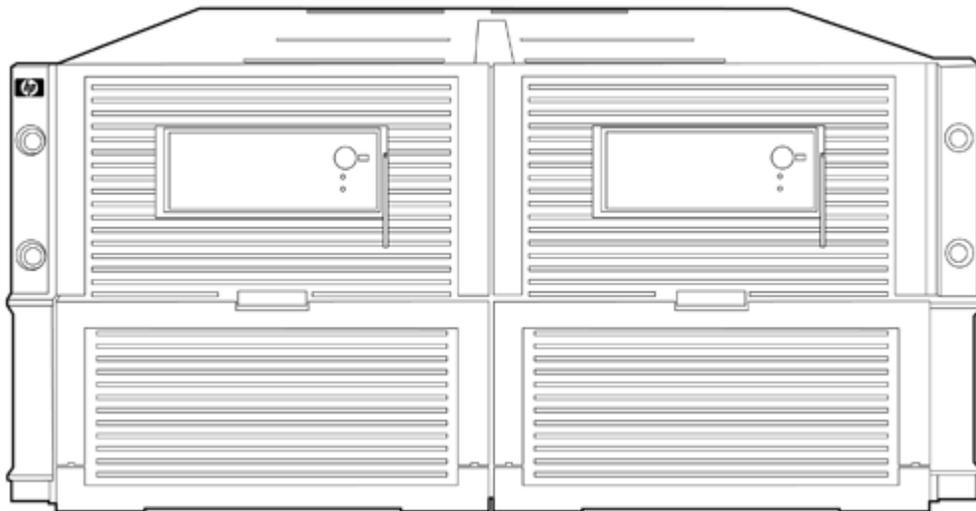## Overview

Finding it difficult to keep up with the growth in unstructured data? Looking for a cost-effective high capacity storage option?

With the new 6 Gb/s SAS HP D6000 Disk Enclosure, HP extends and redefines direct-attached storage for BladeSystem servers, combining the simplicity and cost effectiveness of direct-attached storage without sacrificing flexibility or performance. The D6000 can also be directly connected to selected ProLiant Gen8 servers using the Smart Array P421 and P822 Controllers using a standard 2M SAS cable; Single and Dual Domain (P822) environments The HP D6000 also supports the HP H221 and the H222 Host Bus Adapters (HBA)
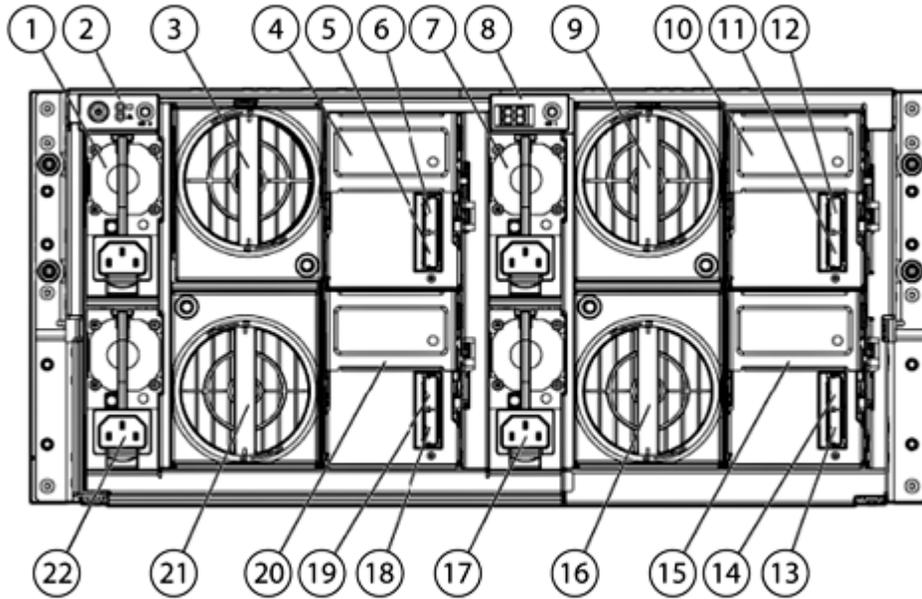
Use the D6000 as part of a straight-forward in-rack 6 Gb/s SAS implementation that delivers high-density, low-cost external zoned direct attach storage for HP BladeSystem servers. Easily configure storage on the fly with easy to use management software.

