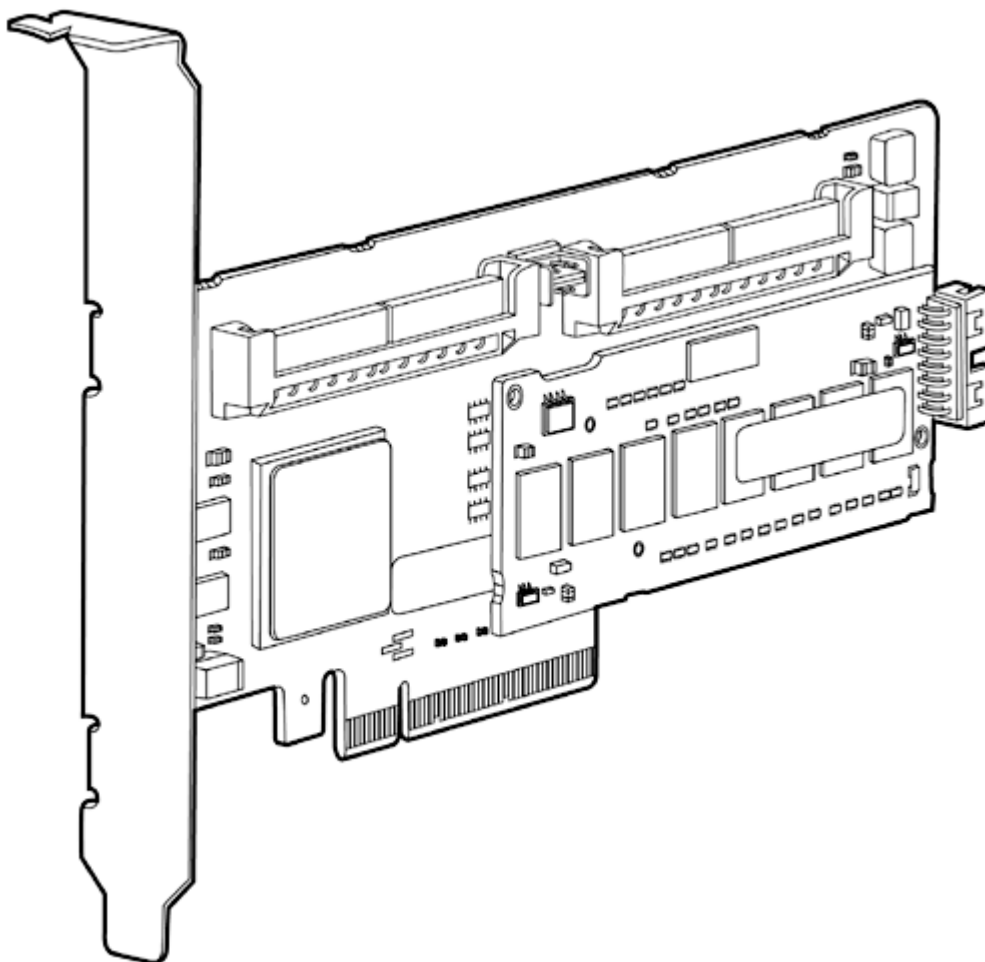


### Overview

The HP Smart Array P400 is HP's first PCI-Express (PCIe) serial attached SCSI (SAS) RAID controller and provides new levels of performance and reliability for HP servers, through its support of the latest SCSI technology and advanced RAID capabilities.



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### What's New

- Native Command Queuing (NCQ) support available
  - Dual domain support for external drives
  - 64 LUN support
-

### Overview

#### Models

HP Smart Array P400 Controller	HP Smart Array P400/256 MB Controller	405132-B21
	HP Smart Array P400/512 MB Controller with BBWC	411064-B21

#### Upgrade Options

Battery Attach Kit	Smart Array P400 Battery Attach Kit	417836-B21
	<b>NOTE:</b> This option kit contains a 24" battery cable and adhesive material for installing a battery into the following servers if a Smart Array P400 is integrated outside of the factory - HP ProLiant ML310 G3, HP ProLiant ML310 G4, HP ProLiant DL320 G4, HP ProLiant DL320 G5, HP ProLiant DL320s, HP ProLiant ML350 G5, HP ProLiant DL380 G5 (installations in a full size slot), HP ProLiant DL385 G2 (installations in a full size slot) and HP ProLiant DL580 G4. For all solutions, please refer to the HP ProLiant QuickSpecs and User's Manual for detailed installation instructions.	
Cache Upgrades	Battery-backed write cache upgrade	383280-B21
	512MB Battery-backed write cache upgrade	405148-B21

### Standard Features

**NOTE:** For a brief, printer friendly data sheet that describes this product and informs you of the essential capabilities and specifications, please visit: <http://h71028.www7.hp.com/ERC/downloads/4AA0-0582ENW.pdf>.

