StorageWorks™

***Solutions***

# 24 SBB, DSSI RAID Subsystem, Deskside Expansion Unit (SW301)

# User's Guide

Order Number: EK–SW301–UG. A01

This guide describes the procedures that install and operate the 24 SBB, DSSI RAID Subsystem deskside expansion unit (SW301).

**Digital Equipment Corporation**
**Maynard, Massachusetts**

**April 1996**

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Any changes or modifications made to this equipment may void the users authority to operate this equipment. Operation of this equipment in a residential area may cause interference in which case the user at his own expense, will be required to take whatever measures may be required to correct the interference.



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# Preface

The *StorageWorks Solutions, 24 SBB, DSSI (*Digital standard system interconnect) *RAID (redundant array of independent disks) Subsystem, Deskside Expansion Unit (DSSI) User's Guide* describes the purpose, function, operation, and use of the DSSI RAID subsystem and the associated power entry controllers, power supplies, environmental monitor units (EMUs), HS1CP SCSI bus controllers, and StorageWorks building blocks (SBBs). This guide, the *StorageWorks Solutions Products Catalog*, the *StorageWorks Solutions 8-Bit I/O Module*, and the *StorageWorks Solutions 16-Bit I/O Module* comprise the StorageWorks Solutions documentation set.

## Intended Audience

This publication is for use by customers and Digital™ employees responsible for configuring, installing, and maintaining the StorageWorks subsystem and its components.

## Documentation Conventions

The following conventions are used in this manual:

| | |
|---|---|
| **boldface type** | Boldface type indicates the first instance of terms being defined in text, in the glossary, or both. |
| *italic type* | Italic type indicates emphasis and complete manual titles. In the glossary, italic type also is used to indicate cross–references. |

## Structure

This manual is organized as follows:

| | |
|---|---|
| **Chapter 1** | Describes the DSSI RAID subsystem including physical characteristics, layout, specifications, components, StorageWorks SBBs and general information. |
| **Chapter 2** | Describes the how to configure the DSSI RAID subsystem power and SCSI buses. |
| **Chapter 3** | Describes how the DSSI RAID subsystem and the device status are monitored and reported. This chapter includes recommended corrective action for fault conditions. |
| **Chapter 4** | Describes the procedures replacing SBB power supplies, SBB storage devices, environmental monitor unit (EMU), controllers, blowers, and power entry controllers. |
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# 1

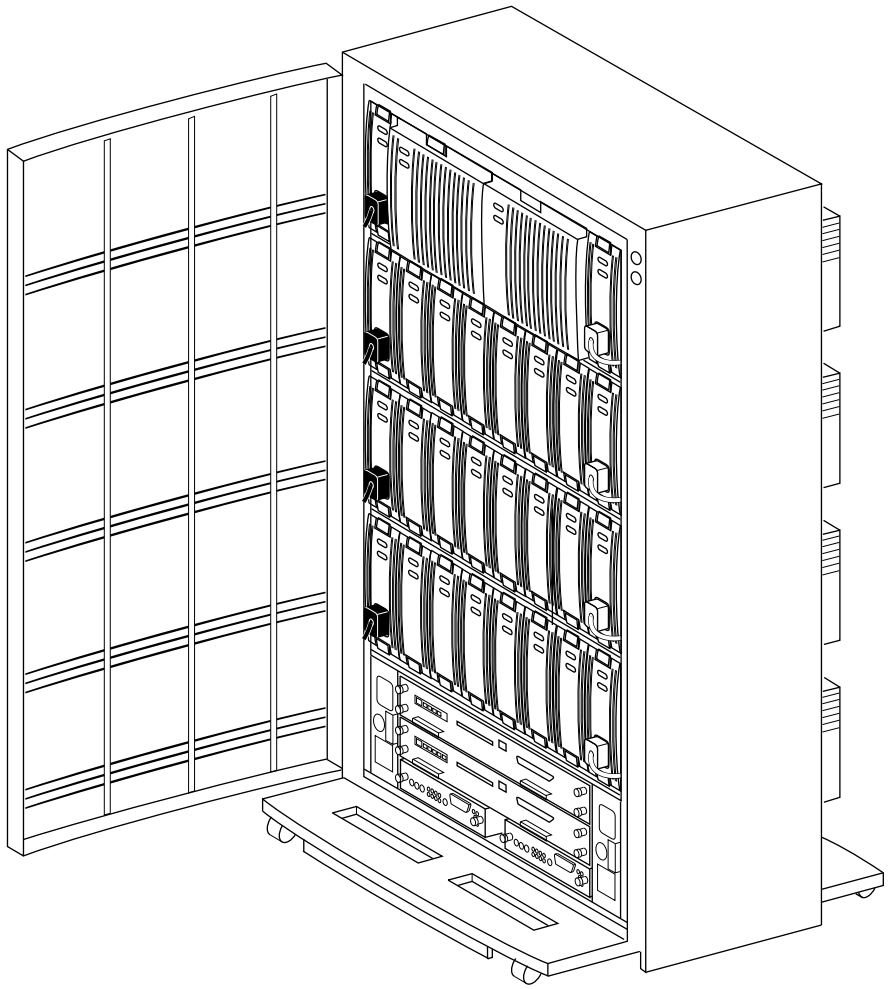
# Introducing the DSSI RAID Subsystem

This chapter describes the **DSSI RAID** subsystem deskside expansion unit shown in Figure 1-1. This description includes features, unit layout, Small Computer System Interface (**SCSI**) bus, power, cabling, StorageWorks building blocks (**SBB**s), and general user information. A label inside the cabinet front door identifies a wide compatible subsystem.

**Note**

The DSSI RAID subsystem requires at least one HS1CP array **controller** for proper operation. This user's guide discusses only controller replacement procedures. For detailed descriptions of the individual controllers, use, configuration, operation, storage device compatibility, SCSI bus, and diagnostics, refer to the specific controller documentation.

**Figure 1-1 DSSI RAID Subsystem**



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## 1.1 Product Overview

The DSSI RAID subsystem is a member of the Digital StorageWorks family of modular enclosures that contain StorageWorks storage devices, power supplies, and controllers. Table 1-1 shows DSSI RAID subsystem components.

**Table 1-1 DSSI RAID Subsystem Components**

| Component | Order No. | Power Configurations | |
|---|---|---|---|
| | | Standard (4+1) | Option (4+4) |
| Blower (dual speed) | BA35X–MD | 8 | 8 |
| Environmental monitor unit (EMU) | BA35X–EA | 1 | 2 |
| Power controller | BA35X–HE | 2 | 2 |
| Shelf power supply (150W) | BA35X–HD | 5 | 8 |
| HS1CP array controller | 2 | | |
| HS1CP cache memory module | 2 | | |

| Customer Specified Options | | | |
|---|---|---|---|
| Storage devices: | **SBB Size** | **Minimum** | **Maximum** |
| (Based on 6 SCSI buses; | 3.5-inch | 6 | 24 |
| minimum of one device per bus) | 5.25-inch | 0 | 8 |
| DSSI cable to host | See Chart | | |

**CAUTION**

The specific storage devices installed must be compatible with the HS1CP controller and with each other.

The following are the major features of the DSSI RAID subsystem:

- All major components, *except* the cache memory modules, can be replaced using either the **hot swap** or **warm swap** methods (see Chapter 4 for detailed information).
- Extensive fault monitoring and reporting capability includes the following:
  - Incorrect voltage
  - Shelf blower failure
  - Power supply failure
  - Operating temperature
  - Storage device removal
  - Device operational status
  - Storage device installation
- Automatic initiation of system protection actions
- Six, single-ended, 8-bit/16-bit *INTERNAL* SCSI buses
- SCSI buses are configured and terminated
- No SCSI cables required to connect controllers to devices

## 1.2 DSSI RAID Subsystem Major Components

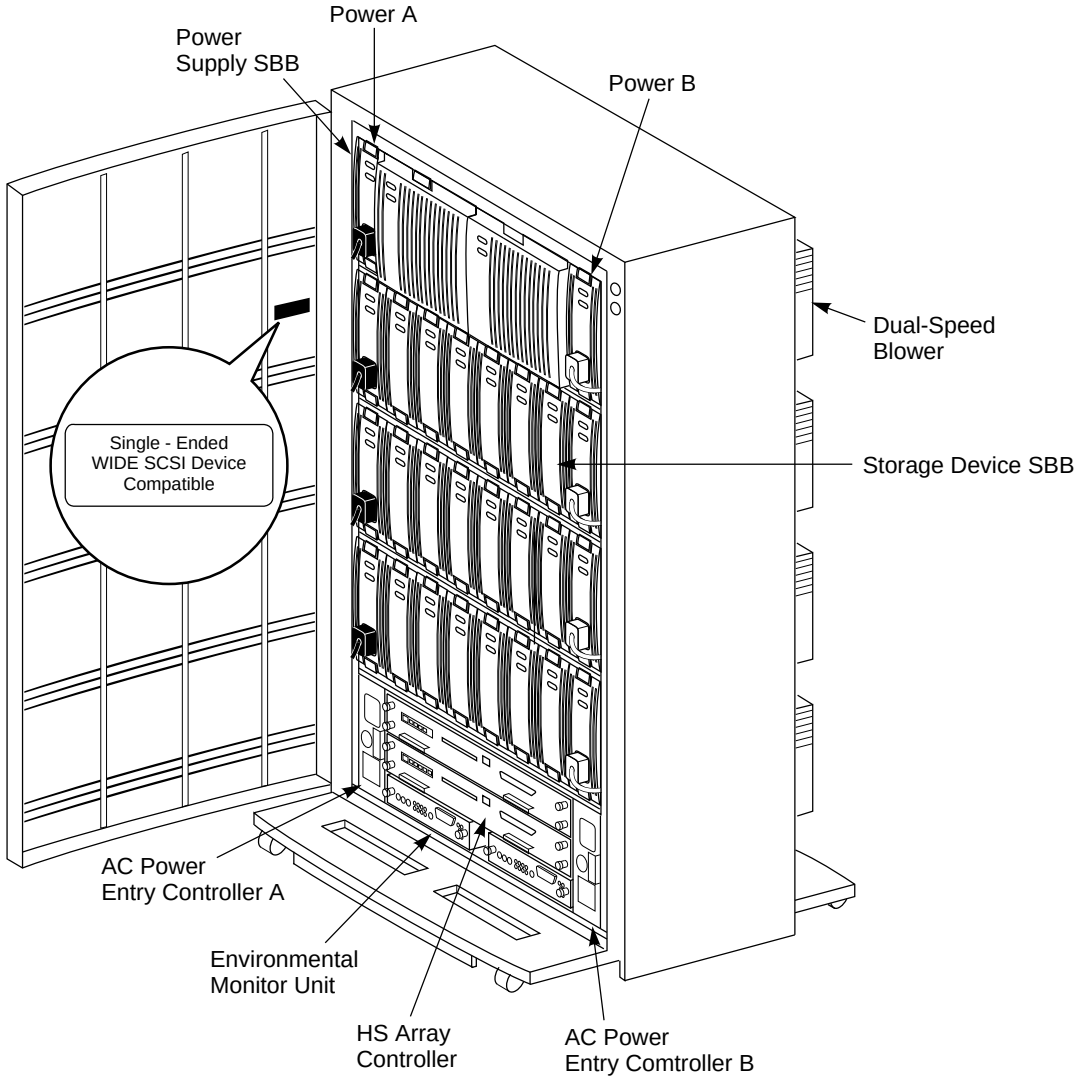
The major components of the DSSI RAID subsystem are shown in Figure 1-2.

- Power controller with a power ON/OFF switch, noise filters, surge suppression, and **electromagnetic interference** (**EMI**) filters.
- SBB power supplies that convert the ac input to +12 V dc and +5 V dc.

