Sun StorEdge™ MultiPack–FC Desktop Array

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Positioning

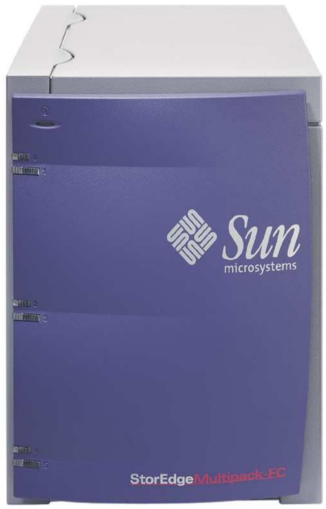

Figure 1: The Sun StorEdge™ MultiPack–FC desktop array

Introduction

The Sun StorEdge™ MultiPack–FC array is a desktop or deskside disk storage subsystem that utilizes a Fiber Channel interface. This is the newest member of the product family that includes the Sun StorEdge MultiPack (SCSI version) and Sun StorEdge UniPack systems. The Sun StorEdge MultiPack–FC desktop array is one of the first Fibre Channel external storage solutions specifically designed for workstations available today.

The Sun StorEdge MultiPack–FC desktop array accommodates up to six hot–pluggable 3.5–inch form factor hard disk drives, accommodating 1–inch high drives. The initial release of this system is configured with 18– GB and 36–GB, 10000–rpm FC–AL drives, with all six drives in one single loop. Drives are accessible to users via a lockable access cover. The system has one high–speed serial data connection (HSSDC) and one gigabit interface converter (GBIC) connector.

The Sun StorEdge MultiPack–FC desktop array complements Sun's mass–storage product line and brings competitive features to the desktop.

Key Messages

- Scalable storage from 36 to 218 GB; up to 436 GB of total storage with two systems
- Fibre Channel host connectivity performance
- Maximum 218.4 GB of storage capacity
- Multiple FC–AL drives in a single desktop enclosure
- Good price/IOPS (input/output operations per second) option

- Hot−swappable drives
- Easily serviced and expanded

Key Features

Some of the features of the new Sun StorEdge MultiPack−FC desktop array include:

- Fibre Channel performance
  - Up to 106 MB/second data transfer rate
    - Fibre Channel disk drives
    - High−speed serial host connectivity
- Compact desktop or deskside design
  - Minimal space requirement
  - Attractive design for the office environment
- The best workstation external storage solutions for the Solaris™ Operating Environment
  - Extensively tested on Sun platforms with the Solaris Operating Environment
  - Optimized performance and reliability
- The new Sun Blade™ 1000 workstation presents an opportunity to provide the next generation external workstation storage expansion solution
  - Sun Blade 1000 currently supports up to two Fibre Channel disk drives
    - Customers need to purchase an external storage solution for larger storage requirements
- The new Sun Blade 1000 workstation has high−speed, serial direct−connect host interface
  - No additional hardware required for Fibre Channel host connectivity and performance
- Sun has designed a storage solution specifically for the Sun Blade 1000 workstation architecture, the Sun StorEdge MultiPack−FC desktop array
  - The Sun StorEdge MultiPack−FC desktop array is the recommended external storage solution for the Sun Blade 1000 workstation

Product Family Placement

The positioning of the Sun StorEdge MultiPack−FC desktop array complements Sun's current storage product line (positioning and specifications are as of October 10, 2000).

	Sun StorEdge UniPack	**Sun StorEdge MultiPack**	**Sun StorEdge D1000**
Bus Type	SCSI	Fibre Channel and SCSI	SCSI
Configuration	Desktop, deskside	Desktop, deskside	4U rack, deskside
Capacity	18 to 36 GB	36 to 218 GB	72 to 436 GB
Devices	1	2 to 6	4 to 12

Target Users

The Fibre Channel Sun StorEdge MultiPack–FC desktop array is the new generation high–performance external storage solution specifically designed for Sun Blade 1000–class workstations. This storage system is ideal for Sun Blade 1000 workstation users with external storage requirements, including:

- Those whose project teams need scalable data–storage solutions with high data transfer rates for large, complex models (data sets)
- Those who require additional platform investment protection by allowing data storage capacity to scale to meet the needs of the project teams

