

# Sun StorEdge™ D2 Storage Array

## Just the Facts



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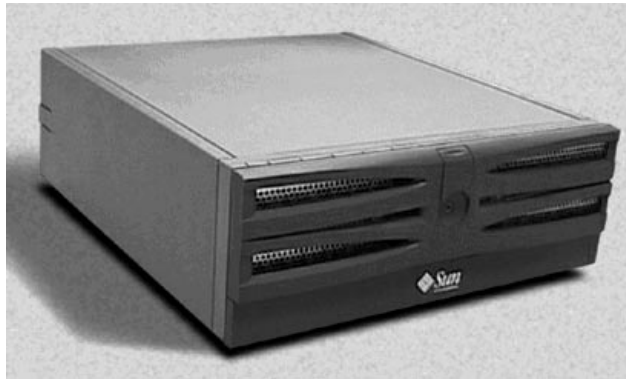
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# Positioning

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**Figure 1.** The Sun StorEdge™ D2 array

## Introduction

The Sun StorEdge™ D2 array provides an exceptional balance of performance and value.

From departmental file sharing to transaction intensive data base environments, the flexible Sun StorEdge D2 array provides an exceptional balance of performance and value. By combining cost-efficient server-based software RAID functionality with high-availability features, customers can realize a lower total cost of ownership. Array functionality is further safeguarded via Sun's Storage Automated Diagnostics Environment that provides proactive fault detection and reporting via an easy to use web-based tool. The Sun StorEdge D2 array's Ultra 3 SCSI architecture provides configuration scalability and flexibility by supporting up to four legacy UltraSCSI/Ultra 2 SCSI low-voltage differential platforms on a single array.

## Features

- Value priced, high data availability disk array providing lower total cost of ownership
- Ultra 3 SCSI maximum performance bandwidth of 160 MB/second, providing faster access to data
- Supports Sun Solstice DiskSuite™ and VERITAS Volume Manager host-based software RAID management
- RAID levels 5, 1, and 1+0 yield predicted steady-state uptimes in excess of 99.99 percent per array
- Sun's Storage Automated Diagnostics Environment featuring proactive health monitoring and reporting
- Dual, load-sharing hot-swap fans and power supplies provides high system availability
- Single- or dual-bus configurations provides flexible configuration options (up to four host ports maximum)
- Low-voltage differential, (LVD), SCSI architecture provides data cable length options of up to 10 meters and backwards compatibility to Ultra/Ultra 2 SCSI LVD
- Up to 436 GB of storage (12 x 36 GB) in a single Sun StorEdge D2 array providing nearly one half terabyte of data storage capacity







The Sun StorEdge D2 array supports a wide range of configurations to accommodate the customer's cost, availability, and performance requirements, as follows:

- Single or dual ESM modules. With a single ESM module installed, the midplane is configured as a single bus with up to 12 drives. With dual ESMs installed, the mid-plane is configured as a "split bus" with up to 6 drives each.
- ESM modules are "hot-pluggable" (hot-swappable).
- Dual host connections from each ESM.
- Host-based software RAID.
- Ultra 3 SCSI (160 MB/sec.) LVD disk and host interface; both interfaces run at Ultra 3 (160 MB/sec.), Ultra 2 (80 MB/sec.), or single-ended (40 MB/sec.), depending on the capabilities of the host bus adapter (HBA) or embedded SCSI controller on the server.
- High-availability, mirrored storage with dual host connections and split-bus drive backplane.
- SAF-TE interface to the host monitors and controls power supplies, fans, temperatures, drives, and fault LEDs.



## Product Family Placement

Sun StorEdge D2 Array	Sun StorEdge A1000/D1000 Array	Sun StorEdge A5X00 Array	Sun StorEdge T3 Array for the Workgroup
			
Workgroup	Workgroup	Department to data center	Workgroup
Host-based software RAID	Controller-based RAID (A1000) Host-based RAID (D1000)	Host-based RAID	Controller-based RAID (single controller)
Solaris™ Operating Environment	Solaris Operating Environment	Solaris Operating Environment, Microsoft Windows NT	Solaris Operating Environment, Microsoft Windows NT, HP-UX, Linux, IBM AIX
When to sell <ul style="list-style-type: none"> <li>• Price/performance</li> <li>• Bridges gap between Sun StorEdge MultiPack systems and higher end products</li> <li>• For apps requiring less than 436 GB in a single array</li> <li>• Performance and flexibility for price-sensitive customers</li> </ul>	When to sell <ul style="list-style-type: none"> <li>• Price/performance</li> <li>• Bridges gap between Sun StorEdge MultiPack systems and higher end products</li> <li>• For apps requiring less than 436 GB in a single array</li> <li>• Performance and flexibility for price-sensitive customers</li> </ul>	When to sell <ul style="list-style-type: none"> <li>• RAS + price/performance</li> <li>• Fibre Channel storage networking</li> <li>• Replaces SPARCstorage™ Array</li> <li>• High sequential performance</li> <li>• High-performance data warehousing and DSS</li> <li>• Campus-area remote mirroring</li> <li>• Flexible configurations (up to 500 m)</li> </ul>	When to sell <ul style="list-style-type: none"> <li>• One-array configurations</li> <li>• RAS + price/performance</li> <li>• Remote mirroring to 10 kilometers (using FC switches)</li> <li>• Enterprise-class redundancy and mission-critical availability features</li> <li>• High-performance data storage</li> <li>• High bandwidth for data capture, retrieval, and storage</li> </ul>
When NOT to sell <ul style="list-style-type: none"> <li>• Applications requiring more than 436 GB in a single array</li> <li>• Customer requires Fibre Channel today</li> </ul>	When NOT to sell <ul style="list-style-type: none"> <li>• Applications requiring more than 436 GB in a single array</li> <li>• Customer requires Fibre Channel today</li> </ul>	When NOT to sell <ul style="list-style-type: none"> <li>• Hardware RAID 5 required</li> <li>• Non-Solaris Operating Environment or Microsoft Windows NT host attach required</li> </ul>	When NOT to sell <ul style="list-style-type: none"> <li>• When mainframe or AS400 attachment is necessary</li> </ul>

### Sun StorEdge D2 Array vs. Sun StorEdge D1000 Array

The Sun StorEdge D2 array leverages the current Sun StorEdge D1000 array chassis, disk drives, and fans. In addition, the Sun StorEdge D2 array includes these new features:

- New midplane design to support Ultra 3 SCSI disk drives
- New front bezel design to comply with the latest Sun design standards
- Dual port Ultra 3 SCSI PCI host bus adapter



- Direct attach to embedded SCSI controller at 40 MB/second maximum bandwidth for workgroup servers (Sun Enterprise™ 220R, 250, 420R, 450 servers; Ultra™ 60, 80, Sun Blade™ 1000 workstations)
- New SCSI cables with VHDCI connectors

Feature	Sun StorEdge D1000 Array	Sun StorEdge D2 Array
Interface	UltraSCSI	Ultra 3 SCSI
Hard Disk Drives	18/36 GB, 10000 rpm	18/36 GB, 10000 rpm
Footprint	4U	4U
Server Support	All	Desktop and workgroup servers only
Solaris Operating Environment Support	2.6 and later	8 only
HBA	X6541, X1065A	X6758A
Dual Bus	Standard	Single- or dual-bus configurations
RAID	Software	Software
Sun Cluster Support	version 3.0	Not supported
Daisy Chain Support	Not supported	Not supported
LVD	Not supported	Yes

Along with the new ESM, the Sun StorEdge D2 array is distinguished from the Sun StorEdge D1000 array by a unique front bezel and nameplate. Both the power supplies have an on/off switch. The functionality and application of the Sun StorEdge D2 array is the same as that of Sun StorEdge D1000 array, except the Sun StorEdge D2 array utilizes the Ultra 3 SCSI at 160 MB/sec. The Sun StorEdge D2 array must connect to a Sun StorEdge PCI dual Ultra 3 SCSI host adapter to attain Ultra 3 performance. If the Sun StorEdge D2 array is connected to the embedded SCSI interface of the Solaris Operating Environment workgroup server, its speed is limited to that of an Ultra SCSI/40 MB second maximum bandwidth.