**CAUTION**

A *minimum* of four operational SBB power supplies is required for operation of the following DSSI RAID subsystem components: 2 – EMUs, 2 – HS1CP Controllers, 2 – Cache Memories, 24 – 3.5-inch SBBs

**Figure 1-2 DSSI RAID Subsystem Major Components**



When there are less than four operational power supplies, the RAID subsystem will cease operating to preserve and protect the data.

See Chapter 2 for a detailed description of the power configurations and power cord connections. Described in the following sections are three possible power configurations for each DSSI RAID subsystem:

- Standard—four power supply SBBs, plus one redundant power supply SBB (4+1)
- Option—four power supply SBBs, plus four redundant power supply SBBs (4+4); and two power controllers

### 1.2.1 AC Power Entry Controllers

The ac input power is routed from the wall outlet to a power entry controller. These power controllers use either of the following input voltages:

- 100–120 V ac, 60 Hz, single-phase, 12A
- 220–240 V ac, 50 Hz, single-phase, 6A

The two ac power entry controllers provide the system ON/OFF switch, ac power to all power supply SBBs.

### 1.2.2 Power Supply SBBs

**CAUTION**

The DSSI RAID subsystem requires power supply SBBs rated for at least 150 W. Lower rated supplies, such as the 131 W BA35X–HA, cannot be used.

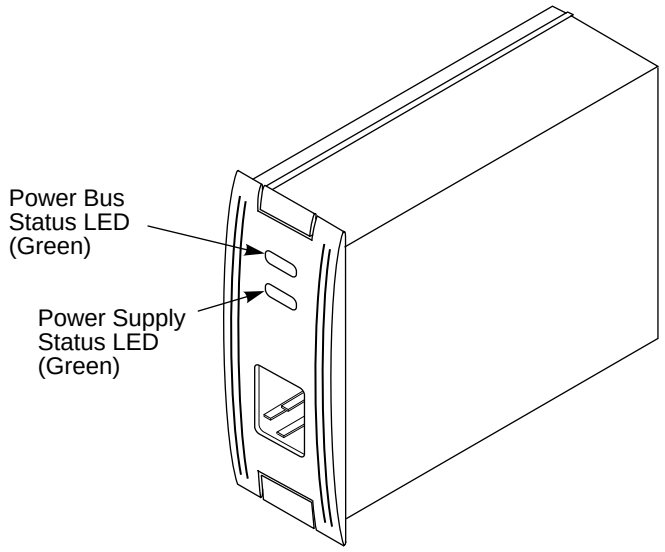
The power supply SBB shown in Figure 1-3 converts the ac voltage from the power controller to +5 V dc and +12 V dc and distributes these voltages throughout the RAID subsystem. The maximum capacity of the DSSI RAID subsystem is eight power supplies. A minimum of five operable power supply SBBs is required for 4+1 standard system operation.

The 4+1 configuration provides five suppies connected to power bus **A** by the black power cords. As long as any four of these supplies are operational, the RAID subsystem is operational. The failure of a second supply places the RAID subsystem controller in a reset state. This precludes further data processing and prevents the corruption or loss of the stored data.

With the 4+4 full redundant power option, the RAID subsystem can survive multiple power supply faults. To fully realize the benefits of the 4+4 configuration, connect the power controllers to different ac distribution circuits (*legs).*

The four RAID subsystem power supply SBBs on the left end of the shelf are connected to power controller **A**. The four RAID subsystem power supply SBBs on the right end of the shelf are connected to power controller **B**.

**Figure 1-3 Typical Shelf Power Supply SBB**



### 1.2.3 Standard (4+1) Power Configuration

**Note**

The black power cord at the upper right corner of the DSSI RAID subsystem is used *only* for the standard (4+1) configuration. It is not used for either the basic or redundant (4+4) configurations.

This standard power configuration *is* recommended by Digital. If a power supply SBB fails you would be able to replace it before a second power supply SBB fails. The standard power configuration has the following components:

5 — power supply SBBs

2 — ac power controllers

Any one of the following error conditions *will* cause the DSSI RAID subsystem to cease operation and may cause loss or corruption of data:

- Failure of *two* power supply SBBs
- Power controller failure

### 1.2.4 Optional (4+4) Power Configuration

Digital *recommends* this power configuration for complete data protection. The redundant power configuration provides complete redundancy for all power system components. Loss or corruption of data may occur only when *any one* of the following *multiple* error conditions occurs before you take corrective action:

- Failure of *five* power supply SBBs
- Failure of *both* power controllers

Two separate ac power sources and two ac power controllers are required for full redundant power operation.

The first ac source provides power to controller **A,** which distributes the ac power through the five *black* power cords at the *left* end of the device shelves.

The second ac source provides power to controller **B**, which distributes the ac power through the four *gray* power cords to shelf power SBBs at the *right* end of the device shelves.

In all configurations, the four power supply SBBs on the *left* end of the shelf are connected to this bus with the black power cords.

For the standard configuration, a power supply SBB is installed at the *right* end of the top device shelf and the black power bus **A** cord is connected.

## 1.3 Enclosure Error Detection and Reporting

The DSSI RAID subsystem error detection and reporting function has two major elements—the fault bus and EMU. For a detailed discussion about error detection, fault reporting, and correction see Chapter 3.

### 1.3.1 Fault Bus

The RAID subsystem fault bus monitors the subsystem enclosure operation and reports fault conditions to the HS1CP array controller and the EMU. The controller and EMU then report the error condition to the user. The fault bus monitors the following conditions:

- Blower failure (SHELF_OK)
- Storage device removal (SWAP_L)
- Power supply failure (SHELF_OK)
- Storage device installation (SWAP_L)
- SBB failure (FAULT_CLK, FAULT_DATA)

The fault bus consists of three subsystem backplane signals routed to the port connectors on the array controllers:

- **Shelf Status Signal**
  The SHELF_OK status signal indicates the state of the RAID subsystem power (ac and dc) and blower operation.
- **SBB Swap Signal**
  The SWAP_L signal is asserted whenever an SBB is either removed from or inserted in the RAID subsystem.
- **SBB Fault Signals**
  The SBB amber light emitting diode (LED) displays either the storage device address or indicates a device fault. This device fault LED is controlled by the fault clock (FAULT_CLK) and the fault data (FAULT_DATA) control signals.

For a detailed technical description of the fault bus, refer to the *High Availability Storage subsystem Fault Bus Engineering Specification*. The controller uses the fault bus signals in the manner described in the controller specifications.

### 1.3.2 Environmental Monitor Unit (EMU)

The EMU provides protection against catastrophic DSSI RAID subsystem faults. Together the EMU and the controller warn the user of existing or impending failures using one or more of the following error reporting systems:

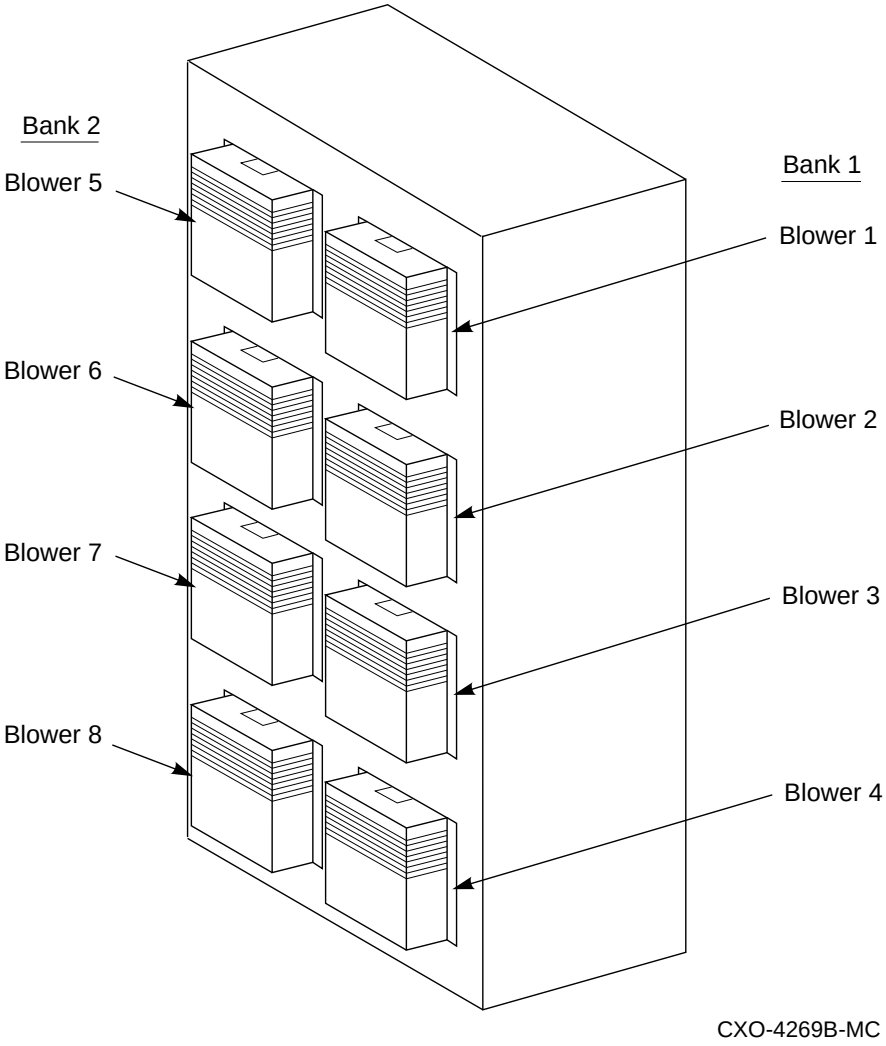
- SBB LEDs.
- EMU LEDs.
- A user-enabled EMU audible alarm
- Error messages on the host interface.
- Error messages on the maintenance terminal.
- Controller operator control panel (OCP) LEDs.
- In some instances, the EMU automatically initiates corrective actions.

## 1.4 DSSI RAID Subsystem Cooling

As shown in Figure 1-4, the DSSI RAID subsystem has eight rear-mounted blowers that pull air in from the front of the cabinet; through the SBBs, controllers, and EMUs; and exhaust it out the rear. Backplane connectors provide +12 V dc to operate the blowers. Blower status signals are routed through these same connectors to the shelf backplane and the EMU. All operational blowers automatically switch from normal to high speed when the following conditions exist:

- When a blower is removed
- When a blower malfunctions
- When a blower is not rotating at the correct speed
- When a high warning temperature condition is detected by the EMU

**Figure 1-4 Dual Speed Blowers**



## 1.5 HS1CP Array Controllers

The HS1CP array controllers provide a means of connecting the Digital host system to the RAID subsystem.

Install two HS1CP controllers with cache memories to provide complete controller redundancy as described in *StorageWorks Array Controllers HS Family of Array Controllers User's Guide*. The controller documentation describes:

- Configuring the controller
- Connecting a maintenance terminal to set initial controller parameters
- Determining the proper method for replacing SBBs (hot swap or warm swap)

The controller firmware revision level determines the devices supported by each controller. See the controller release-specific *StorageWorks Array Controller Operating Firmware Release Notes* for a list of supported storage devices.

The DSSI RAID subsystem supports the HS1CP controller (see Table 1-2). This table shows the number of output SCSI buses (Ports) and the compatible cache memories (Cache Memory).