Key Features and Benefits

Features	Benefits
• Fibre Channel performance	• Up to 106 MB/second data transfer rate • Fibre Channel disk drives • High–speed serial direct connect (HSSDC) for host connectivity • Provides easy to install, high–performance connection between Sun StorEdge MultiPack–FC desktop array and the Sun Blade 1000 workstation
• Scalable storage solution	• 36– to 218–GB configurations • 18– and 36–GB disk drives • Up to six disk drives
• Fibre Channel daisy–chain connectivity	• Connectivity option for a second Sun StorEdge MultiPack–FC desktop array • High–speed optical serial direct connect • Requires two GBIC modules and one optical cable option • Up to 436–GB total storage on a single loop • Provides close to one–half terabytes of storage
• Compact desktop or deskside design	• Provides a space–saving and attractive solution for the office environment
• Hot–swappable disk drives	• Provides easy serviceability

Selling Highlights

Some of the selling highlights of the Sun StorEdge™ MultiPack–FC desktop array include:

- Designed, integrated, and tested for Sun™ workstations
  - Tightly integrated and validated solution
- Optimized serviceability
  - Hot–swappable disk drives
- Fibre Channel performance
  - Hard disks and host connectivity
- Scalable
  - From 36–GB up to 218–GB storage capacity
  - Up to six disk drives
  - Daisy chain two systems for up to one half terabyte of total storage
- Compact design
  - Attractive design for desktop and deskside applications

Enabling Technology

Specifications

FC−AL−based storage systems help 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 106 MB per second
- **Use of existing SCSI protocols—**FC−AL allows SCSI command packets to be sent over a high−speed physical medium, helping to reduce software and firmware costs and minimize impact on existing software.
- **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 hot−pluggable components, and multiple host connections—

- **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, offering lower costs, easier administration, and the easy deployment and redeployment of computing resources.

Fibre Channel Disk Drives

All drives in the Sun StorEdge™ MultiPack−FC desktop array contain an FC−AL interface that supports the SCSI command set. Each drive uses a small form−factor, 40−pin single−connector attachment for FC−AL interconnect.

The FC−AL disk drive is connected directly to the Fibre Channel loop and appears as a node on the loop. Each drive is identified by a World Wide Name that is unique. The FC−AL drives accept all standard SCSI−3 commands. Since SCSI commands are delivered directly to the drives via the Fibre Channel loop, long cables can be used, a legacy copper SCSI interface is not required, helping to enable higher throughput.

FC−AL drives are hot−pluggable. Software preparations, however, must be made for removal, replacement, and additions to be properly recognized and configured.

Gigabit Interface Converter (GBIC) Module

The gigabit interface converter (GBIC) module is a small, hot−pluggable, optical/electrical conversion unit that converts any of the standard Fibre Channel connector and signaling technologies to a standard internal serial connection. The full speed of the module is 1,062.5 Mbit per second.

The standard GBIC supported with the Sun StorEdge MultiPack−FC desktop array operates generically with optical connections. On one end is an electrical connection which interfaces with internal buses, while on the other end is an optical connection with the standard SC fiber cable connector. The GBIC uses a 780−nanometer shortwave laser that operates at an inherently safe power level so that no open fiber control safety circuits are required.

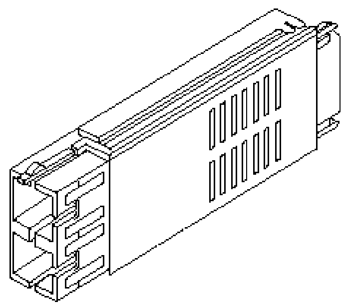

Figure 2. Gigabit interface converter (GBIC)

RAID Support

Sun StorEdge MultiPack−FC desktop arrays support RAID 0+1 and RAID 5. The Sun Solstice Disk Suite and VERITAS Volume Manager software supports RAID technology to optimize performance, availability, and user cost. This technology improves performance, reduces recovery time in the event of file system errors, and increases data availability even in the event of a disk failure. VERITAS Volume Manager software supports four RAID levels that provide varying degrees of availability with corresponding trade−offs in performance and cost:

- RAID 0 (striping and concatenation) allows 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) allows 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.

