

*StorageWorks*<sup>™</sup> Solutions

## DWZZB 16-Bit SCSI Bus Converter Users Guide

Order Number EK-DWZZB-UG. A01

This guide describes the procedures for installing and configuring both the table top (DWZZB-AA) and the StorageWorks (DWZZB-VW) 16-bit SCSI bus converters.

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**March 1995**

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

**Note**

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Only the self-powered table top model, the DWZZB-AA, is FCC Class B certified. The DWZZB-VW converter does not require separate FCC certification but is certified as part the StorageWorks subsystem in which it is installed.

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**FCC ID: A09-DWZZB**

**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

This equipment requires the use of shielded SCSI cables such as the Digital Equipment Corporation BN21K-series or BN21L-series.

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This document was prepared using Microsoft Word for Windows, Version 6.0.

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## Preface

The *StorageWorks Solutions DWZZB SCSI Bus Converter* describes the purpose, function, operation, and use of the 16-bit SCSI bus converter. This SCSI bus converter extends the length of the bus between controllers and the SCSI devices.

## Intended Audience

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

## Documentation Conventions

The following conventions are used in this manual:

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

## Structure

This manual is organized as follows:

- Chapter 1**     **Introducing the DWZZB** Provides a product overview of the StorageWorks SCSI bus converters.
- Chapter 2**     **Using a DWZZB** Describes the procedures for configuring a StorageWorks SCSI bus using a SCSI bus converter.
- Glossary**
- Index**

## Related Documents

The following is a list of the StorageWorks- documents relative to this product:

Document Title	Order Number
<i>StorageWorks Solutions Configuration Guide</i>	EK-BA350-CG
<i>StorageWorks Solutions Shelf and SBB User's Guide</i>	EK-BA350-UG
<i>StorageWorks Solutions BA356-SB 16-Bit Shelf User's Guide</i>	EK-BA356-UG

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# Introducing the 16-bit SCSI Bus Converters

The DWZZB-series **SCSI bus converters** (converter) are SCSI-2 and draft SCSI-3 (ANSI X379.2/91-10R3) compliant single-ended SCSI to differential SCSI 16-bit converters capable of data transfer rates of up to 20 mega bytes per second (20 MB/s). This chapter describes the following converters:

- The DWZZB-AA is a stand alone self powered, table top unit.
- The DWZZB-VW is mounted in a StorageWorks building block (SBB) carrier for installation in a 16-bit SBB shelf.

## Note

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The discussion of the DWZZB-series SCSI bus converters in this guide is limited to the models, applications, cables, and configurations compatible with the StorageWorks building block (SBB) shelves. The capabilities and use of these converters in other environments or with other SCSI systems are not within the scope of this guide.

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## 1.1 SCSI Bus Converter Functions

All the SBB shelves are either 8-bit or 16-bit **single-ended, physical buses**. Some controllers and hosts use **differential** buses and others use a single-ended bus. Single-ended and differential physical buses are not compatible. The SCSI protocol disables both buses when they are connected together. However, by using a SCSI bus converter you can accomplish the following:

- Connect a differential physical bus to a single-ended physical bus
- Extend the maximum length of a SCSI bus

The SCSI bus converter internal **logical bus** establishes compatibility between the differential and single-ended physical buses and connects them together as a single logical bus.

These converters may be installed alone or in combination and can be configured to operate in either the **end-bus** or the **mid-bus** location simply by either installing or removing bus terminators.

## 1.2 Product Descriptions

There are three types of DWZZB SCSI bus converters. The two types used with the StorageWorks product line are the SBB version, the DWZZB-VW and the table top version, the DWZZB-AA.

### Note

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The DWZZB-MA is the third type of SCSI bus converter. This version does not have an enclosure and is therefore outside the scope of this users guide.

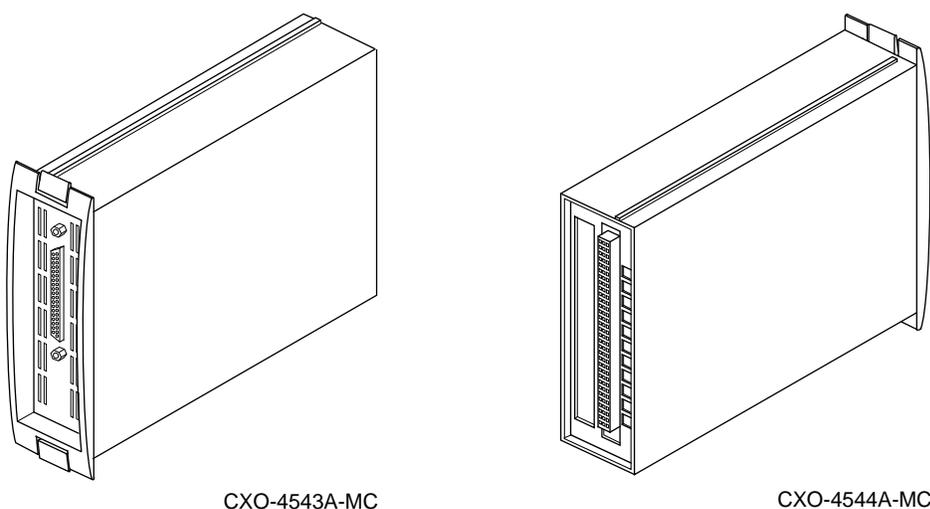
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As described in Chapter 2, these converters can be installed in either the end-bus or the mid-bus position.