#### The Smart Array Advantage

HP's innovative design and integration work of the Smart Array family of products creates customer value that is unmatched in the industry. Use of Smart Array products across multiple applications results in a much lower Total Cost of Ownership (TCO) than any other server storage RAID product. The HP Smart Array family brings an unparalleled return on investment through:

**Data Compatibility** among all models of Smart Array controllers allows simple and easy upgrades any time needs for higher performance, capacity, and availability increase. Even successive generations of Smart Array controllers understand the data format of other Smart Array Controllers.

**Consistent Configuration and Management Tools.** All Smart Array products utilize a standard set of management and utility software. These tools minimize Total Cost of Ownership (TCO) by reducing training requirements and technical expertise necessary to install and maintain the HP server storage.

**Universal Hard Drive** form factor is for use across multiple HP servers, disk enclosures and storage systems. With compatibility across many enterprise platforms, you are free to deploy and re-deploy these drives to quickly deliver increased storage capacity, migrate data between systems, and easily manage spare drives.

**Pre-Failure Warranty** means HP Insight Manager not only reports when a drive is going to fail but allows replacement of failing drives prior to actual failure. For complete details, consult the HP Support Center or refer to your HP Server documentation.

#### Key Features

- The SA-P400 Controller supports up to 18 drives depending on the server implementation. The SA-P400i Controller supports up to 6 drives depending on the server implementation
- Seamless upgrades from past generations and upgrades to next generation HP high performance and high capacity Serial Attached SCSI Smart Array controllers.
- 3G SAS technology delivers high performance and data bandwidth up to 300 MB/s per physical link and contains full compatibility with 1.5G SATA technology.
- x8 2.5G PCI Express host interface technology delivers high performance and data bandwidth up to 2 GB/s maximum bandwidth.
- Modular, easy-to-upgrade design lets you optimize performance by upgrading from 40-bit 256MB cache to 72-bit 512MB battery-backed write cache (BBWC).
- Addition of the battery backed cache upgrade enables BBWC, RAID 6 with ADG, array expansion, logical drive extension, RAID migration, and stripe size migration.
- Mix-and-match SAS and SATA hard drives, lets you deploy drive technology as needed to fit your computing environment.
- Software consistency among all Smart Array family products: Array Configuration Utility (ACU), Option ROM Configuration for Arrays (ORCA), Systems Insight Manager, Array Diagnostic Utility (ADU) and SmartStart.
- Support for greater than 2TB in a single logical drive.
- Low-profile PCI Express form factor - ships with a full size bracket for deployment in either a low-profile or full sized slot.

### Standard Features

#### Management Features

- Online array expansion (with BBWC upgrade)
- Online logical drive extension (with BBWC upgrade)
- Online RAID level migration (with BBWC upgrade)
- Online strip size migration (with BBWC upgrade)
- Offline Mirror splitting and recombining
- Unlimited global online spare assignment
- User selectable expand and rebuild priority
- User selectable RAID level and stripe size
- User selectable read and write cache sizes

#### Ports

- Eight (8) SAS physical links distributed across 2 internal x4 wide port connectors.

#### Performance

HP's High Performance Architecture sets new boundaries of industry performance expectations!

- 3G SAS (300MB/s bandwidth per physical link)
- x8 3G SAS physical links (compatible with 1.5G SATA)
- 256 MB 40-bit wide DDR2-533MHz cache upgradeable to 512 MB 72-bit wide DDR2-533MHz battery-backed cache provides up to 4.2 GB/s maximum bandwidth
- x8 2.5G PCI Express host interface provides 2 GB/s maximum bandwidth
- 440 PowerPC Processor
- Read ahead caching
- Write-back caching (with battery-backed write cache upgrade)

#### Native Command Queuing

Native Command Queuing (NCQ) is a technology designed to increase performance of SATA hard disk drives by allowing the individual hard disk to internally optimize the order in which received read and write commands are executed. This can reduce the amount of unnecessary going back-and-forth on the drive's heads, resulting in increased performance for workloads where multiple simultaneous read/write requests are outstanding, most often occurring in server or storage-type applications. Without NCQ the drive has to process and complete one command at a time. For NCQ to be enabled, it must be supported and turned on in the controller and in the hard drive itself.