In the initial release, the Sun StorEdge D2 array includes the following features:

- Solaris 8 Operating Environment support
- Supported platforms: Sun Enterprise 220R, 420R, 250, and 450 servers; Sun Fire™ 280R and V880 servers; Ultra 60 and 80 workstations; and Sun Blade 1000 workstations
- Single ESM, single back-end host configurations supported
- Dual ESM, dual back-end host configurations supported
- 18- and 36-GB, 10000-rpm, low-profile disk drive with Ultra 3 SCSI LVD interface
- Factory configured with 4 or 12 drives
- Support for VERITAS Volume Manager (VxVM) and VERITAS File System (VxFS) software
- Support for Solstice DiskSuite software
- FCC Class A compliant
- Diagnostics through SunVTS™ software

## Availability

The Sun StorEdge D2 array is scheduled for general availability on February 6, 2002.





## Target Markets, Users, and Applications

The Sun StorEdge D2 array is ideal for IT managers, system administrators, and IT technicians in the direct-attach storage (DAS) market, targeted particularly at workgroup server users supporting the Solaris Operating System Environment.

From an application solution, the Sun StorEdge D2 array provides simple, low cost, high data availability external disk array storage solutions. The most common applications for a Sun StorEdge D2 array and workgroup server combination include the following:

- Database
- Enterprise resource planning (ERP)
- Application/software development
- Static web content delivery
- E-mail
- File and print
- Proxy, caching
- Data warehousing/data mart
- Data analysis/decision support
- Customer relationship management (CRM)



# Selling Highlights

## Market Value Proposition

**Key message:** The Sun StorEdge™ D2 SCSI JBOD array provides an exceptional balance of performance, data availability, and value. Key values include the following:

- Price  
The Sun StorEdge D2 provides competitive pricing with high data-availability features.
- Performance  
Features the latest SCSI architecture, Ultra 3 SCSI, providing a competitive performance solution.
- Cost per gigabyte  
Cost per gigabyte is a common way of measuring a disk array costs. The Sun StorEdge D2 provides the lowest cost per gigabyte disk array from Sun with high availability features.
- Sun end-to-end solution  
Host-based software RAID and health monitoring functionality are provided by Sun. These Sun solutions are integrated and tested with Sun™ server platforms running the Sun Solaris™ Operating Environment. The solution is supported in the field by Sun Enterprise Services.

## Key Features, Technical Functions, and Benefits

Feature	Technical Function	Customer Benefit
• Ultra 3 SCSI	• Up to 160 MB/sec. data transfer	• Faster access and transfer of information
• Sun Solstice DiskSuite™ software or VERITAS Volume Manager	• Software RAID management	• Sun end-to-end RAID solution and ease
• Health monitoring	• Monitors and reports disk drive power supply and fan failure	• Gives customers insight to the functional status of key components
• Redundant and hot-swappable power supplies and fans	• Enhanced system availability	• Provides backup due to a failed power supply or fan and ease of service
• LVD SCSI signal	• Up to 10-meter cable length	• Separate server to array enclosure for ease of physical systems management
• Hot-swap drives, fans, power	• On-line failed component replacement	• Provides easy serviceability and supplies continuous operation



Feature	Technical Function	Customer Benefit
<ul style="list-style-type: none"> <li>• One or two bus option</li> </ul>	<ul style="list-style-type: none"> <li>• Single array can be configured for high availability mirroring or high performance (higher IOPS/spindle count)</li> </ul>	<ul style="list-style-type: none"> <li>• Customization for varied computing environments</li> </ul>
<ul style="list-style-type: none"> <li>• Industry-standard rack/system cabinet mounting</li> </ul>	<ul style="list-style-type: none"> <li>• Center post or four post compatibility</li> </ul>	<ul style="list-style-type: none"> <li>• Provides easy installation</li> </ul>



# Enabling Technology

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## ESM Module

An environmental services module (ESM) monitors the status of the Sun StorEdge™ D2 array enclosure using light-emitting-diodes (LEDs) to display each component's health and activity.

The ESM module also enables remote environmental monitoring from a host by means of the SCSI Accessed Fault-Tolerant Enclosure (SAF-TE) protocol through the low-voltage differential (LVD) SCSI connection. Each ESM has two independent 160-MB Ultra 3 SCSI bus connections. Daisy-chaining is not supported.

Features of the ESM module include:

- Ultra 3 SCSI (160 MB/sec.) LVD disk and host interface (both interfaces run Ultra 3 at 160 MB/sec.), Ultra 2 (80 MB/sec.), or single-ended (40 MB/sec.) depending on the capabilities of the drive and host adapter attached).
- Single or dual ESM modules. With a single ESM module installed, midplane is configured as a single bus with up to 12 drives. With dual ESMs installed, midplane is configured as "split-bus" with up to 6 drives each.
- ESM modules are hot-pluggable.
- Dual host connections from each ESM module.
- Programmable enclosure services processor (53C040) on each ESM. ESM firmware can be downloaded from host.
- SAF-TE interface to host monitors/controls power supplies, fans, and temperature.



# System Architecture

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## Key Facts

Some of the key features of the Sun StorEdge™ D2 array are listed below.

- High RAS is achieved through the use of redundant components.
- The system includes two cooling units (two fans each) and two power supplies.
- Low-profile disks (18 GB or 36 GB, 10000 rpm) can be mixed in the same enclosure.
- The Sun StorEdge D2 arrays are supported on Solaris™ 8 Operating Environment or later releases.
- Ultra 3 SCSI (160 MB/sec.) LVD disk and host interface
- Minimum two host and two disk connections per array
- Front panel LEDs that display power/activity/fault
- ESM card FRU ID
- Support for multi-vendor drives in same array
- Drive FRU ID
- SNMP agent support
- Support for Sun™ platforms:
  - Sun Enterprise™ 220R, 250, 420R, and 450 servers
  - Sun Fire™ 280R and V880 servers
  - Ultra™ 60 and 80 workstations
  - Sun Blade™ 1000 workstations
- Software support
  - Solstice DiskSuite™ software
  - VERITAS Volume Manger (VxVM)
  - VERITAS File System (VxFS)
- Support for Built-In Test and SMART
- MTBF>20,000 hours
- MTTR<5 minutes

## Field-Replaceable Units (FRUs)

The Sun StorEdge D2 array houses the following field-replaceable units (FRUs):

- One or two ESMs (hot-swappable)
- Two power supplies (hot-swappable)
- Two fan canisters with two fans each (hot-swappable)
- Up to twelve Ultra 3 SCSI disk drives (hot-swappable)
- Chassis, front door, and midplane (replaced as a single unit)



Each FRU has a set of LEDs that indicate health and status. Hot-pluggable FRUs can be replaced while the system is running. Cold-pluggable parts can be replaced only when the power is off.

## Environmental Services Modules (ESMs)

The Sun StorEdge D2 array environmental services module (ESM) is designed as a SCSI attachment to a low-voltage differential (LVD) SCSI JBOD subsystem. The Sun StorEdge D2 array can have single or dual ESMs (ESM0 and ESM1). If a machine ships with ESM0 only, keep the coverplate installed in the same slot in which ESM1 would reside to maintain proper cooling within the subsystem.

With a single ESM, the Sun StorEdge D2 array operates as a single-bus device with access to all 12 drives. With dual ESMs, the bus is split and each ESM has access to up to six drives. This means the Sun StorEdge D2 array can be split into two groups of six drives that can be accessed by two separate host connections.

The Ultra 3 SCSI interface operates at 160 MB/sec., while the Ultra 2 interface on the Sun StorEdge D1000 array operates at up to 80 MB/sec. The ESM board provides the SAF-TE interface, which monitors power supplies, fan units, drives, temperatures, and fault LEDs, and reports enclosure status. Each ESM board has a temperature monitor and is a hot-pluggable FRU.

