

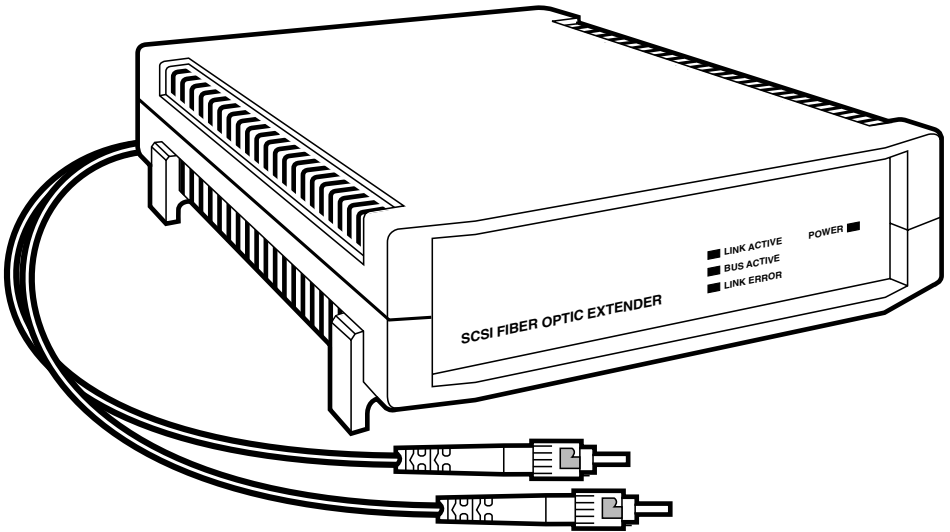


Black Box Corporation  
The Source for Connectivity®



JUNE 1996  
IC495A-R2

# SCSI Fiber Optic Extender



---

## CUSTOMER SUPPORT INFORMATION

Call our Technical Support Specialists to discuss your application.  
For 24-hour technical support: Call **(412) 746-5500** or Fax: **1-800-321-0746**  
To order: Call **(412) 746-5500** 8:00 A.M. to 8:00 P.M. EST  
Mail order: **Black Box Corporation**, P.O. Box 12800, Pittsburgh, PA 15241

### FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFERENCE STATEMENT

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

"This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications."

"Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada."

#### TRADEMARKS

All applied-for and registered trademarks are the property of their respective owners.

ST® is a registered trademark of American Telephone and Telegraph Company.

# 1. Specifications

## FIBEROPTIC INTERFACE

**Maximum Cable Length** — Up to 3000 ft. (about 1 km) of duplex fiberoptic cable between a matched pair of extenders

**Recommended Fiberoptic Cable** — 62.5/125  $\mu\text{m}$ , 100/140  $\mu\text{m}$ , or 50/125  $\mu\text{m}$

**Serial Data Rate** — 175 MHz

**Optical Wavelength** — 830 nm

**Typical Bit Error Rate (BER)** —  $10^{-12}$

## SCSI INTERFACE

**Maximum SCSI Cable Length** — 19.7 ft. (6 m)

**Maximum Speed** — 10 megabytes per second

**Slew Rate** — 5 ns (maximum)

**Protocol** — Sync or async

**Standards** — ANSI X3.131 and X3T9.2

**Interface** — Compatible with SCSI I and SCSI II

**SCSI to Fiber Conversion Delay** — 200 ns

**Termination** — Active Internal Bus

## PHYSICAL

**Indicators** — (4) LEDs: Line Active, Bus Active, Line Error, Power

**Connectors** — (2) fiber ST, (1) 50-pin SCSI, (1) IEC (power)

**Power** — 110/220 VAC  $\pm 10\%$ , 65/45 Hz (switch-selectable), 7 watts

**Size** — 2.1"H x 6"W x 9.6"D (5.3 x 15.2 x 24.4 cm)

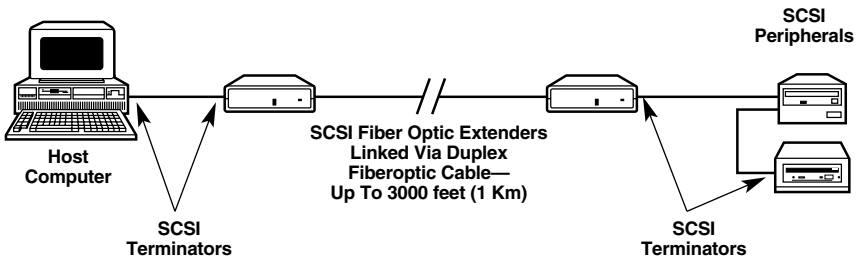
**Weight** — 3 lb. (1.4 kg)

# 2. Introduction

## 2.1 Overview

The SCSI bus (pronounced *scuzzy*) is one of the most popular interfaces for connecting peripheral devices to a computer system. However, the maximum allowable cable distance from computer to SCSI peripheral is just 19.7 ft. (6 m). But by using a pair of SCSI Fiber Optic Extenders, you can far exceed that distance.

