POWERMAX FAMILY

PowerMax Arrays

PowerMax 2000 and 8000

The newest enhancements to the PowerMax family of Dell EMC NVMe (*Non-Volatile Memory Express*) arrays raise the bar again for enterprise storage with the addition of the latest technologies to achieve unmatched levels of performance and consolidation for the high value, high demand workloads of today and tomorrow. PowerMax now supports 32Gb/s FC-NVMe to deliver on the promise of end-to-end NVMe, along with Storage Class Memory Drives (SCM) powered by dual port Intel® Optane™ drives used as persistent storage. FC-NVMe and SCM can further reduce system latencies by up to 50%. The PowerMax 2000 and 8000 arrays provide all of the features and proven data services demanded of an enterprise active-active controller array including security, protection, availability, scalability and massive consolidation, now delivered at latencies measured in microseconds, not milliseconds. PowerMax real-time machine learning optimizes storage performance using pattern recognition and automated data placement, without overhead.

A single PowerMax Brick is architected to provide six-nines (99.9999%) of Availability in the most demanding, mission-critical environments. Utilizing the powerful family of Intel® Xeon® E5 processors, the PowerMax 2000 and 8000 support both global, inline compression and deduplication for at least a 50% gain in data efficiency over the previous generation of arrays.

The PowerMax 2000 can fit its two available Bricks in half of a standard 19" rack, while the PowerMax 8000 redefines space efficiency more than doubling compute density by housing up to four Bricks in a single cabinet, and up to eight Bricks in just two floor tiles. PowerMax arrays come fully pre-configured out of the factory to significantly shorten the time to first I/O. Depending on the model, PowerMax arrays can support Open, Mainframe, IBM i, File, and mixed environments, all on the same array.

Specifications

Appliance-based packaging

PowerMax storage building blocks are defined by appliance-based entities called Bricks (or zBricks for Mainframe). Each Brick includes an engine with two PowerMax directors, packaged software, cache, and 24-slot Drive Array Enclosures. PowerMax arrays are available in two new software packages, the standard "Essentials" package and the application rich "Pro" package, which makes ordering easy. Additional NVMe drive capacity can be added to each Brick or zBrick via Flash capacity packs for up to a total usable capacity of 1.0 PBe on the PowerMax 2000 and up to 4.0 PBe on the PowerMax 8000 (with global, inline compression and deduplication enabled).

Detailed specifications and a comparison of the PowerMax 2000 and 8000 arrays follow:

Array family	PowerMax 2000	PowerMax 8000
Bricks/zBricks		
Number of Bricks or zBricks[5]	1 to 2	1 to 8
ENGINE ENCLOSURE	4u	4u
CPU	Intel Xeon E5-2650-v4 2.5 GHz 12 core[4]	Intel Xeon E5-2697-v4 2.8 GHz 18 core[4]
# CORES PER CPU/PER ENGINE/PER SYSTEM	12/48/96	18/72/576
DYNAMIC VIRTUAL MATRIX INTERCONNECT	Direct Connect InfiniBand 56 Gbps per port	InfiniBand Dual Redundant Fabric: 56 Gbps per port
CACHE		
CACHE-SYSTEM MIN (RAW)	512 GB	1,024 GB
CACHE-SYSTEM MAX (RAW)	4 TB (with 2,048 GB engine)	16 TB (with 2,048 GB engine)
CACHE-PER ENGINE OPTIONS	512 GB, 1 TB, and 2 TB	1 TB, 2 TB
VAULT		
VAULT STRATEGY	Vault to Flash	Vault to Flash
VAULT IMPLEMENTATION	2 to 4 NVMe Flash SLICs / Engine	4 to 8 NVMe Flash SLICs / Engine
FRONT END I/O MODULES		
MAXIMUM FRONT-END I/O MODULES/BRICK	8	8[7]
FRONT-END I/O MODULES AND PROTOCOLS SUPPORTED	4 x 32 Gbs (FC,SRDF) 4 x 32 Gbs (FC-NVMe) 4 x 16 Gbs (FC, SRDF) 10 GbE: 4 x 10 GbE (iSCSI, SRDF)	4 x 32 Gbs (FC, SRDF) 4 x 32 Gbs (FC-NVMe) 4 x 16 Gbs (FC, SRDF) 10 GbE: 4 x 10 GbE (iSCSI, SRDF) 4 x 16 Gbs (FICON)
eNAS I/O MODULES		
MAX eNAS I/O MODULES/ SOFTWARE DATA MOVER	3[6]	3[6]
eNAS I/O MODULES SUPPORTED	10 GbE: 2 x 10 GbE Optical 10 GbE: 2 x 10 GbE Cu[1] 8 Gbs: 4 x 8 Gbs FC (Tape BU) [2]	10 GbE: 2 x 10 GbE Optical 10 GbE: 2 x 10 GbE Cu[1] 8 Gbs: 4 x 8 Gbs FC (Tape BU)[2]
eNAS SOFTWARE DATA MOVERS		
MAX SOFTWARE DATA MOVERS	4 (3 Active + 1 Standby) (4 Data Movers requires minimum 2 Bricks)	8 (7 Active and 1 Standby)[3] (8 Data Movers requires minimum 4 Bricks)
MAX NAS CAPACITY/ARRAY (TERABYTES USABLE)	1158 (cache limited)	3584

