StorageWorks™

Solutions

7 Device, 16-Bit SBB Shelf (BA356–S Series)

User's Guide

Order Number: EK–BA356–UG. B01

This publication describes the major StorageWorks 16-bit components (such as shelves, power units, SBBs, SCSI buses, I/O modules, and cables), status displays, specifications, and replacement procedures.

Digital Equipment Corporation
Maynard, Massachusetts

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While Digital believes the information included in this publication is correct as of the date of publication, it is subject to change without notice.

FCC ID: AO9-BA356

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

Any changes or modifications made to this equipment may void the user's authority to operate this equipment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

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Preface

The *StorageWorks Solutions 7 Device, 16-Bit SBB Shelf, BA356–S series User's Guide* introduces the 16-bit StorageWorks™ system and the elements common to the shelves, StorageWorks building blocks (SBBs), and other components. This guide also describes the components, status reporting, replacement procedures, power, small computer system interface (SCSI) buses, SCSI bus signal converters, and specifications.

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.

Note

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

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 StorageWorks components.
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	Lists the physical and electrical specifications for the StorageWorks family components.
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Manufacturer's Declarations

Acoustic Noise Declaration

BA356–SB StorageWorks Building Block Shelf
Acoustics–Preliminary Declared Values per ISO 9296 and ISO 7779

	Sound Power Level L_{WAd}, B		Sound Pressure Level L_{pAm}d BA, (Bystander Positions)	
Product	**Idle**	**Operate**	**Idle**	**Operate**
BA356–SB SBB Shelf	5.8	5.8	41	41
BA356–SB SBB Shelf with : Seven RZ26–VA Disk Drives	5.9	5.9	41	41
Deskside Expansion Enclosure at the Side of the Desk				
BA356–SB SBB Shelf	5.7	5.7	40	40
BA356–SB SBB Shelf with : Seven RZ26–VA Disk Drives	5.8	5.8	40	40

	Schalleistungspegel L_{WAd}, B		Schalldruckpegel L_{pAm}, dBA (Beistehende Position)	
Gerät	**Leerlauf**	**Betrieb**	**Leerlauf**	**Betrieb**
BA356–SB SBB Shelf	5,8	5,8	41	41
BA356–SB SBB Shelf mit : 7 RZ26–VA Disk Drives	5,9	5,9	41	41
Deskside Expansion Enclosure neben einem Schreibtisch				
BA356–SB SBB Shelf	5,7	5,7	40	40
BA356–SB SBB Shelf mit : 7 RZ26–VA Disk Drives	5,8	5,8	40	40

1
Introduction

The *StorageWorks Solutions 7 Device, 16-Bit SBB Shelf BA356–S series User's Guide* is the basic StorageWorks document. This guide provides information for configuring and operating a system.

1.1 StorageWorks Components

See the *StorageWorks Solutions Products Catalog* for a complete listing of the StorageWorks family products.

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

- Shelf status
- Power supplies
- Power unit status
- Power requirements
- Storage device status
- Component functions
- Shelf replacement procedures
- I/O module replacement procedures
- Blower replacement assembly procedures
- **Small computer system interface (SCSI)** buses
- **StorageWorks building block (SBB)** replacement procedures

Note

The procedures for installing either an **16-Bit SBB shelf**, a **controller shelf**, or a **controller and an SBB**, routing cables, and connecting cables are unique to each cabinet and are described in the cabinet manuals.

1.2 Shelf Description

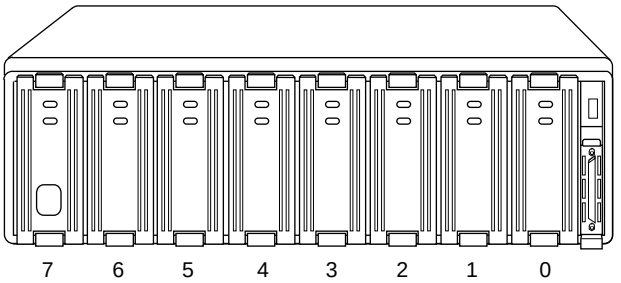
The SBB shelf shown in Figure 1-1 can be used in several different cabinets and orientations. The dimensions of this shelf are as follow:

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

The shelf has the following capabilities and characteristics:

- The capacity of the shelf is eight 3.5-inch SBBs and a I/O module.
- , The SBB slots are numbered 0 through 7 from right to left (see Figure 1-1), starting with the slot adjacent to the I/O module (16-bit I/O module is shown).

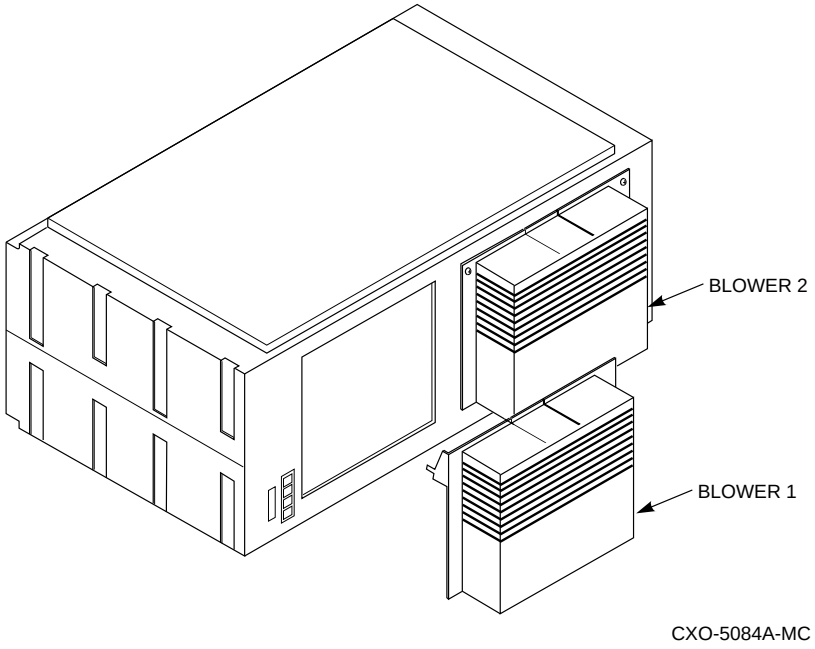
Figure 1-1 Typical 16-Bit Shelf—Front View



- The I/O module provides a multifunction 8- or 16-bit extension of the 16-bit SCSI backplane. It functions as a platform onto which a wide range of logical and interactive circuitry can be placed.
- The I/O module provides the means of configuring device addressing in each shelf to permit a one- or two-shelf **daisy chain** array on one SCSI bus. This provides full 16-bit SCSI address space in two shelves.
- There are seven SCSI bus device addresses (that is, **target IDs**) that are numbered 0 through 6. These addresses can be assigned to either 3.5-inch or 5.25-inch SBBs.
- The single shelf SCSI device addresses and the slot numbers are the same for slots 0 through 6. Slot 7 is reserved for the shelf power unit and does not have a device address.
- Slot 6 can be used for either a storage SBB, a redundant power unit, or **battery backup unit (BBU).**
- There are two 50-pin, high-density, female SCSI connectors on the 8-bit I/O module that are used for I/O and daisy chaining shelves.
- There are two 68-pin, high-density, female SCSI connectors on the 16-bit I/O module that are used for I/O and daisy chaining shelves.
- The cabinet ac or dc cable distribution unit determines the type of power unit installed in slot 7. The output of the power unit is +5 V dc and +12 V dc.

- As shown in Figure 1-2, each shelf has two blowers mounted on the rear of the shelf. These blowers pull air through the shelf and exhaust it out the rear.

Figure 1-2 Blower Assembly



- The I/O module monitors the blower operation via the logic signals on the backplane:
  - If a high ambient temperature condition is detected, both blowers automatically switch to high speed.
  - If one blower is defective, the other blower automatically switches to high speed to compensate.

The backplane supports SCSI–2 standards with 16-bit cabling and addressing as proposed in SCSI–3.

2

StorageWorks Status Reporting

This chapter describes the logic signals, their states and functions, and how to interpret the light emitting diode (LED) displays.

2.1 Shelf Status

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 LEDs. In addition to the visual display, the shelf generates logic signals for processing by the SCSI controller or the host featuring the high-availability storage subsystem fault bus.

The StorageWorks shelf power supply provides dc power, and the blowers provide cooling for storage devices. Failure of all blowers on a shelf causes devices to overheat and fail. When there is only *one* power supply on a shelf, the loss of either dc voltage (+5 V dc, +12 V dc) causes the controllers, cache memories, and storage devices to malfunction. The status of the power supplies and the blowers is displayed by the power supply LEDs. This status signal is available for processing by the SCSI controller or host featuring the high-availability storage subsystem fault bus.

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 two blowers and at least one power supply providing the +5 V dc and +12 V dc.

2.1.1 SHELF_OK Signal

All StorageWorks shelves can accommodate either two ac or two dc power supplies. The loss of any dc voltage or blower causes the SHELF_OK signal to change from a high level to a low level and turn off the upper power supply LED, even if 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 V dc and +12 V dc.

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. These controllers implement the high-availability storage subsystem fault bus.

2.1.2 Processing the SHELF_OK Signal

The controller can process the SHELF_OK signal only if the shelf is properly configured. Make sure that a jumper is properly installed on the shelf backplane.

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 *could* result in the power supply LEDs displaying incorrect shelf status.

Use the procedures in the following sections to configure the SHELF_OK signal.

2.1.3 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 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 Jumper

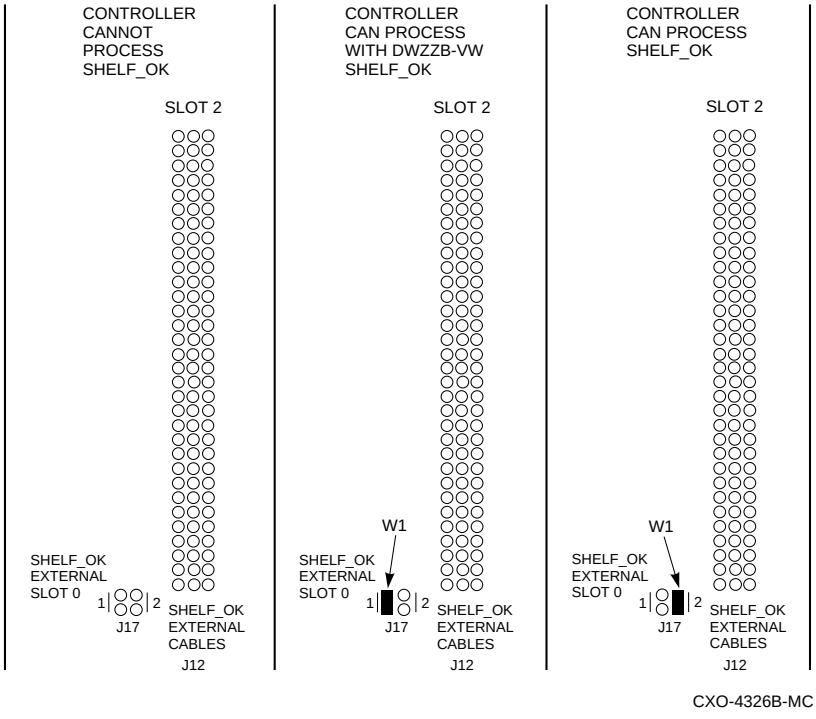


Table 2-1 SHELF_OK Jumper

Controller Condition	W1 Position	Comments
The SCSI controller cannot process the SHELF_OK signal	NONE	Do not install jumper.
A controller that can process a Shelf_OK signal and a DWZZB–VW SCSI signal converter is 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.

† Refer to the DWZZB–VW in EK–DWZZx–UG. A01.

