

## external SCSI enclosures

### hp StorageWorks 43x4/44x4 enclosures

The HP StorageWorks SCSI disk drive enclosure family delivers industry-leading technology to meet industry's demanding and growing storage needs. These enclosures are ideal for data center, departmental and workgroup server users needing a flexible, universal storage enclosure for their current and future deployments. They offer single or dual bus options, dual fan, power supply options and rackmount versions. Key features of the HP StorageWorks enclosures include:

- **higher performance** — U3/U320 SCSI transfer rates combined with the highest spindle count per U of rack space allows HP StorageWorks enclosures to achieve the greatest I/Os per second



- **storage capacity** — 3U rackmount form factor, with up to 146.8GB 10K rpm hard disk drives allows customers to achieve the maximum storage capacity per U
- **upgradability** — U320 single and dual I/O upgrade modules make upgrading the StorageWorks enclosure 42x4 or 43x4 to Ultra320 quick and easy
- **investment protection** — With the ability to upgrade as well as mix and match existing U2/U3 components with U320, HP makes technology transitions simple and cost effective



### hp smart array cluster storage

Simple and affordable shared storage system that provides clustering and direct attached storage for industry standard ProLiant servers

#### high availability

- Redundant controllers, fans and power supplies provide failover protection
- Advanced Data Guarding (ADG) allows for simultaneous failure of two drives
- Support for Microsoft, Novell and Linux system clustering
- Recovery Server Option software offer low cost standby server solution

#### flexibility and performance with 4-port module and smart array multipath software

- Maximize your storage utilization by allowing up to 4 direct attached servers to share up to 2 TB of data
- Increase fault tolerance by adding dual I/O paths protecting against HBA or cable failure
- Static load balancing increases I/O performance

#### zero-cost connectivity

- Attaches to the embedded SA-5i, 5i Plus or SA-532 controllers
- No additional connectivity investments are required for deployment

#### easy configuration and management

- Array Configuration Utility (ACU) provides a standard configuration and monitoring tool for use across the entire Smart Array product line
- Integrated with HP Insight Manager 7

#### DAS-to-SAN technology and data migration

- Easy conversion from Smart Array Cluster Storage system to Modular SAN Array 1000 (msa1000)
- Universal hard drives allow for data migration between HP storage systems

#### ideal for

Remote/Branch offices, small and medium enterprises, bank branches, retail, engineering workgroups, distribution, manufacturing inventory management, startups looking for IT with high growth capabilities

### hp storage enclosure comparison

	hp StorageWorks 4314/4354	hp StorageWorks 4414/4454	hp Smart Array Cluster Storage	hp StorageWorks msa1000
<b>server support</b>	HP ProLiant servers, AlphaServer systems, MA/EMA and msa1000 solutions	HP ProLiant servers, AlphaServer systems, MA/EMA solutions	HP ProLiant servers only	HP ProLiant servers only
<b>clustering</b>	N/A	N/A	2-node clusters, Recovery Server Option (RSO)	2-node clusters, Multipath Clusters
<b>controller failover</b>	N/A	N/A	Redundant	Redundant
<b>multipath failover</b>	N/A	N/A	Smart Array multipath software	HP StorageWorks Secure Path
<b>cache size (max)</b>	N/A	N/A	512 MB	512 MB
<b>RAID levels</b>	N/A	N/A	0, 1, 1+0, 5, ADG	0, 1, 1+0, 5, ADG
<b>backplane</b>	Ultra3 SCSI (Ultra160)	Ultra320 SCSI (Ultra320)	Ultra3 SCSI (Ultra160)	Ultra3 SCSI (Ultra160)
<b>scalability</b>	1 Drive Shelf, up to 14 drives	1 Drive Shelf, up to 14 drives	1 Drive Shelf, up to 14 drives	3 Drive Shelves, up to 42 drives
<b>host connection</b>	Ultra2, Ultra3, Ultra320	Ultra2, Ultra3, Ultra320	Ultra3 SCSI (Ultra160)	1 GB/2 GB Fibre Channel
<b>supported array controller/HBA*</b>	All Smart Array Controllers, U3/U320 HBA	All Smart Array Controllers, U3/U320 HBA	Smart Array 5i, 5i Plus and 532	FCA2101
<b>integrated FC</b>	N/A	N/A	DAS to SAN (DIS) Conversion	1 Port native, 5 Port Fabric Switch option
<b>seamless data migration</b>	N/A	N/A	Yes, from Smart Array & RA4100	Yes, from Smart Array & RA4100
<b>hard disk drives</b>	SCSI Universal HDD	SCSI Universal HDD	SCSI Universal HDD	SCSI Universal HDD
<b>target customer</b>	External SCSI Storage	External SCSI Storage	Remote; Distributed environments	Departmental and Data Center