Up to six D6000 storage devices can be supported off a single BladeSystem enclosure for up to 1260 TB of capacity. End-to-end 6 Gb/s SAS connectivity enables a high performance storage solution using a HP Smart Array P721m or the P731m controller, 6 Gb/s SAS BL switches, and the D6000. 6 Gb/s host connectivity enables higher performance, eases configuration/deployment and broadens supported features of an D6000 using HP Smart Array P721m or the P731m controller and 6 Gb/s SAS BL switches.

For more information on Blade external SAS storage solutions for HP BladeSystem, see: www.hp.com/go/directconnect

Overview

1. Power supply 1
2. Power On/UID 2 status panel
3. Fan module 1 (Drawer 2)
4. Primary I/O module (Drawer 2)
5. SAS 1 connector
6. SAS 2 connector
7. Power supply 3
8. UID 1 status pane

9. Fan module 1 (Drawer 1)
10. Primary I/O module (Drawer 1)
11. SAS 1 connector
12. SAS 2 connector
13. SAS 1 connector
14. SAS 2 connector
15. Secondary I/O module (Drawer 1)
16. Fan module 2 (Drawer 1)

17. Power supply 4
18. SAS 1 connector
19. SAS 2 connector
20. Secondary I/O module (Drawer 2)
21. Fan module 2 (Drawer 2)
22. Power supply 2

What's New

- Adding for fully and partially populated 4 TB SAS MDL HDD bundles
  - **HP D6000 w/35 4TB 6G SAS 7.2K LFF Dual Port MDL HDD 140 TB Bundle**
  - **HP D6000 w/70 4TB 6G SAS 7.2K LFF Dual Port MDL HDD 280 TB Bundle**

Overview

At A Glance

- 5U rackmount form factor
- Supports seventy (70) 3.5" LFF Universal hot pluggable SAS or SAS (Midline) MDL drives
- Two pull-out drive drawers support hot plug large form factor dual-ported SAS or SAS MDL drives in just 5U of rack space (35 hot plug drives per drawer)
- 6 Gb/s front-end SAS connectivity using 6 Gb/s SAS BL switches in the interconnect bays, and HP Smart Array P721m or P731m controllers in each BladeSystem server (**NOTE:** D6000 support requires Blade switch firmware to be 3.0.8.0 or higher)
- The D6000 can also be directly connected to selected ProLiant Gen8 servers using the Smart Array P421 and P822 Controllers using a standard 2M SAS cable; Single and Dual Domain environments. Only P822 supports Dual Domain. No zoning.
- The D6000 also supports the HP H221 or the H222 Host Bus Adapters
- Using the Virtual SAS Manager (VSM) in the HP SAS BL switch, assign or 'zone' D6000 drive bays directly to BladeSystem server bay
- Additional option kit with two dual port I/O modules is added for SAS drives, creating a dual domain environment. A single BladeSystem enclosure supports up to six D6000 's externally. 3-0-0 warranty

Deployment Guide
For detailed deployment information, see the HP direct connect external SAS storage for HP BladeSystem deployment guide. Select Manuals under Resources for HP D6000 Disk Enclosure:

http://www.hp.com/go/d6000/manuals

Features and Benefits

Key Features

High density, low cost SAS storage for BladeSystem and ProLiant DL/ML servers

- 70 LFF Universal SAS or SAS MDL drives in 5U
- Two pull-out drive drawers support hot plug large form factor dual-ported SAS or SAS MDL drives in just 5U of rack space
- Each pull-out drive drawer is supported by a redundant set of hot plug power supplies and redundant hot plug fans. Straight forward SAS architecture provides zoned direct attach storage for BladeSystem servers; just a Smart Array P721m or the P731m controllers in the Blade server, a dual or single 6 Gb/s SAS BL switches in the chassis connected to an D6000.
- Connect directly to selected ProLiant Gen8 servers with the Smart Array P421 and P822 Controllers using a standard 2M SAS cable; Single and Dual Domain environments. Only P822 supports Dual Domain. No zoning.
- HP HBAs H221 and H222 are also supported.