**NOTE:** Please see the [SATA Hard Drive QuickSpecs](http://h18000.www1.hp.com/products/quickspecs/11940_div/11940_div.html) for specific SATA hard drive capacities that support NCQ: [http://h18000.www1.hp.com/products/quickspecs/11940\\_div/11940\\_div.html](http://h18000.www1.hp.com/products/quickspecs/11940_div/11940_div.html)

#### Dual Domain Support

Dual domain SAS creates redundant pathways for external drives from servers to storage devices. The redundant paths created by these configurations reduce or eliminate single points of failure within the storage network. This provides increased levels of high availability with redundant paths from the controller to the drives. Dual domain SAS implementations make it possible to tolerate host bus adapter (HBA) or controller failure, external cable failure, expander failure, cable pulls, expander failure and failure in a spanned disk (JBOD) environments.

#### Capacity

Given the increasing need for high performance and rapid capacity expansion, the SA-P400 Controller offers:

- Up to 2TB of total storage with SATA HDD
- Up to 13.5TB of total storage with 18 x 750GB 3.5" SATA HDD

### Standard Features

#### Availability

Provides increased server uptime by providing advanced storage functionality:

- Online RAID level migration (between any RAID level)
- Online stripe size migration
- Online array expansion
- Online logical drive extension
- Online drive firmware upgrade
- Unlimited global online spare
- Pre-Failure Warranty

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#### Fault Prevention

The following features offer detection of possible failures before they occur, allowing preventive action to be taken:

- S.M.A.R.T.: Self Monitoring Analysis and Reporting Technology first developed at HP detects possible hard disk failure before it occurs, allowing replacement of the hard drive before a real failure occurs.
- Drive Parameter Tracking monitors drive operational parameters, predicting failure and notifying the administrator.
- Dynamic Sector Repairing continually performs background surface scans on the hard disk drives during inactive periods and automatically remaps bad sectors, ensuring data integrity.
- Smart Array Cache Tracking monitors integrity of controller cache, allowing pre-failure preventative maintenance.

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#### Fault Tolerance

Keeps data available and server running while a failed drive is being replaced; several fault tolerance configurations are supported including:

- **RAID 6 with ADG** (Advanced Data Guarding): This is the highest level of fault tolerance. It allocates two sets of parity data across drives and allows simultaneous write operations. This level of fault tolerance can withstand two simultaneous drive failures without downtime or data loss.
- **RAID 5** (Distributed Data Guarding): This allocates one set of parity data across drives and allows simultaneous write operations. This level of fault tolerance can withstand a single drive failure without downtime or data loss.
- **RAID 1, 1+0** (Drive Mirroring): This allocates half of the drive array to data and the other half to mirrored data, providing two copies of every file. It is a high-performance RAID.

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#### Fault Recovery

Minimizes downtime, reconstructs data, and facilitates a quick recovery from drive failure

- Recovery ROM: This feature protects the user from a firmware image corruption by storing a redundant copy of the firmware image. If the active firmware image becomes corrupt, the controller will use the redundant firmware image and continue operating.
- On-Line Spares: There is no limit to the number of spare drives that can be installed prior to drive failure. If a failure occurs, recovery begins with an On-Line Spare and data is reconstructed automatically.
- DRAM ECC detects and corrects data bit errors.
- Battery-backed write cache upgrade provides for up to two days of battery power for data cache retention. The data backup duration could be extended anytime the server's auxiliary power is available during system power down.

### Standard Features

#### Ease of Use

Consistency and Upgradeability make the Smart Array family unique in the industry:

- GUI based configuration, management and diagnostic software tools
- Common data format between generations of products
- Data migration between servers and external StorageWorks Modular Smart Array enclosures

### Compatibility

#### Server Compatibility

For up to date compatibility, please see the following URL for complete Smart Array P400 Controller compatibility and support information:

<http://h18006.www1.hp.com/products/servers/proliantstorage/arraycontrollers/index.html>

