

### Overview

### HPE Integrity Smart Array P411/256MB 2-Port External PCIe 6Gb SAS Controller

The HPE Smart Array P411 is HPE's external connect only, PCI Express (PCIe) 2.0 Serial Attached SCSI (SAS) RAID controller for Integrity rack optimized servers. The low profile, half height card can support up to 8 external SAS physical links via 2 ports (2 x4-port mini-SAS). The P411 is ideal for RAID 0, 1, 1+0, and 5.

### What's New

- Boot from Tape

### Models

<b>HPE Smart Array P411 Controller</b>	HP Integrity Smart Array P411/256 2-port External PCIe 6Gb SAS Controller HPE Smart Array P411/256MB Controller Factory Integrated	AM311A AM311A#0D1
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## Standard Features

### The Smart Array Advantage

HPE'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 HPE 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 HPE server storage.

**Universal Hard Drive** form factor is for use across multiple Hewlett Packard Enterprise 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 HPE 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 HPE Support Center or refer to your HPE Server documentation.

### Key Features

- The SA-P411 Controller supports up to 100 drives.
- The SA-P411 Controller supports the HPE StorageWorks D2600 Disk Enclosure, HPE StorageWorks D2700 Disk Enclosure, HPE StorageWorks 70 Modular Smart Array\*, HPE StorageWorks 60 Modular Smart Array\* and HPE StorageWorks MDS600.
- Seamless upgrades to current or next generation HPE high performance and high capacity Serial Attached SCSI Smart Array controllers
- 6Gb/s SAS technology delivers high performance and data bandwidth
- x8 PCI Express host interface technology delivers high performance and up to 4 GB/s maximum bandwidth.
- Support for greater than 2TB in a single logical drive
- 256 MB 40-bit wide DDR2-800 MHz cache module
- Low-profile PCI Express form factor - ships with a full size bracket for deployment in either a low-profile or full sized slot
- Tape support including boot from tape

### NOTES:

- AM311A has no write cache available as this card has no battery. Battery backup write cache is not supported as there is no provision to fasten the cache battery to the server chassis. The battery would be used to store "write data" on the cache during power failures thus preventing corruption. AM311A is meant to be a lower cost (low performance) solution, intended to replace the older SC44Ge SAS HBA. BCS does not intend the AM311A to be used as a RAID adapter. If the customer needs good performance then we recommend using the P812 card i.e. AM312A. This card has provision to install the battery on the card itself.
- Supports RAID or HBA mode for HP-UX only (no mixed mode). This can be configured through offline saupdate utility.
- Multi-initiator support (future)
- OLRAD is not supported
- \*HPE StorageWorks 70 Modular Smart Array and HPE StorageWorks 60 Modular Smart Array are not supported with HPE Integrity Superdome 2.
- Vpars with the card is not supported with rx7640, rx8640 and Superdome (sx2000). Vpars is supported with Superdome 2.

## Standard Features

- Card supports either JBODs or Tape at one time with Superdome 2. Concurrent function is not supported.

### Online Management Features

- Unlimited global online spare assignment
- User selectable expand and rebuild priority
- User selectable RAID level and stripe size

### Ports

- Eight (8) SAS physical links distributed across 2 external x4 miniSAS connectors.

### Performance

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

- 6Gb/s SAS (600MB/s bandwidth per physical link)
- 8x 6Gb/s SAS physical links
- x8 5Gb/s PCI Express host interface provides 4 GB/s maximum bandwidth during burst transfers

### Capacity

Given the increasing need for high performance and rapid capacity expansion, the SA-P411 offers:

- Up to 57.6TB of external storage per PCIe slot with (8) HPE StorageWorks D2600 Disk Enclosures or (8) HPE StorageWorks 60 MSA and 96 x 600GB 3.5" SAS hard drives.
- Up to 60TB of external storage per PCIe slot with (4) HPE StorageWorks D2700 Disk Enclosures or (4) HPE StorageWorks 70 MSA and 100 x 600GB 3.5" SAS hard drives.

