StorageWorks Family

User's Guide

This publication is part of the basic StorageWorks family documentation set. It describes the major StorageWorks components (such as shelves, power, SBBs, and SCSI buses), status displays, specifications, and replacement procedures.

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Preface

The *StorageWorks Family User's Guide* introduces the StorageWorks™ system and the elements common to the shelves, StorageWorks building blocks (SBBs), and other components. It describes the components, to include status reporting, replacement procedures, power, small computer system interface (SCSI) buses, SCSI bus signal converters, and specifications.

This manual and the *StorageWorks Family Configuration Guide*, which describes the complete subsystem, comprise the basic StorageWorks documentation set. Other documentation for this product line is listed in the Related Documents section.

Intended Audience

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

_____ **Note** _____

Shelf installation procedures are cabinet specific and are not included in this manual.

_____

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 is also used to indicate cross-references.

Structure

This manual is organized as follows:

Chapter 1	Describes the StorageWorks product line.
Chapter 2	Describes how the shelf and the device status are monitored and reported. This chapter includes recommended corrective action for fault conditions.
Chapter 3	Describes the procedures for replacing SBBs and shelves.
Chapter 4	Describes the StorageWorks power supplies, to include function, operation, and status reporting.
Chapter 5	Describes the SBB shelf SCSI buses, including length, terminators, jumpers, and devices.
Chapter 6	Describes the DWZZA–VA SCSI bus converter that provides compatibility between an 8-bit differential SCSI–2 bus and the 8-bit single-ended SCSI–2 bus.
Appendix A	Lists the physical and electrical specifications for the StorageWorks family components.
Glossary	Definitions of StorageWorks subsystem terms.
Index	Cross-reference to major topics.

Related Documents

Table 1 lists the StorageWorks related user documents organized by use, system, or product.

Table 1   StorageWorks Related Documentation

Document Title	Order Number
StorageWorks Primary Publications†	
StorageWorks Family Configuration Guide	EK–BA350–CG
StorageWorks Family User's Guide ‡	EK–BA350–UG
StorageWorks Family StorageWorks Building Blocks User's Guide	EK–SBB35–UG
StorageWorks RAID Array 110 Subsystem	
BA350–EA Modular Storage Shelf User's Guide	EK–350EA–UG
BA35X–VA Vertical Mounting Kit User's Guide	EK–350SV–UG
DEC RAID Utilities User's Guide	EK–DECRA–UG
HSZ10–AA Controller Site Preparation Guide	EK–HSZ10–IN
StorageWorks Expansion Storage Pedestal User's Guide	EK-SMCPA-UG
StorageWorks RAID Array 110 Subsystem User's Guide	EK–SM2CA–UG
StorageWorks RAID Array 110 Utility for MS–DOS User's Guide	AA–Q0N5A–TE

† Provided with each system.
‡ Includes BA350–SA SBB shelf user's guide.
†† Available from your Digital account representative.

Table 1 (Cont.)   StorageWorks Related Documentation

Document Title	Order Number
StorageWorks RAID Array 110 Subsystem	
StorageWorks RAID Array 110 Utility for Novell NetWare User's Guide	AA–Q0N4A–TE
StorageWorks RAID Array 110 Utility for SCO UNIX User's Guide	AA–Q0N6A–TE
StorageWorks Array Controller 140-Series	
StorageWorks Array Controller HS Family of Array Controllers User's Guide	EK–HSFAM–UG
StorageWorks BA350–MA Controller Shelf User's Guide	EK–350MA–UG
DECraid+ Rackmount Storage Subsystem	
HSC Intelligent I/O Servers	
HSC Controller User's Guide	AA–PFSQA–TK
HSC Controller Installation Manual	EK–HSCMN–IN
StorageWorks Enclosures	
BA35X–VA Vertical Mounting Kit User's Guide	EK–350SV–UG
StorageWorks Family Desktop Expansion Unit User's Guide	EK–BA353–UG
StorageWorks Metric Shelf Bracket Kit Installation Guide	EK–35XRD–IG
StorageWorks RETMA Shelf Rail Kit Installation Guide	EK–35XRB–IG
StorageWorks SW500-Series Cabinet Installation and User's Guide	EK–SW500–IG
StorageWorks SW500-Series Cabinet Cable Distribution Unit Installation Guide	EK–SW5CU–IG
StorageWorks SW800-Series Data Center Cabinet Cable Distribution Unit Installation Guide	EK–SWCDU–IS
StorageWorks SW800-Series Data Center Cabinet Installation and User's Guide	EK–SW800–IG
AXP DEC 7000 and DEC 1000 Systems	
BA350–LA Modular Storage Shelf User's Guide	EK–350LA–UG
BA655 SCSI Disk and Tape PIU Installation Guide	EK–BA655–IN
Storage Devices	
Installation Notice—RZ73 Bus Termination and Jumper Installation Guide	EK–RZ73X–IS
RRD42 Disk Drive Owner's Manual	EK–RRD42–OM

† Provided with each system.
‡ Includes BA350–SA SBB shelf user's guide.
†† Available from your Digital account representative.

Table 1 (Cont.)   StorageWorks Related Documentation

Document Title	Order Number
Storage Devices	
RZ Series Disk Drive Installation Guide	EK–DRZ01–IG
RZ Series Disk Drive Reference Manual	EK–RZXXD–RM
RZ24 Hard Disk Drive Installation Guide	EK–RZ24I–IS
RZ26B Disk Drive Installation Guide	EK–RZ26B–IN
RZ2x Hard Disk Drive Upgrade Installation Instructions	EK–RZ2XH–UG
RZ2x Series Drive Bracket Installation Sheet	EK–RZ2XD–UG
SCSI Signal Converter DWZZA–AA	EK–DWZZA–SV
SCSI Signal Converter DWZZA–MA	EK–DWZZM–SV
SCSI Signal Converter DWZZA–VA	EK–DWZAA–SV
StorageWorks Family 5¼-inch Half-Height Device Installation Guide	EK–SBB55–UG
TZ86–VA Cartridge Tape Drive Device Addresses	EK–TZ86A–UG
TLZ06 Cassette Tape Drive Installation Guide	EK–STEXP–AD
TLZ06 Cassette Tape Drive Owner's Manual	EK–TLZ06–OM
TZ30 Cartridge Tape Drive Operator's Manual	EK–OTZ30–OM
TZ30 Cartridge Tape Drive Reference Card	EK–OTZ30–RC
TZ30 Cartridge Tape Drive Technical Manual	EK–OTZ30–TM
TZK11 Tape Backup System User Guide	EK–TZK11-UG
General Reference Publications	
Digital Systems and Options Catalog	††
Small Computer System Interface, An Overview	EK–SCSIS–OV
Small Computer System Interface, A Developer's Guide	EK–SCSIS–DK

    † Provided with each system.
    ‡ Includes BA350–SA SBB shelf user's guide.
    †† Available from your Digital account representative.

Manufacturer's Declarations

The following statements are applicable to the StorageWorks product line:

CAUTION

This is a class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

ACHTUNG !

Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen die Benutzer für entsprechende Gegenmaßnahmen verantwortlich sind.

ATTENTION !

Ceci est un produit de Classe A. Dans un environment domestique, ce produit risque de créer des interférences radiélectriques, il appartiendra alors à l´utilisateur de prendre les mesures spécifiques appropriées.

Acoustic Noise Declaration

BA350–SA StorageWorks Building Block Shelf
February 1, 1993

Acoustics - Preliminary Declared Values per ISO 9296 and ISO 7779

Product†	Sound Power Level L_{WAd}, B‡		Sound Pressure Level L_{pAm}, dBA (Bystander Positions)	
	Idle	Operate	Idle	Operate
BA350–SA SBB Shelf	5.8	5.8	41	41
BA350–SA SBB Shelf with: Seven RZ26–VA Disk Drives	5.9	5.9	41	41
Deskside Expansion Enclosure at the Side of the Desk				
BA350–SA SBB Shelf	5.7	5.7	40	40
BA350–SA SBB Shelf with: Seven RZ26–VA Disk Drives	5.8	5.8	40	40

Product†	Sound Power Level L_{WAd}, B‡		Sound Pressure Level L_{pAm}, dBA (Operator Positions)	
	Idle	Operate	Idle	Operate
Deskside Expansion Enclosure at the Side of the Desk				
BA350–SA SBB Shelf	5.7	5.7	37	37
BA350–SA SBB Shelf with: Seven RZ26–VA Disk Drives	5.8	5.8	37	37
Deskside Expansion Enclosure on Top of the Desk				
BA350–SA SBB Shelf	5.7	5.7	48	48
BA350–SA SBB Shelf with: Seven RZ26–VA Disk Drives	5.8	5.8	48	48

† Current values for specific configurations are available from Digital Account Representatives.

‡ 1 B = 10 dBA

Schallemissionswerte - Vorläufige Werteangaben nach ISO 9296 und ISO 7779/DIN EN27779

Gerät†	Schalleistungspegel L_{WAd}, B‡		Schalldruckpegel L_{pAm}, dBA (Beistehende Position)	
	Leerlauf	Betrieb	Leerlauf	Betrieb
BA350–SA SBB Shelf	5,8	5,8	41	41
BA350–SA SBB Shelf mit: 7 RZ26–VA Disk Drives	5,9	5,9	41	41
Deskside Expansion Enclosure neben einem Schreibtisch				
BA350–SA SBB Shelf	5,7	5,7	40	40
BA350–SA SBB Shelf mit: 7 RZ26–VA Disk Drives	5,8	5,8	40	40

Gerät†	Schalleistungspegel L_{WAd}, B‡		Schalldruckpegel L_{pAm}, dBA (Bediener Position)	
	Leerlauf	Betrieb	Leerlauf	Betrieb
Deskside Expansion Enclosure neben einem Schreibtisch				
BA350–SA SBB Shelf	5,7	5,7	37	37
BA350–SA SBB Shelf mit: 7 RZ26–VA Disk Drives	5,8	5,8	37	37
Deskside Expansion Enclosure auf einem Schreibtisch				
BA350–SA SBB Shelf	5,7	5,7	48	48
BA350–SA SBB Shelf mit: 7 RZ26–VA Disk Drives	5,8	5,8	48	48

† Aktuelle Werte für spezielle Ausrüstungsstufen sind über die Digital Equipment Vertretungen erhältlich.

‡ 1 B = 10 dBA

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Externe Datenkabel:
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gekennzeichnet und mit einer Anmeldepostkarte versehen. Sollte Kennzeichnung
und Anmeldepostkarte übergangsweise nicht mit ausgeliefert werden,
kontaktieren Sie bitte das nächstgelegene Digital Equipment Kundendienstbüro.

1

Introduction

The *StorageWorks Family User's Guide* and *StorageWorks Family Configuration Guide* comprise the basic StorageWorks documentation set. These manuals provide information for configuring and operating a system. Rather than duplicating information these publications complement each other. The information they contain is supplemented by the system, shelf, and device documentation listed in the Related Documents section of the preface.

1.1 StorageWorks Components

See *StorageWorks Family Configuration Guide* for a complete listing of the StorageWorks family products.

The scope of this manual is limited to providing information about the following:

- Component functions
- Shelf status
- Power unit status
- Storage device status
- **StorageWorks building block SBB** replacement procedures
- Shelf replacement procedures
- Power requirements
- Power supplies
- **Small Computer System Interface** (**SCSI**) buses

_____ **Note** _____

The procedures for installing either an **SBB shelf**, a **controller shelf**, or a **controller and SBB shelf**, routing cables, and connecting cables are unique to each cabinet and are described in the cabinet manuals.

_____

1.2 SBB Shelf Description

The SBB shelf shown in Figure 1–1 can be used in several different cabinet and orientations. The dimensions of this shelf are as follows:

Dimension	Millimeters	Inches
Height	150	5.9
Width	445	17.5
Depth	350	13.8

- The capacity of the SBB shelf is eight 3½-inch SBBs.

- As shown in Figure 1–1, the SBB slots are numbered 0 through 7 from right to left, starting with the slot adjacent to the SCSI connectors.

Figure 1–1 Typical SBB Shelf — Front View
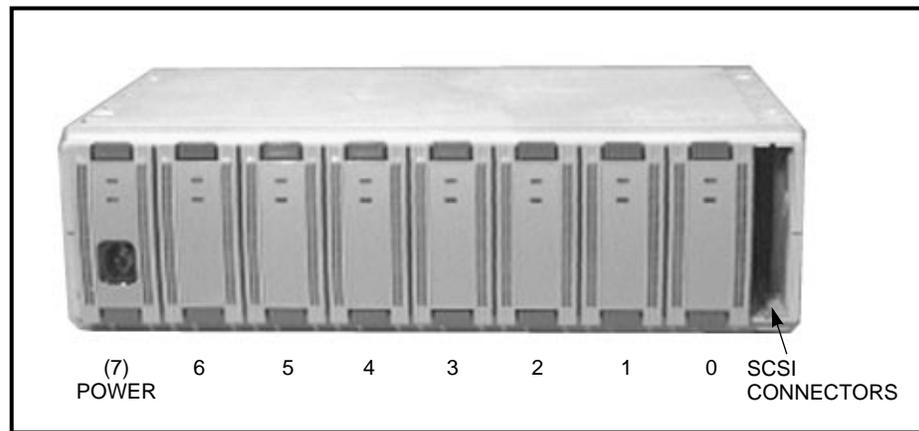
CXO-3617B-PH

- There are seven SCSI bus device addresses (that is, target IDs) that are numbered 0 through 6. These addresses can be assigned to either 3½-inch or 5¼-inch SBBs.

