2019 Washington Street, East
Charleston, WV 25305
Telephone: 304-558-2306
General Fax: 304-558-6026
Bid Fax: 304-558-3970

The following documentation is an electronically-submitted vendor response to an advertised solicitation from the *West Virginia Purchasing Bulletin* within the Vendor Self-Service portal at *wvOASIS.gov*. As part of the State of West Virginia's procurement process, and to maintain the transparency of the bid-opening process, this documentation submitted online is publicly posted by the West Virginia Purchasing Division at *WVPurchasing.gov* with any other vendor responses to this solicitation submitted to the Purchasing Division in hard copy format.

Welcome, Lu Anne Cottrill

View All 1 of 1 | ⓘ Commodity Lines on this Response were deleted since the correspondi ...

wvOASIS

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Procurement | Budgeting | Accounts Receivable | Accounts Payable

Solicitation Response(SR) | **Dept:** 0702 | **ID:** ESR08131900000000854 | **Ver.:** 1 | **Function:** New | **Phase:** Final | ▼ | **Modified by** batch , 08/21/2019

Header 📎 3

[≡ List View]

General Information | Contact | Default Values | Discount | Document Information

Procurement Folder:	602821	SO Doc Code:	CRFQ
Procurement Type:	Central Purchase Order	SO Dept:	0702
Vendor ID:	000000219290 ⬆	SO Doc ID:	TAX2000000001
Legal Name:	Y & S TECHNOLOGIES INC	Published Date:	8/14/19
Alias/DBA:		Close Date:	8/21/19
Total Bid:	$22,795.00	Close Time:	13:30
Response Date:	08/14/2019 📅	Status:	Closed
Response Time:	19:39	Solicitation Description:	Addendum No.01 - 30TB SAN with Warranty
		Total of Header Attachments:	3
		Total of All Attachments:	3

Proc Folder : 602821

Solicitation Description : Addendum No.01 - 30TB SAN with Warranty

Proc Type : Central Purchase Order

Date issued	Solicitation Closes	Solicitation Response	Version
	2019-08-21
13:30:00	SR 0702 ESR08131900000000854	1

VENDOR
000000219290
Y & S TECHNOLOGIES INC

Solicitation Number: CRFQ 0702 TAX2000000001

Total Bid : $22,795.00 **Response Date:** 2019-08-14 **Response Time:** 19:39:52

Comments: All items are new and sealed and come with a full manufacturer warranty.

FOR INFORMATION CONTACT THE BUYER

Brittany E Ingraham

(304) 558-2157
brittany.e.ingraham@wv.gov

Signature on File FEIN # DATE

All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	30TB SAN	1.00000	EA	$22,795.000000	$22,795.00

Comm Code	Manufacturer	Specification	Model #
43212200			

Extended Description : Please see 3.1.1 of the attached specifications.

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
2	3 Year Warranty for 30TB SAN	1.00000	EA	$0.000000	$0.00

Comm Code	Manufacturer	Specification	Model #
81111818			

Extended Description : Please see 3.1.2 of the attached specifications.

Comments: Included in the system

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
3	This line is inactive - do not provide pricing.	0.00000	EA	$0.000000	$0.00

Comm Code	Manufacturer	Specification	Model #
81111818			

Extended Description : This line is inactive - do not provide pricing.

Comments: Included in the system

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
4	This line is inactive - do not provide pricing.	0.00000	EA	$0.000000	$0.00

Comm Code	Manufacturer	Specification	Model #
81111818			

Extended Description : This line is inactive - do not provide pricing.

Purchasing Divison
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Request for Quotation
21 — Info Technology

Proc Folder: 602821

Doc Description: Addendum No.01 - 30TB SAN with Warranty

Proc Type: Central Purchase Order

Date Issued	Solicitation Closes	Solicitation No		Version
2019-08-14	2019-08-21 13:30:00	CRFQ	0702 TAX2000000001	2

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON   WV   25305
US

VENDOR

Vendor Name, Address and Telephone Number:

Tls technologies
383 kingston Ave sec#357 Brooklyn NY 11213
Tel 473-0264 X 203

FOR INFORMATION CONTACT THE BUYER
Brittany E Ingraham
(304) 558-2157
brittany.e.ingraham@wv.gov

Signature X _____   FEIN # 611569205   DATE 08/14/2019

All offers subject to all terms and conditions contained in this solicitation

Addendum

Addendum No.01 issued to publish and distribute the attached information to the vendor community.

****

Request for Quotation

The West Virginia Purchasing Division is soliciting bids on behalf of the Tax Division to establish a fixed term contract for the purchase of hardware, software, licensing, and support for a Storage Area Network (SAN) solution, per the bid requirements, specifications, terms, and conditions attached to this solicitation.

INVOICE TO	SHIP TO
OPERATIONS DIVISION TAX DIVISION OF PO BOX 11748 CHARLESTON WV 25339-1748 US	OPERATIONS DIVISION TAX DIVISION OF REVENUE CENTER 1001 LEE ST E, STE 1 CHARLESTON WV 25301-1725 US

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	30TB SAN	1.00000	EA	$22,795	$22,795

Comm Code	Manufacturer	Specification	Model #
43212200	Lenovo	Exceeds specifications Requested	be4004

Extended Description :
Please see 3.1.1 of the attached specifications.

INVOICE TO	SHIP TO
OPERATIONS DIVISION TAX DIVISION OF PO BOX 11748 CHARLESTON WV 25339-1748 US	OPERATIONS DIVISION TAX DIVISION OF REVENUE CENTER 1001 LEE ST E, STE 1 CHARLESTON WV 25301-1725 US

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
2	3 Year Warranty for 30TB SAN	1.00000	EA	$0	$0

Comm Code	Manufacturer	Specification	Model #
81111818	Lenovo	Enclused with the system	

Extended Description :
Please see 3.1.2 of the attached specifications.

INVOICE TO		SHIP TO	
OPERATIONS DIVISION		OPERATIONS DIVISION	
TAX DIVISION OF		TAX DIVISION OF	
PO BOX 11748		REVENUE CENTER	
		1001 LEE ST E, STE 1	
CHARLESTON	WV25339-1748	CHARLESTON	WV 25301-1725
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
3	This line is inactive - do not provide pricing.	0.00000	EA		

Comm Code	Manufacturer	Specification	Model #
81111818			

Extended Description :

This line is inactive - do not provide pricing.

INVOICE TO		SHIP TO	
OPERATIONS DIVISION		OPERATIONS DIVISION	
TAX DIVISION OF		TAX DIVISION OF	
PO BOX 11748		REVENUE CENTER	
		1001 LEE ST E, STE 1	
CHARLESTON	WV25339-1748	CHARLESTON	WV 25301-1725
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
4	This line is inactive - do not provide pricing.	0.00000	EA		

Comm Code	Manufacturer	Specification	Model #
81111818			

Extended Description :

This line is inactive - do not provide pricing.

Specification WAS:

4.1 Contract Award: The Contract is intended to provide Agencies with a purchase price for the Contract Items. The Contract shall be awarded to the Vendor that provides the Contract Items meeting the required specifications for the lowest overall total cost as shown on the Pricing Pages.

Contract will be evaluated based on the Total Bid Amount and awarded for the first year only.

Renewal options for years 2, 3, and 4 will be initiated by the Agency, agreed to by the Vendor and Processed by the West Virginia Purchasing Division as Change Orders for subsequent years.

Specification IS NOW:

4.1 Contract Award: The Contract is intended to provide Agencies with a purchase price for the Contract Items. The Contract shall be awarded to the Vendor that provides the Contract Items meeting the required specifications for the lowest overall total cost as shown on the Pricing Pages.

Contract will be awarded as a one-time purchase.

Commodity Lines in wvOASIS have been modified as follows:

Commodity Line 1: 30TB SAN
Commodity Line 2: 3 Year Warranty for 30TB SAN
Commodity Line 3: This line is inactive – do not provide pricing.
Commodity Line 4: This line is inactive – do not provide pricing.

Q1.) Does the agency want a rack included in the configuration?

A1.) No

3.1.1.2 Must be compatible and interoperable with Microsoft Windows Server 2012 R2 and later, VMware ESX Server 6.5 and later, and Microsoft SQL Server 2014 and later.

Q2.) (3.1.1.2) - Can you tell us what the actual application is? Would like to know for factoring in deduplication and compression.

A2.) File storage, no deduplication or compression is necessary.

3.1.1.3 Must have FIPS 140-2 certified encryption algorithms for data encryption at rest.

Q3.) (3.1.1.3) - Does the system just need to support this or do all of the drives included in this solution quote need to be FIPS 140-2?

A3.) The system as a whole needs to use FIPS 140-2 validated algorithms for data encryption at rest.

3.1.1.10 Must have a minimum of 30 TB of storage installed. A minimum of 1OTB must be flash storage, with the individual drive sizes being no larger than 2TB. If the vendor chooses to use spinning hard drives for the remaining 20TB, those drives must be at least 10K in RPM speed, 12Gb/s SAS, and no larger than 2TB each.

Q4.) (3.1.1.10) - Are these numbers formatted usable capacity before or after deduplication and compression?

A4.) This is formatted, RAID 5 capacity.

Q5.) (3.1.1.10) - Is there a reason for the "individual drive sizes being no larger than 2TB"? This seems overly restrictive/counter productive as the current industry enterprise (non desktop) flash drive sizes are 960GB, 3.8TB, 7.2TB, 15.4TB, 30.8TB and 61.6TB with only one drive model being smaller than 2TB. The 960GB's will be discontinued first since they are the oldest release so it seems counter productive to request that the drive sizes be smaller than 2TB as that would limit the long term viability over the typical 5-6 year life span of a typical storage solution. It appears this was inserted to restrict what vendors could respond vs. being a reasonable use case requirement since it is self harming.

A5.) Larger spinning drives introduce (a) unacceptable latency and decreased IOPS, (b) increased recovery time for disk failures, and (c) limit the physical geometry of the disk groups.

3.1.1.8 Must have RAID support 0,1,5,6, and 10.

Q6.) (3.1.1.8) - Is this an actual use case requirement as it seems overly restrictive/counter productive? Few to no modern storage products use or provide RAID, 0, 1, 5, or 10. RAID 6 is the current standard and it is being replaced by new technologies such as Erasure Coding and other advanced RAID types. Like the 2TB drive restriction in section 3.1.1.10, this seems counter productive as only older technology solutions would support any of these RAID levels and you would not be getting a current technology capable solution or one that is viable over the typical 5-6 year life span of a typical storage solution. It appears this was inserted to restrict what vendors could respond vs. being a reasonable use case requirement since it is self harming.

A6.) RAID6 uses additional parity which requires extra write operations and incurs longer rebuild times. First tier SAN vendors should have no issue quoting products with a variety of RAID levels available and with drives of varying density and sizes.

Q7.) Can the bid date be move out one week?

A7.) No

Q8.) Warranty clause in section 28 does not state how many years is the limit, can you please provide how many years warranty is required?

A8.) Per 3.1.2.1: Vendor must provide a three (3) year maintenance service and support warranty for one SAN, 24x7x8 support with the following features.

Q9.) Clause 32. LINCENSING – Can you please provide us what is the license required?

A9.) 32. LICENSING: In accordance with West Virginia Code of State Rules § 148-1-6.1.e, Vendor must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or any other state agency or political subdivision. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Upon request, the Vendor must provide all necessary releases to obtain information to enable the Purchasing Division Director or the Agency to verify that the Vendor is licensed and in good standing with the above entities.

Q10.) For shipping calculations – can we assume 1001 Lee St E, STE 1, Charleston WV 25301-1725?

A10.) Yes

Q11.) Understanding that All Flash storage arrays have considerable performance advantages over Hybrid; would the Tax department consider a storage array using only 3.84TB All Flash drives? Also, all flash storage arrays have advantages in maintenance cost, power cost, and cooling cost, and they support the use of deduplication in real-time (not post-processed). Understanding that it is often less expensive to use All Flash with these deduplication features, would the Tax department consider an All flash storage array with online deduplication features that deliver at least 30TB of effective storage, however having less than 30TB of physical media installed?

A11.) All flash arrays will be considered but using deduplication or compression as a means to achieve the 30TB requirement will not.

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: CRFQ TAX20*01

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received)

[✓] Addendum No. 1   [ ] Addendum No. 6

[ ] Addendum No. 2   [ ] Addendum No. 7

[ ] Addendum No. 3   [ ] Addendum No. 8

[ ] Addendum No. 4   [ ] Addendum No. 9

[ ] Addendum No. 5   [ ] Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

_____
YESTechnologes
Company

_____
Authorized Signature

_____
08/14/2019
Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.
Revised 6/8/2012

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

Saai Finck Sales Manager
(Name, Title)

saai Finck Sales manager
(Printed Name and Title)

303 Kingston Ave ste # 357 Brooklyn NY 11213
(Address)

_718 473-0284 X203 718. 360-9627_
(Phone Number) / (Fax Number)

saai @ xandstech.com
(email address)

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through wvOASIS, I certify that I have reviewed this Solicitation in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that I am authorized by the vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

YESTechnologies
(Company)

saai Finck sares manager
(Authorized Signature) (Representative Name, Title)

saai Finck sales manager
(Printed Name and Title of Authorized Representative)

_08/13/2019_
(Date)

_718.473-0284 X203 718-360-9627_
(Phone Number) (Fax Number)

SPECIFICATIONS

1. **PURPOSE AND SCOPE:** The West Virginia Purchasing Division is soliciting bids on behalf of the Tax Division to establish a fixed term contract for the purchase of hardware, software, licensing, and support for a Storage Area Network (SAN) solution.

2. **DEFINITIONS:** The terms listed below shall have the meanings assigned to them below. Additional definitions can be found in section 2 of the General Terms and Conditions.

   2.1 **"Contract Item"** means Storage Area Network (SAN) as more fully described by these specifications.

   2.2 **"Pricing Page"** means the pages, contained in wvOASIS, upon which Vendor should list its proposed price for the Contract Items.

   2.3 **"Solicitation"** means the official notice of an opportunity to supply the State with goods or services that is published by the Purchasing Division.

   2.4 **"FIPS 140-2"** is a U.S. government computer security standard used to approve cryptographic modules.

   2.5 **"GB"** means Gigabyte which is a multiple of the unit byte for digital information.

   2.6 **"Gb/s"** is a unit of data transfer equal to 1,000 megabits per seconds.

   2.7 **"iSCSI"** is an acronym form internet small computer systems interface, an internet protocol (IP)-based storage networking standard for linking data storage facilities.