If the host connection is active when the SCSI cable is disconnected, the ESM board recognizes loss of termination power and disable the interface. This prevents a transfer from being initiated while the cable is unplugged.

**Caution:** When replacing a failed ESM module, ensure all switches are set to the same settings as the failed module before inserting the replacement into the slot, because the switches are active when the module is inserted.

The Ultra 3 SCSI environmental services module (ESM) is shown in the following figure.

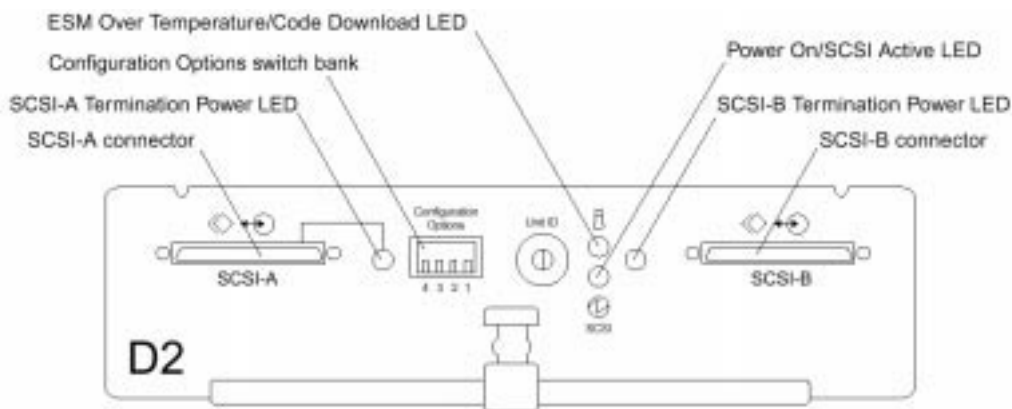


Figure 2. ESM components

The current ESM firmware level is 3034. Currently, ESM firmware is not field-upgradeable.

The table below lists the connectors, switches, and LEDs on the ESM. For all switches, up = ON and down = OFF.

Connector	Description
SCSI- <i>N</i> Connector	The two host connectors on each ESM allow the array to connect to two separate hosts. External terminators are not required. Termination power is sensed through the SCSI <i>N</i> Termination Power LED.
SCSI- <i>N</i> Termination Power LED	Located next to the SCSI connector. This is lit when termination power from the host is sensed. For example, the SCSI cable from host is connected. A PSU also lights the global fault light (subsystem fault) if the power supply is installed, but not connected to a power outlet. This is not a fault condition. <ul style="list-style-type: none"> <li>Green: Termination power is being supplied from the host to the associated connector.</li> </ul>
Configuration Options Switch Bank	Four-position, piano-style switches to set options.
Unit ID	Ten-position switch for setting a unique ID for each ESM. When this switch is used to set an unit ID, an application (such as Storage Automated Diagnostics Environment) can use SAF-TE SCSI commands to locate the ESM by its ID.
ESM Over Temperature/Code Download LED	Located next to the Module ID switch. When lit, it indicates an over-temperature condition detected by the ESM module. This LED is also lit during code load. This does not indicate a fault. <ul style="list-style-type: none"> <li>Yellow: Temperature exceeds the factory preset limits. When this LED is yellow, the Subsystem LED also turns amber.</li> <li>Blinking: A code download is in progress.</li> <li>Off: Temperature is normal, and a code-download is not in progress.</li> </ul>
Power ON/SCSI Active LED	The Unit ID is set using the 10-position switch which sets the unique ID for each ESM board. The Unit ID can be used by Storage Automated Diagnostics Environment or SAF-TE commands, to identify a storage unit. The LED might appear to be off because the activity makes it switch too quickly to be detected. Check for activity using the iostat command. <ul style="list-style-type: none"> <li>Green: Power is applied.</li> <li>Blinking: SCSI activity is occurring through the ESM.</li> <li>Off: Controller is not receiving power.</li> </ul>
Subsystem Fault LED	Located on the front of the box. This LED is turned on when any of the other fault LED's are lit, as when error conditions are detected.
Fan Fault LED	Turned on when an out-of-spec condition is sensed in the fan tray.
Power Fault LED	Located on each power supply and turned on if that power supply is faulty.

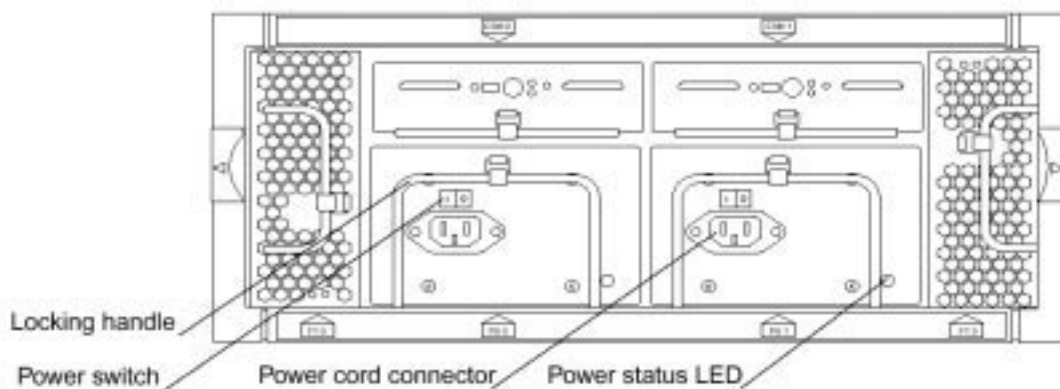
## Power Supplies

The Sun StorEdge D2 array has two hot-pluggable and interchangeable DC power supply units (PSUs). These provide power to the internal components by converting incoming AC voltage to DC voltage. With these redundant power supplies, one maintains electrical power to the system if the other fails. Both PSUs are removable canisters that slide into one of two slots in the back of the system. Each canister has a locking handle, a power status LED, an AC power cord connector, and a power switch.

The PSU for the Sun StorEdge D2 array is differentiated from the Sun StorEdge D1000 array's by the power switch.

Power supplies can be replaced while the Sun StorEdge D2 trays are in operation.





**Figure 3.** Power supply configuration

## Fans

The Sun StorEdge D2 array has two fan canisters. Each canister contains two fans. The fan canisters are hot-pluggable and interchangeable. The fan for this array is the same as that for the Sun StorEdge D1000 array.

The array can operate fully cooled with three of the four fans functioning. If two fans fail, the remaining two fans can maintain the array in an 86° F (30° C) environment, but the reliability of the components may be affected.

The array should not be operated for extended periods without both fan canisters installed. High temperatures can result, which can damage system components.

## Disks

- The Sun StorEdge D2 array ships from the factory with either four or twelve disks installed.
- It is important to keep dummy modules in vacant disk spaces to maintain correct cooling within the disk subsystem.
- Once a failing disk has been identified and properly isolated (if it is being used in a software RAID environment), the field-replaceable unit (FRU) can be hot-swapped with a new disk.
- Only Ultra 3 disks can be used. Do not use Sun StorEdge D1000 drives in the Sun StorEdge D2 array as they hang the box.
- Each Sun StorEdge D2 disk tray holds a maximum of twelve 1-inch hot-plug disk modules. The following drive types are supported:
  - 18 GB, 10000 rpm, low-profile
  - 36 GB, 10000 rpm, low-profile
 Support for the 72-GB low-profile drives is planned for a subsequent release.
- Both drives fit a 3.5-inch form factor.
- Low-voltage differential (LVD) disks are standard with this array.