Hot–Plug Capability

Key Innovation: Single–Connector Drive

Sun Microsystems, Inc. co–invented a type of drive–connector scheme called the single–connector attachment (SCA). In the SCA design, all electrical signals for SCSI interface, power, and jumpers are passed through one small connector, which is integrated directly onto the disk drive's printed circuit board. The drive plugs directly into the Sun StorEdge MultiPack–FC desktop array backplane with no cables or jumpers to set. This design improves reliability and serviceability.

The second–generation version of this connector, called the SCA–2, includes hot–plug features. The drive is grounded before signal pins make contact through the use of hot–plug pins. The drives also reserve two pins to carry signals that indicate when all pins have successfully connected. The single–connector design has been made available to the disk industry's Small Form Factor Committee and is produced by multiple disk–drive manufacturers (spec SFF8046).

Many disk subsystems offer hot–plug disks. Unfortunately, they are inherently unreliable and cumbersome. To be pluggable, a standard disk drive is enclosed in a metal or plastic canister. Internal connections use multiple flex cables, jumpers, and other wires—parts that increase the likelihood of failures. These pluggable–drive schemes cause a disk subsystem to be *less* reliable.

Therefore, SCA–2 gives Sun customers many benefits, the most important being higher reliability. Using SCA–2 provides other valuable advantages:

- SCA–2 is one of the keys to the higher storage density of the Sun StorEdge MultiPack–FC desktop array
- SCA–2 costs less than other drive–carrier schemes
- SCA–2 is more customer–serviceable

With other pluggable–drive schemes, removing the failed drive from the carrier and replacing it with a new drive is tedious and fraught with risks and potential mistakes.

Hot Plug Defined

Annex A of the SCSI–3 Parallel Interface (SPI) document draft proposal (X3T10/855D revision 15a *Removal and Insertion of SCSI Devices*) outlines four cases of plugging devices:

- Case 1: Power–off during removal or insertion
- Case 2: RST signal asserted continuously during removal or insertion
- Case 3: Current I/O processes not allowed during insertion or removal
- Case 4: Current I/O processes allowed during insertion or removal

Hot Plug in the Sun Environment

The Sun StorEdge MultiPack–FC desktop array conforms to all SCSI–3 SPI specifications for Case 4 at the disk–interface level. Activity on the bus can continue without interruption while a device is being removed or inserted. However, drives should not be pulled out randomly. The Sun StorEdge MultiPack–FC desktop array design is intended to allow users to replace failed drives in redundant (mirrored or RAID) configurations. If there is activity against a drive, users need to stop the activity before removing the drive. This can be done without bringing down the operating system or powering down the Sun StorEdge MultiPack–FC desktop array. The *Installation Supplement* of the *SPARCstorage™ MultiPack Product Note* contains detailed information for removing, replacing, and adding drives.

Hardware Considerations Need FC−AL

The Sun StorEdge MultiPack−FC desktop array fully supports hot−plugging. The SCA−2 drive connector eliminates the use of internal drive cables and allows for easy hot−plugging of drives. It is still recommended that a user suspend all operations over the Fibre Channel bus during hot−plug. FC−AL loop bypass circuitry allows the drive to be removable with minimum loop signal interruption.

Software Considerations

When supported by high−availability software solutions (such as VERITAS Volume Manager or Solstice DiskSuite™ software) the disk drives are hot−pluggable. Without the protection of a RAID implementation, outstanding data requests to a removed device may not complete. The *SPARCstorage MultiPack Product Note* has detailed information for various scenarios, including instructions for removing, replacing, and adding drives.

Hot Plug in the Solaris™ Operating Environment

Several levels of device plugging are defined in the Solaris™ Operating Environment. The operations required to support these features are listed below.

