

Lenovo ThinkSystem DE6000F All Flash Storage Array Product Guide

Lenovo ThinkSystem DE6000F is a scalable, all flash mid-range storage system that is designed to provide high performance, simplicity, capacity, security, and high availability for medium to large businesses. The ThinkSystem DE6000F delivers enterprise-class storage management capabilities in a performance-optimized system with a wide choice of host connectivity options and enhanced data management features. The ThinkSystem DE6000F is a perfect fit for a wide range of enterprise workloads, including big data and analytics, video surveillance, technical computing, and other storage I/O-intensive applications.

ThinkSystem DE6000F models are available in a 2U rack form-factor with 24 small form-factor (2.5-inch SFF) drives (2U24 SFF) and include two controllers, each with 64 GB cache for a system total of 128 GB. Base ports provide universal 10 Gb iSCSI or 4/8/16 Gb Fibre Channel (FC) host connectivity, and the host interface cards provide 12 Gb SAS, 10/25 Gb iSCSI, 8/16/32 Gb FC or NVMe/FC, or 25/40/100 Gb NVMe/RoCE connections.

The ThinkSystem DE6000F Storage Array scales up to 120 solid-state drives (SSDs) with the attachment of Lenovo ThinkSystem DE240S 2U24 SFF Expansion Enclosures.

The Lenovo ThinkSystem DE6000F 2U24 SFF enclosure is shown in the following figure.



Figure 1. Lenovo ThinkSystem DE6000F 2U24 SFF enclosure

Did you know?

The ThinkSystem DE6000F offers end-to-end NVMe storage connectivity with NVMe over Fabrics (NVMeOF).

The ThinkSystem DE6000F scales up to 1.84 PB of raw storage capacity.

The ThinkSystem DE6000F supports multiple storage connectivity protocols with a choice of SAS, iSCSI, Fibre Channel, NVMe over Fibre Channel, or NVMe over RoCE.

For the ThinkSystem DE6000F, 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).

Key features

The ThinkSystem DE6000F offers the following key features and benefits:

- All-flash array capabilities and NVMe over Fabrics to meet the demand for higher speed storage and provide higher IOPs and bandwidth with lower power usage and total cost of ownership than hybrid or HDD-based solutions.
- Scalable, high performance mid-range storage with dual active/active controller configurations with 64 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 storage protocols to match diverse client needs with support for 10 Gb iSCSI or 4/8/16 Gb FC and 12 Gb SAS, 10/25 Gb iSCSI, or 8/16/32 Gb FC host connectivity, or 8/16/32 Gb NVMe/FC host connectivity, or 25/40/100 Gb NVMe/RoCE host connectivity.
- 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.
- Scalability to up to 120 SFF drives with the attachment of up to four ThinkSystem DE240S 2U24 SFF expansion enclosures to satisfy growing needs for storage capacity and performance.
- Full set of storage management functions comes with the system, including Dynamic Disk Pools, snapshots, volume copy, thin provisioning, synchronous mirroring, and asynchronous mirroring.
- Intuitive, web-based GUI for easy system setup and management.
- Designed for 99.9999% availability with redundant hot-swap components, including controllers and I/O modules, power supplies, proactive maintenance, and non-disruptive firmware upgrades.

The following solid-state 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
- High performance self-encrypting FIPS SSDs (3 DWD): 1.6 TB

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 four ThinkSystem DE240S 2U24 SFF expansion enclosures are supported by a single ThinkSystem DE6000F system. 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 DE6000F 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 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, 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 DE6000F and DE240S 2U SFF enclosures.

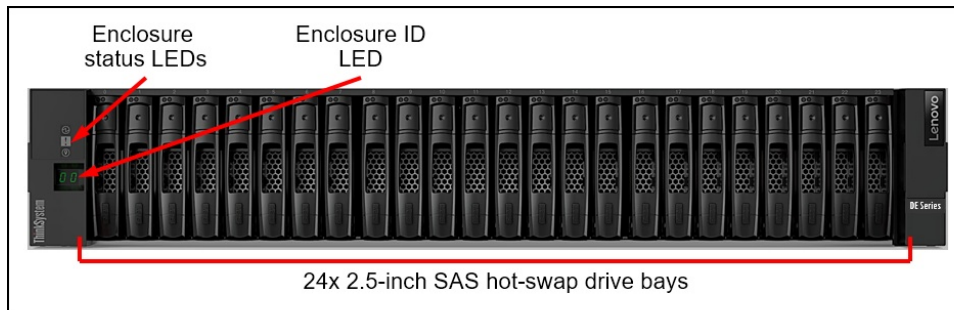


Figure 2. ThinkSystem DE6000F and DE240S 2U SFF enclosures front view

The front of the ThinkSystem DE6000F 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 rear of the ThinkSystem DE6000F 2U SFF controller enclosure.

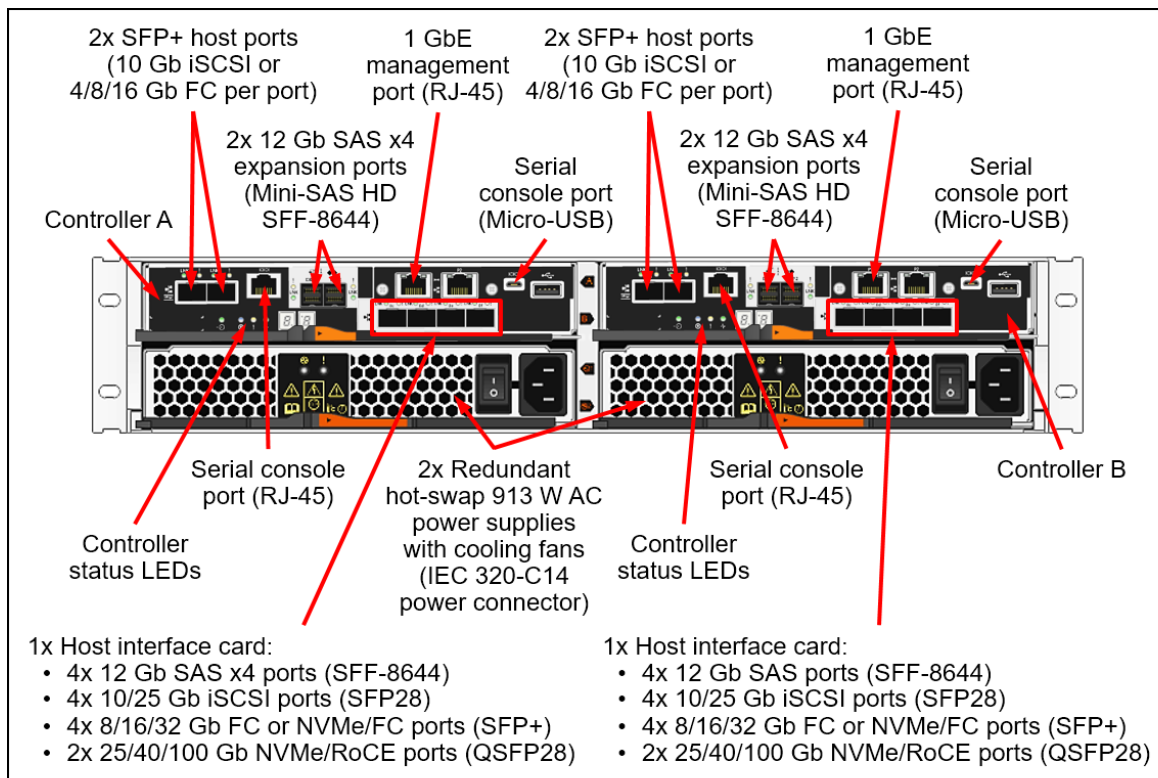


Figure 3. ThinkSystem DE6000F 2U SFF controller enclosure rear view

The rear of the ThinkSystem DE6000F 2U SFF controller enclosure includes the following components:

- Two redundant hot-swap controllers, each with the following ports:
 - Two SFP+ base host ports for 10 Gb iSCSI or 4/8/16 Gb FC connectivity.

Note: When NVMe/FC or NVMe/RoCE connectivity is enabled, the SFP+ base ports in the system are disabled and cannot be used.
 - 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 or NVMe/FC host ports (SFP+).
 - Two 25/40/100 Gb NVMe/RoCE host ports (QSFP28).
 - 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 AC (100 - 240 V) power supplies (IEC 320-C14 power connector) with integrated cooling fans.