**NOTE:** Support for greater than 2TB in a single logical drive.

### Availability

Provides increased server uptime by providing advanced storage functionality:

- Global Online Spare
- Pre-Failure Warranty

### 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) was first developed by HPE which detects possible hard disk failure before it occurs, allowing replacement of the component before 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.
- Environment Tracking for External Storage System: Monitors fan speed and cabinet temperature of StorageWorks Modular Smart Array Enclosures and HPE StorageWorks Disk Enclosures.

### Fault Tolerance

- **RAID 50 (RAID 5+0)** protects against failure of one drive (and failure of particular multiple drives). RAID 50 is a nested RAID method that uses RAID 0 striping across RAID 5 arrays. RAID 50 tolerates one drive failure in each spanned array without loss of data. RAID 50

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## Standard Features

- requires less rebuild time than single RAID 5 arrays RAID 50 requires a minimum of six drives.
- **Distributed Data Guarding (RAID 5):** This allocates parity data across multiple drives and allows simultaneous write operations. It is recommended for up to 14 hard drives.
- **Drive Mirroring (RAID 1, 1+0):** 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.
- **(Striping) RAID 0** provides no extra data protection. Data is striped across all drives in the array to increase performance. RAID 0 requires a minimum of one drive.

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## Fault Recovery

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

- **Recovery ROM:** This new feature provides a unique redundancy feature that protects from a ROM image corruption. A new version of firmware can be flashed to the ROM while the controller maintains the last known working version of firmware. If the firmware becomes corrupt, the controller will revert back to the previous version of firmware and continue operating. This reduces the risk of flashing firmware to the controller.
- **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** corrects against single bit data and address corruption.

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## 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 HPE StorageWorks Modular Smart Array enclosures and HPE StorageWorks Disk Enclosures

## Compatibility

### Server Support

Integrity rx2660  
 Integrity rx2800 i2  
 Integrity rx3600  
 Integrity rx6600  
 Integrity rx7640  
 Integrity rx8640  
 Integrity Superdome  
 Integrity Superdome 2

### Operating Systems

HP-UX 11iv3  
 Microsoft Windows 2008 SP2 for Integrity  
 Microsoft Windows 2008 R2 for Integrity  
 OpenVMS v8.4 (HPE Integrity rx2800 i2 only)

### Software Suite

All Smart Array products share a common set of configuration, management and diagnostic tools, including Array Configuration Utility (ACU), Array Diagnostic Utility (ADU), and Systems Insight Manager. These software tools reduce 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 HPE server storage.

#### Systems Insight Manager

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

#### HPE Array Configuration Utility (ACU)

- Powerful Web based configuration utility for all Smart Array controllers
- Provides a graphical view of HPE 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

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

- An alternative method for easily viewing, creating, and deleting multiple arrays and logical volumes during system power up.
- For advanced array configurations use ACU

**NOTE:** For advanced array configurations use ACU.

#### HPE Array Diagnostic Utility (ADU)

- In depth diagnostic and reporting utility for all Smart Array controllers

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

<b>Warranty</b>	<p>The warranty for this device is 3 years parts only.</p> <p><b>Pre-Failure Warranty:</b> 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 HPE Support Center or refer to your HPE Server Documentation.</p>
<b>Software Product Services</b>	<p>Standalone telephone support</p> <p>Rights to new license version</p> <p>Media and documentation updates</p>
<b>Hardware Product Services</b>	<p>Installation services</p> <p>On-site maintenance (includes warranty support)</p> <p>Response time upgrades during the warranty period</p> <p>Post-warranty coverage</p> <p>RAID setup and performance consulting via statement of work</p> <p><b>NOTE:</b> For additional hardware installation and maintenance information, please refer to the URL: <a href="http://www.hp.com/hps/hardware/">http://www.hp.com/hps/hardware/</a></p>
<b>Warranty Upgrade Options</b>	<p>Response - Upgrade on-site response from next business day to same day 4 hours</p> <p>Coverage - Extend hours of coverage from 9 hours x 5 days to 24 hours x 7 days</p> <p>Duration - Select duration of coverage for a period of 1, 3, or 5 years</p> <p>Warranty upgrade options can come in the form of Care Packs, which are sold at the HPE System level this product attaches too.</p>
<b>HPE Care Pack Information</b>	<p>HPE 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.</p> <p>HPE Care Pack is not available for less than the product's warranty duration.</p> <p>HPE 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.</p> <p>HPE Care Pack services are prepaid.</p> <p><b>NOTE:</b> For additional HPE Care Pack (hardware &amp; software) information, as well as orderable part numbers, please refer to the URL: <a href="http://www.hp.com/hps/carepack/">http://www.hp.com/hps/carepack/</a></p>

