Sun StorEdge™ A1000/D1000 Storage Arrays

Just the Facts

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Positioning

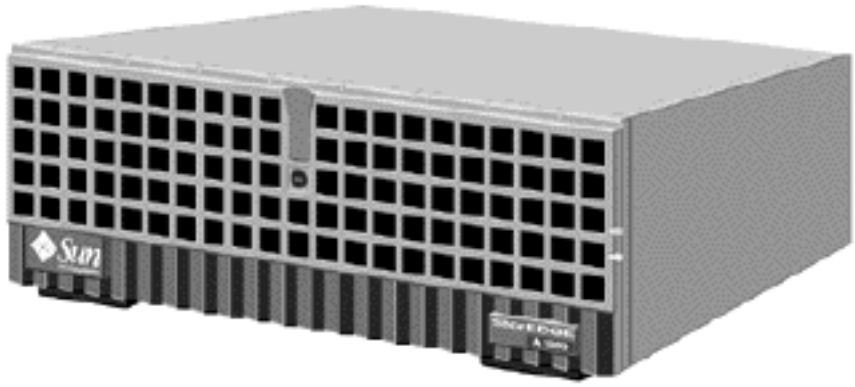


Figure 1. The Sun StorEdge A1000/D1000 array

Introduction

The Sun StorEdge™ A1000 and D1000 storage arrays continue the expansion of the highly successful SPARCstorage™ Array 112 /114 and the 214/219 RSM™ series of products. The Sun StorEdge A1000 and D1000 arrays offer a dramatic improvement in reliability, availability, and serviceability (RAS) over the SPARCstorage Array 112/114 products while retaining their compact form factor. High levels of RAS are achieved through the use of redundant and hot-swappable power supplies, drives, and cooling. Indeed, the Sun StorEdge A1000 and D1000 arrays define a new level of performance, availability, and redundancy for Sun's desktop and workgroup customers.

Two Subsystems (Sun StorEdge A1000 and D1000 Arrays), Same Enclosure Design: Hardware and Software RAID Implementations

Two subsystems are available: the Sun StorEdge A1000 and D1000 arrays. The systems differ primarily in their RAID implementation. The Sun StorEdge A1000 array is a hardware-RAID subsystem, while the Sun StorEdge D1000 array is a software-RAID subsystem. Both subsystems utilize the same chassis design and drive technology, and provide a high-performance 40 MB per second UltraSCSI interface to the host and to each disk drive. High-speed, 10000-rpm drives are used in both subsystems. In addition, both 1-inch and 1.6-inch high drives can be used in both systems. Note that 1-inch and 1.6-inch drives cannot be mixed in the same tray.

Entry-level systems of both models ship with 4 drives. Fully configured systems ship with 12 drives (1-inch) or with 8 drives (1.6-inch). However, the systems are easily configured to meet the most demanding commercial and scientific desktop and workgroup applications.

New Features

The 36-GB, 10000-rpm disk provides 100 percent more storage density than the 18-GB, 7200-rpm option in a given, while sharply reducing the price per MB. With this disk, the eight-disk Sun StorEdge A1000 and D1000 arrays maximum capacity is now 291 GB, and the maximum capacity in the Sun StorEdge expansion rack is now 2.6 TB with nine Sun StorEdge A1000 or D1000 arrays installed. All Sun StorEdge A1000 array configurations with the 36-GB, 10000-rpm disks are immediately supported with Sun Cluster 2.1 and 2.2 software.

The Sun StorEdge A1000 Array—Low-cost, Hardware-RAID Solution

The Sun StorEdge A1000 array is a controller-based (hardware) RAID solution that provides for superior RAID 5 performance and minimal cost for data protection. System I/O throughput is improved as the controller frees the CPU by handling more of the I/O load and doing prefetching and write coalescing with the cache. The Sun StorEdge A1000 array is managed using the same RAID Manager 6 software that is used with the Sun StorEdge A3500 arrays. This software provides status and error indicators, remote system monitoring, and configuration maintenance and monitoring.

The Sun StorEdge A1000 array is a hardware-RAID solution that offers a wide range of capabilities and features:

- Expands on the highly successful SPARCstorage Array
- High-performance, controller-based RAID system with high-RAS features for the desktop
- Superior RAID 3/RAID 5 performance through an intelligent caching controller (includes RAID 0, 1, and 1+0)
- Simple setup and administration using RAID Manager GUI
- Configurations with 36- to 291-GB storage using 9-, 18-, or 36-GB, 10000-rpm drives
- RAID 5 sequential reads at 32 MB per second, sequential writes at 31 MB per second
- UltraSCSI connections to the host system(s) and to the disk drives
- Enhanced RAID Manager 6
- Up to 15 Sun StorEdge A1000 arrays can be daisy-chained on the same UltraSCSI bus (up to nine in a single rack)
- Open storage—UltraSCSI connections to Microsoft Windows NT systems

The Sun StorEdge D1000 Array—Low-Cost Software-RAID Solution

The Sun StorEdge D1000 array does not have a hardware RAID controller. Instead, software RAID solutions are achieved by combining the Sun StorEdge D1000 array with the VERITAS Volume Manager software. The Sun StorEdge D1000 array has two UltraSCSI channels (four UltraSCSI connections). The Sun StorEdge D1000 array backplane is split into two 6-drive or 4-drive segments. Two of the UltraSCSI connections can be jumpered to create a single 12-drive or 8-drive segment.

The Sun StorEdge D1000 array is a software-RAID solution that offers a host of capabilities and features:

- Replaces the RSM 214/219 tray
- Configurations with 36-GB to 291-GB storage using 9-, 18-, or 36-GB, 10000-rpm disk drives
- Software RAID using VERITAS Volume Manager software (Solstice DiskSuite™ software also supported)
- Higher RAS than a Sun StorEdge MultiPack system

The Sun StorEdge D1000 array can be configured with dual, 40-MB-per-second UltraSCSI channels. In combination with 10000-rpm drives, the array excels at bandwidth-intensive applications such as web servers, seismic analysis, video production, MCAD, and other technical applications.

Product Family Placement

The Sun StorEdge A1000 and D1000 arrays replace the SPARCstorage Array family and the RSM 214/219 tray for the most price-sensitive customers. The Sun StorEdge D1000 array is nominally more costly than a Sun StorEdge MultiPack system. This cost is minimal for most customers when compared with the availability, capacity, and performance benefits.

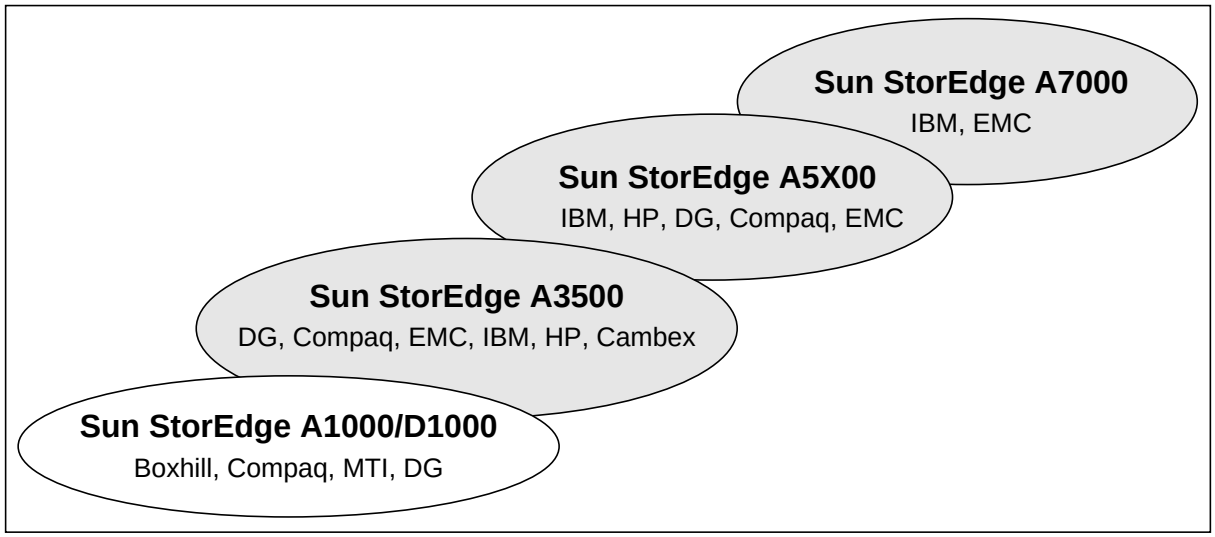
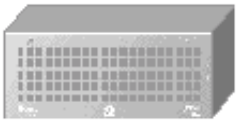
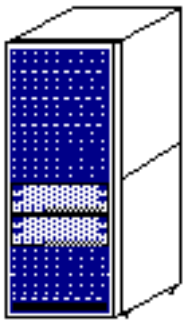


Figure 2. Sun storage product offerings

Sun StorEdge A1000 and D1000 Arrays	Sun StorEdge A3500 Array	Sun StorEdge A5000 Array	Sun StorEdge A7000 Array
			
Workgroup	Department to data center	Department to data center	Data center
Controller-based RAID (A1000) Host-based RAID (D1000)	Controller-based RAID	Host-based RAID	Intelligent Storage Server™ (dual-SMP UNIX® servers used as controllers)
Solaris™ Operating Environment, Microsoft Windows NT	Solaris Operating Environment, Microsoft Windows NT	Solaris Operating Environment, Microsoft Windows NT	Simultaneous OS/390, MVS/ESA, MVS/XA, VM/ESA, VSE/ESA, Solaris Operating Environment, HP-UX, AIX, Microsoft Windows NT
When to sell • Price/performance • Bridges gap between Sun StorEdge MultiPack systems and higher end products • For apps requiring less than 291 GB in a single array • Performance and flexibility for price-sensitive customers	When to sell • RAS + price/performance • Dual-controller, cached architecture • High availability • Best performance for write-intensive apps • High-performance OLTP • SCSI or Fibre Channel (future) host interface • Proven stability for mission-critical data	When to sell • RAS + price/performance • Fibre Channel storage networking • Replaces SPARCstorage Array • High sequential performance • High-performance data warehousing and DSS • Campus-area remote mirroring • Flexible configurations (up to 500 m)	When to sell • Mainframe-class RAS • Mainframe-class performance • Only true information sharing in the industry, allowing mainframe, UNIX, Microsoft Windows NT simultaneous, multi-platform access to the same data • Mainframe backup of open systems • Storage consolidation • Mission-critical data • MF data migration

Sun StorEdge A1000 and D1000 Arrays	Sun StorEdge A3500 Array	Sun StorEdge A5000 Array	Sun StorEdge A7000 Array
When NOT to sell • Applications requiring more than 291 GB in a single array • Customer requires Fibre Channel today	When NOT to sell • Solaris Operating Environment user who wants FC-AL headroom today • Non-Solaris Operating Environment or Microsoft Windows NT operating environment	When NOT to sell • Hardware RAID 5 required • Non-Solaris Operating Environment or Microsoft Windows NT host attach required	When NOT to sell • Price is a primary selection criteria

Sun StorEdge A1000 and D1000 Arrays Key Messages

The Sun StorEdge A1000 and D1000 arrays offer a choice of hardware or software RAID. They offer high performance, high RAS, and industry-standard UltraSCSI technology in a compact desktop package.

The Sun StorEdge A1000 and D1000 array subsystems include either one (Sun StorEdge A1000 array) or two (Sun StorEdge D1000 array) UltraSCSI (40-MB-per-second burst rate) channels to the host. The Sun StorEdge A1000 array is Sun's highest RAS storage solution designed for desktop applications. The system is highly redundant with hot-plug drives, power, and cooling systems.

The same hot-plug disks are designed into both the Sun StorEdge A1000 and D1000 arrays, as well as the Sun StorEdge A3500 array. They are customer serviceable and can be added or removed without interrupting system operation.

Sun StorEdge A1000 Array

The Sun StorEdge A1000 array is Sun's controller-based RAID system for desktop and workgroup RAID 5 performance. The Sun StorEdge A1000 array is a scalable storage subsystem providing a 40-MB-per-second UltraSCSI host interface and UltraSCSI performance drives. Configurations scale from 36 GB to 2.6 TB using nine rackmounted units in a single cabinet (rack).

Performance results are impressive. The Sun StorEdge A1000 array provides exceptional desktop/workgroup system performance utilizing controller-based RAID. How exceptional? Over 2,300 IOPS (input/output operations per second) per array and 32 MB per second of actual user-data bandwidth per array.