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

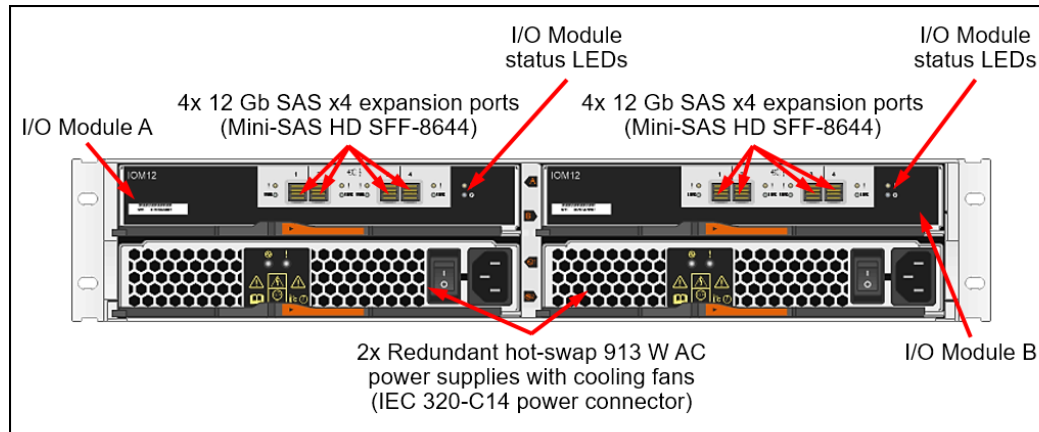


Figure 4. ThinkSystem DE240S 2U SFF expansion enclosure rear view

The rear of the ThinkSystem DE240S 2U SFF 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 AC (100 - 240 V) power supplies (IEC 320-C14 power connector) with integrated cooling fans.

System specifications

The following table lists the ThinkSystem DE6000F 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 DE6000F that can be found at:

<http://datacentersupport.lenovo.com>

Table 1. ThinkSystem DE6000F system specifications

Attribute	Specification
Form factor	<ul style="list-style-type: none"> DE6000F 2U24 SFF controller enclosure (Machine Type 7Y79): 2U rack mount. DE240S 2U24 SFF expansion enclosure (Machine Type 7Y68): 2U 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	128 GB per system (64 GB per controller). Cache mirroring between the controllers. Flash-backed cache protection (includes battery for destaging to flash).
Drive bays	Up to 120 hot-swap drive bays with up to five 2U24 SFF enclosures per system (Controller unit with up to four expansion units).
Drive technology	<ul style="list-style-type: none"> 12 Gb SAS SSDs and FIPS SSDs. 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	<ul style="list-style-type: none"> 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	SFF drives: <ul style="list-style-type: none"> 3.84 TB, 7.68 TB, and 15.36 TB SAS SSDs (1 DWD) 800 GB, 1.6 TB SAS SSDs (3 DWD) 1.6 TB SAS FIPS SSDs (3 DWD)
Storage capacity	Up to 1.84 PB (120x 15.36 TB SAS SSDs).
Storage protocols	SAN (Block access): SAS, iSCSI, FC, NVMe/FC, NVMe/RoCE.
Host connectivity	Base ports (per controller enclosure with two controllers): <ul style="list-style-type: none"> 4x 10 Gb iSCSI (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): <ul style="list-style-type: none"> 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) 4x 25/40/100 Gb NVMe/RoCE QSFP28 host ports (DAC cable or SW fiber optics, MPO) (2 ports per controller) Note: Two host interface cards are required for selection (one per controller).

Attribute	Specification
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. Note: NVMe/FC is supported with RHEL 8 and SLES 15, and NVMe/RoCE is supported with SLES 12 only (see Operating systems for specific version details).
Standard software features	Dynamic Disk Pools, snapshots (up to 2048 targets), volume copy, thin provisioning (DDP only), data assurance, synchronous mirroring, and asynchronous mirroring.
Performance*	<ul style="list-style-type: none"> Up to 1 000 000 random read IOPS (4 KB blocks). Up to 390 000 random write IOPS (4 KB blocks). Up to 21 GBps sequential read throughput (64 KB blocks). Up to 7 GBps sequential write throughput (64 KB blocks).
Configuration maximums**	<ul style="list-style-type: none"> Maximum storage capacity: 1.84 PB Maximum number of logical volumes: 2048 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: <ul style="list-style-type: none"> RAID 0, 1/10: 120 RAID 3, 5, 6: 30 Maximum number of DDP arrays: 20 Maximum number of drives in a DDP array: 120 (11 drives minimum) Maximum number of hosts: 512 Maximum number of snapshots: 2048 Maximum number of mirroring pairs: 128
Cooling	Redundant cooling with the fan modules that are built into power supplies.
Power supply	Two redundant hot-swap 913 W (100 - 240 V) AC Platinum power supplies.
Hot-swap parts	Controllers, I/O modules, drives, power supplies, and SFP+/SFP28/QSFP28 transceivers.
Management ports	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Height: 85 mm (3.4 in.) Width: 449 mm (17.7 in.) Depth: 553 mm (21.8 in.)
Weight	27.6 kg (60.8 lb) (Fully configured)

* 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>

Controller enclosures

The following table lists the relationship models of the ThinkSystem DE6000F All Flash Storage Array.

Table 2. ThinkSystem DE6000F relationship models

Description	Part number		
	European Union	Japan	Other markets worldwide
Lenovo ThinkSystem DE6000F SAS All Flash Array SFF (4x 16 Gb FC base ports [no SFPs], 8x 12 Gb SAS HIC ports)	7Y79A006EA	7Y79A000JP	7Y79A000WW
Lenovo ThinkSystem DE6000F FC All Flash Array SFF (4x 16 Gb FC base ports [no SFPs], 8x 32 Gb FC HIC ports [no SFPs])	7Y79A007EA	7Y79A001JP	7Y79A001WW
Lenovo ThinkSystem DE6000F iSCSI All Flash Array SFF (4x 10 Gb iSCSI base ports [no SFPs], 8x 10/25 Gb iSCSI HIC ports [no SFPs])	7Y79A008EA	7Y79A002JP	7Y79A002WW

The following table lists the CTO base models for the ThinkSystem DE6000F.

Table 3. ThinkSystem DE6000F CTO base models

Description	Machine Type/Model	Feature code
Lenovo ThinkSystem Storage 2U24 Chassis (with 2x PSUs)	7Y79CTO1WW	B38L

Configuration notes:

- For Relationship models, two DE6000 64GB controllers (feature code B4JP) are included in the model configuration.
- For CTO models, two DE6000 64GB controllers (feature code B4JP) are selected by default in the configurator, and the selection cannot be changed.

The models of the ThinkSystem DE6000F ship with the following items:

- One chassis with the following components:
 - Two controllers
 - Two power supplies
 - Two host interface cards
- Rack Mount Kit
- 2 m USB Cable (USB Type A to Micro-USB)
- *Quick Installation Guide*
- *Electronic Publications Flyer*
- Two power cables:
 - Relationship models listed in this section: 1.5 m, 10A/100-250V, C13 to IEC 320-C14 rack power cables
 - CTO models: Customer-configured power cables

Note: The relationship models of the ThinkSystem DE6000F ship without optical transceivers, DAC cables, or SAS cables; they should be purchased for the system (see [Controllers](#) for details).

Controllers

The ThinkSystem DE6000F controller enclosures ship with two DE6000 64GB controllers. A *controller* provides interfaces for host connectivity, management, and internal drives, and it runs storage management software. Each DE6000 64GB controller ships with 64 GB cache for a system total of 128 GB.

The ThinkSystem DE6000F controller enclosures ship with four universal ports (two ports per controller) for 10 Gb iSCSI or 4/8/16 Gb FC host connectivity. Each controller also has one expansion slot for a host interface card (HIC).

The following host interfaces can be added to the ThinkSystem DE6000F controller enclosures with HICs:

- 8x 12 Gb SAS x4 (Mini-SAS HD SFF-8644) ports (4 ports per HIC) for SAS connectivity.
- 8x 10/25 GbE SFP28 ports (4 ports per HIC) for 10/25 Gb iSCSI connectivity (require optical transceivers or DAC cables that should be purchased for the HICs).
- 8x 8/16/32 Gb FC SFP+ ports (4 ports per HIC) for FC or NVMe/FC connectivity (require optical transceivers that should be purchased for the HICs).
- 4x 25/40/100 GbE RoCE QSFP28 ports (2 ports per HIC) for NVMe/RoCE connectivity (require optical transceivers or DAC cables that should be purchased for the HIC).

Each DE6000 64GB controller also provide two 12 Gb SAS x4 expansion ports (Mini-SAS HD SFF-8644 connectors) for the attachment of the ThinkSystem DE Series expansion units.

Configuration notes:

- Two host interface cards are required for selection (one per controller).
- All four SFP+ base ports in the system must have the same connectivity type (either iSCSI or FC, but not both types) and the same type of SFP+ media (either optical transceivers or DAC cables, but not both types).
- Both controllers must have the same type of the host interface card installed (12 Gb SAS SFF-8644, 32 Gb FC SFP+, 10/25 Gb iSCSI SFP28, or 100 Gb NVMe/RoCE QSFP28), and both cards must have SFP+/SFP28/QSFP28 media of the same type (either optical transceivers or DAC cables, but not both types).
- When NVMe/FC or NVMe/RoCE connectivity is enabled, the SFP+ base ports in the system are disabled and cannot be used.