### 1.2.1 SBB Shelf Converter

The DWZZB-VW is SBB shelf converter installed in slot 0 of a 16-bit shelf, such as a BA356-SB. The 16-bit differential input cable connector is a 68-pin, high-density female cable connector. The 16-bit single-ended output connector is a 96-pin DIN connector that mates with the shelf backplane.

**Figure 1-1 SBB Shelf DWZZB-VW SCSI Bus Converter**



### 1.2.2 Table Top Converter

The DWZZB-AA is a table top converter with a self-contained power supply. It can be connected to either a 16-bit SBB shelf personality module or an SBB shelf SCSI. The two 68-pin high-density female cable connectors have unique functions and only can be connected as a differential (see Figure 1-2) and a single-ended SCSI bus (see Figure 1-3).

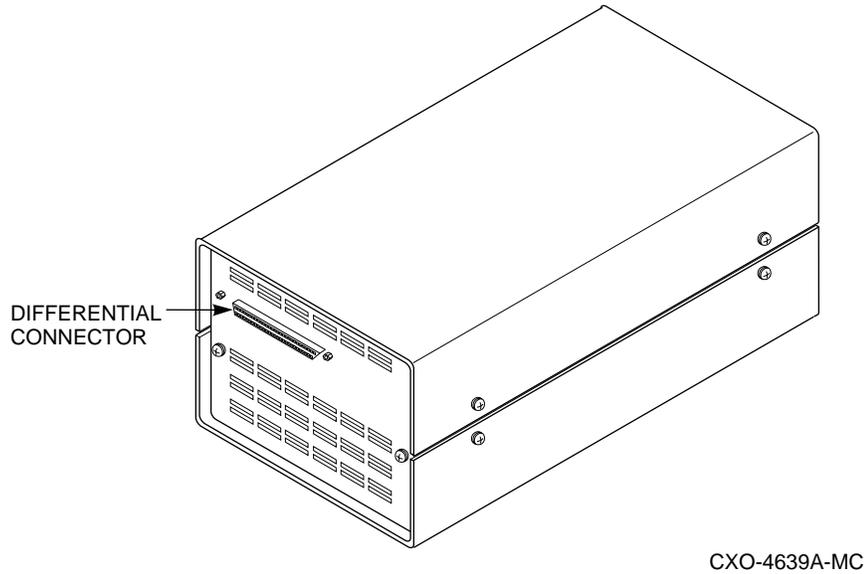
### CAUTION

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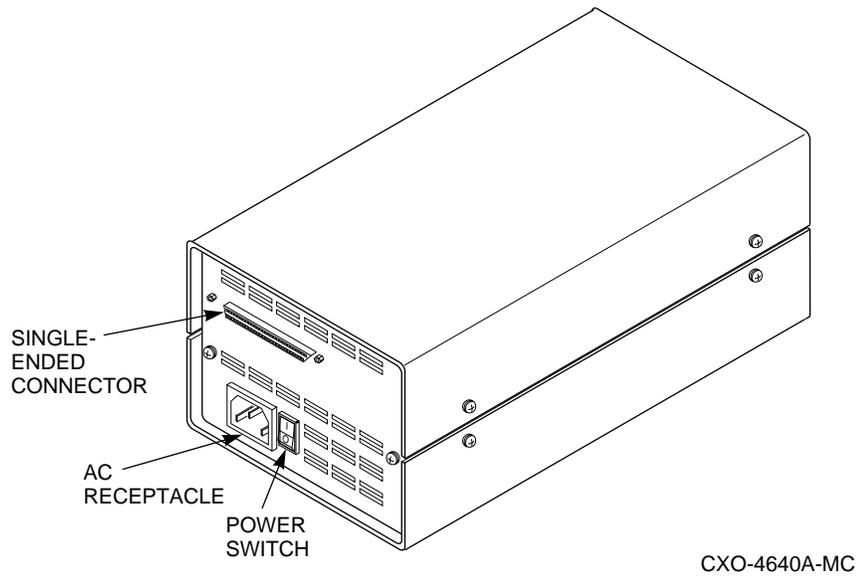
Connecting a differential bus cable to the single-ended connector, or a single-ended bus cable to the differential connector will cause the SCSI bus to fail.

