DIGITAL StorageWorks SBB Shelf I/O Modules

User's Guide

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This publication describes the function and operation of the 16–bit SBB shelf I/O modules.

This publication supersedes all versions of the 8–bit I/O module (EK–35XMG–UG) and the 16–bit I/O module (EK–35XMH–UG) user’s guides.

Digital Equipment Corporation
Maynard, Massachusetts

April 1997

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Preface

The *DIGITAL SBB Shelf I/O Modules User's Guide* describes the 8–bit and 16–bit shelf I/O modules you can use with a 16–bit SBB shelf (BA356-Series). The information in this publication discusses the function, operation, and use of each model.

Intended Audience

This document is for use by personnel responsible for designing, configuring, assembling, installing, and operating pedestals.

Documentation Conventions

The documentation conventions used in this publication are as follows:

boldface type	Boldface type indicates the first instance of terms being defined in the text, the glossary, or both.
italic type	Italic type indicates emphasis and publication titles. Italic type in the glossary indicates a cross–reference.
	A LED that is ON or blinking slowly (1 second or more)
	A LED that is OFF.
	A LED that is FLASHING (blinking rapidly)

Structure

The organization of this publication is as follows:

Chapter 1	This chapter describes 16–bit shelf I/O modules with SCSI bus extender circuitry. Compatible cables and connectors are also described.
Chapter 2	This chapter describes 16–bit shelf I/O single ended (BA35X–MH) modules. Compatible cables and connectors are also described.
Chapter 3	This chapter describes 8–bit shelf I/O modules single ended (BA35X–MG) modules. Compatible cables and connectors are also described.
Appendix A	This appendix describes the valid, switch–selectable SCSI bus device addresses for the all 16–bit shelf I/O modules using a single shelf and a single bus.
Appendix B	This appendix describes the valid, switch–selectable SCSI bus device addresses for the all 16–bit shelf I/O modules using two shelf and a single bus.
Appendix C	This appendix describes the valid, switch–selectable SCSI bus device addresses for the all 16–bit shelf I/O modules using a single shelf and a dual bus.
Glossary	Definitions of unique terms used throughout the publication.
Index	An alphabetical cross–reference, organized by major subject.

Related Documents

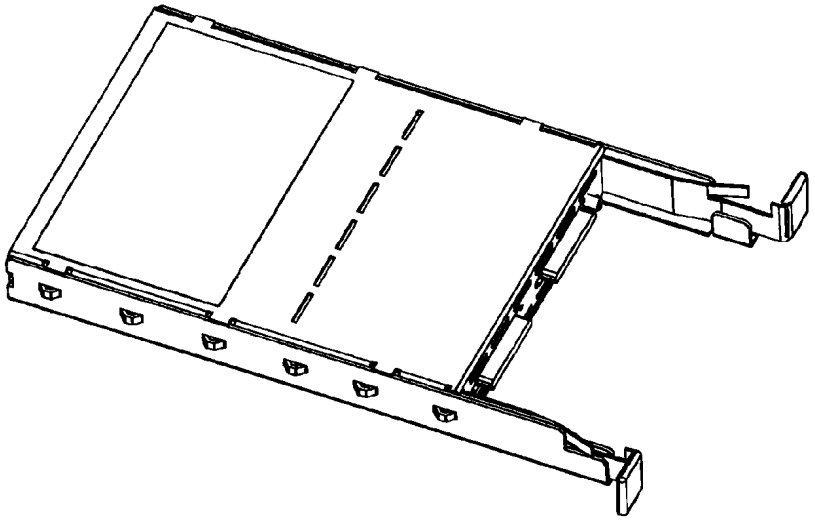
The following is a list of other StorageWorks user documents that are related to the I/O modules.

Document Title	Part No.
StorageWorks Solutions BA356 16–Bit Shelf and SBB User's Guide	EK–BA356–UG
StorageWorks Solutions BA356–K Series 16–Bit Deskside Pedestal User's Guide	EK–356KB–UG
StorageWorks Solutions Product Catalog	EK–BA350–PC

1
The 16–Bit SCSI Bus Extender I/O Modules

This chapter describes the 16–bit SBB shelf I/O modules (see Figure 1–1) with the SCSI bus isolator/converter circuitry. These modules are compatible with both 16–bit and 8–bit external SCSI buses. For a single ended bus, use the BA35X–F series modules.

Figure 1–1 Typical 16–Bit SCSI Conversion I/O Module



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Features

These I/O modules have the following features:

- Ability to electrically isolate the SBB shelf internal SCSI bus
- Single channel, single shelf, single ended bus operation
- Single channel, multiple shelf, single ended bus operation using a trilink connector
- Dual channel, single shelf, single ended bus operation
- External 16–bit data bus connections
- External 8–bit data bus connections
- Switch selectable 16–bit, 8–bit, or no SCSI bus termination
- Switch selectable device addresses (IDs)
- Overtemperature sensing, reporting, and automatic initiation of corrective action
- SBB shelf blower control to include error detection, reporting, and automatic corrective action

Caution

To ensure proper operation, DIGITAL™ only supports configurations that include ac power supplies rated for at least 180 W, such as the BA35X-HH. The use of any power supply that is not rated for at least 180 W is not supported.

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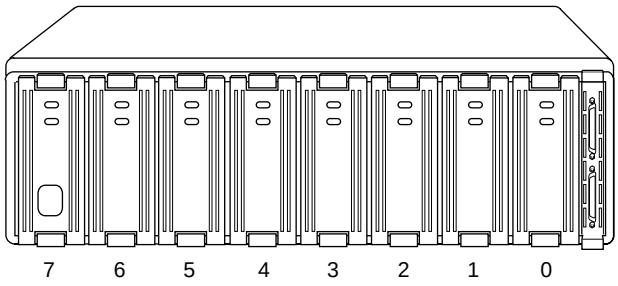
Product Description

These modules, which mount at the right end of the SBB shelf (see Figure 1–2) are available for a single ended SCSI bus (BA35X–F series).

Figure 1–2 I/O Module Location

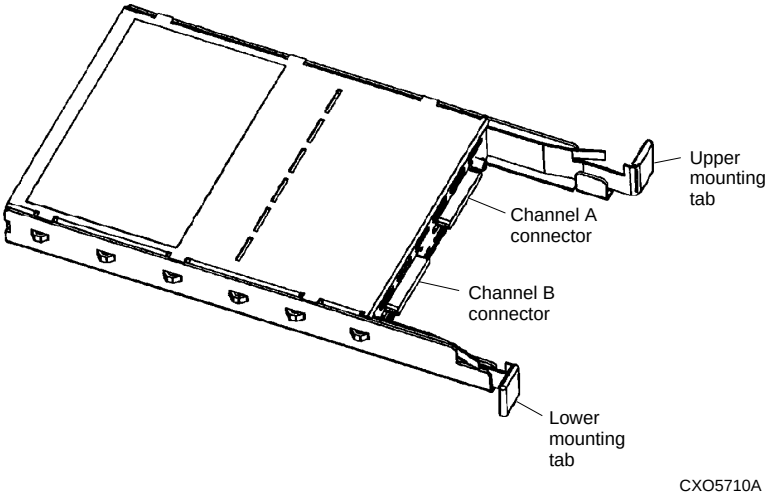


There are two types of I/O modules — single channel and dual channel. The general rules for using the different I/O modules types are as follows:

- You can configure the single channel version (model BA35X–FA) for single bus, single shelf operation.
- You *cannot* configure single channel modules for dual channel, single shelf operation.
- When you use a trilink, you can configure single channel modules for single channel, multiple shelf operation.
- You can configure dual channel I/O modules (BA35X-FB) for dual buses (split buses) on a single shelf .

The dual channel modules have two 68–pin, VHDCI female connectors mounted on the front panel (see Figure 1–3). The upper connector is the channel A connector. The lower connector is the channel B connector. The single channel modules have only a channel A (upper) connector.

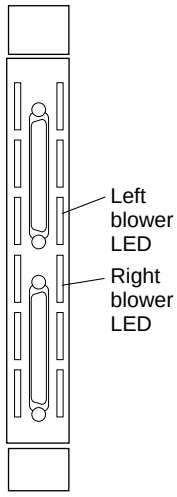
Figure 1–3 I/O Module Features



The I/O module top and bottom guides properly align the module in the shelf and with the backplane connector. When you install the I/O module the two spring steel mounting tabs expand and engage the shelf. The combination of the mounting tabs and the backplane connector ensures that the module is firmly seated in the shelf. To remove the module, press the tabs together until they disengage the shelf and pull the module out.

Mounted on the front of the module printed circuit board are the blower status LEDs (see Figure 1–4). These LEDs are either ON or FLASHING when there is a blower error or an overtemperature condition. The upper LED displays the status of the left blower. The lower displays the status of the right blower.

Figure 1–4 Front Panel Status LEDs



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The blowers cool the I/O module by drawing ambient air in through the slots in the front and exhausting it out the rear of the shelf.

Shelf Cooling

The I/O module ensures that the SBBs and shelf are at the proper operating temperature by monitoring the operational status of the shelf blowers and sensing the ambient air temperature.

The two dual speed blowers (BA35X–MD) cool all the shelf components by drawing ambient air in through the front of the SBBs and exhausting it out the rear of the shelf. These blowers normally operate at low speed. Reduction of the air flow through the shelf or an increase in the ambient temperature may result in overheating. Such a condition can cause component failure or data corruption.

The I/O module ambient temperature circuitry monitors the air flowing through the module. Should the ambient air temperature exceed 32°C + 2°C (90°F + 3°F), this circuitry:

- Turns on both blower LEDs
- Causes both blower to switch to the high-speed mode to increase air flow through the shelf

When the I/O module circuitry detects a blower that is not operating or not operating at the correct RPM, this circuitry:

- Turns ON a LED on the I/O module front panel that identifies the defective blower
- Causes the operational blower to switch to the high–speed mode to increase air flow through the shelf, thereby maintaining the proper operating environment

Note

The shelf power supply status LEDs also display blower error conditions. However, they do not identify the defective blower, nor do they report ambient air temperature faults.

Table 1–1 I/O Module LED Displays

LED Status		
Left	**Right**	**BLOWER STATUS**
		Blowers are operating normally at low speed. There is no blower or ambient air temperature error condition.
		1. The left blower is not operating properly and must be replaced. 2. The right blower is running at high–speed.
		1. The right blower is not operating properly and must be replaced. 2. The left blower is running at high–speed.
		1. The ambient air temperature exceeds 32°C + 2°C (90°F + 3°F) and both blowers are operating at high-speed. 2. Both blowers are not operating properly and must be replaced.
		Both LEDs may flash when power is applied to the shelf.

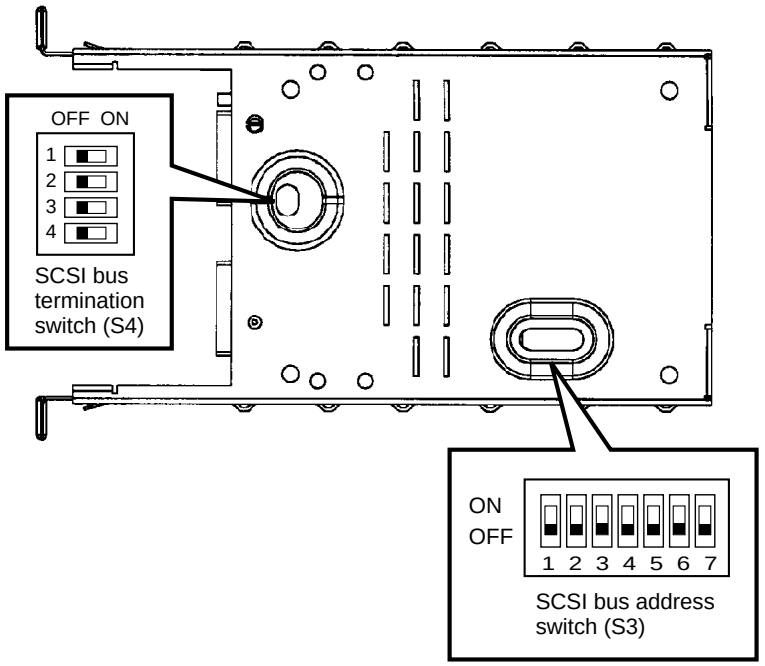
Legend		
OFF	ON	Flashing

User–Defined Configurations

You use the 7 position shelf address switches (S3) and the 4 position SCSI bus termination switch (S4) located on the right side of the module (see Figure 1–5) to establish:

- Shelf device addresses (IDs)
- SCSI bus termination.

Figure 1–5 I/O Module Switches



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SCSI Bus Termination Settings

Switch S4 (see Figure 1–6) determines the shelf bus termination:

- The top two switches (S4–1 and S4–2) control termination for channel A on both single and dual channel I/O modules.
- The bottom two switches (S4–3 and S4–4) control termination for channel B on dual channel I/O modules.

Note

Switches S4–3 and S4–4 have no function on a single channel I/O module.

Figure 1–6 SCSI Bus Termination Switch Settings

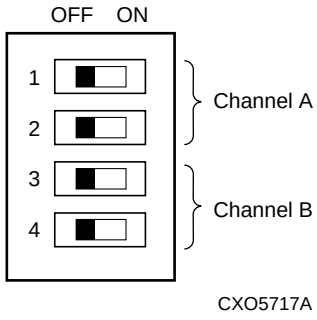
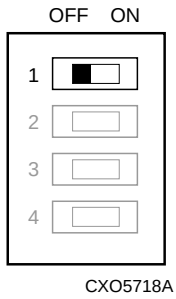
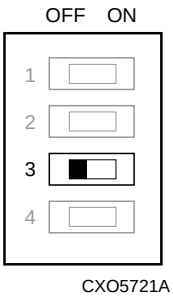
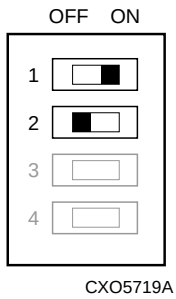
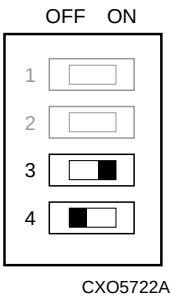
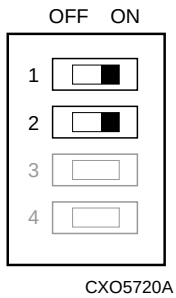
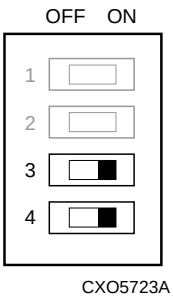


Table 1–2 defines the configurations established by these switches.

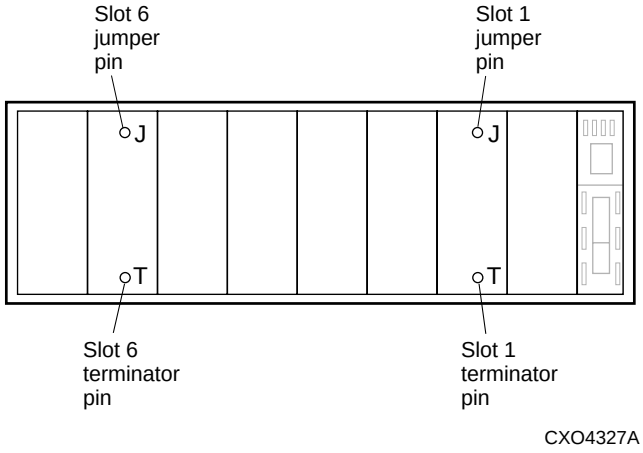
Table 1–2 Channel Termination Configuration Switch Settings

Channel A Switches	Configuration	Channel B Switches
 CXO5718A	**16–Bit Bus Termination** Terminates all SCSI bus bits (full termination). This configuration is used when the shelf is the end point in a SCSI bus and terminates all signals.	 CXO5721A
 CXO5719A	**8–Bit Bus Termination** Terminates only the upper 8 data. This configuration is used when the input bus is a wide (16-bit) bus and it continues as a narrow (8-bit) bus. This could be used with a trilink to a narrow device.	 CXO5722A
 CXO5720A	**Bus Expansion** No termination on the shelf. The shelf is not an end point of a SCSI bus segment and no termination is needed.	 CXO5723A

Shelf Configuration

Unless specifically stated otherwise, the basic shelf configuration (see Figure 1–7) is as follows:

Figure 1–7 16–Bit SBB Shelf Backplane Termination



- The 16–bit jumper module (BA35X–ME) is mounted on the backplane behind slot 6.
- You can store the *optional* 16–bit terminator module (BA35X–MF) behind slot 1.
- To identify the modules installed on the backplane remove the SBB from either slot 1 or slot 6.
  - — The identification pin on a jumper module aligns with the top hole in the backplane.
  - — The identification pin on a terminator module aligns with the bottom hole in the backplane.

Note

The module connector behind slot 1 is for storing the *unused* module. A module in this location has no affect on the shelf SCSI bus.

- The SCSI bus input is on channel A (connector JA1) for single channel I/O modules.

Note

There is no channel B connector on a single channel I/O module.

- The channel B connector on a dual channel module is either:
  - — a SCSI bus input for a second host

or

  - — a second bus

When you are using a dual channel I/O module, the channel B functions are determined by the module installed in slot 6:

- The shelf has one bus when the jumper module is installed in slot 6:
  - — You can connect the single channel host to either the channel A or channel B connector.
  - — You connect dual redundant hosts to the channel A and the channel B connectors.
- When the terminator module is installed in slot 6 the shelf has two buses. Connect the two hosts to the channel A and channel B connectors.

Table 1–3 Connector JB1 Functions

No. of Shelves	Bus Type	Shelf Position	Connector Function
1	Single	Last	Not used
1	Dual	First	Channel B Input

Use the following procedures to configure a shelf:

1. Remove power from the shelf and remove the I/O module.
2. Set switch S3 to establish the shelf addresses.
3. Set switch S4 to establish the SCSI bus termination for each channel.
4. Install the I/O module in the shelf.
5. Connect the external SCSI bus cables.
6. Apply power and test the shelf for proper operation.

The following sections define the DIGITAL-supported SCSI bus configurations and SBB shelf single ended bus lengths.

Configuring a Single Shelf with a Single Bus

You can create this configuration using either a dual channel or a single channel I/O module. The features of this configuration include:

- The internal bus is terminated by the I/O module
- The SCSI bus input is the channel A connector
- The channel B connector is not used

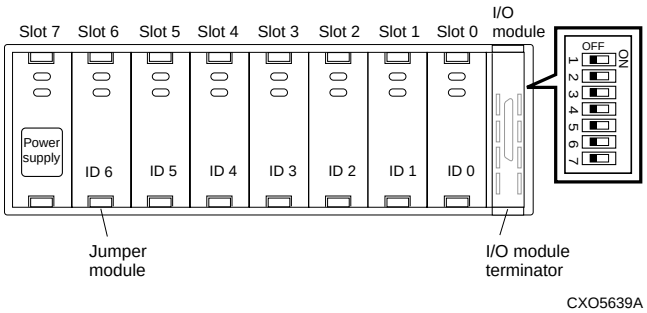
Table 1–4 defines SBB shelf SCSI bus length for this configuration and shows the default device address switch settings.

Note

For additional device address switch settings, see Appendix A.

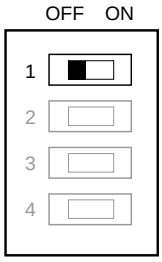
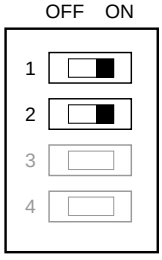
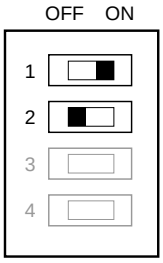
Table 1–4 Single SCSI Bus, Single Shelf Parameters

Shelf No.	Channel	JA1	JB1	Terminator	Jumper	Meters	Feet
1	A	Input	None	I/O module	Slot 6	1.0	3.3



Complete the following procedure to establish a single bus on a single shelf configuration:

1. Remove power from the shelf and remove the I/O module.
2. Set the SCSI bus termination switches to enable one of the following configurations:

When the Shelf Configuration is…	The Switch Setting is…
A SCSI bus segment end point, you use full termination.	 CXO5718A
A SCSI bus segment midpoint, you use no termination.	 CXO5720A
A SCSI bus segment with a wide bus (16-bit) input and a narrow bus (8-bit) output via a trilink, you use 8-bit termination	 CXO5719A

3. Use either the default device address switch settings shown in Table 1–4, or use one of the addresses listed in Appendix A.
4. Install the I/O module in the shelf.
5. Connect the external SCSI bus cables.
6. Assign device address and install SBBs.
7. Apply power and test the shelf for proper operation.

Configuring Two Shelves with a Single Bus

The features of this configuration include:

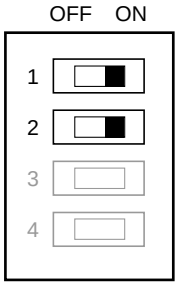
- The I/O module on each shelf terminates the bus on that shelf.
- The host or controller SCSI bus input is the channel A connector on the first shelf.
- The trilink link connector and a SCSI cable connect the SCSI bus input to the second shelf.

Note

For additional device address switch settings, see Appendix B.

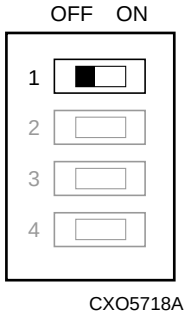
Complete the following procedure, on *both shelves*, to establish a single bus, two shelf configuration*:*

1. Remove power from the shelf and remove both the I/O modules.
2. Set the SCSI bus termination switch on the *first* shelf for no termination.



CXO5720A

3. Set the SCSI bus termination switches on the SECOND I/O module to enable *full* SCSI bus segment end point configuration.



