



# Dell PowerStore

## T model specifications

### Modern storage made simple

The ground-breaking Dell PowerStore enterprise storage appliance helps you achieve new levels of operational agility with advanced storage technologies and intelligent automation to unlock the power of your data. Accelerate block, file and vVols workloads with a single unified platform that scales both up and out, keeping pace with rapidly changing business requirements. Streamline DevOps with automated workflows and extensive support for containerized apps – and simplify your overall ecosystem with deep integrations that let you provision advanced PowerStore services from your management framework of choice.

### Architecture

PowerStore utilizes Intel® Xeon® Scalable processors, plus a flexible all-NVMe design featuring dual-ported Intel® Optane™ SSDs and NVMe-over-fabric networking (both FC and TCP), to deliver end-to-end low latency performance for any workload. Always-on data reduction, intelligent automation, active resource balancing, predictive analytics and non-disruptive software and hardware upgrades keep your storage environment continuously optimized, up-to-date and easy to manage, even as your needs evolve over time.

Per appliance <sup>1</sup>	500	1200	3200	5200	9200
Nodes	Each appliance includes two active/active nodes				
Processors	2 Intel Xeon CPUs 24 cores, 2.2 GHz	4 Intel Xeon CPUs 40 cores, 2.4 GHz	4 Intel Xeon CPUs 64 cores, 2.1 GHz	4 Intel Xeon CPUs 96 cores, 2.2 GHz	4 Intel Xeon CPUs 112 cores, 2.2 GHz
Memory	192GB	384GB	768GB	1152GB	2560GB
Max drives	97	93	93	93	93
NVRAM drives	N/A	2	2	4	4
Base enclosure	2U enclosure with dual active/active nodes and twenty-five (25) 2.5" NVMe drive slots				
Expansion enclosures	2U enclosures with twenty-four (24) 2.5" NVMe drives slots, up to three per appliance.				
Power supplies	Two redundant power supplies (PS) per base and per expansion enclosure.				
Data resiliency	Dynamic Resiliency Engine (DRE), protects against multiple simultaneous drive failures				
Max mezzanine cards <sup>2</sup>	2	2	2	2	2
Max IO modules <sup>3</sup>	4	4	4	4	4
Backend expansion	4 25GbE ports		4 embedded 100GbE QSFP ports		
Max front-end ports (all types)	24	24	24	24	24
Max 16/32Gb FC ports	16	16	16	16	16
Max 10GBase-T/iSCSI ports	16	24	24	24	24

<sup>1</sup> Dell PowerStore Family

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Max 10/25 GbE/iSCSI ports	24 <sup>4</sup>	24	24	24	24
Max 100 GbE/iSCSI ports	N/A	8	8	8	8
Max capacity per appliance <sup>5</sup>	4.71 PBe <small>(1,490TB, 1,355TiB raw)</small>	4.52 PBe <small>(1,430TB, 1,300TiB raw)</small>	4.52 PBe <small>(1,430TB, 1,300TiB raw)</small>	4.52 PBe <small>(1,430TB, 1,300TiB raw)</small>	4.52 PBe <small>(1,430TB, 1,300TiB raw)</small>
Max capacity per cluster <sup>5</sup>	18.83 PBe	18.06 PBe	18.06 PBe	18.06 PBe	18.06 PBe

*Note clusters can include any combination of appliance models. All models scale to >18 PBe max capacity per cluster.*

- 1 - Up to 4 appliances may be combined per scale-out cluster
- 2 - One mezzanine card per node, mirrored
- 3 - Two IO Modules per node, mirrored.
- 4 - Four (4) Onboard ports by default
- 5 - Effective capacity assumes average 4:1 data reduction. Actual results vary, refer to Power Sizer for capacity data in your environment. Maximum capacities are dependent on drive sizes available at time of purchase. Maximum logical capacity supported per appliance is 8 exabytes (EB). Raw value is based on drive vendor raw base capacity. TB is base-10 decimal (1000x1000x1000x1000). TiB is base- 2 binary (1024x1024x1024x1024).

