

Sun StorEdge™ A5000 Configuration Guide

*Includes the Entire Series of Sun StorEdge A5000
Disk Arrays (Formerly the Sun Enterprise Network
Array™)*



THE NETWORK IS THE COMPUTER™

Sun Microsystems, Inc.
901 San Antonio Road
Palo Alto, CA 94303-4900 USA
650 960-1300 Fax 650 969-9131

Part No. 805-0264-15
September 1999, Revision A

Send comments about this document to: docfeedback@sun.com

Copyright 1999 Sun Microsystems, Inc., 901 San Antonio Road • Palo Alto, CA 94303 USA. All rights reserved.

This product or document is protected by copyright and distributed under licenses restricting its use, copying, distribution, and decompilation. No part of this product or document may be reproduced in any form by any means without prior written authorization of Sun and its licensors, if any. Third-party software, including font technology, is copyrighted and licensed from Sun suppliers.

Parts of the product may be derived from Berkeley BSD systems, licensed from the University of California. UNIX is a registered trademark in the U.S. and other countries, exclusively licensed through X/Open Company, Ltd.

Sun, Sun Microsystems, the Sun logo, OpenBoot, Sun StorEdge, Sun StorEdge Volume Manager, Sun Enterprise, Sun Enterprise Volume Manager, Sun Enterprise Network Array, and Solaris are trademarks, registered trademarks, or service marks of Sun Microsystems, Inc. in the U.S. and other countries. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. in the U.S. and other countries. Products bearing SPARC trademarks are based upon an architecture developed by Sun Microsystems, Inc.

The OPEN LOOK and Sun™ Graphical User Interface was developed by Sun Microsystems, Inc. for its users and licensees. Sun acknowledges the pioneering efforts of Xerox in researching and developing the concept of visual or graphical user interfaces for the computer industry. Sun holds a non-exclusive license from Xerox to the Xerox Graphical User Interface, which license also covers Sun's licensees who implement OPEN LOOK GUIs and otherwise comply with Sun's written license agreements.

RESTRICTED RIGHTS: Use, duplication, or disclosure by the U.S. Government is subject to restrictions of FAR 52.227-14(g)(2)(6/87) and FAR 52.227-19(6/87), or DFAR 252.227-7015(b)(6/95) and DFAR 227.7202-3(a).

DOCUMENTATION IS PROVIDED "AS IS" AND ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS AND WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT, ARE DISCLAIMED, EXCEPT TO THE EXTENT THAT SUCH DISCLAIMERS ARE HELD TO BE LEGALLY INVALID.

Copyright 1999 Sun Microsystems, Inc., 901 San Antonio Road • Palo Alto, CA 94303 Etats-Unis. Tous droits réservés.

Ce produit ou document est protégé par un copyright et distribué avec des licences qui en restreignent l'utilisation, la copie, la distribution, et la décompilation. Aucune partie de ce produit ou document ne peut être reproduite sous aucune forme, par quelque moyen que ce soit, sans l'autorisation préalable et écrite de Sun et de ses bailleurs de licence, s'il y en a. Le logiciel détenu par des tiers, et qui comprend la technologie relative aux polices de caractères, est protégé par un copyright et licencié par des fournisseurs de Sun.

Des parties de ce produit pourront être dérivées des systèmes Berkeley BSD licenciés par l'Université de Californie. UNIX est une marque déposée aux Etats-Unis et dans d'autres pays et licenciée exclusivement par X/Open Company, Ltd.

Sun, Sun Microsystems, le logo Sun, AnswerBook, OpenBoot, Sun StorEdge, Sun StorEdge Volume Manager, Sun Enterprise, Sun Enterprise Volume Manager, Sun Enterprise Network Array, et Solaris sont des marques de fabrique ou des marques déposées, ou marques de service, de Sun Microsystems, Inc. aux Etats-Unis et dans d'autres pays. Toutes les marques SPARC sont utilisées sous licence et sont des marques de fabrique ou des marques déposées de SPARC International, Inc. aux Etats-Unis et dans d'autres pays. Les produits portant les marques SPARC sont basés sur une architecture développée par Sun Microsystems, Inc.

L'interface d'utilisation graphique OPEN LOOK et Sun™ a été développée par Sun Microsystems, Inc. pour ses utilisateurs et licenciés. Sun reconnaît les efforts de pionniers de Xerox pour la recherche et le développement du concept des interfaces d'utilisation visuelle ou graphique pour l'industrie de l'informatique. Sun détient une licence non exclusive de Xerox sur l'interface d'utilisation graphique Xerox, cette licence couvrant également les licenciés de Sun qui mettent en place l'interface d'utilisation graphique OPEN LOOK et qui en outre se conforment aux licences écrites de Sun.

CETTE PUBLICATION EST FOURNIE "EN L'ETAT" ET AUCUNE GARANTIE, EXPRESSE OU IMPLICITE, N'EST ACCORDEE, Y COMPRIS DES GARANTIES CONCERNANT LA VALEUR MARCHANDE, L'APTITUDE DE LA PUBLICATION A REpondre A UNE UTILISATION PARTICULIERE, OU LE FAIT QU'ELLE NE SOIT PAS CONTREFAISANTE DE PRODUIT DE TIERS. CE DENI DE GARANTIE NE S'APPLIQUERAIT PAS, DANS LA MESURE OU IL SERAIT TENU JURIDIQUEMENT NUL ET NON AVENU.



Contents

Preface vii

1. Introduction 1-1

- 1.1 Connection Ports 1-1
- 1.2 Fibre Channel Loops 1-2
 - 1.2.1 Full-Loop Configurations 1-3
 - 1.2.2 Split-Loop Configurations 1-6
- 1.3 Configuration Rules 1-9
- 1.4 Configuration Recommendations 1-9

2. Configuration Examples 2-1

- 2.1 Reference Configurations 2-1
 - 2.1.1 One Host 2-2
 - 2.1.2 One Host With Multiple Disk Arrays 2-3
 - 2.1.3 Two Hosts 2-4
 - 2.1.4 Two Hosts With Multiple Disk Arrays 2-5
 - 2.1.5 Three or Four Hosts 2-6
- 2.2 Other Supported Configurations 2-7
 - 2.2.1 One Host, Single Loop 2-7
 - 2.2.2 One Host, Split Loop 2-8
 - 2.2.3 One Host, Dual Path, Split Loop 2-9

- 2.2.4 One Host RAID5 RAS Configuration 2-10
- 2.2.5 Two Hosts, Single Loop 2-12
- 2.2.6 Two Hosts, Dual Path 2-13
- 2.2.7 Two Hosts, Split Loop Shared 2-14
- 2.2.8 Two Hosts, Split Loop Private 2-15
- 2.2.9 Three or Four Hosts, Single Paths 2-16

3. Host Connections 3-1

- 3.1 Introduction 3-1
- 3.2 Enterprise SBus+ and Graphics+ I/O Boards 3-2
 - 3.2.1 System Requirements 3-2
- 3.3 Sun StorEdge PCI FC-100 Host Adapter 3-3
 - 3.3.1 System Requirements 3-3
- 3.4 Sun StorEdge SBus FC-100 Host Adapter 3-4
 - 3.4.1 System Requirements 3-4

4. Disk Array Cabling 4-1

- 4.1 Introduction 4-1
- 4.2 Single Disk Array Configurations 4-3
- 4.3 Daisy-Chain Configurations 4-4
 - 4.3.1 Two Disk Arrays 4-6
 - 4.3.2 Three Disk Arrays 4-7
 - 4.3.3 Four Disk Arrays 4-8
- 4.4 Hub Configurations 4-9
 - 4.4.1 StorEdge Expansion Cabinet 4-9
 - 4.4.1.1 Four Disk Arrays 4-10
 - 4.4.1.2 Six Disk Arrays 4-13
 - 4.4.2 Other Expansion Cabinets 4-16

5. Cabinet Placement 5-1

- 5.1 Rackmount Placement Matrix 5-1

5.2	Cabinet Placement	5-1
5.2.1	StorEdge Expansion Cabinet	5-2
5.2.1.1	Four Disk Arrays	5-2
5.2.1.2	Six Disk Arrays	5-5
5.2.2	Other Expansion Cabinets	5-8

Index	Index-1
--------------	----------------

Preface

The *Sun StorEdge A5000 Configuration Guide* provides information on configuring the Sun StorEdge™ A5000 disk array and the Sun StorEdge FC-100 hub. These instructions are designed for an experienced system administrator or trained service provider.

How This Book Is Organized

Chapter 1 describes the fundamentals of the Fibre Channel ports and connections inside the disk array. It also gives rules and recommendations for configuring your disk array.

Chapter 2 describes the types of host connections that are currently available.

Chapter 3 describes the fundamentals of connecting hosts to disk arrays.

Chapter 4 describes how to cable disk arrays.

Chapter 5 describes how to put disk arrays and hubs in Sun system or expansion cabinets.

Using UNIX Commands

This document does not contain information on basic UNIX[®] commands and procedures such as shutting down the system, booting the system, and configuring devices.

See one or more of the following for this information:

- *Solaris Handbook for Sun Peripherals*
- AnswerBook[™] online documentation for the Solaris[™] software environment
- Other software documentation that you received with your system

Typographic Conventions

TABLE P-1 Typographic Conventions

Typeface	Meaning	Examples
AaBbCc123	The names of commands, files, and directories; on-screen computer output	Edit your <code>.login</code> file. Use <code>ls -a</code> to list all files. % You have mail.
AaBbCc123	What you type, when contrasted with on-screen computer output	% su Password:
<i>AaBbCc123</i>	Book titles, new words or terms, words to be emphasized	Read Chapter 6 in the <i>User's Guide</i> . These are called <i>class</i> options. You <i>must</i> be superuser to do this.
	Command-line variable; replace with a real name or value	To delete a file, type <code>rm filename</code> .

Shell Prompts

TABLE P-2 Shell Prompts

Shell	Prompt
C shell	<i>machine_name%</i>
C shell superuser	<i>machine_name#</i>
Bourne shell and Korn shell	\$
Bourne shell and Korn shell superuser	#

Related Documentation

Refer to the *Sun StorEdge A5000 Disk Array Installation and Documentation Guide*, part number 805-1903, for a list of related documentation.

Sun Documentation on the Web

The `docs.sun.comsm` web site enables you to access Sun technical documentation on the Web. You can browse the `docs.sun.com` archive or search for a specific book title or subject at:

`http://docs.sun.com`

Sun Welcomes Your Comments

We are interested in improving our documentation and welcome your comments and suggestions. You can email your comments to us at:

`docfeedback@sun.com`

Please include the part number of your document in the subject line of your email.

Introduction

This chapter contains information about the Fibre Channel ports and connections of the disk array. It also contains basic rules and recommendations about configuring your disk array. This chapter is organized as follows:

- Connection Ports—page 1-1
- Fibre Channel Loops—page 1-2
- Configuration Rules—page 1-9
- Configuration Recommendations—page 1-9

1.1 Connection Ports

As shown in FIGURE 1-1, the disk array can have up to four ports: A0, A1, B0, and B1.

- **A** and **B** are the two data paths to the dual-ported disk drives. Each disk array interface board (IB) connects to either the A or B loop.
- **0** and **1** are the two gigabit interface converter (GBIC) connections to the loops on each IB.

You can use these ports to connect the disk array directly to a host or hosts. You can also use them to connect multiple disk arrays in daisy-chain or hub configurations.

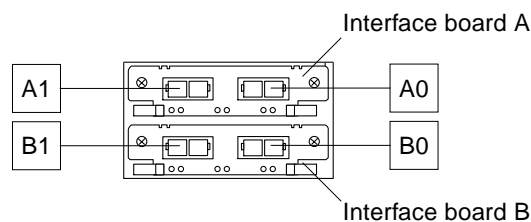


FIGURE 1-1 Connection Ports

1.2 Fibre Channel Loops

Each disk array can be configured for use in one to four Fibre Channel loops. You connect to the loops through the ports discussed in the previous section.

There are two types of loop configurations: *full* and *split*. A full loop attaches to all disk drives in the disk array on one loop. A split loop divides the disk drives between two loops.

Disk drives are internally connected to both A and B loops. To access the disk drives through both loops you need to connect through both the A and B disk array interface boards. This provides both hardware redundancy (if one loop fails you can still access the data through the other loop) and greater performance as the utilization of both 100 Mbytes/sec loops yields 200 Mbytes/sec maximum throughput.

There are two main reasons for configuring split loops:

- **Performance** - Because split loops have fewer disk drives per loop, the performance is better with large sequential I/O. For example, with a typical disk drives being able to sustain a 10 Mbytes/sec transfer rate, having 14 or 22 disk drives per loop can make the 100 Mbytes/sec loop the bottleneck. The speed of large sequential I/O transfers improves as the number of disk drives per loop decreases.
- **Hardware separation** - Having separate front and rear disk drive backplanes and separate host connections can give you a higher fault tolerance. Keeping the host adapters on separate I/O boards and ports protects the connection from an I/O board or port failure. Mirroring the data from one backplane or loop to the other protects from a loop or backplane failure. This is the highest fault-tolerant configuration that can be achieved using a single disk array. Using separate backplanes for each host in a dual-host configuration will completely separate and protect the disk drives and loops from administration errors or heavy loads on the other host.

The following sections provide additional information about full-loop and split-loop configurations.