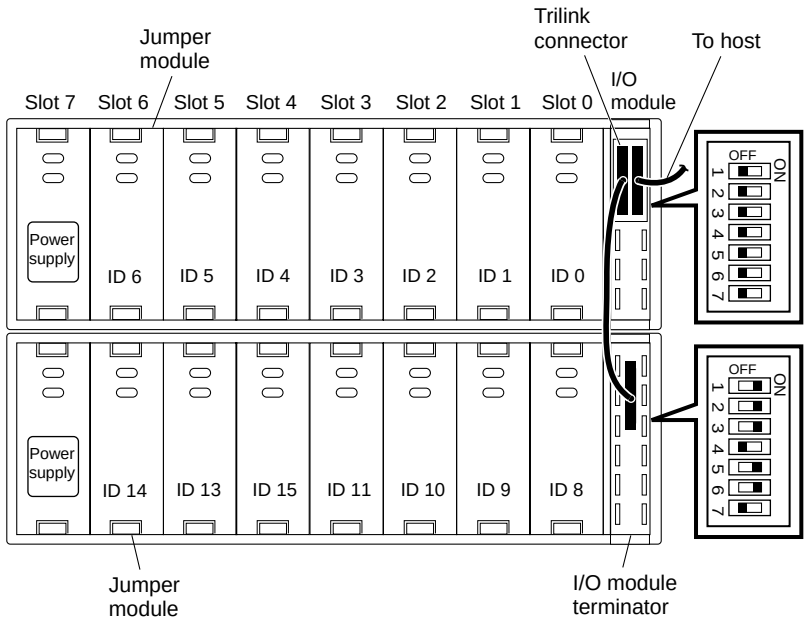
4. Set the device addresses on *both shelves* using either switch settings shown in Table 1–5 or one of the addresses listed in Appendix B.
5. Connect the trilink connector to the channel A connector on the first shelf. Connect a BN37A cable to the trilink connector. Install the I/O module in the shelf.
6. Connect the cable from the trilink connector to the channel A connector on the second shelf. Install the I/O module in the shelf.
7. Install the SBBs.
8. Apply power and test the shelf for proper operation.

Table 1–5 defines the SBB shelf SCSI bus length for this configuration and shows the default device address switch settings.

The 16–Bit SCSI Bus Extender I/O Modules

Table 1–5 Two SBB Shelves with a Single SCSI Bus

Shelf No.	Channel	JA1	JB1	Terminator	Jumper	Meters	Feet
1	A	Input	Output BN37A–0E	I/O module	Slot 6	1.0	3.3
2	A	Input BN37A–0E	None	I/O module	Slot 6	1.0	3.3



Configuring a Single Shelf with a Dual Bus

The features of this configuration include:

- The termination module behind slot 6 terminates both SBB shelf internal buses.
- The host SCSI bus inputs are both the channel A and the channel B connectors.

Note

For additional device address switch settings, see Appendix C.

Complete the following procedure to establish a single shelf dual bus configuration, complete the following procedure*:*

1. Remove power from the shelf and remove the I/O module.
2. Remove both blowers from the rear of the shelf

   Install the termination module on the connector behind slot 6.

   Store the jumper module on the connector behind slot 1.
3. Remove the I/O module and set the device address switch settings as shown in Table 1–6, or use one of the addresses listed in Appendix C.
4. Install the I/O module in the shelf.
5. Connect the external SCSI bus cables.
6. Assign device address and install SBBs.
7. Apply power and test the shelf for proper operation.

This configuration requires a dual channel I/O module (BA35X–FB) and the *optional* 16–bit SBB shelf termination module (BA35X–MF). The features of this configuration include:

- Both channel A and channel B are terminated by the *optional* 16–bit termination module (BA35X–MF) installed on the backplane behind slot 6.
- The channel A SCSI bus input connector is JA1.
- The channel B SCSI bus input connector is JB1.

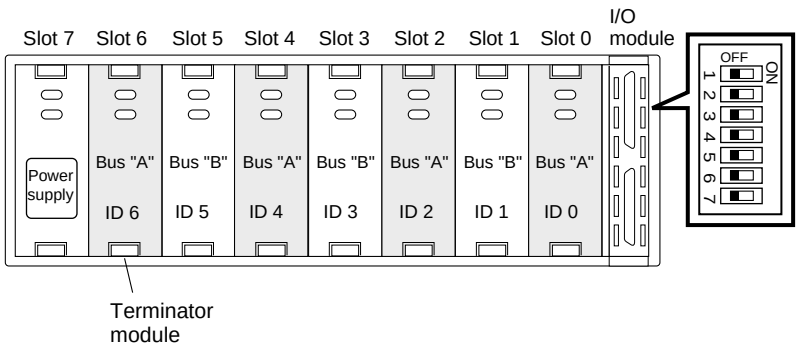
Table 1–6 defines the SBB shelf SCSI bus length for this configuration and shows the default device address switch settings.

Note

For additional device address switch settings, see Appendix C.

Table 1–6 Single SBB Shelf Dual SCSI Bus

1	A	Input	None	Slot 6	None	0.4	1.3
1	B	None	Input	Slot 6	None	0.6	2.0



SCSI Bus Data

Table 1–7 defines the maximum data transfer rates and the maximum SCSI bus lengths when using a 16–bit extender I/O module. The cable lengths are rounded off to the nearest whole unit. The definition of data transfers rates are as follows:

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

Table 1–7 Ultra SCSI Bus Parameters

Parameter	Specification
Transfer rates	20 MT/s — 40 MB/s
Maximum single ended shelf bus length	1 m (3.3 ft)
Maximum *Recommended* cable length	20 m (65.6 ft)
Maximum cable length	20 m (65.6 ft)

Note

Adding or removing devices to a shelf *does not* change the length of the shelf single ended bus. The only way to change the length of the shelf SCSI bus is configure the shelf as a dual bus.

SCSI Bus Cabling

You can connect the I/O module to the external SCSI bus using a combination of:

- VHDCI compatible cables.
- Adapter cables .
- Trilink connectors.
- VHDCI terminator blocks).

To select a compatible cable see Table 1–8.

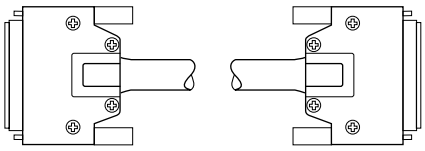
Table 1–8 Ultra SCSI Cable Selection

To connect a…	To a…	Use a…
68-pin, VHDCI female	68-pin, VHDCI female	BN37A
68-pin, VHDCI female	68-pin, high density, male	BN38B
68-pin, VHDCI female	50-pin, high density, male	BN38A
68-pin, VHDCI male	68-pin, high density, female	BN37B

BN37A–Series Ultra SCSI Cables

You can use these cables to connect devices with 68-pin, VHDCI female connectors.

Cable Description	Meters	Feet	Part No.
68-conductor SCSI cable with: 2 — 68-pin, VHDCI, straight, male connectors with jack screws	0.3 0.5 1.0 1.5 2.0 2.5 3.0 5.0 10.0 15.0 20.0 25.0	1.0 1.6 3.3 4.9 6.6 8.2 9.8 16.4 32.8 49.2 65.6 82.0	BN37A–0C BN37A-0E BN37A-01 BN37A-1E BN37A-02 BN37A-2E BN37A-03 BN37A-05 BN37A-10 BN37A-15 BN37A-20 BN37A-25

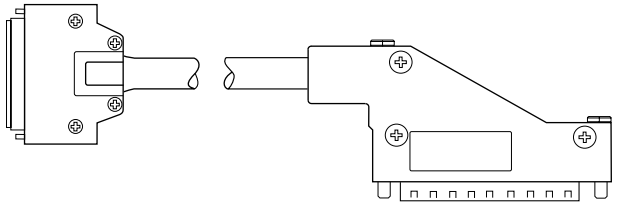


CXO5702A

BN37B–Series Ultra SCSI Adapter Cables

You can use these adapter cables to connect devices with 68-pin, VHDCI male connectors to cables or devices with 68-pin, high density, female connectors.

Cable Description	Meters	Feet	Part No.
68-conductor SCSI adapter cable with: 1 — 68-pin, VHDCI, straight, female connector with jack screws 1 — 68-pin, high density, right-angle, male connector with jack screws	0.2	0.6	BN37B–0B

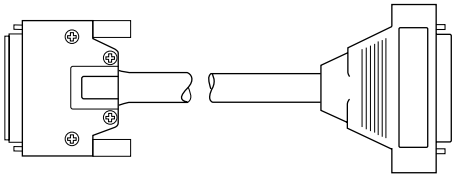


CXO5738A

BN38A–Series Ultra SCSI Adapter Cables

You can use this series of adapter cables to connect devices with a 68-pin, VHDCI female connector to cables or devices with a 50-pin, high density, male connector.

Cable Description	Meters	Feet	Part No.
68-conductor SCSI adapter cable with: 1 — 68-pin, VHDCI, straight, male connector with jack screws 1 — 50-pin, high density, female connector	0.2	0.6	BN38A–0B

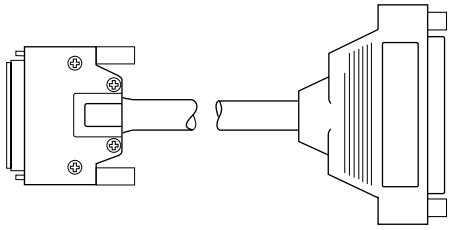


CXO5739A

BN38B–Series Ultra SCSI Adapter Cables

You can use these adapter cables to connect devices with a 68-pin, female VHDCI connector to cables or devices with a 68-pin, high density, male connector.

Cable Description	Meters	Feet	Part No.
68-conductor SCSI adapter cable with: 1 — 68-pin, VHDCI, straight, male connector with jack screws 1 — 68-pin, high density, straight female connector	1.0	3.3	BN38B-01



CXO5740A

SCSI VHDCI Trilink Connector

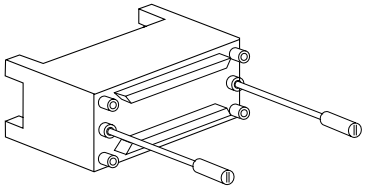
You can use these trilinks with:

- Devices with a 68-pin, VHDCI male connector.

and.

- Cables with a 68-pin, VHDCI female connector.

Description	Part No.
68–pin trilink connector with: 2 — 68–pin, VHDCI female connectors 1 — 68–pin, VHDCI male connectors.	H8861–AA



CXO5744A

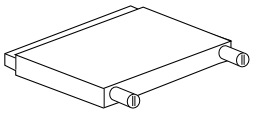
VHDCI Terminator Blocks

You can use these terminator blocks with devices, cables, or trilinks with 68-pin, VHDCI female connectors.

Caution

Although these terminator blocks are similar, *they are not interchangeable*. Using an incorrect terminator block, such as a single ended terminator block on a differential bus or vice-versa, will cause the bus to fail.

Description	Part No.
68–pin active single ended SCSI bus terminator block	H8865–AA
68–pin differential SCSI bus terminator block	H8868–BA

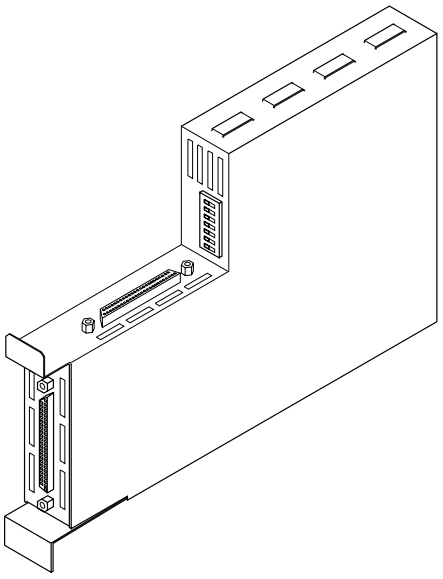


CXO5745A

2
The 16–Bit I/O Module

This chapter describes the SBB shelf 16–bit I/O module.

Figure 2–1 16–Bit I/O Module



CXO-5087A-MC

Features

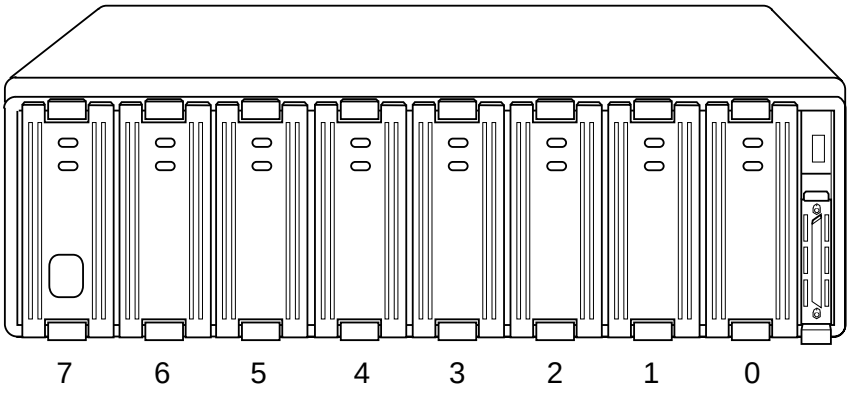
These I/O modules have the following features:

- Single channel, single shelf, single ended bus configuration
- Single channel, multiple shelf, single ended bus configuration
- Dual channel, single shelf, single ended bus configuration
- External 16–bit data bus connections
- Switch selectable device addresses (IDs)
- Overtemperature sensing, reporting, and automatic corrective action
- SBB shelf blower control to include error detection, reporting, and automatic corrective action

Product Description

These modules, (BA35X–MH) mount at the right end of the SBB shelf (see Figure 2–2).

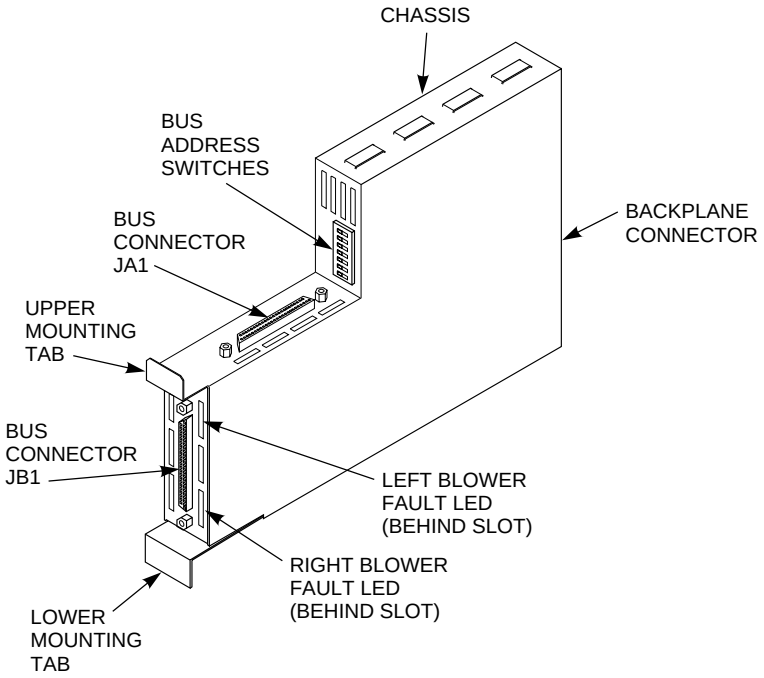
Figure 2–2 I/O Module Location



These modules have two 68–pin, high density, female connectors (see Figure 2–3). The top connector is the channel A connector. The front connector is the channel B connector.

The 7 position SCSI bus address switches determine the SBB shelf device addresses (device IDs).

Figure 2–3 I/O Module Features



CXO-4507A-MC

The I/O module top and bottom guides properly align the module in the shelf and with the backplane connector. When you install the I/O module, the two spring steel mounting tabs expand to engage the shelf. The combination of the mounting tabs and the backplane connector ensures that the module is firmly seated in the shelf. To remove the module, press the tabs together until they disengage the shelf and pull the module out.

The blower status LEDs are also mounted on the I/O module *behind the front panel* (refer to Figure 2–3). These LEDs are either ON or FLASHING when there is a blower error or an overtemperature condition. You can easily view them through slots in the panel to the right of the connector. The top LED displays the status of the left blower. The bottom LED displays the status of the right blower. Both LEDs are on when there is an overtemperature condition.

The blowers cool the I/O module by drawing ambient air in through the slots in the module front and exhausting out the rear of the shelf.

Shelf Cooling

The I/O module ensures that the SBBs and shelf are at the proper operating temperature by monitoring the operational status of the shelf blowers and sensing the ambient air temperature.

The two dual speed blowers (BA35X–MD) cool all the shelf components by drawing ambient air in through the front of the SBBs and exhausting it out the rear of the shelf. These blowers normally operate at low speed. Reduction of the air flow through the shelf or an increase in the ambient temperature may result in overheating. Such a condition can cause component failure or data corruption.

The I/O module ambient temperature circuitry monitors the air flowing through the module. Should the ambient air temperature exceed 32°C + 2°C (90°F + 3°F), this circuitry:

- Turns on both blower LEDs
- Causes both blower to switch to the high-speed mode to increase air flow through the shelf

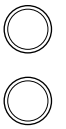
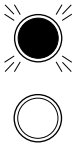
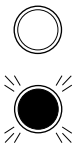
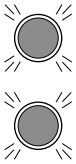
When the I/O module circuitry detects a blower that is not operating or not operating at the correct RPM, this circuitry:

- Turns ON a LED on the I/O module front panel that identifies the defective blower
- Causes the operational blower to switch to the high–speed mode to increase air flow through the shelf, thereby maintaining the proper operating environment

Note

The shelf power supply status LEDs also display blower error conditions. However, they do not identify the defective blower, nor do they report ambient air temperature faults.

Table 2–1 I/O Module LED Displays

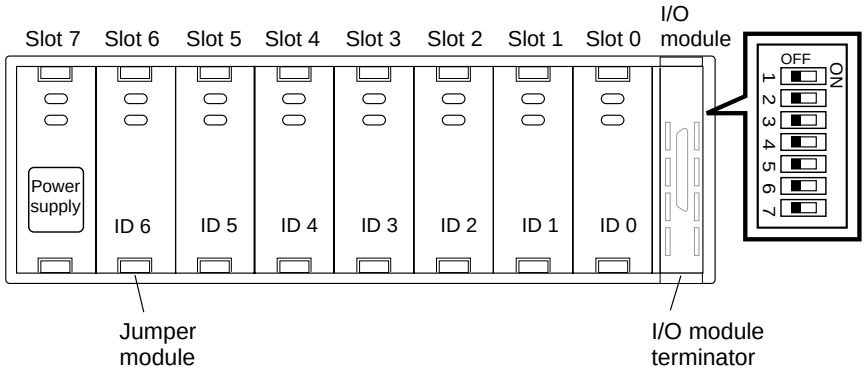
LEDs	Status
	Blowers are operating normally at low speed. There is no blower or ambient air temperature error condition.
	1. The left blower is not operating properly and must be replaced. 2. The right blower is running at high–speed.
	1. The right blower is not operating properly and must be replaced. 2. The left blower is running at high–speed.
	1. The ambient air temperature exceeds 32°C + 2°C (90°F + 3°F) and both blowers are operating at high–speed. 2. Both blowers are not operating properly and must be replaced.
	Both LEDs may flash when power is applied to the shelf.

Legend		
OFF	ON	Flashing

User–Defined Configurations

You use the 7 position shelf address switches (S3) (see Figure 2–4) to establish the shelf device addresses.

Figure 2–4 Shelf Device Address Switches



Shelf Configuration

Unless specifically stated otherwise, the basic shelf configuration is:

- The 16–bit jumper module (BA35X–ME) is mounted on the backplane behind slot 6.
- You can store the *optional* 16–bit terminator module (BA35X–MF) behind slot 1.
- To identify the modules installed on the backplane remove the SBB from either slot 1 or slot 6.
  - — The identification pin on a jumper module aligns with the top hole in the backplane.
  - — The identification pin on a terminator module aligns with the bottom hole in the backplane.
- The SCSI bus input is on channel A (connector JA1).

The channel B functions are determined by:

- The number of shelves (single or multiple)
- The SCSI bus type (single or dual)

- The shelf position in the bus (for example, first, middle, last)

Note

The module connector behind slot 1 is for storing the *unused* module. A module in this location has no affect on the shelf SCSI bus.

Figure 2–5 16–Bit SBB Shelf Backplane Termination

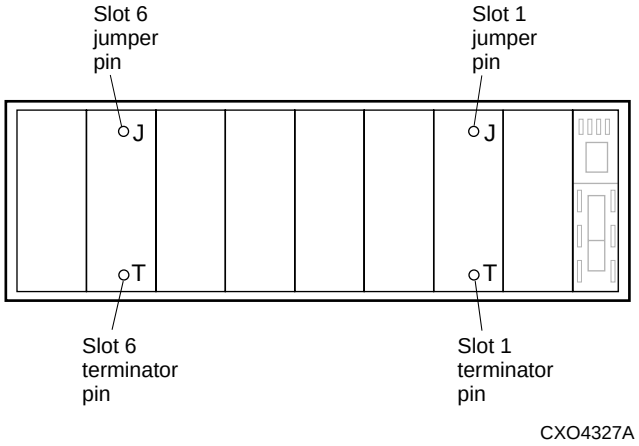


Table 2–2 Connector JB1 Functions

No. of Shelves	Bus Type	Shelf Position	Connector Function
1	Single	Last	Not used
2	Single	First	Channel A output
		Last	Not used
1	Dual	First	Channel B Input

.

Note

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

Use the following procedures to configure a shelf:

1. Remove power from the shelf and remove the I/O module.
2. Set switch S3 to establish the shelf addresses.
3. Install the I/O module in the shelf.
4. Connect the external SCSI bus cables.
5. Apply power and test the shelf for proper operation.

The following sections define the DIGITAL-supported SCSI bus configurations and SBB shelf single ended bus lengths.

Configuring a Single Shelf with a Single Bus

The features of this configuration include:

- The bus is terminated by the I/O module.
- The SCSI bus input is the channel A connector .
- The channel B connector is not used.

Complete the following procedure to establish a single bus on a single shelf configuration:

1. Remove power from the shelf and remove the I/O module.
2. Use either the default device address shown in Table 2–3, or use one of the addresses listed in Appendix A.
3. Connect the external SCSI bus cables.
4. Install the I/O module in the shelf.
5. Assign device address and install SBBs.
6. Apply power and test the shelf for proper operation.