Build BladeSystem server storage on the fly

- D6000 drive bays are assigned or 'zoned' to individual blade bays using SAS 2.0 zoning capabilities. Use the Virtual SAS Manager (VSM) in the 6 Gb/s SAS BL switch to dynamically assign up to 100 drives to specific BladeSystem servers, without complex configuration or re-cabling. Drives zoned to each server appear as local storage to that server. This allows complete flexibility to reconfigure quickly and easily without moving cables
- With zoned direct attached storage capabilities; server administrators can build local storage on the fly according to their configuration requirements.
- Quickly deploy and expand capacity by configuring additional drive bays to a P721m or the P731m Smart Array Controllers without moving a single cable.

HP reliability

Familiar Smart Array technology of the Smart Array Controllers enables support for RAID levels

- Keeps data available and server running while a failed drive is being replaced; two fault tolerance configurations are supported for the internal connections including:
- RAID 0 (striping) provides no extra data protection
- RAID 1 (mirroring) protects against failure of one drive
- RAID 1+0 (mirroring and striping) protects against failure of one drive (and failure of particular multiple drives)
- RAID 5 (distributed data guarding) protects against failure of one drive
- RAID 6 with ADG (Advanced Data Guarding): This is the highest level of fault tolerance
- RAID 50 (RAID 5+0) protects against failure of one drive (and failure of particular multiple drives)
- RAID 60 (RAID 6+0) allows administrators to split the RAID 6 storage across multiple external boxes
- RAID 1 ADM (Advanced Data Mirroring) allows customers to create mirrored RAID set using 3 identical hard drives

Product Technology	**SAS**	6 Gb/s SAS
	Modular Chassis	5U, 70 Large Form Factor Universal SAS or SAS MDL drive bays
	Drives available	Serial Attached SCSI (SAS) enterprise-class drives designed for high volume 24x7 usage. SAS Midline (MDL) are usually reserved for archival of data as they are both relatively inexpensive and are available in very large capacities. The D6000 can accommodate both SAS and SAS MDL drives within the same enclosure. SAS drive performance can be approximately 30% greater than SAS MDL performance on sequential host IO. SAS performance excels in sequential lower latency response time and random IO per second transaction

Features and Benefits

	performance due to higher rpm disk speeds yielding lower seek times.
Scalability	Up to 70 SAS or SAS MDL 3.5" hot plug hard drives per D6000
	A single BladeSystem enclosure supports up to six D6000 's externally.
RAID	RAID is provided by the Smart Array P721m, P731m, P421, and P822 Controllers
Power supplies	Includes four redundant 1200W 12V hot plug power supplies.
Fans	● Includes four redundant hot plug fan
Configuration and Management Tools	SAS BL switch for use with BladeSystem servers: Use the Virtual SAS Manager (VSM) to dynamically assign drive bays in the D6000 to each BladeSystem server bay, without complex configuration or re-cabling. This allows complete flexibility to reconfigure quickly and easily without moving cables.
	Smart Array Controller: Array Configuration Utility (ACU) provides configuration and management of hard drives, and supports online array capacity expansion, logical drive extension, assignment of online spares and RAID or stripe size migration.
Management/Health Utilities	Active hardware management using HP SIM: Manage the array with the highly refined HP Systems Insight Manager. Smart Components are available to easily update firmware. A convenient Integrated Management Log records hundreds of events and stores them in an easy-to-view format.

Family Information

Supported Servers   HP BladeSystem Servers

HP ProLiant BL420c Gen8

HP ProLiant BL460c Gen8

HP ProLiant BL465c Gen8

HP ProLiant BL660c Gen8

HP ProLiant Gen8 Servers

HP ProLiant Gen8 DL and ML servers that support HP Smart Array Controllers P421 and P822

NOTE: Some servers listed above may be discontinued.