1.2.1 Full-Loop Configurations

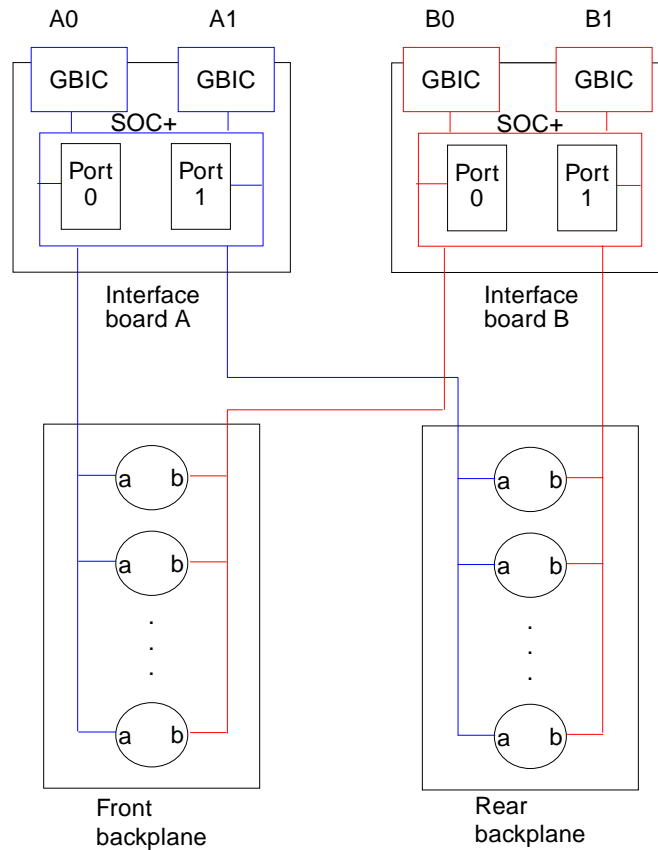


FIGURE 1-2 Full-Loop Diagram

The characteristics of a full-loop configuration include:

- Single A and single B loops
- A1 is interchangeable with A0, and B0 is interchangeable with B1
- Each loop connects to both front and rear backplanes
- A0 and A1 connect to the A loop
- B0 and B1 connect to the B loop
- Each loop has two enclosure services (ses) nodes and 14 or 22 drive (ssd) nodes
- Total of two 100 Mbytes/sec loops

The routing for this configuration is shown in FIGURE 1-3 and FIGURE 1-4.

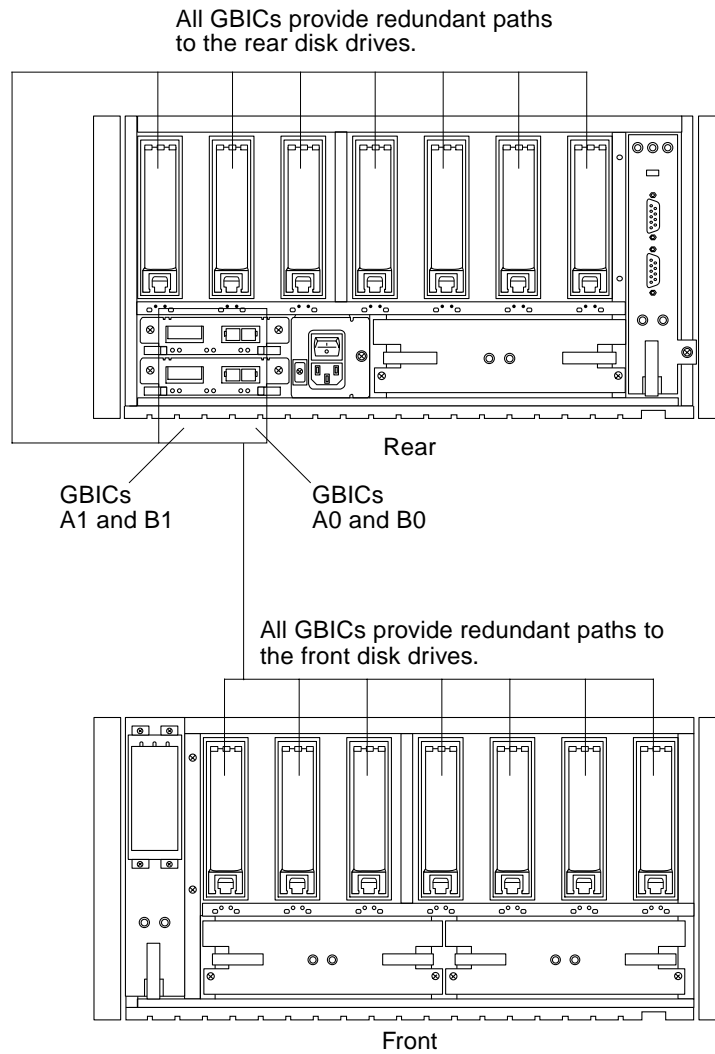


FIGURE 1-3 Full-Loop Routing for a 14-Slot Disk Array

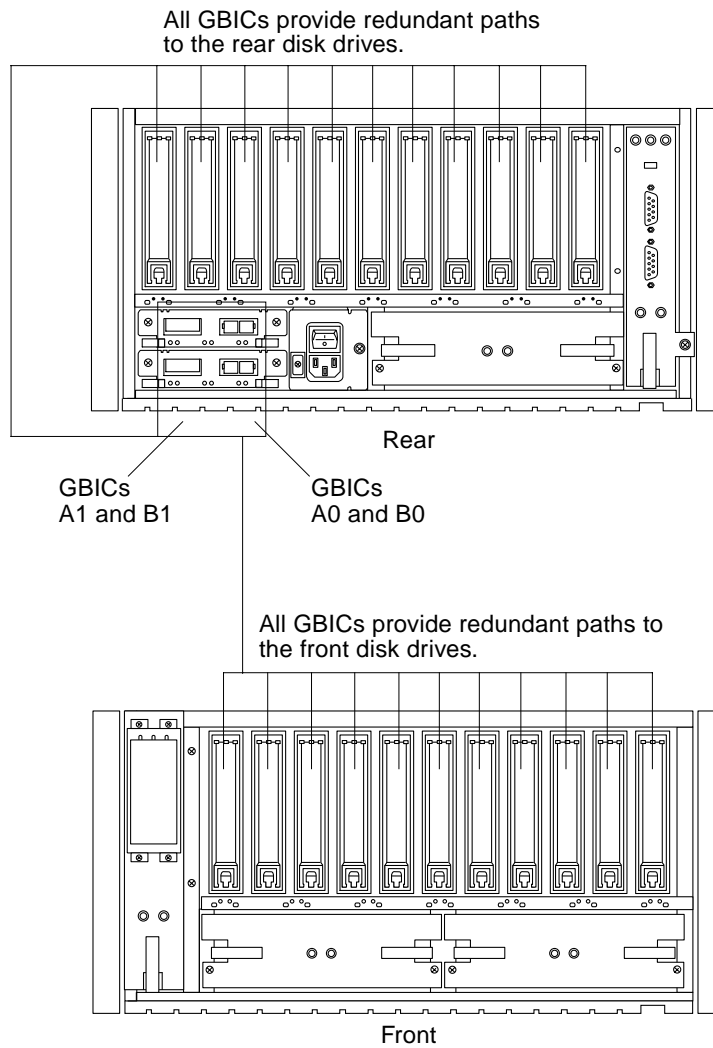


FIGURE 1-4 Full-Loop Routing for a 22-Slot Disk Array

1.2.2 Split-Loop Configurations

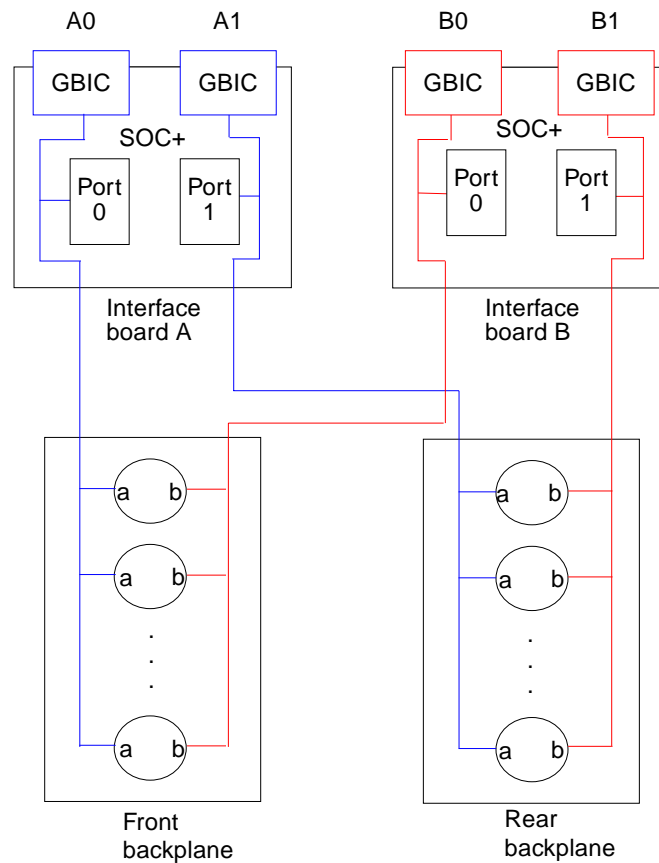


FIGURE 1-5 Split-Loop Diagram

The characteristics of a split-loop configuration include:

- Two A and two B loops
- Each loop connects to either the front or rear backplanes
- A0 connects to the front backplane A loop
- A1 connects to the rear backplane A loop
- B0 connects to the front backplane B loop
- B1 connects to the rear backplane B loop
- Each loop has one enclosure services (ses) node and 7 or 11 drive (ssd) nodes
- Total of four 100-Mbytes/sec loops

The routing for this configuration is shown in FIGURE 1-6 and FIGURE 1-7.

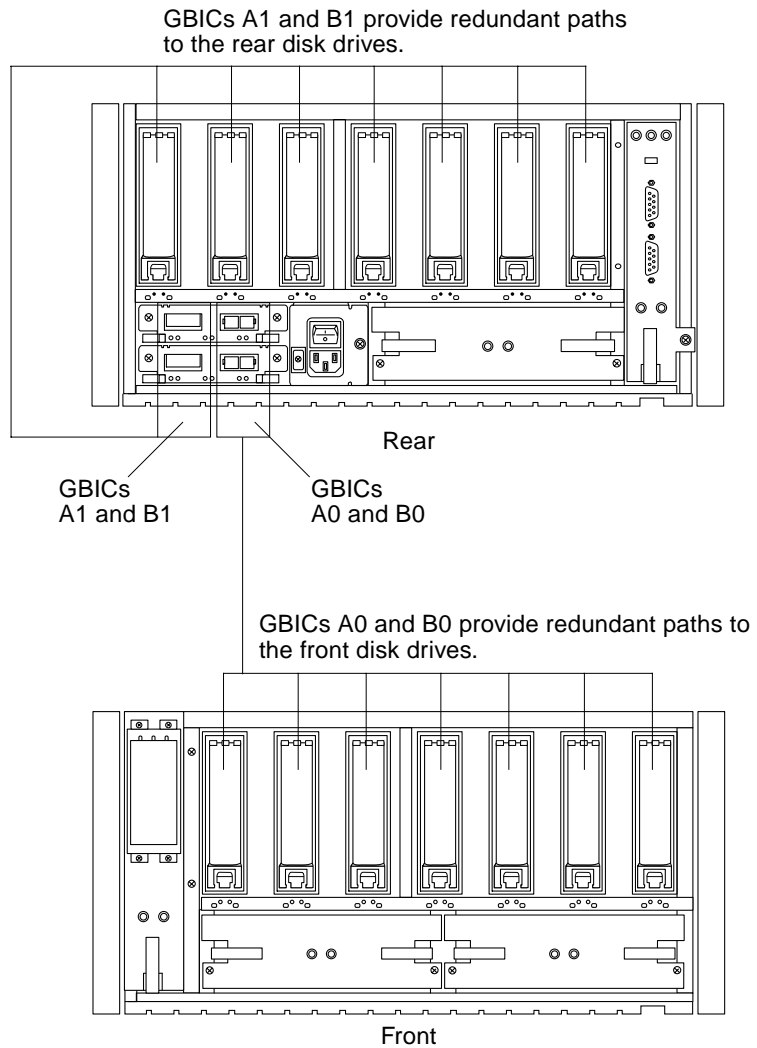


FIGURE 1-6 Split-Loop Routing for a 14-Slot Disk Array

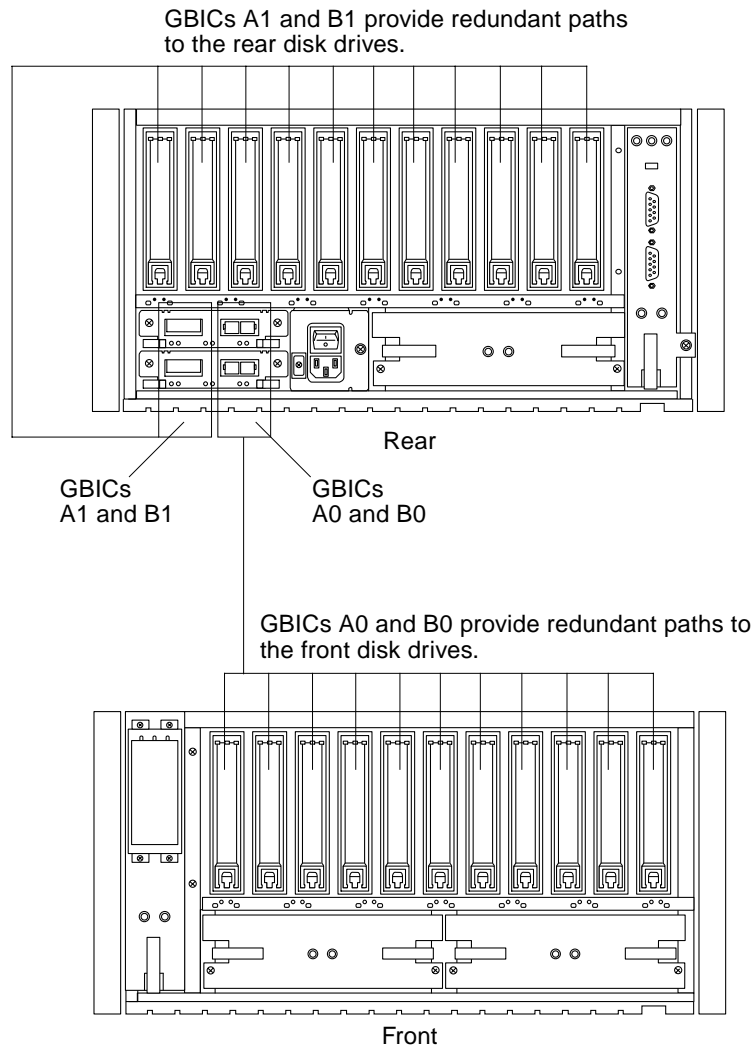


FIGURE 1-7 Split-Loop Routing for a 22-Slot Disk Array

1.3 Configuration Rules

Follow these rules when configuring disk arrays:

- One loop (A or B) per hub or daisy-chain
- A maximum of two host connections per loop or hub
- A maximum of four disk arrays per hub or daisy-chain
- Cable lengths between 2 and 500 meters using short-wave laser and 50 micron fiber optic cable
- Split-loop disk arrays cannot be used in hub or daisy-chains configurations
- Each disk array on a loop must have a unique Box ID

Note – Up to four Sun StorEdge A5000 or A5100 disk arrays can be connected on a loop. Any combination of disk arrays that includes the A5200 disk array is limited to three disk arrays per loop. The online *Sun StorEdge A5000 Installation Supplement* will be updated if there is any change to the configuration rules.