   2.8 **"LDAP"** (Lightweight Directory Access Protocol) is a software protocol for enabling anyone to locate organizations, individuals, and other resources such as files and devices in a network, whether on the public Internet or on a corporate network.

   2.9 **"RAID"** (Redundant Array of Independent Disks) is a data storage virtualization technology that combines multiple physical disk drive components into a single logical unit for the purposes of data redundancy, performance improvement, or both.

   2.10 **"SSD"** means solid state drive.

   2.11 **"Syslog"** is a way for network devices to send event messages to a logging server – usually known as a syslog server. The syslog protocol is supported by a wide range of devices and can be used to log different types of events.

3. GENERAL REQUIREMENTS:

3.1 **Mandatory Contract Item Requirements:** Contract Item must meet or exceed the mandatory requirements listed below.

3.1.1 Storage Area Network/Storage Array

3.1.1.1 Must have Block-Level Storage.

3.1.1.2 Must be compatible and interoperable with Microsoft Windows Server 2012 R2 and later, VMware ESX Server 6.5 and later, and Microsoft SQL Server 2014 and later.

3.1.1.3 Must have FIPS 140-2 certified encryption algorithms for data encryption at rest.

3.1.1.4 Must be able to audit security relevant events such as:

3.1.1.4.1 all unsuccessful login and authorization attempts

3.1.1.4.2 all identification and authentication attempts

3.1.1.4.3 all actions, connections, and requests performed by privileged users and privileged functions

3.1.1.4.4 all changes to logical access control authorities

3.1.1.4.5 all system changes with the potential to compromise the integrity security policy configurations

3.1.1.4.6 the creation, modification, and deletion of objects including files, directories, and user accounts

3.1.1.4.7 the creation, modifications, and deletion of user accounts and group accounts

3.1.1.4.8 the creation, modification, and deletion of user account and group account privileges

3.1.1.4.9 system startup and shutdown functions

3.1.1.5 Must have a Defective Media Retention option which allows the Agency to retain defective hard disks and SSD/Flash components containing sensitive data.

3.1.1.6 Must have at least two storage processors. Each storage processor must have two separate 16Gb/s Fibre Channel ports.

3.1.1.7 Must support thin provisioning.

3.1.1.8 Must have RAID support 0,1,5,6, and 10.

3.1.1.9 Must be able to replace individual drives & power supplies while the system is in production without causing downtime or a degrade in performance.

3.1.1.10 Must have a minimum of 30 TB of storage installed. A minimum of 10TB must be flash storage, with the individual drive sizes being no larger than 2TB. If the vendor chooses to use spinning hard drives for the remaining 20TB, those drives must be at least 10K in RPM speed, 12Gb/s SAS, and no larger than 2TB each.

3.1.1.11 Must be able to support up to 75 hard drives by default or by using expansion shelves or device federation.

3.1.1.12 Must support multi-level account management with individual account authentication.

3.1.1.13 Must support account locking after three unsuccessful login attempts.

3.1.1.14 Must support a user-defined banner before logon.

3.1.1.15 Must support an automatic session expiration timeout of no more than 30 minutes.

3.1.1.16 Must produce audit logs that have timestamps, user ID if available, action requested, success or failure of the action; and source address of the request if available.

3.1.1.17 Must be able to produce Audit logs that are capable of being exported or directed to external systems for long-term retention and review.

3.1.1.18 Must support masked (not clear-text) password entry.

3.1.1.19 Must support integration with an LDAP/Active Directory server for authentication of administrative accounts.

3.1.1.20 Must support logging to a Syslog server.

3.1.1.21 Must support Network Time Protocol (NTP) synchronization to an agency provided NTP server.

3.1.2 **Maintenance and Warranty for SAN**

3.1.2.1 Vendor must provide a three (3) year maintenance service and support warranty for one SAN, 24x7x8 support with the following features.

3.1.2.1.1 24-hours a day, 7 days a week access for telephone support for troubleshooting technical and configuration issues, plus onsite support when deemed necessary by the Agency.

3.1.2.1.2 Replacement parts must be delivered onsite within 8 hours of service call being made. Vendor must install replacement parts unless Agency agrees to perform installation.

3.1.2.1.3 Rights to new software releases

3.1.2.1.4 Access to security patches and firmware updates provided directly by each Original Equipment Manufacturer (OEM).

4. CONTRACT AWARD:

4.1 Contract Award: The Contract is intended to provide Agencies with a purchase price for the Contract Items. The Contract shall be awarded to the Vendor that provides the Contract Items meeting the required specifications for the lowest overall total cost as shown on the Pricing Pages.

Contract will be evaluated based on the Total Bid Amount and awarded for the first year only.

Renewal options for years 2, 3, and 4 will be initiated by the Agency, agreed to by the Vendor and Processed by the West Virginia Purchasing Division as Change Orders for subsequent years.

4.1.1 Vendor should include with their bid a copy of any Software Terms and Conditions or licenses that the State of West Virginia or the Agency will have to agree or accept as a part of this solicitation. **This information will be required before Purchase Order is issued.**

4.1.2 Vendor should include a copy of Maintenance Terms and Conditions or Licenses that the State of West Virginia or the Agency will be required to agree or accept

as a part of this solicitation. **This information will be required before the Purchase Order is issued.**

4.2 Pricing Page: Vendor should complete the Pricing Page in its entirety. Vendor should complete the Pricing Page in full as failure to complete the Pricing Page in its entirety may result in Vendor's bid being disqualified.

Vendor should type or electronically enter the information into the Pricing Page to prevent errors in the evaluation.

Vendors who wish to respond to a centralized Request for Quotation (CRFQ) online may submit information through the state's wvOASIS vendor self-service (VSS). If unable to respond online, vendor must submit their pricing page with their submitted bid prior to the scheduled bid opening date.

Vendor should electronically enter the information into the Pricing Pages through wvOASIS, if available, or as an electronic document. Vendor can download the electronic copy of the Pricing Pages from the wvOASIS Vendor Self-Service (VSS) website. If responding with a paper bid, Vendors should download and/or print the assembled CRFQ document (with the highest version number) from wvOASIS and insert their unit price and extended cost for each line item.

5. PAYMENT:

5.1 Payment: Vendor shall accept payment in accordance with the payment procedures of the State of West Virginia.

6. DELIVERY AND RETURN:

6.1 **Shipment and Delivery:** Vendor shall ship the Contract Items immediately after being awarded this Contract and receiving a purchase order. Vendor shall deliver the Contract Items within fifteen (15) calendar days after receiving a purchase order.

<div align="center">

Contract Items must be delivered to Agency:
West Virginia State Tax Department
1001 Lee Street East, Charleston, WV 25301

</div>

6.2 **Late Delivery:** The Agency placing the order under this Contract must be notified in writing if the shipment of the Contract Items will be delayed for any reason. Any delay in delivery that could cause harm to an Agency will be grounds for cancellation of the Contract, and/or obtaining the Contract Items from a third party.

Any Agency seeking to obtain the Contract Items from a third party under this provision must first obtain approval of the Purchasing Division.

6.3 **Delivery Payment/Risk of Loss:** Vendor shall deliver the Contract Items F.O.B. destination to the Agency's location.

6.4 **Return of Unacceptable Items:** If the Agency deems the Contract Items to be unacceptable, the Contract Items shall be returned to Vendor at Vendor's expense and with no restocking charge. Vendor shall either make arrangements for the return within five (5) days of being notified that items are unacceptable, or permit the Agency to arrange for the return and reimburse Agency for delivery expenses. If the original packaging cannot be utilized for the return, Vendor will supply the Agency with appropriate return packaging upon request. All returns of unacceptable items shall be F.O.B. the Agency's location. The returned product shall either be replaced, or the Agency shall receive a full credit or refund for the purchase price, at the Agency's discretion.

6.5 **Return Due to Agency Error:** Items ordered in error by the Agency will be returned for credit within 30 days of receipt, F.O.B. Vendor's location. Vendor shall not charge a restocking fee if returned products are in a resalable condition. Items shall be deemed to be in a resalable condition if they are unused and in the original packaging. Any restocking fee for items not in a resalable condition shall be the lower of the Vendor's customary restocking fee or 5% of the total invoiced value of the returned items.

7 VENDOR DEFAULT:

7.1 The following shall be considered a vendor default under this Contract.

    7.1.1 Failure to provide Contract Items in accordance with the requirements contained herein.

    7.1.2 Failure to comply with other specifications and requirements contained herein.

    7.1.3 Failure to comply with any laws, rules, and ordinances applicable to the Contract Services provided under this Contract.

    7.1.4 Failure to remedy deficient performance upon request.

7.2 The following remedies shall be available to Agency upon default.

    7.2.1 Immediate cancellation of the Contract.

7.2.2 Immediate cancellation of one or more release orders issued under this Contract.

7.2.3 Any other remedies available in law or equity.

8. MISCELLANEOUS:

8.1 Contract Manager: During its performance of this Contract, Vendor must designate and maintain a primary contract manager responsible for overseeing Vendor's responsibilities under this Contract. The Contract manager must be available during normal business hours to address any customer service or other issues related to this Contract. Vendor should list its Contract manager and his or her contact information below.

Contract Manager: _Saul Fink_

Telephone Number: _718-473-0284 X203_

Fax Number: _718-360-9627_

Email Address: _saul@ xandstech.com_

West Virginia Ethics Commission

Disclosure of Interested Parties to Contracts

Pursuant to *W. Va. Code* § 6D-1-2, a state agency may not enter into a contract, or a series of related contracts, that has/have an actual or estimated value of $1 million or more until the business entity submits to the contracting state agency a Disclosure of Interested Parties to the applicable contract. In addition, the business entity awarded a contract is obligated to submit a supplemental Disclosure of Interested Parties reflecting any new or differing interested parties to the contract within 30 days following the completion or termination of the applicable contract.

For purposes of complying with these requirements, the following definitions apply:

"Business entity" means any entity recognized by law through which business is conducted, including a sole proprietorship, partnership or corporation, but does not include publicly traded companies listed on a national or international stock exchange.

"Interested party" or *"Interested parties"* means:

(1) A business entity performing work or service pursuant to, or in furtherance of, the applicable contract, including specifically sub-contractors;
(2) the person(s) who have an ownership interest equal to or greater than 25% in the business entity performing work or service pursuant to, or in furtherance of, the applicable contract. (This subdivision does not apply to a publicly traded company); and
(3) the person or business entity, if any, that served as a compensated broker or intermediary to actively facilitate the applicable contract or negotiated the terms of the applicable contract with the state agency. (This subdivision does not apply to persons or business entities performing legal services related to the negotiation or drafting of the applicable contract.)

"State agency" means a board, commission, office, department or other agency in the executive, judicial or legislative branch of state government, including publicly funded institutions of higher education: Provided, that for purposes of W. Va. Code § 6D-1-2, the West Virginia Investment Management Board shall not be deemed a state agency nor subject to the requirements of that provision.

The contracting business entity must complete this form and submit it to the contracting state agency prior to contract award and to complete another form within 30 days of contract completion or termination.

This form was created by the State of West Virginia Ethics Commission, 210 Brooks Street, Suite 300, Charleston, WV 25301-1804. Telephone: (304)558-0664; fax: (304)558-2169; e-mail: ethics@wv.gov; website: www.ethics.wv.gov.

Revised June 8, 2018

West Virginia Ethics Commission
Disclosure of Interested Parties to Contracts
(Required by *W. Va. Code* § 6D-1-2)

Name of Contracting Business Entity: F&T Technologie **Address:** 383 kingseih Arb Ste
357 Brooklyn NY 11213

Name of Authorized Agent: Saai Finch **Address:** 383 kingseih Ave Stw 357
brooklyn NY 11213

Contract Number: Tax2000000 **Contract Description:** scanners

Governmental agency awarding contract: _____ TAX Division

☐ **Check here if this is a Supplemental Disclosure**

List the Names of Interested Parties to the contract which are known or reasonably anticipated by the contracting business entity for each category below *(attach additional pages if necessary)*:

1. **Subcontractors or other entities performing work or service under the Contract**
   ☑ Check here if none, otherwise list entity/individual names below.

2. **Any person or entity who owns 25% or more of contracting entity (not applicable to publicly traded entities)**
   ☐ Check here if none, otherwise list entity/individual names below.

3. **Any person or entity that facilitated, or negotiated the terms of, the applicable contract (excluding legal services related to the negotiation or drafting of the applicable contract)**
   ☐ Check here if none, otherwise list entity/individual names below.

Signature: _____ **Date Signed:** 08/08/2019

Notary Verification

State of Colorado , County of Arapahoe

I, Saai Finch , the authorized agent of the contracting business entity listed above, being duly sworn, acknowledge that the Disclosure herein is being made under oath and under the penalty of perjury.

Taken, sworn to and subscribed before me this 8th day of August, 2019.

_____
Notary Public's Signature

To be completed by State Agency:
Date Received by State Agency: _____
Date submitted to Ethics Commission: _____
Governmental agency submitting Disclosure: _____

GARY S. KYLE
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20134007280
MY COMMISSION EXPIRES FEBRUARY 4, 2021

Revised June 8, 2018

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

CONSTRUCTION CONTRACTS: Under W. Va. Code § 5-22-1(i), the contracting public entity shall not award a construction contract to any bidder that is known to be in default on any monetary obligation owed to the state or a political subdivision of the state, including, but not limited to, obligations related to payroll taxes, property taxes, sales and use taxes, fire service fees, or other fines or fees.

ALL CONTRACTS: Under W. Va. Code §5A-3-10a, no contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and: (1) the debt owed is an amount greater than one thousand dollars in the aggregate; or (2) the debtor is in employer default.

EXCEPTION: The prohibition listed above does not apply where a vendor has contested any tax administered pursuant to chapter eleven of the W. Va. Code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

DEFINITIONS:

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Employer default" means having an outstanding balance or liability to the old fund or to the uninsured employers' fund or being in policy default, as defined in W. Va. Code § 23-2c-2, failure to maintain mandatory workers' compensation coverage, or failure to fully meet its obligations as a workers' compensation self-insured employer. An employer is not in employer default if it has entered into a repayment agreement with the Insurance Commissioner and remains in compliance with the obligations under the repayment agreement.

"Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

AFFIRMATION: By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (*W. Va. Code* §61-5-3) that: (1) for construction contracts, the vendor is not in default on any monetary obligation owed to the state or a political subdivision of the state, and (2) for all other contracts, that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

WITNESS THE FOLLOWING SIGNATURE:

Vendor's Name: _____KST Technologies_____

Authorized Signature: _____   Date: __08/08/2019__

State of ___Colorado___

County of ___Arapahoe___, to-wit:

Taken, subscribed, and sworn to before me this 8th day of __August__, 20_19_.

