Sun StorEdge™ A3500FC Array

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Positioning

Introduction

The Sun StorEdge™ A3500 Fibre Channel array offers a high level of storage density and scalable capacity for Sun's mission-critical enterprise customers, along with very high performance and excellent availability features. Expanding on the highly successful Sun StorEdge A3500 array, the Sun StorEdge A3500FC storage array includes the following features:

- A space-saving, 19-inch rackmount cabinet that facilitates high-density configurations
- Sun StorEdge A3500 Fibre Channel-arbitrated loop (FC-AL) host interface card and RAID Manager (RM) 6.22 software
- FC-AL hub and FC-AL host bus adapter support
- Fibre Channel RAID controller with 256-MB configured cache per controller module, (16 LUN support for PCI systems)
- Installed base upgrades from RSM™2000 and Sun StorEdge A3000 and A3500 arrays
- Controller-based (hardware) RAID with excellent performance, reliability, availability, and serviceability (RAS)
- Flexible, scalable, high-capacity configurations, from 182 GB to 3.2 TB of storage with 18-GB drives; and 364 GB to 6.5 TB of storage using 36-GB drives
- Dual hot-plug RAID controller boards in each controller module, allowing automatic controller failover
- Hot-pluggable disks, power supplies, and cooling systems for additional high availability
- Outstanding RAID 3 and 5 performance with flexible configurations for single or multiple hosts
    - Single-host connection with automatic controller failover
    - Fibre Channel arbitrated loop (FC-AL)
    - Box sharing across two independent Solaris™ Operating Environment hosts
    - Multi-initiator support for Sun Enterprise™ server clusters
- Simple setup and administration using Sun StorEdge RAID Manager command line or graphical user interfaces
- Simultaneous support of RAID levels 0, 1, 1+0, 3, and 5, and global hot spares

Product Family Placement

Customers' storage capacity requirements are growing at an unprecedented rate. In today's data centers, it is not uncommon to have requirements for multiple terabyte storage solutions. The Sun StorEdge A3500FC array, with its 73.5-inch cabinet, provides a high-density storage solution. The maximum capacity exceeds 49 TB, using 36-GB drives and 34 controller modules. The Sun StorEdge A3500FC array offers scalable configurations, with excellent performance and sophisticated availability features.
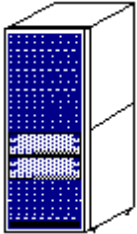
The Sun StorEdge A3500FC array will be sold in addition to the already successful Sun StorEdge A3500 array. Like the Sun StorEdge A3500 array, the Sun StorEdge A3500FC array is a controller-based

(hardware) RAID solution. As such, it provides superior RAID 5 performance and minimal cost for data protection. RAID levels 0, 1, 1+0, and 3 are also supported.

The Sun StorEdge A3500FC array offers sophisticated availability features. Sun StorEdge A3500FC array data availability is 99.999 percent through the use of hot-plug controllers, disks, power, and cooling systems. Hot-plug components allow the system to be serviced while it is still in use. Also, the Sun StorEdge A3500FC array controller provides automatic controller failover. If a controller fails, I/O operations are automatically failed over to the second controller, and users can continue to access their applications and data without any interruption.

The Sun StorEdge A3500FC array can be configured to meet departmental storage requirements and will scale to high-capacity data center requirements. Mission-critical applications—application and file service, database, OLTP, data warehousing, and decision support applications—will benefit from the robust availability features and high performance of the Sun StorEdge A3500FC array.

Sun StorEdge A1000 and D1000 Arrays	Sun StorEdge A3500FC Array	Sun StorEdge A5100/A5200 Array	Sun StorEdge T3 Array
Workgroup	Department to data center	Department to data center	Department to data center
Controller-based RAID (A1000) Host-based RAID (D1000)	Controller-based RAID	Host-based RAID	Controller-based RAID
Solaris Operating Environment, Microsoft Windows NT	Solaris Operating Environment	Solaris Operating Environment, Microsoft Windows NT	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 • Excellent performance for write-intensive applications • High-performance OLTP • Fibre Channel host interface • Excellent 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 10 km distance)	When to sell • Fibre Channel storage networking • Excellent stability for mission-critical data • Fibre Channel host interface • Mission-critical data • Flexible configurations

Sun StorEdge A1000 and D1000 Arrays	Sun StorEdge A3500FC Array	Sun StorEdge A5100/A5200 Array	Sun StorEdge T3 Array
When NOT to sell • Applications requiring more than 291 GB in a single array • Customer requires Fibre Channel today	When NOT to sell • Non-Solaris 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 • Clustering is required

Sun StorEdge A3500FC Array Key Messages

Sun StorEdge A3500FC array is a scalable, high-performance, high-availability solution that uses a 73.5-inch tall expansion cabinet for high-density storage solutions. It leverages existing technologies (Sun StorEdge D1000 array-style disk trays, and 18- or 36-GB, 10000-rpm drives) to provide flexible, scalable, and high-capacity configurations. Designed for high availability, all components are redundant, support automatic failover, and are hot pluggable.

Each Sun StorEdge A3500FC array includes the following:

• One or two 73.5-inch tall Sun StorEdge expansion cabinets, with two power sequencers per cabinet

• One Sun StorEdge A3500FC array controller module, each with two controller boards for automatic failover

• Sun StorEdge RAID Manager software version 6.22 for the Solaris Operating Environment, including the RDAC driver which helps enable controller failover

• Five to fifteen Sun StorEdge D1000 disk trays, each with environmental service module (ESM) boards

• Up to twelve 1-inch, 18-GB, 10000-rpm disks, or 36-GB, 10000-rpm disk drives per tray

Customers can order these basic system configurations:

• 1 x 5 (one controller module, five disk trays) in a single cabinet

• 2 x 7 (2 controller modules, 7 disk trays) in a single cabinet

• 3 x 15 (3 controller modules, 15 disk trays) in dual cabinets

• Choice of fixed configurations or configure-to-order models

There are two fixed configuration X-options, each of which includes one Fibre Channel controller module, five Sun StorEdge D1000 arrays fully loaded with drives, and one Sun StorEdge rack. These fixed configuration x-options are available in a choice of 18-GB or 36-GB disks. Alternatively, the A3500FC can be ordered through a configure-to-order process that follows the same ordering rules as the Sun StorEdge A3500 array. Refer to the Ordering section for details.

By offering more trays and a taller cabinet than the previous generation Sun StorEdge A3000 array, the Sun StorEdge A3500FC array provides a higher density, higher capacity solution. With the larger number of drive trays and controller modules supported, higher capacity is achieved while still offering high performance and reliability. Minimum and maximum capacities for each configuration are as follows:

Configuration	Minimum Capacity	Maximum Capacity
1 x 5, 18-GB drives	182 GB	1092 GB
1 x 5, 36-GB drives	364 GB	2184 GB
2 x 7, 18-GB drives	364 GB	1528 GB
2 x 7, 36-GB drives	728 GB	3057 GB
3 x 15, 18-GB drives	546 GB	3276 GB
3 x 15, 36-GB drives	1092 GB	6552 GB

Building Fibre Channel arbitrated loops with hubs enables even higher capacity storage solutions. In summary, the Sun StorEdge A3500FC array configurations provide high-density storage, offering scalability, high capacity, excellent availability, and high performance in a remarkably small footprint.

Sun StorEdge A3500FC Array Key Features and Benefits

Features	Benefits
• Fibre Channel host connectivity	• Up to 47 MB/sec. data transfer speeds per controller card
	• Up to 500 meters separation between host and storage
• Hub support	• Doubles the amount of storage capacity that can be addressed per server I/O slot
• 256-MB write cache per controller module	• Increases performance in OLTP applications
• 10000-rpm disk drives	• Approximately 25 to 30 percent faster data access in OLTP applications than 7200-rpm disks
• Large capacity configurations	• Nearly 50 TB of storage is supported on a single server
• Controller upgrade kits	• Convert any Sun StorEdge A3000 or A3500 array to FC-AL host interface and protect investment in existing Sun storage
• Higher density 73.5-inch tall expansion cabinet	• Offers scalable, high-capacity configurations in a narrow footprint
• These basic configurations:	• Helps enable scalable capacity, high-performance configurations in a space-saving footprint
– 1 x 5 (1 controller module, 5 disk trays) in a single cabinet	• Allows customer to design a storage solution with plenty of room for future growth
– 2 x 7 (2 controller modules, 7 disk trays) in a single cabinet	
– 3 x 15 (3 controller modules, 15 disk trays) in dual cabinets	
• Controller-based RAID	• Delivers high performance by decreasing CPU drain for I/O processing
	• Dual active controllers provide high bandwidth and automatic failover to the second controller

Features	Benefits
• Sun StorEdge RAID Manager software	• Easy configuration, management and recovery of RAID implementation
	• Simple-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 mission-critical array applications
	• RAID 5 performance multiplies the power of the industry's very popular line of scalable UNIX servers: Sun Enterprise servers, SPARCserver™ and SPARCcenter™ systems
• Dual hot-plug controllers, power supplies/cooling, power sequencers, and hot-plug disks	• Full redundancy provides high availability for a mission-critical data center. If one controller fails, I/O traffic automatically fails over to the other controller. Applications continue to run without interruption.
	• Each controller module power supply can support the power requirements for both controller boards
	• Hot-plug components permit immediate servicing without system down time
• Battery backup for cache memory	• Protects data written to cache for up to three days after a power failure
• UltraSCSI communication between controller boards in controller module	• Improved cache mirroring performance
• UltraSCSI between controller boards and disk trays	• Increased RAID performance
• Environmental service module (ESM) in each disk tray	• Environmental monitoring and reporting for temperature, voltage, fan failure, power supply status, and a complete health check of each disk tray
• Multi-initiator support for Sun Enterprise clusters	• High availability and automatic failover of the host and disk array. Redundancy reduces the frequency and duration of outages.
• Box sharing across independent controllers	• Allows two Solaris Operating Environment hosts to share the same Sun StorEdge A3500FC array data center. Specific controller and LUNs assigned to each host (no controller failover).