1.4 Configuration Recommendations

These recommendations may be useful when configuring disk arrays:

- Use redundant paths to all disk drives
- Connect redundant paths to separate host adapters, system buses, I/O cards
- Spread all paths over separate system buses to maximize bandwidth
- Maximize the number of loops (minimize number of devices per loop)
- Use hubs instead of daisy-chains
- Use Volume Manager with Dynamic Multipathing (DMP). This enables dual-loop (A and B) access to disk drives with load balancing, which increases performance.

In addition, these suggestions for cabling may eliminate confusion and errors:

- Connect A loops to host adapter port 0
- Connect B loops to host adapter port 1
- Disk array port A0 connects to host adapter port 0
- Disk array port B0 connects to host adapter port 1
- Label cable ends

Configuration Examples

This chapter contains the following sections:

- Reference Configurations—page 2-1
- Other Supported Configurations—page 2-7

Note – Example configurations that show a single disk array (except split loop) can use multiple disk arrays connected with either daisy-chains or hubs. A single disk array is shown for simplicity.

Your host may look different from the ones shown in the following illustrations.

Note – You can use the onboard GBIC connections on SBus+ and Graphics+ I/O boards instead of host adapter connections if your system has one of these boards installed. See Section 3.2 “Enterprise SBus+ and Graphics+ I/O Boards” on page 3-2 for more information.

2.1 Reference Configurations

Although there are many supported configurations, the reference configurations in this section provide the best solution for most installations:

- One Host—page 2-2
- One Host With Multiple Disk Arrays—page 2-3
- Two Hosts—page 2-4
- Two Hosts With Multiple Disk Arrays—page 2-5
- Three or Four Hosts—page 2-6

For a detailed discussion of configuration issues, see “*Mass Storage Subsystem Best Practices*,” part number 806-1949.

2.1.1 One Host

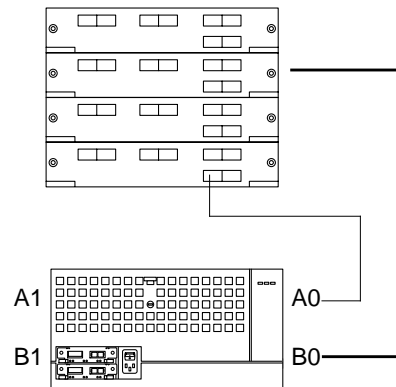


FIGURE 2-1 One Host

This is a high-availability configuration that uses two host adapters, fiber optic cables and interface boards to provide dual paths. It is also a high-performance configuration; it distributes host adapters across I/O ports for maximum bandwidth and throughput (up to 200 Mbytes/sec). You can use the second host adapter ports to connect additional disk arrays to double the capacity.

To ensure maximum redundancy, put each host adapter on a separate I/O board.

2.1.2 One Host With Multiple Disk Arrays

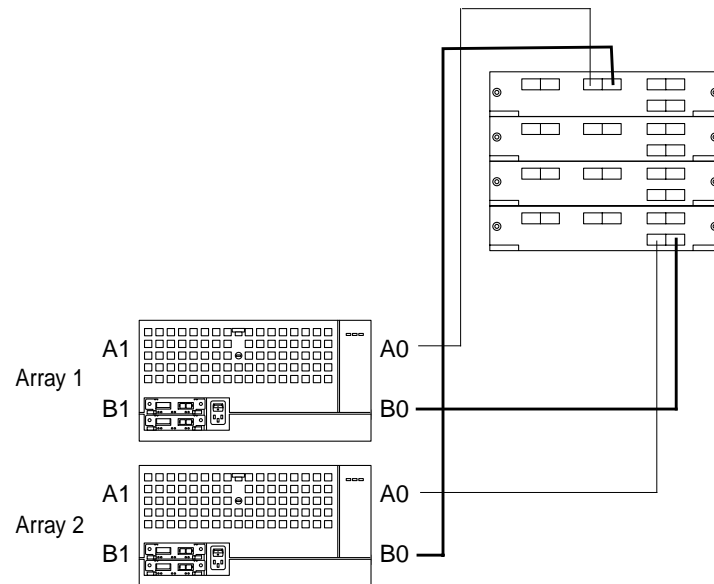


FIGURE 2-2 One Host With Multiple Disk Arrays

This configuration provides dual paths to the disk arrays. Both disk arrays on separate loops provides best Reliability Availability Serviceability (RAS).

To ensure maximum redundancy, put each path on a separate host adapter and each host adapter on a separate I/O board.

2.1.3 Two Hosts

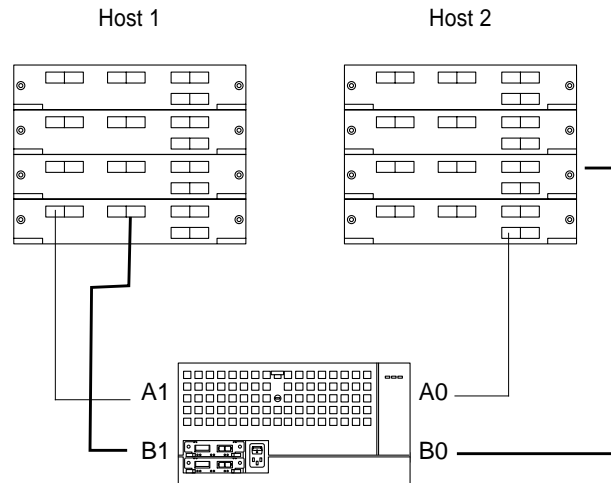


FIGURE 2-3 Two Hosts

Using two hosts with a disk array enables both hosts to access both paths to all the disk drives. It also provides dual paths to each disk array. Volume manager software is used to divide the disk drives into disk groups owned by each host.

To ensure maximum redundancy, put each path on a separate host adapter and each host adapter on a separate I/O board.

2.1.4 Two Hosts With Multiple Disk Arrays

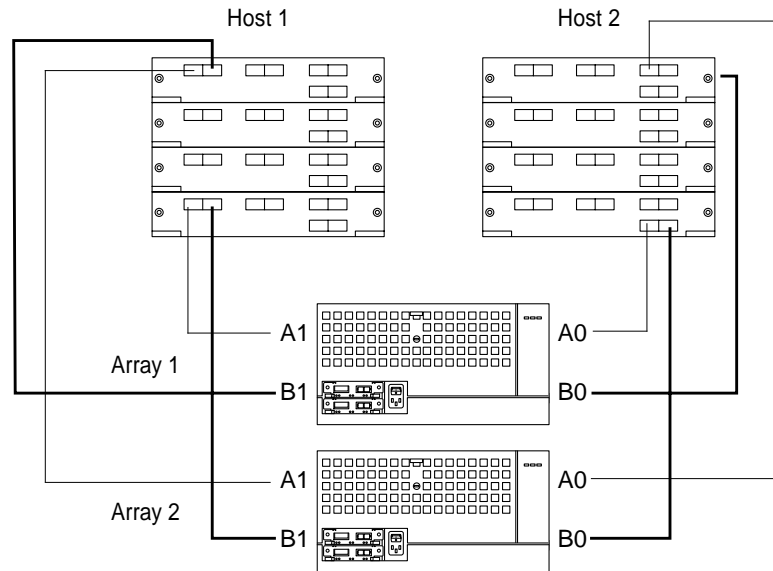


FIGURE 2-4 Two Hosts With Multiple Disk Arrays

Using two hosts with multiple disk arrays enables both hosts to access both paths to all the disk drives. It also provides dual paths to each disk array. Volume manager software is used to divide the disk drives into disk groups owned by each host. When mirroring across disk arrays, no single hardware failure, or even many dual failures, can bring the data service down.

To ensure maximum redundancy, put each host adapter on a separate I/O board.

2.1.5 Three or Four Hosts

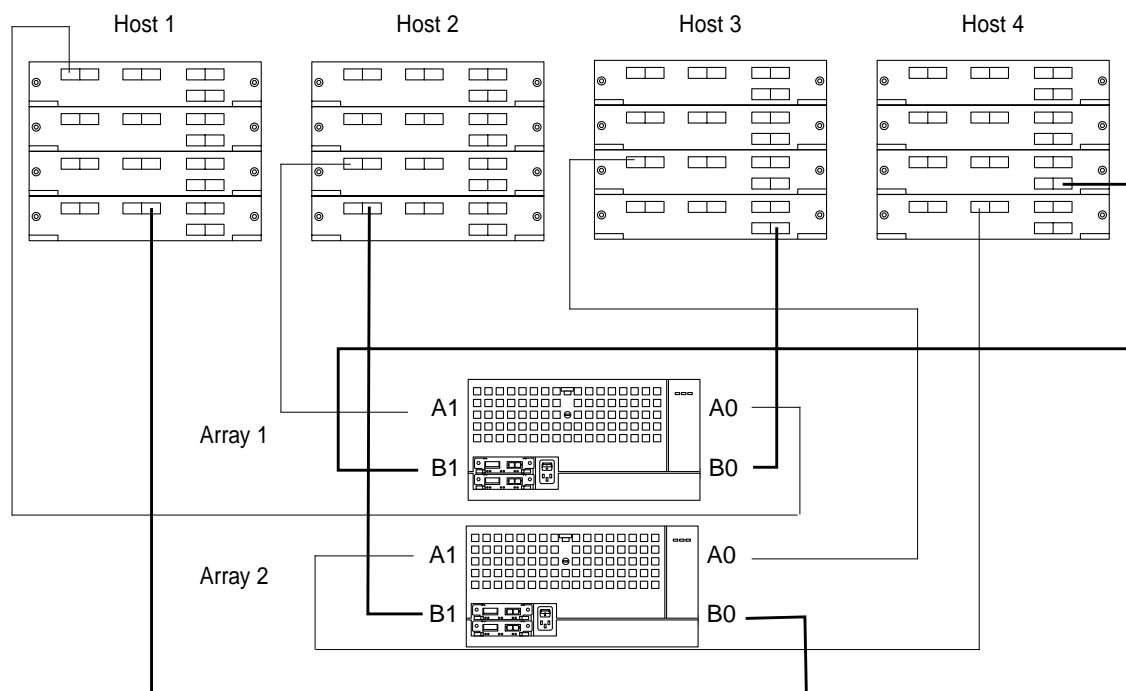


FIGURE 2-5 Three Or Four Hosts

This configuration shows how redundancy can be added to the configuration described in Section 2.2.9 “Three or Four Hosts, Single Paths” on page 2-16 by mirroring across disk arrays. This configuration is the basic building block for a four-node cluster. In this configuration:

- The disk arrays are mirrors. This could be extrapolated for RAID5.
- The paths from a host to the other half of the mirror are on different host adapters, SBus or PCI slots, and I/O cards.
- There are no restrictions as to how building blocks are used beyond the cable connections. However, mirrored halves must be the same size.
- Cabling requires a minimum of two connections per four disk arrays.

Note – Each host is connected only once to each disk array. Sun Cluster 2.1 software does not currently support Dynamic Multipathing (DMP).

2.2 Other Supported Configurations

2.2.1 One Host, Single Loop

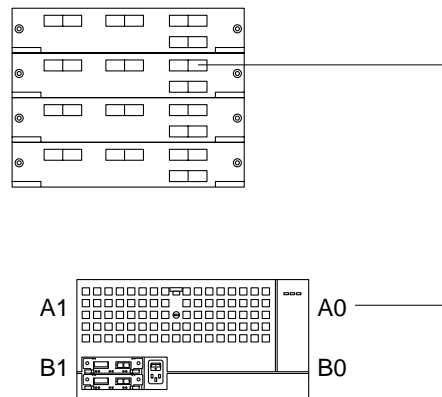


FIGURE 2-6 One Host, Single Loop

The most basic way to connect the disk array is using this configuration. Only a single path is provided. Although you should usually use multiple pathing, this configuration can be used for the direct replacement of SPARCStorage Arrays that had only one host connection.

2.2.2 One Host, Split Loop

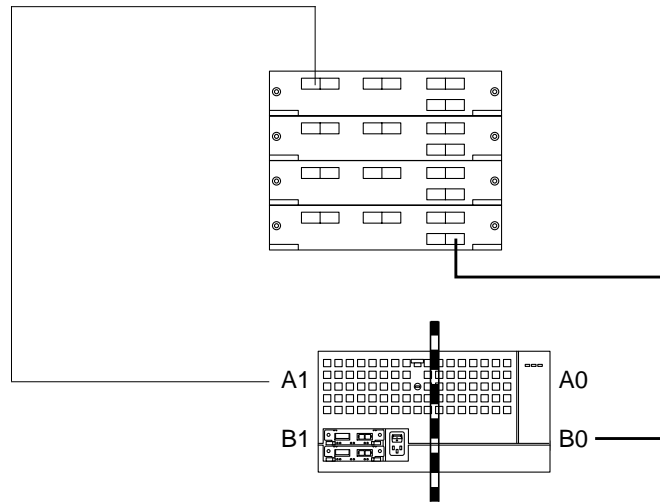


FIGURE 2-7 One Host, Split Loop

This is the minimum split-loop configuration with only one path to the disk drives. This is a good configuration for a host connected to a single disk array when the data is mirrored from the front disk drives to the rear disk drives.