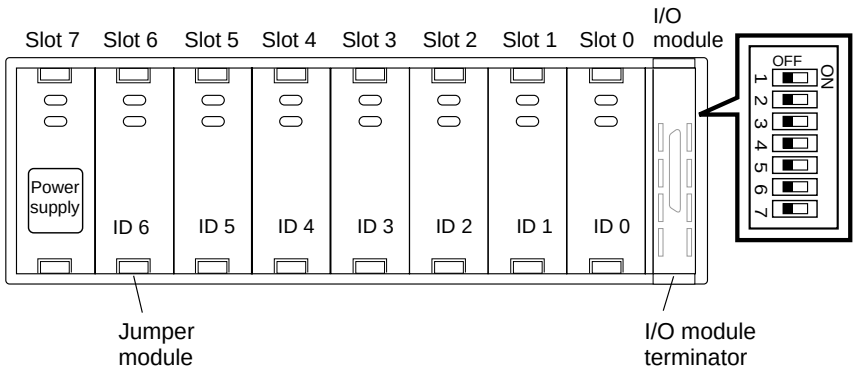
Table 2–3 defines SBB shelf SCSI bus length for this configuration and shows the default device address switch settings.

Note

For additional device address switch settings, see Appendix A.

Table 2–3 Single SCSI Bus, Single Shelf Parameters

Shelf No.	Channel	JA1	JB1	Terminator	Jumper	Meters	Feet
1	A	Input	None	I/O module	Slot 6	1.0	3.3



Configuring Two Shelves with a Single Bus

The features of this configuration include:

- The bus is terminated by the I/O module on the last shelf.
- The SCSI bus input is connector JA1 on the first shelf.
- Installing a jumper cable between the first shelf channel B connector and the second shelf A channel connector extends the bus to the second shelf.

Table 2–4 defines the SBB shelf SCSI bus length for this configuration and shows the default device address switch settings.

Note

For additional device address switch settings, see Appendix B.

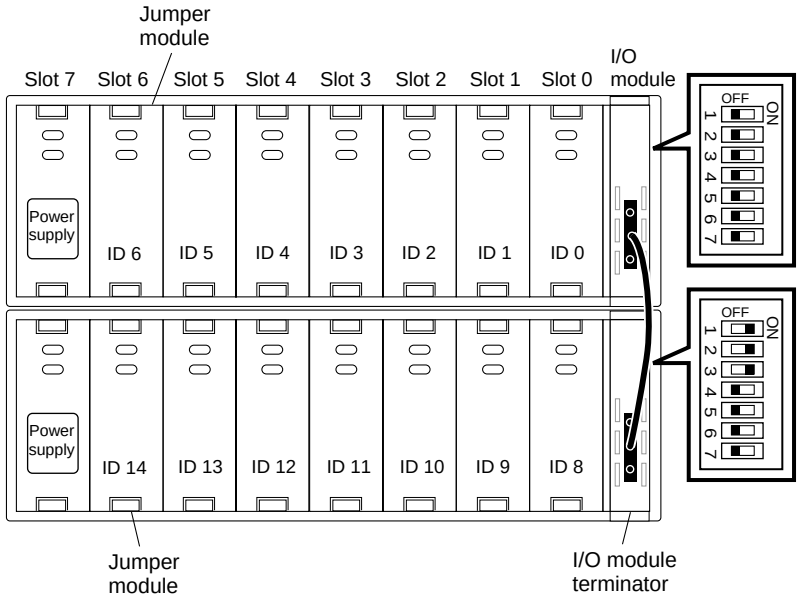
Complete the following procedure, on *each shelf*, to establish a single bus, two shelf configuration:

1. Remove power from the shelf and remove the I/O module.
2. Use either the default device address switch setting shown in Table 2–4, or use one of the addresses listed in Appendix B.
3. Connect the external SCSI bus cables.
4. Install the I/O module in the shelf.
5. Assign device address and install SBBs.
6. Apply power and test the shelf for proper operation.

The following table defines this configuration.

Table 2–4 Two SBB Shelves with a Single SCSI Bus

Shelf No.	Channel	JA1	JB1	Terminator	Jumper	Meters	Feet
1	A	Input	Output BN37A–0E	None	Slot 6	1.0	3.3
					Jumper cable BN37A–0E	0.5	1.6
2	A	Input BN37A–0E	None	I/O module	Slot 6	1.0	3.3
					Total Bus Length	2.5	8.2



Configuring a Single Shelf with a Dual Bus

The features of this configuration include:

- Both channel A and channel B are terminated by the *optional* 16–bit termination module (BA35X–MF) installed on the backplane behind slot 6.
- The channel A SCSI bus input connector is JA1.
- The channel B SCSI bus input connector is JB1.

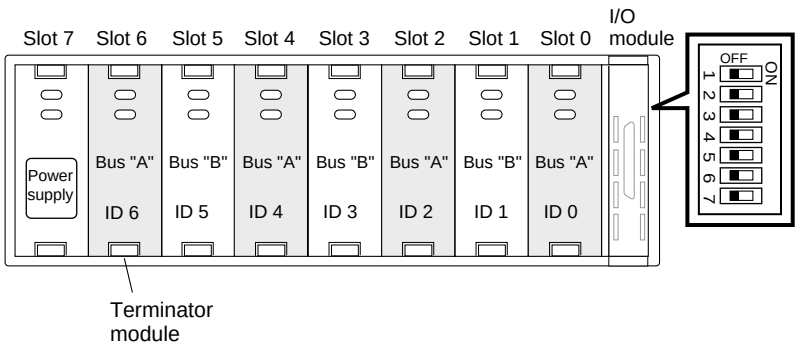
Table 2–5 defines the SBB shelf SCSI bus length for this configuration and shows the default device address switch settings.

Note

For additional device address switch settings, see Appendix C.

Table 2–5 Single SBB Shelf, Dual SCSI Bus Parameters

Shelf No.	Channel	JA1	JB1	Terminator	Jumper	Meters	Feet
1	A	Input	None	Slot 6	None	0.4	1.3
1	B	None	Input	Slot 6	None	0.6	2.0



Complete the following procedure to establish a dual bus on a single shelf configuration:

1. Turn off the shelf power.
2. Remove the blowers.
3. Discharge any static build–up by momentarily touching a finger to the I/O module tabs.
4. Remove the jumper module (BA35X–ME) from the backplane connector behind slot 6.
5. Remove the termination module (BA35X–MF) from the backplane connector behind slot 1.
6. Install the jumper module on the backplane connector behind slot 1.
7. Install the termination module on the backplane connector behind slot 6.
8. Replace the blowers.
9. Remove the I/O module.
10. Use either the default device address switch settings shown in Table 2–5, or use one of the addresses listed in Appendix C.
11. Connect the channel A SCSI cable to connector JA1.
12. Install the I/O module in the shelf.
13. Connect the channel B SCSI cable to connector JB1.
14. Assign device address and install SBBs.
15. Connect the power cables to the shelf power supplies.

SCSI Bus Data

Table 2–6 defines the maximum data transfer rates and the maximum SCSI bus lengths when using a 16–bit I/O module. The cable lengths are rounded off to the nearest whole unit. The definition of data transfers rates are as follows:

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

Table 2–6 Fast 10 SCSI Bus Parameters

Parameter	Specification
Transfer rates	10 MT/s — 20 MB/s
Maximum single ended shelf bus length	1 m (3.3 ft)
Maximum single ended cable length	2 m (6.6 ft)

Note

Adding or removing devices to a shelf *does not* change the length of the shelf single ended bus. The only way to change the length of the shelf SCSI bus is to configure the shelf as a dual bus.

SCSI Bus Cabling

The input and output cables on the SCSI bus connect to the two connectors. The shelf SCSI bus configuration, single or dual, determines whether the connector functions as input connector or an output connector.

There are two cable variations available:

- High density cable with a 68–pin, right angle, connector on each end (see “BN21L–Series SCSI Cables,” on page 2–15)
- High density cable with a 68–pin, right angle, connector on one end and a 68–pin, standard connector on the other (see “BN21K–Series SCSI Adapter Cables,” on page 2–16)

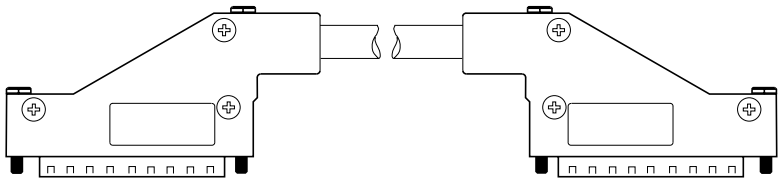
Note

Do NOT exceed the maximum 3 meter bus length unless you use a SCSI bus converter such as a DWZZC.

BN21L–Series SCSI Cables

You can use these cables to connect devices with 68-pin, high density, female connectors.

Cable Description	Meters	Feet	Part No.
68–conductor single ended SCSI cable with: 2 — 68–pin, high density, straight, male connectors with screw fasteners.	0.3 1.0 1.5 2.0 3.0 5.0 10.0 15.0 20.0	0.5 3.3 4.9 6.6 9.8 16.4 32.8 49.2 65.6	BN21L–0E BN21L–01 BN21L–1E BN21L–02 BN21L–03 BN21L–05 BN21L–10 BN21L–15 BN21L–20

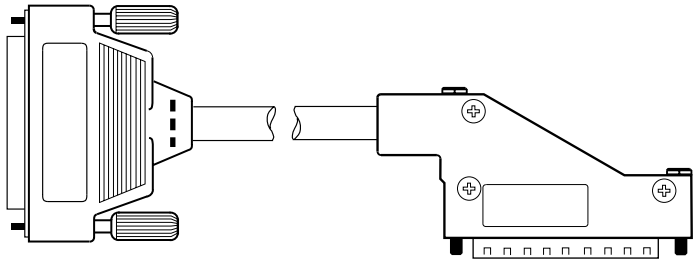


CXO-4172A-MC_R

BN21K–Series SCSI Adapter Cables

You can use these adapter cables to connect devices with *different configuration* 68-pin, high density, female connectors.

Cable Description	Meters	Feet	Part No.
68–conductor single ended SCSI cable with: 1 — 68–pin, high density, straight, male connector with thumb latches 1 — 68–pin, high density, right–angle, male connector with screw fasteners.	1.0 1.5 2.0 3.0 5.0 8.0 10.0 15.0 20.0 23.0	3.3 4.9 6.6 9.8 16.4 26.2 32.8 49.2 65.6 75.5	BN21K–01 BN21K–1E BN21K–02 BN21K–03 BN21K–05 BN21K–08 BN21K–10 BN21K–15 BN21K–20 BN21K–23

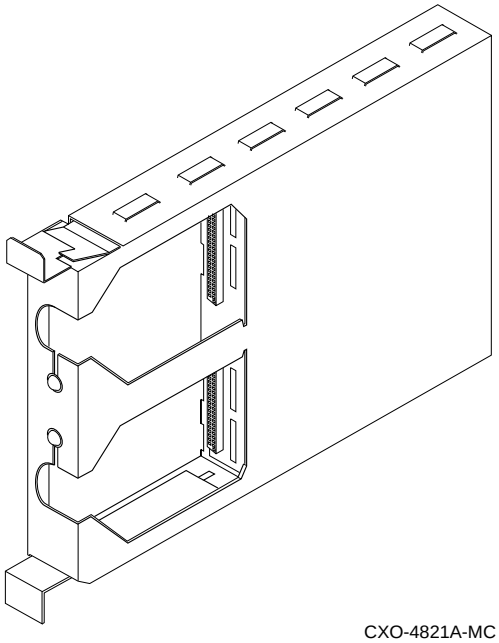


CXO-4171A-MC_R

3
The 8–Bit I/O Module

This chapter describes the 8–bit I/O module (see Figure 3–1). It explains how to install the I/O module in the 16–bit SBB shelf, and how to set the shelf small computer system interface (SCSI) addresses.

Figure 3–1 8–Bit I/O Module



CXO-4821A-MC

Features

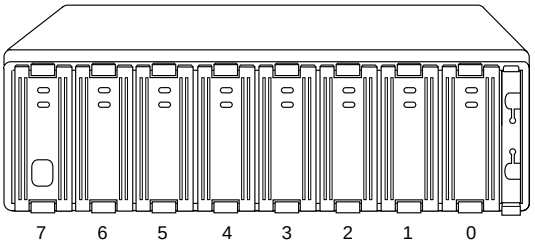
These I/O modules have the following features:

- Single channel, single shelf, single ended bus configuration
- Dual channel, single shelf, single ended bus configuration
- External 8–bit data bus connections
- Overtemperature sensing, reporting, and automatic corrective action
- SBB shelf blower control to include error detection, reporting, and automatic corrective action

Product Description

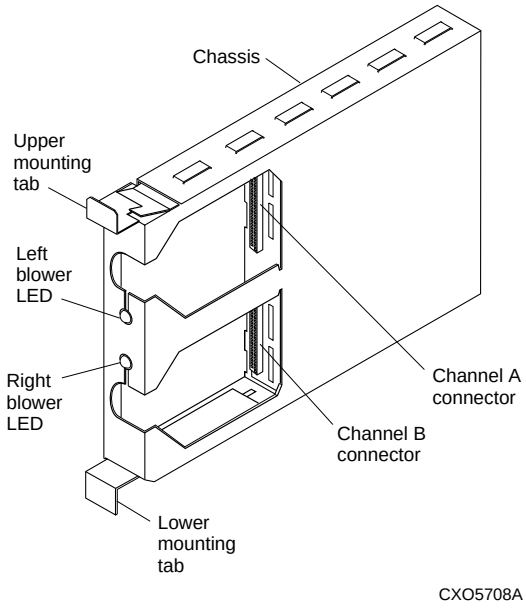
The 8–bit I/O module is located on the right side of the shelf, next to slot 0 (see Figure 3–2).

Figure 3–2 16–Bit SBB Shelf with 8–Bit I/O Module



On the front of the I/O module (see Figure 3–3) there are two 50-pin female connectors: channel A and channel B (see Figure 3–3). The blower status LEDs are also mounted on the front frame between the cable mounting slots. These LEDs are either ON or FLASHING when there is a blower error or an overtemperature condition. The top LED displays the status of the left blower. The bottom LED displays the status of the right blower. Both LEDs are on when there is an overtemperature condition.

Figure 3–3 I/O Module Features



The I/O module top and bottom guides properly align the module in the shelf and with the backplane connector. When you install the I/O module, the two spring steel mounting tabs expand to engage the shelf. The combination of the mounting tabs and the backplane connector ensures that the module is firmly seated in the shelf. To remove the module, press the tabs together until they disengage the shelf and pull the module out.

The blower status LEDs are also mounted on the I/O (refer to Figure 3–3). These LEDs are either ON or FLASHING when there is a blower error or an overtemperature condition. You can easily view them through slots in the panel to the right of the connector. The top LED displays the status of the left blower. The bottom LED displays the status of the right blower. Both LEDs are on when there is an overtemperature condition.

The blowers cool the I/O module by drawing ambient air in through the slots in the module front and exhausting out the rear of the shelf.

Shelf Cooling

The I/O module ensures that the SBBs and shelf are at the proper operating temperature by monitoring the operational status of the shelf blowers and sensing the ambient air temperature.

The two dual speed blowers (BA35X–MD) cool all the shelf components by drawing ambient air in through the front of the SBBs and exhausting it out the rear of the shelf. These blowers normally operate at low speed. Reduction of the air flow through the shelf or an increase in the ambient temperature may result in overheating. Such a condition can cause component failure or data corruption.

The I/O module ambient temperature circuitry monitors the air flowing through the module. Should the ambient air temperature exceed 32°C + 2°C (90°F + 3°F), this circuitry:

- Turns on both blower LEDs
- Causes both blower to switch to the high-speed mode to increase air flow through the shelf

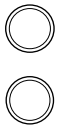
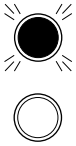
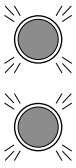
When the I/O module circuitry detects a blower that is not operating or not operating at the correct RPM, this circuitry:

- Turns ON a LED on the I/O module front panel that identifies the defective blower
- Causes the operational blower to switch to the high–speed mode to increase air flow through the shelf, thereby maintaining the proper operating environment

Note

The shelf power supply status LEDs also display blower error conditions. However, they do not identify the defective blower, nor do they report ambient air temperature faults.

Table 3–1 I/O Module LED Displays

LEDs	Status
	Blowers are operating normally at low speed. There is no blower or ambient air temperature error condition.
	1. The left blower is not operating properly and must be replaced. 2. The right blower is running at high–speed.
	1. The right blower is not operating properly and must be replaced. 2. The left blower is running at high–speed.
	1. The ambient air temperature exceeds 32°C + 2°C (90°F + 3°F) and both blowers are operating at high–speed. 2. Both blowers are not operating properly and must be replaced.
	Both LEDs may flash when power is applied to the shelf.

Legend		
OFF	ON	Flashing

Selecting a Bus Type

The 8–bit I/O module can operate as either a single or dual bus. The bus type is determined by —

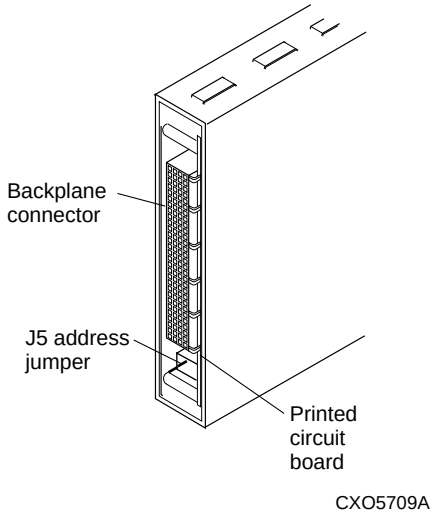
- The location of SBB shelf jumper module.
- The location of the SBB shelf termination module.

- The position of the I/O module address jumper.

Note

The bus type selected has no affect on the SCSI bus device addresses. These addresses cannot be changed.

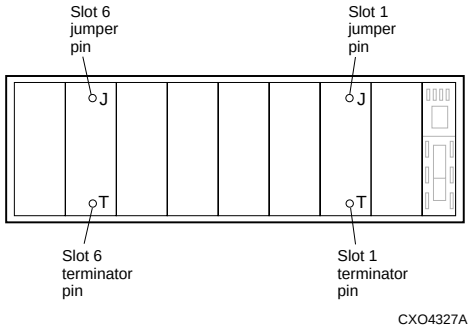
Figure 3–4 I/O Module Bus Type Jumper Location



Shelf Configuration

Unless specifically stated otherwise, the basic shelf configuration (see Figure 3–5) is:

Figure 3–5 16–Bit SBB Shelf Backplane Termination



- The 16–bit jumper module (BA35X–ME) is mounted on the backplane behind slot 6.
- You can store the *optional* 16–bit terminator module (BA35X–MF) behind slot 1.
- To identify the modules installed on the backplane remove the SBB from either slot 1 or slot 6.
  - — The identification pin on a jumper module aligns with the top hole in the backplane.
  - — The identification pin on a terminator module aligns with the bottom hole in the backplane.

Note

The module connector behind slot 1 is for storing the *unused* module. A module in this location has no affect on the shelf SCSI bus.

- The SCSI bus input is on channel A (connector JA1) for both single bus and dual bus configurations.
- For *single bus operation* install the *jumper module* on the backplane connector behind slot 6.

- For *dual bus* operation install the *terminator module* on the backplane connector behind slot 6.

Table 3–2 Connector JB1 Functions

No. of Shelves	Bus Type	Shelf Position	Connector Function
1	Single	Last	Not used
1	Dual	First	Channel B Input

Note

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

Use the following procedures to configure a shelf:

1. Remove power from the shelf and remove the I/O module.
2. Set jumper J5 for either single bus or dual bus operation.
3. Install the I/O module in the shelf.
4. Verify that terminator module and the jumper module are installed on proper backplane connector for the bus type.
5. Connect the external SCSI bus cables.
6. Apply power and test the shelf for proper operation.

The following sections define the DIGITAL-supported SCSI bus configurations and SBB shelf single ended bus lengths.

Configuring a Single Shelf with a Single Bus

The features of this configuration include:

- The bus is terminated by the I/O module.
- The SCSI bus input is the channel A connector .
- The channel B connector is not used.

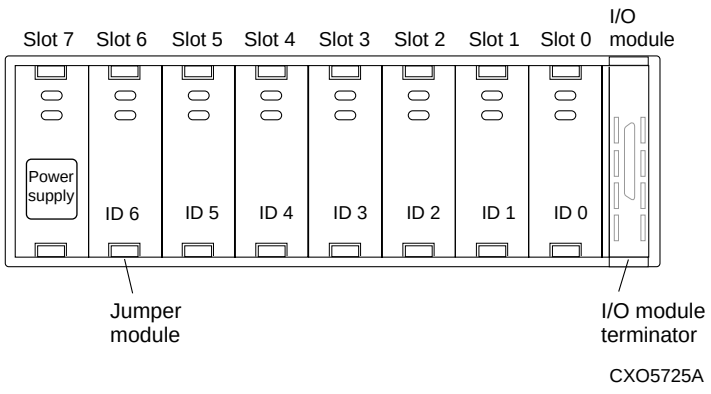
Table 3–3 defines SBB shelf SCSI bus length for this configuration and shows the default device address switch settings.

Note

For additional device address switch settings, see Appendix A.

Table 3–3 Single 8–Bit Shelf, Single SCSI Bus

Shelf No.	Channel	JA1	JB1	Terminator	Jumper	Meters	Feet
1	A	Input	None	I/O module	Slot 6	1.0	3.3



Complete the following procedure to establish a single bus on a single shelf configuration:

1. Remove power from the shelf and remove the I/O module.
2. *Remove* jumper J5 for single bus operation.
3. If the *jumper module* is mounted on backplane connector behind slot 6, go to step 11.
4. Remove the blowers.
5. Discharge any static build–up by momentarily touching a finger to the I/O module tabs.
6. Remove the termination module (BA35X–MF) from the backplane connector behind slot 6.
7. Remove the jumper module (BA35X–ME) from the backplane connector behind slot 1.
8. Install the jumper module on the backplane connector behind slot 6.
9. Install the termination module on the backplane connector behind slot 1.
10. Replace the blowers.
11. Connect the external SCSI bus cables.
12. Install the I/O module in the shelf.
13. Install SBBs.
14. Apply power and test the shelf for proper operation.

Configuring a Single Shelf with a Dual Bus

The features of this configuration include:

- Both channel A and channel B are terminated by the *optional* 16–bit termination module (BA35X–MF) installed on the backplane behind slot 6.
- The channel A SCSI bus input connector is JA1.
- The channel B SCSI bus input connector is JB1.