My Commission expires __02/04/2021__, 20_21_.

AFFIX SEAL HERE   NOTARY PUBLIC _____

Purchasing Affidavit (Revised 01/19/2018)

Date 08/13/2019

TAX DIVISION WEST VIRGINIA
Solicitation: TAX2000000001
Brittany E Ingraham

<div align="center">

30TB SAN with Maintenance

</div>

Dear Brittany,

<div align="center">

Proposal

</div>

      After extensive research, we are proposing a solution by Lenovo. Lenovo is the leading PC manufacture in the world. Over the past **28 quarters** they have had the highest growth rate of any major PC manufacture in the world. Their US headquarters is located in Raleigh, North Carolina and all tech support is handled by US technicians based out of Atlanta, GA. Lenovo has acquired prestigious accounts, including the NYC Board of Education (largest school district in the country), Clark County School District (Las Vegas) and the United Nations Etc.

      Lenovo Corporation has been in business for over 25 years. They began as a small manufacturer of PC clone computers and 10 years ago they purchased the IBM ThinkPad line computers. Just as, IBM they value engineering and quality. The products that they release meets the heights standards of quality and durability. **Gartner,** an independent and well known testing lab, rates Lenovo as the leader in this industry. We will be attaching the **Gartner Table** for your consideration.

<div align="center">

Solution

QTY 1 Storage Area Network/Storage Array or Equal

</div>

      For this solution, we are proposing **QTY 1 Lenovo ThinkSystem DE4000H FC Hybrid Flash Array SFF** that meets or exceeds the specifications that you requested. Please see the build below on what we are proposing. I have attached Data sheets on the San for your convenience.

Part number	Product Description	Qty
7Y75A002WW	**Lenovo ThinkSystem DE4000H FC Hybrid Flash Array SFF - 24 x HDD Supported - 24 x SSD Supported - 2 x 12Gb/s SAS Controller - RAID Supported 0, 1, 3, 5, 6, 10 - 24 x Total Bays - 24 x 2.5" Bay - Gigabit Ethernet - 2 USB Port(s) - - FCP,**	**1**

	SSH, SMI-S, SNMP, SSL, LDAP - 4 SAS Port(s) External - 2U - Rack-mountable FLASH ARRAY SFF	
4M17A13527	Lenovo 10Gb iSCSI/16Gb FC Universal SFP+ Module - For Data Networking, Optical Network - 1 10GBase-X iSCSI - Optical Fiber10 Gigabit Ethernet, 16 Gigabit Ethernet - 10GBase-X, 16GBase-X, Fiber Channel SFP+ MODULE	4
4XB7A14114	Lenovo ThinkSystem DE Series 1.8TB 10K 2.5" HDD FIPS 2U24	18
4XB7A14107	Lenovo ThinkSystem DE Series 1.6TB 3DWD 2.5" SSD FIPS 2U24	6
5PS7A22122	Premier with Essential - 1Yr Post Wty 24x7 4Hr Response + YourDrive YourData	1
5PS7A22072	Premier with Essential - 3Yr 24x7 4Hr Response + YourDrive YourData	1
	Lenovo will update the drives to FIPS models for encryption	1

Warranty

Y&S is providing a Lenovo full manufacturer warranty that exceeds the specifications requested **Lenovo services1: Essential Service - 3Yr 24x7 4Hr onsite Response + YourDrive YourData. Including holidays.**

Post Warranty

We are including an optional warranty for year 4 as the unit comes with a 3 year warranty.

Insurance

Y&S Technologies maintains all required commercial insurance policies and will be more than happy to provide proof of insurance if the State requests it.

Pricing

Please see bid paperwork for pricing.

Delivery

We can provide delivery within 14 days ARO. Our price includes shipping and handling.

Lenovo Authorized Dealer

Y&S Technologies is a Lenovo Certified Silver partner. Our partner ID is 1213379364. All items are new and sealed and come with full manufacturer warranty

Y&S References

Y&S has provided solutions like this throughout the country. Here are a few references for your convenience:

1) **Reginal Transportation Authority** in Dayton, OH. Point of Contact is Jim Canaday, Ph #937-425-8320, E-mail jcanaday@greaterdaytonrta.org. We provided 5 Lenovo System X servers with Microsoft Licenses worth over $189,000 in June 2016.
2) **Applied Materials** in Hopewell Junction, NY. Point of Contact is Paul Llanos, Ph #845-227-0298, E-mail Paul_Llanos@amat.com. We provided Applied Materials with over $700,000 worth of System X Server equipment over the past couple of years.
3) **Knoxville Utility Board** in Knoxville, KY. Point of Contact is Rebekah Taylor. Ph #865-558-2307, E-mail Rebekah.taylor@kub.org. KUB purchases over $150,000 worth of System X servers over the past couple of years.
4) **Craven County Schools**, in New Bern, NC. The point of contact is Lori Prescott who can be reached at 252-514-6357 or by E-mail at Lori.prescott@craven.k12.nc,us. We supplied over 750 Lenovo Chromebooks with services valued over $350, 000 in over the past couple of years.
5) **Wilton Public Schools** in Wilton, CT. The point of contact is Helaine Walker who is the senior Admin for the IT Director. Helaine can be reached by 203-834-4874 or by walkerh@wilton.k12.ct.us. We sold over $575,000 worth of Lenovo Laptops and accessories with Image services.

Point of Contact

Saul Finck (Sales Manager) will be your point of contact for this contract and will assist the State and its personnel in any matters related to this contract. Contact Information is as follows: PH #718-473-0284 Ext 200. E-mail saul@yandstech.com.

Brief History of our Company

Y&S Technologies have been in business for over twelve years with our primary focus on the education and government sector. Our senior staffs have over 40 years of combined experience, selling and servicing the academic and government market. Y & S Technologies was established in the midst of the worst recession since the Great Depression. We have not only survived but we have grown our business every year by a minimum of 20%. We offer our customers highly competitive solutions, the best products at the best prices, and a high level of service and support. These directly contribute to our successful and expanding business.

If you should need any further information please feel free to contact me at your earliest convenience. Thanking for the opportunity to do business with your city.

Saul Finck
Sales Manager
Y&S Technologies

Lenovo ThinkSystem DE4000H Hybrid Storage Array
Product Guide

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

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

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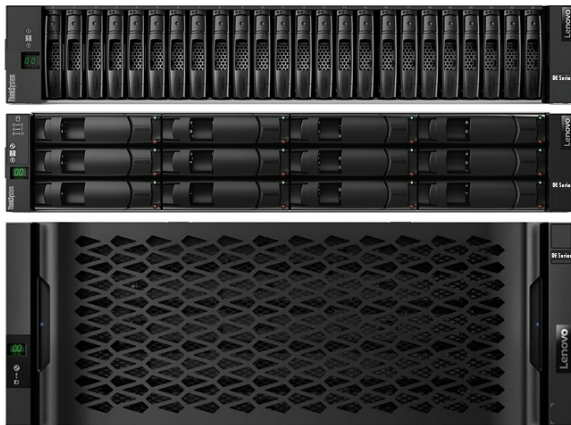

Figure 1. Lenovo ThinkSystem DE4000H 2U24 SFF (top), 2U12 LFF (middle), and 4U60 LFF (bottom)

Did you know?

The ThinkSystem DE4000H scales up to 2.3 PB of raw storage capacity, and it offers block storage connectivity with support for 1/10 Gb iSCSI or 4/8/16 Gb FC, and 12 Gb SAS, 10/25 Gb iSCSI, or 8/16/32 Gb FC at the same time.

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

Key features

The ThinkSystem DE4000H offers the following key features and benefits:

- Scalable entry-level hybrid storage with dual active/active controller configurations with 8 GB cache per controller for high availability and performance.

- Improved performance and data protection with Dynamic Disk Pools (DDP) technology, as well as support for traditional RAID 0, 1, 3, 5, 6, and 10.

- Flexible host connectivity to match diverse client needs with support for 1/10 Gb iSCSI or 4/8/16 Gb FC, and 12 Gb SAS, 10/25 Gb iSCSI, or 8/16/32 Gb FC connectivity at the same time.

- 12 Gb SAS drive-side connectivity with support for up to 24x 2.5-inch small form factor (SFF) drives in the 2U24 SFF enclosures, up to 12x 3.5-inch large form factor (LFF) drives in the 2U12 LFF enclosures, or up to 60x 3.5-inch LFF drives in the 4U60 LFF enclosures.

- Scalability to up to 192 SFF or LFF drives with the attachment of the ThinkSystem DE240S 2U24 SFF, DE120S 2U12 LFF, or DE600S 4U60 LFF expansion enclosures to satisfy growing needs for storage capacity and performance.

- Rich set of standard storage management functions available at no extra cost, including Dynamic Disk Pools, SSD read cache, snapshots, volume copy, thin provisioning, and encryption (requires optional FIPS drives).

- Optional licensed functions, including higher number of snapshots for greater scalability and synchronous or asynchronous mirroring for continuous data availability.

- Intuitive, web-based GUI for easy system setup and management.

- Designed for 99.999% availability with redundant hot-swap components, including controllers and I/O modules, power supplies, cooling modules (4U60 LFF enclosures only), proactive maintenance, and non-disruptive firmware upgrades.

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

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

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

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

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

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

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

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

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

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

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

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

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

Components and connectors

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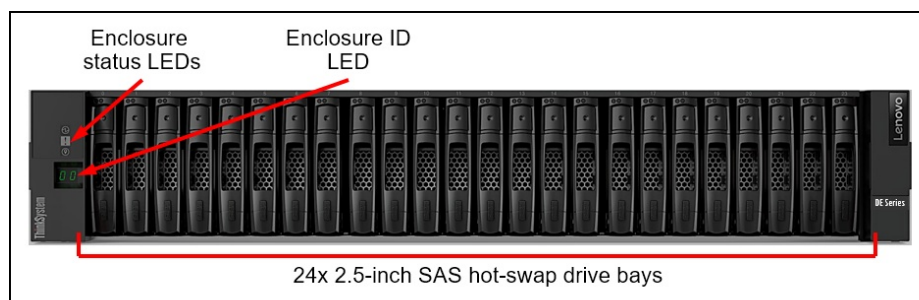

Figure 2. ThinkSystem DE4000H and DE240S 2U SFF enclosures front view

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

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

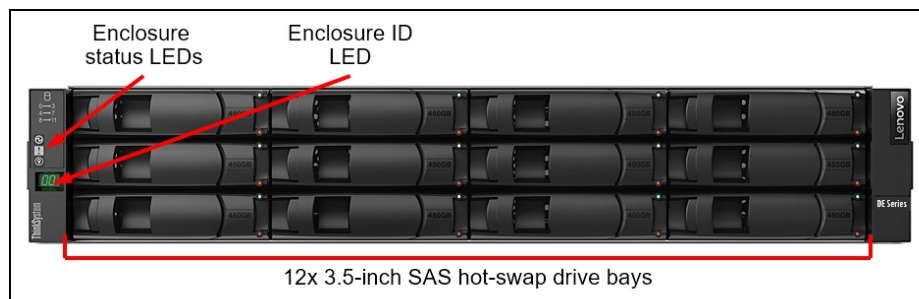The following figure shows the front of the ThinkSystem DE4000H and DE120S 2U LFF enclosures.

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

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

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

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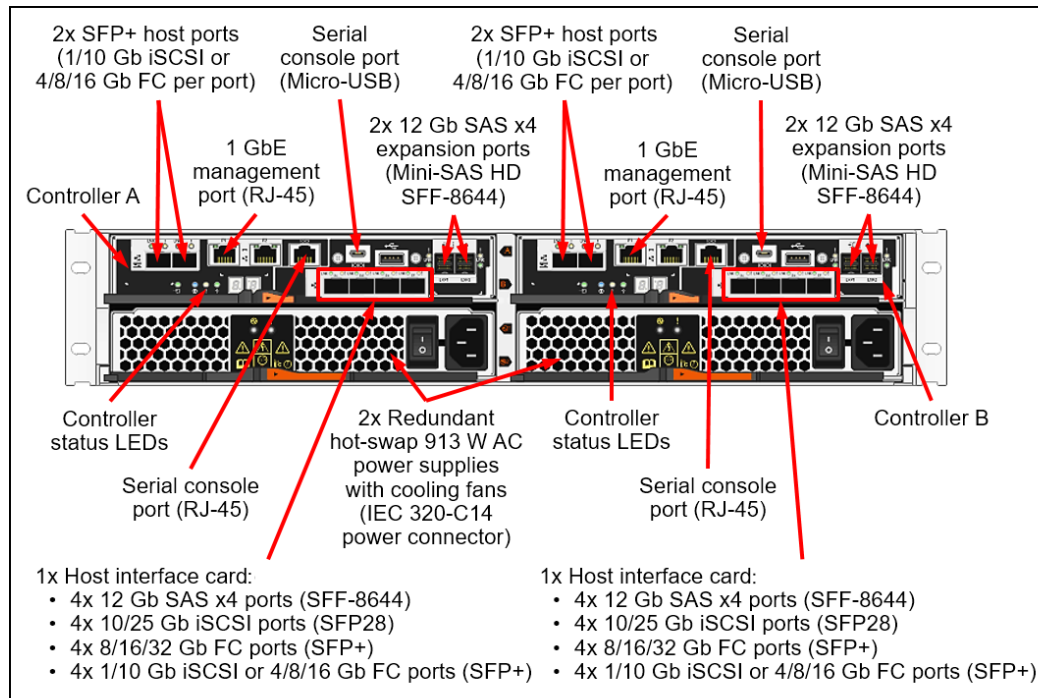

Figure 4. ThinkSystem DE4000H 2U controller enclosure rear view

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

- Two redundant hot-swap controllers, each with the following ports:
  - Two SFP+ base host ports for 1/10 Gb iSCSI or 4/8/16 Gb FC connectivity.
  - One slot for the host interface card (a host interface card is required):
    - Four 12 Gb SAS x4 host ports (Mini-SAS HD SFF-8644).
    - Four 10/25 Gb iSCSI host ports (SFP28).
    - Four 8/16/32 Gb FC host ports (SFP+).
    - Four 1/10 Gb iSCSI or 4/8/16 Gb FC host ports (SFP+).
  - Two 12 Gb SAS x4 expansion ports (Mini-SAS HD SFF-8644) for connections to the expansion enclosures.
  - One RJ-45 10/100/1000 Mb Ethernet port for out-of-band management.
    Note: The Ethernet port (P2) next to the GbE management port is not available for use.
  - Two serial console ports (RJ-45 and Micro-USB) for another means to configure the system.
  - One USB Type A port (reserved for factory use)
- Two redundant hot-swap 913 W (100 - 240 V) AC power supplies (IEC 320-C14 power connector) with integrated cooling fans.