2.2.3 One Host, Dual Path, Split Loop

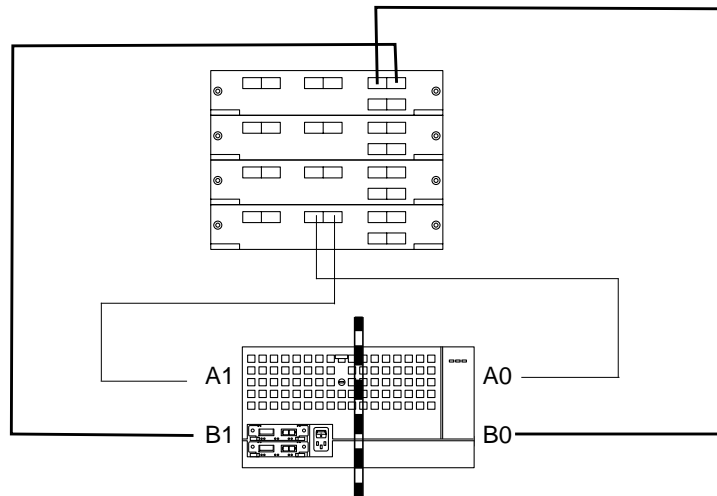


FIGURE 2-8 One Host, Dual Path, Split Loop

This is an improved split-loop configuration with the added redundancy of dual paths, which eliminates a single point of failure.

It also has the following characteristics:

- Provides dual paths to each backplane
- Is good for mirroring of disk drives within the same disk array

To ensure maximum redundancy, put each host adapter on a separate I/O board.

2.2.4 One Host RAID5 RAS Configuration

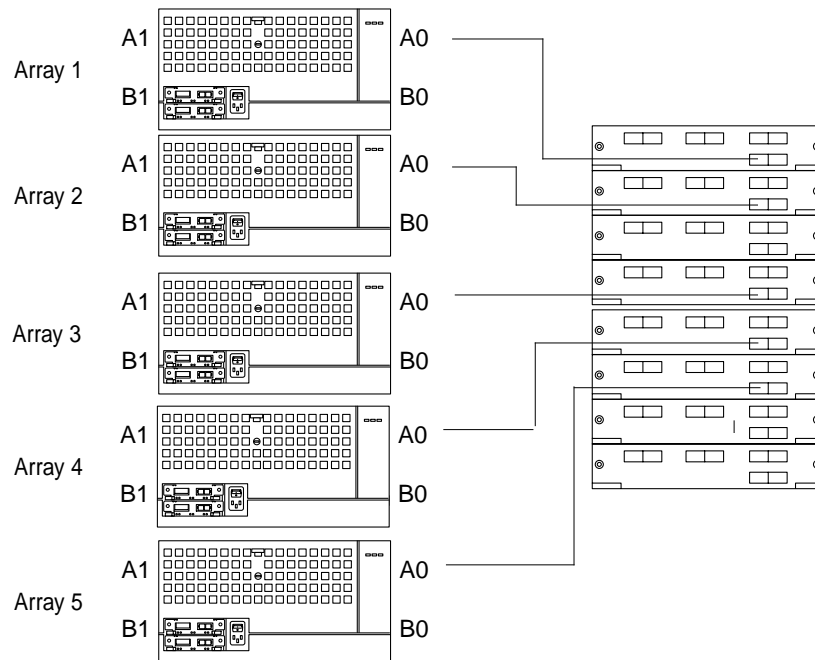


FIGURE 2-9 One Host RAID5 RAS Configuration (A Loop Connections)

This is the optimal RAID5 Reliability Availability Serviceability (RAS) hardware configuration. Configure the RAID5 volumes so that one disk drive in each disk array is used. This gives very high fault-tolerance; even the failure of an entire disk array will not cause loss of data. This configuration can utilize the full bandwidth of 10 loops, giving the highest possible throughput of 1000 Mbytes/sec.

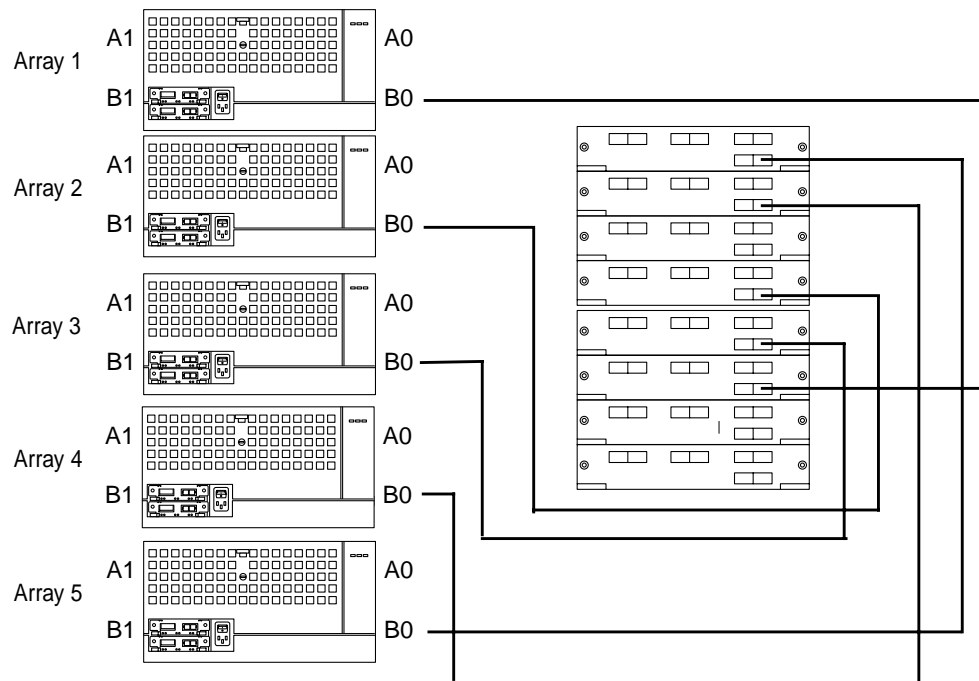


FIGURE 2-10 One Host RAID5 RAS Configuration (B Loop Connections)

It also has the following characteristics:

- Five disk drives per RAID5 volume
- Each disk drive in volume in different enclosure
- Solves any single disk array failure scenario
- High performance
- Dual paths to all disk drives
- Can only be implemented with host-based RAID

To ensure maximum redundancy, put each path on a separate host adapter and each host adapter on a separate I/O board.

2.2.5 Two Hosts, Single Loop

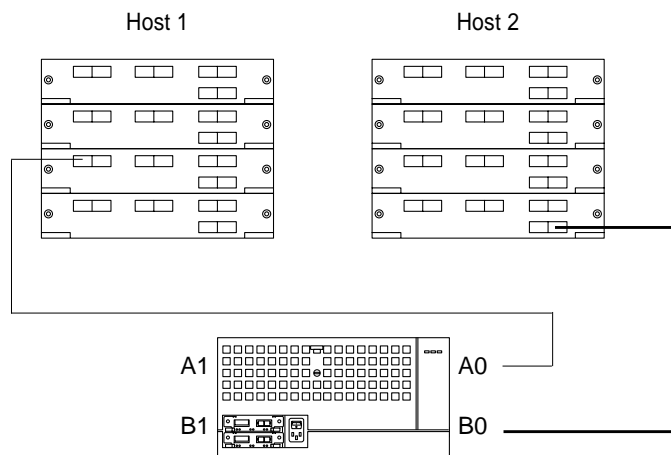


FIGURE 2-11 Two Hosts, Single Loop

This is the most basic two-host configuration. This is a direct replacement for a dual-hosted SPARCStorage Array configuration. This configuration does not provide any redundant paths.

Note – The two hosts use the two physical loops. This is important for clustering applications, since a single loop failure could bring the entire cluster down if both hosts are connected to the same loop.

2.2.6 Two Hosts, Dual Path

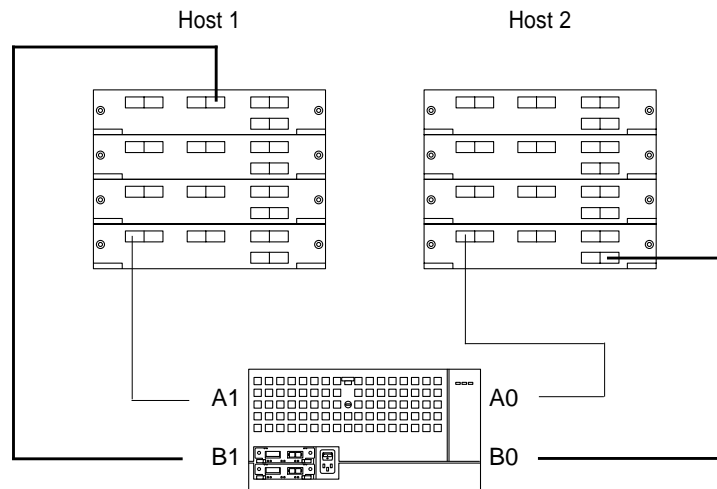


FIGURE 2-12 Two Hosts, Dual Path

Each host has redundant paths to all devices. It also provides dual paths for both hosts.

Note – This dual path configuration is not currently supported with Sun Cluster 2.1 software.

To ensure maximum redundancy, put each path on a separate host adapter and each host adapter on a separate I/O board.

2.2.7 Two Hosts, Split Loop Shared

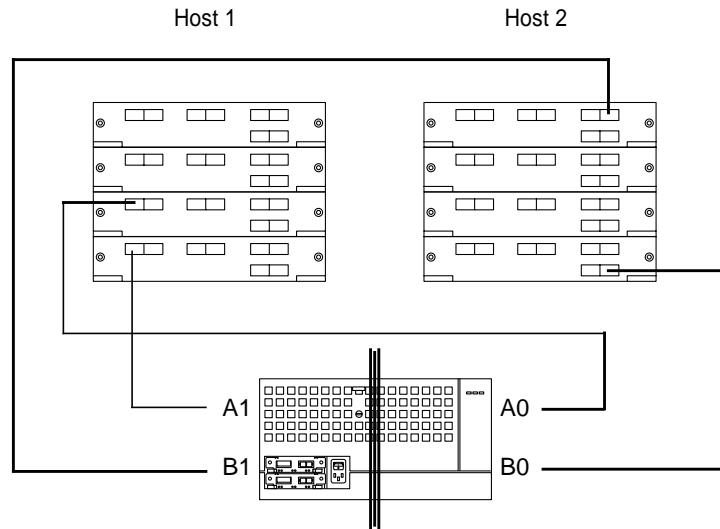


FIGURE 2-13 Two Hosts, Split Loop Shared

Both hosts can access all disk drives in the disk array, which enables the hosts to share the disk array utilizing four loops. Each host has use of two loops. This may be done for performance reasons. This configuration provides only a single path to each disk drive.

2.2.8 Two Hosts, Split Loop Private

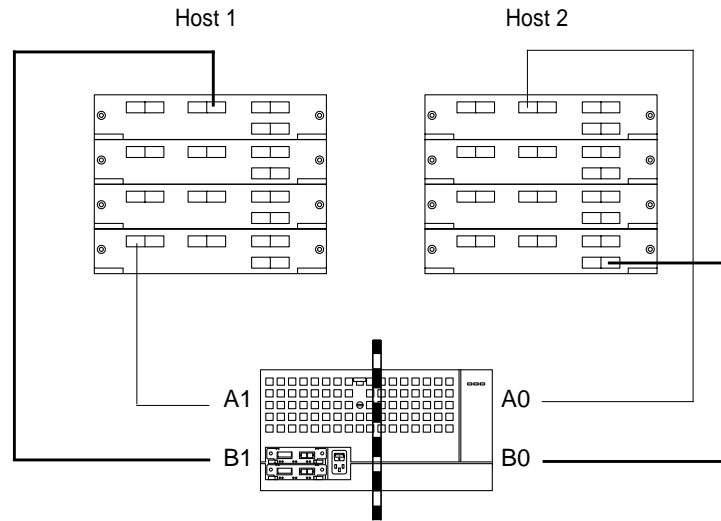


FIGURE 2-14 Two Hosts, Split Loop Private

In this configuration, each host can access only half the disk drives or one backplane. This configuration is for disk array sharing, where each host has private and exclusive access to half the disk drives. This is a fully redundant configuration.

It also has the following characteristics:

- Maximum bandwidth/ mirroring within disk array
- Provides dual paths
- Each host owns one backplane of a disk drives

To ensure maximum redundancy, put each path on a separate host adapter and each host adapter on a separate I/O board.