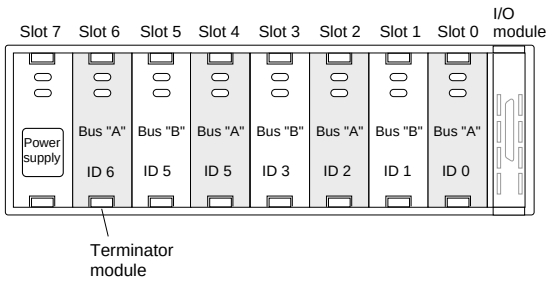
Table 3–4 defines the SBB shelf SCSI bus length for this configuration and shows the default device address switch settings.

Note

For additional device address switch settings, see Appendix C.

Table 3–4 Single 8–Bit SBB Shelf, Split SCSI Bus

Shelf No.	Channel	JA1	JB1	Terminator	Jumper	Meters	Feet
1	A	Input	None	Slot 6	None	0.4	1.3
1	B	None	Input	Slot 6	None	0.6	2.0



Complete the following procedure to establish a dual bus on a single shelf configuration:

1. Remove power from the shelf and remove the I/O module.
2. *Install* jumper J5 for dual bus operation.
3. If the *terminator module* is mounted on backplane connector behind slot 6, go to step 11.
4. Remove the blowers.
5. Discharge any static build–up by momentarily touching a finger to the I/O module tabs.
6. Remove the jumper module (BA35X–ME) from the backplane connector behind slot 6.
7. Remove the termination module (BA35X–MF) from the backplane connector behind slot 1.
8. Install the termination module on the backplane connector behind slot 6.
9. Install the jumper module on the backplane connector behind slot 1.
10. Replace the blowers.
11. Connect the channel A SCSI cable to connector JA1.
12. Install the I/O module in the shelf.
13. Connect the channel B SCSI cable to connector JB1.
14. Install SBBs.

15. Apply power and test the shelf for proper operation.

SCSI Bus Data

Table 3–5 defines the maximum data transfer rates and the maximum SCSI bus lengths when using a 16–bit I/O module. The cable lengths are rounded off to the nearest whole unit. The definition of data transfers rates are as follows:

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

Table 3–5 Fast 10 SCSI Bus Parameters

Parameter	Specification
Transfer rates	5 MT/s — 10 MB/s
Maximum single ended shelf bus length	1 m (3.3 ft)
Maximum single ended cable length	2 m (6.6 ft)

Note

Adding or removing devices to a shelf *does not* change the length of the shelf single ended bus. The only way to change the length of the shelf SCSI bus is configure the shelf as a dual bus.

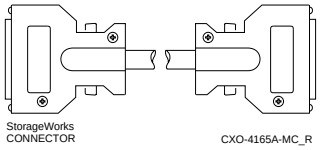
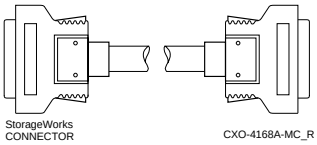
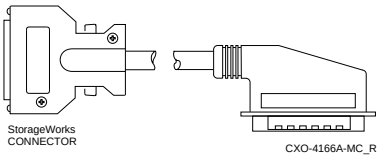
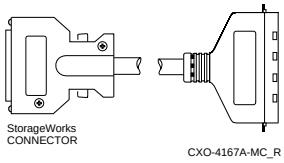
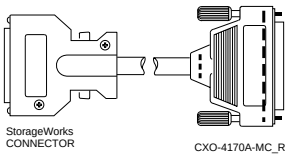
SCSI Bus Cabling

The SCSI cables connect to connectors JA1 and JB1 on the I/O module. Both connectors are 50–pin, high density, female connectors.

- Connector JA1, the connector on the top, is always an input connector.
- In the dual bus configuration, JB1 is an input connector.

The cable you should use depends upon the host, adapter, or controller connector. You can use Table 3–6 to identify compatible cables. For a detailed description of each cable type, refer to the individual cable sections.

Table 3–6 Selecting a SCSI Cable

To connect to…	the recommended cable is a…
A 50–pin, high density connector	**BN21H** 
A 50–pin, high density connector within an DIGITAL Alpha™ system cabinet	**BC10U** 
A 50–pin, low density connector	**BN21R**  **BN23G** 
An HSC™ controller	**BN31B** 

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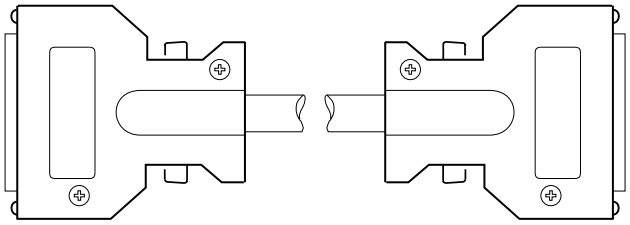
BN21H–Series SCSI Cables

You can use these cables to connect SCSI devices with 50-pin, high density, female connectors.

Cable Description	Meters	Feet	Part No.
50–conductor single ended SCSI cable with: 2 — 50–pin, high density, straight, male connectors with thumb latches.	0.3 0.5 1.0 1.5 2.0 3.0 5.0	0.5 1.6 3.3 4.9 6.6 9.8 16.4	BN21H–0C BN21H–0E BN21H–01 BN21H–1E BN21H–02 BN21H–03 BN21H–05



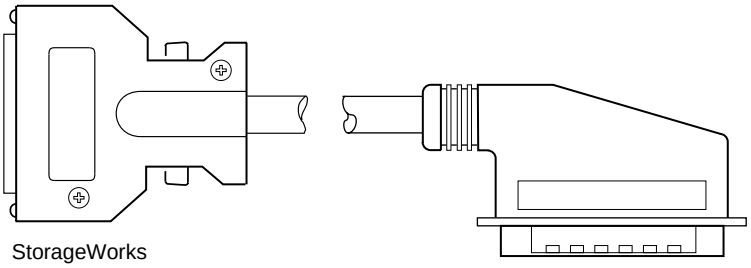
StorageWorks
CONNECTOR

CXO-4165A-MC_R

BN21R–Series SCSI Adapter Cables

You can use these cables to connect devices with a 50-pin, high density, female connector to 50-pin, low density, female connectors in DEC 4000™ model 610 Alpha distributed/departmental server.

Cable Description	Meters	Feet	Part No.
50–conductor single ended SCSI cable with: 1 — 50–pin, high density, straight, male connectors with thumb latches. 1 — 50–pin, low density, right–angle, male connector.	0.5 1.0 2.0 3.0 5.0	1.6 3.3 6.6 9.8 16.4	BN21R–0E BN21R–01 BN21R–02 BN21R–03 BN21R–05

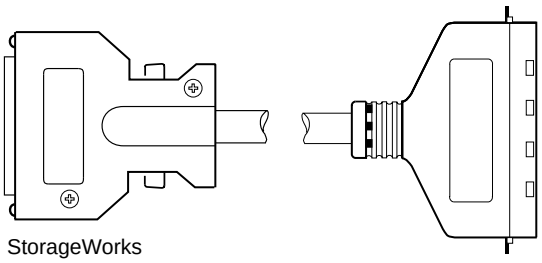


™ Trademark of Digital Equipment Corporation

BN23G–Series SCSI Adapter Cables

You can use these cables to connect to connect devices with a 50-pin, high density, female connector to devices with a 50-pin, low density, female connector.

Cable Description	Meters	Feet	Part No.
50–conductor single ended SCSI cable with: 1 — 50–pin, high density, straight, male connector with thumb latches. 1 — 50–pin, low density, straight, male connector with bale locks.	0.5 1.0 2.0 3.0 5.0	1.6 3.3 6.6 9.8 16.4	BN23G–0E BN23G–01 BN23G–02 BN23G–03 BN23G–05

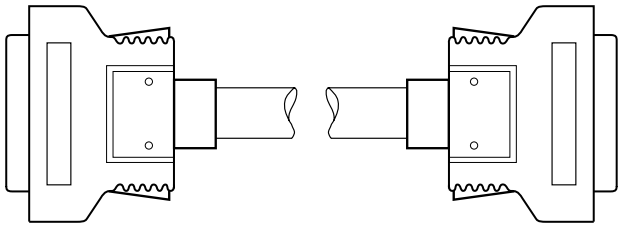


CXO-4167A-MC_R

BC10U–Series SCSI Cables

You can *only* use these cables in an Alpha system to connect devices with 50-pin, high density, female connectors. *Do not use this SCSI cable for any other configuration.*

Cable Description	Meters	Feet	Part No.
For Alpha DEC 7000™ and DEC 1000™ 50–conductor single ended SCSI cable with: 2 — 50–pin, high density, straight, male connectors with thumb latches.	2.0 3.0 5.0	6.6 9.8 16.4	BC10U–02 BC10U–03 BC10U–05



StorageWorks CONNECTOR

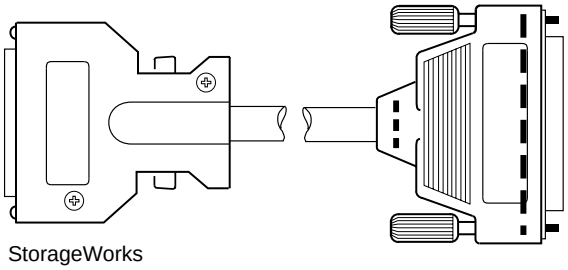
CXO-4168A-MC_R

™ Trademark of Digital Equipment Corporation

BC31B–Series SCSI Adapter Cables

You can use these adapter cables to connect SCSI devices with a 50-pin, high density, female connector to devices such as an HSC controller that has a different type 50-pin, high density, female connector.

Cable Description	Meters	Feet	Part No.
50–conductor single ended SCSI cable with: 1 — 50–pin, high density, straight, male connectors with thumb latches. 1 — 50–pin, high density, straight, male connectors with jack screws	0.3 1.0 1.5 2.0 3.0 5.0 10.0 15.0 20.0	0.5 3.3 4.9 6.6 9.8 16.4 32.8 49.2 65.6	BC31B–0E BC31B–01 BC31B–1E BC31B–02 BC31B–03 BC31B–05 BC31B–10 BC31B–15 BC31B–20



CXO-4170A-MC_R

A

Single Bus, Single Shelf Addresses

The valid device addresses for a 16–bit I/O module on a single shelf with a single SCSI bus depends on the following factors:

- The controller configuration — single or dual redundant
- The settings of the 7 position SBB I/O module shelf address switch
- The settings of the 4 position SCSI bus termination switches on I/O modules with SCSI bus extender circuitry

Note

The information in this appendix applies to all 16–bit shelf I/O modules.
The information in this appendix *does not* apply to 8–bit shelf I/O modules.

SCSI Bus Configuration Rules

The basic rules and considerations for configuring a SCSI bus and assigning device addresses (IDs) using an SBB I/O module address switch are as follows:

- No SCSI ID can be used more than once on any SCSI bus.
- All controller configurations reserve SCSI bus ID 7 for the primary controller. When you use a dual redundant configuration, SCSI bus ID 6 is reserved for the redundant controller.

Many of the shelf address switch settings automatically assign device ID 6 and 7 to a slot and often assigns one of the other addresses to more than one slot on the bus. There are many ways to compensate for these conflicts. Some of the more common ways to accomplish this include:

- Ensure that there is no conflict between an SBB and a controller by never inserting an SBB in a slot assigned device address 6 or 7.
- Ensure that when the same address occurs more than once on the same bus, that you install a device in only one of the slots.
- Use the SBB device address switch to assign an unused device ID to the SBB prior to installation.
- In most cases, the only viable solution is to not use a slot when there is a known device ID conflict. Using this solution can reduce the total number of devices on a single bus, single shelf configuration to only three or four SBBs.

Note

The alternate solution of using the SBB device address switch may not be viable, since most 3.5–inch SBBs *do not* have a device address switch.

The following sections list the DIGITAL-recommended shelf address switch settings that:

1. Do not use a device ID 7.
2. Do not use any device ID more than once on a single bus.
3. Do not use device ID 6 when there are two controllers on the bus.
4. List addresses for both single controller and dual controller configurations.

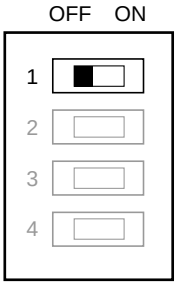
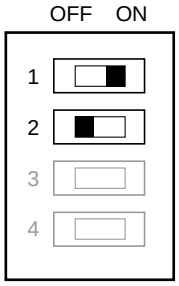
Single Controller Configurations

Complete the following procedure to configure a single SCSI bus on a single shelf when there is a single controller (device ID 7) on the bus:

Note

The drawings in this appendix define the SCSI bus address switch settings and the resulting SBB device addresses for all 16-bit I/O modules.

1. Connect the controller SCSI bus cable to the bus A connector on the SBB I/O module.
2. For the SBB I/O extender modules set the SCSI bus termination for one of the following bus configurations:

16–Bit Bus	8–Bit Bus
 CXO5718A	 CXO5719A

Caution

Connecting a cable to bus B connector disables the internal I/O module termination.

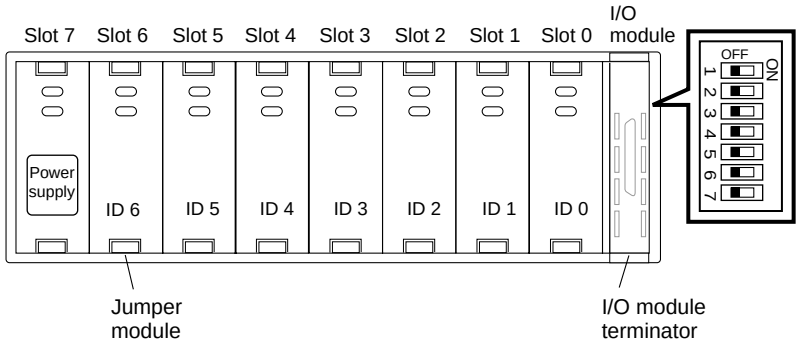
3. Select one of the following shelf address settings:

Note

The following drawings define SCSI bus address switch settings and the resulting SBB device addresses. They *do not* represent a specific I/O module type.