The following table lists the supported host port configurations for the ThinkSystem DE6000F controller enclosures (each row in the table represents a supported combination of the host ports).

Table 4. ThinkSystem DE6000F host port configurations

Port type and total number of ports					
12 Gb SAS (SFF-8644)	10 Gb iSCSI (SFP+) or 16 Gb FC (SFP+)	10/25 Gb iSCSI (SFP28)	32 Gb FC (SFP+)	32 Gb NVMe/FC (SFP+)	100 Gb NVMe/RoCE (QSFP28)
8 (4 per controller)	4 (2 per controller)	-	-	-	-
-	4 (2 per controller)	8 (4 per controller)	-	-	-
-	4 (2 per controller)	-	8 (4 per controller)	-	-
-	-*	-	-	8 (4 per controller)	-
-	-*	-	-	-	4 (2 per controller)

* When NVMe/FC or NVMe/RoCE connectivity is enabled, the SFP+ base ports in the system are disabled and cannot be used.

The following table lists the DE6000F controller and supported connectivity options.

Table 5. DE6000F controller and connectivity options

Description	Part number	Feature code	Maximum quantity per controller enclosure
Controllers			
Lenovo ThinkSystem DE6000F Controller 64GB	None*	BBCV	2
Host interface cards			
Lenovo ThinkSystem DE6000 12Gb SAS 4-ports HIC	4C57A14372	B4J9	2
Lenovo ThinkSystem DE6000 10/25Gb iSCSI 4-ports HIC	4C57A14371	B4J8	2
Lenovo ThinkSystem DE6000 32Gb FC 4-ports HIC	4C57A14370	B4J7	2
Lenovo ThinkSystem DE6000 100Gb NVMe-RoCE 2-port HIC	4C57A14373	B6KW	2
Transceiver options			
Lenovo 10Gb iSCSI/16Gb FC Universal SFP+ Module (for SFP+ base ports)	4M17A13527	B4B2	4
Lenovo 10/25GbE iSCSI SFP28 Module (for 10/25 Gb iSCSI HIC ports)	4M17A13529	B4B4	8
Lenovo 32Gb FC SFP+ Transceiver (for 32 Gb FC HIC ports)	4M17A13528	B4B3	8
OM4 optical cables for 16/32 Gb FC and 10/25 Gb iSCSI SW SFP+/SFP28 optical transceivers			
Lenovo 0.5m LC-LC OM4 MMF Cable	4Z57A10845	B2P9	12
Lenovo 1m LC-LC OM4 MMF Cable	4Z57A10846	B2PA	12
Lenovo 3m LC-LC OM4 MMF Cable	4Z57A10847	B2PB	12
Lenovo 5m LC-LC OM4 MMF Cable	4Z57A10848	B2PC	12
Lenovo 10m LC-LC OM4 MMF Cable	4Z57A10849	B2PD	12
Lenovo 15m LC-LC OM4 MMF Cable	4Z57A10850	B2PE	12
Lenovo 25m LC-LC OM4 MMF Cable	4Z57A10851	B2PF	12
Lenovo 30m LC-LC OM4 MMF Cable	4Z57A10852	B2PG	12
OM3 optical cables for 16/32 Gb FC and 10/25 Gb iSCSI SW SFP+/SFP28 optical transceivers			
Lenovo 0.5m LC-LC OM3 MMF Cable	00MN499	ASR5	12
Lenovo 1m LC-LC OM3 MMF Cable	00MN502	ASR6	12
Lenovo 3m LC-LC OM3 MMF Cable	00MN505	ASR7	12
Lenovo 5m LC-LC OM3 MMF Cable	00MN508	ASR8	12
Lenovo 10m LC-LC OM3 MMF Cable	00MN511	ASR9	12
Lenovo 15m LC-LC OM3 MMF Cable	00MN514	ASRA	12
Lenovo 25m LC-LC OM3 MMF Cable	00MN517	ASRB	12
Lenovo 30m LC-LC OM3 MMF Cable	00MN520	ASRC	12
Active optical cables for 100 Gb NVMe/RoCE QSFP28 HIC ports			
Lenovo 3m 100G QSFP28 Active Optical Cable	7Z57A03546	AV1L	4
Lenovo 5m 100G QSFP28 Active Optical Cable	7Z57A03547	AV1M	4
Lenovo 10m 100G QSFP28 Active Optical Cable	7Z57A03548	AV1N	4
Lenovo 15m 100G QSFP28 Active Optical Cable	7Z57A03549	AV1P	4
Lenovo 20m 100G QSFP28 Active Optical Cable	7Z57A03550	AV1Q	4

Description	Part number	Feature code	Maximum quantity per controller enclosure
DAC cables for 10 Gb iSCSI SFP+ base ports and iSCSI HIC ports			
0.5m Passive DAC SFP+ Cable	00D6288	A3RG	12
1m Passive DAC SFP+ Cable	90Y9427	A1PH	12
1.5m Passive DAC SFP+ Cable	00AY764	A51N	12
2m Passive DAC SFP+ Cable	00AY765	A51P	12
3m Passive DAC SFP+ Cable	90Y9430	A1PJ	12
5m Passive DAC SFP+ Cable	90Y9433	A1PK	12
7m Passive DAC SFP+ Cable	00D6151	A3RH	12
DAC cables for 25 Gb iSCSI SFP28 HIC ports			
Lenovo 1m Passive 25G SFP28 DAC Cable	7Z57A03557	AV1W	8
DAC cables for 100 Gb NVMe/RoCE QSFP28 HIC ports			
Lenovo 1m Passive 100G QSFP28 DAC Cable	7Z57A03561	AV1Z	4
Lenovo 3m Passive 100G QSFP28 DAC Cable	7Z57A03562	AV20	4
Lenovo 5m Passive 100G QSFP28 DAC Cable	7Z57A03563	AV21	4
SAS host connectivity cables: Mini-SAS HD (controller) to Mini-SAS HD (host)			
0.5m External MiniSAS HD 8644/MiniSAS HD 8644 Cable	00YL847	AU16	8
1m External MiniSAS HD 8644/MiniSAS HD 8644 Cable	00YL848	AU17	8
2m External MiniSAS HD 8644/MiniSAS HD 8644 Cable	00YL849	AU18	8
3m External MiniSAS HD 8644/MiniSAS HD 8644 Cable	00YL850	AU19	8
1 GbE management ports			
0.75m Green Cat6 Cable	00WE123	AVFW	2
1.0m Green Cat6 Cable	00WE127	AVFX	2
1.25m Green Cat6 Cable	00WE131	AVFY	2
1.5m Green Cat6 Cable	00WE135	AVFZ	2
3m Green Cat6 Cable	00WE139	AVG0	2
10m Green Cat6 Cable	90Y3718	A1MT	2
25m Green Cat6 Cable	90Y3727	A1MW	2

* Factory-installed only.

Expansion enclosures

The ThinkSystem DE6000F supports attachment of up to four ThinkSystem DE240S 2U24 SFF expansion enclosures. The expansion enclosures can be added to the system non-disruptively.

The following table lists the relationship models of the supported ThinkSystem DE240S expansion enclosures.

Table 6. ThinkSystem DE240S relationship models

Description	Part number		
	European union	Japan	Other markets worldwide
Lenovo ThinkSystem DE240S 2U24 SFF Expansion Enclosure	7Y68A004EA	7Y681001JP	7Y68A000WW

The following table lists the TopSeller models of the supported ThinkSystem DE Series expansion enclosures.

Table 7. ThinkSystem DE240S TopSeller models: Brazil and Latin America

Description	Part number	
	Latin America	Brazil
Lenovo ThinkSystem DE240S 2U24 SFF Expansion Enclosure (TopSeller)	7Y681002LA	7Y681002BR

The following table lists the CTO base models for the ThinkSystem DE240S expansion enclosures.

Table 8. ThinkSystem DE240S CTO base models

Description	Machine Type/Model	Feature code
Lenovo ThinkSystem Storage 2U24 Chassis (with 2x PSUs)	7Y68CTO1WW	B38L

Configuration notes:

- For Relationship models, two I/O expansion modules (feature code B4BS) are included in the model configuration.
- For CTO models, two I/O expansion modules (feature code B4BS) are selected by default in the configurator, and the selection cannot be changed.

The models of the ThinkSystem DE240S ship with the following items:

- One chassis with the following components:
 - Two I/O modules
 - Two power supplies
- Four 1 m MiniSAS HD 8644/MiniSAS HD 8644 cables (Relationship models listed in this section)
- Rack Mount Kit
- *Quick Installation Guide*
- *Electronic Publications Flyer*
- Two power cables:
 - Models listed in Tables 6 and 7: 1.5 m, 10A/100-250V, C13 to C14 rack power cables
 - CTO models: Customer-configured power cables

Note: The Relationship and TopSeller models of the ThinkSystem DE240S listed in this section ship with four 1 m SAS cables; additional SAS cables that are listed in this section can be purchased for the system, if needed.

