



Lenovo ThinkSystem DE4000H Hybrid Storage Array Product Guide

Lenovo ThinkSystem DE4000H is a scalable, hybrid entry-level storage system that is designed to provide performance, simplicity, capacity, security, and high availability for medium to large businesses. It delivers enterprise-class storage management capabilities with a wide choice of host connectivity options, flexible drive configurations, and enhanced data management features. The ThinkSystem DE4000H is a perfect fit for a wide range of enterprise workloads, including big data and analytics, video surveillance, technical computing, backup and recovery, and other storage I/O-intensive applications.

ThinkSystem DE4000H models are available in a 2U rack form-factor with 24 small form-factor (2.5-inch SFF) drives (2U24 SFF), 12 large form-factor (3.5-inch LFF) drives (2U12 LFF), or a 4U rack form-factor with 60 LFF drives (4U60 LFF) and include two controllers, each with 8 GB or 32 GB cache for a system total of 16 GB or 64 GB. Universal 1/10 Gb iSCSI or 4/8/16 Gb Fibre Channel (FC) ports provide base host connectivity, and the host interface cards provide additional 1/10 Gb iSCSI or 4/8/16 Gb FC, 12 Gb SAS, 10/25 Gb iSCSI, or 8/16/32 Gb FC connections.

The ThinkSystem DE4000H Storage Array scales up to 192 drives with the attachment of Lenovo ThinkSystem DE120S 2U12, DE240S 2U24 SFF, and DE600S 4U60 LFF Expansion Enclosures. It also offers flexible drive configurations with the choice of 2.5-inch (SFF) and 3.5-inch (LFF) form factors, 10 K rpm SAS and 7.2 K rpm NL SAS hard disk drives (HDDs), and SAS solid-state drives (SSDs).

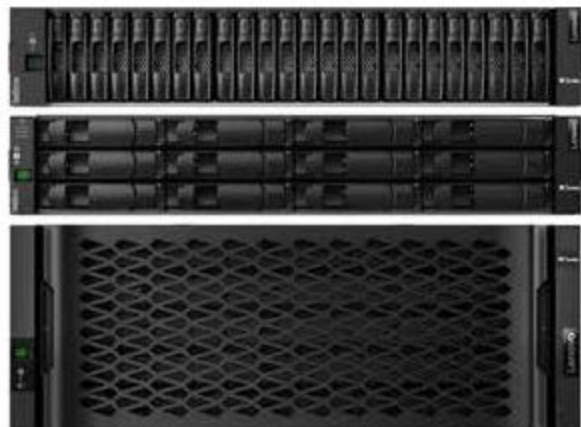


Figure 1. Lenovo ThinkSystem DE4000H 2U24 SFF (top), 2U12 LFF (middle), and 4U60 LFF (bottom)

Did you know?

The ThinkSystem DE4000H scales up to 3 PB of raw storage capacity, and it offers block storage connectivity with support for 1/10 Gb iSCSI or 4/8/16 Gb FC, and 12 Gb SAS, 10/25 Gb iSCSI, or 8/16/32 Gb FC at the same time.

For the ThinkSystem DE4000H, customers can change the host port protocol from FC to iSCSI or from iSCSI to FC for the SFP+ host ports built into the controller (base host ports), or the universal SFP+ host ports on the host interface card (HIC ports), or for all SFP+ base and universal HIC ports.

Key features

The ThinkSystem DE4000H offers the following key features and benefits:

- Scalable entry-level hybrid storage with dual active/active controller configurations with 8 GB or 32 GB cache per controller for high availability and performance.
- Improved performance and data protection with Dynamic Disk Pools (DDP) technology, as well as support for traditional RAID 0, 1, 3, 5, 6, and 10.
- Flexible host connectivity to match diverse client needs with support for 1/10 Gb iSCSI or 4/8/16 Gb FC, and 12 Gb SAS, 10/25 Gb iSCSI, or 8/16/32 Gb FC connectivity at the same time.
- 12 Gb SAS drive-side connectivity with support for up to 24x 2.5-inch small form factor (SFF) drives in the 2U24 SFF enclosures, up to 12x 3.5-inch large form factor (LFF) drives in the 2U12 LFF enclosures, or up to 60x 3.5-inch LFF drives in the 4U60 LFF enclosures.
- Scalability to up to 192 SFF or LFF drives with the attachment of the ThinkSystem DE240S 2U24 SFF, DE120S 2U12 LFF, or DE600S 4U60 LFF expansion enclosures to satisfy growing needs for storage capacity and performance.
- Rich set of standard storage management functions available at no extra cost, including Dynamic Disk Pools, SSD read cache, snapshots, volume copy, thin provisioning, and encryption (requires optional FIPS drives).
- Optional licensed functions, including higher number of snapshots for greater scalability and synchronous or asynchronous mirroring for continuous data availability.
- Intuitive, web-based GUI for easy system setup and management.
- Designed for 99.999% availability with redundant hot-swap components, including controllers and I/O modules, power supplies, cooling modules (4U60 LFF enclosures only), proactive maintenance, and non-disruptive firmware upgrades.

