Lenovo ThinkSystem DM5000F Unified and DM5000F SAN Flash Storage Array

Product Guide

Lenovo ThinkSystem DM5000F is an all-flash storage system, available as either unified or SAN, that is designed to provide performance, simplicity, capacity, security, and high availability for medium enterprises. Powered by the ONTAP software, ThinkSystem DM5000F delivers enterprise-class storage management capabilities with a wide choice of host connectivity options and enhanced data management features. The ThinkSystem DM5000F is a perfect fit for a wide range of enterprise workloads, including big data and analytics, artificial intelligence, engineering and design, enterprise applications, and other storage I/O-intensive applications.

ThinkSystem DM5000F models are 2U rack-mount controller enclosures that include two controllers, 64 GB RAM and 8 GB battery-backed NVRAM (32 GB RAM and 4 GB NVRAM per controller), and 24 SFF hot-swap drive bays (2U24 form factor). Controllers provide universal 1/10 GbE NAS/iSCSI or 8/16 Gb Fibre Channel (FC) ports, or 1/10 GbE RJ-45 ports for host connectivity.

A single ThinkSystem DM5000F Storage Array scales up to 144 solid-state drives (SSDs) with the attachment of Lenovo ThinkSystem DM240S 2U24 SFF Expansion Enclosures.

Figure 1. Lenovo ThinkSystem DM5000F

Up to 12 DM5000F Storage Arrays can be combined into a clustered system in a NAS environment, or up to 6 DM5000F Storage Arrays can be combined into a clustered system in a SAN environment.

Did you know?

A single ThinkSystem DM5000F scales up to 2.2 PB of raw storage capacity. A cluster of the DM5000F storage systems scales up to 26.5 PB for NAS or up to 13.2 PB for SAN environments.

The ThinkSystem DM5000F offers unified file and block storage connectivity with support for 1 GbE or 10 GbE NAS and iSCSI, and 8 Gb or 16 Gb Fibre Channel protocols at the same time.

Key features

The ThinkSystem DM5000F offers the following key features and benefits:

- Available as a Unified storage platform - allowing NAS, SAN, and Object workloads or as a SAN storage platform that serving only SAN workloads.
- Both platform options, Unified and SAN are available with either the Fundamentals or Premium software feature offerings which provide feature flexibility.
- All-flash array capabilities 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.
- All-flash storage with dual active/active controller configurations for high availability and performance.
- Improved performance and data protection with RAID-DP and RAID-TEC, as well as support for traditional RAID 4.
- Flexible host connectivity to match diverse client needs with support for unified NAS and SAN storage protocols, including 1/10 GbE NAS and iSCSI, and 8/16 Gb Fibre Channel connectivity.
- 12 Gb SAS drive-side connectivity with multipathing with up to 24x 2.5-inch small form factor (SFF) drives in the 2U24 SFF enclosures.
- Scalability to up to 144 SFF drives with the attachment of the ThinkSystem DM240S 2U24 SFF expansion enclosures to satisfy growing needs for storage capacity and performance.
- A rich set of storage management functions available, including snapshots, volume copy, quality of service, thin provisioning, compression, deduplication, encryption, disk-based backup, application- and virtual machine-aware backup, quick data recovery, clustering, synchronous replication, and asynchronous replication.
- Optional licensed functions, including WORM (write once, read many) data protection (SnapLock) and object storage tiering (FabricPool).
- Scale-out clustering of up to 12 ThinkSystem DM Series storage systems for NAS connectivity or up to six DM Series storage systems for SAN connectivity.
- Intuitive, web-based GUI for easy system setup and management.
- Lenovo XClarity support for centralized systems management of Lenovo x86 servers, switches, and storage, which provides automated agent-less discovery, inventory, monitoring, and additional platform-specific functions across multiple systems.
- Designed for 99.9999% availability with redundant hot-swap components, including controllers and I/O modules, power supplies, and non-disruptive firmware upgrades.
- Certified Enterprise Storage for SAP HANA Tailored Data center Integration (TDI).
- Certified storage for Oracle VM.
- Certified storage for Citrix XenServer: http://hcl.xenserver.org/storage/910/Lenovo_DM_Series.

The ThinkSystem DM5000F supports the 2.5-inch 960 GB, 3.84 TB, 7.68 TB, and 15.36 TB capacity-optimized SAS SSDs. All drives are dual-port and hot-swappable.

The ThinkSystem DM5000F supports attachment of up to five ThinkSystem DM240S 2U24 SFF expansion enclosures. 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 DM5000F offers high levels of system and data availability with the following features:

- Dual-active controllers (high availability pair) with automatic load balancing and failover
- Mirrored, battery-backed controller NVRAM
- Dual-port SAS SSDs with automatic drive failure detection and rebuild
- Redundant, hot-swappable and customer replaceable hardware components, including SFP+ transceivers, controllers, I/O modules, power supplies, and drives

- Automated failover for the data path between the host and the drives with multipathing
- Non-disruptive controller and drive firmware upgrades
- Scale-out clustering

Components and connectors

The following figure shows the front of the ThinkSystem DM5000F or DM240S 2U SFF enclosure.

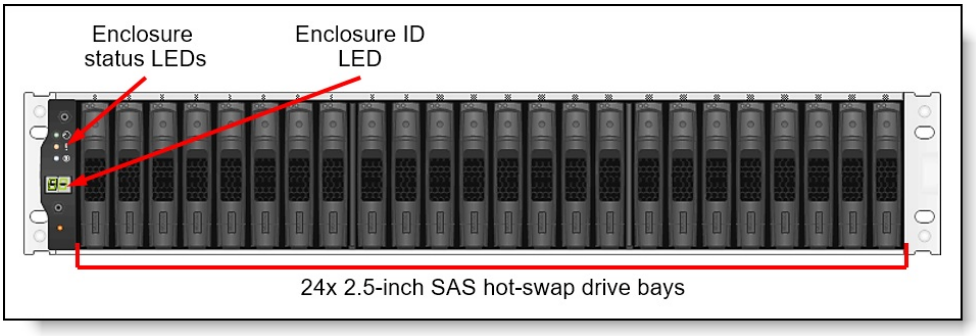

Figure 2. ThinkSystem DM5000F or DM240S enclosure front view

The front of the ThinkSystem DM5000F or DM240S 2U SFF enclosure 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 DM5000F 2U controller enclosure with universal SFP+ host ports.