Each ThinkSystem DE Series expansion enclosure ships with two SAS I/O expansion modules. Each *I/O expansion module* provides four external 12 Gb SAS x4 ports (Mini-SAS HD SFF-8644 connectors labelled Port 1-4) that are used for connections to the ThinkSystem DE6000F and for daisy chaining the expansion enclosures between each other.

Two expansion ports on the Controller A are connected to the Ports 1 and 2 on the I/O Module A in the first expansion enclosure in the chain, and the Ports 3 and 4 on the I/O Module A in the first expansion enclosure are connected to the Ports 1 and 2 on the I/O Module A in the adjacent expansion enclosure, and so on.

Two expansion ports on the Controller B are connected to the Ports 1 and 2 on the I/O Module B in the last expansion enclosure in the chain, and the Ports 3 and 4 on the I/O Module B in the expansion enclosure are connected to the Ports 1 and 2 on the I/O Module B in the adjacent expansion enclosure, and so on.

The connectivity topology for the DE Series expansion enclosures is shown in the following figure.

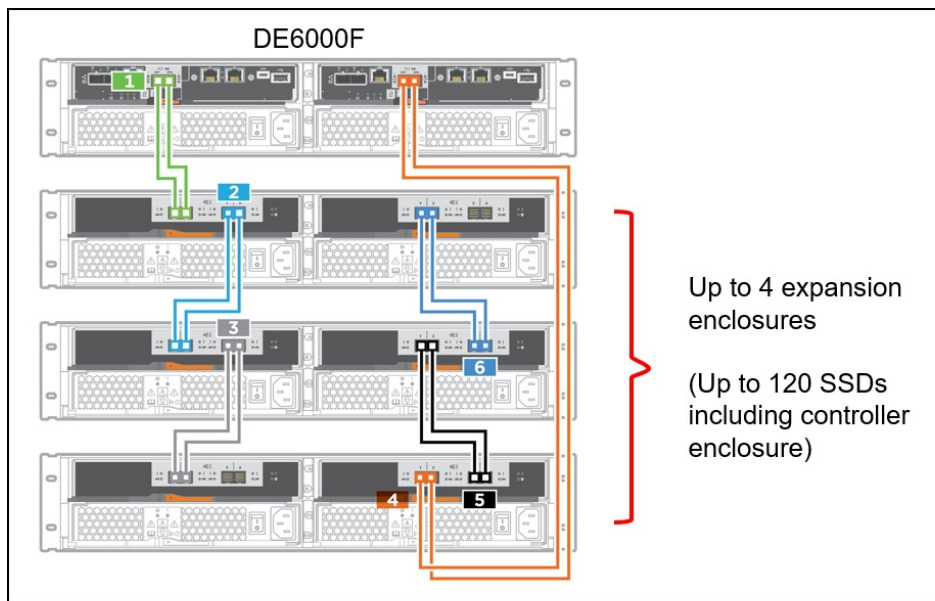


Figure 5. DE Series expansion enclosure connectivity topology

The following table lists ordering information for the supported expansion enclosure connectivity options.

Table 9. Expansion unit connectivity options

Description	Part number	Feature code	Quantity per one expansion enclosure
External MiniSAS HD 8644/MiniSAS HD 8644 0.5M Cable	00YL847	AU16	4
External MiniSAS HD 8644/MiniSAS HD 8644 1M Cable	00YL848	AU17	4
External MiniSAS HD 8644/MiniSAS HD 8644 2M Cable	00YL849	AU18	4
External MiniSAS HD 8644/MiniSAS HD 8644 3M Cable	00YL850	AU19	4

Configuration notes:

- The Relationship and TopSeller models of the ThinkSystem DE240S listed in this section ship with four 1 m SAS cables.
- Four SAS cables are needed per each expansion enclosure (two SAS cables per I/O Module) for connections to the controller enclosure and for daisy chaining of the expansion enclosures.

Drives

The ThinkSystem DE Series 2U24 SFF enclosures support up to 24 SFF hot-swap drives.

The following table lists supported drive options for the 2U24 SFF controller and expansion enclosures.

Table 10. 2U24 SFF drive options

Description	Part number	Feature code	Maximum quantity per 2U24 SFF enclosure
2.5-inch 12 Gbps SAS hot-swap SSDs (1 Drive Write per Day)			
Lenovo ThinkSystem DE Series 3.84TB 1DWD 2.5" SSD 2U24	4XB7A14173	B4RX	24
Lenovo ThinkSystem DE Series 7.68TB 1DWD 2.5" SSD 2U24	4XB7A14176	B4RY	24
Lenovo ThinkSystem DE Series 15.36TB 1DWD 2.5" SSD 2U24	4XB7A14110	B4CD	24
2.5-inch 12 Gbps SAS hot-swap SSDs (3 Drive Writes per Day)			
Lenovo ThinkSystem DE Series 800GB 3DWD 2.5" SSD 2U24	4XB7A14105	B4BT	24
Lenovo ThinkSystem DE Series 1.6TB 3DWD 2.5" SSD 2U24	4XB7A14106	B4BU	24
2.5-inch 12 Gbps SAS hot-swap FIPS SSDs (SED SSDs) (3 Drive Writes per Day)			
Lenovo ThinkSystem DE Series 1.6TB 3DWD 2.5" SSD FIPS 2U24	4XB7A14107	B4BV	24

The following table lists supported drive pack options for the 2U24 SFF controller and expansion enclosures.

Table 11. 2U24 SFF drive pack options

Description	Part number	Feature code	Maximum quantity per 2U24 SFF enclosure
2.5-inch 12 Gbps SAS hot-swap SSD packs (3 Drive Writes per Day)			
Lenovo ThinkSystem DE6000F 9.6TB Pack (12x 800GB SSDs)	4XB7A14158	B4D6	2
Lenovo ThinkSystem DE6000F 19.2TB SSD Pack (12x 1.6TB SSDs)	4XB7A14241	B4SB	2
2.5-inch 12 Gbps SAS hot-swap SSD packs (1 Drive Write per Day)			
Lenovo ThinkSystem DE6000F 46.08TB Pack (12x 3.84TB SSDs)	4XB7A14175	B4RZ	2
Lenovo ThinkSystem DE6000F 92.16TB Pack (12x 7.68TB SSDs)	4XB7A14239	B4S0	2
2.5-inch 12 Gbps SAS hot-swap FIPS SSD packs (SED SSD packs) (3 Drive Writes per Day)			
Lenovo ThinkSystem DE6000F 19.2TB FIPS Pack (12x 1.6TB FIPS SSDs)	4XB7A14160	B4D8	2

Configuration notes:

- Intermix of FIPS drives and non-FIPS drives is supported within the system.
- FIPS drives are not available in the following countries:
 - Belarus
 - Kazakhstan
 - People's Republic of China
 - Russia

Software

The following functions are included with every ThinkSystem DE6000F:

- **RAID levels 0, 1, 3, 5, 6, and 10** : Provide the flexibility to choose the level of performance and data protection required.
- **Dynamic Disk Pools (DDP) technology**: Helps improve performance and availability with significantly faster rebuild time and reduced exposure to multiple drive failures by allowing data and built-in spare capacity to be distributed across all physical drives in the storage pool.
- **All Flash Array (AFA) capability** : Meets the demand for higher speed storage and provide higher IOPS and bandwidth with lower power usage and total cost of ownership than hybrid or HDD-based solutions.
- **Thin provisioning**: Optimizes efficiency of Dynamic Disk Pools by allocating storage space based on the minimum space required by each application at any given time, so that applications consume only the space they are actually using, not the total space that has been allocated to them, which allows customers to purchase storage they need today and add more as application requirements grow.
- **Snapshots**: Enables creation of copies of data for backup, parallel processing, testing, and development, and have the copies available almost immediately (up to 2048 snapshot targets per system).
- **Encryption**: Provides encryption for data at rest for enhanced data security with the optional FIPS 140-2 Level 2 drives and embedded key management (AES-256) or an external key management server.
- **Automatic load balancing**: Provides automated I/O workload balancing of I/O traffic from the hosts across both controllers.
- **Data assurance**: Ensures industry-standard T10-PI end-to-end data integrity in the storage system (from the host ports to the drives).
- **Dynamic volume and capacity expansion**: Allows the capacity of a volume to be expanded by adding new physical drives or making use of unused space on existing drives.
- **Synchronous mirroring**: Provides storage system-based online, real-time data replication between the storage systems containing primary (local) and secondary (remote) volumes by using synchronous data transfers over Fibre Channel communication links (both storage systems must have licenses for synchronous mirroring).
- **Asynchronous mirroring**: Provides storage system-based data replication between the storage systems containing primary (local) and secondary (remote) volumes by using asynchronous data transfers over iSCSI or Fibre Channel communication links at set intervals (both storage systems must have licenses for asynchronous mirroring).

Note: The synchronous and asynchronous mirroring features of the ThinkSystem DE6000F interoperate with other ThinkSystem DE Series storage arrays.