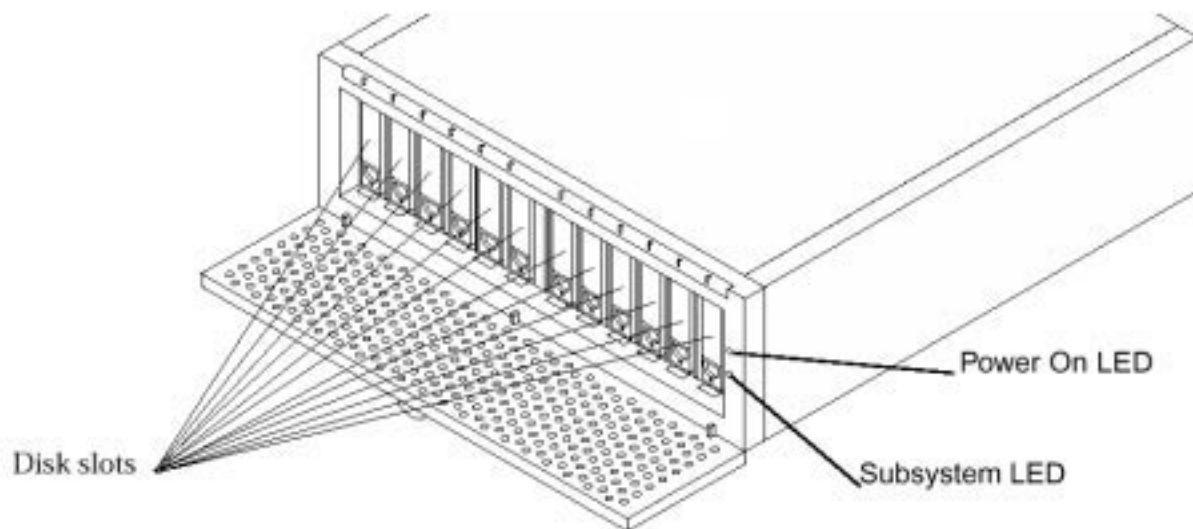
## Midplane

The Sun StorEdge D2 array has a newly design midplane which supports an Ultra 3 SCSI. This is a departure from the Sun StorEdge D1000 array, which supported speeds up to that of Ultra 2. As a result, the midplane FRU cannot be interchanged between Sun StorEdge D2 and D1000 arrays. The Sun StorEdge D2 array FRU is the chassis and midplane as a unit; the midplane is not a separate FRU.

## Front-Panel Components

This section describes the components accessed at the front of the array. Behind the lockable front door are:

- Slots containing disks and possibly fillers
- LEDs that indicate drive conditions
- LEDs that indicate overall system conditions

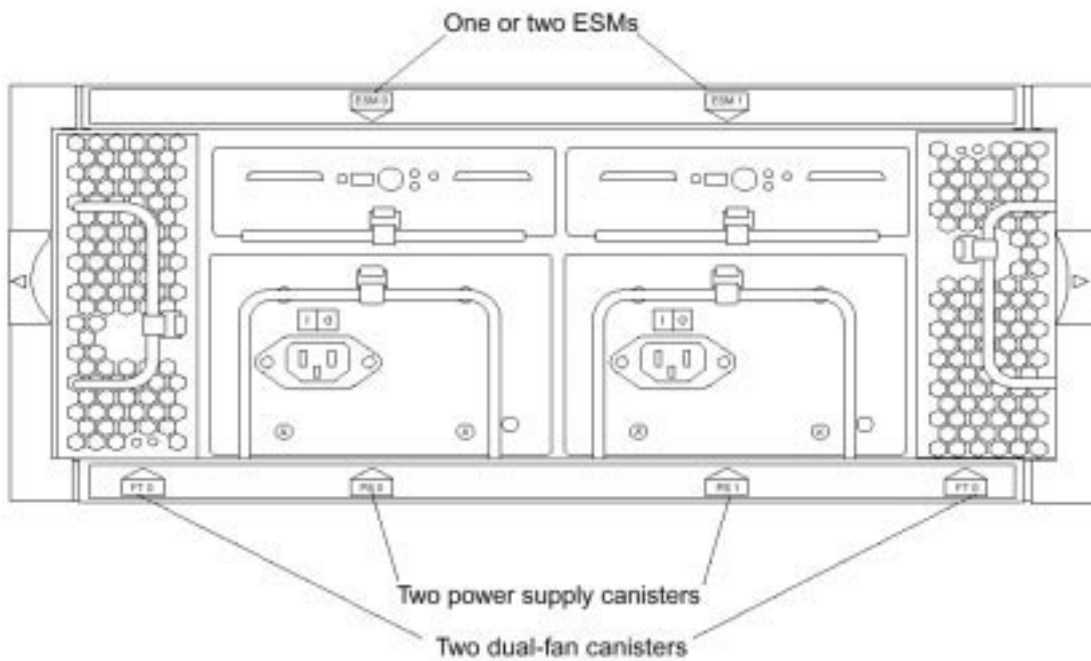


**Figure 4.** Sun StorEdge D2 array front with door open and disk slots accessible

## Rear-Panel Components

This section describes the components that are at the back of the Sun StorEdge D2 array.

- One or two ESMs (labeled ESM 0 and ESM 1)  
If only one ESM is used, the ESM is in position 0, and a filler is inserted on the right (in position 1).
- Two power supply canisters (labeled PS 0 and PS 1)
- Two dual fan canisters (labeled FT 0 and FT 1)



**Figure 5.** Sun StorEdge D2 array rear view

# Requirements and Configuration

## Supported Platforms

Sun StorEdge™ D2 arrays are supported on the following host platforms.

System	Array to Host Connection Ultra 3 PCI HBA X6758A (Solaris™ 8 Operating Environment Only)	Array-to-Host Connection On-board SCSI Host Connection 40 MB/sec. Max. Bandwidth
Sun Enterprise™ 220R server	Yes	Yes
Sun Enterprise 420R server	Yes	Yes
Sun Enterprise 250 server	Yes	Yes
Sun Enterprise 450 server	Yes	Yes
Sun Fire™ 280R server	Yes	No
Sun Fire V880 server	Yes	No
Sun Blade™ 1000 workstation	No	Yes
Ultra™ 60 and 80 workstations	No	Yes

## Supported Configurations

The Sun StorEdge D2 array is supported in the configurations listed below. Note that this array cannot be daisy-chained.

- Single host
- Single bus
- Tabletop
- Dual host
- Dual bus
- Rackmount

The table below shows the maximums and minimums supported for the Sun StorEdge D2 array.

Number of ESMs	Number of Hosts per ESM	Maximum	Termination	Disks
1 or 2 ESMs	2	2 ESMs, 4 hosts	Not required (automatic internal termination)	Up to 12 Ultra 3 disks

## Host Connections

The Sun StorEdge D2 array can be connected to a host in one of the two following ways:

- By means of a Sun PCI dual Ultra 3 SCSI host adapter (160 MB/second) installed in a host
- By means of an on-board single-ended, 40 MB/second SCSI port attachment in a Sun Solaris Operating Environment workgroup server. Supported servers with embedded SCSI port attachments are Sun Enterprise 220R, 250, 420R, 450, and Sun Fire 280R servers.



Sun StorEdge D2 arrays ship in one of two bus configurations:

- In a single-bus configuration (with one ESM).
- In a split-bus configuration (with two ESMs). In a split-bus configuration, the Sun StorEdge D2 array can be configured either as a high-availability storage subsystem or as two separate storage subsystems.

## Single-Bus Configuration

In a single-bus configuration, a single ESM controls all the disks.