Target Markets

The Sun StorEdge A3500FC array is ideal for enterprise customers who need on-line transaction processing data storage for enterprise resource planning applications. The Fibre Channel host interface will help allow these customers to integrate their Sun StorEdge A3500FC arrays into future storage networks. The Sun StorEdge A3500FC offers greater bandwidth performance and increased distance separation over a SCSI interface.

The Sun StorEdge A3500FC array is a hardware-RAID, internal controller, storage subsystem that offers high-performance RAID 5 capabilities. The Sun StorEdge A3500 and A3500FC arrays are Sun's best storage choice for high-performance OLTP-type applications (random I/O) that are heavily used in the financial, retail, health care, and telecommunications industries.

The Sun StorEdge A3500FC array is ideally suited for high capacity and I/O performance requirements in the enterprise and transaction processing markets. A fully configured Sun StorEdge A3500FC rack provides more than 3 TB of storage in footprint a little over 6 square feet.

Market Value Proposition

The Sun StorEdge™ A3500FC array is the latest addition to the product family that includes the Sun StorEdge D1000, A1000, and A3500 disk arrays. Customers can scale from a desktop or workgroup solution in either the Sun StorEdge D1000 JBOD array or a single controller Sun StorEdge A1000 array up to a dual (auto failover) controller Sun StorEdge A3500 or A3500FC array for high-availability, high-performance applications.

The Sun StorEdge A3500FC array is available with a choice of 18- or 36-GB, high-performance, 10000-rpm disk drives. These drives offer outstanding price/performance making the arrays ideal choices for OLTP applications. The 36-GB disks will allow more than 3 TB of storage in a single rack at an excellent cost per MB.

Sun customers who purchase the Sun StorEdge A3500FC array receive a high-availability, high-performance storage subsystem with the RAS features and scalability expected in modern information technology systems.

Enabling Technology

Technology Overview

Fibre Channel technology is the answer to the growing problems of SCSI-based peripherals. Fibre Channel is a high-performance, serial-interconnect standard, designed for bidirectional, point-to-point communications between servers, storage systems, workstations, switches, and hubs. It offers a variety of benefits over other link-level protocols, including efficiency, high performance, scalability, simplicity, easy use, easy installation, and support for popular high-level protocols.

An important enhancement to Fibre Channel has been the development of Fibre Channel arbitrated loop (FC-AL) technology, developed specifically to meet the needs of storage interconnects. Employing a simple loop topology, FC-AL can support both simple configurations and sophisticated arrangements of hubs, switches, servers, and storage systems. Furthermore, by using SCSI protocols over the much faster, more robust Fibre Channel link, FC-AL provides higher levels of performance without requiring expensive and complex changes to existing device drivers and firmware.
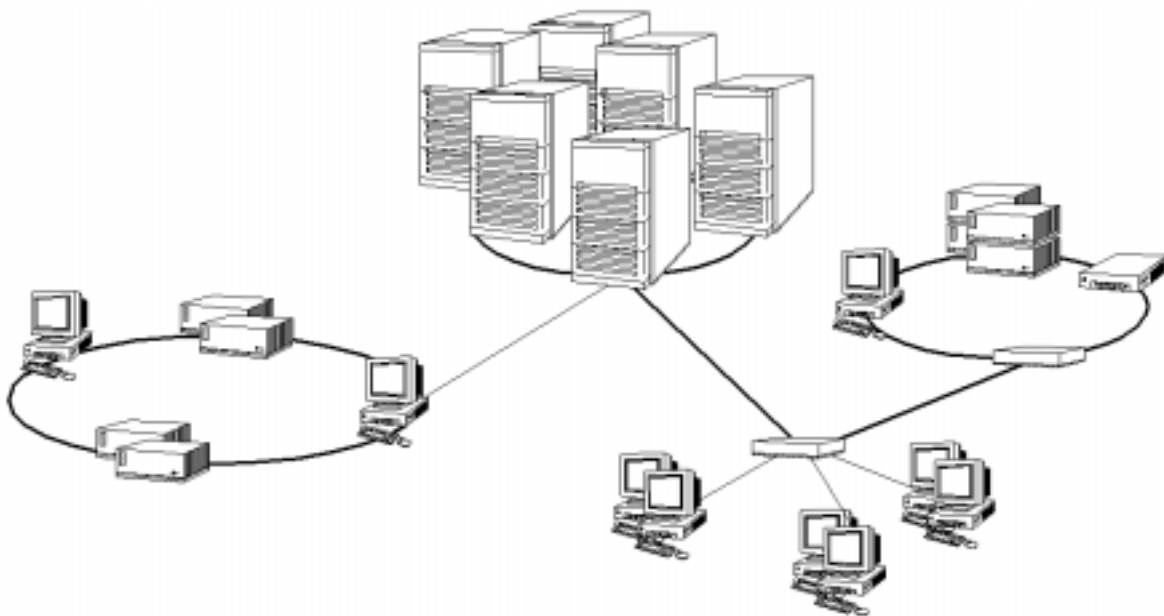
Figure 2. FC-AL's loop topology can support both simple and complex configurations

Impressive Specifications

FC-AL-based storage systems enable the creation of new applications that take full advantage of some impressive specifications:

• **Gigabit bandwidth**—FC-AL is capable of data transfer rates of up to 200 MB/second (full duplex), with 400 MB per second envisioned for the future. This is far faster than SCSI, serial storage architecture, or P1394 (FireWire®).

• **Suitability for networks** —In addition to performance, Fibre Channel is ideal for building storage networks. Employing hubs and switches just like those used in networks, Fibre Channel will allow

complex arrangements of storage and systems to be connected together in highly scalable, highly available networks, or fabrics.

- **Use of existing SCSI protocols**—FC-AL allows SCSI command packets to be sent over a high-speed physical medium, reducing software and firmware costs and minimizing impact on existing software.

- **Node-addressability far better than SCSI**—With the ability to support up to 127 FC-AL devices on a single host adaptor, cost and implementation complexity is greatly reduced. Using optical fiber media, a single FC-AL loop can support nodes with a separation of up to 10 kilometers.

- **Greatly simplified wiring and cabling requirements**—Because Fibre Channel is a simple, largely optical serial protocol, electrical interference and expensive cabling are much less of an issue than with the complex parallel data paths used by SCSI.

  In addition to these features, FC-AL supports redundant data paths, hot-pluggable components, multiple host connections, and dual ported drives—features that 15-year-old SCSI technology was never intended to support. The technical advantages of FC-AL alone would be enough to convince most that it clearly represents the future of high-speed peripheral interconnects, but FC-AL can also provide peace of mind to those who worry about the bottom line.

- **Industry-standard**—The FC-AL development effort is part of the ANSI/ISO accredited SCSI-3 standard, helping to avoid the creation of nonconforming, incompatible implementations.

- **Broadly supported**—Major system vendors are implementing FC-AL, as are all major disk drive and storage subsystem vendors. The Fibre Channel Association, an industry group dedicated to the promotion of Fibre Channel, is a *Who's Who* of systems, subsystems, drive, and component vendors. Such wide support provides competition, lower costs, and user choice.

- **Vastly more flexible**—Fibre Channel can also be used to do more than disk I/O. The Fibre Channel specification supports high-speed system and network interconnects using a wide variety of popular protocols, including HIPPI, TCP/IP, IPPI, FDDI, and ATM, in addition to SCSI. Many of the interconnect requirements of large enterprises may one day be met by Fibre Channel, promising lower costs, easier administration, and the easy deployment and redeployment of computing resources.

The following table shows a number of important technical advantages to Fibre Channel arbitrated loop (FC-AL) technology.

FC-AL Feature	Comparable SCSI Feature	FC-AL Benefits
100 MB/second data rates (burst)	40 MB/second data rates (burst)	Throughput to match modern computing, and peripheral and networking performance
Networking capability	None	Easier, simpler configuration of high-performance computing, file, and storage servers and clusters
Up to 500 meters between nodes using optical fiber	Up to 25-meter differential	More flexible and secure hardware configurations
Hot-plug, dual porting	Hot plug, single porting	Support for high availability and disaster-tolerant configurations, and disk arrays
Use of cyclic redundancy checks to provide data integrity	Same	Better security and reliability
Simple serial protocol over a copper or fiber medium	Parallel over copper	Less expensive, less complex cable requirements
Use of standard protocols like IP and SCSI	Same SCSI protocols	Reduced impact on system software and firmware; leverages existing code

System Architecture Overview

To provide scalable storage solutions, there are three basic Sun StorEdge™ A3500 array configurations with varying numbers of controllers and drive trays. Capacities are shown for 36-GB, 1-inch high, 10000-rpm disk configurations.
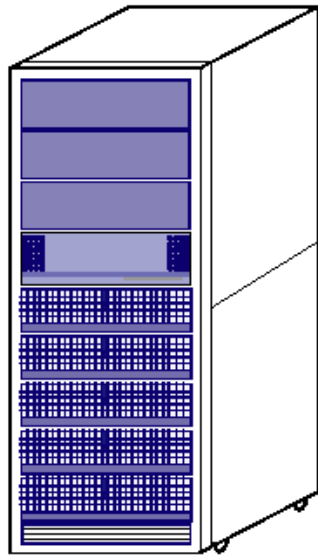
1 x 5 Configuration
Up to 2.1-TB disk capacity
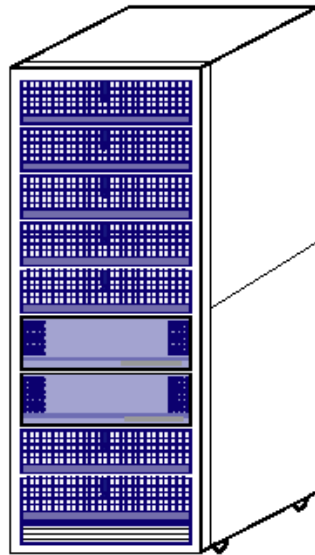
2 x 7 Configuration
Up to 3.0-TB disk capacity
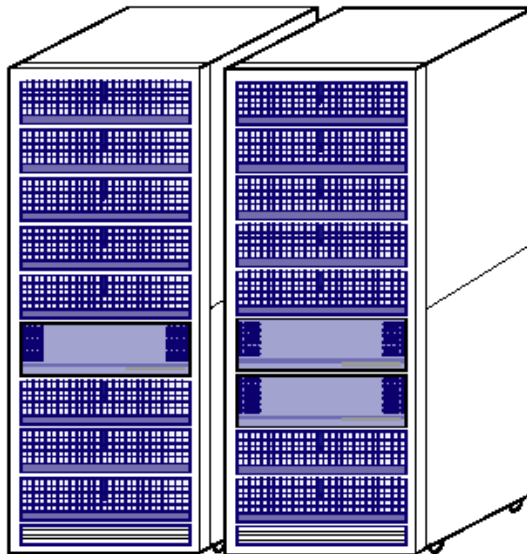
3 x 15 Configuration
Up to 6.5-TB disk capacity

Sun StorEdge A3500FC Array Key Facts

To achieve higher density and higher capacity storage solutions, all Sun StorEdge A3500FC array configurations use the 73.5-inch Sun StorEdge expansion cabinet.

