

# *Compaq StorageWorks*

## **Application Note Enterprise/Modular Storage RAID Array FC-AL Configurations for SGI IRIX**

**EK-SMA40-AN.D01**

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Printed in the U.S.A.

**Enterprise/Modular Storage RAID Array FC-AL HA Configurations for SGI IRIX**

**Application Note**

**First Edition (June 2001)**

**Part Number: EK-SMA40-AN.D01**

## Enterprise Network Storage Architecture (ENSA)

Compaq StorageWorks Enterprise Storage Array (RA8000/MA8000 and ESA12000/EMA12000) products are the latest in fully integrated Fibre Channel RAID storage solutions. These products provide the key initial step in delivering the Compaq ENSA vision. ENSA addresses the issues that customers expect to face now and in the future. Both products address today's issues including: economical capacity growth, data protection, high availability, increased distance, multi-vendor platform support, and investment protection by serving as the base for building the ENSA vision.

### Product Overview

The Enterprise/Modular Storage RAID Array Fibre Channel systems are based on a common architecture and offer customers centralized management, high availability, exceptional performance and scalability in open systems environments. These products provide a Fibre Channel storage solution with industry leading Storage Area Network (SAN) support using Fibre Channel Arbitrated Loop (FC-AL) technology.

The RA8000/MA8000 Fibre Channel is a mid-range storage system available in a pedestal enclosure for departmental use in the office. It can also be installed in server racks for data centers. An easy-to-deploy, flexible solution for open systems, the RA8000/MA8000 currently supports up to 1.3 TB of storage with the use of 18 GB disks.

The ESA12000/EMA12000 Fibre Channel, designed for the data center, is available in three easy-to-order building blocks, each optimized for specific, high-capacity customer requirements. The ESA12000/EMA12000 Fibre Channel offers unprecedented levels of storage, scaling in performance and capacity as user requirements increase.

These storage systems incorporate the latest in RAID technology providing RAID levels 0, 1, 0+1, adaptive 3/5, and non-RAID disks. Compaq implementation of RAID capability assures that data availability will be maintained despite hardware failure. Features such as read-ahead cache and mirrored write-back cache improve performance while preserving data and high availability support.

Platform kits are components of software and documentation created for each specific operating system that can be used with the Compaq StorageWorks RAID arrays. Platform kits exist for the SGI (IRIX), SUN (Solaris), Hewlett-Packard (HP-UX) and other operating systems.

The SGI IRIX Fibre Channel platform kits contain the necessary operating system specific software and documentation needed to install, configure, and monitor your storage system. All platform kits include the StorageWorks Command Console (SWCC) for storage management operations including configuring, status inquiry and notification facilities. Additionally, the SWCC provides a graphical user interface (GUI), simplifying the most complex of storage management operations.

## Configuration References

Table 1 lists the documents that provide further information on the configuration of Enterprise/Modular Storage RAID Array Fibre Channel Storage Systems.

**Table 1 Configuration Reference Material**

Document Title	Order Number
Release Notes, HSG80 Array Controller Solution Software for SGI IRIX V8.6	AA-RFBJF-TE
HSG80 ACS Solution Software Version 8.6 for SGI IRIX Installation and Configuration Guide	AA-RFBKE-TE
HSG80 Array Controller ACS V8.6 CLI Reference Guide	EK-G80CL-RA.A01
HSG80 Array Controller ACS Version 8.6 Maintenance and Service Guide	EK-G80MS-SA.A01
Compaq StorageWorks Command Console V2.3 User Guide	AA-RFA2H-TE
Compaq StorageWorks Warranty Terms and Conditions	EK-HSXSU-WC.C01

## General Configuration Guidelines

Fibre Channel storage technology offers more configuration flexibility than parallel SCSI storage. This application note describes typical Enterprise/Modular Storage RAID Array Fibre Channel SGI IRIX configurations based on the configuration maximums listed below. For configurations not shown here, the configuration maximums should be used to determine the viability of a proposed configuration. Exceeding the maximum will create unsupported configurations. Additional information specific to a particular configuration is provided by section.

## Configuration Maximums

The HSG80 controller configuration maximums are listed below:

- Maximum 128 visible LUNS (64 per port)
- Maximum 200 assignable unit numbers
- Maximum 72 physical devices
- Maximum 20 RAID-5 StorageSets
- Maximum 30 (RAID-5 and RAID-1) StorageSets
- Maximum 45 (RAID-5 and RAID-1 and RAID-0) StorageSets
- Maximum 8 partitions of a StorageSet or individual disk
- Maximum 6 members of a MirrorSet
- Maximum 14 members per RAID-5 StorageSet
- Maximum 24 members per StripeSet
- Maximum 48 physical devices per Striped-MirrorSet
- Maximum 32 Connections
- Maximum 9 Characters per Connection Name

The configuration considerations for the IRIX operating system are listed below:

- Maximum 512GB file system per LUN (IRIX Version 6.5)
- Maximum 64 LUNs per Fibre Channel host adapter port

Refer to *Enterprise/Modular Storage RAID Array Solution Software V8.6 for SGI IRIX Release Notes* for supported operating system revisions and required patch levels.

The configuration considerations for the Fibre Channel Loop are listed below:

- Maximum 300 meters per optical cable segment, 50 micron, multi-mode.  
175 meters per optical cable segment, 62.5 micron, multi-mode.
- Maximum 1 Fibre Channel Host Based Adapter per loop.  
For Transparent Failover Mode (Used exclusively in these configurations.)
- Maximum of 1 Server on a single FC-AL Loop
- Maximum of 2 Storage Systems
- Maximum of 4 Controllers with 2 Active controller ports per controller pair.