## Appliance system limits

Per appliance	500	1200	3200	5200	9200
Max Initiators	1,000	2,000	2,000	2,000	2,000
Max Block Volumes/Clones (FC/iSCSI)	1,000	3,000	4,000	6,000	16,000
Max Block Volumes/Clones (NVMe-oF)	1,000	3,000	4,000	6,000	16,000
Max Volumes per Volume Group	75	75	75	75	75
Max Volume Groups	125	125	125	125	125
Max Volume Size	256 TB	256 TB	256 TB	256 TB	256 TB
Max Snapshots (Block)	50,000	100,000	100,000	100,000	100,000
Max User File Systems*	1500	2000	2000	2000	2000
Max NAS Servers*	50	50	250	250	250
Max File System Size*	256 TB	256 TB	256 TB	256 TB	256 TB
Max vVol Storage Containers	50	50	50	50	50
Max vVols	5,700	10,600	11,600	13,600	16,000
OS Support	See the Dell Simple Support Matrix on <a href="http://delltechnologies.com">delltechnologies.com</a>				
* Available for PowerStore T models only					

## Cluster system limits

Features			
Max. Appliances	4	Max. Initiators	2,000
Max. Front End Ports	96	Max. Initiators in an Initiator Group	1,024
Max. iSCSI sessions	2,048	Max Volumes and vVols	32,000
Maximum number of drives & maximum raw capacity of a PowerStore cluster will depend on the appliance level limits mentioned above.			

## Connectivity

Connectivity options via Mezzanine cards and IO modules for file, for NFS/SMB connectivity, and block storage for FC and iSCSI host connectivity (see above table for number of modules supported per node).

Connectivity options		
Type	Description	Details
Mezzanine card / IO Module *	Two-Port 10 Gb/s Optical Module (Block)	Two port 10GbE IP/iSCSI module. Uses SFP+ optical connection or active/passive twinax copper connection to Ethernet switch
Mezzanine card / IO Module **	Four-Port 10GBASE-T Module (File & Block)	Four port 10GBASE-T Ethernet IP/iSCSI module with copper connection to Ethernet switch
Mezzanine card / IO Module ***	Four-Port 25 Gb/s Optical Module (File & Block)	Four port IP/iSCSI module supporting 25GbE or 10GbE. Uses SFP+ optical connection or twinax copper connection (active/passive for 10GbE, passive for 25GbE) to Ethernet switch
IO Module	Four-Port 32 Gb/s Fibre Channel Module (Block only)	Four port FC module with choice of 16Gb/s or 32Gb/s connectivity. Uses multimode optical SFP and OM2/OM3/OM4 cabling to connect directly to host HBA or FC switch
IO Module ****	Four-Port 10GBASE-T Module	Four port 10GBASE-T Ethernet IP/iSCSI module with copper connection to Ethernet switch
IO Module ****	Four-Port 25 Gb/s Optical Module	Four port IP/iSCSI module supporting 25GbE or 10GbE. Uses SFP+ optical connection or twinax copper connection (active/passive for 10GbE, passive for 25GbE) to Ethernet switch
IO Module **/****	Two-Port 100 Gb/s Optical Module	Two port IP/iSCSI module with QSFP optical or active/passive copper connection to Ethernet switch
<p>* Only available for PowerStore 500            ** Not available for PowerStore 500            *** Ports 2 and 3 on the 4-Port Mezzanine card on 500T are reserved for backend connectivity            **** IO module type only available for PowerStore T models</p>		

## Back-end (drive) connectivity

Each node connects to one side of each of two redundant pairs of GbE ports, providing continuous drive access to hosts in the event of a node or port fault.