High reliability, availability, and serviceability (RAS) features, including controller failover, RAID support, and redundant components.

- Each Sun StorEdge A3500FC controller module contains two controller boards, two cooling units, two power supplies, and one battery back-up unit.
- The battery back-up unit includes redundant battery cells and charger circuits.
- The disk trays include dual fans and power supplies, and hot-pluggable disks.
- Each expansion cabinet uses two power sequencers, each connecting to separate wall outlets and separate power supplies.

The Sun StorEdge A3500FC array is supported on the Solaris™ 2.6 Operating Environment or later releases with the required system patches. Solaris Operating Environment patches are available on the SunSolve℠ program web site at `http://sunsolve.sun.com`.

Sun StorEdge Expansion Cabinet Key Facts

The 73.5-inch tall Sun StorEdge expansion cabinet is a standard, 19-inch internal width rack. It has room for a maximum of nine components: up to two controllers and seven disk trays. To support the 3 x 15 configuration, a second expansion cabinet is used.

Sun StorEdge Expansion Cabinet Technical Facts

The Sun StorEdge expansion cabinet measures:

- Height: 187.9 cm (73.5 inches)
- Width: 61 cm (24 inches)
- Depth: 93 cm (36.5 inches)
- Internal dimensions conform to EIA RS-310C (RETMA) for 482-mm (19-inch) racks

Each Sun StorEdge expansion cabinet is equipped with two power sequencers to support separate power sources (for example, from separate wall outlets). Two independent 220-volt or 240-volt power sources are required. Each power sequencer is rated at a maximum 5.4 kW.

Sun StorEdge A3500FC Array Controller Module Key Facts

The heart of the Sun StorEdge A3500FC system is an intelligent RAID controller with two active RAID controller boards. There are redundant power supplies, cooling units, and backup batteries within the module.
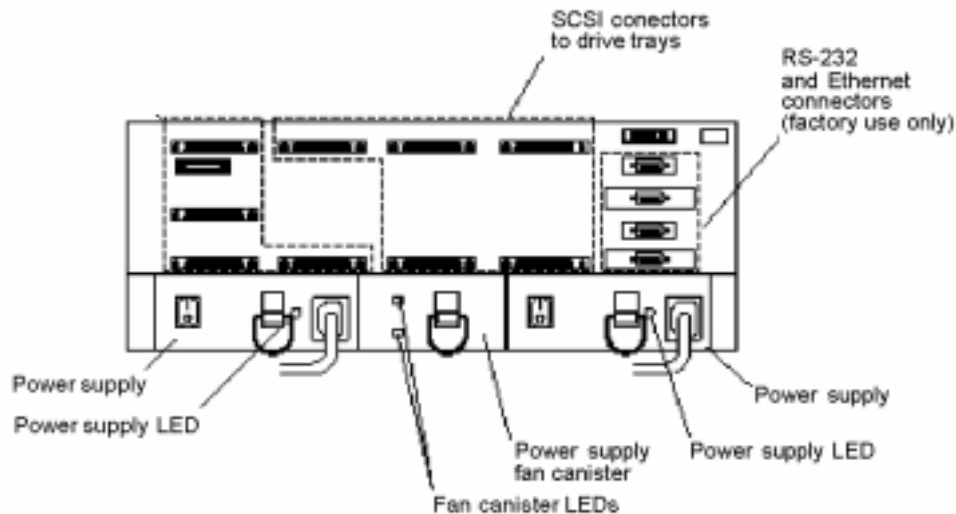
Figure 3. Controller module, rear components
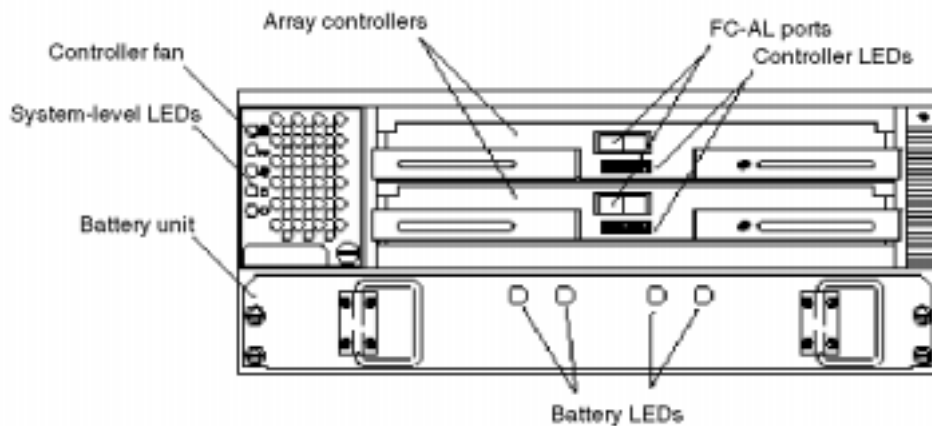
Figure 4. Controller module, front components

Sun StorEdge A3500FC Controller Module Technical Facts

The Sun StorEdge A3500FC intelligent RAID controller module contains the following:

• Two RAID controller boards (see "Sun StorEdge A3500FC Controller Board Key Facts" below).

• One battery backup unit, which provides a minimum three days of power backup for cache memory. The battery module uses redundant batteries and charger circuits. Battery shelf life is rated for two years.

- Two hot-plug power supplies rated at 240 volts, 1.0 amp, and power-factor corrected (PFC). PFC smoothes out input current voltage.
- Redundant rear fans for the power supplies and redundant front fans for the controller boards.
- Five controller module LEDs, indicating module power status, power supply fault, fan fault, controller fault, and fast write cache enabled.

The Sun StorEdge A3500FC controller module contains a backpanel circuit board where the module components interconnect. This module includes the following:

- Two controller boards plug directly into the controller module backpanel, using a 600-pin TBC+ connector for all SCSI and subsystem interconnections.
- Two FC-AL connectors attach to the FC-AL host bus adapters.
- Five drive tray interfaces are contained in each controller module. These are 8- or 16-bit, synchronous or asynchronous, differential UltraSCSI (40 MB/sec.).
- The battery module and power supplies also interface to the backpanel circuit board.

Sun StorEdge A3500FC Controller Board Key Facts

The Sun StorEdge A3500FC controller board includes a 486DX4 100-MHz processor and a 128-MB mirrored data cache.
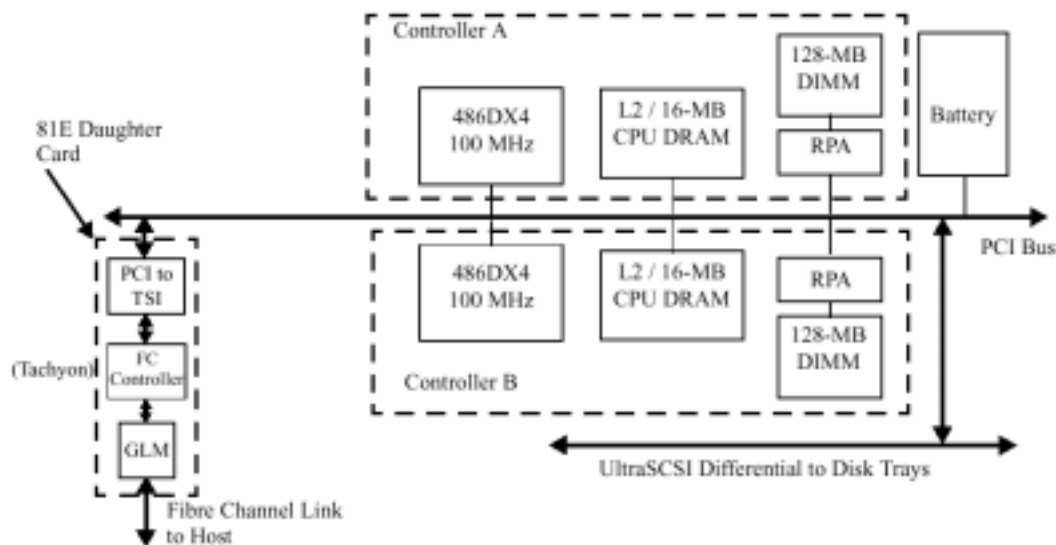
The intelligent Sun StorEdge A3500FC array controllers support RAID 0, 1, 1+0, 3, and 5. The controller microprocessor performs all RAID parity calculations. This improves system performance by reducing the CPU load and I/O traffic between the host and the array.

Disk Tray and Hot-plug Disk Module Key Facts

The disk trays used in the Sun StorEdge A3500FC subsystem are the same as those used in the Sun StorEdge D1000 arrays. In the Sun StorEdge A3500FC array, the trays are populated with either 18- or 36-GB, 10000-rpm disks. The disk trays are easily serviceable, with hot-plug disk modules and hot-plug redundant power and cooling.

Disk Tray and Hot-plug Disk Module Technical Facts

• All drives are 10000 rpm, either the 1-inch, 18- or 36-GB disks.

• Each tray holds a maximum of twelve 1-inch, 18- or 36-GB disks. These are the same disk trays as those used in the Sun StorEdge D1000 arrays.

• 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 (ESM) board at the rear of the disk tray enables the host system to obtain environmental status information over the SCSI bus. The ESM board also provides status and control information for individual drive faults back to the host system.