2.2 Shelf Status and Power Supply Status

The status of both the shelf blowers and the power supplies is displayed by the green power supply LEDs as shown Figure 2-2. The upper LED displays the shelf status and the lower LED displays the power supply status.

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

Figure 2-2 Power Supply LEDs

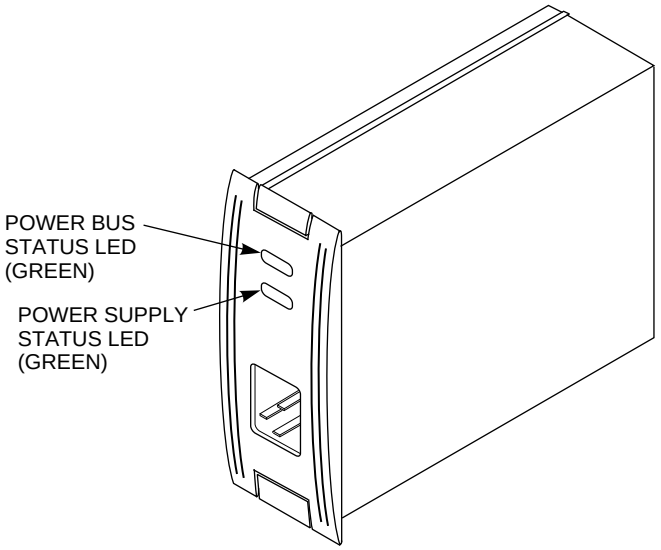


Table 2-2 Shelf and Single Power Supply Status LEDs

Status LED	State	Indication
Shelf (upper) PS (lower)	On On	Normal operation.
Shelf (upper) PS (lower)	Off Off	Fault status, shelf and power supply fault. Replace power supply as described in Section 4–1.
Shelf (upper) PS (lower)	Off On	Fault status, shelf fault but no power supply fault. Replace shelf blower.

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

† Shelf power supply installed in slot 7.
‡ Redundant power supply installed in slot 6.
§ See I/O module indicators to determine the failed blower.

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 High-availability storage subsystem fault bus controls the fault (lower) LED.

As shown in Figure 2-3, each storage SBB has two LED indicators that display the SBBs 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 status LED and indicates an error condition when it is either on or flashing.

Figure 2-3 Storage SBB LEDs

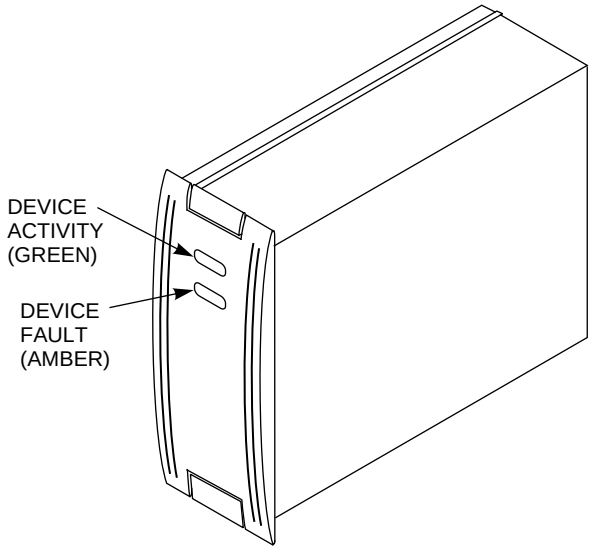


Table 2-4 defines the valid states for these LEDs.

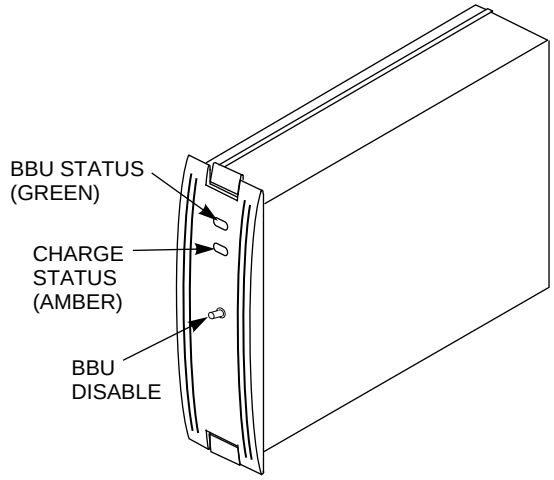
Table 2-4 Storage SBB Status LEDs

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. Digital recommends that you replace the SBB.
Device activity Device fault	Off On	Fault status SBB is inactive and spun down. Digital recommends that you replace the SBB.
Device activity Device fault	On Flashing	Fault status SBB is active and is spinning down because of the fault.
Device activity Device fault	Off Flashing	Fault status SBB has been identified by the controller as failed. Digital recommends that you replace the SBB.

2.4 Battery Backup Unit Status

The LEDs shown in Figure 2-4 display the status of the BBU.

Figure 2-4 BBU LEDs



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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. **Error! Reference source not found.** defines the valid states for these LEDs.

Table 2-5 BBU Status LEDs

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

2.5 16-Bit I/O Module Status

16-Bit I/O module LEDs indicate a blower failure or overtemperature condition. An ambient temperature above 32 ±2°C (90 ±3°F) causes both blowers to operate at high speed. Figure 2-5 and Table 2-6 define the valid states for these LEDs. Table 2-2 defines the power supply shelf status LED's.

Figure 2-5 16-Bit I/O Module LEDs

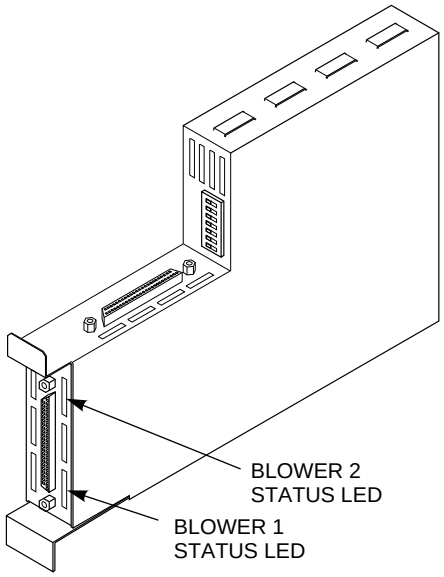

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Table 2-6 16-Bit I/O Module Status LEDs

LED	Status	Indication
Blower 2†	Off	Normal status. Blowers are operational.
Blower 1	Off	
Power Supply Shelf Status	On	
Blower 2	On	Overtemperature condition. Both blowers to high speed.
Blower 1	On	
Power Supply Shelf Status	On	
Blower 2	On	Blower 2 has failed. Blower 1 to high speed.
Blower 1	Off	
Power Supply Shelf Status	Off	
Blower 2	Off	Blower 1 has failed. Blower 2 to high speed.
Blower 1	On	
Power Supply Shelf Status	Off	
Blower 2	On	Both blowers failed.
Blower 1	On	
Power Supply Shelf Status	Off	

† See Figure 1-2 for blower identification.

3

Replacement Procedures

This chapter describes the detailed procedures for replacing SBBs and blowers and the general procedures for replacing an SBB shelf.

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 device address

Once a device with a specific device address has been initialized on a SCSI bus, moving the device to another bus or changing the device address can cause the bus to be erratic.

Adding devices to a redundant array of independent disks (RAID) set 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 the same device address that they had prior to the expansion).

A label on the front of the SBB identifies the bus and device address for each storage device. Figure 3-1 shows the factory and user entered definitions on a typical SBB identification label.

3.1 Replacing a Storage Device or a Power Unit

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

The light emitting diodes (LEDs) on the front of the SBB indicate the status, either active or inactive. The three SBB replacement methods are listed as follows:

CAUTION

If you are not certain that your SCSI controller supports hot swap, Digital recommends using warm swap to protect the integrity of your data.

1. Use hot swap to remove and replace SBBs from a system that is on-line and active. Not all controllers support hot swap. Digital HSZ10™, and HSZ15™ controllers support hot swap.

   Read the controller documentation to determine which controller-supported swap method to use.

   Use hot swap 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.

CAUTION

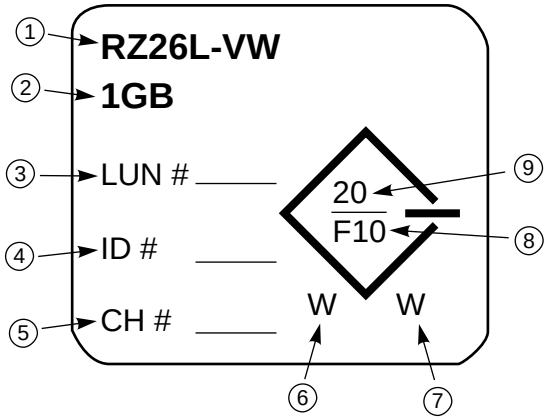
Warm swap *only* if the device activity LED is *off* and the controller supports warm swap. The following Digital controllers support warm swap: HSD30-series, HSJ30-series, HSJ40-series, HSZ40-series, and HSD05.

2. Use warm swap *only* if you quiesce the bus. Quiesce the bus by removing all signal activity.
3. Use cold swap during initial installation or when adding shelves. All devices are inactive and without power and are not operational until power is restored.

3.1.1 SBB Identification Label

The SBB identification label shows the SBB device, the shelf bus type (8- or 16-bit), and user specific information (see Figure 3-1).

Figure 3-1 SBB Identification Label



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The following describes the SBB identification label nouns and symbols:

1. **Order Number** is the type of SBB.
2. **Capacity** is the total amount of data the device stores.
3. **SCSI Logical Unit Number** is assigned by the user.
4. **SCSI ID** is assigned by the user.
5. **Controller Channel Number** is assigned by the user.
6. **Device Bus Width** is either narrow (N) or wide (W):
   N is a 8-bit device
   W is a 16-bit device
7. **Device Bus Compatibility** is the type of shelf in which the device functions.
   N - the device is 8-bit shelf compatible.
   W - the device is 16-bit shelf compatible.
   N/W - the device is compatible with either shelf.
8. **Bus Bit Rate in Mbits** is the speed of the bus:
   S - Slow device (5 Mb/s)
   F - Fast device (10 Mb/s)
   10 is Mbits per second.
9. **Transfer Rate in MB** is the data transfer rate in MBytes per second.

3.1.2 Replacing an SBB

Use the following procedure to remove or replace an SBB:

CAUTION

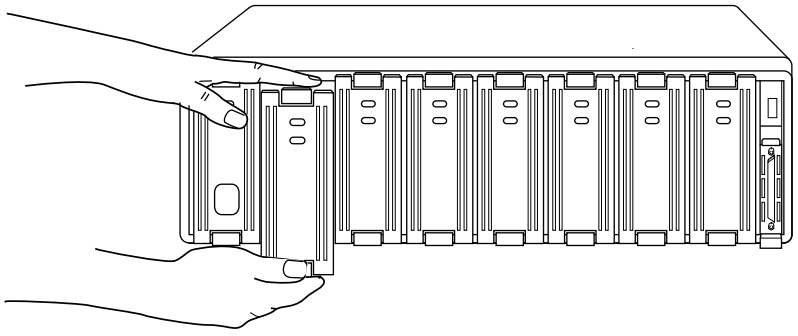
Be sure that the replacement device is the same model as the one being replaced. When removing or replacing an SBB, always use both hands to support the weight of the SBB.

CAUTION

Touching the SBB connector can cause **electrostatic discharge (ESD)** damage to the SBB.

1. Press the two mounting tabs together to release the SBB (see Figure 3-2).
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 battery backup unit SBB, the amber charge status LED is on.