Features as of April 2003

\* Please see Individual Product Quickspecs for more detailed information

### smart array cluster storage compatibility matrix

	ML330 G2 (ATA)	ML330 G2 (SCSI)	ML350 G2	ML350 G3	ML370 G2	ML370 G3	DL360 G2	DL360 G3	DL380 G2	DL380 G3	DL560	DL580	DL580 G2	DL740	DL760	DL760 G2
<b>Microsoft Operating Systems</b>																
Microsoft Windows NT Server 4.0	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Microsoft Windows NT Server, EE 4.0																
Microsoft Windows 2000 Server	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Microsoft Windows 2000 Advanced Server																
<b>Linux Operating Systems</b>																
Red Hat Linux 7.2	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Red Hat Linux 7.3	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Red Hat Linux 8.0	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Red Hat Linux Advanced Server 2.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SuSE Linux Enterprise Server 7	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
<b>Novell Operating Systems</b>																
Novell NetWare 5.1	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Novell NetWare 6.0	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
<b>Unix Operating Systems</b>																
SCO OpenServer 5.0.5																
SCO OpenServer 5.0.6a																

● Supports OS clustering. Go to [www.hp.com/products/sharedstorage](http://www.hp.com/products/sharedstorage) for additional information.

This matrix includes supported configurations utilizing Smart Array Cluster Storage directly attached to a ProLiant server as a dedicated storage system or shared with up to 4 servers utilizing Selective Storage Presentation (SSP) functionality. SSP is provided with the Smart Array Cluster Storage controller with FW version 1.66 or higher, no additional software required.

As of April 2003

## hp server storage

## hard disk drives, smart array controllers and external SCSI enclosures



## a winning combination

## a winning combination with winning advantages

### hard disk drives and smart array technology

#### universal architecture

- All hard drives are pre-tested to ensure immediate, flawless integration into HP ProLiant servers, StorageWorks products, and AlphaServer systems, for DAS, network attached storage, and SAN deployments
- Reduces service spares from a warehouse to a closet
- Offers ease of storage redeployment when upgrading systems

#### lowest total cost of ownership

- Superior quality, guaranteed compatibility, superior service, and Pre-Failure Warranty provide primary storage solutions with the lowest TCO
- Seamless technology migration paths and backwards compatibility offered, whenever possible, in an effort to protect customers' investment

#### warranty

- Smart Array controllers and SCSI hard drives assume the remaining warranty of the HP server product in which it is installed, for a maximum three-year limited warranty or minimum one-year, on-site limited warranty
- All ATA hard drives are covered by a one-year limited on-site warranty

[www.hp.com/products/harddiskdrives](http://www.hp.com/products/harddiskdrives)  
[www.hp.com/products/smartarray](http://www.hp.com/products/smartarray)  
[www.hp.com/products/sharedstorage](http://www.hp.com/products/sharedstorage)  
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### adaptive infrastructure

In today's IT environments, change is a constant. Mounting competitive pressures, shrinking resources, and expanding customer expectations present new challenges for your IT every day.

The HP portfolio of integrated servers, storage, and software addresses your unique needs with a wide range of flexible, cost-effective technologies and infrastructure solutions. With a full range of global services and strong partnerships with industry leaders, HP helps you create agile, efficient IT environments that help solve your toughest business challenges.

Whether you manage a small business or run a global enterprise, an adaptive infrastructure from HP will benefit your business operations and your bottom line.



## hard disk drives

### hot-pluggable SCSI disk drives

Mounted on the HP universal hot-pluggable drive tray, these drives provide the reliability and functionality needed for today's enterprise class systems. Hard drives from the new HP are designed and tested for compatibility and interoperability in order to provide the immediate, flawless integration expected for HP server and storage solutions.



	18.2-GB Ultra320 15,000 rpm	36.4-GB Ultra320 10,000 rpm	36.4-GB Ultra320 15,000 rpm	72.8-GB Ultra320 10,000 rpm	72.8-GB Ultra320 15,000 rpm	146.8-GB Ultra320 10,000 rpm
part number	286775-B22	286713-B22	286776-B22	286714-B22	286778-B22	286716-B22
logical capacity	18209.3 MB	36419.2 MB	36419.2 MB	72837.2 MB	72837.2 MB	146815.7 MB
height	Third, 1 inch					
size	3.5 inch					
interface	Wide Ultra 320 SCSI					
transfer rate	320 MB/s					
seek times						
single track	0.4ms	0.55ms	0.4ms	0.55ms	0.4ms	0.55ms
average	3.8ms	4.9ms	3.8ms	4.9ms	3.8ms	4.9ms
full stroke	8ms	10ms	8ms	10ms	8ms	10ms
physical configuration						
bytes/sector	512	512	512	512	512	512
logical blocks	35,565,080	71,132,000	71,132,000	142,264,000	142,264,000	286,749,488

### non-pluggable SCSI and ATA disk drives

HP non-pluggable hard disk drives provide a cost effective primary storage solution. These drives provide functionality and features to satisfy entry level server requirements. ATA and SCSI non-pluggable drives are supported on the HP ProLiant DL320 and ML330 servers.

