Overview

The SA6400A is a high-performance Ultra320, PCI-X array controller. It provides maximum performance, flexibility, and reliable data protection for HP OpenVMS AlphaServers through its unique modular design and support for Advanced Data Guarding (RAID ADG). This new generation Smart Array controller again raises the standards of performance, introducing a Double Data Rate (DDR) battery-backed write cache architecture and a new RAID engine.

This controller is ideal for workgroup, departmental, and enterprise servers. And like other Smart Array controllers, the SA6400A features complete data compatibility with previous generation's Smart Array controllers for easy data migration from server to server and for controller upgradability*.

*Please see the white paper covering migration from the SA5300 to the SA6400 series which covers the SA5300A and SA6400A.

Models	Smart Array 6402A/128 Controller	3X-KZPEC-BF
	Smart Array 6404A/256 two 2 channel Controllers	3X-KZPEC-DG

HP Smart Array 6400 Controller Feature List

- Advanced RAID level: Advanced Data Guarding
- High Performance Architecture
- High Capacity

  o SA6402A 2 channel model supports up to 28 drives
  o SA6404A 4 channel model supports up to 56 drives, 28 drives per controller

Key Features

- **Advanced Data Guarding** (RAID ADG) offers breakthrough level of fault protection of RAID volumes up to 1TB and a total of 28 disk drives in a RAID volume. RAID ADG provides fault protection greater than RAID 1 or RAID 5 and only consumes the capacity of 2 disk drives for distributed parity data. RAID ADG protects against any 2 disk drive failures. This higher level of protection is ideal to protect large logical volumes and with high capacity disk drives where a failed drive rebuild time may be significant.
- **High-performance,** Sixth generation architecture offers a new hardware RAID engine, and a new performance 266MHz DDR memory architecture for increased performance over previous controllers.
- **Recovery ROM** protects against a ROM failure or corruption.
- **Ultra320 SCSI** technology delivers high performance and data bandwidth up to 320 MB/s bandwidth per channel.
- **Mix-and-match** LVD SCSI compatibility protects your investments and lets you deploy drives as needed.
- **Battery-backed Cache** protects cached data in the event of a power outage, server failure or controller failure, and redundant, replaceable batteries take that protection even further. Maximum cache configuration is 256-MB of battery-backed cache.
- **64-bit, 133 MHz PCI-X** interface boosts bandwidth above 1GB/s burst transfer rate over PCI-X bus
- **Online Management Features:** Capacity Expansion, RAID Level Migration, Stripe Size Migration, Multiple Spares (Global), User Selectable Read/Write cache, User Selectable Expand and Rebuild Priority.

Product Highlights

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 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. |
| **Data Compatibility** | Data compatibility among all models of Smart Array Controllers means customers can instantly upgrade their Smart Array products to get to higher performance, capacity and availability. Unlike competitive products, successive generations of Smart Array products understand the data format of other Smart Array controllers, providing investment protection for your HP storage solution. |
| **Performance** | HP's new high-performance architecture sets new boundaries of industry performance expectations!

- Ultra320 SCSI (320-MB/s bandwidth) per channel
- High-performance 64-bit architecture, featuring a super-scalar RISC processor
- New RAID XOR engine
- Innovative dual processor, dual XOR engine design for the SA6404A
- New performance 266MHz DDR memory architecture providing for greater performance through greater bandwidth
- 64-bit, 133-MHz PCI-X bus (1-GB/s bandwidth) |
| **Capacity** | Given the need for rapid capacity expansion, the SA6400A offers:

- Up to four Ultra320 SCSI channels, supporting up to 56 disk drives
- More than 16TB of storage per PCI slot |
| **Availability** | Provides increased server uptime by providing advanced storage functionality:

- Online RAID Level Migration (between any RAID level)
- Online Capacity Expansion
- Global Online Spare
- Pre-Failure Warranty |

Product Highlights

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 Compaq 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 re-maps 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.

Fault Tolerance

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

- **Advanced Data Guarding** (RAID ADG): 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. It is available standard with the SA6400A.
- **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 configuration.