**CAUTION**

To replace a write-back cache module you must use the procedures in *StorageWorks Array Controllers HS Family of Array Controllers User's Guide.*

**Table 1-2 HS1CP Controller**

| Model | Input | Ports | Cache Memory |
|---|---|---|---|
| HS1CP | DSSI | 6 | Any of the following caches *may be* installed:<br>16-MB read 32-MB read<br>16-MB write-back 32-MB write-back |

## 1.6 Connecting the DSSI Cables

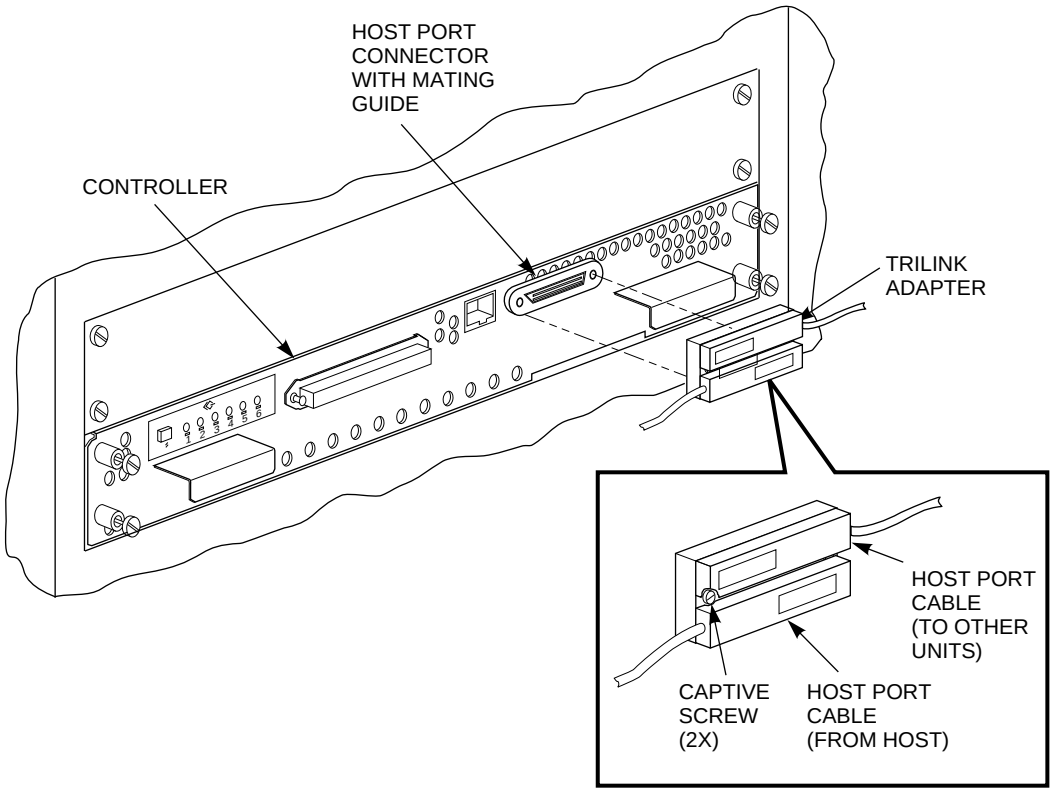
**CAUTION**

All DSSI buses must be terminated whenever power is applied. Disconnecting a DSSI bus cable when the power is applied removes termination from the bus and can generate erroneous signals and cause the bus to *hang*. To avoid this condition never connect or disconnect a DSSI cable with power applied to either the host or the controller.

Complete the following procedure to connect the DSSI cable to the HS1CP controller (see Figure 1-5):

1. Install the connector guide over the 68-pin DSSI controller connector.
2. Connect the DSSI cable as required.
3. Install the tri-link connector on the 68-pin DSSI controller connector.

**Figure 1-5 Typical DSSI Tri-Link Connector**

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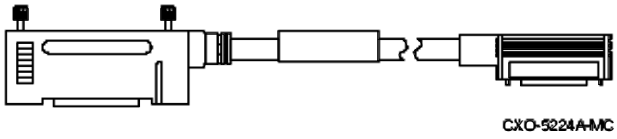
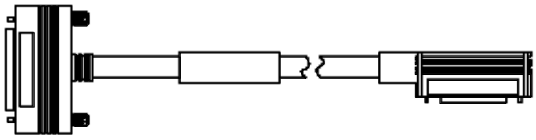
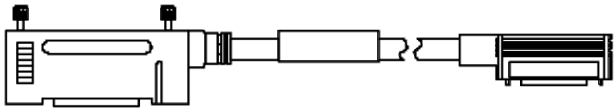
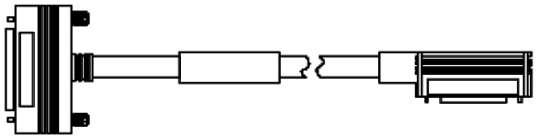
The DSSI bus cable you use is dependent upon the following:

- The computer host.
- The adapter type.

See Table 1-3 to determine the compatible DSSI cable series for connecting the pedestal to a host adapter. For detailed information about these cables see the *StorageWorks Solutions HS1CP Array Controller Release Notes*, order number EK–HS1CP–RN.

**Table 1-3 DSSI Subsystem Compatible Cables**

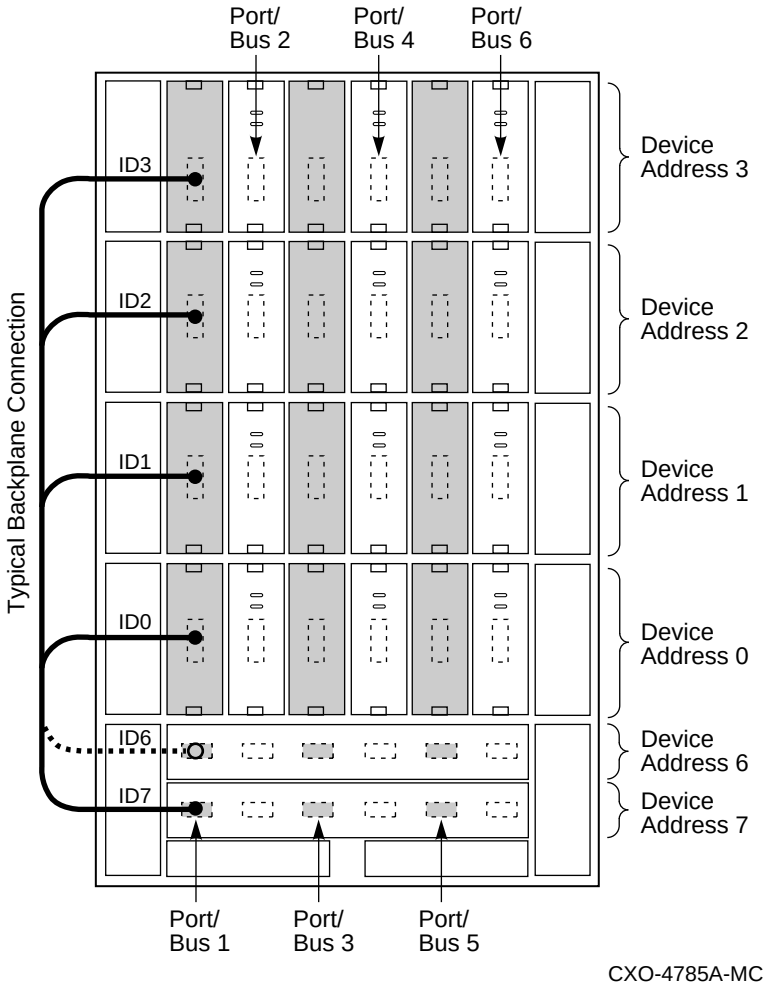
| If the host and adapter are… | the cable to use is … |
|---|---|
| Alpha Server 2000™<br>KFESA | **BC29R**<br>  <br>CXO-5224A-MC |
| Alpha Server 2000™<br>KFESB<br>KFPSA | **BC29S**<br>  <br>CXO-5192A-MC |
| Alpha Server 2100™<br>KFESA | **BC29R**<br>  <br>CXO-5224A-MC |
| Alpha Server 2100™<br>KFESB<br>KFPSA | **BC29S**<br>  <br>CXO-5192A-MC |

## 1.7 SCSI Buses

The factory-configured six 8-bit SCSI buses and the associated ports and device addresses are shown in Figure 1-6. The DSSI RAID subsystem enclosure supports 16-bit storage devices operating in -bit mode. The configuration rules for these single-ended SCSI buses are as follows:

- May install all current level 8-bit -VW devices.
- Termination boards are installed on the top, rear of the backplane.
- All devices and ports in the same column are on the same SCSI bus or port.
- Device addresses 4 and 5 are only used if the SBB has a device address switch.
- All the devices in the same horizontal row (device shelf) have the same device address.
- Device addresses are determined by the backplane connector into which the device is inserted.
- Each terminator board terminates two buses (that is, Bus 1–Bus 2, Bus 3–Bus 4, and Bus 5–Bus 6).

**Figure 1-6 DSSI SCSI Buses**



## 1.8 Storage Device SBBs

The DSSI RAID subsystem accommodates the 3.5-inch and 5.25-inch storage device SBBs (see Figure 1-7).

- 24 — 3.5-inch SBBs, each occupying one slot *OR*
- 8 — 5.25-inch SBBs, each occupying three slots *OR*
- a combination of both

The 8-bit SCSI device addresses can be assigned in the following ways:

- By the backplane connector
- With the SCSI device address switch mounted on the rear of the 5.25-inch SBBs and some 3.5-inch SBBs

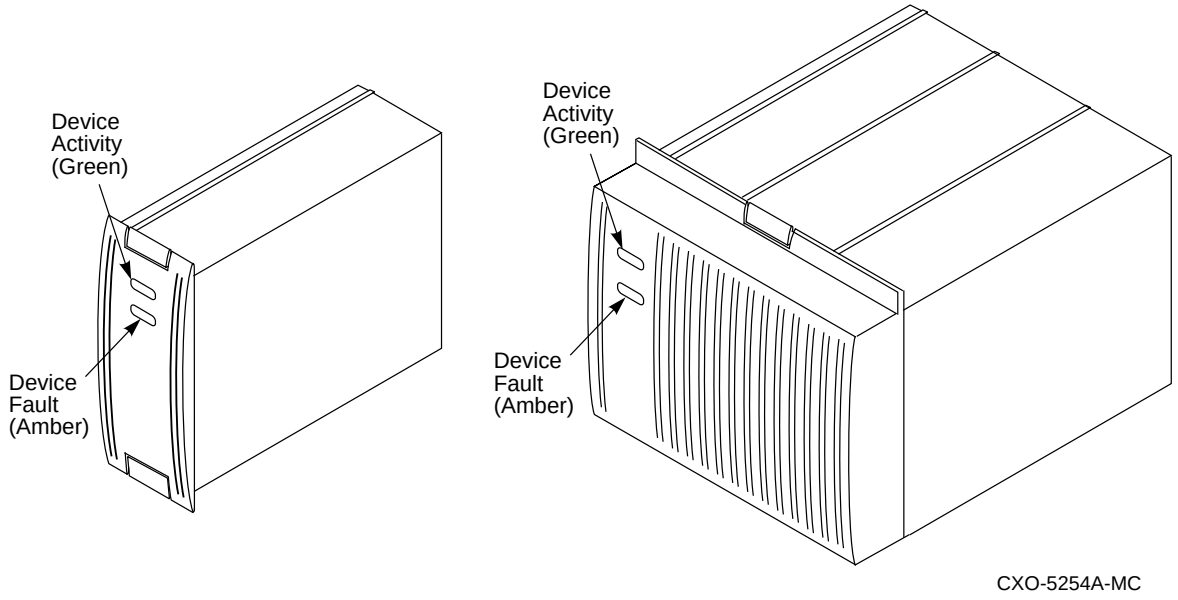
The 16-bit SCSI devices are assigned only the lower 8-bits of the address.

For detailed information about SCSI device addressing see either *StorageWorks Solutions Shelf and SBB User's Guide* or the *StorageWorks Solutions SBB User's Guide.*

To determine the SBBs that can be used in a DSSI RAID subsystem—refer to the HS array controller (HS1CP) software product descriptions (SPDs).