Now you can connect SCSI components such as disk drives, CD-ROM systems, RAID arrays, tape backup drives, and laser printers up to 3000 feet (about 1 km) from the host computer, via fiberoptic cable (see Figure 2-1).



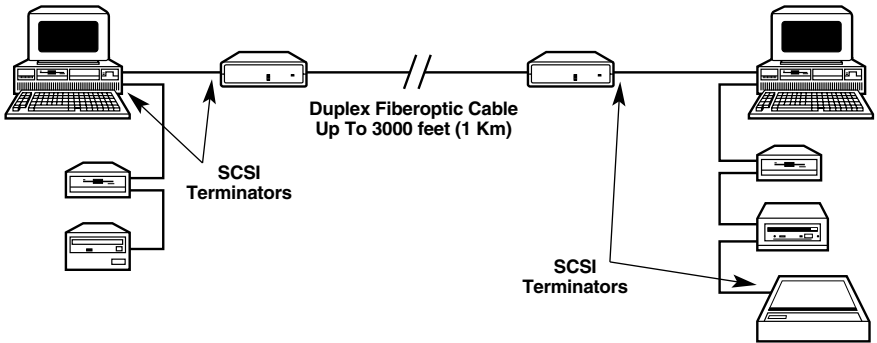
**Figure 2-1. Sample Application Using SCSI Fiber Optic Extenders.**

Note the location of the SCSI terminators.

SCSI Fiber Optic Extender supports a maximum SCSI data rate of 10 MBytes per second in asynchronous or synchronous mode. It supports the “Fast SCSI” standard, available in top-of-the-line computers and peripherals. And proprietary switching enables the Extender to maintain complete SCSI command functionality and remain transparent to the user.

The Extender conforms to ANSI X3.131 and X3T9.2 specifications with single-ended device termination. Disconnect and Reselect are fully supported to ensure complete SCSI compatibility. Also, the Extender does not require a SCSI device address.

Besides extending a single SCSI chain, you can use a pair of these Extenders to link two remote SCSI chains (see Figure 2-2), enabling computer users in distant workgroups to share multiple SCSI peripherals.



**Figure 2-2. Sample Application Using SCSI Fiber Optic Extenders.**

Note the location of the SCSI terminators.

Connect to a host or peripheral via the single-ended SCSI connector on the rear panel of the Extender. An internal “active” bus terminator is included to improve SCSI reliability and performance. This terminator can be removed for systems requiring external termination.

A standard duplex fiberoptic cable with ST connectors provides the interface between the local and remote Extender units. And for greater application flexibility, the Extender supports 110- or 220-VAC operation via a user-selectable switch and International standard IEC power connector.

## 2.2 Unpacking Your Shipment

Unpack your SCSI Fiber Optic Extender from its original shipping carton and inventory the contents. The package includes:

- (1) SCSI Fiber Optic Extender.
- (1) IEC AC Power Cord.
- (1) Package of Replacement Parts:
  - (1) 1-Amp fuse
  - (1) 2-Amp fuse
  - (1) 110-ohm network resistor.
- This User’s Manual.

## SCSI Fiber Optic Extender

### 2.3 Operator Controls and Indicators

Four front-panel LEDs light to give you at-a-glance status information about the operation of the Extender (see Figure 2-3.).

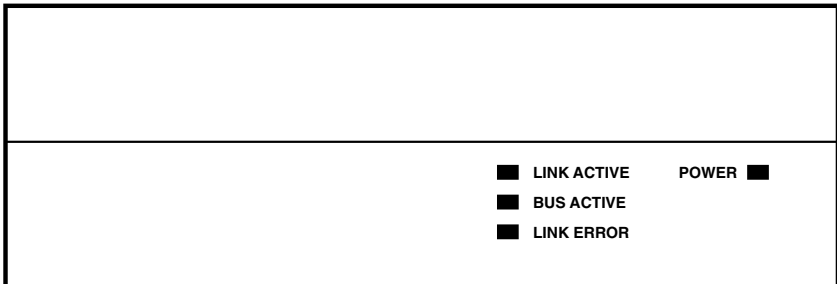
**POWER**—This lights when AC power is connected and switched-on to the unit.