Disk expansion enclosure (ENS24)	
24 X 2.5" NVMe Drive Enclosure	
Drive Types Supported	NVMe SSD
Controller Interface	100 GbE QSFP

Supported media					
Drive Type	Interface	Raw base-10 Capacity *	Raw base-2 Capacity **	Base Enclosure	Expansion Enclosure
NVMe TLC SSD	PCIe	1.92 TB	1.7466 TiB	✓	✓
NVMe TLC SSD	PCIe	3.84 TB	3.4931 TiB	✓	✓
NVMe TLC SSD	PCIe	7.68 TB	6.9863 TiB	✓	✓
NVMe TLC SSD	PCIe	15.36 TB	13.9707 TiB	✓	✓
NVMe Optane SCM SSD	PCIe	750 GB	698.6 GiB	✓	
* Base-10 vendor raw TB (bytes X (1000 x 1000 x 1000 x 1000))			All drives are 512 bytes/sector.		
** Base-2 vendor raw TiB (bytes X (1024 x 1024 x 1024 x 1024))			All drives are FIPS 140-2 Level 2 validated TCG SED		

## OE protocols and software facilities

Support is provided for a wide variety of protocols and advanced features available via various software suites, plug-ins, drivers and packs.

Protocols and facilities supported		
Access-based Enumeration (ABE) for SMB protocol	Key Management Interoperability Protocol (KMIP) compliant external key manager for D@RE	REST API: Open API that uses HTTP requests to provide management
Address Resolution Protocol (ARP)	Lock Manager (NLM) v1, v2, v3, and v4	RSVD v1 for Microsoft Hyper-V (SMB3)
Block Protocols: iSCSI, Fibre Channel (FCP SCSI-3), NVMe/FC, NVMe/TCP, vVols	Management & Data Ports IPv4 or IPv6	Simple Home Directory access for SMB protocol
DFS Distributed File System (Microsoft) as Standalone Root Server	NAS Servers Multi-protocol for UNIX and SMB clients (Microsoft, Apple, Samba)	Simple Mail Transfer Protocol (SMTP)
Direct Host Attach for Fibre Channel	Network Data Management Protocol (NDMP) v1-v4, 3-way	Simple Network Management Protocol v2c & v3 (SNMP) Trap support
Dynamic Access Control (DAC) with claims support	Network Information Service (NIS) Client	Virtual LAN (IEEE 802.1q)
Fail Safe Networking (FSN)	Network Status Monitor (NSM)	VMware Virtual Volumes (vVols) 2.0
Internet Control Message Protocol (ICMP)	Network Time Protocol (NTP) Client	vStorage APIs for Array Integration (VAAI)
Kerberos Authentication	NFS v3/v4 Secure Support	vStorage APIs for Storage Awareness (VASA)
LDAP (Lightweight Directory Access Protocol)	NT LAN Manager (NTLM)	

Security & compliance
US Department of Defense Information Network Approved Products List (DoDIN APL) – in process*
Common Criteria - in process
Data at Rest Encryption (D@RE) in PowerStore utilizes FIPS 140-2 Level 2 validated Self-Encrypting Drives (SEDs) by respective drive vendors for primary storage (NVMe SSD and NVMe SCM SSD). The NVRAM caching device is encrypted and FIPS 140-2 Level 2 validated.
(KMIP) compliant external key manager for D@RE
Multi-factor authentication via RSA SecurID
Immutable and secure snapshots
FIPS 140-2 Level 2 validated
IPv6 USGv6-R1 certification
Native SHA2 certificate
Restriction of Hazardous Substances (RoHS) compliance
TLS 1.2 support by default, TLS 1.1 and older are disabled by default. TLS 1.1 can be optionally enabled.
* As of PowerStoreOS 3.5, PowerStore has been STIG-hardened to meet the security requirements of the US Department of Defense.

## Service and support

World-Class Dell Technologies services	
Deployment Services	Dell ProDeploy Enterprise Suite Dell Migration Services Dell Residency Services
Support Services	Dell ProSupport Enterprise Suite Anytime Upgrades Dell Optimize for Storage
Services & Support Technologies	MyService360 SupportAssist Enterprise