Software maintenance is included in the ThinkSystem DE6000F base warranty and optional warranty extensions, which provides 3-year software support with the option to extend it up to 5 years in 1-year or 2-year increments (see [Warranty and support](#) for details).

Management

The ThinkSystem DE6000F supports the following management interfaces:

- Lenovo System Manager, a web-based interface via HTTPS for single-system management, that runs on the storage system itself and requires only a supported browser (Microsoft Internet Explorer, Google Chrome, or Mozilla Firefox), so there is no need for a separate console or plug-in.
- Lenovo SAN Manager, a host-installed GUI-based application, for centralized management of multiple storage systems.
- Command line interface (CLI) via SSH or through serial console.
- Syslog, SNMP, and e-mail notifications.
- Optional Lenovo XClarity for discovery, inventory, and monitoring.

Power supplies and cables

The ThinkSystem DE Series 2U24 SFF enclosures ship with two redundant hot-swap 913 W (100 - 240 V) Platinum AC power supplies, each with an IEC 320-C14 connector. The Relationship models of the ThinkSystem DE6000F 2U24 SFF and DE240S 2U24 SFF enclosures listed in [Controller enclosures](#) and [Expansion enclosures](#) ship with two 1.5 m, 10A/100-250V, C13 to IEC 320-C14 rack power cables.

The CTO models require the selection of two power cables.

The following table lists the rack power cable and line cord options that can be ordered for the DE Series 2U24 SFF enclosures (two power cords per enclosure).

Table 12. Power cables for DE Series 2U24 SFF enclosures

Description	Part number	Feature code
Rack power cables		
1.0m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable	00Y3043	A4VP
1.0m, 13A/100-250V, C13 to IEC 320-C14 Rack Power Cable	4L67A08367	B0N5
1.5m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable	39Y7937	6201
1.5m, 13A/100-250V, C13 to IEC 320-C14 Rack Power Cable	4L67A08368	B0N6
2.0m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable	4L67A08365	B0N4
2.0m, 13A/125V-10A/250V, C13 to IEC 320-C14 Rack Power Cable	4L67A08369	6570
2.8m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable	4L67A08366	6311
2.8m, 13A/125V-10A/250V, C13 to IEC 320-C14 Rack Power Cable	4L67A08370	6400
2.8m, 10A/100-250V, C13 to IEC 320-C20 Rack Power Cable	39Y7938	6204
4.3m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable	39Y7932	6263
4.3m, 13A/125V-10A/250V, C13 to IEC 320-C14 Rack Power Cable	4L67A08371	6583
Line cords		
Argentina 2.8m, 10A/250V, C13 to IRAM 2073 Line Cord	39Y7930	6222
Argentina 4.3m, 10A/250V, C13 to IRAM 2073 Line Cord	81Y2384	6492
Australia/New Zealand 2.8m, 10A/250V, C13 to AS/NZS 3112 Line Cord	39Y7924	6211
Australia/New Zealand 4.3m, 10A/250V, C13 to AS/NZS 3112 Line Cord	81Y2383	6574
Brazil 2.8m, 10A/250V, C13 to NBR 14136 Line Cord	69Y1988	6532
Brazil 4.3m, 10A/250V, C13 to NBR14136 Line Cord	81Y2387	6404
China 2.8m, 10A/250V, C13 to GB 2099.1 Line Cord	39Y7928	6210

Description	Part number	Feature code
China 4.3m, 10A/250V, C13 to GB 2099.1 Line Cord	81Y2378	6580
Denmark 2.8m, 10A/250V, C13 to DK2-5a Line Cord	39Y7918	6213
Denmark 4.3m, 10A/250V, C13 to DK2-5a Line Cord	81Y2382	6575
Europe 2.8m, 10A/250V, C13 to CEE7-VII Line Cord	39Y7917	6212
Europe 4.3m, 10A/250V, C13 to CEE7-VII Line Cord	81Y2376	6572
India 2.8m, 10A/250V, C13 to IS 6538 Line Cord	39Y7927	6269
India 4.3m, 10A/250V, C13 to IS 6538 Line Cord	81Y2386	6567
Israel 2.8m, 10A/250V, C13 to SI 32 Line Cord	39Y7920	6218
Israel 4.3m, 10A/250V, C13 to SI 32 Line Cord	81Y2381	6579
Italy 2.8m, 10A/250V, C13 to CEI 23-16 Line Cord	39Y7921	6217
Italy 4.3m, 10A/250V, C13 to CEI 23-16 Line Cord	81Y2380	6493
Japan 2.8m, 12A/125V, C13 to JIS C-8303 Line cord	46M2593	A1RE
Japan 2.8m, 12A/250V, C13 to JIS C-8303 Line Cord	4L67A08357	6533
Japan 4.3m, 12A/125V, C13 to JIS C-8303 Line Cord	39Y7926	6335
Japan 4.3m, 12A/250V, C13 to JIS C-8303 Line Cord	4L67A08362	6495
Korea 2.8m, 12A/250V, C13 to KS C8305 Line Cord	39Y7925	6219
Korea 4.3m, 12A/250V, C13 to KS C8305 Line Cord	81Y2385	6494
South Africa 2.8m, 10A/250V, C13 to SABS 164 Line Cord	39Y7922	6214
South Africa 4.3m, 10A/250V, C13 to SABS 164 Line Cord	81Y2379	6576
Switzerland 2.8m, 10A/250V, C13 to SEV 1011-S24507 Line Cord	39Y7919	6216
Switzerland 4.3m, 10A/250V, C13 to SEV 1011-S24507 Line Cord	81Y2390	6578
Taiwan 2.8m, 10A/125V, C13 to CNS 10917-3 Line Cord	23R7158	6386
Taiwan 2.8m, 10A/250V, C13 to CNS 10917-3 Line Cord	81Y2375	6317
Taiwan 2.8m, 15A/125V, C13 to CNS 10917-3 Line Cord	81Y2374	6402
Taiwan 4.3m, 10A/125V, C13 to CNS 10917-3 Line Cord	4L67A08363	AX8B
Taiwan 4.3m, 10A/250V, C13 to CNS 10917-3 Line Cord	81Y2389	6531
Taiwan 4.3m, 15A/125V, C13 to CNS 10917-3 Line Cord	81Y2388	6530
United Kingdom 2.8m, 10A/250V, C13 to BS 1363/A Line Cord	39Y7923	6215
United Kingdom 4.3m, 10A/250V, C13 to BS 1363/A Line Cord	81Y2377	6577
United States 2.8m, 10A/125V, C13 to NEMA 5-15P Line Cord	90Y3016	6313
United States 2.8m, 10A/250V, C13 to NEMA 6-15P Line Cord	46M2592	A1RF
United States 2.8m, 13A/125V, C13 to NEMA 5-15P Line Cord	00WH545	6401
United States 4.3m, 10A/125V, C13 to NEMA 5-15P Line Cord	4L67A08359	6370
United States 4.3m, 10A/250V, C13 to NEMA 6-15P Line Cord	4L67A08361	6373
United States 4.3m, 13A/125V, C13 to NEMA 5-15P Line Cord	4L67A08360	AX8A

Rack installation

The individually shipped ThinkSystem DE Series 2U24 enclosures ship with the ThinkSystem Storage Rack Mount Kit 2U24/4U60 listed in the following table.

Table 13. 4-post rack mount kit

Description	Feature code	Quantity
Lenovo ThinkSystem Storage Rack Mount Kit 2U24/4U60	B38Y	1

When the ThinkSystem DE Series enclosures are factory-integrated and shipped installed in a rack cabinet, the rack mount kits that support Ship-in-Rack (SIR) capabilities are derived by the configurator. The SIR-capable rack mount kits are listed in the following table.

Table 14. 4-post SIR rack mount kits

Description	Feature code	Quantity
Lenovo ThinkSystem Storage SIR Rack Mount Kit (for 2U24 enclosures)	B6TH	1

The following table summarizes the rack mount kit features and specifications.

Table 15. Rack mount kit features and specifications summary

Attribute	Screw-in fixed rail with adjustable depth	
	2U24/4U60	2U24 SIR
Feature code	B38Y	B6TH
Enclosure support	DE6000F DE240S	DE6000F DE240S
Rail type	Fixed (static) with adjustable depth	Fixed (static) with adjustable depth
Tool-less installation	No	No
In-rack maintenance	Yes*	Yes*
Ship-in-rack (SIR) support	No	Yes
1U PDU support	Yes	Yes
0U PDU support	Limited**	Limited**
Rack type	IBM or Lenovo 4-post, IEC standard-compliant	IBM or Lenovo 4-post, IEC standard-compliant
Mounting holes	Square or round	Square or round
Mounting flange thickness	2 mm (0.08 in.) – 3.3 mm (0.13 in.)	2 mm (0.08 in.) – 3.3 mm (0.13 in.)
Distance between front and rear mounting flanges [^]	605 mm (23.8 in.) – 812.8 mm (32 in.)	605 mm (23.8 in.) – 812.8 mm (32 in.)