- The slot numbers and the **SCSI device addresses** are the same for slots 0 through 6. Slot 7 is reserved for the shelf power unit and does not have a device address.

- There are two 50-pin, high-density, female SCSI connectors on the backplane adjacent to slot 0.

- The cabinet ac or dc cable distribution unit determines the type of power unit installed in slot 7.

- Slot 6 can be used for *either* a storage SBB, a redundant power unit, or **battery backup unit** (**BBU**).

- As shown in Figure 1–2, each shelf has two redundant blowers mounted on the rear of the shelf.

Figure 1–2 Shelf Blowers

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2
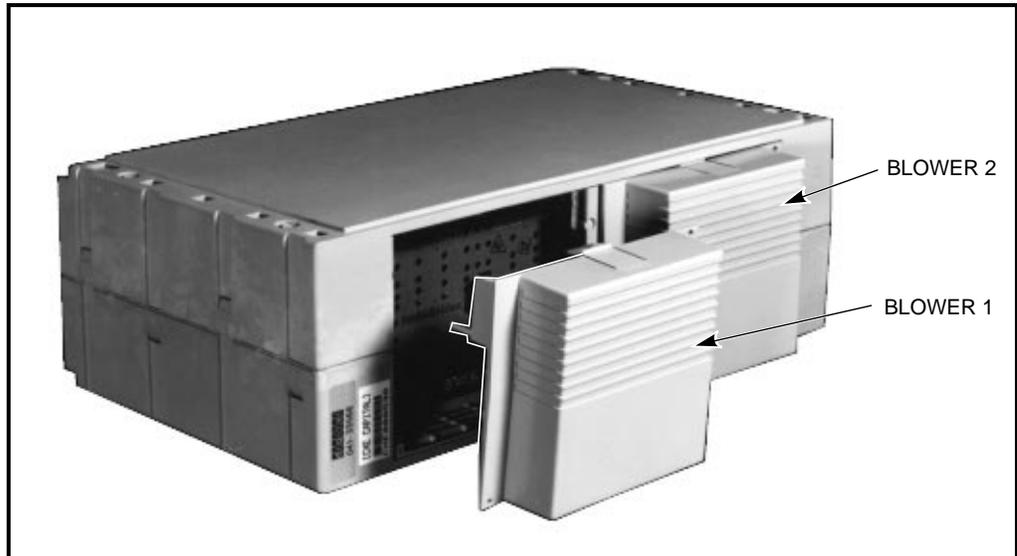
StorageWorks Status Reporting

Each StorageWorks shelf identifies error conditions or failures caused by the major shelf components, such as blowers, power supplies, or storage devices. This status is displayed on either the power supply or the SBB light emitting diodes (LEDS). In addition to the visual display, the shelf generates logic signals for processing by the SCSI controller or the host. The following sections describe the logic signals, their states and functions, and how to interpret the LED displays.

2.1 Shelf Status

The StorageWorks shelf power supply provides dc power, and the blowers provide cooling for the controllers, cache memories, and storage devices. Failure of all blowers on a shelf can cause devices to overheat and fail. When there is only *one* power supply on a shelf, the loss of either dc voltage (+5 Vdc, +12 Vdc) will cause the controllers, cache memories, and storage devices to malfunction. The status of the power supplies and the the blowers is displayed on the upper power supply LED. This status signal is available for processing by the SCSI controller or host.

The status signal, SHELF_OK, is the result of logically "anding" a signal based on the speed of all blowers on the shelf and the "power good" signals for all power units on the shelf. All StorageWorks shelves have at least two blowers and one power supply providing the +5 Vdc and +12 Vdc. The BA350–EA controller and SBB shelf has four blowers and from two to four power units.

2.1.1 SHELF_OK Signal

All StorageWorks shelves can accommodate either two ac or two dc power supplies. Some shelves (such as the BA350–EA controller and SBB shelf) have four blowers and can accommodate four ac or dc supplies. The loss of any dc voltage or blower will cause the SHELF_OK signal to change from a high level to a low level and turn off the upper power supply LED, even though there is sufficient power for proper SBB operation. The defective blower or power supply should be replaced as soon as possible to restore the subsystem to a redundant capability.

Note

A single shelf can operate correctly with only one power supply furnishing +5 Vdc and +12 Vdc.

When an error condition exists and the SHELF_OK signal level changes from high to low, the result is as follows:

*   The upper power supply LED, the Shelf Status LED, is off.

*   Some controllers can process this signal and notify the host that a power supply or blower has failed. Review the SCSI controller documentation to determine if this signal can be processed.

2.1.2 Processing the SHELF_OK Signal

To ensure that the shelf is properly configured so that a controller can process the SHELF_OK signal, you must install a jumper either on the shelf backplane or on both the terminator and jumper boards.

There are two ways to route the SHELF_OK signal to the controller. BA350–SA SBB shelves shipped after February 1993 have backplane jumpers. These jumpers are located on the rear of the backplane adjacent to slot 2. For shelves manufactured earlier, there are SHELF_OK jumpers on both the terminator board and the jumper board. In both cases, the default configuration has the SHELF_OK jumper installed.

_____ **CAUTION** _____

Not all hosts and controllers can process the SHELF_OK signal. *Before* installing the SHELF_OK jumper. Read the controller documentation to determine if the controller can process the SHELF_OK signal.

Installing the SHELF_OK jumper when the controller cannot process the SHELF_OK signal *may* result in an incorrect shelf status being displayed.

_____

Use the procedures in the following sections to configure the SHELF_OK as follows:

- If the SBB shelf was received March 1993, use the procedures in the Backplane SHELF_OK Jumper section.

- If the SBB shelf was received before March 1993, use the procedures in the Terminator Board and Jumper Board SHELF_OK Jumpers section.

- If you are not sure when the SBB shelf was received, remove the left-hand blower from the rear of the shelf and check for jumper pins adjacent to slot 2.

2.1.3 Backplane SHELF_OK Jumper

As shown in Figure 2–1, the SHELF_OK connector (J17), located on the backplane adjacent to slot 2 (J12) behind the left-hand blower, has two pairs of jumper pins. Placement of jumper W1 on these pins determines whether the SHELF_OK signal is:

- Routed to the upper external cable connector (JA1 and JB1)

- Routed to slot 0

Figure 2–1 and Table 2–1 describe the proper use of the SHELF_OK jumper W1.

Figure 2–1 SHELF_OK Backplane Jumpers
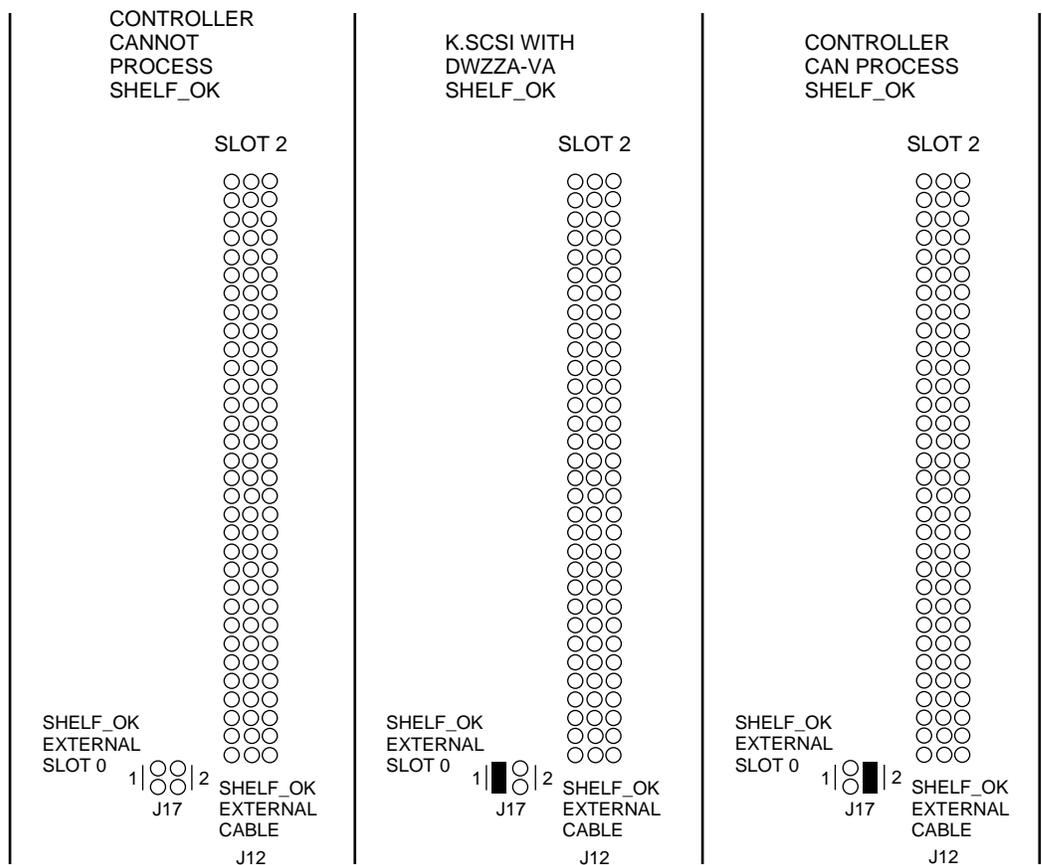
CXO-3832A-MC

Table 2–1   SHELF_OK Backplane Jumpers

Controller Condition	W1 Position	Comments
The SCSI controller cannot process the SHELF_OK signal.	NONE	Do not install the jumper.
An HSC K.scsi controller and a DWZZA–VA SCSI signal converter are installed.	1	SHELF_OK is routed to slot 0.
The SCSI controller can process the SHELF_OK signal.	2	SHELF_OK is routed to an external cable connector.

- *Do not* install W1 when:

    – The controller cannot process the SHELF_OK signal.

    – You are not sure that the controller can process the SHELF_OK signal[1].

- When the controller can process the SHELF_OK signal and there is a SCSI bus signal converter installed in slot 0, install W1 in position 1 (SHELF_OK EXTERNAL SLOT 0).

- When the controller can process the SHELF_OK signal and a SCSI bus signal converter *is not* installed in slot 0, install W1 in position 2 (SHELF_OK EXTERNAL CABLES).

---

[1]   Check the controller documentation.

2.1.4 Terminator Board and Jumper Board SHELF_OK Jumpers

The rules for installing jumper W1 on *both* the terminator board (BA35X–MB) and the jumper board (BA35X–MC) for SBB shelves shipped before March 1993[2] are as follows:

- Install jumper W1 on the *two ground pins* as shown in Figure 2–2 when either of the following conditions is met:

    – The host or controller cannot process the SHELF_OK signal.

    – You are not sure that the host or controller *can* process the SHELF_OK signal.

_____ **CAUTION** _____

The terminator and jumper SHELF_OK jumpers are not compatible with the **HSC** (hierarchical storage controller) K.scsi channel module. The K.scsi channel module requires a backplane with connector J17.

_____

Figure 2–2   SHELF_OK Disabled
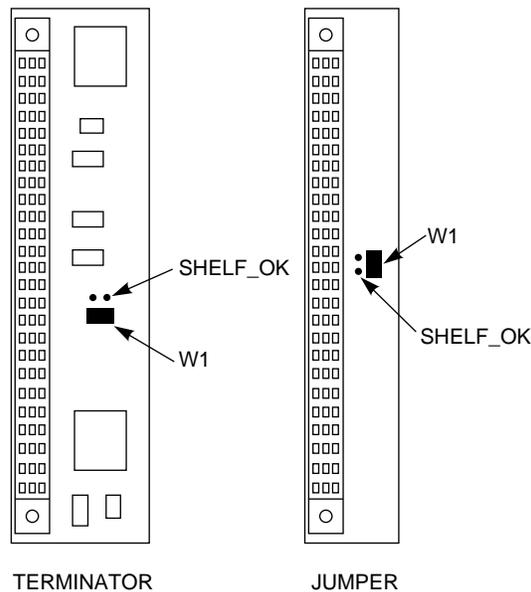
TERMINATOR   JUMPER

CXO-3840A-MC

_____

[2] Remove the left-hand blower from the rear of the shelf. If there are jumper pins adjacent to the slot 2 connector, there are no jumpers on the terminator and jumper boards. Use the procedure in the Backplane SHELF_OK Jumper section.