Software	
All Inclusive Base Software	<p><b>Management Software:</b></p> <ul style="list-style-type: none"> <li>• PowerStore Manager</li> <li>• CloudIQ: Cloud-based storage analytics</li> <li>• Thin Provisioning</li> <li>• Dynamic Resiliency Engine (DRE) – Single &amp; Dual parity</li> <li>• Data Reduction: Zero Detect/Deduplication/Compression</li> <li>• Proactive Assist: Configure remote support, online chat, open a service request, etc.</li> <li>• Quality of Service (Block and vVols)</li> </ul> <p><b>Protocols: PowerStore T Models</b></p> <ul style="list-style-type: none"> <li>• Block</li> <li>• vVols</li> <li>• File</li> </ul> <p><b>Local Protection:</b></p> <ul style="list-style-type: none"> <li>• SED Based Encryption with self-managed and external key management</li> <li>• Local Point-In-Time Copies (Snapshots and Thin Clones)</li> <li>• Immutable &amp; Secure Snapshots</li> <li>• AppSync Basic</li> <li>• File Level Retention (FLR)</li> <li>• Dell EMC Common Event Enabler; AntiVirus Agent (CEPA)</li> </ul> <p><b>Remote Protection:</b></p> <ul style="list-style-type: none"> <li>• Native Asynchronous Block Replication</li> <li>• Native Asynchronous vVol Replication</li> <li>• Native Metro Volume Synchronous Block Replication</li> <li>• Native Asynchronous File Replication</li> <li>• Native PowerProtect DD integration - manage local or multicloud backups directly from PowerStore</li> </ul> <p><b>Migration:</b></p> <ul style="list-style-type: none"> <li>• Native Block migration from Dell EMC Unity, VNX, SC Series, PS Series</li> <li>• Native File Migration from Dell EMC VNX</li> </ul>
Interface Protocols	Block: FC, NVMe/FC, iSCSI, NVMe/TCP and VMware Virtual Volumes (vVols) 2.0 File: NFSv3, NFSv4, NFSv4.1; CIFS (SMB 1), SMB 2, SMB 3.0, SMB 3.02, and SMB 3.1.1; FTP and SFTP
Optional Solutions	AppSync Advanced Connectrix SAN Data Protection Suite: Backup, Archive and Collaboration Software Dell EMC RP4VM PowerPath Migration Enabler PowerPath Multipathing PowerStore metro node (block synchronous metro Active/Active, zero RPO/RTO) VPLEX
Note: For more details on software licensing, please contact your sales representative	


## Virtualization and container solutions

PowerStore supports a wide variety of protocol and advanced features available via various software suites and packs including but not limited to:

- Dell Virtual Storage Integrator (VSI) for VMware vSphere™: For provisioning, management, and cloning
- OpenStack Cinder Driver: For provisioning and managing block volumes within an OpenStack environment
- VMware Site Recovery Manager (SRM) Integration: Managing failover and failback making disaster recovery rapid and reliable
- Virtualization API Integration: VMware: VAAI and VASA.
- vRO Plugin for PowerStore
- Container Storage Interface (CSI) Plugin for PowerStore
- Ansible Module for PowerStore

## Electrical specifications

Power figures represent product configurations in typical operating conditions of 26°C and worst-case, maximums operating in extreme temperature environments of 40°C.