## Related Options

**NOTE:** This is a list of supported options. Some may be discontinued.

### Hard Drives

**NOTE:** The components of a storage subsystem (e.g. the drive, the HBA/controller, firmware, and the server backplane) should operate at the same data transfer rate or the system bandwidth will be negotiated down to an acceptable level for all components.

**NOTE:** Hard drives have either a one year or three year warranty; refer to the specific hard drive QuickSpecs for details.

#### SAS Hot Plug SFF Enterprise (ENT) Drives

HP 900GB 6G SAS 10K rpm SFF (2.5-inch) Dual Port Enterprise 3yr Warranty Hard Drive	619291-B21
HP 600GB 6G SAS 10K rpm SFF (2.5-inch) Dual Port Enterprise 3yr Warranty Hard Drive	581286-B21
HP 450GB 6G SAS 10K rpm SFF (2.5-inch) Dual Port Enterprise 3yr Warranty Hard Drive	581284-B21
HP 300GB 6G SAS 10K rpm SFF (2.5-inch) Dual Port Enterprise 3yr Warranty Hard Drive	507127-B21
HP 146GB 6G SAS 15K rpm SFF (2.5-inch) Dual Port Enterprise 3yr Warranty Hard Drive	512547-B21
HP 72GB 10K rpm Hot Plug SAS 2.5 Dual Port Hard Drive	384842-B21
HP 36GB 15K rpm Hot Plug SAS 2.5 Dual Port Hard Drive	418369-B21

#### SAS Non-Hot Plug SFF Enterprise (ENT) Drives

HP 300GB 6G SAS 10K rpm SFF (2.5-inch) Non-hot Plug Dual Port Enterprise 3yr Warranty Hard Drive	537809-B21
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#### SAS Hot Plug 3.5" Enterprise (ENT) Drives

HP 72GB 15K rpm Hot Plug SAS 3.5 Dual Port Hard Drive	384852-B21
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**NOTE:** Please see the QuickSpecs for Technical Specifications and additional information:

<https://www.hpe.com/h20195/v2/GetHTML.aspx?docname=c04282704>  
(Worldwide)

### Disk Enclosures

#### Modular Storage Arrays

HPE D2700 Disk Enclosure	AJ941A
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**NOTE:** Supports 25 SFF drives, and SAS 6 Gb/s.

**NOTE:** Please see the QuickSpecs for additional information including configuration steps and additional options needed for a complete solution at: <https://www.hpe.com/h20195/v2/GetHTML.aspx?docname=c04111697> (D2000 Disk Enclosures)

**NOTE:** Please see the QuickSpecs for additional information including configuration steps and additional options needed for a complete solution at: <https://www.hpe.com/h20195/v2/GetHTML.aspx?docname=c04140213> (600 Modular Disk System)

### Tape Solutions

#### Tape Libraries

HP StorageWorks MSL8096 2 Ultrium 920 SAS Tape Library	AH561A
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#### SAS Cables for Tape Drives

HP SAS Min-Min 1x-2M Cable Assembly Kit	AE470A
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**NOTE:** Use this cable to connect HPE StorageWorks SAS external tape devices to HPE SAS controllers with external Mini-SAS (SFF8088) connectors.

HP SAS MIN-MIN 1X-4M Cable Assembly Kit	AE465A
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## Related Options

**NOTE:** Use this cable to connect HPE StorageWorks SAS external tape devices to HPE SAS controllers with external Mini-SAS (SFF8088) connectors.

HPE StoreEver 2m External Mini-SAS to 4x1 Mini-SAS Cable

AN975A

**NOTE:** One cable is required for every four drives. Use this cable to connect HPE StorageWorks MSL SAS Tape Libraries to Mini-SAS (SFF8088) ports.