NOTE: For more information on internal vs. external connections, please refer to proper blade QuickSpecs please visit: http://h18000.www1.hp.com/products/quickspecs/division/12534.html

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Supported OS   Microsoft Windows 2003

Microsoft Windows 2008 R2

Microsoft Windows Server 2012

SLES 10 SP3

SLES 11 SP1

Red Hat Enterprise Linux 5

Red Hat Enterprise Linux 6

VMware ESX 4.1

VMware ESX 5.0

Service and Support, HP Care Pack, and Warranty Information

Warranty	3-0-0 warranty Three-year parts exchange, next business day delivery **NOTE:** The warranties of the hard drive options purchased for the D6000 are different for SAS hard drives versus SAS Midline (MDL) hard drives. SAS hard drive options have a three year warranty and SAS MDL hard drive options have a one year warranty.

Warranty Upgrade Options	● Response - Upgrade on-site response from next business day to same day 4-hour response or 6 Hour Call To Repair ● Coverage - Extend hours of coverage from next business day to 9 hours x 5 days to 24 hours x 7 days ● Duration Select duration of coverage for a period of 1, 3, 4 or 5 years

Service and Support	**Services to accelerate time to results** HP Storage Services bring you a rich portfolio of consulting and support services designed to add value to our core storage products and solutions. We have the know-how and experience to put storage technology to work for you. We work closely with you as your strategic partner, leveraging our full services portfolio to make sure that everything works to optimize your enterprise. Choose from services aligned to our storage product offerings and lifecycle. From mission-critical onsite services to innovative web-based remote support, you choose the precise level of attention and support your business demands.
Discover, plan, and design	Choose from a rich portfolio of services to make the most of HP D6000 Disk Enclosures (Rockford - PL LL)), so you can efficiently and affordably consolidate, manage, and extract value from unstructured data. **HP Services can help you discover needs and create a plan for simplifying the environment, reducing risk, and maximizing your storage investments** **HP Storage Efficiency Analysis** - The HP Storage Efficiency Analysis provides customers with a view of their storage infrastructure and operating environment; highlighting recommendations for improvements. The report provides extensive insight about the existing storage environment, opportunities for efficiency gains, asset aging and replacement through interaction with key decision makers http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA3-6727ENW.pdf **HP Storage Impact Analysis (SIA)**: The HP Storage Impact Analysis service provides a 2-4 week discovery engagement with executive summary presentation. The goal of this service is to help provide customers guidance on storage related issues and develop remediation plans. http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA4-1174ENW.pdf **HP Storage Modernization Service**: The HP Storage Modernization service is a 4-6 week service that defines the customers envisioned target storage environment based on a proven solution design methodology. HP architects will quickly perform tool-assisted automatic discovery and facilitate a two-day strategy workshop with all key stakeholders involved in the storage infrastructure initiative http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA3-4620ENW.pdf

Service and Support, HP Care Pack, and Warranty Information

Deploy and integrate

We can help you configure, set up, and efficiently use your HP D6000 Disk Enclosures (Rockford - PL LL)), as well as help migrate data, improve capacity utilization, and establish information management standards used across backup, replication, and archiving needs.

HP MSA/P2000 Family Disk Array Installation and Startup Service - Implement right from the start, as HP experts install, test, and configure your hardware and software onsite. We deliver a tailored storage deployment properly integrated into your environment.
Basic hardware installation only for D6000 Modular Disk System

HP Storage Data Migration Services - End-to-end data migration service providing seamless discovery, assessment, planning, and design, completely customizable to your organization's storage area network or network attached storage environment and using innovative software to help you migrate to HP storage quickly and efficiently.
http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA3-0774ENW.pdf

HP Storage and Data Residency Service - Strategic augmentation of your current environment with HP resources who become your trusted advisor to provide answers that are right for your storage and backup environment. http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA3-9481ENW.pdf

HP Proactive Select - A flexible way to purchase services to fit your environment with an extensive menu of HP Proactive Select event and technical services, such as onsite firmware upgrades, health checks, assessments, and education.
http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA2-3842ENW.pdf

Operate and support

Choose the right support to maximize uptime, free up your resources, and achieve improved value-as you get the most out of the existing IT assets while accelerating time-to-revenue.