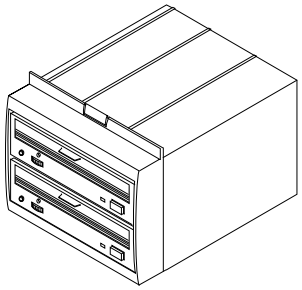
See the *StorageWorks Solutions Product Catalog* for a list of available SBBs.

**Figure 1-7 Typical 3.5-Inch and 5.25-inch SBBs**



### 1.8.1 CD-ROM Drives

You can install the following CE Mark certified StorageWorks CD-ROM drives:



CXO-5167A-MC

0.600 GB Quad Speed (4X) High Performance CD-ROM
Lower Half-Height ..... RRD45-VA

0.600 GB Quad Speed (4X) High Performance CD-ROM
Upper Half-Height ..... RRD45-VU

**NOTE**

You can install, but not order, the following compatible devices.

*0.600 GB Dual Speed (2X) High Performance CD-ROM*
*Lower Half-Height* ..... *RRD43-VA*

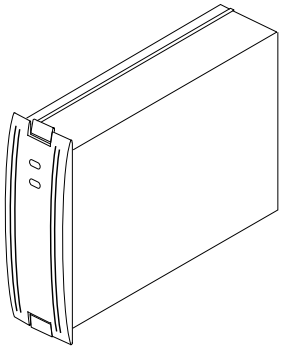
*0.600 GB Dual Speed (2X) High Performance CD-ROM*
*Upper Half-Height* ..... *RRD43-VU*

*0.600 GB Dual Speed (2X) High Performance CD-ROM*
*Lower Half-Height* ..... *RRD44-VA*

*0.600 GB Quad Speed (4X) High Performance CD-ROM*
*Upper Half-Height* ..... *RRD44-VU*

### 1.8.2 Disk Drives

You can install the following CE–Mark certified disks drives, (fixed, removable):



CXO-4562A-MC

**CAUTION**

Installing a 7200 RPM disk drive may require additional cooling.

1.05 GB Fixed Disk Drive—5400 RPM..... RZ26L–VW
1.05 GB Fixed Disk Drive—5400 RPM..... RZ26N–VA
1.05 GB Fixed Disk Drive—5400 RPM..... RZ26N–VW
2.1 GB Fixed Disk Drive—5400 RPM..... RZ28M–VA
2.1 GB Fixed Disk Drive—5400 RPM..... RZ28M–VW
2.1 GB Fixed Disk Drive—7200 RPM..... RZ28D–VA
2.1 GB Fixed Disk Drive—7200 RPM..... RZ28D–VW
4.3 GB Fixed Disk Drive—7200 RPM..... RZ29B–VA
4.3 GB Fixed Disk Drive—7200 RPM..... RZ29B–VW

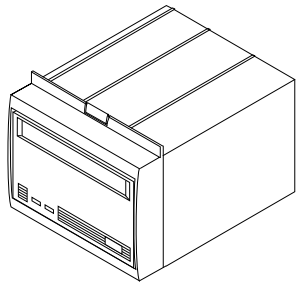
**NOTE**

You can install, but not order, the following compatible devices.

*1.05 GB Fixed Disk Drive—5400 RPM*..... *RZ26L–VA*
*2.1 GB Fixed Disk Drive—5400 RPM*..... *RZ28–VA*
*2.1 GB Fixed Disk Drive—5400 RPM*..... *RZ28–VW*
*2.1 GB Fixed Disk Drive—5400 RPM*..... *RZ28B–VA*

## 1.8.3 Optical Disk Drives

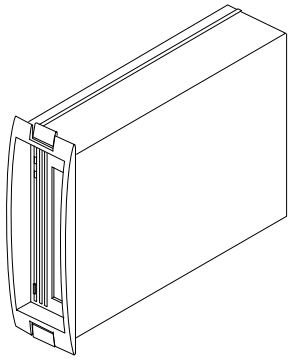
You can install the following CE Mark certified StorageWorks optical disk drive:


CXO-5169A-MC

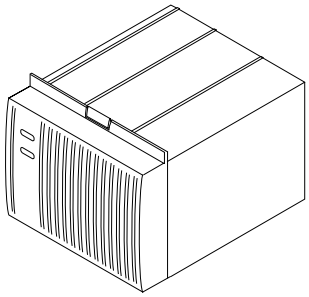
1.3 GB Removable Optical Disk Drive, Full-Height..... RWZ52–VA

## 1.8.4 Solid State Disks

You can install the following CE–Mark certified StorageWorks solid state disks (SSDs):


CXO-5168A-MC

134 Mb Solid State Disk, Full-Height..... EZ31–VW
268 Mb Solid State Disk, Full-Height..... EZ32–VW


CXO-4800A-MC

0.475 GB Solid State Disk, Full-Height ..... EZ64–VA
0.950 GB Solid State Disk, Full-Height ..... EZ69–VA

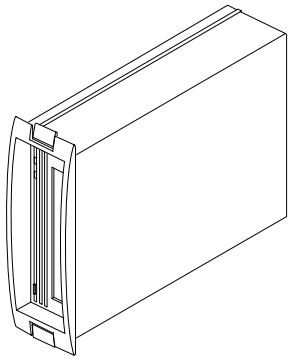
**NOTE**

You can install, but not order, the following compatible devices.

*0.107 GB Solid State Disk with Integrated Data Retention, Full-Height* *EZ51R–VA*
*0.428 GB Solid State Disk with Integrated Data Retention, Full-Height* *EZ54R–VA*
*0.856 GB Solid State Disk with Integrated Data Retention, Full-Height* *EZ58R–VA*

### 1.8.5 Cartridge Tape Drives

You can install the following CE–Mark certified StorageWorks cartridge tape drives (DAT, DLT)



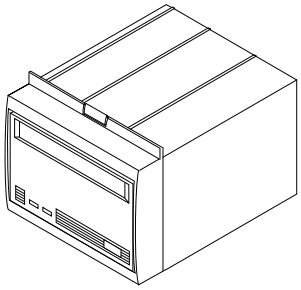
CXO-5168A-MC

8 GB 4 mm DAT Cartridge Tape Drive..... TLZ07–VA

**NOTE**

You can install, but not order, the following compatible devices.

*4 GB 4 mm DAT Cartridge Tape Drive ..... TLZ06–VA*



CXO-5169A-MC

20 GB DLT Cartridge Tape Drive—Full Height..... TZ87–VA

20 GB DLT Cartridge Tape Drive—Full Height..... TZ87N–VA

32 GB 4 mm DAT 4 Cartridge Tape Drive Loader—Full Height..... TLZ7L–VA

**NOTE**

You can install, but not order, the following compatible devices.

*16 GB 4 mm DAT 4 Cartridge Tape Drive Loade—Full Height r..... TLZ6L–VA*

# 2

# Configuring the DSSI RAID Subsystem

This chapter describes the basic rules for configuring a DSSI RAID subsystem. Table 2-1 lists the components required for an operational DSSI RAID subsystem. The first part of the table lists the components supplied with shelf and the upgrade kit. The second part of this table lists the components required to make the system operational, the configure-to-order (CTO) components.

**Table 2-1 DSSI RAID Subsystem Components**

| DSSI Series Standard Components | Quantity |
|---|---|
| Dual speed blowers | 8 |
| Environmental monitor unit (EMU) | 1 |
| HS1CP controller with cache memory | 2 |
| Power entry controller | 2 |
| Power supply SBBs | 5 |
| ac power cord—black | 5 |
| ac power cord—gray | 4 |
| Power entry controller ac power cords | 2 |

| Customer Specified Components | Min | Max |
|---|---|---|
| 3.5-inch storage SBBs | 6 | 24 |
| 5.25-inch storage SBBs | 0 | 8 |
| Environmental monitor unit (EMU) | 1 | 2 |
| DSSI cables: controller to host | 1 | 4 |

## 2.1 Power Configurations

The DSSI RAID subsystem is configured for dual ac power which includes two ac power controllers.

This is the *optimum* ac power configuration and is recommended for use with the 4+4 redundant shelf power configuration. These configurations provide the maximum protection for your data.

Table 2-2 lists the RAID subsystem power configurations. To easily identify the ac power controller providing power to the power bus, different colored (black and gray) power cords are used:

- Black power cords are connected to power entry controller A.
- Gray power cords are connected to power entry controller B.

**Table 2-2 DSSI Power Configurations**

| | | Power Cords | |
|---|---|---|---|
| **Bus Type** | **Power Supply Locations** | **Bus A (Black)** | **Bus B (Gray)** |
| **Power Supply Bus A (Single Power Controller)** | | | |
| Standard (4+1) | Single SBB power supply in Slot A on each shelf<br>Single SBB power supply in Slot B, top shelf | 5 | 0 |
| **Power Supply Buses A and B (Dual Power Controllers)** | | | |
| Optional (4+4) | SBB power supplies in Slots A and B on each shelf | 4 | 4 |

## 2.2 Power Distribution

The ac power is distributed to the DSSI power supply SBBs over two separate ac power buses—power bus A and power bus B. Each bus has its own ac input power source, power controller, and power cords.

### 2.2.1 Power Bus A

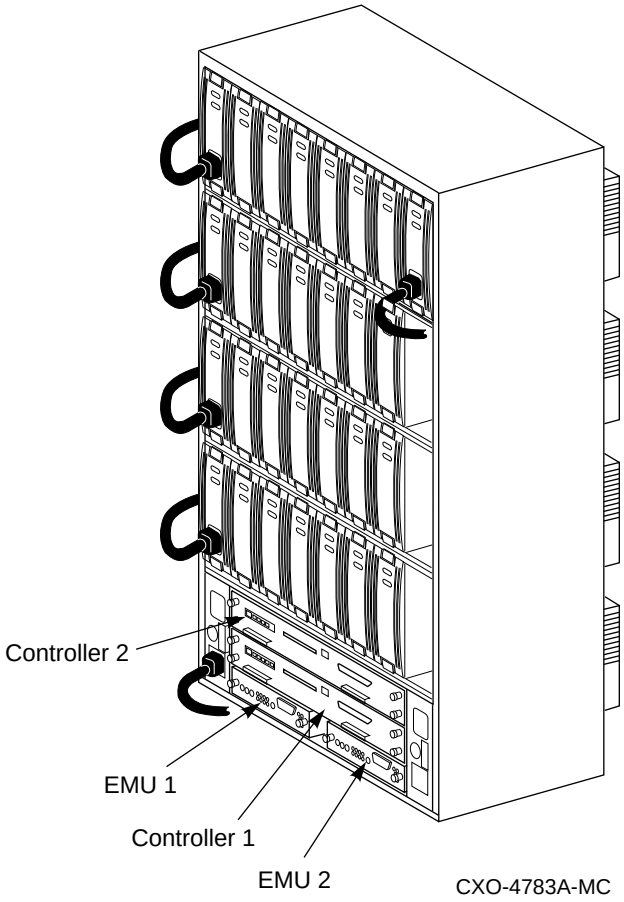
The power controller A, located in the lower left corner of the DSSI RAID subsystem, provides power for both power configurations. All the black power cords are connected to power bus **A.**

Figure 2-1 shows the *standard* (4+1) power configuration for power bus **A.** In this configuration, a second power supply is installed at the right end of the top shelf. It is connected to the power bus **A** using the black power cord. Digital recommends this configuration to provide basic power redundancy.

**Note**

Although power controller B is installed it is not used in the standard power configuration.