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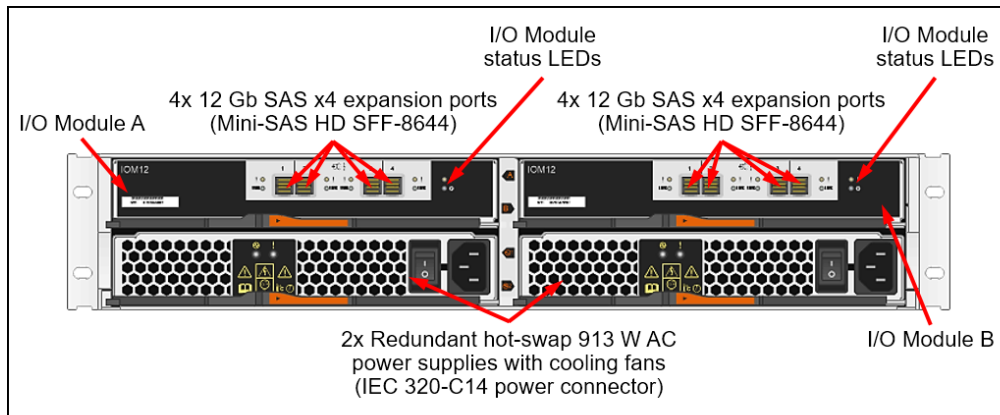

Figure 5. ThinkSystem DE240S or DE120S 2U expansion enclosure rear view

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

- Two redundant hot-swap I/O Modules; each I/O Module provides four 12 Gb SAS x4 expansion ports (Mini-SAS HD SFF-8644) for connections to the controller enclosures and for connecting the expansion enclosures between each other.

- Two redundant hot-swap 913 W (100 - 240 V) AC power supplies (IEC 320-C14 power connector) with integrated cooling fans.

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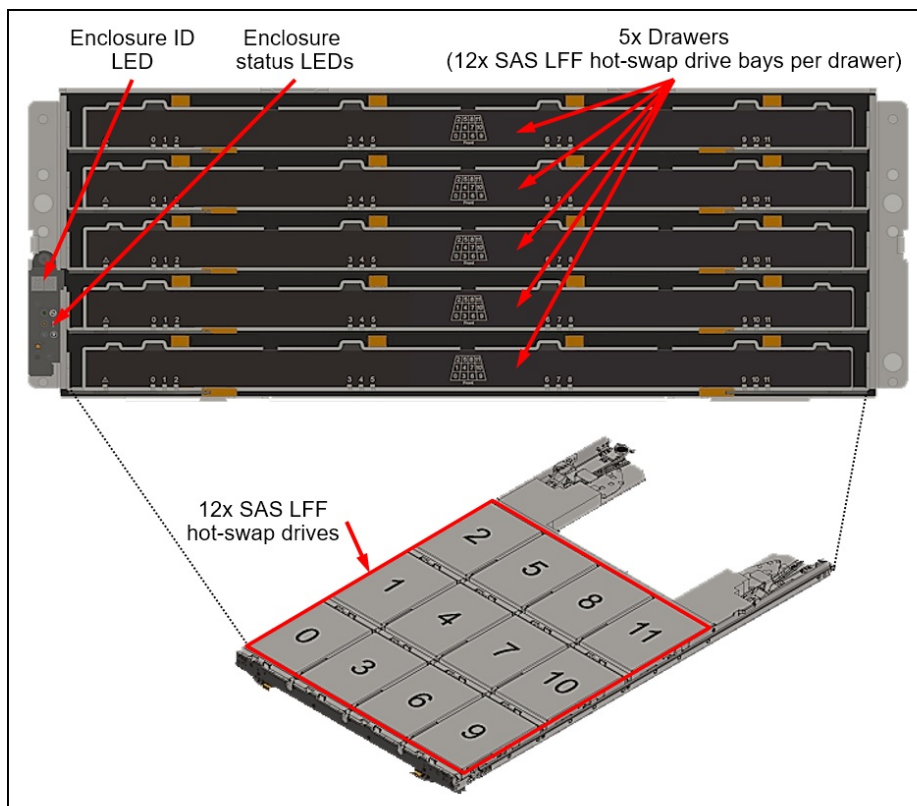

Figure 6. ThinkSystem DE4000H and DE600S 4U LFF enclosures front view (without the front bezel)

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

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

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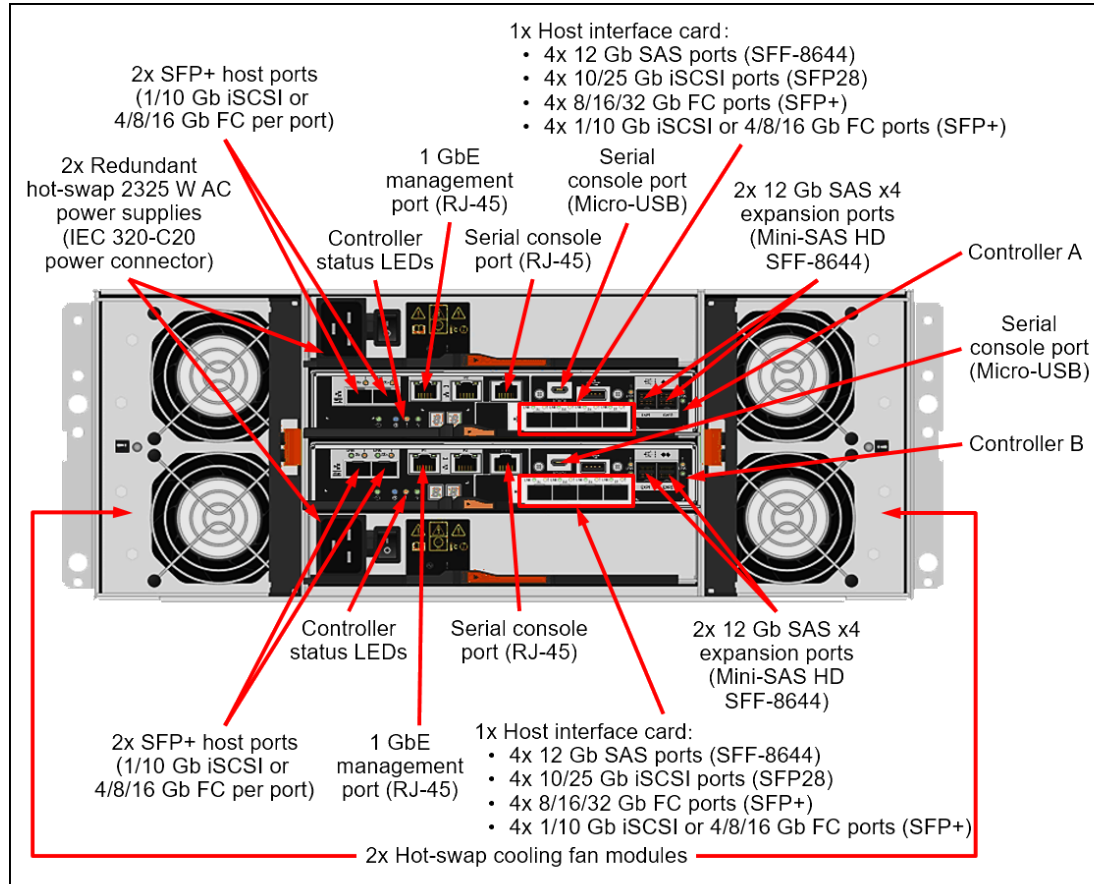

Figure 7. ThinkSystem DE4000H 4U LFF controller enclosure rear view

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

- Two redundant hot-swap controllers, each with the following ports:
  - Two SFP+ base host ports for 1/10 Gb iSCSI or 4/8/16 Gb FC connectivity.
  - One slot for the host interface card (a host interface card is required):
    - Four 12 Gb SAS x4 host ports (Mini-SAS HD SFF-8644).
    - Four 10/25 Gb iSCSI host ports (SFP28).
    - Four 8/16/32 Gb FC host ports (SFP+).
    - Four 1/10 Gb iSCSI or 4/8/16 Gb FC host ports (SFP+).
  - Two 12 Gb SAS x4 expansion ports (Mini-SAS HD SFF-8644) for connections to the expansion enclosures.
  - One RJ-45 10/100/1000 Mb Ethernet port for out-of-band management.
    Note: The Ethernet port (P2) next to the GbE management port is not available for use.
  - Two serial console ports (RJ-45 and Micro-USB) for another means to configure the system.
  - One USB Type A port (reserved for factory use)
- Two redundant hot-swap 2325 W (200 - 240 V) AC power supplies (IEC 320-C20 power connector)
- Two hot-swap cooling fan modules; each module has two fans.
  Note: The failed cooling module should be replaced as soon as possible.

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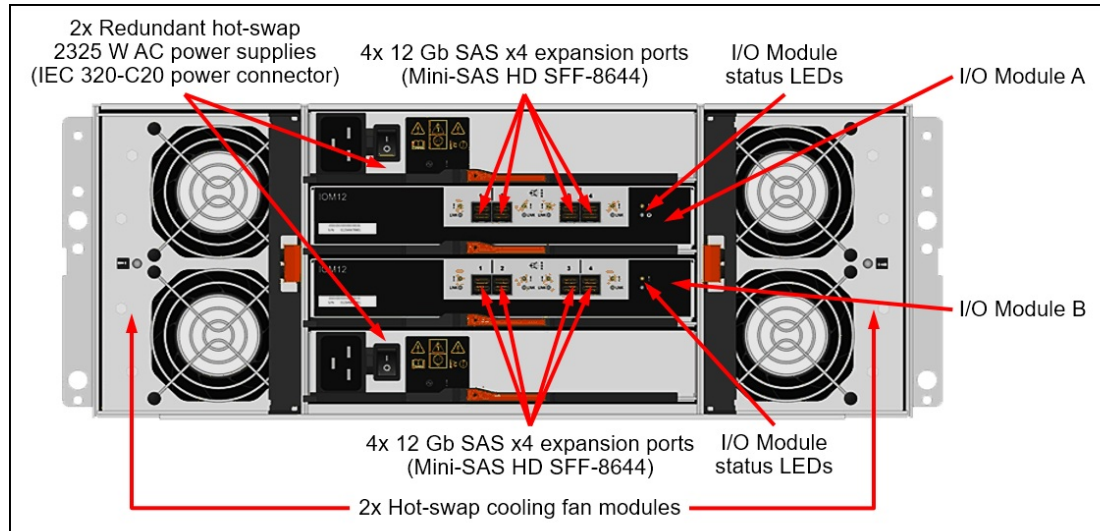

Figure 8. ThinkSystem DE600S 4U LFF expansion enclosure rear view

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

- Two redundant hot-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 2325 W (200 - 240 V) AC power supplies (IEC 320-C20 power connector)

- Two hot-swap cooling fan modules; each module has two fans.
  Note: The failed cooling module should be replaced as soon as possible.

System specifications

The following table lists the ThinkSystem DE4000H storage system specifications.

Note: The supported hardware options and software features listed in this product guide are based on the software version 11.50. For details about specific software releases that introduced support for certain hardware options and software features, refer to the Release notes of the particular software release for the ThinkSystem DE4000H that can be found at:
http://datacentersupport.lenovo.com

Table 1. ThinkSystem DE4000H system specifications

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

Attribute	Specification
Drive bays	Up to 8 enclosures per system (Controller unit with up to 3 [4U60] or 7 [2U24 or 2U12] expansion units): • Up to 192 LFF hot-swap drive bays (Up to 1x 2U12 and 3x 4U60 LFF enclosures) • Up to 192 SFF hot-swap drive bays (Up to 8x 2U24 LFF enclosures) Intermix of 2U24 SFF, 2U12 LFF, and 4U60 LFF enclosures is supported for a total of up to 192 drives per system.
Drive technology	• 12 Gb SAS and NL SAS HDDs and FIPS HDDs, 12 Gb SAS SSDs and FIPS SSDs. • Intermix of HDDs and SSDs is supported within a system. • Intermix of HDDs and SSDs is *not* supported within a volume group or disk pool. • A maximum of 120 SAS SSDs is supported. • Intermix of FIPS drives and non-FIPS drives is supported within a system. • Intermix of FIPS drives and non-FIPS drives is *not* supported within a volume group or disk pool.
Drive expansion connectivity	• 2x 12 Gb SAS x4 (Mini-SAS HD SFF-8644) expansion ports on each of two controllers in the controller enclosure for the attachment of the expansion enclosures. • 4x 12 Gb SAS x4 (Mini-SAS HD SFF-8644) expansion ports on each of two I/O modules in the expansion enclosure for the attachment to the controller enclosure and daisy chaining of the expansion enclosures.
Drives	2U24 SFF drives: • 1.2 TB and 1.8 TB 10K rpm SAS HDDs • 1.8 TB 10K rpm SAS FIPS HDDs • 3.84 TB, 7.68 TB, and 15.36 TB SAS SSDs (1 DWD) • 800 GB, 1.6 TB, and 3.2 TB SAS SSDs (3 DWD) • 1.6 TB SAS FIPS SSDs (3 DWD) 2U12 LFF drives: • 4 TB, 8 TB, 10 TB, and 12 TB 7.2K rpm NL SAS HDDs • 6 TB and 10 TB 7.2K rpm NL SAS FIPS HDDs • 800 GB SAS SSDs (3 DWD) • 1.6 TB SAS FIPS SSDs (3 DWD) 4U60 LFF drives: • 4 TB, 8 TB, 10 TB, and 12 TB 7.2K rpm NL SAS HDDs • 10 TB 7.2K rpm NL SAS FIPS HDDs • 800 GB, 1.6 TB, and 3.2 TB SAS SSDs (3 DWD) • 1.6 TB SAS FIPS SSDs (3 DWD)
Storage capacity	Up to 2.3 PB (192x 12 TB LFF HDDs).
Host connectivity	Base ports (per controller enclosure with two controllers): • 4x 1/10 Gb iSCSI (RJ-45 [1 Gb iSCSI only], DAC, or SW fiber optics [LC]) or 4/8/16 Gb FC (SW fiber optics [LC]) SFP+ host ports (2 ports per controller) Additional ports on host interface cards (per controller enclosure with two controllers): • 8x 12 Gb SAS host ports (Mini-SAS HD, SFF-8644) (4 ports per controller) • 8x 10/25 Gb iSCSI SFP28 host ports (DAC or SW fiber optics [LC]) (4 ports per controller) • 8x 8/16/32 Gb FC SFP+ host ports (SW fiber optics [LC]) (4 ports per controller) • 8x 1/10 Gb iSCSI (RJ-45 [1 Gb iSCSI only], DAC, or SW fiber optics [LC]) or 4/8/16 Gb FC (SW fiber optics [LC]) SFP+ host ports (4 ports per controller) **Note:** Two host interface cards are required for selection (one per controller).
Host operating systems	Microsoft Windows Server 2012 R2, 2016, and 2019; Red Hat Enterprise Linux (RHEL) 6 and 7; SUSE Linux Enterprise Server (SLES) 11, 12, and 15; VMware vSphere 6.0, 6.5, and 6.7.
Standard software features	Dynamic Disk Pools, SSD read cache, snapshots (up to 128 targets), volume copy, thin provisioning (DDP only), encryption (requires optional FIPS drives), and data assurance.