Sun StorEdge A3500FC Array Configuration	Disk and Tray Configurations	# of Disks per System	Total Capacity
1 x 5	18 GB, minimum	10 disks	182 GB
	18 GB, maximum	60 disks	1092 GB
	36 GB, minimum	10 disks	364 GB
	36 GB, maximum	60 disks	2184 GB
2 x 7	18 GB, minimum	20 disks	364 GB
	18 GB, maximum	84 disks	1528 GB
	36 GB, minimum	20 disks	728 GB
	36 GB, maximum	84 disks	3057 GB
3 x 15	18 GB, minimum	30 disks	546 GB
	18 GB, maximum	180 disks	3276 GB
	36 GB, minimum	30 disks	1092 GB
	36 GB, maximum	180 disks	6552 GB

• An "Option" switch on the drive tray determines whether all disks in the tray reside on a single bus or whether the "split bus" option is used. The 2 x 7 configurations include three trays in the split bus configuration, with the drives in a single tray logically divided between two busses.

Drive tray in "split bus" configuration (12 drives per tray shown)
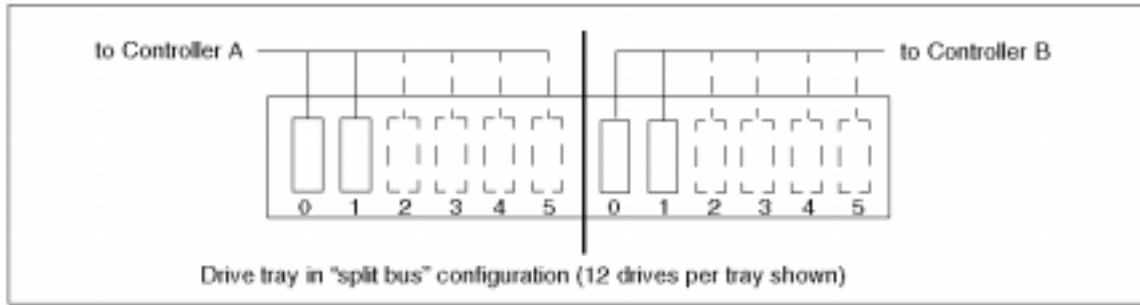
The split bus tray permits the definition of RAID 5 LUNs that span across five trays. In the minimum 2 x 7 configuration, the three split bus trays are each populated with four drives, while the other four trays contain two drives each, for a total of 20 drives. In the case of the minimum 2 x 7 configuration, the split bus tray allows the default LUN configuration to include two 4+1 RAID 5 LUNs, one per controller. (See the default LUN configurations under the discussion of the Sun StorEdge RAID Manager, and also the configuration information in the *Sun StorEdge A3500FC Hardware Configuration Guide, 805-4981-10*.)

FC-AL Seven-port Hub

The FC-AL hub supplied as an option is a seven-port device which simplifies the cabling of arrays. Each slot can hold one GBIC optical module, up to a total of seven. Hubs can be mounted in a Sun StorEdge A3500FC array with a 1 x 5 configuration. The 2 x 7 and 3 x 15 configurations have no space available for mounting hubs. Up to four Sun StorEdge A3500FC arrays are supported per hub pair.
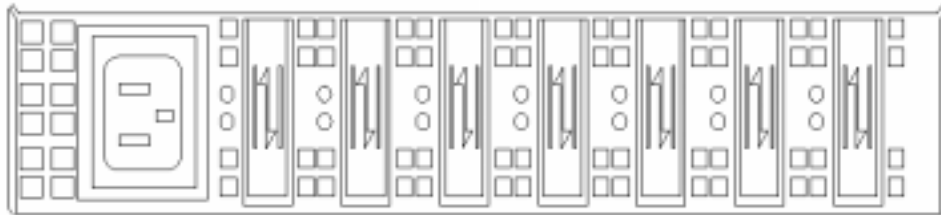
Figure 5. FC-AL seven-port hub

FC-AL SBus Host Adapter

The FC-AL SBus host adapter for the Sun StorEdge A3500FC system is a dual-channel, 100-MB/second SBus card, which includes one GBIC optical module. Installation of a second GBIC is not supported.
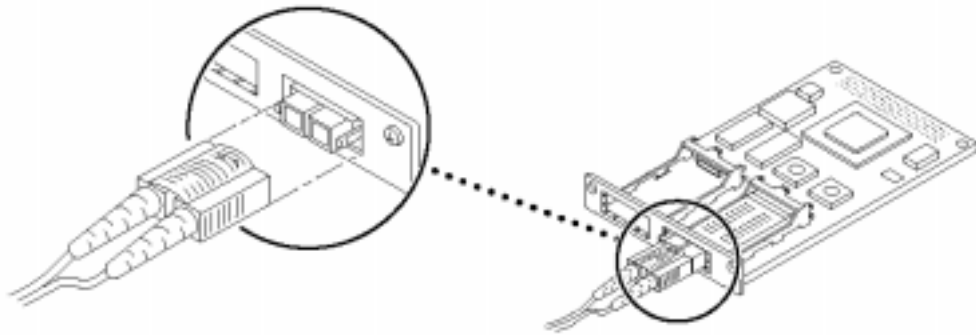
Figure 6. FC-AL SBus host adapter

GBIC

The gigabit interface converter (GBIC) for the Sun StorEdge A3500FC array converts FC-AL electrical signals to optical signals for connecting fiber optic cables. It is a hot-plug device supported on the hub.
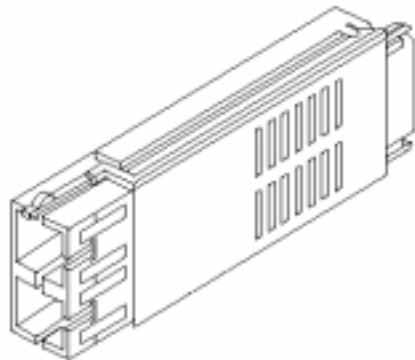
Figure 7. Gigabit interface converter (GBIC)

Host Bus Adapter Key Facts

- For SBus-based hosts—FC-AL 100 MB per second, dual-channel, SBus host adapter with one GBIC module (X6730A)
- For PCI-based hosts—PCI FC-AL, single-loop host adapter, 100 MB/second optical interface (X6729A)

Requirements and Configuration

Operating Environment

- Solaris™ 7 Operating Environment
- Solaris 2.6 Operating Environment

Solaris Operating Environment patches are available on the SunSolve℠ program web site at `http://sunsolve.sun.com.`

Sun StorEdge™ A3500FC Array Configuration Guidelines

The Sun StorEdge™ A3500FC array is supported on the following host platforms.

Platform	Maximum Number of A3500FC Controller Modules Direct/Hub	Maximum Capacity 18-GB, and 36-GB Disks	
		Direct	Hub
Sun Enterprise™ 10000 server	21/34	22,932 GB/ 45,864 GB	37,128 GB/74,256 GB
Sun Enterprise 6X00 server	21/34	22,932 GB/ 45,864 GB	37,128 GB/74,256 GB
Sun Enterprise 5X00 server	10/34	10,920 GB/21,840 GB	37,128 GB/74,256 GB
Sun Enterprise 4X00 server	10/34	10,920 GB/21,840 GB	37,128 GB/74,256 GB
Sun Enterprise 3500 server	6/24	6,552 GB/13,140 GB	26,208 GB/52,416 GB
Sun Enterprise 3000 server	4/16	4,368 GB/8,736 GB	17,472 GB/34,944 GB
Sun Enterprise 450 server	3/12	3,276 GB/6,552 GB	13,104 GB/26,208 GB
Sun Enterprise 250 server	2/8	2,184 GB/4,368 GB	8,736 GB/17,472 GB
Sun Enterprise 420 server	2/8	2,184 GB/4,368 GB	8,736 GB/17,472 GB
Sun Enterprise 220 server	2/8	2,184 GB/4,368 GB	8,736 GB/17,472 GB
Ultra™ 80 workstation	2/8	2,184 GB/4,368 GB	8,736 GB/17,472 GB
Ultra 60 workstation	2/8	2,184 GB/4,368 GB	8,736 GB/17,472 GB

Supported Host Configurations

The Sun StorEdge A3500FC array is supported in these configurations:

- Single host with one controller module
- Single host with up to four controller modules using hubs
- Box sharing—independent controller
- Multi-initiator

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Refer also to the *Sun StorEdge A3500FC Hardware Configuration Guide*. This guide contains detailed information about correct Sun StorEdge A3500FC SCSI cabling, SCSI bus termination requirements, and power sequencing for each of these configurations.

Single Host with One Controller Module
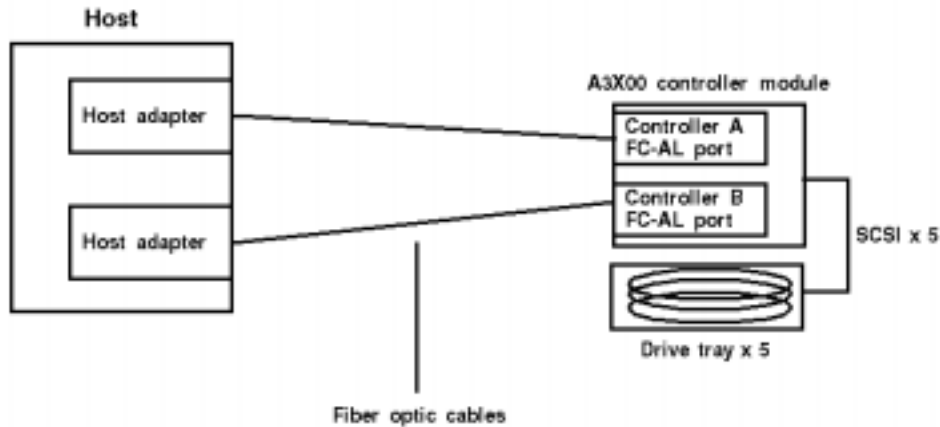
This is the basic configuration. Each Sun StorEdge A3500FC controller module interfaces to the host via two FC-AL host bus adapters. Order two host bus adapters for each controller module in the Sun StorEdge A3500FC array (that is, order two adapters for a 1 x 5 configuration, four for a 2 x 7 configuration, and six for a 3 x 15 configuration).