Figure 3-2 Removing an SBB from the Shelf



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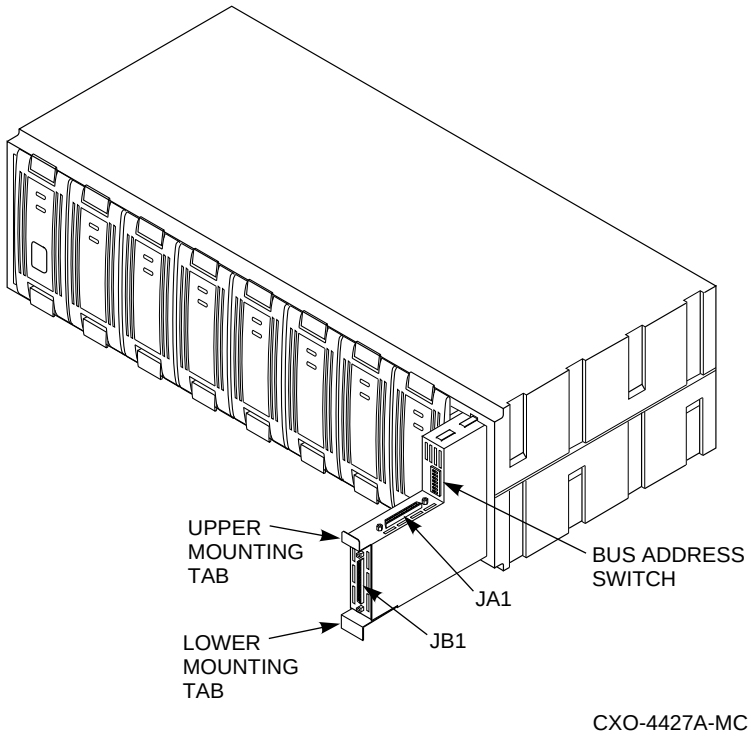
3.1.3 Replacing the I/O Module

Use the following procedure to remove the I/O module (see Figure 3-3):

CAUTION

Be sure that the I/O module is the same model as the one being replaced.

Figure 3-3 Removing the I/O Module from the Shelf



1. Loosen the two captive screws on the lower cable connector JB1 and remove the cable from the I/O module.
2. Press the two mounting tabs together and pull forward to release the module.
3. Pull the I/O module partially out of the shelf.
4. Loosen the two captive screws on the upper cable connector JA1 and remove the cable from the I/O module.
5. Pull the module out of the shelf.
6. Set the bus address switches on the replacement I/O module to match the settings on the removed I/O module (refer to section 2.5).

CAUTION

To prevent system failure, install the replacement module with the lower mounting tab on the bottom of the shelf (see Figure 3-3).

7. Insert the replacement module into the guide slots and push it partially into the shelf.
8. Insert the upper cable connector JA1 and tighten the two captive screws.
9. Push the module into the slot until it is fully seated and the lower mounting tab engages the shelf.
10. Insert the lower cable connector JB1 and tighten the two captive screws.
11. When power is applied, make sure that the I/O module status LEDs light and then go off.

3.2 Replacing a Blower Assembly

Each StorageWorks shelf has blowers mounted on the rear. Connectors on the backplane provide the +12 V dc of power to operate the blowers. When a blower fails, the shelf status (upper) LED on the power SBB is *OFF* and an error message is passed to the controller or host via the shelf status signal. The remaining blower automatically switches to high speed and the I/O module status LEDs indicate which blower has failed (see Figure 2-5).

WARNING

Service procedures described in this guide 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 supplies before removing shelf blower assemblies or performing service in the backplane area, such as modifying the SCSI bus.

Use one of the following procedures to replace a blower (see Figure 3-4).

Note

Be aware that the blowers on this shelf are dual speed blowers and should be replaced *only* with dual speed blowers.

CAUTION

Shelf air flow is lost when a blower is removed. Replace the blower immediately or damage can result.

If you *CAN* access the blowers, proceed as follows:

1. Use a Phillips screwdriver to remove the safety screw (see Figure 3-4).
2. Press the upper and lower blower mounting tabs together to release the blower.
3. Pull the blower straight out to disconnect it from the shelf power connector.
4. Align the replacement blower connector and push the blower straight in, making sure that both mounting tabs lock in place.

5. Insert the safety screw.
6. Verify that the shelf and all SBBs are operating properly by observing the LEDs.

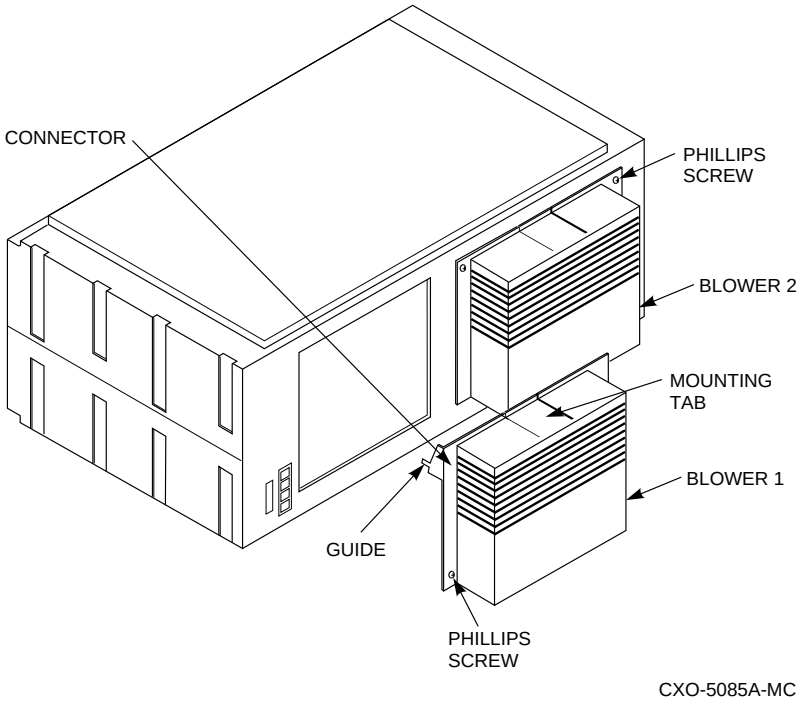
If you *CANNOT* access the blowers, proceed as follows:

1. If you cannot access the rear of the shelf, remove the shelf as described in Section 3.3.1.
2. Use a Phillips screwdriver to remove the safety screw.
3. Press the upper and lower blower mounting tabs together to release the blower.
4. Pull the blower straight out to disconnect it from the shelf power connector.
5. Align the replacement blower connector and push the blower straight in, making sure that both mounting tabs lock in place.
6. Insert the safety screw.
7. Install the shelf as described in Section 3.3.2**.**
8. Verify that the shelf and all SBBs are operating properly by observing the LEDs.

Note

If the I/O module status LEDs are not off and the all shelf power supplies are operating, the second blower could have failed or the wrong blower was replaced.

Figure 3-4 Replacing a Blower Assembly



3.3 Replacing a StorageWorks Shelf

The procedures for removing or replacing any StorageWorks shelf are basically the same. The major differences are the shelf orientation and the type of enclosure or cabinet in which the shelf is mounted. Normally, a shelf is removed only to replace a blower.

Installing an additional shelf is not within the scope of this guide. Detailed instructions for installing a shelf in a cabinet are contained in the cabinet installation guide.

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. Disconnect the power cords to remove shelf power.
2. Record the location of the storage devices in the shelf before removing the SBBs.
3. Record the location of the controller interface cables before removing.
4. Record the location of the SCSI cables before removing.
5. Remove the I/O module (refer to Section 3.1.3, steps 1 through 5).
6. Remove the SBBs.
7. Remove both the front locking brackets.

WARNING

A shelf with devices in all slots weighs approximately 15 kilograms (33 pounds). Be sure to fully support the weight of the shelf with both hands at all times to protect yourself and avoid damaging the devices.

8. 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 (refer to Section 2.1.3).
2. Orient the shelf and carefully slide it into the mounting brackets.
3. When it is fully seated, install the front locking brackets.
4. Install each SBB, controller, or cache memory in the same slot from which it was removed and connect the power cords.
5. Install the I/O module (refer to Section 3.1.3, steps 6 through 11).
6. Connect each controller interface cable to the same connector from which it was removed.
7. Make sure that the shelf, power supplies, and all devices are functioning properly.

If you replaced a shelf blower, make sure that both blowers are functioning properly.

4

Power

This chapter describes the StorageWorks power units and power configuration rules. Each of the StorageWorks power units are mounted in 3.5-inch SBBs.

Listed below are the types of 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 supports a maximum of seven 3.5-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 can be mounted in slot 6.
- Both ac and dc power supplies are used in the same shelf as either the shelf power supply or the redundant power supply.

Table 4-1, Table 4-2, and Table 4-3 describe the StorageWorks power units, dc power requirements, and the receptacle wiring for each shelf, respectively.

CAUTION

Only the power units listed in Table 4-1 are used in the StorageWorks product line. The power units pose no safety hazard to personnel during their replacement, provided that the configuration rules described in section 4.1 are followed *exactly*.

Table 4-1 StorageWorks Power Units

Item	Description	
BA35X–HC	Battery Backup Unit	
	Quantity	Maximum of one per BA356 shelf
	Input:	+12 V dc from BA35X–HA or BA35X–HB
	Output:	+12 V dc, +5 V dc 200 W peak, internal selection for 16, 32, or 64 seconds
BA35X–HF	Power Factor Correcting ac input power supply	
	Quantity	Maximum of two per BA356 shelf
	Input:	90-132 V ac or 175-264 V ac, 47-63 Hz (autoranging, power factor correcting)
	Output:	150 W, +12 V dc, +5 V dc
BA35X–-HG	Universal dc input power supply	
	Quantity	Maximum of two per BA356 shelf
	Input:	38-60 V dc (nominal 48 V dc)
	Output:	150 W, +12 V dc, +5 V dc

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

CAUTION

If sequential device spin-up is less than 4 seconds, the power supply rating is exceeded and system operation is impaired.

Table 4-2 Typical SBB DC Power Requirements

	Steady State		Spin-Up	
Device	+5 V dc	+12 V dc	+5 V dc	+12 V dc
3.5-inch SBB	4 W	9.6 W	4 W	24.0 W
5.25-inch SBB	12 W	28.8 W	12 W	72.0 W
Blower	N/A	7.2 W	N/A	7.2 W

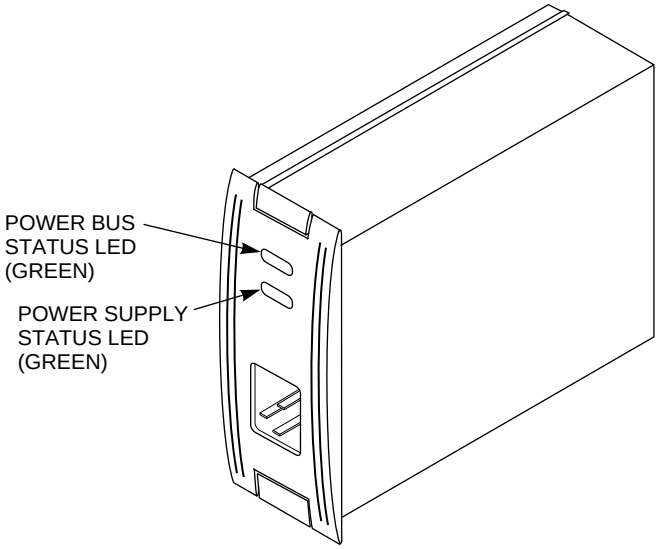
The power available for original equipment manufacturers (OEM) devices depends upon the device power requirements and power supply type used.