- Install jumper W1 as shown in Figure 2–3 when you are *positive* that the host or the controller can process the SHELF_OK signal.

Figure 2–3   SHELF_OK Enabled
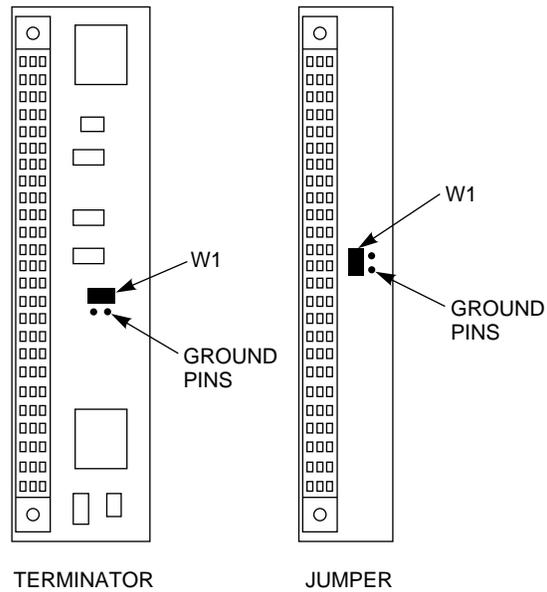
CXO-3636A-MC

2.2 Shelf Status and Power Supply Status

The status of both the shelf blowers and the power supplies is displayed on the power supply LEDs as shown in Figure 2–4. The upper LED displays the shelf status and the lower LED displays the power supply status.

- When the upper LED is on, both the shelf blowers and the power supplies are functioning properly.

- When the upper LED is off, either a shelf blower or a power supply is not functioning properly.

- When the lower LED is off, either there is an input power problem or the power supply is not functioning.

Figure 2–4 Power Supply LEDs

SHELF
STATUS LED

POWER SUPPLY
STATUS LED
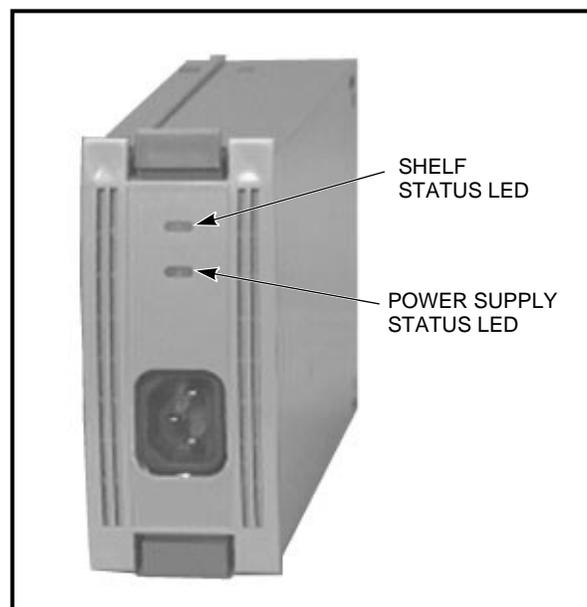
CXO-3613B-PH

For a detailed explanation of the power supply LED codes, see Tables 2–2 and 2–3.

Table 2–2 Shelf and Single Power Supply Status LEDs

Status LED	State	Indication
Shelf (upper)	On	System is operating normally.
PS (lower)	On	
Shelf (upper)	Off	Fault status
PS (lower)	On	There is a shelf fault; there is no power supply fault. Replace blower.
Shelf (upper)	Off	Fault status
PS (lower)	Off	Shelf and power supply fault Replace power supply as described in Chapter 4.

_____ **Note** _____

When a shelf has two power supplies, you must observe the LEDs on *both*
power supplies (see Table 2–3) to determine the status.

_____

Table 2–3   Shelf and Dual Power Supply Status LEDs

Status LED	PS1†	PS2‡	Indication
Shelf (upper)	On	On	Normal status
PS (lower)	On	On	System is operating normally.
Shelf (upper)	Off	Off	Fault status
PS (lower)	On	On	There is a shelf fault; there is no power supply fault. Replace blower.
Shelf (upper)	Off	Off	Fault status
PS (lower)	On	Off	PS1 is operational. Replace PS2.
Shelf (upper)	Off	Off	Fault status
PS (lower)	Off	On	PS2 is operational. Replace PS1.
Shelf (upper)	Off	Off	Fault status
PS (lower)	Off	Off	Possible PS1 and PS2 fault or input power problem

† Shelf power supply installed in slot 7.

‡ Redundant power supply installed in slot 6.

2.3 Storage SBB Status

StorageWorks shelves monitor the status of the storage SBBs. When a fault occurs, the fault and the SBB device address (SCSI target ID) are reported to the controller or host for processing. The SBB internal fault/identity bus controls the fault (lower) LED.

As shown in Figure 2–5, each storage SBB has two LED indicators that display the SBB's status. These LEDs have three states: on, off, and flashing.

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

_____ **CAUTION** _____

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

_____

- The lower LED (amber) is the storage SBB fault LED and indicates an error condition, when it is either on or flashing.

Figure 2–5   Storage SBB LEDs
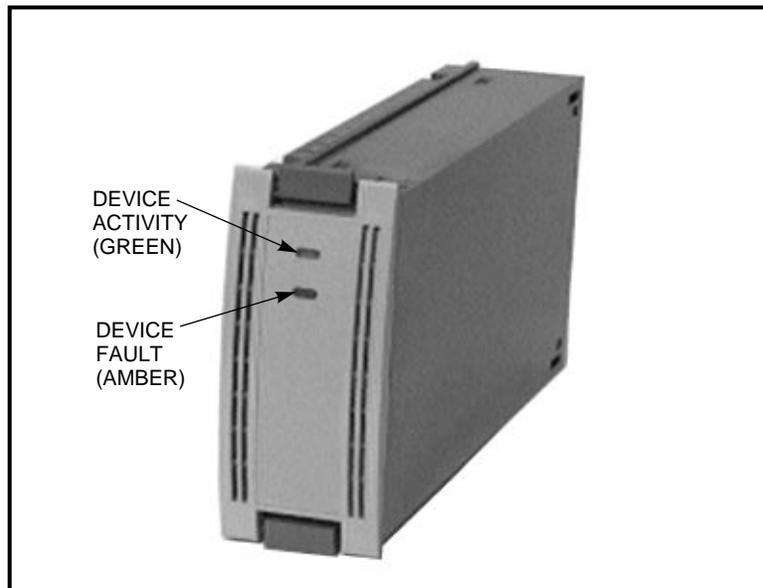
CXO-3671A-PH

Table 2–4 defines the valid states for these LEDs.

Table 2–4   Storage SBB Status LEDs

LED	Status	Indication
Device activity Device fault	On Off	SBB is operating normally.
Device activity Device fault	Flashing Off	SBB is operating normally.
Device activity Device fault	Off Off	SBB is operating normally. The SBB is inactive, and there is no fault.
Device activity Device fault	On On	Fault status SBB is probably not responding to control signals. It is recommended that you replace the SBB.
Device activity Device fault	Off On	Fault status SBB is inactive and spun down. It is recommended that you replace the SBB.
Device activity Device fault	On Flashing	Fault status SBB is active and is spinning down because of the fault.

2.4 BBU Status

The LEDs shown in Figure 2–6 display the status of the BBU.

*   The upper LED (green) is the BBU status LED.

*   The lower LED (amber) is the charge status LED.

Figure 2–6   BBU LEDs
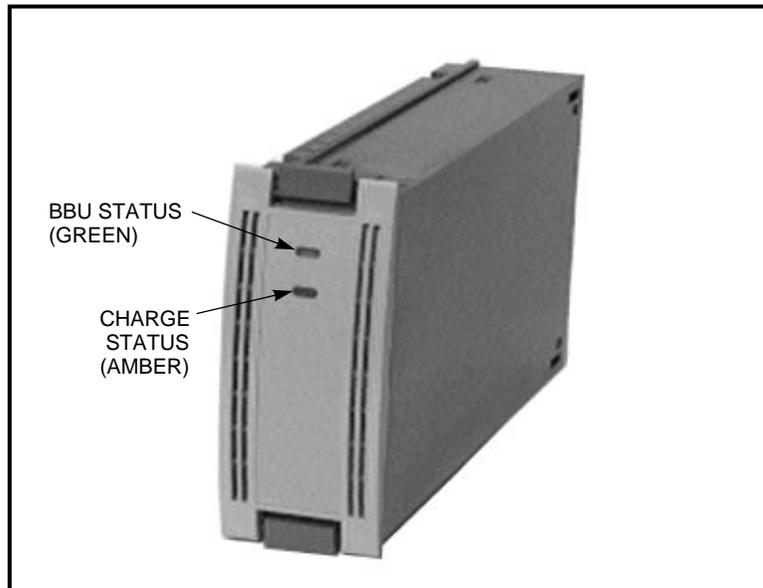
CXO-3670A-PH

These LEDs are controlled by internal BBU signals. The BBU status LED has three states: on, off, and flashing. The charge status LED is either on or off. The Table 2–5 defines the valid states for these LEDs.

Table 2–5   BBU Status LEDs

LED	Status	Indication
BBU Status (upper)	On	Normal status
BBU Charge (lower)	Off	BBU is fully charged and operational.
BBU Status (upper)	Off	Normal status
BBU Charge (lower)	On	BBU is charging.
BBU Status (upper)	Flashing	Fault status
BBU Charge (lower)	ON	Power supply failure. BBU is in use.
BBU Status (upper)	Off	Fault status
BBU Charge (lower)	Off	Either power supply or BBU failure.

3

StorageWorks Replacement Procedures

This chapter describes the detailed procedures for replacing SBB and blowers and the general procedures for replacing shelves. These procedures are applicable to *all* StorageWorks shelves except as noted. The procedures for replacing controllers and cache memories are described in the individual shelf manuals.

The most critical factors relating to removing or replacing storage SBBs or expanding a StorageWorks system are as follows:

- The device type
- The SCSI bus
- The SCSI bus device address

Once a device has been initialized on a SCSI bus with a specific device address, moving the device to another bus or changing the device address can cause problems on the bus. Therefore, it is imperative that devices remain on the same bus and use the same device address. Be sure to clearly identify the bus and device address for each storage device before removing them.

When adding devices to a **random array of independent disks** (**RAID**) set it can involve adding shelves and rerouting the SCSI buses. Rerouting a SCSI bus to a different shelf requires that the configured SBBs must be located in the same *logical* location, that is the same bus and and the same device address, that they were prior to the expansion.

3.1 Replacing a Storage Device or a Power Unit

There are three methods for replacing SBBs, including power supplies—the **hot-swap** method, the **warm-swap** method, and the **cold-swap** method. You must determine the appropriate replacement method prior to replacing a device or power supply.

The LEDs on the front of the SBB indicate the status, either operational or non-operational.

- For storage SBBs, you can use the hot-swap method providing that device is not active (that is, the green device activity LED is off).

_____ CAUTION _____

A hot-swap is a method of device removal that allows SBB removal and replacement while the rest of the system remains on line and active. Not all controllers support the hot-swap method. Read the controller documentation to determine which controller-supported swap method may be used.

_____

- Use the hot-swap method to replace power supplies *only* when there are two power supplies in a shelf. You can remove the failed power supply while the other furnishes the power.

- The warm-swap method is used when there are multiple shelves in a cabinet and power is removed from a shelf to replace an SBB. When this method is used, none of the devices on that shelf is operational until the power is restored.

- The cold-swap method is normally used during initial installation or when adding shelves. The power is removed from all shelves and all devices are inactive. None of the devices is operational until the power is restored.

The removal or replacement of a storage SBB is reported to the controller or host by the SWAP signal. The transition of this normally high signal to low indicates that a storage SBB has been removed or inserted. Upon receipt of this signal, the controller can respond as described in Table 3–1.

Table 3–1 Controller Response to SBB Replacement

Replacement Action	Controller Response
Removing a storage device when data is not being transferred.	None
Removing a storage device *during* during a data transfer operation	Verify data validity.
Installing a storage device	Begin the storage device configuration process.

Use the following procedure to remove or replace an SBB:

―――――――――――――――― **CAUTION** ――――――――――――――――

Be sure that the replacement device is the same model as the one being replaced.

When removing or replacing an SBB, always use both hands to support the weight of the SBB.

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

――――――――――――――――――――――――――――――――――――――

1. Press the two mounting tabs together (see Figure 3–1) to release the SBB.

2. Use both hands and pull the SBB out of the shelf.

3. Insert the replacement SBB into the guide slots and push it in until it is fully seated and the mounting tabs engage the shelf.

4. After power is applied, observe the status LEDs for the following indications:
   - On a power SBB, both green status LEDs should be on.
   - On a storage SBB, the green device activity LED is either on, flashing, or off. The amber device fault LED is off.
   - On a BBU, the amber charge LED is on.