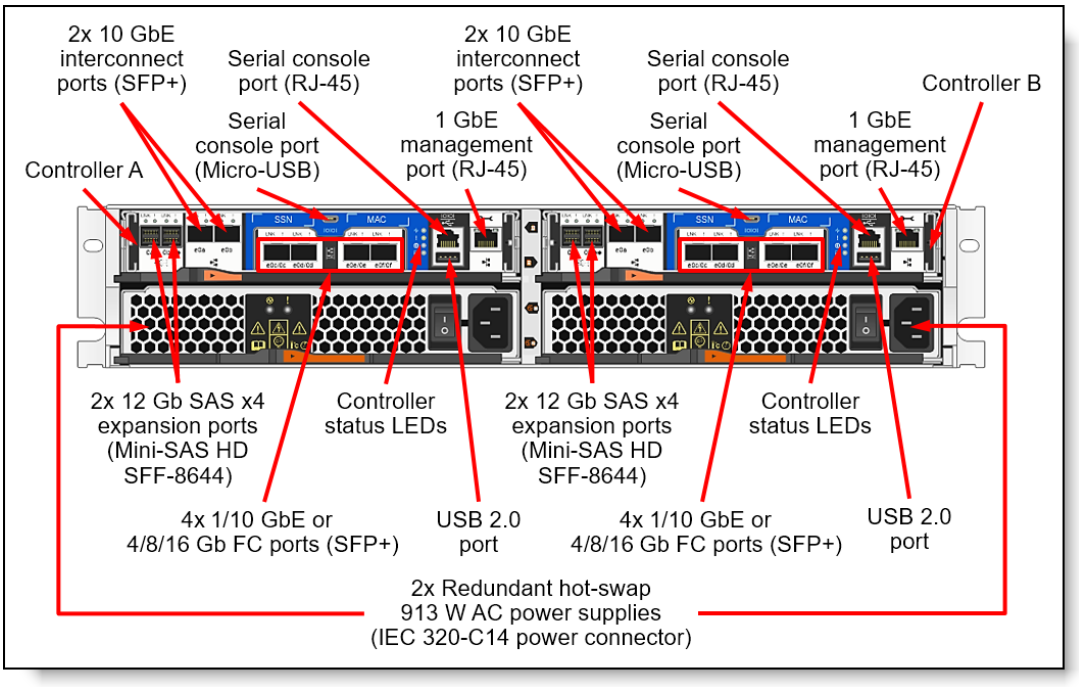

Figure 3. ThinkSystem DM5000F 2U controller enclosure rear view: Universal SFP+ host ports

The following figure shows the rear of the ThinkSystem DM5000F 2U controller enclosure with 10GBASE-T host ports.

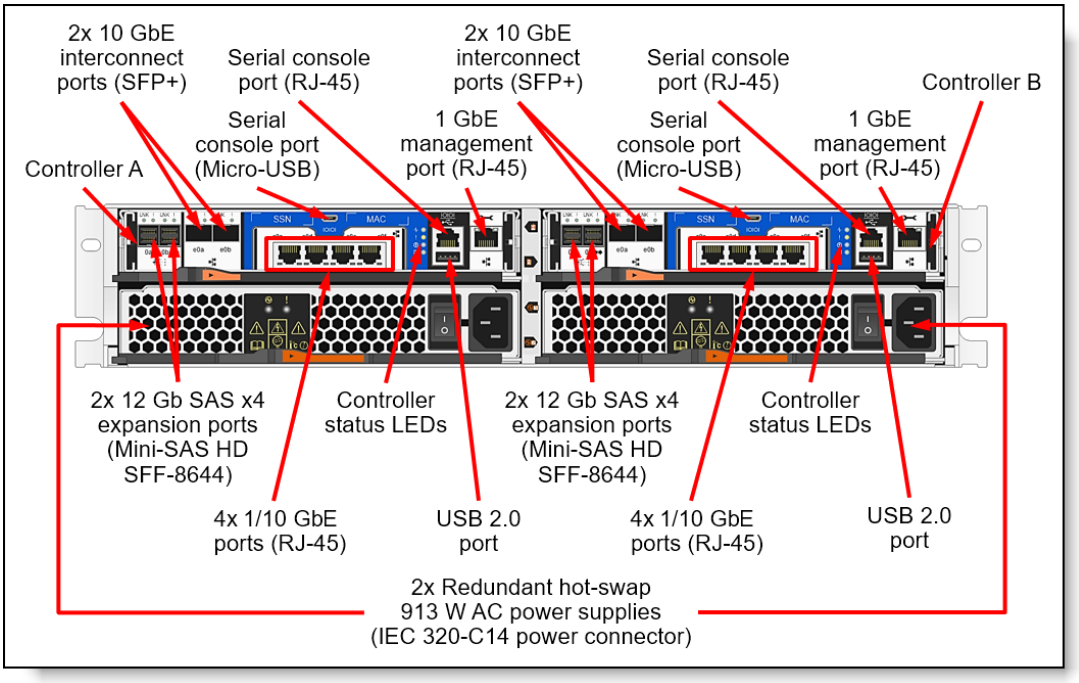

Figure 4. ThinkSystem DM5000F 2U controller enclosure rear view: 10GBASE-T host ports

The rear of the ThinkSystem DM5000F 2U controller enclosure includes the following components:

- Two redundant hot-swap controllers, each with the following ports:
  - Two SFP+ interconnect ports for direct-attach HA pair or switched cluster connections.
  - Four SFP+ host ports for 1/10 Gb GbE or 4/8/16 Gb FC connectivity, or four 1/10 GbE RJ-45 ports.
  - Two 12 Gb SAS x4 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.
  - Two serial console ports (RJ-45 and Micro-USB) for another means to configure the system.
  - One USB Type A port (for ONTAP software installation or booting)
- Two redundant hot-swap 913 W (100 - 240 V) AC power supplies (IEC 320-C14 power connector) with integrated cooling fans.
- Controller status LEDs.

The following figure shows the rear of the ThinkSystem DM240S 2U expansion enclosure.

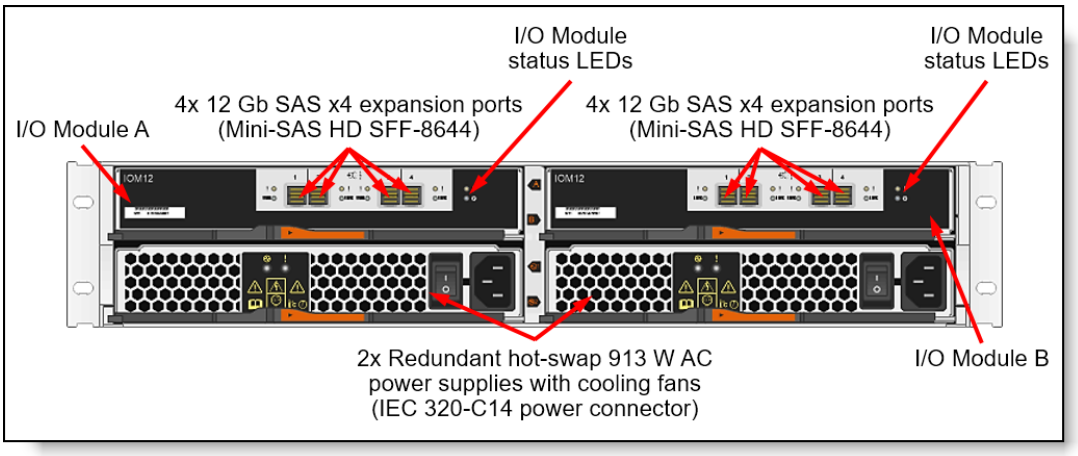

Figure 5. ThinkSystem DM240S 2U expansion enclosure rear view

The rear of the ThinkSystem DM240S 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.
- I/O Module status LEDs.

System specifications

The following table lists the ThinkSystem DM5000F storage system specifications.