**LINK ACTIVE**—This LED lights when two SCSI Fiber Optic Extenders are powered up and connected to one another via fiberoptic cable.

**BUS ACTIVE**—This LED provides a visual indication of the SCSI interface BUSY signal. It is a general indication that devices are communicating via the SCSI bus.

**LINK ERROR**—Lights when the integrity of the fiberoptic link dips below specification. When this LED is lit, data errors have occurred. The SCSI Fiber Optic Extender will disconnect from the SCSI bus when a Link Error is detected.

**POWER SWITCH**—Located on the rear panel (see Figure 3-1.) Turn on power by pressing the half of the switch marked “I”. Turn power off by pressing the half of the switch marked “O”.



**Figure 2-3. Front-Panel View.**

## **2.4 Calling Your Supplier**

If the Extender arrives incomplete, or subsequently malfunctions, *do not attempt to alter or repair the unit*. It contains no user-serviceable parts. Contact your supplier. Before you do, make a record of the history of the problem. Your supplier will be able to provide more efficient and accurate assistance if you have a complete description, including:

- The nature and duration of the problem.
- When the problem occurs.
- The components involved in the problem.
- Any particular application that, when used, appears to create the problem or make it worse.

## **2.5 Shipping and Packaging**

If you need to transport or ship your SCSI Fiber Optic Extender:

- We recommend that you use the original packaging container.
- If you are shipping the unit for repair, make sure you include its power supply. If you are returning it, make sure you include this manual as well. Before you ship, contact your supplier to get a Return Materials Authorization (RMA) number.

## 3. Installation

The SCSI Fiber Optic Extender requires no software configuration and only nearby access to an AC electrical outlet for proper operation. That makes installation fast and easy.

Install the Extender in any position and any location near the host computer or peripherals that's most convenient for you. Make sure that the ventilation slots on the side of the unit are unobstructed and receive adequate air flow. *Do not* place the Extender on any device that generates heat.

### NOTE

Switch off power to all computers and peripherals attached to the SCSI bus before installing the SCSI Fiber Optic Extender.

### 3.1 Setting the AC Line Voltage Switch

The SCSI Fiber Optic Extender can be powered from either a 110- or 220-VAC power source. Figure 3-1 shows the location of the external voltage-selection switch on back of the unit. The default setting is 110-VAC.

### CAUTION

Before installing this unit, verify that the voltage-selection switch is switched to the appropriate setting to match your AC input source.

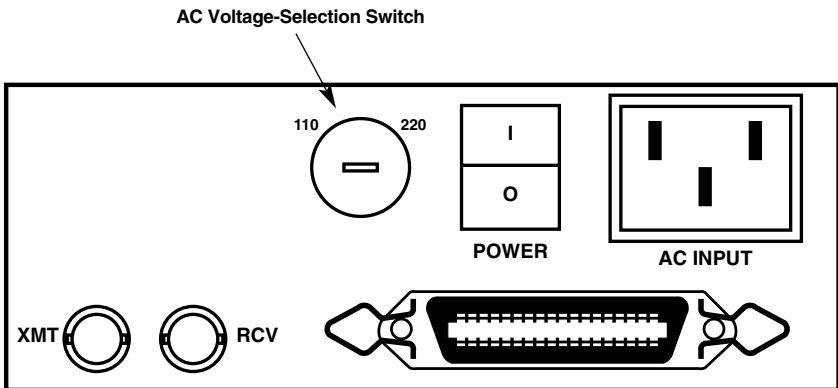


Figure 3-1. Rear-Panel View.



With the voltage-selection switch set properly, plug the female end of the power cord into the back of the unit and plug the male end of the cord into your AC power outlet.

### 3.2 Recommended Cable

**Twisted-Pair Cable**—A 50-pin shielded cable and connector will provide a connection with the greatest noise immunity and distance from your host or peripheral to the SCSI Fiber Optic Extender. But note that this cable connection may never exceed 6 feet (19.7 m). *Section 3.5* describes requirements for connecting to the SCSI Bus. **Appendix B** shows the standard SCSI connector pinning chart.

**Fiber optic Cable**—Up to 3000 feet (about 1 km) of standard, full-duplex multimode 62.5/125  $\mu\text{m}$ , 100/140  $\mu\text{m}$ , or 50/125  $\mu\text{m}$  fiberoptic cable. Improper connector termination, splicing of the fiberoptic cable, or use of other cable diameters will result in reduced link distances and increased data error rates.