2.2.9 Three or Four Hosts, Single Paths

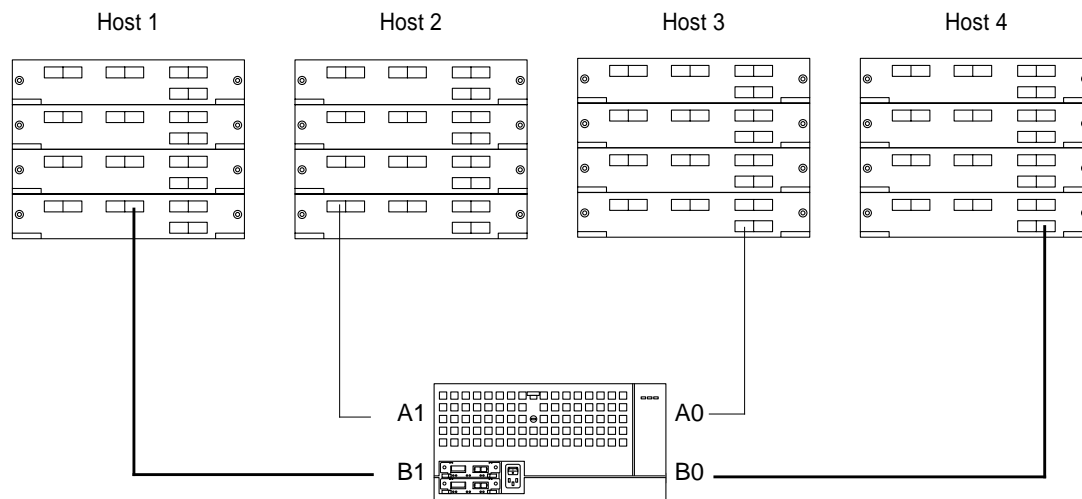


FIGURE 2-15 Three Or Four Hosts, Single Paths

This single-path configuration is currently the only way to support three- and four-host configurations.

Lack of disk array ports, lack of hub ports, and technical drive issues all combine to make dual-path configurations non-feasible at this time for more than two hosts. The above configuration shows four hosts; however, the removal of Host 4 and its connection will create a three host configuration.

Note – One of the hosts can have dual paths in a three-host configuration.

Host Connections

This chapter describes the various connections that can be used to connect your host to a disk array or hub. It includes the following devices:

- Enterprise SBus+ and Graphics+ I/O Boards—page 3-2
- Sun StorEdge PCI FC-100 Host Adapter—page 3-3
- Sun StorEdge SBus FC-100 Host Adapter—page 3-2

These devices were supported when this document was published. See the online *Sun StorEdge A5000 Installation Supplement*, part number 805-4516, for other supported host connections.

3.1 Introduction

A dual-ported host adapter enables you to make two connections from a host to disk arrays while only using one SBus slot. This could be a factor on smaller servers. Using a dual-ported host adapter on one port gives you less overall bus bandwidth. However, the host adapter also becomes a single point of failure.

Although using two host adapters costs more and occupies an additional slot, the host adapter is eliminated as a single point of failure.

3.2 Enterprise SBus+ and Graphics+ I/O Boards

SBus+ and Graphics+ I/O boards each provide mounting for two GBICs. The I/O boards are further described in the *Sun Enterprise 6x00/5x00/4x00/3x00 Systems SBus+ and Graphics+ I/O Boards Installation Guide*, part number 805-2704.

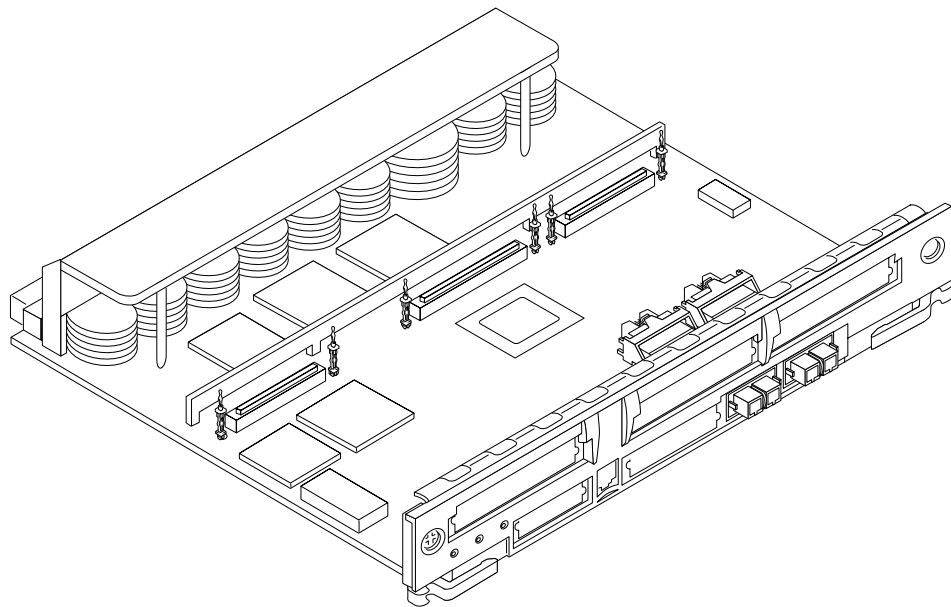


FIGURE 3-1 Enterprise 6x00/5x00/4x00/3x00 SBus+ I/O Board

3.2.1 System Requirements

Your system must meet the following hardware and software requirements:

- Sun Enterprise™ 6x00/5x00/4x00/3x00 system
- An available I/O board slot
- OpenBoot™ PROM Version 3.2.10 or later
- Solaris 2.5.1 Hardware: 4/97, or Solaris 2.6, or other compatible version of the Solaris operating environment

3.3 Sun StorEdge PCI FC-100 Host Adapter

This is a 33-MHz, 100 Mbytes/sec, single-loop Fibre Channel PCI host adapter with an onboard GBIC. This host adapter is PCI Version 2.1 compliant. This product is further described in the *Sun StorEdge PCI FC-100 Host Adapter Installation Manual*, part number 805-3682.

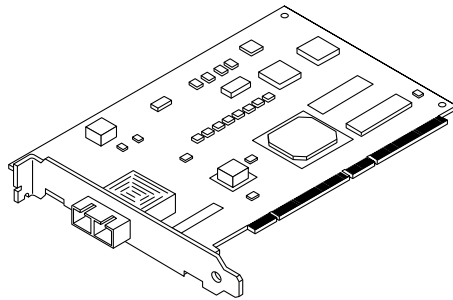


FIGURE 3-2 Sun StorEdge PCI FC-100 Host Adapter

3.3.1 System Requirements

Your system must meet the following hardware and software requirements:

- Solaris 2.6 or other compatible version of the Solaris operating environment
- Disk array firmware at least version 1.05
- An available PCI port

If the firmware level is less than 1.05, you must upgrade it using an SBus-based host system before you can connect the disk array to the Sun StorEdge SBus FC-100 Host Adapter. The instructions for obtaining the upgrade patch are in the manual referenced above.

3.4 Sun StorEdge SBus FC-100 Host Adapter

The Sun StorEdge SBus FC-100 Host Adapter is a single-width Fibre Channel SBus card with a Sun Serial Optical Channel ASIC. You can connect up to two loops to each card using hot-pluggable GBICs. This product is further described in the *Sun StorEdge SBus FC-100 Host Adapter Installation and Service Manual*, part number 802-7572.

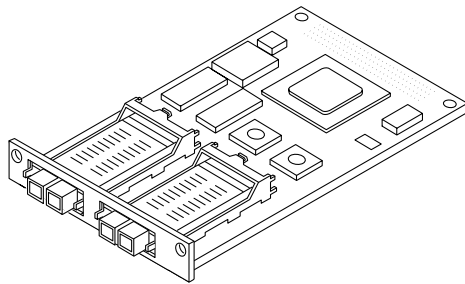


FIGURE 3-3 Sun StorEdge SBus FC-100 Host Adapter

3.4.1 System Requirements

Your system must meet the following hardware and software requirements:

- Solaris 2.5.1 Hardware: 8/97 or other compatible version of the Solaris operating environment
- An available SBus port

Disk Array Cabling

This chapter describes the supported disk array configurations. It is divided into the following sections:

- Single Disk Array Configurations—page 4-3
- Daisy-Chain Configurations—page 4-4
- Hub Configurations—page 4-9

4.1 Introduction

The loop connections go to FC-AL initiators, other disk arrays, or hubs. You can make connections from single or multiple hosts. See Chapter 3 for information on how to connect to FC-AL initiators.

Note – The ports on host connections do not necessarily correspond to the A1, A0, B1, and B0 nomenclature used to describe disk array cabling. Any port of a host adapter can be connected to any of the loops.

To connect up to four disk arrays on the loop you can either use hubs or daisy-chain the disk arrays. Using hubs is recommended because they simplify cabling, make disk array maintenance easier, and automatically bypass a disk array that loses power.

Note – The only requirement regarding Box IDs is that they must be unique on a loop. The preset Box IDs on disk arrays you receive from Sun Microsystems may differ from those in the following sections. If so, you can either keep a record of which Box IDs correspond to which disk arrays or use the FPMs to change the Box IDs of the disk arrays. See Chapter 5 of the *Sun StorEdge A5000 Installation and Service Manual* for information about using the FPM.

Note – Up to four Sun StorEdge A5000 or A5100 disk arrays can currently be connected on a loop. Any combination of disk arrays that includes the A5200 disk array is limited to three disk arrays per loop. The online *Sun StorEdge A5000 Installation Supplement* will be updated if there is any change to the configuration rules.

To fit the illustrations of the configurations on the following pages, only the interface boards for the disk arrays are shown. The interface boards are located at the rear of the disk array (FIGURE 4-1).

The maximum number of paths are shown. Depending on your configuration, you may not need to connect A1, B0, or B1.

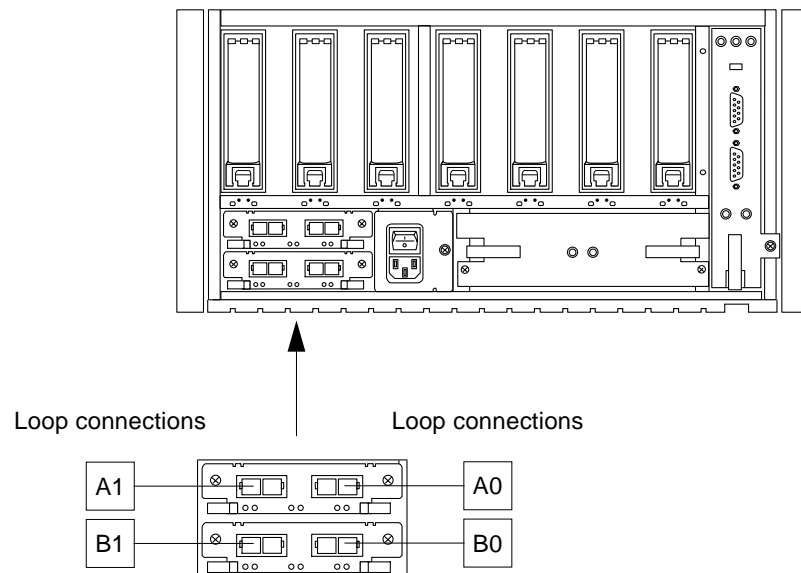


FIGURE 4-1 Interface Board Location

More disk arrays and disk drives per loop yield lower overall bandwidth per disk drive. For maximum performance per disk drive in heavy sequential I/O loads, its best to keep only one disk array per loop, or even run split loops.

More disk arrays per loop can also have lower fault tolerance with the loss of a host connection effecting multiple disk arrays, although correct configurations of dual path disk arrays and disk drives will eliminate any single point of failure.

4.2 Single Disk Array Configurations

All single disk array configurations can be derived from the following illustration.

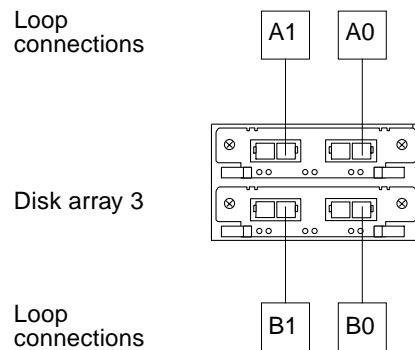


FIGURE 4-2 Single Disk Array Configuration

See Chapter 1 for information about configuring the disk array as single or split-loops.

4.3 Daisy-Chain Configurations

This section contains the following daisy-chain configurations:

- Two Disk Arrays—page 4-6
- Three Disk Arrays—page 4-7
- Four Disk Arrays—page 4-8

Using a daisy chain configuration allows multiple disk arrays to be used through a single host connection and saves the cost of hubs. However, unless there are dual host connections (front and back), this approach has a lower fault tolerance: a failure to the host adapter, first disk array, or first fiber optic cables can disrupt the entire loop. Disk array removal and insertion is awkward and disruptive to an active loop.

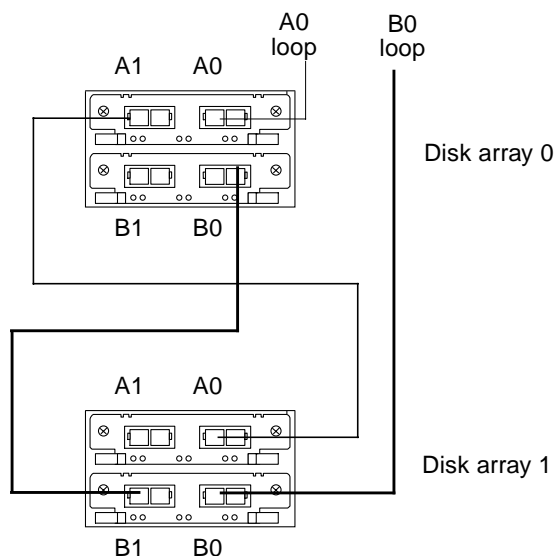


FIGURE 4-3 Optimal Two Disk Array Daisy-Chain

The configuration in FIGURE 4-3 is optimal because it uses only two host connections to maintain redundancy. The B cable is connected from the back of the chain. If the first disk array or cable were to fail the remaining disk arrays will be accessed through the B loop.