## Assumptions

This application note assumes familiarity with configuring RAID Storage Arrays, specifically the Command Line Interface (CLI) and the SGI IRIX operating system. Additionally, an understanding of Fibre Channel terminology and concepts is assumed.

**NOTE:** Table 1 lists the documents related to the HSG80 Controller and the configuration of the Enterprise/Modular Storage RAID Array. Refer to these documents for more detailed help on a specific topic.

## General Configuration Notes

- All single controller storage configurations can be upgraded to dual controller configurations.
- Controller pairs can be configured for either Dual Redundant Failover Mode or Multiple-bus Failover Mode. When controllers are in Dual Redundant Failover Mode, this is referred to as Transparent Failover Mode.

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**IMPORTANT:** This application note describes Transparent Failover Mode configurations only.

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- All configuration diagrams show a frontal view of the storage system.
  - Controller Host Port 1 is the left port; Controller Host Port 2 is the right port.
  - Controller A is the top controller; Controller B is the bottom controller.
- Each storage system can be configured using the Storage Works Command Console (SWCC) or the Command Line Interface (CLI) configured through either the HSG80 controller maintenance serial port or a TCP/IP interface.
- All configurations require Array Controller Software (ACS) V8.6F for the FC-AL topology. This is software support at the controller level.
  - All configurations require the Fibre Channel Solution Software V8.6 for the SGI IRIX operating system.

- All configurations use short wavelength lasers and multi-mode Fibre Channel optical cables. They do not include Fibre Channel Switch technology or single-mode optical cables and long wavelength laser technology. Additionally, cascading Fibre Channel hubs are not supported in these configurations.
- All configurations require Arbitrated Loop Physical Addresses (ALPAs). There is one ALPA for each device on a loop. Each ALPA is configured as LOOP\_HARD and must be unique. (See Appendix A starting on page 25 for valid ALPAs)
  - ❑ Controller Defaults: Host Port 1 has an ALPA of 71; Host Port 2 has an ALPA of 72.
  - ❑ In configurations with two Storage Systems, this document uses the following convention:
    - Storage System #1: ALPA 71 for Port 1 and ALPA 72 for Port 2
    - Storage System #2: ALPA 73 for Port 1 and ALPA 74 for Port 2
- All configurations require the connection name *Operating System* parameter to be set to "SGI". (CLI: SET *connection-name* OPERATING\_SYSTEM = SGI)
- Only one SWCC Agent must be running per RAID system. In configurations 4 and 5, the SWCC Agent may be run on only 1 SGI Origin Server.
- If the SWCC Agent is being used in a single host configuration that includes two or more FC-AL Host Bus Adapters, the Agent should be configured to use only one path to the storage subsystem. Specifying multiple paths for the Agent through more than one HBA to the same storage subsystem will result in the SWCC Client not being able to communicate with the storage subsystem.
- By default the HSG80 Command Console LUN (CCL) is enabled. This is the recommended setting for SGI.
 

**NOTE:** The HSG80 controllers support a range of 200 unit numbers. In Transparent Failover Mode, the units D0-D99 are assigned to Port 1 and units D100 - D199 are assigned to Port 2. IRIX supports up to 64 LUNs per host adapter port. In this document, examples show a range of unit values as D0-D63 and D100-D163.
- For single controller configurations with two active controller host ports on the same loop, use the connection name *Unit\_Offset* value to set the range of unit numbers to be visible from controller host port 2.
- For two storage system (4 controller) configurations with more than one controller host port on the same loop, set the ALPA for each controller host port in the second enclosure to a different LOOP\_HARD address (CLI: SET *controller* PORT\_1\_AL\_PA = xy)
  - ❑ Record the Fibre Channel host bus adapter WorldWide Identification (WWID) address, using the CLI SHOW CONNECTIONS command.
- Use the recorded WWID and the WWID from the HSG80 to identify the connection name displayed from the CLI at the controller using the CLI: SHOW CONNECTIONS command.
- Rename connection names. By default, new connection names are automatically added to the controller connection name table as !NEWCONnn (where *nn* is a number from 1 to 32). The controller adds a connection when a path to an adapter from each active controller host port is detected. Once you have identified each connection using the Fibre Channel HBA WWID, rename the connection names to a name meaningful to the specific configuration. (CLI: RENAME *old-name new-name*. Connection names may contain nine (9) characters). In some cases, host name and Port value may suffice (that is, WESTP1, WESTP2, EASTP1, EASTP2, etc.).
- Each active controller host port on a loop presents one SCSI Target ID with up to sixty-four (64) logical units (LUNs) to each Fibre Channel HBA on the same loop. LUNs can consist of single disks (JBOD), a storage set of multiple disks or a partition (up to 64), configured for a specific RAID level of 0, 0 + 1, or 3/5.

- There are two points of view regarding Fibre Channel connections.
  - The first view is taken from the server side. The targets and logical units visible to a server may be configured as desired within the maximum values for the operating system and restrictions of the Fibre Channel specifications.
  - The second view is from the controller side. On a loop, the controller knows about each host-adapter combination (HAC) that it can communicate with. The controller creates one connection on each active controller port for each HAC. Thus, if there are four servers on a loop, each with a Fibre Channel adapter, the controller will create four connections for the servers for each active controller port. If there is one active port, the controller will establish four connections. If there are two active ports, the controller will create eight connections.
- By combining the server point of view and the controller point of view, you have the flexibility to use all connections. A complete table of decimal to hex values is provided in Appendix A and the required set are shown in each configuration.

**NOTE:** The CLI provides the ability to delete a connection. This deletion is good ONLY until the controller re-initializes. When a controller reboots, it rebuilds its connection table for all devices that it can see.

## Configuration Descriptions

Table 2 lists the most common Enterprise/Modular Storage RAID Arrays Fibre Channel SGI IRIX configurations and where a description of capacities and configuration notes are provided.