The ThinkSystem DE4000H supports the complete range of data storage requirements, from highly used applications to high-capacity, low usage applications.

The following drives are supported in the 2U24 SFF enclosures:

- Capacity-optimized SSDs (1 drive write per day [DWD]): 3.84 TB, 7.68 TB, and 15.36 TB
- High performance SSDs (3 DWD): 800 GB, 1.6 TB, and 3.2 TB
- High performance self-encrypting FIPS SSDs (3 DWD): 1.6 TB
- Performance-optimized, enterprise class HDDs: 1.2 TB and 1.8 TB 10K rpm
- Performance-optimized, enterprise class self-encrypting FIPS HDDs: 1.8 TB 10K rpm

The following drives are supported in the 2U12 LFF enclosures:

- High-performance SSDs (3 DWD; 2.5" drive in a 3.5" drive tray): 800 GB
- High performance self-encrypting FIPS SSDs (3 DWD; 2.5" drive in a 3.5" drive tray): 1.6 TB
- High-capacity, archival-class nearline HDDs: 4 TB, 8 TB, 10 TB, 12 TB, and 16 TB 7.2K rpm
- High-capacity, archival-class nearline self-encrypting FIPS HDDs: 6 TB and 10 TB 7.2K rpm

The following drives are supported in the 4U60 LFF enclosures:

- High-performance SSDs (3 DWD; 2.5" drive in a 3.5" drive tray): 800 GB, 1.6 TB, and 3.2 TB
- High performance self-encrypting FIPS SSDs (3 DWD; 2.5" drive in a 3.5" drive tray): 1.6 TB
- High-capacity, archival-class nearline HDDs: 4 TB, 8 TB, 10 TB, 12 TB, and 16 TB 7.2K rpm
- High-capacity, archival-class nearline self-encrypting FIPS HDDs: 10 TB 7.2K rpm

All drives are dual-port and hot-swappable. Drives of the same form factor can be intermixed within the appropriate enclosure, which provides the flexibility to address performance and capacity needs within a single enclosure.

Up to seven ThinkSystem DE240S 2U24 SFF or ThinkSystem DE120S 2U12 LFF, or up to three ThinkSystem DE600S 4U60 LFF, or a combination of the ThinkSystem DE240S, DE120S, and DE600S expansion enclosures for a total of up to 192 drives per system (including controller and expansion enclosures) are supported by a single ThinkSystem DE4000H system.

Customers can intermix 2U24 SFF, 2U12 LFF, and 4U60 LFF expansion enclosures behind a 2U24 SFF, 2U12 LFF, or 4U60 LFF controller enclosure. This configuration delivers the added flexibility to mix 3.5-inch and 2.5-inch drives within a single system (but not within the enclosure).

More drives and expansion enclosures are designed to be dynamically added with virtually no downtime, which helps to quickly and seamlessly respond to ever-growing capacity demands.

The ThinkSystem DE4000H offers high levels of system and data availability with the following technologies:

- Dual-active controller modules with automatic load balancing and failover
- Mirrored data cache with flash backup (battery-backed destaging to flash)
- Dual-port SAS HDDs and SSDs with automatic drive failure detection and rebuild with global hot spares
- Redundant, hot-swappable and customer replaceable hardware components, including SFP/SFP+ transceivers, controller and I/O modules, power supplies, cooling modules (4U60 LFF only), and drives
- Automated path failover support for the data path between the host and the drives with multipathing software
- Non-disruptive controller and drive firmware upgrades

Components and connectors

The following figure shows the front of the ThinkSystem DE4000H and DE240S 2U SFF enclosures.