#### Operating Systems

Microsoft® Windows™ 2000 Server  
Microsoft Windows 2000 Advanced Server  
Microsoft Windows 2003 / R2 Standard Edition  
Microsoft Windows 2003 / R2 Enterprise Edition  
Microsoft Windows 2003 / R2 Standard x64 Edition  
Microsoft Windows 2003 / R2 Enterprise x64 Edition  
Microsoft Windows 2003 / R2 SBS  
Novell Open Enterprise Server, NetWare 6.5 SP5  
Red Hat Enterprise Linux  
SUSE Linux Enterprise Server  
SCO OpenServer 5.0.7, 6  
SCO UnixWare 7.1.3, 7.1.4  
Solaris 10  
VMWare ESX 3.0

**NOTE:** For more Linux OS support & certification information, please visit our the ProLiant & BladeSystem Server Linux matrix: <http://h18004.www1.hp.com/products/servers/linux/hpLinuxcert.html>

#### Software Suite

All Smart Array products share a common set of configuration, management and diagnostic tools, including Array Configuration Utility, Array Diagnostic Utility (ADU), and Systems Insight Manager. This software consistency of tools reduces the cost of training for each successive generation of product and takes much of the guesswork out of troubleshooting field problems. These tools lower the total cost of ownership by reducing training and technical expertise necessary to install and maintain HP server storage.

##### Systems Insight Manager

- Powerful server and server options/storage manager tool
- Monitors over 1200 system wide parameters
- Configuration/Diagnostic Utilities

##### HP Array Configuration Utility (ACU)

- Powerful Web based configuration utility for all Smart Array controllers
- Provides a graphical view of HP drive array configurations
- Allows for management of multiple arrays over a secure internet connection from anywhere in the world
- Easy to use Wizards for configuration
- Runs offline for all supported Operating Systems and runs online for Windows and Linux. For online configuration of NetWare, use CPQONLIN

##### HP Option ROM Configuration for Arrays (ORCA)

### Compatibility

- A simple method for managing logical drives during system power up by pressing F8 during POST
- Allows the ability to create arrays, logical drives, and assign an online spare drive
- Allows the ability to view and delete logical drives
- Allows the ability to select the boot controller
- For advanced array configurations use ACU

#### HP Array Diagnostic Utility (ADU)

- In depth diagnostic and reporting utility for all Smart Array controllers
- Runs offline for all supported Operating Systems, and runs online for Windows and Linux



### Service and Support, HP Care Pack, and Warranty Information

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**Warranty** The warranty for this device is 3-years parts only.  
**Pre-Failure Warranty:** Drives attached to the Smart Array Controller and monitored under Insight Manager are supported by a Pre-Failure (replacement) Warranty. For complete details, consult the HP Support Center or refer to your HP Server Documentation.

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**Software Product Services** Standalone telephone support  
Rights to new license version  
Media and documentation updates

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**Hardware Product Services** Installation services  
On-site maintenance (includes warranty support)  
Response time upgrades during the warranty period  
Post-warranty coverage  
For additional hardware installation and maintenance information, please refer to the URL:  
<http://www.hp.com/hps/hardware/>

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**Warranty Upgrade Options** Response - Upgrade on-site response from next business day to same day 4 hours  
Coverage - Extend hours of coverage from 9 hours x 5 days to 24 hours x 7 days  
Duration - Select duration of coverage for a period of 1, 3, or 5 years  
Warranty upgrade options can come in the form of Care Packs, which are sold at the HP System level this product attaches too.

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**HP Care Pack Information** HP Care Pack is defined as an upgrade to the product warranty attribute, available for a specific duration and hours of coverage. Care Packs for this option is sold at the system level this option attaches too.  
HP Care Pack is not available for less than the product's warranty duration.  
HP Care Pack is available for sale anytime during the warranty period for most products, but the commencement date will be the same as the Warranty Start Date (delivery date to end user customer). Proof of purchase may be required.  
HP Care Pack services are prepaid.  
For additional HP Care Pack (hardware & software) information, as well as orderable part numbers, please refer to the URL <http://www.hp.com/hps/carepack/>

### Related Options

#### Hard Drives

##### Hot Plug SFF SAS 2.5" Drives

HP 146GB 3G SAS 10K SFF SP HDD	431958-B21
HP 72GB 3G SAS 10K SFF SP HDD	375861-B21
HP 72GB 3G SAS 15K SFF SP HDD	431935-B21
HP 36GB 3G SAS 15K SFF SP HDD	431933-B21

##### Hot Plug SAS 3.5" Drives

HP 300GB 3G SAS 15K 3.5" SP HDD	431944-B21
HP 146GB 3G SAS 15K 3.5" SP HDD	375872-B21
HP 72GB 3G SAS 15K 3.5" SP HDD	375870-B21

