface modules.
- This interface module cannot be used for container services.
- This interface module cannot be used for connections between storage devices as replication links.

Ports

Figure 3-49 shows the appearance of a 25 Gbit/s NoF interface module. FE stands for front-end.

Figure 3-49 25 Gbit/s NoF interface module
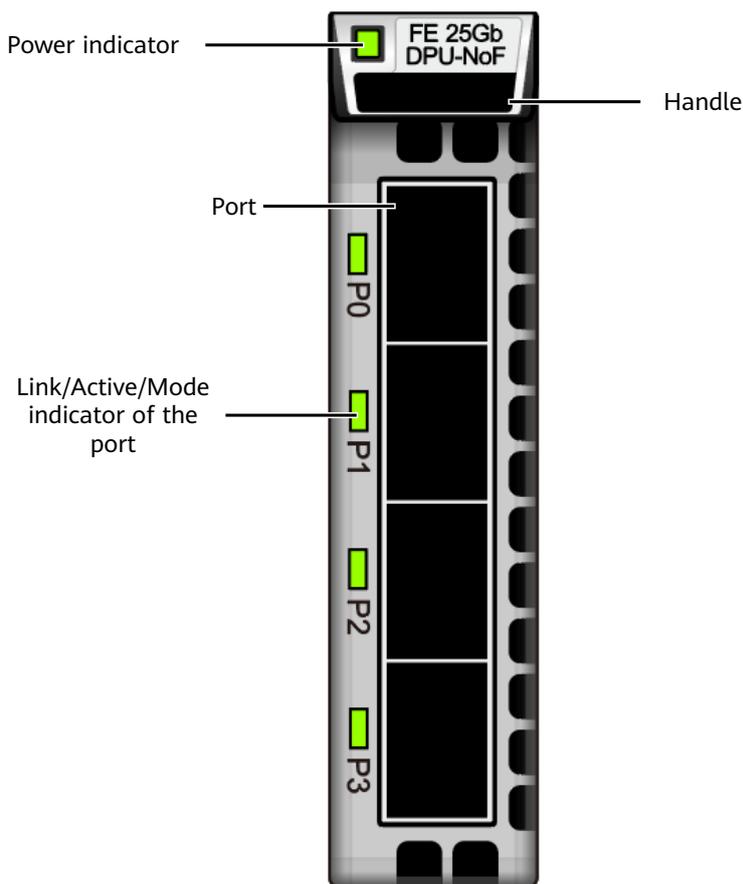
Indicators

Table 3-16 describes the indicators on a 25 Gbit/s NoF interface module after the storage system is powered on.

Table 3-16 Indicators on a 25 Gbit/s NoF interface module

Indicator	Status and Description
Power indicator	● Steady green: The module is working properly. ● Blinking green: There is a hot swap request to the module. ● Steady yellow: The module is faulty. ● Off: The module is powered off or hot swappable.

Indicator	Status and Description
Port Link/Active/Mode indicator	● Steady green: The interface module is working in Ethernet mode and the port link is up. ● Blinking green (2 Hz): The interface module is working in Ethernet mode and data is being transmitted. ● Steady yellow: The optical module is faulty or does not match the port specifications. ● Off: The port is not connected.

3.5.5 40GE Interface Module

40GE interface modules are used for front-end services between storage devices and application servers or for replication links between storage devices. Select such interface modules based on service bandwidth requirements.

Function

A 40GE interface module provides two 40 Gbit/s optical ports. The optical module rate must be consistent with that on the interface module label. Otherwise, the storage system reports an alarm and this port is unavailable.

Table 3-17 describes the requirements for the optical modules on the storage system and at the peer end of the storage system.

Table 3-17 Optical module parameters

| Optical Module Rate on the Storage System	Type	Optical Module Rate at the Peer End	Negotiated Rate
40 Gbit/s	QSFP+	40 Gbit/s	40 Gbit/s

◪ NOTE

● The storage system does not support optical modules purchased by the customer elsewhere. Use optical modules that match the interface modules of the storage system.
● A 40GE interface module does not support auto-negotiation of rates.

Ports

Figure 3-50 shows the appearance of a 40GE interface module. FE stands for front-end.

Figure 3-50 40GE interface module
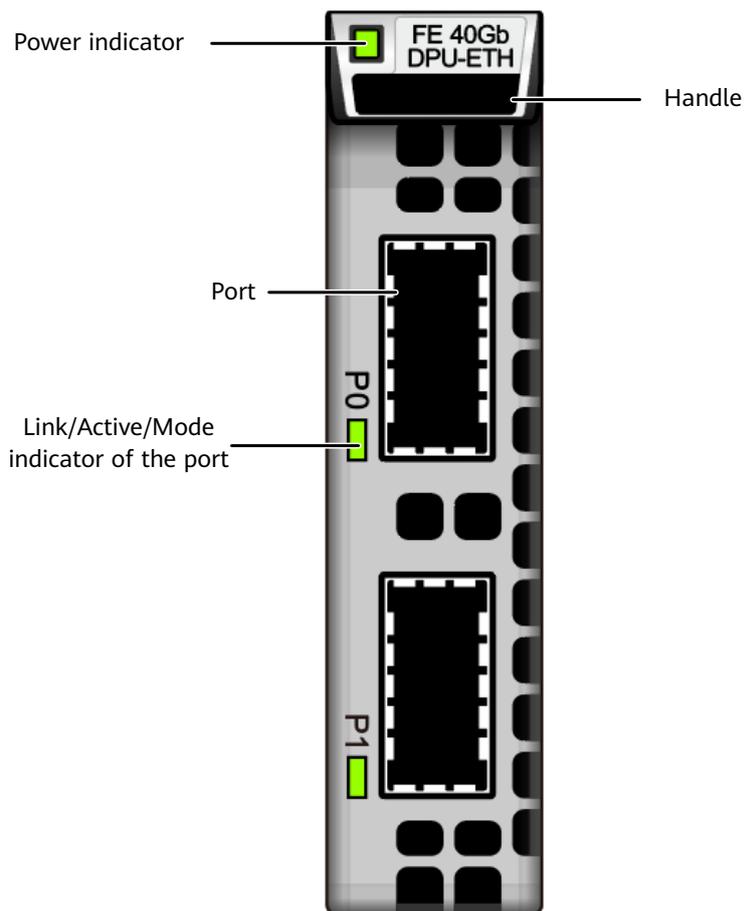
Indicators

Table 3-18 describes the indicators on a 40GE interface module after the storage system is powered on.

Table 3-18 Indicators on a 40GE interface module

Indicator	Status and Description
Power indicator	● Steady green: The module is working properly. ● Blinking green: There is a hot swap request to the module. ● Steady yellow: The module is faulty. ● Off: The module is powered off or hot swappable.

Indicator	Status and Description
Link/Active/Mode indicator of the port	● Steady green: The interface module is working in Ethernet mode and the port link is up. ● Blinking green (2 Hz): The interface module is working in Ethernet mode and data is being transmitted. ● Steady yellow: The optical module is faulty or does not match the port specifications. ● Off: The port is not connected.

3.5.6 100GE Interface Module

100GE interface modules are used for front-end services between storage devices and application servers or for replication links between storage devices. Select such interface modules based on service bandwidth requirements.

Function

A 100GE interface module provides two 100 Gbit/s optical ports. **FE** on the label stands for front-end, meaning that the ports are used for front-end services. The optical module rate must be consistent with that on the interface module label. Otherwise, the storage system reports an alarm and this port is unavailable.

Table 3-19 describes the requirements for the optical modules on the storage system and at the peer end of the storage system.

Table 3-19 Optical module parameters

Optical Module Rate on the Storage System	Type	Optical Module Rate at the Peer End	Negotiated Rate
100 Gbit/s	QSFP28	100 Gbit/s	100 Gbit/s

◫ NOTE

● The storage system does not support optical modules purchased by the customer elsewhere. Use optical modules that match the interface modules of the storage system.

● A 100GE interface module does not support auto-negotiation of rates.

Ports

Figure 3-51 shows the appearance of a 100GE electrical interface module.

Figure 3-51 100GE interface module
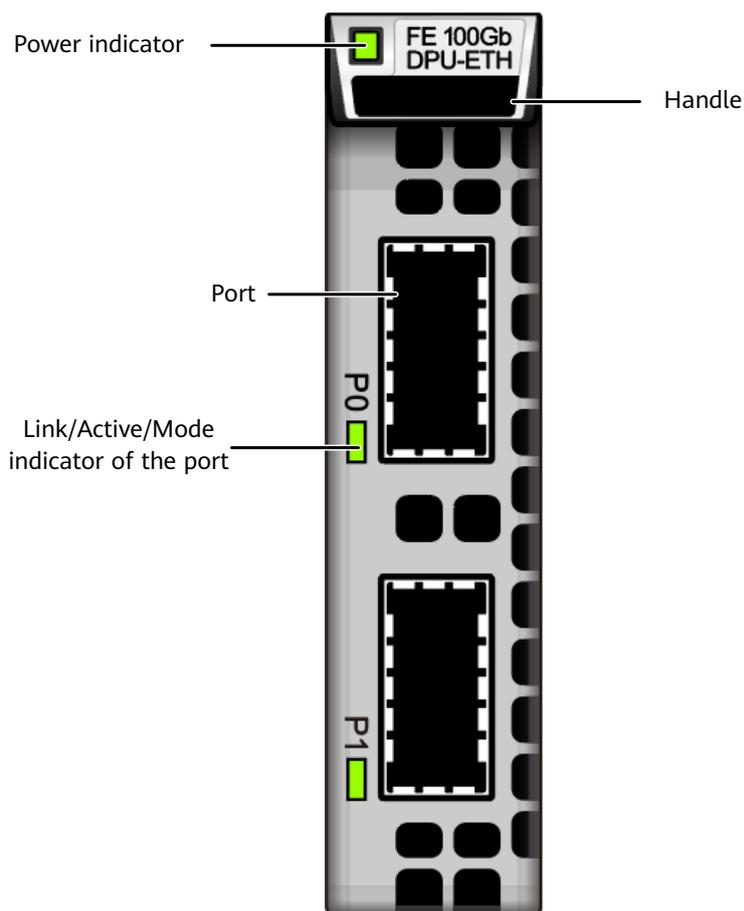
Indicators

Table 3-20 describes the indicators on a 100GE interface module after the storage system is powered on.

Table 3-20 Indicators on a 100GE interface module

Indicator	Status and Description
Power indicator	● Steady green: The module is working properly. ● Blinking green: There is a hot swap request to the module. ● Steady yellow: The module is faulty. ● Off: The module is powered off or hot swappable.

Indicator	Status and Description
Link/Active/Mode indicator of the port	• Steady blue: The interface module is working in Ethernet mode and the port link is up. • Blinking blue (2 Hz): The interface module is working in Ethernet mode and data is being transmitted. • Steady yellow: The optical module or cable is faulty or not supported by the port. • Off: The port is not connected.

3.5.7 100 Gbit/s RoCE Interface Module

100 Gbit/s RoCE interface modules are used for front-end services between storage devices and application servers or for replication links between storage devices. Select such interface modules based on service bandwidth requirements.

Function

A 100 Gbit/s RoCE interface module provides two 100 Gbit/s optical ports. The optical module rate must be consistent with that on the interface module label. Otherwise, the storage system reports an alarm and this port is unavailable.

Table 3-21 describes the requirements for the optical modules on the storage system and at the peer end of the storage system.

Table 3-21 Optical module parameters

| Optical Module Rate on the Storage System	Type	Optical Module Rate at the Peer End	Negotiated Rate
100 Gbit/s	QSFP28	100 Gbit/s	100 Gbit/s

📖 **NOTE**

The storage system does not support optical modules purchased by the customer elsewhere. Use optical modules that match the storage interface modules.

Ports

Figure 3-52 shows the appearance of a 100 Gbit/s RoCE interface module. FE stands for front-end.

Figure 3-52 100 Gbit/s RoCE interface module
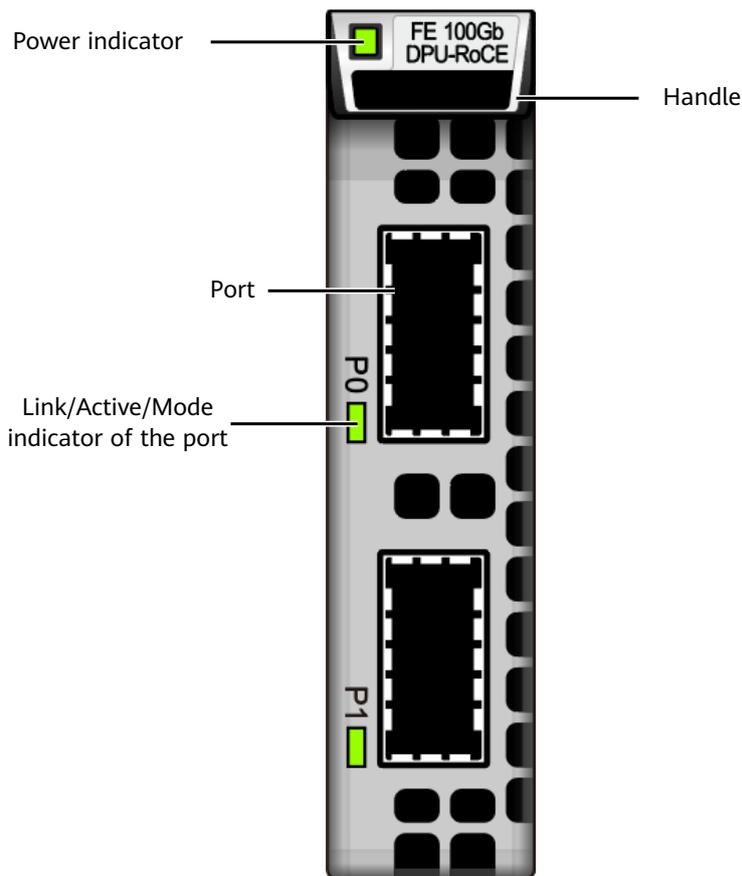
Indicators

Table 3-22 describes the indicators on a 100 Gbit/s RoCE interface module after the storage system is powered on.

Table 3-22 Indicators on a 100 Gbit/s RoCE interface module

Indicators	Status and Description
Power indicator	• Steady green: The module is working properly. • Blinking green: There is a hot swap request to the module. • Steady yellow: The module is faulty. • Off: The module is powered off or hot swappable.

Indicators	Status and Description
Link/Active/Mode indicator of the port	• Steady blue: The interface module is working in Ethernet mode and the port link is up. • Blinking blue (2 Hz): The interface module is working in Ethernet mode and data is being transmitted. • Steady yellow: The optical module or cable is faulty or not supported by the port. • Off: The port is not connected.

3.5.8 100 Gbit/s RDMA Interface Module

The 100 Gbit/s RDMA interface module is used for scale-out connections between controllers or for back-end services between controller enclosures and smart disk enclosures.

Function

A 100 Gbit/s RDMA interface module provides two 100 Gbit/s optical ports.

Ports

Figure 3-53 and **Figure 3-54** show the appearances of 100 Gbit/s RDMA interface modules. SO stands for scale-out and BE stands for back-end.

Figure 3-53 100 Gbit/s RDMA interface module (SO)
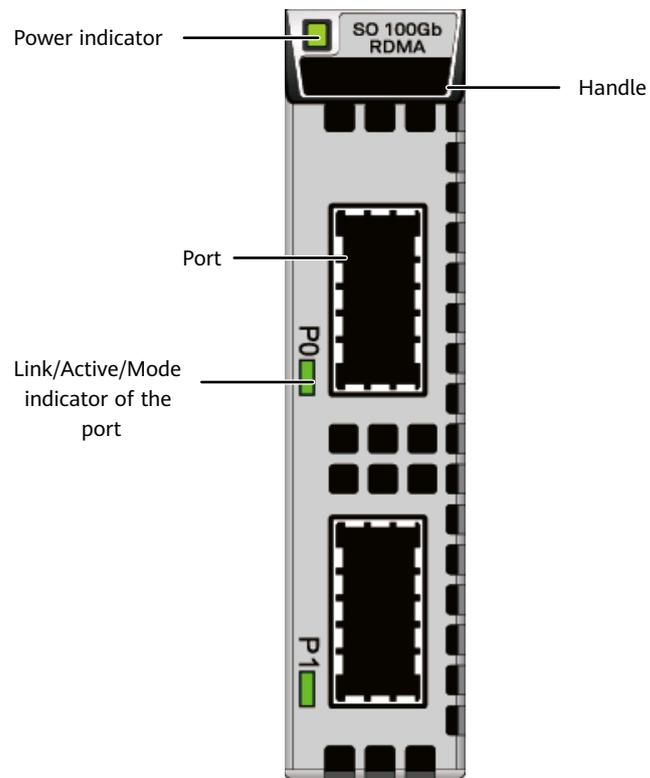
Figure 3-54 100 Gbit/s RDMA interface module (BE)
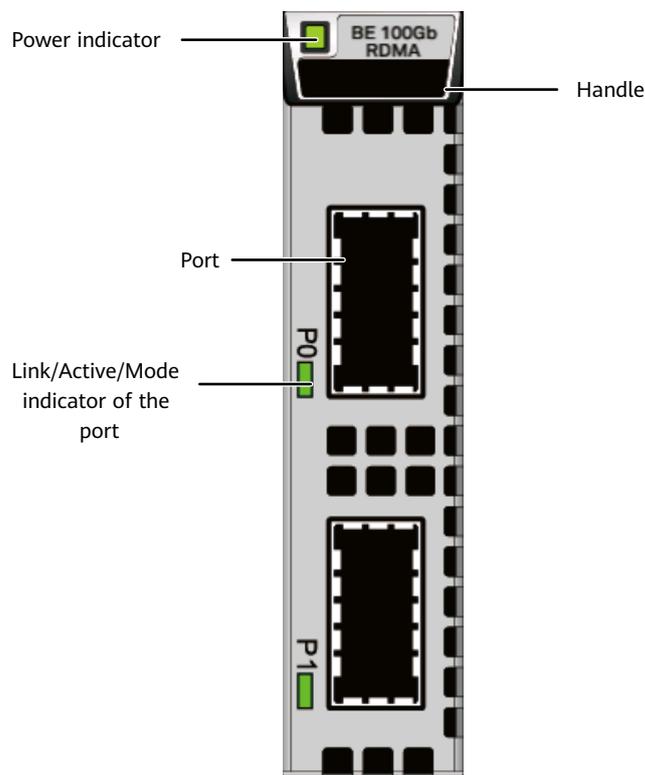
Indicators

Table 3-23 describes the indicators on a 100 Gbit/s RDMA interface module after the storage system is powered on.

Table 3-23 Indicators on a 100 Gbit/s RDMA interface module

Indicator	Status and Description
Power indicator	• Steady green: The module is working properly. • Blinking green: There is a hot swap request to the module. • Steady yellow: The module is faulty. • Off: The module is powered off or hot swappable.

Indicator	Status and Description
Link/Active/Mode indicator of the port	• Steady blue: The interface module is working in Ethernet mode and the port link is up. • Blinking blue (2 Hz): The interface module is working in Ethernet mode and data is being transmitted. • Steady yellow: The optical module or cable is faulty or not supported by the port. • Off: The port is not connected.

3.5.9 100 Gbit/s NoF Interface Module

The 100 Gbit/s NoF interface module is used for front-end services between storage devices and application servers.

Function

A 100 Gbit/s NoF interface module provides two 100 Gbit/s optical ports. The optical module rate must be consistent with that on the interface module label. Otherwise, the storage system reports an alarm and this port is unavailable.

Table 3-24 describes the requirements for the optical modules on the storage system and at the peer end of the storage system.

Table 3-24 Optical module parameters

Optical Module Rate on the Storage System	Type	Optical Module Rate at the Peer End	Negotiated Rate
100 Gbit/s	QSFP28	100 Gbit/s	100 Gbit/s

◫ NOTE

• The storage system does not support optical modules purchased by the customer elsewhere. Use optical modules that match the storage interface modules.
• This interface module cannot be used for container services.
• This interface module cannot be used for connections between storage devices as replication links.

Ports

Figure 3-55 shows the appearance of a 100 Gbit/s NoF interface module. FE stands for front-end.

Figure 3-55 100 Gbit/s NoF interface module

Power indicator

FE 100Gb
DPU-NoF

Handle

Port

P0

Link/Active/Mode
indicator of the port

P1
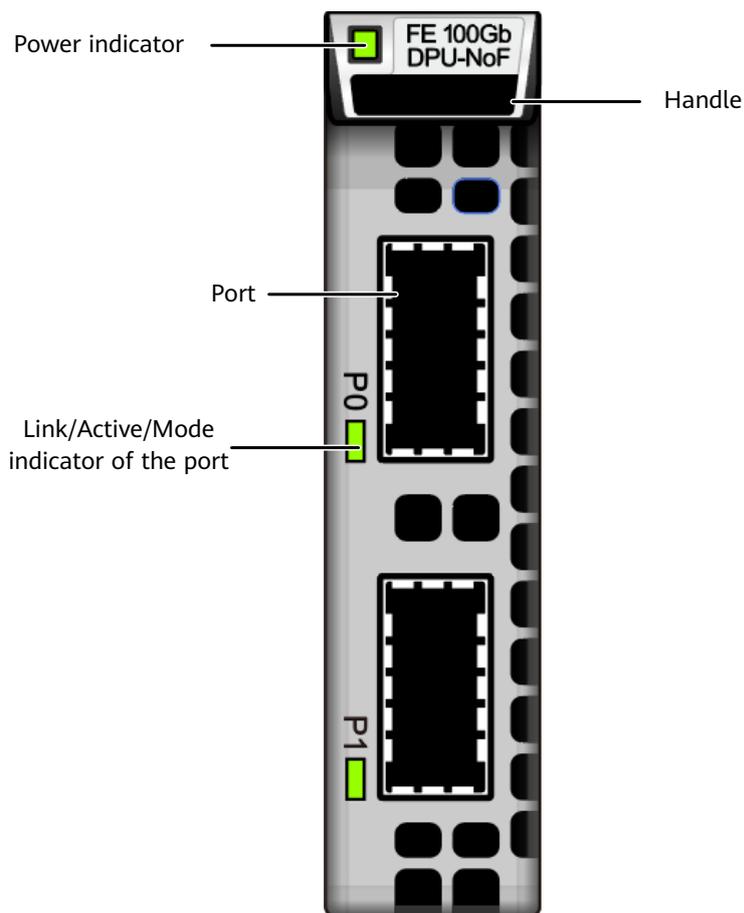
Indicators

Table 3-25 describes the indicators on a 100 Gbit/s NoF interface module after the storage system is powered on.

Table 3-25 Indicators on a 100 Gbit/s NoF interface module

Indicator	Status and Description
Power indicator	● Steady green: The module is working properly. ● Blinking green: There is a hot swap request to the module. ● Steady yellow: The module is faulty. ● Off: The module is powered off or hot swappable.

Indicator	Status and Description
Link/Active/Mode indicator of the port	- Steady blue: The speed is the highest. - Blinking blue (2 Hz): The port is transmitting data at the highest speed. - Steady yellow: The optical module or cable is faulty or not supported by the port. - Off: The port is not connected.

3.5.10 SmartIO Interface Module

SmartIO interface modules are used for front-end services between storage devices and application servers or for replication links between storage devices. Select such interface modules based on service bandwidth requirements.

Function

A SmartIO interface module supports 8 Gbit/s, 10 Gbit/s, 16 Gbit/s, 25 Gbit/s, 32 Gbit/s, and 64 Gbit/s optical modules. The optical module rate must be consistent with that on the interface module label. Otherwise, the storage system reports an alarm and this port is unavailable.

☐ NOTE

- For a Fibre Channel interface module, the FDMI protocol is supported. You can view information about the registered interface module on the switch that supports the FDMI protocol.
- The interface module with the label rate of 16 Gbit/s supports both 16 Gbit/s optical modules and 32 Gbit/s single-mode optical modules.
- For a Fibre Channel optical module, the enabled auto-negotiation function allows it to auto-negotiate a maximum of three speeds. The Ethernet optical module does not support auto-negotiation.
- 10 Gbit/s and 25 Gbit/s SmartIO interface modules can be used for HyperMetro quorum links.
- Fibre Channel interface modules support the Fabric Performance Impact Notification (FPIN) feature, which is used to quickly locate and demarcate faults when the Fibre Channel network fluctuates.

Table 3-26 describes the requirements for the optical modules on the storage system and at the peer end of the storage system.