Neither of these cables are included with this unit. Call your supplier to order them separately.

### 3.3 Internal/External Terminator Options

The SCSI Fiber Optic Extender features internal active SCSI bus termination to improve the cable-matching characteristics between multiple SCSI devices. Since some applications require external terminators, you may remove these internal terminators for added application flexibility.

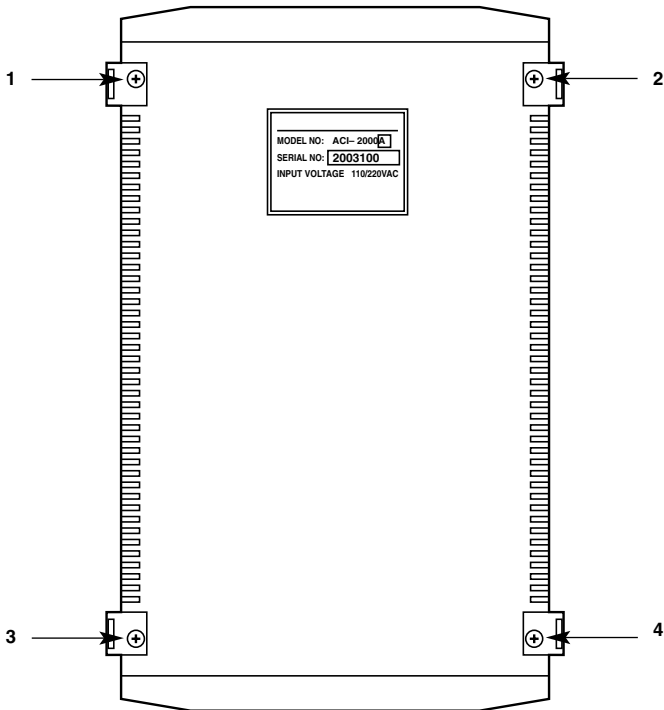
To remove the internal terminators, remove the four screws on the bottom of the unit (see *Figure 3-2*) and gently unplug terminators RN1, RN2, and RN3 from their positions on the printed circuit board (PCB) (see *Figure 3-3*).

Normally, terminators should be installed on opposite ends of the SCSI bus. Note that data errors may result if more than two sets of terminators are installed on any SCSI bus.

### 3.4 Internal Terminator Power and Fuse

The SCSI Fiber Optic Extender contains a replaceable internal fuse to provide power for an external terminator. This fuse supplies 1 amp at 5 volts to the TERMPWR signal. The fuse is installed in the socket labeled F2 on the PCB (see *Figure 3-3*). The Extender contains internal protection and will not be affected if other SCSI devices provide terminator power.