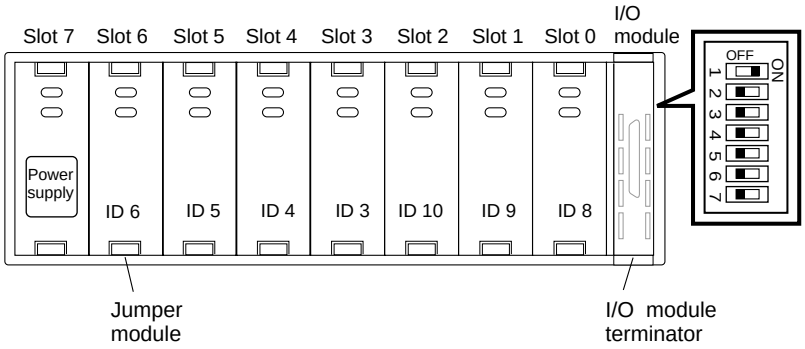
Single Bus, Single Shelf Addresses

Address 0



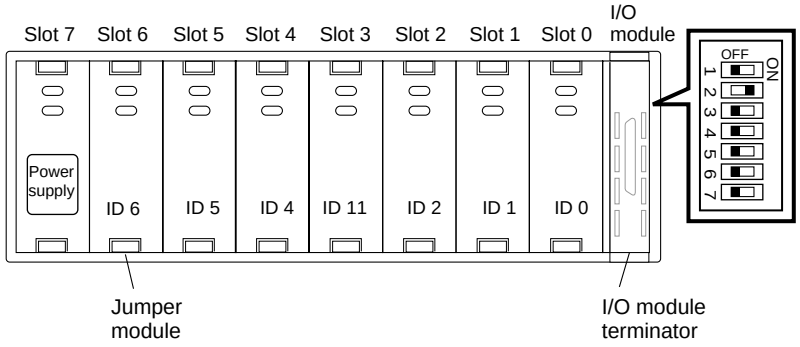
CXO5639A

Address 1



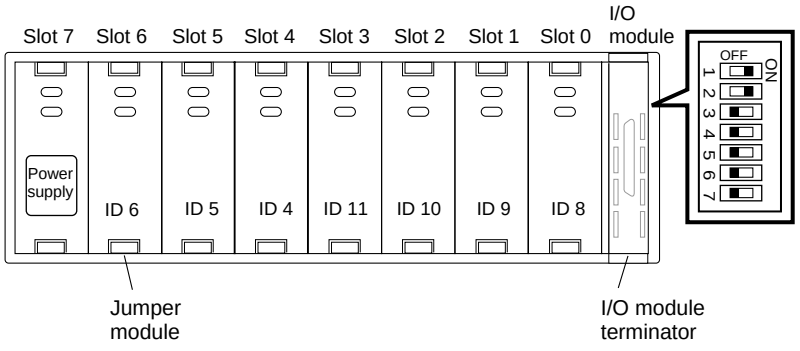
CXO5640A

Address 2



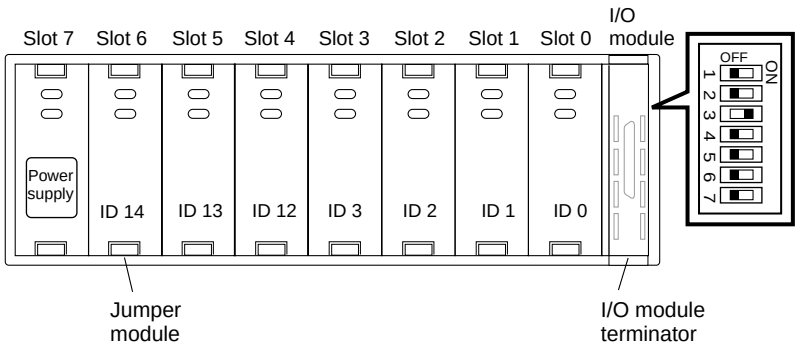
CXO5641A

Address 3



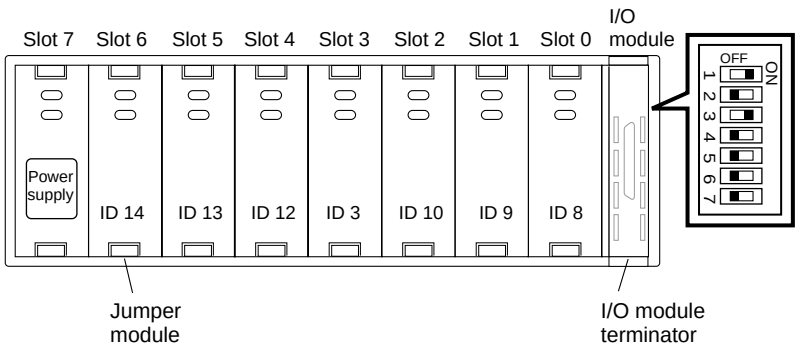
CXO5642A

Address 4



CXO5726A

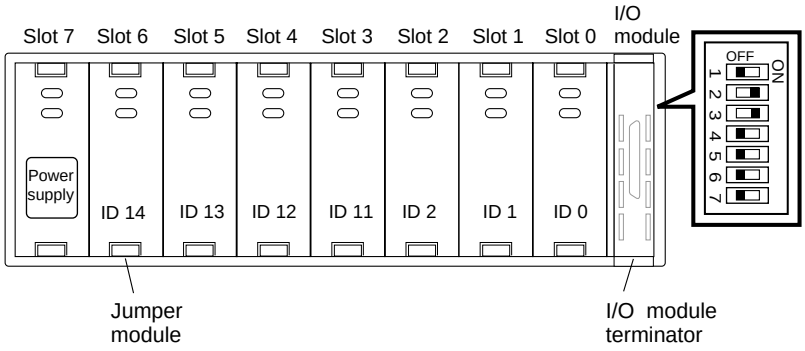
Address 5



CXO5644A

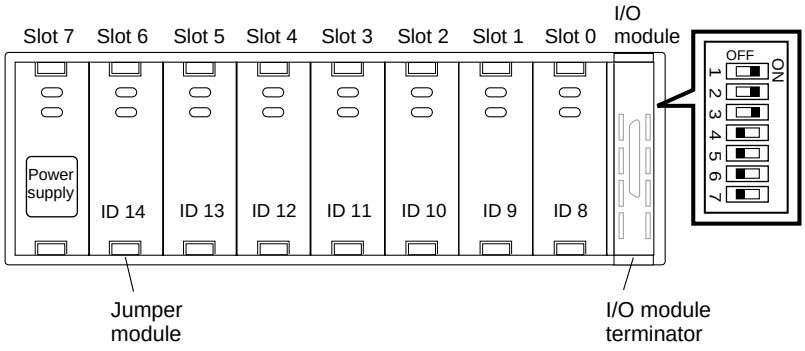
Single Bus, Single Shelf Addresses

Address 6



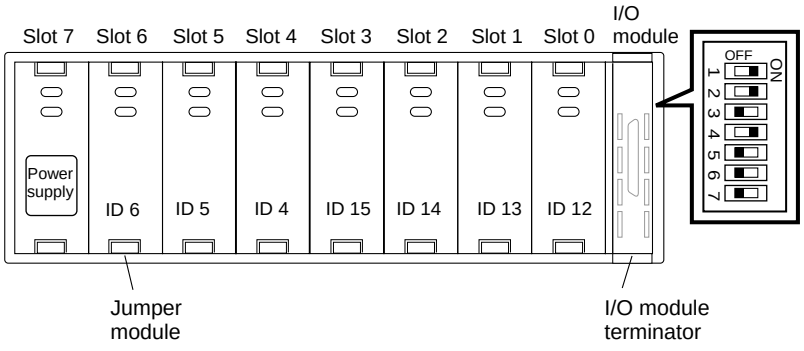
CXO5645A

Address 7



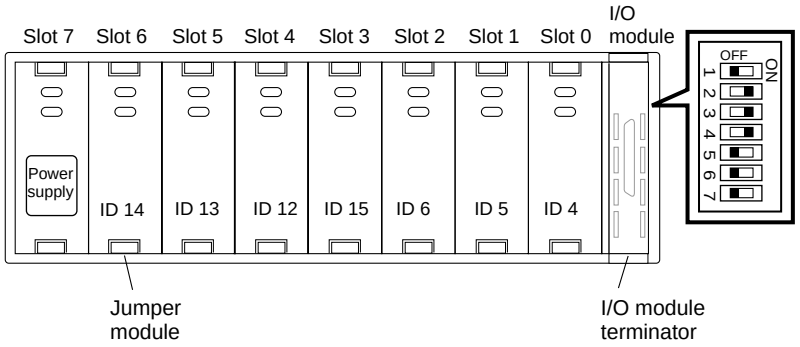
CXO5646A

Address 11



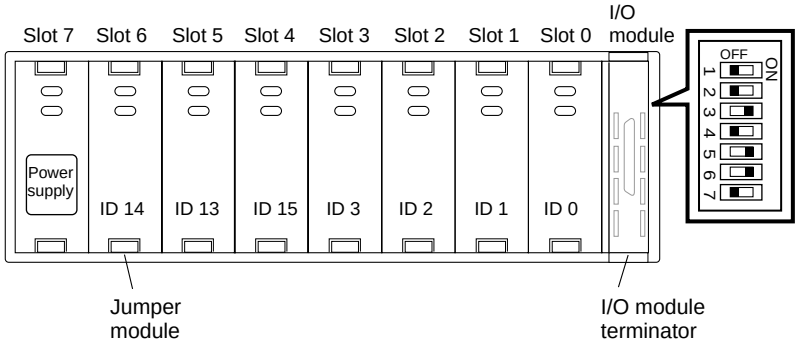
CXO5647A

Address 14



CXO5648A

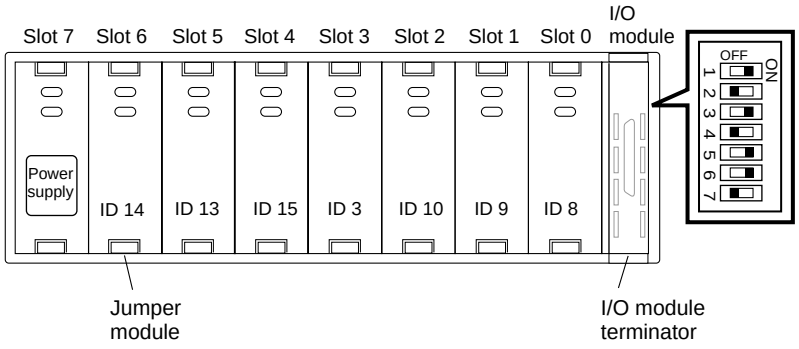
Address 52



CXO5649A

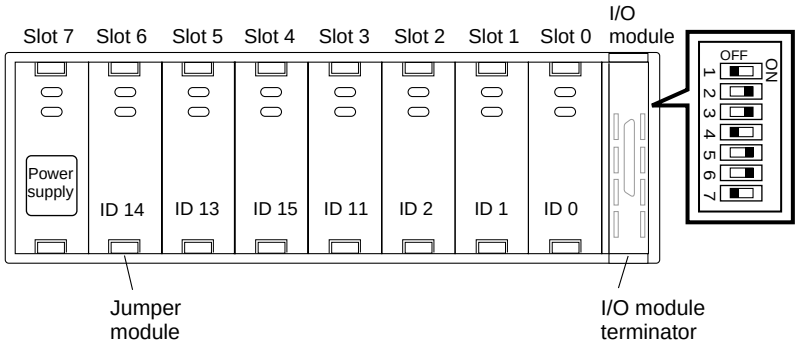
Single Bus, Single Shelf Addresses

Address 53



CXO5650A

Address 54



CXO5651A

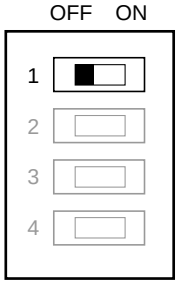
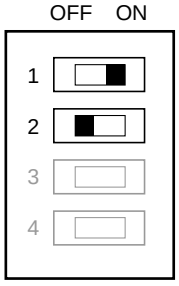
Dual Controller Configurations

Complete the following procedure to configure a single SCSI bus on a single shelf when there are dual controllers:

Note

The drawings in this appendix define the SCSI bus address switch settings and the resulting SBB device addresses for all 16-bit I/O modules.

1. Install the jumper module (BA35X–MF) behind slot 6 on the shelf backplane.
2. Connect the controller SCSI bus cable to the bus A connector on the SBB I/O module.
3. For the BA35X–D series SBB I/O modules set the SCSI bus termination for one of the following bus configurations:

16–Bit Bus	8–Bit Bus
 CXO5718A	 CXO5719A

Caution

Connecting a cable to bus B connector disables the internal I/O module termination.

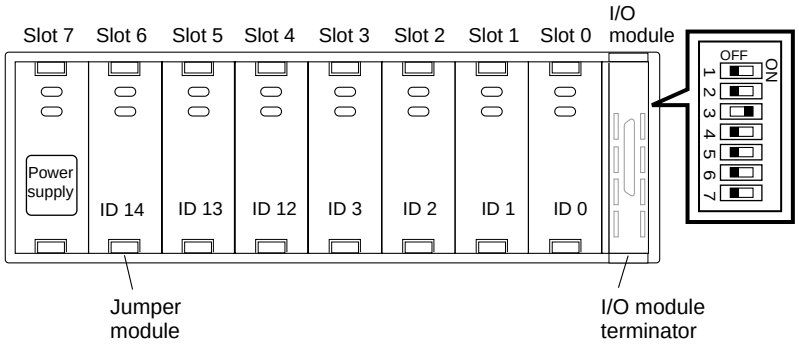
4. Select one of the following shelf address settings:

Single Bus, Single Shelf Addresses

Note

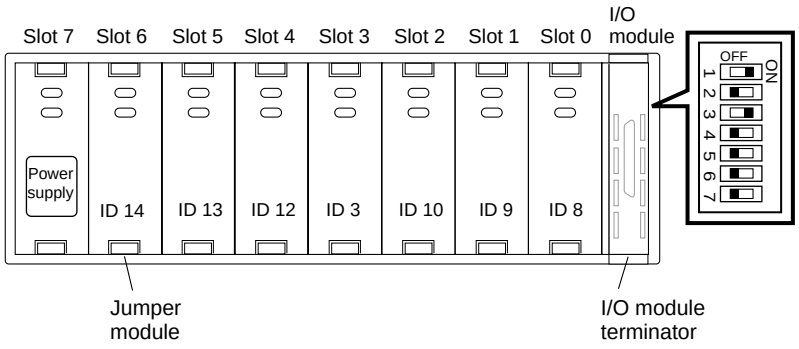
The following drawings define SCSI bus address switch settings and the resulting SBB device addresses. They *do not* represent a specific I/O module type.

Address 4



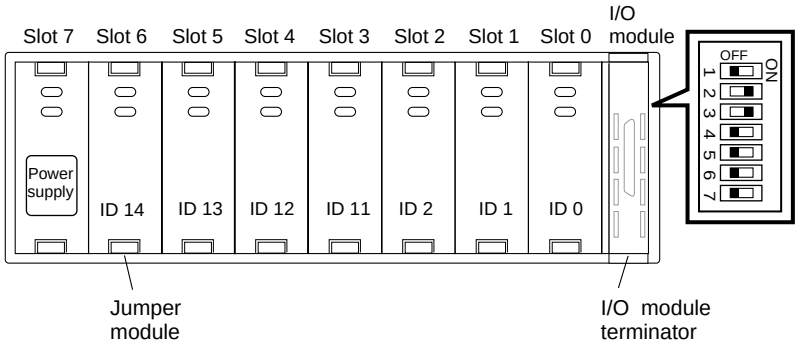
CXO5726A

Address 5



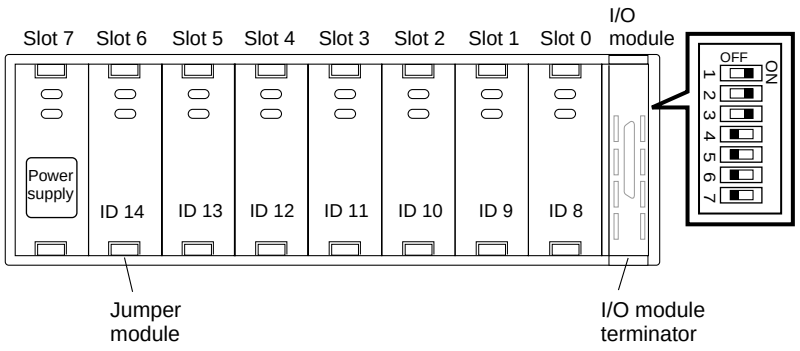
CXO5644A

Address 6



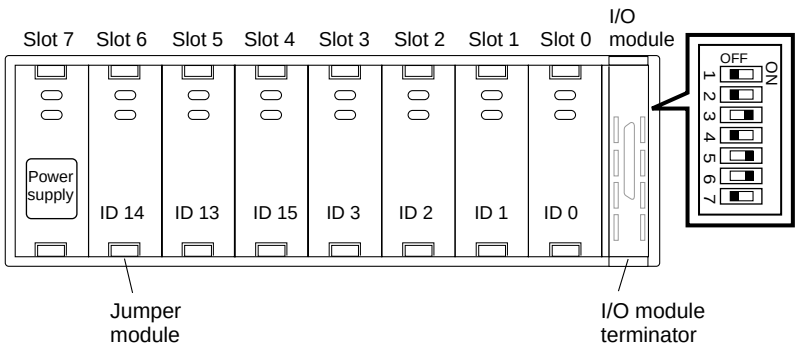
CXO5645A

Address 7



CXO5646A

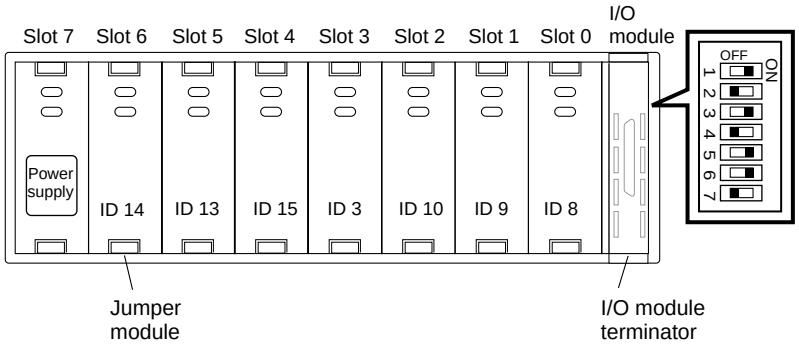
Address 52



CXO5649A

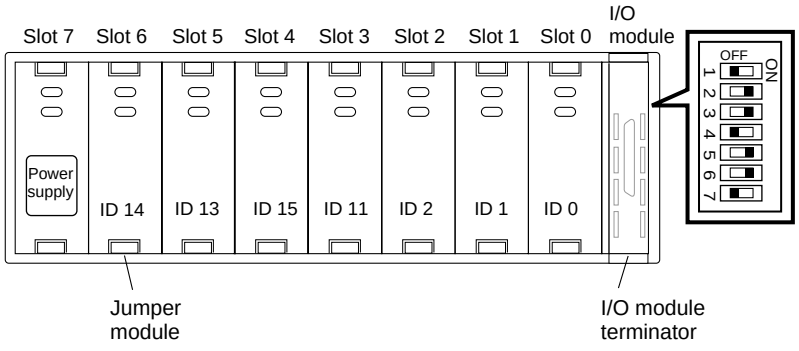
Single Bus, Single Shelf Addresses

Address 53



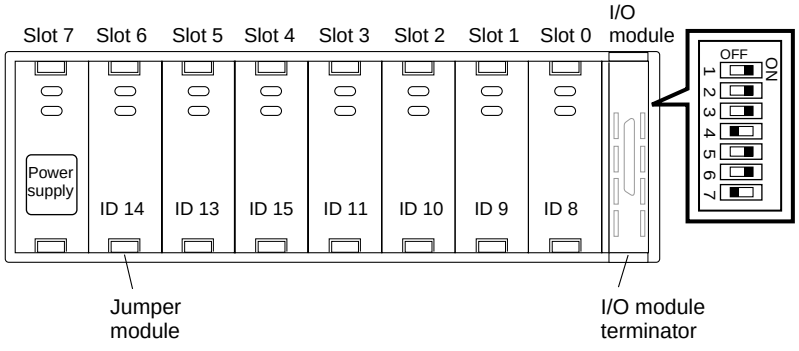
CXO5650A

Address 54



CXO5651A

Address 55



CXO5652A

B

Single Bus, Two Shelf Addresses

The valid device addresses for with a single SCSI bus, two shelf configuration 16–bit I/O module depends on the following factors:

- The controller configuration — single or dual redundant
- The settings of the 7 position SBB I/O module shelf address switch
- The settings of the 4 position SCSI bus termination switches on I/O modules with SCSI bus extender circuitry

Note

The information in this appendix applies to all 16–bit shelf I/O modules.
The information in this appendix *does not* apply to 8–bit shelf I/O modules.

SCSI Bus Configuration Rules

The basic rules and considerations for configuring a SCSI bus and assigning device addresses (IDs) using an SBB I/O module address switch are as follows:

- No SCSI ID can be used more than once on any SCSI bus.
- All controller configurations reserve SCSI bus ID 7 for the primary controller. When you use a dual redundant configuration, SCSI bus ID 6 is reserved for the redundant controller.

Many of the shelf address switch settings automatically assign device ID 6 and 7 to a slot and often assigns one of the other addresses to more than one slot on the bus. There are many ways to compensate for these conflicts. Some of the more common ways to accomplish this include:

- Ensure that there is no conflict between an SBB and a controller by never inserting an SBB in a slot assigned device address 6 or 7.
- Ensure that the when the address switch assigns the same address to more than one slot on the same bus that you use only one of the slots.
- Use the SBB device address switch to assign an unused device ID to the SBB prior to installation.
- In most cases, the only viable solution is to not use a slot when there is a known device ID conflict. Using this solution can reduce the total number of devices on a single bus, single shelf configuration to only three or four SBBs.

Note

The alternate solution of using the SBB device address switch may not be viable, since most 3.5–inch SBBs *do not* have a device address switch.

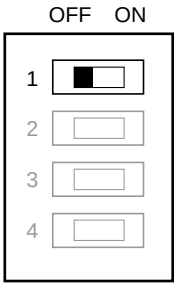
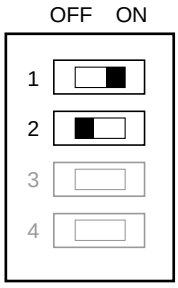
The following sections list the DIGITAL-recommended shelf address switch settings that:

1. Do not use a device ID 7.
2. Do not use any device ID more than once on a single bus.
3. Do not use device ID 6 when there are two controllers on the bus.
4. List addresses for both single controller and dual controller configurations.

Controller Configurations

Complete the following procedure to configure a single SCSI bus on two shelf, when there is either a single or a dual controller:

1. Install the jumper module (BA35X–MF) behind slot 6 on the shelf backplane.
2. Connect the controller SCSI bus cable to the bus A connector on the SBB I/O module.
3. For the SBB I/O extender modules set the SCSI bus termination for one of the following bus configurations:

16–Bit Bus	8–Bit Bus
 CXO5718A	 CXO5719A

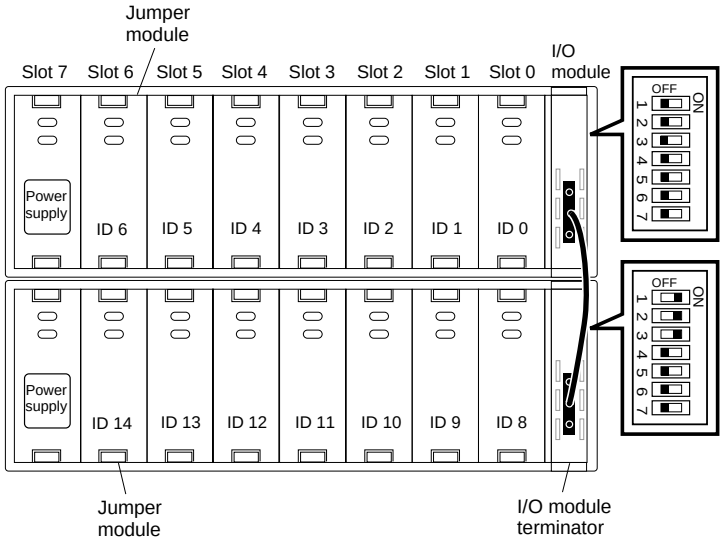
4. Select one of the following shelf address settings:

Note

The following drawings define SCSI bus address switch settings and the resulting SBB device addresses. They *do not* represent a specific I/O module type.

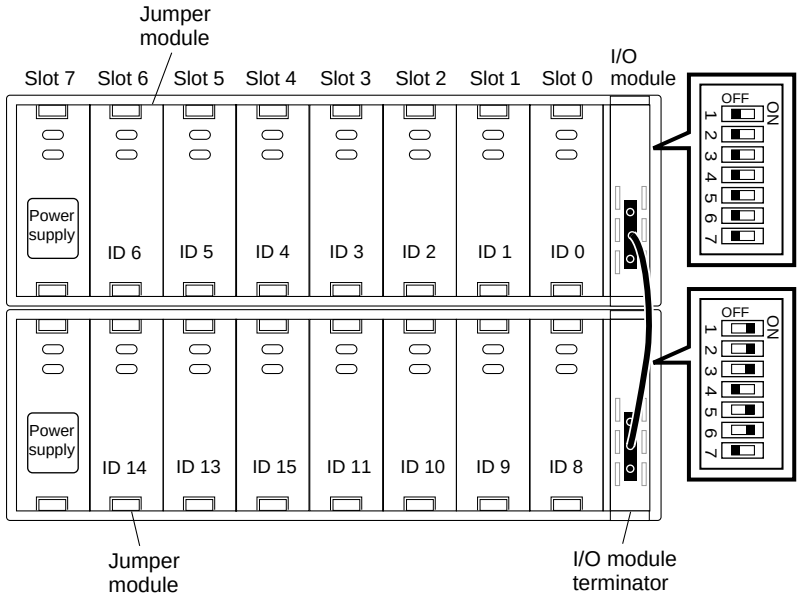
Single Bus, Two Shelf Addresses

Addresses 0 — 7



CXO5699A

Addresses 0 — 55



CXO5700A

C

Dual Bus, Single Shelf Addresses

The valid device addresses for a 16–bit I/O module with a single shelf with a dual SCSI bus depends on the following factors:

- The controller configuration — single or dual redundant
- The settings of the 7 position SBB I/O module shelf address switch
- The settings of the 4 position SCSI bus termination switches on I/O modules with SCSI bus extender circuitry

Note

The information in this appendix applies to all 16–bit shelf I/O modules.
The information in this appendix *does not* apply to 8–bit shelf I/O modules.

SCSI Bus Configuration Rules

The basic rules and considerations for configuring a SCSI bus and assigning device addresses (IDs) using an SBB I/O module address switch are as follows:

- No SCSI ID can be used more than once on any SCSI bus.
- All controller configurations reserve SCSI bus ID 7 for the primary controller. When you use a dual redundant configuration, SCSI bus ID 6 is reserved for the redundant controller.

Many of the shelf address switch settings automatically assign device ID 6 and 7 to a slot and often assigns one of the other addresses to more than one slot on the bus. There are many ways to compensate for these conflicts. Some of the more common ways to accomplish this include:

- Ensure that there is no conflict between an SBB and a controller by never inserting an SBB in a slot assigned device address 6 or 7.
- Ensure that when the same address occurs more than once on the same bus, that you install a device in only one of the slots.
- Use the SBB device address switch to assign an unused device ID to the SBB prior to installation.
- In most cases, the only viable solution is to not use a slot when there is a known device ID conflict. Using this solution can reduce the total number of devices on a single bus, single shelf configuration to only three or four SBBs.

Note

The alternate solution of using the SBB device address switch may not be viable, since most 3.5–inch SBBs *do not* have a device address switch.

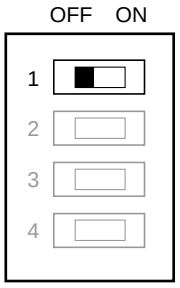
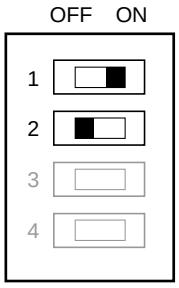
The following sections list the DIGITAL-recommended shelf address switch settings that:

1. Do not use a device ID 7.
2. Do not use any device ID more than once on a single bus.
3. Do not use device ID 6 when there are two controllers on the bus.
4. List addresses for both single controller and dual controller configurations.

Single Controller Configurations

Complete the following procedure to configure a single SCSI bus, single shelf when there is a single controller complete the following procedure:

1. Install the jumper module (BA35X–MF) behind slot 6 on the shelf backplane.
2. Connect the controller SCSI bus cable to the bus A connector on the SBB I/O module.
3. For the SBB I/O extender modules set the SCSI bus termination for one of the following bus configurations:

16–Bit Bus	8–Bit Bus
 CXO5718A	 CXO5719A

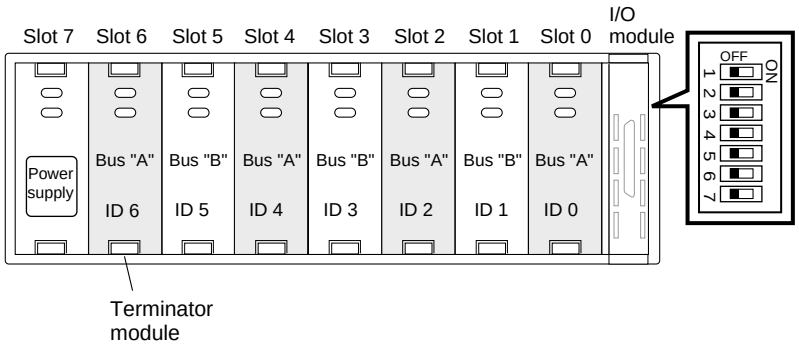
4. Select one of the following shelf address settings:

Note

The following drawings define SCSI bus address switch settings and the resulting SBB device addresses. They *do not* represent a specific I/O module type.