Attribute	Specification
Optional software features	Snapshots (up to 512 targets), synchronous mirroring, and asynchronous mirroring.
Performance*	- Up to 300 000 random read IOPS (4 KB blocks). - Up to 109 000 random write IOPS (4 KB blocks). - Up to 9.2 GBps sequential read throughput (64 KB blocks). - Up to 2.7 GBps sequential write throughput (64 KB blocks).
Configuration maximums**	- Maximum storage capacity: 2.3 PB - Maximum number of logical volumes: 512 - Maximum logical volume size: 2 PB - Maximum thin-provisioned logical volume size (DDP only): 256 TB - Maximum number of drives in a RAID volume group: - RAID 0, 1/10: 192 - RAID 3, 5, 6: 30 - Maximum number of DDP arrays: 20 - Maximum number of drives in a DDP array: 192 (11 drives minimum) - Maximum SSD read cache size: 4 TB - Maximum number of hosts: 256 - Maximum number of snapshots: 512 (requires an optional license) - Maximum number of mirroring pairs: 32 (requires an optional license)
Cooling	Redundant cooling with two cooling modules (4U60 LFF) or with the fans that are built into power supplies (2U24 SFF and 2U12 LFF).
Power supply	Two redundant hot-swap 913 W (100 - 240 V) (2U24 and 2U12 enclosures) or 2325 W(200 - 240 V) (4U60 enclosures) Platinum AC power supplies.
Hot-swap parts	Controllers, I/O modules, drives, power supplies, cooling modules (4U60 LFF only), and SFP+/SFP28 transceivers.
Management ports	1x 1 GbE port (UTP, RJ-45) per controller for out-of-band management. 2x Serial console ports (RJ-45 and Micro-USB) for system configuration. - In-band management via I/O path.
Management interfaces	System Manager web-based GUI; SAN Manager standalone GUI; SSH CLI; Serial console CLI; SMI-S Provider; SNMP, email, and syslog alerts; optional Lenovo XClarity.
Security features	Secure Socket Layer (SSL), Secure Shell (SSH), user level security, role-based access control (RBAC), LDAP authentication.
Warranty and support	Three-year customer-replaceable unit and onsite limited warranty with 9x5 next business day (NBD) parts delivered. Also available are 9x5 NBD onsite response, 24x7 coverage with 2-hour or 4-hour onsite response, or 6-hour or 24-hour committed repair (select countries), YourDrive YourData, Premier Support, and 1-year or 2-year post-warranty extensions.
Software maintenance	Included in the base warranty and any Lenovo warranty extensions.
Dimensions	2U24 SFF enclosure: - Height: 85 mm (3.4 in.) - Width: 449 mm (17.7 in.) - Depth: 553 mm (21.8 in.) 2U12 LFF enclosure: - Height: 85 mm (3.4 in.) - Width: 447 mm (17.6 in.) - Depth: 483 mm (19.0 in.) 4U60 LFF enclosure: - Height: 174 mm (6.9 in.) - Width: 449 mm (17.7 in.) - Depth: 922 mm (36.3 in.)

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

* Estimated performance based on internal measurements.
** For a detailed list of configuration limits and restrictions for a specific version of the software, refer to the Lenovo Data Center Support website:
http://datacentersupport.lenovo.com

Controller enclosures

The following table lists the relationship models of the ThinkSystem DE4000H Hybrid Storage Array.

Table 2. ThinkSystem DE4000H relationship models

Description	Part number	
	Worldwide	Japan
2U24 SFF models		
Lenovo ThinkSystem DE4000H SAS Hybrid Flash Array SFF (4x 16 Gb FC base ports [no SFPs], 8x 12 Gb SAS HIC ports)	7Y75A000WW	7Y75A000JP
Lenovo ThinkSystem DE4000H FC Hybrid Flash Array SFF (4x 16 Gb FC base ports [no SFPs], 8x 16 Gb FC HIC ports [no SFPs])	7Y75A002WW	7Y75A002JP
Lenovo ThinkSystem DE4000H iSCSI Hybrid Flash Array SFF (4x 10 Gb iSCSI base ports [no SFPs], 8x 10/25 Gb iSCSI HIC ports [no SFPs])	7Y75A001WW	7Y75A001JP
2U12 LFF models		
Lenovo ThinkSystem DE4000H SAS Hybrid Flash Array LFF (4x 16 Gb FC base ports [no SFPs], 8x 12 Gb SAS HIC ports)	7Y74A000WW	7Y74A000JP
Lenovo ThinkSystem DE4000H FC Hybrid Flash Array LFF (4x 16 Gb FC base ports [no SFPs], 8x 16 Gb FC HIC ports [no SFPs])	7Y74A001WW	7Y74A001JP
Lenovo ThinkSystem DE4000H iSCSI Hybrid Flash Array LFF (4x 10 Gb iSCSI base ports [no SFPs], 8x 10/25 Gb iSCSI HIC ports [no SFPs])	7Y74A002WW	7Y74A002JP
4U60 LFF models		
Lenovo ThinkSystem DE4000H SAS Hybrid Flash Array 4U60 (4x 16 Gb FC base ports [no SFPs], 8x 12 Gb SAS HIC ports)	7Y77A002WW	7Y771000JP
Lenovo ThinkSystem DE4000H FC Hybrid Flash Array 4U60 (4x 16 Gb FC base ports [no SFPs], 8x 16 Gb FC HIC ports [no SFPs])	7Y77A001WW	7Y771001JP
Lenovo ThinkSystem DE4000H iSCSI Hybrid Flash Array 4U60 (4x 10 Gb iSCSI base ports [no SFPs], 8x 10/25 Gb iSCSI HIC ports [no SFPs])	7Y77A000WW	7Y771002JP

The following tables list the TopSeller models of the ThinkSystem DE4000H Hybrid Storage Array.

Table 3. ThinkSystem DE4000H TopSeller models: Brazil and Latin America

Description	Part number	
	Latin America	Brazil
2U24 SFF models		
Lenovo ThinkSystem DE4000H FC Hybrid Flash Array SFF (4x 16 Gb FC base ports, 8x 16 Gb FC HIC ports, 8x 16 Gb SFPs, 8x 5 m LC-LC MMF cables)	7Y75A005LA	7Y75A005BR
Lenovo ThinkSystem DE4000H FC Hybrid Flash Array SFF (4x 16 Gb FC base ports, 8x 16 Gb FC HIC ports)	Brazil only	7Y751000BR
2U12 LFF models		
Lenovo ThinkSystem DE4000H FC Hybrid Flash Array LFF (4x 16 Gb FC base ports, 8x 16 Gb FC HIC ports, 8x 16 Gb SFPs, 8x 5 m LC-LC MMF cables)	7Y74A004LA	7Y74A004BR
Lenovo ThinkSystem DE4000H FC Hybrid Flash Array LFF (4x 16 Gb FC base ports, 8x 16 Gb FC HIC ports)	Brazil only	7Y741000BR

Table 4. ThinkSystem DE4000H TopSeller models: Europe, Middle East, and Africa (EMEA)

Description	Part number
2U24 SFF models	
Lenovo ThinkSystem DE4000H SAS Hybrid Flash Array SFF (4x 16 Gb FC base ports [no SFPs], 8x 12 Gb SAS HIC ports, 2x 800 GB 3DWD SSDs)	7Y75A008EA
Lenovo ThinkSystem DE4000H iSCSI Hybrid Flash Array SFF (4x 10 Gb iSCSI base ports [no SFPs], 8x 10/25 Gb iSCSI HIC ports [no SFPs], 2x 800 GB 3DWD SSDs)	7Y75A006EA
Lenovo ThinkSystem DE4000H FC Hybrid Flash Array SFF (4x 16 Gb FC base ports [no SFPs], 8x 16 Gb FC HIC ports [no SFPs], 2x 800 GB 3DWD SSDs)	7Y75A009EA
Lenovo ThinkSystem DE4000H FC Hybrid Flash Array SFF (4x 16 Gb FC base ports [no SFPs], 8x 32 Gb FC HIC ports [no SFPs], 2x 800 GB 3DWD SSDs)	7Y75A007EA
2U12 LFF models	
Lenovo ThinkSystem DE4000H SAS Hybrid Flash Array LFF (4x 16 Gb FC base ports [no SFPs], 8x 12 Gb SAS HIC ports, 6x 4 TB 7.2K HDDs)	7Y74A008EA
Lenovo ThinkSystem DE4000H iSCSI Hybrid Flash Array LFF (4x 10 Gb iSCSI base ports [no SFPs], 8x 10/25 Gb iSCSI HIC ports [no SFPs], 6x 4 TB 7.2K HDDs)	7Y74A006EA
Lenovo ThinkSystem DE4000H FC Hybrid Flash Array LFF (4x 16 Gb FC base ports [no SFPs], 8x 16 Gb FC HIC ports [no SFPs], 6x 4 TB 7.2K HDDs)	7Y74A005EA
Lenovo ThinkSystem DE4000H FC Hybrid Flash Array LFF (4x 16 Gb FC base ports [no SFPs], 8x 32 Gb FC HIC ports [no SFPs], 6x 4 TB 7.2K HDDs)	7Y74A007EA

The following table lists the CTO base models for the ThinkSystem DE4000H.

Table 5. ThinkSystem DE4000H CTO base models

Description	Machine Type/Model	Feature code
Lenovo ThinkSystem Storage 2U24 Chassis (with 2x PSUs)	7Y75CTO1WW	B38L
Lenovo ThinkSystem Storage 2U12 Chassis (with 2x PSUs)	7Y74CTO1WW	B38M
Lenovo ThinkSystem Storage 4U60 Chassis (with 2x PSUs)	7Y77CTO1WW	B38N

Configuration notes:

- For Relationship and TopSeller models, two DE4000 controllers (feature code B4BB) are included in the model configuration.
- For CTO models, two DE4000 controllers (feature code B4BB) are selected by default in the configurator, and the selection cannot be changed.

The models of the ThinkSystem DE4000H ship with the following items:

- One chassis with the following components:
  - Two controllers
  - Two power supplies
  - Two cooling modules (4U60 LFF only)
  - 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 and TopSeller models listed in this section:
    - 2U24 SFF, 2U12 LFF: 1.5 m, 10A/100-250V, C13 to IEC 320-C14 rack power cables
    - 4U60 LFF: 2.5 m, 16A/100-240V, C19 to IEC 320-C20 rack power cables
  - CTO models: Customer-configured power cables

Note: Some models of the ThinkSystem DE4000H ship with SFP+ transceivers and cables. For models that ship without transceivers and cables, the supported SFP+ transceivers, DAC cables, SAS cables, or RJ-45 UTP cables should be purchased for the system (see Controllers for details).

Controllers

The ThinkSystem DE4000H controller enclosures ship with two DE4000 controllers. A *controller* provides interfaces for host connectivity, management, and internal drives, and it runs storage management software. Each DE4000 controller ships with 8 GB cache for a system total of 16 GB.

The ThinkSystem DE4000H controller enclosures ship with four universal ports (two ports per controller) for 1/10 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 DE4000H 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 1/10 Gb iSCSI or 4/8/16 Gb FC SFP+ ports (4 ports per HIC) for iSCSI or FC connectivity (require transceivers or DAC cables [10 Gb iSCSI only] that should be purchased for the HICs)
- 8x 8/16/32 Gb FC SFP+ ports (4 ports per HIC) for FC connectivity (require optical transceivers that should be purchased for the HICs)

Each DE4000 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, 10 Gb iSCSI / 16 Gb FC SFP+, 10/25 Gb iSCSI SFP28, or 32 Gb FC SFP+), and both cards must have SFP+/SFP28 media of the same type (either optical transceivers or DAC cables, but not both types).

The following table lists the supported host port configurations for the ThinkSystem DE4000H controller enclosures (each row in the table represents a supported combination of the host ports).

Table 6. ThinkSystem DE4000H host port configurations

Port type and total number of ports			
12 Gb SAS (SFF-8644)	**1/10 Gb iSCSI (SFP+) or 16 Gb FC (SFP+)**	**10/25 Gb iSCSI (SFP28)**	**32 Gb FC (SFP+)**
Base ports with additional HIC ports			
-	12 (6 per controller)	-	-
8 (4 per controller)	4 (2 per controller)	-	-
-	4 (2 per controller)	8 (4 per controller)	-
-	4 (2 per controller)	-	8 (4 per controller)

The following table lists the DE4000H controller and supported connectivity options.

Table 7. DE4000H controller and connectivity options

Description	Part number	Feature code	Maximum quantity per controller enclosure
Controllers			
Lenovo ThinkSystem DE4000 Controller	None*	B4BB	2
Host interface cards			
Lenovo ThinkSystem DE4000 HIC, 12Gb SAS, 4 ports	4C57A14367	B4B8	2
Lenovo ThinkSystem DE4000 HIC, 10/25GbE iSCSI, 4 ports	4C57A14369	B4BA	2
Lenovo ThinkSystem DE4000 HIC, 16Gb FC/10GbE, 4 ports	4C57A14366	B4B7	2
Lenovo ThinkSystem DE4000 HIC, 32Gb FC, 4 ports	4C57A14368	B4B9	2
SFP+ options for base ports and 10 Gb iSCSI / 16 Gb FC host interface card			
1Gb RJ-45 iSCSI SFP+ Module (1-pack)	4XF7A14917	B4K7	12
Lenovo 10Gb iSCSI/16Gb FC Universal SFP+ Module	4M17A13527	B4B2	12
SFP28 options for 10/25 Gb iSCSI host interface card			
Lenovo 10/25GbE iSCSI SFP28 Module	4M17A13529	B4B4	8
SFP+ options for 32 Gb FC host interface card			
Lenovo 32Gb FC SFP+ Transceiver	4M17A13528	B4B3	8
OM4 cable options 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 cable options 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
DAC cable options for 10 Gb iSCSI SFP+ host connectivity (base ports and iSCSI HICs)			
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

Description	Part number	Feature code	Maximum quantity per controller enclosure
5m Passive DAC SFP+ Cable	90Y9433	A1PK	12
7m Passive DAC SFP+ Cable	00D6151	A3RH	12
DAC cable options for 25 Gb iSCSI SFP28 host connectivity (iSCSI HICs)			
Lenovo 1m Passive 25G SFP28 DAC Cable	7Z57A03557	AV1W	8
Lenovo 3m Passive 25G SFP28 DAC Cable	7Z57A03558	AV1X	8
Lenovo 5m Passive 25G SFP28 DAC Cable	7Z57A03559	AV1Y	8
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 DE4000H supports attachment of up to seven ThinkSystem DE240S 2U24 SFF or ThinkSystem DE120S 2U12 LFF, or up to three ThinkSystem DE600S 4U60 LFF, or a combination of the ThinkSystem DE240S, DE120S, and DE600S expansion enclosures for a total of up to 192 drives per system (including controller and expansion enclosures).