Table 3-26 Optical module parameters

Optical Module Rate on the Storage System	Type	Optical Module Rate at the Peer End	Negotiated Rate
8 Gbit/s	SFP+	8 Gbit/s	8 Gbit/s
		16 Gbit/s	8 Gbit/s

| Optical Module Rate on the Storage System	Type	Optical Module Rate at the Peer End	Negotiated Rate
		32 Gbit/s	8 Gbit/s
10 Gbit/s	SFP+	10 Gbit/s	10 Gbit/s
16 Gbit/s	SFP+	8 Gbit/s	8 Gbit/s
		16 Gbit/s	16 Gbit/s
		32 Gbit/s	16 Gbit/s
		64 Gbit/s	16 Gbit/s
25 Gbit/s	SFP28	25 Gbit/s	25 Gbit/s
32 Gbit/s	SFP28	8 Gbit/s	8 Gbit/s
		16 Gbit/s	16 Gbit/s
		32 Gbit/s	32 Gbit/s
		64 Gbit/s	32 Gbit/s
64 Gbit/s	SFP56	16 Gbit/s	16 Gbit/s
		32 Gbit/s	32 Gbit/s
		64 Gbit/s	64 Gbit/s

 NOTE

- The storage system does not support optical modules purchased by the customer elsewhere. Use optical modules that match the storage interface modules. The working mode and rate of the interface module cannot be modified. If the customer requires a different rate on the interface module, contact Huawei technical support engineers and purchase a new interface module of the required rate.

- If the storage system uses 32 Gbit/s single-mode optical modules on an interface module with the label rate of 16 Gbit/s, the peer optical module rate and negotiated rate can be 16 Gbit/s and 8 Gbit/s.

- If the storage system uses 1822V120 Fibre Channel interface modules and negotiates the port rate with the peer end to 8 Gbit/s, bit errors may occur on the ports. If the number of bit errors is within the threshold, services are not affected and you can ignore the bit errors. If the number of bit errors exceeds the threshold and an alarm is generated, contact technical support engineers for evaluation and alarm clearance.

Ports

Figure 3-56, **Figure 3-57**, **Figure 3-58**, **Figure 3-59**, **Figure 3-60**, and **Figure 3-61** show the appearances of SmartIO interface modules. FE stands for front-end.

> **NOTE**
>
> A 10GE electrical interface module has the same appearance as a SmartIO interface
> module that uses a 10 Gbit/s optical module. You can distinguish between them only by the
> BOM numbers on their handles. You can check the BOM number on the **Spare Parts Query**
> tool to determine the interface module type.

Figure 3-56 8 Gbit/s interface module
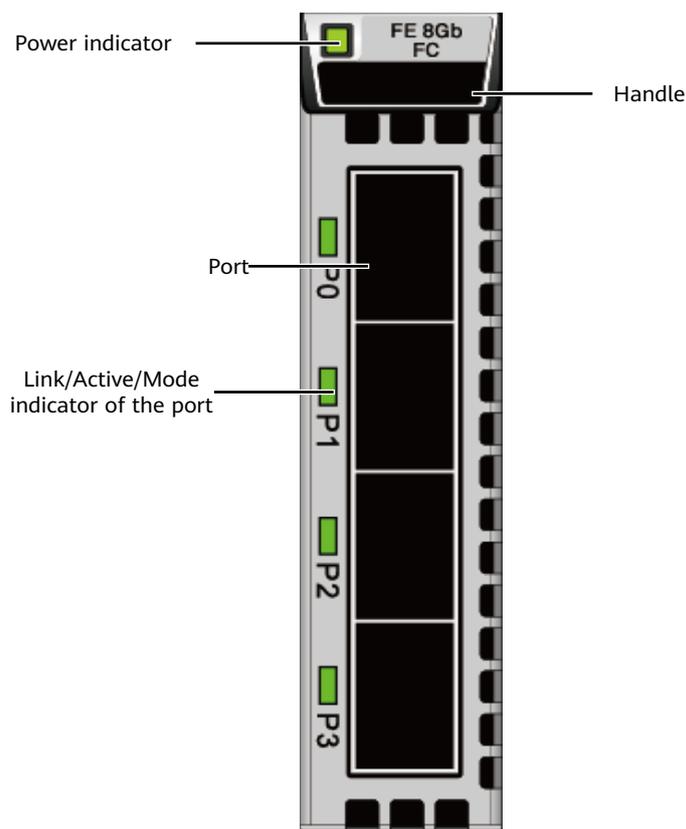
Figure 3-57 16 Gbit/s interface module
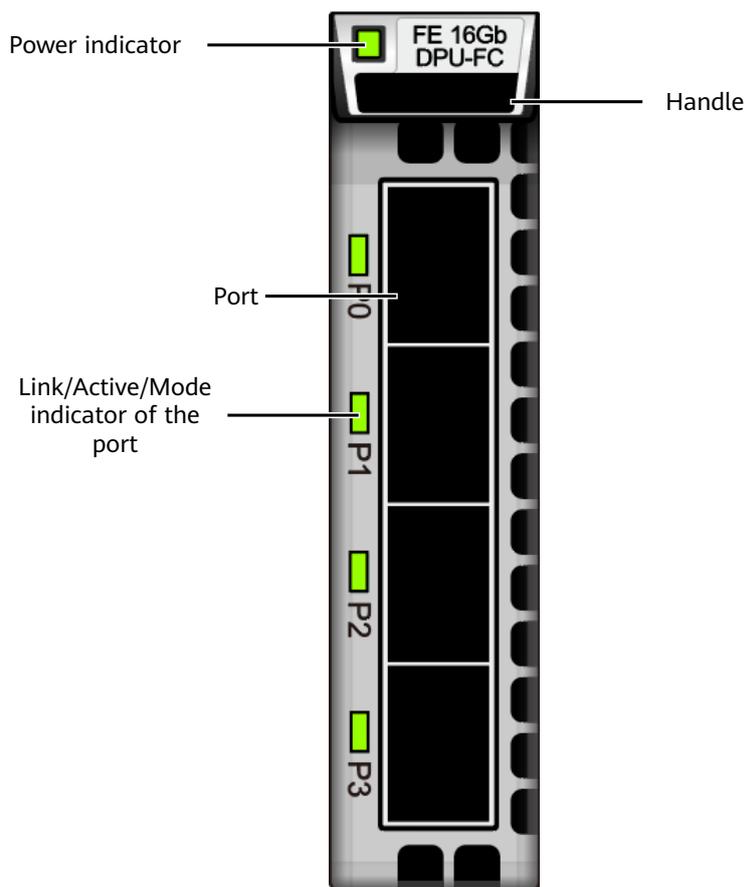
Figure 3-58 32 Gbit/s interface module

Power indicator

FE 32Gb
DPU-FC

Handle

Port

F0

Link/Active/Mode
indicator of the
port

P1

P2

P3
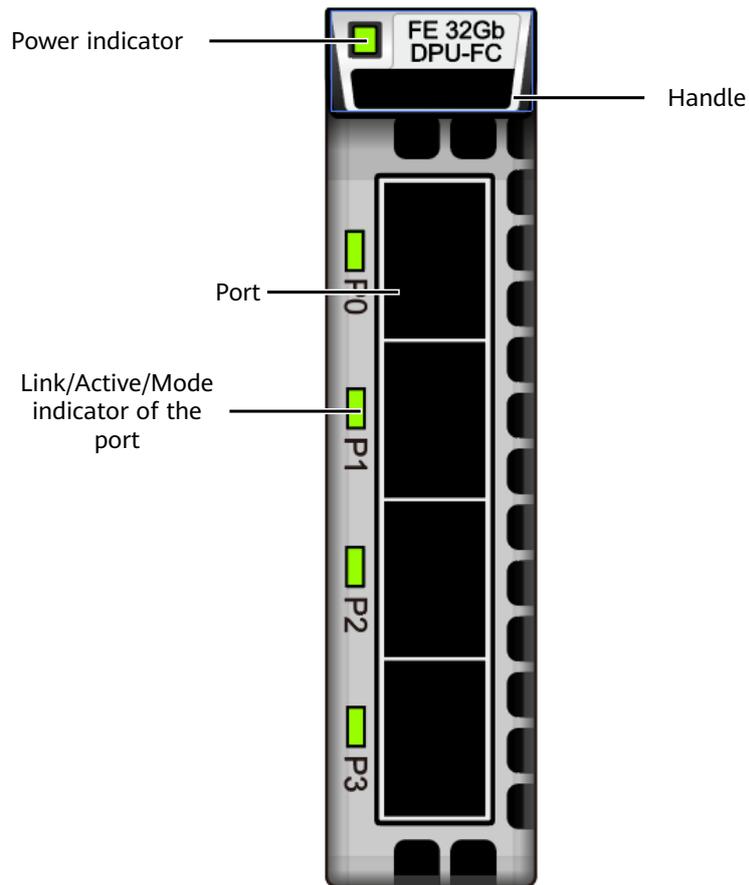
Figure 3-59 64 Gbit/s interface module

Power indicator

FE 64Gb
DPU-FC

Handle

Port

Link/Active/Mode
indicator of the
port

P0

P1

P2

P3
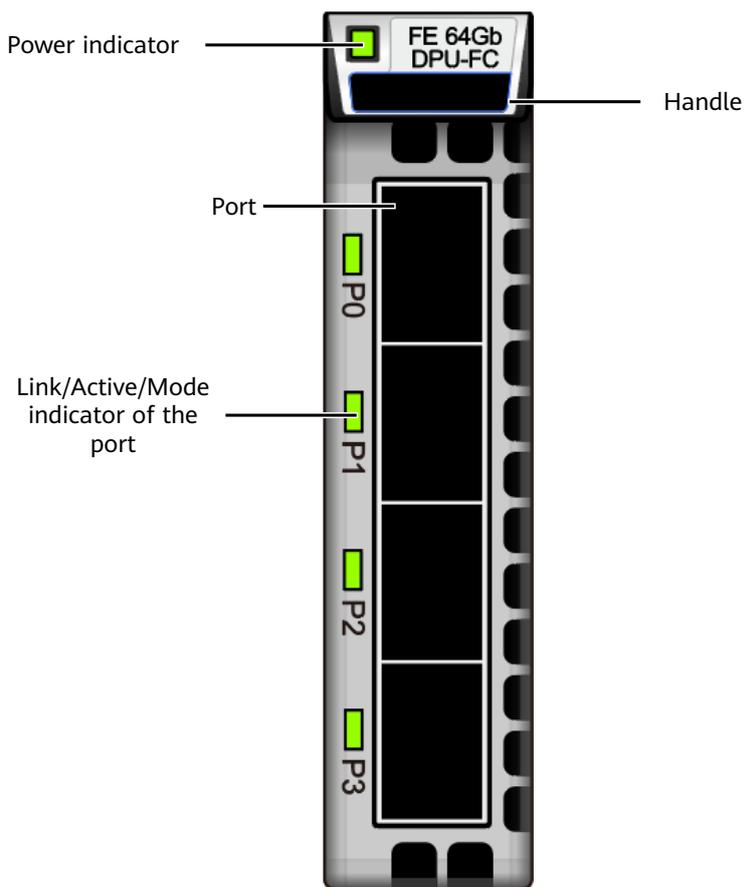
Figure 3-60 10 Gbit/s interface module

Power indicator

Handle

Port

Link/Active/Mode
indicator of the
port

FE 10Gb
DPU-ETH

P0

P1

P2

P3
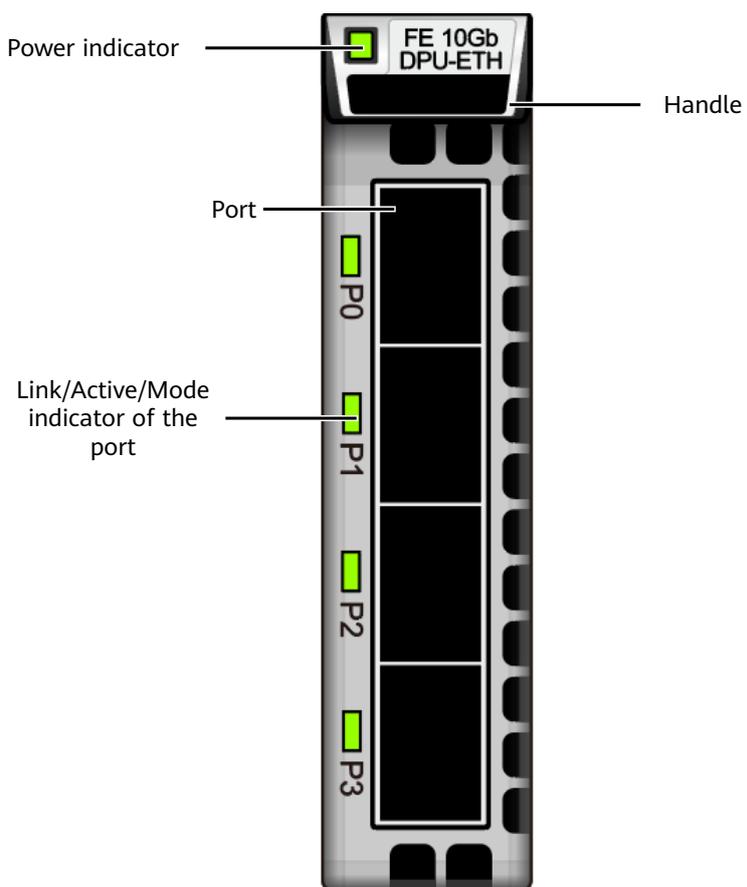
Figure 3-61 25 Gbit/s interface module
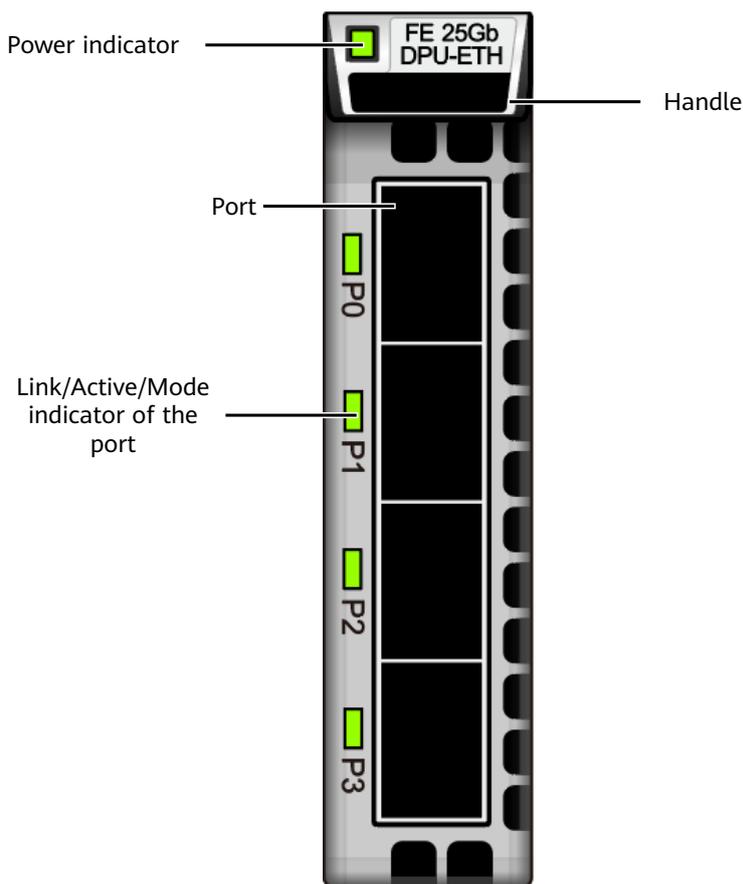
Indicator

Table 3-27 describes the indicators on a SmartIO interface module after the storage system is powered on.

Table 3-27 Indicators on a SmartIO interface module

Indicator	Status and Description
Power indicator	- Steady green: The module is working properly. - Blinking green: There is a hot swap request to the module. - Steady yellow: The module is faulty. - Off: The module is powered off or hot swappable.

Indicator	Status and Description
Link/Active/Mode indicator of the port	● Steady blue: The interface module is working in FC mode and the port link is up. ● Blinking blue (2 Hz): The interface module is working in FC mode and data is being transmitted. ● Steady green: The interface module is working in Ethernet mode and the port link is up. ● Blinking green (2 Hz): The interface module is working in Ethernet mode and data is being transmitted. ● Steady yellow: The optical module is faulty or does not match the port specifications. ● Off: The port is not connected.

☐ **NOTE**

● If the host uses the iSCSI protocol, the MTU value of the SmartIO port must be the same as that of the host.

● If the SmartIO port works in 10GE or 25GE mode, it is recommended that you enable the LRO function for the HBAs on the host. The method for querying and enabling the LRO function varies with operating system. The following provides the methods used by common operating systems. If the HBAs do not support the LRO function, it is recommended that you use the Jumbo frame mode by setting the MTU to 9000 for the host, switch, and SmartIO interface module of the storage system.

  ● Linux: Run **ethtool -k ethx** to query the LRO function and **ethtool -K ethx lro on** to enable the LRO function.

  ● Windows: Query and set the LRO function in the HBA properties on the Device Manager.

  ● ESXi: Run **esxcfg-advcfg -g /Net/TcpipDefLROEnabled** to query the LRO function and run **esxcfg-advcfg -s 1 /Net/TcpipDefLROEnabled** to enable the LRO function.

3.5.11 12 Gbit/s SAS V2 Interface Module

The 12 Gbit/s SAS V2 interface module provides expansion ports for communication and data transmission between a controller enclosure and a SAS disk enclosure.

☐ **NOTE**

OceanStor Dorado 8000 (NVMe) and Dorado 18000 (NVMe) do not support 12 Gbit/s SAS V2 expansion modules.

Function

A 12 Gbit/s SAS V2 interface module provides four 12 Gbit/s mini SAS HD expansion ports, which are connected to the back-end disk arrays of the storage system through mini SAS HD cables. If the transmission rate of the device connected to an expansion port is lower than the port rate, the expansion port

automatically adjusts the transmission rate to ensure connectivity of the data transmission channel and consistency of transmission rates.

Ports

Figure 3-62 shows the appearance of a 12 Gbit/s SAS V2 interface module. BE stands for back-end.

Figure 3-62 12 Gbit/s SAS V2 interface module
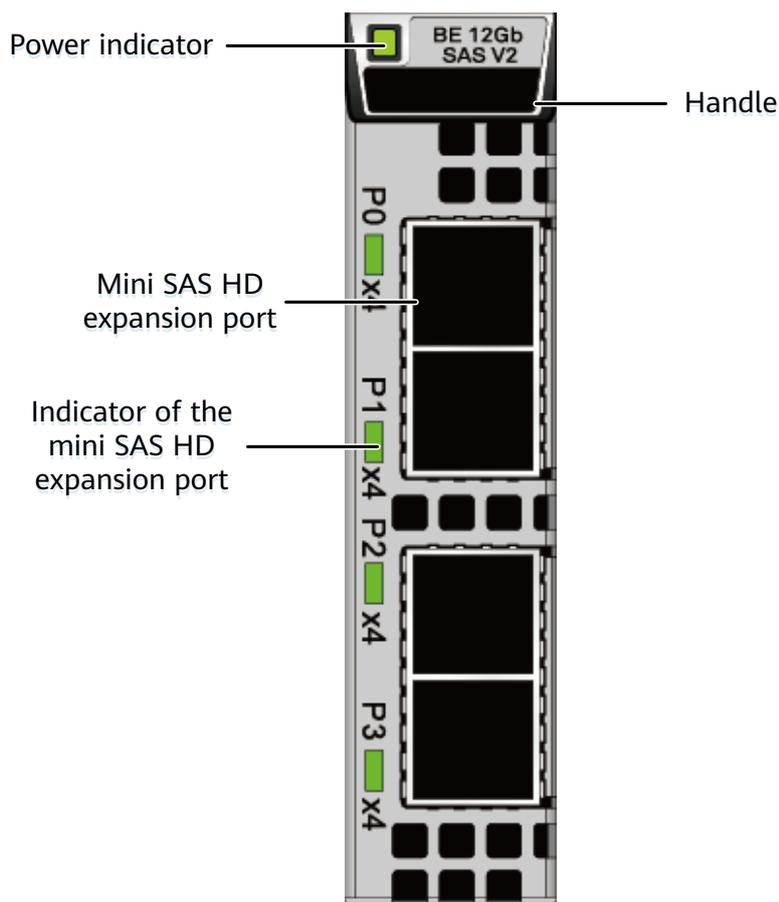
Indicators

Table 3-28 describes the indicators on a 12 Gbit/s SAS V2 interface module after the storage system is powered on.

Table 3-28 Indicators on a 12 Gbit/s SAS V2 interface module

Indicator	Status and Description
Power indicator/Hot swap button	- Steady green: The module is working properly. - Blinking green: There is a hot swap request to the module. - Steady yellow: The module is faulty. - Off: The module is powered off or hot swappable.
Mini SAS HD expansion port indicator	- Steady blue: Data is transmitted to the disk enclosure at a speed of 4 x 12 Gbit/s. - Steady green: Data is transmitted to the disk enclosure at a speed of 4 x 6 Gbit/s or 4 x 3 Gbit/s. - Steady yellow: The port is faulty. - Off: The port is not connected.

3.5.12 SmartDedupe and SmartCompression Acceleration Module

A SmartDedupe and SmartCompression acceleration module is used in compression scenarios. It dynamically offloads compression and decompression processes from CPUs, reducing the compression computing power consumption of the CPUs and improving the overall system performance.

Appearance

Figure 3-63 shows the appearance of the SmartDedupe and SmartCompression acceleration module.

Figure 3-63 SmartDedupe and SmartCompression acceleration module

Indicator

Figure 3-64 Position of the indicator on a SmartDedupe and SmartCompression acceleration module
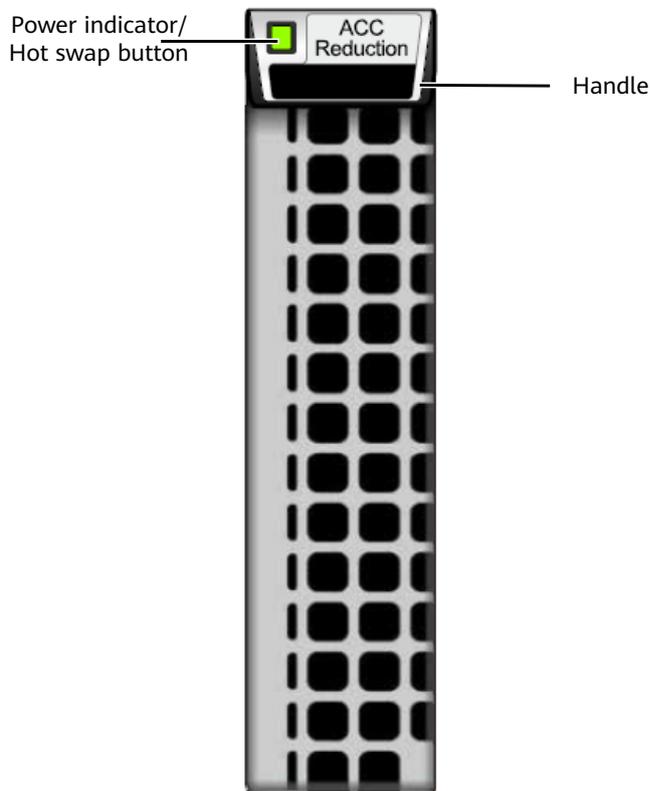
Table 3-29 describes the indicator on a SmartDedupe and SmartCompression acceleration module after the storage system is powered on.

Table 3-29 Indicators on a SmartDedupe and SmartCompression acceleration module

Indicator	Status and Description
Power indicator/Hot swap button	- Steady green: The module is working properly. - Blinking green (2 Hz): There is a hot swap request to the module. - Steady yellow: The module is faulty. - Off: The module is powered off or hot swappable.

3.6 2 U SAS Disk Enclosure

This section describes the hardware structure, component functions, front and rear views, and indicators of a 2 U SAS disk enclosure.

2 U SAS disk enclosures are applicable to Dorado 8000 (SAS) and Dorado 18000 (SAS).

3.6.1 Overview

The disk enclosure uses a modular design and consists of a system subrack, expansion modules, disk modules, and power modules.

Overall Structure

Figure 3-65 shows the overall structure of a 2 U SAS disk enclosure.

Figure 3-65 Overall structure of a 2 U SAS disk enclosure
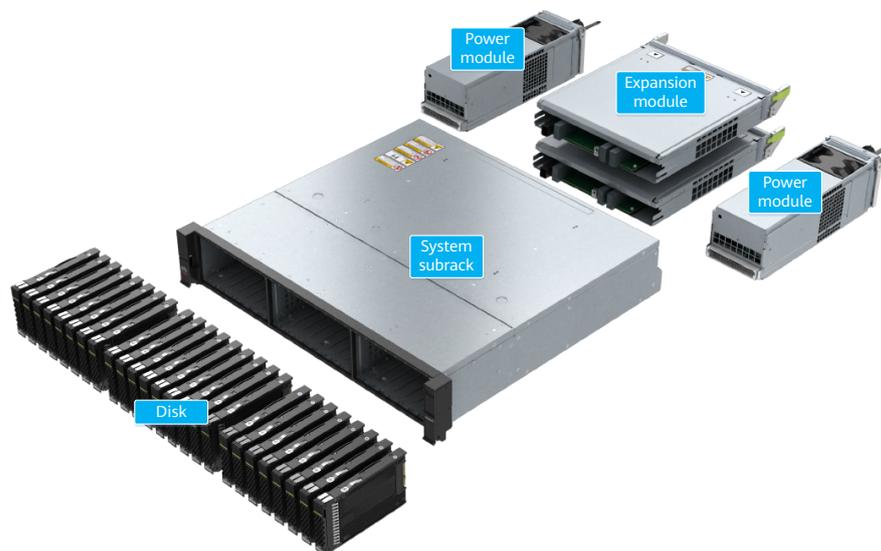
Front View

Figure 3-66 shows the front view of a disk enclosure.