Fault Recovery

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

- **Recovery ROM:** provides a unique redundancy feature that protects from a ROM failure. A new version of firmware can be flashed to the ROM while the controller maintains the last know 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:** Up to four spare drives can be installed prior to drive failure. If a failure occurs, recovery begins with an On-Line Spare and data is reconstructed automatically.
- **ECC-Protected Cache Memory:** Removable, battery-backed cache memory protects data, up to four days (three days with 256-MB Module), in the event of power failure, server hardware failure or controller failure. In addition, HP provides an exclusive design that includes redundant and replaceable batteries for greater cache protection.

Ease of Use

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

- GUI based configuration, management and diagnostic software tools
- Common data formatting between generations of products
- Data migration between servers and external storage enclosures

QuickSpecs

HP Smart Array 6400A (SA6400A) Controller

Product Highlights

Servers Compatibility   The SA6400A is supported on the following AlphaServers:

- DS15
- DS25
- ES45, ES47, ES80
- GS1280

Operating Systems Compatibility
- OpenVMS V7.3-2, OpenVMS V8.2

Configuration/ Diagnostic Utilities
- HP Array Configuration Utility (ACU)
  - Powerful Web based configuration utility for all Smart Array controllers
  - Easy to use Wizards for configuration
  - 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
- Options ROM Configuration for Arrays
  - Rapid configuration upon initial install of the OS

Software Suite   All Smart Array products share a common set of configuration, management and diagnostic tools, including Array Configuration Utility (ACU) and 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 the HP server storage.

Insight Manager
- Powerful server and server options/storage manager tool
- Monitors over 1200 server parameters

Service and Support, HP Care Pack, and Warranty Information

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

Available Hardware Product Services	Installation services
	On-site maintenance (includes warranty support)
	Response time upgrades during the warranty period
	Post-warranty coverage
	RAID setup and performance consulting via statement of work
	For additional hardware installation and maintenance information, please refer to the URL: http://h18002.ww1.hp.com/alphaserver/products/storage/sa6400a

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

HP Care Packs	HP Care Pack is defined as an upgrade to the product warranty attribute, available for a specific duration and hours of coverage.
	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/.
	NOTE: HP Care Packs are not sold with the server they are not sold with the Option Card.

Options

Hard Drives	*Ultra320 - Universal Hot Plug*	
	300-GB 10,000 rpm, U320 Universal Hard Drive (1")	3R-A4952-AA 350964-B22
	146.8-GB 10,000 rpm U320 Universal Hard Drive (1")	3R-A3841-AA 286716-B22
	72.8-GB 10,000 rpm U320 Universal Hard Drive (1")	3R-A3839-AA 286714-B22
	146-GB 15,000 rpm U320 Universal Hard Drive (1")	3R-A4945-AA 347708-B22
	72.8-GB 15,000 rpm U320 Universal Hard Drive (1")	3R-A3851-AA 286778-B22
	36.4-GB 15,000 rpm U320 Universal Hard Drive (1")	3R-A3849-AA 286776-B22

NOTE: Please see the Hard Drive QuickSpecs for Technical Specifications such as capacity, height, width, interface, transfer rate, seek time, physical configuration, and operating temperature: U320 Hard Drive QS: http://h18000.www1.hp.com/products/quickspecs/11531_na/11531_na.HTML

NOTE: Ultra320 Universal Hard Drives are compatible to Ultra2 or Ultra3 speeds.