Intermix of 2U24 SFF, 2U12 LFF, and 4U60 LFF expansion enclosures behind a 2U24 SFF, 2U12 LFF, or 4U60 LFF controller enclosure is supported. The expansion enclosures can be added to the system non-disruptively.

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

Table 8. ThinkSystem DE240S, DE120S, and DE600S relationship models

Description	Part number	
	Worldwide	Japan
Lenovo ThinkSystem DE240S 2U24 SFF Expansion Enclosure	7Y68A000WW	7Y681001JP
Lenovo ThinkSystem DE120S 2U12 LFF Expansion Enclosure	7Y63A000WW	7Y631000JP
Lenovo ThinkSystem DE600S 4U60 LFF Expansion Enclosure	7Y69A000WW	7Y691000JP

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

Table 9. ThinkSystem DE240S and DE120S TopSeller models: Brazil and Latin America

Description	Part number	
	Latin America	Brazil
Lenovo ThinkSystem DE240S 2U24 SFF Expansion Enclosure (TopSeller)	7Y681002LA	7Y681002BR
Lenovo ThinkSystem DE120S 2U12 LFF Expansion Enclosure (TopSeller)	7Y631001LA	7Y631001BR

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

Table 10. ThinkSystem DE240S, DE120S, and DE600S CTO base models

Description	Machine Type/Model	Feature code
Lenovo ThinkSystem Storage 2U24 Chassis (with 2x PSUs)	7Y68CTO1WW	B38L
Lenovo ThinkSystem Storage 2U12 Chassis (with 2x PSUs)	7Y63CTO1WW	B38M
Lenovo ThinkSystem Storage 4U60 Chassis (with 2x PSUs)	7Y69CTO1WW	B38N

Configuration notes:

- For Relationship and TopSeller 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, DE120S, and DE600S ship with the following items:

- One chassis with the following components:
    - Two I/O modules
    - Two power supplies
    - Two cooling modules (4U60 LFF only)
- Four 1 m MiniSAS HD 8644/MiniSAS HD 8644 cables (Models listed in Tables 8 and 9)
- Rack Mount Kit
- *Quick Installation Guide*
- *Electronic Publications Flyer*
- Two power cables:
    - Models listed in Tables 8 and 9:
        - 2U24 SFF, 2U12 LFF: 1.5 m, 10A/100-250V, C13 to C14 rack power cables
        - 4U60 LFF: 2.5 m, 16A/100-240V, C19 to C20 rack power cables
    - CTO models: Customer-configured power cables

Note: The Relationship and TopSeller models of the ThinkSystem DE240S, DE120S, and DE600S 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 DE4000H 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.
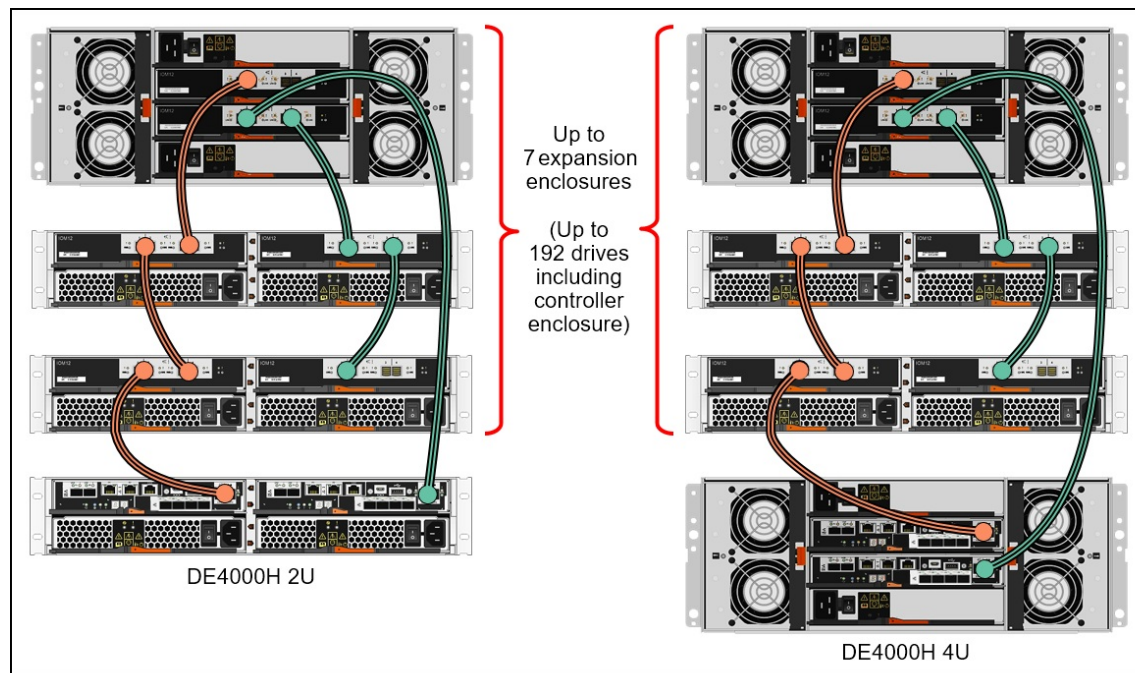
Figure 9. DE Series expansion enclosure connectivity topology

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

Table 11. 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, DE120S, and DE600S 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.
- The length of the SAS cables that connect a 2U12 or 2U24 enclosure to an adjacent 4U60 enclosure should be at least 1 meter.

Drives

The ThinkSystem DE Series 2U24 SFF enclosures support up to 24 SFF hot-swap drives, the 2U12 LFF enclosures support up to 12 LFF hot-swap drives, and the 4U60 LFF enclosures support up to 60 LFF hot-swap drives.

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

Table 12. 2U24 SFF drive options

Description	Part number	Feature code	Maximum quantity per 2U24 SFF enclosure
2.5-inch 12 Gbps SAS hot-swap HDDs			
Lenovo ThinkSystem DE Series 1.2TB 10K 2.5" HDD 2U24	4XB7A14112	B4BY	24
Lenovo ThinkSystem DE Series 1.8TB 10K 2.5" HDD 2U24	4XB7A14113	B4BZ	24
2.5-inch 12 Gbps SAS hot-swap FIPS HDDs (SED HDDs)			
Lenovo ThinkSystem DE Series 1.8TB 10K 2.5" HDD FIPS 2U24	4XB7A14114	B4C0	24
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
Lenovo ThinkSystem DE Series 3.2TB 3DWD 2.5" SSD 2U24	4XB7A14108	B4BW	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 options for the 2U12 LFF controller and expansion enclosures.

Table 13. 2U12 LFF drive options

Description	Part number	Feature code	Maximum quantity per 2U12 LFF enclosure
3.5-inch 12 Gbps NL SAS hot-swap HDDs			
Lenovo ThinkSystem DE Series 4TB 7.2K 3.5" HDD 2U12	4XB7A14099	B4C3	12
Lenovo ThinkSystem DE Series 8TB 7.2K 3.5" HDD 2U12	4XB7A14101	B4C5	12
Lenovo ThinkSystem DE Series 10TB 7.2K 3.5" HDD 2U12	4XB7A14102	B4C6	12
Lenovo ThinkSystem DE Series 12TB 7.2K 3.5" HDD 2U12	4XB7A14104	B4C8	12
3.5-inch 12 Gbps NL SAS hot-swap FIPS HDDs (SED HDDs)			
Lenovo ThinkSystem DE Series 6TB 7.2K 3.5" HDD FIPS 2U12	4XB7A14100	B4C4	12
Lenovo ThinkSystem DE Series 10TB 7.2K 3.5" HDD FIPS 2U12	4XB7A14103	B4C7	12
3.5-inch 12 Gbps SAS hot-swap SSDs (3 Drive Writes per Day)			
Lenovo ThinkSystem DE Series 800GB 3DWD 2.5" SSD 2U12	4XB7A14097	B4C1	12
3.5-inch 12 Gbps SAS hot-swap FIPS SSDs (SED SSDs) (3 Drive Writes per Day) (2.5" drive in a 3.5" tray)			
Lenovo ThinkSystem DE Series 1.6TB 3DWD 2.5" SSD FIPS 2U12	4XB7A14098	B4C2	12

The following table lists supported drive options for the 4U60 LFF controller and expansion enclosures.

Table 14. 4U60 LFF drive options

Description	Part number	Feature code	Maximum quantity per 4U60 LFF enclosure
3.5-inch 12 Gbps NL SAS hot-swap HDDs			
Lenovo ThinkSystem DE Series 4TB 7.2K 3.5" HDD 4U60	4XB7A14124	B4GG	60
Lenovo ThinkSystem DE Series 8TB 7.2K 3.5" HDD 4U60	4XB7A14125	B4GH	60
Lenovo ThinkSystem DE Series 10TB 7.2K 3.5" HDD 4U60	4XB7A14126	B4GJ	60
Lenovo ThinkSystem DE Series 12TB 7.2K 3.5" HDD 4U60	4XB7A14128	B4GL	60
3.5-inch 12 Gbps NL SAS hot-swap FIPS HDDs (SED HDDs)			
Lenovo ThinkSystem DE Series 10TB 7.2K 3.5" HDD FIPS 4U60	4XB7A14127	B4GK	60
3.5-inch 12 Gbps SAS hot-swap SSDs (3 Drive Writes per Day) (2.5" drive in a 3.5" tray)			
Lenovo ThinkSystem DE Series 800GB 3DWD 2.5" SSD 4U60	4XB7A14115	B4G9	60
Lenovo ThinkSystem DE Series 1.6TB 3DWD 2.5" SSD 4U60	4XB7A14116	B4GA	60
Lenovo ThinkSystem DE Series 3.2TB 3DWD 2.5" SSD 4U60	4XB7A14118	B4GC	60
3.5-inch 12 Gbps SAS hot-swap FIPS SSDs (SED SSDs) (3 Drive Writes per Day) (2.5" drive in a 3.5" tray)			
Lenovo ThinkSystem DE Series 1.6TB 3DWD 2.5" SSD FIPS 4U60	4XB7A14117	B4GB	60

The following table lists supported drive pack options for the 4U60 LFF controller and expansion enclosures.

Table 15. 4U60 LFF drive pack options

Description	Part number	Feature code	Maximum quantity per 4U60 LFF enclosure
3.5-inch 12 Gbps NL SAS hot-swap HDD packs			
Lenovo ThinkSystem DE4000H 80TB HDD Pack (20x 4TB HDDs)	4XB7A14163	B4GN	3
Lenovo ThinkSystem DE4000H 160TB HDD Pack (20x 8TB HDDs)	4XB7A14165	B4GP	3
Lenovo ThinkSystem DE4000H 200TB HDD Pack (20x 10TB HDDs)	4XB7A14167	B4GQ	3
Lenovo ThinkSystem DE4000H 240TB HDD Pack (20x 12TB HDDs)	4XB7A14171	B4GS	3
3.5-inch 12 Gbps NL SAS hot-swap FIPS HDD packs (SED HDD packs)			
Lenovo ThinkSystem DE4000H 200TB HDD FIPS Pack (20x 10TB FIPS HDDs)	4XB7A14169	B4GR	3
3.5-inch 12 Gbps SAS hot-swap SSD packs (3 Drive Writes per Day) (2.5" drive in a 3.5" tray)			
Lenovo ThinkSystem DE4000H 32TB SSD Pack (20x 1.6TB SSDs)	4XB7A14161	B4GM	3

Configuration notes:

- For hybrid (HDDs and SSDs) and all flash (SSDs only) storage configurations, a single ThinkSystem DE4000H storage system can support a maximum of 120 SSDs.
- A minimum of 20 drives is required for each 4U60 LFF enclosure (the front row of each drawer must be populated with four drives).
- 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 DE4000H:

- **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.
- **SSD Read Cache**: Helps accelerate performance of read-centric workloads.
- **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. Base software supports up to 128 snapshot targets per system.
- **Encryption:** Provides encryption for data at rest for enhanced data security with the optional FIPS drives and embedded key management 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.

The ThinkSystem DE4000H capabilities can be expanded with optional licensed functions. Optional licensed functions include:

- **Snapshots upgrade**: Increase the supported number of snapshot targets to 512.
- **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 DE4000H interoperate with other ThinkSystem DE Series storage arrays.

The following table lists the Feature on Demand (FoD) upgrades for the ThinkSystem DE4000H to enable optional software features. Each optional DE4000H function is licensed on a per-system basis and covers both controller enclosure and all attached expansion enclosures.

Table 16. Optional software features

Description	Part number	Feature code
Lenovo ThinkSystem DE4000H Snapshot Upgrade 512	4ZN7A14708	B4QL
Lenovo ThinkSystem DE4000 Synchronous Mirroring	4ZN7A16002	B598
Lenovo ThinkSystem DE4000H Asynchronous Mirroring	4ZN7A14709	B4QM

Software maintenance is included in the ThinkSystem DE4000H 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 DE4000H 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 and 2U12 LFF 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 and TopSeller models of the ThinkSystem DE4000H 2U24 SFF and 2U12 LFF, DE240S 2U24 SFF, and DE120S LFF 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 ThinkSystem DE Series 4U60 LFF enclosures ship with two redundant hot-swap 2325 W (200 - 240 V) Platinum AC power supplies, each with an IEC 320-C20 connector. The Relationship models of the ThinkSystem DE4000H 4U60 LFF and DE600S 4U60 LFF enclosures listed in Controller enclosures and Expansion enclosures ship with two 2.5 m, 16A/100-240V, C19 to IEC 320-C20 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 and 2U12 LFF enclosures (two power cords per enclosure).