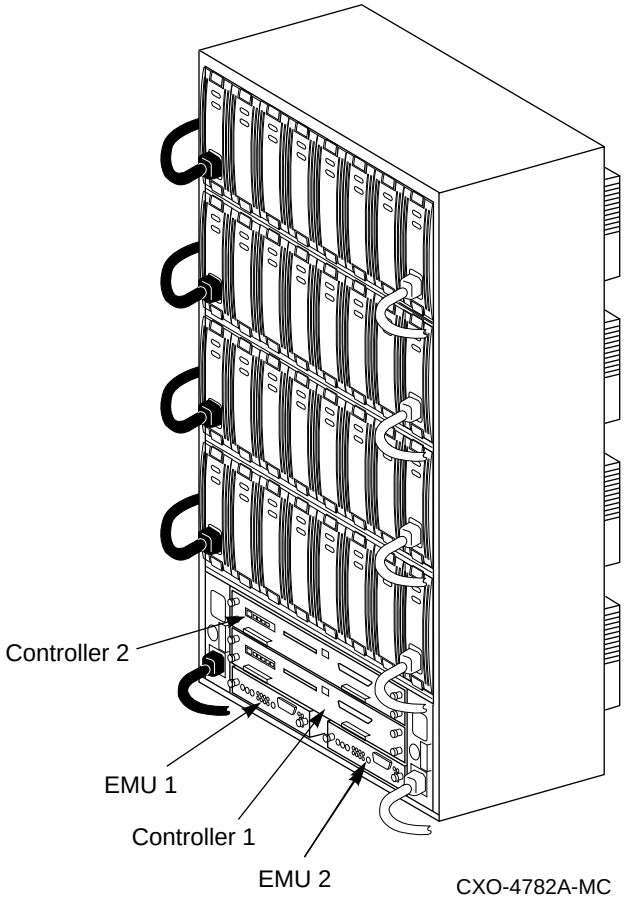
**Figure 2-1 Standard (4+1) DSSI Power Configuration**



## 2.2.2 Power Bus B

Power Bus **B** is only used in the *optional* (4+4) power configuration (see Figure 2-2). Power controller **B** provides power to four power supply SBBs at the right end of the RAID subsystem (gray power cords).

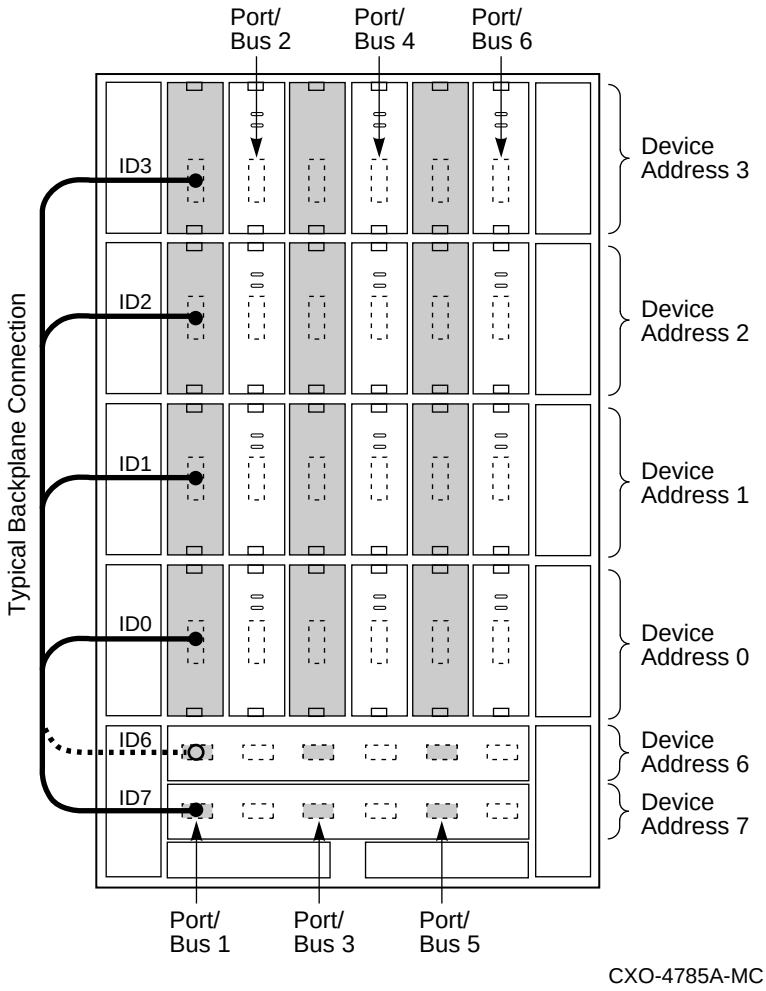
**Figure 2-2 Redundant (4+4) DSSI Power Configuration**



## 2.3 SCSI Bus Configurations

The six single-ended, SCSI buses are oriented vertically on the RAID subsystem backplane. Each bus connects a HS1CP controller to one device on each device shelf for a total of four devices per SCSI bus (device addresses 0 through 3). The two HS1CP array controllers, SCSI initiator device addresses are preset by slot location to device addresses 6 and 7 (see Figure 2-3).

**Figure 2-3 DSSI RAID Subsystem SCSI Buses**




## 2.4 HS Array Controller Configurations

For information on RAID and other controller configurations, see the following publications:

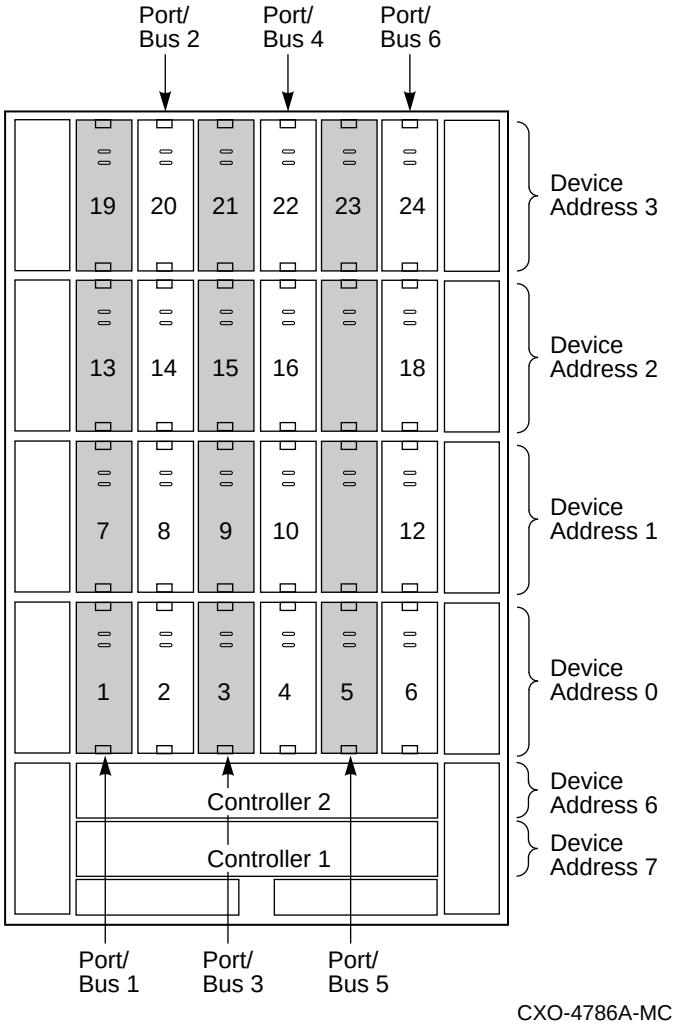
- *StorageWorks Array Controllers HS Family of Array Controllers User's Guide*
- *StorageWorks Array Controllers HS Family of Array Controllers Service Manual*

## 2.5 Installation Sequence

For the most effective DSSI RAID subsystem operation, install the HS1CP controllers and SBBs in the following sequence (see Figure 2-4):

1. Install the *first HS1CP* controller in Device Address 7.
2. Install the *second HS1CP* controller in Device Address 6.
3. Install the *first* storage device SBB at the left end of the bottom shelf (Device Address 0, SCSI Bus 1). Completely fill the bottom shelf from left to right.
4. Once the bottom shelf is full, install the next SBB starting at the left end of the second shelf (Device Address 1, SCSI Bus 1). Completely fill the second shelf from left to right.
5. Once the second shelf is full, install the next SBB starting at the left end of the third shelf (Device Address 2, SCSI Bus 1). Completely fill the third shelf from left to right.
6. Once the third shelf is full, install the next SBB starting at the left end of the top shelf (Device Address 3, SCSI Bus 1). Completely fill the third shelf from left to right.

**Figure 2-4 HS1CP Controller and SBB Installation Sequence**



# 3

# Enclosure Error Analysis and Fault Isolation

This chapter describes the errors, faults, and significant events that can occur during the DSSI RAID subsystem initialization and normal operation. The error and event descriptions isolate failures to a user-replaceable component.

## 3.1 DSSI RAID Subsystem Enclosure Fault Notification

There are two light emitting diodes (LEDs) on the front of the DSSI RAID subsystem that indicate DSSI RAID subsystem status (see Figure 3-1and Table 3-1).