Note: The supported hardware options, software features, and interoperability listed in this product guide are based on the ONTAP software version 9.7. 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 DM5000F that can be found at:
http://datacentersupport.lenovo.com

Table 1. ThinkSystem DM5000F system specifications

Attribute	Specification
Form factor	• DM5000F controller enclosure (machine types 7Y41, 7D7W): 2U rack mount. • DM240S 2U24 SFF expansion enclosure (machine types 7Y58, 7D7Y): 2U rack mount.
Controller configuration	Dual active-active controller configuration (HA pair). Up to 6 HA pairs can be combined into a single SAN cluster, or up to 12 HA pairs can be combined into a single NAS cluster.
HA pair/cluster interconnect ports	4x 10 GbE SFP+ ports (DAC cables or SW fiber optics [LC]) (2 ports per controller).
RAID levels	RAID-4, RAID-DP, RAID-TEC.
Controller memory	64 GB RAM per system (32 GB per controller). 8 GB battery-backed NVRAM per system (4 GB per controller) mirrored between the controllers.
Drive bays	Up to 144 SFF hot-swap drive bays (1x 2U24 controller enclosure + up to 5x 2U24 SFF expansion enclosures). **Note**: The Fundamentals software bundles only support up to 84 drives.

Attribute	Specification
Drive technology	12 Gb SAS SSDs.
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	960 GB, 3.84 TB, 7.68 TB, and 15.36 TB SAS SSDs (1 DWD).
Storage capacity	Up to 2.160PB
Storage protocols	• NAS (File access): NFS and CIFS/SMB. • SAN (Block access): iSCSI and FC.
Host connectivity	Base ports (per controller enclosure): • 8x 1 GbE (RJ-45 UTP)/10 GbE (DAC cable or SW fiber optic cable, LC) or 4/8/16 Gb FC (SW fiber optic cable, LC) SFP+ host ports (4 ports per controller); or • 8x 1/10 GbE RJ-45 UTP host ports (4 ports 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 6.0, 6.5, 6.7, and 7.0.
Performance*	Up to 148 000 random read IOPS (8 KB blocks).

Configuration maximums**	• Maximum raw storage capacity: 2.2 PB
	• Maximum aggregate size: 400 TB
	• Maximum number of FlexVol volumes per controller: 1000
	• Maximum FlexVol volume size: 100 TB
	• Maximum number of LUNs per controller: 8192
	• Maximum number of LUNs per FlexVol volume: 512
	• Maximum LUN size: 16 TB
	• Maximum number of drives in a RAID group (data + parity drives):
	  ◦ RAID 4: 14 (13 + 1 SAS SSDs)
	  ◦ RAID-DP: 28 (26 + 2 SAS SSDs)
	  ◦ RAID-TEC: 29 (26 + 3 SAS SSDs)
	• Maximum number of initiators per controller: 2048
	• Maximum number of snapshots per FlexVol volume: 1023

Cooling	Redundant cooling with the fans that are built into power supplies (DM5000F and DM240S 2U24 SFF enclosures).
Power supply	Two redundant hot-swap 913 W (100 - 240 V) (DM5000F and DM240S 2U24 enclosures) Platinum AC power supplies.
Hot-swap parts	Controllers, I/O modules, drives, power supplies, and SFP+ transceivers and DAC cables.
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.
Management interfaces	ThinkSystem Storage Manager web-based GUI; SSH CLI; Serial console CLI; 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	1-year or 3-year, customer-replaceable unit and onsite limited warranty with selectable service levels: 9x5 service coverage next business day (NBD) onsite response (Foundation) or 24x7 service coverage with 4-hour onsite response (Essential). Premier Support is also available. Software support is included in the Foundation or Essential Service for the duration of the warranty period.

Attribute	Specification
Dimensions	Controller enclosure: • Height: 85 mm (3.4 in.) • Width: 447 mm (17.6 in.) • Depth: 483 mm (19.0 in.) 2U24 SFF expansion enclosure: • Height: 85 mm (3.4 in.) • Width: 449 mm (17.7 in.) • Depth: 484 mm (19.1 in.)
Weight	• Controller enclosure (fully configured): 27.6 kg (60.8 lb) • 2U24 SFF expansion enclosure (fully configured): 24.4 kg (53.8 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 Support website:
http://datacentersupport.lenovo.com

Controller enclosures

Preconfigured and factory-integrated models of the ThinkSystem DM5000F Unified Flash Storage Array are configured by using the Lenovo Data Center Solution Configurator (DCSC):
http://dcsc.lenovo.com

The following table lists the CTO base model for the ThinkSystem DM5000F.

Table 2. ThinkSystem DM5000F CTO base models

Description	Machine Type/Model	Feature code
Lenovo ThinkSystem DM5000F (1-year warranty)	7Y41CTO1WW	BEY7
Lenovo ThinkSystem DM5000F (3-year warranty)	7D7WCTO1WW 7D7WCTORWW*	BEY7

* CTORWW is for customers in Russia; CTO1WW is for all other markets

Configuration note:

- Two DM3000/DM5000 SFP+ controllers (feature code B39F) must be selected during the configuration process.

The models of the ThinkSystem DM5000F ship with the following items:

- One chassis with the following components:
  - Two controllers
  - Two power supplies
- Rack Mount Kit
- 2 m USB Cable (USB Type A to Micro-USB)
- *Electronic Publications Flyer*
- Two customer-configured power cables

The following table lists the feature codes for controller software. The selection here must match the software license selected as described in the Software section.

DM Series controller software is available as a Unified offering, supporting SAN, NAS and Object storage protocols, or as a SAN offering, supporting only SAN protocols. Within each of these is Premium (available world-wide), Fundamentals (available world-wide except China), and Base (for China) that include specific features. See the Software section for details.

Table 3. Controller software selection

Feature code	Description	Offering availability	
		China only	All other markets
Unified offering (SAN, NAS, Object storage protocols)			
B5RJ	DM Series Premium Offering	Yes	Yes
B72U	DM Series Fundamentals Offering	No	Yes
B5RH	DM Series Base Offering	Yes	No
SAN offering (SAN storage protocols only)			
BKKE	DM Series Premium - SAN Only Offering	Yes	Yes
BKKD	DM Series Fundamental - SAN Only Offering	No	Yes
BKKC	DM Series Base - SAN Only Offering	Yes	No

Controllers

The ThinkSystem DM5000F controller enclosures ship with two DM3000/DM5000 10GBASE-T or SFP+ controllers. A *controller* provides interfaces for host connectivity, management, and internal drives, and it runs ONTAP storage management software. Each DM5000F controller enclosure provides 64 GB RAM and 8 GB battery-backed NVRAM (32 GB RAM and 4 GB NVRAM per controller).

The ThinkSystem DM5000F controller enclosures ship with four interconnect 10 GbE SFP+ ports (two ports per controller) to cable a directly-connected dual-controller HA pair or for switched cluster interconnect with multiple dual-controller HA pairs. Up to six HA pairs can be combined into a single SAN cluster or up to 12 HA pairs can be combined into a single NAS cluster.

The ThinkSystem DM5000H controller enclosures ship with one of the following interface types:

- 8x Universal SFP+ ports (four ports per controller) for 1/10 GbE NAS / iSCSI or 4/8/16 Gb FC host connectivity.
- 8x 1/10 GbE RJ-45 ports (four ports per controller) for 1/10 GbE NAS / iSCSI host connectivity.

Each DM5000F controller enclosure also provides four integrated 12 Gb SAS x4 expansion ports (Mini-SAS HD SFF-8644 connectors) (two ports per controller) for the attachment of the ThinkSystem DM Series expansion enclosures.