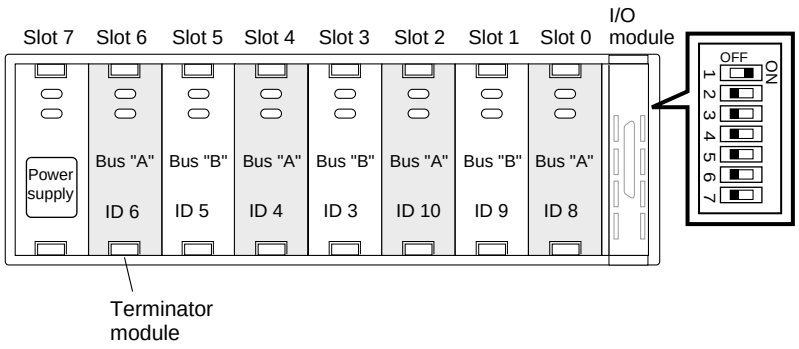
Dual Bus, Single Shelf Addresses

Address 0



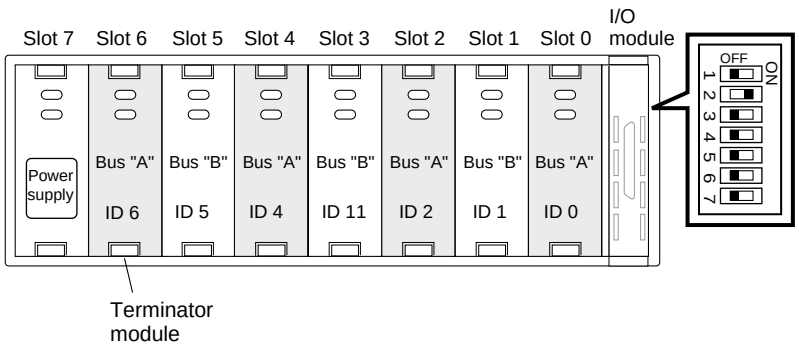
CXO5653A

Address 1



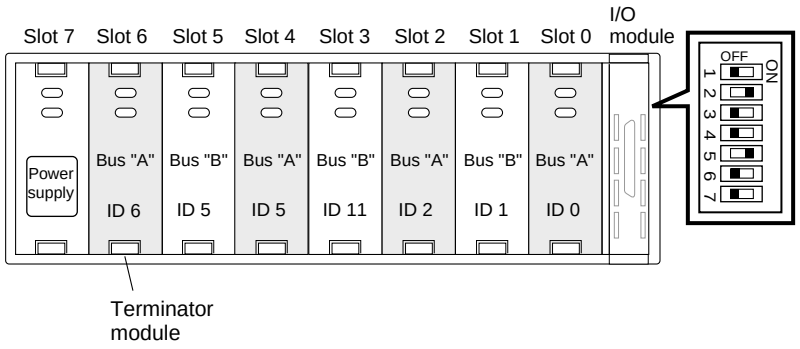
CXO5654A

Address 2



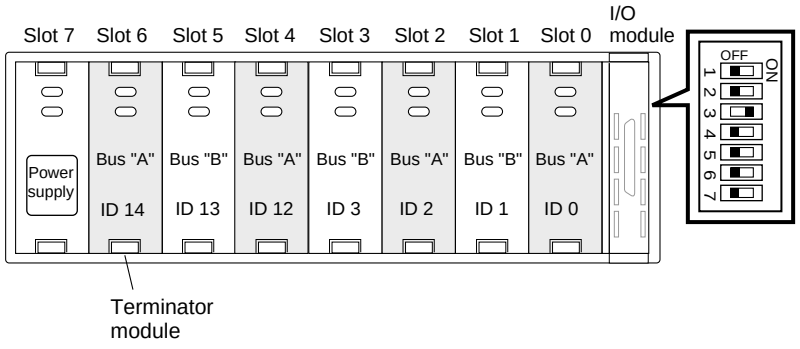
CXO5655A

Address 3



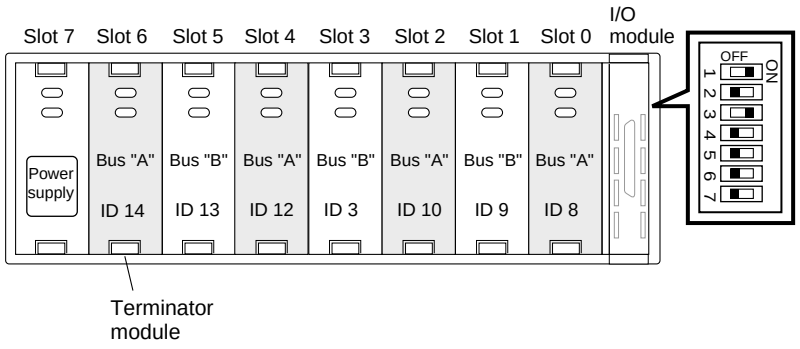
CXO5665A

Address 4



CXO5657A

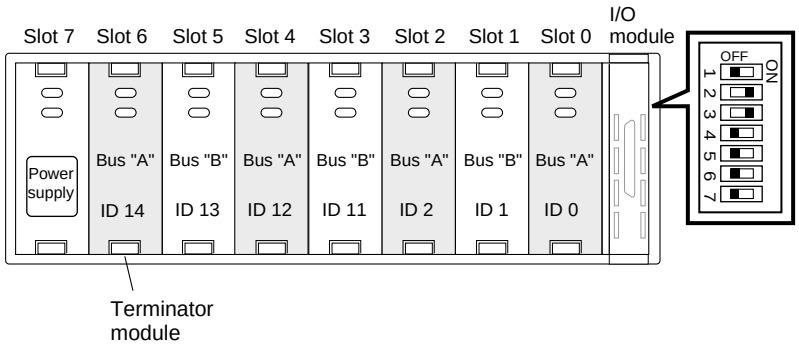
Address 5



CXO5658A

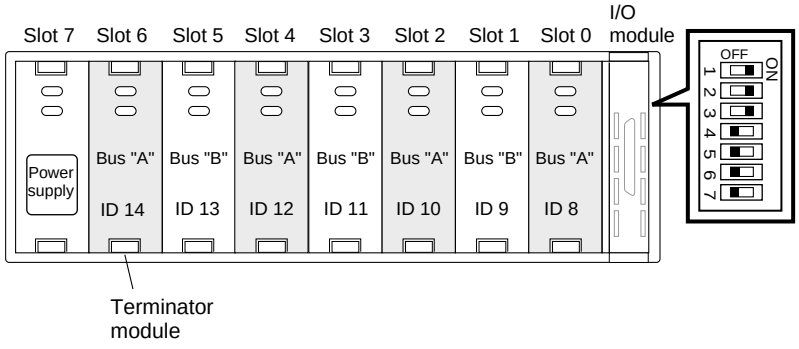
Dual Bus, Single Shelf Addresses

Address 6



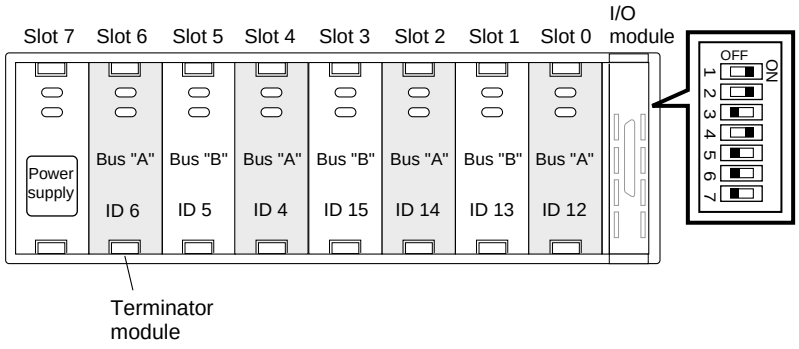
CXO5659A

Address 7



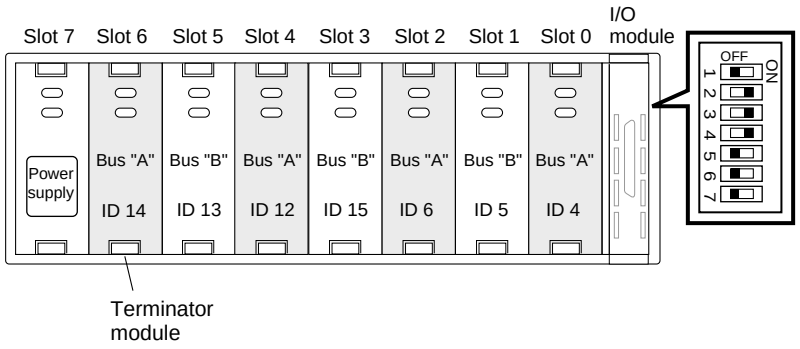
CXO5660A

Address 11



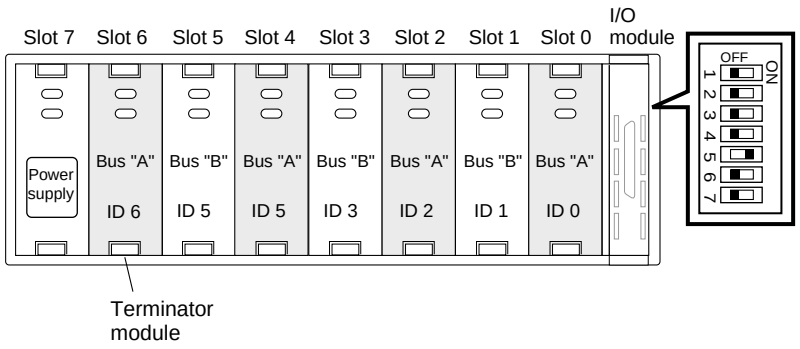
CXO5661A

Address 14



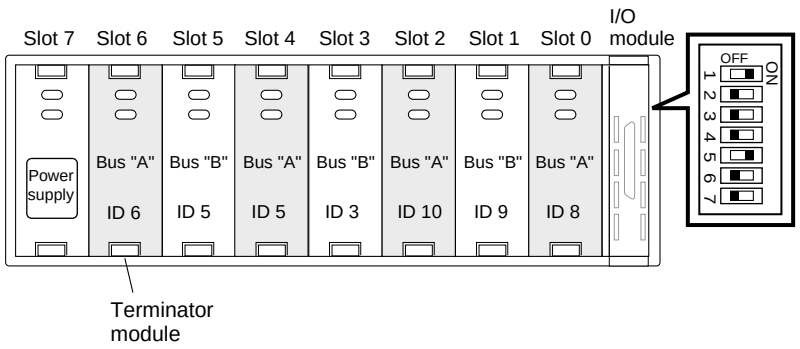
CXO5662A

Address 16



CXO5663A

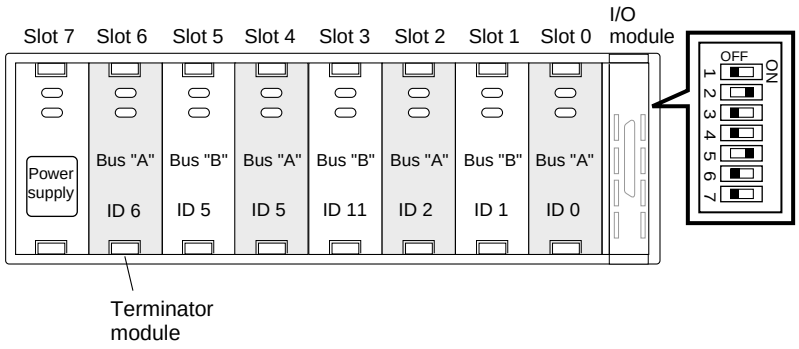
Address 17



CXO5664A

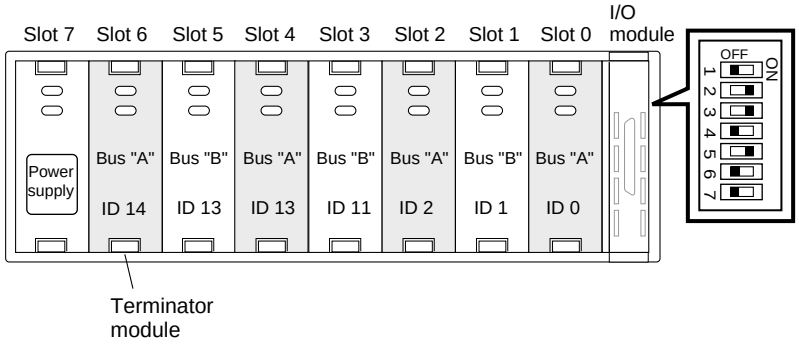
Dual Bus, Single Shelf Addresses

Address 18



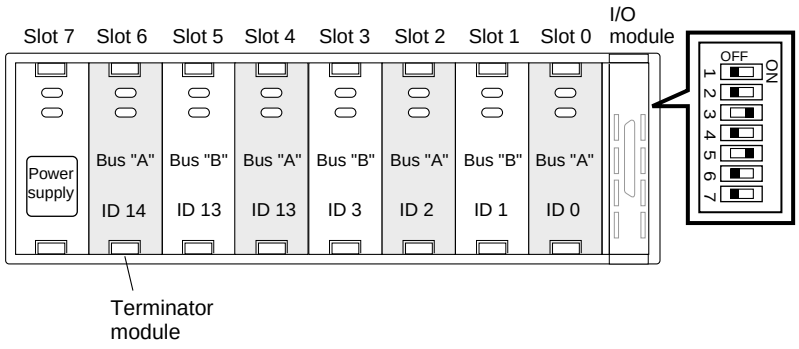
CXO5665A

Address 19



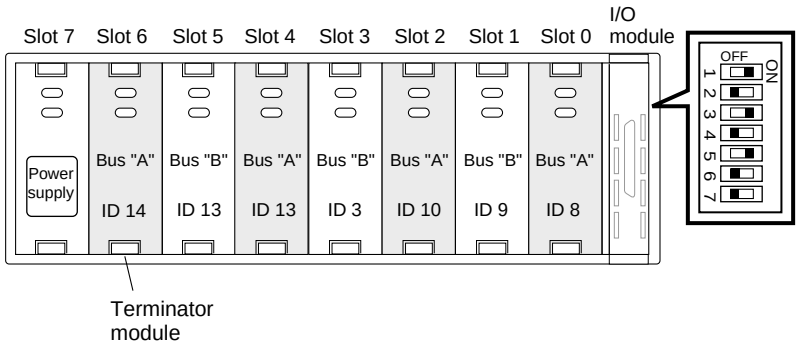
CXO5669A

Address 20



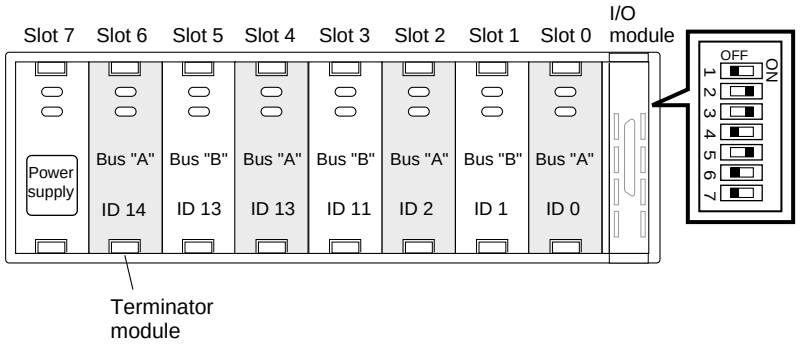
CXO5667A

Address 21



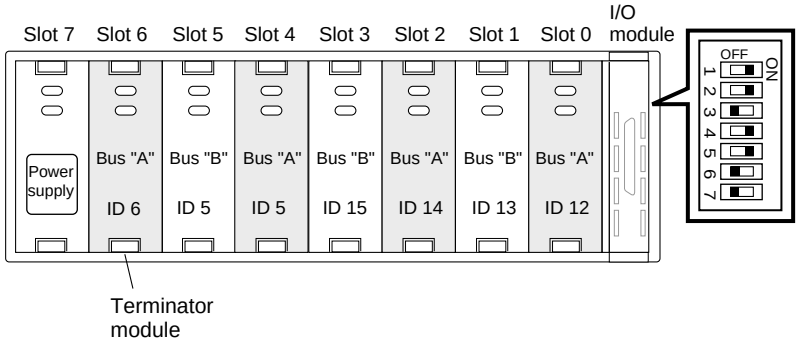
CXO5668A

Address 22



CXO5669A

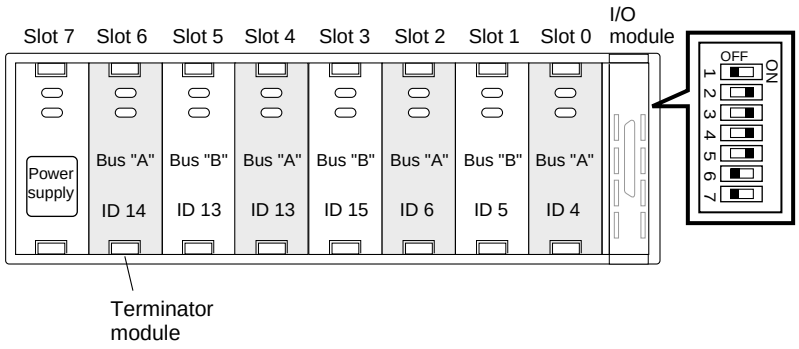
Address 23



CXO5727A

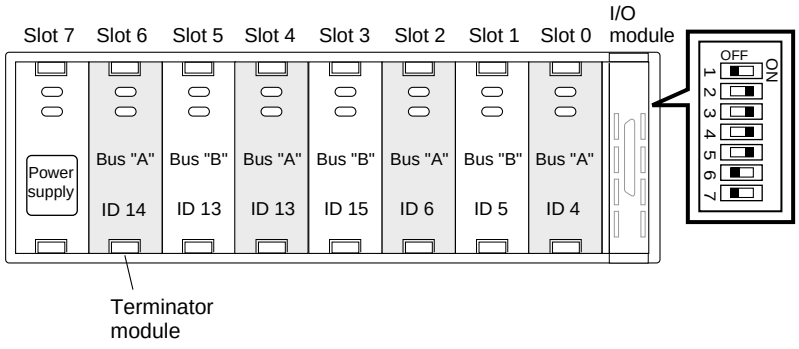
Dual Bus, Single Shelf Addresses

Address 27



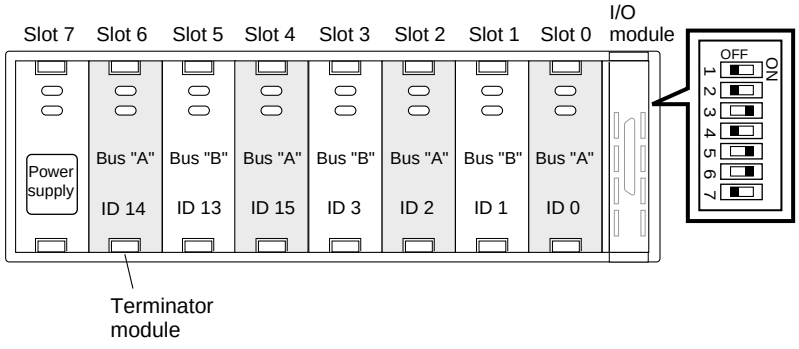
CXO5671A

Address 30



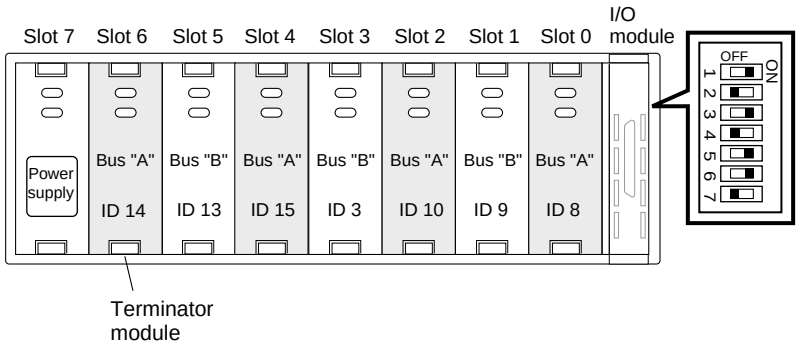
CXO5671A

Address 52



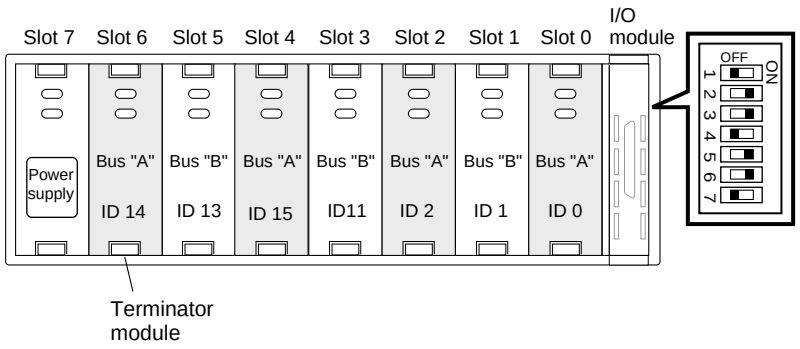
CXO5672A

Address 53



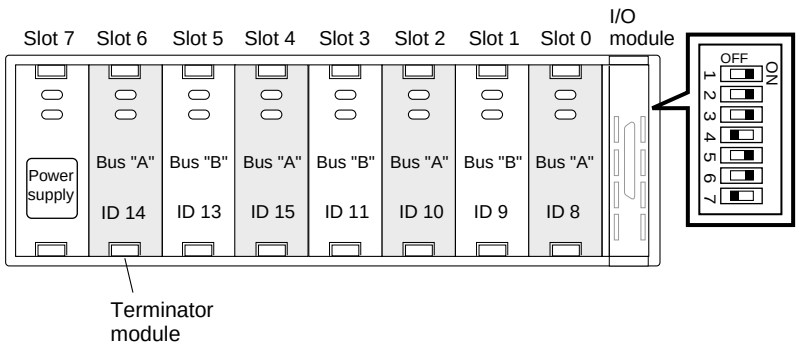
CXO5673A

Address 54



CXO5674A

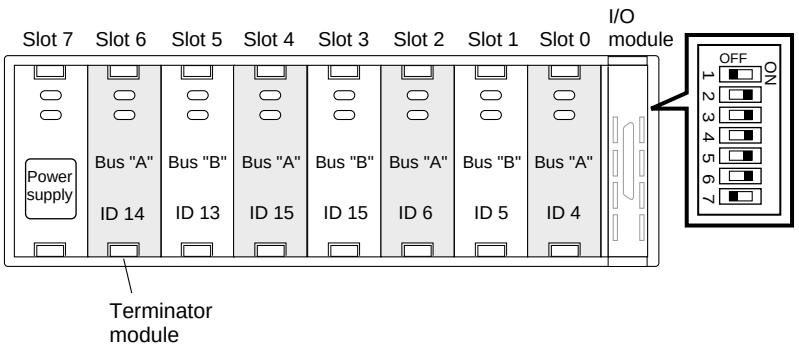
Address 55



CXO5675A

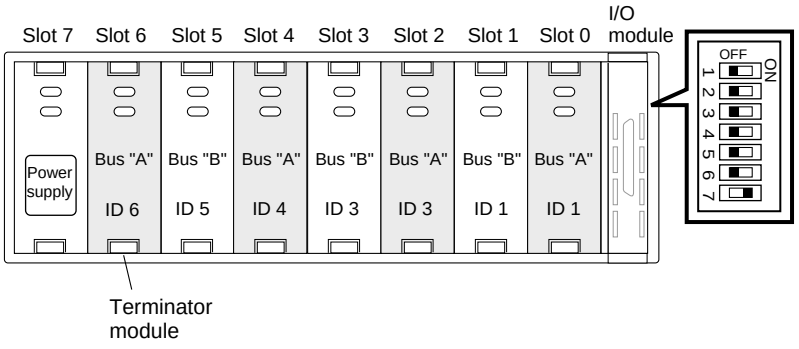
Dual Bus, Single Shelf Addresses

Address 62



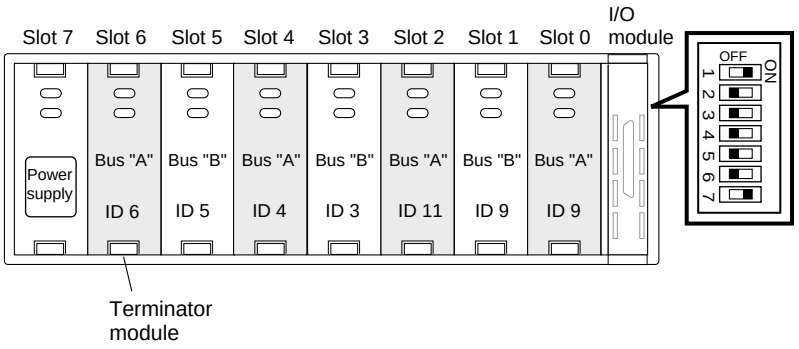
CXO5676A

Address 64



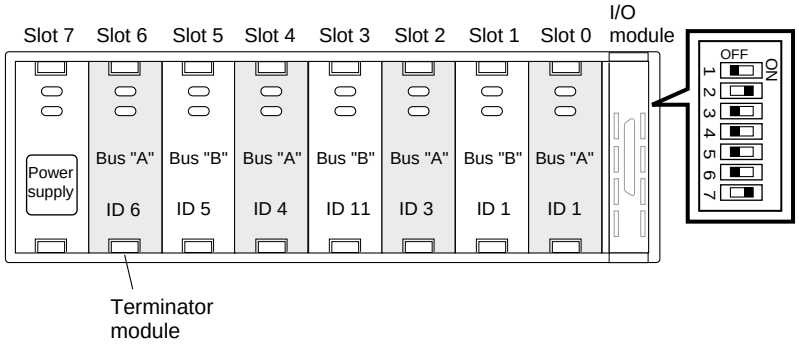
CXO5677A

Address 65



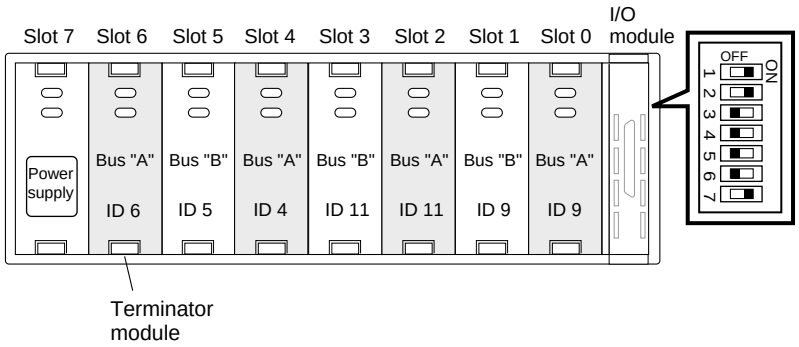
CXO5678A

Address 66