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**Figure 1–2 DWZZB–AA SCSI Bus Converter—Differential Connector**



**Figure 1–3 DWZZB–AA SCSI Bus Converter—Single-Ended Connector**



### 1.2.3 SCSI Bus Components

To install a SCSI bus converter you need SCSI “P” cables (see Figure 2–6 and Figure 2–7). Please refer to the StorageWorks Solutions Configuration Guide for a complete list of the available cables. For a mid-bus configuration you will need an H885–AA tralink connector (see Figure 2–3).

## 1.3 Product Specifications

Table 1–1 lists the functional specifications for the table top (DWZZB–AA) and SBB shelf (DWZZB–VW) SCSI bus converters.

**Table 1–1 SCSI Bus Converter Functional Specifications**

<b>Features</b>	
SCSI ID SCSI Addresses	No SCSI Ids (device addresses) are consumed by the converter.
Overload Protection DTERMPOWER STERMPOWER	1.5 A self-resetting thermal fuse 1.5 A self-resetting thermal fuse
Shielding Enclosure Connectors	Shielded for ESD, EMI, and safety requirements Shielded for ESD, EMI, and safety requirements
Power-Up Reset	Automatically clears <ul style="list-style-type: none"> <li>● Initiator detection circuit</li> <li>● Target detection circuit</li> <li>● BSY glitch filter</li> </ul>
SCSI Bus Reset	Automatically clears <ul style="list-style-type: none"> <li>● Initiator detection circuit</li> <li>● Target detection circuit</li> <li>● BSY glitch filter</li> </ul>
Single-Ended SCSI Bus Length Slow (5 mega transfers per second or 10 MB/s) Fast (10 megatransfers per second or 20 MB/s)	6 meters (19.7 feet)  3 Meters (9.8 feet) <i>(See Table 2–1 for detailed specifications)</i>
Differential SCSI Bus Length	25 meters (82 feet)
Data Timing	The relationship between the data and the control signals is brought to SCSI compatibility before transmission to the other SCSI bus.
Design	High reliability SMT
Cable Fault	DIFFSENSE support
Glitch Elimination	<ul style="list-style-type: none"> <li>● 100% glitch free operation during power-up</li> <li>● BUSY GLITCH trap eliminates cable length constraint due to wired-OR glitches on the BSY line</li> </ul>
<b>Termination</b>	
<ul style="list-style-type: none"> <li>● End-bus terminators installed and enabled at the factory.</li> <li>● Remove or disable terminators for mid-bus operation.</li> </ul>	
Singled-ended	User selectable 16-bit active termination. Remove two jumpers for mid-bus operation.
Differential	Five 14-pin SIP resistors. Remove SIPs for mid-bus operation
<b>TERMPOWER</b> Supplied to both buses.	
<b>Service</b>	
<ul style="list-style-type: none"> <li>● The user can install, remove, enable, or disable the bus termination.</li> <li>● Contact Digital service personnel for all other service.</li> </ul>	

**Table 1–1 SCSI Bus Converter Functional Specifications (Continued)**

<b>Configuration Rules</b>	
The maximum number of DWZZBs between any two devices is <b>2</b> .	
<b>Agency Approvals</b>	
UL, CSA, FCC Class B, TUV	
<b>Environmental Specifications</b>	
Relative Humidity	10% to 85% non-condensing
Operating Temperature	10°C to 40°C (50°F to 104°F)
Storage Temperature (non-operating)	–40°C to 66°C (–40°F to 151°F)
<b>Power Requirements</b>	
Input Voltage	+5.0 V dc, ±0.25 V dc
Input Current	
Electronics	3.1 Amps
Terminators	0 to 3.0 Amps (in addition to electronics)
TERMPower	Supplied to both buses
<b>SCSI Connectors and Cables</b>	
Single-Ended	Surface mount unitized connector includes: <ul style="list-style-type: none"> <li>● Standard 4-pin power connector</li> <li>● 68-pin, female, high-density SCSI “P” connector</li> </ul>
Differential	Board mounted 68-pin, female, high-density SCSI “P” connector
Cables	BN21K-series and BN21L-series shielded SCSI “P” cables



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## Using a 16-bit SCSI Bus Converter

This chapter discusses how to effectively use a converter by selecting configurations, cables, terminating the buses, and installing the converter. Complete the following procedures in the specified sequence to install and use a converter:

- Determine the SCSI bus type, speed, and maximum physical length (see Section 2.1).
- Determine the optimum configuration for your system (see Section 2.2).
- Select the SCSI bus cables (see Section 2.4).
- Set the bus terminations on the converter (see Section 2.3).