Configuration notes:

- A pair of the universal SFP+ base ports (e0c/0c and e0d/0d or e0e/0e and e0f/0f) in the system must have the same connectivity type (either Ethernet or Fibre Channel, but not both types) and the same type of physical connections; different pairs might have different types of connectivity.
- Two controllers are required for selection. Both controllers must be of the same type (either 16 Gb FC / 10 GbE or 10GBASE-T, but not both types), and they must have matching configurations of the base ports (type and physical connections).

The following table lists the controllers for the DM5000F Storage Array and supported connectivity options.

Table 4. DM5000F controllers and connectivity options

Description	Part number	Feature code	Maximum quantity per controller enclosure
Controllers			
Lenovo ThinkSystem DM3000/DM5000 Controller, 10GBASE-T	None*	B39G	2

Description	Part number	Feature code	Maximum quantity per controller enclosure
Lenovo ThinkSystem DM3000/DM5000 Controller, 16Gb FC / 10GbE	None*	B39F	2
SFP+ options for base ports			
1Gb RJ-45 iSCSI SFP+ Module 1 pack	4XF7A14917	B4K7	8
8Gb Fibre Channel SFP+ Module 1 pack	4XF7A14918	B4K8	8
16Gb Fibre Channel SFP+ Module 1 pack	4XF7A14920	B4KA	8
SFP+ options for base ports and interconnect ports			
10Gb SW Optical iSCSI SFP+ Module 1 pack	4XF7A14919	B4K9	12
OM4 cable options for 8 Gb FC, 16 Gb FC, and 10 GbE SW SFP+ 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 cable options for 8 Gb FC, 16 Gb FC, and 10 GbE SW SFP+ 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
DAC cable options for 10 GbE SFP+ connectivity (SFP+ base ports and interconnect 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
UTP Category 6 cables options for 1/10 GbE RJ-45 host connectivity and 1 GbE RJ-45 management ports			
0.75m Green Cat6 Cable	00WE123	AVFW	10
1.0m Green Cat6 Cable	00WE127	AVFX	10
1.25m Green Cat6 Cable	00WE131	AVFY	10
1.5m Green Cat6 Cable	00WE135	AVFZ	10
3m Green Cat6 Cable	00WE139	AVG0	10

Description	Part number	Feature code	Maximum quantity per controller enclosure
10m Green Cat6 Cable	90Y3718	A1MT	10
25m Green Cat6 Cable	90Y3727	A1MW	10

* Factory-installed only.

Expansion enclosures

The ThinkSystem DM5000F supports attachment of up to five ThinkSystem DM240S 2U24 SFF enclosures. The expansion enclosures can be added to the system non-disruptively.

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

Table 5. CTO base models for the ThinkSystem DM Series expansion enclosures

Description	Machine Type/Model	Feature code
DM240S 2U24 SFF Expansion Enclosure (1-year warranty)	7Y58CTO1WW	BEY7
DM240S 2U24 SFF Expansion Enclosure (3-year warranty)	7D7YCTO1WW	BEY7

Configuration note: Two I/O expansion modules (feature code B39J) are pre-selected by the configurator.

The models of the ThinkSystem DM240S ship with the following items:

- One chassis with the following components:
  - Two I/O modules
  - Two power supplies
- Rack Mount Kit
- Electronic Publications Flyer
- Two customer-configured power cables

Each ThinkSystem DM Series expansion enclosure ships with two SAS I/O expansion modules. Each *I/O expansion module* provides two external 12 Gb SAS x4 ports (Mini-SAS HD SFF-8644 connectors labelled Port 1-4) that are used for connections to the ThinkSystem DM5000F and for daisy chaining the expansion enclosures between each other.

The dual-path HA (high availability) connectivity topology for the enclosures is shown in the following figure.

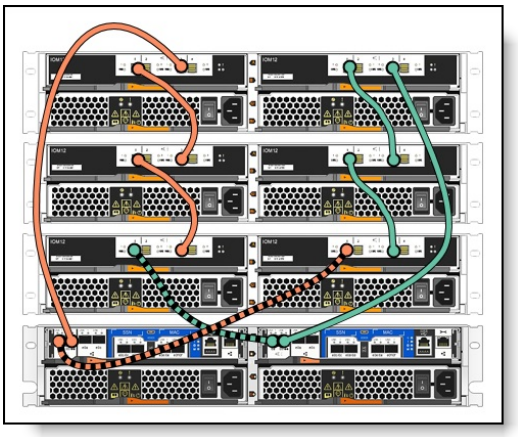

Figure 6. DM5000F expansion enclosure connectivity topology

Expansion cabling rules:

- Port 0b on the Controller 1 is the primary path that is connected to the Port 3 on the I/O Module A in the last expansion enclosure in a stack.
- Port 1 on the I/O Module A in the last expansion enclosure is connected to Port 3 on the I/O Module A in the adjacent expansion enclosure, and so on (until the first expansion enclosure in a stack is cabled).
- Port 0a on the Controller 1 is the secondary path that is connected to the Port 1 on the I/O Module B in the first expansion enclosure in a stack.
- Port 0b on the Controller 2 is the primary path that is connected to the Port 3 on the I/O Module B in the last expansion enclosure in a stack.
- Port 1 on the I/O Module B in the last expansion enclosure is connected to Port 3 on the I/O Module B in the adjacent expansion enclosure, and so on (until the first expansion enclosure in a stack is cabled).
- Port 0a on the Controller 2 is the secondary path that is connected to the Port 1 on the I/O Module A in the first expansion enclosure in a stack.

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

Table 6. Expansion enclosure connectivity options

Description	Part number	Feature code	Maximum 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 note: The following quantities of SAS cables are needed for the stack of the expansion enclosures:

- Two SAS cables per expansion enclosure in the stack for connecting the first expansion enclosure in the stack to the controller enclosure and for connections to the adjacent expansion enclosures.
- Two additional SAS cables for connecting the last expansion enclosure in the stack to the controller enclosure.

Drives

The ThinkSystem DM5000F and DM240S 2U24 SFF enclosures support up to 24 SFF hot-swap drives. The following table lists supported drive options for the DM5000F and DM240S 2U24 SFF enclosures.

The following table lists supported drive packs for the controller and expansion enclosures.

Configuration notes:

- When ordering the systems, select the drives that match the ONTAP offering and bundle you are installing on the DM controller. Drive feature codes are specific to Unified or SAN Only offerings, and to Base, Fundamentals and Premium bundles. See the Software section for details.
- Drives are sold in packs. Supported quantities are as follows:
  - The DM5000F 2U24 SFF controller enclosures support only 12, 18 or 24 SFF drives
  - The DM240S 2U24 SFF expansion enclosures support only 6, 12, 18 or 24 SFF drives
- All drives in the enclosure must be of the same type and capacity.

Field upgrades: Drive packs for field upgrades can be ordered via the CTO base 7D4FCTO4WW, ThinkSystem DM Drive Pack Upgrades. These are for use in existing expansion enclosures that have not been fully populated with the factory-installed drive packs

Table 7. Drive option feature codes

	Unified			SAN Only			
Drive Pack (6 drives each)	**Base***	**Funda-mentals†**	**Premium**	**Base***	**Funda-mentals†**	**Premium**	**Max Qty**
Lenovo ThinkSystem 5.8TB (6x 960GB, 2.5", SSD) Drive Pack for DM5000F	B65Q	BKKK	BKKP	BKKF	BK1W	B65P	4
Lenovo ThinkSystem 23TB (6x 3.84TB, 2.5", SSD) Drive Pack for DM5000F	B65S	BKKL	BKKQ	BKKG	BK1X	B65R	4
Lenovo ThinkSystem 46.1TB (6x 7.68TB, 2.5", SSD) Drive Pack for DM5000F	B65U	BKKM	BKKR	BKKH	BK1Y	B65T	4
Lenovo ThinkSystem 92.2TB (6x 15.36TB, 2.5", SSD) Drive Pack for DM5000F	B65W	BKKN	BKKS	BKKJ	BK1Z	B65V	4

* China only
† Available world-wide except China

Software

In this section:

ONTAP software unifies data management across flash, disk, and cloud to simplify the Lenovo DM storage environment. It builds the foundation for a Data Fabric, making it easy to move the data where it is needed across flash, disk, and cloud resources.