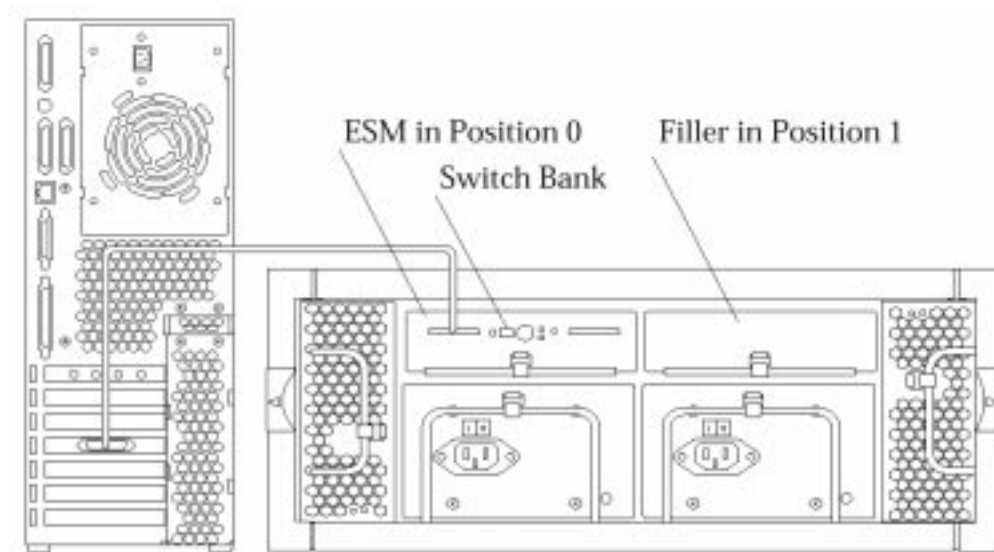
- A single ESM must be in position 0, which is the left slot as viewed from the rear of the enclosure.
- A filler must be in position 1, which is the right slot as viewed from the rear.
- Switch number 1 in the switch bank on the front of the ESM must be set Up.

The SCSI cable from a host can be connected to either the SCSI-A or SCSI-B connector on the ESM.

In a single-bus configuration, the ESM in the 0 position signals all 12 drive slots, and two hosts can be connected to the ESM. The 12 drive slots are mapped to SCSI IDs 0-5 and 8-13. The physical drive slot position corresponding to these SCSI IDs is illustrated in the image.

Both host 1 and host 2 can communicate with all 12 drives. The numbers 6 and 7 next to the two host connections represent the SCSI IDs that are assigned to the initiator in each host. The 15, next to the box with the 040, which is the SAF-TE processor, represents the SAF-TE processor SCSI ID. In a split-bus configuration, both the ESM in the 0 and 1 positions are populated, and the ESM in the 0 position has option switch 1 set to off (dual bus).

Another configuration that is not illustrated, but also supported is connecting the Sun StorEdge D2 array to an embedded SCSI connection in a supported Sun workgroup server.



**Figure 6.** Single-bus configuration (with a single ESM) connected to a host adapter on a single host

## Split-Bus Configuration

A split-bus configuration splits a single Sun StorEdge D2 array between two ESMs, with each ESM controlling half the disks. The array can then be used either as two independent storage subsystems or as a single high-availability system.

- Two ESMs must be installed
- Switch number 1 in the switch bank on the front of both ESMs must be set Down.

The ESM in the 0 position communicates with one set of six drives while the ESM in the 1 position communicates with the other set of six drives. Environmental information on the status of the fans and power supplies can be read through the SAF-TE interface of either ESM. Both sets of six drives are mapped to SCSI IDs 8-13.

The physical drive slot position corresponding to these SCSI IDs is illustrated in the attached image. Note that the six drives signaling the ESM in the 0 position are on the left side of the enclosure (as viewed from the front), while the six drives signaling the ESM in the 1 position are on the right side of the enclosure.

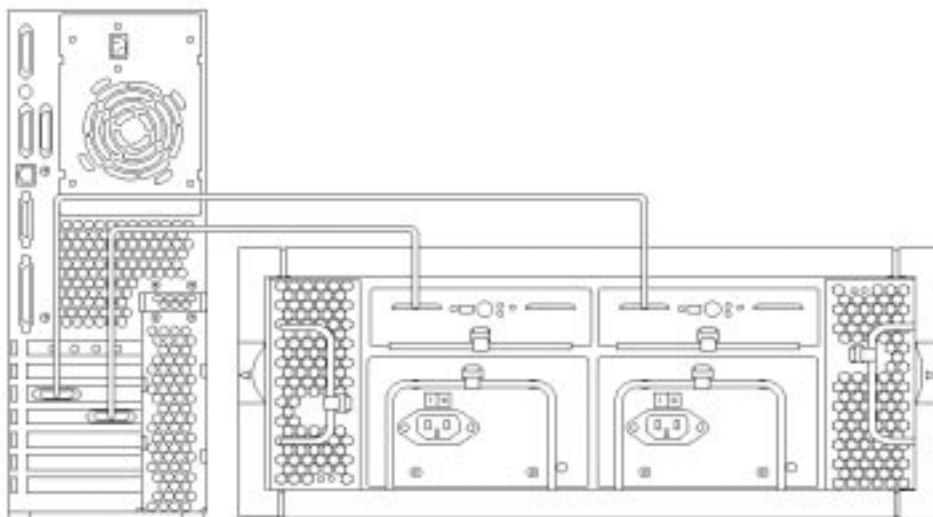
The slot numbers used by the SAF-TE commands to communicate with the drive slots are 0-5 for ESM 0, and 0-5 for ESM 1. In the split-bus configuration, SAF-TE commands issued through an ESM only communicate with the six drives associated with that ESM. Two hosts can be attached to ESM 0 and to ESM 1.

The split-bus configuration forms the basis of a high-availability storage configuration with no single point of failure in a single enclosure. This high-availability configuration is created using independent host adapters to communicate with each ESM and mirror data between the two independent buses.

**Caution:** When connecting to a PCI HBA, the cable length restriction is 10 meters. When connecting to an onboard SCSI interface, the length restriction is 2 meters.

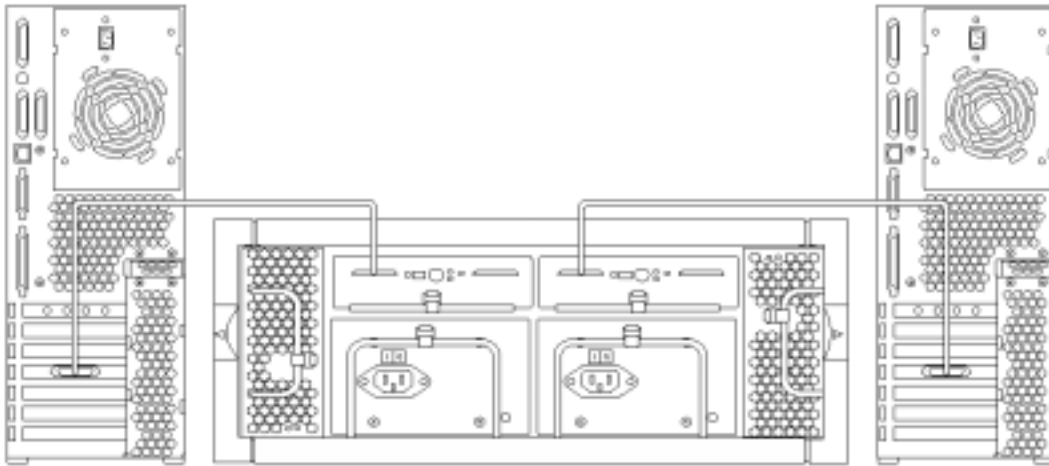
The figure below shows the split-bus configuration with two ESMs connected to two different HBAs on a single host. The array is configured in this example for high availability. In this configuration, data is mirrored in the two separate sets of disks.

The SCSI cable from a host can be connected to either the SCSI-A or SCSI-B connector on the ESM.



**Figure 7.** High-availability split-bus configuration (with two ESMs), two host adapters, and a single host

The figure below shows a Sun StorEdge D2 array in a split-bus configuration with two ESMs connected to two hosts. Each host uses one half of the array independently.



**Figure 8.** Split-bus configuration (with two ESMs) and two hosts

## Mounting Options

Sun StorEdge D2 arrays can be mounted in the following two ways:

- On the desktop  
Designed to be placed on the desktop or non-rackmount applications.
- As rackmounted systems  
The arrays can be installed in qualified Sun cabinets. Customers can purchase the hardware needed to install a Sun StorEdge D2 tabletop array in a qualified Sun cabinet by ordering the D2 rackmount upgrade kit. Rackmount configurations are only available as field-installed X-options.