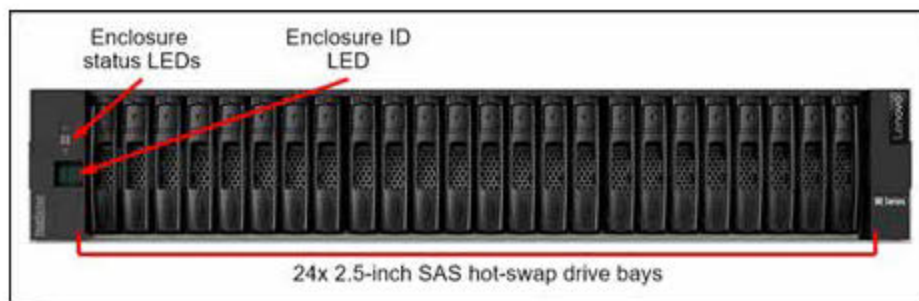


Figure 2. ThinkSystem DE4000H and DE240S 2U SFF enclosures front view

The front of the ThinkSystem DE4000H and DE240S 2U SFF enclosures includes the following components:

- 24 SFF hot-swap drive bays
- Enclosure status LEDs
- Enclosure ID LED

The following figure shows the front of the ThinkSystem DE4000H and DE120S 2U LFF enclosures.

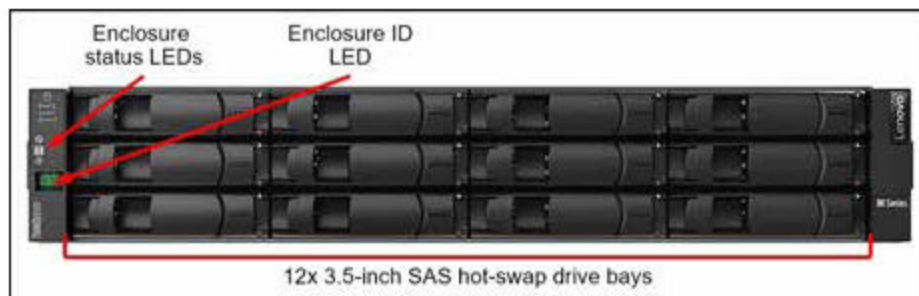


Figure 3. ThinkSystem DE4000H and DE120S 2U LFF enclosures front view

The front of the ThinkSystem DE4000H and DE120S 2U LFF enclosures includes the following components:

- 12 LFF hot-swap drive bays
- Enclosure status LEDs
- Enclosure ID LED

The following figure shows the rear of the ThinkSystem DE4000H 2U controller enclosure.

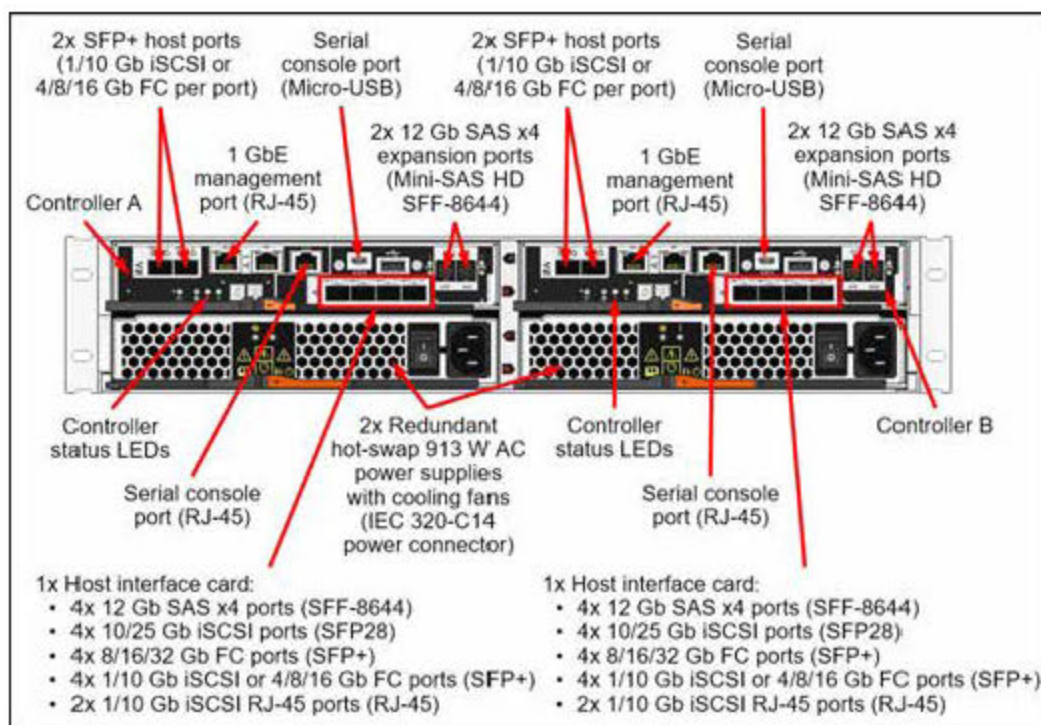


Figure 4. ThinkSystem DE4000H 2U controller enclosure rear view

The rear of the ThinkSystem DE4000H 2U controller enclosure includes the following components:

- Two redundant hot-swap controllers, each with the following ports:
 - Two SFP+ base host ports for 1/10 Gb iSCSI or 4/8/16 Gb FC connectivity.
 - One slot for the host interface card (a host interface card is required):
 - Four 12 Gb SAS x4 host ports (Mini-SAS HD SFF-8644).
 - Four 10/25 Gb iSCSI host ports (SFP28).
 - Four 8/16/32 Gb FC host ports (SFP+).
 - Four 1/10 Gb iSCSI or 4/8/16 Gb FC host ports (SFP+).
 - Two 1/10 Gb iSCSI host ports (RJ-45).
 - Two 12 Gb SAS x4 expansion ports (Mini-SAS HD SFF-8644) for connections to the expansion enclosures.
 - One RJ-45 10/100/1000 Mb Ethernet port for out-of-band management.

Note: The Ethernet port (P2) next to the GbE management port is not available for use.
 - Two serial console ports (RJ-45 and Micro-USB) for another means to configure the system.
 - One USB Type A port (reserved for factory use)
- Two redundant hot-swap 913 W (100 - 240 V) AC power supplies (IEC 320-C14 power connector) with integrated cooling fans.

The following figure shows the rear of the ThinkSystem DE240S or DE120S 2U expansion enclosure.

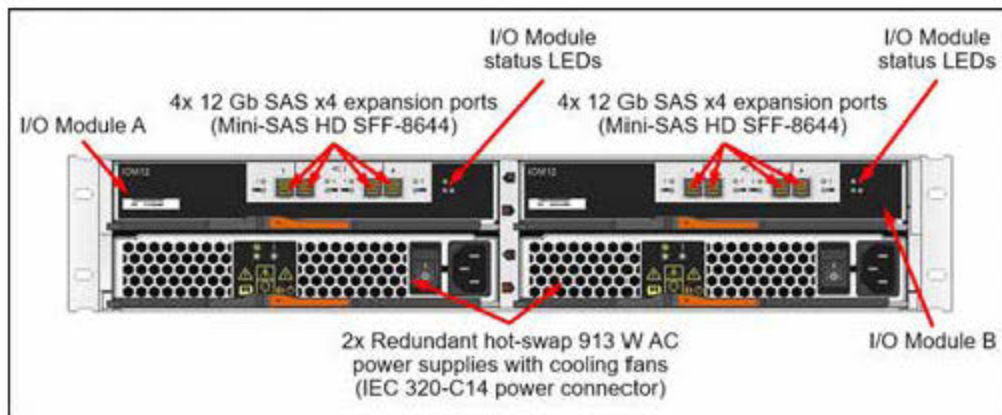


Figure 5. ThinkSystem DE240S or DE120S 2U expansion enclosure rear view

The rear of the ThinkSystem DE240S or DE120S 2U expansion enclosure includes the following components:

- Two redundant hot-swap I/O Modules; each I/O Module provides four 12 Gb SAS x4 expansion ports (Mini-SAS HD SFF-8644) for connections to the controller enclosures and for connecting the expansion enclosures between each other.
- Two redundant hot-swap 913 W (100 - 240 V) AC power supplies (IEC 320-C14 power connector) with integrated cooling fans.

The following figure shows the front of the ThinkSystem DE4000H and DE600S 4U LFF enclosures without the front bezel.