Sun StorEdge D1000 Array

The Sun StorEdge D1000 array is a storage subsystem providing two UltraSCSI host interfaces and UltraSCSI performance drives. Like the Sun StorEdge A1000 array, its configurations scale from 36 GB to 2.6 TB using nine rackmounted units in a single cabinet (rack).

High RAS (Reliability, Availability, Serviceability)

The RAS features of this array exceed those of the SPARCstorage Array and RSM array families.

Feature	Sun StorEdge MultiPack System	SPARCstorage Array	Sun StorEdge A1000/D1000 Array
Hardware RAID controller	No	No	Yes (A1000)
Redundant power	No	No	Yes
Hot-swappable drives	Yes	No	Yes
Hot-swappable power	No	No	Yes
Hot-swappable cooling	No	No	Yes
Power supply fault sensing and failover	No	No	Yes
Fan tray fault sensing and failover	No	No	Yes

Availability

The Sun StorEdge A1000 and D1000 arrays ship in a variety of configurations, including 9-GB, 18-GB, and 36-GB disk drives, and desktop, deskside, and rackmountable versions of the systems.

Target Markets

The Sun StorEdge A1000 and D1000 arrays are well-suited for the performance requirements of modern desktop and workgroup applications, network data services, web servers, and performance-oriented systems with capacity needs up to 291 GB.

The Sun StorEdge A1000 array is a hardware RAID, internal controller storage subsystem that provides high-performance RAID 5 capabilities. This array is one of Sun's best storage choices for OLTP-type applications (random I/O) that are heavily used in the financial, retail, health care, and Telco industries.

The Sun StorEdge A1000 array is ideally suited for the workgroup and desktop markets with scalability, high-RAS, high-performance RAID 5, UltraSCSI throughput, and priced to be competitive in the desktop/workgroup segment.

Industry/Customer	Key Features to Highlight
Departmental storage	Tabletop design with proper capacity to support department sizes
Technical computing	High-performance data storage for engineering design projects
Scientific computing	High bandwidth for data capture, retrieval and storage
High-performance computing	40-MB-per-second UltraSCSI interface(s) and 10000-rpm drives for the most demanding performance needs

Target Customer Environments and Applications

The Sun StorEdge A1000 and D1000 arrays are designed for a variety of cost-sensitive storage environments and applications where high performance and availability are required.

Customer Environment	Key Features to Highlight
Solaris Operating Environment only	• Single-vendor systems support and service • High storage density in a compact desktop/deskside enclosure. • Sun commitment to continued support and enhancement • Centralized storage management capability, capacity, and RAS features
Microsoft Windows NT host systems	• Desktop and workgroup capacities, RAS features, compatibility, configurability • Hardware RAID (Sun StorEdge A1000 array) and software RAID (Sun StorEdge D1000 array) for Microsoft Windows NT

Application	Requirements
Workgroup shared storage	Scalable capacity with high RAS support
Web server	Scalable capacity with fast sequential throughput for web content delivery
Technical and scientific	Scalable capacity with high RAS support
Decision support systems	High, scalable throughput for delivery of large records and reports
On-line transaction processing	Fast I/O in support of multiple transactions
Network file service	Fastest random-read performance for file delivery service
Enterprise clusters	Business-critical application availability

Market Value Proposition

The Sun StorEdge A1000 and D1000 arrays offer flexibility, high performance, and availability in a small footprint. The Sun StorEdge A1000 and D1000 arrays provide flexible configuration offerings, including desktop, deskside, and rackmount versions that are supported on the entire range of Sun server products. With a 40 MB per second UltraSCSI bus and hardware- and software-based RAID options, these arrays excel in the most demanding OLTP (Sun StorEdge A1000 array) and data warehousing and DSS (Sun StorEdge D1000 array) environments.

High-performance, 10000-rpm disks are available in 9-GB, 18-GB, and 36-GB capacities. These drives offer outstanding price/performance, making the arrays excellent choices for OLTP applications.

The Sun StorEdge A1000 and D1000 arrays offer flexible, high-performance storage subsystems with a variety of configurations, capacities, RAID capabilities (hardware versus software), and RAS, which make them ideally suited for the desktop, workgroup, and departmental environments.

Sun StorEdge A1000 and D1000 Arrays Key Features and Benefits

Features

- High-density chassis
- Controller-based RAID (Sun StorEdge A1000 array)

Benefits

- Provides scalable configurations in a small footprint
- Delivers high performance by decreasing CPU drain for I/O processing, prefetching, and write coalescing

Features	Benefits
• Sun StorEdge RAID Manager software (Sun StorEdge A1000 array)	• Easy configuration, management, and recovery of RAID implementation • Easy-to-use graphical user interface (GUI) as well as command line interface (CLI) for scripting
• RAID 0, 1, 1+0, 3, and 5	• High data availability for OLTP, data warehousing, and DSS applications • RAID 5 performance multiplies the power of the industry's most popular line of scalable UNIX servers: Sun Enterprise™ servers, SPARCserver™ systems, and SPARCcenter™ systems
• 10000-rpm disk drives	• Approximately 25 to 30 percent faster data access in OLTP applications than 7200-rpm disks
• 36-GB, 1.6-inch high disks	• Doubles capacity per footprint in eight-disk trays, reducing price per MB
• Redundant power supplies, cooling, and hot-plug disk drives	• Redundancy provides high availability for the business-critical applications • Each power supply can support the power requirements of the intelligent controller • Hot-plug components permit immediate servicing without system downtime
• Multiple configurations	• Enables customers to design storage solutions that fit their needs and scale into the future
• UltraSCSI interface to the host	• Provides high bandwidth (40 MB per second) data transfers
• UltraSCSI between controller board and disk trays	• Increases RAID performance
• Environmental sensing in each disk tray	• Environmental monitoring and reporting for temperature, controller voltage, fan failure, power supply status, and a complete health check of each disk tray
• Daisy chaining	• Increases storage capacity with fewer host connections
• Open SCSI host interface	• Protects customers' storage subsystem investment by providing interoperability with other host environments

Overview of System Architecture

The Sun StorEdge™ A000 and D1000 arrays are high-availability, mass-storage subsystems that use a disk enclosure capable of supporting up to 291 GB of storage, with greater capacities to come as disk capacities grow. The systems employ the same enclosure and drive subsystem architecture. However, the Sun StorEdge A1000 array incorporates an additional intelligent RAID controller.

Sun StorEdge A1000 Array System Architecture

The heart of the Sun StorEdge A1000 system is the controller module, an intelligent RAID controller. There are redundant power supplies and cooling units in the system, as well as backup batteries on the controller board.

- Power and fan components in the disk enclosure are redundant and may be replaced while the subsystem is operating.
- Dual power supplies, choice of DC or AC power
- Dual fan trays, each with two fans. Fans speed up in response to higher temperatures. Three fans active out of four will cool the controller indefinitely. Two fans will support the tray for at least eight hours.
- One controller module with either 24 MB or 80 MB of DRAM and battery pack.

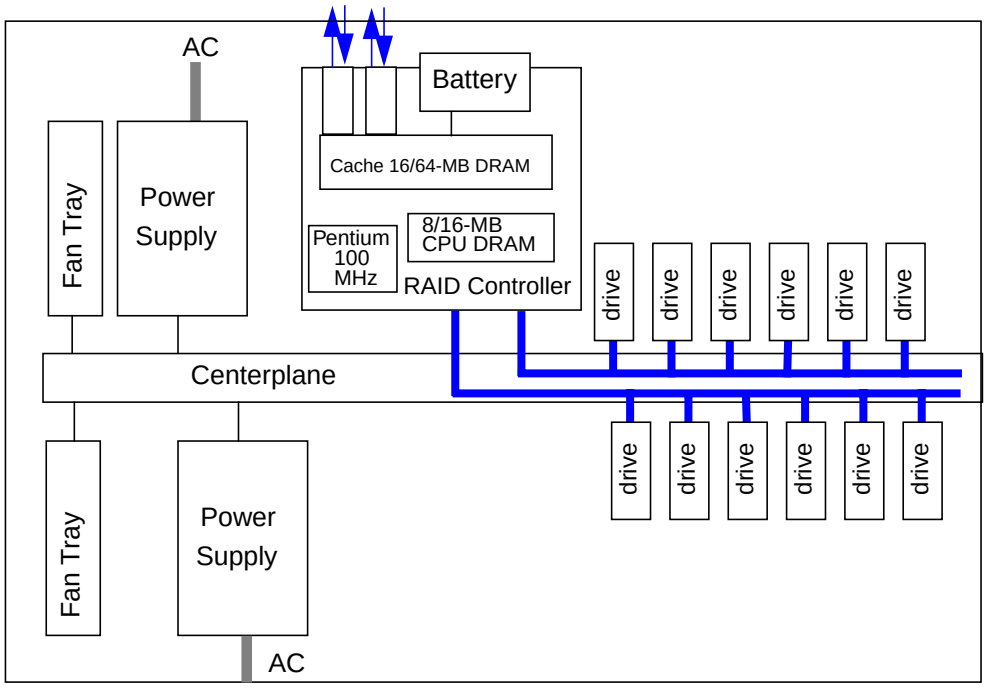


Figure 3. Sun StorEdge A1000 array system architecture

Sun StorEdge D1000 Array System Architecture

- Dual power supplies
- Dual fan trays, each with two fans. Fans speed up in response to higher temperatures. Three fans active out of four will cool the interface board indefinitely. Two fans will support the tray for eight hours.
- Environmental service module board
- Two independent differential UltraSCSI channels. Each uses a 53C120 SCSI interface chip and a GEM200 SAF-TE (SCSI accessed fault-tolerant enclosure) chip.
- Each SCSI channel supports either six 1-inch UltraSCSI disks or four 1.6-inch UltraSCSI disks. Either 4-GB, 9-GB, 18-GB, or 36-GB drives are supported.
- The two channels can be daisy-chained together to form a single SCSI bus.

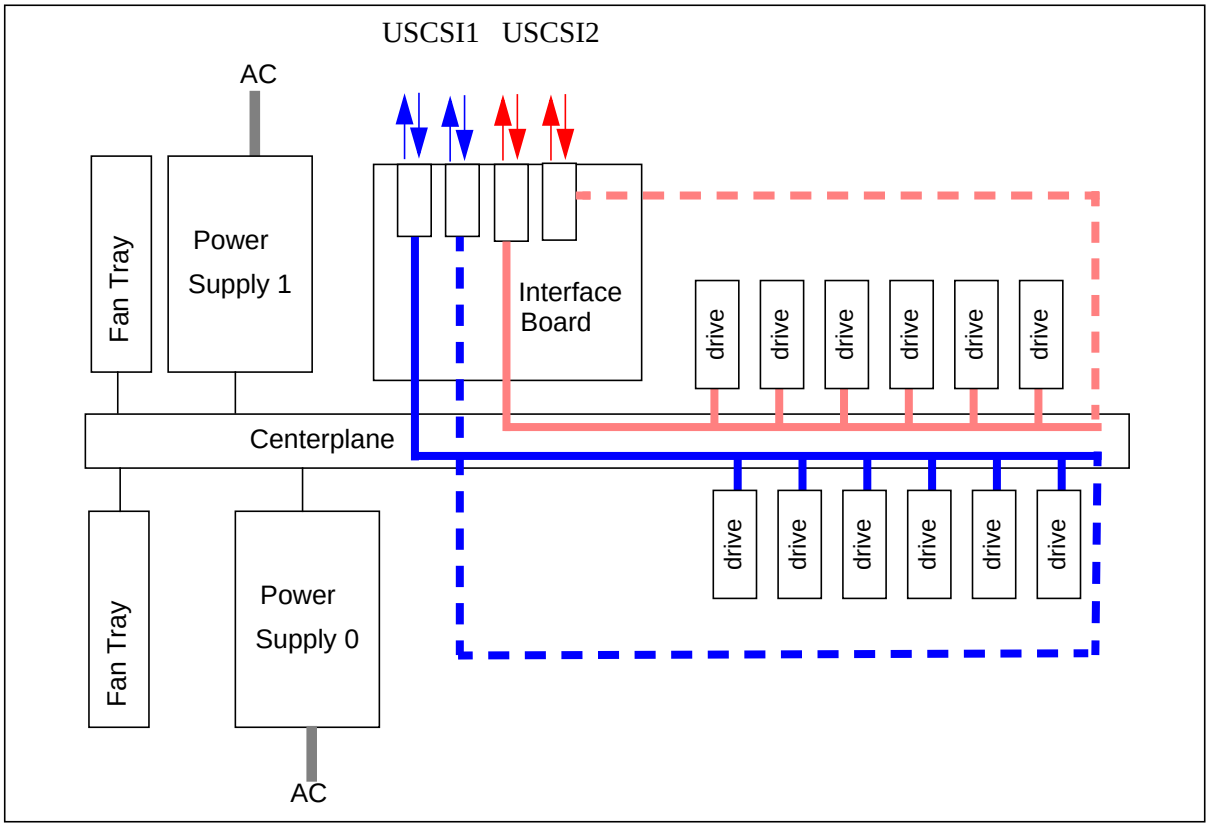


Figure 4. Sun StorEdge D1000 array system architecture

Sun StorEdge A1000 and D1000 Arrays Key Facts

- High RAS is achieved through the use of redundant components.
- The system includes two cooling units (two fans each) and two power supplies.
- The battery system includes battery cells and charger (Sun StorEdge A1000 array).
- The Sun StorEdge A1000 and D1000 arrays require two 100-volt to 240-volt AC power sources.
- 1-inch disks (4 GB, 10000 rpm; 9 GB, 7200 rpm; 9 GB, 10000 rpm; or 18 GB, 10000 rpm) can be mixed in the same enclosure. 1.6-inch disks (18 GB, 7200 rpm; or 36 GB, 10000-rpm) can also be mixed in the same enclosure. However, 1-inch disks cannot be mixed with 1.6-inch disks in the same enclosure.