Hot Reconfiguration	Tasks
Adding disk drive to increase capacity	• Quiesce the FC−AL loop into which the drive will be inserted • Select a slot for the new disk drive • Add the disk drive • Configure the Solaris Operating Environment to recognize the drive • Configure the application to recognize the drive
Replacing a failed disk drive while the system is running	• Identify the failed drive at the system level • Detach the drive from the application using it • Map the device to a physical drive and determine its physical location • Quiesce the FC−AL loop from which the drive is to be removed • Remove the drive • Insert the replacement drive • Configure the replacement drive to be similar to the failed drive at the system level • Reattach the replacement drive to the application • Rebuild the data on the new drive if possible
Removing a disk drive from a system that no longer needs it	• Identify the drive to be removed • Detach the drive from any applications that are using it • Map the device to a physical drive and determine its location • Quiesce the FC−AL loop that the drive is in • Remove the drive • Reconfigure the Solaris Operating Environment to recognize that the drive is no longer available

System Architecture

Overview

Features include the following:

- The Sun StorEdge™ MultiPack–FC desktop array is connected to a Sun Blade™ 1000 workstation via HSSDC copper connector.
- The system supports a maximum of two FC–AL combo boxes daisy–chained (12 drives).
- The enclosure is designed for desktop or deskside installation.
- The Sun StorEdge MultiPack–FC desktop array has an industrial design (ID) that is consistent with the new ID language.

Sun StorEdge MultiPack–FC Technology Overview

The Sun StorEdge MultiPack–FC desktop array drive enclosure uses 3.5–inch form factor, and FC–AL SCA–2 disk drives. Each unit is configured with a minimum of two and a maximum of six 1–inch high disk drives per enclosure.

Types of Connections

Box IDs 1–15 are available. Sun suggests that customers use box IDs 1 and 2 for daisy–chained units. Box IDs are set on the back panel with a switch. When connecting multiple units to a host system be sure that each unit has a unique box ID.

Target IDs, the formula for target IDs (target addresses) is: Box ID * 8 + Slot ID = Target ID.

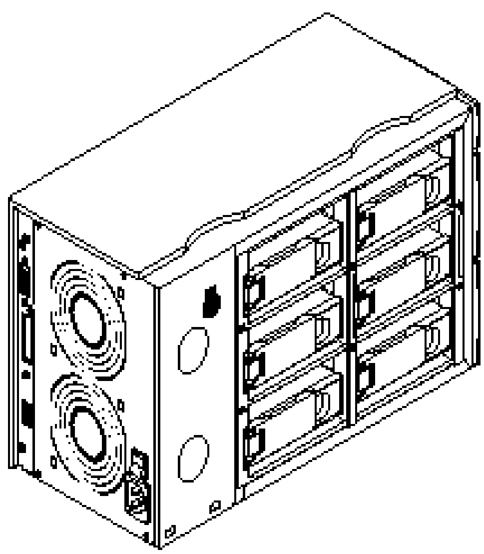

Figure 3: Sun StorEdge MultiPack system enclosure

Connectivity features of the Sun StorEdge MultiPack–FC desktop array do not require external bus termination. A maximum of two Sun StorEdge MultiPack–FC units can be connected in a daisy–chain. Customers must order optical GBICs and cables separately.

Power Supply

The Sun StorEdge MultiPack−FC desktop array includes a 180−Watt autoranging power supply.

Easy to Open and Service

The Sun StorEdge MultiPack−FC desktop array is designed with a key−locking door that gives users quick access to the drive bays while protecting valuable data from inadvertent removal. Engaging the lock is not required to keep the door shut.

Single−Connector Attachment (SCA) Disks

All disk drives use the single−connector attachment (SCA) interface. The SCA interface eliminates the need for internal cables, improving reliability and serviceability.

Specifications

Physical Specifications

Specification	U.S.	Metric
Height	9.45 in.	240 mm
Width	7.76 in.	197 mm
Depth	17.80 in.	452 mm
Weight (without drives)	19.0 lb.	8.6 kg
Weight (with six 25.4mm (1.0 in) height drives)	28.0 lb.	12.7 kg

Electrical Specifications

Specification	
Input voltage	100–240 VAC
Frequency	47–63 Hz
Maximum input current	3.0 A
Maximum input VA	300 VA
Maximum input power	185 Watts
Maximum heat output	900 BTU

Environmental Specifications

Specification	
Temperature	
• Operating	5 to 40°C (41 to 104°F)
• Non–operating	–40 to 60°C (–40 to 140°F)
Relative Humidity	
• Operating	20% @ 40°C to 80% @ 31°C
• Non–operating	5 to 93%
Altitude	
• Operating	3,000 meters @ maximum operating temperature derated 1.8°C per 1,000 meters of altitude above sea level
• Non–operating	12,000 meters

Specification	
Vibration	
• Operating	0.2 G (0~Pk) swept sine
• Non–operating	1.0 G (0~Pk) swept sine

Regulations

The Sun StorEdge™ MultiPack–FC desktop array meets or exceeds the following specifications.