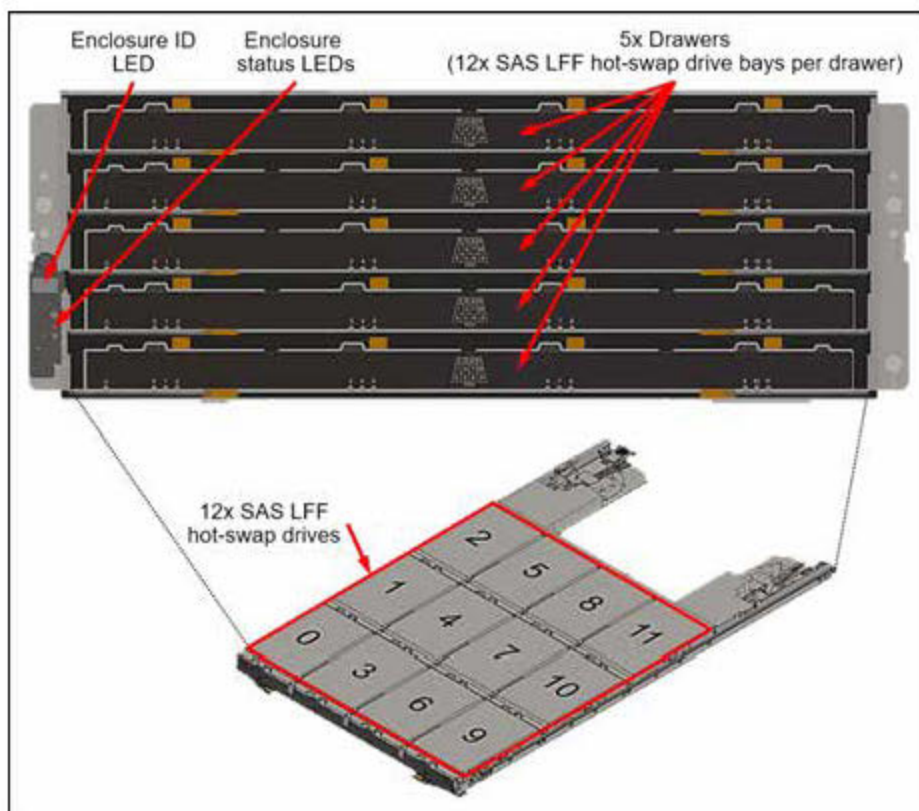


Figure 6. ThinkSystem DE4000H and DE600S 4U LFF enclosures front view (without the front bezel)

The front of the ThinkSystem DE4000H and DE600S 4U LFF enclosures includes the following components:

- Five drawers, each with 12 LFF hot-swap drive bays
- Enclosure ID LED
- Enclosure status LEDs

The following figure shows the rear of the ThinkSystem DE4000H 4U LFF controller enclosure.

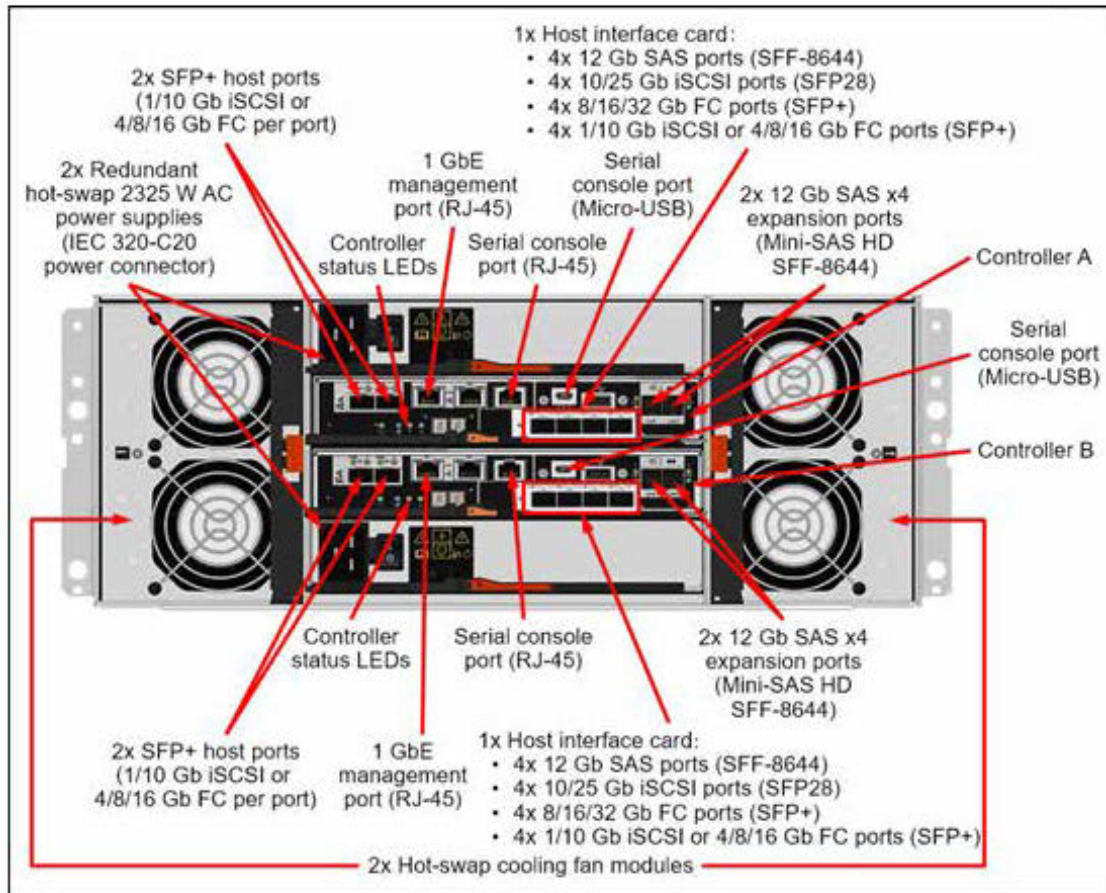


Figure 7. ThinkSystem DE4000H 4U LFF controller enclosure rear view

The rear of the ThinkSystem DE4000H 4U LFF controller enclosure includes the following components:

- Two redundant hot-swappable controllers, each with the following ports:
 - Two SFP+ base host ports for 1/10 Gb iSCSI or 4/8/16 Gb FC connectivity.
 - One slot for the host interface card (a host interface card is required):
 - Four 12 Gb SAS x4 host ports (Mini-SAS HD SFF-8644).
 - Four 10/25 Gb iSCSI host ports (SFP28).
 - Four 8/16/32 Gb FC host ports (SFP+).
 - Four 1/10 Gb iSCSI or 4/8/16 Gb FC host ports (SFP+).
 - Two 12 Gb SAS x4 expansion ports (Mini-SAS HD SFF-8644) for connections to the expansion enclosures.
 - One RJ-45 10/100/1000 Mb Ethernet port for out-of-band management.

Note: The Ethernet port (P2) next to the GbE management port is not available for use.
 - Two serial console ports (RJ-45 and Micro-USB) for another means to configure the system.
 - One USB Type A port (reserved for factory use)
- Two redundant hot-swap 2325 W (200 - 240 V) AC power supplies (IEC 320-C20 power connector)
- Two hot-swap cooling fan modules; each module has two fans.

Note: The failed cooling module should be replaced as soon as possible.

The following figure shows the rear of the ThinkSystem DE600S 4U LFF expansion enclosure.

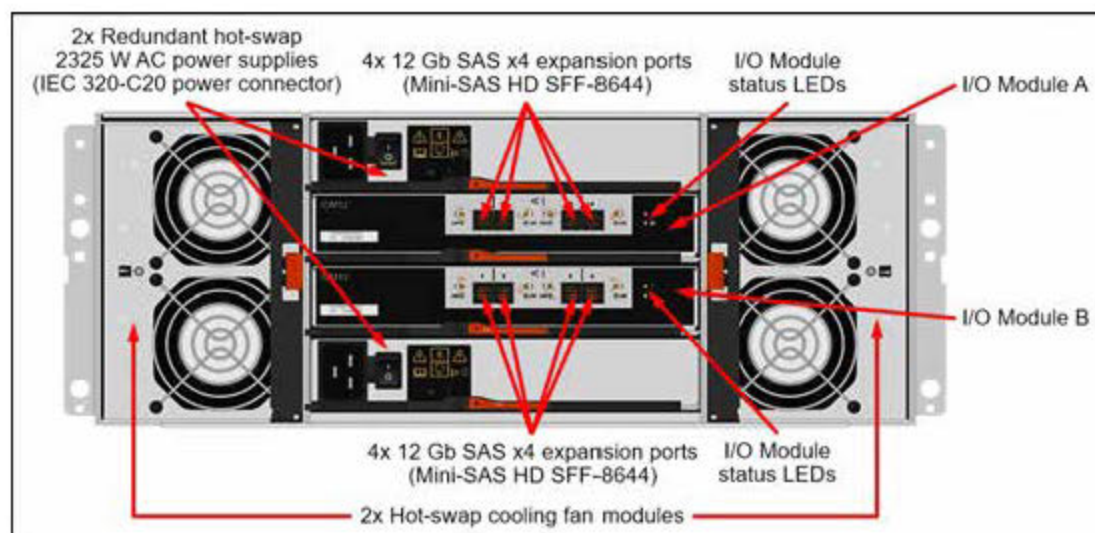


Figure 8. ThinkSystem DE600S 4U LFF expansion enclosure rear view

The rear of the ThinkSystem DE600S 4U LFF expansion enclosure includes the following components:

- Two redundant hot-swappable I/O Modules; each I/O Module provides four 12 Gb SAS x4 expansion ports (Mini-SAS HD SFF-8644) for connections to the controller enclosures and for connecting the expansion enclosures between each other.
- Two redundant hot-swappable 2325 W (200 - 240 V) AC power supplies (IEC 320-C20 power connector)
- Two hot-swappable cooling fan modules; each module has two fans.
Note: The failed cooling module should be replaced as soon as possible.

System specifications

The following table lists the ThinkSystem DE4000H storage system specifications.