- The Sun StorEdge A1000 and D1000 arrays and the SPARCstorage™ Array may coexist on the same server system but not on the same SCSI chain.
- The Sun StorEdge A1000 and D1000 arrays are supported on Solaris™ 2.5.1 Operating Environment or later releases. Configurations with the 18-GB, 10000-rpm, 1-inch disks or the 36-GB, 10000-rpm, 1.6-inch disks are supported on Solaris 2.6 Operating Environment or higher.

Sun StorEdge A1000 Array Controller Module Technical Facts

The Sun StorEdge A1000 array disk enclosure is capable of supporting up to twelve 1-inch disk drives or eight 1.6-inch drives. The enclosure is designed to be mounted in a standard Sun rack, in a tower stand, or on a table top. No cables are used inside the Sun StorEdge A1000 array disk enclosure.

- The intelligent hardware controller in the Sun StorEdge A1000 array supports RAID 0, 1, 1+0, 3, and 5. The controller microprocessor does all RAID calculations for I/O and volume management. This improves system performance by reducing the CPU load and I/O traffic between the host and the array.
- The controller board includes capacity for 16 MB of CPU memory and 64 MB of data cache memory. Below are the possible configurations for cache memory.

Configuration	**Per Controller Board**
• Base configuration	8-MB microprocessor program memory 16-MB data cache
• Upgrade	Add on to a maximum 16-MB microprocessor program memory Add-on to a maximum 64-MB data cache

- The Pentium chip is a 100-MHz processor, which is a socketed PGA part.
- The Sun StorEdge A1000 array base configuration is 16 MB of DRAM for controller data cache and 8 MB of DRAM for instruction cache.
- The data cache uses 60-ns DRAM, organized x 36 (either 2 MB x 36 or 8 MB x 36) in a 72-pin package.
- The data cache is controlled by the RPA (RAID parity assist) chipset. There are two slots for data cache memory and the slots need to be filled one pair at a time.
- The data cache is protected from a power failure by a lead acid rechargeable battery. A fully charged battery will protect the cache for a minimum of three days.
- Users can expand the controller DRAM up to a maximum of 80 MB.
- The controller module has six LEDs visible from the rear of the tray. They indicate the status of the controller module.

Sun StorEdge A1000 Array Controller Board Key Facts

The Sun StorEdge A1000 array controller board includes a 100-MHz Pentium processor and an upgradable 16-MB data cache.

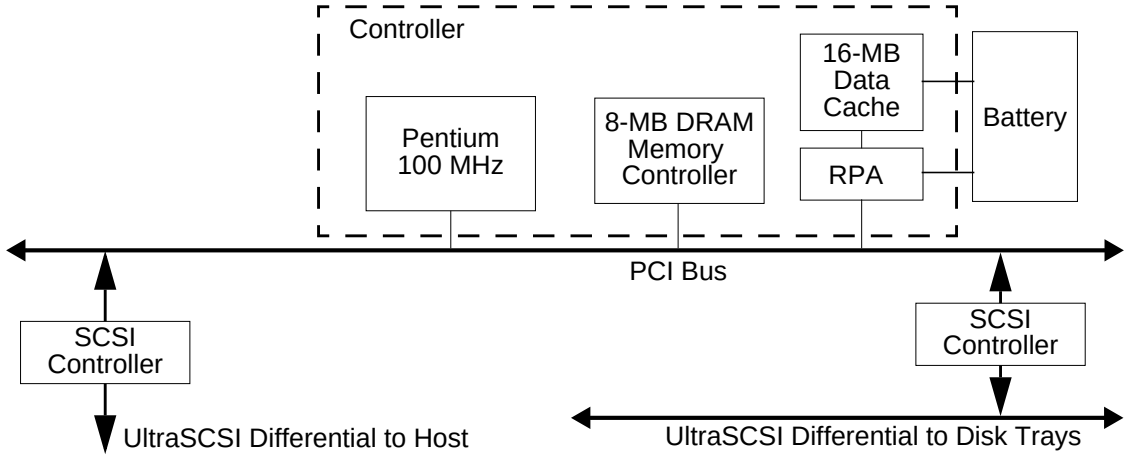


Figure 5. Sun StorEdge A1000 array controller board architecture

Disk Tray and Hot-plug Disk Module Key Facts

- Each Sun StorEdge A1000 and D1000 disk tray holds a maximum of twelve 1-inch, or eight 1.6-inch hot-plug disk modules. Six drive types are supported, including
  - 4 GB, 10000 rpm, 1-inch high
  - 9 GB, 7200 rpm, 1-inch high
  - 9 GB, 10000 rpm, 1-inch high
  - 18 GB, 7200 rpm, 1.6-inch high
  - 18 GB, 10000 rpm, 1-inch high
  - 36 GB, 10000 rpm, 1.6-inch high

  All drives fit a 3.5-inch form factor.
- All drives are mounted in a “spud” bracket for easy installation and removal from the tray.
- The drives use SCA-2 connectors in which the ground leads make contact first for hot-plug support. This ensures electrical hot-plugging. The cable free drives plug directly into backplanes to provide higher reliability.
- Redundant power supplies and cooling. Each power supply unit is capable of running in non-degraded operation in the event of a power supply failure. A single power supply can handle the start-up power surge for all disks. In addition, a power supply can be replaced while the Sun StorEdge A1000 and D1000 trays are in operation. Each cooling unit can maintain operating temperatures in the event of a single fan failure.

Disk Tray and Hot-plug Disk Module Technical Facts

- Supported 1-inch disks include 4 GB, 10000 rpm; 9 GB, 7200 and 10000 rpm; and 18 GB 10000 rpm. 1.6-inch, 18-GB, 7200-rpm and 36-GB, 10000-rpm disks are also supported.
- Each drive tray holds a maximum of twelve 1-inch disks, or eight 1.6-inch disks. These are the same disk drives used in the Sun StorEdge A3500 array.

- The 3.5-inch form-factor drives are mounted in a plastic bracket for easy installation and removal from the tray.
- In the event of a power supply failure, a single power supply can handle the start-up power surge for all disks. In addition, a power supply can be replaced while the tray and disks are in operation. Each cooling unit can maintain operating temperatures in the event of a single fan failure.
- The drives use SCA-2 connectors in which the ground leads make contact first for hot-plug support. The drives plug directly into the disk tray backplane without any cabling, providing higher reliability.
- An environmental service module board at the rear of the Sun StorEdge D1000 disk tray enables the host system to obtain environmental status information over the SCSI bus. The environmental service module board also provides status and control information for individual drive faults back to the host system.

Host Bus Adapter Key Facts

- For SBus-based hosts: SBus-to-differential UltraSCSI adapter, UDWIS/S Model X1065A.
- For PCI-based hosts: PCI-to-differential UltraSCSI adapter, Model X6541A.

Host Bus Adapter Technical Facts

The UDWIS/S host bus adapter:

- Allows data transfer up to 40 MB per second per channel
- Is rated at an average of 10.5 Watts (15 Watts maximum)
- Measures 5.776 x 3.3-inches (146.70 mm x 83.82 mm)
- Weighs less than 1 pound (0.45 kg)

The PCI differential UltraSCSI host bus adapter:

- Supports data transfers up to 40 MB per second per channel
- Provides dual UltraSCSI channels per card

  To avoid a single point of failure and enhance availability, it is recommended that customers attach the controller to channels on different host bus adapter cards.
- Measures 7.5-inches long by 4-inches wide
- Uses the following input power from the host's PCI slot: +5.0VDC @ 3A max., +3.3VDC @ 130ma max., +12.0VDC @ 50ma max.
- Weighs less than 1 pound (0.45 kg)
- Requires a 68-pin to UHDC differential SCSI cable to connect to a Sun StorEdge A1000 or D1000 array

Enclosure Service

Enclosure services provide and/or accept configuration and maintenance information. Information about the Sun StorEdge A1000 array is obtained through use of the RAID Manager 6 host software.

The following units generate or receive enclosure status or control information:

- Power supplies
- Fan trays
- Disk drives

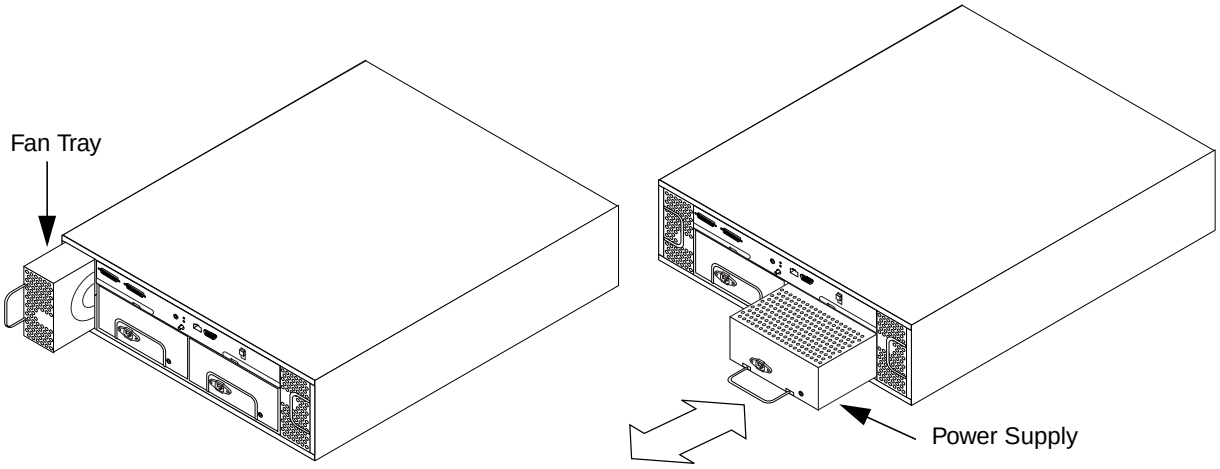


Figure 6. Sun StorEdge A1000 and D1000 arrays fan trays and power supplies

Front Panel Indicators

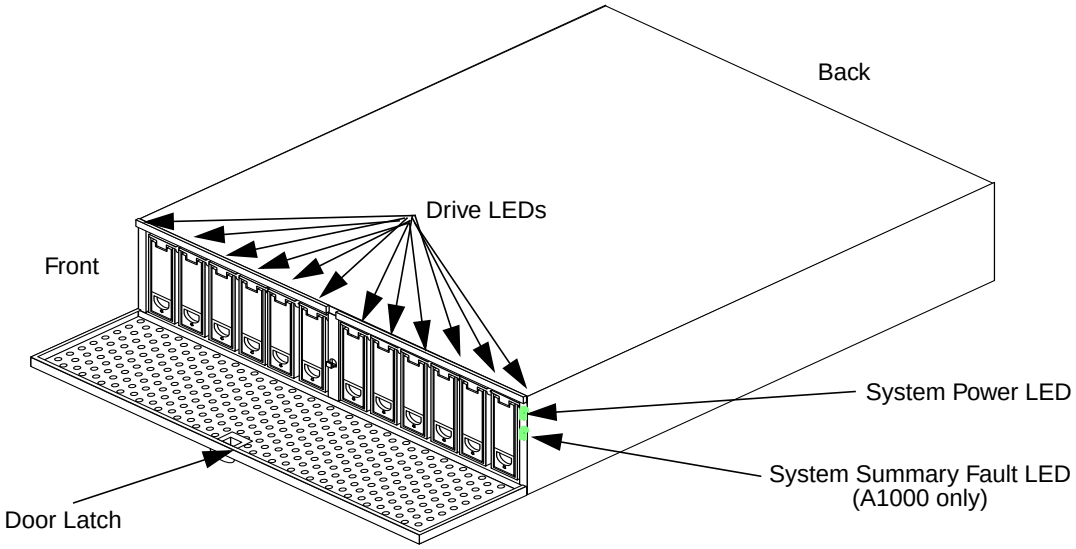


Figure 7. Sun StorEdge A1000 and D1000 arrays front view

Rear Panel Indicators and Switches

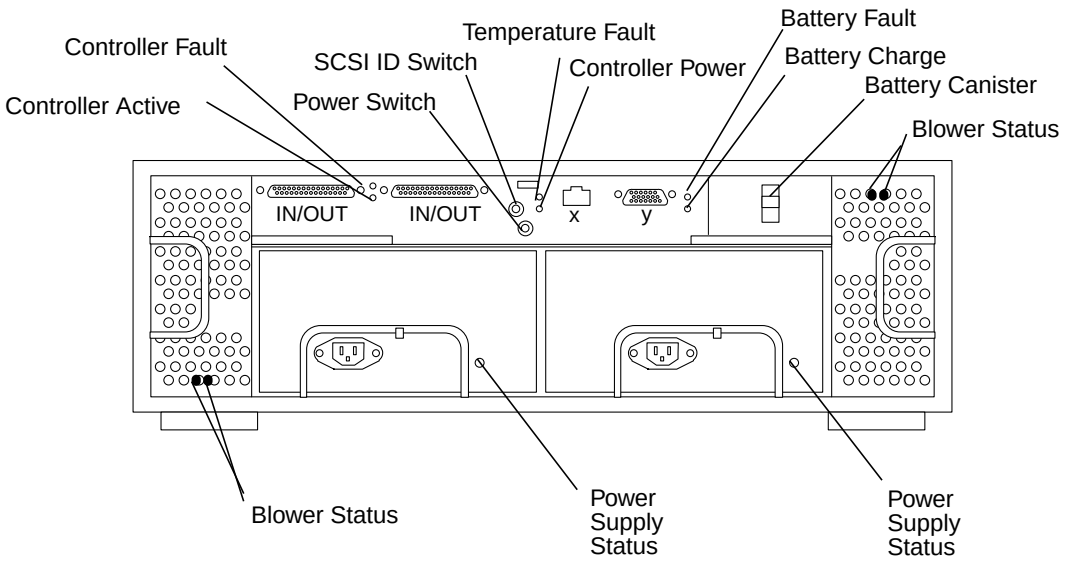


Figure 8. Sun StorEdge A1000 array rear view

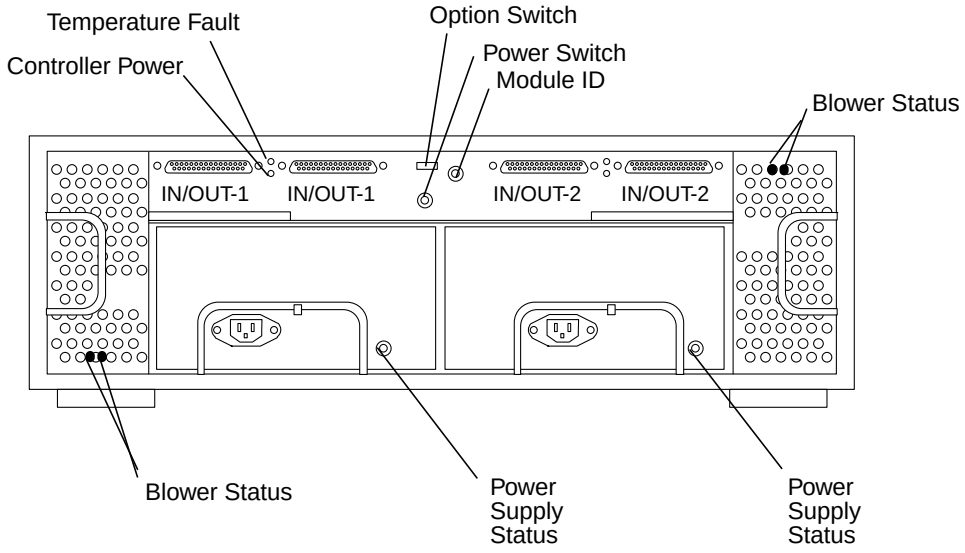


Figure 9. Sun StorEdge D1000 array rear view

Sun StorEdge™ A1000 and D1000 Arrays Configuration Guidelines

Sun StorEdge™ A1000 and D1000 arrays are supported on the following host platforms:

- Sun Enterprise™ 10000 server (Sun StorEdge D1000 array only)
- Sun Enterprise 6000, 5000, and 4000 servers
- Sun Enterprise 6500, 5500, and 4500 servers
- Sun Enterprise 3000 and 3500 servers
- Sun Enterprise 250 and 450 servers
- Sun Enterprise Ultra™ 5S and 10S servers
- Ultra™ 5, 10, 30, and 60 workstations
- Ultra 2 (Sun Enterprise 2) server
- Ultra 1 (Sun Enterprise 1) server (excludes 18-GB, 10000-rpm and 36-GB, 10000-rpm disk configurations)
- Microsoft Windows NT servers (9-GB, 10000-rpm disk configurations only)

Supported Configurations

The Sun StorEdge A1000 array is supported in the following configurations:

- Single host
- Daisy chain
- Box sharing
- Cluster
- Tabletop
- Tower stand
- Rackmount

Refer also to the *Sun StorEdge A1000 Installation, Operation, and Service Guide*. This guide contains detailed information about correct Sun StorEdge A1000 array SCSI cabling, SCSI bus termination requirements, and power sequencing for each of these configurations.

Sun StorEdge A1000 Array Single-host Configuration

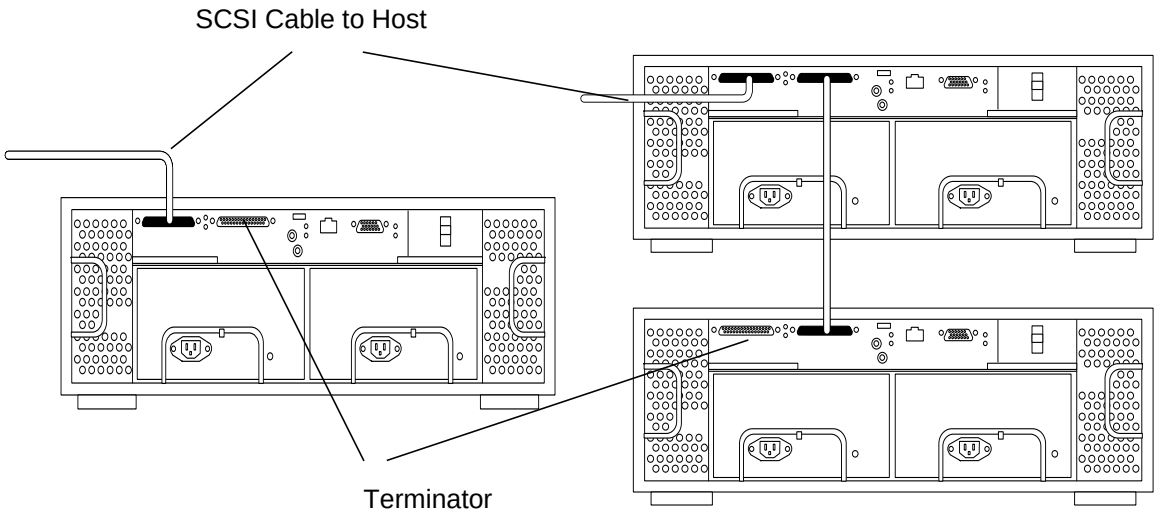


Figure 10. Single and Daisy-chained Sun StorEdge A1000 array connected to a single host

Sun StorEdge A1000 Array Cluster Support Configuration

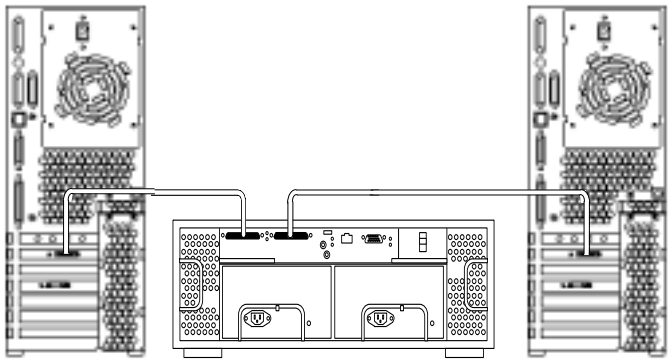


Figure 11. Sun StorEdge A1000 array connected to two hosts

- Single host is the basic configuration. Clustering is also supported. Each Sun StorEdge A1000 array controller module interfaces to the host through an UltraSCSI differential host bus adapter.
- The SCSI Out ports on the Sun StorEdge A1000 array controller module must be terminated unless the array is daisy-chained to another array or clustered with two hosts. (Refer to the *Sun StorEdge A1000 Installation, Operation, and Service Guide*.)

Sun StorEdge D1000 Array Single-host Configuration

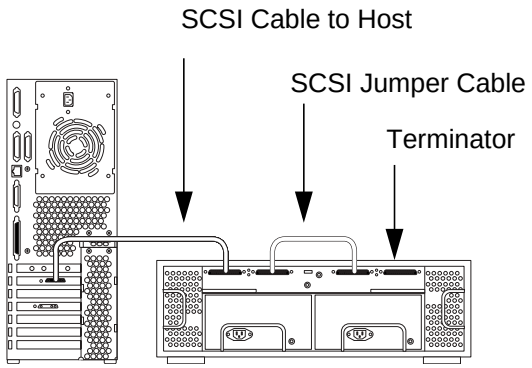


Figure 12. Bridged Sun StorEdge D1000 Array connected to single host

Sun StorEdge D1000 Array Split-box Configuration

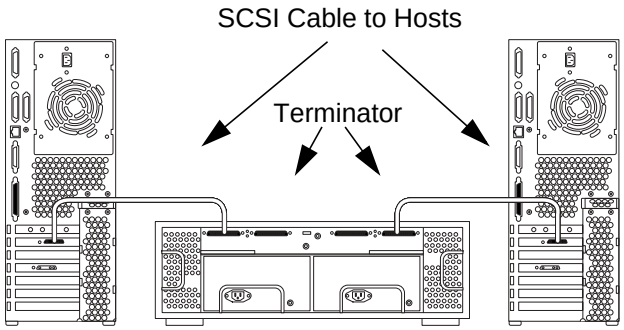


Figure 13. Unbridged Sun StorEdge D1000 array connected to two hosts

Sun StorEdge D1000 Array Cluster Support

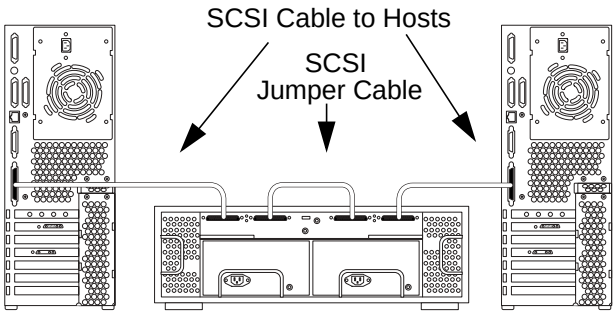


Figure 14. Bridged Sun StorEdge D1000 array connected to dual hosts

- Single host is the basic configuration. Box sharing and clustering are also supported.
- Each Sun StorEdge D1000 array interfaces to the host through an UltraSCSI differential host bus adapter.
- The SCSI out ports on the Sun StorEdge D1000 array must be terminated unless the array is clustered with two hosts. (Refer to the Sun StorEdge D1000 Installation, Operation, and Service Guide.)

Daisy-chained Configuration

- Daisy-chaining enables higher capacity storage solutions per host.
- The Sun StorEdge A1000 array controller module can be daisy-chained in the same or separate cabinets. Up to a maximum of fifteen units may be daisy-chained together (up to nine units in a single enclosure total). For optimal performance, a maximum of three Sun StorEdge A1000 arrays is recommended.

Some customers will require large, multiple terabyte storage capacities. These customers will need to configure and daisy-chain multiple Sun StorEdge A1000 arrays.