Figure 3–1   Removing an SBB from the Shelf
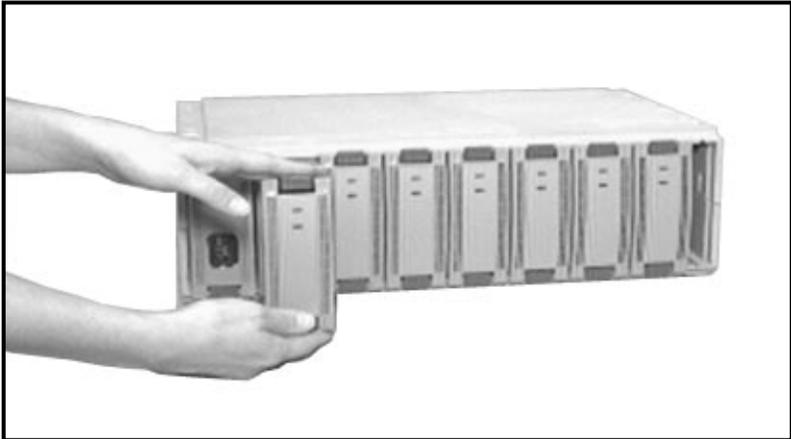
CXO-3611B-PH

3.2 Replacing a Blower

_____ **Note** _____

These procedures do not apply to the BA350–LA SBB shelf.

_____

Each StorageWorks shelf has blowers mounted on the rear. Connectors on the backplane provide the +12 Vdc of power to operate the blowers. When either blower fails, the shelf status (upper) LED on the power SBB is off and an error message is passed to the controller or host.

_____ **WARNING** _____

Service procedures described in this manual that involve blower removal or access to the rear of the shelf must be performed only by qualified service personnel.

To reduce the risk of electrical energy hazard, disconnect the power cables from the shelf power SBBs before removing shelf blower assemblies or performing service in the backplane area, such as modifying the SCSI bus.

_____

Use the following procedure to replace a blower (see Figure 3–2).

1. If you cannot access the rear of the shelf, remove the shelf as described in Section 3.3.1.

2. Disconnect the power cables to the shelf power SBBs.

3. Use a Phillips screwdriver to remove the safety screw in the upper right corner or lower left corner of the blower.

4. Press the upper and lower blower mounting tabs together to release the blower.

5. Pull the blower straight out to disconnect it from the shelf power connector.

6. Align the replacement blower connector and push the blower straight in, making sure that both mounting tabs lock in place.

7. Replace the safety screw.

8. Replace the shelf as described in Section 3.3.2.

9. Connect the shelf power cables and verify that the shelf and all SBBs are operating properly by observing the LEDs.

_____ **Note** _____

If the upper power supply LED (shelf status) does not come on and all the shelf power supplies are operating, the second blower may have failed or the wrong blower was replaced.

_____

Figure 3–2 Replacing Blowers
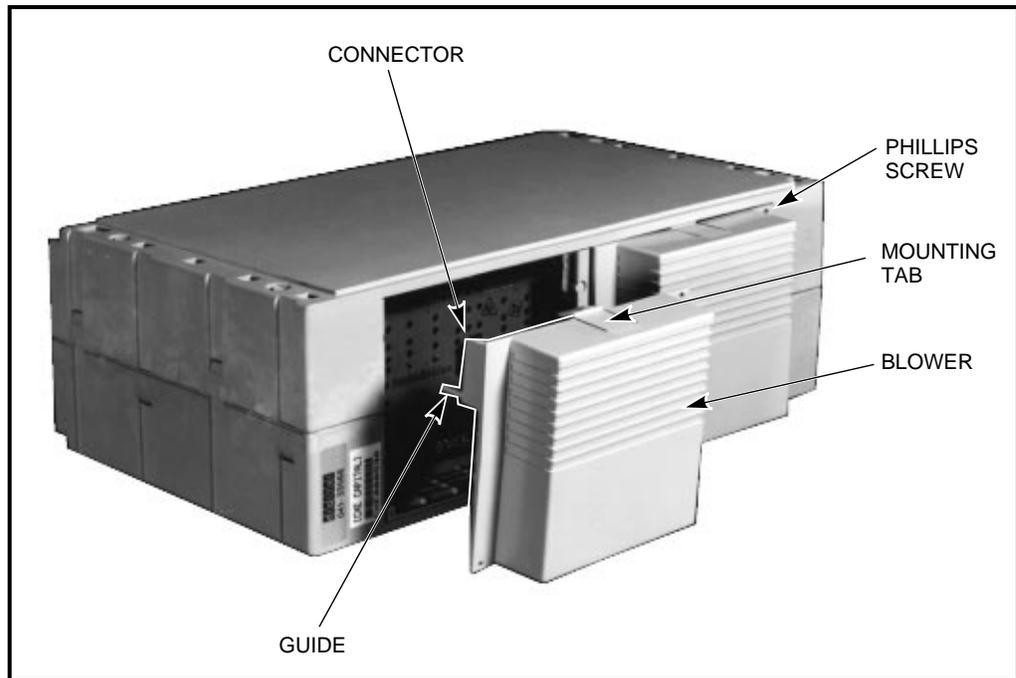
CXO-3659A-PH

3.3 Replacing a StorageWorks Shelf

The procedures for removing or replacing any StorageWorks shelf are basically the same. The major differences are the enclosure or cabinet in which the shelf is mounted and the shelf orientation. Usually the only time you would remove a shelf is to replace a blower.

Installing an additional shelf is not within the scope of this publication. Detailed instructions for mounting a shelf in a cabinet are contained in the cabinet installation guide listed in the Related Documents section of the preface.

3.3.1 Removing a Shelf

All shelves, except those mounted in a **deskside expansion unit**, are inserted into a set of mounting brackets and secured in place with a front locking bracket. Complete the following procedure to remove a shelf:

1. Turn off power to the shelf and disconnect the power cords.

2. Record the location of each storage device, controller, or cache memory in the shelf.

3. Record the location of each controller interface cable.

4. Remove devices for access to the SCSI cable connectors.

5. Record the location of each SCSI cable.

6. Remove both the front locking brackets.

WARNING

A shelf with devices in all slots will weigh approximately 15 kgs (33 lbs). Be sure to fully support the weight of the shelf with both hands at all times to protect yourself and avoid damaging the devices. Removing all the SBBs will significantly reduce the shelf weight.

---

7. Note the shelf orientation and carefully slide it out of the mounting brackets.

3.3.2 Installing a Shelf

Complete the following procedure to install a shelf.

1. Install the SHELF_OK jumpers.

2. Orient the shelf and carefully slide it into the mounting brackets.

3. When it is fully seated, install the front locking brackets.

4. Connect each SCSI cable to the same connector from which it was removed.

5. Install each SBB, controller, or cache memory in the same slot from which it was removed.

6. Connect each controller interface cable to the same connector from which it was removed.

7. Insert the power SBB and connect the power cord.

8. Apply power to the shelf and ensure that the shelf, the power supplies, and all devices are functioning properly.

9. If you replaced a shelf blower, ensure that both blowers are functioning.

4

Power

This chapter describes the StorageWorks power units and power configuration rules. All of the StorageWorks power units are mounted in a 3½-inch SBB.

The are three StorageWorks power units:

- Universal ac input power supply
- Universal dc input power supply
- BBU

4.1 Shelf Power Configuration Rules

The rules for configuring the StorageWorks shelves are as follows:

- Each shelf requires either an ac or dc shelf power supply.
- Each power supply requires a switch-controlled power source.
- Each power supply can support a maximum of seven 3½-inch SBBs.
- The shelf power supply must be mounted in slot 7 (the power slot) of the shelf.
- Either an *optional* redundant power supply or an *optional* BBU[1] can be mounted in slot 6.
- Both ac and dc power supplies can be used in the same shelf as either the shelf power supply or the redundant power supply.

---

[1] BBUs cannot be used in a BA350–MA controller shelf.

4.2 Power Specifications

Tables 4–1 through 4–3 describe the StorageWorks power units, dc power requirements, and the maximum power available for each shelf, respectively.

_____ **CAUTION** _____

Only the power units listed in Table 4–1 can be used with the StorageWorks product line.

The power units pose no safety hazard to personnel during their replacement, provided that the procedures described in Section 4.5 are followed *exactly*.

_____

Table 4–1   StorageWorks Power Units

Item	Description
BA35X–HA	Universal ac input power supply
	Quantity: Maximum of two per BA350 shelf Input: 90–132 Vac or 175–264 Vac, 47–63 Hz (autoranging) Output: 131 W, +12 Vdc, +5 Vdc
BA35X–HB	Universal dc input power supply
	Quantity: Maximum of two per BA350 shelf Input: 38–60 Vdc (nominal 48 Vdc) Output: 131 W, +12 Vdc, +5 Vdc
BA35X–HC	Battery Backup Unit†
	Quantity: Maximum of one per BA350 shelf Input: +12 Vdc from BA35X–HA or BA35X–HB Output: +12 Vdc, +5 Vdc 200 W *peak* for 16, 32, or 64 seconds

†BBUs cannot be used in a BA350–MA controller shelf.

Typical power requirements for StorageWorks SBBs and blowers are listed in Table 4–2. These requirements are based on *sequential* SBB spin-up.

Table 4–2   Typical SBB DC Power Requirements

Device	Steady State		Spin-Up	
	+5 Vdc	+12 Vdc	+5 Vdc	+12 Vdc
3½-inch SBB	4 W	9.6 W	4 W	24.0 W
5¼-inch SBB	12 W	28.8 W	12 W	72.0 W
Blower	N/A	7.2 W	N/A	7.2 W

The power available for original equipment manufacturers (OEM) devices depends upon the shelf type—either an SBB shelf, such as the BA350–SA, or a controller and SBB shelf, such as the BA350–EA. Table 4–3 lists the power available for each shelf type. Use this data to determine the number of OEM devices that can be installed.

Table 4–3 Maximum Available Power

Shelf Type	+5 Vdc	+12 Vdc
SBB Shelf	28.0 W	81.6 W
Controller and SBB Shelf	26.4 W	75.0 W

4.3 Universal AC and DC Input Power Supplies

Shelf and power supply status are displayed on the power supply LEDs shown in Figure 4–1. The upper LED displays the shelf status and the lower LED displays the status of the supply. A complete description of the status signals generated by the shelf and power supply is contained in Chapter 2.

- When the upper LED is on, both the shelf blowers and the power supplies are functioning properly.

- When the upper LED is off, either a shelf blower or a power supply is not operating properly.

Figure 4–1 Power Supply Status LEDs
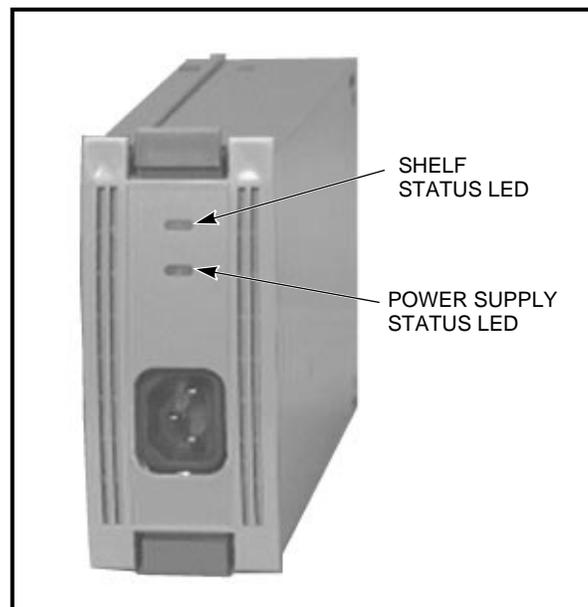
CXO-3613B-PH

4.4 Battery Backup Units

The LEDs on the BBU (see Figure 4–2) display the status of the BBU. These LEDs are controlled by internal BBU signals. The status LED has three states: on, off, and flashing. The charge status LED has two states: on or off. The *valid* states of these LEDs are listed in Table 2–5

- The upper LED (green) is the BBU status LED.

- The lower LED (amber) is the charge status LED.