[1] Quantity one (1) 2 x 10 GbE Optical module is the default choice/Data Mover.
[2] Used to support NDMP Tape Backup.
[3] Support for 8 Data Movers on the PowerMax 8000 is available by request.
[4] CPUs run continuously in Turbo Mode except at significantly elevated ambient temperatures.
[5] zBricks applicable to PowerMax 8000 only.
[6] Two eNAS I/O modules/Datamover standard. Three can be supported depending on configuration via RPQ.
[7] When born as a multi-engine system. A system born as single engine system is limited to 6 I/O modules per engine

Array family	PowerMax 2000	PowerMax 8000
CAPACITY, DRIVES		
Max Capacity per Array (Open)[1]	1 PBe	4 PBe
Base Capacity per Brick (NAND, Open)	13.2 TBu[3]	54.0 TBu
Base Capacity per Brick (SCM, Open)	21.0 TBu[5]	21.0 TBu[5]
Base Capacity per zBrick (NAND, Mainframe)	N/A	13.2 TBu
Base Capacity per zBrick (SCM, Mainframe)	N/A	21.0 TBu[5]
Incremental Flash Capacity Packs (NAND)	13.2 TBu[3]	13.2 TBu
Incremental Flash Capacity Packs (SCM)	5.25 TBu[6]	5.25 TBu
Max Drives per Brick	44 Usable + spare(s)	32 Usable + spare(s)
Max Drives per Array	96	288
Max Drives per System Bay	96/192[2]	144
Min Drive Count per Brick	4 + 1 Spare	8 + 1 spare
NVMe DRIVES		
NVMe Drives Supported (2.5")	1.92 TB, 3.84 TB, 7.68 TB, 15.36 TB	1.92 TB, 3.84 TB, 7.68 TB, 15.36 TB
SCM DRIVES		
SCM Drives Supported (2.5")	750 GB, 1.5 TB	750 GB, 1.5 TB
BE Interface	NVMe over PCIe	NVMe over PCIe
RAID Options Supported	RAID 5(7+1) (default) RAID 5(3+1) RAID 6(6+2)	RAID 5(7 +1) (default) RAID 6(6+2)
Mixed RAID Group Support	No	No
Support for Mixed Drive Capacities	Yes[4]	Yes[4]
NVMe DRIVE ARRAY ENCLOSURE		
24 x 2.5" Drive DAE	Yes	Yes
CABINET CONFIGURATIONS		
Standard 19" bays	Yes	Yes
Single Brick System Bay Configuration	No (Packaging based on Dual Bricks, but initial Brick in each System Bay supported)	No (Packaging based on Quad Bricks, but initial Brick in each System Bay supported)
Dual/Quad Brick System Bay Configuration	Dual	Quad
Third Party Rack Mount Option	Yes	Yes
DISPERSION		
Standard and 3rd Party Cabinets	N/A - single floor tile system	Yes
PRE-CONFIGURATION FROM FACTORY		
100% Thin Provisioned	Yes	Yes
HOST SUPPORT		
Open Systems	Yes	Yes
Mainframe	No	Yes
Mixed Mainframe and Open	No	Yes
POWER OPTIONS		
Input Power Options	Single or Three Phase Delta or Wye	Single or Three Phase Delta or Wye

[1] Max capacity per array based on over provisioning ratio of 1.0 for a NAND or Mixed SCM/NAND based array. All SCM arrays will have lower maximum capacities.

[2] 192 drives can be supported in a single cabinet when two systems are packaged in the same rack.