HP Proactive Care 24x7 - Hardware and software support services designed specifically for your technology with rapid access to Advanced Solution Center Specialists plus firmware and software management and best practice advice
http://h20195.www2.hp.com/v2/GetPDF.aspx/4AA3-8855ENW.pdf

HP Proactive Care Personalized Support - An option-if you have HP Proactive Care- to bring increased personalization of the Proactive Care support experience through the assignment of an Account Service Manager (ASM) who provides IT best practice advice to help address IT issues and projects.
http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA4-3446ENW.pdf

HP Support Plus 24 - Support for environments where proactive help from HP is not required, with 24x7 hardware and software support onsite that includes third-party support with a maximum four-hour onsite response. http://h20195.www2.hp.com/V2/GetPDF.aspx/5981-6638EN.pdf

HP Education Services - Comprehensive training for new, as well as experienced, storage administrators designed to expand your skills and keep you up to speed with the latest storage and virtualization technology from HP Storage. http://education.hp.com/curr-storsan.htm

Optimized Care - Delivers the highest levels of performance and stability through deployment and

Choose from three levels of operate and support care

HP Proactive Care 24x7-Plus, 20 credits per year

Service and Support, HP Care Pack, and Warranty Information

proactive management practices	**environment), an additional day of HP Personalized Support, and 10 additional HP Proactive Select credits per year**
Standard Care - maintains high level of uptime, along with expert help to cut the cost and complexity of implementation and support	**HP Proactive Care 24x7-Plus, 10 credits per year** **Additional options -HP Proactive Care Personalized Support (once per Proactive Care support new environment), an additional day of HP Personalized Support, and 10 additional HP Proactive Select credits per year**
Basic Care - Minimum recommended support	**HP Support Plus 24- Plus, 10 credits per year** **Additional options - 10 HP Proactive Select credits per year**
Remote Support Automation	HP Automation provides 24x7 coverage, proactive problem prevention, accurate problem diagnosis and faster problem resolution, as well as interactive support portals and tools. This is an integral, and cost-free, part of your HP support relationship and we are continually investing in additional cutting-edge capabilities to make it better.
For more information	www.hp.com/services/storage To learn more on HP Storage Services, please contact your HP sales representative or HP Authorized Channel Partner HP Care Pack Services are sold by HP and HP Authorized Service Partners: ● Services for customers purchasing from HP or an enterprise reseller are quoted using HP order configuration tools. ● Customers purchasing from a commercial reseller can find HP Care Pack Services at: www.hp.com/go/lookuptool