Category	Specification
Safety	UL 1950; USA ITE CSA 22.2 No. 950; Canada ITE EN60950; Europe (TUV) ITE EMKO–TSE (74–SEC)–207; Nordic deviations to EN60950 CB scheme; Report to IEC950 and Nordic deviations
EMI	EN55022 class B; EMI regulations for CE mark, Europe EN61000–3–2; Power harmonics, Europe FCC Part 15, class B; USA VCCI class 2; Japan CSA C108.8–M1983 class B; Canada
Electrical Disturbances	EC1000–4–2; Electrostatic discharge (ESD) EC1000–4–3; Radiated electromagnetic field EC1000–4–4; Electrical fast transient EC1000–4–5; Surge
Product label	UL, GS (TUV) FCC Class B Canadian Class B VCCI Class 2, CE Australian C–tick mark Russian Gost–R Taiwan BSMI

- Meets or exceeds FCC Class B regulatory compliance
- Adheres to Sun compliant specification 990–1151–01
- Meets or exceeds Sun’s MultiPack–FCAL combo environmental robustness requirements

Requirements and Configuration

Sun StorEdge™ System Support

The Sun StorEdge™ MultiPack–FC desktop arrays are supported on Sun Blade™ 1000 workstations.

Host Adapter Connectivity

Onboard HSSDC on Sun Blade 1000 workstations.

Configuring Drives

Each Sun StorEdge MultiPack–FC unit is configured with a minimum of two and a maximum of six hard drives that are 25.4 mm (1.0 in.) in height.

Software Requirements

The Sun StorEdge MultiPack–FC is fully functional with the Solaris™ 8 Operating Environment and later releases.

Diagnostic Software

The SunVTS™ diagnostic software program verifies that the Sun StorEdge MultiPack–FC desktop array functions properly. It is used to locate failed field replaceable units.

Cables

The Sun StorEdge MultiPack–FC desktop array utilizes the following cables.

- **Sun StorEdge MultiPack–FC copper cables with HSSDC connectors**

Length	Application	Marketing Part Number
3.0 meters	Included with each Sun StorEdge MultiPack–FC desktop array for host or daisy–chain connections	N/A
1.0 meters	Optional	X6760A
10.0 meters	Optional	X6761A

- **Sun StorEdge MultiPack–FC optical cables**

Length	Application	Marketing Part Number
2.0 meters	Optional	X973A
15.0 meters	Optional	X978A

- **Sun StorEdge MultiPack−FC GBIC modules**

Module	**Application**	**Marketing Part Number**
Optical	Optional for daisy chaining two Sun StorEdge Multipack−FC desktop arrays	X6731A

Refer to Figure 4 below.