4.2 Universal AC and DC Input Power Supplies

Shelf and power supply status are displayed on the power supply LEDs shown in Figure 4-1. A complete description of the status signals generated by the shelf and power supply is contained in Table 2-2 and Table 2-3.

- The upper LED indicates shelf status.
- The lower LED indicates power supply status.

Figure 4-1 Power Supply Status LEDs



4.3 Battery Backup Unit

The LEDs on the BBU, shown in Figure 4-2, display the status of the BBU. The *valid* states of these LEDs are listed in Table 2-4.

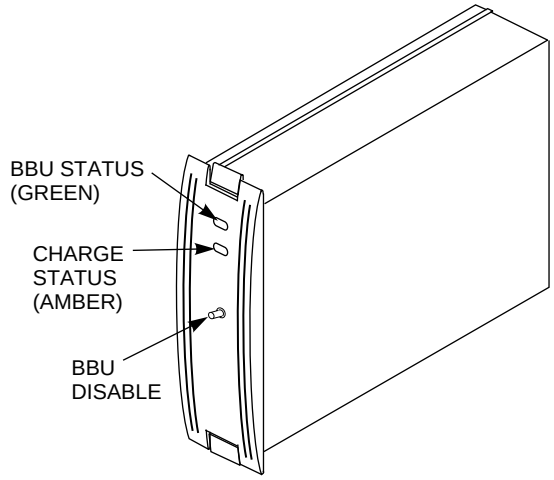
- The upper LED (green) is the BBU status LED.
- The lower LED (amber) is the charge status LED.

To remove power from a 16-bit shelf and prevent the BBU from supplying power to the shelf, push the BBU disable switch (see Figure 4-2) and remove the power.

Note

You must remove power within 5 seconds of pressing the BBU disable switch to prevent the battery from discharging.

Figure 4-2 BBU LEDs



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4.4 Power Supply Replacement

To remove power from a single power supply, you simply disconnect the power cable from that power supply.

There are three methods for replacing power units: hot swap, warm swap, and cold swap (refer to Section 3.1 for a detailed explanation for these methods). Digital recommends that you use the warm swap method whenever operational requirements permit.

4.4.1 Replacing a Shelf Power Supply

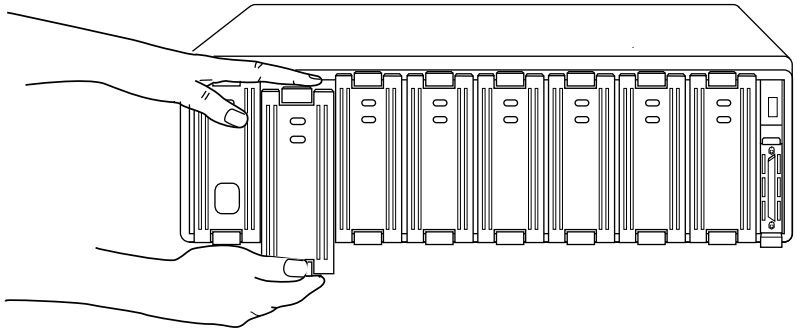
Complete the following procedure to replace either a shelf power supply or a redundant power supply:

Note

Use both hands when removing or replacing an SBB to fully support its weight.

1. Remove the input power cable from the shelf power supply.
2. Press the two mounting tabs to release the SBB, and slide the SBB out of the shelf, as shown in Figure 4-3.
3. Insert the replacement SBB into the guide slots push until the tabs lock in place.
4. Connect the input power cable to the shelf power supply.
5. Observe the LEDs and make sure the supply is functioning properly (refer Section 2.2).
6. If the shelf power is removed during power supply replacement, the controller must place the storage devices on-line sequentially at 4-second intervals. Make sure the LEDs on both the power supply and the storage device indicate normal operation.

Figure 4-3 Removing an SBB from a Shelf



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4.4.2 Replacing a BBU

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

WARNING

Use both hands when removing or replacing an SBB to fully support its weight.

1. Press the two mounting tabs to release the SBB, and slide the SBB 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 make sure the BBU is charging as specified in Section 2.2. The BBU should be fully charged in approximately 1 hour.

4.5 Power Cords and Cables

Each BA35X–HF and BA35X–HG universal input ac power supplies require 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.

Each BA35X–HB universal input dc power requires an individual dc power cable that has a plug receptacle and six female pins. Molex connector (part number 39-01-2060) mates with Molex connector (part number 39-00-0055). Table 4-3 describes the receptacle wiring.

Table 4-3 Power Receptacle Wiring

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

5

StorageWorks SCSI Buses

This chapter describes the SBB shelf SCSI buses, including bus lengths, terminators, jumpers, and component locations.

WARNING

Service procedures described in this guide 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.

Each BA356 shelf requires one of the following for a SCSI connection:

- I/O module
- I/O module and a DWZZB–VW
- DWZZB–VW and a termination module

A BA356 shelf with a 8-bit I/O module has the following:

- Two 50-pin, high-density, female, **single-ended**, SCSI–2 connectors: JA1 (upper) and JB1 (lower)
- Either one or two SCSI buses, as determined by the jumper board location and the optional terminator board

A BA356 shelf with a 16-bit I/O module has the following:

- Two 68-pin, high-density, female, **single-ended**, SCSI–3 connectors: JA1 (upper) and JB1 (lower)
- Either one or two SCSI buses, as determined by the jumper board location and the optional terminator board

5.1 Assigning Device Addresses

There is no device address switch on a 16-bit, 3.5-inch SBB. The BA356 shelf and the I/O module bus address switch automatically set the device address (Refer to Figure 5-1 and Table 5-1).

The 8-bit device address switches are located on the rear of some SBBs. Use the following rules to assign device addresses to 8-bit SBBs (disk drives, tape drives):

All 8-bit SBB devices in a 16-bit shelf must be assigned to addresses 0 to 6.

1. Each device address is used once on a SCSI bus.
2. Each device address is used once on an SBB shelf *unless* the shelf has multiple buses, the SBBs have device address switches, and a I/O module is installed.
3. An SBB has a six or an eight position device address switch. In all cases, the following is true:
   - Switch positions 1, 2, and 3 set the device SCSI address.
   - Switch positions 4, 5, and 6 disconnect the device address input from the backplane SCSI address setting.
   - Switch positions 7 and 8 are unused.
4. A 5.25-inch SBB can contain one full-height (FH), two half-height (HH) or three third-height (TH) devices. Use the following guidelines to set the device addresses on a 5.25-inch SBB with either two HH or three TH devices installed (see Figure 5-1).
   - Use the right switch to set the lower device address.
   - Use the middle switch to set the middle device address.
   - Use the left switch to set the upper device address.
5. Before installing the SBB in the shelf, set the device address switches on the rear of the SBB to one of the addresses shown in Table 5-1.

Figure 5-1 SBB Device Address Switches

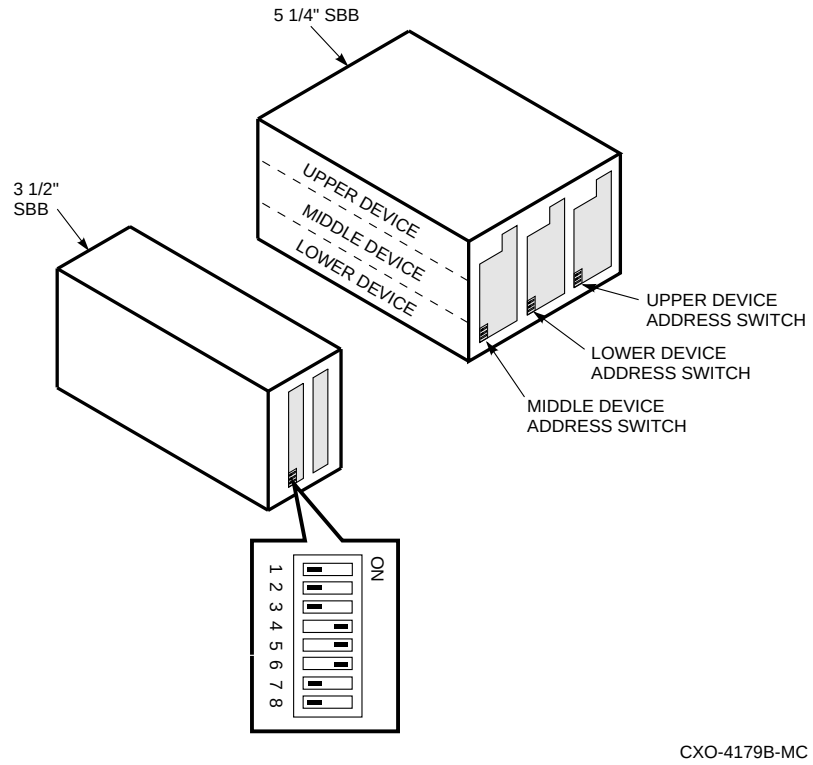


Table 5-1 SBB Device Address Switches

	Switch Number							
Address	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
5	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF
6	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
7*	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
Automatic†	OFF	OFF	OFF	ON	ON	ON	OFF	OFF

* Normally reserved for the host.

† Default setting; address is defined by the shelf connector.

Note

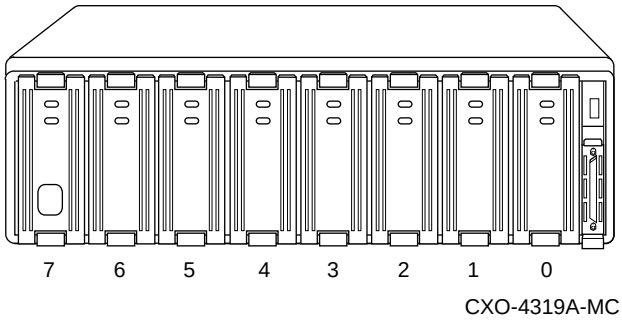
Only the middle switch is installed when there is a FH 5.25-inch device or only one HH or TH 5.25-inch device in a 5.25-inch SBB.

- 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 StorageWorks BA356 shelf is 7 for a single shelf or 14 for two shelves.
- The SBB device address for 3½-inch disk SBBs is determined automatically by its physical location in the shelf and the I/O module bus switch setting.
- When there is no address switch or the switch is set to automatic, the shelf backplane connector and the I/O module switch settings determine the **SCSI device** address. For example, in a single shelf configuration:
  - 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 16-Bit I/O Module

The 16-Bit I/O module is located on the right side of the shelf next to slot 0 (see Figure 5-2).

Figure 5-2 BA356 Shelf with 16-Bit I/O Module

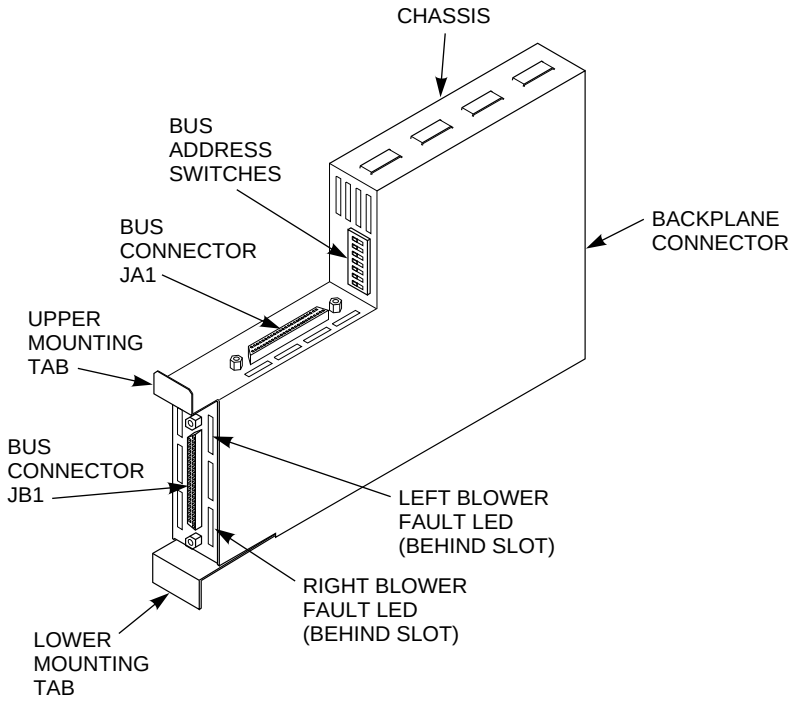


On the front of the I/O module (see Figure 5-3) is a seven-position bus address switch and two 68-pin female connectors: bus connector JA1, the data input connector and bus connector JB1, the data output connector.