### Note

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In this section, the term controller means any one of the following SCSI devices (1) a controller, (2) a host computer, or (3) an adapter.

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## 2.1 SCSI Buses

The SCSI bus length is the total length from the bus terminator on the controller to the terminator at the other end of the bus. For a basic configuration, this is the distance from the controller terminator to the shelf terminator.

Table 2–1 is a synopsis of the SCSI buses supported by the 16-bit converter organized by bus type (single-ended or differential). This table includes the following information:

- Bus speed (fast or slow)
- Data transfers per seconds expressed either in mega bytes (MB/s) or mega transfers (MT/s)
- The maximum length of each bus in meters (M) and feet (ft)
- The maximum SCSI “P” cable length for each.

### Note

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Changes in differential bus speed or width only affect the data transmission rate. The maximum bus length and cable length remains constant.

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**Table 2–1 SCSI Buses and Cables**

Buses			Transfer Rate		Bus Length		Recommended Cable		
Width	Speed	Type	MT/s*	MB/s	Meters	Feet	Order Number	Meters	Feet
8-bit	Fast	Single-ended	10	10	3	9.8	BN21K–02 BN21L–02	2	6.6
8-bit	Slow	Single-ended	5	5	6	19.7	BN21K–05 BN21L–05	5	16.4
16-bit	Fast	Single-ended	10	20	3	9.8	BN21K–02 BN21L–02	2	6.6
16-bit	Slow	Single-ended	5	10	6	19.7	BN21K–05 BN21L–05	5	16.4
8-bit	Fast	Differential	10	10	25	82	BN21K–23 BN21L–23	23	75.5
8-bit	Slow	Differential	5	5	25	82	BN21K–23 BN21L–23	23	75.5
16-bit	Fast	Differential	10	20	25	82	BN21K–23 BN21L–23	23	75.5
16-bit	Slow	Differential	5	10	25	82	BN21K–23 BN21L–23	23	75.5

### Note

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MT/s (megatransfers per second) is the repetitive rate at which words of data are transferred across a bus. The number of megabytes per second (MB/s) is determined by the bus width (8-, 16-, or 32-bit) and the number of bytes per word (1, 2, or 4, respectively).

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\* Megatransfers per second

The maximum bus length and maximum cable length *are not* the same.

- The bus length is measured from the controller terminator to the SBB shelf terminator and *includes* the SCSI cables.
- The maximum cable length is the longest cable length that can be used without exceeding the maximum bus length. For example, you cannot use a 25 m (82 ft) cable when the maximum bus length is 25 m. You must allow for the SBB shelf bus length. Therefore, the maximum length cable you should use is 23 m (75.5 ft).

## 2.2 Determining the Configuration

The manner in which you configure the SCSI bus converter is based upon the SCSI controller and what you are planning to accomplish. The following are the two basic configurations for a converter:

- The end-bus configuration (see Section 2.2.1)
- The mid-bus configuration (see Section 2.2.2)

### CAUTION

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Regardless of the configuration used, end-bus or mid-bus, you cannot separate the controller and the devices with *more than two* converters. Your configuration cannot include more than one table top and an SBB shelf converter in series.

---

### 2.2.1 End-Bus Configuration

The end-bus configurations shown in Figure 2–1 terminate all cables in the converter, the shelf, and in the controller. This effectively creates two physical buses, one between the converter and the controller; the other between the converter and the SBB shelf.

### Note

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Both the differential and the single-ended SCSI bus terminators are factory-installed. You do not need to change the termination to operate the converter in the end-bus position.

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Figure 2–1 shows the three basic end-bus configurations:

### Note

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Device addresses 0 through 15 are valid when using a 16-bit controller. When using an 8-bit controller the valid device addresses are 0 through 6.

---

- **Single-Ended Controller to SBB Shelf**  
All StorageWorks SBB shelves are single-ended SCSI buses. When the controller is a single-ended the maximum SCSI bus length is 6 m (9.8 ft).
- **Differential Controller to SBB Shelf**  
This configuration requires an SBB shelf converter in Slot 0. Connect the controller to the SBB shelf converter with a SCSI “P” cable.
- **Single-Ended Controller to SBB Shelf—Extended Length**  
This configuration requires two SCSI bus converters—a table top model and an SBB shelf converter (see Figure 2–1). Depending upon the bus speed (fast or slow) the total bus length could be between 31 m (101.8 ft) or 37 m (121.4 ft).
  - Install the –VW model in SBB shelf slot 0.
  - Connect the controller to the table top converter single-ended connector using a SCSI “P” cable.
  - Connect the table top converter differential connector to the SBB shelf converter with a SCSI “P” cable.