Figure 4–2   BBU LEDs
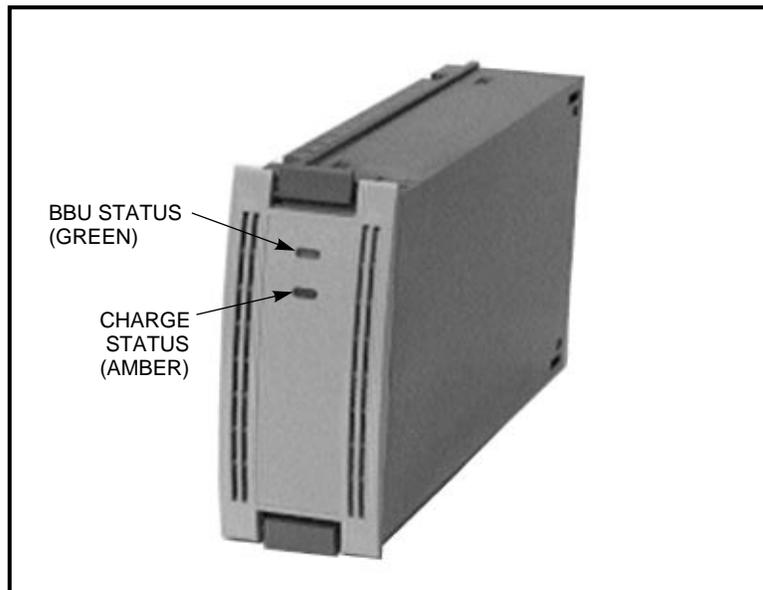
CXO-3670A-PH

4.5 Power Supply Replacement

The input power for each ac and dc power supply is controlled by a switch on the cable distribution unit. Turning this switch off removes power from *all* power supplies in the cabinet. To remove power from a single power supply, you simply disconnect the power cable from that power supply.

The three methods for replacing power units are described in Section 3.1. Digital recommends that you use the warm-swap method whenever operational requirements permit.

4.5.1 Replacing a Shelf Power Supply

_____ WARNING _____

Always use both hands when removing or replacing an SBB in order to fully support its weight.

_____

Complete the following procedure to replace either a shelf power supply or a redundant power supply:

1. Remove the input power cable from the supply.

2. Press the two mounting tabs to release the unit, and slide the unit out of the shelf, as shown in Figure 4–3.

3. Insert the replacement unit into the guide slots and push it in until the tabs lock in place.

4. Connect the input power cord.

5. Observe the LEDs and make sure the supply is functioning properly (refer to Table 2–2).

6. Sequentially place the storage devices online. Observe the LEDs on both the power supply and the storage device for normal operation indications.

Figure 4–3 Removing an SBB from a Shelf

CXO-3611B-PH

4.5.2 Replacing a BBU

_____ WARNING _____

Always use both hands when removing or replacing an SBB, to fully
support its weight.

_____

To replace a BBU in slot 6, complete the following procedure:

1. Press the two mounting tabs to release the unit, and slide the unit out of the
   shelf.

2. Insert the replacement unit in the guide slots and push it in until the tabs
   lock in place.

3. Observe the LEDs and ensure the BBU is charging as specified in Table 2–2.
   The BBU should be fully charged in approximately 1 hour.

4.6 Power Cords and Cables

Each BA35X–HA universal input ac power supply requires an individual ac
power cord that is compatible with an International Electronic Committee (IEC)
C–14 shrouded ac receptacle connector. These cords are part of the enclosure and
are listed in the enclosure documentation.

_____ CAUTION _____

Input ac power must be routed through the enclosure cable distribution
unit. This ensures proper line voltage protection for the supply. _Do not
connect an ac supply directly to a wall outlet._

_____

Each BA35X–HB universal input dc power requires an individual dc power cable
that has a plug receptacle (Molex part number 39–01–2060) and six female
pins (Molex part number 39–00–0055). The receptacle wiring is described in
Table 4–4.

Table 4–4 DC Power Receptacle Wiring

Pin No.	Signal	Pin No.	Signal
1	+48 Vdc	4	+48 Vdc RTN
2	BAT_STAT H	5	Not used
3	ENABLE H	6	SIGNAL RTN

5

StorageWorks SCSI Buses

This chapter describes the StorageWorks building block (SBB) shelf SCSI buses, including bus lengths, terminators, jumpers, and component locations.

_____ **WARNING** _____

Service procedures described in this manual, involving blower removal or access to the rear of the shelf must be performed only by qualified service personnel.

To reduce the risk of electrical energy hazard, disconnect the power cables from the shelf power supplies before removing shelf blower assemblies or performing service in the backplane area, such as modifying the SCSI bus.

_____

As shown in Figure 5–1, the SBB shelf has the following:

- Two 50-pin, high-density, female, **single-ended**, SCSI–2 connectors: JA1 and JB1 (lower)

- Either one or two SCSI buses as determined by the terminator board and the jumper board location

Figure 5–1 Typical SBB Shelf
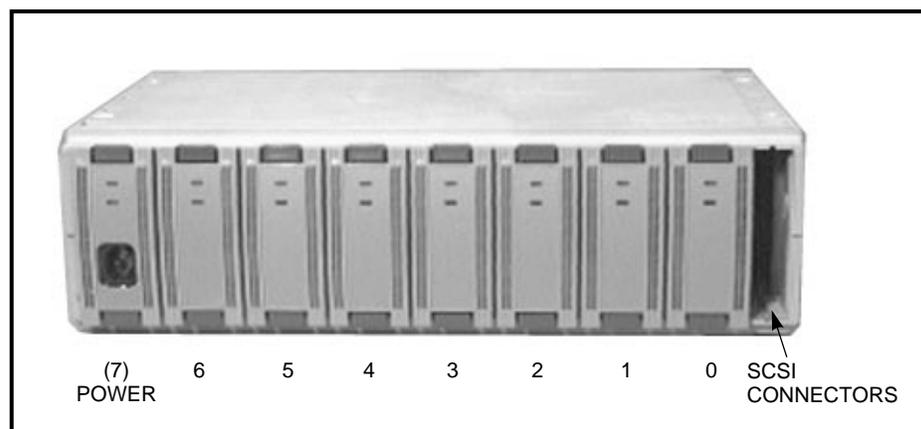
CXO-3617B-PH

5.1 Assigning Device Addresses

Use the following rules and procedures to assign device addresses to the SBBs (disk drives, tape drives, and so forth).

CAUTION

Each device address on a SCSI bus can only be used once.

Each device address on an SBB shelf can only be used only once *unless* the shelf has multiple buses *and* the SBBs have device address switches.

- The SBB device address for the 3½-inch **tape** SBBs and all 5¼-inch SBBs is determined by the address switch on the rear of the SBB. When the address switch is set to the automatic position, the address is determined by the physical location in the shelf. When these switches are set to any other *valid* address, the SBB shelf connector device address is disabled.
- Before installing the SBB in the shelf, set the switches on the rear of the SBB to one of the addresses shown in Table 5–1.

Table 5–1 SBB Device Address Switch Settings

Address	Switch Number					
	1	2	3	4	5	6
0	OFF	OFF	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF	OFF
5	ON	OFF	ON	OFF	OFF	OFF
6	OFF	ON	ON	OFF	OFF	OFF
7†	ON	ON	ON	OFF	OFF	OFF
Automatic‡	OFF	OFF	OFF	ON	ON	ON

† Normally reserved for the host.

‡ Sets the device address to the shelf default value.

- A 5¼-inch SBB can contain one **full-height** (FH) or two **half-height** (HH) devices. To set the device addresses for a 5¼-inch SBB with two HH devices installed (see Figure 5–2):
  - Use the center switch to set the lower device address switch.
  - Use the left switch to set the upper device address.

Note

Only the center switch is installed when there is a FH 5¼-inch device or only one HH 5¼-inch device in a 5¼-inch SBB.

Figure 5–2 SBB Device Address Switches
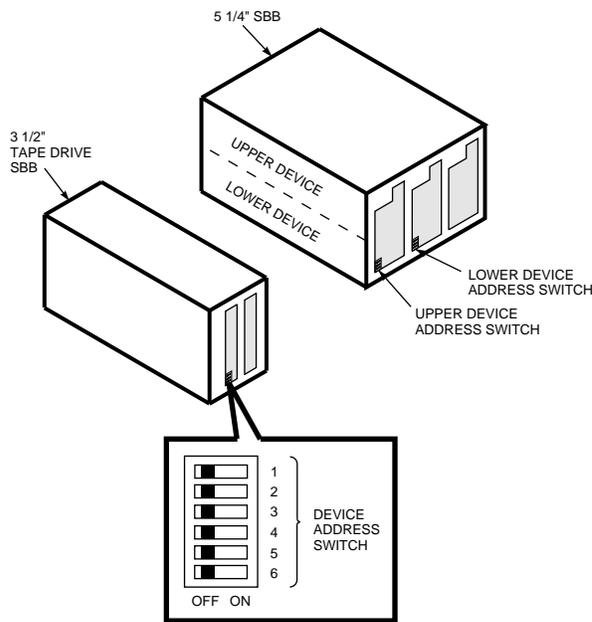
CXO-3630A-MC_R

- To use the default shelf device address, set the switches to the automatic setting as shown in Table 5–1.

- The maximum number of device addresses per SCSI bus or StorageWorks SBB shelf is seven.

- The SBB device address for 3½-inch disk SBBs is determined automatically by its physical location in the shelf.

- When there is no address switch or the switch is set to automatic, the shelf backplane connector determines the SCSI device address. For example,

   – If the SBB is in slot 5, the device address is 5.

   – If the SBB is in slot 3, the device address is 3.

5.2 SCSI Bus Length and Termination

Two important considerations for all SCSI buses are bus termination and bus length.

- Each bus requires a terminator. The terminator (T) and jumper (J) connectors are mounted on the rear of the backplane.

- Table 5-2 defines the *maximum* lengths of the StorageWorks SCSI buses as measure between the two bus terminators.

Table 5–2 SCSI Bus Parameters

Bus Type	Transfer Rate	Meters	Feet
8-bit, single-ended	5 MB/s	6	19.7
8-bit, single-ended	10 MB/s	3	9.8
16-bit, differential	20 MB/s	25	82

See Section 5.3 for detailed discussion of shelf SCSI bus lengths.

- The total length of the SCSI bus is critical. The components of bus length are as follows:

  - Shelf backplane

  - Controller backplane

  - SCSI cables connecting the **host**, the **controller**, and the SBB shelf

- The length of the SBB shelf SCSI bus is measured from the input connector, JA1 or JB1, to the bus terminator.

_____ **Note** _____

Adding or removing devices to a shelf *does not* change the length of the shelf bus. The only way to change the length of the shelf SCSI bus is to reposition the terminator.

_____

5.3 SBB Shelf SCSI Bus Configurations

Prior to shipment, the SBB shelf SCSI buses are configured to meet system requirements in one of the following ways:

- A single bus with seven device addresses (seven SBBs maximum) on one shelf

- Two buses with four device addresses on one bus (four SBBs maximum) and three device addresses on the other (three SBBs maximum)

- A single bus with seven device addresses (seven SBBs maximum) on multiple shelves

A customer can configure buses provided that the rules listed in the following sections are strictly observed. For a complete listing of compatible SCSI cables, see the *StorageWorks Family Configuration Guide*.

_____ **Note** _____

The length of a shelf SCSI bus is the distance from the input connector to the terminator on the shelf.

_____

Table 5-3 lists the standard factory SCSI bus configurations and defines the bus lengths.

Table 5–3 StorageWorks Bus Lengths

Shelf	Bus	Input	Slot 1	Slot 5	Meters	Feet
				Single Shelf—Single Bus		
1	1	JA1	Terminator	Jumper	0.9	2.9

7-DEVICE BUS INPUT
BUS LENGTH: 0.9 m (34.7 in)

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Shelf	Bus	Input	Slot 1	Slot 5	Meters	Feet
				Single Shelf—Two Buses		
1	1	JA1	Jumper†	Terminator	0.4	1.4
1	2	JB1	Jumper†	Terminator	0.6	2.0

3-DEVICE BUS INPUT
BUS LENGTH: 0.4 m (16.4 in)

4-DEVICE BUS INPUT
BUS LENGTH: 0.6 m (23.6 in)

CXO-3597B-MC

† The jumper is placed here for safekeeping and has no effect on the SCSI bus.
‡ From input connector (JA1) to output connector (JB1)
§ Do not install a terminator here.

Table 5–3 (Cont.)   StorageWorks Bus Lengths

Shelf	Bus	Input	Slot 1	Slot 5	Meters	Feet
			Two Adjacent Shelves—Single Bus			
1	1	JA1	NONE§	Jumper	0.9‡	2.9‡
2	1	JA1	Terminator	Jumper	0.9	2.9
			BN21H–0E Cable		0.5	1.6
			Total Bus Length		2.3	7.4

CXO-3598B-MC

† The jumper is placed here for safekeeping and has no effect on the SCSI bus.
‡ From input connector (JA1) to output connector (JB1)
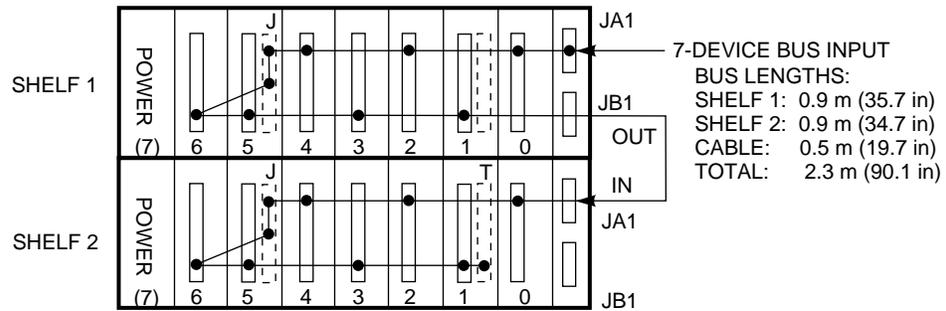§ Do not install a terminator here.