**Figure 3-1 DSSI RAID Subsystem Status LEDs**

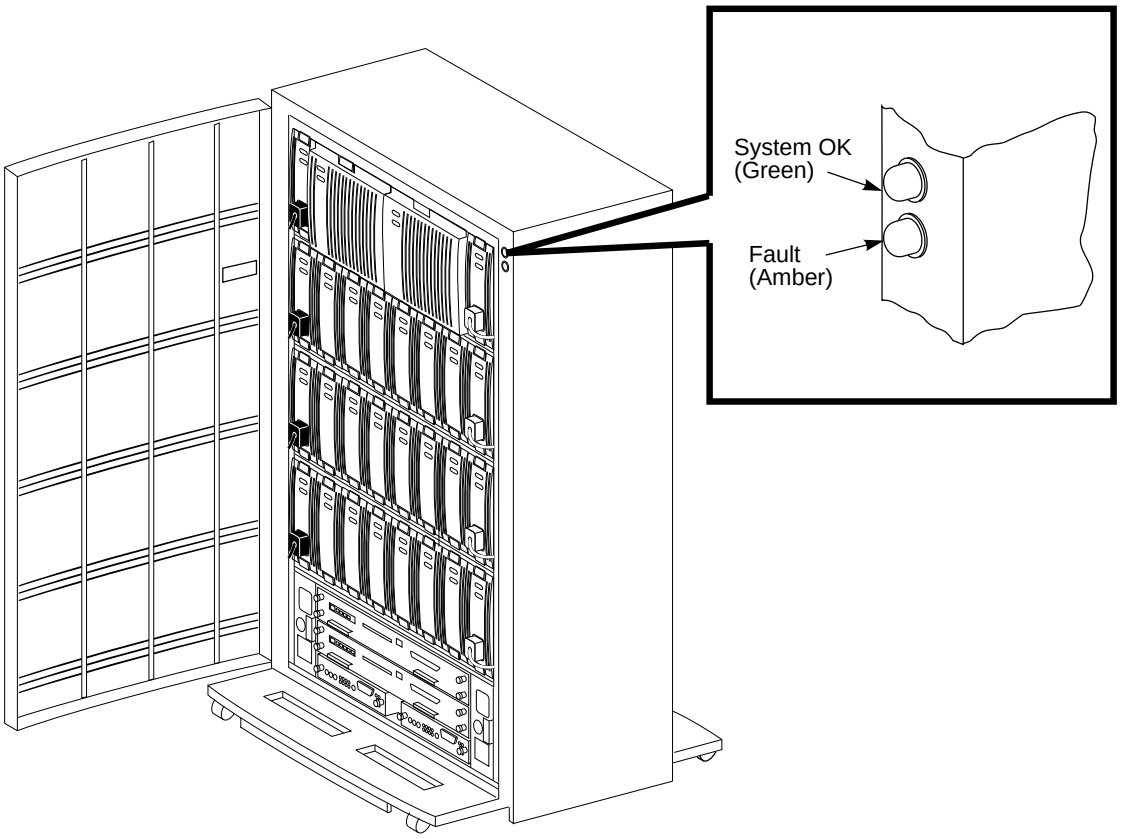


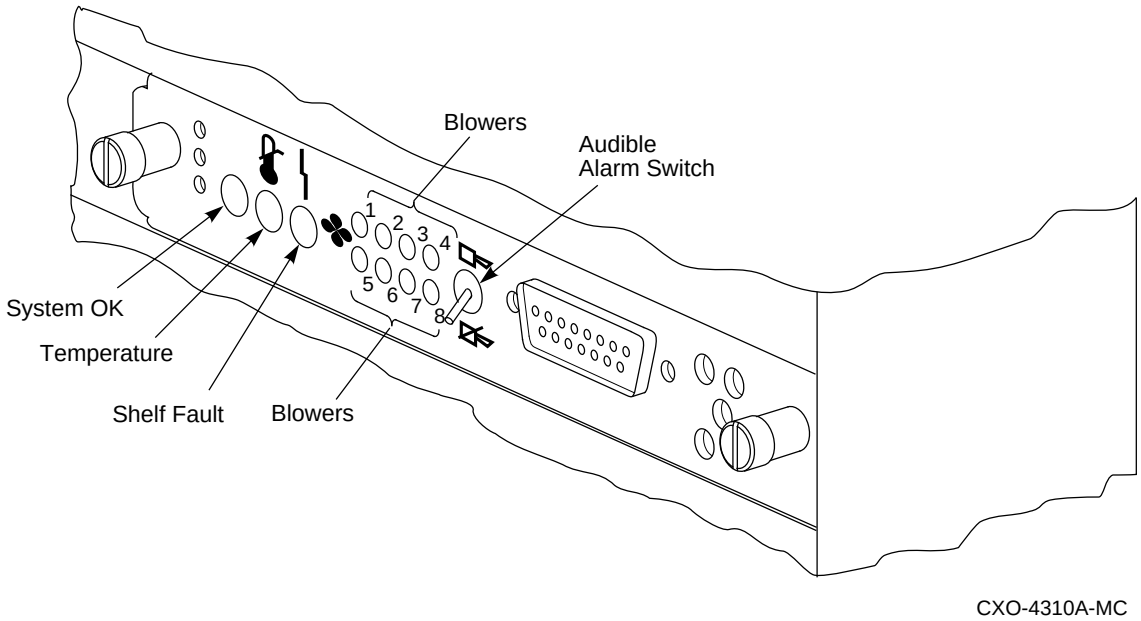
**Table 3-1 DSSI RAID Subsystem Enclosure Status**

| When the SW300 LEDs are... | | The subsystem status is... |
|---|---|---|
| System OK<br>Fault LED | ON<br>OFF | Is in the normanl operating state. |
| System OK | OFF | The subsystem does not have power applied or is in a Reset state.<br>1. Check that ac power is applied.<br>2. Check the EMU control panel LEDs to determine which FRU has failed.<br>3. Check the system has at least four operational power supply SBBs.<br>4. Check for any error messages on the terminal (if one is attached). |
| Fault LED | ON | Has a failed FRU. Check the EMU control panel LEDs to determine which FRU has failed. |

## 3.2 Error Reporting

DSSI RAID subsystem enclosure error conditions are displayed on the EMU front panel LEDs (see Figure 3-2).

**Figure 3-2 EMU Front Panel**




All DSSI RAID subsystem enclosure error conditions are processed by the EMU which performs the following functions during routine operations:

- Senses shelf temperature
- Monitors the power supplies
- Monitors the power supply voltage
- Monitors and controls the cabinet blowers

When the EMU detects one or more fault conditions, it implements the following actions:

- Enables the audible alarm
- Turns on the amber shelf fault LED
- Turns on one or more EMU panel LEDs

The front panel LEDs display DSSI RAID subsystem enclosure status information (see Figure 3-2). Any error condition can cause the audible alarm to sound.

**Note**

The audible alarm only operates when the EMU front panel audible alarm switch is in the up (enabled) position.

The EMU front panel LEDs (see Figure 3-3) display the status of the DSSI RAID subsystem enclosure (SYSTEM OK), the temperature (TEMPERATURE), error conditions (SHELF FAULT), and the status of the individual blowers and banks of blowers (BLOWERS). When the DSSI RAID subsystem enclosure is functioning properly, only the SYSTEM OK LED is on.

**Figure 3-3 EMU LED Indicators**

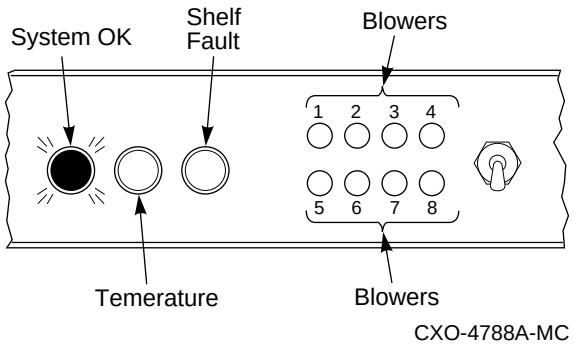
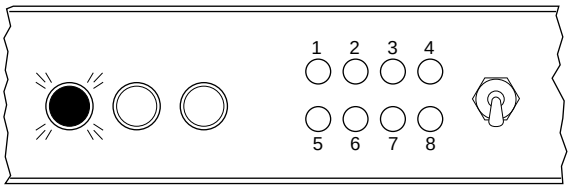
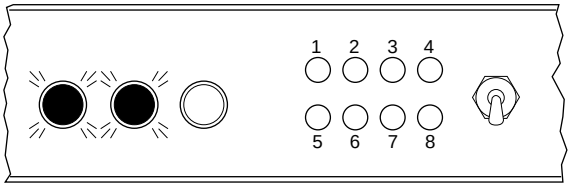
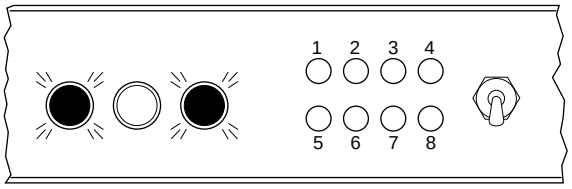
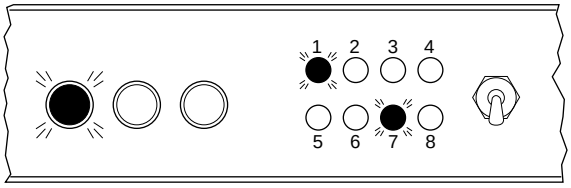
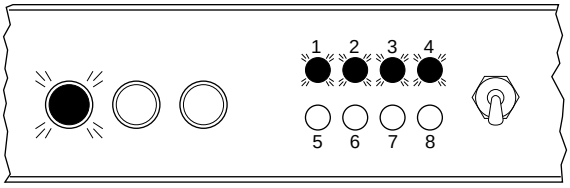


Table 3-2 is a summary of the basic EMU LED displays, the DSSI status, and corrective actions.

**Table 3-2 EMU DSSI Status Indications**

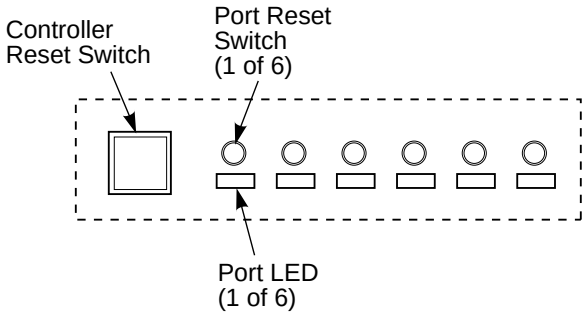
| When the EMU LED display is… | The DSSI status is… |
|---|---|
|  CXO-4789A-MC | The RAID shelf is fully operational. |
|  CXO-4790A-MC | The RAID subsystem temperature is above 35°C (95°F).<br>All blowers are operating at high speed.<br>Determine and correct the cause of this condition as quickly as possible.<br><br>When the temperature exceeds 50°C (122°F) the EMU places the HS array controller in the RESET state. This will halt all data transfers thereby preventing the loss or corruption of data. |
|  CXO-4791A-MC | There is a RAID subsystem power problem.<br><br>Observe the power supply LEDs to determine the defective supply and replace it. |
|  CXO-4792A-MC | One or more blowers are nonoperational.<br><br>In this example Blowers 1 and 7 are nonoperational and must be replaced. |
|  CXO-4793A-MC | Either a blower is not installed or it is installed incorrectly.<br><br>In this example, the error condition is caused by a Bank 1 blower.<br><br>Check Blowers 1, 2, 3, and 4 to isolate the blower causing the problem and install it properly. |

## 3.3 Controller Error Conditions

The HS1CP operator control panel (OCP) (see Figure 3-4), has the following switches and indicators:

- Controller reset switch with an embedded green status LED
- Six SCSI port (bus) reset switches
- Six amber SCSI bus status LEDs

**Figure 3-4 HS1CP OCP**




The green controller reset LED indicates controller status. This LED flashes constantly once the controller initialization is complete and the firmware is functioning. Pressing this switch resets the controller.

The amber port LEDs are off when the bus is functioning properly. A port LED that is on or flashing indicates that a device on the bus is not functioning properly.

Pressing and holding any port reset switch will quiesce the bus and turn on the amber LED. Depending on the controller, you may have to quiesce a bus to replace a storage device. For further information about requirements for quiescing the bus, see the *StorageWorks Array Controllers HS Family of Array Controller User's Guide.*

## 3.4 Storage Device Fault Notification

The storage device SBBs are either a 3.5-inch or a 5.25-inch form factor (see Figure 3-5). The front panel LEDs have three states (on, off, and flashing) to display the SBB status.

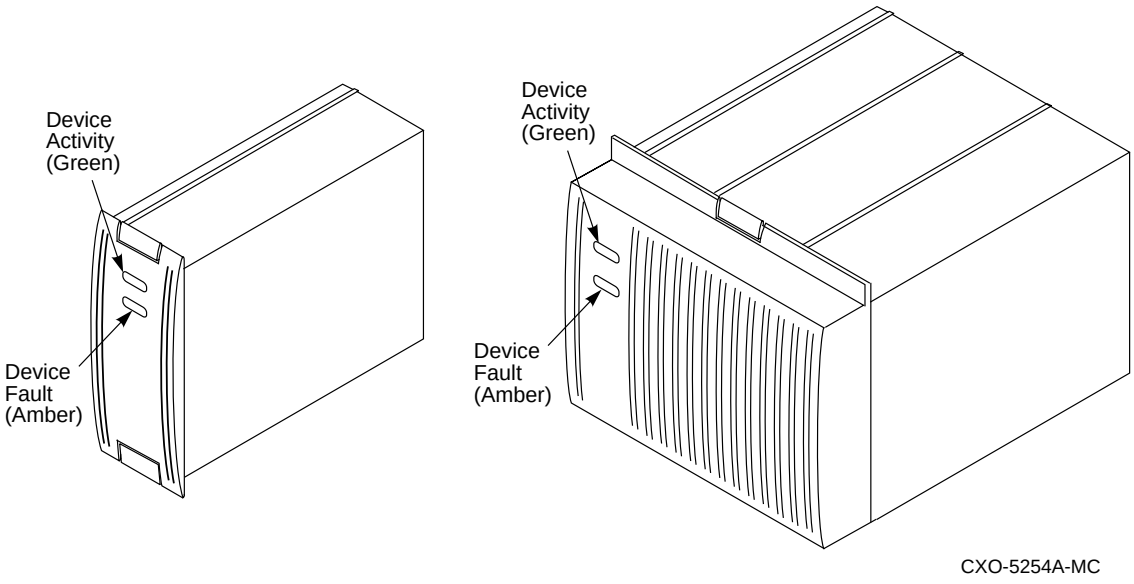
- The green LED is the device activity LED and is on or flashing when the SBB is active.