Single Host with up to Four Controller Modules
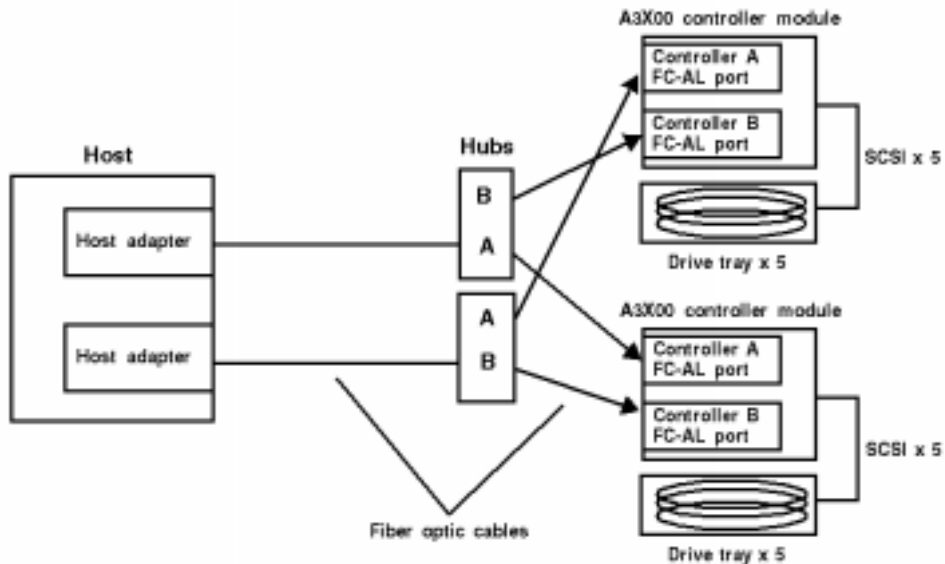
One host with two hubs can be connected through fiber optic cables to up to four controller modules. Controller modules can be connected in the same or separate cabinets.

Each controller module that is connected to a hub must have a unique LOOP ID. Therefore, when adding a second controller to a hub, make sure that the LOOP ID of the controller being connected is different from the LOOP ID of any other controller currently connected to the same hub.

Ensure that the controller module IDs are set so that each hub is connected to A and B controller canisters.

Multi-initiator Clustering with up to Four Controller Modules
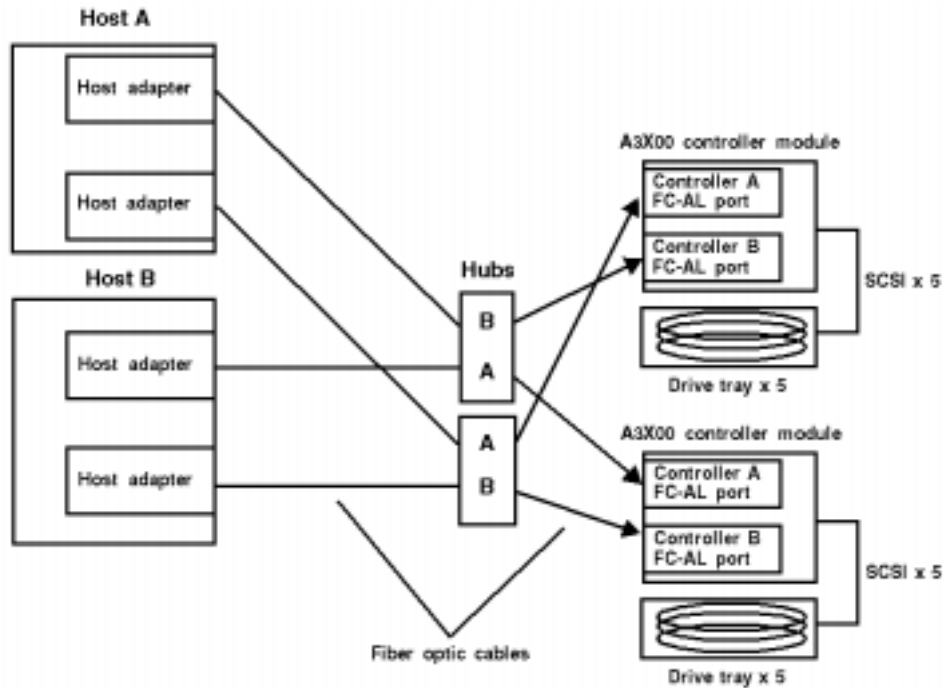
Two hosts with two hubs can be connected through fiber optic cables to up to four controller modules. Controller modules can be connected in the same or separate cabinets.

Each controller that is connected to a hub must have a unique LOOP ID. Therefore, when adding a second controller to a hub, make sure that the LOOP ID of the controller being connected is different from the LOOP ID of any other controller currently connected to the same hub.

Ensure that the controller module IDs are set so that each hub is connected to A and B controller canisters.

Sun Enterprise server clusters and the Sun StorEdge A3500FC array in a multi-initiator configuration can provide a robust, high-availability, clustered solution. Two cluster nodes are attached to the same controller module in the Sun StorEdge A3500FC disk array. The nodes share access to the controllers as well as to the LUNs assigned to the controllers. With the multi-initiator cluster configuration, both host and controller failover are supported.

Dual Hosts with One Controller Module
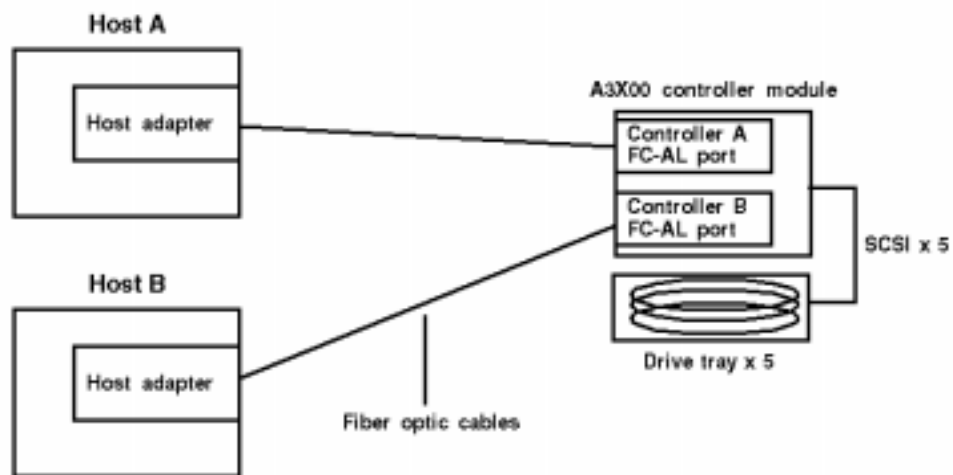
Dual hosts can be directly connected to one Sun StorEdge A3500FC controller module. The hosts can share the storage box where each host is assigned dedicated disks without failover. Alternatively, multi-initiator clustering can be installed for high availability.

Sun StorEdge™ RAID Manager Key Facts

The Sun StorEdge™ RAID Manager software includes both graphical and command line interfaces for configuring, monitoring, and maintenance/tuning of the RAID configuration. For the Sun StorEdge A3500FC array, version 6.2.2 or above is required. Included with the RAID Manager software is the redundant dual active controller (RDAC) driver, which enables automatic controller failover.

The graphical user interface (GUI) of the Sun StorEdge RAID Manager software displays this menu.
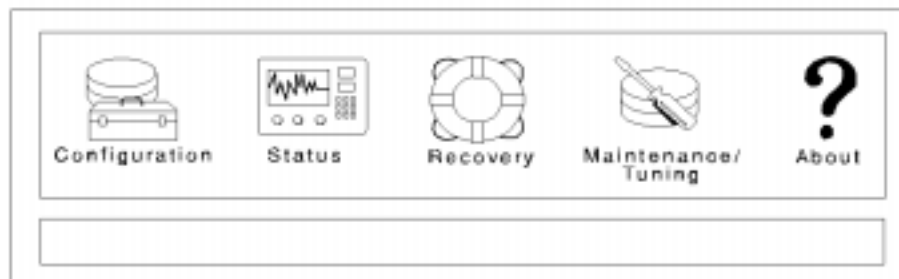
Application	Functions
• Configuration Application	• Design flexible RAID configurations
	• Locate a drive group
	• Create logical units (LUNs) and hot spares from unassigned drives
	• Add LUNs to an existing drive group
	• Delete LUNs in a drive group or a hot spare drive
	• Modify drive group/LUN
	• RAID-level migration
	• Dynamic drive group capacity expansion
	• Dynamic segment size
	• Drive group defragmentation
• Status Application	• Real-time view of log files with system information about failures and system events
	• Manage error log file
	• View the status of LUN reconstructions or change the LUN reconstruction rate
	• Performance Monitor
	• Monitor and display controller performance data

Application	**Functions**
• 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 including failing, reconstructing, and reviving drives, formatting and reviving LUNs, and changing the status of controllers
	• Automatic LUN reconstruction
	• Recovery Guru and health check
• 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
	• Set controller mode to active/active
• About	• Software version information

Sun StorEdge RAID Manager Technical Facts

- The Sun StorEdge RAID Manager software includes both graphical and command line interfaces for configuring and managing the RAID configurations.

- The Sun StorEdge RAID Manager software also includes the redundant dual active controller (RDAC) driver, a kernel-level driver that manages automatic controller failover. The RDAC driver sits logically above the SCSI driver in the Solaris™ Operating Environment kernel, and automatically re-routes active I/So to the remaining controller when a controller failure occurs.

- 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 the Solaris 2.6 Operating Environment (Hardware: 5/98), each SCSI device driver can support a maximum of 32 LUNs, each capable of supporting seven partitions. For the Sun StorEdge A3500FC array, the Sun StorEdge RAID Manager software supports a maximum of 16 LUNs on PCI or 32 LUNs on SBus.

- A drive group is a logical grouping of drives. Drive groups are renumbered automatically on the next reconfiguration boot after configuration changes.

- Sun StorEdge RAID Manager software uses the standard device code (cX tY dZ s0)

  - cX = host bus adapter with a maximum of 32 LUNS per host bus adapter and two daisy-chained RAID controller modules.

  - tY = the controller SCSI target ID.

  - dZ = the LUN

  - s0 = slice number. With Sun StorEdge RAID Manager, the slice number is always "0."