* The majority of the enclosure components can be serviced from the front or rear of the enclosure, which does not require the removal of the enclosure from the rack cabinet.

** If a 0U PDU is used, the rack cabinet must be at least 1000 mm (39.37 in.) deep for 2U24 enclosures.

[^] Measured when mounted on the rack, from the front surface of the front mounting flange to the rear most point of the rail.

Physical specifications

The ThinkSystem DE Series 2U24 SFF enclosures have the following dimensions and weight (approximate):

- Height: 85 mm (3.4 in.)
- Width: 449 mm (17.7 in.)
- Depth: 553 mm (21.8 in.)
- Weight (fully configured): 27.6 kg (60.8 lb)

Operating environment

The ThinkSystem DE Series 2U24 SFF enclosures are supported in the following environment:

- Air temperature:
 - Operating: 5 °C - 45 °C (41 °F - 113 °F)
 - Non-operating: -10 °C - +50 °C (14 °F - 122 °F)
 - Maximum altitude: 3050 m (10,000 ft)
- Relative humidity:
 - Operating: 8% - 90% (non-condensing)
 - Non-operating: 10% - 90% (non-condensing)
- Electrical power:
 - 100 to 127 V AC (nominal); 50 Hz / 60 Hz
 - 200 to 240 V AC (nominal); 50 Hz / 60 Hz
- Heat dissipation:
 - DE6000F 2U24 SFF: 1396 BTU/hour
 - DE240S 2U24 SFF: 1331 BTU/hour
- Acoustical noise emission:
 - DE6000F 2U24 SFF: 7.2 bels
 - DE240S 2U24 SFF: 6.6 bels

The following table lists the maximum enclosure power load, inlet current, and heat output based on the source voltage.

Table 16. Enclosure power load, inlet current, and heat output

Enclosure	Source voltage (nominal)	Maximum power load	Current per inlet	Heat output
DE6000F 2U24 SFF	100 - 127 V AC	738 W	7.77 A	2276 BTU/hour
	200 - 240 V AC	702 W	3.7 A	1973 BTU/hour
DE240S 2U24 SFF	100 - 127 V AC	389 W	4.1 A	1328 BTU/hour
	200 - 240 V AC	382 W	2.02 A	1304 BTU/hour

Warranty and support

The ThinkSystem DE Series enclosures have a three-year customer-replaceable unit (CRU) and onsite limited (for field-replaceable units [FRUs] only) warranty with standard call center support during normal business hours and 9x5 Next Business Day Parts Delivered.

Lenovo's additional support services provide a sophisticated, unified support structure for a customer's data center, with an experience consistently ranked number one in customer satisfaction worldwide.

The following Lenovo support services are available:

- **Premier Support** provides a Lenovo-owned customer experience and delivers direct access to technicians skilled in hardware, software, and advanced troubleshooting, in addition to the following capabilities:
 - Direct technician-to-technician access through a dedicated phone line.
 - 24x7x365 remote support.
 - Single point of contact service.
 - End to end case management.
 - 3rd Party collaborative software support.
 - Online case tools and live chat support.
 - On-demand remote system analysis.
- **Warranty Upgrades (Preconfigured Support)** are available to meet the on-site response time targets that match the criticality of customer's systems:
 - 3, 4, or 5 years of service coverage.
 - 1-year or 2-year post-warranty extensions.
 - **Foundation Service:** 9x5 service coverage with next business day onsite response, with optional YourDrive YourData.
 - **Essential Service:** 24x7 service coverage with 4-hour onsite response or 24-hour committed repair (available only in select regions), with optional YourDrive YourData.
 - **Advanced Service:** 24x7 service coverage with 2-hour onsite response or 6-hour committed repair (available only in select regions), with optional YourDrive YourData.
- **Managed Services**

Lenovo Managed Services provide continuous 24x7 remote monitoring (plus 24x7 call center availability) and proactive management of a customer's data center using state of the art tools, systems, and practices by a team of highly skilled and experienced Lenovo services professionals.

Quarterly reviews check error logs, verify firmware and operating system device driver levels, and software as needed. Lenovo will also maintain records of latest patches, critical updates, and firmware levels, to ensure customer's systems are providing business value through optimized performance.
- **Technical Account Management (TAM)**

A Lenovo Technical Account Manager helps customers optimize operations of their data centers based on a deep understanding of customer's business. Customers gain direct access to a Lenovo TAM, who serves as their single point of contact to expedite service requests, provide status updates, and furnish reports to track incidents over time. Also, a TAM helps proactively make service recommendations and manage service relationship with Lenovo to make certain that customer's needs are met.
- **YourDrive YourData**

Lenovo's YourDrive YourData service is a multi-drive retention offering that ensures that customer's data is always under their control, regardless of the number of drives that are installed in their Lenovo system. In the unlikely event of a drive failure, customers retain possession of their drive while Lenovo replaces the failed drive part. Customer's data stays safely on customer premises, in their hands. The YourDrive YourData service can be purchased in convenient bundles with Foundation, Essential, or Advanced Service upgrades and extensions.

- **Health Check**

Having a trusted partner who can perform regular and detailed health checks is central to maintaining efficiency and ensuring that customer systems and business are always running at their best. Health Check supports Lenovo-branded server, storage, and networking devices, as well as select Lenovo-supported products from other vendors that are sold by Lenovo or a Lenovo-Authorized Reseller.

Some regions might have different warranty terms and conditions than the standard warranty. This is due to local business practices or laws in the specific region. Local service teams can assist in explaining region-specific terms when needed. Examples of region-specific warranty terms are second or longer business day parts delivery or parts-only base warranty.

If warranty terms and conditions include onsite labor for repair or replacement of parts, Lenovo will dispatch a service technician to the customer site to perform the replacement. Onsite labor under base warranty is limited to labor for replacement of parts that have been determined to be field-replaceable units (FRUs). Parts that are determined to be customer-replaceable units (CRUs) do not include onsite labor under base warranty.

If warranty terms include parts-only base warranty, Lenovo is responsible for delivering only replacement parts that are under base warranty (including FRUs) that will be sent to a requested location for self-service. Parts-only service does not include a service technician being dispatched onsite. Parts must be changed at customer's own cost and labor and defective parts must be returned following the instructions supplied with the spare parts.

Lenovo support services are region-specific. Not all support services are available in every region. For information about Lenovo support services that are available in a specific region, refer to the following resources:

- Service part numbers in Data Center Solution Configurator (DCSC):
<http://dcsc.lenovo.com/#/services>
- Lenovo Services Availability Locator
<https://lenovolocator.com/>

For service definitions, region-specific details, and service limitations, refer to the following documents:

- Lenovo Statement of Limited Warranty for Data Center Group (DCG) Servers and System Storage
<http://pcsupport.lenovo.com/us/en/solutions/ht503310>
- Lenovo Data Center Services Agreement
<http://support.lenovo.com/us/en/solutions/ht116628>

Services

Lenovo Services is a dedicated partner to your success. Our goal is to reduce your capital outlays, mitigate your IT risks, and accelerate your time to productivity.

Note: Some service options may not be available in all countries. For more information, go to <https://www.lenovo.com/systems/services>. For information about Lenovo service upgrade offerings that are available in your region, contact your local Lenovo sales representative or business partner.

Here's a more in-depth look at what we can do for you:

- **Asset Recovery Services**

Asset Recovery Services (ARS) helps customers recover the maximum value from their end-of-life equipment in a cost-effective and secure way. On top of simplifying the transition from old to new equipment, ARS mitigates environmental and data security risks associated with data center equipment disposal. Lenovo ARS is a cash-back solution for equipment based on its remaining market value, yielding maximum value from aging assets and lowering total cost of ownership for your customers. For more information, see the ARS page, <https://lenovopress.com/lp1266-reduce-e-waste-and-grow-your-bottom-line-with-lenovo-ars>.

- **Assessment Services**

An Assessment helps solve your IT challenges through an onsite, multi-day session with a Lenovo technology expert. We perform a tools-based assessment which provides a comprehensive and thorough review of a company's environment and technology systems. In addition to the technology based functional requirements, the consultant also discusses and records the non-functional business requirements, challenges, and constraints. Assessments help organizations like yours, no matter how large or small, get a better return on your IT investment and overcome challenges in the ever-changing technology landscape.

- **Design Services**

Professional Services consultants perform infrastructure design and implementation planning to support your strategy. The high-level architectures provided by the assessment service are turned into low level designs and wiring diagrams, which are reviewed and approved prior to implementation. The implementation plan will demonstrate an outcome-based proposal to provide business capabilities through infrastructure with a risk-mitigated project plan.

- **Basic Hardware Installation**

Lenovo experts can seamlessly manage the physical installation of your server, storage, or networking hardware. Working at a time convenient for you (business hours or off shift), the technician will unpack and inspect the systems on your site, install options, mount in a rack cabinet, connect to power and network, check and update firmware to the latest levels, verify operation, and dispose of the packaging, allowing your team to focus on other priorities.