Feature bundles

Controller software for the DM5000F is available in the following bundles of features:

- SAN Fundamentals (All markets except China) (Feature BKKD)
- SAN Base (China only) (Feature BKKC)
- SAN Premium (Feature BKKE)
- Unified Fundamentals (All markets except China) (Feature B72U)
- Unified Base (China only) (Feature B5RH)
- Unified Premium (Feature B5RJ)

The following table summarizes the features in each bundle for the DM5000F.

Table 8. Comparison of software features for the DM5000F

Feature	SAN Fundamentals	SAN Base (PRC only)	SAN Premium	Unified Fundamentals	Unified Base (PRC only)	Unified Premium
Controller software feature code	BKKD	BKKC	BKKE	B72U	B5RH	B5RJ
RAID-4, RAID-DP, and RAID-TEC data protection	Included	Included	Included	Included	Included	Included
All Flash Array (AFA) capability	Included	Included	Included	Included	Included	Included
Thin provisioning	Included	Included	Included	Included	Included	Included
Compression	Included	Included	Included	Included	Included	Included
Compaction	Included	Included	Included	Included	Included	Included
Deduplication	Included	Included	Included	Included	Included	Included
Snapshots	Included	Included	Included	Included	Included	Included
Encryption*	Included*	No	Included*	Included*	No	Included*
Balanced placement	Included	Included	Included	Included	Included	Included
Dynamic capacity expansion	Included	Included	Included	Included	Included	Included
Adaptive Quality of Service	Included	Included	Included	Included	Included	Included
SnapRestore	Included	Included	Included	Included	Included	Included
FlexClone	Included	Included	Included	Included	Included	Included
FlexVol	Included	Included	Included	Included	Included	Included
FlexCache	No	No	No	Included	Included	Included
SnapMirror asynchronous replication	Included	No	Included	Included	No	Included
SyncMirror data protection	Included	Included	Included	Included	Included	Included
Trusted Platform Module (TPM) support	Included	No	Included	Included	No	Included
MetroCluster IP	Included	Included	Included	Included	Included	Included
NVMe over FC Protocol	No	No	No	No	No	No
NVMe over TCP Protocol	Included	Included	Included	Included	Included	Included
SnapMirror Business Continuity (SMBC)	No	No	Included	No	No	Included
SnapMirror synchronous replication	No	No	Included	No	No	Included

Feature	SAN Fundamentals	SAN Base (PRC only)	SAN Premium	Unified Fundamentals	Unified Base (PRC only)	Unified Premium
FlexGroup	No	No	No	Included	Included	Included
SnapVault disk-based storage backup	No	No	No	No	No	Included
SnapCenter	No	No	Included	No	No	Included
ONTAP S3	No	No	No	Included	Included	Included
ONTAP S3 SnapMirror	No	No	No	No	No	Optional
FabricPool object storage tiering	Optional	Optional	Optional	Optional	Optional	Optional
SnapLock data protection	No	No	No	Optional	No	Optional
Security and Compliance Bundle (Anti-ransomware, MTKM, SnapLock)	No	No	No	Optional	No	Optional
Hybrid Cloud Bundle (FabricPool, SnapMirror Cloud)	Optional**	Optional**	Optional**	Optional**	Optional**	Optional

* Requires the encryption version of ONTAP. See the ONTAP software section.
** When used with bundles other than Unified Premium, Hybrid Cloud Bundle only adds FabricPool. The use of SnapMirror Cloud requires Unified Premium.

The features are summarized as follows:

- **RAID-4, RAID-DP, and RAID-TEC data protection** : Provides the flexibility to choose the level of data protection required and helps improve performance and availability with built-in spare capacity and by distributing data across all physical drives in the aggregate, sustaining to up to one (RAID-4), two (RAID-DP), or three (RAID-TEC) concurrent drive failures.
- **All Flash Array (AFA) capability** : Meets the demand for higher speed, lower latency storage and provides higher IOPS and bandwidth with lower power usage and total cost of ownership than hybrid or HDD-based solutions.
- **Thin provisioning**: Optimizes efficiency 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.
- **Compression:** Provides transparent inline and post-process data compression to reduce the amount of storage that customers need to purchase and manage.
- **Compaction:** enhances compression to further reduce the amount of storage that customers need to purchase and manage.
- **Deduplication:** Performs general-purpose deduplication for removal of redundant data to reduce the amount of storage that customers need to purchase and manage.
- **Snapshots**: Enables creation of read-only copies of data for backup, parallel processing, testing, and development, and have the copies available almost immediately.
- **Encryption:** Provides software-based encryption for data at rest for enhanced data security with the traditional drives and embedded key management (requires the encryption-capable version of the ONTAP software).
- **Balanced placement:** Provides automated workload distribution across the cluster to help increase utilization and performance.

- **Dynamic capacity expansion:** Allows the capacity of a volume or aggregate to be expanded by adding new physical drives.
- **Adaptive Quality of Service:** Simplifies operations and maintains consistent workload performance by defining QoS policies and automatically adjusting storage resources to respond to workload changes.
- **SnapRestore:** Enables quick recovery of data by reverting a local volume or file to its previous state from a particular snapshot copy stored on the file system.
- **FlexClone:** References snapshot metadata to create writable point-in-time copies of a volume.
- **FlexVol:** Provides abstraction layer between the logical volume and its physical location in the storage array.
- **FlexCache:** Speeds up access to data and offloads traffic from heavily accessed volumes for read-intensive workloads by placing frequently used data in cache locally or remotely (closer to the point of client access) and serving the data to the clients directly from cache without accessing the data source.
- **SnapMirror asynchronous replication:** Provides storage system-based data replication between the storage systems containing source (local) and destination (remote) volumes by using asynchronous (at specified regular intervals) data transfers over IP communication links.
- **SyncMirror data protection:** Adds extra level of data protection and availability by mirroring a pair of RAID aggregates.
- **Trusted Platform Module (TPM)**: For encryption enabled systems. The encryption keys for the onboard key manager (OKM) are no longer stored in the boot device, but instead are stored in the physical TPM for systems so equipped, offering greater security and protection. Moving to the TPM is a nondisruptive process.
- **MetroCluster IP:** Provides storage system-based clustering with online, real-time data mirroring between the local and remote sites by using synchronous data transfers over IP communication links to deliver continuous availability with zero RPO and near-zero RTO. All storage systems in a MetroCluster IP configuration must be of the same model. New to ONTAP 9.11: MetroCluster with Storage Virtual Machine Disaster Recovery (SVM-DR) can now use a third site for the SVM-DR
- **NVMe over TCP Protocol**: Enables NVMe over TCP
- **Data Protection Optimized (DPO)**: Increases the amount of concurrent SnapMirror sessions per node, as well as improving SnapMirror performance to the cluster.
- **SnapMirror Business Continuity (SMBC):** Non-disruptive failover active-active cross site clusters. Based on existing SnapMirror Synchronous Replication. Offers Zero data loss, zero downtime. You do not have to failover the application. If there is a failure the application will continue to run and there will be no need to restart.
- **SnapMirror synchronous replication:** Provides storage system-based data replication between the storage systems containing source (local) and destination (remote) volumes by using synchronous (as soon as the data is written to the source volume)
- **FlexGroup:** Enables a single volume to span across multiple clustered storage arrays to maximize storage capacity and automate load distribution. New to ONTAP 9.11: FlexGroups can now be created as SnapLock volumes.
- **SnapVault disk-based storage backup:** Enables data stored on multiple systems to be backed up to a central, secondary system quickly and efficiently as read-only snapshot copies.
- **SnapCenter:** Provides application- and virtual machine-aware backup and restoration of data by using the Snapshots technology and leverages the SnapMirror capabilities of storage systems to provide onsite or offsite backup set mirroring for disaster recovery.
- **ONTAP S3**: Expands the DM Series unified story and allows customers to manage, block, file, and object data from one interface. Customers can now natively store data in S3 buckets onboard the DM Series.