## SCSI Fiber Optic Extender



**Figure 3-2. Remove Four Bottom-Panel Screws to Access the PCB.**

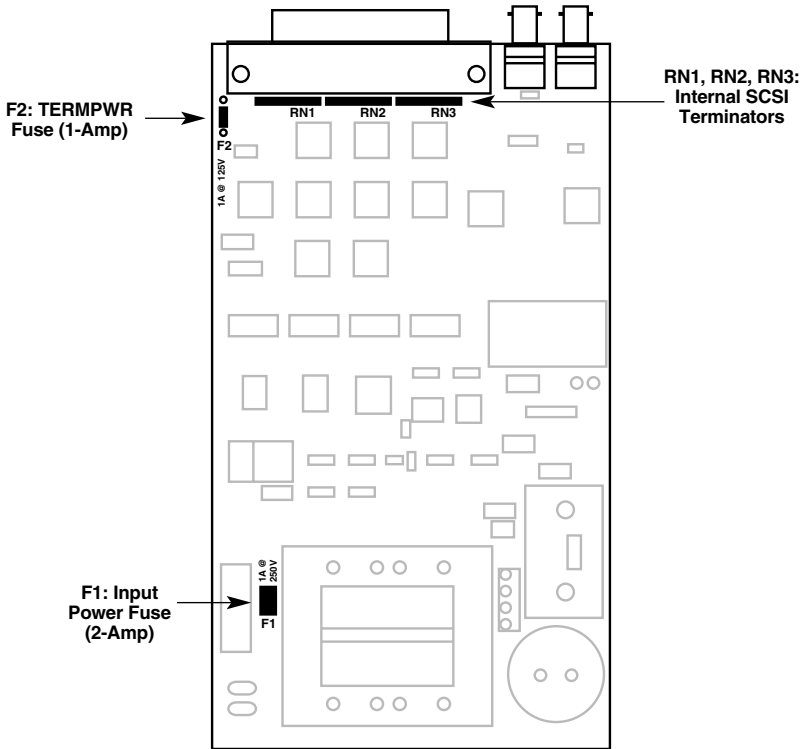
### 3.5 Connecting to the SCSI Bus

The SCSI Fiber Optic Extender provides a transparent, optically isolated SCSI bus over extended distances, so you can install the Extender at any point on your SCSI bus. Terminators must be installed on both the local and extended bus, so make sure that a maximum of two terminators are installed on each side of the Extender link (see *Figures 2-1* and *2-2*).

Connect the twisted-pair cable from the host or SCSI peripheral to the 50-pin SCSI connector on back of the Extender. Use the bail-locking mechanism to anchor the connection securely.

#### NOTE

If external termination is required, be sure to remove the internal termination networks and replace them with an internal terminator fuse F2 (included).  
(See *Figures 3-2.* and *3-3.*)



**Figure 3-3. Location of the Internal Fuses and Terminators.**

### **3.6 Connecting the Fiberoptic Cable**

Most duplex fiberoptic cable is marked to indicate which fiber connector is transmit (XMT) and which is receive (RCV). Attach the appropriate connectors to the labeled ST<sup>®</sup> connectors on the rear panel of the SCSI Fiber Optic Extender. Do this for both the local and remote Extender units.

Take care to keep the fiberoptic connectors and optical components free of dust and dirt. And whenever cables are not attached to the Extender's ST ports, cover them with the protective plastic caps included with the unit.

For the link to operate properly, connect the transmit (XMT) port of the local Extender to the receive (RCV) port of the remote Extender and connect the receive (RCV) port of the local Extender to the transmit (XMT) port of the remote Extender.

## SCSI Fiber Optic Extender

To identify unmarked fiber connectors, attach both connectors at one end of the cable to the SCSI Fiber Optic Extender and then switch on power to the unit. Then visually examine both connectors at the opposite end of the cable to determine which one is the transmit fiber. A faint red light will be visible at the tip of one of the connectors. This indicates the transmit fiber. This is the connector that should be attached to the receive (RCV) port of the remote Extender unit.

### 3.7 Verify the Connection

Switch on power to both SCSI Fiber Optic Extenders and verify that the LINK ACTIVE LEDs are lit on the front panels of both units. This confirms that the local and remote units are communicating.

You may now switch on power to your attached computers and peripherals.

## 4. Operation

### 4.1 Overview

The SCSI Fiber Optic Extender converts SCSI data and command information into a serial data stream that's transmitted over a high-speed (175-Mhz) fiberoptic interface to the remote Extender. The remote unit decodes the data stream and reconverts it back into proper SCSI signals.

The fiberoptic serial link conforms to the ANSI X3T9.5 encoding scheme specified in FDDI local area networks and is virtually immune to all forms of radio-frequency and electromagnetic interferences (RFI/EMI). An unauthorized tap of the link is nearly impossible without detection.

### 4.2 System Performance

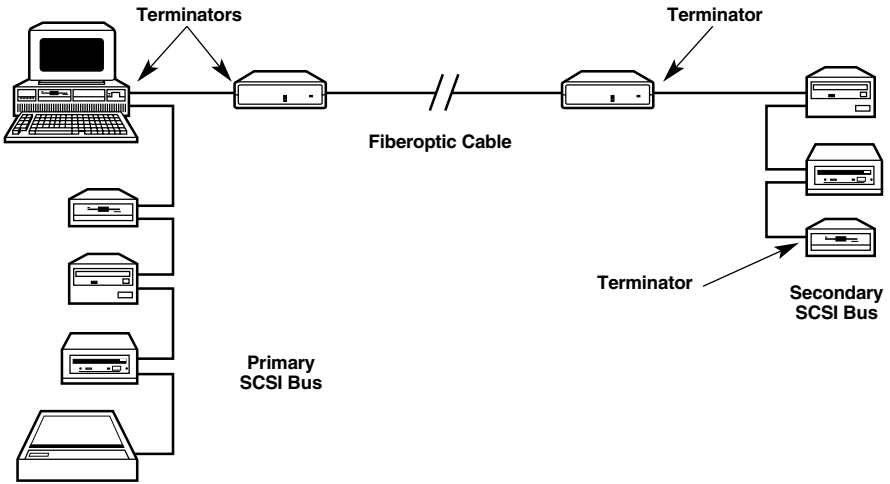
The SCSI Fiber Optic Extender will support any combination of asynchronous and synchronous SCSI devices on the bus. Overall system performance will depend on the individual data rate and protocol of each SCSI device plus the overhead of the host computer.