[3] 13.2TBu Brick and Flash capacity pack usable capacities are based on RAID 5 (7+1). 11.3TBu base capacity and Flash capacity pack increments possible with RAID 5(3+1) on PowerMax 2000.

[4] Up to two consecutive drive capacities supported, e.g. 1.92TB and 3.84TB

[5] Base capacities associated with the selection of an SCM only system, after which you are constrained to SCM only additional capacity. Available only with RAID 5(7+1), 1TB cache engines, and the PRO package.
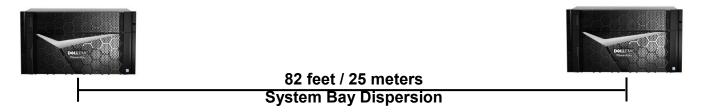
[6] SCM incremental capacity packs based on RAID 5(7+1). 2.25 TBu incremental is possible with RAID 5(3+1) on PowerMax 2000

Array family	PowerMax 2000	PowerMax 8000
FRONT END AND SRDF I/O PROTOCOLS SUPPORTED		
32 Gb/s FC/FC-NVMe Host Ports		
Maximum/Brick	32	32[1]
Maximum/Array	64	256[1]
32 Gb/s FC SRDF Ports		
Maximum/Brick	32	32[1]
Maximum/Array	64	256[1]
16 Gb/s FC Host Ports		
Maximum/Brick	32	32[1]
Maximum/array	64	256[1]
16 Gb/s FC SRDF Ports		
Maximum/Brick	32	32[1]
Maximum/array	64	256[1]
16 Gb/s FICON Host Ports		
Maximum/Brick	N/A	32[1]
Maximum/array	N/A	256[1]
10 GbE iSCSI Ports (Optical)		
Maximum/Brick	32	32[1]
Maximum/array	64	256[1]
10 GbE SRDF Ports (Optical)		
Maximum/Brick	32	32[1]
Maximum/array	64	256[1]
EMBEDDED eNAS PORTS		
10 GbE Optical Ports		
Max ports/Software Data Mover	4	4
Maximum ports/array	16	32
10 GbE Copper Ports		
Max ports/Software Data Mover	4	4
Maximum ports/array	16	32
8 Gb/s FC Tape Back Up Ports		
Max ports/Software Data Mover	2	2
Maximum ports/array	8	16

[1] Maximum number of ports/brick and maximum ports/array based on initial system sale as multi-brick. If system originates as a single brick, port counts will be reduced to a 24 per brick maximum and a 192 per array maximum.

System bay dispersion

System Bay Dispersion allows customers to separate any individual or contiguous group of system bays by up to a distance of 82 feet (25 meters) from System Bay 1. This provides unsurpassed datacenter flexibility in solving floor loading constraints or working around obstacles that might preclude fully contiguous configurations. This is only applicable to PowerMax 8000, as the PowerMax 2000 is a single bay solution.

82 feet / 25 meters
System Bay Dispersion

Flash drive support

The PowerMax 2000 and PowerMax 8000 support the latest dual ported native NVMe Flash and SCM drives. All drives support two independent I/O channels with automatic failover and fault isolation. Check with your Dell EMC sales representative for the latest list of supported drives and types. All capacities are based on 1 GB = 1,000,000,000 bytes. Actual usable capacity may vary depending upon configuration.

2.5" Supported NVMe Flash Drives used in Bricks and capacity pack upgrades

Platform support	PowerMax 2000/8000	PowerMax 2000/8000	PowerMax 2000/8000	PowerMax 2000/8000
Nominal capacity (GB)	1920[1]	3840[1]	7680[1]	15360[1]
Type	NVMe Flash	NVMe Flash	NVMe Flash	NVMe Flash
Raw Capacity (GB)	1920	3840	7680	15360
Open systems formatted capacity (GB) [3]	1920.15	3840.30	7680.61	15047.65
Mainframe 3390 formatted capacity	1919.82[2]	3840.41[2]	7680.83[2]	15047.98[2]

2.5" Supported SCM Drives

Platform support	PowerMax 2000/8000	PowerMax 2000/8000
Nominal capacity (GB)	750[1]	1500[1]
Type	SCM	SCM
Raw Capacity (GB)	750	1500
Open systems formatted capacity (GB) [3]	748.68	1499.13
Mainframe 3390 formatted capacity	749.89[2]	1499.79[2]

[1] Bricks and capacity pack upgrades in any given configuration could contain a maximum of two different underlying drive sizes to best achieve the desired usable capacity. This is automatically optimized by the configuration tools.