Figure 3-66 Front view of a disk enclosure
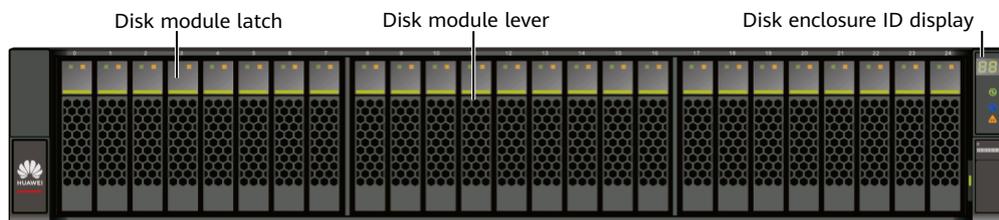
☐ **NOTE**

The disk slots are numbered 0 to 24 from left to right.

Rear View

Figure 3-67 shows the rear view of a disk enclosure.

Figure 3-67 Rear view of a disk enclosure (using the AC power module as an example)
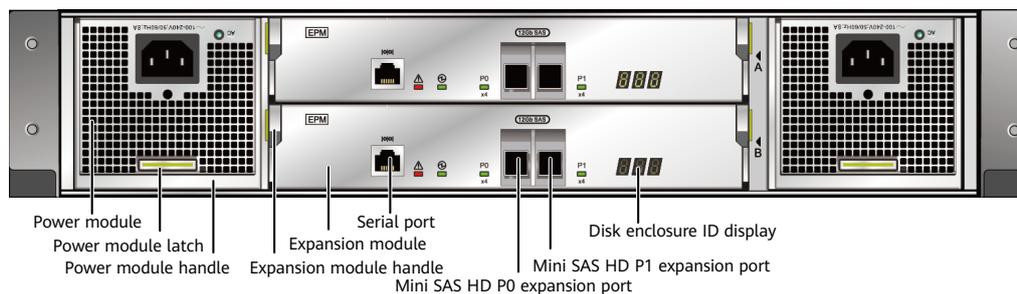
Power module
Power module latch
Power module handle
Expansion module
Expansion module handle
Serial port
Mini SAS HD P0 expansion port
Mini SAS HD P1 expansion port
Disk enclosure ID display

NOTICE

Only serial cables can be inserted into serial ports. Do not insert network cables into serial ports.

Hardware Specifications

Table 3-30 lists the dimensions, weight, and power specifications of the disk enclosure. For more specifications, refer to **Specifications Query**.

Table 3-30 Hardware specifications

Item	Specifications
Dimensions (H x W x D)	86.1 mm x 447 mm x 410 mm
Weight (excluding auxiliary materials such as guide rails and cables)	• 19.65 kg (including disk modules) • 13.4 kg (excluding disk modules)
AC power voltage and rated current	Rated 800 W AC power supply: 100–240 V AC±10% input (10 A, single-phase, 50/60 Hz); 110 V dual-live-wire input (2W+PE); 110 V single-live-wire input
High-voltage DC	800 W power supply (240 V DC input), 192 V to 288 V, 10 A
Low-voltage DC	600 W power supply (supporting –48 V/–60 V DC input), –38.4 V to –75 V DC, 16 A

3.6.2 Component Description

This section provides the detailed illustration and description for each component.

3.6.2.1 System Subrack

The system subrack houses a midplane that provides reliable connections for interface modules and distributes power and signals to inner modules.

Appearance

Figure 3-68 shows the appearance of a system subrack.

Figure 3-68 System subrack

3.6.2.2 Expansion Module

An expansion module provides expansion ports for communication between the disk enclosure and the controller enclosure. Each expansion module provides two expansion ports P0 and P1.

Appearance

Figure 3-69 shows the appearance of an expansion module.

Figure 3-69 Expansion module

Ports

Figure 3-70 shows the ports on an expansion module.

Figure 3-70 Ports on an expansion module
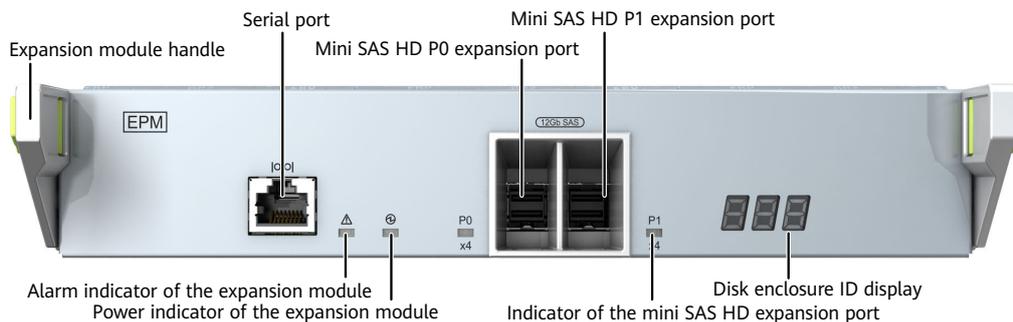
> **NOTICE**
>
> Only serial cables can be inserted into serial ports. Do not insert network cables into serial ports.

Indicators

For the indicators on an expansion module after the storage system is powered on, see **Indicators on the Rear Panel**.

3.6.2.3 Power Module

The disk enclosure uses AC and DC power modules to ensure proper running at maximum power.

Appearance

Figure 3-71 shows the appearance of an AC power module. **Figure 3-72** shows the appearance of a DC power module.

Figure 3-71 AC power module
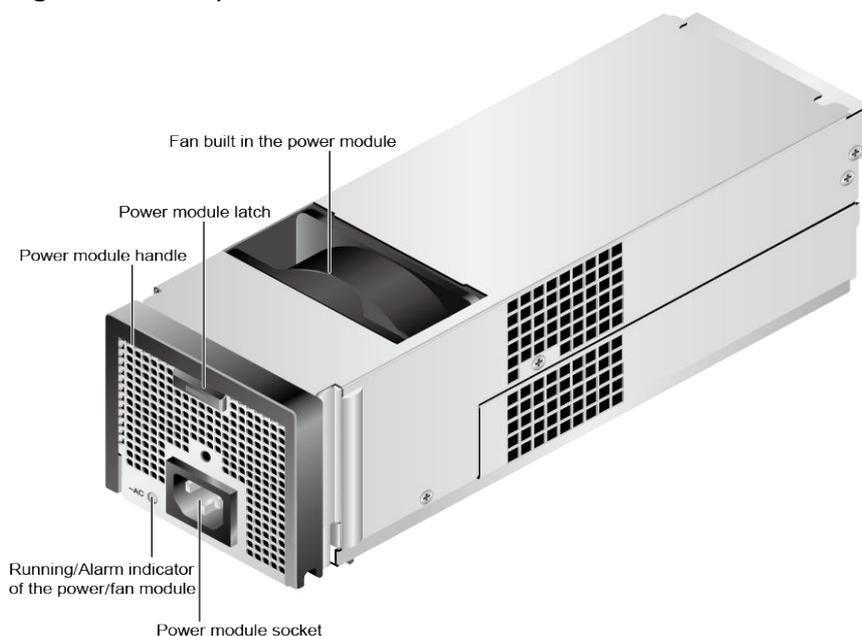
Figure 3-72 DC power module
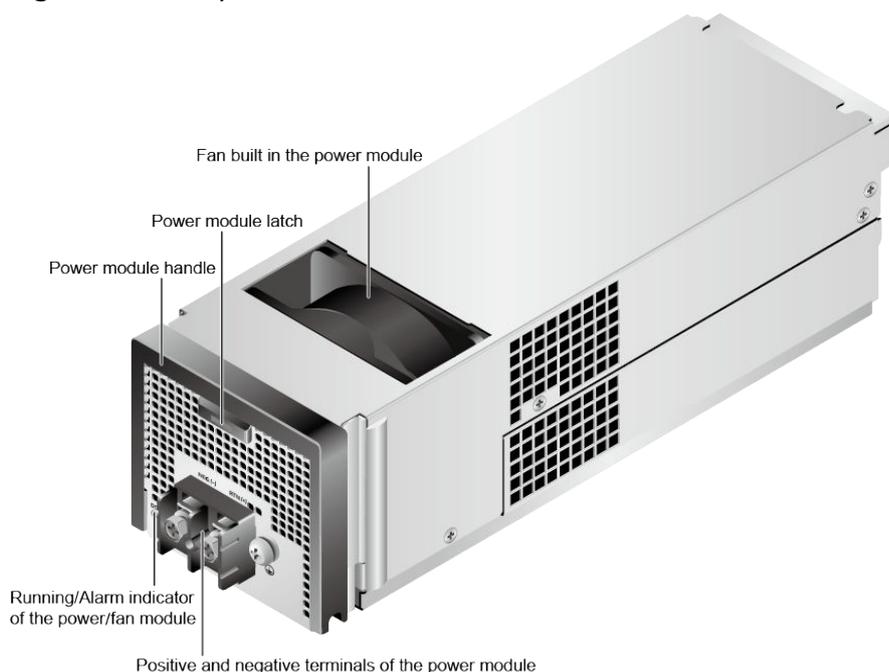
Indicators

For the indicators on a power module after the storage system is powered on, see **Indicators on the Rear Panel**.

3.6.2.4 Disk Module

Disk modules provide storage space for the storage system to save service data, system data, and cache data.

Appearance

Figure 3-73 shows the appearance of a disk module.

Figure 3-73 Disk module
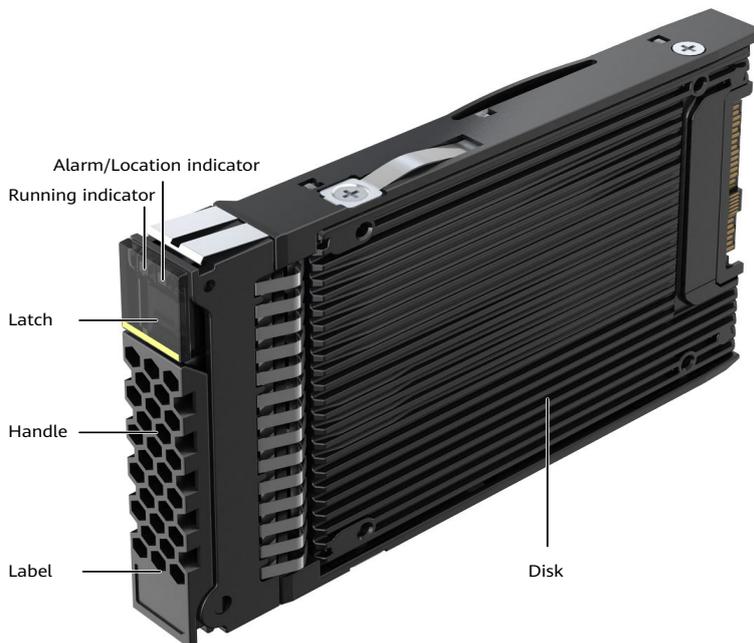
Indicators

For the indicators on a disk module after the storage system is powered on, see
Indicators on the Front Panel.

3.6.3 Indicator Description

After a disk enclosure is powered on, you can check the current operating status of
the disk enclosure by observing its indicators.

Indicators on the Front Panel

Figure 3-74 shows the indicators on the front panel of a disk enclosure.

Figure 3-74 Indicators on the front panel of a disk enclosure

Table 3-31 describes meanings of the indicators on the front panel of a disk
enclosure.

Table 3-31 Meanings of the indicators on the front panel

Module	Indicator	Status and Description
Disk module	Running indicator of the disk module	• Steady green: The disk module is working properly. • Blinking green (4 Hz or higher): Data is being read and written on the disk module. • Off: The disk module is powered off or incorrectly powered on.
	Alarm/Location indicator of the disk module	• Steady yellow: The disk module is faulty. • Blinking yellow (2 Hz): The disk module is being located. • Off: The disk module is working properly or hot swappable.
System subrack	Location indicator of the disk enclosure	• Blinking blue (2 Hz): The disk enclosure is being located. • Off: The disk enclosure is not located.
	Alarm indicator of the disk enclosure	• Steady yellow: An alarm is reported by the disk enclosure. • Off: The disk enclosure is working properly.
	Power indicator of the disk enclosure	• Steady green: The disk enclosure is powered on. • Off: The disk enclosure is powered off.

Indicators on the Rear Panel

Figure 3-75 shows the indicators on the rear panel of a disk enclosure.

Figure 3-75 Indicators on the rear panel of a disk enclosure
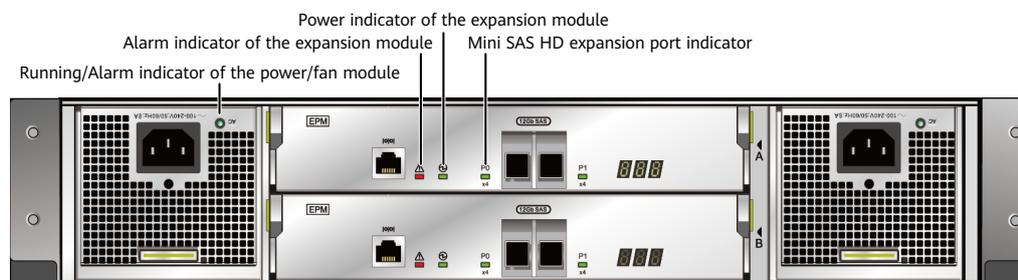
Table 3-32 describes meanings of the indicators on the rear panel of a disk enclosure.

Table 3-32 Meanings of the indicators on the rear panel

Module	Indicator	Status and Description
Expansion module	Alarm indicator of the expansion module	● Steady yellow: An alarm is reported by the expansion module. ● Off: The expansion module is working properly.
	Power indicator of the expansion module	● Steady green: The expansion module is powered on. ● Off: The expansion module is powered off.
	Mini SAS HD expansion port indicator	● Steady blue: Data is transmitted to the disk enclosure at a speed of 4 x 12 Gbit/s. ● Steady green: Data is transmitted to the disk enclosure at a speed of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Steady yellow: The port is faulty. ● Off: The port is not connected.
Power module	Running/Alarm indicator of the power/fan module	● Steady green: The power input is normal. ● Blinking green (1 Hz): The power input is normal but the device is powered off. ● Blinking green (4 Hz): The power module is being upgraded online. ● Steady yellow: The power module or fan module is faulty. ● Off: There is no external power input.

3.7 2 U Smart NVMe Disk Enclosure

This section describes the hardware structure, component functions, front and rear views, and indicators of a smart NVMe disk enclosure.

Smart NVMe disk enclosures fall into two categories: common and high-performance. You can distinguish between them by checking whether the BOM code contains the keyword "high performance". High-performance smart NVMe disk enclosures support dual-uplink networking, which effectively improves service performance. 2 U smart NVMe disk enclosures are applicable to Dorado 8000 (NVMe) and Dorado 18000 (NVMe).

3.7.1 Overview

The disk enclosure uses a modular design and consists of a system subrack, expansion modules, disk modules, and power modules.

Overall Structure

Figure 3-76 shows the overall structure of a 2 U smart NVMe disk enclosure.

Figure 3-76 Overall structure of a smart NVMe disk enclosure
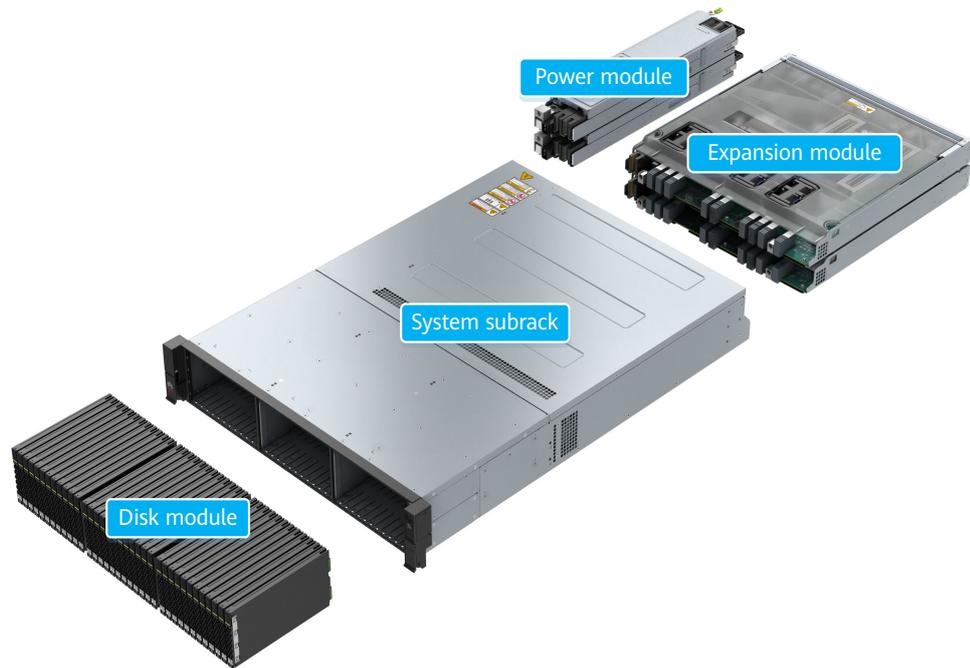
Front View

Figure 3-77 shows the front view of a disk enclosure.

Figure 3-77 Front view of a disk enclosure
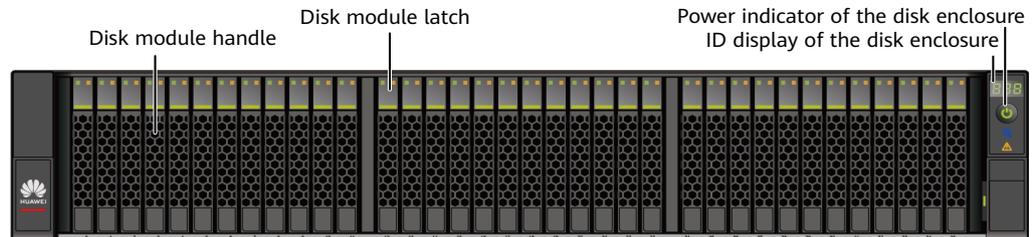
📖 **NOTE**

- The disk slots are numbered 0 to 35 from left to right.
- The disk enclosure indicator is designed as a button, but the button function is reserved and currently unavailable.

Rear View

Figure 3-78 and **Figure 3-79** show the rear views of disk enclosures.

Figure 3-78 Rear view of a disk enclosure without USB ports (using the AC power module as an example)
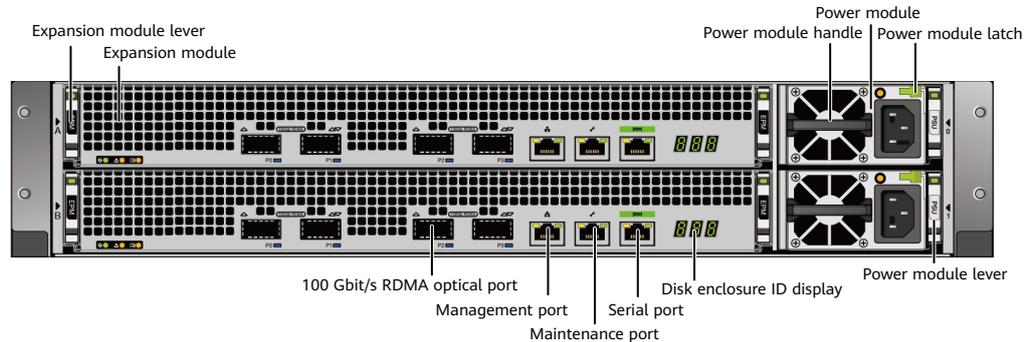
Figure 3-79 Rear view of a disk enclosure with USB ports (using the AC power module as an example)
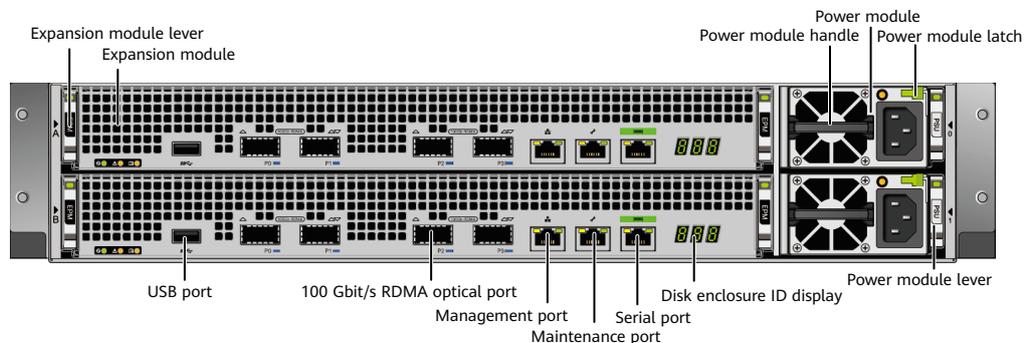
> **NOTICE**
>
> Only serial cables can be inserted into serial ports. Do not insert network cables into serial ports.

> **NOTE**
>
> - The management, maintenance, and serial ports of a smart disk enclosure are reserved and do not need cable connections.
> - The USB ports of a smart disk enclosure supply power to the status indicator on the front door of a disk bay only in the scenario where the 4 U controller enclosure is delivered as bay.

Hardware Specifications

Table 3-33 lists the dimensions, weight, and power specifications of the disk enclosure. For more specifications, refer to **Specifications Query**.

Table 3-33 Hardware specifications

Item	Specifications
Dimensions (H x W x D)	86.1 mm x 447 mm x 620 mm

Item	Specifications
Weight (excluding auxiliary materials such as guide rails and cables)	• 33.95 kg (including disk modules) • 24.95 kg (excluding disk modules)
AC power voltage and rated current	2000 W power supply (supporting 110 V dual-live-wire input (2W+PE)), 200 V to 240 V AC ±10%, 10 A, single-phase, 50/60 Hz 900 W power supply (supporting 110 V dual-live-wire input (2W+PE)), 200 V to 240 V AC ±10%, 10 A, single-phase, 50/60 Hz
High-voltage DC	900 W power supply (240 V DC input), 192 V to 288 V DC, 5 A
Low-voltage DC	1200 W power supply (supporting –48 V/–60 V DC input), –38.4 V to –72 V DC, 32 A

3.7.2 Component Description

This section provides the detailed illustration and description for each component.

3.7.2.1 System Subrack

The system subrack houses a midplane that provides reliable connections for interface modules and distributes power and signals to inner modules.

Appearance

Figure 3-80 shows the appearance of a system subrack.

Figure 3-80 System subrack

3.7.2.2 Expansion Module

An expansion module provides expansion ports for communication between a disk enclosure and a controller enclosure, or between different disk enclosures. Each expansion module provides four expansion ports P0, P1, P2, and P3.

Appearance

Figure 3-81 shows the appearance of an expansion module.

Figure 3-81 Expansion module

Ports

Figure 3-82 and Figure 3-83 show the ports on an expansion module.

Figure 3-82 Ports of an expansion module without a USB port
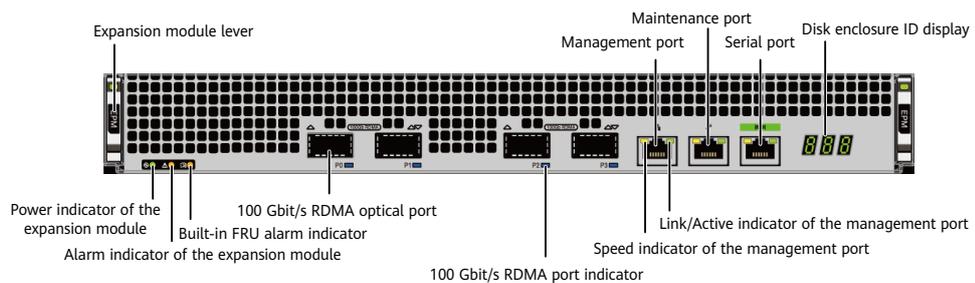
Figure 3-83 Ports of an expansion module with a USB port
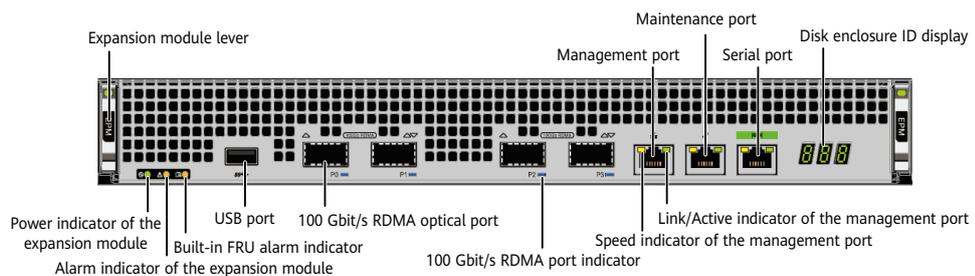
> **NOTICE**
>
> Only serial cables can be inserted into serial ports. Do not insert network cables into serial ports.