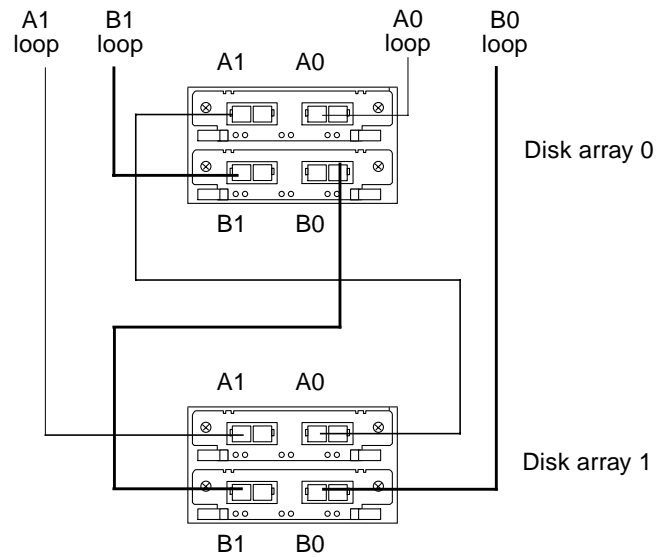


FIGURE 4-4 Redundant Two Disk Array Daisy-Chain

The configuration in FIGURE 4-4 also achieves redundancy but at the cost of four host connections. Both loops are cabled from the front and back of the disk array chain. The back connection is needed to protect from an disk array failure at the front of the chain which could take out both loops.

The B0 connection is needed for redundancy. If not, a failure to disk array 0 can cause the loss of access to subsequent disk arrays.

A1 and B1 connections can be used for additional redundancy from a single host or for dual host connections.

4.3.1 Two Disk Arrays

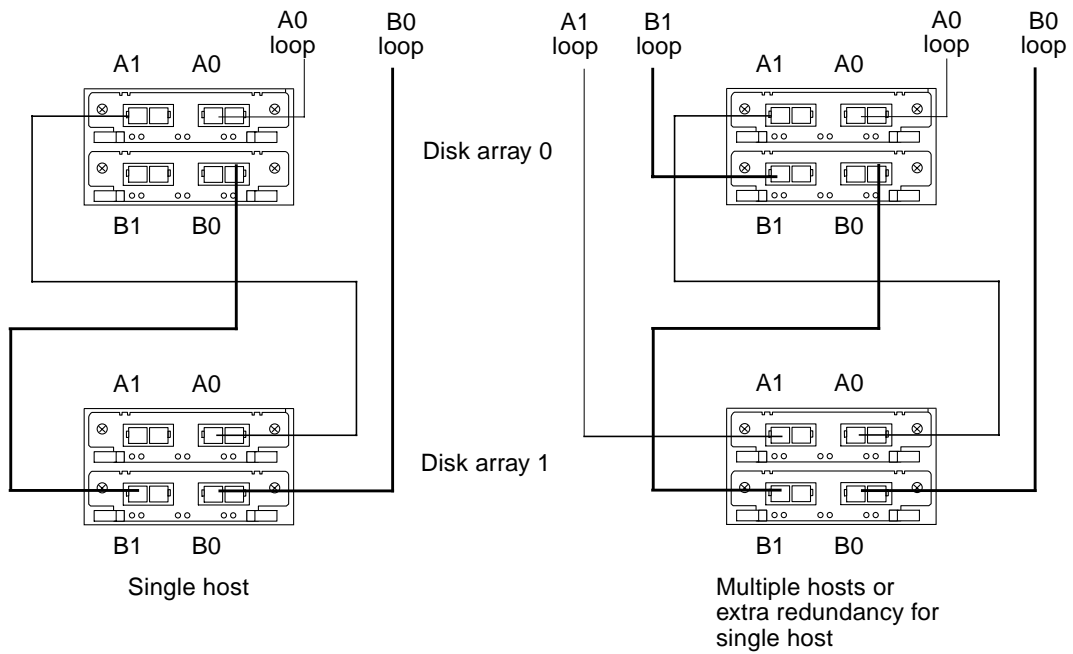


FIGURE 4-5 Two Disk Array Daisy-Chain

4.3.2 Three Disk Arrays

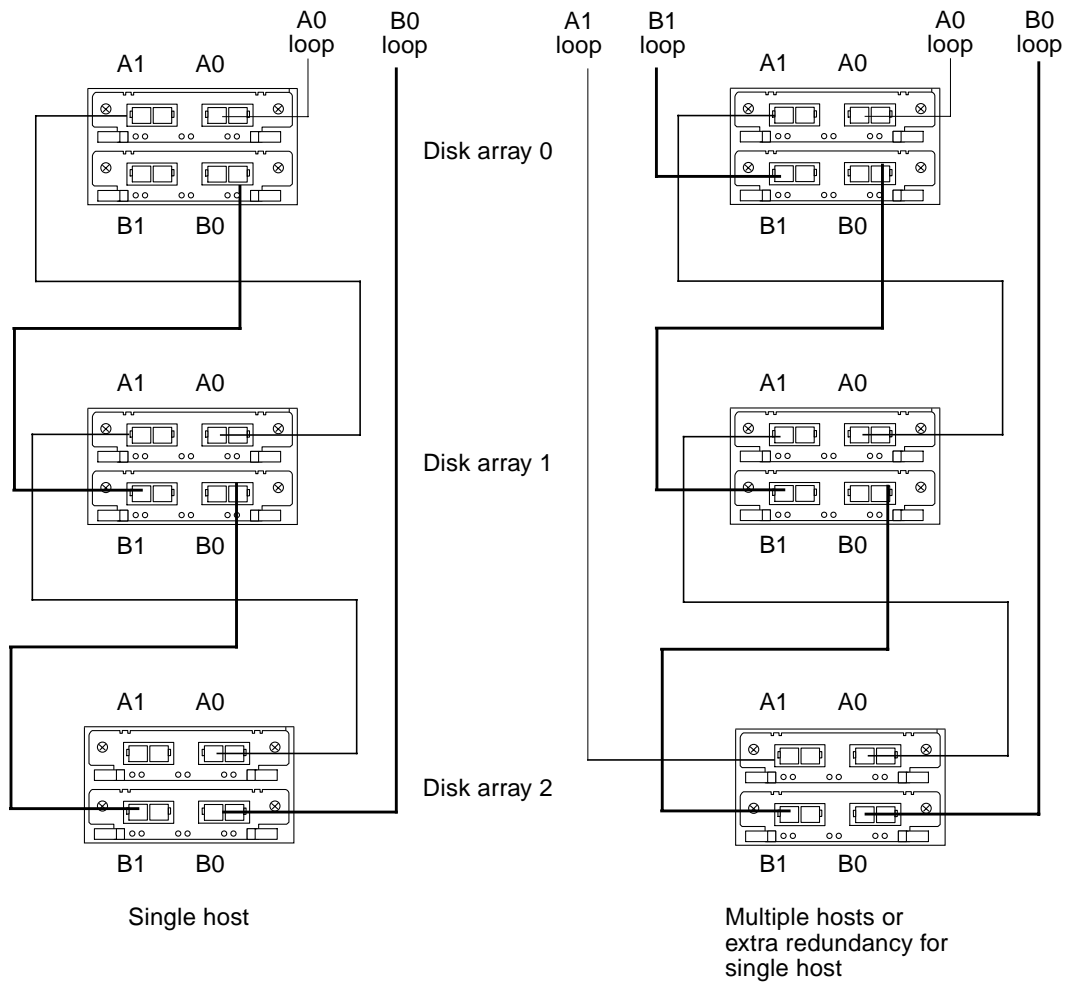


FIGURE 4-6 Three Disk Array Daisy-Chain

4.3.3 Four Disk Arrays

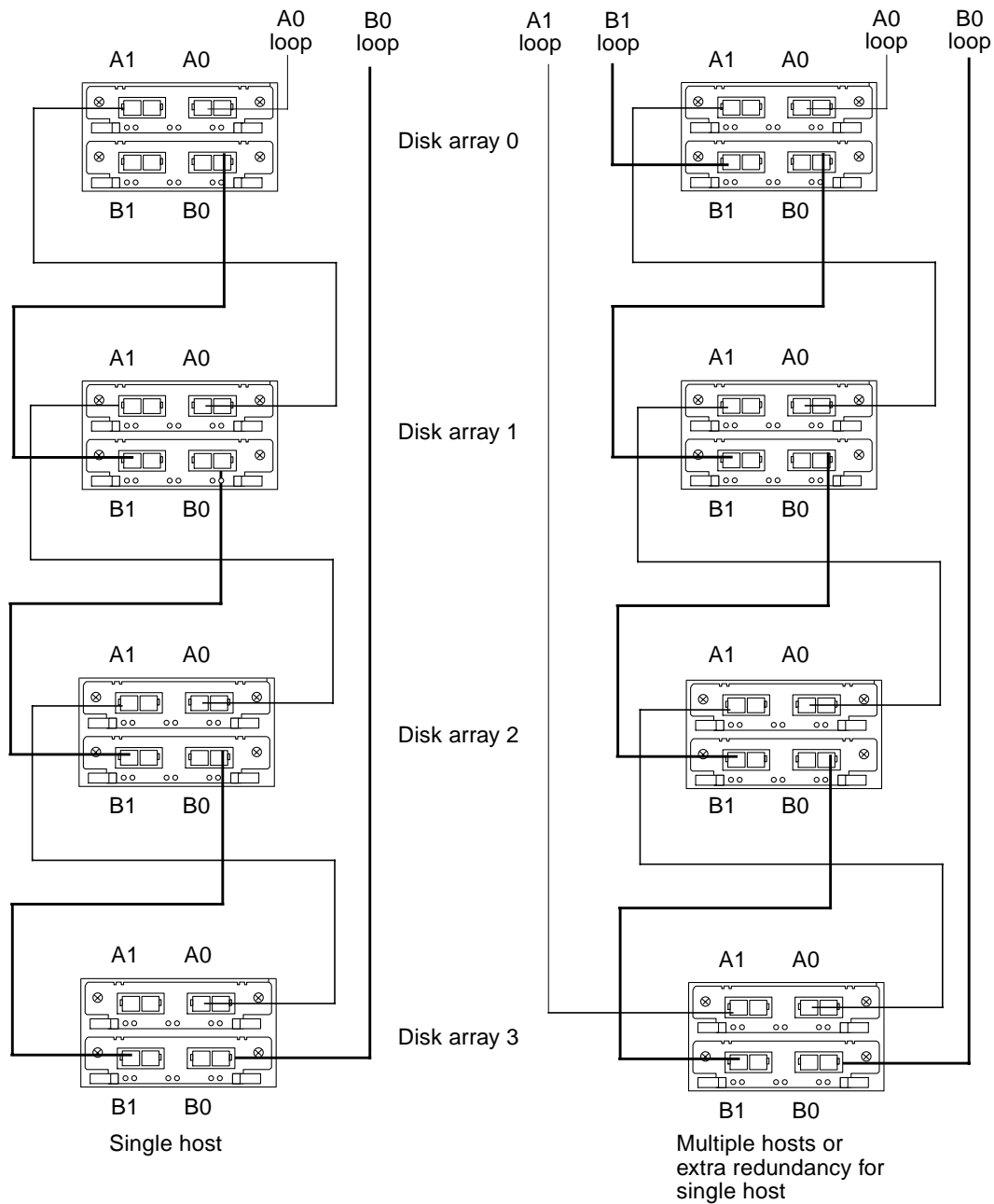


FIGURE 4-7 Four Disk Array Daisy-Chain

4.4 Hub Configurations

Hubs make multiple disk array connections simple. The hub configures a loop into a star topology eliminating loop break failures and ensuring that a single disk array failure will not impact other devices on the loop. The hub is part of the disk array loop; any device connected to the hub becomes part of the loop.

The hub is capable of bypassing a port with a powered-off disk array or a missing or broken fiber optic cable. The hub is not capable of filtering out bad packets and will pass CRC errors, similar to an ethernet repeater. This means that a hub can increase fault tolerance but only for certain types of loop failures. Disk array removal and insertion is simple and doesn't disrupt an active loop. Because it centralizes connections, the hub will greatly assist in problem determination.

The incremental cost of using hubs over daisy-chaining disk arrays together is the cost of the hubs plus four GBICs. A power failure to the hub will bring the entire loop down. A power failure to both hubs in a dual path configuration will disable connections to all disk arrays.

Although up to four disk arrays per loop is supported you achieve greater performance and fault tolerance with fewer disk arrays on a loop.

This section contains information on cabling two to six disk arrays.

Note – You can substitute a Sun StorEdge FibreSwitch-F8 in any Sun StorEdge A5000 family configuration that employs a hub. Switches are placed in the cabinet in the same position as the hubs, but they require different mounting trays. Refer to the documentation that comes with your Switch for more information.

4.4.1 StorEdge Expansion Cabinet

The following sections explain how to connect four and six disk array configuration in the Sun StorEdge expansion cabinet.