5.4 SBB Shelf with a Single SCSI Bus

Use the following procedure to configure a single SBB shelf for seven devices on a single SCSI bus (see Figure 5–3):

1. Turn off the shelf power by disconnecting the power cable from the shelf power supplies.

2. Remove the blowers as described in Section 3.2.

3. Discharge any static buildup by momentarily touching a finger to a blank space on the backplane.

4. Make sure that the SHELF_OK jumpers are installed correctly on either the backplane or on both the terminator board and the jumper board as described in Chapter 2.

5. Install the BA35X–MC jumper board in the backplane connector behind slot 5.

6. Install the BA35X–MB terminator board in the backplane connector behind slot 1.

7. Connect the SCSI cable to the upper connector.

8. Replace the blowers as described in Section 3.2.

9. Turn on the power and verify that all the devices are active.

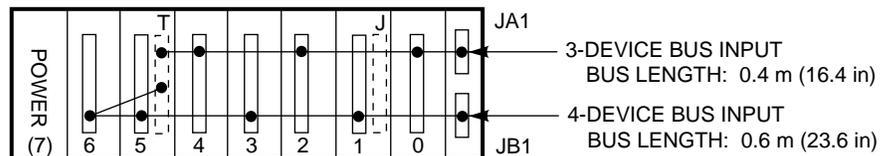**Figure 5–3   Single SCSI Bus**
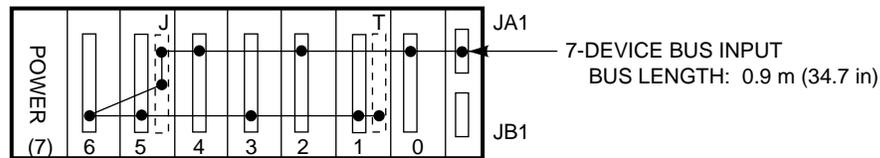
CXO-3596B-MC

5.5 SBB Shelf with Two SCSI Buses

Use the following procedure to configure an SBB shelf for two SCSI buses, one with three devices and one with four devices, as shown in Figure 5–4:

1. Turn off the shelf power by disconnecting the power cable from the shelf power SBBs.

2. Remove the blowers as described in Section 3.2.

3. Discharge any static buildup by momentarily touching a finger to a blank space on the backplane.

4. Make sure that the SHELF_OK jumpers are installed correctly on either the backplane or on both the terminator board and the jumper board as described in Chapter 2.

5. Install the BA35X–MB terminator board in the backplane connector behind slot 5.

6. Install the unused BA35X–MC jumper board in the backplane connector behind slot 1.

7. Connect the SCSI cable for device addresses 0, 2, and 4 to the upper connector.

8. Connect the SCSI cable for device addresses 1, 3, 5, and 6 to the lower connector.

9. Replace the blowers as described in Section 3.2.

10. Turn on the power and verify that all the devices are active.

Figure 5–4   SBB Shelf SCSI Buses

CXO-3597B-MC

5.6 Multiple SBB Shelves with a Single SCSI Bus

Use the following procedure to configure two SBB shelves with seven devices on one SCSI bus, as shown in Figure 5–5:

---------------------------------- **Note** ----------------------------------

The maximum number of SBB shelves on a single SCSI bus is two. A maximum of seven storage SBBs can be installed in both shelves.

----

1. Turn off the shelf power by disconnecting the power cable from the shelf power SBBs.

2. Remove the blowers as described in Section 3.2.

3. Discharge any static buildup by momentarily touching a finger to a blank space on the backplane.

4. Make sure that the SHELF_OK jumpers are installed correctly on either the backplane or on both the terminator board and the jumper board as described in Chapter 2.

5. On the upper shelf, install the BA35X–MC jumper board in the backplane connector behind slot 5.

6. On the lower shelf, install the BA35X–MC jumper board in the backplane connector behind slot 5.

7. On the lower shelf, install the BA35X–MB terminator board in the backplane connector behind slot 1.

8. Connect a BN21H-0E SCSI cable between the lower connector on the upper shelf and the upper connector on the lower shelf.

9. Ensure that each device has a different SCSI bus address.

10. Replace the blowers as described in Section 3.2.

11. Turn on the power and verify that all the devices are active.

Figure 5–5 Single SCSI Bus on Two SBB Shelves

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6
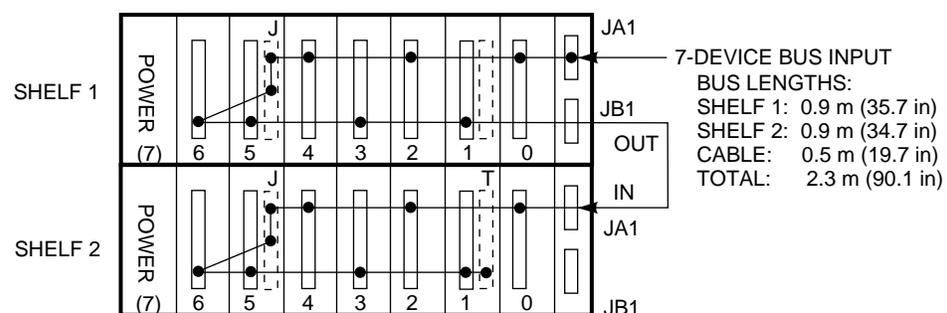
SCSI Bus Signal Converters

_____ **Note** _____

The discussion of the **DWZZA**-series **SCSI bus signal converters**
in this chapter is limited to the models, applications, cables, and
configurations applicable to the SBB shelves. The capabilities and use of
these converters in other environments or with other SCSI systems is not
within the scope of this manual.

_____

The SBB shelf SCSI buses are 8-bit, single-ended, SCSI–2 buses. Some
controllers and hosts, or their SCSI adapters, use a 16-bit, **differential SCSI
bus**. Singled-ended and differential buses are incompatible. The SCSI protocol
will disable these buses when they are connected together.

SCSI bus signal converters permits connecting these buses together _without_
modifying the SCSI devices. For an SBB shelf the DWZZA-series SCSI bus signal
converters are used to establish compatibility between the host SCSI bus and the
SBB bus and extend the length of the SCSI bus.

Two SCSI bus signal converters are used with StorageWorks products—the
DWZZA–AA and the DWZZA–VA. Electrically and operationally these models are
identical. The primary differences are as follows:

- The DWZZA–AA is a desktop model with a self-contained power supply
  that can be connected to an SBB shelf or a DWZZA–VA converter. The
  DWZZA–AA has two female cable connectors—a 68-pin, high-density and a
  50-pin, low-density.

- The DWZZA–VA is and installed in slot 0 of an SBB shelf. It has a single
  female cable connector—a 68-pin, high-density.

_____ **Note** _____

The DWZZA–VA input connector is a 68-pin, differential connector. There
is no provision for connecting a 50-pin, single-ended connector to the
DWZZA–VA.

_____

In this chapter, SCSI buses are either a single-ended or a differential **physical
bus** or a single-ended physical bus connected to a differential physical bus by a
SCSI bus signal converter, a **logical bus**.

6.1 DWZZA Description

The following is a list of the features and functions of the DWZZA SCSI bus signal converters:

- Converts two physical buses (a single-ended bus and a differential bus) into a single logical bus.

Note

The 16-bit differential host or controller bus must be operating in the 8-bit mode.

- The length of the logical bus is equal to the length of the two physical buses.

- The logical bus has a total of eight device addresses (0 through 7).

- The converter does not use a SCSI device address.

- Establishes a physical connection between a 16-bit, differential bus operating in the 8-bit mode and an 8-bit, single-ended SCSI device (communication between the host and the SBB are 8-bit).

- Data transfers at rates of up to 10 million transfers per seconds (10 Megabytes/second[1]) are supported.

- The converter operation is transparent to both buses.

6.2 Installing SCSI Bus Signal Converters

The manner in which SCSI bus signal converters are installed is primarily based upon the SCSI host.

Note

Unless otherwise stated, the DWZZA signal converters are installed in the **end-bus** position. This requires that both the differential bus and the single-ended bus be terminated within the DWZZA.

As shown in Figure 6–1 you would connect a host to the SBB shelf as follows:

- When using a single-ended host, you can connect the host SCSI controller or adapter directly to the SBB shelf with a single ended cable. No DWZZA is required for this configuration.

- A differential host operating in the 8-bit mode can be connected directly to the DWZZA.

- To create a logical bus longer than the single-ended physical bus, you would install *two* DWZZAs, a DWZZA–AA, and a DWZZA–VA.

  - The desktop model, the DWZZA–AA, is connected to the host with a 50-conductor, single-ended (**SCSI–A**) cable, such as a BC09D or BN21H.
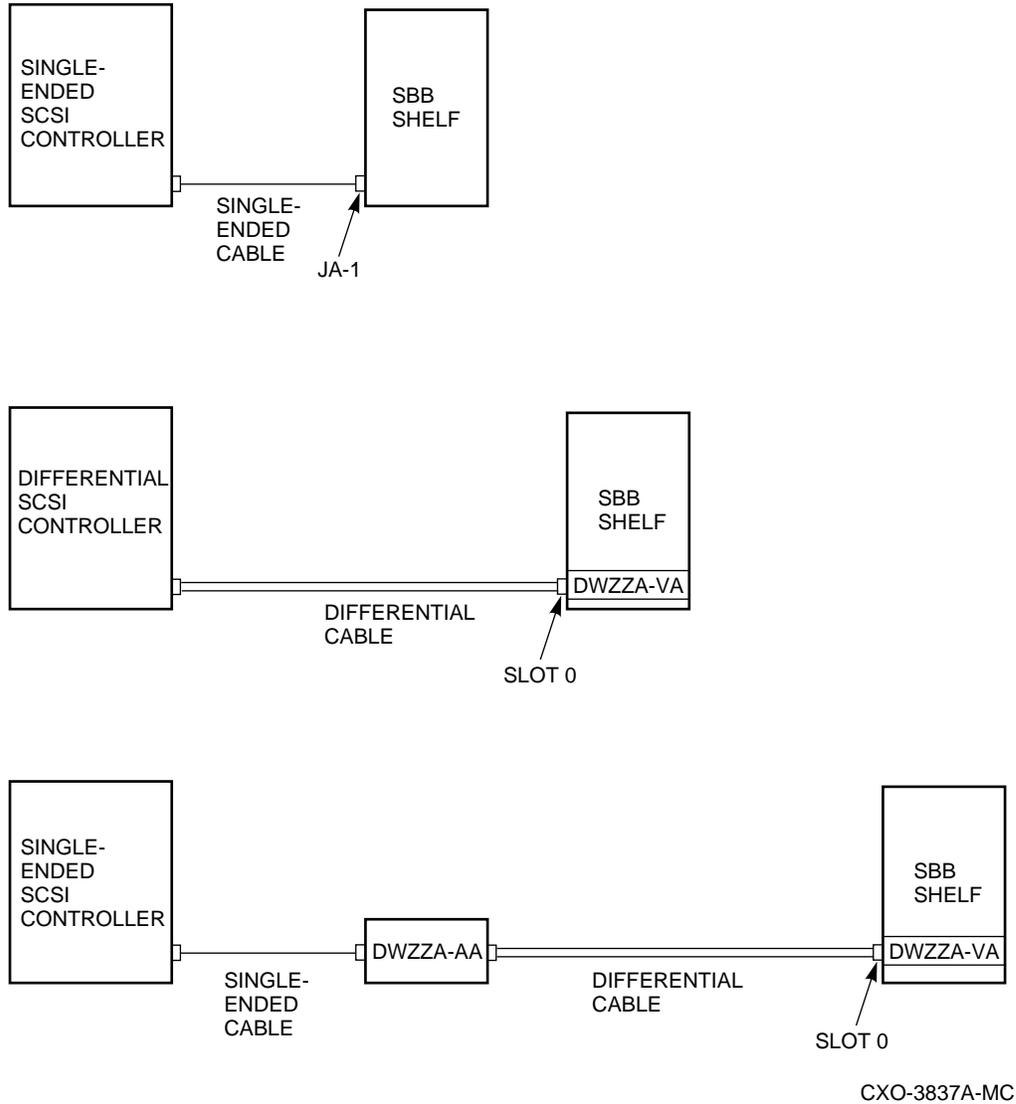
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[1] This rate is supported *only* when at least one device supports the 10 MB/s transfer rate and the bus has been designed as a fast bus.

Figure 6–1 Typical SCSI Bus Signal Converter End-Bus Cabling

CXO-3837A-MC

– The desktop model is connected to the DWZZA–VA using a 68-conductor, differential (**SCSI–P**) cable, such as a BN21K or BN21L.