- The RAID Manager software 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:

  - Write caching—Data can be written from the host to the controller's cache by enabling Write Caching. 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.

  - Write cache mirroring—When enabled, cached data is written to the cache memory of both controllers so that when a controller fails, the second controller completes all outstanding write operations.

  - Cache without batteries—Users can enable write caching when the batteries are discharged.

  - Fast writes to the data cache are enabled by default.

- Manual load balancing is provided to enable an administrator to balance the I/O load between controllers and improve overall system performance.

- The Recovery Guru in the RAID Manager software 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™ software (SunNet Manager™ software) and Sun™ Management Center software.

- RAID Manager enables on-line rollover upgrades of the controller firmware. All LUNs are rolled over to one controller, the revision of the firmware is downloaded to the idle controller, and then the LUNs are rolled back

- The Sun StorEdge A3500FC array comes pre-configured with default LUN configurations, which may be reconfigured to match the customer's specific requirements. In multiple controller configurations, the LUNS are divided evenly among the controllers to balance system performance. The following LUN configurations are the factory defaults:

Sun StorEdge A3500FC Configuration	Disk Type and Configuration	Factory Default LUN Configurations (*# of LUN* x *LUN type = # disks used*)
1 x 5	18-GB minimum configuration	1 x (4+1) = 5 (RAID 5) 1 x (2+2) = 4 (RAID 0+1) 1 x GHS (global host spare) = 1 (GHS)
1 x 5	36-GB minimum configuration	1 x (4+1) = 5 (RAID 5) 1 x (2+2) = 4 (RAID 0+1) 1 x GHS (global host spare) = 1 (GHS)
1 x 5	18-GB maximum configuration	5 x (4+1) = 25 (RAID 5) 3x (5+5) = 30 (RAID 0+1) 5x GHS (global host spare) = 5 (GHS)
1 x 5	36-GB maximum configuration	5 x (4+1) = 25 (RAID 5) 3x (5+5) = 30 (RAID 0+1) 5x GHS (global host spare) = 5 (GHS)

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Sun StorEdge A3500FC Configuration	Disk Type and Configuration	Factory Default LUN Configurations (*# of LUN* x *LUN type = # disks used*)
2 x 7	18-GB minimum configuration	2 x (4+1) = 10 (RAID 5) 2 x (2+2) = 8 (RAID 0+1) 2 x GHS (global host spare) = 2 (GHS)
2 x 7	36-GB minimum configuration	2 x (4+1) = 10 (RAID 5) 2 x (2+2) = 8 (RAID 0+1) 2 x GHS (global host spare) = 2 (GHS)
2 x 7	18-GB maximum configuration	12 x (4+1) = 60 (RAID 5) 2 x (3+3) = 12 (RAID 0+1) 2 x (2+2) = 8 (RAID 0+1) 4 x GHS (global host spare) = 4 (GHS)
2 x 7	36-GB maximum configuration	12 x (4+1) = 60 (RAID 5) 2 x (3+3) = 12 (RAID 0+1) 2 x (2+2) = 8 (RAID 0+1) 4 x GHS (global host spare) = 4 (GHS)
3 x 15	18-GB minimum configuration	3 x (4+1) = 15 (RAID 5) 3 x (2+2) = 12 (RAID 0+1) 3 x GHS (global host spare) = 3 (GHS)
3 x 15	36-GB minimum configuration	3 x (4+1) = 15 (RAID 5) 3 x (2+2) = 12 (RAID 0+1) 3 x GHS (global host spare) = 3 (GHS)
3 x 15	18-GB maximum configuration	15 x (4+1) = 75 (RAID 5) 9 x (5+5) = 90 (RAID 0+1) 15 x GHS (global host spare) = 15 (GHS)
3 x 15	36-GB maximum configuration	15 x (4+1) = 75 (RAID 5) 9 x (5+5) = 90 (RAID 0+1) 15 x GHS (global host spare) = 15 (GHS)

Sun StorEdge A3500FC Array Software Requirements

Solaris 2.6 or 7 Operating Environment is required with any necessary operating system patches. Solaris Operating Environment patches are available on the SunSolve℠ database web site at `http://sunsolve.sun.com`.

Sun StorEdge RAID Manager 6.22 software is also required.

Alternate Pathing/Dynamic Reconfiguration Support

The Sun StorEdge RAID Manager software allows the Sun StorEdge A3500FC array to be mapped from one Sun Enterprise™ 10000 server domain to another without requiring a domain reboot. (RAID Manager 6.22 software has an enhanced RDAC that checks for added devices.)

The Solaris 2.6 Operating Environment adds alternate pathing support for disk and network controllers in Sun Enterprise servers (Sun Enterprise 3X00, 4X00, 5X00, and 6X00 servers). Since the Sun StorEdge A3500FC array already includes controller failover functionality, alternate pathing and dynamic reconfiguration in the Solaris 2.6 Operating Environment should not be used with the Sun StorEdge A3500FC array on the Sun Enterprise 3X00, 4X00, 5X00, and 6X00 servers.

Other Supported Software

- VERITAS Volume Manager software versions 2.6 and 3.0.2
- Sun StorEdge Instant Image 1.0 software
- Sun™ Cluster 2.2 software

VERITAS Volume Manager (VxVM) Software Support

The VERITAS Volume Manager (VxVM) software, formerly known as Sun StorEdge Volume Manager™ software, is supported with the Sun StorEdge A3500FC array. However, certain cautions apply:

- **Installation**

  Installation is a very sensitive process. Sun StorEdge A3500FC array installation procedures must be followed exactly as documented in the Sun StorEdge A3500FC array Product Release Notes, the Sun StorEdge A3500FC System Manual, and the Sun StorEdge RAID Manager manual.

- **Installation guide**

  Deviation from the following sequence will likely cause incompatibility between Sun StorEdge A3500FC array and VxVM software.

  VxVM software should be installed only after the following steps have been completed:

  1. Sun StorEdge A3500FC array hardware is properly installed and connected to the host.

  2. Sun StorEdge A3500FC array software is properly installed.

  3. Sun StorEdge A3500FC array devices (LUNs) are properly configured using RAID Manager software.

  4. The host system is rebooted using the -r option. On reboot the RAID Manager software must recognize the configured LUNs and create the appropriate device nodes.

     It is also important to modify startup scripts as necessary to help ensure that Sun StorEdge A3500FC array daemons are invoked prior to VxVM software.

- **Device naming**

  Sun StorEdge A3500FC array device (LUN) entries in /etc/vfstab which will be encapsulated using VxVM software must use the standard Solaris Operating Environment device names (for example, /dev/rdsk/c3t4d0s0). Do not use the device names generated by the Sun StorEdge RAID Manager software (for example, /dev/rRAID_module01/0s0).

- **Controller error recovery**

  Follow Sun StorEdge A3500FC array controller error recovery procedures in the documentation. Failure to do so will result in an incompatibility with VxVM software.

- **Configuration**

  Building VxVM RAID 5 volumes from Sun StorEdge A3500FC array devices (LUNs) is not recommended, and in particular from Sun StorEdge A3500FC 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 A3500FC array), or it may be implemented in software on the host. The advantages of each method are described below.

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 A3500FC array, an intelligent cache controller does all the multi-stripe 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, which increases bus traffic and impacts 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 A3500FC array is a controller-based FC-AL (hardware) RAID subsystem that enables users to achieve the ideal balance of high data availability, performance, capacity, and cost. Furthermore the Sun StorEdge RAID Manager software makes it easy for users to configure, monitor, or reconstruct array configurations while the system is operating.

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 • High 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 software actually implements RAID 5, eliminating the typical RAID 3 bottleneck of parity information being written to a single disk

RAID Level	Characteristics
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

High Availability (HA) with Sun StorEdge A3500FC Array RAID Implementations

Features

- Independent disks, plus RAID levels 0, 1, 1+0, 3, and 5 are all available at the same time within the same array

- RAID groups may span multiple arrays

- RAID levels 5, 1, and 1+0 yield predicted steady-state uptimes in excess of 99.999 percent per array and mean time between data loss (MTBDL) in the millions of hours.

- Hot spares are automatically swapped in to replace any failed disk in a RAID 5, RAID 1, or RAID 1+0 group

- RAID stripe sizes are adjustable to optimize for random or sequential I/O patterns.

Benefits

- Can easily match data layouts to meet users' specific requirements for capacity, performance, high availability, and cost

- Greater flexibility; allows creation of fully redundant configurations

- High availability, so customers can be confident that data will be available when needed and that it will not be lost

- Continuous redundant data protection even if a disk fails; maintenance can be deferred for days, weeks, or even months when needed

- Users can tune performance for their specific applications

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 software 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.

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- 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 to 16 KB, a stripe width of 2 KB may be best.