Table 17. Power cables for DE Series 2U24 SFF and 2U12 LFF 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

Description	Part number	Feature code
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
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

Description	Part number	Feature code
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

The following table lists the rack power cable and line cord options that can be ordered for the DE Series 4U60 LFF enclosures (two power cords per enclosure).

Table 18. Power cables for DE Series 4U60 enclosures

Description	Part number	Feature code
Rack power cables		
2.0m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable	None*	B4L2
2.5m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable	39Y7916	6252
Line cords		
Argentina 4.3m, 16A/250V, C19 to IRAM 2073 Line Cord	40K9777	6276
Australia/New Zealand 4.3m, 15A/250V, C19 to AS/NZS 3112 Line Cord	40K9773	6284
Brazil 4.3m, 16A/250V, C19 to NBR 14136 Line Cord	40K9775	6277
China 4.3m, 16A/250V, C19 to GB2099.1 Line Cord	40K9774	6288
Denmark/Switzerland 4.3m, 16A/250V, C19 to IEC 309 P+N+G Line Cord	40K9769	6283
Europe 4.3m, 16A/250V, C19 to CEE7-VII Line Cord	40K9766	6279
India 4.3m, 16A/250V, C19 to IS6538 Line Cord	40K9776	6285
Israel 4.3m, 16A/250V, C19 to SI 32 Line Cord	40K9771	6282
Italy 4.3m, 16A/250V, C19 to CEI 23-16 Line Cord	40K9768	6281
Japan 4.3m, 15A/200V, C19 to JIS C-8303 Line Cord	41Y9233	6291
Korea 4.3m, 15A/250V, C19 to KSC 8305 Line Cord	41Y9231	6289
South Africa 4.3m, 16A/250V, C19 to SABS 164 Line Cord	40K9770	6280
Switzerland 4.3m, 16A/250V, C19 to SEV 1011 Line Cord	81Y2391	6549
Taiwan 4.3m, 16A/250V, C19 to CNS 10917-3 Line Cord	41Y9230	6287
United Kingdom 4.3m, 13A/250V, C19 to BS 1363/A Line Cord	40K9767	6278
United States 4.3m, 15A/250V, C19 to NEMA 6-15P Line Cord	00D7197	A1NV
United States 4.3m, 18A/250V, C19 to NEMA L6-20P Line Cord	40K9772	6275

* CTO only.

Rack installation

The individually shipped ThinkSystem DE Series 2U12 enclosures come with the ThinkSystem Storage Rack Mount Kit 2U12, and the individually shipped ThinkSystem DE Series 2U24 and 4U60 enclosures come with the ThinkSystem Storage Rack Mount Kit 2U24/4U60. These rack mount kits are listed in the following table.

Table 19. 4-post rack mount kits

Description	Feature code	Quantity
Lenovo ThinkSystem Storage Rack Mount Kit 2U12	B38X	1
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 20. 4-post SIR rack mount kits

Description	Feature code	Quantity
Lenovo ThinkSystem Storage Rack Mount Kit 2U12	B38X	1
Lenovo ThinkSystem Storage SIR Rack Mount Kit (for 2U24 enclosures)	B6TH	1
DM/DE 4U Adjustable Rail Kit (SIR)	B742	1

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

Table 21. Rack mount kit features and specifications summary

Attribute	Screw-in fixed rail with adjustable depth			
	2U12	2U24/4U60	2U24 SIR	4U SIR
Feature code	B38X	B38Y	B6TH	B742
Enclosure support	DE4000H 2U LFF DE120S	DE4000H 2U SFF DE4000H 4U DE240S DE600S	DE4000H 2U SFF DE240S	DE4000H 4U DE600S
Rail type	Fixed (static) with adjustable depth	Fixed (static) with adjustable depth	Fixed (static) with adjustable depth	Fixed (static) with adjustable depth
Tool-less installation	No	No	No	No
In-rack maintenance	Yes*	Yes*	Yes*	Yes*
Ship-in-rack (SIR) support	Yes	No	Yes	Yes
1U PDU support	Yes	Yes	Yes	Yes
0U PDU support	Limited**	Limited**	Limited**	Limited**
Rack type	IBM or Lenovo 4-post, IEC standard-compliant	IBM or Lenovo 4-post, IEC standard-compliant	IBM or Lenovo 4-post, IEC standard-compliant	IBM or Lenovo 4-post, IEC standard-compliant
Mounting holes	Square or round	Square or round	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.)	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.)	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 2U12 and 2U24 enclosures, or at least 1200 mm (47.24 in.) deep for 4U60 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)

The ThinkSystem DE Series 2U12 LFF enclosures have 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 DE Series 4U60 LFF enclosures have the following dimensions and weight (approximate):

- Height: 174 mm (6.9 in.)
- Width: 449 mm (17.7 in.)
- Depth: 922 mm (36.3 in.)
- Weight (fully configured): 111.5 kg (245.8 lb)

Operating environment

The ThinkSystem DE Series 2U24 SFF, 2U12 LFF, and 4U60 LFF enclosures are supported in the following environment:

- Air temperature:
  - Operating:
    - DE4000H and DE240S 2U24 SFF: 5 °C - 45 °C (41 °F - 113 °F)
    - DE4000H and DE120S 2U12 LFF: 10 °C - 40 °C (50 °F - 104 °F)
    - DE4000H and DE600S 4U60 LFF: 10 °C - 40 °C (50 °F - 104 °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 (except 4U60 LFF enclosures)
  - 200 to 240 V AC (nominal); 50 Hz / 60 Hz
- Acoustical noise emission:
  - DE4000H 2U24 SFF and DE120S 2U12 LFF: 6.8 bels
  - DE4000H 2U12 LFF and DE240S 2U24 SFF: 6.6 bels
  - DE4000H and DE600S 4U60 SFF: 7.2 bels

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

Table 22. Enclosure power load, inlet current, and heat output

Enclosure	Source voltage (nominal)	Maximum power load	Current per inlet	Heat output
DE4000H 2U24 SFF	100 - 127 V AC	667 W	7.03 A	2276 BTU/hour
	200 - 240 V AC	578 W	3.05 A	1973 BTU/hour
DE4000H 2U12 LFF	100 - 127 V AC	570 W	6 A	1945 BTU/hour
	200 - 240 V AC	508 W	2.68 A	1734 BTU/hour
DE4000H 4U60 LFF	200 - 240 V AC	1512 W	7.96 A	5159 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
DE120S 2U12 LFF	100 - 127 V AC	306 W	3.3 A	1045 BTU/hour
	200 - 240 V AC	300 W	1.58 A	1024 BTU/hour
DE600S 4U60 LFF	200 - 240 V AC	1446 W	7.62 A	4934 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 countries), with optional YourDrive YourData.
    - **Advanced Service:** 24x7 service coverage with 2-hour onsite response or 6-hour committed repair (available only in select countries), 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 countries might have different warranty terms and conditions than the standard warranty. This is due to local business practices or laws in the specific country. Local service teams can assist in explaining country-specific terms when needed. Examples of country-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 country-specific. Not all support services are available in every country. For information about Lenovo support services that are available in a specific country or area, 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, country-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 customer success. Lenovo's goal for customers is to reduce capital outlays, mitigate IT risks, and accelerate time to productivity.

Here is a more in-depth look at what Lenovo can do for their customers:

- **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 customers.

- **Assessment Services**
  An assessment helps solve customer IT challenges through an onsite, multi-day session with a Lenovo technology expert. Lenovo performs 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, no matter how large or small, get a better return on their IT investment and overcome challenges in the ever-changing technology landscape.

- **Design Services**
  Professional Services consultants perform infrastructure design and implementation planning to support customer's 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 customer's server, storage, or networking hardware. Working at a time convenient for the customer (business hours or off shift), the technician will unpack and inspect the systems on customer 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 customers to focus on other priorities.

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

- **Integration, Migration, and Expansion Services**
  Integration, Migration, and Expansion Services allow to move existing physical and virtual workloads easily, or to determine technical requirements to support increased workloads while maximizing performance. These services include tuning, validation, and documenting ongoing run processes, and they leverage migration assessment planning documents to perform necessary migrations.

Some service options may not be available in every country. For more information about Lenovo service offerings that are available in a specific country or area, contact a local Lenovo sales representative or business partner.

Regulatory compliance

The ThinkSystem DE 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 DE4000H Hybrid Storage Array supports attachment to Lenovo ThinkSystem, System x, ThinkServer, and Flex System hosts by using SAS, iSCSI, or Fibre Channel storage connectivity protocols. Hybrid storage connectivity also is supported.

For end-to-end storage configuration support, refer to the Lenovo ThinkSystem DE Series Interoperability Matrix that can be found on the ThinkSystem DE4000H Documentation page on the Lenovo Data Center Support web site:
http://datacentersupport.lenovo.com/us/en/products/storage/lenovo-storage/thinksystem-de4000h/documentation

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 DE4000H Hybrid 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. End-to-end storage configuration support *must* be verified through the Lenovo ThinkSystem DE4000H Interoperability Matrix.

Adapters

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

- SAS connectivity
- iSCSI connectivity
- Fibre Channel connectivity

SAS connectivity

The following table lists currently available SAS adapters for Lenovo servers that are compatible with the ThinkSystem DE4000H SAS storage (direct attach). Other SAS HBAs also might be supported (see the Interoperability Matrix for details).

Table 23. 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
ThinkServer SAS HBAs	
ThinkServer 9300-8e PCIe 12Gb 8 Port External SAS Adapter by LSI	4XB0F28703

iSCSI connectivity

The ThinkSystem DE4000H supports iSCSI attachments via standard 1 Gb, 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 DE4000H storage.

With software iSCSI initiators, any supported 1 Gb, 10 Gb, or 25 Gb Ethernet adapter for Lenovo servers is compatible with the ThinkSystem DE4000H iSCSI storage.

Fibre Channel connectivity

The ThinkSystem DE4000H supports direct FC attachments and FC switch-based attachments. Lenovo B Series and DB Series FC SAN switches and directors can be used to provide FC connectivity.

Currently available FC adapters for Lenovo servers that are compatible with the ThinkSystem DE4000H FC storage are listed in the following table. Other FC HBAs also might be supported (see the Interoperability Matrix for details).

Table 24. Fibre Channel adapters

Description	Part number
ThinkSystem HBAs: 32 Gb FC	
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
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
ThinkServer HBAs: 16 Gb FC	
ThinkServer LPe16000B Single Port 16Gb Fibre Channel HBA by Emulex	4XB0F28653
ThinkServer LPe16002B Dual Port 16GB Fibre Channel HBA by Emulex	4XB0F28650
ThinkServer LPe16002B-M6-L PCIe 16Gb 2 Port Fibre Channel Adapter by Emulex	4XB0F28705
ThinkServer LPe16004B-M6-L PCIe 16Gb 4 Port Fibre Channel Adapter by Emulex	4XB0F28681
ThinkServer LPm16002-M6-L AnyFabric 16Gb 2 Port Fibre Channel Adapter by Emulex	4XB0F28706
ThinkServer QLE2672 PCIe 16Gb 2 Port Fibre Channel Adapter by QLogic	4XC0F28745
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
Flex System FC5052 2-port 16Gb FC Adapter	95Y2386
Flex System FC5054 4-port 16Gb FC Adapter	95Y2391
Flex System FC5172 2-port 16Gb FC Adapter	69Y1942

Ethernet LAN switches

The following table lists currently available rack-mount Ethernet switches that are currently offered by Lenovo that can be used with the ThinkSystem DE4000H Hybrid Storage Array in IT solutions.

Table 25. Ethernet rack-mount switches

Description	Part number
1 Gb Ethernet (iSCSI connectivity)	
Lenovo ThinkSystem NE0152T RackSwitch (Rear to Front)	7Y810011WW
Lenovo ThinkSystem NE0152TO RackSwitch (Rear to Front, ONIE)	7Z320O11WW
Lenovo RackSwitch G7028 (Rear to Front)	7159BAX
Lenovo RackSwitch G7052 (Rear to Front)	7159CAX
Lenovo CE0128TB Switch (3-Year Warranty)	7Z340011WW
Lenovo CE0128TB Switch (Limited Lifetime Warranty)	7Z360011WW
Lenovo CE0128PB Switch (3-Year Warranty)	7Z340012WW
Lenovo CE0128PB Switch (Limited Lifetime Warranty)	7Z360012WW
Lenovo CE0152TB Switch (3-Year Warranty)	7Z350021WW
Lenovo CE0152TB Switch (Limited Lifetime Warranty)	7Z370021WW
Lenovo CE0152PB Switch (3-Year Warranty)	7Z350022WW
Lenovo CE0152PB Switch (Limited Lifetime Warranty)	7Z370022WW
10 Gb Ethernet (iSCSI connectivity)	
Lenovo ThinkSystem NE1032 RackSwitch (Rear to Front)	7159A1X
Lenovo ThinkSystem NE1032T RackSwitch (Rear to Front)	7159B1X
Lenovo ThinkSystem NE1072T RackSwitch (Rear to Front)	7159C1X
Lenovo RackSwitch G8272 (Rear to Front)	7159CRW
Lenovo RackSwitch G8296 (Rear to Front)	7159GR6
25 Gb Ethernet (iSCSI connectivity)	
Lenovo ThinkSystem NE2572 RackSwitch (Rear to Front)	7159E1X
Lenovo ThinkSystem NE2572O RackSwitch (Rear to Front, ONIE)	7Z210O21WW
100 Gb Ethernet (4x 25 Gb Ethernet breakout connectivity out of a 100 Gb port; iSCSI connectivity)	
Lenovo ThinkSystem NE10032 RackSwitch (Rear to Front)	7159D1X
Lenovo ThinkSystem NE10032O RackSwitch (Rear to Front, ONIE)	7Z210O11WW

For more information, see the list of Product Guides in the Top-of-rack Switches category:
http://lenovopress.com/servers/options/switches#rt=product-guide

The following table lists currently available embedded Ethernet switches and pass-thru modules for Flex System that can be used with the ThinkSystem DE4000H Hybrid Storage Array in IT solutions.

Table 26. Embedded Ethernet switches for Flex System

Description	Part number
1 Gb Ethernet (iSCSI connectivity)	
Lenovo Flex System EN2092 1Gb Ethernet Scalable Switch	49Y4294
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

The following table lists currently available rack-mount Fibre Channel SAN switches that are offered by Lenovo that can be used with the ThinkSystem DE4000H Hybrid Storage Array in IT solutions.