- **ONTAP S3 SnapMirror** : Enables you to protect buckets in ONTAP S3 object stores using familiar SnapMirror mirroring and backup functionality. Requires ONTAP 9.10.1 or later on both source and destination clusters. Requires the Unified Premium Bundle.
- **SnapMirror Cloud**: A backup and recovery technology designed for ONTAP users who want to transition their data protection workflows to the cloud. SnapMirror Cloud is an extension to the family of SnapMirror replication technologies. While SnapMirror is frequently used for ONTAP-to-ONTAP backups, SnapMirror Cloud uses the same replication engine to transfer Snapshot copies for ONTAP to S3-compliant object storage backups.
- **Multitenant Key Management (MTKM)**: Provides the ability for individual tenants or storage virtual machines (SVMs) to maintain their own keys through KMIP for NVE. With multitenant external key management, you can centralize your organization's key management functions by department or tenant while inherently confirming that keys are not stored near the assets. This approach decreases the possibility of compromise.
- **Anti-ransomware**: Uses workload analysis in NAS (NFS and SMB) environments to proactively detect and warn about abnormal activity that might indicate a ransomware attack. When an attack is suspected, anti-ransomware also creates new Snapshot backups, in addition to existing protection from scheduled Snapshot copies. New to ONTAP 9.11: Optional multi-admin verification to approve administration functions that could result in data loss.

Add-on feature bundles:

- **Security and Compliance Bundle**: Licensed per 2-node HA Pair, the Security and Compliance Bundle provides built-in protection from ransomware and while also providing the ability to meet regulatory compliance and organizational data retention requirements.
    - Includes: Anti-ransomware feature with Multitenant Key Management (MTKM) and SnapLock
- **Hybrid Cloud Bundle**: Licensed per TB (3 Year & 5 Year Offerings) the Hybrid Cloud Bundle provides the ability to use S3 SnapMirror from ONTAP to the Public Cloud (AWS S3) and/or SnapMirror Cloud with participating ISV Backup providers.
    - Includes SnapMirror Cloud and FabricPool

Optional Extended features also available via Feature on Demand (FoD) (see the Extended ONTAP features section)

- **FabricPool**: FabricPool is a hybrid storage solution that uses an all flash (all SSD) aggregate as the performance tier and an object store as the external capacity tier. Data in a FabricPool is stored in a tier based on whether it is frequently accessed or not. Using a FabricPool helps you reduce storage cost without compromising performance, efficiency, or protection.
- **SnapLock data protection:** Creates Write-Once-Read-Many (WORM) non-rewritable, non-erasable data on hard disk drives to prevent files from being altered or deleted until a predetermined or default retention date.

ONTAP software versions

The following table lists the software selection options for the DM5000F. The table also indicates which markets each version is available in.

Table 9. Software selection

Feature code	Description	Availability
ONTAP 9.10		
BNLY	Lenovo ThinkSystem DM Series ONTAP 9.10 Software Base NonEncryption	China only
BNM2	Lenovo ThinkSystem DM Series ONTAP 9.10 Software Encryption	All markets except China
BNM1	Lenovo ThinkSystem DM Series ONTAP 9.10 Software NonEncryption	All markets
BNM0	Lenovo ThinkSystem DM Series ONTAP 9.10 Software Fundamentals Encryption	All markets except China
BNLZ	Lenovo ThinkSystem DM Series ONTAP 9.10 Software Fundamentals NonEncryption	All markets
ONTAP 9.11		
BRK0	Lenovo ThinkSystem DM Series ONTAP 9.11 Software Base NonEncryption	China only
BRJW	Lenovo ThinkSystem DM Series ONTAP 9.11 Software Encryption	All markets except China
BRJX	Lenovo ThinkSystem DM Series ONTAP 9.11 Software NonEncryption	All markets
BRJY	Lenovo ThinkSystem DM Series ONTAP 9.11 Software Fundamentals Encryption	All markets except China
BRJZ	Lenovo ThinkSystem DM Series ONTAP 9.11 Software Fundamentals NonEncryption	All markets

Software maintenance is included in the DM5000F warranty and support (see Warranty and support for details).

Extended ONTAP features

FabricPool and SnapLock WORM data protection are optional extended features. To obtain these feature licenses, order the part numbers as listed in the following table. Upgrades are supported in specific bundles as listed in the Comparison of software features table.

Note: Extended features are only available as field upgrades and are not orderable as part of a CTO configuration.

Table 10. Optional software features

Part number	Feature code	Description	Quantity
4P47A16547	None*	DM Series SnapLock License	1 per system (contains two licenses)
4P47A37057	None*	DM Series FabricPool – 1TB Increment – 3 years	1 per TB of storage capacity
4P47A37288	None*	DM Series FabricPool – 1TB Increment – 5 years	1 per TB of storage capacity
4P47A82668	BPQ6	Security and Compliance Bundle	1 per system (contains two licenses)
4P47A83121	BQ8X	Hybrid Cloud Bundle 3 year per TB License	1 per TB of storage capacity
4P47A83123	BQ8W	Hybrid Cloud Bundle 5 year per TB License	1 per TB of storage capacity

* Field upgrade only; no factory installation.

Configuration notes:

- The SnapLock feature is licensed on a per-controller basis; that is, two licenses are needed per system, and these two licenses are contained in a single orderable part number. These licenses also include 5-year software support entitlement.
- The FabricPool feature is a cluster-wide, capacity-based license that is available for 3-year or 5-year subscription terms.

Upgrading to Unified Premium ONTAP

To upgrade your existing ONTAP installation to Unified Premium ONTAP, use DCSC to specify the storage you already have installed, since the upgrade license is based on your existing configuration.
https://dcsc.lenovo.com/#/configuration/cto/7D4FCTO2WW?hardwareType=storage

The software license for field upgrades is ordered via the CTO base 7D4FCTO2WW, as listed in the following table.