Guides are embossed on the top and bottom of the I/O module to conform to slots built into the top and bottom of the shelf slot, that permit centering the module in the shelf slot. Two spring-steel mounting tabs lock into ledges molded into the top and bottom of the shelf secure the I/O module. Squeeze the mounting tabs together to pull the I/O module out of the shelf slot.

There are also six small slots in the chassis, three on each side of JB1. Behind two of these slots are the blower fault indicators. Behind the upper slot is the left blower fault LED and behind the lower slot is the right blower fault LED. Fans at the rear of the shelf draw air from the front to cool the I/O module.

Figure 5-3 16-Bit I/O Module Features



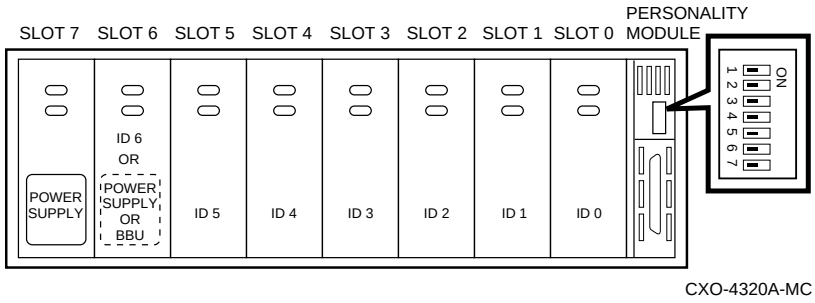
5.2.1 Address Switches

The shelf address switch sets single and dual-shelf configurations. A single shelf supports up to 7 devices, while a dual-shelf supports up to 14 installed devices.

5.2.1.1 Single Shelf Address Configuration

When one shelf is used, all switch positions are set to OFF, regardless of the number of installed devices. Disk addresses are set from 0 to 6 right to left on the shelf (see Figure 5-4).

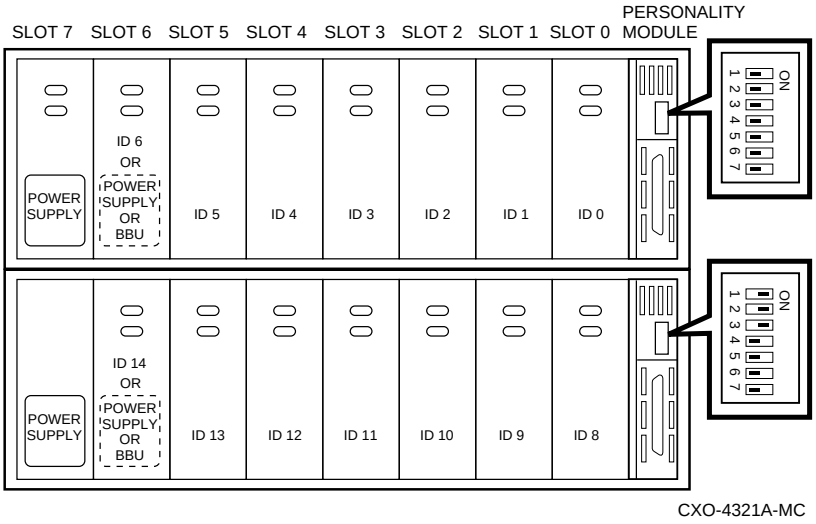
Figure 5-4 Single-Shelf Address Configuration



5.2.1.2 Dual-Shelf Address Configuration

When two shelves are used, the switch positions are set to OFF on the first shelf. The first three switches on the second shelf are set to ON for addresses 8 to 14, thereby providing the two shelves with up to 14 installed devices (see Figure 5-5).

Figure 5-5 Dual-Shelf Address Configuration



The terminator in the shelf 1 I/O module is automatically disabled if a SCSI cable is connected to the JB1 connector on the front of the module, and is attached to a standard SCSI device at the other end. This daisy chain permits configuration of two shelves with the termination provided in the second shelf.

Note

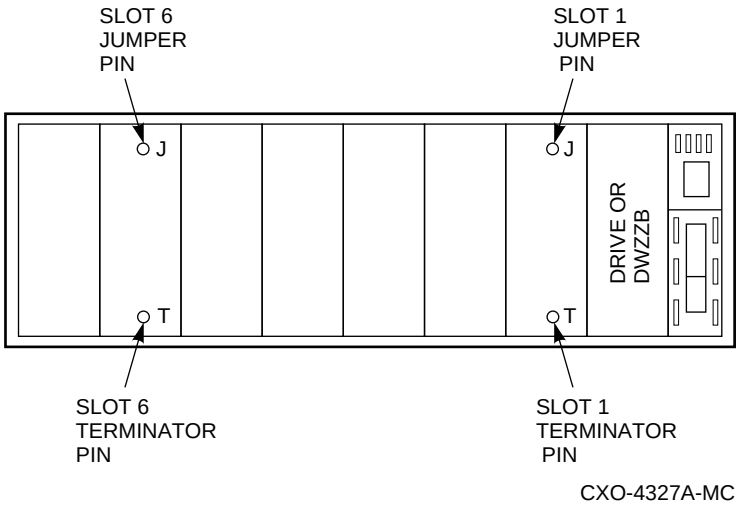
In dual shelf configuration, the connecting cable to the host computer or controller should be a maximum of 1 meter long, to maintain error-free operation at 10 MegaTransfers/sec. Longer cables can be used if the bus speed is reduced.

5.3 SCSI Bus Length and Termination

There are three important considerations for all SCSI buses. The first two considerations are the shelf jumper and the terminator. Each bus requires a terminator, whether internal to the I/O module or a separate terminator. Figure 5-6 shows the backplane location for the jumper and the optional terminator. The jumper (J) and terminator (T) connectors are mounted on the rear of the backplane.

The third consideration is to make sure that the host controller is configured to provide term-power for SCSI operation. Either install a jumper on the controller to enable term-power or use the software setup utility to enable term-power. (For further information, refer to the applicable controller installation documentation.)

Figure 5-6 16-Bit Backplane Termination



When installed, the terminator or jumper position can be determined from the front of the shelf by removing the SBBs in slot 1 and 6. An indicator pin protruding through the backplane in the T position in the bottom of the slot indicates a terminator is installed in that position. An indicator pin protruding through the J position in the top of the slot indicates a jumper is installed in that position.

Note

The terminator module is used in a dual bus configuration or when using a DWZZB–VW without a I/O module.

When configured as a single bus, a jumper module is required in slot 6 and the shelf termination is provided in the I/O module at the end of the bus. When configured as a dual bus, the optional terminator module is required in slot 6.

The I/O module terminator is automatically disabled when a cable is connected between the I/O module JB1 and a SCSI controller or second shelf.

Table 5-2 defines the maximum lengths of StorageWorks SCSI buses as measured between the two bus terminators. All bus lengths are rounded off to the nearest tenth of a unit.

Table 5-2 SCSI Bus Parameters

Bus Type	Mega Transfer per second	Mega B/S	Length Meters	Length Feet	Supported Shelves
16-bit, single-ended	10	20	3.0	9.8	2
16-bit, differential with a DWZZB–VW	10	20	25.0	82.0	2*

* Cable connected in front of DWZZB–VW

See section 5.5 for a 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**, or **controller**, and the BA356 shelf

The 1 meter length of the SBB shelf SCSI bus is measured from the input connector JA1 to the bus terminator in the I/O module.

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 remove the jumper module and reconfigure as a dual bus.

5.4 SCSI Bus Cables

The input and output cables on the SCSI bus connect to the two connectors on the front of the I/O module. The upper connector JA1 is a 68-pin, high density, female, input connector. The lower connector JB1 is a 68-pin, high density, female, output connector (refer to Figure 5-3). In dual bus configurations, JB1 functions as an input connector to the second bus.

There are two cable variations available:

1. High density cable with a 68-pin, right angle connector on each end (see Table 5-3).
2. High density cable with a 68-pin, right angle connector on one end and a 68-pin, standard connector on the other (see Table 5-4).

Note

Do NOT exceed the maximum 3 meter bus length.

Table 5-3 BN21L, 68-Pin High Density, Right Angle Connector Cable

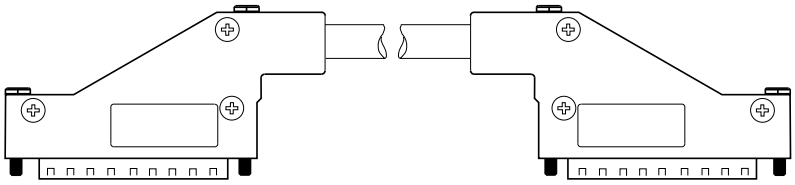
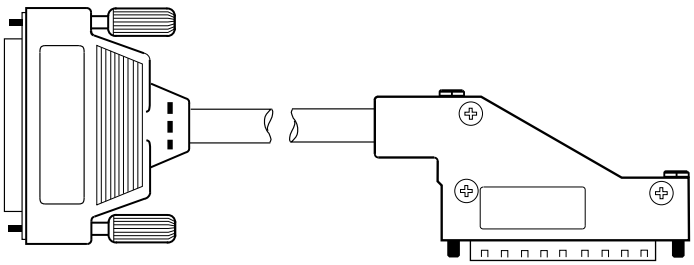
Cable Description	Meters	Feet	Order No
 CXO-4172A-MC_R			
Standard cable, 68-conductor with two 68-pin, high - density, right-angle connectors with screw fasteners.	0.3	0.5	BN21L–0B
	0.5	1.6	BN21L–0E
	1.0	3.3	BN21L–01
	2.0	6.5	BN21L–02
	3.0	9.8	BN21L–03
	5.0	16.4	BN21L–05
	10.0	32.8	BN21L–10
	15.0	49.2	BN21L–15
	20.0	65.6	BN21L–20

Table 5-4 BN21K-68-Pin, High Density, Standard to Right Angle Connector Cable

Cable Description	Meters	Feet	Order No
 CXO-4171A-MC_R			
Standard cable, 68-conductor with the following connectors:	1.0	3.3	BN21K–01
	1.5	4.9	BN21K–1E
One 68-pin, high-density, male, straight connector with jackscrew (thumbscrew) fasteners	2.0	6.5	BN21K–02
	3.0	9.8	BN21K–03
One 68-pin, high-density, male, right-angle connector with screw fasteners	5.0	16.4	BN21K–05
	8.0	26.2	BN21K–08
	10.0	32.8	BN21K–10
	15.0	49.2	BN21K–15
	20.0	65.6	BN21K–20
	23.0	75.5	BN21K–23

5.5 Shelf SCSI Bus Configurations

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

Note

Bus address switch settings other than those shown in Figure 5-8, Figure 5-10 and Figure 5-12 can cause SCSI bus conflicts.

- A single bus with seven device addresses on one shelf
- Two buses with four device addresses on one bus and three device addresses on the other
- Dual shelf on a single bus with seven device addresses per shelf.

You 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 Solutions Product Catalog*.