[2] Mainframe is not supported on PowerMax 2000.

[3] Open systems formatted capacity is also referred to as TBu in this document.

Power consumption and heat dissipation at <26 and >35 degrees C

Component	PowerMax 2000				PowerMax 8000			
Maximum power and heat dissipation at temperatures <26° C and >35° C [2,3]	Maximum Total power consumption (kVA)		Maximum Heat dissipation (Btu/hr)		Maximum Total power consumption (kVA)		Maximum Heat dissipation (Btu/hr)	
	<26° C	>35° C	<26° C	>35° C	<26° C	>35° C	<26° C	>35° C
System bay 1, dual engine	4.313	6.166	14,716	21,038	N/A	N/A	N/A	N/A
System bay 1, quad engine [1]	N/A	N/A	N/A	N/A	8.339	11.695	28,453	39,903
System bay 2, quad engine [1]	N/A	N/A	N/A	N/A	7.976	11.332	27,214	38,665

[1] Power values for Quad System Bays 1 and 2 (PowerMax 8000 only)

[2] Power values and heat dissipations shown at >35 degrees C reflect the higher power levels associated with both the battery recharge cycle, and the initiation of high ambient temperature Adaptive Cooling algorithms.

[3] Values at <26° C are reflective of more steady state maximum values during normal operation

Physical specifications

Component	Height (in/cm)	Width (in/cm)	Depth (in/cm)	Weight (maximum lbs/kgs)
System bay 1, quad engine PowerMax 8000	75/190	24/61	47/119	1670/758
System bay 2, quad engine PowerMax 8000	75/190	24/61	47/119	1525/692
System bay, dual engine PowerMax 2000	75/190	24/61	42/106.7	950/431
System bay, dual engine, dual system PowerMax 2000	75/190	24/61	42/106.7	1610/730

Input power requirements
Single phase North American, International, Australian

Specification	North American 3-wire connection (2 L and 1 G)[1]	International and Australian 3-wire connection (1 L and 1 N and 1 G)[1]
Input nominal voltage	200 – 240 VAC +/- 10% L- L nom	220 – 240 VAC +/- 10% L - N nom
Frequency	50 – 60 Hz	50 – 60 Hz
Circuit breakers	30 A	32 A
Power zones	Two	Two
Power requirements at customer site	Max of two 30A single phase drops per system per cabinet for PowerMax 2000 • Quantity one 30A drop per zone for single Brick • Quantity two 30A drops per zone for two Bricks Max of three 30A, single phase drops (per cabinet) PowerMax 8000 as follows: • Quantity one 30A drop per zone for single Brick • Quantity two 30A drops per zone for two Bricks • Quantity three 30A drops per zone for three or four Bricks	

[1]L = line or phase, N = neutral, G = ground

Three-phase North American, International, Australian

Specification	North American (DELTA) 4-wire connection (3 L and 1 G)[1]	International (WYE) 5-wire connection (3 L and 1 N and 1 G)[1]
Input voltage[2]	200 – 240 VAC +/- 10% L- L nom	220 – 240 VAC +/- 10% L - N nom
Frequency	50 – 60 Hz	50 – 60 Hz
Circuit breakers	50 A	32 A
Power zones	Two	Two
Power requirements at customer site (min)	Two 50 A, three-phase drops per bay	Two 32 A, three-phase drop per bay

[1]L = line or phase, N = neutral, G = ground

[2]An imbalance of AC input currents may exist on the three-phase power source feeding the array, depending on the configuration. The customer's electrician must be alerted to this possible condition to balance the phase-by-phase loading conditions within the customer's data center

Radio frequency interference

Electro-magnetic fields which include radio frequencies can interfere with the operation of electronic equipment. Dell EMC products have been certified to withstand radio frequency interference in accordance with standard EN61000-4-3. In Data Centers that employ intentional radiators, such as cell phone repeaters, the maximum ambient RF field strength should not exceed 3 Volts /meter.

Repeater power level (watts)	Recommended minimum distance (feet/meters)
1	9.84 FT (3 M)
2	13.12 FT (4 M)
5	19.69 FT (6 M)
7	22.97 FT (7 M)
10	26.25 FT (8 M)
12	29.53 FT (9 M)
15	32.81 FT (10 M)

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