##### Non-Hot Plug SAS 3.5" Drives

HP 300GB SAS 3.5" 15K NHP	431950-B21
HP 146GB SAS 3.5" 15K NHP	432093-B21
HP 72GB SAS 3.5" 15K NHP	432095-B21

##### Small Form Factor (SFF) SATA Hot Plug Drives

HP 60GB 1.5G SATA 5.4K SFF HDD	379306-B21
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##### SFF SATA Hot Plug Entry (ETY) Drives

HP 120GB 1.5G SATA 5.4K SFF ETY HDD	458924-B21
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##### SFF SATA Non-Hot Plug Entry (ETY) Drives

HP 120GB 1.5G SATA 5.4K NHP SFF ETY HDD	459357-B21
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##### 3.5" SATA Hot Plug Drives

HP 750GB 1.5G SATA 7.2K 3.5" HDD	432341-B21
HP 500GB 1.5G SATA 7.2K 3.5" HDD	395473-B21
HP 250GB 1.5G SATA 7.2K 3.5" HDD	349239-B21
HP 160GB 1.5G SATA 7.2K 3.5" HDD	349238-B21
HP 80GB 1.5G SATA 7.2K 3.5" HDD	349237-B21

##### 3.5" SATA Non-Hot Plug Drives

HP 250GB 1.5G SATA 7.2K NHP 3.5" HDD	411276-B21
HP 160GB 1.5G SATA 7.2K NHP 3.5" HDD	411275-B21
HP 80GB 1.5G SATA 7.2K NHP 3.5" HDD	383410-B21

**NOTE:** Go to the [HP Hard Drive Compatibility table](http://www.hp.com/products/harddiskdrives) for complete drive compatibility information (<http://www.hp.com/products/harddiskdrives>). Using hard drives in unsupported configurations will result in voiding the warranty and could result in damage to the drive and/or loss of data.

**NOTE:** There is a known compatibility issue with some early 3.5" SATA HDD that will make them unable to be used with the SA-P400 controller. Customers should verify that they are not using hard drive part number 332649-002/003 (spare 353042-001), 332650-002/003 (spare 353043-001), or 356536-002/003 (spare 353044-001).

**NOTE:** SATA Drive Write Cache is disabled by default to minimize the risk of data loss in case of power loss and cannot be enabled for SATA drives attached to all HP Smart Array controllers and HP 8 Port internal SAS/SATA HBA with RAID.

### Related Options

#### Tape Solutions

#### SAS Tape Drives

**NOTE:** Supported on HP Smart Array P400 Controller only.

HP StorageWorks DAT 160 SAS Internal Tape Drive	Q1587A
HP StorageWorks DAT 160 SAS External Tape Drive	Q1588A
HP StorageWorks LTO-2 Ultrium 448 SAS Internal Tape Drive	DW085A
HP StorageWorks LTO-2 Ultrium 448 SAS External Tape Drive	DW086A
HP StorageWorks LTO-3 Ultrium 920 SAS Internal Tape Drive	EH847A
HP StorageWorks LTO-3 Ultrium 920 SAS External Tape Drive	EH848A
HP StorageWorks LTO-4 Ultrium 1760 SAS Internal Tape Drive	EH919A
HP StorageWorks LTO-4 Ultrium 1760 SAS External Tape Drive	EH920A
HP StorageWorks 1U SAS Rack-mount kit with one LTO-4 Ultrium 1760	EH946A
HP StorageWorks LTO-4 Ultrium 1840 SAS Internal Tape Drive	EH860A
HP StorageWorks LTO-4 Ultrium 1840 SAS External Tape Drive	EH861A

#### Rack-mount Tape Drive Enclosures

HP StorageWorks 1U SAS Rack-Mount Kit	AE459A
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**NOTE:** The 1U SAS Rack-Mount Kit can support up to (2) half-height tape drives and is compatible with the DAT 160 SAS, LTO-2 Ultrium 448 SAS, LTO-3 Ultrium 920 SAS and LTO-4 Ultrium 1760 SAS tape drives.

HP StorageWorks 3U SAS Rack-mount Kit	AG576A
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**NOTE:** The 3U Rack-mount Kit can support up to (2) full-height or (4) half-height tape drives and compatible with multiple SAS tape drives including DAT 160 SAS, LTO-2 Ultrium 448 SAS, LTO-3 Ultrium 920 SAS, LTO-4 Ultrium 1760 SAS and LTO-4 Ultrium 1840 SAS tape drives.