Table 11. Feature codes for ONTAP upgrades (MTM 7D4FCTO2WW)

Feature code	Description
BNDK	Unified Fundamental to Unified Premium ONTAP Upgrade Selection
BNDJ	All SAN Premium to Unified Premium ONTAP Upgrade Selection
BNDH	All SAN Fundamental to Unified Premium ONTAP Upgrade Selection
BNKP	All SAN Base to Unified Premium CFC Selection (PRC only)
BNKN	Unified Base to Unified Premium CFC Selection (PRC only)

Ansible playbooks for DM Series

Ansible Playbooks give customers the ability to quickly deploy and use DM Series storage systems using a standard open source deployment tool. Each playbook executes a set of tasks to achieve a configuration/provisioning goal.

Lenovo has created playbooks that can be used with DM Series storage systems to help with:

- Provisioning
- Configuring

To access the Ansible Playbooks for Lenovo ThinkSystem DM Series storage systems, go to the following page:
https://github.com/lenovo/ansible-dm-series-ontap

Management

The ThinkSystem DM5000F supports the following management interfaces:

- Lenovo ThinkSystem Storage Manager, a web-based interface via HTTPS for single-system management or centralized management of the cluster of systems, 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.
- Command line interface (CLI) via SSH or through serial console.
- Syslog, SNMP, and e-mail notifications.
- Optional Lenovo XClarity for discovery, inventory, monitoring, and alerts.

Power supplies and cables

The ThinkSystem DM5000F and DM240S 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.

Each ThinkSystem DM Series enclosure requires the selection of two power cables.

Rack installation

The individually shipped ThinkSystem DM5000F and DM240S enclosures come with the ThinkSystem Storage Rack Mount Kit 2U24/4U60 listed in the following table.

Table 12. 4-post rack mount kit

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

When the ThinkSystem DM 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 13. 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 14. Rack mount kit features and specifications summary

	Screw-in fixed rail with adjustable depth	
Attribute	**2U24/4U60**	**2U24 SIR**
Feature code	B38Y	B6TH
Enclosure support	DM5000F, DM240S	DM5000F, DM240S
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 DM5000F controller enclosure has the following dimensions and weight (approximate):

- Height: 85 mm (3.4 in.)
- Width: 447 mm (17.6 in.)
- Depth: 483 mm (19.0 in.)
- Weight (fully configured): 27.6 kg (60.8 lb)

The ThinkSystem DM240S 2U24 SFF enclosures have the following dimensions and weight (approximate):

- Height: 85 mm (3.4 in.)
- Width: 449 mm (17.7 in.)
- Depth: 484 mm (19.1 in.)
- Weight (fully configured): 24.4 kg (53.8 lb)

Operating environment

The ThinkSystem DM5000F and DM240S 2U24 SFF enclosures are supported in the following environment:

- Air temperature:
  - Operating: 5 °C - 45 °C (41 °F - 113 °F)
  - Non-operating: -40 °C - +70 °C (-40 °F - 158 °F)
  - Maximum altitude: 3050 m (10,000 ft)
- Relative humidity:
  - Operating: 8% - 90% (non-condensing)
  - Non-operating: 10% - 95% (non-condensing)
- Electrical power:
  - DM5000F
    - 100 to 127 (nominal) V AC; 50 Hz or 60 Hz; 5.52 A
    - 200 to 240 (nominal) V AC; 50 Hz or 60 Hz; 2.76 A
    - Maximum system power load: 524 W
  - DM240S 2U24 SFF
    - 100 to 127 (nominal) V AC; 50 Hz or 60 Hz; 4.11 A
    - 200 to 240 (nominal) V AC; 50 Hz or 60 Hz; 2.05 A
    - Maximum system power load: 390 W
- Heat dissipation:
  - DM5000F: 1788 BTU/hour
  - DM240S 2U24 SFF: 1331 BTU/hour
- Acoustical noise emission:
  - DM5000F: 6.9 bels
  - DM240S 2U24 SFF: 6.9 bels

Warranty and support

The DM5000F and expansion enclosures have a 1-year or 3-year warranty based on the machine type of the system, as listed in the following table.

Table 15. Duration of standard warranty

System	Machine type 1 year warranty	Machine type 3 year warranty
DM5000F Controller Enclosure	7Y41	7D7W
DM240S 2U24 SFF Expansion Enclosure	7Y58	7D7Y

The standard warranty terms are customer-replaceable unit (CRU) and onsite (for field-replaceable units FRUs only) 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 your data center, with an experience consistently ranked number one in customer satisfaction worldwide. Available offerings include:

- **Premier Support**

  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:

  - Direct technician-to-technician access through a dedicated phone line
  - 24x7x365 remote support
  - Single point of contact service
  - End to end case management
  - Third-party collaborative software support
  - Online case tools and live chat support
  - On-demand remote system analysis

- **Warranty Upgrade (Preconfigured Support)**

  Services are available to meet the on-site response time targets that match the criticality of your 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. YourDrive YourData is an optional extra (see below).
  - **Essential Service:** 24x7 service coverage with 4-hour onsite response or 24-hour committed repair (available only in select markets). Bundled with YourDrive YourData.
  - **Advanced Service:** 24x7 service coverage with 2-hour onsite response or 6-hour committed repair (available only in select markets). Bundled with YourDrive YourData.

- **Managed Services**

  Lenovo Managed Services provides continuous 24x7 remote monitoring (plus 24x7 call center availability) and proactive management of your 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 & OS device driver levels, and software as needed. We'll also maintain records of latest patches, critical updates, and firmware levels, to ensure you systems are providing business value through optimized performance.

- **Technical Account Management (TAM)**

  A Lenovo Technical Account Manager helps you optimize the operation of your data center based on a deep understanding of your business. You gain direct access to your Lenovo TAM, who serves as your single point of contact to expedite service requests, provide status updates, and furnish reports to track incidents over time. In addition, your TAM will help proactively make service recommendations and manage your service relationship with Lenovo to make certain your needs are met.

- **Enterprise Server Software Support**

  Enterprise Software Support is an additional support service providing customers with software support on Microsoft, Red Hat, SUSE, and VMware applications and systems. Around the clock availability for critical problems plus unlimited calls and incidents helps customers address challenges fast, without incremental costs. Support staff can answer troubleshooting and diagnostic questions, address product comparability and interoperability issues, isolate causes of problems, report defects to software vendors, and more.

- **YourDrive YourData**

  Lenovo's YourDrive YourData is a multi-drive retention offering that ensures your data is always under your control, regardless of the number of drives that are installed in your Lenovo server. In the unlikely event of a drive failure, you retain possession of your drive while Lenovo replaces the failed drive part. Your data stays safely on your premises, in your hands. The YourDrive YourData service can be purchased in convenient bundles and is optional with Foundation Service. It is bundled with Essential Service and Advanced Service.

- **Health Check**

  Having a trusted partner who can perform regular and detailed health checks is central to maintaining efficiency and ensuring that your 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.

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 Service offerings are region-specific. Not all preconfigured support and upgrade options are available in every region. For information about Lenovo service upgrade offerings that are available in your region, refer to the following resources:

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

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

- Lenovo Statement of Limited Warranty for Infrastructure Solutions Group (ISG) 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 markets or regions. For more information, go to https://www.lenovo.com/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 DM Series enclosures conform to the following regulations:

- United States: FCC Part 15, Class A; UL 60950-1
- Canada: ICES-003, Class A; CAN/CSA-C22.2 60950-1
- Mexico NOM
- European Union: CE Mark (EN55032 Class A, EN55024, IEC/EN60950-1); ROHS Directive 2011/65/EU
- Russia, Kazakhstan, Belarus: EAC
- China: CCC GB 4943.1, GB 17625.1, GB 9254 Class A; CELP; CECP
- 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 DM5000F Unified Flash Storage Array supports attachment to Lenovo servers by using NAS (NFS and CIFS/SMB), iSCSI, and Fibre Channel storage connectivity.