Server Platform	**Maximum Number of Sun StorEdge A1000 and D1000 Subsystems Single/Daisy Chain** [1]	**Maximum Supported Capacity 9-GB, 10000-rpm Drives Single/Daisy Chain** [1]	**Maximum Supported Capacity 18-GB, 10000-rpm Drives Single/Daisy Chain** [1]	**Maximum Supported Capacity 36-GB, 10000-rpm Drives Single/Daisy Chain** [1]
Sun Enterprise 10000 server	45 / 45 (D1000 only)	4914 / 4914 GB (D1000 only)	9828 / 9828 GB (D1000 only)	13104 / 13104 GB (D1000 only)
Sun Enterprise 6X00/5X00/4X00 servers	18 / 18	1965/ 1965 GB	3931 / 3931 GB	5241 / 5241 GB
Sun Enterprise 3X00 servers	9 / 9	982 / 982 GB	1965 / 1965 GB	2620 / 2620 GB
Sun Enterprise 450 and 250 servers	8 / 20	873 / 2184 GB	1747 / 4368 GB	2329 / 5824 GB
Sun Enterprise Ultra 5S and 10S servers	6 / 8	655 / 873 GB	1310 / 1747 GB	1747 / 2329 GB
Ultra 30 and Ultra 60 workstations	8 / 8	873 / 873 GB	1747 / 1747 GB	2329 / 2329 GB
Ultra 5 and Ultra 10 workstations	6 / 8	655 / 873 GB	1310 / 1747 GB	1747 / 2329 GB
Ultra 2 workstation and Sun Enterprise 2 server	2 / 4	218/ 436 GB	436 / 873 GB	582 / 1164 GB
Ultra 1 workstation and Sun Enterprise 1 server	2 / 4	218 / 436 GB	not supported	not supported
Microsoft Windows NT server	2 / 4	218 / 436 GB	not supported	not supported

[1] The Sun StorEdge D1000 array cannot be daisy-chained.

Note: The last Sun StorEdge A1000 array controller module in any daisy-chain must have one terminator in the SCSI Out port. Refer to the *Sun StorEdge A1000 Installation, Operation, and Service Guide*.

Sun StorEdge A1000 and D1000 Arrays Rackmount Configuration

The Sun StorEdge A1000 and D1000 arrays can be rackmounted to create larger configurations in a single enclosure. Up to nine Sun StorEdge A1000 or D1000 systems can be mounted in the Sun StorEdge expansion cabinet. In this configuration it is possible to store up to 2.6 TB in a single cabinet. The array may be rackmounted in the field with optional hardware.

In order to rackmount the Sun StorEdge A1000 or D1000 arrays, customers must:

- Install mounting brackets onto tabletop configurations or order rackmount configurations
- Install the Sun StorEdge A1000 or D1000 arrays in the enclosure
- Cable the units

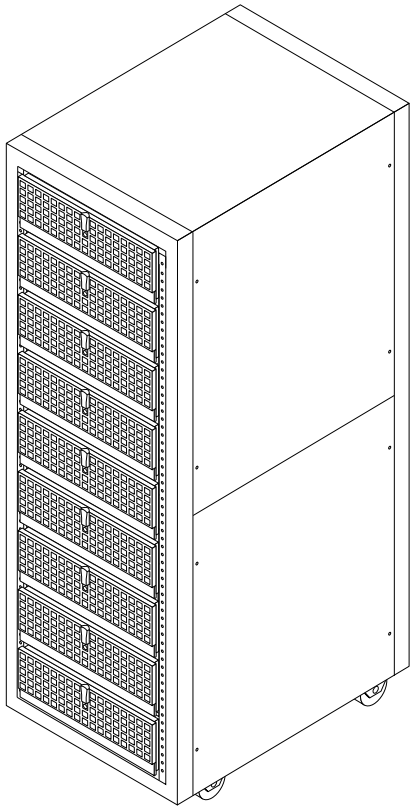


Figure 15. Rackmounting the Sun StorEdge A1000 and D1000 arrays

Detailed information on rackmounting procedures can be found in the *Sun StorEdge A1000 and D1000 Rackmount Installation* guide, part number 805-2626-10.

Other Configuration Guidelines

The total length of all SCSI cables on any one bus should not exceed 25 meters. The Sun StorEdge A1000 array ships with one 2-meter UltraSCSI differential cable. The Sun StorEdge D1000 array ships with two 2-meter UltraSCSI differential cables and one 0.8 meter cable (for jumper into single drive chain). See the ordering information for part numbers of other cables. Cable lengths are as follows:

- External differential UltraSCSI cable, 10.0 meters
- External differential UltraSCSI cable, 4.0 meters
- External differential UltraSCSI cable, 2.0 meters
- UltraSCSI host bus adapter, 0.1 meter of internal cable length
- Sun StorEdge A1000 array controller, 0.1 meter of internal cable length

Sun StorEdge™ RAID Manager Key Facts (Sun StorEdge A1000 Array)

The Sun StorEdge™ RAID Manager software includes both graphical and command line interfaces for configuring, monitoring, maintenance, tuning of the RAID configuration. For the Sun StorEdge A1000 array, version 6.1.1 or above is required.

The graphical user interface (GUI) of the Sun StorEdge RAID Manager software displays this menu.

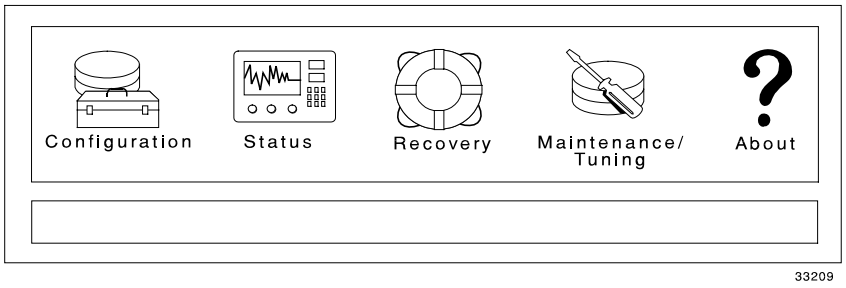


Figure 16. The RAID Manager GUI

Application	Functions
• Configuration application	• Design flexible RAID configurations • Locate a drive group • Create logical units (LUNs) and hot spares from unassigned drives • Add LUNs to an existing drive group • Delete LUNs in a drive group or a hot-spare drive
• Status application	• Real-time view of log files with system information about failures, parity checks, and system events • Perform health check on RAID modules • View the status of LUN reconstructions or change the LUN reconstruction rate
• Recovery application	• On-line instructions for easy restoration of failed components in a RAID module • Manual parity check/repair of LUNs • Manual recovery of drives and controllers. You can fail, reconstruct, and revive drives, format and revive LUNs, and change the status of controllers • Automatic LUN reconstruction

Application	Functions
• Maintenance/tuning application	• Change LUN reconstruction rate • Balance LUNs between active controllers • View/set cache parameters for each LUN • Upgrade controller firmware • Change/set automatic parity check • Manage error log file
• About	• Software version information

Sun StorEdge RAID Manager Tech Facts

- The Sun StorEdge RAID Manager software includes both graphical and command line interfaces for configuring and managing the RAID configurations.
- A RAID module is a set of associated drives, controllers, power supplies, and cooling fans.
- The Solaris™ Operating Environment sees each LUN as one virtual disk drive. With Solaris 2.6 Operating Environment Hardware: 5/98, each SCSI device driver can support a maximum of 16 LUNs, each capable of supporting seven partitions. For the Sun StorEdge A1000 array, the RAID Manager software supports a maximum of 16 LUNs.
- A drive group is a logical grouping of drives. Drive groups are renumbered automatically on the next reconfiguration boot after configuration changes.
- RAID Manager uses the standard device code (cX tY dZ s0)
  - cX = Host bus adapter with a maximum of 16 LUNs per target.
  - tY = The controller SCSI target ID. This is limited to 8 under the Solaris 2.5.1 Operating Environment.
  - dZ = The LUN
  - s0 = Slice number. With the Sun StorEdge RAID Manager, the slice number is always “0.”
- The RAID Manager supports global hot spares, which are disks that contain no data and act as a standby in case of a drive failure. Once a failed disk has been replaced, data is returned automatically to the original disk to preserve the original configuration and performance; the spare disk is then made available again as a global hot spare.

The RAID Manager supports global hot spares, which are disks that contain no data and act as a standby in case of a drive failure. Once a failed disk has been replaced, data is returned automatically to the original disk to preserve the original configuration and performance; the spare disk is then made available again as a global hot spare.

- The RAID Manager software allows the user to customize how data is cached.
- By enabling write caching, data can be written from the host to the controller’s cache. This improves overall performance because the host considers the write operation complete once the data is written to cache. By default, write caching is enabled.

  Fast writes to the data cache are enabled by default.
- The Recovery Guru in the RAID Manager GUI provides on-line instructions for easy restoration of failed components. The Recovery Guru provides step-by-step failure recovery instructions to simplify administration and minimize the possibility of error.

- Message/event logging is provided by default, and can be customized to meet customer needs.
- Parity checks are run automatically to verify that there are no parity errors. If any parity errors are found, the parity is automatically repaired and rewritten to disk.
- Simple network management protocol (SNMP) support is provided, enabling integration with network management tools such as Solstice Domain Manager™ (SunNet Manager™) and Sun Enterprise SyMON™ 2.0 software.

Other RAID Manager 6.1 Enhancements

- Added information to show how drives are mirrored in a logical representation. The RAID Manager 6.1.1 graphical user interface has been enhanced to show how drives are mirrored in a RAID 1 configuration.
- Frozen node names map LUNs to controllers even after a controller failover (check).
- User-defined module selection/removal assigns abstract names for each Sun StorEdge A1000 array module instead of using the device name (`dev/[r]RAID_Module_NN`).

Default Configuration

The Sun StorEdge A1000 array comes preconfigured with a default LUN configurations, which may be reconfigured to match the customer's specific requirements.

	4-Drive Configuration	**12-Drive Configuration**
Default Configuration	1 x (3+1) = 4 (RAID 5)	2 x (5 + 1) = 12 (RAID 5)

Year 2000 Compliance

The Sun StorEdge A1000 array with RAID Manager 6.1.1 is year 2000 compliant.

Sun StorEdge A1000 and D1000 Arrays Software Requirements

- Solaris 2.5.1 Operating Environment (Hardware: 8/97) or above with the required operating system patches must be used to support the Sun StorEdge A1000 and D1000 arrays. Configurations with 18-GB, 10000-rpm, 1-inch or 36-GB, 10000-rpm, 1.6-inch disks are supported on the Solaris 2.6 Operating Environment or higher.
- Sun StorEdge RAID Manager 6.1.1 update 1 (Sun StorEdge A1000 array)

Other Supported Software

- VERITAS Volume Manager software, versions 2.4, 2.5, 2.5.x, and 2.6
- Solstice DiskSuite™ software version 4.1
- Sun Cluster 2.1, 2.2 software

VERITAS Volume Manager (VxVM) Software

VERITAS Volume Manager software (also known as Sun StorEdge Volume Manager™) is offered primarily for use with the Sun StorEdge D1000 array in order to support software-based RAID solutions. However, VERITAS Volume Manager software can be used as a shell with the Sun StorEdge A1000 array and RAID Manager software to enable the mirroring across storage units.

VERITAS Volume Manager software supports RAID technology to optimize performance, availability, and user cost. This technology improves performance, reduces recovery time in the event of file system errors, and increases data availability even in the event of a disk failure. VERITAS Volume Manager software supports four RAID levels that provide varying degrees of availability with corresponding trade-offs in performance and cost:

- RAID 0 (striping and concatenation) enables data to span more than a single disk. While performance is improved, the lack of redundancy in this level leaves data unprotected.
- RAID 1 (mirroring) enables users to keep multiple copies of their data. In the event of a disk failure, data can be obtained from the remaining good copy, increasing data availability.
- RAID 0+1 (striping plus mirroring) provides the data protection of RAID 1 with the performance benefit of RAID 0.
- RAID 5 (striping with distributed parity) offers the ability to reconstruct data in the event of a single disk failure. Significantly less expensive than mirroring, RAID 5 is a common choice when low-cost availability is desired.

Disk Groups

In the event of a system failure, users need assurance that access to their data can be obtained quickly. Sun VERITAS Volume Manager software enables users to group disks and the volumes and file system that reside on them into disk groups. A disk group can be exported from a failed system and imported onto another system, providing users with access to the data.

On-line Resizing

File systems, and consequently the volumes on which they reside, change and grow over time. In the past, as file systems became full, administrators were required to take the file system offline, back up the data, create a larger file system and restore the data. With VERITAS Volume Manager software, volumes and their UNIX® file systems (UFS) can grow online, without disruption of user access. This capability increases data availability and eases administration.

On-line Backups

Backups are an essential part of any data management strategy yet pose problems in enterprises that run 24 hours a day, 7 days a week, for 365 days a year. The traditional technique of performing backups during scheduled downtimes may be unacceptable for many organizations and application environments.