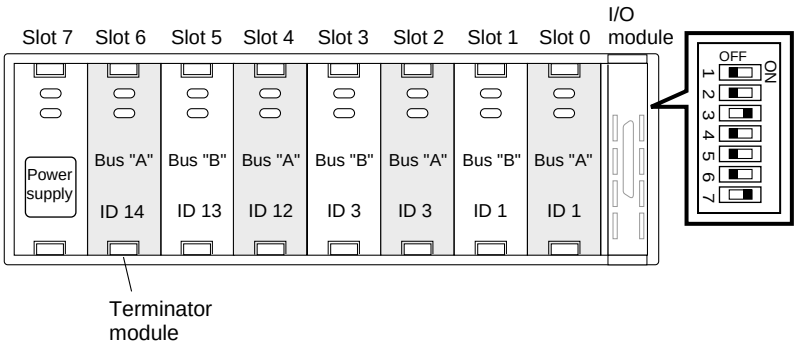
CXO5679A

Address 67



CXO5680A

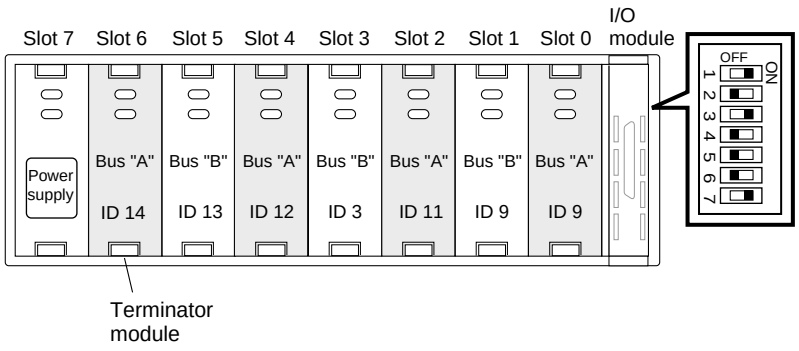
Address 68



CXO5681A

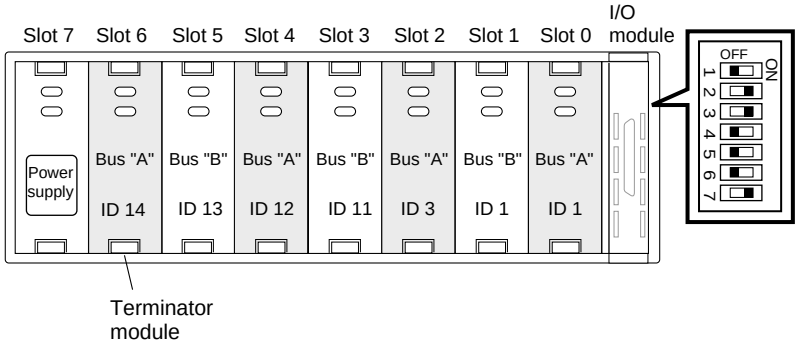
Dual Bus, Single Shelf Addresses

Address 69



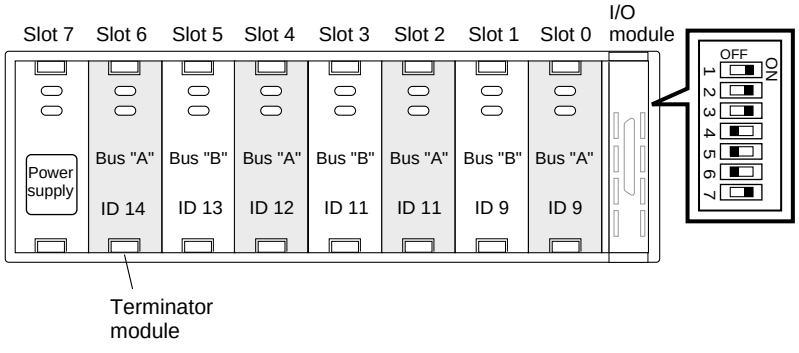
CXO5682A

Address 70



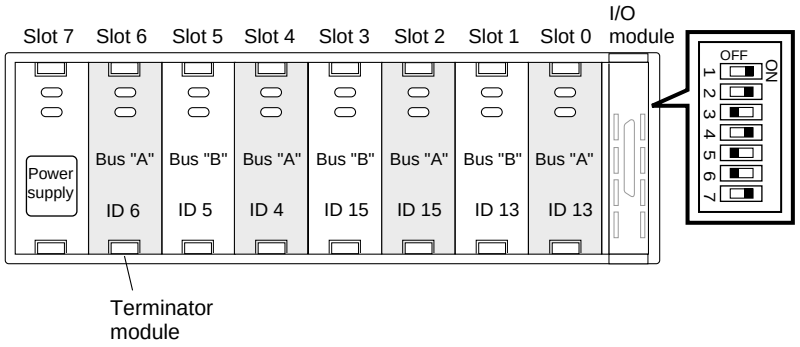
CXO5683A

Address 71



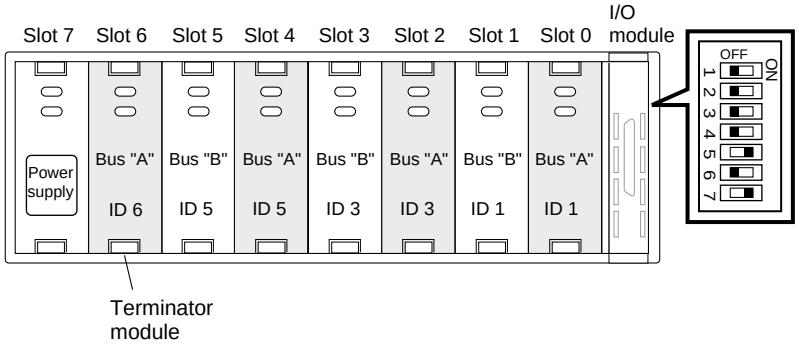
CXO5684A

Address 75



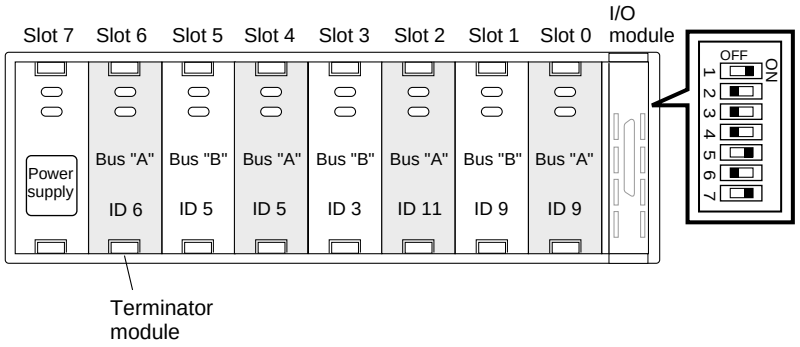
CXO5685A

Address 80



CXO5687A

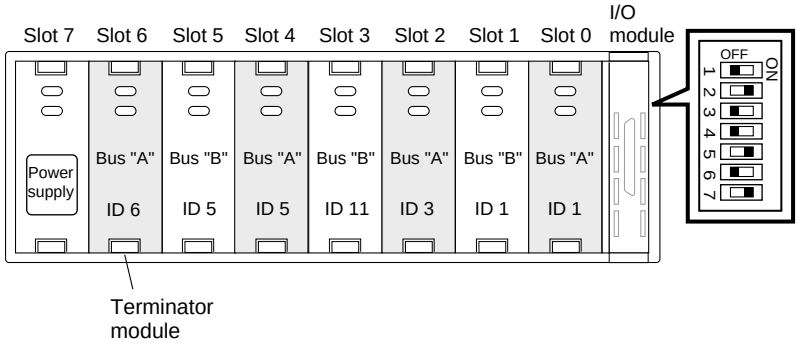
Address 81



CXO5688A

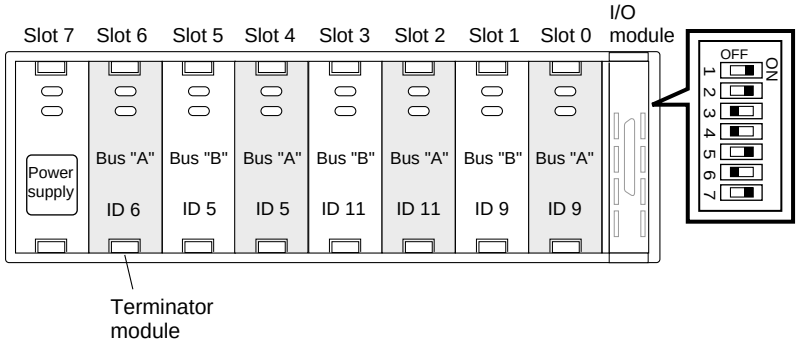
Dual Bus, Single Shelf Addresses

Address 82



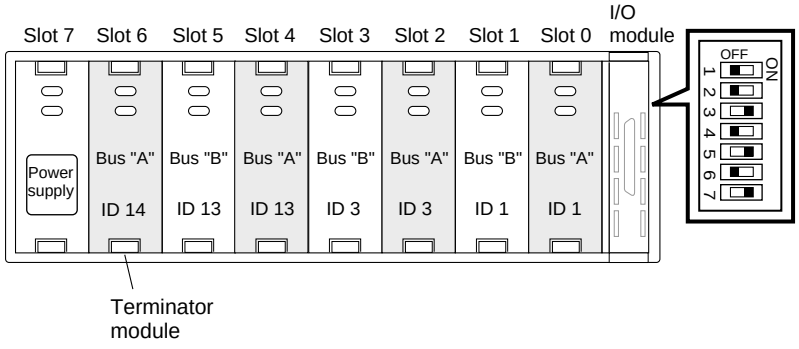
CXO5689A

Address 83



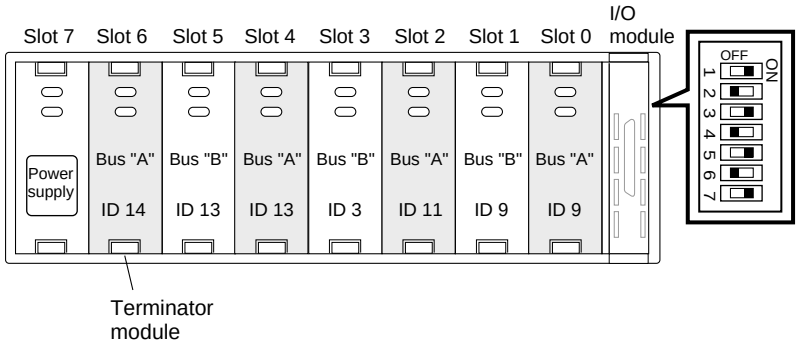
CXO5690A

Address 84



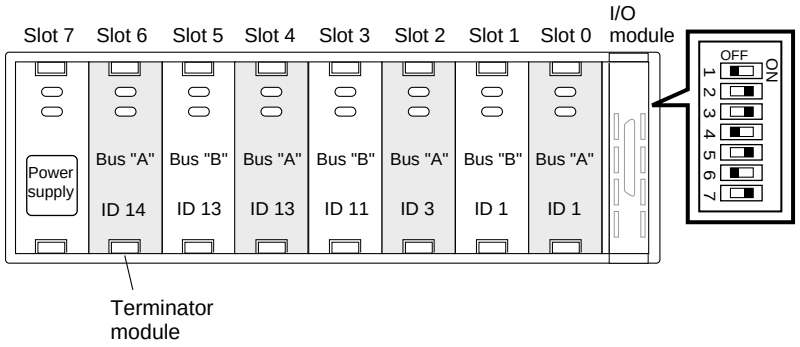
CXO5691A

Address 85



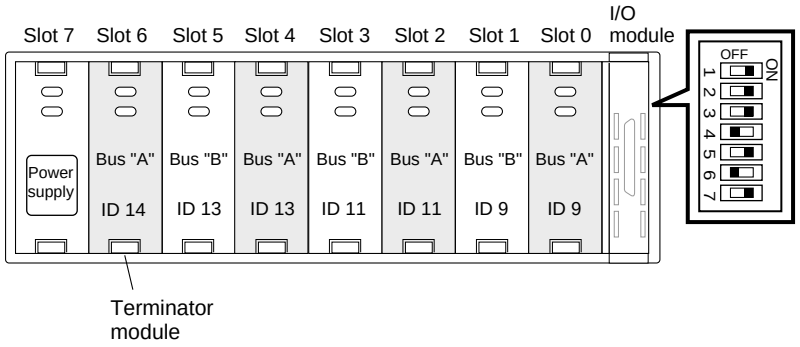
CXO5692A

Address 86



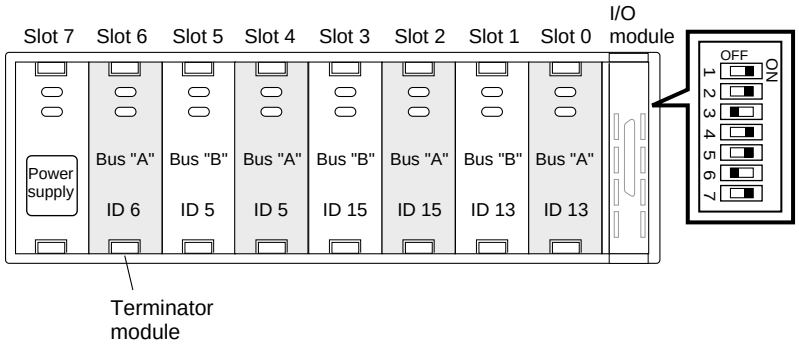
CXO5693A

Address 87



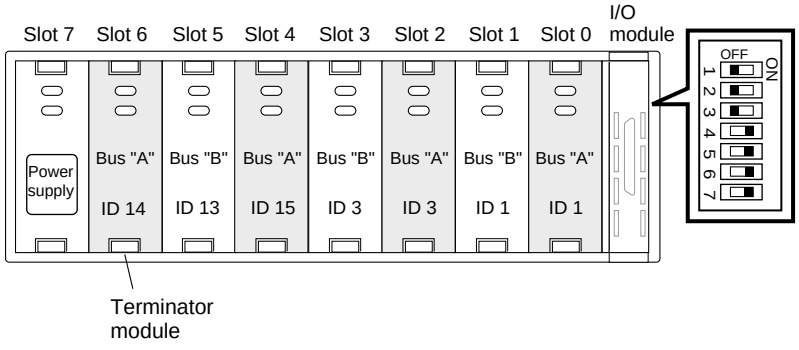
CXO5694A

Address 91



CXO5695A

Address 120

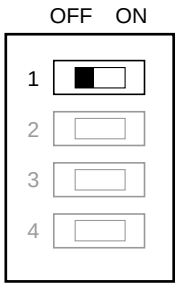
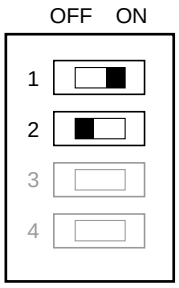


CXO5696A

Dual Controller Configurations

Complete the following procedure to configure a single SCSI bus, single shelf when there are dual controllers:

1. Install the jumper module (BA35X–MF) behind slot 6 on the shelf backplane.
2. Connect the controller SCSI bus cable to the bus A connector on the SBB I/O module.
3. For the BA35X–D and BA35X–F series SBB I/O modules set the SCSI bus termination for one of the following bus configurations:

16–Bit Bus	8–Bit Bus
	
CXO5718A	CXO5719A

Caution

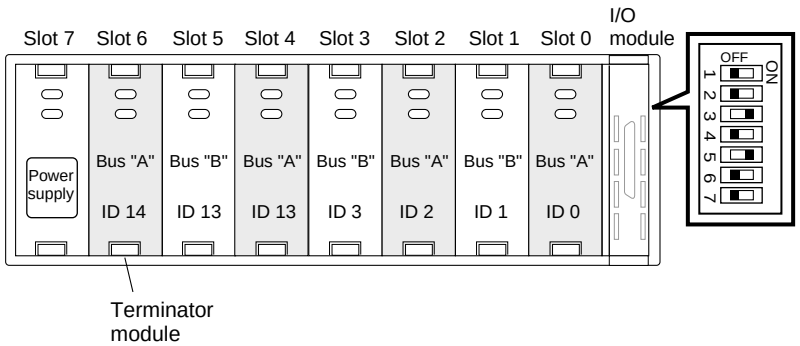
Connecting a cable to bus B connector disables the internal I/O module termination.

4. Select one of the following shelf address settings:

Note

The following drawings define SCSI bus address switch settings and the resulting SBB device addresses. They *do not* represent a specific I/O module type.