**Table 2 Typical FC-AL SGI IRIX Configurations - Index**

Configuration #	Description	Page
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### Configuration Parts Lists

A list of parts for each specific configuration is provided at the end of this document (Page 17) following the configuration descriptions. Verify that you have all the required parts before beginning the installation.

### Configuration 1 - One Server, Single Controller

The single controller configuration (Figure 1) is an entry-level Enterprise/Modular Storage RAID Array Fibre Channel that can be expanded to accommodate additional storage capacity or performance needs as required. The configuration consists of an Enterprise/Modular Storage RAID Array enclosure with a single HSG80 array controller on a single Fibre Channel loop. In the initial configuration a single controller host port (Port 1) is active providing up to 64 LUNs across up to 24 disks. An additional 48 disks can be added using two expansion enclosures.

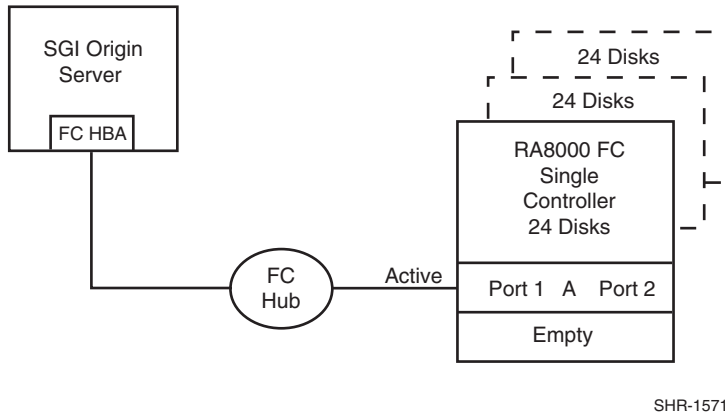


Figure 1. Configuration 1

The number of available LUNs can be doubled by adding a third Fibre Channel cable from the hub to Port 2 of the controller, resulting in the configuration shown in Figure 2.

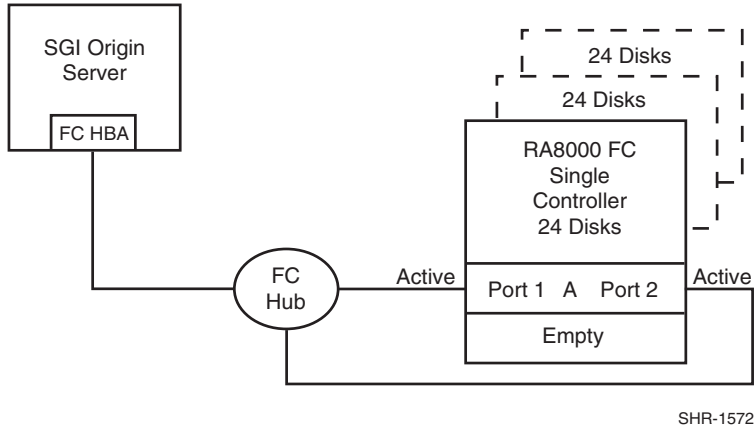


Figure 2. Configuration 1 with Double LUN Capacity

## Configuration 1 Notes

- Single Fibre Channel Loop
- Single HSG80 controller; controller failover is not available
- Up to 300 meters per 50-micron cable segment between the host with MIA and the hub
- Up to 500 meters per 50-micron cable segment between the hub and the HSG80 controller
- Up to 72 disks with 2 optional expansion enclosures

## Figure 1 Description

In this configuration, 1 logical connection is available with up to 64 LUNs. This Host-Hub-Storage configuration is developed in later configurations. Suggested controller unit number assignment: Port 1, units D0 – D63.



**Storage Enclosure**

Verify/Set the following for Port 1:

```
AL_PA = 71
TOPOLOGY = LOOP_HARD
```

**SGI Server**

In this configuration, using Port 1 will allow access to 64 units and the controller will allow access to units D0 - D99 only. Unit D0 will be the Command Console LUN.

Verify/Set the following:

```
# scsiha -r -p N
# cd /hw
# ioconfig -f ./
# hinvt -v
```

where N is the SGI controller number for the SGI Fibre Channel host adapter.

Target	ALPA
64	72
65	71

**Figure 2 Description**

In this configuration, 2 logical connections are available with up to 128 LUNs. Suggested controller unit numbers: Port 1, units D0 – D63; Port 2, units D100 – D163.

**Storage Enclosure**

Verify/Set the following for Port 1:

```
AL_PA = 71
TOPOLOGY = LOOP_HARD
```

Verify/Set the following for Port 2:

```
AL_PA = 72
TOPOLOGY = LOOP_HARD
```

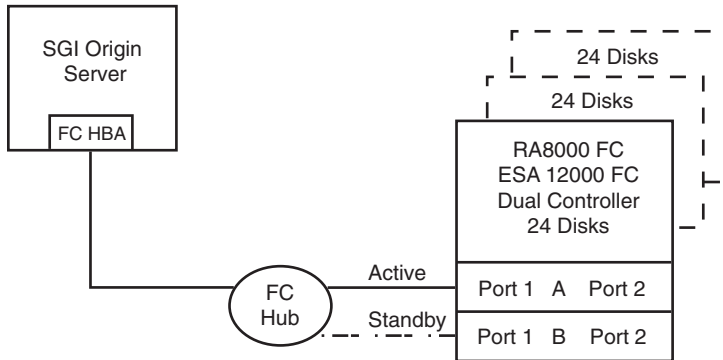
**SGI Server**

Uses the same values as the first configuration diagram. In this configuration, both ports will be accessed: ALPAs and the second connection. Unit D0 will be the Command Console LUN.