#### SAS Cables for Tape Drives

2M External Infiniband (SFF8470) to Mini SAS (SFF8088) 1x SAS Cable	AE466A
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**NOTE:** Use this cable to connect HP StorageWorks Ultrium SAS External Tape Drives to SAS Controllers with Infiniband (SFF8470) connectors.

4M External Mini SAS to Mini SAS (SFF8088) 3x/1x External Split SAS Cable	AE464A
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**NOTE:** This split cable connects internally to SAS Hard Drive Cage (3x) and externally to the HP Storage Works 1U SAS Rack-Mount Kit (1x) with other connector going to internal SAS Controller port inside the server. Requires additional PCI slot on server for threading 1x split cable to SAS tape.

4M External Infiniband (SFF8470) to Mini SAS (SFF8088) 1x SAS Cable	AE468A
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**NOTE:** Use this cable to connect HP StorageWorks 1U SAS Rack-mount Kit to SAS Controllers with Infiniband (SFF8470) connectors.

2M External Mini SAS (SFF8088) to Mini SAS (SFF8088) 1x SAS Cable	AE470A
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**NOTE:** Use this cable to connect HP StorageWorks Ultrium SAS External Tape Drives.

4M External Mini SAS (SFF8088) to Mini SAS (SFF8088) 1x SAS Cable	AE465A
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**NOTE:** Use this cable to connect HP StorageWorks 1U SAS Rack-mount Kit.

4M External Mini SAS to Mini SAS (SFF8088) 3x/1x External Split SAS Cable	AG452A
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**NOTE:** This split cable connects internally to SAS Hard Drive Cage (3x) and externally to the HP Storage Works 1U SAS Rack-Mount Kit (1x) with other connector going to internal SAS Controller port inside the server. Requires additional PCI slot on server for threading 1x split cable to SAS tape. Valid only for ProLiant DL360 G5 and ProLiant DL365 servers.

### Technical Specifications

<b>Dimensions</b> (not including bracket)	Low Profile PCIe Form Factor 6.61 in x 2.75 in x 0.7 in (16.8 cm x 7.0 cm x 1.8 cm)
<b>Disk Drive and Enclosure Interface</b>	3G SAS (Serial Attached SCSI) 1.5G SATA (Serial ATA)
<b>SAS Connectors</b>	2 internal (SFF8484) x4 wide port connectors
<b>Cache Memory Speed</b>	DDR2-533MHz with 40 or 72-bit wide bus provides up to 4.2 GB/s maximum bandwidth.
<b>Server Interface</b>	x8 2.5G PCIe provides 2GB/s maximum bandwidth.
<b>SAS Speed</b>	x8 3G SAS provides 2.4GB/s maximum bandwidth.
<b>Cache Memory</b>	40-bit 256MB ECC protected cache (72-bit 512MB module upgrades available); transportable with battery-backed upgrade
<b>Logical Drives Supported</b>	Up to 32 logical drives
<b>Maximum Logical Drive Capacity</b>	Greater than 2TB
<b>Host Memory Addressing</b>	64-bit, supporting greater than 4GB server memory space
<b>RAID Support</b>	RAID 6 with ADG (Advanced Data Guarding) requires Battery Backed Write Cache Upgrade RAID 5 (Distributed Data Guarding) RAID 1+0 (Striping & Mirroring) RAID 0 (Striping)
<b>Upgradeable Firmware</b>	Upgradeable Firmware with recovery ROM feature

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<b>Environment-friendly Products and Approach</b>	<b>End-of-life Management and Recycling</b>	Hewlett-Packard offers end-of-life HP product return, trade-in, and recycling programs in many geographic areas. For trade-in information, please go to: <a href="http://www.hp.com/go/green">http://www.hp.com/go/green</a> . To recycle your product, please go to: <a href="http://www.hp.com/go/green">http://www.hp.com/go/green</a> or contact your nearest HP sales office. Products returned to HP will be recycled, recovered or disposed of in a responsible manner.
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The EU WEEE directive (2002/95/EC) requires manufacturers to provide treatment information for each product type for use by treatment facilities. This information (product disassembly instructions) is posted on the Hewlett Packard web site at: <http://www.hp.com/go/green>. These instructions may be used by recyclers and other WEEE treatment facilities as well as HP OEM customers who integrate and re-sell HP equipment.

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For hard drives, 1 GB = 1 billion bytes. Actual formatted capacity is less.