> **NOTE**
>
> - The management, maintenance, and serial ports of a smart disk enclosure are reserved and do not need cable connections.
> - The USB ports of a smart disk enclosure supply power to the status indicator on the front door of a disk bay only in the scenario where the 4 U controller enclosure is delivered as bay.

Indicators

For the indicators on an expansion module after the storage system is powered on, see **Indicators on the Rear Panel**.

3.7.2.3 Fan Module

Fan modules dissipate heat from the system, allowing the disk enclosure to operate normally at maximum power.

Appearance

Figure 3-84 shows the appearance of a fan module.

Figure 3-84 Fan module
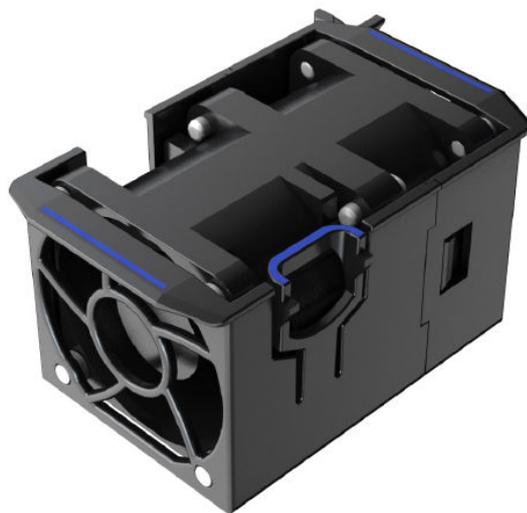
Indicators

Fans are embedded inside expansion modules and do not have independent indicators. You can check the running status of fans by observing the indicators on the expansion modules. For details, see **Indicators on the Rear Panel**.

3.7.2.4 Power Module

The disk enclosure uses AC and DC power modules to ensure proper running at maximum power.

Appearance

Figure 3-85 or **Figure 3-86** shows the appearance of an AC power module. **Figure 3-87** shows the appearance of a DC power module.

Figure 3-85 Appearance of an AC power module
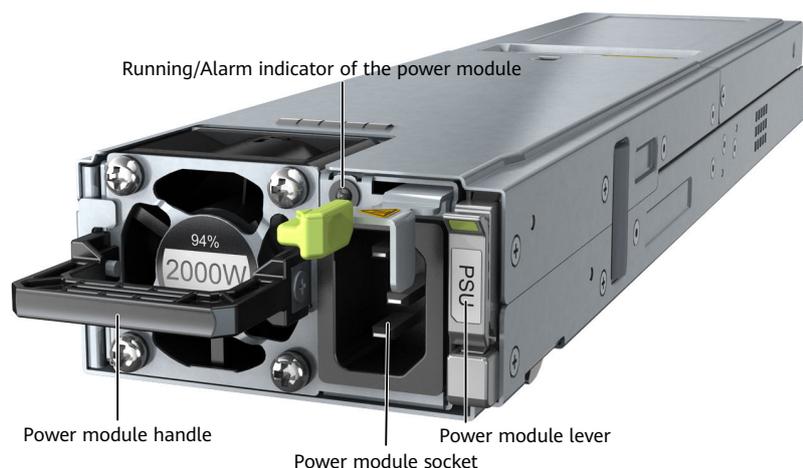
Figure 3-86 (Optional) Appearance of an AC power module
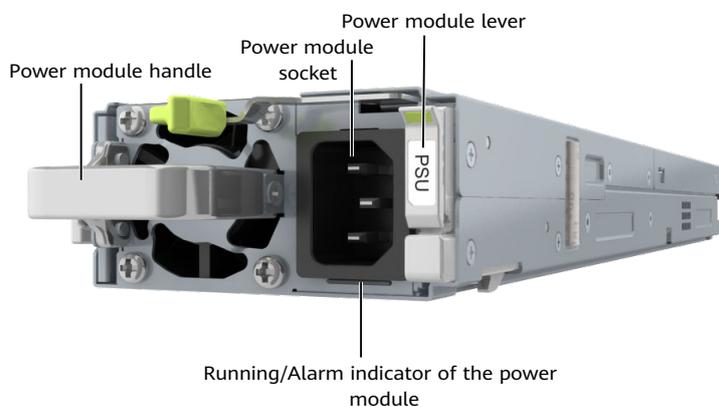
Figure 3-87 Appearance of a DC power module
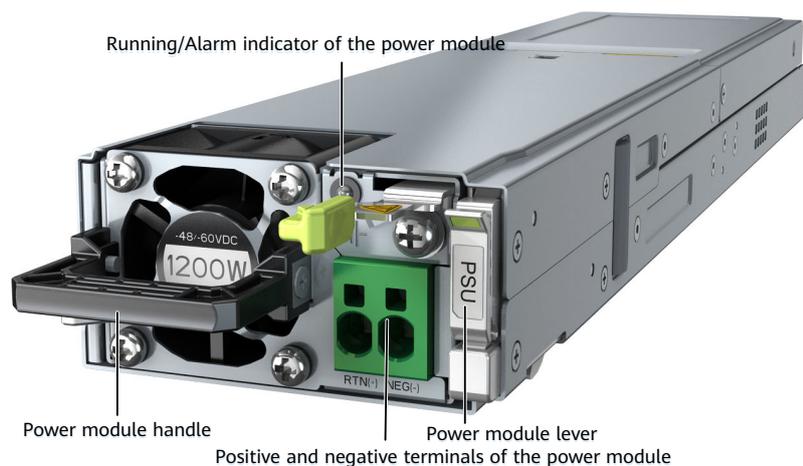
Running/Alarm indicator of the power module

-48/-60VDC
1200W
PSU
RTN(+) NEG(-)

Power module handle

Power module lever
Positive and negative terminals of the power module

Indicators

For the indicators on a power module after the storage system is powered on, see **Indicators on the Rear Panel**.

3.7.2.5 Disk Module

Disk modules provide storage space for the storage system to save service data, system data, and cache data.

In V700R001C20 and later versions, palm-sized capacity-optimized SSDs are supported and can be identified by their BOM codes or the keyword Capacity-Optimized SSD on their electronic labels.

Appearance

Figure 3-88 shows the appearance of a disk module.

Figure 3-88 Disk module
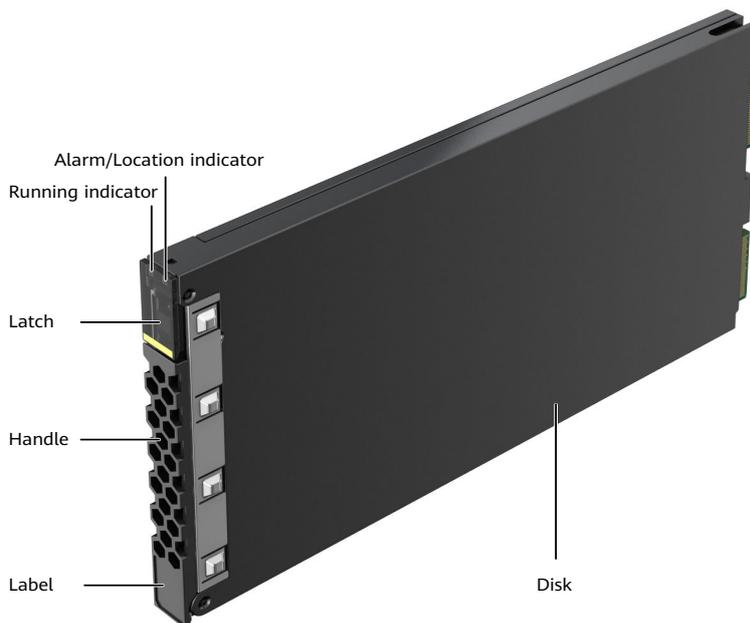
Indicators

For the indicators on a disk module after the storage system is powered on, see
Indicators on the Front Panel.

3.7.3 Indicator Description

After a disk enclosure is powered on, you can check the current operating status of
the disk enclosure by observing its indicators.

Indicators on the Front Panel

Figure 3-89 shows the indicators on the front panel of a disk enclosure.

Figure 3-89 Indicators on the front panel of a disk enclosure
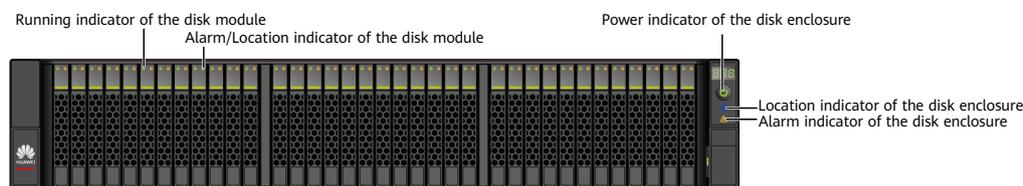
📖 **NOTE**

The power button of the disk enclosure is unavailable. It cannot be used to power on or
power off the disk enclosure separately.

Table 3-34 describes meanings of the indicators on the front panel of a disk
enclosure.

Table 3-34 Meanings of the indicators on the front panel

Module	Indicator	Status and Description
Disk module	Running indicator of the disk module	• Steady green: The disk module is working properly. • Blinking green (4 Hz): Data is being read and written on the disk module. • Off: The disk module is powered off or incorrectly powered on.
	Alarm/Location indicator of the disk module	• Steady yellow: The disk module is faulty. • Blinking yellow (2 Hz): The disk module is being located. • Off: The disk module is working properly or hot swappable.
System subrack	Location indicator of the disk enclosure	• Blinking blue (2 Hz): The disk enclosure is being located. • Off: The disk enclosure is not located.
	Alarm indicator of the disk enclosure	• Steady yellow: An alarm is reported by the disk enclosure. • Off: The disk enclosure is working properly.
	Power indicator of the disk enclosure	• Steady green: The disk enclosure is powered on. • Off: The disk enclosure is powered off.

Indicators on the Rear Panel

Figure 3-90 and **Figure 3-91** show the indicators on the rear panel of a disk enclosure.

Figure 3-90 Indicators on the rear panel of a disk enclosure without USB ports (using the AC power module as an example)

Running/Alarm indicator of the power module

Power indicator of the expansion module

Built-in FRU alarm indicator

Alarm indicator of the expansion module

100 Gbit/s RDMA port indicator

Link/Active indicator of the management port

Speed indicator of the management port
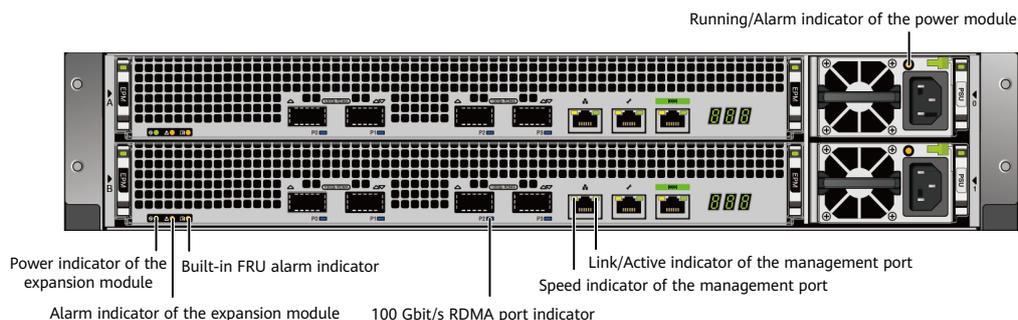
Figure 3-91 Indicators on the rear panel of a disk enclosure with USB ports (using the AC power module as an example)
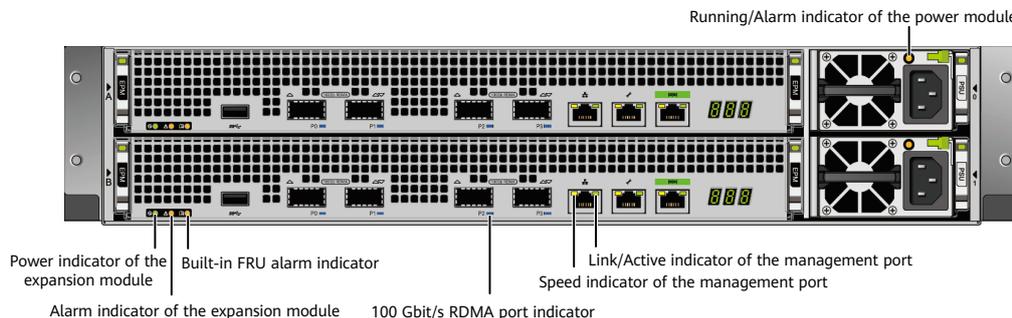
Table 3-35 describes meanings of the indicators on the rear panel of a disk enclosure.

Table 3-35 Meanings of the indicators on the rear panel

Module	Indicator	Status and Description
Expansion module	Alarm indicator of the expansion module	• Steady yellow: An alarm is reported by the expansion module. • Off: The expansion module is working properly.
	Power indicator of the expansion module	• Steady green: The expansion module is powered on. • Off: The expansion module is powered off.
	Built-in FRU Alarm indicator	• Steady yellow: A built-in FRU (fan module) of the controller is faulty. • Off: The built-in FRUs of the controller are normal.
	100 Gbit/s RDMA port indicator	• Steady blue: The speed is the highest. • Blinking blue (2 Hz): The port is transmitting data at the highest speed. • Steady green: The speed is not the highest. • Blinking green (2 Hz): The port is transmitting data, but not at the highest speed. • Steady yellow: The optical module or cable is faulty or not supported by the port. • Blinking yellow (2 Hz): The port is being located. • Off: The port is not connected.

Module	Indicator	Status and Description
Power module	Running/Alarm indicator of the power module	• Steady green: The power input is normal. • Blinking green (1 Hz): The power input is normal but the device is powered off. • Blinking green (4 Hz): The power module is being upgraded online. • Steady yellow: The power module is faulty. • Off: There is no external power input.

3.8 SCM Card

When SmartCache is used, SCM cards must be installed on controller enclosures.

 NOTE

Each controller supports a maximum of two SCM cards. The slot numbers and preference for SCM cards are the same as those for interface modules of iSCSI, NVMe over RoCE, and NAS networks.

● In a dual-controller system, a controller enclosure can have a maximum of four SCM cards.

● In a four-controller system, a controller enclosure can have a maximum of eight SCM cards.

Appearance

Figure 3-92 shows the appearance of the SCM card, and **Figure 3-93** shows its indicators.

Figure 3-92 SCM card

Figure 3-93 Indicators
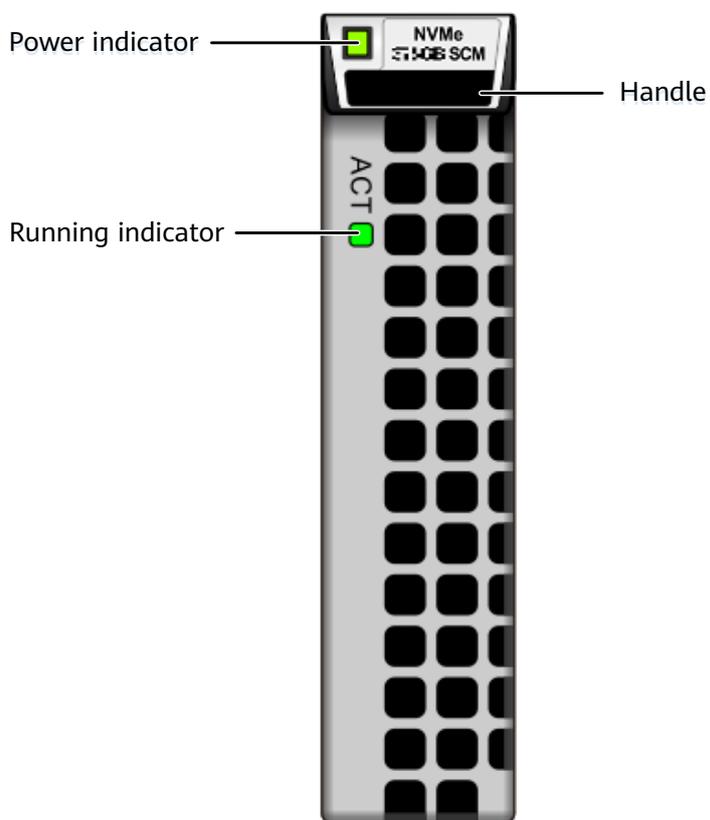
Indicators

Table 3-36 describes the indicators on the SCM card after the storage system is powered on.

Table 3-36 Indicators on the SCM card

Indicator	Status and Description
Power indicator	• Steady green: The SCM card is working properly. • Blinking green: There is a hot swap request to the SCM card. • Steady yellow: The SCM card is faulty. • Off: The SCM card is powered off or hot swappable.
Running indicator	• Steady green: The SCM card is working properly. • Blinking green (4 Hz or higher): Data is being read and written on the SCM card. • Off: The SCM card is powered off or incorrectly powered on.

3.9 Power Devices in a Bay

The storage system supports AC power and high voltage DC power. Both the North American and European standards for AC power transmission are supported. All bays must use the same power supply standard.

AC and High Voltage DC

Each bay of the storage system is equipped with power distribution units (PDUs) on the two sides in the back of the bay. This enables the storage system to have dual power inputs. Table 3-37 lists the number of PDUs for each type of power supply.

Table 3-37 Number of PDUs for each type of power supply (system bay)

Power Supply Type	Number of PDUs	Male Plugs of Power Connectors Delivered or Not	Female Sockets of Power Connectors Delivered or Not
Single-phase AC, 220 V	4	Yes	Yes
Three-phase AC, 380 V	2	Yes	Yes
High voltage DC, 240 V	4	Yes	Yes

NOTE

> When connecting the power cables of bays, you can use the existing female sockets onsite or prepare female sockets yourself by following instructions in section "Connecting the Power Cables of a Bay" in the installation guide specific to your product model.

The following figures show the appearances of different PDUs.

Figure 3-94 PDU for single-phase AC
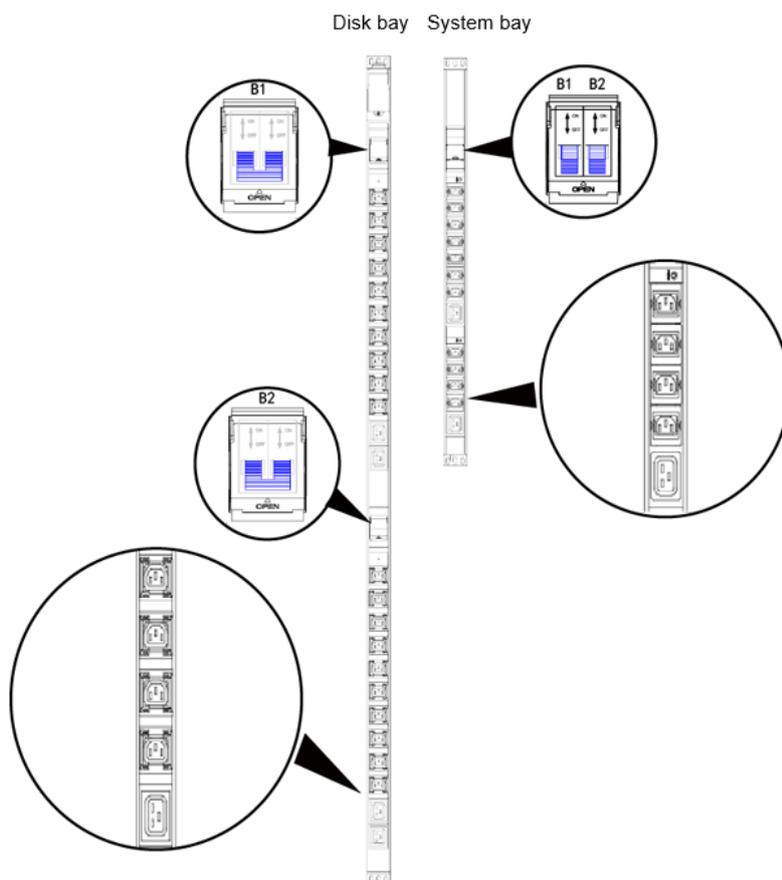
Figure 3-95 PDU for three-phase AC
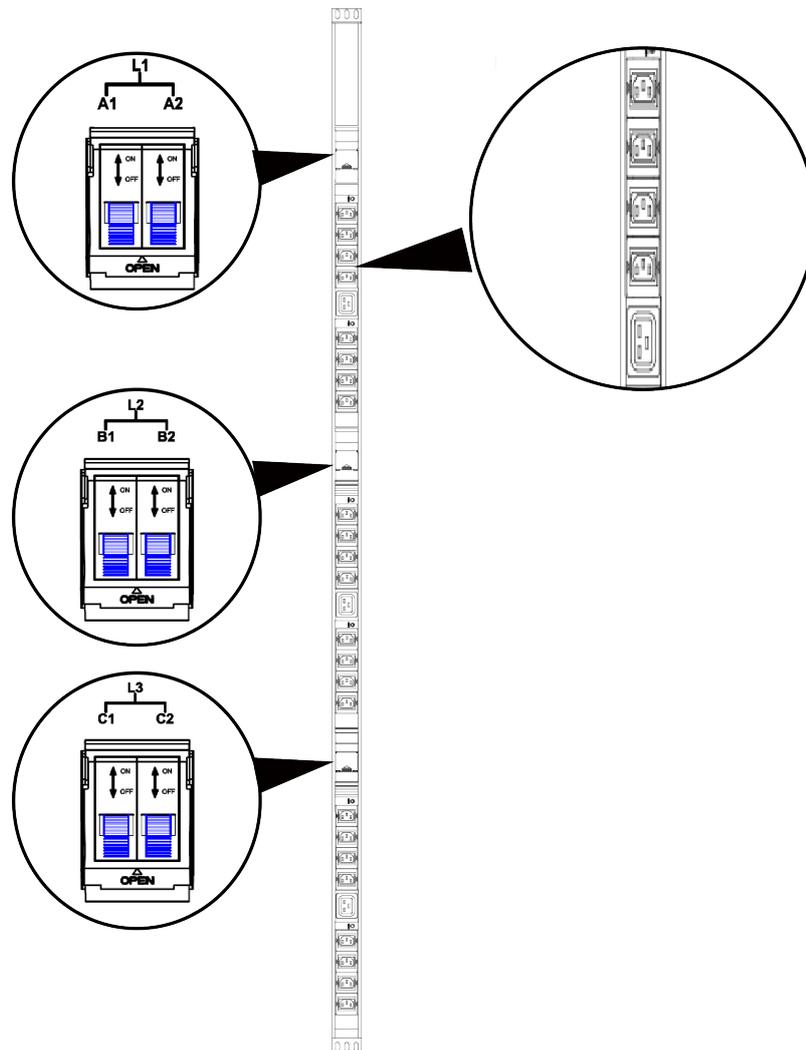
Figure 3-96 PDU for high voltage DC
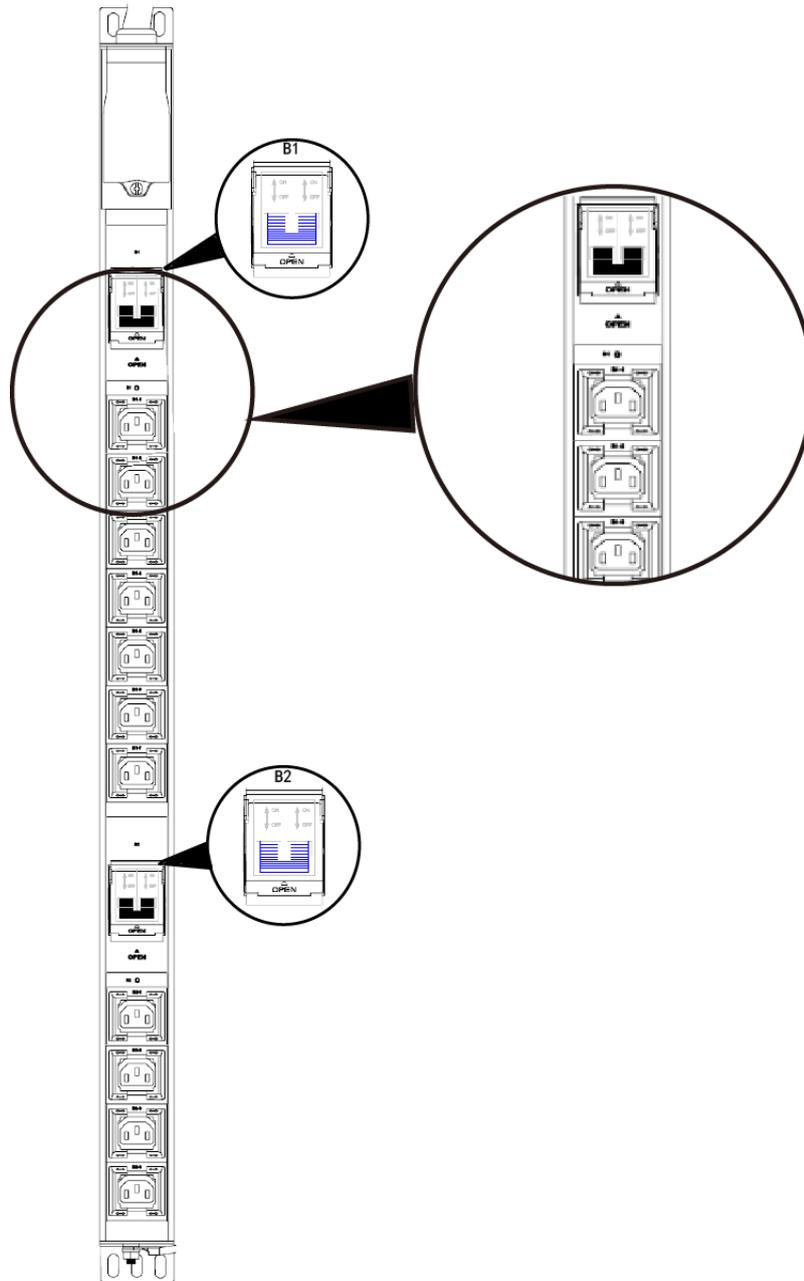
Figure 3-97 PDU for North America three-phase AC
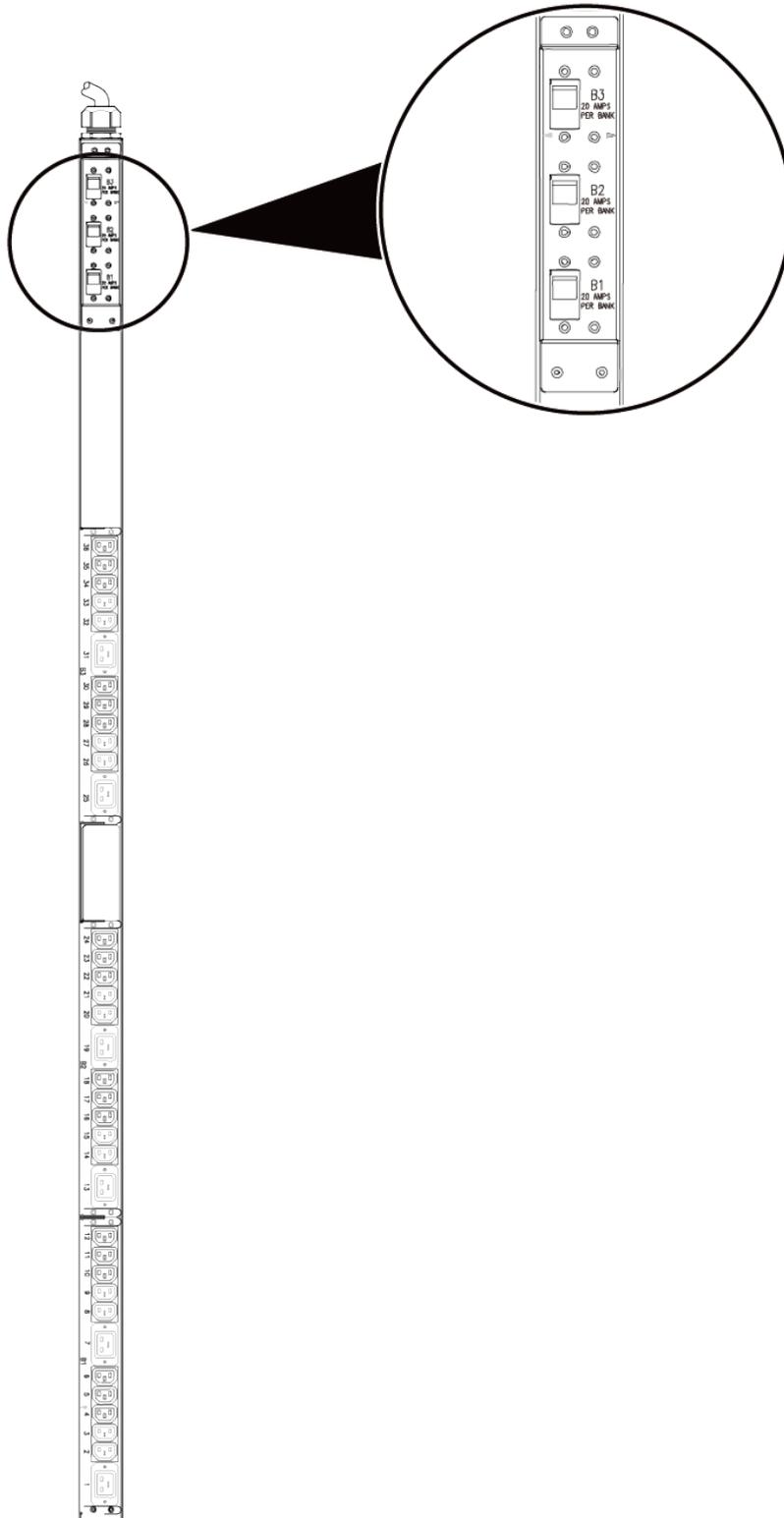
3.10 (Optional) Quorum Server