**Note**

Removing a storage SBB when the device activity (upper) LED is on or flashing can cause the loss or corruption of data.

The amber LED is the device fault LED and indicates an error condition or configuration problem when it is either on or flashing.

**Figure 3-5 Typical 3.5-Inch and 5.25-Inch SBBs**



## 3.5 Power Supply Fault Notification

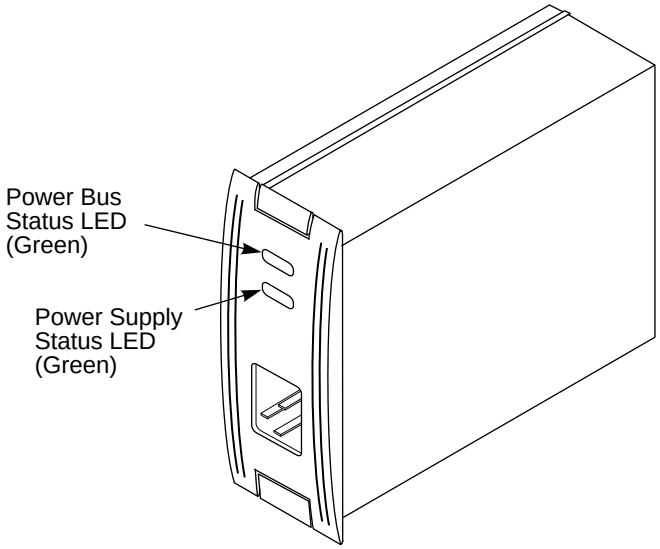
Each power supply SBB has two green LEDs that display the power supply status, as shown in Table 3-3.

**Table 3-3 DSSI Power Supply Status LEDs**

| When the LED display is... | The RAID subsystem power status is ... |
|---|---|
|  | All the power supply SBBs on the *associated* power bus are functioning properly. |
|  | At least one power supply on the *associated* power bus has malfunctioned.<br>This supply is operating properly. |
|  | Either there is no ac power to this supply or this power supply should be replaced. |

CXO-5191A-MC

**Figure 3-6 3.5 Inch Power Supply SBB**




CXO-4787A-MC

## 3.6 Dual Speed Blowers

**Note**

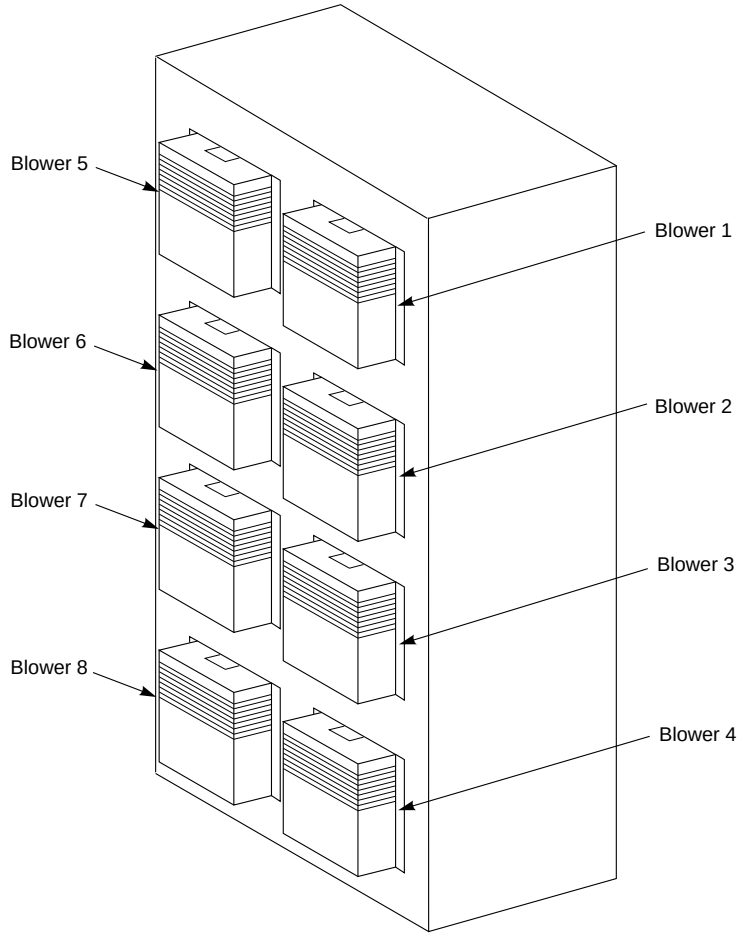
The DSSI RAID subsystem uses only Model BA35X–MD, dual speed blowers. Model BA35X–MA, the single speed blower, *is not* an acceptable substitute and *cannot* be used as a replacement.

As shown in Figure 3-7, the RAID subsystem has eight rear-mounted blowers that pull air in from the front of the cabinet; through the SBBs, controllers, and EMUs; and exhaust it out the rear. Backplane connectors provide +12 V dc to operate the blowers. Blower status signals are routed through these connectors to the shelf backplane and the EMU. All operational blowers go from normal to high speed when the following conditions exist:

- When a blower is removed
- When a blower malfunctions
- When a blower is not rotating at the correct speed
- When a high warning temperature condition is detected by the EMU

The EMU monitors the blower status logic signals and displays error conditions and controls the blower operating speed.

**Figure 3-7 Dual Speed Blowers Locations**



# 4

# Replacing Components

This chapter describes the procedures to remove and install the following components in the DSSI RAID subsystem:

- Power entry controller
- SBB storage device
- Dual speed blower
- Power supply SBBs
- EMU

## 4.1 Replacing a Controller or a Cache Module

Replacing the HS1CP array controllers and cache memories are complex procedures. Therefore, these procedures are not within the scope of this publication. The *StorageWorks Array Controllers HS Family of Array Controllers User's Guide's* contain the complete procedures for replacing these devices.

## 4.2 Replacing an SBB Storage Device

Replacing an SBB involves quickly removing and replacing a storage device or power supply using either the warm swap or the hot swap method depending upon the capabilities of the controller. The differences between these two methods are as follows:

**hot swap**—A method of device replacement whereby the complete system remains on-line and active during device removal or insertion. The device being removed or inserted is the only device that cannot perform operations during this process.

**warm swap—**A method of device replacement whereby the complete system remains on-line during device removal or insertion. A single SCSI bus may be halted for a brief period of time, during device insertion or removal. No booting or loading of code is permitted except on the device being inserted.

The method used to replace a device must preserve the data integrity and either the controller or the operator must determine that the swap is necessary. The SBB swap methods can be used to add a device.

The controller determines that a device is bad by trying to access the device, receiving no response from the device, or detecting excessive errors from the device.

The operator decides to remove a device by examining the controller operator control panel (OCP) codes, the SBB LEDs, system messages, or system error log information.

**CAUTION**

Both the hot swap and warm swap methods support removing and replacing a *single* storage SBB. You must repeat the complete procedure for each SBB you are replacing.

### 4.2.1 Before You Replace a Storage SBB

Whenever you replace a storage SBB, you must consider the following factors:

- Installing a different model device requires you to reconfigure the subsystem.
- You cannot replace a device that is active (the green device activity LED is flashing) without losing or corrupting data.
- You do not need electrostatic discharge (ESD) protection, such as an ESD wrist strap, to replace an SBB. However, you can cause ESD damage by touching the SBB connector.

Always use both hands to remove or install an SBB.

### 4.2.2 SBB Replacement

The procedures for replacing a storage SBB accomplish the following:

- Preserve data integrity.
- Make sure that the controller performs in a predictable manner.
- Reduce the time a port and the associated devices are not available.

Removing or inserting a storage SBB generates the C_SWAP low signal. Table 4-1 describes the expected controller responses.

**Table 4-1 Controller Response to SBB Replacement**

| Action | Expected Controller Response |
|---|---|
| Removing a storage device when data is not being transferred | No controller response expected. |
| Removing a storage device during a data transfer operation | Reduced operation. |
| Installing a storage device | The controller begins to reconstruct the data on the disk. |

In general, the procedure for replacing an SBB is the same for most controllers. However, there may be significant operating system or firmware differences. Therefore, the following procedure is an *outline*. Refer to the controller user documentation for the detailed procedure you should use.

Complete the following procedure to replace an SBB:

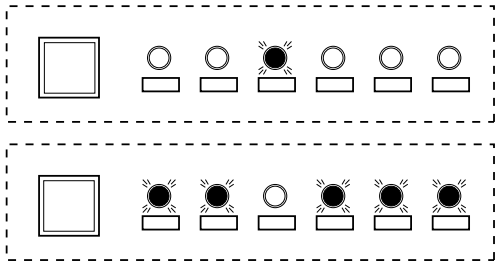
1. Dismount the device.
2. Quiesce the SCSI bus (port). The controller OCP LEDs display indicates the bus status and when you can remove or insert an SBB.

**Note**

You can quiesce only one port at a time.

3. You can remove or install an SBB *only* when the controller OCP LEDs indicate:
   - There is no I/O activity on any bus.
   - Removing or installing an SBB will not cause the data loss or corruption.

The reset light blinks at a normal rate, while the port LEDs indicate the condition by flashing in an alternating pattern. For example, when you quiesce port 3 and I/O has halted, the OCP LED pattern alternates as follows:



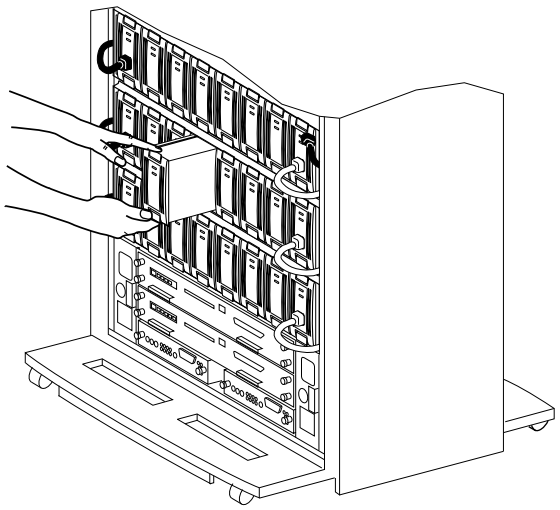
CXO-4824A-MC

4. Remove the SBB by pressing the two mounting tabs together to release it from the shelf, and pull it out using both hands (see Figure 4-1) .
5. Insert the replacement SBB into the guide slots and firmly push it into the shelf until the mounting tabs snap into place.
6. Observe the status LEDs for the following indications:

- The green device activity LED is either on, flashing, or off.
- The amber device fault LED is off.

The controller should automatically configure the replacement SBB (see the *StorageWorks Array Controllers HS Family of Array Controllers Service Manual*).

**Figure 4-1 Removing a Storage Device SBB**



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For additional information on storage device replacement, see the *StorageWorks Solutions Shelf* or the *SBB User's Guide* or the *StorageWorks Solutions SBB User's Guide.*

## 4.3 Replacing DSSI RAID Subsystem Blowers

You can install a dual speed blower only one way and have it operate properly. The blower connector and the guide allow you to insert the unit without the possibility of a connector mismatch.