VERITAS Volume Manager software supports online backups through the use of snapshots, read-only copies of the volume and/or file system. When a snapshot is created, write operations continue to modify the active volume or file system, enabling application access to continue without interruption.

Performance Analysis Tools

VERITAS Volume Manager software includes performance analysis tools. The system can monitor the I/O load and obtain statistics on reads and writes at the disk and volume level. With this capability, users can monitor I/O performance and isolate bottlenecks. Once identified, bottlenecks can be removed by moving or reorganizing data, resulting in improved performance.

VERITAS Volume Manager Software and the Sun StorEdge D1000 Array

When using the VERITAS Volume Manager software with the Sun StorEdge D1000 array, standard installation procedures should be followed. See the installation guide provided with VERITAS Volume Manager software.

VERITAS Volume Manager Software and the Sun StorEdge A1000 Array and RAID Manager

The VERITAS Volume Manager software is supported with the Sun StorEdge A1000 array. However, certain caveats apply:

- **Installation**

  Installation ordering is very sensitive. The Sun StorEdge A1000 array installation procedures must be followed exactly as documented in the Sun StorEdge A1000 product release notes, the Sun StorEdge A1000 system manual, and the Sun StorEdge RAID Manager manual.

- **Installation guide**

  Deviation from the following sequence can and will cause incompatibility between Sun StorEdge A1000 array and VERITAS Volume Manager software.

  VERITAS Volume Manager software should be installed only after the following steps have been completed:

  1. Sun StorEdge A1000 array hardware is properly installed and connected to the host.
  2. Sun StorEdge A1000 array software is properly installed.
  3. Sun StorEdge A1000 array devices (LUNs) are properly configured using RAID Manager.
  4. The host system is rebooted using the `-r` option. On reboot the RAID Manager must recognize the configured LUNs and create the appropriate device nodes.

  It is also important to modify start-up scripts as necessary to ensure that Sun StorEdge A1000 array daemons are invoked prior to VERITAS Volume Manager software.

- **Device naming**

  Sun StorEdge A1000 array device entries in `/etc/vfstab`, which will be encapsulated using Sun VERITAS Volume Manager software, must use the standard Solaris Operating Environment device names (e.g., `/dev/rdsk/c3t4d0s0`). Do not use the device names generated by the Sun StorEdge RAID Manager (e.g., `/dev/rRAID_module01/0s0`).

- **Boot volumes**

  For information on utilizing the Sun StorEdge A1000 array as a boot device, contact your sales representative for information.

- **Configuration**

  It is recommended that you do not build VERITAS Volume Manager software RAID 5 volumes from Sun StorEdge A1000 array devices, and in particular, that you do not build them from Sun StorEdge A1000 array RAID 5 LUNs.

RAID Implementation

Hardware versus Software-based RAID

In any RAID storage product, RAID functionality may be implemented in hardware (on the array controller, as with the Sun StorEdge A1000 array), or it may be implemented in software on the host (as is done in Sun StorEdge D1000 array configurations). Each method has its advantages:

- In most configurations, controller-based RAID delivers higher performance than host-based RAID. For RAID 5, the system I/O bus traffic is lower because the controller does the parity calculations. This decreases host/array bus traffic and improves system I/O throughput. In the Sun StorEdge A1000 array, an intelligent cache controller does all the multistripe I/O and performs prefetch. The controller converts small sequential I/O into full-stripe I/O to even further improve RAID 5 performance. In host-based RAID systems, each read/write command requires multiple I/O requests to the disk, increasing bus traffic and impacting I/O performance for RAID 5.
- The primary advantage of host-based software RAID is flexibility. In this type of RAID implementation, software on the host system controls the RAID configuration, as well as management and redundant data synchronization operations. This provides a high degree of flexibility, allowing many different RAID levels to be configured, and even allows RAID groups to span multiple disk controllers. Host software RAID also enables configurations to be easily changed over time, as customers' needs change.

RAID Levels Supported

The Sun StorEdge A1000 and D1000 arrays are RAID subsystems that enables users to achieve the ideal balance of high data availability, performance, capacity, and cost.

RAID Level	Characteristics
RAID 0—Striping	• Spreads data across multiple-disk spindles for better performance • Can be tuned to optimize either random or sequential I/O performance • No redundant data protection, lower reliability than independent disks • Same low cost per usable megabyte as independent disks
RAID 1—Mirroring	• Maintains duplicate copies of data, so if a disk fails, data is available and applications keep running • Same performance as independent disks • Highest cost per usable megabyte
RAID 1+0—Mirroring and striping	• Combines performance of striping with data protection of mirroring • Duplicate copies of striped data remain available even if a disk fails • Same cost per usable megabyte as mirroring
RAID 3—Striping with parity on single disk	• Good for large sequential data transfers per I/O request, and low I/O request rates • When selecting RAID 3, the Sun StorEdge RAID Manager actually implements RAID 5, eliminating the typical RAID 3 bottleneck of parity information being written to a single disk
RAID 5—Striping with Parity	• Provides data protection by storing parity information on all disks in the LUN, so data can be reconstructed if a single disk fails; good for applications with high I/O request rates. • Stripes data across multiple-disk spindles to optimize random or sequential performance • Higher cost per megabyte than independent disks or RAID 0, but much lower than RAID 1 or 1+0 • Lower performance on small-sized writes than in RAID 0, 1, 1+0 or independent disks

These RAID levels are implemented via a hardware controller in the Sun StorEdge A1000 array, and through host software in Sun StorEdge D1000 array configurations.

High Availability with Sun StorEdge A1000 and D1000 Arrays RAID Implementations

Features	Benefits
• Independent disks, plus RAID levels 0, 1, 1+0, 3, and 5 are all available at the same time within the same array	• Can easily match data layouts to meet users' specific requirements for capacity, performance, high availability, and cost
• RAID groups may span multiple arrays	• Greater flexibility; allows creation of fully redundant configurations
• RAID levels 5, 1, and 1+0 yield predicted steady-state uptimes in excess of 99.99 percent per array and mean time between data loss (MTBDL) in the millions of hours	• High availability, so customers can be confident that data will be available when needed and that it will not be lost
• Hot spares are automatically swapped in to replace any failed disk in a RAID 5, 1, or 1+0 group	• Continuous redundant data protection even if a disk fails; maintenance can be deferred for days or weeks, if necessary
• RAID stripe sizes are adjustable to optimize for random or sequential I/O patterns	• Users can tune performance for their specific applications. See the *Sun StorEdge A3000 Performance Tuning and Configuration* white paper at `http://www.sun.com/storage/white-papers/a3000-tuning.html` for more details.

RAID Technical Facts

- Each array may have several hot-spare drives. If a drive in a RAID 5, 1, or 1+0 volume fails, a hot-spare drive is assigned and the Sun StorEdge RAID Manager (Sun StorEdge A1000 array) or VERITAS Volume Manager software (Sun StorEdge D1000 array) detects the failure and automatically rebuilds the data from the failed drive onto a hot-spare drive.
- Striped-data organizations (RAID 0, 1+0, 3, and 5) can be tuned to optimize for either random or sequential I/O performance.
- To optimize for random performance, the I/O load must be evenly balanced across the disk spindles. This is done by setting the stripe width as large or larger than the typical application I/O request. For example, if the typical I/O request is 8 KB, setting the stripe width to 64 KB might be appropriate. This tends to evenly distribute I/O requests across all the disk spindles in the LUN.
- Sequential performance is optimized when data is spread out so that each application I/O spans all the drives in the RAID group. This requires setting the stripe width so that it is small relative to the size of the typical I/O request. For example, in a RAID group with four data disks, if typical application I/O size is 8 KB to 16 KB, a stripe width of 2 KB may be best.

Performance Summary

- The Sun StorEdge™ A1000 array's highest bandwidth is 32 MB per second when performing sequential reads with a 320-KB I/O size.
- The Sun StorEdge D1000 array's highest bandwidth is 63 MB per second when performing sequential reads with a 128-KB I/O size.
- The Sun StorEdge A1000 array's highest I/O operations per second (IOPS) is over 2,300 with 2 KB when performing random reads.
- The Sun StorEdge D1000 array's highest IOPS is 919 KB when performing random reads.

RAID Benchmark Configuration

Benchmark testing on the Sun StorEdge A1000 and D1000 arrays was performed on a Sun Enterprise™ 4000 server running Solaris™ 2.5.1 Operating Environment. The server was configured with 512 MB of memory, two 167-MHz UltraSPARC™ processors, and two SBus host-bus adapters.

The Sun StorEdge A1000 array used for performance testing was configured with a single controller with 24 MB of NVRAM. RAID Manager 6.1 was used to configure the array subsystem.

All tests were performed using the `vxbench` utility.

Test Results

Test Parameter	**RAID 1+0**		**RAID 5**		**JBOD**	
	Sun StorEdge A1000 Array		**Sun StorEdge A1000 Array**		**Sun StorEdge D1000 Array**	
Configuration	12 x 4.2-GB drives		12 x 4.2-GB drives		8 x 9-GB drives	
Workload	IOPS	MB/sec	IOPS	MB/sec	IOPS	MB/sec
Random read	749		> 2,300		919	
Random write	361		400		627	
Sequential read		31		32		> 62
Sequential write		26		25		60

Standards and Conformance

Environmental Specifications

Temperature range (dry bulb)	
Operating	5 to 40 degrees C
Non-operating	-20 to 60 degrees C
Relative humidity	
Operating	20 percent to 80 percent RH @ 27 C, maximum wet bulb non-condensing
Non-operating	93 percent RH non-condensing
Altitude	
Operating and non-operating	30.5 m (100 ft.) below to 3,048m (10,000 ft.) above sea level
Heat dissipation (operating)	260 Watts, 1092 BTU per hour
Sound power and pressure (operating)	6.6 bels (power), 63.7 dBA (pressure)

Physical Specifications

Height	17.78 cm/7.0 in.	
Width (single rack)	53.34 cm/21.0 in.	
Depth (single rack)	44.7 cm/17.6 in.	
Weight		
A1000 array	Without disk drives	19.3 kg/42.5 lbs.
	Fully loaded	28.4 kg/62.5 lbs.
D1000 array	Without disk drives	18.6 kg/41.0 lbs.
	Fully loaded	27.4 kg/60.5 lbs.

Drive Tray Physical Specifications

Height	175 mm / 6.9 in.
Width	445 mm / 17.5 in.
Depth	525 mm / 20.7 in.
Weight (2 power modules)	17.25 kg / 38 lb. without drives 26 kg / 57 lb. with drives

Drive Tray Electrical Specifications

Input voltage	100-240 VAC 50/60 Hz
Input current	24 amps
Power output	260 Watts
VA	~300 VA
Heat output	1092 BTU

Sun StorEdge A1000 and D1000 Array Regulation

System Regulation	Specifications
Safety	• UL1950 • CSA C22 No.950 • EN60950 (TUV)
RFI/EMI	• VCCI Class 2 • FCC Part 15 Class B • CISPR 22 Class B
Immunity	• EN50082-1 • EMC Directive (89/336/EEC)
Product label	• FCC Class B • VCCI Class 2 • Industry Canada Class A • UL Mark • cUL Mark • TUV Mark • CE Mark

Ordering Information

Sun StorEdge™ A1000 and D1000 Array Systems

Order Number	Title and Description
SG-XARY144A-36G	36-GB Sun StorEdge A1000 array including four 9-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, battery module, two dual-fan modules, one controller card with 24-MB data cache; RAID Manager 6 software.
SG-XARY144A-109G	109-GB Sun StorEdge A1000 array including twelve 9-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, battery module, two dual-fan modules, one controller card with 24-MB data cache; RAID Manager 6 software.
SG-XARY146A-36G	36-GB Sun StorEdge A1000 array rackmount X-option including four 9-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, battery module, two dual-fan modules, one controller card with 24-MB data cache; RAID Manager 6 software. Available as R5 expansion rack.
SG-XARY151A-72G	72-GB Sun StorEdge A1000 array including four 18-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, battery module, two dual-fan modules, one controller card with 24-MB data cache; RAID Manager 6 software.
SG-XARY151A-218G	218-GB Sun StorEdge™ A1000 array including twelve 18-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, battery module, two dual-fan modules, one controller card with 24-MB data cache; RAID Manager 6 software.
SG-XARY152A-72G	72-GB Sun StorEdge A1000 array rackmount X-option including four 18-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, battery module, two dual-fan modules, one controller card with 24-MB data cache; RAID Manager 6 software. Available as R5 expansion rack.
SG-XARY161A-145G	145-GB Sun StorEdge A1000 array including four 36-GB, 10000-rpm, 1.6-inch UltraSCSI drives, two power supplies, battery module, two dual-fan modules, one controller card with 24-MB data cache, and RAID Manager 6 software.