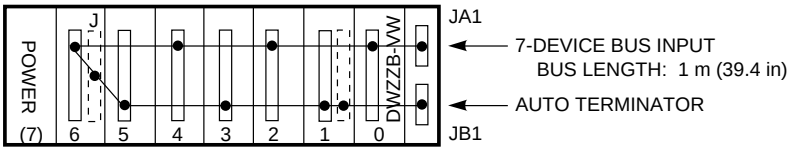
Note

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

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

Table 5-5 StorageWorks Bus Lengths

Single Shelf–DWZZB						
Shelf	**Bus**	**Input**	**Slot 6**	**Slot 1**	**Meters**	**Feet**
1	1	JA1	Jumper	None	1.0	3.3



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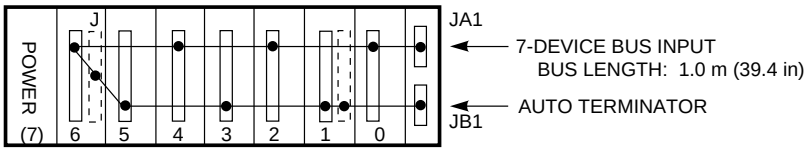
Single Shelf–Single Bus						
Shelf	**Bus**	**Input**	**Slot 6**	**Slot 1**	**Meters**	**Feet**
1	1	JA1	Jumper	None	1.0	3.3



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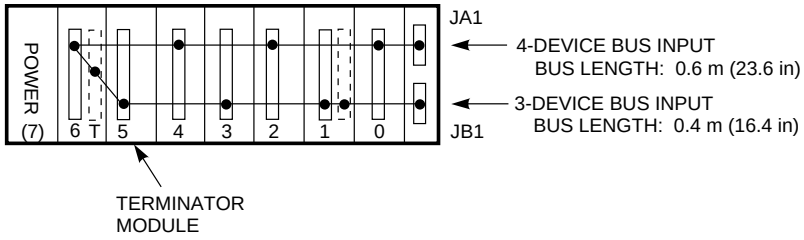
Single Shelf–Two Buses						
Shelf	**Bus**	**Input**	**Slot 6**	**Slot 1**	**Meters**	**Feet**
1	1	JA1	Terminator	Jumper*	0.4	1.3
1	2	JB1			0.6	2.0

* The jumper is placed here for safekeeping and has no effect on the SCSI bus.



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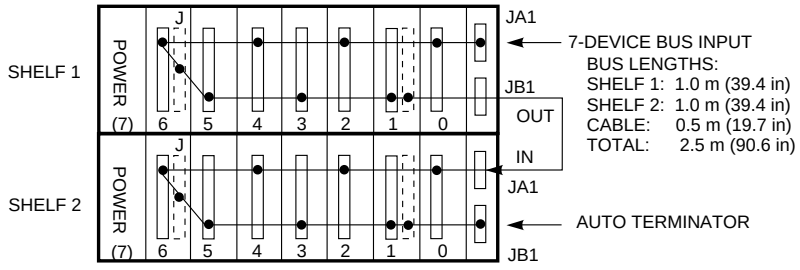
Two Adjacent Shelves–Single Bus						
Shelf	**Bus**	**Input**	**Slot 6**	**Slot 1**	**Meters**	**Feet**
1	1	JA1	Jumper	None†	1.0‡	3.3‡
2	1	JA1	Jumper	None	1.0	3.3
			BN21L–0E Cable		0.5	1.6
			Total Bus Length		2.5	8.2

‡ From the input connector (JA1) to output connector (JB1).

† Do not install a terminator here.



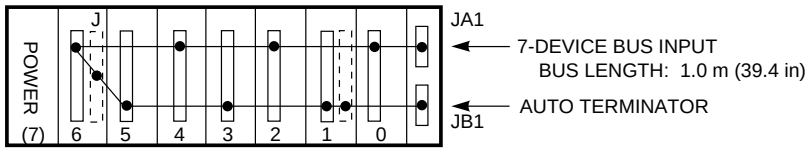
CXO-4515A-MC

5.6 Shelf with a Single SCSI Bus

Figure 5-7 and Figure 5-8 shows an BA356 shelf with a single SCSI bus with seven devices. Use the following procedure to configure a single BA356 shelf for seven devices on a single SCSI bus:

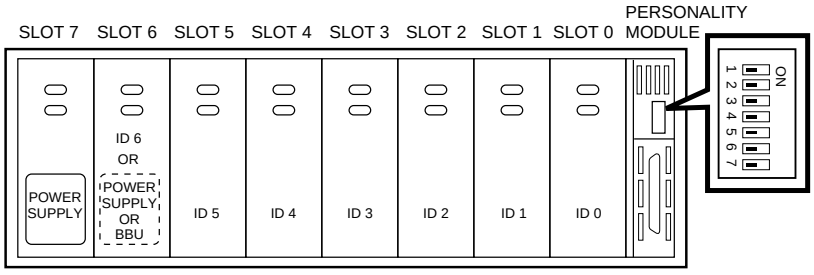
1. Turn off the shelf power by disconnecting the power cables from the shelf power supplies.
2. Remove the blowers as described in section.
3. Discharge any static build-up by momentarily touching a finger to the I/O module tabs.
4. Make sure that the SHELF_OK jumpers are installed correctly either on the backplane or on both the jumper board and the optional terminator board, as described in section 2.2
5. Install the jumper board in the backplane connector behind slot 6 (see Table 5-5).
6. Replace the blowers as described in section 3.2.
7. Connect the SCSI cable to the JA1 connector (refer to section 3.1).
8. Assign device address and install SBBs (refer to section 5.2).
9. Connect the power cables to the shelf power supplies.

Figure 5-7 Single Shelf SCSI Bus



CXO-4513A-MC

Figure 5-8 Single Shelf Configuration Address



CXO-4320A-MC

5.7 Shelf with a Split SCSI Bus

Use the following procedure to configure a BA356 shelf for a split shelf SCSI bus, one with three devices and one with four devices, as shown in Figure 5-9:

1. Turn off the shelf power by disconnecting the power cables from the shelf power supplies.
2. Remove the blowers, as described in section 3.2.
3. Discharge any static build-up by momentarily touching a finger to the I/O module tabs.
4. Make sure that the SHELF_OK jumpers are installed correctly on either the backplane or the jumper board and the optional terminator board as described in section 2.1.3
5. Install the terminator board in the backplane connector behind slot 6.
6. Install the unused jumper board in the backplane connector behind slot 1.
7. Replace the blowers as in section 3.2.
8. Verify the I/O module address switch settings as in Figure 5-10.
9. Connect the SCSI cable for device addresses 0, 2, 4, and 6 to the JA1 connector.
10. Connect the SCSI cable for device addresses 1, 3, and 5 to the JB1 connector.
11. Install the SBB devices and assign the device addresses as in section 5–2.
12. Connect the power cables to the shelf power supplies.

Figure 5-9 Shelf with a Split SCSI Bus

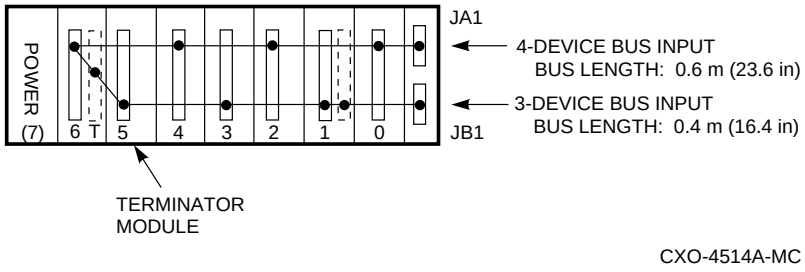
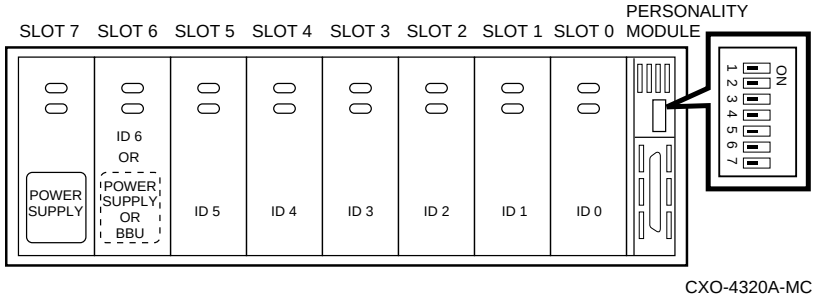


Figure 5-10 Single Shelf Configuration Address



5.8 Two Shelves with a Single SCSI Bus

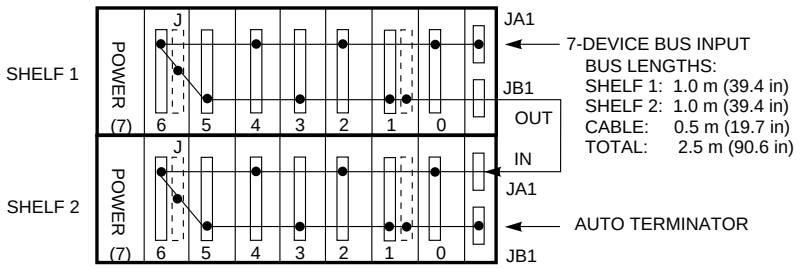
Use the following procedure to configure two SBB shelves with seven devices on one SCSI bus, as shown in Figure 5-11:

Note

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

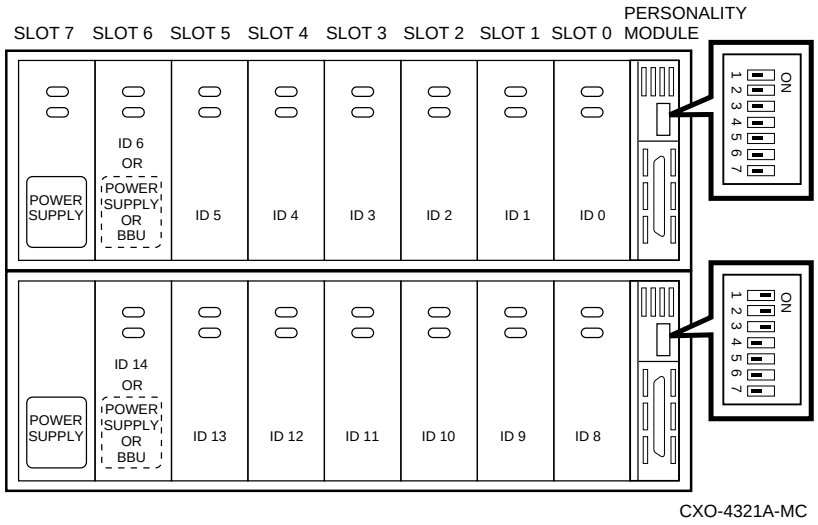
1. Turn off the shelf power by disconnecting the power cables from the shelf power supplies.
2. Remove the blowers as described in section 3.2.
3. Discharge any static build-up by momentarily touching a finger to the I/O module tabs.
4. Make sure that the SHELF_OK jumpers are installed correctly either on the backplane or on both the jumper board and the optional terminator board as described in section 2.1.1.
5. On the upper shelf, install the jumper board in the backplane connector behind slot 6.
6. On the lower shelf, install the jumper board in the backplane connector behind slot 6.
7. Replace the blowers as described in section 3.2**.**
8. Verify the I/O module address switch settings as in Figure 5-12.
9. Connect a BN21L–0E SCSI cable between connector JB1 on the upper shelf and connector JA1 on the lower shelf.
10. Make sure that each device has a different SCSI address as described in section 5.1.
11. Connect the power cables to the shelf power supplies.