- **Deployment Services**

When investing in new IT infrastructures, you need to ensure your business will see quick time to value with little to no disruption. Lenovo deployments are designed by development and engineering teams who know our Products & Solutions better than anyone else, and our technicians own the process from delivery to completion. Lenovo will conduct remote preparation and planning, configure & integrate systems, validate systems, verify and update appliance firmware, train on administrative tasks, and provide post-deployment documentation. Customer's IT teams leverage our skills to enable IT staff to transform with higher level roles and tasks.

- **Integration, Migration, and Expansion Services**

Move existing physical & virtual workloads easily, or determine technical requirements to support increased workloads while maximizing performance. Includes tuning, validation, and documenting ongoing run processes. Leverage migration assessment planning documents to perform necessary migrations.

Regulatory compliance

The ThinkSystem DE Series enclosures conform to the following regulations:

- United States: FCC Part 15, Class A; UL 60950-1 and 62368-1
- Canada: ICES-003, Class A; CAN/CSA-C22.2 60950-1 and 62368-1
- Argentina: IEC60950-1
- Mexico NOM
- European Union: CE Mark (EN55032 Class A, EN55024, IEC/EN60950-1 and 62368-1); ROHS Directive 2011/65/EU
- Russia, Kazakhstan, Belarus: EAC
- China: CCC GB 4943.1, GB 17625.1, GB 9254 Class A; CELP; CECP
- India: BIS
- Japan: VCCI, Class A
- Taiwan: BSMI CNS 13438, Class A; CNS 14336-1
- Korea KN32/35, Class A
- Australia/New Zealand: AS/NZS CISPR 22 Class A

Interoperability

Lenovo provides end-to-end storage compatibility testing to deliver interoperability throughout the network. The ThinkSystem DE6000F All Flash Storage Array supports attachment to Lenovo ThinkSystem, System x, and Flex System hosts by using SAS, iSCSI, Fibre Channel, NVMe over Fibre Channel (NVMe/FC), or NVMe over RoCE (RDMA over Converged Ethernet) (NVMe/RoCE) storage connectivity protocols.

The following sections list adapters and Ethernet LAN and FC SAN switches that are currently offered by Lenovo that can be used with the ThinkSystem DE6000F All Flash Storage Array in IT solutions:

- [Adapters](#)
- [Ethernet LAN switches](#)
- [Fibre Channel SAN switches](#)

Note: Tables that are provided in these sections are for ordering reference purposes only.

For end-to-end storage configuration support, refer to the Lenovo Storage Interoperation Center (LSIC): <https://datacentersupport.lenovo.com/us/en/lxic>

Use the LSIC to select the known components of your configuration and then get a list all other supported combinations, with details about supported hardware, firmware, operating systems, and drivers, plus any additional configuration notes. View results on screen or export them to Excel.

Adapters

This section lists the adapters for the following types of storage connectivity:

- [SAS connectivity](#)
- [iSCSI connectivity](#)
- [Fibre Channel and NVMe/FC connectivity](#)
- [NVMe/RoCE connectivity](#)

SAS connectivity

The following table lists currently available SAS adapters for Lenovo servers that are compatible with the ThinkSystem DE6000F SAS storage (direct attach). Other SAS HBAs also might be supported (see the Interoperability Matrix for details).

Table 17. SAS adapters

Description	Part number
ThinkSystem SAS HBAs	
ThinkSystem 430-8e SAS/SATA 12Gb HBA	7Y37A01090
ThinkSystem 430-16e SAS/SATA 12Gb HBA	7Y37A01091
System x SAS HBAs	
N2225 SAS/SATA HBA (12Gb)	00AE912
N2226 SAS/SATA HBA (12Gb)	00AE916

iSCSI connectivity

The ThinkSystem DE6000F supports iSCSI attachments via standard 10 Gb or 25 Gb Ethernet connections (direct attach or switch-based). Any compatible Ethernet switch, including Lenovo ThinkSystem and RackSwitch Ethernet switches and embedded Flex System Ethernet I/O modules, can be used to provide iSCSI connectivity for the ThinkSystem DE6000F storage.

With software iSCSI initiators, any supported 10 Gb or 25 Gb Ethernet adapter for Lenovo servers is compatible with the ThinkSystem DE6000F iSCSI storage.

Fibre Channel and NVMe/FC connectivity

The ThinkSystem DE6000F supports direct FC attachments and FC switch-based attachments for Fibre Channel and NVMe over Fibre Channel connectivity. Lenovo B Series and DB Series FC SAN switches and directors can be used to provide FC and NVMe/FC connectivity.

Currently available FC adapters for Lenovo servers that are compatible with the ThinkSystem DE6000F storage are listed in the following table. Other FC HBAs also might be supported (see the Interoperability Matrix for details).

Table 18. Fibre Channel adapters

Description	Part number
ThinkSystem HBAs: 32 Gb FC, NVMe/FC	
ThinkSystem Emulex LPe35000 32Gb 1-port PCIe Fibre Channel Adapter	4XC7A08250
ThinkSystem Emulex LPe35002 32Gb 2-port PCIe Fibre Channel Adapter	4XC7A08251
ThinkSystem Emulex LPe32000-M6-LP PCIe 32Gb 1-Port SFP+ Fibre Channel Adapter	7ZT7A00517
ThinkSystem Emulex LPe32002-M6-LP PCIe 32Gb 2-Port SFP+ Fibre Channel Adapter	7ZT7A00519

Description	Part number
ThinkSystem HBAs: 32 Gb FC	
ThinkSystem QLogic QLE2740 PCIe 32Gb 1-Port SFP+ Fibre Channel Adapter	7ZT7A00516
ThinkSystem QLogic QLE2742 PCIe 32Gb 2-Port SFP+ Fibre Channel Adapter	7ZT7A00518
System x HBAs: 16 Gb FC	
Emulex 16Gb Gen6 FC Single-port HBA (LPe31000)	01CV830
Emulex 16Gb Gen6 FC Dual-port HBA (LPe31002)	01CV840
Emulex 16Gb FC Single-port HBA (LPe16000)	81Y1655
Emulex 16Gb FC Dual-port HBA (LPe16002)	81Y1662
QLogic 16Gb Enhanced Gen5 FC Single-port HBA (QLE2690)	01CV750
QLogic 16Gb Enhanced Gen5 FC Dual-port HBA (QLE2692)	01CV760
QLogic 16Gb FC Single-port HBA (QLE2660)	00Y3337
QLogic 16Gb FC Dual-port HBA (QLE2662)	00Y3341
Flex System HBAs: 16 Gb FC	
ThinkSystem Emulex LPm16002B-L Mezz 16Gb 2-Port Fibre Channel Adapter	7ZT7A00521
ThinkSystem Emulex LPm16004B-L Mezz 16Gb 4-Port Fibre Channel Adapter	7ZT7A00522
ThinkSystem QLogic QML2692 Mezz 16Gb 2-Port Fibre Channel Adapter	7ZT7A00520

NVMe/RoCE connectivity

The ThinkSystem DE6000F supports direct and Ethernet switch-based attachments for NVMe over RoCE connectivity.

Currently available RoCE network adapters for Lenovo servers that are compatible with the ThinkSystem DE6000F are listed in the following table. Other RoCE network adapters also might be supported (see the Interoperability Matrix for details).

Table 19. RoCE network adapters

Description	Part number
NVMe/RoCE connectivity - 25 Gb Ethernet	
Mellanox ConnectX-6 Lx 10/25GbE SFP28 2-port PCIe Ethernet Adapter	4XC7A62580
Mellanox ConnectX-4 Lx 10/25GbE SFP28 1-port ML2 Ethernet Adapter	00MN990
Mellanox ConnectX-4 Lx 10/25GbE SFP28 2-port ML2 Ethernet Adapter	7ZT7A00507
Mellanox ConnectX-4 Lx 10/25GbE SFP28 2-Port PCIe Ethernet Adapter	01GR250
NVMe/RoCE connectivity - 40 Gb Ethernet	
Mellanox ConnectX-4 Lx 1x40GbE QSFP+ Adapter	00MM950
Mellanox ConnectX-4 PCIe FDR 1-Port QSFP VPI Adapter	7XC7A05524
Mellanox ConnectX-4 PCIe FDR 2-Port QSFP VPI Adapter	7ZT7A00500
NVMe/RoCE connectivity - HDR100 InfiniBand /100 Gb Ethernet	
Mellanox ConnectX-6 HDR100/100GbE QSFP56 1-port PCIe VPI Adapter	4C57A14177
Mellanox ConnectX-6 HDR100/100GbE QSFP56 2-port PCIe VPI Adapter	4C57A14178
Mellanox ConnectX-4 1x100GbE/EDR IB QSFP28 VPI Adapter	00KH924
Mellanox ConnectX-4 2x100GbE/EDR IB QSFP28 VPI Adapter	00MM960
NVMe/RoCE connectivity - HDR InfiniBand /200 Gb Ethernet	
Mellanox ConnectX-6 HDR QSFP56 1-port PCIe 4 InfiniBand Adapter	4C57A15326

Ethernet LAN switches

The following table lists currently available embedded Ethernet switches and pass-thru modules for Flex System that can be used with the ThinkSystem DE6000F All Flash Storage Array in IT solutions.