PowerStore Base System Enclosures					
	500 	1200	3200	5200	9200
	25x2.5" drives, four IO modules	21x2.5" drives, 2xNVRAM modules four IO modules	21x2.5" drives, 2xNVRAM modules four IO modules	21x2.5" drives, 4xNVRAM modules four IO modules	21x2.5" drives, 4xNVRAM modules four IO modules
Power					
AC Line Voltage	100-240 VAC ± 10%, single phase, 47 to 63 Hz (500T) 200-240 VAC ± 10%, single phase, 47 to 63 Hz (1200-9200)				
AC Line Current					
Typical operating temperature of 26°C	7 A max at 100V 3.5 A max at 200V	4.7 A max at 200V	5.4 A max at 200V	7.1 A max at 200V	8.1 A max at 200V
Maximum operating temperature of 40°C	10 A max at 100V 5 A max at 200V	6.5 A max at 200V	7.1 A max at 200V	8.8 A max at 200V	9.8 A max at 200V
Power Consumption					
Typical operating temperature of 26°C	683.5 W (697.4 VA) max at 200V-240V	921.8 W (940.6 VA) max at 200V-240V (+/- 10%)	1056.4 W (1078 VA) max at 200V-240V (+/- 10%)	1391.2 W (1419.6 VA) max at 200V-240V (+/- 10%)	1597 W (1629.6VA) max at 200V-240V (+/- 10%)
Maximum operating temperature of 40°C	984 W (1004.1 VA) max at 200V-240V	1271.3 W (1297.2 VA) max at 200V-240V (+/- 10%)	1393.6 W (1422.0 VA) max at 200V-240V (+/- 10%)	1734.4 W (1769.8 VA) max at 200V-240V (+/- 10%)	1919.4 W (1958.6 VA) max at 200V-240V (+/- 10%)
Heat Dissipation					
Typical operating temperature of 26°C	2.46 x 10 <sup>6</sup> J/hr (2,332 Btu/hr) max 200VAC	3.32 x 10 <sup>6</sup> J/hr, (3,145 Btu/hr) max 200VAC	3.80 x 10 <sup>6</sup> J/hr, (3,605 Btu/hr) max 200VAC	5.01 x 10 <sup>6</sup> J/hr, (4,747 Btu/hr) max 200VAC	5.75 x 10 <sup>6</sup> J/hr, (5,449 Btu/hr) max 200VAC
Maximum operating temperature of 40°C	3.54 x 10 <sup>6</sup> J/hr (3,358 Btu/hr) max 200VAC	4.58 x 10 <sup>6</sup> J/hr, (4,338 Btu/hr) max 200VAC	5.02 x 10 <sup>6</sup> J/hr, (4,755 Btu/hr) max 200VAC	6.24 x 10 <sup>6</sup> J/hr, (5,918 Btu/hr) max 200VAC	6.91 x 10 <sup>6</sup> J/hr, (6,549 Btu/hr) max 200VAC
Power Factor	0.95 minimum at full load, @ 200 VAC				
In-rush Current	45 Apk "cold" per line cord, at any line voltage				
Startup Surge Current	120 Apk "hot" per line cord, at any line voltage				
AC Protection	20 A fuse on each power supply, single line				
AC Inlet Type	IEC320-C20 (100VAC) (500T Low line) EC320-C14 or IEC320-C20	IEC320-C14 or IEC320-C20	IEC320-C14 or IEC320-C20	IEC320-C14 or IEC320-C20	IEC320-C20
Ride-through Time	10 ms min				
Current Sharing	± 5 percent of full load, between power supplies				
Note: Power consumption values for enclosures are based on fully populated enclosures (power supplies, drives and I/O modules).					
Weight and Dimensions					
Weight kgs/lbs	empty 30.38/66.97 full 37.4/82.4	empty 35.80/79 full 41.7/92	empty 35.80/79 full 41.7/92	empty 35.80/79 full 41.7/92	empty 35.80/79 full 41.7/92
Vertical size	2 NEMA units				
Height cm/inches	8.72/3.43				
Width cm/inches	44.72/17.61				
Depth cm/inches	79.55/31.32				
* PowerStore 500T supports running native low line power (100-120VAC +/-10)					

## Drive Expansion Enclosure

### 24 X 2.5" Drive Expansion Enclosure (ENS24)

#### Power

AC Line Voltage 100 to 240 VAC  $\pm$  10%, single phase, 47 to 63 Hz

AC Line Current  
Typical operating temperature of 26°C 4.6 A max at 100 VAC  
2.3 A max at 200 VAC  
Maximum operating temperature of 40°C 6.4 A max at 100 VAC  
3.2 A max at 200 VAC

Power Consumption  
Typical operating temperature of 26°C 447 W (510 VA) max at 200V-240V

Maximum operating temperature of 40°C 636 W (663 VA) max at 200V-240V

Power Factor 0.92 minimum at full load, @ 100V/200V

Heat Dissipation  
Typical operating temperature of 26°C 1.61 x 10<sup>6</sup> J/hr. (1,525 Btu/hr.) max 200VAC

Maximum operating temperature of 40°C 2.29 x 10<sup>6</sup> J/hr. (2,170 Btu/hr.) max 200VAC