System Specifications

RAID 5 Performance (3 x 15 Configuration, 12 x 18-GB drives/tray, 4+1 RAID 5 LUNs, 12 LUNs)

Sequential Read	220 MB/sec.
Sequential Write	127 MB/sec.
Random Writes 2-KB Block Size	16,452 IOPS
Random Writes, 2-KB Block Size	4,203 IOPS
Random Reads, 2-KB Block Size	15,264 IOPS

Sun StorEdge™ A3500FC Array Drive Module Performance

Drive Specifications	18 GB, 10000 rpm	36 GB, 10000 rpm
Capacity (formatted, in bytes)	18,113,808,384 (512 bytes/sector)	36,420,074,496 (512 bytes/sector)
Average Seek Read (ms)	7.5	7.5
Average Seek Write (ms)	8.5	8.5
Average Latency (ms)	3.0	3.0
Burst Data Rate (MB/sec.)	40	40
Data Transfer Rate (MB/sec.)	22.7	19
Rotational Speed (rpm)	10000	10000
Buffer (KB)	512	512

Sun StorEdge A3500FC Array System Electrical Specifications (2 x 7 configuration with 20 x 18.2-GB drives)

Input Voltage	200–240 VAC, single-phase 50–60 Hz
Input Current	24 Amps (PDU rating)
Power Output	1390 Watts (see chart below for other configurations)
VA	~1544 VA
Heat Output	4744 BTU (see chart below for other configurations)
Plug Type—U.S.	NEMA L6-30P for 200–240 VAC
Plug Type—International	IEC 309, 32A, 250V

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Sun StorEdge A3500FC Controller Module Electrical Specifications

Input Voltage	200–240 VAC 50/60 Hz
Input Current	1.0 Amp
Power Output	214 watts
VA	238 VA
Heat Output	731 BTU

Sun StorEdge A3500FC 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 A3500FC Array Heat Output and Power Consumption

Configurations	30 Degrees C*	40 Degrees C*
1 x 5, 18 GB minimum	2206 BTU (646 W)	2709 BTU (794 W)
1 x 5, 36 GB minimum	2206 BTU (646 W)	2709 BTU (794 W)
1 x 5, 18 GB maximum	6472 BTU (1896 W)	6975 BTU (2044 W)
1 x 5, 36 GB maximum	6472 BTU (1896 W)	6975 BTU (2044 W)
2 x 7, 18 GB minimum	4039 BTU (1183 W)	4744 BTU (1390 W)
2 x 7, 36 GB minimum	4039 BTU (1183 W)	4744 BTU (1390 W)
2 x 7, 18 GB maximum	9500 BTU (2783 W)	10204 BTU (2990 W)
2 x 7, 36 GB maximum	9500 BTU (2783 W)	10204 BTU (2990 W)
3 x 15, 18 GB minimum	6618 BTU (1939 W)	8126 BTU (2381 W)
3 x 15, 36 GB minimum	6618 BTU (1939 W)	8126 BTU (2381 W)
3 x 15, 18 GB maximum	19417 BTU (5689 W)	20925 BTU (6131 W)
3 x 15, 36 GB maximum	19417 BTU (5689 W)	20925 BTU (6131 W)

Note: *The temperature-dependent power difference is due to the variable speed fans in the Sun StorEdge A3500FC array tray. The temperatures of 30 and 40 degrees Centigrade refer to the air flow temperature passing through the Sun StorEdge A3500FC array fan.*

Sun StorEdge A3500FC Array Environmental Specifications

Temperature Range (dry bulb)	
Operating	5 to 35 degrees C (41 to 95 degrees F), 10 to 32 degrees C (50 to 90 degrees F) if removable tape media is installed in the Sun StorEdge A3500FC array cabinet
Non-operating	-10 to 60 degrees C (-14 to 140 degrees F)
Relative Humidity	
Operating	20% to 80% RH @ 27 C, maximum wet bulb non-condensing
Non-operating	93% RH non-condensing
Altitude	
Operating	-30 m to 3 km (-100 to 10,000 feet)
Non-operating	-30 m to 3 km (-100 to 10,000 feet)

Sun StorEdge A3500FC System Physical Specifications

Height	187.9 cm / 73.5 in.
Width (single rack)	61 cm / 24 in.
Depth (single rack)	93 cm / 36.5 in.
Weight (rack and 2 sequencers)	159 kg / 350 lb.
Clearance and Service Area	
• Front	122 cm / 48 in.
• Back	92 cm / 36 in.
Sides (side access required for some service procedure)	92 cm / 36 in.

Controller (with Bezel) Physical Specifications

Height	176.3 mm / 6.94 in.
Width	445 mm / 17.50 in.
Depth	609.6 mm / 24.00 in.
Weight	
• Enclosure	13.6 kg / 30 lb.
• Controller module	37.2 kg / 82 lb.
• Power supply	1.5 kg / 3.3 lb.
• Fan	0.9 kg / 2.0 lb.
• Battery	10.9 kg / 24 lb.
• One controller board	2.9 kg / 6.5 lb.

Disk Tray Physical Specifications

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

Sun StorEdge A3500FC Array System Regulation

System Regulation	Specifications
Safety	UL1950, CSA C22 No.950 EN60950 (TUV) CB Scheme (to IEC 950 and Nordic deviations)
RFI/EMI	VCCI Class 1 FCC Class A DOC Class A EN55022 Class A EN61000-3-2
Immunity	EN50082-1 Sun Specification 990-1151-xx
Product Label	FCC Class A VCCI Class 1 Industry Canada Class A UL Mark cUL Mark TUV Mark CE Mark

Ordering Information

Configurations

There are two fixed configuration X-options available for the Sun StorEdge™ A3500FC array. Each of these includes one Fibre Channel controller module, five Sun StorEdge D1000 arrays fully loaded with drives, and one Sun StorEdge rack. These fixed configuration X-options are available in a choice of 18-GB or 36-GB disks. Alternatively, the Sun StorEdge A3500FC array can be ordered through a configure-to-order process that follows the same ordering rules as the Sun StorEdge A3500 array.

The Sun StorEdge A3500FC array can be configured with one controller module and five Sun StorEdge D1000 arrays, two controller module and seven Sun StorEdge D1000 arrays, or three controller modules and fifteen Sun StorEdge D1000 arrays. The Light configuration, with one Sun StorEdge A3500FC controller module with two Sun StorEdge D1000 arrays, will not be a supported configuration.

Sun StorEdge A3500FC Array, 18-GB, 10000-rpm Disk Configurations

Order Number	Description
SG-XARY380B-1092G	1092-GB Sun StorEdge A3500FC array fixed configuration including one FC-AL controller module, five disk trays with 60 x 18-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet with two 15-meter fiber optic cables
SG-ARY380A-182G	182-GB Sun StorEdge A3500 array configure-to-order base configuration including five disk trays with 10 x 18-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet
SG-ARY382A-364G	364-GB Sun StorEdge A3500 array configure-to-order base configuration including seven disk trays with 20 x 18-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet
SG-ARY384A-546G	546-GB Sun StorEdge A3500 array configure-to-order base configuration including fifteen disk trays with 30 x 18-GB, 10000-rpm disks mounted in two Sun StorEdge 72-inch expansion cabinets

Sun StorEdge A3500FC Array, 36-GB, 10000-rpm Disk Configurations

Order Number	Description
SG-XARY390B-2184G	2184-GB Sun StorEdge A3500FC array fixed configuration including one FC-AL controller module, five disk trays with 60 x 36-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet with two 15-meter fiber optic cables

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Order Number	Description
SG-ARY391A-364G	364-GB Sun StorEdge A3500 array configure-to-order base configuration including five disk trays with 10 x 36-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet
SG-ARY393A-728G	728-GB Sun StorEdge A3500 array configure-to-order base configuration including seven disk trays with 20 x 36-GB, 10000-rpm disks mounted in one Sun StorEdge 72-inch expansion cabinet
SG-ARY395A-1092G	1092-GB Sun StorEdge A3500 array configure-to-order base configuration including fifteen disk trays with 30 x 36-GB, 10000-rpm disks mounted in two Sun StorEdge 72-inch expansion cabinets

Sun StorEdge A3500 Array, Configurations for the Sun Enterprise™ 10000 Server

The array part numbers in this section are specifically configured for the Sun Enterprise™ 10000 server. These are preconfigured and pretested with the server prior to delivery. All configurations are factory installed only.

Sun StorEdge A3500FC Array, 18-GB, 10000-rpm Disk Configurations for the Sun Enterprise 10000 Server

Order Number	Description
SG-ARY380B4-182G	182-GB Sun StorEdge A3500FC array includes one FC-AL controller module and five disk trays with 10 x 18-GB, 10000-rpm disks (minimum configuration, 1 x 5 x 18-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with two 15-meter fiber optic cables
SG-ARY380B4-1092G	1092-GB Sun StorEdge A3500FC array includes one FC-AL controller module and five disk trays with 60 x 18-GB, 10000-rpm disks (maximum configuration, 1 x 5 x 18-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with two 15-meter fiber optic cables
SG-ARY382B4-364G	364-GB Sun StorEdge A3500FC array includes two FC-AL controller modules and seven disk trays with 20 x 18-GB, 10000-rpm disks (minimum configuration, 2 x 7 x 18-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with four 15-meter fiber optic cables
SG-ARY384B4-546G	546-GB Sun StorEdge A3500FC array includes three FC-AL controller modules and fifteen disk trays with 30 x 18-GB, 10000-rpm disks (minimum configuration, 3 x 15 x 18-GB disks) mounted in two Sun StorEdge 72-inch expansion cabinets with six 15-meter fiber optic cables

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Sun StorEdge A3500FC Array, 36-GB, 10000-rpm Disk Configurations for the Sun Enterprise 10000 Server

Order Number	Description
SG-ARY391B4-364G	364-GB Sun StorEdge A3500FC array includes one FC-AL controller module and five disk trays with 10 x 36-GB, 10000-rpm disks (minimum configuration, 1 x 5 x 36-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with two 15-meter fiber optic cables
SG-ARY390B4-2184G	2184-GB Sun StorEdge A3500FC array includes one FC-AL controller module and five disk trays with 60 x 36-GB, 10000-rpm disks (maximum configuration, 1 x 5 x 36-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with two 15-meter fiber optic cables
SG-ARY393B4-728G	728-GB Sun StorEdge A3500FC array includes two FC-AL controller modules and seven disk trays with 20 x 36-GB, 10000-rpm disks (minimum configuration, 2 x 7 x 36-GB disks) mounted in one Sun StorEdge 72-inch expansion cabinet with four 15-meter fiber optic cables
SG-ARY395B4-1092G	1092-GB Sun StorEdge A3500FC array includes three FC-AL controller modules and fifteen disk trays with 30 x 36-GB, 10000-rpm disks (minimum configuration, 3 x 15 x 36-GB disks) mounted in two Sun StorEdge 72-inch expansion cabinets with six 15-meter fiber optic cables

Ordering Process—Sun StorEdge A3500FC Array, Fixed Configurations

Step 1: Choose one:

SG-XARY380B-1092G	1 x 5 maximum configuration with 18-GB, 10000-rpm disks
SG-XARY390B-2184G	1 x 5 maximum configuration with 36-GB, 10000-rpm disks

Step 2: Choose one:

3858A	U.S. power cord for cabinet (order two per cabinet)
3859A	International power cord for cabinet (order two per cabinet)

Step 3: Choose options

Ordering Process—Sun StorEdge A3500FC Array, Configure-to-Order

Step 1: Choose one:

SG-ARY380A-182G	Base configuration with five trays, 10 x 18-GB, 10000-rpm disks and one Sun StorEdge rack
SG-ARY382A-364G	Base configuration with seven trays, 20 x 18-GB, 10000-rpm disks and one Sun StorEdge rack
SG-ARY384A-546G	Base configuration with fifteen trays, 30 x 18-GB, 10000-rpm disks and two Sun StorEdge racks
SG-ARY391A-364G	Base configuration with five trays, 10 x 36-GB, 10000-rpm disks and one Sun StorEdge rack
SG-ARY393A-728G	Base configuration with seven trays, 20 x 36-GB, 10000-rpm disks and one Sun StorEdge rack
SG-ARY395A-1092G	Base configuration with fifteen trays, 30 x 36-GB, 10000-rpm disks and two Sun StorEdge racks

Step 2: Order controllers:

6538A	FC-AL controller; order one per 5-tray configuration, two per 7-tray configuration, and three per 15-tray configuration

Step 3: Choose one:

3858A	U.S. power cord for cabinet (order two per cabinet)
3859A	International power cord for cabinet (order two per cabinet)

Step 4: Choose options

Ordering Process—Sun StorEdge A3500FC Array for Sun Enterprise 10000 Server Configurations

Step 1: Choose one:

SG-ARY380B4-182G	1 x 5 minimum configuration with 18-GB, 10000-rpm disks
SG-ARY380B4-1092G	1 x 5 maximum configuration with 18-GB, 10000-rpm disks
SG-ARY382B4-364G	2 x 7 minimum configuration with 18-GB, 10000-rpm disks
SG-ARY384B4-546G	3 x 15 minimum configuration with 18-GB, 10000-rpm disks
SG-ARY391B4-364G	1 x 5 minimum configuration with 36-GB, 10000-rpm disks
SG-ARY390B4-2184G	1 x 5 maximum configuration with 36-GB, 10000-rpm disks
SG-ARY393B4-728G	2 x 7 minimum configuration with 36-GB, 10000-rpm disks
SG-ARY395B4-1092G	3 x 15 minimum configuration with 36-GB, 10000-rpm disks

Step 2: Choose one:

3858A	U.S. power cord for cabinet (order two per cabinet)
3859A	International power cord for cabinet (order two per cabinet)

Step 3: Choose options

Options

Sun StorEdge A3500FC Array Options

Order Number	Option Description	Comments
NF-INST-SSA	Sun StorEdge ArrayStart℠ Onsite Installation (Contact Sun Enterprise Services representative to order)	Recommended one installation contract per Sun StorEdge A3500FC array
Disk and Tray Options		
X5238A	18-GB, 10000-rpm UltraSCSI disk	Add-on drive for 12 x 18-GB trays
X5243A	36-GB, 1000-rpm UltraSCSI disk	Add-on drive for 12 x 36-GB trays
SG-XARY154A-72G	Sun StorEdge D1000 array rackmount tray with 4 x 18-GB, 10000-rpm disks	
SG-XARY173A-145G	Sun StorEdge D1000 array rackmount tray with 4 x 36-GB, 10000-rpm disks	
Sun StorEdge A3500FC Array Accessories		
X6538A	Sun StorEdge A3500FC array FC-AL controller module	
X9818A	Front door assembly for 72-inch Sun StorEdge rack	
X3858A	Power cord—U.S.	Order two per rack
X3859A	Power cord—International	Order two per rack
X6729A	FC-AL PCI single-loop host adapter 100 MB/sec. optical interface	
X6730A	FC-AL 100 MB/sec. dual-channel SBus host adapter with one cable module	
X6731A	100 MB/sec. FC-AL GBIC for host adapter or hub	
X6732A	100 MB/sec. FC-AL seven-port hub, no GBICs included	
X6735A	Hub rackmounting kit	
X973A	2-meter fiber optic cable	
X978A	15-meter fiber optic cable	

Sun StorEdge™ A3500FC Array Upgrade Paths

Sun-to-Sun and competitive upgrades to the Sun StorEdge™ A3500FC arrays provide excellent trade-in values for older SPARCstorage™ Array 1XX, 2XX, RSM™ 200 series, RSM 2000, or Sun StorEdge A3000 system arrays, making it more cost-effective to migrate to the latest technology. On August 29, 2000, the Installed Base Business (IBB) organization will be introducing new upgrade offerings in conjunction with the announcement of the new percentage-base model, Sun Upgrade Allowance Program (Sun UAP). This new model will simplify the upgrades process by providing a "trade-in" value as a percentage allowance that can be applied to the list price of a regular Sun system configuration.

Upgrade-Specific Configuration Notes

With the introduction of the new Sun Upgrade Allowance Program on August 29, 2000, there will be specific ordering instructions when ordering upgrades using the new model. The Return Materials Authorization (RMA) Kit, part number UG-RMA, must be quoted and ordered on the same sales order as a separate line item at no charge. This kit is mandatory and contains detailed information for the customer on how to return the older equipment.

Upgrade Ordering

New allowance codes for the Sun StorEdge A3500FC array will be announced on August 29, 2000.

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 Mission-critical Support	SUNSPECTRUM GOLD Business-critical Support	SUNSPECTRUM SILVER Systems Support	SUNSPECTRUM BRONZE 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℠)	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 Operating Environment 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℠ Service	Yes	Yes	Yes	Yes

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Warranty

The warranty on the array hardware is two years. In addition, the Sun StorEdge A3500FC array carries 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

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™ Software 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 an 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 A3500FC array 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*
Arbitrated loop	A loop topology where two or more ports can be interconnected, but only two ports at a time may communicate.
Bandwidth	A measure of the capacity of a communication channel, usually specified in MB/sec.
Channel	An interface directed toward high-speed transfer of large amounts of information.
CLI	Command line interface.
Data cache	64 MB to 128 MB of cache memory (per controller board) 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.
Fabric	A group of interconnections between ports that includes a fabric element.
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.
FC-AL	Fibre Channel arbitrated loop. A loop topology used with Fibre Channel.
Fiber	A wire or optical strand. Spelled "fibre" in the Fibre Channel name.
Fiber-optic cable	Jacketed cable made from thin strands of glass through which pulses of light transmit data. Used for high-speed transmission over medium to long distances.
Frame	An indivisible unit for transfer of information in Fibre Channel.
Full-duplex	Data transmission in both directions at the same time. See also Half-duplex and Simplex.
GBIC	Gigabit interface converter.

GUI	Graphical user interface. The Sun StorEdge™ RAID Manager software 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.
Hub	A device for connecting fiber cables.
IOPS	Input/output operations per second. A measure of I/O performance, this is usually used to quote random I/O performance. See throughput.
IP	Internet protocol. A set of protocols developed by the United States Department of Defense to communicate between dissimilar computers across networks.
Laser	Light amplification by stimulated emission of radiation. A device for generating coherent radiation in the visible, ultraviolet, and infrared portions of the electromagnetic spectrum.
LED	Light emitting diode.
Link	One inbound fiber and one outbound fiber connected to a port.
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.
Network	An arrangement of nodes and connecting branches, or a configuration of data processing devices and software connected for information exchange.
N_Port	A port attached to a node for use with point-to-point or fabric topology.
NL_Port	A port attached to a node for use in all three topologies (point-to-point, arbitrated loop or fabric).
Node	A device that has at least one N_Port or NL_Port.
Optical fiber	Any filament of fiber, made of dielectric material, that guides light.

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.
Point-to-point	A topology where exactly two ports communicate.
Port	An access point in a device where a link attaches.
Protocol	A convention for data transmission that defines timing, control, format, and data representation.
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 A3500FC 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.
Throughput	A measure of sequential I/O performance, quoted in MB/sec. See IOPS.
Topology	The components used to connect two or more ports together. Also, a specific way of connecting those components, as in point-to-point, fabric, or arbitrated loop.

Volume	In the 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. 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/sec. 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 #
Sales Tools				
– *Sun StorEdge™ A3500FC Array, Just the Facts*	Reference guide for the Sun StorEdge A3500FC Array (this document)	Sales Tool	SunWIN, Reseller Web	111737
– *Sun StorEdge A3500 Disk Array Customer Presentation*	Customer Presentation with Notes	Sales Tool	SunWIN	89073
Training				
– *Performance Tuning and Configuration White Paper*	Ongoing Training for SE and SSE	Training	SunWIN	76868
– *Transfer of Information Video*	Ongoing Training for SE and SSE	Training	SunWIN	ME 1935-0
Product Literature				
– *Sun StorEdge A3500 Array Data Sheet*	Two-page Color Data Sheet	Sales Tool	SunWIN, Field Distribution	87288 DE852-0
– *Storage Reference Card*	Sun Product Reference Card	Sales Tool	SunWIN	73691
Product Update Information				
– *Product Update Bulletin: Sun StorEdge A3500 Product Updates*	Product Update	Sales Tool	SunWIN	96339
– *Product Update Bulletin: Sun StorEdge A3500 Boot Capability*	Product Update	Sales Tool	SunWIN	97281, 98192
– *Product Update Bulletin: Sun StorEdge A3500/A1000 Microsoft Windows NT Certification*	Product Update	Sales Tool	SunWIN	99695
– *Sun Product Intro—Sun StorEdge A3500-Light Upgrades; Transition of Sun StorEdge A3000 Upgrades, 1/26/99*	Product Update	Sales Tool	SunWIN	98877

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Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
− *Product Update Bulletin: A3500-Light Now Supported in Enterprise 5500/6500 System and 68-inch Enterprise Expansion Cabinets, 4/14/99*	Product Update	Sales Tool	SunWIN	102412
− *Product: Sun StorEdge A3500-Light Now Supported on Sun Cluster 2.1, 1/22/99*	Product Update	Sales Tool	SunWIN	98664
− *Product Update Bulletin: Sun StorEdge A3500 Configure-to-order Process, 6/99*	Product Update	Sales Tool	SunWIN	105821
− *Product Update Bulletin: Availability of Sun StorEdge D1000/A1000/A3500 Configurations with 18-GB/10000-rpm Disks, 6/99*	Product Update	Sales Tool	SunWIN	106230
External Web Site				
− *Sun StorEdge A3500 Array Information Site*	`http://www.sun.com/storage/A3500`			
Internal Web Site				
− *Sun StorEdge Products, References*	`http://webhome.ebay/networkstorage/products/A3500`			