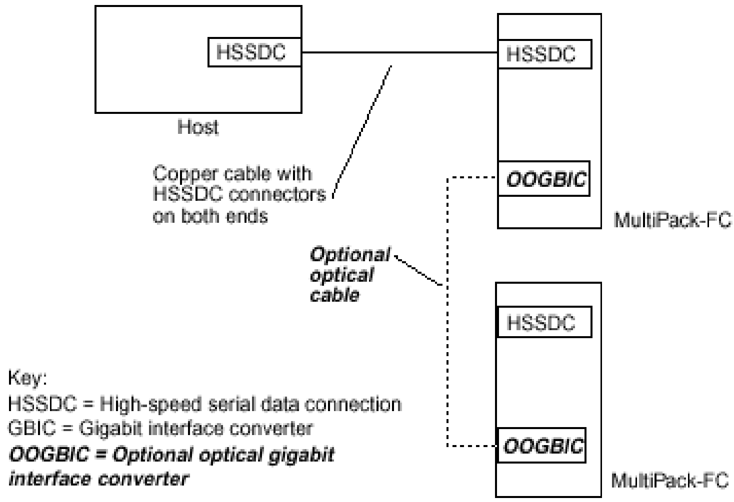

Figure 4: 3.0−meter copper cable with HSSDC connectors for host connection

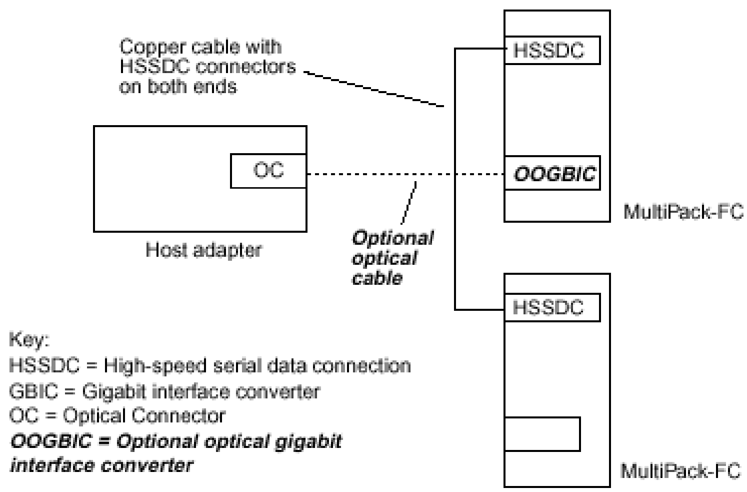

Figure 5: 3.0−meter copper cable with HSSDC connectors for daisy−chain connection

System Management

Operating Environment

The StorEdge™ MultiPack–FC desktop array is supported only on the Solaris™ 8 Operating Environment (or later).

Diagnostics

The SunVTS™ test utility checks each drive in the tray using the SunVTS disk test. These tests only provide state (presence) of the devices and do not provide any diagnostics capability. The power supply is diagnosed for failure using the LED indicators on the front.

Light indicators are provided for both the enclosure power status and disk drive status and are visible to the user. Enclosure power status are visible from the front and the disk drive status are visible from the front and when installing or removing drives.

Ordering Information

Sun StorEdge™ MultiPack–FC Marketing Part Numbers

Part Number	Option Description
SG–XFDSK020C–36G	36.4–GB Sun StorEdge™ MultiPack–FC, 2 x 18.2–GB, 10000–rpm disks
SG–XFDSK020E–72G	72.8–GB Sun StorEdge MultiPack–FC, 2 x 36.4–GB, 10000–rpm disks
SG–XFDSK060C–109G	109.2–GB Sun StorEdge MultiPack–FC, 6 x 18.2–GB, 10000–rpm disks
SG–XFDSK060E–218G	218.4–GB Sun StorEdge MultiPack–FC, 6 x 36.4–GB, 10000–rpm disks

Options

Sun StorEdge MultiPack–FC Drives and Cables (for host connectivity)

Part Number	Option Description
X6728A	18.2–GB, 10000–rpm, Fibre Channel disk drive
X6724A	36.4–GB, 10000–rpm, Fibre Channel disk drive
X6760A	1–meter Fibre Channel cable, HSSDC to HSSDC
X6761A	10–meter Fibre Channel cable, HSSDC to HSSDC

Configuration Guidelines

- No host bus adapter is required for the Sun Blade 1000 workstation.
- Two Sun StorEdge MultiPack–FC desktop arrays can be connected. This requires two GBICs and one cable. See the table below.

Part Number	Option Description
X6731A	GBIC interface module
X973A	2–meter optical cable
X978A	15–meter optical cable

Service and Support

Customers should check with their local Sun Enterprise Services representatives for program and feature availability in their areas.

Warranty

The worldwide service model for the Sun StorEdge™ MultiPack−FC desktop array is a standard support model. The standard support model provides local support in each country where Sun Enterprise Services has a presence. This model provides telephone technical assistance for basic hardware installation, telephone technical support for hardware troubleshooting, and a process for engaging support for warranty service on the Sun StorEdge MultiPack−FC product.

This coverage includes a one−year, 15 day RTD warranty.