In general, devices connected via a SCSI Fiber Optic Extender link up to 300 feet ( about 100 m) will achieve aggregate data rates of 225 kilobytes per second in asynchronous mode. In synchronous mode, with a byte offset of 8, sustainable data rates of 4 megabytes per second can be expected. A synchronous offset of 16 will provide 5 megabytes per second data rates.

### 4.3 System Configuration Options

The SCSI Fiber Optic Extender supports a maximum data rate of 10 megabytes per second. This data rate is often referred to as Fast SCSI. To ensure optimum system performance, some system configurations may require a secondary SCSI channel to interface with the Extender (see *Figure 4-1*).

## SCSI Fiber Optic Extender



**Figure 4-1. Alternate Configuration Linking Two SCSI Buses.**

In this configuration, the primary SCSI bus is used to connect the local high-speed peripherals. The secondary SCSI bus is used exclusively as the extended SCSI bus.

## Appendix A—SCSI Signal Descriptions

A total of 18 signals are required for the SCSI interface. These signals are described as follows:

**BSY (BUSY)**—An “OR-tied” signal indicating that the bus is being used.

**SEL (SELECT)**—An “OR-tied” signal used by an initiator to select a target or by a target to reselect an initiator.

**C/D (CONTROL/DATA)**—A signal driven by a target that indicates whether CONTROL or DATA information is on the DATA BUS. True indicates CONTROL.

**I/O (INPUT/OUTPUT)**—A signal driven by a target that controls the direction of data movement on the DATA BUS with respect to an initiator. True indicates input to the initiator. This signal is also used to distinguish between SELECTION and RESELECTION phases.

**MSG (MESSAGE)**—A signal driven by a target during the MESSAGE phase.

**REQ (REQUEST)**—A signal driven by a target to indicate a request for a REQ/ACK data transfer handshake.

**ACK (ACKNOWLEDGE)**—A signal driven by an initiator to indicate an acknowledgement for a REQ/ACK data transfer handshake.

**ATN (ATTENTION)**—A signal driven by an initiator to indicate the ATTENTION condition.

**RST (RESET)**—An “OR-tied” signal that indicates the RESET condition.

**DB(7-0,P) (DATA BUS)**—Eight data-bit signals, plus a parity-bit signal that form a DATA BUS. DB(7) is the most significant bit and has the highest priority during the ARBITRATION phase. Bit number, significance, and priority decrease downward to DB(0). A data bit is defined as one when the signal value is true and is defined as zero when the signal value is false. Data parity DB(P) shall be odd.

# Appendix B—SCSI Connector Pinning

CONNECTOR PIN NUMBER			CONNECTOR PIN NUMBER		
SIGNAL NAME	UNSHIELDED	SHIELDED	SIGNAL NAME	UNSHIELDED	SHIELDED
-DB(0)	2	26	GROUND	1	1
-DB(1)	4	27	GROUND	3	2
-DB(2)	6	28	GROUND	5	3
-DB(3)	8	29	GROUND	7	4
-DB(4)	10	30	GROUND	9	5
-DB(5)	12	31	GROUND	11	6
-DB(6)	14	32	GROUND	13	7
-DB(7)	16	33	GROUND	15	8
-DB(P)	18	34	GROUND	17	9
GROUND	20	35	GROUND	19	10
GROUND	22	36	GROUND	21	11
GROUND	24	37	GROUND	23	12
TERMPWR	26	38	OPEN	25	13
GROUND	28	39	GROUND	27	14
GROUND	30	40	GROUND	29	15
-ATN	32	41	GROUND	31	16
GROUND	34	42	GROUND	33	17
-BSY	36	43	GROUND	35	18
-ACK	38	44	GROUND	37	19
-RST	40	45	GROUND	39	20
-MSG	42	46	GROUND	41	21
-SEL	44	47	GROUND	43	22
-C/D	46	48	GROUND	45	23
-REQ	48	49	GROUND	47	24
-I/O	50	50	GROUND	49	25





Black Box Corporation  
*The Source for Connectivity*<sup>®</sup>

© Copyright 1996. Black Box Corporation. All rights reserved.

P.O. Box 12800



Pittsburgh, PA 15241



(412) 746-5500



Fax (412) 746-0746