Table 21. Embedded Ethernet switches for Flex System

Description	Part number
10 Gb Ethernet (iSCSI connectivity)	
Lenovo Flex System Fabric EN4093R 10Gb Scalable Switch	00FM514
Lenovo Flex System SI4091 10Gb System Interconnect Module	00FE327
Lenovo Flex System Fabric SI4093 System Interconnect Module	00FM518
25 Gb Ethernet (iSCSI connectivity)	
Lenovo ThinkSystem NE2552E Flex Switch	4SG7A08868
Pass-thru modules (require a compatible external switch)	
Lenovo Flex System EN4091 10Gb Ethernet Pass-thru	88Y6043

For more information, see the list of Product Guides in the Blade Network Modules category:
<http://lenovopress.com/servers/blades/networkmodule#rt=product-guide>

Fibre Channel SAN switches

Lenovo offers the ThinkSystem DB Series of Fibre Channel SAN switches and directors for high-performance storage expansion. See the DB Series product guides for models and configuration options:

- ThinkSystem DB Series SAN Switches and Directors:
<https://lenovopress.com/storage/switches/rack#rt=product-guide>

Rack cabinets

The following table lists the supported rack cabinets.

Table 22. Rack cabinets

Part number	Description
93072RX	25U Standard Rack
93072PX	25U Static S2 Standard Rack
93634PX	42U 1100mm Dynamic Rack
93634EX	42U 1100mm Dynamic Expansion Rack
93604PX	42U 1200mm Deep Dynamic Rack
93614PX	42U 1200mm Deep Static Rack
93084EX	42U Enterprise Expansion Rack
93084PX	42U Enterprise Rack
93074RX	42U Standard Rack

For specifications about these racks, see the Lenovo Rack Cabinet Reference, available from:
<https://lenovopress.com/lp1287-lenovo-rack-cabinet-reference>

For more information, see the list of Product Guides in the Rack cabinets category:
<https://lenovopress.com/servers/options/racks>

Power distribution units

The following table lists the power distribution units (PDUs) that are offered by Lenovo.

Table 23. Power distribution units

Part number	Description
0U Basic PDUs	
00YJ776	0U 36 C13/6 C19 24A/200-240V 1 Phase PDU with NEMA L6-30P line cord
00YJ777	0U 36 C13/6 C19 32A/200-240V 1 Phase PDU with IEC60309 332P6 line cord
00YJ778	0U 21 C13/12 C19 32A/200-240V/346-415V 3 Phase PDU with IEC60309 532P6 line cord
00YJ779	0U 21 C13/12 C19 48A/200-240V 3 Phase PDU with IEC60309 460P9 line cord
Switched and Monitored PDUs	
00YJ780	0U 20 C13/4 C19 Switched and Monitored 32A/200-240V/1Ph PDU w/ IEC60309 332P6 line cord
00YJ781	0U 20 C13/4 C19 Switched and Monitored 24A/200-240V/1Ph PDU w/ NEMA L6-30P line cord
00YJ782	0U 18 C13/6 C19 Switched / Monitored 32A/200-240V/346-415V/3Ph PDU w/ IEC60309 532P6 cord
00YJ783	0U 12 C13/12 C19 Switched and Monitored 48A/200-240V/3Ph PDU w/ IEC60309 460P9 line cord
46M4003	1U 9 C19/3 C13 Switched and Monitored 60A 3 Phase PDU with IEC 309 3P+Gnd line cord
46M4004	1U 12 C13 Switched and Monitored DPI PDU (without line cord)
46M4005	1U 12 C13 Switched and Monitored 60A 3 Phase PDU with IEC 309 3P+Gnd line cord
Ultra Density Enterprise PDUs (9x IEC 320 C13 + 3x IEC 320 C19 outlets)	
71762NX	Ultra Density Enterprise C19/C13 PDU Module (without line cord)
71763NU	Ultra Density Enterprise C19/C13 PDU 60A/208V/3ph with IEC 309 3P+Gnd line cord
C13 Enterprise PDUs (12x IEC 320 C13 outlets)	
39M2816	DPI C13 Enterprise PDU+ (without line cord)
39Y8941	DPI Single Phase C13 Enterprise PDU (without line cord)
C19 Enterprise PDUs (6x IEC 320 C19 outlets)	
39Y8948	DPI Single Phase C19 Enterprise PDU (without line cord)
39Y8923	DPI 60A 3 Phase C19 Enterprise PDU with IEC 309 3P+G (208 V) fixed line cord
Front-end PDUs (3x IEC 320 C19 outlets)	
39Y8938	DPI 30amp/125V Front-end PDU with NEMA L5-30P line cord
39Y8939	DPI 30amp/250V Front-end PDU with NEMA L6-30P line cord
39Y8934	DPI 32amp/250V Front-end PDU with IEC 309 2P+Gnd line cord
39Y8940	DPI 60amp/250V Front-end PDU with IEC 309 2P+Gnd line cord
39Y8935	DPI 63amp/250V Front-end PDU with IEC 309 2P+Gnd line cord
NEMA PDUs (6x NEMA 5-15R outlets)	
39Y8905	DPI 100-127V PDU with Fixed NEMA L5-15P line cord
Line cords for PDUs that ship without a line cord	
40K9611	DPI 32a Line Cord (IEC 309 3P+N+G)
40K9612	DPI 32a Line Cord (IEC 309 P+N+G)
40K9613	DPI 63a Cord (IEC 309 P+N+G)
40K9614	DPI 30a Line Cord (NEMA L6-30P)
40K9615	DPI 60a Cord (IEC 309 2P+G)

Part number	Description
40K9617	DPI Australian/NZ 3112 Line Cord
40K9618	DPI Korean 8305 Line Cord

For more information, see the Lenovo Press documents in the PDU category:

<https://lenovopress.com/servers/options/pdu>

Uninterruptible power supply units

The following table lists the uninterruptible power supply (UPS) units that are offered by Lenovo.

Table 24. Uninterruptible power supply units

Part number	Description
55941AX	RT1.5kVA 2U Rack or Tower UPS (100-125VAC)
55941KX	RT1.5kVA 2U Rack or Tower UPS (200-240VAC)
55942AX	RT2.2kVA 2U Rack or Tower UPS (100-125VAC)
55942KX	RT2.2kVA 2U Rack or Tower UPS (200-240VAC)
55943AX	RT3kVA 2U Rack or Tower UPS (100-125VAC)
55943KX	RT3kVA 2U Rack or Tower UPS (200-240VAC)
55945KX	RT5kVA 3U Rack or Tower UPS (200-240VAC)
55946KX	RT6kVA 3U Rack or Tower UPS (200-240VAC)
55948KX	RT8kVA 6U Rack or Tower UPS (200-240VAC)
55949KX	RT11kVA 6U Rack or Tower UPS (200-240VAC)
55948PX	RT8kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)
55949PX	RT11kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC)
55943KT†	ThinkSystem RT3kVA 2U Standard UPS (200-230VAC) (2x C13 10A, 2x GB 10A, 1x C19 16A outlets)
55943LT†	ThinkSystem RT3kVA 2U Long Backup UPS (200-230VAC) (2x C13 10A, 2x GB 10A, 1x C19 16A outlets)
55946KT†	ThinkSystem RT6kVA 5U UPS (200-230VAC) (2x C13 10A outlets, 1x Terminal Block output)
5594XKT†	ThinkSystem RT10kVA 5U UPS (200-230VAC) (2x C13 10A outlets, 1x Terminal Block output)

† Only available in China and countries in the Asia Pacific region.

For more information, see the list of Product Guides in the UPS category:

<https://lenovopress.com/servers/options/ups>

Lenovo Financial Services

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<https://www.lenovo.com/us/en/landingpage/lenovo-financial-services/>

Related publications and links

For more information, see the following resources:

- Lenovo SAN Storage product page
<http://www.lenovo.com/us/en/c/storage-area-network>
- ThinkSystem DE Series product page
<https://www.lenovo.com/us/en/data-center/storage/storage-area-network/c/thinksystem-de-series>
- ThinkSystem DE All Flash Array interactive 3D Tour
<https://lenovopress.com/lp0956-thinksystem-de-all-flash-interactive-3d-tour>
- ThinkSystem DE All-Flash Array datasheet
<https://lenovopress.com/ds0051-lenovo-thinksystem-de-series-all-flash-array>
- Lenovo Data Center Solution Configurator
<http://dcsc.lenovo.com>
- Lenovo Data Center Support
<http://datacentersupport.lenovo.com>

Related product families

Product families related to this document are the following:

- [Lenovo Storage](#)
- [DE Series Storage](#)
- [External Storage](#)

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