This section describes Huawei quorum servers: 1288H V5 and TaiShan 200 (2280 balanced model).

> 📖 **NOTE**
>
> When HyperMetro is used, the storage systems can also connect to third-party quorum servers. For the compatibility requirements on third-party quorum servers, see **Huawei Storage Interoperability Navigator**. For details, see **How Can I Query Compatibility of the Quorum Server on Huawei Storage Interoperability Navigator?**

3.10.1 Quorum Server (1288H V5)

For HyperMetro, if the heartbeats between two storage systems are interrupted, the quorum server decides which storage system continues providing services, thereby greatly improving host service continuity.

Front Panel of the Quorum Server

Figure 3-98 shows the front panel of the quorum server.

Figure 3-98 Front panel of the quorum server
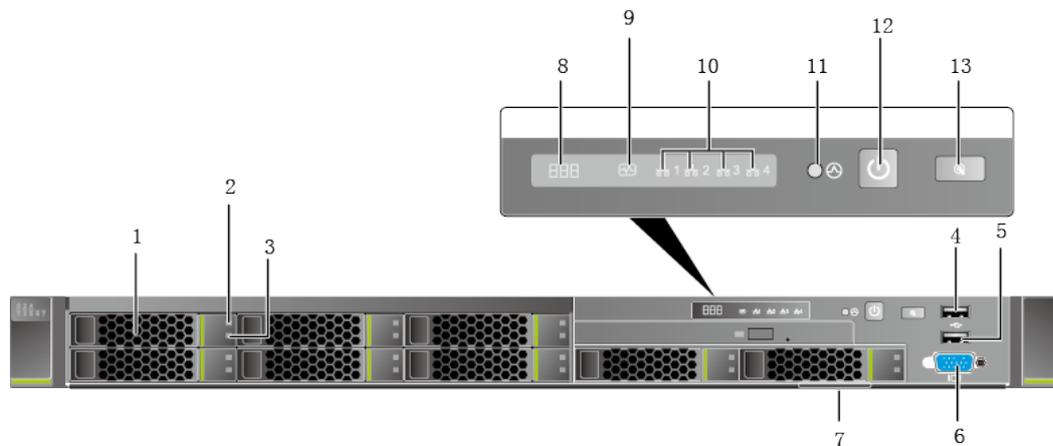
1	Disk	2	Disk Fault indicator
3	Disk Active indicator	4	USB 2.0 port
5	USB 3.0 port	6	Video graphics array (VGA) port
7	Label (including ESN label)	8	Fault diagnosis LED

9	Health indicator	10	Network port Link indicator
11	NMI button	12	Power button/ indicator
13	Unit Identification (UID) button/ indicator	-	-

Table 3-38 describes the indicators and buttons on the quorum server front panel.

Table 3-38 Indicators and buttons on the front panel

Number	Indicator and Button	Color	State
2	Disk Fault indicator	Yellow	• Off: The disk is working properly or disks cannot be detected in the RAID group. • Blinking yellow: The disk is being located, or the RAID is being reconstructed. • Steady yellow: The disk is faulty or member disks in the RAID group are abnormal.
3	Disk Active indicator	Green	• Off: The disk is not detected or is faulty. • Blinking green: Data is being read from, written to the disk, or synchronized between disks. • Steady green: The disk is inactive.
8	Fault diagnosis LED	None	• ---: The quorum server is operating properly. • **Error Code**: A fault occurs in quorum server hardware.
9	Health indicator	Red and green	• Steady green: The device is operating properly. • Blinking red at 1 Hz: A major alarm is generated. • Blinking red at 5 Hz: A critical alarm is generated.

Nu mb er	Indicator and Button	Color	State
10	Network port Link indicator	Green	Each indicator shows the status of an Ethernet port on the network interface card (NIC). ● Steady green: The port is properly connected. ● Off: The port is not in use. **NOTE** If the NIC provides only two network ports, network port indicators 1 and 2 on the front panel are used.
11	NMI button	None	The NMI button triggers a quorum server to generate a non-maskable interrupt. You can press this button or control it remotely through the WebUI. **NOTE** ● Click the NMI button only when the OS is abnormal. Do not click this button when the quorum server is operating properly. ● Click the NMI button only for internal commissioning. Before clicking this button, ensure that the OS has the handler for NMI interrupt. Otherwise, the OS may crash. Exercise caution when clicking this button.
12	Power button/ indicator	Yellow and green	● Off: The device is not powered on. ● Blinking yellow: The system is being started. ● Steady yellow: The system is in the standby state. ● Steady green: The system is properly powered on. **NOTE** You can hold down the power button for 6 seconds to power off the quorum server.

Nu mb er	Indicator and Button	Color	State
13	UID button/ indicator	Blue	The UID button/indicator helps identify and locate a quorum server in a rack. You can turn on or off the UID indicator by manually pressing the UID button or remotely running a command on the iBMC. ● Steady on: The quorum server is located. ● Off: The quorum server is not located. ● You can hold down the UID button for 4 to 6 seconds to reset the system.

Rear View of the Quorum Server

Figure 3-99 shows the rear view of the quorum server.

Figure 3-99 Rear view of the quorum server
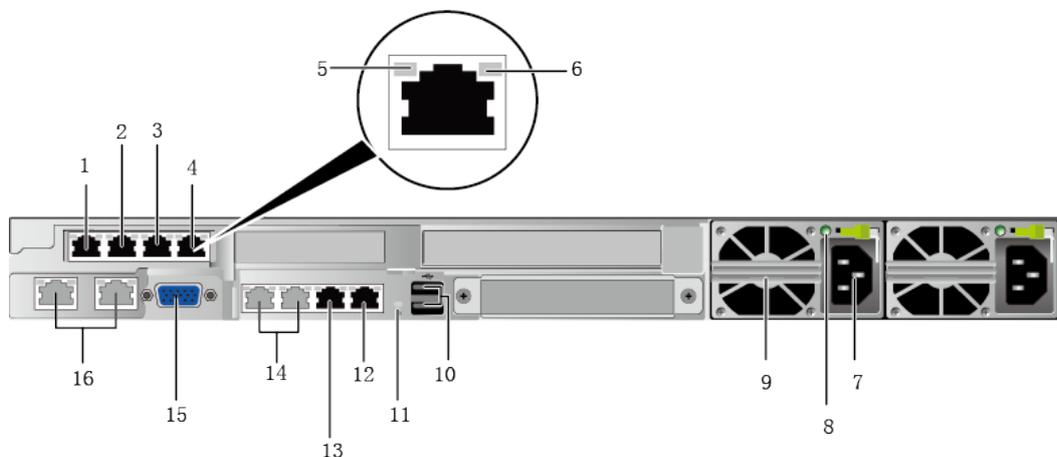
1	GE electrical port P4	2	GE electrical port P3
3	GE electrical port P2	4	GE electrical port P1
5	Data transmission status indicator	6	Connectivity status indicator

7	Power socket for a power module	8	Power module indicator
9	Power module	10	USB 3.0 port
11	UID indicator	12	Serial port
13	Management network port	14	GE electrical ports[a]
15	VGA port	16	10GE electrical ports[a]

□ NOTE

- The default IP address of the management network port on the quorum server is 192.168.2.100, and the default subnet mask is 255.255.255.0.
- a: This port is reserved and does not have any function. Do not connect cables here.

Table 3-39 describes the indicators on the quorum server rear panel.

Table 3-39 Indicators on the rear panel

Number	Indicator	Color	Status
5	Data transmission status indicator	Yellow	- Off: No data is being transmitted. - Blinking: Data is being transmitted.
6	Connectivity status indicator	Green	- Steady green: The port is properly connected. - Off: The port is not in use.
8	Power module indicator	Green	- Steady green: The power input is normal. - Off: There is no AC power input, or the power module is in the standby state or is faulty.

Nu mb er	Indicator	Color	Status
11	UID indicator	Blue	The UID indicator helps identify and locate a quorum server. You can turn on or off the UID indicator by manually pressing the UID button or remotely running a command. ● Steady on: The quorum server is located. ● Off: The quorum server is not located. ● You can hold down the UID button for 4 to 6 seconds to reset the system.

3.10.2 Quorum Server (TaiShan 200)

This section describes the 2280 balanced model (2280 for short) of the TaiShan 200 server. For HyperMetro, if the heartbeats between two storage systems are interrupted, the quorum server decides which storage system continues providing services, thereby greatly improving host service continuity.

Front Panel Components

Figure 3-100 shows the components on the front panel of a server with 12 x 3.5-inch disks.

Figure 3-100 Components on the front panel of a server with 12 x 3.5-inch disks

1	Disk	2	VGA port
3	USB 3.0 port	4	Label plate with an SN label

Table 3-40 Description of ports on the front panel

Port	Type	Description
USB port	USB 3.0	The USB ports allow USB devices to be connected to the server. **NOTE** Before connecting an external USB device, check that the USB device functions properly. A server may operate abnormally if an abnormal USB device is connected.
VGA port	DB15	Connects to a terminal, such as a monitor or KVM.

Front Panel Indicators and Buttons

Figure 3-101 shows the indicators and buttons on the front panel of a server with 12 x 3.5-inch disks.

Figure 3-101 Indicators and buttons on the front panel of a server with 12 x 3.5-inch disks

1	UID button/indicator	2	Health indicator
3	Power button/indicator	4	Fault diagnosis LED
5	FlexIO presence indicators (1 and 2)	-	-

Table 3-41 Indicators and buttons on the front panel

No.	Type	Description
1	UID button/indicator	The UID button/indicator helps identify and locate a device. UID indicator: ● Off: The device is not being located. ● Blinking blue: The device has been located and is differentiated from other devices that have also been located. ● Steady blue: The device is being located. UID button: ● You can turn on or off the UID indicator by pressing the UID button on the panel or by using the iBMC CLI or WebUI. ● You can press this button to turn on or off the UID indicator. ● You can press and hold down this button for 4 to 6 seconds to reset the iBMC.
2	Health indicator	● Steady green: The device is operating properly. ● Blinking red at 1 Hz: A major alarm is generated. ● Blinking red at 5 Hz: A critical alarm is generated.
3	Power button/ indicator	Power indicator: ● Steady yellow: The server is in the standby state. ● Steady green: The server is properly powered on. ● Blinking yellow: The iBMC is starting. ● Off: The server is not connected to a power source. Power button: ● When the server is powered on, you can press this button to shut down the OS. ● When the server is powered on, you can hold down this button for 6 seconds to forcibly power off the server. ● When the server is ready to power on, you can press this button to start the server.
4	Fault diagnosis LED	● ---: The server is operating normally. ● Error code: A server component is faulty.

No.	Type	Description
5	FlexIO presence indicators (1 and 2)	● 1 and 2: The numbers 1 and 2 respectively represent the FlexIOs 1 and 2. ● Steady green: The FlexIO is properly connected. ● Off: The FlexIO is faulty or not in use.

Rear Panel Components

shows the components on the rear panel of the 2280.

Figure 3-102 Rear panel components
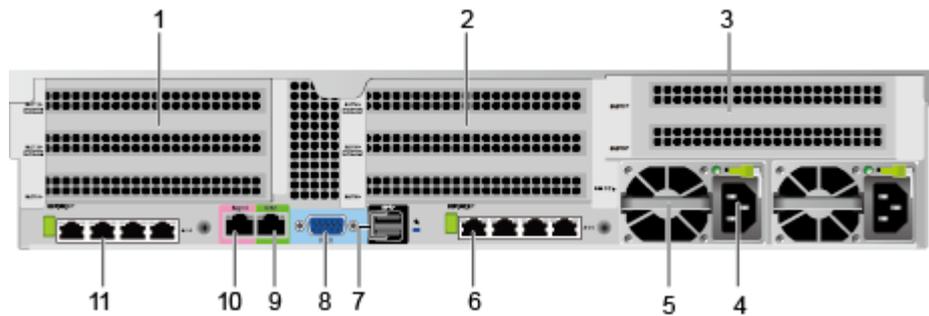
1	I/O module 1	2	I/O module 2
3	I/O module 3	4	PSU socket
5	Power supply unit (PSU)	6	FlexIO 2
7	USB 3.0 port	8	VGA port
9	Serial port	10	Management network port
11	FlexIO 1	-	-

NOTE

● I/O modules 1, 2 and 3 can be disk modules or riser modules. The preceding figure is for reference only.
● FlexIO 1 or 2 can be a NIC with four GE electrical ports.
● FlexIO 1 or 2 is not hot-swappable. If you need to replace it, power off the server.

Table 3-42 Ports on the rear panel

Port	Type	Quantity	Description
VGA port	DB15	1	Connects to a terminal, such as a monitor or KVM.
USB port	USB 3.0	2	The USB ports allow USB devices to be connected to the server. **NOTE** Before connecting an external USB device, check that the USB device functions properly. A server may operate abnormally if an abnormal USB device is connected.
Management network port	RJ45	1	This 1000 Mbit/s Ethernet port is used for server management.
Serial port	RJ45	1	The serial port is used as the system serial port by default. You can set it as the iBMC serial port by using the iBMC CLI. This port is used for debugging.
GE electrical port	RJ45	4/8	The mainboard CPU can provide GE electrical ports. A maximum of eight GE electrical ports can be provided through the two FlexIOs.
PSU socket	-	2	Determine the number of PSUs based on actual requirements, but ensure that the rated power of the PSUs is greater than that of the server. When one PSU is used, **Predicted PSU Status** cannot be set to **Active/Standby** on the iBMC WebUI.

Rear Panel Indicators

Figure 3-103 shows the indicators on the rear panel of the 2280.

Figure 3-103 Rear panel indicators
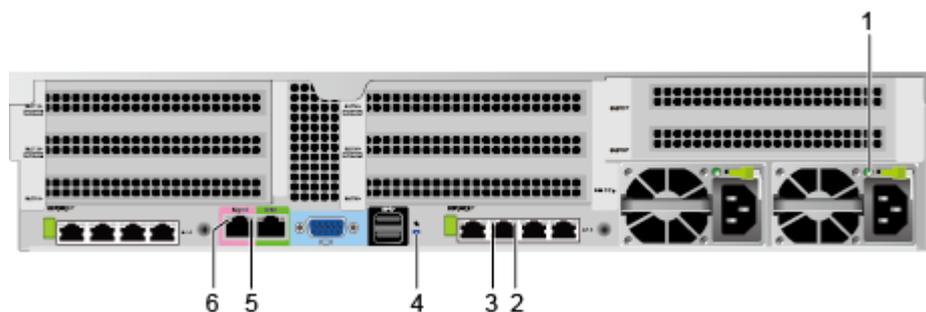
1	PSU indicator	2	GE electrical port link status indicator
3	GE electrical port data transmission status indicator	4	UID indicator
5	Management network port link status indicator	6	Management network port data transmission status indicator

Table 3-43 Indicators on the rear panel

No.	Indicator	Status

1	PSU indicator	• Steady green: The power input and output are normal.
		• Steady orange: The input is normal, but no power output is supplied due to overheat protection, overcurrent protection, short circuit protection, output overvoltage protection, or some component failures.
		• Blinking green at 1 Hz:
		  – The input is normal, the server is standby.
		  – The input is overvoltage or undervoltage.
		• Blinking green at 4 Hz: under online PSU firmware upgrade.
		• Off: No AC power is supplied.

2	GE electrical port link status indicator	• Steady green: The network is properly connected. • Off: The network is not connected.
3	GE electrical port data transmission status indicator	• Blinking yellow: Data is being transmitted. • Off: No data is being transmitted.
4	UID indicator	The UID indicator helps identify and locate a device. • Off: The device is not being located. • Blinking blue: The device has been located and is differentiated from other devices that have also been located. • Steady blue: The device is being located. **NOTE** You can turn on or off the UID indicator by pressing the UID button or remotely running a command on the iBMC CLI.

No.	Indicator	Status
5	Management network port link status indicator	• Steady green: The network is properly connected. • Off: The network is not connected.
6	Management network port data transmission status indicator	• Blinking yellow: Data is being transmitted. • Off: No data is being transmitted.

☐ NOTE

For details about the components of the 2280 balanced model of the TaiShan 200 server, see the *TaiShan 200 Server User Guide (Model 2280)*.

3.11 (Optional) Data Switch

This section describes the data switches used for adding controller enclosures for capacity expansion.

3.11.1 CE8850-SAN Data Switch

Data switches provide a high bandwidth and low latency to connect controller enclosures for their control information exchange and service data flows.

Data switches are typically used for connections between multiple controller enclosures when:

- The storage system is installed for the first time. For detailed connection diagrams and configurations, see the *Installation Guide* specific to your product model.
- The storage system capacity is expanded. To expand the capacity of storage components, contact the technical support center.

☐ NOTE

The switches used for controller expansion can be deployed on a scale-out network only, not for front-end service networking or other purposes.

Appearance

Figure 3-104 shows the appearance of a data switch.

Figure 3-104 Data switch appearance
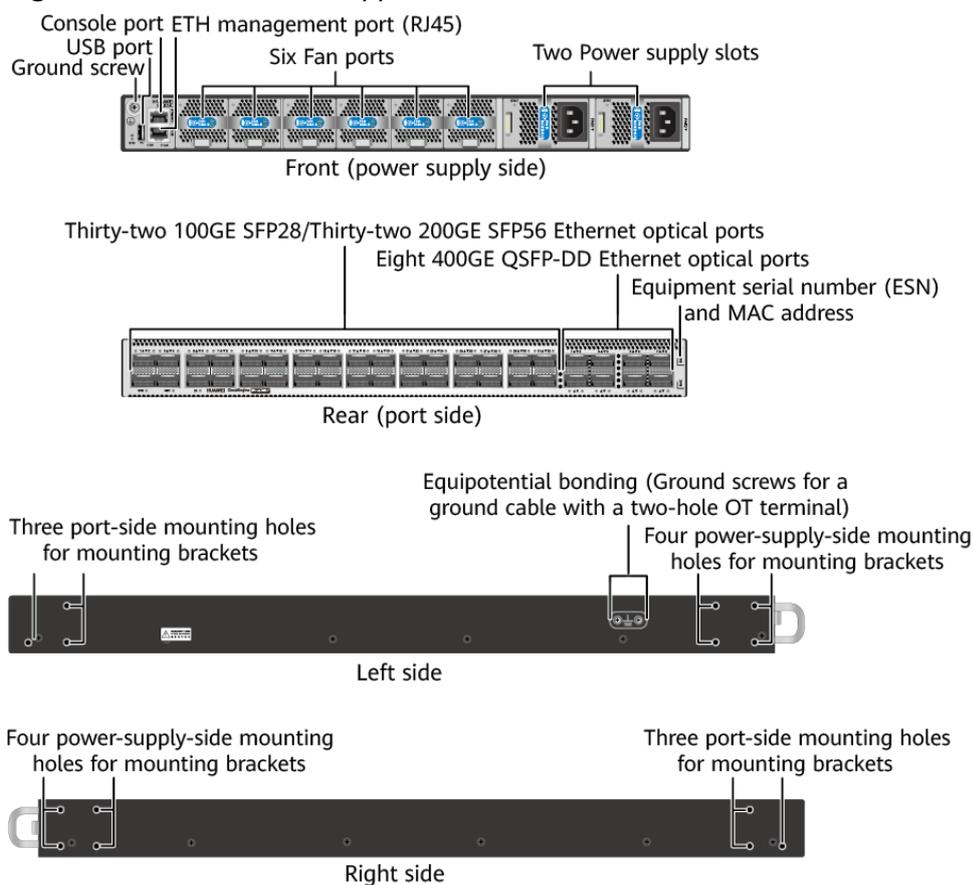
Indicators

The following figures and tables show and describe the indicators on a data switch.