	36.4-B Ultra320 10,000 rpm	40-GB ULTRA ATA/100 7,200 rpm	80-GB ULTRA ATA/100 7,200 rpm
part number	271832-B21	230534-B21	278424-B21
logical capacity	36419.5 MB	40020 MB	80025 MB
height	Third, 1 inch	Third, 1 inch	Third, 1 inch
size	3.5 inch	3.5 inch	3.5 inch
interface	Wide Ultra 320 SCSI	ATA 100	ATA 100
transfer rate	320 MB/s	100 MB/s	100 MB/s
seek times			
single track	0.7ms	0.8ms	0.8ms
average	5.4ms	8.5ms	8.5ms
full stroke	11ms	17.8 ms	17.8 ms
physical configuration			
bytes/sector	512	512	512
logical blocks	71,132,000	78,165,360	156,301,488

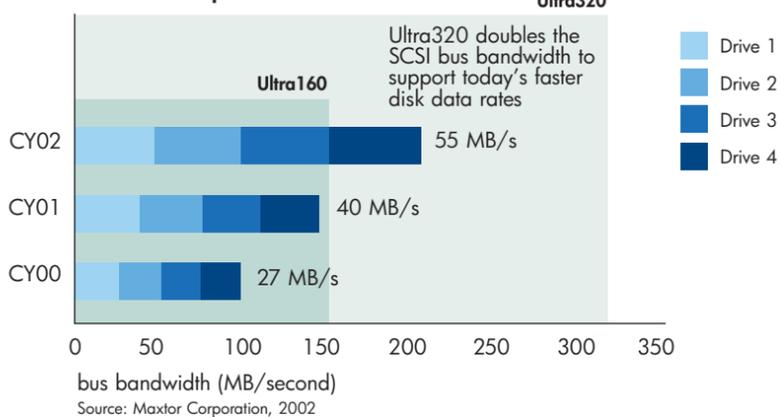
### about SCSI

- Small Computer Systems Interface (SCSI) is the proven hard drive interface of choice, well suited for today's demanding, business critical applications
- Backward and forward compatibility for an unequalled level of investment protection as well as easily scalable to multiple terabytes to grow with your environment
- Provides greater manageability through use of technologies such as SMART (Self-Monitoring Analysis and Reporting Technology), HP Insight Manager, Smart Array Controller technology
- All disk drives on the same SCSI channel can be within a server (internal) or in a storage system (external), but not both. A configuration with both internal and external SCSI disk drives, requires a multi-channel SCSI controller
- For ease of deployment, HP recommends that RAID sets not contain a combination of Ultra320 drives and previous interface version SCSI drives. Mixed RAID sets may be used if desired, however some combinations may require reconfiguring of the RAID array

### Ultra320 — the next SCSI interface

- Bus bandwidth is increased to support data transfer rates up to 320 MB/second offering faster access to data (see SCSI bandwidth graph)
- U320 will replace U160 as the standard parallel SCSI interface
- Technology enhancements increase protection against data corruption

### SCSI bandwidth comparison



- Backward compatible to U2, U3 providing a clear upgrade path, ease of integration into existing systems, investment protection and lower total cost of ownership

### 15K rpm disk drives

- 15K drives access data 33% faster than 10K drives for improved productivity and profitability shattering TPC benchmarks
- 40% fewer 15K drives are needed to achieve same performance as 10K drives resulting in lower Total Cost of Ownership (TCO)
- 15K drives require no more power consumption or cooling than 10K drives allowing for easy integration into existing platforms and applications

### about ATA

- HP Advanced Technology Attachment (ATA) hard drives offer a spindle speed of 7200 rpm and a maximum transfer rate of 100 MB/s
- This traditional technology is designed to deliver large capacities of the best price for entry level server environments

### firmware

- Hard drives are provided with specific firmware optimized for performance and integration into a HP system
- All firmware is tested and proved to provide highest level of integrity, error recovery, and functionality

## smart array controllers

### the hp smart array advantage

The innovative design and integration work of the HP 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 TCO than any other server storage RAID products. The HP Smart Array family brings an unparalleled return on investment through:

- data compatibility** — Smart Array controllers allow simple and easy upgrades when higher performance, capacity, and availability is needed. 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 HP server storage.