Order Number	Title and Description
SG-XARY161A-291G	291-GB Sun StorEdge A1000 array including eight 36-GB, 10000-rpm, 1.6-inch UltraSCSI drives, two power supplies, battery module, two dual-fan modules, one controller card with 24-MB data cache, and RAID Manager 6 software.
SG-XARY162A-145G	145-GB Sun StorEdge A1000 array rackmount X-option including four 36-GB, 10000-rpm, 1.6-inch UltraSCSI drives, two power supplies, battery module, two dual-fan modules, one controller card with 24-MB data cache, and RAID Manager 6 software. Available as R5 expansion rack.
SG-XARY145A-36G	109-GB Sun StorEdge D1000 array including four 9-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, battery module, and two dual-fan modules.
SG-XARY145A-109G	109-GB Sun StorEdge D1000 array including twelve 9-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, battery module, and two dual-fan modules.
SG-XARY147A-36G	36-GB Sun StorEdge D1000 array rackmount X-option including four 9-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, two UltraSCSI host interface modules, and two dual-fan modules. Available as R4 or R5 expansion racks.
SG-XARY153A-72G	72-GB Sun StorEdge D1000 array including four 18-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, battery module, and two dual-fan modules.
SG-XARY153A-218G	218-GB Sun StorEdge D1000 array including twelve 18-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, battery module, and two dual-fan modules.
SG-XARY154A-72G	72-GB Sun StorEdge D1000 array rackmount X-option including four 18-GB, 10000-rpm, 1-inch UltraSCSI drives, two power supplies, two UltraSCSI host interface modules, and two dual-fan modules. Available as R4 or R5 expansion racks.
SG-XARY163A-145G	145-GB Sun StorEdge D1000 array including four 36-GB, 10000-rpm, 1.6-inch UltraSCSI drives, two power supplies, battery module, and two dual-fan modules.

Order Number	Title and Description
SG-XARY163A-291G	291-GB Sun StorEdge D1000 array including eight 36-GB, 10000-rpm, 1.6-inch UltraSCSI drives, two power supplies, battery module, and two dual-fan modules.
SG-XARY164A-291G	145-GB Sun StorEdge D1000 array rackmount X-option including four 36-GB, 10000-rpm, 1.6-inch UltraSCSI drives, two power supplies, battery module, and two dual-fan modules. Available as R5 expansion rack.

Options

Sun StorEdge A1000 and D1000 Array Options

Order Number	Option Description
X5235A [1]	9.1-GB, 10000-rpm, 1-inch UltraSCSI disk drive
X5238A [1]	18.2-GB, 10000-rpm, 1-inch UltraSCSI disk drive
X5233A [1]	18-GB, 7200-rpm, 1.6-inch UltraSCSI disk drive
X5240A [1]	36.4-GB, 10000-rpm, 1.6-inch UltraSCSI disk drive
X1065A	UDWIS/S SBus differential UltraSCSI host bus adapter
X6541A	UD2S PCI dual-port UltraSCSI host bus adapter
SG-XARY030A [2]	Sun StorEdge empty rack [1]
X9653A	Sun StorEdge/Sunfire rackmount kit
X9606A	Tower stand kit
X7040A	64-MB add-on cache memory
X9818A	Front door assembly for 72-inch StorEdge rack
ARRAYNT-6221-B	Volume management software for Microsoft Windows NT hosts

[1] Remove the “X” to order factory installed into an R4 or R5 rackmount Sun StorEdge A1000 or D1000 array configuration

[2] Remove the “X” to order with a minimum quantity of three Sun StorEdge A1000 or D1000 trays installed

Sun StorEdge A1000 and D1000 Array Cables

Order Number	Option Description
X3830A	4-meter, 68-pin to UHDC Differential SCSI Cable
X3831A	10-meter, 68-pin to UHDC Differential SCSI Cable
X979A	12.0-meter UltraSCSI external cable

Upgrades

Upgrade Paths

Sun-to-Sun and competitive upgrades to the Sun StorEdge™ A1000 and D1000 arrays provide excellent trade-in values for older SPARCstorage™ Array systems, desktop drive enclosure modules, and older drives; making it more cost-effective to migrate to the latest technology. See the ordering information below for available upgrade configurations.

Upgrade Options

Order Number	Title and Description
UG-AX000-DISK-9G-2	Upgrade to internal 9.1-GB, 10000-rpm, 1-inch high, UltraSCSI expansion hard drive with barrier plate.
UG-AX000-DISK-18G	Upgrade to internal 18.2-GB, 10000-rpm, 1-inch high, UltraSCSI expansion hard drive with barrier plate.
UGFA-AX000-DISK-36G	Upgrade to internal 36.4-GB, 10000-rpm, 1.6-inch high, UltraSCSI expansion hard drive with barrier plate. Factory installed.
UG-D1000-36G-10K	Upgrade to 36-GB (4 x 9.1-GB, 10000-rpm disks) Sun StorEdge D1000 array tabletop or deskside system, one software RAID interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host-ports.
UG-D1000-36G-RK-2	Upgrade to 36-GB (4 x 9.1-GB, 10000-rpm disks) Sun StorEdge D1000 array for rackmounting in the Sun StorEdge or Sun Enterprise™ expansion racks, one software RAID interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host-ports.
UG-A1000-36G-10K	Upgrade to 36-GB (4 x 9.1-GB, 10000-rpm disks) Sun StorEdge A1000 array tabletop or deskside system, one hardware RAID controller, two power supplies, two fan trays (four fans), and two differential UltraSCSI-to-host-ports.
UG-A1000-109G-10K	Upgrade to 109-GB (12 x 9.1-GB, 10000-rpm disks) Sun StorEdge A1000 array tabletop or deskside system, one hardware RAID controller, two power supplies, two fan trays (four fans), and two differential UltraSCSI-to-host-ports.

Order Number	Title and Description
UG-A1000-36G-RK-2	Upgrade to 36-GB (4 x 9.1-GB, 10000-rpm disks) Sun StorEdge A1000 array for rackmounting in the Sun StorEdge or Sun Enterprise expansion racks, one hardware RAID controller, two power supplies, two fan trays (four fans), and two differential UltraSCSI-to-host-ports.
UG-A1K-72G-18G10K	Upgrade to 72-GB (4 x 18.2-GB, 10000-rpm disks) Sun StorEdge A1000 array tabletop or deskside system, one hardware RAID controller, two power supplies, two fan trays (four fans), two differential UltraSCSI ports, and 24-MB standard cache.
UG-A1K-218G-18G10K	Upgrade to 218-GB (12 x 18.2-GB, 10000-rpm disks) Sun StorEdge A1000 array tabletop or deskside system, one hardware RAID controller, two power supplies, two fan trays (four fans), two differential UltraSCSI ports, and 24-MB standard cache.
UG-A1K-72G-18G-RK	Upgrade to 72-GB (4 x 18.2-GB, 10000-rpm disks) Sun StorEdge A1000 array for rackmounting in the Sun StorEdge or Sun Enterprise expansion racks, one hardware RAID controller, two power supplies, two fan trays (four fans), and two differential UltraSCSI ports.
UG-A1K-145G-36G10K	Upgrade to 145-GB (4 x 36-GB, 10000-rpm disks) Sun StorEdge A1000 array tabletop or deskside system, one hardware RAID controller, two power supplies, two fan trays (four fans), and four differential UltraSCSI ports, and 24-MB standard cache.
UG-A1K-291G-36G10K	Upgrade to 291-GB (8 x 36-GB, 10000-rpm disks) Sun StorEdge A1000 array tabletop or deskside system, one hardware RAID controller, two power supplies, two fan trays (four fans), and four differential UltraSCSI ports, and 24-MB standard cache.
UG-A1K-145G-RK	Upgrade to 145-GB (4 x 36-GB, 10000-rpm disks) Sun StorEdge A1000 array for rackmounting in Sun StorEdge or Sun Enterprise expansion racks, one hardware RAID controller, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.
UG-A1000-CONTBD	Upgrade to Sun StorEdge A1000 array controller. Customer returns Sun StorEdge D1000 array controller board.
UG-D1K-72G-18G10K	Upgrade to 72-GB (4 x 18.2-GB, 10000-rpm disks) Sun StorEdge D1000 array tabletop or deskside system, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.

Order Number	Title and Description
UG-D1K-72G-18G-RK	Upgrade to 72-GB (4 x 18.2-GB, 10000-rpm disks) Sun StorEdge D1000 array for rackmounting in the Sun StorEdge or Sun Enterprise expansion racks, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI ports.
UG-D1K-218G-18G10K	Upgrade to 218-GB (12 x 18.2-GB, 10000-rpm disks) Sun StorEdge D1000 array tabletop or deskside system, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.
UG-D1K-145G-36G10K	Upgrade to 145-GB (4 x 36-GB, 10000-rpm disks) Sun StorEdge D1000 array tabletop or deskside system, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.
UG-D1K-291G-36G10K	Upgrade to 291-GB (8 x 36-GB, 10000-rpm disks) Sun StorEdge D1000 array tabletop or deskside system, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.
UG-D1K-145G-RK	Upgrade to 145-GB (4 x 36-GB, 10000-rpm disks) Sun StorEdge D1000 array for rackmounting in Sun StorEdge or Sun Enterprise expansion racks, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.

Competitive Upgrade Ordering

Order Number	Title and Description
CU-A1K-72G-18G10K	Competitive upgrade to 72-GB (4 x 18.2-GB, 10000-rpm disks) Sun StorEdge A1000 array tabletop or deskside system, one hardware RAID controller, two power supplies, two fan trays (four fans), two differential UltraSCSI ports, and 24-MB standard cache.
CU-A1K-218G-18G10K	Competitive upgrade to 218-GB (12 x 18.2-GB, 10000-rpm disks) Sun StorEdge A1000 array tabletop or deskside system, one hardware RAID controller, two power supplies, two fan trays (four fans), two differential UltraSCSI ports, and 24-MB standard cache.
CU-A1K-72G-18G-RK	Competitive upgrade to 72-GB (4 x 18.2-GB, 10000-rpm disks) Sun StorEdge A1000 array for rackmounting in the Sun StorEdge or Sun Enterprise expansion racks, one interface card, two power supplies, two fan trays (four fans), and two differential UltraSCSI ports.

Order Number	Title and Description
CU-A1K-145G-36G10K	Competitive upgrade to 145-GB (4 x 36-GB, 10000-rpm disks) Sun StorEdge A1000 array tabletop or deskside system, one hardware RAID controller, two fan trays (four fans), four differential UltraSCSI-to-host ports, and 24-MB standard cache.
CU-A1K-291G-36G10K	Competitive upgrade to 291-GB (8 x 36-GB, 10000-rpm disks) Sun StorEdge A1000 array tabletop or deskside system, one hardware RAID controller, two power supplies, two fan trays (four fans), four differential UltraSCSI-to-host ports, and 24-MB standard cache.
CU-A1K-145G-RK	Competitive upgrade to 145-GB (4 x 36-GB, 10000-rpm disks) Sun StorEdge A1000 array for rackmounting in Sun StorEdge or Sun Enterprise expansion racks, one hardware RAID controller, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.
CU-D1K-72G-18G10K	Competitive upgrade to 72-GB (4 x 18.2-GB, 10000-rpm disks) Sun StorEdge D1000 array tabletop or deskside system, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.
CU-D1K-218G-18G10K	Competitive upgrade to 218-GB (12 x 18.2-GB, 10000-rpm disks) Sun StorEdge D1000 array tabletop or deskside system, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.
CU-D1K-72G-18G-RK	Competitive upgrade to 72-GB (4 x 18.2-GB, 10000-rpm disks) Sun StorEdge A1000 array for rackmounting in the Sun StorEdge or Sun Enterprise expansion racks, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI ports.
CU-D1K-145G-36G10K	Competitive upgrade to 145-GB (4 x 36-GB, 10000-rpm disks) Sun StorEdge D1000 array tabletop or deskside system, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.

Order Number	Title and Description
CU-D1K-291G-36G10K	Competitive upgrade to 291-GB (8 x 36-GB, 10000-rpm disks) Sun StorEdge D1000 array tabletop or deskside system, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.
CU-D1K-145G-RK	Competitive upgrade to 145-GB (4 x 36-GB, 10000-rpm disks) Sun StorEdge D1000 array for rackmounting in Sun StorEdge or Sun Enterprise expansion racks, one interface card, two power supplies, two fan trays (four fans), and four differential UltraSCSI-to-host ports.