**Configuration 2 - One Server, Dual Controller Transparent Failover**

This two-controller configuration (Figure 3) provides dual redundant controllers configured in Transparent Failover mode. The configuration consists of an Enterprise/Modular Storage RAID Arrays enclosure with two HSG80 array controllers on a single loop. In normal operation Controller A provides the active path for all storage sets to the server through Port 1. A second controller, Controller B is a hot

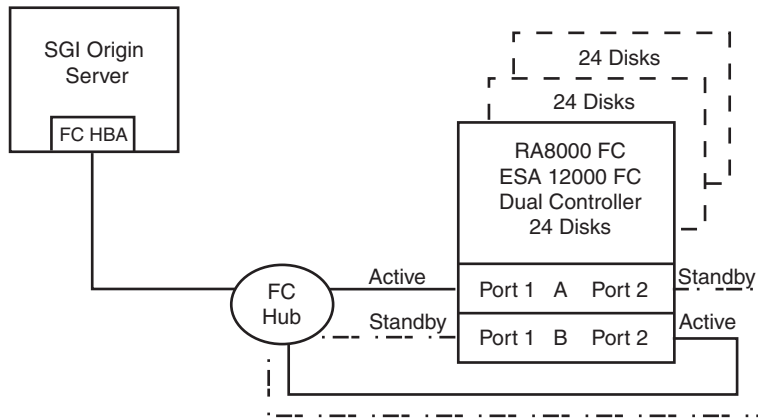
standby. Controller B will automatically become active in the event of a failure in Controller A. All units being accessed through Port 1 of Controller A will become accessible through Port 1 of Controller B. In Figure 3, a single controller host port, Port 1 is active providing up to 64 LUNs across up to 24 disks. An additional 48 disks can be added using two expansion enclosures. Additional servers can be added to this configuration as required using the existing hub (refer to Configuration 5).



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Figure 3. Configuration 2

Use of the second controller, Controller B, as an active controller to increase performance and double LUN capacity can be accomplished without sacrificing redundancy. Two Fibre Channel cables, one connected to Controller A, Port 2, and one connected to Controller B, Port 2, result in the configuration shown in Figure 4. This configuration provides full controller redundancy in the event either controller fails. During failover, the surviving controller will transition the standby port to the active state providing access to all units for the server.



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Figure 4. Configuration 2 with Increased Performance and Double LUN Capacity

### Configuration 2 Notes

- Single Fibre Channel Loop
- Dual HSG80 controllers configured in Transparent Failover Mode
- Up to 300 meters per 50-micron cable segment between the SGI server with MIA and the hub

- Up to 500 meters per 50-micron cable segment between the hub and the HSG80 controller
- Up to 72 disks with 2 optional expansion enclosures
- By default, setting the controller pair in Transparent Failover Mode will automatically configure Port 1 and Port 2 of both controllers to the Active and Standby state indicated, and set the unit offset values to 0 for Port 1 and 100 for Port 2

### Figure 3 Description

In this configuration, up to 64 LUNs are supported with 1 active controller host port. Suggested controller unit numbers: Port 1, units D0 – D63

#### Storage Enclosure

Verify/Set the following for Port 1:

```
AL_PA = 71
TOPOLOGY = LOOP_HARD
```

#### SGI Server

Verify/Set the following:

```
# scsiha -r -p N
# cd /hw
# ioconfig -f ./
# hin v
```

where **N** is the SGI controller number.

Target	ALPA
65	71

### Figure 4 Description

In this configuration, 2 logical connections are available with up to 128 LUNs. Suggested controller unit numbers: Port 1, units D0 – D63; Port 2, units D100 – D163

#### Storage Enclosure

Verify/Set the following for Port 1:

```
AL_PA = 71
TOPOLOGY = LOOP_HARD
```

Verify/Set the following for Port 2:

```
AL_PA = 72
TOPOLOGY = LOOP_HARD
```

#### SGI Server

Verify/Set the following:

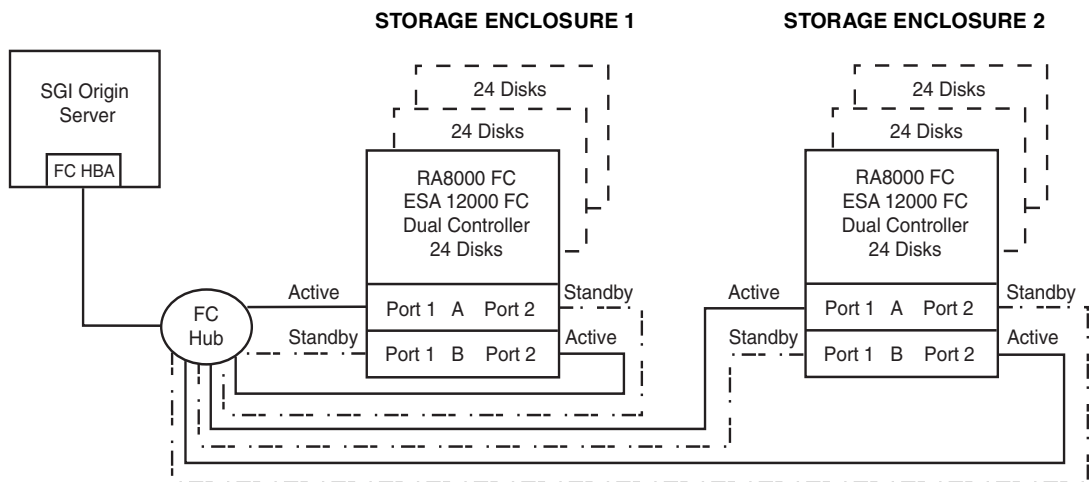
```
# scsiha -r -p N
# cd /hw
# ioconfig -f ./
# hinvt -v
```

where N is the SGI controller number.