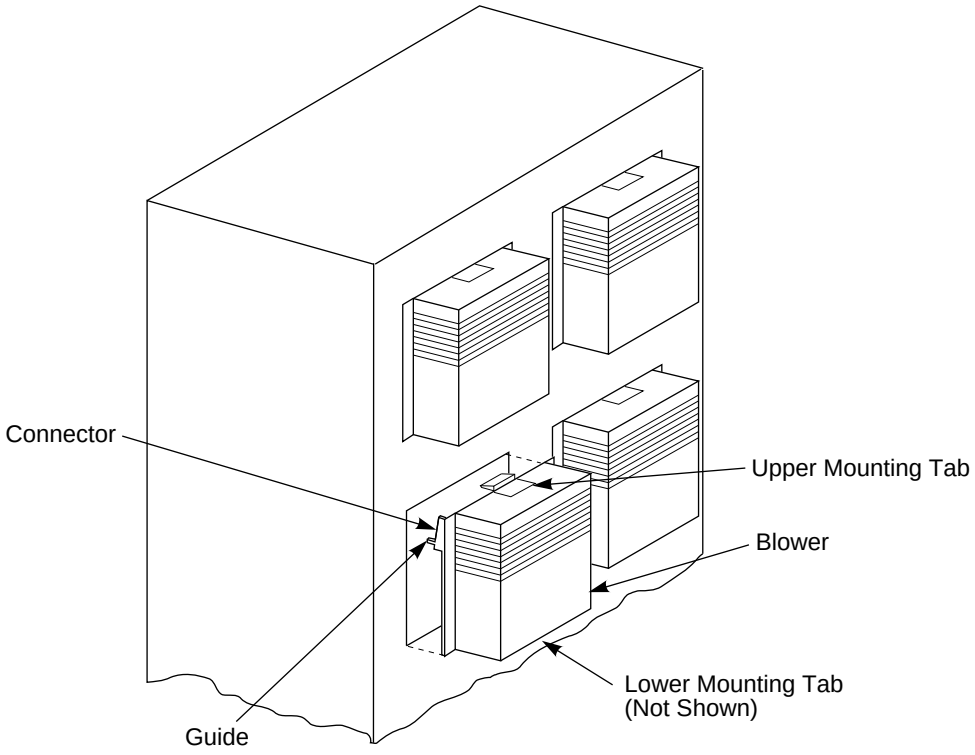
**Caution**

Operating a DSSI RAID subsystem with a blower removed significantly changes the air flow pattern and reduces air flow through the shelf and devices, This causes an overtemperature condition. *Do not* remove a blower unless you replace it within 1 minute.

To remove a dual speed blower, refer to Figure 4-2 and complete the following procedure:

1. Remove the blower safety screw.
2. Press the upper and lower blower mounting tabs together to release the blower.
3. Pull the blower straight out.

**Figure 4-2 Dual Speed Blower Replacement**




To replace a dual speed blower, refer to Figure 4-2 and complete the following procedure:

1. Orient the replacement blower so the connector and guide pin align with the blower opening on the rear panel.
2. Push the blower straight in, making sure the upper and lower mounting tabs snap in place.
3. Install the blower safety screw.

## 4.4 Replacing a Power Supply SBB

The basic procedure for removing and replacing power supply SBBs is the same as for replacing storage devices. Power supply SBBs normally are replaced while power is applied to the unit and the other power supply SBBs.

There are two methods for replacing power supply SBBs—the hot swap method and the cold swap method. The cold swap involves removing all power from a power bus. Unless you are using a full redundant (4+4) power configuration, this will turn off the DSSI RAID subsystem and can result in the loss or corruption of data.

The light emitting diodes (LEDs) on the front of the SBB indicate the status, either operational or non-operational.

- Normally you use the warm swap method when both LEDs are off.
- The cold swap method is normally used only during initial installation. The power is removed from the DSSI RAID subsystem and all devices are inactive. None of the devices are operational until power is restored.

Use the following procedure to replace a power supply SBB:

**CAUTION**

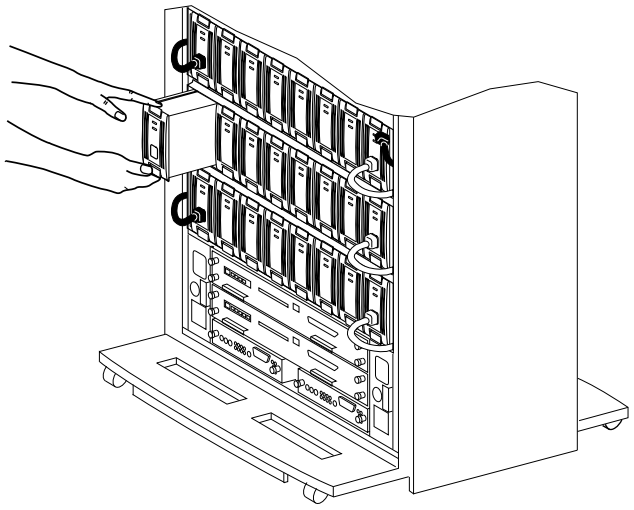
To prevent ESD (electrostatic discharge) damage to an SBB, do not touch the SBB connector.

1. Disconnect the power cord from the front of the SBB.
2. Press the two mounting tabs together to release the power supply SBB from the shelf (see Figure 4-3).
3. Use both hands and pull the power supply SBB out of the shelf.

**CAUTION**

Always use both hands when removing a power supply.

**Figure 4-3 Removing a Power Supply SBB**



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Use the following procedure to install a power supply SBB:

1. Insert the replacement power supply SBB into the guide slots and push it in until it is fully seated and the mounting tabs engage the shelf.
2. Connect the power cord to the power supply SBB.
3. After input power is applied, observe the power supply SBB LEDs to make sure the power supply is functioning properly. Both status LEDs should be on.

## 4.5 Replacing an EMU

Use the following procedure to remove or install an EMU (see Figure 4-4) without turning off the DSSI RAID subsystem:

**Note**

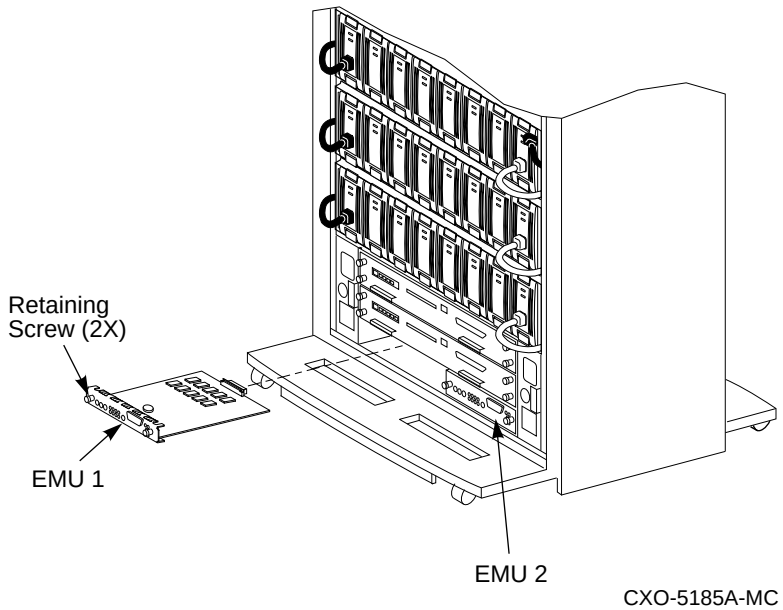
You may remove or install this component while power is ON. When there are two EMUs, one EMU can be hot swapped without affecting system operation.

1. Loosen the two retaining screws.
2. Use a gentle back-and-forth rocking motion to loosen the EMU from the backplane.
3. Pull the EMU straight out to disconnect it from the backplane.

Use the following procedure to install an EMU:

1. Insert the replacement EMU into the guide slots and push it in against the backplane connector.
2. Use a gentle back-and-forth rocking motion while pushing in to seat the EMU into the backplane. Press firmly in on the EMU until it is fully seated.
3. Tighten the two retaining screws.

**Figure 4-4 Replacing an EMU**



## 4.6 Replacing a Power Entry Controller

**WARNING**

Removing and installing a power entry controller can be performed only by qualified service personnel. Failure to comply may result in injury or death as a result of electric shock.

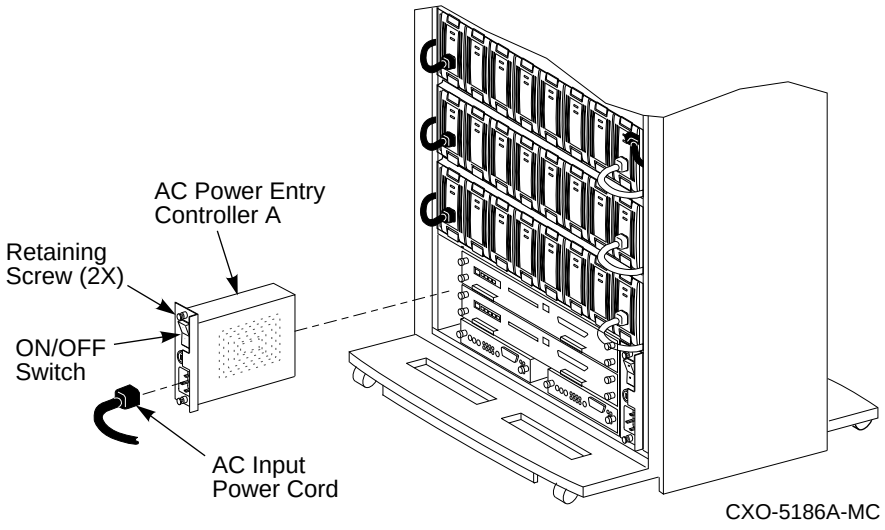
Use the following procedure to remove a power entry controller (see Figure 4-5):

1. Press **0** on the ON/OFF switch to turn the power controller to OFF.
2. Disconnect the ac input power cord.
3. Loosen the two retaining screws.
4. Pull the power controller from the DSSI RAID subsystem.

Use the following procedure to install a power entry controller:

1. Press **0** on the ON/OFF switch to turn the replacement power controller to OFF.
2. Insert the replacement power controller into the DSSI RAID subsystem.
3. Tighten retaining screws.
4. Connect the ac input power cord.
5. Press | on the ON/OFF switch to turn the power controller to ON.

**Figure 4-5 Replacing a Power Entry Controller**



# Glossary

**array controller**
A device that exercises control over the SCSI bus, for example, an HS1CP disk array controller.

**cache memory**
A fast storage buffer.

**CI**
A Digital trademark for the Digital Computer Interconnect bus.

**cold swap**
A method of device replacement that requires that power be removed from *all* shelves in a cabinet. This method is used when conditions preclude the use of a warm-swap or hot-swap method.

See also **warm swap** and **hot swap**.

**controller**
A hardware line device that manages communications over a line. Controllers can be point-to-point, multipoint, or multiple line controllers.

**DSSI**
Digital standard system interconnect.

**electromagnetic interference**
*See* **EMI**.

**electrostatic discharge**
*See* **ESD**.

**EMI**
Electromagnetic interference. The impairment of a signal by an electromagnetic disturbance.

**ESD**
Electrostatic discharge. The discharge of a potentially harmful static electric voltage as a result of improper grounding.

**host**
The primary or controlling computer in a multiple computer network.

**hot swap**
A method of device replacement whereby the complete system remains on-line and active during device removal or insertion. The device being removed or inserted is the only device that cannot perform operations during this process.

*See also* **cold swap** and **warm swap**.

**quiesce**
To make a bus inactive or dormant. The operator must quiesce SCSI bus operations, for example, during a device warm swap.

**RAID**
Redundant array of independent disks. A set of storage techniques devised to increase the performance and availability of a storage subsystem.

**SBB**
System building block. A modular carrier plus the individual mechanical and electromechanical interface required to mount it into a shelf. Any device conforming to shelf mechanical and electrical standards is considered an SBB.

**SCSI**
Small Computer System Interface. This interface defines the physical and electrical parameters of a parallel I/O bus used to connect computers and a maximum of seven SBBs. The StorageWorks system implementation uses SCSI–2, which permits the synchronous transfer of 8-bit data at rates of up to 10 MB/s.

**warm swap**
A method of device replacement whereby the complete system remains on-line during device removal or insertion. The system bus may be halted for a brief period of time, during device insertion or removal. No booting or loading of code is permitted except on the device being inserted.

*See also* **cold swap** and **hot swap**.

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