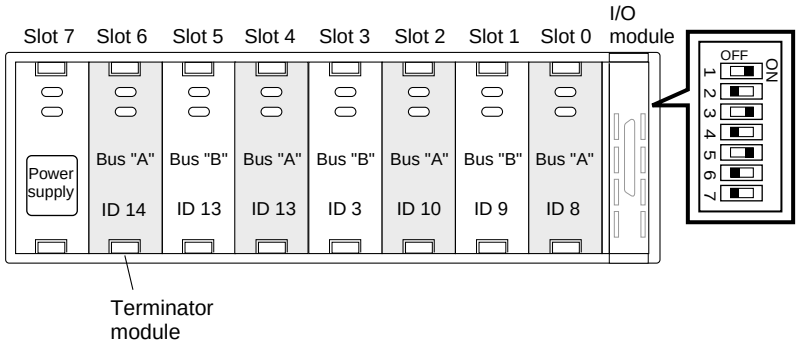
Address 20



CXO5667A

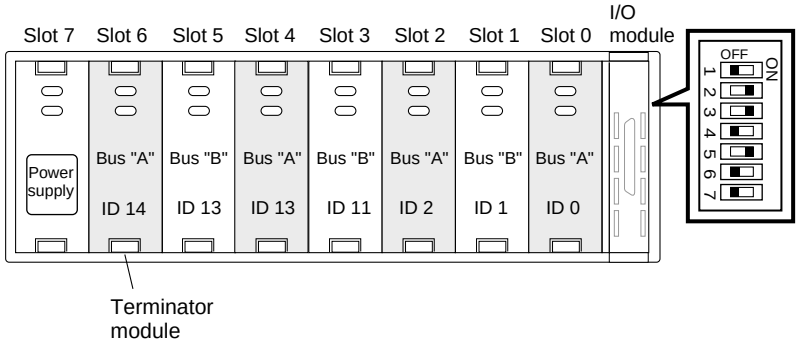
Dual Bus, Single Shelf Addresses

Address 21



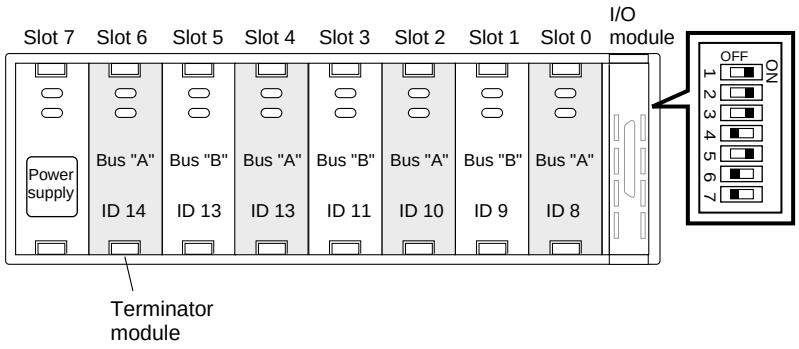
CXO5668A

Address 22



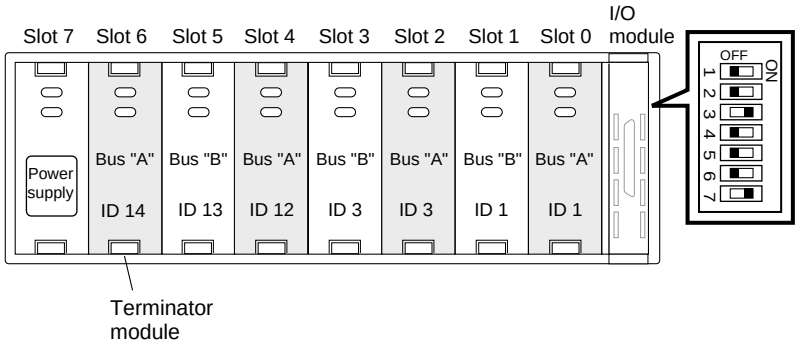
CXO5669A

Address 23



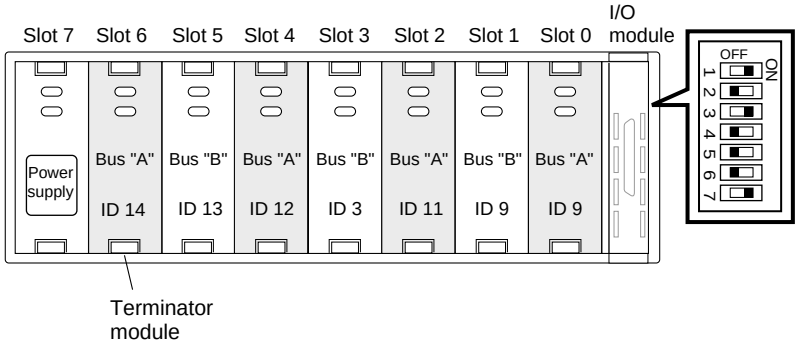
CXO5670A

Address 68



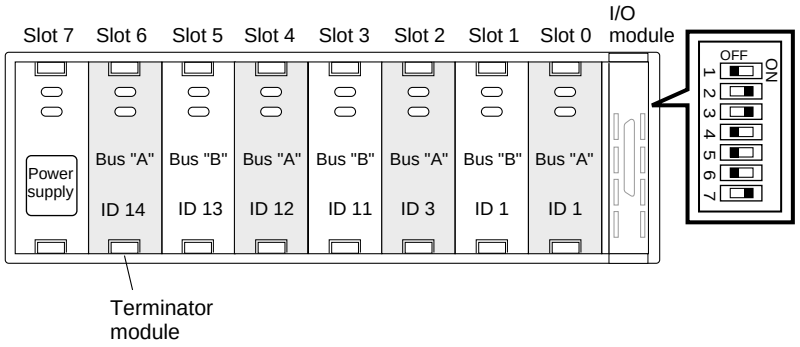
CXO5681A

Address 69



CXO5682A

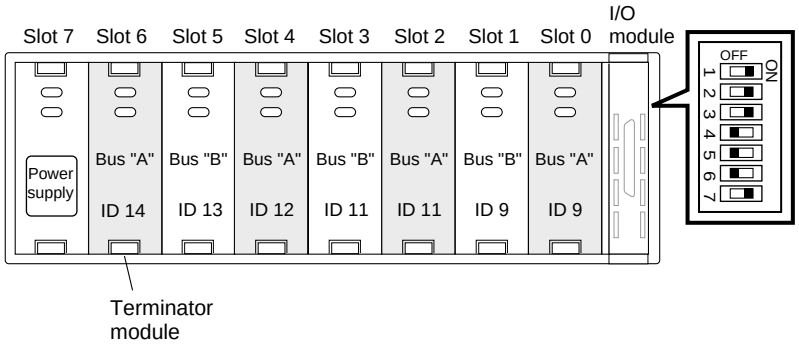
Address 70



CXO5683A

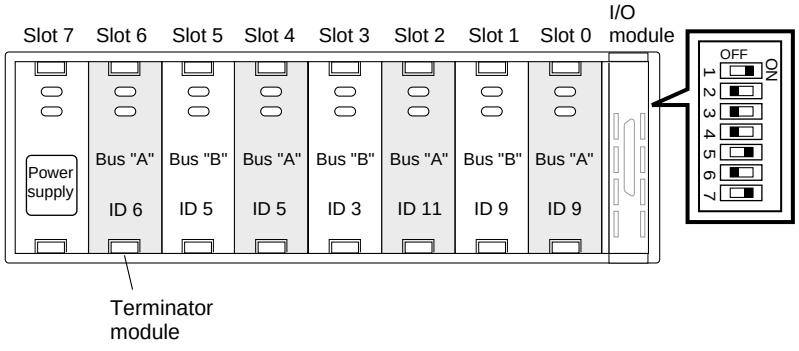
Dual Bus, Single Shelf Addresses

Address 71



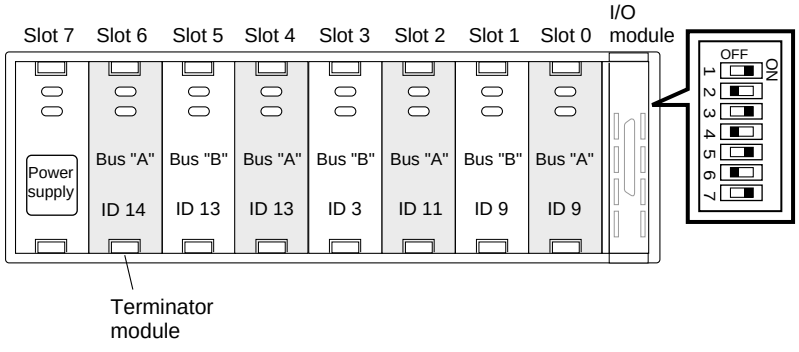
CXO5684A

Address 81



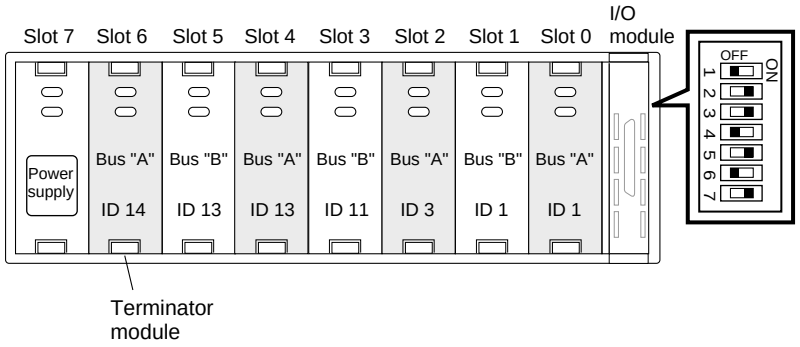
CXO5688A

Address 85



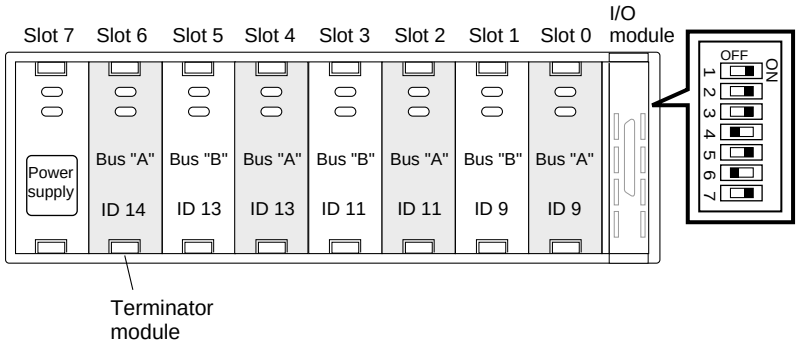
CXO5692A

Address 86



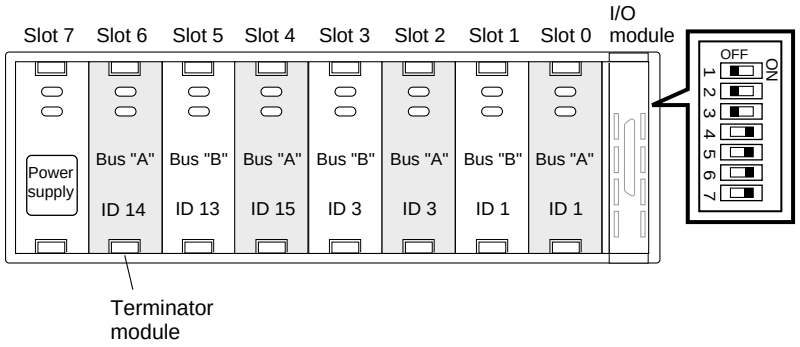
CXO5693A

Address 87



CXO5694A

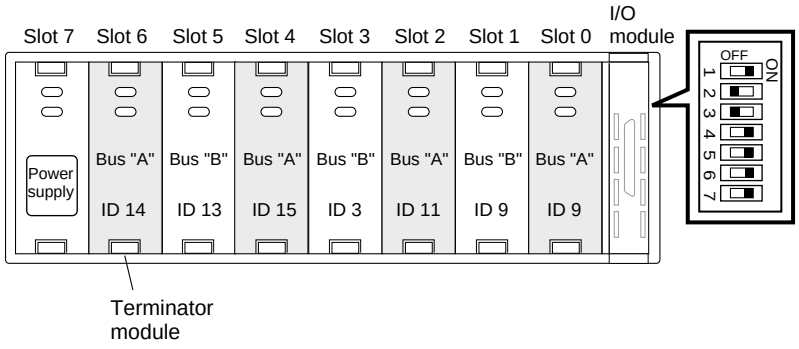
Address 120



CXO5696A

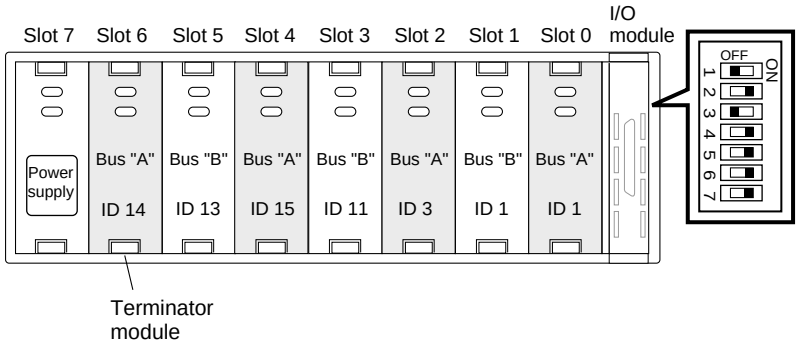
Dual Bus, Single Shelf Addresses

Address 121



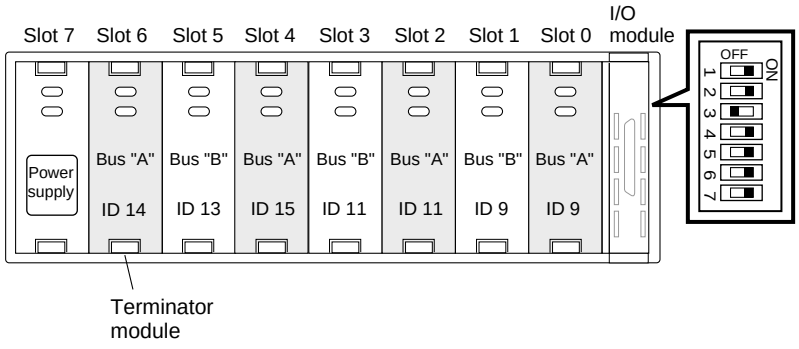
CXO5697A

Address 122



CXO5698A

Address 123



CXO5728A

Glossary

AC–DC converter
A stand–alone device that converts an ac input to a dc voltage for the operation of table–top SCSI bus converters.

adapter

See **SCSI signal bus converter**.

backplane

The electronic printed circuit board mounted in the rear of the shelf. This board contains the terminators for the SBBs, power supplies, terminators, and other components.

blower assembly

An airflow device mounted in a StorageWorks shelf.

bus extender

Devices that couple bus segments together without any impact on the SCSI protocol, the firmware, or software are called bus extenders. The DWZZx family includes both single ended to differential and single ended to single ended bus extenders. The term extender is a general term that includes both “repeater” and “isolator.”

bus–path

The electrical connection directly between two terminators in a bus segment.

bus–path connector

Any connector used to provide part of the bus–path.

bus segment

A SCSI bus segment consists of all the conductors and connectors required to attain signal line continuity between every driver, receiver, and two terminators for each signal. It is not necessary that a SCSI bus segment contain any initiators or targets, but it must have at least two devices attached. (Drivers and receivers may be part of extenders as well as part initiators and targets.)

The allowed length of a bus segment depends on the electrical loading, transmission media type, and data transfer rate. In many cases, heavier loading, smaller wires, and higher speeds demand shorter lengths. Loading is produced by increasing the number of devices in a given length of the bus, by using longer stubs, or higher capacitance devices.

bus segment types

There following are the SCSI bus segments types:

- Single ended (SE)
- High voltage differential (HVD)

The bus segment type is determined by the properties of the terminators used. Devices that do not have the same transceiver type as the terminators cannot operate in the segment defined by the terminators.

BUSY_GLITCH

The condition that may occur during the SCSI arbitration phase when nodes requesting service cause the BUSY signal to “bounce.”

cable connector

Any connector that is physically part of a cable assembly attached to backplanes or other non–device connectors.

CE–Mark

A European Economic Community (EEC) certification label that identifies electronic devices authorized for sale within member nations.

CE–Mark Class A

Similar to, but more stringent than the FCC Class A certification, this certification label appears on electronic devices that can only be used in a commercial environment. You can also use a CE–Mark certified device in the United States.

CE–Mark Class B

Similar to, but more stringent than the FCC Class B certification, this certification label appears on electronic devices that can only be used in either a home or a commercial environment. You can also use a CE–Mark certified device in the United States.

certified device

A storage device that has been tested and found to be in compliance with either an FCC or a CE certification standard.

channel

Another term for a SCSI bus.

converter

See **SCSI signal bus converter**.

device connector

Any connector physically part of a SCSI device.

differential I/O module

A 16–bit I/O module with SCSI bus converter circuitry for extending a differential SCSI bus.

See also **shelf I/O Module**.

differential SCSI bus

A bus in which the signal 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.

DIFFSENSE

The SCSI bus node signal that identifies the node bus type. A low or ground identifies a single ended device. A high signal (HVD) identifies a differential node.

DTERMPOWER

Terminator power on a differential SCSI bus.

See **TERMPOWER**.

dual bus

A single SBB shelf SCSI bus that is configured as two individual buses (a four device bus and a three device bus) is commonly referred to as a dual or split bus.

DWZZA

The 8–bit single ended compatible SCSI bus signal converter SBB.

See also **SCSI bus signal converter**.

DWZZB

The 16–bit single ended compatible SCSI bus signal converter SBB.

See also **SCSI bus signal converter**.

DWZZC

The 16–bit table–top SCSI bus signal converter for either extending a single ended SCSI bus or connecting a differential SCSI bus to a single ended SCSI bus.

See also **SCSI bus signal converter**.

electromagnetic interference

See **EMI**.

electrostatic discharge

See **ESD**.

EMI

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

enclosure connector

Any connector that is physically part of the enclosure (for example, pedestal, deskside enclosure, cabinet, and so forth).

end–bus position

See **SCSI end–bus position**.

ESD

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

FAST 20

See **ultra SCSI**.

fast differential SCSI bus

See **FD SCSI**.

fast wide differential SCSI bus

See **FWD SCSI**.

FCC

Federal Communications Commission. The federal agency responsible for establishing standards and approving electronic devices within the United States.

FCC Class A

This certification label appears on electronic devices that can only be used in a commercial environment within the United States. A CE–Mark certified device can be used in the United States in the same environment as the equivalent FCC certification.

FCC Class B

This certification label appears on electronic devices that can only be used in either a home or a commercial environment within the United States. A CE–Mark certified device can be used in the United States in the same environment as the equivalent FCC certification.

FD SCSI

The fast, narrow, differential SCSI bus with an 8–bit data transfer rate of 10 MB/s.

See also **FWD SCSI** and **SCSI**.

Federal Communications Commission

See **FCC.**

FWD SCSI

The fast, wide, differential SCSI bus with a 16–bit data transfer rate of up to 20 MB/s.

See also **FD SCSI** and **SCSI**.

high voltage differential

See **HVD**.

host

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

host compute

See **host**.

HVD

A bus segment or node that uses high voltage differential terminators.

I/O module

A 16–bit SBB shelf device that integrates the SBB shelf with either an 8–bit single ended, 16–bit single ended, or 16–bit differential SCSI bus.

See also **shelf I/O Module**.

Input/Output module

See **I/O module.**

isolator

See **bus extender**.

logical bus

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

logical units

A group of devices addressable as a virtual unit.

MB/s

Megabytes per second. The number of megabytes per second (MB/s) determined by the bus width (8– or 16–bit) and the number of bytes per word (1 or 2, respectively).

megabytes per second

See **MB/s.**

megatransfers per second

See **MT/s.**

mid–bus position

See **SCSI bus mid–bus position**.

MT/s

Megatransfers per second. 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– or 16–bit) and the number of bytes per word (1 or 2, respectively).

personality module

See **shelf I/O module**.

physical bus

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

port

(1) A logical route for data in and out of a controller. A port can contain one or more channels, all of which contain the same type data. (2) The hardware and software that connects a host controller to a CI™, SCSI, or SDI™ bus.

radio frequency interference

See **RFI**.

RAID

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

repeater

See **bus extender**.

RFI

Radio frequency interference. The impairment of a signal by an unwanted radio signal or radio disturbance.

SBB shelf

The common name for a StorageWorks storage device shelf. This shelf also contains shelf power supply SBBs.

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. (3) The device that extends the length of a differential or single ended SCSI bus.

See also **bus extender**, **DWZZA**, **DWZZB**, **DWZZC**, and **shelf I/O module**.

SCSI bus connector

Any connector used to create a SCSI bus segment. SCSI bus connectors are defined by both their function and their physical placement. There are only two allowed functions: bus–path and stub. There are numerous physical placement descriptions, for example, device stub connector and terminator bus–path connector.

SCSI busing connection

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

SCSI device

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

SCSI device ID

The bit–significant representation of the SCSI addressing referring to one of the signal lines. For an 8–bit bus the addresses are 0 through 7. For a 16-bit bus the addresses are 0 through 15 for a. Also referred to as “target ID”.

SCSI device–side device address

The 8 (0 through 7) or 16 (0 through 15) device addresses (target IDs) assigned to the SCSI controller and the devices it controls.

See also **SCSI host–side device address**.

SCSI domain

A SCSI domain is a logical bus with at least one bus segment, at least one initiator, and at least one target. Domains with multiple bus segments are enabled through the use of bus extenders. Domains are limited by device addressability. Domains are limited to a maximum of 16 initiators and targets without the use of LUN bridges.

SCSI end–bus position

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

SCSI host–side device address

The eight device addresses (target IDs) assigned to the host device or the SCSI controllers and the devices they control.

See also **SCSI device–side device address**.

SCSI mid–bus position

The physical location of a controller or a device that does not terminate the SCSI bus. The SCSI bus signals pass through these devices enroute to the device that has the SCSI bus termination.

SCSI port

(1) Software. The channel that controls communications to and from a specific SCSI bus in the system. (2) Hardware. The name of the logical socket at the back of the system unit to which a SCSI device is connected.

SCSI stubbing connection

A connection in the SCSI bus path between a terminator and a connector, such as a trilink connector, that is used to place a controller in the mid–bus position.

SCSI–A cable

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

SCSI–P cable

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

shelf I/O module

The circuit board that connects a 16–bit SBB shelf to a differential or single ended SCSI bus.

See also **differential I/O module** and **single ended I/O module**.

single ended I/O module

The 16–bit I/O module for extending an ultra SCSI bus between RAID subsystem shelves, such as the BA370-Series.

See also **shelf I/O Module**.

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**.

split bus

See **dual bus.**

STERMPOWER

Terminator power on a single ended SCSI bus.

See **TERMPOWER**.

StorageWorks

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

StorageWorks building bloc

See **SBB**.

stub

Any electrical path in a bus segment that is not part of the bus–path.

stub connection

The point where a stub meets the bus–path.

Stub connector

Any connector used to provide part of a stub.

table–top converter

A stand–alone, externally mounted SCSI bus converter that converts or extends a bus, or converts a differential bus to a single ended bus, or vice–versa. Usually requires an ac–dc power converter.

See also **I/O module**.

terminator

Interconnect components that form the ends of the transmission lines in bus segments. A SCSI domain must have at least one segment and therefore at least two terminators, *except* for special cases where the electrical transmission lines are very short and only one termination or pull–up is required.

terminator connectors

Any connectors physically part of a terminator. It is not uncommon for terminators to have both stub and bus–path connectors.

TERMPOWER

The electrical current power required for SCSI bus terminators. This power may be supplied by an external SCSI bus, the shelf power supply or an ac–dc power converter.

transmission medium

an electrical conductor have bus termination on each end and possibly stubs. Common examples of media are cables, printed wiring boards, flex circuits, and connectors that create electrical connections between various combinations SCSI devices, bus extenders, and terminators.

ultra SCSI

A FAST 20 SCSI bus.

VHDCI

Very High Density Cable Interface. A 68–pin interface with connectors on 8 mm centers. Required for ultra SCSI.