4.4.1.1 Four Disk Arrays

Component Placement

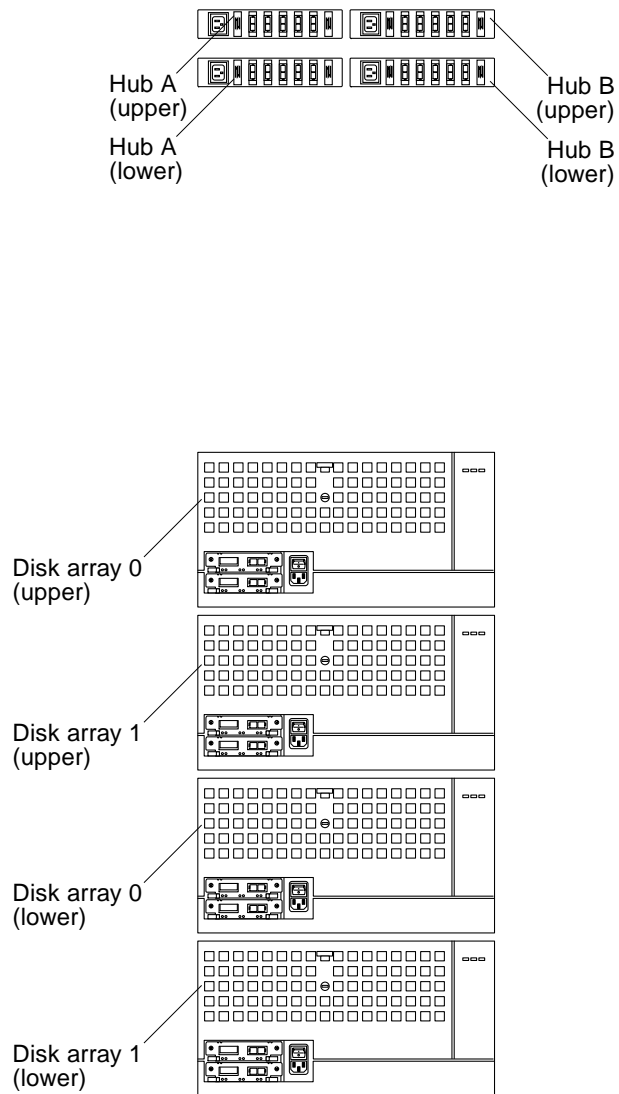


FIGURE 4-8 Component Placement

Upper Disk Arrays and Hubs

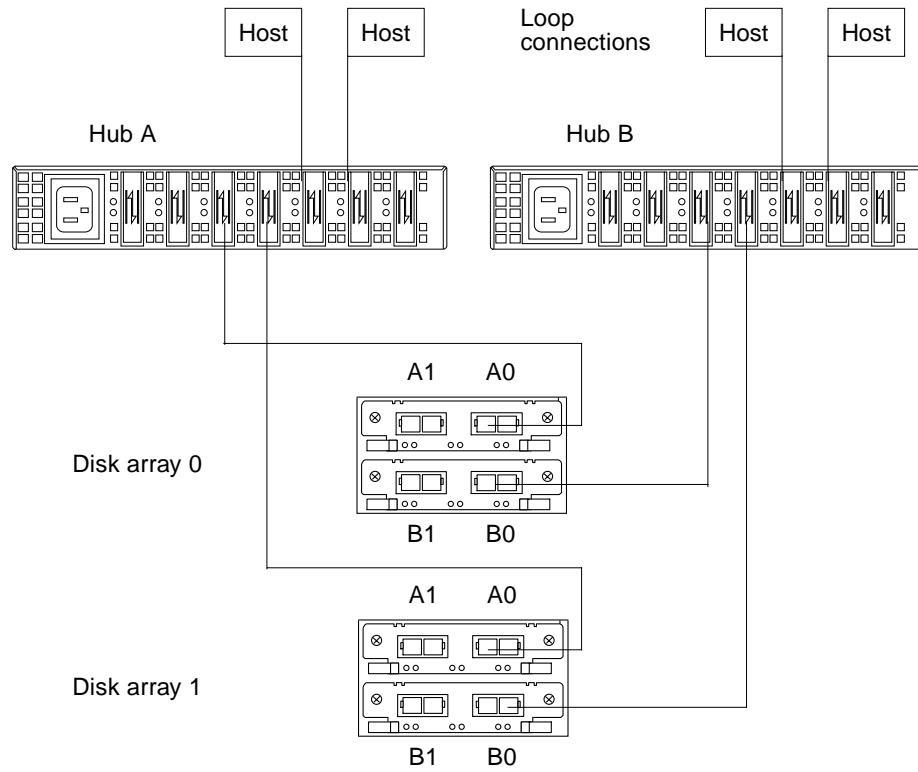


FIGURE 4-9 Four Disk Arrays and Four Hubs (Upper)

Lower Disk Arrays and Hubs

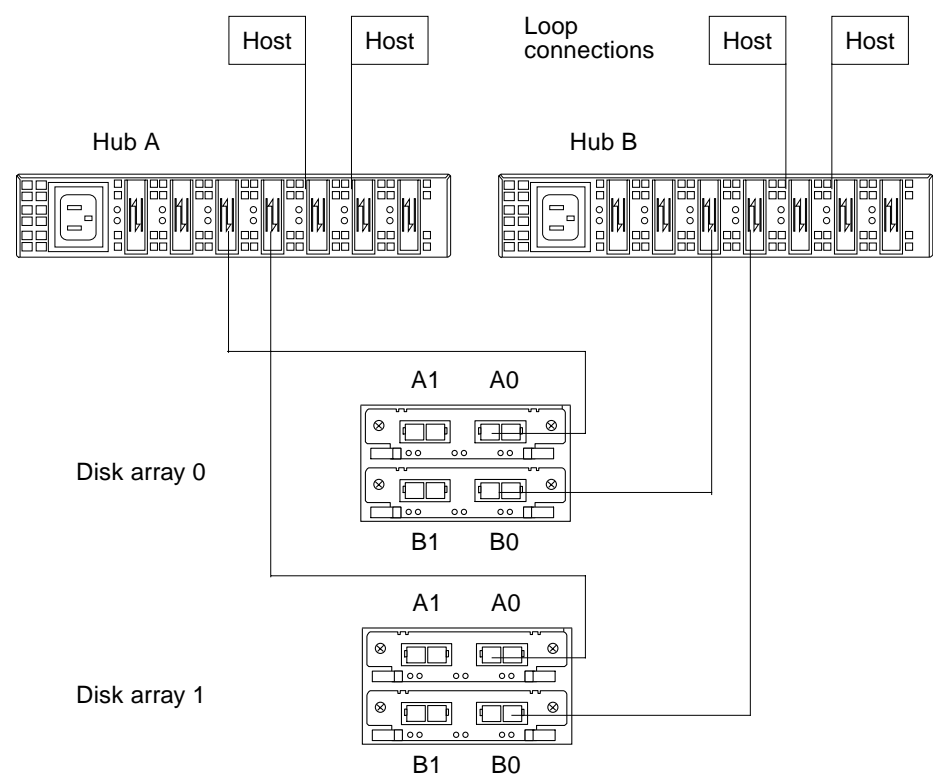


FIGURE 4-10 Four Disk Arrays and Four Hubs (Lower)

4.4.1.2 Six Disk Arrays

Component Placement

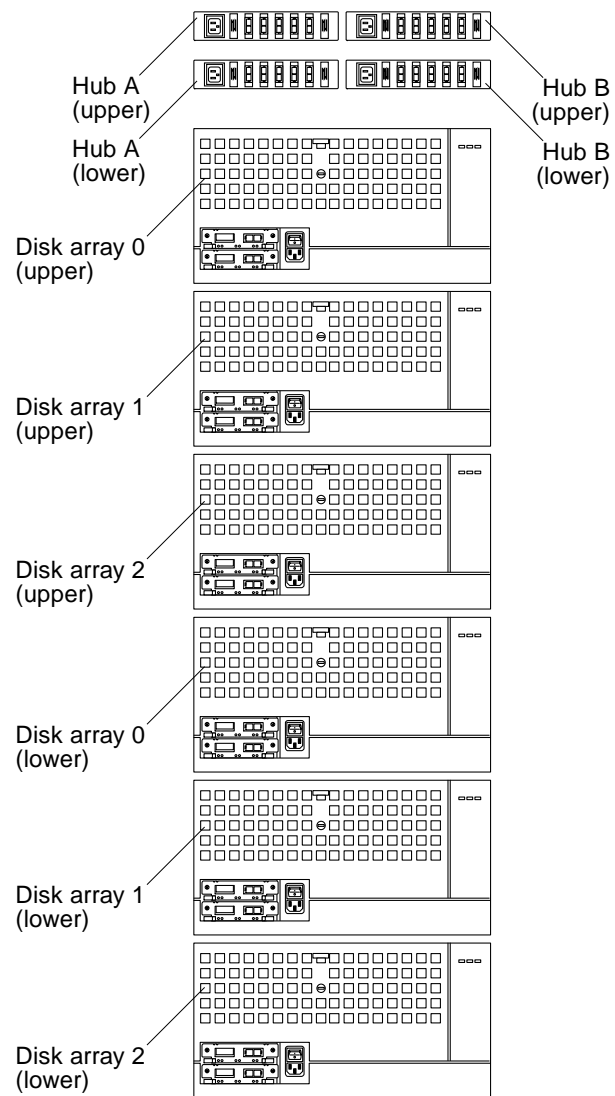


FIGURE 4-11 Component Placement

Upper Disk Arrays and Hubs

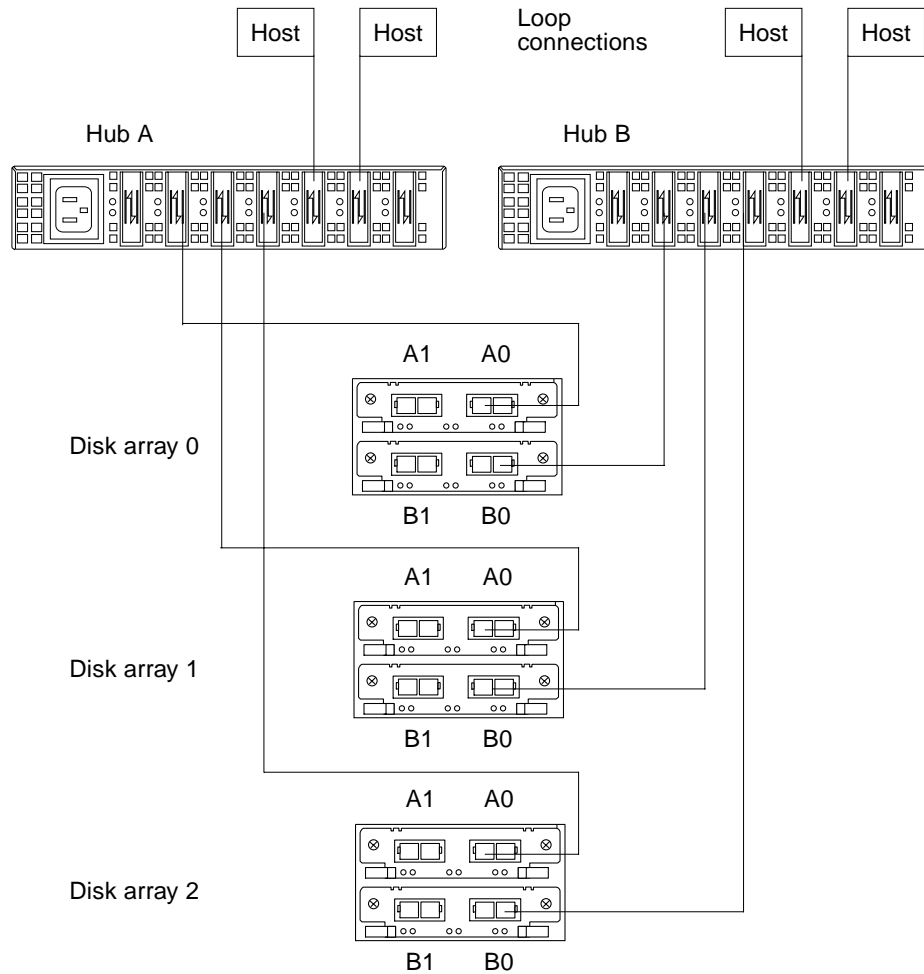


FIGURE 4-12 Six Disk Arrays and Four Hubs (Upper)

Lower Disk Arrays and Hubs

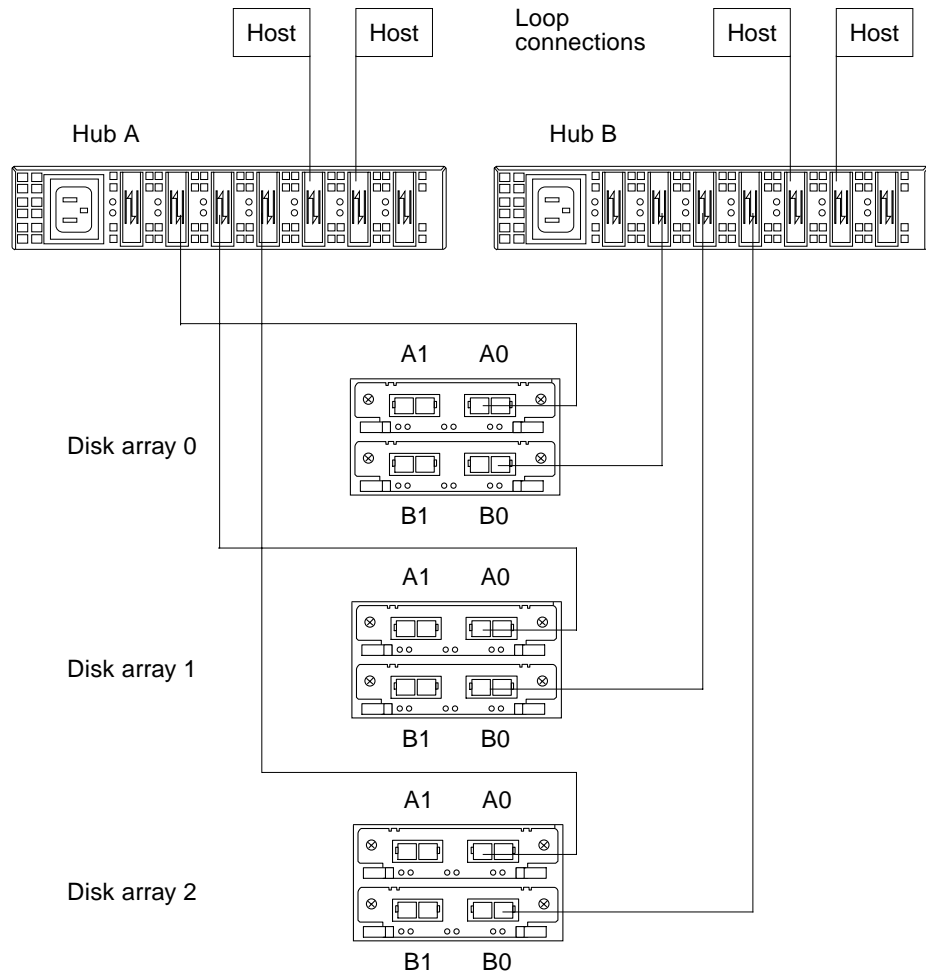


FIGURE 4-13 Six Disk Arrays and Four Hubs (Lower)