**Note**

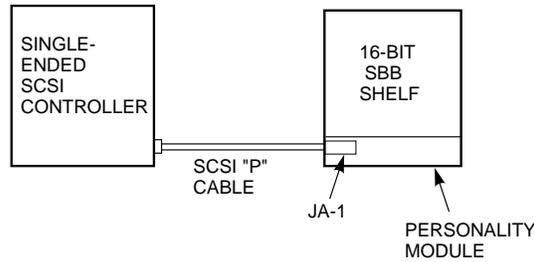
When using an 8-bit single-ended controller the valid shelf device addresses are 0 through 6.

**Note**

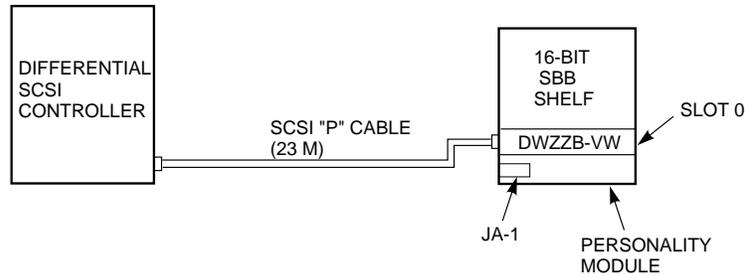
You could connect the table top converter directly to the personality module. Depending upon the bus speed (fast or slow) the total bus length would be between 28 m (91.9 ft) or 31 m (101.8 ft)

**Figure 2-1 Typical End-Bus Configurations**

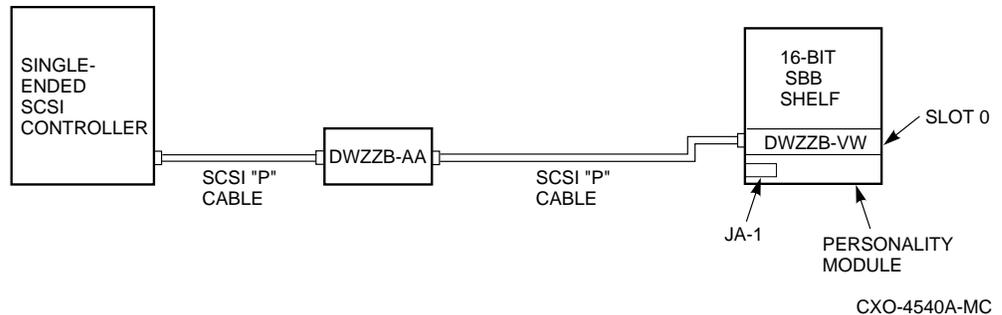
CONFIGURATION 1



CONFIGURATION 2



CONFIGURATION 3



## 2.2.2 Mid-Bus Configuration

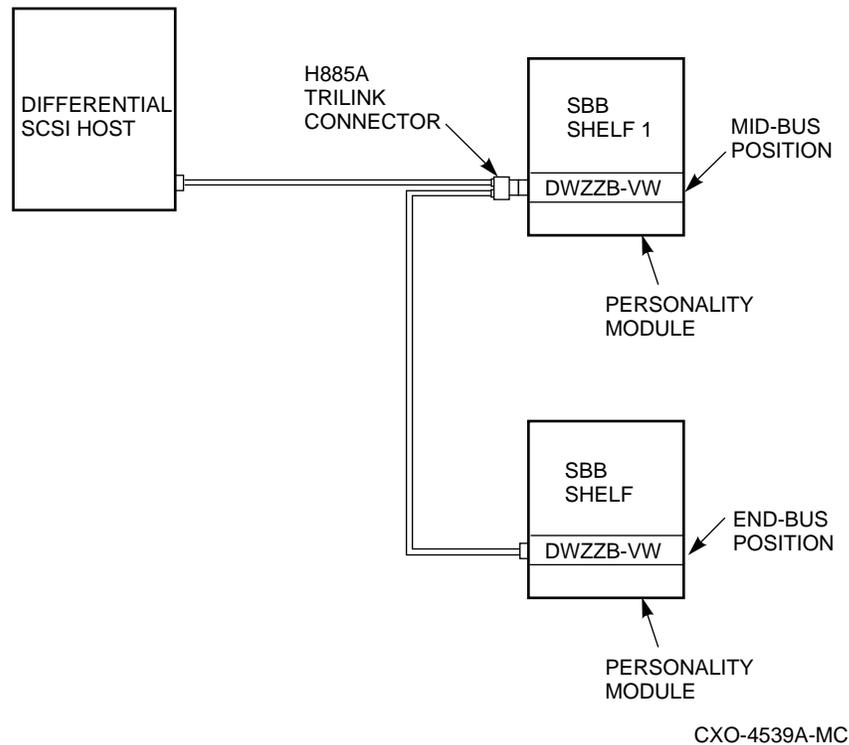
The typical mid-bus configuration shown in Figure 2–2 creates the following three buses:

- A 25 m (82 ft) differential bus from the controller through the tri-link connector on the SBB shelf 1 converter to SBB shelf 2 converter.
- A single-ended bus on SBB shelf 1
- A single-ended bus on SBB shelf 2

To create this shelf requires that you remove the differential termination from SBB shelf 1 converter using the procedure Section 2.3.1. The single-ended termination would remain in place. The termination in SBB shelf 2 converter would remain in the end-bus configuration.