Figure 3-105 Indicators on the data switch (rear view)
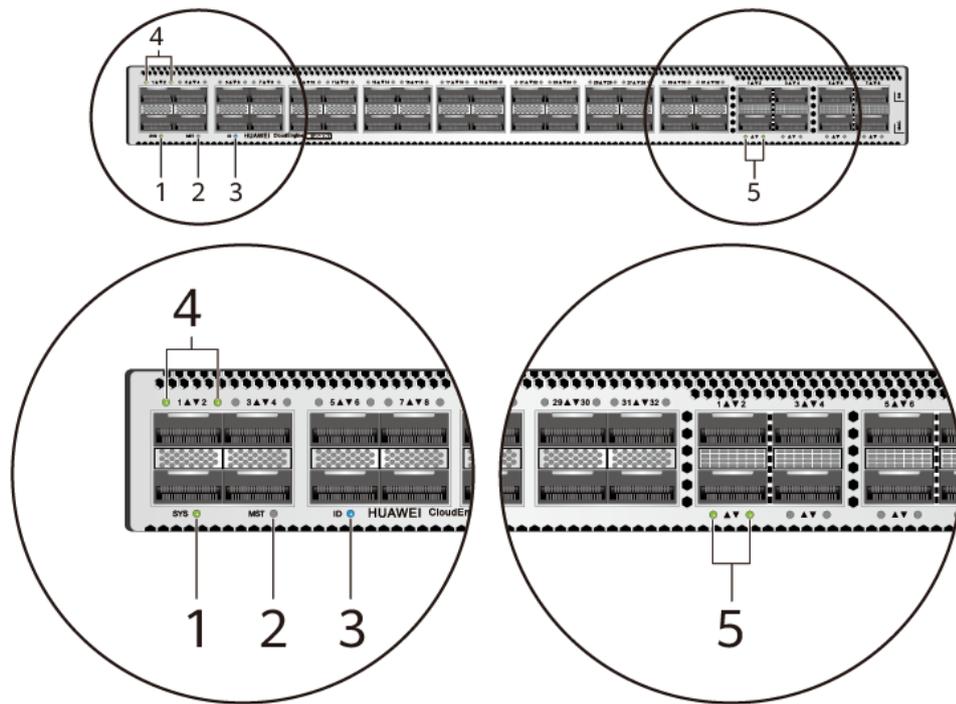
Figure 3-106 Indicators on the data switch (front view)
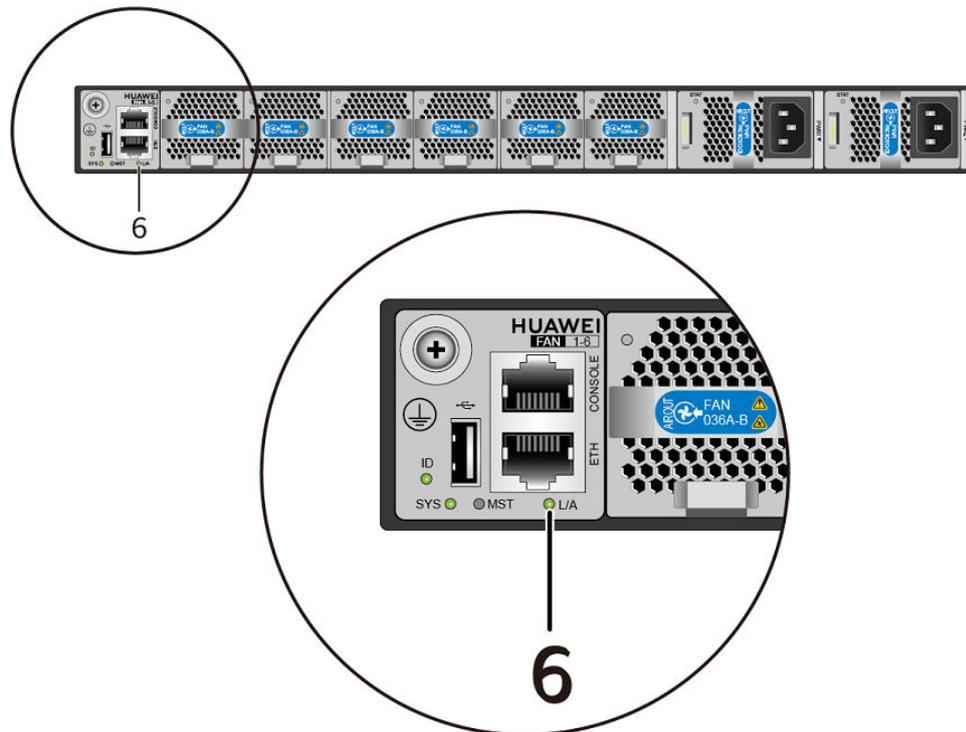
Table 3-44 Indicators

No.	Indicator	Name	Color and State	Meaning
1	SYS	System status indicator	Off	The system is not running.
			Green, blinking fast	The system is starting.
			Green, blinking slowly	The system is running normally.
			Red, steady on	- The system fails to start. - At least one power module does not work normally. - At least one fan module does not work normally.
2	MST	Stack master/slave indicator	Off	The switch does not support stacking.
3	ID	ID indicator	Off	The ID indicator is not used (off by default).
			Blue, steady on	The ID indicator can be turned on or off remotely to help field engineers find the switch to maintain.
4	-	Service port indicator (200GE/100GE/40GE optical port) Arrowheads show the positions of ports. A down arrowhead indicates a port at the bottom, and an up arrowhead indicates a port at the top.	Off	No link has been established on the port or the port has been shut down.
			Green, steady on	A link is established on the port.
			Green, blinking	The port is sending or receiving data.

No.	Indicator	Name	Color and State	Meaning
5	-	Service port indicator (400GE optical port) Arrowheads show the positions of ports. A down arrowhead indicates a port at the bottom, and an up arrowhead indicates a port at the top.	Off	No link has been established on the port or the port has been shut down.
			Green, steady on	A link is established on the port.
			Green, blinking	The port is sending or receiving data.
6	L/A	ETH management port indicator	Off	No link is established on the port.
			Green, steady on	A link is established on the port.
			Green, blinking	The port is sending or receiving data.

3.11.2 CE8855-32CQ4BQ Data Switch

Data switches provide a high bandwidth and low latency to connect controller enclosures for their control information exchange and service data flows.

Data switches are typically used for connections between multiple controller enclosures when:

- The storage system is installed for the first time. For detailed connection diagrams and configurations, see the *Installation Guide* specific to your product model.

- The storage system capacity is expanded. To expand the capacity of storage components, contact the technical support center.

📖 **NOTE**

The switches used for controller expansion can be deployed on a scale-out network only, not for front-end service networking or other purposes.

Appearance

Figure 3-107 Appearance of the CE8855-32CQ4BQ

Front (power supply side)
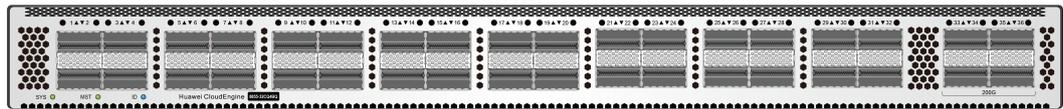
Rear (port side)

📖 **NOTE**

Figures in the document are for reference only, and the actual appearance of the devices may vary depending on the exact device model.

Components

Figure 3-108 Components of the CE8855-32CQ4BQ

Front (power supply side)

Rear (port side)

Left side

Right side
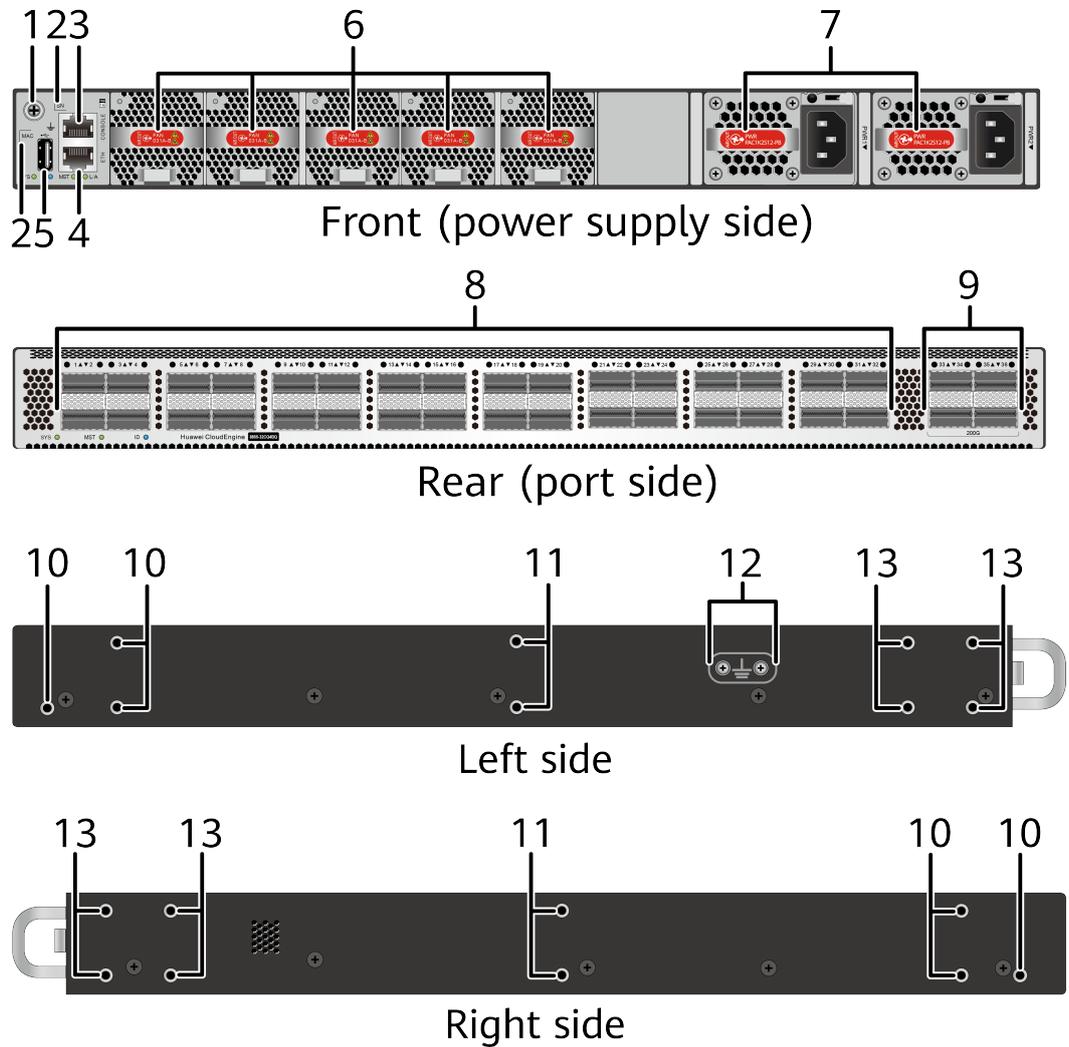
Table 3-45 Components of the CE8855-32CQ4BQ

No.	Structure	No.	Structure
1	Ground screw	2	ESN and MAC address **NOTE** You can scan the code to view the ESN and MAC address of the switch.
3	Console port	4	ETH management port (RJ-45)
5	USB port	6	Five fan slots
7	Two power module slots	8	Thirty-two 100GE QSFP28 Ethernet optical ports

No.	Structure	No.	Structure
9	Four 200GE QSFP56 Ethernet optical ports	10	Three mounting holes on the port side
11	Two middle mounting holes for mounting brackets	12	Equipotent bonding Ground screw used in the dual-OT scenario
13	Four mounting ears on the power supply side	-	-

Indicators

Figure 3-109 Indicators on the CE8855-32CQ4BQ (port side)
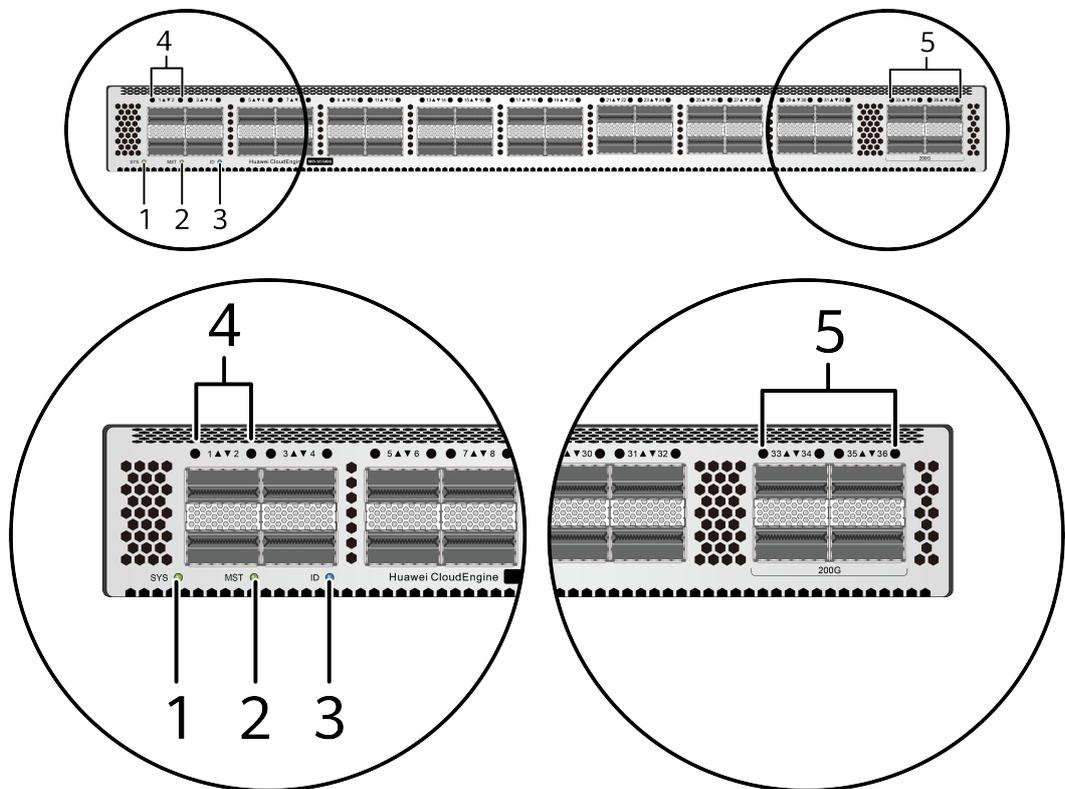
Figure 3-110 Indicators on the CE8855-32CQ4BQ (power supply side)
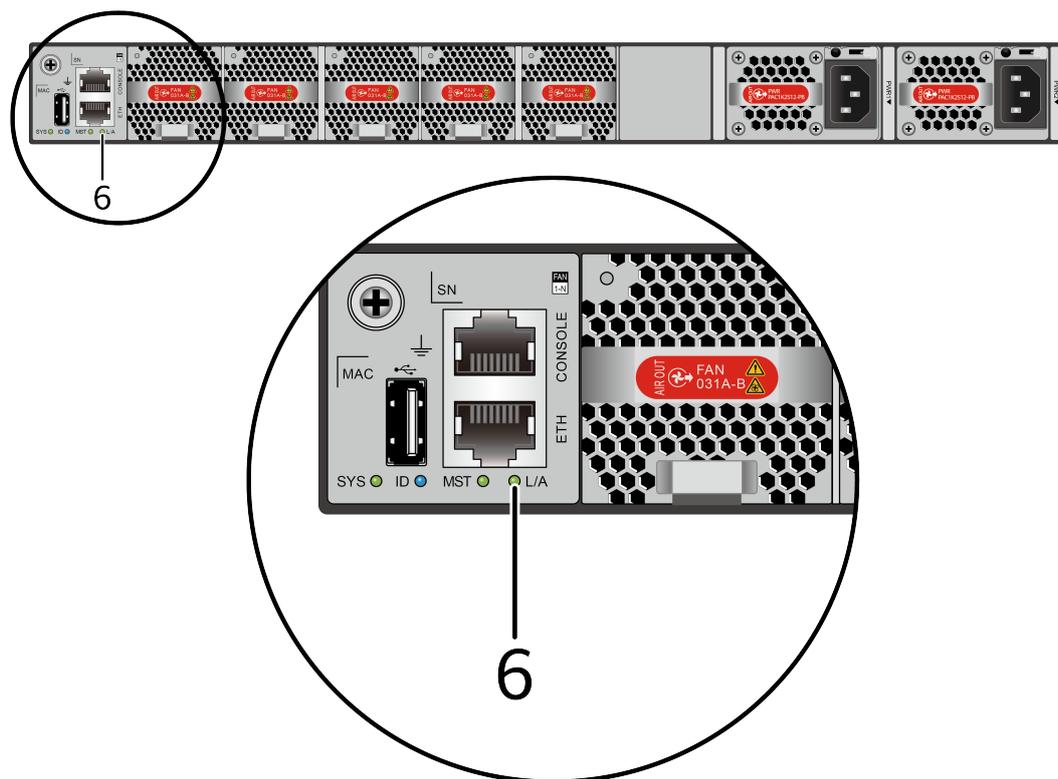
Table 3-46 Indicators

No.	Indicator	Name	Color and State	Meaning
1	SYS	System status indicator	Green, steady off	The system is not running.
			Green, blinking fast	The system is starting.
			Green, blinking slowly	The system is running normally.
			Red, steady on	● The system fails to start. ● At least one power module does not work normally. ● At least one fan module does not work normally.
2	MST	Stack master/slave indicator	-, steady off	This function is reserved and is not enabled currently.

No.	Indicator	Name	Color and State	Meaning
3	ID	ID indicator	Blue, steady off	The ID indicator is not used (default state).
			Blue, steady on	The ID indicator can be turned on or off remotely to help field engineers find the switch to maintain.
4	-	Service port indicator (100GE optical port)	Green, steady off	No link has been established on the port or the port has been shut down.
			Green, steady on	A link is established on the port.
			Green, blinking	The port is sending or receiving data.
5	-	Service port indicator (200GE/100GE optical port)	Green, steady off	No link has been established on the port or the port has been shut down.
			Green, steady on	A link is established on the port.
			Green, blinking	The port is sending or receiving data.
6	L/A	ETH management port indicator	Green, steady off	No link is established on the port.
			Green, steady on	A link is established on the port.
			Green, blinking	The port is sending or receiving data.

3.12 Device Cables

Device cables used in the storage system include power cables, ground cables, and signal cables. This section shows their appearances and describes the functions and specifications of various cables.

3.12.1 Power Cables

Power cables include DC, AC, and PDU power cables. One end of a power cable is connected to the power socket of the storage system, and the other end to an external power supply.

DC Power Cable

Each DC power module is equipped with two DC power cables. **Figure 3-111** shows the appearance of a DC power cable.

Figure 3-111 DC power cable

 NOTE

Connect the black cable to the positive pole (+) of the power supply and the blue cable to the negative pole (-).

AC Power Cable

Each AC power module is equipped with one AC power cable. **Figure 3-112** shows the appearance of an AC power cable.

Figure 3-112 AC power cable

PDU Power Cable

If a cabinet is equipped with PDUs, use PDU power cables to supply power to devices in the cabinet. **Figure 3-113** shows the appearance of a PDU power cable.

Figure 3-113 PDU power cable

3.12.2 Ground Cables

Ground cables are used for device grounding to improve the security when you perform operations on a storage device.

Appearance

Figure 3-114 shows the appearance of a ground cable.

Figure 3-114 Ground cable
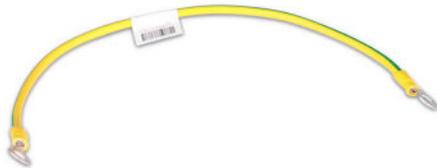
3.12.3 Network Cables

The storage system communicates with the external network using network cables. One end of the network cable connects to the management network port, service network port, or other network port of the storage system, and the other end connects to the network switch, application server, or other devices.

Appearance

Figure 3-115 shows the appearance of a network cable.

> 📖 **NOTE**
>
> - For the management and maintenance GE electrical ports, standard cables are Cat5 network cables while Cat6A shielded network cables can also be used.
> - For service GE electrical ports, standard cables are Cat5e shielded network cables while Cat6A shielded network cables can also be used.
> - For 10GE electrical ports, standard cables are Cat6A or Cat7 shielded network cables. The cable length cannot exceed 10 m. For details, see **Specifications Query**.

Figure 3-115 Network cable

3.12.4 Serial Cables

A serial cable connects the serial port on a storage system to a maintenance terminal.

Appearance

A serial cable connects the serial port of a storage system to the port of a maintenance terminal.

One end of a serial cable is an RJ-45 connector connecting to the serial port on a storage system. The other end is a DB-9 connector connecting to the port on a maintenance terminal.

Figure 3-116 shows the appearance of a serial cable.

Figure 3-116 Serial cable

Structure

Figure 3-117 shows the structure of a serial cable.

Figure 3-117 Structure of a serial cable
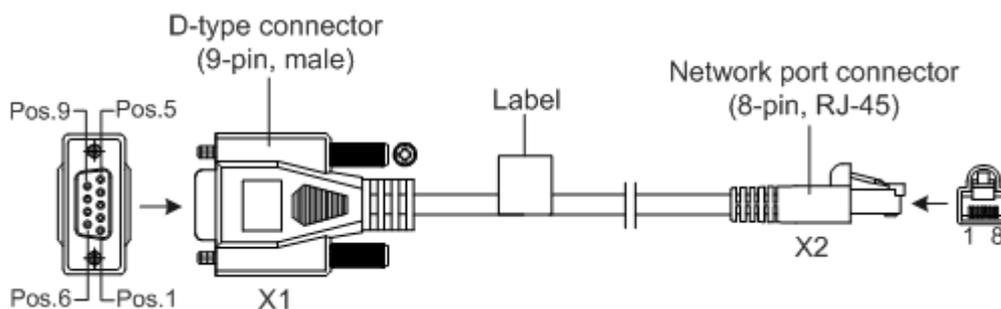
Pin Assignments

Table 3-47 describes the pin assignments of a serial cable.

Table 3-47 Pin assignments of a serial cable

X1 (DB9)	X2 (RJ45)	Signal
8	1	CTS (Clear to Send)
6	2	DSR (Data Set Ready)
2	3	RXD (Receive Data)
5	4	GND

X1 (DB9)	X2 (RJ45)	Signal
5	5	GND
3	6	TXD (Transmit Data)
4	7	DTR (Data Terminal Ready)
7	8	RTS (Request to Send)

3.12.5 Mini SAS HD Cables

Mini SAS HD cables are used to connect expansion ports. They can be either electrical or optical cables.

◻ NOTE

- For the lengths of the mini SAS HD electrical and optical cables, see **Specifications Query**.
- The mini SAS HD optical cables can be used to connect devices over distance, for example, for connections between cabinets.
- The optical connector of a mini SAS HD optical cable has a built-in O/E conversion module and provides electrical ports.

3.12.5.1 Mini SAS HD Electrical Cables

Mini SAS HD electrical cables are used to connect a controller enclosure to a disk enclosure that is in compliance with SAS or connect two disk enclosures that are in compliance with SAS.

◻ NOTE

For the lengths of the mini SAS HD electrical cables, see **Specifications Query**.

Figure 3-118 shows the appearance of a mini SAS HD electrical cable.

Figure 3-118 Mini SAS HD electrical cable

3.12.5.2 Mini SAS HD Optical Cables

Mini SAS HD optical cables are used to connect a controller enclosure to a disk enclosure that is in compliance with SAS or connect two disk enclosures that are in compliance with SAS.

📖 **NOTE**

For the lengths of the mini SAS HD optical cables, see **Specifications Query**.

Figure 3-119 shows the appearance of a mini SAS HD optical cable.

Figure 3-119 Mini SAS HD optical cable

📖 **NOTE**

The only difference between a mini SAS HD optical cable and an optical fiber is the connector. You can bind mini SAS HD optical cables in the same way as binding optical fibers. For details, see section "Cable Routing and Bundling Basics" in the **General Cable Operation Guide**

3.12.6 Optical Fibers

The storage system communicates with Fibre Channel switches through optical fibers. One end of the optical fiber connects to an interface module on the storage system, and the other end connects to the Fibre Channel switch or the application server. An optical fiber uses LC connectors at both ends.

Figure 3-120 shows the appearances of optical fibers.

📖 **NOTE**

- When connecting cables, select proper cables according to site requirements and label information.
- For details on how to bind the cables, see section "Cable Routing and Bundling Basics" in the **General Cable Operation Guide**.