Table 27. Rack-mount Fibre Channel SAN switches

Description	Part number
16 Gb FC	
Lenovo ThinkSystem DB610S, 8 ports licensed, 8x 16Gb SWL SFPs, 1 PS, Rail Kit, 1Yr FW	6559F2A
Lenovo ThinkSystem DB610S, ENT., 24 ports licensed, 24x 16Gb SWL SFPs, 1 PS, Rail Kit, 1Yr FW	6559F1A
Lenovo ThinkSystem DB620S, 24 ports licensed, 24x 16Gb SWL SFPs, 2 PS, Rail Kit, 1Yr FW	6415J1A
Lenovo B6505, 12 ports licensed, 12x 16Gb SWL SFPs, 1 PS, Rail Kit, 1Yr FW	3873ER1
Lenovo B6510, 24 ports licensed, 24x 16Gb SWL SFPs, 2 PS, Rail Kit, 1Yr FW	3873IR1
Lenovo B6510, 24 ports licensed, 24x 16Gb SWL SFPs, 2 PS, Rail Kit, 3Yr FW	3873BR3
32 Gb FC	
Lenovo ThinkSystem DB610S, 8 ports licensed, No SFPs, 1 PS, Rail Kit, 1Yr FW	6559F3A
Lenovo ThinkSystem DB620S, 24 ports licensed, No SFPs, 2 PS, Rail Kit, 1Yr FW	6415G3A
Lenovo ThinkSystem DB620S, 24 ports licensed, 24x 32Gb SWL SFPs, 2 PS, Rail Kit, 1Yr FW	6415H11
Lenovo ThinkSystem DB620S, ENT., 48 ports licensed, 48x 32Gb SWL SFPs, 2 PS, Rail Kit, 1Yr FW	6415H2A
Lenovo ThinkSystem DB630S, 48 ports licensed, No SFPs, 2 PS, Rail Kit, 1Yr FW	7D1SA001WW
Lenovo ThinkSystem DB630S, 48 ports licensed, 48x 32Gb SWL SFPs, 2 PS, Rail Kit, 1Yr FW	7D1SA002WW
Lenovo ThinkSystem DB630S, ENT., 96 ports licensed, 96x 32Gb SWL SFPs, 2 PS, Rail Kit, 1Yr FW	7D1SA003WW
Lenovo ThinkSystem DB400D 32Gb FC Director, ENT., 4 Blade slots, 8U, 1Yr FW	6684D2A
Lenovo ThinkSystem DB400D 32Gb FC Director, ENT., 4 Blade slots, 8U, 3Yr FW	6684B2A
Lenovo ThinkSystem DB800D 32Gb FC Director, ENT., 8 Blade slots, 14U, 1Yr FW	6682D1A

For more information, see the list of Product Guides in the Rack SAN Switches category:
http://lenovopress.com/storage/switches/rack#rt=product-guide

The following table lists currently available embedded Fibre Channel SAN switches for Flex System that can be used with the ThinkSystem DE4000H Hybrid Storage Array in IT solutions.

Table 28. Embedded FC SAN switches for Flex System

Description	Part number
16 Gb FC	
Lenovo Flex System FC5022 16Gb SAN Scalable Switch	88Y6374
Lenovo Flex System FC5022 24-port 16Gb SAN Scalable Switch (includes two 16 Gb SFPs)	00Y3324
Lenovo Flex System FC5022 24-port 16Gb ESB SAN Scalable Switch	90Y9356

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

Operating systems

The ThinkSystem DE4000H supports host attachments to the Lenovo servers running the following operating systems:

- Microsoft:
    - Microsoft Windows Server 2019
    - Microsoft Windows Server 2016
    - Microsoft Windows Server 2012 R2
- Red Hat:
    - Red Hat Enterprise Linux 7.6
    - Red Hat Enterprise Linux 7.5
    - Red Hat Enterprise Linux 7.4
    - Red Hat Enterprise Linux 7.3
    - Red Hat Enterprise Linux 7.2
    - Red Hat Enterprise Linux 6.10
    - Red Hat Enterprise Linux 6.9
    - Red Hat Enterprise Linux 6.8
    - Red Hat Enterprise Linux 6.7
- SUSE:
    - SUSE Linux Enterprise Server 15
    - SUSE Linux Enterprise Server 12 SP4
    - SUSE Linux Enterprise Server 12 SP3
    - SUSE Linux Enterprise Server 12 SP2
    - SUSE Linux Enterprise Server 12 SP1
    - SUSE Linux Enterprise Server 11 SP4
    - SUSE Linux Enterprise Server 11 SP3
    - SUSE Linux Enterprise Server 11 SP2
- VMware:
    - VMware vSphere 6.7 (ESXi) Update 1
    - VMware vSphere 6.7 (ESXi)
    - VMware vSphere 6.5 (ESXi) Update 2
    - VMware vSphere 6.5 (ESXi) Update 1
    - VMware vSphere 6.5 (ESXi)
    - VMware vSphere 6.0 (ESXi) Update 3
    - VMware vSphere 6.0 (ESXi) Update 2
    - VMware vSphere 6.0 (ESXi) Update 1

Rack cabinets

The following table lists the rack cabinets that are offered by Lenovo that can be used with the ThinkSystem DE4000H Hybrid Storage Array in IT solutions.

Table 29. Rack cabinets

Description	Part number
25U S2 Standard Rack (1000 mm deep; 2 sidewall compartments)	93072RX
25U Static S2 Standard Rack (1000 mm deep; 2 sidewall compartments)	93072PX
42U S2 Standard Rack (1000 mm deep; 6 sidewall compartments)	93074RX
42U 1100mm Enterprise V2 Dynamic Rack (6 sidewall compartments)	93634PX
42U 1100mm Enterprise V2 Dynamic Expansion Rack (6 sidewall compartments)	93634EX
42U 1200mm Deep Dynamic Rack (6 sidewall compartments)	93604PX
42U 1200mm Deep Static Rack (6 sidewall compartments)	93614PX
42U Enterprise Rack (1105 mm deep; 4 sidewall compartments)	93084PX
42U Enterprise Expansion Rack (1105 mm deep; 4 sidewall compartments)	93084EX

For more information, see the list of Product Guides in the Rack cabinets category:
http://lenovopress.com/servers/options/racks#rt=product-guide

Power distribution units

The following table lists the power distribution units (PDUs) that are currently offered by Lenovo that can be used for distributing electrical power to the ThinkSystem DE Series enclosures and other IT infrastructure building blocks mounted in a rack cabinet.

Table 30. Power distribution units

Description	Part number
0U Basic PDUs	
0U 36 C13/6 C19 24A/200-240V 1 Phase PDU with NEMA L6-30P line cord	00YJ776
0U 36 C13/6 C19 32A/200-240V 1 Phase PDU with IEC60309 332P6 line cord	00YJ777
0U 21 C13/12 C19 32A/200-240V/346-415V 3 Phase PDU with IEC60309 532P6 line cord	00YJ778
0U 21 C13/12 C19 48A/200-240V 3 Phase PDU with IEC60309 460P9 line cord	00YJ779
Switched and Monitored PDUs	
0U 20 C13/4 C19 Switched and Monitored 24A/200-240V/1Ph PDU w/ NEMA L6-30P line cord	00YJ781
0U 20 C13/4 C19 Switched and Monitored 32A/200-240V/1Ph PDU w/ IEC60309 332P6 line cord	00YJ780
0U 18 C13/6 C19 Switched / Monitored 32A/200-240V/346-415V/3Ph PDU w/ IEC60309 532P6 cord	00YJ782
0U 12 C13/12 C19 Switched and Monitored 48A/200-240V/3Ph PDU w/ IEC60309 460P9 line cord	00YJ783
1U 9 C19/3 C13 Switched and Monitored DPI PDU (without line cord)	46M4002
1U 9 C19/3 C13 Switched and Monitored 60A 3Ph PDU with IEC 309 3P+Gnd cord	46M4003
1U 12 C13 Switched and Monitored DPI PDU (without line cord)	46M4004
1U 12 C13 Switched and Monitored 60A 3 Phase PDU with IEC 309 3P+Gnd line cord	46M4005
Ultra Density Enterprise PDUs (9x IEC 320 C13 + 3x IEC 320 C19 outlets)	
Ultra Density Enterprise C19/C13 PDU Module (without line cord)	71762NX
Ultra Density Enterprise C19/C13 PDU 60A/208V/3ph with IEC 309 3P+Gnd line cord	71763NU

Description	Part number
C13 Enterprise PDUs (12x IEC 320 C13 outlets)	
DPI C13 Enterprise PDU+ (without line cord)	39M2816
DPI Single Phase C13 Enterprise PDU (without line cord)	39Y8941
C19 Enterprise PDUs (6x IEC 320 C19 outlets)	
DPI Single Phase C19 Enterprise PDU (without line cord)	39Y8948
DPI 60A 3 Phase C19 Enterprise PDU with IEC 309 3P+G (208 V) fixed line cord	39Y8923
Front-end PDUs (3x IEC 320 C19 outlets)	
DPI 30amp/125V Front-end PDU with NEMA L5-30P line cord	39Y8938
DPI 30amp/250V Front-end PDU with NEMA L6-30P line cord	39Y8939
DPI 32amp/250V Front-end PDU with IEC 309 2P+Gnd line cord	39Y8934
DPI 60amp/250V Front-end PDU with IEC 309 2P+Gnd line cord	39Y8940
DPI 63amp/250V Front-end PDU with IEC 309 2P+Gnd line cord	39Y8935
Universal PDUs (7x IEC 320 C13 outlets)	
DPI Universal 7 C13 PDU (with 2 m IEC 320-C19 to C20 rack power cord)	00YE443
NEMA PDUs (6x NEMA 5-15R outlets)	
DPI 100-127V PDU with fixed NEMA L5-15P line cord	39Y8905
Line cords for PDUs that ship without a line cord	
DPI 30a Line Cord (NEMA L6-30P)	40K9614
DPI 32a Line Cord (IEC 309 P+N+G)	40K9612
DPI 32a Line Cord (IEC 309 3P+N+G)	40K9611
DPI 60a Cord (IEC 309 2P+G)	40K9615
DPI 63a Cord (IEC 309 P+N+G)	40K9613
DPI Australian/NZ 3112 Line Cord (32A)	40K9617
DPI Korean 8305 Line Cord (30A)	40K9618

For more information, see the list of Product Guides in the PDU category:
http://lenovopress.com/servers/options/pdu#rt=product-guide

Uninterruptible power supply units

The following table list the uninterruptible power supply (UPS) units that are currently offered by Lenovo that can be used with the ThinkSystem DE4000H Hybrid Storage Array in IT solutions.

Table 31. Uninterruptible power supply units

Description	Part number
Worldwide models	
RT1.5kVA 2U Rack or Tower UPS (100-125VAC) (8x NEMA 5-15R 12A outlets)	55941AX
RT1.5kVA 2U Rack or Tower UPS (200-240VAC) (8x IEC 320 C13 10A outlets)	55941KX
RT2.2kVA 2U Rack or Tower UPS (100-125VAC) (8x NEMA 5-20R 16A outlets)	55942AX
RT2.2kVA 2U Rack or Tower UPS (200-240VAC) (8x IEC 320 C13 10A, 1x IEC 320 C19 16A outlets)	55942KX
RT3kVA 2U Rack or Tower UPS (100-125VAC) (6x NEMA5-20R 16A, 1x NEMA L5-30R 24A outlets)	55943AX
RT3kVA 2U Rack or Tower UPS (200-240VAC) (8x IEC 320 C13 10A, 1x IEC 320 C19 16A outlets)	55943KX
RT5kVA 3U Rack or Tower UPS (200-240VAC) (8x IEC 320 C13 10A, 2x IEC 320 C19 16A outlets)	55945KX
RT6kVA 3U Rack or Tower UPS (200-240VAC) (8x IEC 320 C13 10A, 2x IEC 320 C19 16A outlets)	55946KX
RT8kVA 6U Rack or Tower UPS (200-240VAC) (4x IEC 320-C19 16A outlets)	55948KX
RT11kVA 6U Rack or Tower UPS (200-240VAC) (4x IEC 320-C19 16A outlets)	55949KX
RT8kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC) (4x IEC 320-C19 16A outlets)	55948PX
RT11kVA 6U 3:1 Phase Rack or Tower UPS (380-415VAC) (4x IEC 320-C19 16A outlets)	55949PX
ASEAN, HTK, INDIA, and PRC models	
ThinkSystem RT3kVA 2U Standard UPS (200-230VAC) (2x C13 & 2x GB 10A, 1x C19 16A outlets)	55943KT
ThinkSystem RT3kVA 2U Long Backup UPS (200-230VAC) (2x C13 & 2x GB 10A, 1x C19 16A outlets)	55943LT
ThinkSystem RT6kVA 5U UPS (200-230VAC) (2x C13 10A outlets, 1x Terminal Block output)	55946KT
ThinkSystem RT10kVA 5U UPS (200-230VAC) (2x C13 10A outlets, 1x Terminal Block output)	5594XKT

For more information, see the list of Product Guides in the Uninterruptible Power Supply Units category:
http://lenovopress.com/servers/options/ups#rt=product-guide

Lenovo Financial Services

Lenovo Financial Services reinforces Lenovo's commitment to deliver pioneering products and services that are recognized for their quality, excellence, and trustworthiness. Lenovo Financial Services offers financing solutions and services that complement your technology solution anywhere in the world.

We are dedicated to delivering a positive finance experience for customers like you who want to maximize your purchase power by obtaining the technology you need today, protect against technology obsolescence, and preserve your capital for other uses.

We work with businesses, non-profit organizations, governments and educational institutions to finance their entire technology solution. We focus on making it easy to do business with us. Our highly experienced team of finance professionals operates in a work culture that emphasizes the importance of providing outstanding customer service. Our systems, processes and flexible policies support our goal of providing customers with a positive experience.

We finance your entire solution. Unlike others, we allow you to bundle everything you need from hardware and software to service contracts, installation costs, training fees, and sales tax. If you decide weeks or months later to add to your solution, we can consolidate everything into a single invoice.

Our Premier Client services provide large accounts with special handling services to ensure these complex transactions are serviced properly. As a premier client, you have a dedicated finance specialist who manages your account through its life, from first invoice through asset return or purchase. This specialist develops an in-depth understanding of your invoice and payment requirements. For you, this dedication provides a high-quality, easy, and positive financing experience.

For more information about your region-specific offers, contact your Lenovo sales representative or your technology provider about the use of Lenovo Financial Services. For more information, see the following Lenovo website:
http://www.lenovo.com/us/en/landingpage/lenovo-financial-services

Related publications and links

For more information, see the following resources:

- Lenovo Data Center SAN Storage product page
  http://www.lenovo.com/us/en/c/storage-area-network
- 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
- External Storage

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