Note: The supported hardware options, software features, and interoperability listed in this product guide are based on the software version 11.60. For details about specific software releases that introduced support for certain hardware options and software features, refer to the Release notes of the particular software release for the ThinkSystem DE4000H that can be found at:

<http://datacentersupport.lenovo.com>

Table 1. ThinkSystem DE4000H system specifications

Attribute	Specification
Form factor	• DE4000H 2U24 SFF controller enclosure (Machine Type 7Y75): 2U rack mount. • DE4000H 2U12 LFF controller enclosure (Machine Type 7Y74): 2U rack mount. • DE4000H 4U60 LFF controller enclosure (Machine Type 7Y77): 4U rack mount. • DE240S 2U24 SFF expansion enclosure (Machine Type 7Y68): 2U rack mount. • DE120S 2U12 LFF expansion enclosure (Machine Type 7Y63): 2U rack mount. • DE600S 4U60 LFF expansion enclosure (Machine Type 7Y69): 4U rack mount.
Controller configuration	Dual active-active controller configuration with automatic load balancing.
RAID levels	RAID 0, 1, 3, 5, 6, and 10; Dynamic Disk Pools. Note: RAID 3 can be configured only through the CLI.
Controller cache	16 GB or 64 GB per system (8 GB or 32 GB per controller). Cache mirroring between the controllers. Flash-backed cache protection (includes battery for destaging to flash).

Attribute	Specification
Drive bays	Up to 8 enclosures per system (Controller unit with up to 3 [4U60] or 7 [2U24 or 2U12] expansion units): - Up to 192 LFF hot-swap drive bays (Up to 1x 2U12 and 3x 4U60 LFF enclosures) - Up to 192 SFF hot-swap drive bays (Up to 8x 2U24 LFF enclosures) Intermix of 2U24 SFF, 2U12 LFF, and 4U60 LFF enclosures is supported for a total of up to 192 drives per system.
Drive technology	12 Gb SAS and NL SAS HDDs and FIPS HDDs, 12 Gb SAS SSDs and FIPS SSDs. - Intermix of HDDs and SSDs is supported within a system. - Intermix of HDDs and SSDs is <i>not</i> supported within a volume group or disk pool. - A maximum of 120 SAS SSDs is supported. - Intermix of FIPS drives and non-FIPS drives is supported within a system. - Intermix of FIPS drives and non-FIPS drives is <i>not</i> supported within a volume group or disk pool.
Drive expansion connectivity	2x 12 Gb SAS x4 (Mini-SAS HD SFF-8644) expansion ports on each of two controllers in the controller enclosure for the attachment of the expansion enclosures. 4x 12 Gb SAS x4 (Mini-SAS HD SFF-8644) expansion ports on each of two I/O modules in the expansion enclosure for the attachment to the controller enclosure and daisy chaining of the expansion enclosures.
Drives	2U24 SFF drives: 1.2 TB and 1.8 TB 10K rpm SAS HDDs 1.8 TB 10K rpm SAS FIPS HDDs 3.84 TB, 7.68 TB, and 15.36 TB SAS SSDs (1 DWD) 800 GB, 1.6 TB, and 3.2 TB SAS SSDs (3 DWD) 1.6 TB SAS FIPS SSDs (3 DWD) 2U12 LFF drives: 4 TB, 8 TB, 10 TB, 12 TB, and 16 TB 7.2K rpm NL SAS HDDs 6 TB and 10 TB 7.2K rpm NL SAS FIPS HDDs 800 GB SAS SSDs (3 DWD) 1.6 TB SAS FIPS SSDs (3 DWD) 4U60 LFF drives: 4 TB, 8 TB, 10 TB, 12 TB, and 16 TB 7.2K rpm NL SAS HDDs 10 TB 7.2K rpm NL SAS FIPS HDDs 800 GB, 1.6 TB, and 3.2 TB SAS SSDs (3 DWD) 1.6 TB SAS FIPS SSDs (3 DWD)
Storage capacity	Up to 3 PB (192x 16 TB LFF HDDs).
Host connectivity	Base ports (per controller enclosure with two controllers): 4x 1/10 Gb iSCSI (RJ-45 [1 Gb iSCSI only], DAC, or SW fiber optics [LC]) or 4/8/16 Gb FC (SW fiber optics [LC]) SFP+ host ports (2 ports per controller) Additional ports on host interface cards (per controller enclosure with two controllers): 8x 12 Gb SAS host ports (Mini-SAS HD, SFF-8644) (4 ports per controller) 8x 10/25 Gb iSCSI SFP28 host ports (DAC or SW fiber optics [LC]) (4 ports per controller) 8x 8/16/32 Gb FC SFP+ host ports (SW fiber optics [LC]) (4 ports per controller) 8x 1/10 Gb iSCSI (RJ-45 [1 Gb iSCSI only], DAC, or SW fiber optics [LC]) or 4/8/16 Gb FC (SW fiber optics [LC]) SFP+ host ports (4 ports per controller) 4x 1/10 Gb iSCSI RJ-45 host ports (2 ports per controller; 2U12 LFF and 2U24 SFF only) Note: Two host interface cards are required for selection (one per controller).
Host operating systems	Microsoft Windows Server 2012 R2, 2016, and 2019; Red Hat Enterprise Linux (RHEL) 6, 7, and 8; SUSE Linux Enterprise Server (SLES) 11, 12, and 15; VMware vSphere 6.5, 6.7, and 7.0.
Standard software features	Dynamic Disk Pools, SSD read cache, snapshots (up to 128 targets), volume copy, thin provisioning (DDP only), encryption (requires optional FIPS drives), and data assurance.