## Other Configuration Guidelines

The total length of all SCSI cables on any one bus should not exceed 20 meters (point to point). The Sun StorEdge D2 array ships with two 4-meter UltraSCSI differential cables. See the Ordering Information section of this document for part numbers. 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
- External differential UltraSCSI cable, 0.8 meters
- External differential UltraSCSI cable, 1.2 meters

# Software Architecture

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## Operating Environment Requirements

The Sun StorEdge™ D2 array requires the Solaris 8 Operating Environment or later with the required operating system patches. Solaris Operating Environment patches are available on the SunSolve™ web site at <http://sunsolve.sun.com>.

## Supported Software

- VERITAS Volume Manager software, version 3.1.1
- Solstice DiskSuite™ software version 4.2
- SunVTS™ diagnostics software verifies the connectivity and functionality of hardware controllers and devices on Sun platforms.
- Storage Automated Diagnostics Environment

## VERITAS Volume Manager (VxVM) Software

VERITAS Volume Manager software is offered for use with the Sun StorEdge D2 array in order to support software-based RAID solutions.

VERITAS Volume Manager software supports RAID technology to optimize performance, availability, and user cost. This technology is designed to improve performance, reduce recovery time in the event of file system errors, and increase 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 D2 Array

When using the VERITAS Volume Manager software with the Sun StorEdge D2 array, standard installation procedures should be followed. See the installation guide provided with VERITAS Volume Manager software.

## RAID Implementation

Cost effective software RAID management is achieved by utilizing the Solstice DiskSuite and the VERITAS Volume manager. The newer PCI hardware RAID host bus adapter complements the software solutions. The preference between software and PCI hardware RAID is approximately a 50/50 split.

## 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 D2 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 D2 arrays are RAID subsystems that are designed to enable users to achieve the ideal balance of high data availability, performance, capacity, and cost.

RAID Level	Characteristics
RAID 0—Striping	<ul style="list-style-type: none"> <li>• Spreads data across multiple-disk spindles for better performance</li> <li>• Can be tuned to optimize either random or sequential I/O performance</li> <li>• No redundant data protection, lower reliability than independent disks</li> <li>• Same low cost per usable megabyte as independent disks</li> </ul>
RAID 1—Mirroring	<ul style="list-style-type: none"> <li>• Maintains duplicate copies of data, so if a disk fails, data is available and applications keep running</li> <li>• Same performance as independent disks</li> <li>• Highest cost per usable megabyte</li> </ul>
RAID 1+0—Mirroring and striping	<ul style="list-style-type: none"> <li>• Combines performance of striping with data protection of mirroring</li> <li>• Duplicate copies of striped data remain available even if a disk fails</li> <li>• Same cost per usable megabyte as mirroring</li> </ul>
RAID 3—Striping with parity on single disk	<ul style="list-style-type: none"> <li>• Good for large sequential data transfers per I/O request, and low I/O request rates</li> <li>• 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</li> </ul>
RAID 5—Striping with Parity	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Stripes data across multiple-disk spindles to optimize random or sequential performance</li> <li>• Higher cost per megabyte than independent disks or RAID 0, but much lower than RAID 1 or 1+0</li> <li>• Lower performance on small-sized writes than in RAID 0, 1, 1+0 or independent disks</li> </ul>

These RAID levels are implemented via a hardware controller in the Sun StorEdge A1000 array, and through host software in Sun StorEdge D2 array configurations.

## High Availability with 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

### 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



## Features

- 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
- Hot spares are automatically swapped in to replace any failed disk in a RAID 5, 1, or 1+0 group
- RAID stripe sizes are adjustable to optimize for random or sequential I/O patterns

## Benefits

- High availability, so customers can be confident that data is available when needed and that it is not lost
- Continuous redundant data protection even if a disk fails; maintenance can be deferred for days or weeks, if necessary
- 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 (Sun StorEdge A1000 array) or VERITAS Volume Manager software (Sun StorEdge D2 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 to 16 KB, a stripe width of 2 KB may be best.

## Solstice DiskSuite Software

Solstice DiskSuite software is a disk and storage management solution for enterprise environments. It provides high data availability and reliability, delivers excellent I/O performance, and simplifies large system and disk administration. With Solstice DiskSuite software, customers get a powerful set of tools to enhance data availability.

## SunVTS Software

The Sun Validation and Test Suite, or SunVTS software, is an online diagnostics tool and system exerciser for verifying the configuration and functionality of Sun hardware controllers, devices, and platforms. SunVTS software is included in Solaris Easy Access Server software.

Customers can run SunVTS software using any of these interfaces: a command line interface, a tty interface, or a graphical interface that runs within a windowed desktop environment.



SunVTS software lets customers view and control a testing session over modem lines or over a network. Using a remote system, customers can view the progress of a SunVTS testing session, change testing options, and control all testing features of another system on the network.

SunVTS `drivetest` is essentially the same test as that used for the Sun StorEdge D1000 array and exercises the drives in the enclosure. It detects the Sun StorEdge D2 array enclosure in new releases.

SunVTS `enctest` has been added for the Sun StorEdge D2 arrays.

## Storage Automated Diagnostics Environment

The Storage Automated Diagnostics Environment monitors array enclosures and their status points for the FRUs via an intuitive Web-based GUI. It also provides event logging, alarm indicators, and problem notification via e-mail. An easy-to-use, easy-to-access Web GUI allows an administrator to easily define the monitored environment. The Storage Automated Diagnostics Environment is a Perl-based, lightweight, non-intrusive health monitoring agent capable of not only indicating the bad status, but also generating events for the good status.

## VERITAS File System Software

VERITAS File System (VxFS) software is a high-performance, quick-recovery file system. VxFS software augments UNIX file management with high availability, increased bandwidth, and up-to-date and reliable structural integrity. It provides scalable performance and capacity to meet the demands of increased user loads and client/server environments.

VxFS software provides fast recovery following a system crash or reboot. The system completes a file system check (fsck) in seconds, regardless of file system size. In addition, VxFS software supports on-line backup, on-line resizing (shrinking and growing of a file system), and on-line defragmentation. These capabilities allow administrators to respond to dynamic data capacity and performance requirements while reducing scheduled maintenance interruptions.

VxFS software allocates disk space to files in large, contiguous areas called extents, rather than in small fixed-size blocks. This results in a significant reduction in the number of I/O operations required to read and write large amounts of data.

## StorTools™ Software

StorTools™ diagnostic software is designed to help improve Sun StorEdge array diagnosability. The StorTools toolkit allows field service and support personnel to more quickly troubleshoot and isolate problems on FC-AL loops. The capabilities include installation (revision checker, fibre loop test, disk functional verification), monitoring (configuration snapshot, status, message display), diagnostics (host adapter, fiber loop, field-replaceable unit isolation), scripted menu, and configuration display.



# Specifications

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## Physical Specifications

Specification	Metric	U.S.
Height	17.78 cm	7.0 in.
Width	53.34 cm	21.0 in.
Depth	44.7 cm	17.6 in.
Weight <sup>1</sup>		
• Without drives	19.7 kg	43.5 lb.
• Fully loaded	28.6 kg	63 lb.
<b>Notes:</b>		
1. The unit's total weight depends on the number of components installed in the chassis. The fully loaded weight includes two ESMs.		