With a SCSI bus signal converter you can extend the maximum length of the SCSI bus. This distance is measured from the terminator on the SCSI host to the terminator on the SBB shelf. This length includes the following:

- The distance from the host terminator to the host SCSI cable connector

- The length of all cables

- The distance from the SBB shelf input connector *or* the DWZZA–VA connector to the shelf terminator

Table 6–1 lists the maximum bus lengths using the end-bus configuration for all DWZZAs.

Table 6–1 StorageWorks SCSI Buses

SCSI Bus		DWZZAs		SCSI Bus Length			Cable	
Type	MB/s	–VA	–AA	SBB Shelf†	Cable–Host‡	Maximum§	Type	Order No.
No SCSI Bus Signal Converters								
Fast	10	0	0	0.9 m (3.0 ft)	2.1 m (6.9 ft)	3 m (9.8 ft)	SE	BC09D, BN21H
Slow	5	0	0	0.9 m (3.0 ft)	5.1 m (16.7 ft)	6 m (19.7 ft)	SE	BC09D, BN21H
Differential SCSI Host								
One SCSI Bus Signal Converter								
Fast	10	1	0	3 m (9.8 ft)	23 (75.5 ft)	26 m (85.3 ft)	DF	BN21K, BN21L
Slow	5	1	0	6 m (19.7 ft)	23 (75.5 ft)	29 m (95.1 ft)	DF	BN21K, BN21L
Single-Ended SCSI Host								
Two SCSI Bus Signal Converters								
Fast	10	1	1	3 m (9.8 ft)	26 m (85.3 ft)	29 m (95.1 ft)	SE DF	BC09D, BN21H BN21K, BN21L
Slow	5	1	1	6 m (19.7 ft)	29 m (95.1 ft)	35 m (114.8 ft)	SE DF	BC09D, BN21H BN21K, BN21L

Legend:
†—First shelf input connector to last shelf terminator.
‡—Host terminator to SBB shelf input connector or SBB shelf DWZZA–VA input connector.
§—Host terminator to SBB shelf terminator.
SE—SCSI–A SCSI cable, 50-conductor.
DF—SCSI–P SCSI cable, 68-conductor.

In the end-bus configuration, all the cables are terminated in the converter as well as at the host and the SBB shelf. Note that this configuration effectively starts a new bus at each connection.

For example, when using a single-ended and no converters, the maximum length of the single-ended SCSI bus from the host terminator to the SBB shelf terminator is 6 meters (19.7 ft). By using two converters, the maximum distance from the host terminator to the SBB shelf terminator would theoretically be 37 meters (121.4 feet). However, the actual maximum length when using approved cables is as shown in Table 6–1.

- The maximum bus length from the host terminator to the desktop converter 50-pin connector can be either 3 meters (9.8 ft) or 6 meters (19.7 ft) depending upon the bus speed.

- The maximum cable length from desktop converter 68-pin connector to the SBB shelf converter 68-pin connector is 23 meters (75.5 ft).

- The maximum bus length from the SBB shelf converter backplane connector to the shelf terminator can be either 3 meters (9.8 ft) or 6 meters (19.7 ft) depending upon the bus speed.

_____ Note _____

Maximum SCSI bus length is not the same as maximum cable length.

The longest StorageWorks BN21K or BN21L SCSI–P cable is 23 meters.
Do not use a longer SCSI–P cable.

_____

6.3 SCSI Cables

The *StorageWorks Family Configuration Guide* describes SCSI cables in detail.
The particular cable used with a SCSI bus signal converter depends upon the
following:

- The bus type

  – A DWZZA–AA has both a 68-pin, high-density, differential connector and
    a 50-pin, low-density, single-ended connector.

  – A DWZZA–VA has only one cable connector, a 68-pin, high-density,
    differential connector for connecting to a host or controller. The DWZZA–
    VA single-ended SCSI bus is routed to the SBB shelf through the 96-pin
    connector on the rear of the DWZZA–VA

- The maximum allowable bus length

- The cable connector clearance. In some cases you *must* use a right-angle
  connector because there is not enough clearance to use a straight connector.

DWZZA compatible cable types are listed in Table 6–2.

Table 6–2 SCSI Cable Types

Bus Connector	Cable Type	Connectors
DWZZA–VA SBB SCSI Bus Signal Converter Compatible Cables		
Single-ended	N/A	The single-ended connector is a 96-pin connector that mates with the SBB shelf connector.
Differential	BN21K–23	One 68-pin, high-density, straight, connector and one 68-pin, high-density, right-angle connector
Differential	BN21L–23	Two 68-pin, high-density, right-angle connectors
DWZZA–AA Desktop SCSI Bus Signal Converter Compatible Cables		
Single-ended (Low-density host)	BC06P	Two 50-pin, low-density, straight connectors with bale locks.
Single-ended (High-density host)	BC09D	50-pin, high-density, straight connector and 50-pin, low-density, straight connector
Differential	BN21K–23	One 68-pin, high-density, straight connector and one 68-pin, high-density, right-angle connector
Differential	BN21L–23	Two 68-pin, high-density, right-angle connectors

6.4 Terminating SCSI Buses

All SCSI buses are terminated at the physical ends of the bus or cable. This is true even when using a SCSI bus signal converter. Both DWZZA SCSI bus signal converters supply terminator power (TERMPOWER) to the SCSI terminators. TERMPOWER is current limited by self-resetting fuses.

The following sections describe the procedures for configuring a DWZZA for either end-bus (see Section 6.4.1) or **mid-bus** (see Section 6.4.2) operation.

CAUTION

Removing the DWZZA SCSI bus signal converter or disconnecting the SCSI cable when the power is on can cause the SCSI bus to malfunction.

6.4.1 End-Bus SCSI Bus Signal Converter Terminators

Use the following procedure to install the single-ended and differential terminators when the DWZZA-series SCSI bus signal converter is installed in the end-bus position.

CAUTION

To prevent damage, the SBB bezel should be removed as few times as possible and *minimal* pressure used when pushing down on the mounting tabs.


CAUTION

Do not attempt the following procedure unless you have taken proper precautions against electrostatic discharge (ESD). When you remove the cover from any enclosure or device, wear an ESD grounding wrist strap.

---

1. Turn off the power.
2. Disconnect the SCSI cables.
3. Remove either the SBB bezel and cover or the desktop cover.
4. Install jumper J2, the single-ended SCSI–2 bus termination (see Figure 6–2), to terminate the single-ended bus.

Figure 6–2 End-Bus DWZZA Bus Terminators

SINGLE-ENDED
SCSI-2 TERMINATION

DIFFERENTIAL
TERMINATOR
RESISTOR SIPS

J2

68-PIN
CONNECTOR
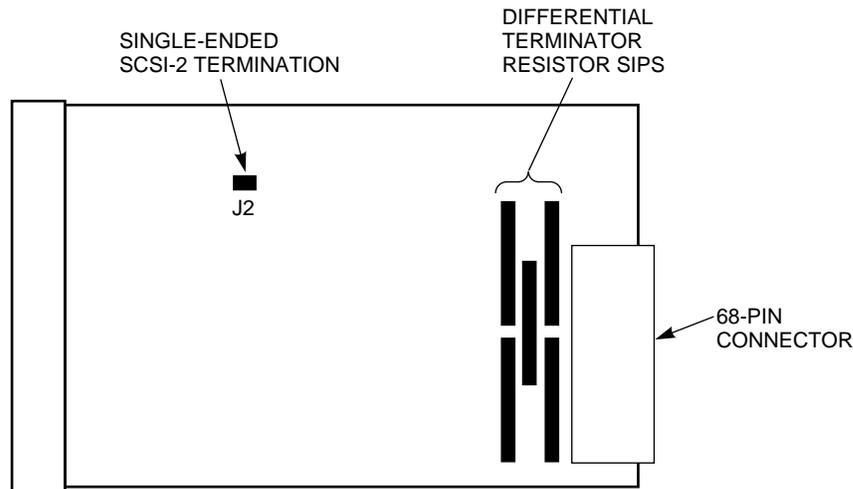
CXO-3836A-MC

5. Terminate the SCSI–P cable by installing the five resistor single-inline-packages (SIPs).

6. Replace the SBB cover and bezel or replace the desktop cover.

7. Label the SBB bezel or the desktop cover with the status of both the differential terminator and the single-ended terminator as either "IN" or "OUT."

8. Install the SBB, in the shelf, connect the SCSI cable, and apply power to the shelf.

9. Observe the system to determine if the SCSI bus and devices are functioning properly.

6.4.2 Mid-Bus SCSI Bus Signal Converter Terminators

The SBB shelf SCSI bus signal converter, a DWZZA can be placed in the mid-bus position using an H885–AA trilink connector (see Figure 6–3). Use the following procedure to configure the differential connector for mid-bus operation.

Figure 6–3   H885–A Trilink Connector

REAR VIEW

FRONT VIEW

CXO-3851A-MC
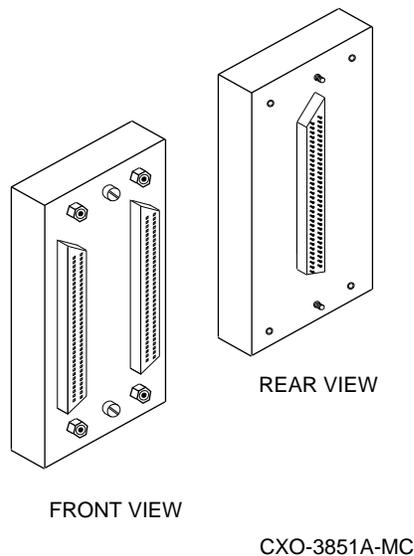
_____ **Note** _____

Normally, this procedure is only completed during initial installation of the SCSI bus signal converter.

_____ **CAUTION** _____

Do not attempt the following procedure unless you have taken proper precautions against electrostatic discharge (ESD). When you remove the cover from any enclosure or device, wear an ESD grounding wrist strap.

1. Turn off the power.
2. Disconnect the SCSI cables.
3. Remove either the SBB bezel and cover or the desktop cover.
4. Install jumper J2, the single-ended SCSI–2 bus termination (see Figure 6–4), to terminate the single-ended bus.

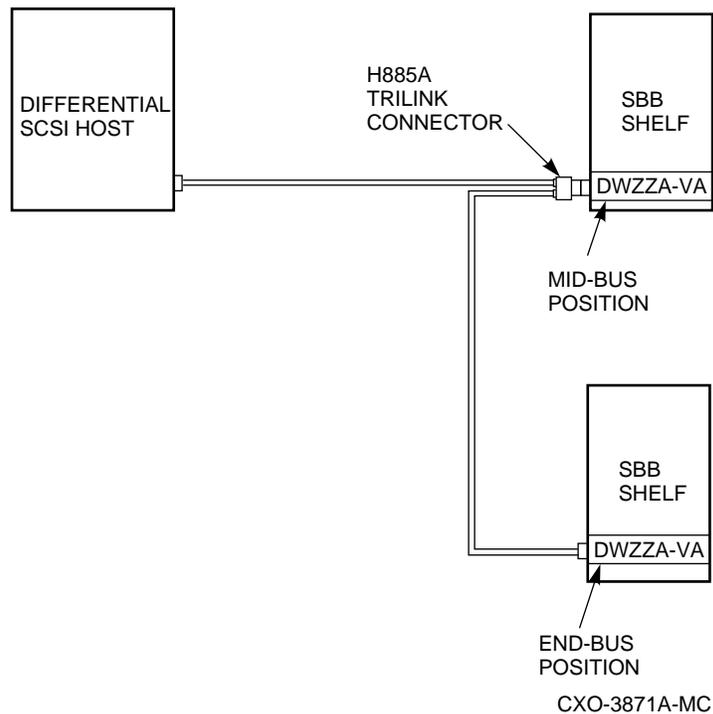**Figure 6–4 Mid-Bus DWZZA Bus Terminators**

CXO-3872A-MC
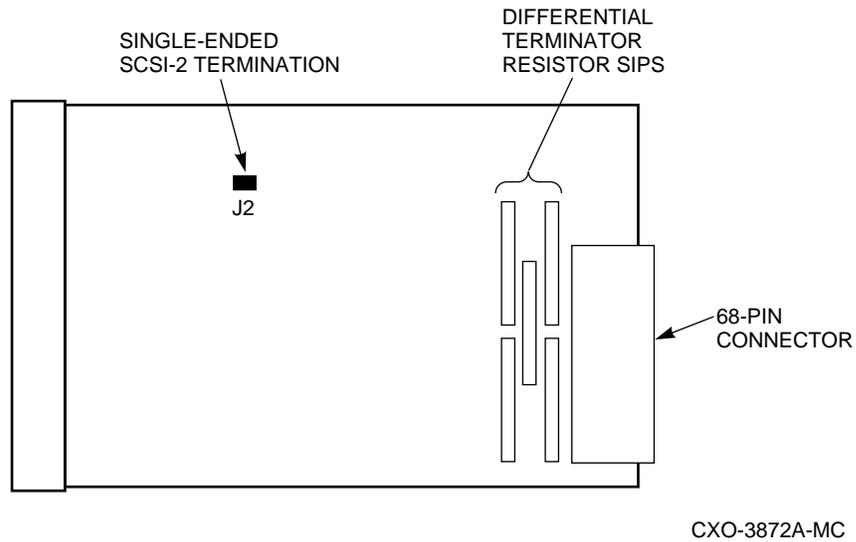
5. Remove the five differential bus resistor SIPs.