Target	ALPA
64	72
65	71

### Configuration 3 - One Server, Two Dual Controller Pairs, Transparent Failover

Configuration 3 (Figure 5) is a two dual-controller configuration with two dual-redundant controller pairs using two RA8000/MA8000 enclosures or a single ESA12000/EMA12000 enclosure. The controllers are configured in Transparent Failover Mode providing controller redundancy in each storage enclosure. This configuration takes advantage of the high capacity of a single Fibre Channel loop allowing for expansion of storage capacity without the addition of another hub. As with Configuration 2, full controller redundancy and two controller capacity is provided in both storage enclosures. In this configuration four active controller ports provide up to 256 LUNs across up to 48 disks. An additional 96 disks can be added using four expansion enclosures.



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Figure 5. Configuration 3

### Configuration 3 Notes

- Single Fibre Channel Loop

- Two Dual HSG80 controller pairs configured in Transparent Failover Mode
- Up to 300 meters per 50-micron cable segment between the SGI server with MIA and the hub
- Up to 500 meters per 50-micron cable segment between the hub and the HSG80 controller
- Up to 144 disks with 4 optional expansion enclosures
- In this configuration, 4 logical connections are available. There are 2 per storage enclosure with up to 128 LUNs each.
- By default, setting the controller pairs in Transparent Failover Mode will automatically configure Port 1 and Port 2 of both controllers to the Active and Standby state indicated, and set the unit offset values to 0 for Port 1 and 100 for Port 2

### Storage Enclosure 1 (Figure 5) Description

Verify/Set the following for Port 1:

Port 1 units D0 – D63

AL\_PA = 71

TOPOLOGY = LOOP\_HARD

Verify/Set the following for Port 2:

Port 2 units D100 – D163

AL\_PA = 72

TOPOLOGY = LOOP\_HARD

### Storage Enclosure 2 (Figure 5) Description

Verify/Set the following for Port 1:

Port 1 units D0 – D63

AL\_PA = 73

TOPOLOGY = LOOP\_HARD

Verify/Set the following for Port 2

Port 2 units D100 – D163

AL\_PA = 74

TOPOLOGY = LOOP\_HARD

### SGI Server

Verify/Set the following:

```
# scsiha -r -p N
```

```
# cd /hw
```

```
# ioconfig -f ./
```

```
# hin v
```

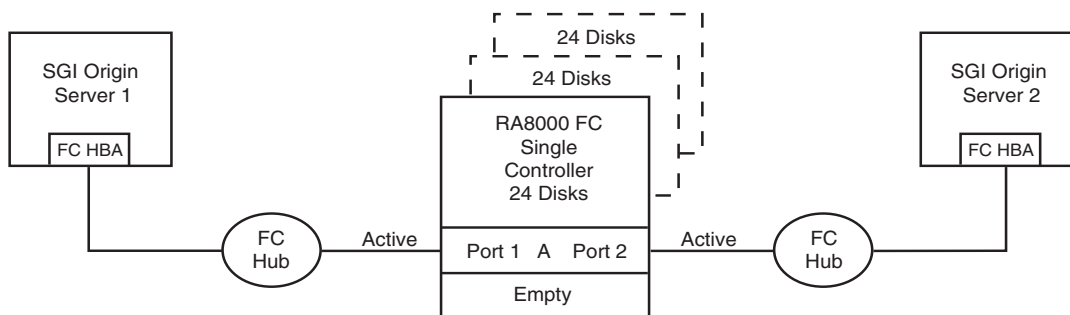
where N is the SGI controller number.

Target to ALPA mapping shown below.

Target	ALPA
62	74
63	73
64	72
65	71

### Configuration 4 – Two Servers, Single Controller, Shared Storage Enclosure

Configuration four (Figure 6) uses the second controller host port to provide storage to a second separate (non-cooperating) server. The two servers share the storage enclosure in that each server has exclusive access to its own LUNs through the use of mutually exclusive LUN numbering and Target identification. This configuration uses two separate Fibre Channel loops.



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Figure 6. Configuration 4

### Configuration 4 Notes

- Two Fibre Channel loops
- Shared storage enclosure
- Single HSG80 controller, controller failover is not available
- Up to 300 meters per 50-micron cable segment between the SGI server with MIA and the hub
- Up to 500 meters per 50-micron cable segment between the hub and the HSG80 controller
- Up to 72 disks with 2 optional expansion enclosures
- Up to 128 LUNs total, 64 available to each server with 2 active controller host ports.

**Storage Enclosure**

Verify/Set the following for Port 1:

Port 1 units D0-D63

AL\_PA = 71

TOPOLOGY = LOOP\_HARD

Verify/Set the following for Port 2:

Port 2 units D100-D163

AL\_PA = 72

TOPOLOGY = LOOP\_HARD

**SGI Server 1**

Verify/Set the following:

```
# scsiha -r -p N
```

```
# cd /hw
```

```
# ioconfig -f ./
```

```
# hinv -v
```

where **N** is the SGI controller number.