In-rush Current 82A max for 1/2 Line cycle per line cord at 200 VAC

Startup Surge Current 100 Apk Max for up to 125uSec

AC Protection 15 A fuse on each power supply, single line

AC Inlet Type IEC320-C14 appliance coupler, per power zone

Ride-through Time 10 ms minimum

Current Sharing  $\pm$  5 percent of full load, between power supplies

#### Weight and Dimensions

Weight kg/lbs Empty: 27.2 kg / 60lb  
Full: 33.5 kg / 74lb

Vertical size 2 NEMA units

Height cm/inches 8.89 cm / 3.5in

Width cm/inches 43.18 cm / 17in

Depth cm/inches 65.30 cm / 25.71in

Note: Power consumption values for Base Enclosure and Expansion Enclosures are based on fully populated enclosures (power supplies, drives and I/O modules).

#### Cabinets

##### Standard 42U Cabinet

Power Configuration One, two, three, four, five, six power domains, each redundant

Power Inlet Count Two, four, six, eight, ten, or twelve (two per domain)

Plug Types NEMA L6-30P or IEC309-332 P6 or IP57 (Australia)

Input Power Capacity  
1 Domain: 4,800 VA @ 200 VAC, 5,760 VA @ 240 VAC  
2 Domain: 9,600 VA @ 200 VAC, 11,520 VA @ 240 VAC  
3 Domain: 14,400 VA @ 200 VAC, 17,280 VA @ 240 VAC  
4 Domain: 19,200 VA @ 200 VAC, 23,040 VA @ 240 VAC  
5 Domain: 24,000 VA @ 200 VAC, 28,800 VA @ 240 VAC  
6 Domain: 28,800 VA @ 200 VAC, 34,560 VA @ 240 VAC

AC Protection 20 A site circuit breakers on each power branch

42U Cabinet Dimensions Height – 78.4 in (199.1 cm); Width - 23.6 in (60.0 cm); Depth - 39.3 in (99.8 cm); Weight Empty – 387 lb (176 kg)



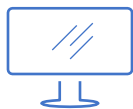
## Operating Environment

	Description	Specification
Recommended Range Operation	The limits under which equipment will operate the most reliably while still achieving reasonably energy-efficient data center operation.	18°C to 27°C (64.4°F to 80.6°F) and 15°C (59°F) dew point
Continuous Allowable Range Operation	Data center economization techniques (e.g. free cooling) may be employed to improve overall data center efficiency. These techniques may cause equipment inlet conditions to fall outside the recommended range but still within the continuously allowable range. Equipment may be operated without any hourly limitations in this range.	5°C to 35°C (50°F to 95°F) at 20% to 80% relative humidity with 21°C (69.8°F) maximum dew point (maximum wet bulb temperature). De-rate maximum allowable dry bulb temperature at 1°C per 300m above 950m (1°F per 547 ft above 3117 ft).
Improbable Operation (Excursion Limited)	During certain times of the day or year, equipment inlet conditions may fall outside the continuously allowable range but still within the expanded improbable range. Equipment operation is limited to ≤ 10% of annual operating hours in this range.	35°C to 40°C (with no direct sunlight on the equipment) at -12°C minimum dew point and 8% to 85% relative humidity with 24°C maximum dew point (wet bulb temperature). Outside the continuously allowable range (10°C to 35°C), the system can operate down to 5°C or up to 40°C for a maximum of 10% of its annual operating hours. For temperatures between 35°C and 40°C (95°F to 104°F), de-rate maximum allowable dry bulb temperature by 1°C per 175m above 950m (1°F per 319 ft above 3117 ft).
Temperature Gradient		20°C / hour (36°F / hour)
Altitude	Max Operating	3,050m (10,000ft)

## Statement of Compliance

Dell Information Technology Equipment is compliant with all currently applicable regulatory requirements for Electromagnetic Compatibility, Product Safety, and Environmental Regulations where placed on market.

Detailed regulatory information and verification of compliance is available at the Dell Regulatory Compliance website. <https://www.dell.com/learn/us/en/uscorp1/regulatory-compliance>



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