## Electrical Specifications

Electrical Element	Requirement
Voltage	100-120 VAC to 220-240 VAC
Frequency	47 to 63 Hz
• Idle	1.64 amps at 120 VAC
• Max. Operating	2.05 amps at 120 VAC
• Max. Surge	2.2 amp peaks

## Environmental Specifications

Climate Control	Fahrenheit	Celsius
Altitude (based on drives)		
• Operating	100 ft below to 10,000 ft above sea level	30.5 m below to 3,048 m above sea level
• Storage	100 ft below to 10,000 ft above sea level	30.5 m below to 3,048 m above sea level
• Transit	100 ft below to 40,000 ft above sea level	30.5 m below to 12,192 m above sea level
Temperature (dry bulb)		
• Operating	41°F to 104°F	5°C to 40°C
• Storage/Transit	-4°F to 140°F	-20°C to 60°C
Temperature Derating (max.) <sup>1</sup>	1.7°F per 1000 ft above sea level	3.3°C per 1000 m



Climate Control	Fahrenheit	Celsius
Relative humidity (non-condensing) <ul style="list-style-type: none"> <li>• Operating</li> <li>• Storage</li> <li>• Transit</li> </ul>	20 to 80% 10 to 93% 5 to 95%	
Heat dissipation (maximum)	260 Watts, 1092 BTU per hour	
Sound power and pressure	6.6 bels (power), 63.7 dBA (pressure)	
1. If the customer plans to operate the array at altitudes between 1000 m and 3,000 m (3280 ft. and 9850 ft.), the environmental temperature must be reduced 3.3° C (1.7° F) for every 1000 m (3280 ft.) above sea level.		

## Compliance

System Regulation	Specifications
Safety	This equipment complies with the following requirements of Low Voltage Directive 73/23/EEC: EC Type Examination Certificates: EN60950:1992, 2nd Edition, Amendments 1, 2, 3, 4 TÜV Rheinland Certificate No. S 9772487 IEC 950:1991, 2nd Edition, Amendments 1, 2, 3 CB Scheme Certificate No. UL2108-138989/USA Evaluated to all CB Countries
RFI/EMI	<ul style="list-style-type: none"> <li>• FCC Part 15 Class B</li> </ul>
Product Label	<ul style="list-style-type: none"> <li>• FCC Class B</li> <li>• CE Mark</li> </ul>
Federal Communications Commission (FCC) — USA	FCC Class A Notice, Part 15 FCC Class B Notice, Part 15
Industry Canada Equipment Standard for Digital Equipment (ICES-003) — Canada	ICES-003 Class A Notice - Avis NMB-003, Classe A ICES-003 Class B Notice - Avis NMB-003, Classe B



System Regulation	Specifications
Immunity	<ul style="list-style-type: none"> <li>• EMC Directive (89/336/EEC)</li> </ul> <p>As Telecommunication Network Equipment (TNE) in both Telecom and Other Than Telecom Centers per:</p> <ul style="list-style-type: none"> <li>• EN300-386:2000 Required Limits (as applicable):</li> <li>• EN55022/CISPR22 Class B</li> <li>• EN300-386:2000 Subclause 6.2 (DC port Conducted Emissions 20 kHz - 30 MHz)</li> <li>• EN61000-3-2 Pass</li> <li>• EN61000-3-3 Pass</li> <li>• EN61000-4-2 Criteria B: 6 kV (Direct), 8 kV (Air); Criteria R: 8 kV (Direct), 15 kV(Air)</li> <li>• EN61000-4-3 3 V/m</li> <li>• EN61000-4-4 1 kV AC and DC Power Lines, 0.5 kV Signal Lines</li> <li>• EN61000-4-5 Criteria B: 2 kV AC Line-Gnd, 0.5 kV Indoor Signal Lines; 1 kV AC Line-Line and Outdoor Signal Lines; Criteria R: 2 kV AC Line-Line, 4 kV AC Line-Gnd and Outdoor Signal Lines as applicable</li> <li>• EN61000-4-6 3 V</li> <li>• EN61000-4-11 Pass</li> </ul> <p>As Information Technology Equipment (ITE) Class B per:</p> <ul style="list-style-type: none"> <li>• EN55022:1998/CISPR22:1997 Class B</li> <li>• EN55024:1998 Required Limits (as applicable):</li> <li>• EN61000-4-2 4 kV (Direct), 8 kV (Air)</li> <li>• EN61000-4-3 3 V/m</li> <li>• EN61000-4-4 1 kV AC Power Lines, 0.5 kV Signal and DC Power Lines</li> <li>• EN61000-4-5 1 kV AC Line-Line and Outdoor Signal Lines; 2 kV AC Line-Gnd, 0.5 kV DC Power Lines</li> <li>• EN61000-4-6 3 V</li> <li>• EN61000-4-8 1 A/m</li> <li>• EN61000-4-11 Pass</li> </ul>



# Ordering Information

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## Sun StorEdge™ D2 Array Ordering

All configurations of the Sun StorEdge™ D2 array ship with documentation, power cords, and two 4-meter cables.

## Sun StorEdge D2 Array Systems

<b>Order Number</b>	<b>Title and Description</b>
<b>SG-XARYSB185A-72G</b>	72-GB (4 x 18.2-GB 10000-rpm disks) Sun StorEdge D2 array, tabletop or desktide, single bus, two LVD Ultra 3 SCSI to host ports, two fan trays (four fans), two power supplies
<b>SG-XARYSB186A-72G</b>	72-GB (four x 18.2-GB 10000-rpm disks) Sun StorEdge D2 array, rackmount, single bus, two LVD Ultra 3 SCSI to host ports, two fan trays (four fans), two power supplies
<b>SG-XARYDB185A-72G</b>	72-GB (4 x 18.2-GB 10000-rpm disks) Sun StorEdge D2 array, tabletop or desktide, dual bus, two LVD Ultra 3 SCSI to host ports per bus, two fan trays (four fans), two power supplies
<b>SG-XARYDB186A-72G</b>	72-GB (4 x 18.2-GB 10000-rpm disks) Sun StorEdge D2 array, rackmount, dual bus, two LVD Ultra 3 SCSI to host ports per bus, two fan trays (four fans), two power supplies
<b>SG-XARYSB185A-218G</b>	218-GB (12 x 18.2-GB 10000-rpm disks) Sun StorEdge D2 array, tabletop or desktide, single bus, two LVD Ultra 3 SCSI to host ports, two fan trays (four fans), two power supplies
<b>SG-XARYSB186A-218G</b>	218-GB (12 x 18.2-GB 10000-rpm disks) Sun StorEdge D2 array, rackmount, single bus, two LVD Ultra 3 SCSI to host ports, two fan trays (four fans), two power supplies
<b>SG-XARYDB185A-218G</b>	218-GB (12 x 18.2-GB 10000-rpm disks) Sun StorEdge D2 array, tabletop or desktide, dual bus, two LVD Ultra 3 SCSI to host ports per bus, two fan trays (four fans), two power supplies
<b>SG-XARYDB186A-218G</b>	218-GB (12 x 18.2-GB 10000-rpm disks) Sun StorEdge D2 array, rackmount, dual bus, two LVD Ultra 3 SCSI to host ports per bus, two fan trays (four fans), two power supplies
<b>SG-XARYSB195A-145G</b>	145-GB (4 x 36.4-GB 10000-rpm disks) Sun StorEdge D2 array, tabletop or desktide, single bus, two LVD Ultra 3 SCSI to host ports, two fan trays (four fans), two power supplies



<b>Order Number</b>	<b>Title and Description</b>
<b>SG-XARYSB196A-145G</b>	145-GB (4 x 36.4-GB 10000-rpm disks) Sun StorEdge D2 array, rackmount, single bus, two LVD Ultra 3 SCSI to host ports, two fan trays (four fans), two power supplies
<b>SG-XARYDB195A-145G</b>	145-GB (4 x 36.4-GB 10000-rpm disks) Sun StorEdge D2 array, tabletop or deskside, dual bus, two LVD Ultra 3 SCSI to host ports per bus, two fan trays (four fans), two power supplies
<b>SG-XARYDB196A-145G</b>	145-GB (4 x 36.4-GB 10000-rpm disks) Sun StorEdge D2 array, rackmount, dual bus, two LVD Ultra 3 SCSI to host ports per bus, two fan trays (four fans), two power supplies
<b>SG-XARYSB195A-436G</b>	436-GB (12 x 36.4-GB 10000-rpm disks) Sun StorEdge D2 array, tabletop or deskside, single bus, two LVD Ultra 3 SCSI to host ports, two fan trays (four fans), two power supplies
<b>SG-XARYSB196A-436G</b>	436-GB (12 x 36.4-GB 10000-rpm disks) Sun StorEdge D2 array, rackmount, single bus, two LVD Ultra 3 SCSI to host ports, two fan trays (four fans), two power supplies
<b>SG-XARYDB195A-436G</b>	436-GB (12 x 36.4-GB 10000-rpm disks) Sun StorEdge D2 array, tabletop or deskside, dual bus, two LVD Ultra 3 SCSI to host ports per bus, two fan trays (four fans), two power supplies
<b>SG-XARYDB196A-436G</b>	436-GB (12 x 36.4-GB 10000-rpm disks) Sun StorEdge D2 array, rackmount, dual bus, two LVD Ultra 3 SCSI to host ports per bus, two fan trays (four fans), two power supplies