### smart array 6400

The SA-6400 provides maximum performance, reliability, flexibility, and data protection for HP ProLiant servers.

- Smart Array high performance architecture
- Dual U320 SCSI channels (2 int., 2 ext. ports)
- 64-bit, 133MHz PCI-X
- Performance memory architecture, with 128 MB DDR-RAM BBWC standard
- Support for Advanced Data Guarding (ADG)
- Modular design, upgrade to 256 MB BBWC and from 2-4 U320 SCSI channels



### smart array 642

The SA-642 delivers excellent value to entry level and workgroup servers, without sacrificing performance.

- Dual U320 SCSI channels (1 int., 1 ext. port)
- 64-bit, 133MHz PCI-X
- 64 MB DDR-RAM standard, optional 64 MB BBWC module available



### smart array 641

The SA-641 offers affordable RAID protection with the manageability and reliability of a Smart Array.

- Single U320 SCSI channel (1 int. port)
- 64-bit, 133MHz PCI-X
- 64 MB DDR-RAM standard, optional 64 MB BBWC module available



### smart array 5i/5i plus

The SA-5i/5i Plus is an embedded array controller on select ProLiant servers, offering entry-level hardware RAID.

- Dual Ultra3 SCSI channels
- Up to 64 MB Read cache
- Optional BBWC enabler module available



### server/controller compatibility

	SA-6402	SA-5304	SA-642	SA-641	SA-5i	SA-5i Plus
ProLiant DL Series						
DL320 G2		■	■	■	■	
DL360 G2		■	■	■	■	
DL360 G3	■	■	■			■
DL380 G2	■	■	■	■	■	■ <sup>1</sup>
DL380 G3	■	■	■	■	■	■
DL560	■	■	■	■	■	■
DL580 G2	■	■	■	■	■	■
DL740	■	■	■	■	■	■
DL760	■	■	■	■	■	■
DL760 G2	■	■	■	■	■	■
DL380 Package Cluster						■
ML Series						
ML310			■	■		
ML330 G2	■		■	■		
ML350 G2		■				
ML350 G3	■	■	■	■		
ML370 G2		■			■ <sup>1</sup>	■ <sup>1</sup>
ML370 G3	■	■	■	■		
ML530 G2	■	■	■	■		
ML570 G2	■	■	■	■		

<sup>1</sup> Note: Configurable option.

### hp smart array controller comparison

	SA-5304	SA-6402	SA-642	SA-641	SA-5i Plus
product number	283551-B21	273914-B21	291967-B21	291969-B21	264030-B21
SCSI protocols	Ultra3, Ultra2,	Ultra 320,	Ultra 320,	Ultra 320,	Ultra3, Ultra2
supported channels	Wide-Ultra 4	Ultra3, Ultra2 2*	Ultra3, Ultra2 2	Ultra3, Ultra2 1	Ultra3, Ultra2 2**
SCSI ports (external/internal)	4/2	2/2	1/1	0/1	1/1
RAID levels supported	0, 1, 1+0, 5, ADG	0, 1, 1+0, 5, ADG	0, 1, 1+0, 5	0, 1, 1+0, 5	0, 1, 1+0, 5
recovery ROM	Yes	Yes	Yes	Yes	Yes
cache — read/write	128 or 256 MB	128 MB DDR (256 MB option)	64 MB DDR (64 MB bbwc enabler option)	64 MB DDR (64 MB bbwc enabler option)	64 MB read only (bbwc enabler option)
battery-backed cache	Yes	Yes	Yes <sup>1</sup>	Yes <sup>1</sup>	Yes
PCI bus	64-bit/66MHz	64-bit/133MHz PCI-X	64-bit/133MHz	64-bit/133MHz	64-bit/66MHz
SCSI peak data transfer rate	640 MB/s (160 MB/s per channel)	640 MB/s (320 MB/s per channel)	640 MB/s (320 MB/s per channel)	3200 MB/s (320 MB/s per channel)	320 MB/s (160 MB/s per channel)
drives supported (maximum)	56	28	20	6	20**
array configuration utility	Yes	Yes	Yes	Yes	Yes
online spare support	Yes	Yes	Yes	Yes	Yes

<sup>1</sup> Future support for 2 channel upgrade module when available

\*\* Support for external channel/port and total drives supported, dependent on server model

<sup>1</sup> BBWC available with 64 MB bbwc enabler