Target	ALPA
65	71

**SGI Server 2**

Verify/Set the following:

```
# scsiha -r -p N
```

```
# cd /hw
```

```
# ioconfig -f ./
```

```
# hinv -v
```

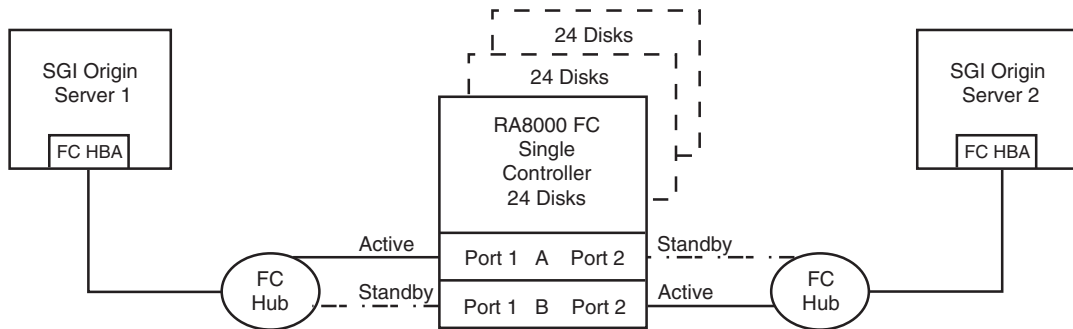
where **N** is the SGI controller number.

Target	ALPA
64	72

**Configuration 5 – Two Servers, Dual Controller Transparent Failover, Shared Storage Enclosure**

Configuration 5 (Figure 7) uses a dual controller pair to provide storage and controller redundancy to a second, separate (non-cooperating) server. The two servers share the storage enclosure in that each server has exclusive access to its own LUNs through the use of mutually exclusive LUN and Target numbering. This configuration uses two separate Fibre Channel loops. Each server has access to its own dedicated controller. In the event of a controller failover, the surviving controller continues to provide full access to units of both servers.

In normal operations, Controller A provides the active path for all storagesets assigned to Server 1 through Port 1. Controller B provides the active path for all storagesets assigned to Server 2 through Port 2. Each server has a dedicated standby port in the event that there is a controller failover.



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Figure 7. Configuration 5

## Configuration 5 Notes

- Two Fibre Channel loops
- Shared storage enclosure
- Dual HSG80 controllers configured in Transparent Failover Mode
- Up to 300 meters per 50-micron cable segment between the SGI server with MIA and the hub
- Up to 500 meters per 50-micron cable segment between the hub and the HSG80 controller
- Up to 72 disks with 2 optional expansion enclosures
- Up to 128 LUNs total, 64 available to each server with 2 active controller host ports.
- By default, setting the controller pair in Transparent Failover Mode will automatically configure Port 1 and Port 2 of both controllers to the Active and Standby state indicated, and set the unit offset values to 0 for Port 1 and 100 for Port 2

## Storage Enclosure

Verify/Set the following for Port 1:

Port 1 units D0-D63

AL\_PA = 71

TOPOLOGY = LOOP\_HARD

Verify/Set the following for Port 2:

Port 2 units D100-D163

AL\_PA = 72

TOPOLOGY = LOOP\_HARD



**SGI Server 1**

Verify/Set the following:

```
# scsiha -r -p N
```

```
# cd /hw
```

```
# ioconfig -f ./
```

```
# hinv -v
```

where **N** is the SGI controller number.

Target	ALPA
65	71

**SGI Server 2**

Verify/Set the following:

```
# scsiha -r -p N
```

```
# cd /hw
```

```
# ioconfig -f ./
```

```
# hinv -v
```

where **N** is the SGI controller number.

Target	ALPA
64	72

## Configuration Parts Lists

### Configuration 1 Parts List

One SGI Server running a version of the IRIX operating system is listed in the V8.6 Solutions Software for SGI-IRIX release notes

**Table 3 Configuration 1 Parts List**

Compaq Part #	Description	Quantity
380556-001	RA8000/ESA12000 and MA8000/EMA12000 Fibre Channel Solution Software V8.6 for SGI IRIX	1
380577-001	ACS V8.6F FC-AL Controller SW	1
	SGI XIO FC HBA SGI PCI FC HBA	Choose 1 depending on server model

**Table 3 Configuration 1 Parts List (Continued)**

Compaq Part #	Description	Quantity
	Media Interface Adapter (MIA) SGI P/N: X-F-OE-KIT This kit is only required for the older versions of SGI AIC-1160, based on copper interface boards.	1 per host adapter connection
380550-B21 (Blue) 380550-B22 (Opal) 380660-B21	RA8000 Pedestal w/single HSG80 RA8000 Pedestal w/single HSG80 RA8000 Rackable w/single HSG80	Choose 1 depending on configuration
242795-B21 295573-B22	FC Optical Hub, 7-Port (no GBICs) FC Optical Hub, 12-Port (no GBICs)	Choose 1
380561-B21	FC Optical GBIC	2 3 for 2 <sup>nd</sup> Port
234457-B21 234457-B22 234457-B23 234457-B24 234457-B25	FC 2 Meter Optical Cable FC 5 Meter Optical Cable FC 15 Meter Optical Cable FC 30 Meter Optical Cable FC 50 Meter Optical Cable	Choose 2 Add 1 for 2 <sup>nd</sup> Port
380691-B21 380595-B21 380588-B21 380694-B21 380589-B21	4GB UW 7200 RPM Disk 9GB UW 7200 RPM Disk 9GB UW 10000 RPM Disk 18GB UW 7200 RPM Disk 18GB UW 10000 RPM Disk	Choose up to 24 (48 for ESA 48 slot)

The following table contains the optional components.