HPE StoreEver 4m External Mini-SAS to 4x1 Mini-SAS Cable

AN976A

**NOTE:** One cable is required for every four drives. Use this cable to connect HPE StorageWorks MSL SAS Tape Libraries to Mini-SAS (SFF8088) ports.

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## Technical Specifications

<b>Dimensions</b> (excluding bracket)	Low Profile PCIe Form Factor 19.05 cm x 24.13 cm x 5.72 cm (7.5 in x 9.5 in x 2.25 in)
<b>Disk Drive and Enclosure Protocol Support - Transfer rate</b>	6Gb/s SAS (Serial Attached SCSI)
<b>SAS Connectors</b>	2 external (Mini SAS) x8 wide port connectors
<b>Data Transfer Method</b>	x8 5G PCIe 2.0 Express (4 GB/s maximum bandwidth)
<b>Memory Bus Speed</b>	DDR2-800 MHz with 40 bit or 72-bit wide bus provides up to 4.2 GB/s maximum bandwidth
<b>PCI</b>	PCIe Express Gen 2.0
<b>Simultaneous Drive Transfer Ports</b>	2 x4 Wide SAS Ports
<b>SAS Port Link Rate</b>	24 Gb/s per x4 wide port connector (4 x 6 Gb/s)
<b>Software upgradeable Firmware</b>	Yes
<b>Cache Memory</b>	40-bit 256 MB Read/Write ECC protected cache
<b>Logical Drives Supported</b>	Up to 64 logical drives
<b>Maximum Capacity</b>	100TB (100 x 1TB) <b>NOTE: Support for greater than 2TB in a single logical drive.</b>
<b>Memory Addressing</b>	64-bit, supporting servers memory space greater than 4 GB
<b>RAID Support</b>	RAID 0 (Striping) RAID 1 (Drive Mirroring) RAID 1+0 (Striping and Mirroring) RAID 5 (Distributed Data Guarding)
<b>Upgradeable Firmware</b>	Upgradeable Firmware with Recovery ROM feature
<b>Environment-friendly Products and Approach</b>	<b>End-of-life Management and Recycling</b> Hewlett Packard Enterprise offers end-of-life Hewlett Packard Enterprise 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 Hewlett Packard Enterprise sales office. Products returned to Hewlett Packard Enterprise will be recycled, recovered or disposed of in a responsible manner.

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 Enterprise web site at: <http://www.hp.com/go/green>. These instructions may be used by recyclers and other WEEE treatment facilities as well as Hewlett Packard Enterprise OEM customers who integrate and re-sell Hewlett Packard Enterprise equipment.

## Summary of Changes

Date	Version History	Action	Description of Change
21-Oct-2016	From Version 13 to 14	Changed	Rebranding edition.
29-Sep-2014	From Version 12 to 13	Changed	Changes were made throughout the QuickSpecs.
10-Aug-2014	From Version 11 to 12	Added	Changes made throughout the QuickSpecs.
11-May-2012	From Version 10 to 11	Added	Added a note to the Key features section.
09-Nov-2011	From Version 9 to 10	Added	Added a note to the Key features section.
21-Oct-2011	From Version 8 to 9	Changed	Key Features and Fault Tolerance were revised in Standard Features and Hard Drives were revised in Related Options.
06-Apr-2011	From Version 6 to 8	Changed	Key Features was updated RAID 50 was added to Fault Tolerance HPE Integrity rx2800 i2 only was added to OpenVMS v8.4 in Operating Systems
25-Feb-2011	From Version 5 to 6	Changed	Changes made in the What's New, Standard Features, Compatibility and Related Options sections.
24-Jan-2011	From Version 4 to 5	Added	Added the Tape Solutions section.
15-Nov-2010	From Version 3 to 4	Changed	Changes made in the What's New, Standard Features, Compatibility and Related Options sections.
19-Oct-2010	From Version 2 to 3	Added	Added Support for rx7640, rx8640, Superdome.
03-Sep-2010	From Version 1 to 2	Removed	Integrity rx2800 i2 was removed from Server Support.



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

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