Configuration Information

Step 1: D6000 Disk Enclosure

Model	Model Description	Part Number
D6000	HP D6000 Dual I/O Module Disk Enclosure **NOTE:** Base model for SAS and SAS Midline (MDL) drives. Add QQ696A when using dual-ported SAS drives to create a dual domain environment. **NOTE:** Includes four hot plug power supplies for n+2 redundancy and four hot plug fans for n+1 redundancy. **NOTE:** Includes two right angle and two left angle power cords.	QQ695A
	HP D6000 Disk Enclosure Dual I/O Module Kit **NOTE:** Add QQ696A option kit to QQ695A when using dual-ported SAS drives to create a dual domain environment.	QQ696A
	HP D6000 w/35 2TB 6G SAS 7.2K LFF Dual port MDL HDD 70TB Bundle **NOTE:** Includes D6000 with (35) 2TB LFF Midline SAS drives, (4) dual port I/O modules, redundant power supplies and redundant fans	QQ697A
	HP D6000 w/70 2TB 6G SAS 7.2K LFF Dual port MDL HDD 140TB Bundle **NOTE:** Includes D6000 with (70) 2TB LFF Midline SAS drives, (4) dual port I/O modules, redundant power supplies and redundant fans	QQ698A
	HP D6000 w/35 3TB 6G SAS 7.2K LFF Dual port MDL HDD 105TB Bundle **NOTE:** Includes D6000 with (70) 3TB LFF Midline SAS drives, (4) dual port I/O modules, redundant power supplies and redundant fans	QQ699A
	HP D6000 w/70 3TB 6G SAS 7.2K LFF Dual port MDL HDD 210TB Bundle **NOTE:** Includes D6000 with (70) 3TB LFF Midline SAS drives, (4) dual port I/O modules, redundant power supplies and redundant fans.	QQ700A
	HP D6000 w/35 4TB 6G SAS 7.2K LFF Dual Port MDL HDD 140TB Bundle **NOTE:** Includes D6000 with (35) 4TB LFF Midline SAS drives, (4) dual port I/O modules, redundant power supplies and redundant fans.	E7W30A
	HP D6000 w/70 4TB 6G SAS 7.2K LFF Dual Port MDL HDD 280TB Bundle **NOTE:** Includes D6000 with (70) 4TB LFF Midline SAS drives, (4) dual port I/O modules, redundant power supplies and redundant fans.	E7W31A

Configuration Information

Step 2: Choose Supported Options

		Part Number
HP Smart Array P721m controller	HP Smart Array P721m/2G FBWC 4-ports Ext Mezzanine SAS Controller	650072-B21
	HP Smart Array P731m/2GB FBWC 6Gb 4-ports Ext Mezzanine SAS Controller	698535-B21
HP Smart Arry P421 controller	HP Smart Array P421/1GB FBWC 6Gb 2-ports Ext SAS Controller	631673-B21
	HP Smart Array P421/2GB FBWC 6Gb 2-ports Ext SAS Controller	631674-B21
HP Smart Arry P822 controller	HP Smart Array P822/2GB FBWC 2-ports Int/4-ports Ext SAS Controller	615418-B21
HP Host Bus Adapters (HBAs)	HP H221 Host Bus Adapter	650931-B21
	HP H222 Host Bus Adapter	650926-B21
HP 6 Gb/s SAS BL Switch	HP 6Gb SAS Switch Single Pack for HP BladeSystem c-Class	BK763A
	HP 6Gb SAS Switch Dual Pack for HP BladeSystem c-Class	BK764A

Step 2b - SAS Cable

Model Description

HP External Mini SAS 1m Cable ALL	407337-B21
HP External Mini SAS 2m Cable	407339-B21

Step 3 - D6000 Drive Options

3.5" SAS Midline (MDL) Drives

HP 4TB 6G SAS 7.2K rpm LFF (3.5-inch) Midline 1yr Warranty Hard Drive	693689-B21
HP 3TB 6G SAS 7.2K rpm LFF (3.5-inch) Midline 1yr Warranty Hard Drive	625031-B21
HP 2TB 6G SAS 7.2K rpm LFF (3.5-inch) Dual Port Midline 1yr Warranty Hard Drive	507616-B21
HP 1TB 6G SAS 7.2K rpm LFF (3.5-inch) Dual Port Midline 1yr Warranty Hard Drive	507614-B21

3.5" SAS Drives

HP 300GB 6G SAS 15K rpm LFF (3.5-inch) Dual Port Enterprise 3yr Warranty Hard Drive	516814-B21
HP 450GB 6G SAS 15K rpm LFF (3.5-inch) Dual Port Enterprise 3yr Warranty Hard Drive	516816-B21
HP 600GB 6G SAS 15K rpm LFF (3.5-inch) Dual Port Enterprise 3yr Warranty Hard Drive	516828-B21

Configuration Information

Step 4: Choose Rack Options

Choose HP Rack 10000 series Cabinets for the D6000
The increasing power of new high-performance processor technology requires increased cooling efficiency for rack-mounted servers. The 10000 Series Racks provide enhanced airflow for maximum cooling, allowing these racks to be fully loaded with servers using the latest processors.

http://h18004.www1.hp.com/products/servers/proliantstorage/racks/10000series/index.html

NOTE: An D6000 fully loaded with drives weighs 320lbs.