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 *Active Terminator.*
Bandwidth	A measure of the capacity of a communication channel, usually specified in MB/second.
Channel	An interface directed toward high−speed transfer of large amounts of information.
DSBE/S	SBus fast differential SCSI−2/buffered Ethernet card.
DWIS/S	SBus differential fast/wide intelligent SCSI−2 host adapter.
Fabric	A group of interconnections between ports that includes a fabric element.
Fast SCSI	Data transfer rate of 10 MB/second.
Fast/wide SCSI	Data transfer rate of 20 MB/second wide devices can be connected to a narrow SCSI interface, but the extra data lines need to be terminated.
FC−AL	Fibre Channel arbitrated loop, a loop technology used with Fibre Channel.
Fiber	A wire or optical strand. Spelled *fibre* in the context of Fibre Channel.
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.
FSBE/S	Fast SCSI buffered Ethernet.
GB	Gigabyte. A gigabyte is 1,073,741,824 (2^{30}) bytes.
Host adapter	A device that connects a peripheral device I/O protocol and medium 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 on the bus.
Hot spare	A drive in an array that is held in reserve to replace any other drive that fails.
Hot swap	The specific case of hot−plugging which involves replacing a device with another of the same size, type, and layout.
IOPS	Input/output operations per second. A measure of I/O performance, IOPS is usually used to quote random I/O performance. See Throughput.
MTBF	Mean time between failures. A measure of reliability, this is the average expected time between failures of equipment, usually measured in operating hours.

RAID	Redundant array of independent disks. 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, availability, and cost characteristics.
Release	A SCSI command to release a previously granted reservation. See Reserve.
Reserve	A SCSI command issued by a host system to reserve access to a controller or disk drive. Once a reservation is granted to a system, commands to the controller or disk drive by any other system are rejected. This is a valuable safety feature in dual−hosted Sun StorEdge array configurations.
SBE/S	SCSI controller 5 MB/second transfer rate.
SCSI address	The octal representation of the unique address (0–7) assigned to a narrow device; or the hex representation of the unique address (0–15) assigned to a wide SCSI device.
Single connector	A SCSI disk connector technology co−invented by Sun Microsystems. The single connector attachment (SCA) provides all SCSI, power, and control signals in a single connector, and enables easy servicing and highly reliable, pluggable disk drives.
SSHA	SBus SCSI host adapter.
SunSwift™	Single−ended fast/wide SCSI−2 10/100 Mbps Ethernet SBus host adapter.
SunSwift PCI	Single−ended UltraSCSI 10/100 Mbps Ethernet PCI host adapter.
SWIS/S	Single−ended wide intelligent SCSI.
Throughput	A measure of sequential I/O performance, measured in MB/second. See IOPS.
UltraSCSI	Data transfer rate of 40 MB/second. Wide devices can be connected to a narrow SCSI interface, but the extra data lines need to be terminated.
US2S	PCI UltraSCSI dual channel host adapter.
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. The volume manager 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 only while all I/O processes are suspended.

Materials Abstract

All materials will be available on SunWIN except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
Powerpack				
– *Sun StorEdge™ MultiPack–FC Desktop Array, Just the Facts*	Just The Facts	Training Sales Tool	SunWIN, Reseller Web	126786
– *Sun StorEdge MultiPack–FC Desktop Array Customer Presentation*	Customer Presentation	Sales Tool	SunWIN, Reseller Web, E–mail	126785
Product Literature				
– *Literature – Sun StorEdge MultiPack–FC Desktop Array Data Sheet*	Data Sheet	Sales Tool	SunWIN, Reseller Web, E–mail	66769
– *Sun StorEdge MultiPack–FC Desktop Array Elevator Pitch*	Elevator Pitch	Sales Tool	SunWIN, Reseller Web	126872
Success Stories				
– *Paradigm Geophysical Ltd. Gives Sun StorEdge MultiPack–FC Array An A+*	Success Story	Sales Tool	SunWIN, Reseller Web	126328
White Papers				
– *Fibre Channel Technology from Sun Microsystems*	Technical Brief	Sales Tool, Training	SunWIN, Reseller Web	65659
– *Fibre Channel versus Alternative Storage Interfaces: An Overview*	Technical Brief	Sales Tool, Training	SunWIN, Reseller Web	65663
External Web Sites				
– *Site for Information on Sun StorEdge MultiPack–FC Desktop Array*	`http://www.sun.com/storage/multipack/`			