Attribute	Specification
Optional software features	Snapshots (up to 512 targets), synchronous mirroring, and asynchronous mirroring.
Performance*	■ Up to 300 000 random read IOPS (4 KB blocks). ■ Up to 109 000 random write IOPS (4 KB blocks). ● Up to 9.2 GBps sequential read throughput (64 KB blocks). ■ Up to 2.7 GBps sequential write throughput (64 KB blocks).
Configuration maximums**	■ Maximum storage capacity: 3 PB ● Maximum number of logical volumes: 512 ■ Maximum logical volume size: 2 PB ■ Maximum thin-provisioned logical volume size (DDP only): 256 TB ■ Maximum number of drives in a RAID volume group: ● RAID 0, 1/10: 192 ■ RAID 3, 5, 6: 30 ■ Maximum number of DDP arrays: 20 ■ Maximum number of drives in a DDP array: 192 (11 drives minimum) ● Maximum SSD read cache size: 4 TB ■ Maximum number of hosts: 256 ■ Maximum number of snapshots: 512 (requires an optional license) ■ Maximum number of mirroring pairs: 32 (requires an optional license)
Cooling	Redundant cooling with two cooling modules (4U60 LFF) or with the fans that are built into power supplies (2U24 SFF and 2U12 LFF).
Power supply	Two redundant hot-swap 913 W (100 - 240 V) (2U24 and 2U12 enclosures) or 2325 W(200 - 240 V) (4U60 enclosures) Platinum AC power supplies.
Hot-swap parts	Controllers, I/O modules, drives, power supplies, cooling modules (4U60 LFF only), and SFP+/SFP28 transceivers.
Management ports	● 1x 1 GbE port (UTP, RJ-45) per controller for out-of-band management. ■ 2x Serial console ports (RJ-45 and Micro-USB) for system configuration. ● In-band management via I/O path.
Management interfaces	System Manager web-based GUI; SAN Manager standalone GUI; SSH CLI; Serial console CLI; SMI-S Provider; SNMP, email, and syslog alerts; optional Lenovo XClarity.
Security features	Secure Socket Layer (SSL), Secure Shell (SSH), user level security, role-based access control (RBAC), LDAP authentication.
Warranty and support	Three-year customer-replaceable unit and onsite limited warranty with 9x5 next business day (NBD) parts delivered. Also available are 9x5 NBD onsite response, 24x7 coverage with 2-hour or 4-hour onsite response, or 6-hour or 24-hour committed repair (select areas), YourDrive YourData, Premier Support, and 1-year or 2-year post-warranty extensions.
Software maintenance	Included in the base warranty and any Lenovo warranty extensions.
Dimensions	2U24 SFF enclosure: ■ Height: 85 mm (3.4 in.) ■ Width: 449 mm (17.7 in.) ● Depth: 553 mm (21.8 in.) 2U12 LFF enclosure: ■ Height: 85 mm (3.4 in.) ● Width: 447 mm (17.6 in.) ■ Depth: 483 mm (19.0 in.) 4U60 LFF enclosure: ● Height: 174 mm (6.9 in.) ■ Width: 449 mm (17.7 in.) ■ Depth: 922 mm (36.3 in.)

Attribute	Specification
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Weight	2U24 SFF enclosure (fully configured): 27.6 kg (60.8 lb)
	2U12 LFF enclosure (fully configured): 27.6 kg (60.8 lb)
	4U60 LFF enclosure (fully configured): 111.5 kg (245.8 lb)

* Estimated performance based on internal measurements.

** For a detailed list of configuration limits and restrictions for a specific version of the software, refer to the Lenovo Data Center Support website:

<http://datacentersupport.lenovo.com>