Figure 5-11 Single SCSI Bus on Two Shelves



CXO-4515A-MC

Figure 5-12 Dual Shelf Configuration Address

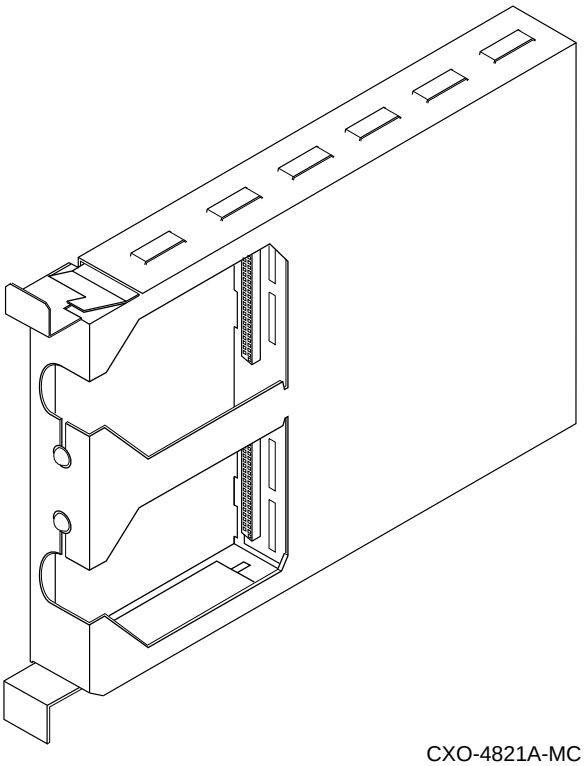


CXO-4321A-MC

5.9 8-Bit I/O Module

This document describes the 8-bit I/O module (see Figure 5-13). It explains how to install the I/O module in the BA356 shelf, and how to set the shelf small computer system interface (SCSI) addresses. The basic documentation set for the I/O module is *StorageWorks Solutions, 7 Device, 16-Bit SBB Shelf (BA356–S series) User's Guide (*EK–BA356–UG. B01).

Figure 5-13 8-Bit I/O Module



CXO-4821A-MC

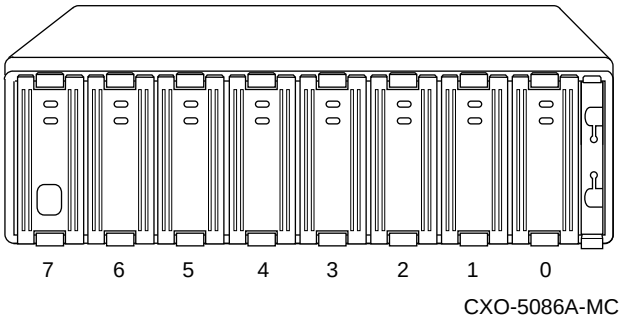
The I/O module employs active circuitry to provide the following features to the BA356–SB SBB shelf:

- Eight-bit data bus connections to external units
- Shelf device address assignment
- Blower speed control
- Blower fault indicators
- Ambient air overtemperature sensing and indication
- Active, automatic bus termination

5.10 Description

The 8-Bit I/O module is located on the right side of the shelf next to slot 0 (see Figure 5-14).

Figure 5-14 BA356 Shelf with 8-Bit I/O Module

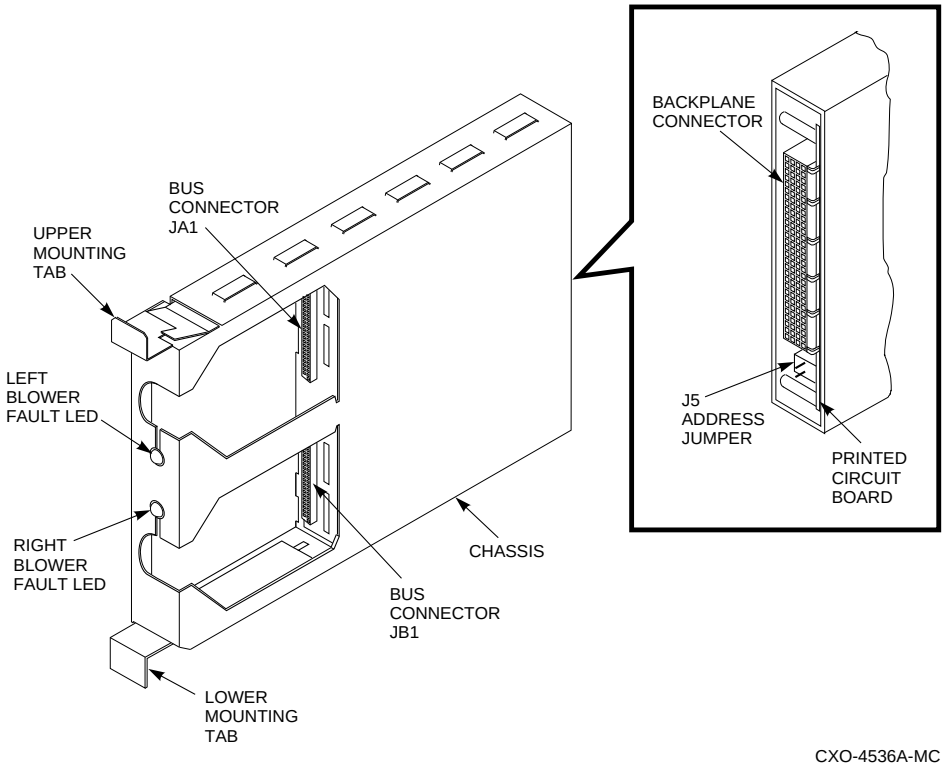


On the front of the I/O module (see Figure 5-15) are two 50-pin female connectors: bus connector JA1, the data input connector and bus connector JB1, the data output connector.

Guides are embossed on the top and bottom of the I/O module to conform to slots built into the top and bottom of the shelf slot, that permit centering the module in the shelf slot. Two spring-steel mounting tabs lock into ledges molded into the top and bottom of the shelf secure the I/O module. Squeeze the mounting tabs together to pull the I/O module out of the shelf slot

The upper LED indicates that the left (as viewed from the front of the shelf) blower motor has failed. The lower LED indicates that the right blower motor has failed. Fans at the rear of the shelf draw air from the front to cool the I/O module.

Figure 5-15 I/O Module Features



5.10.1 Data Bus Connections

The I/O module provides external connection for the two, 16-bit shelf buses. The backplane connector on the rear of the I/O module (see Figure 5-15) routes the bus and control signals from the shelf backplane to the I/O module circuits. These circuits connect the lower eight bits (0 through 7) of bus A to external bus connector JA1 and the lower eight bits of bus B to external bus connector JB1.

5.10.2 Bus Termination

The I/O module provides both active and passive bus termination for the two, 16-bit shelf buses. The upper eight bits (8 through 15) of each bus are passively terminated by termination resistors. These data lines do not pass to the external bus connectors (JA1 and JB1). The lower eight bits (0 through 7) of SCSI bus B are actively terminated. These data lines are terminated as long as there is no connection to JB1. If JB1 is connected to a SCSI device, the active terminators are disabled and these data lines pass through JB1.

5.10.3 Shelf Device Address Assignment

The I/O module determines the SCSI address for each slot in the shelf. This is accomplished by either installing or not installing the address jumper (J5) on the address pins at the rear of the I/O module. The location of J5 is shown in Figure 5-15. Shelf slot addresses are determined as shown in Table 5-6

Table 5-6 Device Address Configurations

Bus Address Jumper J5	Resultant Device Addresses Slot 6 ⟶ Slot 0
Not installed	6 5 4 3 2 1 0
Installed	6 5 5 3 3 1 1

5.10.4 Swap Control

The I/O module informs the controller when the I/O module is being removed from or inserted into the shelf, thus allowing a warm swap of the I/O module.

5.10.5 Temperature Control

The I/O module regulates the air temperature in the shelf. Air temperature and motor status are indicated by the blower fault LEDs (see Figure 5-15). An ambient air temperature exceeding a preset value causes both blower fault LEDs to light and the blower motors to run at high speed. This condition does not cause the SHELF_OK LED on the power supply to light.

5.11 Connecting to External Devices

Bus connectors JA1 and JB1 are used to connect to external SCSI buses. These connectors are 50-pin, high-density, female connectors. The I/O module may be connected as either a single bus or dual bus configuration.

5.11.1 Single Bus Configuration

Connector JA1 is the input connector. Connector JB1 is either the output connector to another SCSI device, or it has no connection and the I/O module provides internal bus termination for the shelf.

5.11.2 Dual Bus Configuration

Connector JA1 is the I/O connector for bus A, which consists of slots 0, 2, 4, and 6 when the jumper is in place. Connector JB1 is the I/O connector for bus B, which consists of slots 1, 3, and 5 when the terminator is installed in slot 6 on the rear of the shelf.

5.12 SCSI Bus Cables

The input and output cables on the SCSI bus connect to the two connectors on the front of the I/O module. The upper connector JA1 is a 50-pin, high density, female, input connector. The lower connector JB1 is a 50-pin, high density, female, output connector. In dual bus configurations, JB1 functions as an input connector to the second bus.

5.12.1 BN21H-Series SCSI Single-Ended Cables

he BN21H-Series cables are shown and described in Table 5-7. These cables are typically used to connect SBB shelves to the following:

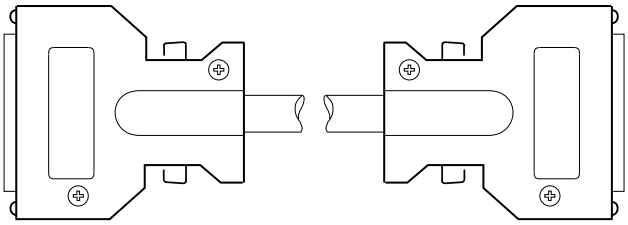
- Other SBB shelves
- SCSI adapters , such as:

– KZMSA, an XMI to SCSI adapter

– PMAZ-AA and PMAZ-AB

– K.scsi

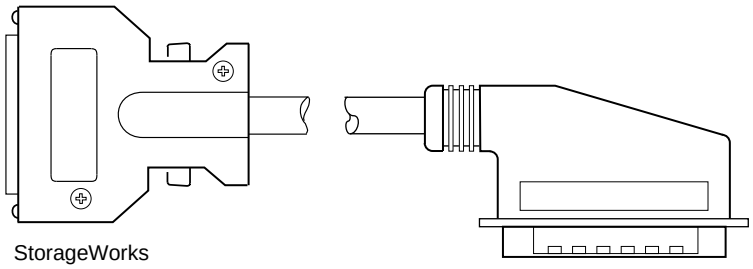
Table 5-7 BN21H-Series Cables

Cable Description	Meters	Feet	Order No
			
Standard cable, 50-conductor	0.3	1.0	BN21H–0C
Two 50-pin, high-density, male, straight connectors	0.5	1.6	BN21H–0E
with thumb latches	1.0	3.3	BN21H–01
	1.5	4.9	BN21H–1E
	2.0	6.6	BN21H–02
	3.0	9.8	BN21H–03
	5.0	16.4	BN21H–05

5.12.2 BN21R-Series SCSI Single-Ended Cables

The BN21R-series single-ended cables are shown and described in Table 5-8 . These cables are typically used to connect a StorageWorks shelf to a 50-pin, low-density receptacle, such as that used by the DEC 4000 model 610 Alpha distributed/departmental server.