Figure 3-120 Optical fibers

3.12.7 100G QSFP28 Cables

The 100G QSFP28 cable is used to connect multiple controller enclosures or connect smart disk enclosures.

 NOTE

For the types and lengths of the cables, see "Type and length of back-end cables" in the **Specifications Query**.

Figure 3-121 shows the appearance of a 100G QSFP28 cable.

Figure 3-121 QSFP28 cable

4 Software Architecture

Storage system software manages storage devices and stored data, and assists application servers in data operations.

The software suite provided by OceanStor Dorado storage systems consists of software running on the storage system, maintenance terminal, and application server. These three types of software work jointly to deliver storage, backup, and disaster recovery services in a smart, efficient, and cost-effective manner.

Figure 4-1 shows the storage system software architecture.

Figure 4-1 Storage system software architecture
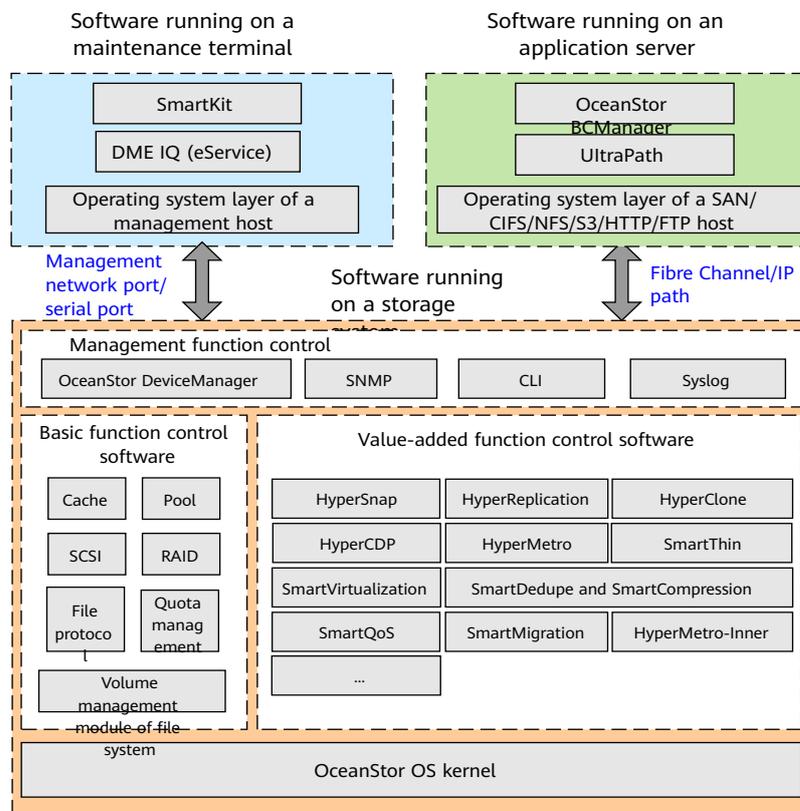
Table 4-1 describes the storage system software architecture.

Table 4-1 Storage system software architecture

Software	Function
Software running on a storage system	The storage system uses Huawei-developed storage operating system (OceanStor OS), which consists of the following: • The basic function software provides basic data storage and access functions. • The value-added software provides advanced functions such as backup, disaster recovery, and performance tuning. • The management software provides the management utilities to the storage system. • The OceanStor OS kernel manages hardware and runs storage service software.

Software	Function
Software running on a maintenance terminal	Configures and maintains the storage system. The software includes SmartKit and DME IQ.
Software running on an application server	Enables the application server to communicate and cooperate with the storage system. The software includes OceanStor BCManager and UltraPath.

Table 4-2 describes the software running on a storage system.

Table 4-2 Software running on a storage system

Software Set	Software	Function
OceanStor OS kernel	-	It is customized based on the EulerOS to manage hardware and run storage service software.
Management software	OceanStor DeviceManager	OceanStor DeviceManager is an integrated storage management platform developed by Huawei. It provides easy configuration, management, and maintenance of storage devices.
	SNMP[a, b]	The storage system can interwork with third-party management software using the SNMP protocol, and provide the functions of the third-party management software using the MIB interface. A variety of network management software supports SNMP. Users can choose desired software based on their requirements.
	CLI[c]	The storage system supports CLI-based management and configuration. Users can use a third-party terminal software to log in to the storage system through its serial port or management network port (over SSH), and manage the storage system on the CLI.
	Syslog	The storage system can send alarm information to a third party. Syslog software is used to receive and save the information. Users can choose desired Syslog software based on site requirements.

Software Set	Software	Function
Basic function software	SCSI software module	Manages the status of SCSI commands, and dispatches, resolves, and processes SCSI commands.
	RAID software module	Uses data stripping and redundancy to provide high performance, large capacity, and high reliability for data storage. A wide range of RAID levels are provided for diversified data reliability and access performance.
	Pool software module	Logically combines disks from different disk enclosures into storage pools to provide storage resources for services.
	Cache software module	Uses high-speed and small-capacity memory as a buffer to improve system performance. It is mainly used for data caching.
	File protocol module	Provides file system sharing and backup functions.
	Quota management module	Provides quota management for file system sharing. A shared file system allows you to specify the maximum storage capacity available to a specific directory.
	Volume management module of file system	Implements virtualized management based on volumes.
Value-added software	HyperSnap software module	Provides the snapshot function. Snapshot does not provide a complete physical duplicate but only an image of the source data, and locates the image through a mapping table.

Software Set	Software	Function
	HyperReplication software module	Provides the remote replication function. Remote replication creates an available data duplicate almost in real time on a storage system that resides in a different region from the local storage system. The duplicate can be used immediately without data recovery, protecting service continuity and data availability to the maximum. A consistency group manages remote replication tasks in batches. Any operation to the consistency group is also applied to the remote replication tasks in the group, ensuring data consistency throughout those remote replication tasks.
	HyperClone software module	Provides the clone function. HyperClone creates physical backup copies for source data in the local storage system. It supports incremental synchronization, reverse synchronization, and consistency groups, and allows data copy between different controller enclosures or disk domains, ensuring local data availability.
	HyperMetro software module	Provides the HyperMetro function. HyperMetro enables real-time data synchronization and access between two storage systems, improving resource utilization. If data access fails, HyperMetro implements seamless service switchover, ensuring data security and service continuity.
	HyperMetro-Inner software module	Provides the HyperMetro-Inner function. HyperMetro-Inner takes the advantage of continuous mirroring, back-end global sharing, and three cache copies to tolerate successive failure of seven out of eight controllers, simultaneous failure of two controllers, and failure of one controller enclosure on an eight-controller network.
	HyperCDP software module	HyperCDP achieves continuous data protection at an interval of several seconds, generating more intensive recovery points on storage devices.
	SmartQoS software module	Provides the SmartQoS function. SmartQoS controls the storage performance of LUNs, and prioritizes the quality of service (QoS) of critical applications.

Software Set	Software	Function
	SmartThin software module	Provides the SmartThin function. SmartThin achieves the on-demand space allocation. It allocates free storage space in quota to application servers only as needed, increasing the storage space usage.
	SmartMigration software module	Provides the SmartMigration function. SmartMigration migrates services on a source LUN transparently to a target LUN without interrupting host services. After the migration, the target LUN can replace the source LUN to carry the services.
	SmartVirtualization software module	Provides the SmartVirtualization function. SmartVirtualization enables a local storage system to centrally manage storage resources of third-party storage systems, simplifying storage system management and reducing maintenance costs.
	SmartDedupe and SmartCompression software module	Provides deduplication and compression. The deduplication function is used to analyze and delete duplicate data in a storage system. The compression function is used to minimize space occupied by data.
a: Simple Network Management Protocol		
b: The supported character encoding is UTF-8.		
c: Command Line Interface		

Table 4-3 describes the software running on a maintenance terminal.

Table 4-3 Software running on a maintenance terminal

Software	Function
SmartKit	SmartKit helps service engineers and O&M engineers deploy, maintain, and upgrade devices.
DME IQ	DME IQ is remote maintenance and management software used for device monitoring, alarm reporting, and device inspection.

Table 4-4 describes the software running on an application server.

Table 4-4 Software running on an application server

Software	Function
OceanStor BCManager	Provides data protection and disaster recovery for application servers by using value-added features (asynchronous remote replication and snapshot) on the storage system. It centrally manages the requirements for data protection and disaster recovery between storage systems and application servers.
UltraPath	A storage system driver program installed on application servers. When multiple data channels are set up between an application server and a storage system, UltraPath selects an optimal channel for the application server to access the storage system. UltraPath provides an easy and efficient path management solution for proven data transmission reliability and high path security.

5 Product Specifications

Refer to the **Specifications Query** for the hardware and software specifications of the product.

6 Environmental Requirements

Environmental requirements cover the following aspects: temperature, humidity, particle contaminants, corrosive airborne contaminants, heat dissipation, and noise.

6.1 Environmental Parameters

6.2 Contaminants

6.1 Environmental Parameters

Refer to the **Specifications Query** for the environmental conditions required by the storage system for proper running or safe storage.

Heat Dissipation

Heat dissipation of storage systems is implemented as follows:

- Controller enclosure

  Cooling air enters from the front fan holes and gaps of the controller enclosure. After dissipating the heat of interface modules, controllers, power modules, disks, and BBUs, the air is discharged out of rear fan holes and gaps. The controller enclosure dynamically adjusts rotational speed of the fans based on the operational temperature of the storage system.

- Disk enclosure

  Cooling air enters from the front fan holes and gaps of disk enclosures. After dissipating the heat of power modules, disks, and expansion modules, hot air is exhausted from the power modules' fan holes in the rear side or the holes and gaps in the rear air vents. The disk enclosure dynamically adjusts rotational speed of the fans based on the operational temperature of the storage system.

For better maintenance, ventilation, and heat dissipation, pay attention to the following when installing the storage system in the cabinet:

- To ensure smooth ventilation, the cabinet should be at least 100 cm away from the equipment room walls and at least 120 cm away from other cabinets (that are in front of or behind).

- To keep air convection between the cabinet and the equipment room, no enclosed space is allowed in the cabinet. 1 U (44.45 mm) space should be left above and below each device.

Noise

Disks and fans, especially fans, emit noise when they are working. If the temperature rises, the fans rotate faster and emit more noise. Therefore, the noise of the storage system is related to the ambient temperature. Actual sound levels generated during operation vary depending on system configuration, load, and ambient temperature.

Disk Storage

SSDs and HDDs (including NL-SAS and SAS disks) cannot be preserved for a long time after being powered off:

- When SSDs are powered off and the ambient temperature is lower than 40°C, the maximum preservation time for SSDs that carry no data is 12 months, and that for SSDs carrying data is 3 months. Exceeding the maximum preservation time may cause data loss or SSD failure.

- Packed HDDs can be preserved for a maximum of 6 months when the wet-bulb temperature is below 30°C. Unpacked HDDs that are powered off can also be preserved for a maximum of 6 months when the wet-bulb temperature is below 30°C. Exceeding the maximum preservation time may cause data loss or HDD failure. The maximum preservation time is determined by the disk preservation specifications provided by disk vendors. For details, see the manuals provided by the disk vendors.

Cabinet Requirements

Devices that comply with the FCC/ICES standard must be used in shielded cabinets, such as Huawei FR42612L.

Equipment Room Management

- After the equipment room has been constructed, check whether the static air quality meets the requirements of ISO 14644-1 Class 8. Devices can be installed in the equipment room only after the requirements are met. During device running, check whether the dynamic air quality meets the requirements of ISO 14644-1 Class 8.

- Wear shoe covers and ESD clothes before entering the equipment room. After devices have been installed in the equipment room, do not decorate, polish, or drill holes in the equipment room to prevent dust. If necessary, take dust-proof measures.

- If more devices are added when the existing devices are running in the equipment room, the operations (such as unpacking, cable making, and hole drilling) must be performed in an isolated area to prevent dust and pollution.

- The humidifiers must use purified water without any salt.

- Salt mist must not exist in the equipment room.

Equipment Room Cleaning

Contaminants in an equipment room may be from various sources and in various forms. Mechanical processes in the equipment room may generate dangerous contaminants or stir the contaminants on the ground. Opening or closing hardware panels or any movement between metal components may generate metal scraps. Measures must be taken to clean contaminants (such as metal particles, dust, solvent vapor, corrosive gases, soot, useless optical fibers, and salt) in the environment to prevent short circuits, corrosion, and electrical impacts on devices. Therefore, it is important to keep a highly clean data center environment.

Table 6-1 Equipment room cleaning requirements

Frequency	Task
Daily	Clear visible garbage, metal scraps, and dust in time.
Weekly	Clean and maintain the raised floor.
Quarterly	Clean the surfaces in the equipment room (such as equipment tops and racks), and clean the air filters of the air conditioners.
Every two years	Clean the air conditioning system, ventilation pipes, and floor gaps. If dust around the equipment room is heavy, increase the cleaning frequency.

⚠ **CAUTION**

- You are advised to have qualified professionals to clean the equipment room during device running.

- You are advised to use vacuum cleaners and dedicated dry lint-free clothes to clean the equipment room. If detergents are required, use professional detergents for the equipment room. Ensure that the detergents do not contain ammonia, chlorine, phosphate, decolorizer, sulfur, nitrogen oxide, hydrofluoric acid, volatile ingredients, or flammable ingredients. During routine cleaning, you are not advised to use water to clean large areas of the equipment room, avoiding impact on the equipment room humidity.

- You are advised to use vacuum cleaners and dedicated dry lint-free clothes to clean the devices in cabinets. (Keep the cleaners and clothes away from the heat dissipation holes to prevent foreign objects from entering the devices.) If detergents are required, use professional detergents for the equipment room. Ensure that the detergents do not contain ammonia, chlorine, phosphate, decolorizer, sulfur, nitrogen oxide, hydrofluoric acid, volatile ingredients, or flammable ingredients. You are not advised to use water to clean devices, avoiding corrosion of devices.

6.2 Contaminants

6.2.1 Particle Contaminants

Particle contaminants and other negative environmental factors (such as abnormal temperature and humidity) may expose IT equipment to a higher risk of corrosive failure. This section specifies the limitation on particle contaminants with the aim at avoiding such risks.

The concentration level of particle contaminants in a data center should meet the requirements listed in the white paper entitled *2011 Gaseous and Particulate Contamination Guidelines for Data Centers* by American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Technical Committee (TC) 9.9.

ASHRAE, affiliated to International Organization for Standardization (ISO), is an international organization operated for the exclusive purpose of advancing the arts and sciences of heating, ventilation, air-conditioning, and refrigeration (HVAC & R). The *2011 Gaseous and Particulate Contamination Guidelines for Data Centers* is widely accepted, which is prepared by the members of ASHRAE TC 9.9.

According to the Guidelines, particle contaminants in a data center shall reach the cleanliness of ISO 14644-1 Class 8:

- Each cubic meter contains not more than 3,520,000 particles that are greater than or equal to 0.5 μm.

- Each cubic meter contains not more than 832,000 particles that are greater than or equal to 1 μm.

- Each cubic meter contains not more than 29,300 particles that are greater than or equal to 5 μm.

It is recommended that you use an effective filter to process air flowing into the data center as well as a filtering system to periodically clean the air already in the data center.

ISO 14644-1, Cleanrooms and Associated Controlled Environments - Part 1: Classification of Air Cleanliness, is the primary global standard on air cleanliness classification. Table 6-2 gives the air cleanliness classification by particle concentration.

Table 6-2 Air cleanliness classification by particle concentration of ISO 14644-1

ISO Class	Maximum Allowable Concentrations (Particles/m³) for Particles Equal To and Greater Than the Following Sizes					
-	≥ 0.1 μm	≥ 0.2 μm	≥ 0.3 μm	≥ 0.5 μm	≥ 1 μm	≥ 5 μm
Class 1	10	2	-	-	-	-
Class 2	100	24	10	4	-	-
Class 3	1000	237	102	35	8	-

ISO Class	Maximum Allowable Concentrations (Particles/m³) for Particles Equal To and Greater Than the Following Sizes					
Class 4	10,000	2,370	1,020	352	83	-
Class 5	100,000	23,700	10,200	3,520	832	29
Class 6	1,000,000	237,000	102,000	35,200	8,320	293
Class 7	-	-	-	352,000	83,200	2,930
Class 8	-	-	-	3,520,000	832,000	29,300
Class 9	-	-	-	-	8,320,000	293,000

6.2.2 Corrosive Airborne Contaminants

Corrosive airborne contaminants and other negative environmental factors (such as abnormal temperature and humidity) may expose IT equipment to higher risks of corrosive failure. This section specifies the limitation on corrosive airborne contaminants with an aim at avoiding such risks.

Table 6-3 lists common corrosive airborne contaminants and their sources.

Table 6-3 Common corrosive airborne contaminants and their sources

Category	Source
H_2S	Geothermal emissions, microbiological activities, fossil fuel processing, wood rot, sewage treatment
SO_2 and SO_3	Coal combustion, petroleum products, automobile emissions, ore smelting, sulfuric acid manufacture
S	Foundries, sulfur manufacture, volcanoes
HF	Fertilizer manufacture, aluminum manufacture, ceramics manufacture, steel manufacture, electronics device manufacture
NO_x	Automobile emissions, fossil fuel combustion, chemical industry
NH_3	Microbiological activities, sewage, fertilizer manufacture, geothermal emissions, refrigeration equipment
C	Incomplete combustion (aerosol constituent), foundry
CO	Combustion, automobile emissions, microbiological activities, tree rot

Category	Source
Cl_2 and ClO_2	Chlorine manufacture, aluminum manufacture, zinc manufacture, refuse decomposition
HCl	Automobile emissions, combustion, forest fire, oceanic processes, polymer combustion
HBr and HI	Automobile emissions
O_3	Atmospheric photochemical processes mainly involving nitrogen oxides and oxygenated hydrocarbons
C_NH_N	Automobile emissions, animal waste, sewage, tree rot
Organosilicon and organotin	Chemical plant, rubber plant, paint or ink containing organosilicon

The concentration level of corrosive airborne contaminants in a data center should meet the requirements listed in the white paper entitled *2011 Gaseous and Particulate Contamination Guidelines for Data Centers* by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Technical Committee (TC) 9.9.

According to the Guidelines, corrosive airborne contaminants in a data center should meet the following requirements:

- Copper corrosion rate

  Less than 300 Å/month as per ANSI/ISA-71.04-1985 severity level G1.

- Silver corrosion rate

  Less than 200 Å/month.

◻ NOTE

   Å, or angstrom, is a unit of length. One Å is equal to 1/10,000,000,000 meter.

According to ANSI/ISA-71.04-1985 Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants, the gaseous corrosivity levels are G1 (mild), G2 (moderate), G3 (harsh), and GX (severe), as described in **Table 6-4**.

Table 6-4 Gaseous corrosivity levels as per ANSI/ISA-71.04-1985

Severity Level	Copper Reactivity Level	Description
G1 (mild)	300 Å/month	An environment sufficiently well-controlled such that corrosion is not a factor in determining equipment reliability.
G2 (moderate)	300 Å/month to 1000 Å/month	An environment in which the effects of corrosion are measurable and may be a factor in determining equipment reliability.

Severity Level	Copper Reactivity Level	Description
G3 (harsh)	1000 Å/month to 2000 Å/month	An environment in which there is high probability that corrosion will occur.
GX (severe)	> 2000 Å/month	An environment in which only specially designed and packaged equipment would be expected to survive.

See **Table 6-5** for the copper and silver corrosion rate requirements.

Table 6-5 Concentration limitation of corrosive airborne contaminants in a data center

Group	Gas	Unit	Concentration
Group A	H_2S	ppb[a]	< 3
	SO_2	ppb	< 10
	Cl_2	ppb	< 1
	NO_2	ppb	< 50
Group B	HF	ppb	< 1
	NH_3	ppb	< 500
	O_3	ppb	< 2
a: Part per billion (ppb) is the number of units of mass of a contaminant per billion units of total mass.			

Group A and group B are common gas groups in a data center. The concentration limits of group A or group B that correspond to copper reactivity level G1 are calculated based on the premise that relative humidity in the data center is lower than 50% and that the gases in the group interact with each other. A 10% increase in the relative humidity will heighten the gaseous corrosivity level by 1.

Corrosion is not determined by a single factor, but by comprehensive environmental factors such as temperature, relative humidity, corrosive airborne contaminants, and ventilation. Any of the environmental factors may affect the gaseous corrosivity level. Therefore, the concentration limitation values specified in the previous table are for reference only.

6.2.3 Organisms

Plants and animals are not allowed in the equipment room.

To meet these requirements, take the following measures in the equipment room:

- Keep the atmosphere dry.
- Prevent molds on everything.
- Block cable holes and antenna holes.
- Clean and sterilize the equipment room periodically (do not use volatile or corrosive substances for sterilization).

6.2.4 Mechanically Active Substance

The equipment room should be free from explosive, conductive, magnetism-permeable, and corrosive dust. **Table 6-6** lists the requirements for concentration of the mechanically active materials in the equipment room.

Table 6-6 Requirements for concentration of mechanically active materials

Mechanically Active Material	Unit	Concentration
Sand	mg/m^3	≤30
Suspending dust	mg/m^3	≤0.2
Dust deposit	mg/(m^{2}h)	≤1.5

To meet these requirements, take the following measures in the equipment room:

- Use dustproof materials on the ground, wall, and ceiling of the equipment room.
- Install screens for outdoor doors and windows, and use dustproof materials for outer windows.
- Clean the equipment room, especially the air filters once every three months.
- In areas with heavy dust, you are advised to clean the equipment once a year. (Invite professional companies to do so.)
- Wear shoe covers and ESD clothes before entering the equipment room.

7 Standards Compliance and Certifications

For details about the standards and certifications of the product, see the **Standards Compliance and Certifications for Enterprise Storage Products**.

8 Operation and Maintenance

The storage systems can be operated and maintained by using DeviceManager and the command-line interface (CLI), adapting to different environments and user habits.

Introduction to DeviceManager

DeviceManager is a piece of software for managing Huawei storage devices. It helps you configure, manage, and maintain storage devices with ease. The following figure shows the home page of DeviceManager. The home page may vary depending on the product model.

Figure 8-1 DeviceManager home page (for a 4 U device)
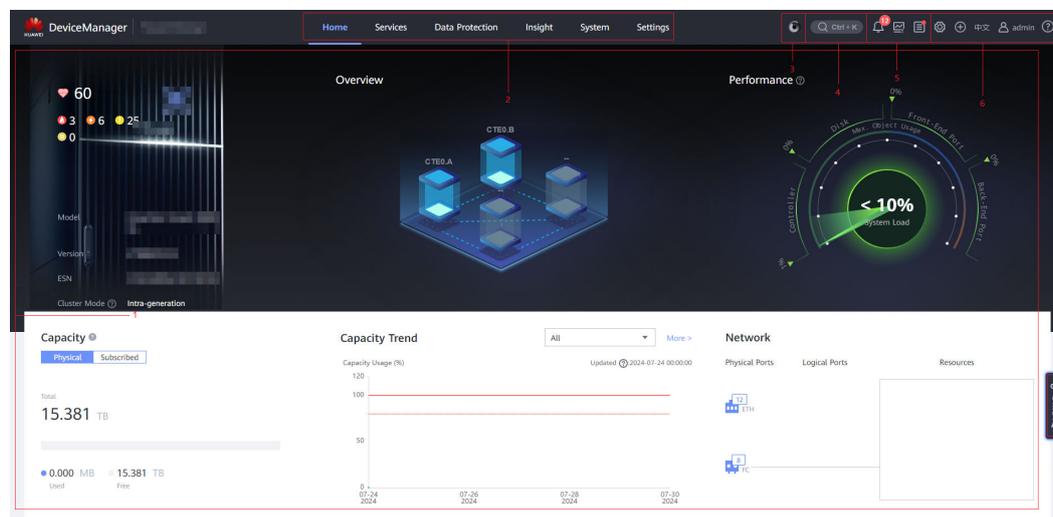
The following table describes the components of the DeviceManager main window.

Table 8-1 DeviceManager elements

No.	Name	Description
1	Function pane	The function pane displays the operations you can perform.
2	Navigation bar	The navigation bar lists the logical functional modules of the storage system.
3	SmartGUI	SmartGUI mines users' historical operation data and builds a configuration parameter recommendation model to recommend configuration parameters for the block and file services.
4	Global search	Global search allows you to search for object pages and operation entries.
5	Statistics area	The statistics area displays the number of faults of each severity, performance fluctuations, and latest tasks.
6	Shortcut operation area	Lists the setting buttons, shortcut operation entries of common tasks, language switch button, current login user, and other shortcut entries.
7	DME IQ	Provides the QR code for querying device information and DME IQ (formerly eService) settings.

Introduction to the CLI

The CLI enables users to manage and maintain the storage systems using command lines.