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

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.

Cluster interconnect

The following table lists the Ethernet storage switch that can be used with the ThinkSystem DM5000F All Flash Storage Array for cluster interconnect and MetroCluster IP configurations.

Table 16. Ethernet storage switch

Description	Part number
BES-53248 Ethernet Storage Switch: 16x SFP ports and 2x QSFP ports active, 2 PS (CTO only)	7D2SCTO1WW

For more information, see the BES-53248 Ethernet Storage Switch for Lenovo Product Guide: http://lenovopress.com/lp1226

Fibre Channel SAN switches

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

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

Rack cabinets

The following table lists the supported rack cabinets.

Table 17. Rack cabinets

Part number	Description
93072RX	25U Standard Rack (1000mm)
93072PX	25U Static S2 Standard Rack (1000mm)
7D6DA007WW	ThinkSystem 42U Onyx Primary Heavy Duty Rack Cabinet (1200mm)
7D6DA008WW	ThinkSystem 42U Pearl Primary Heavy Duty Rack Cabinet (1200mm)
93604PX	42U 1200mm Deep Dynamic Rack
93614PX	42U 1200mm Deep Static Rack
93634PX	42U 1100mm Dynamic Rack
93634EX	42U 1100mm Dynamic Expansion Rack
93074RX	42U Standard Rack (1000mm)
7D6EA009WW	ThinkSystem 48U Onyx Primary Heavy Duty Rack Cabinet (1200mm)
7D6EA00AWW	ThinkSystem 48U Pearl Primary Heavy Duty Rack Cabinet (1200mm)

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 18. Power distribution units

Part number	Feature code	Description	ANZ	ASEAN	Brazil	EET	MEA	RUCIS	WE	HTK	INDIA	JAPAN	LA	NA	PRC
0U Basic PDUs															
00YJ776	ATZY	0U 36 C13/6 C19 24A 1 Phase PDU	N	Y	Y	N	N	N	N	N	N	Y	Y	Y	N
00YJ777	ATZZ	0U 36 C13/6 C19 32A 1 Phase PDU	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y
00YJ778	AU00	0U 21 C13/12 C19 32A 3 Phase PDU	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y
0U Switched and Monitored PDUs															
00YJ783	AU04	0U 12 C13/12 C19 Switched and Monitored 48A 3 Phase PDU	N	N	Y	N	N	N	Y	N	N	Y	Y	Y	N

Part number	Feature code	Description	ANZ	ASEAN	Brazil	EET	MEA	RUCIS	WE	HTK	INDIA	JAPAN	LA	NA	PRC
00YJ781	AU03	0U 20 C13/4 C19 Switched and Monitored 24A 1 Phase PDU	N	N	Y	N	Y	N	Y	N	N	Y	Y	Y	N
00YJ782	AU02	0U 18 C13/6 C19 Switched and Monitored 32A 3 Phase PDU	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y
00YJ780	AU01	0U 20 C13/4 C19 Switched and Monitored 32A 1 Phase PDU	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y
1U Switched and Monitored PDUs															
4PU7A81117	BNDV	1U 18 C19/C13 switched and monitored 48A 3P WYE PDU - ETL	N	N	N	N	N	N	N	N	N	N	N	Y	N
4PU7A77467	BLC4	1U 18 C19/C13 Switched and Monitored 80A 3P Delta PDU	N	N	N	N	N	N	N	N	N	Y	N	Y	N
4PU7A77469	BLC6	1U 12 C19/C13 switched and monitored 60A 3P Delta PDU	N	N	N	N	N	N	N	N	N	N	N	Y	N
4PU7A77468	BLC5	1U 12 C19/C13 switched and monitored 32A 3P WYE PDU	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
4PU7A81118	BNDW	1U 18 C19/C13 switched and monitored 48A 3P WYE PDU - CE	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y
1U Ultra Density Enterprise PDUs (9x IEC 320 C13 + 3x IEC 320 C19 outlets)															
71763NU	6051	Ultra Density Enterprise C19/C13 PDU 60A/208V/3PH	N	N	Y	N	N	N	N	N	N	Y	Y	Y	N
71762NX	6091	Ultra Density Enterprise C19/C13 PDU Module	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1U C13 Enterprise PDUs (12x IEC 320 C13 outlets)															
39M2816	6030	DPI C13 Enterprise PDU Plus Module (WW)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
39Y8941	6010	DPI C13 Enterprise PDU Module (WW)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1U C19 Enterprise PDUs (6x IEC 320 C19 outlets)															
39Y8948	6060	DPI C19 Enterprise PDU Module (WW)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1U Front-end PDUs (3x IEC 320 C19 outlets)															
39Y8938	6002	DPI Single-phase 30A/120V Front-end PDU (US)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
39Y8939	6003	DPI Single-phase 30A/208V Front-end PDU (US)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
39Y8934	6005	DPI Single-phase 32A/230V Front-end PDU (International)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
39Y8940	6004	DPI Single-phase 60A/208V Front-end PDU (US)	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N
39Y8935	6006	DPI Single-phase 63A/230V Front-end PDU (International)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
1U NEMA PDUs (6x NEMA 5-15R outlets)															
39Y8905	5900	DPI 100-127V NEMA PDU	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Line cords for 1U PDUs that ship without a line cord															
40K9611	6504	4.3m, 32A/380-415V, EPDU/IEC 309 3P+N+G 3ph wye (non-US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Part number	Feature code	Description	ANZ	ASEAN	Brazil	EET	MEA	RUCIS	WE	HTK	INDIA	JAPAN	LA	NA	PRC
40K9612	6502	4.3m, 32A/230V, EPDU to IEC 309 P+N+G (non-US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9613	6503	4.3m, 63A/230V, EPDU to IEC 309 P+N+G (non-US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9614	6500	4.3m, 30A/208V, EPDU to NEMA L6-30P (US) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9615	6501	4.3m, 60A/208V, EPDU to IEC 309 2P+G (US) Line Cord	N	N	Y	N	N	N	Y	N	N	Y	Y	Y	N
40K9617	6505	4.3m, 32A/230V, Souriau UTG Female to AS/NZ 3112 (Aus/NZ) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
40K9618	6506	4.3m, 32A/250V, Souriau UTG Female to KSC 8305 (S. Korea) Line Cord	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

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 19. 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 the Asia Pacific market.

For more information, see the list of Product Guides in the UPS category:
https://lenovopress.com/servers/options/ups

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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 Data Center Unified Storage product page
  https://www.lenovo.com/us/en/c/data-center/storage/unified-storage
- Lenovo Data Center Solution Configurator
  http://dcsc.lenovo.com
- ThinkSystem DM Series documentation
  http://thinksystem.lenovofiles.com/storage/help/topic/ontap_software/overview.html
- Lenovo Data Center Support - ThinkSystem DM5000F
  http://datacentersupport.lenovo.com/us/en/products/storage/lenovo-storage/thinksystem-dm5000f

Related product families

Product families related to this document are the following:

- DM Series Storage
- Lenovo Storage
- External Storage

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