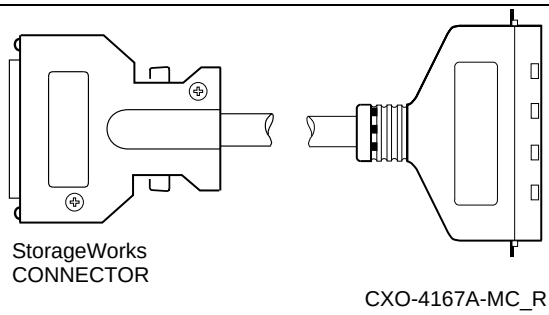
Table 5-8 BN21R-Series Single-Ended Cables

Cable Description	Meters	Feet	Order No
			
Adapter cable, 50-conductor	0.5	1.6	BN21R–0E
One 50-pin, high-density, male, straight connector with thumb latches	1.0	3.3	BN21R–01
	2.0	6.6	BN21R–02
One 50-pin, low-density, male, right-angle connector	3.0	9.8	BN21R–03
	5.0	16.4	BN21R–05

5.12.3 BN23G-Series SCSI Single-Ended Cables

The BN23G-series cables are sown and described in Table 5-9. These cables allow you to connect SCSI devices that have different density, 50-pin connectors. The BN23G-series cables are typically used to connect SBB shelves to SCSI adapter cards in personal computers and workstations.

Table 5-9 BN23G-Series SCSI Single-Ended Cables

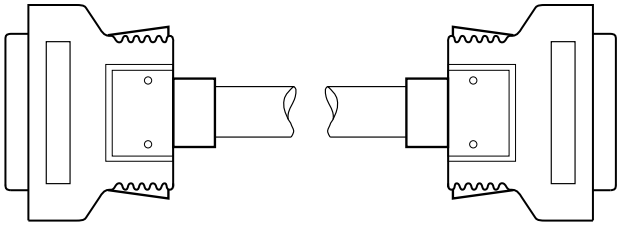
Cable Description	Meters	Feet	Order No
			
Adapter cable, 50-conductor	0.5	1.66	BN23G–0E
One 50-pin, high-density, straight connector with thumb latches	1	3.3	BN23G–01
	2	6.6	BN23G–02
One 50-pin, low-density, straight connector with bail locks	3	9.8	BN23G–03
	5	16.4	BN23G–05

5.12.4 BC10U-Series SCSI Single-Ended Cables

The BC10U-series single-ended cables are shown and described in Table 5-10. The BC10U-series cables are used only with Alpha systems with the BA655 SCSI plug-in unit (PIU). Do not use this SCSI cable in any other configuration. These cables are typically used to connect SBB shelves to the following:

- Other SBB shelves
- KZMSA, an XMI to SCSI adapter

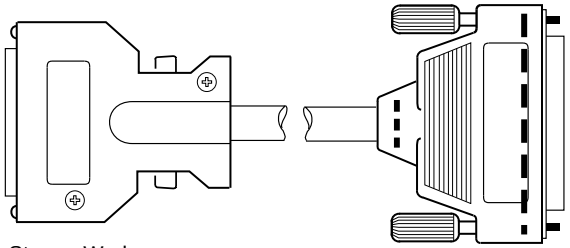
Table 5-10 BC10U-Series SCSI Single-Ended Cables

Cable Description	Meters	Feet	Order No
 StorageWorks CONNECTOR CXO-4168A-MC_R			
Alpha DEC 7000 and DEC 1000 SCSI cable, 50-conductor Two 50-pin, high-density, male, straight connectors with thumb latches	2.0 3.0 5.0	6.6 9.8 16.4	BC10U–02 BC10U–03 BC10U–05

5.12.5 BC31B-Series HSC Controller Single-Ended Cable

The BN31B-series HSC controller singled-ended cable is shown and described in Table 5-11.

Table 5-11 BN31B-Series HSC Controller Single-Ended Cables

Cable Description	Meters	Feet	Order No
 StorageWorks CONNECTOR CXO-4170A-MC_R			
HSC controller to StorageWorks shelf cable, 50-conductor One 50-pin, high-density, male, straight connector with thumb latches One 50-pin, high-density, male, straight connector with thumb screws	2.0 3.0	6.6 9.8	BN31B–02 BN31B–03

5.13 Installing the I/O Module

Use the following procedure to install the I/O module in a shelf (see Figure 5-16):

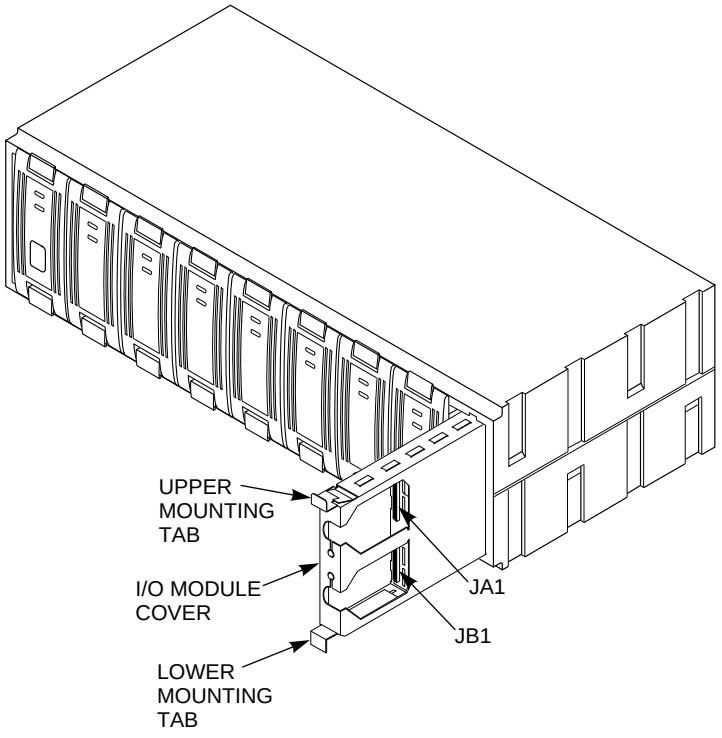
1. If necessary, remove an I/O module using the procedure in steps a through c:
   a) Press the two mounting tabs together and pull forward to release the I/O module.
   b) Pull the I/O module out of the shelf.
   c) Disconnect the cables from the I/O module.
1. Set the address jumper in one of the following three ways:
   - To match the I/O module removed.
   - For a single bus configuration, do not install the address jumper.
   - For a dual bus configuration, with duplicate addresses on each bus, install the address jumper. You must also install the active terminator in slot six on the rear of the backplane.

CAUTION

To prevent system failure, install the I/O module with the I/O module cover facing to the left (see Figure 5-16).

3. Insert the 50-pin cable connectors into JA1 and JB1.
4. Push the module into the shelf slot until it is fully seated and both mounting tabs engage the shelf. There is an audible snap when this occurs.
5. When the power is applied, verify that the I/O module status LEDs light and then go off.

Figure 5-16 Installing the I/O Module



6

StorageWorks Product Specifications

This section 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.

6.1 Input Power Requirements

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

6.2 Power Supplies

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

All shelves can have a redundant power supply to make sure that a power supply failure does not disable the shelf. In some cases, BBUs are combined with the shelf power supply to provide extended system data integrity.

Table 6-1 shows the specifications for the StorageWorks power supplies: and the BA35X–HG.

CAUTION

If sequential device spin-up is less than 4 seconds, the power supply rating is exceeded and system operation is impaired.

Table 6-1 StorageWorks Power Supplies

Specifications	BA35X–HC	BA35X–HF	BA35X–HG
Power supply type	Battery backup	Power Factor Correcting ac input	dc input
Input voltage range	N/A	90-264 V ac	36-72 V dc
Input voltage, nominal	12 V dc (Charging from shelf power bus)	101, 120, 220, 240 ac	48 V dc
Auto–ranging feature	N/A	Yes	Yes
Output voltages	12 V dc 5 V dc	12 V dc 5 V dc	12 V dc 5 V dc
Output power (Sequential device spin-up at 4-second interval mandatory)	200 W *peak* power for 16, 32, or 64 seconds	150 W	150 W

6.3 Physical Specifications

Table 6-2 lists the physical specifications of the cabinets, StorageWorks shelves, and SBBs.

Table 6-2 StorageWorks Products Physical Specifications

Description	Height		Width		Depth		Total Shelves
	mm	in	mm	in	mm	in	
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	22.8	203	8.0	400	15.7	1
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	N/A
BA350–LA SBB shelf	150	5.9	445	17.5	350	13.8	N/A
BA350–SA SBB shelf	150	5.9	445	17.5	350	13.8	N/A
BA350–MA controller shelf	150	5.9	445	17.5	350	13.8	N/A
BA356–SB shelf	150	5.9	445	17.5	350	13.8	N/A
StorageWorks Building Blocks							
3.5-inch SBB	121	4.8	51	2.0	216	8.5	N/A
5.25-inch SBB	121	4.8	152	6.0	267	10.5	N/A

6.4 Environmental Specifications

The StorageWorks product line environmental specifications listed in Table 6-3 are the same as for other Digital storage devices.

Table 6-3 StorageWorks Environmental Specifications

Condition	Specification
Optimum Operating Environment	
Temperature Rate of change Step change	+18 C to +24 C (+65 F 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 +40 C (+50 to +104 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 Environment (Range)	
Temperature	-40 to +66 C (-40 to +151 F) (during transportation and associated short-term storage)
Relative humidity Nonoperating	8% to 95% in original shipping container (noncondensing); otherwise, 50% (noncondensing)
Altitude	From 300 m (-1000 ft) to +3600 m (+12,000 ft) MSL

6.5 Environmental Stabilization

To make sure of the proper operation of Digital storage devices, the SBB temperature must be within 18-29°C (65-85°F). Table 6-4 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 can be damaged when power is applied to the unit.

If This Condition Exists …	Then You Must …
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.
Condensation is not visible on the outside of the storage device	Thermally stabilize the device for the amount of time specified in Table 6-4.

Table 6-4 Thermal Stabilization

Storage Temperature Range C	Storage Temperature Range F	Minimum Stabilization Time
60 to 66	140 to 151	3 hours
50 to 59	122 to 138	2 hours
40 to 49	104 to 120	1 hour
30 to 39	86 to 102	30 minutes
18 to 29	64 to 84	None
10 to 17	50 to 63	30 minutes
0 to 9	32 to 48	1 hour
-10 to -1	14 to 30	2 hours
-20 to -11	-4 to 12	3 hours
-30 to -21	-22 to -6	4 hours
-40 to -31	-40 to -24	5 hours

Glossary

adapter

See **SCSI bus signal converter**.

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 provides power only 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. 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 used only 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).

daisy chain

Two or more StorageWorks shelves that are connected.

deskside expansion unit

The StorageWorks floor mounted stand that encloses a BA356–SB 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.

DWZZB

A StorageWorks compatible SCSI bus signal converter.

See **SCSI bus signal converter.**

electrostatic discharge

See **ESD**.

ESD

Electrostatic discharge is 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.

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 unit (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**.**

I/O module

The module (either 8-bit or 16-bit) that interfaces the single-ended SCSI-bus to the SBB shelf.

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 cables, connectors, and/or the backplane circuitry.

RAID

Redundant Array of Independent Disks. A set of storage techniques that increases the performance and availability of a storage subsystem.

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 is 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 devices. The StorageWorks subsystem implementation uses SCSI–2 for the transfer of data.

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 differential SCSI bus to a single-ended SCSI bus.

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 15. Also referred to as target ID.

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 68-conductor (34 twisted pair) cable used for single-ended, SCSI–3 bus connections.

SCSI–P cable

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

single-ended SCSI bus

A bus in which 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 level enclosures to house the shelves. Standard mounting devices for SBBs are also included.

StorageWorks building block

See **SBB**.

tape controller

See **controlle***r*.

target

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

target ID

See **SCSI device ID**.

termpower

Is an electrical current that is limited by self-resetting fuses.

third-height

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

warm swap

A method of device replacement whereby the complete system remains on line during device removal or insertion. Activity can 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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