Note that the total length of the differential bus remains at 25 m (82 ft). Therefore, for proper operation the total length of the SCSI “P” cables would have to be less than 25 m.

**Figure 2–2 Typical Mid-Bus Converter Configuration**



## 2.3 Setting the Bus Termination

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

The following sections describe the procedures for configuring a DWZZB SCSI bus converter for either a mid-bus (see Section 2.3.1) or end-bus (see Section 2.3.2) operation.

### **CAUTION**

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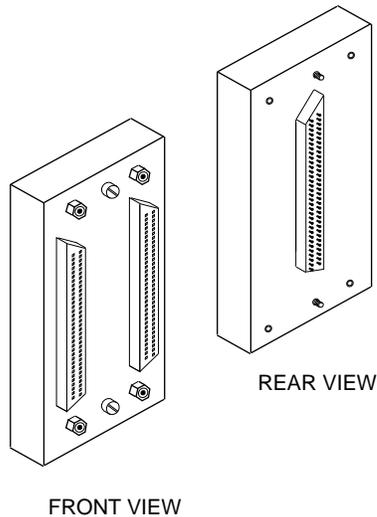
To prevent SCSI bus malfunction, *do not* remove the DWZZB SCSI bus converter or disconnect the SCSI cable when power is on.

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### 2.3.1 Mid-Bus SCSI Bus Converter

Use an H885-AA trilink connector (see Figure 2–3), to place the converter in the mid-bus position as shown in Figure 2–2. Use the following procedure to configure the differential connector for mid-bus operation:

**Figure 2–3 H885–AA Trilink Connector**



#### CAUTION

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Do not attempt the following procedure without 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 and remove the input power cable.
2. Disconnect the SCSI cables.
3. Remove either the SBB bezel and cover, or the table top converter cover.

#### CAUTION

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The tri-link connector is always installed on the converter SCSI bus *input connector*. Remove the bus termination only for the input connector. Do not remove the termination for the output connector.

---

4. For a mid-bus position table top converter with a *single-ended input*, remove jumpers W1 and W2 (see Figure 2–4).
5. For a mid-bus position converter with a *differential input*, remove the five differential bus resistor SIPs.

#### Note

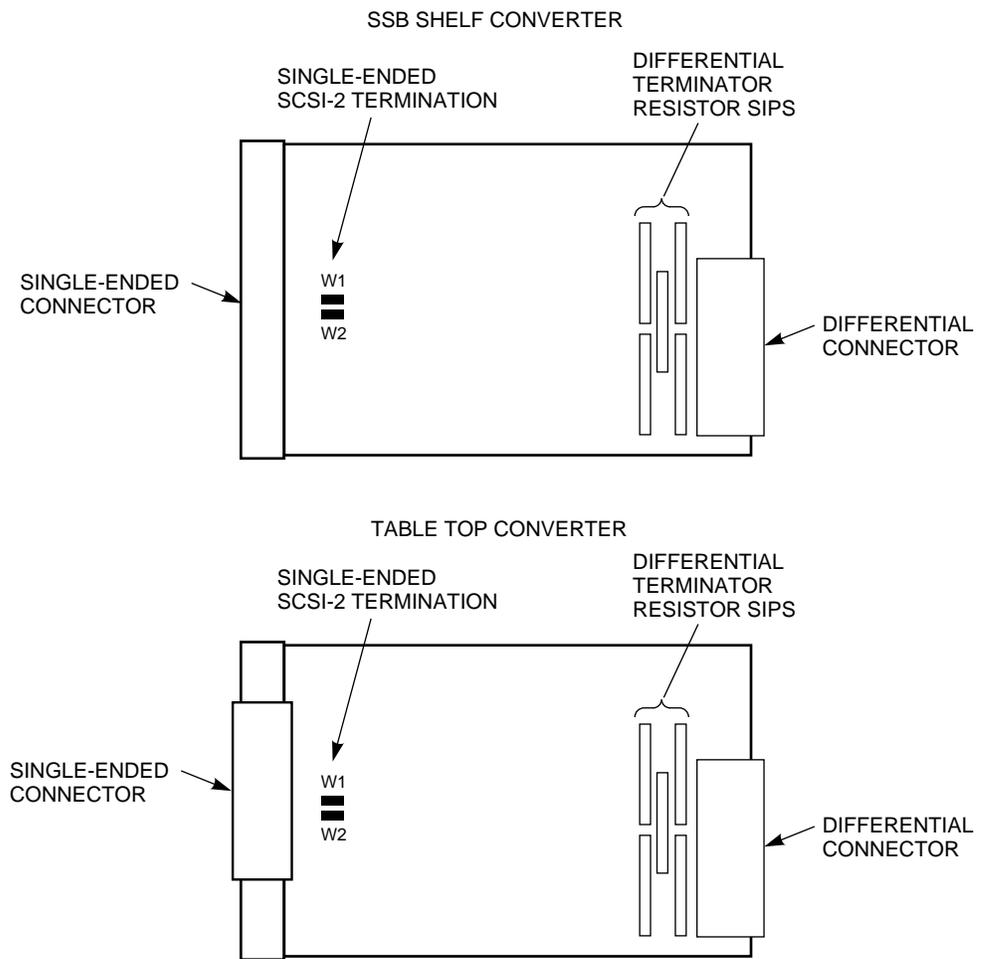
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The converters in the end-bus position are configured as shown in Figure 2–5.