Users need to log in to the CLI by using terminal software, such as the HyperTerminal provided by Windows, or PuTTY.

There are two ways to log in to the CLI.

- Log in through a serial port of a storage system. To connect to a serial port, the maintenance terminal must be located next to the storage system. Therefore, this login mode is applicable to users who do not know the management IP address of a storage system or a storage system is faulty.

- Log in through a management network port of a storage system. When there are reachable routes, a user can log in to the CLI by entering the IP address of the management network port of a storage system in the terminal software. IP networks are easily accessible. Therefore, a user can log in to a storage system remotely, and this login mode is more popular.

A How to Obtain Help

If a tough or critical problem persists in routine maintenance or troubleshooting, contact Huawei for technical support.

A.1 Preparations for Contacting Huawei

To better solve the problem, you need to collect troubleshooting information and make debugging preparations before contacting Huawei.

A.1.1 Collecting Troubleshooting Information

You need to collect troubleshooting information before troubleshooting.

You need to collect the following information:

- Name and address of the customer
- Contact person and telephone number
- Time when the fault occurred
- Description of the fault phenomena
- Device type and software version
- Measures taken after the fault occurs and the related results
- Troubleshooting level and required solution deadline

A.1.2 Making Debugging Preparations

When you contact Huawei for help, the technical support engineer of Huawei might assist you to do certain operations to collect information about the fault or rectify the fault directly.

Before contacting Huawei for help, you need to prepare the boards, port modules, screwdrivers, screws, cables for serial ports, network cables, and other required materials.

A.2 How to Use the Document

Huawei provides guide documents shipped with the device. The guide documents can be used to handle the common problems occurring in daily maintenance or troubleshooting.

To better solve the problems, use the documents before you contact Huawei for technical support.

A.3 How to Obtain Help from Website

Huawei provides users with timely and efficient technical support through the regional offices, secondary technical support system, telephone technical support, remote technical support, and onsite technical support.

Contents of the Huawei technical support system are as follows:

- Huawei headquarters technical support department
- Regional office technical support center
- Customer service center
- Technical support website: **https://support.huawei.com/enterprise/**

You can query how to contact the regional offices at **https://support.huawei.com/enterprise/**.

A.4 Ways to Contact Huawei

Huawei Technologies Co., Ltd. provides customers with comprehensive technical support and service. For any assistance, contact our local office or company headquarters.

Huawei Technologies Co., Ltd.

Address: Huawei Industrial Base Bantian, Longgang Shenzhen 518129 People's Republic of China

Website: **https://e.huawei.com/**

B Glossary

A

AC power module	The module that transfers the external AC power supply into the power supply for internal use.
Application server	A service processing node (a computer device) on the network. Application programs of data services run on the application server.
Asynchronous remote replication	A kind of remote replication. When the data at the primary site is updated, the data does not need to be updated synchronously at the mirroring site to finish the update. In this way, performance is not reduced due to data mirroring.
Air baffle	It optimizes the ventilation channels and improves the heat dissipation capability of the system.
Audit log guarantee mode	A mode for recording audit logs. This mode preferentially ensures that the audit log function is normal and no audit log is missing.
Audit log non-guarantee mode	A mode for recording audit logs. In this mode, services are running properly. Audit logs may be missing.

B

Backup	A collection of data stored on (usually removable) non-volatile storage media for purposes of recovery in case the original copy of data is lost or becomes inaccessible; also called a backup copy. To be useful for recovery, a backup must be made by copying the source data image when it is in a consistent state. The act of creating a backup.

Backup window	An interval of time during which a set of data can be backed up without seriously affecting applications that use the data.
Bandwidth	The numerical difference between the upper and lower frequencies of a band of electromagnetic radiation. A deprecated synonym for data transfer capacity that is often incorrectly used to refer to throughput.
Baud rate	The maximum rate of signal state changes per second on a communications circuit. If each signal state change corresponds to a code bit, then the baud rate and the bit rate are the same. It is also possible for signal state changes to correspond to more than one code bit, so the baud rate may be lower than the code bit rate.
Bit error	An incompatibility between a bit in a transmitted digital signal and the corresponding bit in the received digital signal.
Bit error rate	The probability that a transmitted bit will be erroneously received. The bit error rate (BER) is measured by counting the number of bits in error at the output of a receiver and dividing by the total number of bits in the transmission. BER is typically expressed as a negative power of 10.
Bonding	Bonding of multiple independent physical network ports into a logical port, which ensures the high availability of server network connections and improves network performance.
Boundary scan	A test methodology that uses shift registers in the output connections of integrated circuits (ICs). One IC is often connected to the next IC. A data pattern is passed through the chain and the observed returned data stream affected by the circuit conditions gives an indication of any faults present. The system is defined under IEEE standard 1149.1 and is also known as Joint Test Action Group (JTAG).
Browser/Server	Architecture that defines the roles of the browser and server. The browser is the service request party and the server is the service provider.
Built-in FRU Alarm indicator	It indicates errors on the built-in FRUs of a controller, such as errors on fans or memory modules.

C

Cache hit ratio	The ratio of the number of cache hits to the number of all I/Os during a read task, usually expressed as a percentage.
Captive screw	Specially designed to lock into place on a parent board or motherboard, allowing for easy installation and removal of attached pieces without release of the screw.
Challenge Handshake Authentication Protocol	A password-based authentication protocol that uses a challenge to verify that a user has access rights to a system. A hash of the supplied password with the challenge is sent for comparison so the cleartext password is never sent over the connection.
Compliance mode	A protection mode of WORM. In compliance mode, files within their protection period cannot be changed or deleted by either the file user or by the system administrator. Files with expired protection periods can be deleted but not changed by the file user or the system administrator.
Controller	The control logic in a disk or tape that performs command decoding and execution, host data transfer, serialization and deserialization of data, error detection and correction, and overall management of device operations. The control logic in a storage subsystem that performs command transformation and routing, aggregation (RAID, mirroring, striping, or other), high-level error recovery, and performance optimization for multiple storage devices.
Controller enclosure	An enclosure that accommodates controllers and provides storage services. It is the core component of a storage system and generally consists of components, such as controllers, power supplies, and fans.
Copying	A pair state. The state indicates that the source LUN data is being synchronized to the target LUN.
Container root directory	Space used to store the metadata for running container images and container instances.
Container image	An image is a special file system, which provides the programs, libraries, resources, and configuration files required for running containers. It also contains configuration parameters, for example, for anonymous disks, environment variables, and users. The image does not contain dynamic data, and its content will not be modified after construction.
Containerized application	An image can start multiple containers, and an application can contain one or a group of containers.

Container node	Controller that runs the container service.	
Configuration item list	A series of modifiable configuration items defined in the Helm chart of the container.	
Container service	Containerized application management service, which manages the lifecycle of containerized applications.	
CloudVxLAN	CloudVxLAN is a feature that uses the Virtual eXtensible Local Area Network (VxLAN) technology, which allows storage systems to directly connect to the VPC network and become a part of Huawei Cloud Stack for unified management and maintenance, greatly simplifying O&M.	

D

Data compression	The process of encoding data to reduce its size. Lossy compression (i.e., compression using a technique in which a portion of the original information is lost) is acceptable for some forms of data (e.g., digital images) in some applications, but for most IT applications, lossless compression (i.e., compression using a technique that preserves the entire content of the original data, and from which the original data can be reconstructed exactly) is required.
Data flow	A process that involves processing data extracted from the source system. These processes include: filtering, integration, calculation, and summary, finding and solving data inconsistency, and deleting invalid data so that the processed data meets the requirements of the destination system for the input data.
Data migration	A movement of data or information between information systems, formats, or media. Migration is performed for reasons such as possible decay of storage media, obsolete hardware or software (including obsolete data formats), changing performance requirements, the need for cost efficiencies etc.
Data source	A system, database (database user; database instance), or file that can make BOs persistent.
Deduplication	The replacement of multiple copies of data — at variable levels of granularity — with references to a shared copy in order to save storage space and/or bandwidth.
Dirty data	Data that is stored temporarily on the cache and has not been written onto disks.

Disaster recovery		The recovery of data, access to data and associated processing through a comprehensive process of setting up a redundant site (equipment and work space) with recovery of operational data to continue business operations after a loss of use of all or part of a data center. This involves not only an essential set of data but also an essential set of all the hardware and software to continue processing of that data and business. Any disaster recovery may involve some amount of down time.
Disk array		A set of disks from one or more commonly accessible disk subsystems, combined with a body of control software. The control software presents the disks' storage capacity to hosts as one or more virtual disks. Control software is often called firmware or microcode when it runs in a disk controller. Control software that runs in a host computer is usually called a volume manager.
Disk domain		A disk domain consists of the same type or different types of disks. Disk domains are isolated from each other. Therefore, services carried by different disk domains do not affect each other in terms of performance and faults (if any).
Disk enclosure		Consists of the following parts in redundancy: expansion module, disk, power module, and fan module. System capacity can be expanded by cascading multiple disk enclosures.
Disk location		The process of locating a disk in the storage system by determining the enclosure ID and slot ID of the disk.
Disk utilization		The percentage of used capacity in the total available capacity.

E

eDevLUN		Logical storage array space created by a third-party storage array.
Expansion module		A component used for expansion.
Expansion		Connects a storage system to more disk enclosures through connection cables, expanding the capacity of the storage system.

Enhanced Direct Connect   Enhanced Direct Connect automatically manages Huawei hardware switches and provides Layer 3 interconnection between private IP addresses in your cloud and networks outside the cloud. The networking type and data plane are optimized based on the original hardware Direct Connect. You can select the firewall interconnection mode and networking type to suit your business needs in different scenarios.

F

Field replaceable unit   A unit or component of a system that is designed to be replaced in the field, i.e., without returning the system to a factory or repair depot. Field replaceable units may either be customer-replaceable or their replacement may require trained service personnel.

Firmware   Low-level software for booting and operating an intelligent device. Firmware generally resides in read-only memory (ROM) on the device.

Flash Translation Layer   Flash Translation Layer (FTL) organizes and manages host data, enables host data to be allocated to NAND flash chips of SSDs in an orderly manner, maintains the mapping relationship between logical block addresses (LBAs) and physical block addresses (PBAs), and implements garbage collection, wear leveling, and bad block management.

Front-end port   The port that connects the controller enclosure to the service side and transfers service data. Front-end port types are Fibre Channel and iSCSI.

Front-end interconnect I/O module (FIM)   On a storage device, all controllers share the front-end interface modules.

G

Garbage collection   The process of reclaiming resources that are no longer in use. Garbage collection has uses in many aspects of computing and storage. For example, in flash storage, background garbage collection can improve write performance by reducing the need to perform whole block erasures prior to a write.

Gateway   A device that receives data via one protocol and transmits it via another.

	Global garbage collection	With a view to defragmentation of storage arrays and garbage collection of disks, global garbage collection reduces garbage of disks by enabling storage arrays to inform disks of not implementing invalid data relocation and of controlling space release so that disks and controllers consume less space, reducing costs and prolonging the useful life of storage arrays.
	Global system for mobile communications	The second-generation mobile networking standard defined by the European Telecommunications Standards Institute (ETSI). It is aimed at designing a standard for global mobile phone networks. GSM consists of three main parts: mobile switching subsystem (MSS), base station subsystem (BSS), and mobile station (MS).
	Global wear leveling	With a view to individual characteristics of a single disk, global wear leveling uses space allocation and write algorithms to achieve wear leveling among disks, preventing a disk from losing efficacy due to excessive writes and prolonging the useful life of the disk.

H

	Hard disk tray	The tray that bears the hard disk.
	Heartbeat	Heartbeat supports node communication, fault diagnosis, and event triggering. Heartbeats are protocols that require no acknowledgement. They are transmitted between two devices. The device can judge the validity status of the peer device.
	Hit ratio	The ratio of directly accessed I/Os from the cache to all I/Os.
	Hot swap	The substitution of a replacement unit (RU) in a system for a defective unit, where the substitution can be performed while the system is performing its normal functioning normally. Hot swaps are physical operations typically performed by humans.
	HyperMetro	A value-added service of storage systems. HyperMetro means two datasets (on two storage systems) can provide storage services as one dataset to achieve load balancing among applications and failover without service interruption.
	HyperMetro domain	A HyperMetro configuration object generally; made up of two storage arrays and one quorum server. HyperMetro services can be created on a HyperMetro domain.

HyperMetro vStore pair	A HyperMetro vStore pair consists of two vStores, that is, two tenants. After a HyperMetro relationship is set up for a pair of vStores, the datasets in the two vStores work in redundancy mode and provide storage services in one dataset view, achieving hitless service failover.
HyperMetro-Inner	On an eight-controller network, with HyperMetro-Inner, continuous mirroring, back-end global sharing, and three-copy technologies, a storage system can tolerate one-by-one failures of seven controllers among eight controllers, concurrent failures of two controllers, and failure of a controller enclosure.
HyperDetect	HyperDetect is a feature that provides ransomware detection.
Handle	A handle resides on the structural part of a module. It is used to insert or remove a module into or from a chassis, not helpful in saving efforts.
Helm chart	A Helm chart is in TAR format. It is similar to the deb package of APT or the rpm package of Yum. It contains a group of yaml files that define Kubernetes resources.

I

In-band management	The management control information of the network and the carrier service information of the user network are transferred through the same logical channel. In-band management enables users to manage storage arrays through commands. Management commands are sent through service channels, such as I/O write and read channels. The advantages of in-band management include high speed, stable transfer, and no additional management network ports required.
Initiator	The system component that originates an I/O command over an I/O interconnect. The endpoint that originates a SCSI I/O command sequence. I/O adapters, network interface cards, and intelligent I/O interconnect control ASICs are typical initiators.

	I/O	Shorthand for input/output. I/O is the process of moving data between a computer system's main memory and an external device or interface such as a storage device, display, printer, or network connected to other computer systems. This encompasses reading, or moving data into a computer system's memory, and writing, or moving data from a computer system's memory to another location.
	Intelligent ransomware detection	The system detects known ransomware features to identify whether the file systems are attacked by ransomware. If no ransomware attack is identified, the system analyzes and compares the changes in file system snapshots, and uses machine learning algorithms to further check whether the file systems are infected by ransomware.
	Interface module	A replaceable field module that accommodates the service or management ports.

L

	Load balance	A method of adjusting the system, application components, and data to averagely distribute the applied I/Os or computing requests to physical resources of the system.
	Logical unit	The addressable entity within a SCSI target that executes I/O commands.
	Logical unit number	The SCSI identifier of a logical unit within a target. Industry shorthand, when phrased as "LUN", for the logical unit indicated by the logical unit number.
	LUN formatting	The process of writing 0 bits in the data area of the logical drive and generating related parity bits so that the logical drive can be in the ready state.
	LUN mapping	A storage system maps LUNs to application servers so that application servers can access storage resources.
	LUN migration	A method for the LUN data to migrate between different physical storage spaces while ensuring data integrity and uninterrupted operation of host services.
	LUN snapshot	A type of snapshot created for a LUN. This snapshot is both readable and writable and is mainly used to provide a snapshot LUN from point-in-time LUN data.

	Lever	A lever resides on the structural part of a module. It is used to insert or remove a module into or from a chassis, saving efforts.
	Local image repository	A private repository used to store the container images and Helm charts imported by users. It is different from the standard image repository. The imported images and Helm charts must meet the compatibility requirements of the system.

M

	Maintenance terminal	A computer connected through a serial port or management network port. It maintains the storage system.
	Management interface module	The module that integrates one or more management network ports.
	Management network	An entity that provides means to transmit and process network management information.
	Management network port	The network port on the controller enclosure connected to the maintenance terminal. It is provided for the remote maintenance terminal. Its IP address can be modified with the change of the customer's environment.

N

	NVM Express	A host controller interface with a register interface and command set designed for PCI Express-based SSDs.
	NVMe SSD	A solid state disk (SSD) with a non-volatile memory express (NVMe) interface. Compared with other SSDs, such SSDs can deliver higher performance and shorter latency.

O

	Out-of-band management	A management mode used during out-of-band networking. The management and control information of the network and the bearer service information of the user network are transmitted through different logical channels.

P

Power failure protection	When an external power failure occurs, the AC PEM depends on the battery for power supply. This ensures the integrity of the dirty data in the cache.
Pre-copy	When the system monitors a failing member disk in a RAID group, the system copies the data from the disk to a hot spare disk in advance.
Palm-sized NVMe SSD	A palm-sized NVMe SSD is a type of NVMe SSD of which the dimensions (H x W x D) are 160 mm x 79.8 mm x 9.5 mm (neither 3.5-inch nor 2.5-inch).

Q

Quorum server	A server that can provide arbitration services for clusters or HyperMetro to prevent the resource access conflicts of multiple application servers.
Quorum Server Mode	A HyperMetro arbitration mode. When a HyperMetro arbitration occurs, the quorum server decides which site wins the arbitration.

R

RAID level	The application of different redundancy types to a logical drive. A RAID level improves the fault tolerance or performance of the logical drive but reduces the available capacity of the logical drive. You must specify a RAID level for each logical drive.
Ransomware file interception	When launching attacks, ransomware usually generates encrypted files with special file name extensions. In light of this, the system intercepts the write to files with specific file name extensions to block the extortion from known ransomware and protect file systems in the storage system.
Real-time ransomware detection	Ransomware has similar I/O behavior characteristics. By analyzing file I/O behavior characteristics, the system quickly filters out abnormal files and performs deep content analysis on the abnormal files to detect files attacked by ransomware. Then, secure snapshots are created for file systems where files have been attacked, and alarms are reported to notify the data protection administrator, limiting the impact of ransomware and reducing losses.

	Reconstruction	The regeneration and writing onto one or more replacement disks of all of the user data and check data from a failed disk in a mirrored or RAID array. In most arrays, a rebuild can occur while applications are accessing data on the array's virtual disks.
	Redundancy	The inclusion of extra components of a given type in a system (beyond those required by the system to carry out its function) for the purpose of enabling continued operation in the event of a component failure.
	Remote replication	A core technology for disaster recovery and a foundation that implements remote data synchronization and disaster recovery. This technology remotely maintains a set of data mirrors through the remote data connection function of the storage devices that are separated in different places. Even when a disaster occurs, the data backup on the remote storage device is not affected. Remote replication can be divided into synchronous remote replication and asynchronous remote replication.
	Reverse synchronization	The process of restoring data from the redundancy machine (RM) when the services of the production machine (PM) are recovering.
	Route	The path that network traffic takes from its source to its destination. On a TCP/IP network, each IP packet is routed independently. Routes can change dynamically.

S

	Script	A parameterized list of primitive I/O interconnect operations intended to be executed in sequence. Often used with respect to ports, most of which are able to execute scripts of I/O commands autonomously (without policy processor assistance). A sequence of instructions intended to be parsed and carried out by a command line interpreter or other scripting language. Perl, VBScript, JavaScript and Tcl are all scripting languages.
	Serial port	An input/output location (channel) that sends and receives data (one bit at a time) to and from the CPU of a computer or a communications device. Serial ports are used for serial data communication and as interfaces for some peripheral devices, such as mouse devices and printers.

Service data	The user and/or network information required for the normal functioning of services.
Service network port	The network port that is used to store services.
Simple network management protocol	An IETF protocol for monitoring and managing systems and devices in a network. The data being monitored and managed is defined by an MIB. The functions supported by the protocol are the request and retrieval of data, the setting or writing of data, and traps that signal the occurrence of events.
Single point of failure	One component or path in a system, the failure of which would make the system inoperable.
Slot	A position defined by an upper guide rail and the corresponding lower guide rail in a frame. A slot houses a board.
Small computer system interface	A collection of ANSI standards and proposed standards that define I/O interconnects primarily intended for connecting storage subsystems or devices to hosts through host bus adapters. Originally intended primarily for use with small (desktop and desk-side workstation) computers, SCSI has been extended to serve most computing needs, and is arguably the most widely implemented I/O interconnect in use today.
Snapshot	A point in time copy of a defined collection of data. Clones and snapshots are full copies. Depending on the system, snapshots may be of files, LUNs, file systems, or any other type of container supported by the system.
Snapshot copy	A copy of a snapshot LUN.
Source LUN	The LUN where the original data is located.
Static Priority Mode	A HyperMetro arbitration mode. When a HyperMetro arbitration occurs, the preferred site always wins the arbitration.
Storage system	An integrated system that consists of the following parts: controller, storage array, host bus adapter, physical connection between storage units, and all control software.
Storage unit	An abstract definition of backup storage media for storing backup data. The storage unit is connected to the actual storage media used to back up data.

Streaming media	Streaming media is media continuously streamed over the network. Combining technologies concerning streaming media data collection, compression, encoding, storage, transmission, playback, and network communications, streaming media can provide high-quality playback effects in real time at low bandwidth.	
Subnet	A type of smaller network that forms a larger network according to a rule, such as, forming a network according to different districts. This facilitates the management of a large network.	
Smart disk enclosure	Being compared with traditional disk enclosures, the smart disk enclosures are equipped with Arm chips and DDR memories or other computing modules to achieve powerful computing capabilities. With such capabilities, the smart disk enclosures can help controllers to share some computing loads, accelerating data processing.	
Share authentication	During vStore configuration synchronization, the share authentication information (including the share information and domain controller configuration) is synchronized to the secondary end.	

T

Target	The endpoint that receives a SCSI I/O command sequence.
Target LUN	The LUN on which target data resides.
Thin LUN	A logic disk that can be accessed by hosts. It dynamically allocates storage resources from the thin pool according to the actual capacity requirements of users.
Topology	The logical layout of the components of a computer system or network and their interconnections. Topology deals with questions of what components are directly connected to other components from the standpoint of being able to communicate. It does not deal with questions of physical location of components or interconnecting cables. The communication infrastructure that provides Fibre Channel communication among a set of PN_Ports (e.g., a Fabric, an Arbitrated Loop, or a combination of the two).

	Trim	A method by which the host operating system may inform a storage device of data blocks that are no longer in use and can be reclaimed. Many storage protocols support this functionality via various names, e.g., ATA TRIM and SCSI UNMAP.

U

	User interface	The space where users interact with a machine.
	U-shaped bracket	It is an optional structural part like letter "U". It is located between the mounting ear of a chassis and the mounting bar of a cabinet or bay and is used to adjust the locations of the chassis and mounting bar of the cabinet or bay.

W

	Wear leveling	A set of algorithms utilized by a flash controller to distribute writes and erases across the cells in a flash device. Cells in flash devices have a limited ability to survive write cycles. The purpose of wear leveling is to delay cell wear out and prolong the useful life of the overall flash device.
	Write amplification	Increase in the number of write operations by the device beyond the number of write operations requested by hosts.
	Write amplification factor	The ratio of the number of write operations on the device to the number of write operations requested by the host.
	Write back	A caching technology in which the completion of a write request is signaled as soon as the data is in the cache. Actual writing to non-volatile media occurs at a later time. Write back includes inherent risks: an application will take action predicated on the write completion signal, and a system failure before the data is written to non-volatile media will cause media contents to be inconsistent with that subsequent action. For these reasons, sufficient write back implementations include mechanisms to preserve cache contents across system failures (including power failures) and a flushed cache at system restart time.

Write Once Read Many   A type of storage, designed for fixed content, that preserves what is written to it in an immutable fashion. Optical disks are an example of WORM storage.

Write through   A caching technology in which the completion of a write request is not signaled until data is safely stored on non-volatile media. Write performance equipped with the write through technology is approximately that of a non-cached system. However, if the written data is also held in a cache, subsequent read performance may be dramatically improved.

Z

Zone   A collection of Fibre Channel N_Ports and/or NL_Ports (i.e., device ports) that are permitted to communicate with each other via the fabric. Any two N_Ports and/or NL_Ports that are not members of at least one common zone are not permitted to communicate via the fabric. Zone membership may be specified by: 1) port location on a switch, (i.e., Domain_ID and port number); or, 2) the device's N_Port_Name; or, 3) the device's address identifier; or, 4) the device's Node_Name. Well-known addresses are implicitly included in every zone.

C Acronyms and Abbreviations

B

BBU   Backup Battery Unit

C

CLI   Command Line Interface

F

FC   Fibre Channel

H

HBA   Host Bus Adapter

HPC   High-performance Computing

I

IOPS   Input/Output Operations Per Second

iSCSI   Internet Small Computer Systems
                                           Interface

L

LUN   Logical Unit Number

N

NVMe   Non-volatile Memory Express

O

ODT   Offloaded Data Transfer

OLTP   Online Transaction Processing

OLAP	Online Analytical Processing
R	
RAID	Redundant Array of Independent Disks
ROW	Redirect-On-Write
S	
SAS	Serial Attached SCSI
SNMP	Simple Network Management Protocol
SRM	Site Recovery Manager
SSD	Solid-State Drive
T	
TCO	Total Cost of Ownership
V	
VAAI	vSphere Storage APIs for Array Integration
VDI	Virtual Desktop Infrastructure
VSS	Volume Shadow Copy Service