4.4.2 Other Expansion Cabinets

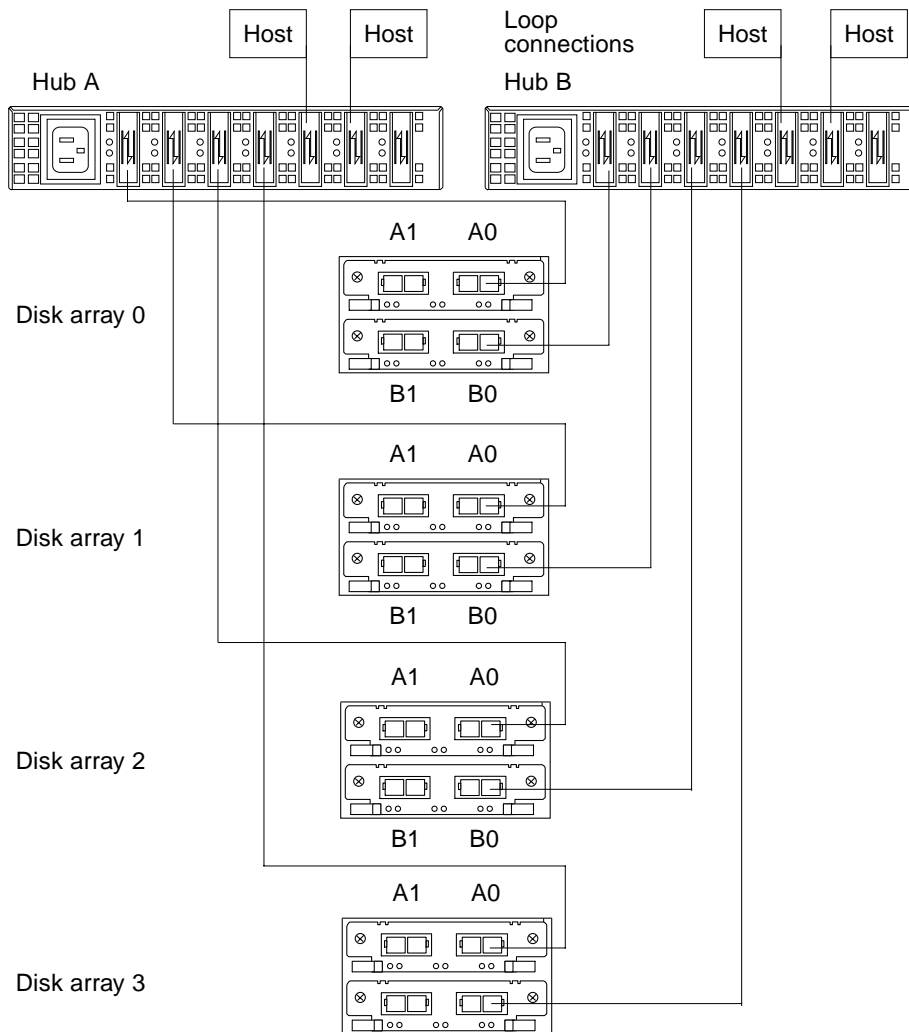


FIGURE 4-14 Two to Four Disk Arrays and Two Hubs

Cabinet Placement

This chapter describes where to place disk arrays and hubs in system and expansion cabinets.

5.1 Rackmount Placement Matrix

Rackmount placement information for the disk array, as well as other devices that can be mounted in Sun system and expansion cabinets, is available on the Web at:

`http://docs.sun.com`

Click on “Storage and Peripherals” in the Hardware section, and then open the *Rackmount Placement Matrix* document.

If you do not have access to the Web, contact your service provider.

Note – Retrieve the placement information for the disk array before beginning the installation.

5.2 Cabinet Placement

This contains information about placing disk arrays and hubs in expansion cabinets.

5.2.1 StorEdge Expansion Cabinet

5.2.1.1 Four Disk Arrays

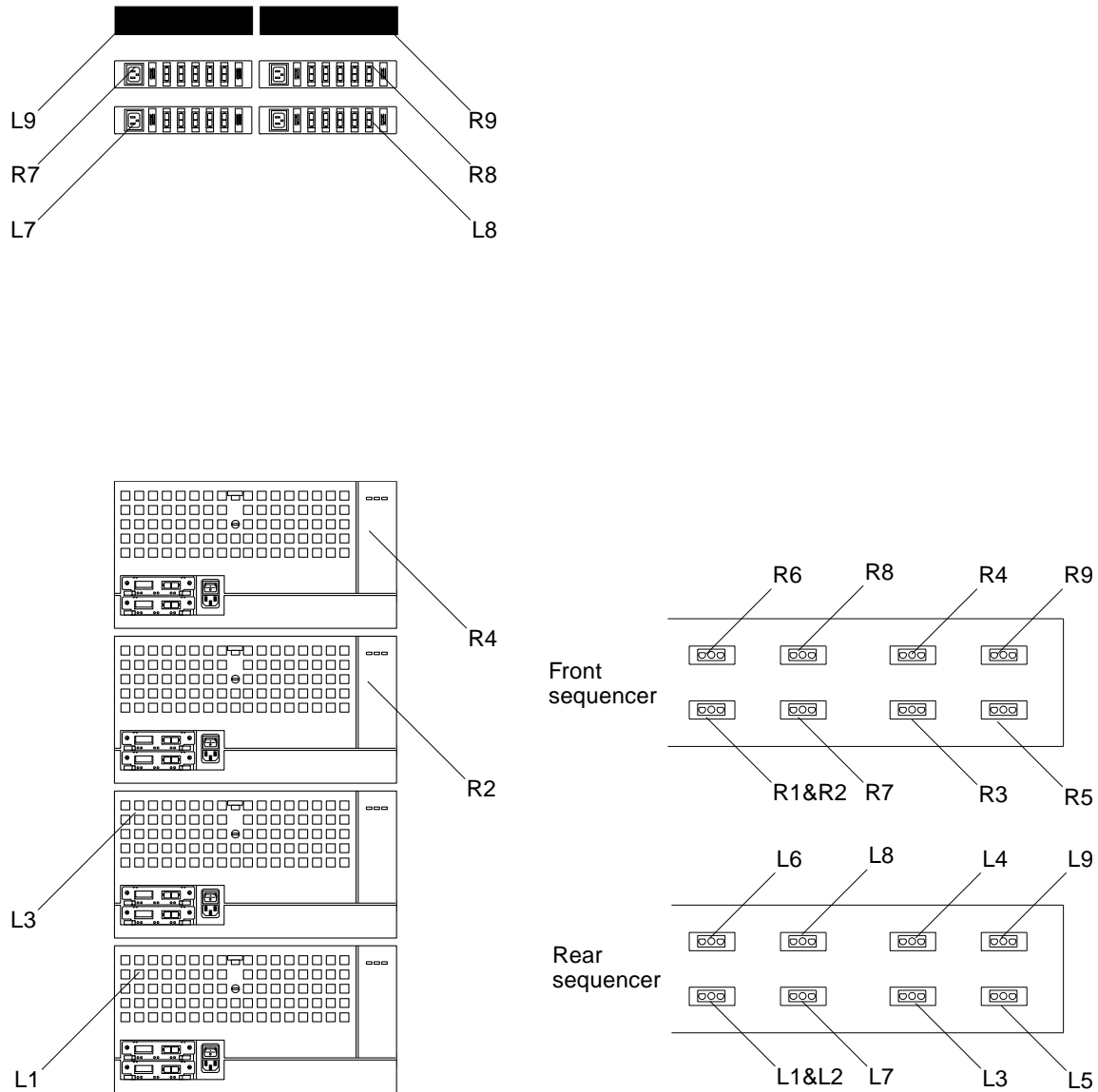


FIGURE 5-1 Four Disk Arrays in a StorEdge Expansion (72-inch) Cabinet

Lower Arrays and Hubs

TABLE 5-1 AC Power Sorted By Power Connections (Lower)

Power Connection	Device	Sequencer
L1	Disk array 0 (lower)	Rear first stage
L3	Disk array 1 (lower)	Rear second stage
L7	Hub A (lower)	Rear first stage
L8	Hub B (lower)	Rear first stage
L9	Fan tray (left)	Rear second stage

Upper Arrays and Hubs

TABLE 5-2 AC Power Sorted By Power Connections (Upper)

Power Connection	Device	Sequencer
R2	Disk array 0 (upper)	Front second stage
R4	Disk array 1 (upper)	Front second stage
R7	Hub A (upper)	Front first stage
R8	Hub B (upper)	Front first stage
R9	Fan tray (right)	Front second stage

Note – Ensure that a serial cable is connected from the serial port of a fan tray to the J4 connector of the power sequencer that provides power to the fan tray.

Front Sequencer

TABLE 5-3 AC Power Sorted By Sequencer (Front)

Power Connection	Device	Sequencer Stage
R7	Hub A (upper)	First
R8	Hub B (upper)	
R2	Disk array 0 (upper)	
R4	Disk array 1 (upper)	Second
R9	Fan tray (right)	

Rear Sequencer

TABLE 5-4 AC Power Sorted By Sequencer (Rear)

Power Connection	Device	Sequencer Stage
L1	Disk array 0 (lower)	First
L7	Hub A (lower)	
L8	Hub B (upper)	
L3	Disk array 1 (lower)	Second
L9	Fan tray (left)	

The diagram illustrates a 6U rackmount chassis with the following components and labels:

- Top Panel:** Features two rows of 16-pin D-sub connectors. The left row is labeled **L9** and the right row is labeled **R9**.
- Front Panel:** Includes two rows of 16-pin D-sub connectors. The left row is labeled **R7** and the right row is labeled **R8**.
- Internal Components:** The chassis contains six identical modules, each with a 16-pin D-sub connector on the left (labeled **L7**), a 16-pin D-sub connector on the right (labeled **R8**), and a 16-pin D-sub connector on the bottom (labeled **R6**). The modules are labeled **L8**, **R6**, **R5**, **R4**, **R3**, and **R2** from top to bottom.
- Bottom Panel:** Features two rows of 16-pin D-sub connectors. The left row is labeled **L4** and the right row is labeled **R4**.
- Internal Components:** The chassis contains six identical modules, each with a 16-pin D-sub connector on the left (labeled **L4**), a 16-pin D-sub connector on the right (labeled **R4**), and a 16-pin D-sub connector on the bottom (labeled **R3**). The modules are labeled **L3**, **L2**, **L1**, **R3**, **R2**, and **R1** from top to bottom.



Lower Arrays and Hubs

TABLE 5-5 AC Power Sorted By Power Connections (Lower)

Power Connection	Device	Sequencer
L1	Disk array 0 (lower)	Rear first stage
L3	Disk array 1 (lower)	Rear second stage
L4	Disk array 2 (lower)	Rear second stage
L7	Hub A (lower)	Rear first stage
L8	Hub B (lower)	Rear first stage
L9	Fan tray (left)	Rear second stage

Upper Arrays and Hubs

TABLE 5-6 AC Power Sorted By Power Connections (Upper)

Power Connection	Device	Sequencer
R4	Disk array 0 (upper)	Front second stage
R5	Disk array 1 (upper)	Front second stage
R6	Disk array 2 (upper)	Front first stage
R7	Hub A (upper)	Front first stage
R8	Hub B (upper)	Front first stage
R9	Fan tray (right)	Front second stage

Note – Ensure that a serial cable is connected from the serial port of a fan tray to the J4 connector of the power sequencer that provides power to the fan tray.

Front Sequencer

TABLE 5-7 AC Power Sorted By Sequencer (Front)

Power Connection	Device	Sequencer Stage
R6	Disk array 2 (upper)	First
R7	Hub A (upper)	
R8	Hub B (upper)	
R4	Disk array 0 (upper)	Second
R5	Disk array 1(upper)	
R9	Fan tray (right)	

Rear Sequencer

TABLE 5-8 AC Power Sorted By Sequencer (Rear)

Power Connection	Device	Sequencer Stage
L1	Disk array 0 (lower)	First
L7	Hub A (lower)	
L8	Hub B (upper)	
L3	Disk array 1(lower)	Second
L4	Disk array 2 (lower)	
L9	Fan tray (left)	

5.2.2 Other Expansion Cabinets

Install disk arrays and hubs as shown in FIGURE 5-3.

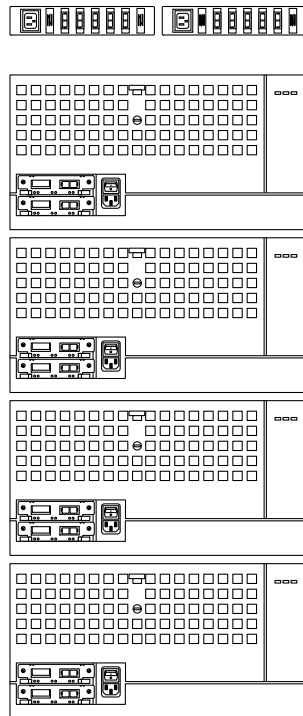


FIGURE 5-3 Fully-Loaded Enterprise Expansion (56-inch) Cabinet

Index

C

- cabinet placement
 - 56-inch and 68-inch expansion cabinets, 5-1
 - StorEdge Expansion Cabinet, 5-2
- cabling
 - single disk array, 4-3
- configuration
 - recommendations, 1-9

D

- daisy chain
 - four disk arrays, 4-8
 - three disk arrays, 4-7
 - two disk arrays, 4-6
- diagram
 - full loop, 1-3
 - split loop, 1-6

F

- full loop
 - diagram, 1-3

H

- host adapter
 - PCI, 3-3
 - SBus, 3-4
- hub cabling
 - other expansion cabinets, 4-16

StorEdge Expansion Cabinet

- four disk arrays, 4-10
- six disk arrays, 4-13

L

- loop, 1-2
 - full, 1-3
 - split, 1-6

P

- port, 1-1

R

- rackmount placement matrix, 5-1

S

- split loop
 - diagram, 1-6