6. Replace the SBB cover and bezel or replace the desktop cover.

7. Install the H885–AA trilink connector in the differential connector (see Figure 6–5).

Figure 6–5 Mid-Bus DWZZA Cabling

CXO-3871A-MC

8. Connect the input SCSI–P cable from the host or the desktop converter to the trilink connector.

9. Connect a SCSI–P cable from the trilink connector to the input connector on the second DWZZA–VA.

10. Ensure that the differential bus is terminated on the last DWZZA on the bus (see Section 6.4.1).

11. Label the SBB bezels with the status of both the differential terminator and the single-ended terminator as either "IN" or "OUT."

12. Install the SBB DWZZA signal converter, connect the SCSI cable, and apply power to the shelf.

13. Observe the system to determine if the SCSI bus and devices are functioning properly.

A

StorageWorks Product Specifications

This appendix chapter describes the physical and environmental specifications for the StorageWorks products. See the *Digital Systems and Options Catalog* for the operating specifications for storage devices, controllers, and host computers.

A.1 Input Power Requirements

The input power requirements for a StorageWorks enclosure are determined by the number of shelves, the enclosure power distribution units, the fans, and other features.

A.2 Power Units

Each StorageWorks shelf requires an ac or dc power unit. The power unit type is determined by the enclosure power system, either ac or –48 V dc.

All shelves can have a redundant power unit to ensure that a power unit failure does not disable the shelf. In most cases, battery backup units (BBUs) can be combined with the shelf power unit to provide extended system data integrity. See the following table and *StorageWorks Family User's Guide* for more information about the power units.

Table A-4 contains the specifications for the BA35X–HA, the BA35X–HB, and the BA35X–HC StorageWorks power units.

Table A–1   StorageWorks Power Units

Specifications	BA35X–HA	BA35X–HB	BA35X–HC
Power unit type	AC input	DC input	Battery backup
Input voltage range	90–264 V ac	36–72 V dc	N/A
Nominal input voltage	110 V ac	48 V dc	12 V dc‡
Autoranging feature	Yes	Yes	No
Output voltages	12 V dc 5 V dc	12 V dc 5 V dc	12 V dc 5 V dc
Output power†	131 W	131 W	200 W *peak* power for 16, 32, or 64 seconds

† Sequential device spin-up at 4-second interval mandatory.
‡ Charging voltage.

A.3 Physical Specifications

Table A–2 lists the physical specifications of the cabinets, StorageWorks shelves, and StorageWorks building blocks (SBBs).

_____ **Note** _____

The depth specifications in Table A–2 do not include the service area requirements, which are as follow:

- The data center cabinet requires both front and rear service areas of 762 millimeters (30 inches).

- Deskside expansion enclosures are portable and should be positioned to provide a front or rear service area of 762 millimeters (30 inches).

- Desktop expansion enclosures do not require a service area.

_____

Table A–2 StorageWorks Cabinet Physical Specifications

Description	Height mm (in)	Width mm (in)	Depth mm (in)	Capacity†
StorageWorks Enclosures				
SW500-series data center cabinet	1070 (42.1)	600 (23.6)	875 (34.5)	10
SW800-series data center cabinet	1700 (66.6)	800 (31.5)	875 (34.5)	24
Deskside expansion enclosure	578 (22.75)	203 (8.0)	400 (15.75)	1
Deskside expansion enclosure‡	578 (22.75)	356 (14.0)	400 (15.75)	N/A
Desktop expansion enclosure	60 (2.4)	432 (17.0)	400 (15.7)	N/A
StorageWorks Shelves				
BA350–EA controller and SBB shelf	300 (11.8)	445 (17.5)	350 (13.8)	
BA350–LA SBB shelf	150 (5.9)	445 (17.5)	350 (13.8)	
BA350–SA SBB shelf	150 (5.9)	445 (17.5)	350 (13.8)	
BA350–MA controller shelf	150 (5.9)	445 (17.5)	350 (13.8)	
StorageWorks Building Blocks				
3½-inch SBB	121 (4.8)	51 (2.0)	216 (8.5)	
5¼-inch SBB	121 (4.8)	152 (6.0)	267 (10.5)	

† BA350–SA SBB shelves.

‡ StorageWorks RAID Array 110 Subsystem configuration.

A.4 Environmental Specifications

The StorageWorks product line environmental specifications listed in Table A–3 are the same as for other Digital storage devices.

Table A–3 Environmental Specifications

Condition	Specification
Optimum Operating Environment	
Temperature Rate of change Step change	+18° to +24°C (+65° to +75°F) 3°C (5.4°F) 3°C (5.4°F)
Relative humidity	40% to 60% (noncondensing) with a step change of 10% or less (noncondensing)
Altitude	From sea level to 2400 m (8000 ft)
Air quality	Maximum particle count .5 micron or larger, not to exceed 500,000 particles per cubic ft of air
Inlet air volume	.026 cubic m per second (50 cubic ft per minute)
Maximum Operating Environment (Range)	
Temperature	+10° to +35°C (+50° to +95°F) Derate 1.8°C for each 1000 m (1.0°F for each 1000 ft) of altitude Maximum temperature gradient 11°C/hr (20°F/hr) ±2°C/hr (4°F/hr)
Relative humidity	10% to 90% (noncondensing) Maximum wet bulb temperature: 28°C (82°F) Minimum dew point: 2°C (36°F)
Maximum Nonoperating or Storage Environment (Range)	
Temperature Nonoperating Storage	 +18° to +29°C (+65° to +85°F) −40° to +66°C (−40° to +151°F)
Relative humidity Nonoperating Storage	 10% to 90% (noncondensing) 8% to 95% in original shipping container (noncondensing); otherwise, 50% (noncondensing)
Altitude	From −300 m (−1000 ft) to +3600 m (+12,000 ft) MSL

A.5 Environmental Stabilization

To ensure proper operation of Digital storage devices, the SBB temperature must be within 18–29°C (65–85°F). Table A–4 specifies the time required to thermally stabilize SBBs based on the ambient shipping temperature.

CAUTION

Always stabilize storage devices in the operating environment prior to installation or operation. Otherwise, the media or associated electronics may be damaged when power is applied to the unit.

If condensation is visible on the outside of the storage device:

Stabilize the device and the SBB in the operating environment for 6 hours or until the condensation is no longer visible, whichever is longer. Do not insert the storage device into the shelf until it is fully stabilized.

If condensation is not visible on the outside of the storage device:

Thermally stabilize the device for the amount of time specified in Table A–4.

Table A–4   Thermal Stabilization Specifications

Ambient Temperature Range °C	Ambient Temperature Range °F	Minimum Stabilization Time
60 to 66	140 to 151	3 hours
50 to 59	122 to 139	2 hours
40 to 49	104 to 121	1 hour
30 to 39	86 to 103	30 minutes
18 to 29	65 to 85	None
10 to 17	50 to 64	30 minutes
0 to 9	32 to 49	1 hour
−10 to −1	14 to 31	2 hours
−20 to −11	−4 to 13	3 hours
−30 to −21	−22 to −5	4 hours
−40 to −31	−40 to −21	5 hours

Glossary

ac distribution

The method of distributing ac power in a cabinet.

adapter

See *SCSI signal bus converter*.

ANSI

American National Standards Institute

Battery backup unit

See *BBU*.

BBU

Battery backup unit. StorageWorks power unit option that extends power availability after the loss of primary ac power or a power supply to protect against the corruption or loss of data.

_____ **Note** _____

The BBU does not provide power for the operation of a storage device. It only provides power for protecting data.

_____

building block shelf

See *SBB*.

cold-swap

A method of device replacement that requires that power be removed from one or more shelves in a cabinet thereby affecting other devices therein. User applications that are not dependent upon the devices being swapped are impacted as a result. This method is used when conditions preclude the use of a warm-swap or hot-swap method. Normally, this method is only used when installing or upgrading a StorageWorks subsystem.

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

controller

A hardware/firmware device that manages communications on behalf of host systems over the SCSI bus to devices, such as the HSC–series, HSJ–series, and HSZ–series controllers. Controllers typically differ by the type of interface to the host and provide functions beyond what the devices support.

controller and SBB shelf

A generic reference to a StorageWorks shelf that can contain both controller SBBs and storage SBBs, for example, a BA350–EA shelf.

controller shelf

Any StorageWorks shelf that contains *only*] controllers and cache memories, for example, a BA350–MA shelf.

deskside expansion unit

The StorageWorks floor mounted stand stand that encloses a BA350–SA SBB shelf. Two units are used to enclose a BA350–EA controller and SBB shelf.

differential SCSI bus

A signal's level is determined by the potential difference between two wires. A differential bus is more robust and less subject to electrical noise than is a single-ended bus.

disk

A storage device supporting random access to fixed size blocks of data.

DWZZA

The StorageWorks compatible SCSI bus signal converter.

See *SCSI bus signal converter*.

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.

full-height

(1) In the storage industry, a device of conventional dimensions. (2) A single device mounted in an 5¼-inch SBB. Full-height devices have an order number suffix of "VA."

half-height

(1) In the storage industry, a device of conventional dimensions, except for height. (2) A device that occupies only one-half of a 5¼-inch SBB. The first half-height device is always mounted in the lower (bottom) part of the SBB. The second device in an SBB is mounted in the upper (top) part of the SBB.

host

The primary or controlling computer or any such (in a multiple computer network) to which storage is attached.

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. User applications that are not dependent upon the device being swapped are not impacted.

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

logical bus

A single-ended, physical bus connected to a differential, physical bus by a SCSI bus signal converter.

physical bus

Two SCSI terminators separated by a cables, connectors, and backplane circuitry.

RAID

Redundant Array of Independent Disks

SBB

StorageWorks building block. The basic building block of the StorageWorks product line. Any device conforming to shelf mechanical and electrical standards installed in either a 3½-inch or 5¼-inch carrier is considered to be an SBB, whether it be a storage device, a power supply, or other device.

SBB shelf

The common name for any StorageWorks shelf that contains only power supply and storage SBBs.

SCSI

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

SCSI bus signal converter

Sometimes referred to as an adapter. (1) A connecting device that permits the attachment of accessories or provides the capability to mount or link units. (2) The device that connects a 16-bit, differential SCSI bus operating in the 8-bit mode to an 8-bit, single-ended SCSI bus.

SCSI busing connection

A connection in the SCSI bus between two terminators such as the SBB shelf SCSI input connector.

SCSI device

A host computer adapter, a peripheral controller, or an intelligent peripheral that can be attached to the SCSI bus.

SCSI device ID

The bit-significant representation of the SCSI addressing referring to one of the signal lines numbered 0 through 7. Also referred to as *target ID*.

SCSI device-side device address

The eight device addresses (target IDs) assigned to the SCSI controller and the devices it controls.

See also *SCSI host-side device address*.

SCSI end-bus position

The physical location of a controller, a SCSI bus controller, or a device that contains the bus terminator.

SCSI host-side device address

The eight device addresses (target IDs) assigned to the host device and the SCSI controllers and the devices it controls.

See also *SCSI device-side device address*.

SCSI mid-bus

The physical location of a controller or a device that the SCSI bus passes through enroute to the controller or device that contains the SCSI bus termination.

SCSI–A cable

A 50-conductor (25 twisted pair) cable used for single-ended, SCSI–2 bus connections.

SCSI–P cable

A 68-conductor (34 twisted pairs) cable used for differential bus connections.

single-ended SCSI bus

Each signal's logic level is determined by the voltage of a single wire in relation to ground.

Small Computer System Interface

See *SCSI*.

StorageWorks

The Digital set of enclosure products that allows customers to design and configure their own storage subsystem. Components include power, packaging, and interconnections in a StorageWorks shelf. SBBs and array controllers are integrated therein to form storage subsystems. System-level enclosures to house the shelves and standard mounting devices for SBBs are also included.

StorageWorks building block

See *SBB*.

tape

A storage device supporting sequential access to variable sized data records.

tape controller

See *controller*.

target

A SCSI device that performs an operation requested by an initiator.

target ID

See *SCSI device ID*.

warm-swap

A method of device replacement whereby the complete system remains on line during device removal or insertion. Activity may be suspended or paused 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. User applications that are not dependent upon the devices on the *affected SCSI bus* are not noticeably impacted.

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

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