## Sun StorEdge D2 Array Options

<b>Order Number</b>	<b>Option Description</b>
X6758A	Sun StorEdge PCI dual Ultra 3 SCSI host bus adapter
X5248A	18.2-GB, 10000-rpm, low-voltage differential (LVD) UltraSCSI disk drive
X5250A	36.4-GB, 10000-rpm, low-voltage differential (LVD) UltraSCSI disk drive
X9653B	Universal rackmount kit





## Sun StorEdge D2 Array Cables

The total length of all SCSI cables on any one bus should not exceed 20 meters (point to point). The Sun StorEdge D2 array ships with one 4-meter UltraSCSI differential cable per bus. Cable lengths are as follows.

Order Number	Option Description	Use
X1136A	0.8-meter, SCSI VHDCI/VHDCI cable	Sun StorEdge D2 array to host bus adapter P/N X6758A (PCI dual Ultra 3 SCSI)
X1137A	1.2-meter, SCSI VHDCI/VHDCI cable	Sun StorEdge D2 array to host bus adapter P/N X6758A (PCI dual Ultra 3 SCSI)
X1138A	2-meter, SCSI VHDCI/VHDCI cable	Sun StorEdge D2 array to host bus adapter P/N X6758A (PCI dual Ultra 3 SCSI)
X3830B	4-meter, SCSI VHDCI/VHDCI cable	Sun StorEdge D2 array to host bus adapter P/N X6758A (PCI dual Ultra 3 SCSI)
X3831B	10-meter, SCSI VHDCI/VHDCI cable	Sun StorEdge D2 array to host bus adapter P/N X6758A (PCI dual Ultra 3 SCSI)
X3832A	2-meter, SCSI 68-pin to VHDCI cable	Sun StorEdge D2 array to embedded SCSI controller of the Sun Ultra 60/80 and Sun Enterprise 220R, 250, 420R, 450 platforms

## Parts

The table below shows the parts for a Sun StorEdge D2 array to be mounted on a tabletop or desktop. All parts listed below are included with the purchase of an array.

Quantity	Item
1	Sun StorEdge D2 array (with one or two ESMs)
2	Power cord
1	Disk drive manual
1 or 2	SCSI cable (one for each ESM)
2	Key (for the lockable front door)
1	CD-ROM including Sun StorEdge D2 array documents containing the following manuals in PDF format: <ul style="list-style-type: none"> <li>Sun StorEdge D2 Installation, Operation, and Service Manual</li> </ul> The CD-ROM also includes Adobe Acrobat Reader

The table below shows the additional parts for a Sun StorEdge D2 array that is to be mounted in a Sun cabinet.

Quantity	Item
2	4U trim strip (with 2 screws)
16	#10-32 x 1/2 in. screw
4	#10-14 x 7/16 in. screw
2	Mounting bracket



# Service and Support

The SunSpectrum<sup>SM</sup> 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<sup>TM</sup> Operating Environment software, and telephone support for Sun<sup>TM</sup> 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.

## Support Contracts

SunSpectrum program support contracts are available both during and after the warranty program. Customers may choose to uplift the service and support agreement to meet their business needs by purchasing a SunSpectrum contract. For more information on the SunSpectrum program offerings refer to the following URL:

[http://service.central/TS/ESP/SunSpectrum/Feature\\_Matrix/index.html](http://service.central/TS/ESP/SunSpectrum/Feature_Matrix/index.html).

The four levels of SunSpectrum support contracts are outlined below.

## SunSpectrum Program Support

Program	Description
<b>Mission-Critical SunSpectrum Platinum<sup>SM</sup> Support</b>	Designed to support client-server, mission critical solutions by focusing on failure prevention, rapid recovery and year round technical services planning. Support is provided 24 x 7.
<b>Business-Critical SunSpectrum Gold<sup>SM</sup> Support</b>	Includes a complete package of proactive and responsive services for customers who require maximum uptime for their strategic business-critical systems. Support is provided 24 x 7.
<b>System Coverage SunSpectrum Silver<sup>SM</sup> Support</b>	Combines the service expertise, responsive on-site support and technical support by telephone and SunSolve <sup>TM</sup> CD/on-line services. Support is provided 8 a.m. to 8 p.m. Mon. through Fri.
<b>Self-Directed SunSpectrum Bronze<sup>SM</sup> Support</b>	Provided for customers who rely primarily upon their own in-house service capabilities. Enables customers to deliver high quality service by giving them access to UNIX <sup>®</sup> expertise, Sun certified replacement parts, software releases and technical tools. Support is provided 8 a.m. to 5 p.m. Mon. through Fri.

## Warranty

The warranty on the Sun StorEdge<sup>TM</sup> D2 array hardware is two years. In addition, the Sun StorEdge D2 arrays carry a one-year on-site warranty. Software warranty is 90 days.



# Glossary

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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/second.
CLI	Command line interface.
Data cache	24 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. <i>See also</i> Half-duplex and Simplex.
Half-duplex	Refers to an interface, such as SCSI, that can transmit data in only one direction at a time. <i>See also</i> 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. <i>See</i> 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. <i>See also</i> 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. <i>See</i> 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/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 #
<b>Product Literature</b>				
– <i>Sun StorEdge™ D2 Storage Arrays, Just the Facts</i>	Reference Guide (this document)	Sales Tool	SunWIN, Reseller Web	332197
– <i>Sun StorEdge D2 Customer Presentation</i>	Customer Presentation and Slide Notes	Sales Tool	SunWIN, Reseller Web	332200
– <i>Sun StorEdge D2 Data Sheet</i>	Two-page Color Data Sheet	Sales Tool	SunWIN, Reseller Web, COMAC	332201
– <i>Sun StorEdge Product Overview Quick Reference Card</i>	Sun Product Quick Reference Card	Sales Tool	SunWIN, First Resort, Reseller Web	73691
– <i>Pocket Guide</i>	Product Overview	Sales Tool	SunWIN, Reseller Web, COMAC	88967 SE608-0
<b>External Web Sites</b>				
– <i>Sun StorEdge D2Array Information Site</i>	<a href="http://www.sun.com/storage/D2">http://www.sun.com/storage/D2</a>			
– <i>Additional Information</i>	<a href="http://www.sun.com/products_n_solutions/hardware/docs">http://www.sun.com/products_n_solutions/hardware/docs</a>			
– <i>Upgrades Information</i>	<a href="http://www.sun.com/ibb">http://www.sun.com/ibb</a>			
<b>Internal Web Sites</b>				
– <i>Storage Products Business Unit Web Site</i>	<a href="http://webhome.ebay/networkstorage/products/D2">http://webhome.ebay/networkstorage/products/D2</a>			
– <i>Specifications Sheet</i>	<a href="http://webhome.east/workgroupserverstorage/Carmel_ESM_Spec.pdf">http://webhome.east/workgroupserverstorage/Carmel_ESM_Spec.pdf</a>			
– <i>Upgrades Information</i>	<a href="http://ibb.eng/upgrades">http://ibb.eng/upgrades</a>			