**Table 4 Configuration 1 Optional Components**

Compaq Part #	Description	Quantity
380570-B21 (Blue) 380570-B22 (Opal) 380568-B21	Pedestal Expansion with additional 24 slots Pedestal Expansion with additional 24 slots Rackable Expansion with additional 24 slots	Up to 2
380563-B21	Expansion Cable Kit	1 per Expansion
See Configuration 1 Parts List	Additional Disk Drives	Up to 48

## Configuration 2 Parts List

One SGI Server running a version of the IRIX operating system is listed in the V8.6 Solutions Software for SGI-IRIX release notes

**Table 5 Configuration 2 Parts List**

Compaq Part #	Description	Quantity
380556-001	RA8000/ESA12000 and MA8000/EMA12000 FC Solution Software V8.6 for SGI IRIX	1
380577-001	ACS V8.6F FC-AL Controller SW	2
	SGI XIO FC HBA SGI PCI FC HBA	Choose 1 depending on server model
	Media Interface Adapter SGI P/N: X-F-OE-KIT This kit is only required for the older versions of SGI AIC-1160, based on copper interface boards.	1 per host connection
380550-B21 (Blue) 380550-B22 (Opal) 380660-B21 380580-001 (Blue) 380580-002 (Opal) 380590-B21 (Blue) 380590-B22 (Opal) 380600-001 (Blue) 380600-002 (Opal) 380610-B21 (Blue) 380610-B22 (Opal)	RA8000 Pedestal w/dual HSG80 RA8000 Pedestal w/dual HSG80 RA8000 Rackable w/dual HSG80 ESA12000 w/dual HSG80 24 Slot 60HZ ESA12000 w/dual HSG80 24 Slot 60HZ ESA12000 w/dual HSG80 24 Slot 50HZ ESA12000 w/dual HSG80 24 Slot 50HZ ESA12000 w/dual HSG80 48 Slot 60HZ ESA12000 w/dual HSG80 48 Slot 60HZ ESA12000 w/dual HSG80 48 Slot 50HZ ESA12000 w/dual HSG80 48 Slot 50HZ	Choose 1
242795-B21 295573-B22	FC Optical Hub, 7-Port (no GBICs) FC Optical Hub, 12-Port (no GBICs)	Choose 1
380561-B21	FC Optical GBIC	3, 5 for 2 <sup>nd</sup> Port
234457-B21 234457-B22 234457-B23 234457-B24 234457-B25	FC 2 Meter Optical Cable FC 5 Meter Optical Cable FC 15 Meter Optical Cable FC 30 Meter Optical Cable FC 50 Meter Optical Cable	Choose 3 Choose 3 for 2 <sup>nd</sup> Port
380691-B21 380595-B21 380588-B21 380694-B21 380589-B21	4GB UW 7200 RPM Disk 9GB UW 7200 RPM Disk 9GB UW 10000 RPM Disk 18GB UW 7200 RPM Disk 18GB UW 10000 RPM Disk	Choose up to 24 (48 for ESA 48 slot)

**Configuration 2 Optional Components****Table 6 Configuration 2 Optional Components**

Compaq Part #	Description	Quantity
380570-B21 (Blue)	Pedestal Expansion 24 slots	Up to 2
380570-B22 (Opal)	Pedestal Expansion 24 slots	OR Choose 1
380568-B21	Rackable Expansion 24 slots	
380640-001 (Blue)	ESA12000 Expansion 48 Slot 60HZ	
380640-002 (Opal)	ESA12000 Expansion 48 Slot 60HZ	
380650-B21 (Blue)	ESA12000 Expansion 48 Slot 50HZ	
380650-B22 (Opal)	ESA12000 Expansion 48 Slot 50HZ	
380563-B21	Expansion Cable Kit	1 per Expansion
See Configuration 1 Parts List	Additional Disks Drives	Up to 48

**Configuration 3 Parts List**

One SGI Server running a version of the IRIX operating system is listed in the V8.6 Solutions Software for SGI-IRIX release notes

**Table 7 Configuration 3 Parts List**

Compaq Part #	Description	Quantity
380556-001	RA8000/ESA12000 and MA8000/EMA12000 FC Solution Software V8.6 for SGI IRIX	2
380577-001	ACS V8.6F FC-AL Controller SW	4
	SGI XIO FC HBA SGI PCI FC HBA	Choose 1 depending on server model
	Media Interface Adapter (MIA) SGI P/N: X-F-OE-KIT This kit is only required for the older versions of SGI AIC-1160, based on copper interface boards.	1 per host adapter connection



## Configuration 4 Parts List

Two SGI Servers running a version of the IRIX operating system is listed in the V8.6 Solutions Software for SGI-IRIX release notes.

**Table 9 Configuration 4 Parts List**

Compaq Part #	Description	Quantity
380554-001	RA8000/ESA12000 and MA8000/EMA12000 FC Solution Software V8.6 for SGI IRIX	1
380577-001	ACS V8.6F FC-AL Controller SW	1
	SGI XIO FC HBA SGI PCI FC HBA	Choose 1 depending on server models
	Media Interface Adapter (MIA) SGI P/N: X-F-OE-KIT This kit is only required for the older versions of SGI AIC-1160, based on copper interface boards.	1 per host adapter connection
380550-B21 (Blue) 380550-B22 (Opal) 380660-B21 380580-001 (Blue) 380580-002 (Opal) 380590-B21 (Blue) 380590-B22 (Opal) 380600-001 (Blue) 380600-002 (Opal) 380610-B21 (Blue) 380610-B22 (Opal)	RA8000 Pedestal w/dual HSG80 RA8000 Pedestal w/dual HSG80 RA8000 Rackable w/dual HSG80 ESA12000 w/dual HSG80 24 Slot 60HZ ESA12000 w/dual HSG80 24 Slot 60HZ ESA12000 w/dual HSG80 24 Slot 50HZ ESA12000 w/dual HSG80 24 Slot 50HZ ESA12000 w/dual HSG80 48 Slot 60HZ ESA12000 w/dual HSG80 48 Slot 60HZ ESA12000 w/dual HSG80 48 Slot 50HZ ESA12000 w/dual HSG80 48 Slot 50HZ	Choose 1
242795-B21 295573-B22	FC Optical Hub, 7-Port (no GBICs) FC Optical Hub, 12-Port (no GBICs)	Choose 2
380561-B21	FC Optical GBIC	4
234457-B21 234457-B22 234457-B23 234457-B24 234457-B25	FC 2 Meter Optical Cable FC 5 Meter Optical Cable FC 15 Meter Optical Cable FC 30 Meter Optical Cable FC 50 Meter Optical Cable	Choose 4
380691-B21 380595-B21 380588-B21 380694-B21 380589-B21	4GB UW 7200 RPM Disk 9GB UW 7200 RPM Disk 9GB UW 10000 RPM Disk 18GB UW 7200 RPM Disk 18GB UW 10000 RPM Disk	Choose up to 24 (48 for ESA 48 slot)