Service and Support

The SunSpectrum℠ program is an innovative and flexible service offering that allows customers to choose the level of service best suited to their needs, ranging from mission-critical support for maximum solution availability to backup assistance for self-support customers. The SunSpectrum program provides a simple pricing structure in which a single fee covers support for an entire system, including related hardware and peripherals, the Solaris™ Operating Environment software, and telephone support for Sun™ software packages. The majority of Sun's customers today take advantage of the SunSpectrum program, underscoring the value that it represents. Customers should check with their local Sun Enterprise™ Services representatives for program and feature availability in their areas.

FEATURE	SUNSPECTRUM PLATINUM℠ Mission-critical Support	SUNSPECTRUM GOLD℠ Business-critical Support	SUNSPECTRUM SILVER℠ Systems Support	SUNSPECTRUM BRONZE℠ Self Support
Systems Features				
Systems approach coverage	Yes	Yes	Yes	Yes
System availability guarantee	Customized	No	No	No
Account Support Features				
Service account management team	Yes	No	No	No
Local customer support management	No	Yes	No	No
Personal technical account support	Yes	Yes	Option	No
SunStart™ installation service	Yes	No	No	No
Account support plan	Yes	Yes	No	No
Software release planning	Yes	No	No	No
On-site account reviews	Monthly	Semiannual	No	No
Skills assessment	Yes	No	No	No
Site activity log	Yes	Yes	No	No
Coverage / Response Time				
Standard telephone coverage hours	7 day/24 hour	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday
Standard on-site coverage hours	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday	N/A
7-day/24-hour telephone coverage	Yes	Yes	Option	Option
7-day/24-hour on-site coverage	Yes	Option	Option	N/A
7-day/12-hour on-site coverage	No	Option	No	No
5-day/24-hour on-site coverage	No	Option	No	No

FEATURE	SUNSPECTRUM PLATINUM[SM] Mission-critical Support	SUNSPECTRUM GOLD[SM] Business-critical Support	SUNSPECTRUM SILVER[SM] Systems Support	SUNSPECTRUM BRONZE[SM] Self Support
Coverage / Response Time (cont.)				
Customer-defined priority setting	Yes	Yes	Yes	Option
• Urgent (phone/on-site)	Live transfer/ 2 hour	Live transfer/ 4 hour	Live transfer/ 4 hour	4 hour / N/A
• Serious (phone/on-site)	Live transfer/ 4 hour	2 hour/next day	2 hour/next day	4 hour / N/A
• Not critical (phone/on-site)	Live transfer/ customer convenience	4 hour/ customer convenience	4 hour/ customer convenience	4 hour / N/A
2-hour on-site response	Yes	Option	Option	N/A
Additional contacts	Option	Option	Option	Option
Premier Support Features				
Mission-critical support team	Yes	For urgent problems	No	No
Sun Vendor Integration Program (SunVIP[SM])	Yes	Yes	No	No
Software patch management assistance	Yes	No	No	No
Field change order (FCO) management assistance	Yes	No	No	No
Hardware Support Delivery				
Replacement hardware parts	On-site technician	On-site technician	On-site technician	Courier
Two day parts delivery	N/A	N/A	N/A	Yes
Overnight parts delivery	N/A	N/A	N/A	Option
Same-day parts delivery	Yes	Yes	Yes	Option
Remote Systems Diagnostics				
Remote dial-in analysis	Yes	Yes	Yes	Yes
Remote systems monitoring	Yes	Yes	No	No
Remote predictive failure reporting	Yes	Yes	No	No
Software Enhancements and Maintenance Releases				
Solaris enhancement releases	Yes	Yes	Yes	Yes
Patches and maintenance releases	Yes	Yes	Yes	Yes
Sun unbundled software enhancements	Option	Option	Option	Option
Internet and CD-ROM Support Tools				
SunSolve™ license	Yes	Yes	Yes	Yes
SunSolve EarlyNotifier[SM] Service	Yes	Yes	Yes	Yes

Warranty

The warranty on the array hardware is two years. In addition, the Sun StorEdge A1000 and D1000 arrays carry a one year on-site warranty. Software warranty is 90 days.

Education

- Support Readiness Training
- IQ Kit Sales Guide
- IQ Kit Tech Guide
- SunU

Professional Services

Sun StorEdge ArrayStart™ Service

The Sun StorEdge ArrayStart™ service provides an installation and custom-configuration service that quickly gets mission-critical data-center applications up and running. For one fixed fee, this service includes consultation for determining the configuration that best meets the customer's needs, installation of the hardware and RAID management software, and configuration to the appropriate RAID profile determined during the consultation.

Solstice DiskSuite™ to VERITAS Volume Manager Software Data Migration

A Sun Professional Service consultant will deliver four days of onsite consulting services to assist customers who wish to migrate their mission-critical data from existing storage system to a new array. This service will help customers complete the transition with minimal downtime and without risking loss of their valuable data. Specially trained Sun consultants will use their extensive data-migration expertise to complete the service in the most cost- and time-effective manner available. Sun consultants will also fully integrate and optimize the Sun StorEdge A1000 and D1000 arrays into the customer's computing environment.

If desired, customers can choose tasks from the following list to customize the service to meet their specific business needs:

- Design and configuration planning
- Capacity planning
- Performance tuning and optimization

Travel and expenses incur an additional charge for delivery requiring more than 50 miles of travel. When this service is desired by the customer, the account manager will contact the SunPS℠ Data and Storage Management Competency Practice to schedule delivery of the service.

Glossary

Active termination, regulated	Terminates the SCSI bus with a series of resistors tied to +5 volts. The terminator is labeled Regulated but is often referred to as an Active Terminator.
Bandwidth	A measure of the capacity of a communication channel, usually specified in MB per second.
CLI	Command line interface.
Data cache	24 MB to 80 MB of cache memory for fast writes to cache and read-ahead cache operations. Cache memory permits intermediate storage of read and write data without physically reading/writing to the disk, increasing overall performance.
Device name	Software device address that identifies the controller/LUN, such as cXtYdZs0, where X is the host bus adapter, Y is the controller, and Z is the LUN. s0 slice number is used by the system, not by RAID Manager.
Disk array	A subsystem that contains multiple disk drives, designed to provide performance, high availability, serviceability, or other benefits.
Drive group	A physical set of drives in the RAID module. Drive groups are defined during configuration.
Fast write	Allows disk write commands to be safely acknowledged to the host before the data is actually written to the disk media. This can be enabled/disabled through RAID Manager.
Fast/wide SCSI	Data transfer rate of 20 MB/sec. Wide devices can be connected to a standard SCSI interface but the extra data lines need to be terminated.
Full-duplex	Data transmission in both directions at the same time. See also Half-duplex and Simplex.
GB	Gigabyte. A disk GB is 1 billion (1,000,000,000) bytes. A memory GB is 1,073,741,824 bytes (2 to the 30th power).
GUI	Graphical user interface. The Sun StorEdge™ RAID Manager provides a powerful, easy-to-use GUI.

Half-duplex	Refers to an interface, such as SCSI, that can transmit data in only one direction at a time. See also Full-duplex and Simplex.
Host adapter	A card that connects a peripheral device to the computer system's I/O bus.
Hot plug	The ability to remove, replace, or add a device while current I/O processes continue.
Hot spare	A drive in an array that is held in reserve to replace any other drive that fails. After a reconstruction, the hot-spare drive is returned to the standby status.
Hot swap	A specific case of hot plug which involves replacing a device with another of the same size, type, and layout, without any notification to the operating environment.
IOPS	Input/output operations per second. A measure of I/O performance, this is usually used to quote random I/O performance. *See* throughput.
LUN	Logical unit number. A LUN is a set of physical drives in a RAID configuration which are seen by the operating system as one virtual drive.
MTBF	Mean time between failures. A measure of reliability, this is the average expected time between failures of equipment, usually measured in operating hours.
MTBDL	Mean time between data loss. In a RAID system, this is the average expected time between two rapid disk failures that would cause irreparable data loss.
Parity	Additional information stored along with the data that allows the controller to reconstruct lost data on RAID 3 or 5 LUNs if a single drive fails.
Reconstruction	Process used to restore a degraded RAID 1, 3, or 5 LUN to its original state after replacing a single failed drive.
RDAC	Redundant disk array controller. The RDAC driver is included in the RAID Manager software, and manages the rerouting of active I/O operations when a controller fails.
RAID	Redundant array of independent disks. A RAID is a set of disk drives that appears to be a single logical disk drive to an application such as a database or file system. Different RAID levels provide different capacity, performance, high availability, and cost characteristics.
RAID module	A set of drives, controllers, power supplies and cooling.
RAS	Reliability, availability, and serviceability. Features that enhance these attributes, including hot-pluggable capability and redundancy, are important for keeping mission-critical applications and data on-line.
RAID Manager	The software that allows the customer to configure and manage the Sun StorEdge A1000 array.

SCA	Single connector attachment. A SCSI disk connector technology co-invented by Sun Microsystems. The SCA provides all SCSI, power, and control signals in a single connector, and enables easy servicing and highly reliable, pluggable disk drives.
SCSI address	The octal representation of the unique address (0–7) assigned to a narrow device; or hex representation of the unique address (0–15) assigned to a wide SCSI device.
Simplex	Transmission in one preassigned direction only. See also Full-duplex and Half-duplex.
SNMP	Simple network management protocol. SNMP enables RAID events to be remotely monitored by designated network management stations.
Striping	Spreading, or interleaving, logically contiguous blocks of data across multiple independent disk spindles. The amount of data written on each disk before moving to the next drive is the stripe width.
TB	Terabyte. A disk terabyte is 1 trillion (1,000,000,000,000) bytes. A memory terabyte is 1,099,511,627,776 bytes (2 to the 40th power).
Throughput	A measure of sequential I/O performance, quoted in MB/sec. See IOPS.
Volume	In VERITAS Volume Manager software, a volume is a virtual disk partition into which a file system, DBMS, or other application can place data. A volume can physically be a single disk partition or multiple disk partitions on one or more physical disk drives. Applications that use volumes do not need to be aware of their underlying physical structure. The VERITAS Volume Manager software handles mapping of virtual partition addresses to physical addresses.
Warm plug	The ability to remove, replace or add a device while power is still applied but all I/O processes are suspended.
UltraSCSI	Data transfer rate of 40 MB per second per channel.
XOR	eXclusive OR. A binary mathematical operation performed on data to produce parity information. In RAID levels 3 and 5, parity is generated from the user data, stored, and used to regenerate lost data if a drive failure occurs.

Materials Abstract

All materials are available on SunWIN, except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
Powerpack				
– *Sun StorEdge™ A1000/D1000 Storage Arrays Just the Facts*	Reference Guide for the *Sun StorEdge A1000/D1000 Storage Arrays (this document)*	Sales Tool	SunWIN, Reseller Web	97468
– *Sun StorEdge A1000/D1000 Customer Presentation*	Customer Presentation and Slide Notes	Sales Tool	SunWIN, Reseller Web	76742
References				
– *Sun Product Intro: Sun StorEdge A1000/D1000 Workgroup Storage Arrays, 2/24/98*	Introduction E-mail	Sales Tool	SunWIN, Reseller Web	80987 80988
– *Sun Product Intro: Sun StorEdge A1000 and Sun StorEdge D1000 Arrays, 4/28/98*	Introduction E-mail	Sales Tool	SunWIN, Reseller Web	85159
– *Sun Product Intro: Sun StorEdge A1000 and D1000 Disk Arrays Support 9-GB and 18-GB Drives, 5/19/98*	Introduction E-mail	Sales Tool	SunWIN, Reseller Web	87112
– *Sun Product Intro: Sun StorEdge Expansion Rack and Drive Trays for Sun StorEdge A1000/D1000, 5/19/98*	Introduction E-mail	Sales Tool	SunWIN, Reseller Web	87065
– *Sun Product Intro: Sun StorEdge A1000, D1000, and A3500 Products and Repricing, 11/10/98*	Introduction E-mail	Sales Tool	SunWIN, Reseller Web	95418
Product Literature				
– *Sun StorEdge A1000 Data Sheet*	Two-page Color Data Sheet	Sales Tool	SunWIN, Reseller Web, COMAC	75836 DE807-2
– *Sun StorEdge Product Overview Quick Reference Card*	Sun Product Quick Reference Card	Sales Tool	SunWIN, First Resort, Reseller Web	73691
– *Pocket Guide*		Sales Tool	SunWIN, Reseller Web, COMAC	88967 SE608-0
External Web Site				
– *Sun StorEdge A1000/D1000 Array Information Site*	`http://www.sun.com/storage/A1000`			