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6. Replace the SBB converter cover and bezel, or the table top converter cover.
7. Install the trilink connector on the differential connector (see Figure 2-3).
8. Connect the input SCSI "P" cable from the controller or the table top converter to the trilink connector (see Figure 2-2).

**Figure 2-4 DWZZB-VW Mid-Bus Bus Terminators**



CXO-4649A-MC

9. Connect a SCSI-P cable from the trilink connector to the input connector on the second converter.
10. Make sure that the differential bus is terminated in the last converter on the bus (refer to Section 2.3.2).
11. Digital recommends that you label the converters with the status of both the differential terminator and the single-ended terminator, as either *IN* or *OUT*.
12. Install the SBB converter.
13. Connect the SCSI "P" cable.
14. Connect the input power cable and apply power to the shelf.
15. Observe the system to determine if the SCSI bus and devices are functioning properly.

## 2.3.2 End-Bus SCSI Bus Converter Terminators

Use the following procedure to configure the converter termination for an end-bus position (see Figure 2-1 and .

### CAUTION

---

Do not attempt the following procedure without proper precautions against electrostatic discharge (ESD). Always wear an ESD grounding wrist strap when you remove the cover from any enclosure or device.

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### Note

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Both the differential and the single-ended SCSI bus terminators are factory-installed. You do not need to change the termination to operate the converter in the end-bus position.

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1. Turn off the power and remove the input power cable.
2. Disconnect the SCSI cables.
3. Remove either the SBB converter bezel and cover, or the table top converter cover.

### CAUTION

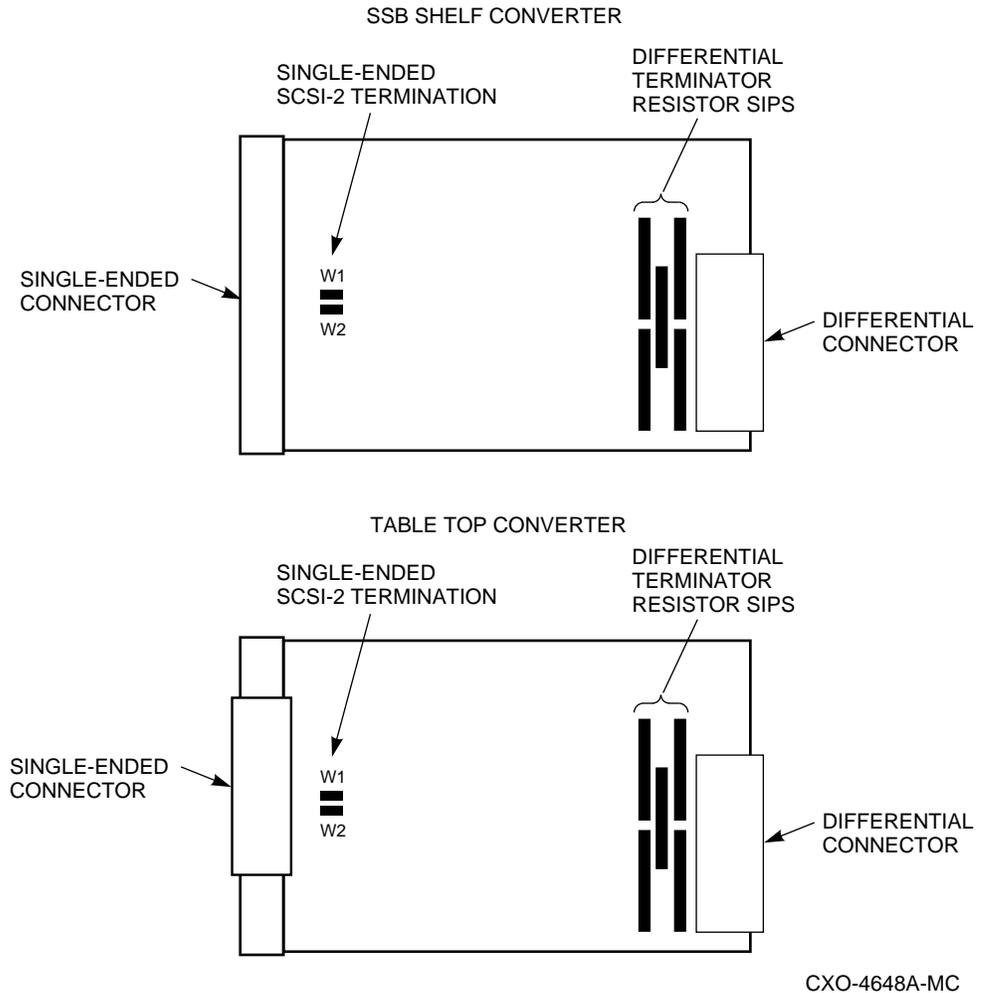
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To prevent damage, remove the SBB bezel only as required and use *minimal* pressure used when pushing down on the mounting tabs.