Disk Drive Enclosures	HP StorageWorks Modular Smart Array 30 SB *	3R-A4075-AA 302969-001
	HP StorageWorks Modular Smart Array 30 DB *	3R-A4076-AA 302970-001
	StorageWorks Enclosure 4314R **	DS-SL13R-AA 190209-001
	StorageWorks Enclosure 4314R (Int'l) **	DS-SL13R-AB 190209-B31
	StorageWorks Enclosure 4314R (Japan) **	DS-SL13R-AJ 190209-291
	StorageWorks Enclosure 4354R **	DS-SL13R-BA 190211-001
	StorageWorks Enclosure 4354R (Int'l) **	DS-SL13R-BB 190211-B31
	StorageWorks Enclosure 4354R (Japan) **	DS-SL13R-BJ 190211-291
	Internal Card Cage (DS25, ES45)	BA610-6D

* Rack-mountable 14 drive enclosure with dual bus, redundant power supplies
** Rack-mountable 14 drive enclosure with single bus, redundant power supplies

Family Information

This is a brief overview and comparison of the Smart Array family of PCI RAID controllers.

	Smart Array 6402A/6404A	Smart Array 5302A/5304A
Introduction Date	February 2006	July 2000
SCSI Protocols Supported	Ultra320, Ultra3, Ultra2	Ultra3, Ultra2, Wide-Ultra
Maximum Channel Transfer Rate (MB/s)	1280 total 320 per channel	640 total 160 per channel
Channels	2, 4	2, 4
SCSI Ports (external/internal)	2 channel model: 2/2 4 channel model: 4/2	2 channel model: 2/2 4 channel model: 4/2
Maximum Drives	56*	56*
Cache	128- or 256-MB read-write	128- or 256-MB read-write
Battery-backed, Removable Cache	Yes, Redundant, Replaceable Batteries	Yes, Redundant, Replaceable Batteries
Upgradable Cache	No	Yes
Recovery ROM	Yes	Yes
RAID Support	0,1,1+0,5, Advanced Data Guarding	0,1,1+0,5, Advanced Data Guarding**
Configuration Tool(s)	ACU ORCA	ACU ORCA
Management and Diagnostic Tools	IM	IM
Maximum Volumes	32	32
Drive Roaming	Yes	Yes
Online Expansion	Yes	Yes
Online & Offline Configuration	Yes	Yes
Stripe Set Migration	Yes	Yes
RAID Level Migration	Yes	Yes
Online Spare Support	Yes	Yes
Capacity Extension	No	No
SAN Access Module	No	Yes
PCI Bus	64-bit, 133-MHz PCI-X	64-bit, 66-MHz

* Based on use of MSA30 Enclosure family (14 drives enclosure)

** RAID ADG is a standard feature of SA6404A, SA6402A and SA5304A, and available as an option on the SA5302A RAID ADG requires a minimum of 128-MB battery-backed cache.

Technical Specifications

Electrical Interface	LVD (Low Voltage Differential)
Protocol Support	Ultra320 SCSI (320 MB/s per channel)
SCSI Ports	2 channel model: 2 external/2 internal shared
	4 channel model: 4 external/2 internal shared
Drives Supported	2 channel model: up to 28 drives
	4 channel model: up to 56 drives
Maximum Capacity	2 channel model: 8.40 TB (28 drives x 300 GB)
	4 channel model: 16.80 TB (56 drives x 300 GB)
PCI	PCI-X and 3.3 volt PCI compatibility only NOTE: The SA6400A is not supported in 5 volt PCI slots.
PCI Bus Speed	64-bit/133-MHz PCI-X (1 GB/s maximum bandwidth)
Logical Drives	Up to 32 logical drives
	Up to 2 TB per Logical Drive
RAID Support	RAID ADG (Advanced Data Guarding)
	RAID 5 (Distributed Data Guarding)
	RAID 1+0 (Striping & Mirroring)
	RAID 0 (Striping)
Cache Memory	128- or 256-MB Read/Write
	ECC protection, battery-backed, and removable
Cache Batteries	Up to 4 days of redundant battery life, removable for easy replacement (3 days with 256-MB Module)
Upgradeable Firmware	2-MB flashable ROM
Disk Drive and Enclosure Protocol Support	Ultra320, Ultra3, Ultra2
Dimensions (H x W x D)	12.3 x 4.2 x 0.7 in (31.2 x 10.7 x 1.8 cm)
Weight	SA6402A/128 3.12 lb (1.42 kg)
	SA6404A/256 4.22 lb (1.91 kg)