## Configuration 4 Optional Components

**Table 10 Configuration 4 Optional Components**

Compaq Part #	Description	Quantity
380570-B21 (Blue)	Pedestal Expansion 24 slots	Up to 2
380570-B22 (Opal)	Pedestal Expansion 24 slots	OR Choose 1
380568-B21	Rackable Expansion 24 slots	
380640-001 (Blue)	ESA12000 Expansion 48 Slot 60HZ	
380640-002 (Opal)	ESA12000 Expansion 48 Slot 60HZ	
380650-B21 (Blue)	ESA12000 Expansion 48 Slot 50HZ	
380650-B22 (Opal)	ESA12000 Expansion 48 Slot 50HZ	
380563-B21	Expansion Cable Kit	
See above	Additional Disks Drives	Up to 48

## Configuration 5 Parts List

Two SGI Servers running a version of the IRIX operating system is listed in the V8.6 Solutions Software for SGI-IRIX release notes.

**Table 11 Configuration 5 Parts List**

Compaq Part #	Description	Quantity
380554-001	RA8000/ESA12000 and MA8000/EMA12000 FC Solution Software V8.6 for SGI IRIX	1
380577-001	ACS V8.6F FC-AL Controller SW	2
	SGI XIO FC HBA SGI PCI FC HBA	Choose 1 depending on server models
	Media Interface Adapter SGI P/N: X-F-OE-KIT This kit is only required for the older versions of SGI AIC-1160, based on copper interface boards.	1 per host adapter connection
380550-B21 (Blue)	RA8000 Pedestal w/dual HSG80	Choose 1
380550-B22 (Opal)	RA8000 Pedestal w/dual HSG80	
380660-B21	RA8000 Rackable w/dual HSG80	
380580-001 (Blue)	ESA12000 w/dual HSG80 24 Slot 60HZ	
380580-002 (Opal)	ESA12000 w/dual HSG80 24 Slot 60HZ	
380590-B21 (Blue)	ESA12000 w/dual HSG80 24 Slot 50HZ	
380590-B22 (Opal)	ESA12000 w/dual HSG80 24 Slot 50HZ	
380600-001 (Blue)	ESA12000 w/dual HSG80 48 Slot 60HZ	
380600-002 (Opal)	ESA12000 w/dual HSG80 48 Slot 60HZ	
380610-B21 (Blue)	ESA12000 w/dual HSG80 48 Slot 50HZ	
380610-B22 (Opal)	ESA12000 w/dual HSG80 48 Slot 50HZ	

242795-B21 295573-B22	FC Optical Hub, 7-Port (no GBICs) FC Optical Hub, 12-Port (no GBICs)	Choose 2
380561-B21	FC Optical GBIC	6
234457-B21 234457-B22 234457-B23 234457-B24 234457-B25	FC 2 Meter Optical Cable FC 5 Meter Optical Cable FC 15 Meter Optical Cable FC 30 Meter Optical Cable FC 50 Meter Optical Cable	Choose 6
380691-B21 380595-B21 380588-B21 380694-B21 380589-B21	4GB UW 7200 RPM Disk 9GB UW 7200 RPM Disk 9GB UW 10000 RPM Disk 18GB UW 7200 RPM Disk 18GB UW 10000 RPM Disk	Choose up to 24 (48 for ESA 48 slot)

The following table lists configuration 5 optional components.

**Table 12 Configuration 5 Optional Components**

Compaq Part #	Description	Quantity
380570-B21 (Blue) 380570-B22 (Opal) 380568-B21	Pedestal Expansion 24 slots Pedestal Expansion 24 slots Rackable Expansion 24 slots	Up to 2 OR Choose 1
380640-001 (Blue) 380640-002 (Opal) 380650-B21 (Blue) 380650-B22 (Opal)	ESA12000 Expansion 48 Slot 60HZ ESA12000 Expansion 48 Slot 60HZ ESA12000 Expansion 48 Slot 50HZ ESA12000 Expansion 48 Slot 50HZ	
380563-B21	Expansion Cable Kit	1 per Expansion
See above	Additional Disks Drives	Up to 48



## Appendix A - Arbitrated Loop Physical Addresses (ALPAs)

AL_PA (hex)	7-Bit Loop ID (decimal)	AL_PA (hex)	7-Bit Loop ID (decimal)	AL_PA (hex)	7-Bit Loop ID (decimal)
71	65	A3	43	C7	21
72	64	A5	42	C9	20
73	63	A6	41	CA	19
74	62	A7	40	CB	18
75	61	A9	39	CC	17
76	60	AA	38	CD	16
79	59	AB	37	CE	15
7A	58	AC	36	D1	14
7C	57	AD	35	D2	13
80	56	AE	34	D3	12
81	55	B1	33	D4	11
82	54	B2	32	D5	10
84	53	B3	31	D6	9
88	52	B4	30	D9	8
8F	51	B5	29	DA	7
90	50	B6	28	DC	6
97	49	B9	27	E0	5
98	48	BA	26	E1	4
9B	47	BC	25	E2	3
9D	46	C3	24	E4	2
9E	45	C5	23	E8	1
9F	44	C6	22	EF	0