NOTE: HP has not tested or validated the D6000 with any third-party racks. Before installing the D6000 in a third-party rack, be sure to properly scope the limitations of the rack. Before proceeding with the installation, consider the following:

- You must fully understand the static and dynamic load carrying capacity of the rack and be sure that it can accommodate the weight of the D6000 .
- If the D6000 is not sitting atop a Blade c-Class enclosure or another D6000 or MDS600 in a 3rd party rack , then install a 1U tray (part no 501037-B21) beneath the D6000 to ensure proper support
- Be sure sufficient clearance exists for cabling, installation and removal of the enclosure, actuation of the rack doors, and full articulation of the drive drawers

NOTE: Please note that while configured as CTO, a maximum of four D6000 is supported in a 42u standard rack (AF002A) and five in a 42u deep rack(AF092A). The 47U deep rack (AF094A) will also be limited to a maximum of five D6000 for CTO config. But additional D6000 can still be ordered as BTOs. Customers can then install them into racks at the customer site for a maximum of six D6000 per rack. The quantity of D6000 units supported in a rack is dependent upon the other components configured in the rack relative to the rack weight limit.

Technical Specifications

D6000	**INPUT POWER** (per power supply)	**Rated Line Voltage**	90 to 132 VAC 180 to 264 VAC
		Rated Input Frequency	47 to 63 Hz
		Rated Input Current	10A (at 100 VAC), 7.8A (at 200VAC)
		Rated Input Power	@ 100VAC, 70 drives x 2TB-7.2K = 1043.7W @ 100VAC, 70 drives x 600GB-15K = 1601.9W
	TEMPERATURE AND HUMIDITY RANGES	**Operating Temperature**	50° to 95° F (10° to 35° C) **NOTE:** Maximum Rated 10°C per/hr (50°F/hr)
		Storage Temperature	-22° to 140° F (-30° to 60° C) **NOTE:** Maximum Rated 20°C/hr (68°F/hr)
		Operating Humidity	10% to 90% relative humidity (Rh), 28° C (82.4º F) maximum wet bulb temperature, non-condensing
		Non-Operating Humidity	5% to 95% relative humidity (Rh), 38.7º C (101.66º F) maximum wet bulb temperature, non-condensing
	PHYSICAL	**Length**	89.12 cm
		Width	44.7 cm (17.6 in)
		Height	22.1 cm (8.7 in)
		Chassis	72.58 kg (160 lb) with no hard drives installed
		Weight	145 kg (320 lb) with hard drives installed

Power Consumption (maximum)

Power consumption at 208VAC

Drive Type	Typical	Service Position Maximum (drawers being pulled out causing all fans to go to full speed
7200 RPM SAS MDL	1035W (3532 Btu/hr)	1470W (5021 Btu/hr)
10K 400G SAS	940W	1340W
15K SAS	1280W	1710W

NOTE: Input Power and Heat Dissipation specifications are maximum values and apply to worst-case conditions at full rated power supply load. The power/heat dissipation for your installation will vary depending on the equipment configuration.
NOTE: Temperature ratings shown are for sea level. An altitude derating of 1°C per 300 m (1.8°F per 1,000 ft) to 3048 m (10,000 ft) is applicable. No direct sunlight allowed. The upper limit may be limited by the type and number of options installed.
NOTE: Storage maximum humidity of 95% is based on a maximum temperature of 45°C (113°F). Altitude maximum for storage corresponds to a pressure minimum of 70 KPa.
NOTE: The "service position maximum" column is the test result with the drawers open.

Upgradeable Firmware	Offline
Disk Drives and Enclosure Protocol Support	HP 3.5" SAS and SAS MDL 6 Gb/s

Technical Specifications

I/O Module	Connector Type	External mini-SAS 4x (SFF8088)
	Number of Ports	Two