---

4. To terminate the single-ended input SCSI bus, install jumpers W1 and W2 (see Figure 2-5).
5. To terminate the differential input SCSI bus install the five resistor single-inline-packages (SIPs).

**Figure 2-5 DWZZB-VW End-Bus Bus Terminators**



6. Replace the SBB converter cover and bezel, or replace the table top converter cover.
7. Digital recommends that you label the converters 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.
9. Connect the SCSI "P" cables.
10. Connect the input power cable and apply power.
11. Observe the system to determine if the SCSI bus and devices are functioning properly.

## 2.4 Selecting the SCSI Cables

The *StorageWorks Solutions Configuration Guide* describes SCSI cables in detail.

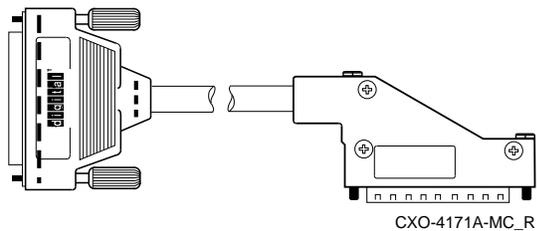
When selecting a cable you must consider the cable connector clearance. Be sure to determine the type connector compatible with the controller connector. In some cases you must use a right-angle connector because there is not enough clearance to use a straight connector. The following are the cable connector requirements:

**Table 2–2 Connector Compatibility**

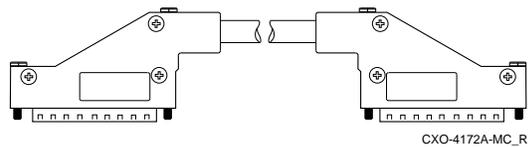
Component	68-Pin Connector Type
SBB shelf converter (DWZZB–VW)	Right-angle
Personality module–16-bit shelf	Right-angle
Table top converter (DWZZB–AA)	Right-angle or straight
Host, adapter, or controller	Check the controller user documentation to determine requirements

The recommended cables are the BN21K-series (see Figure 2–6) and the BN21L-series (see Figure 2–7).

**Figure 2–6 BN21K-Series Cable Connectors**



**Figure 2–7 BN21L-Series Cable Connectors**



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## Glossary

**adapter**

*See* SCSI bus converter.

**building block shelf**

*See* SBB shelf.

**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.

**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.

**DWZZB**

A StorageWorks compatible 16-bit SCSI bus converter.

*See* SCSI bus converter.

**electrostatic discharge**

*See* ESD.

**ESD**

Electrostatic discharge is the discharge of a potentially harmful static electric voltage as a result of improper grounding.

**host**

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

**initiator**

A SCSI device that requests another device on the bus to perform an operation. Any device on the bus can be an initiator or a target.

**logical bus**

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

**personality module**

The BA356 module that interfaces the single-ended SCSI-bus to the BA356 shelf.

**physical bus**

Two SCSI terminators separated by cables, connectors, and/or the backplane circuitry.

**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 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. For example, SCSI device ID 1 would be represented as 00001.

**SCSI mid-bus position**

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-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.

**target**

A SCSI device that performs an operation requested by an initiator. Any device on the bus can be an initiator or a target.

**target ID**

*See* SCSI device ID.

**termpower**

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