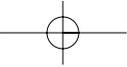


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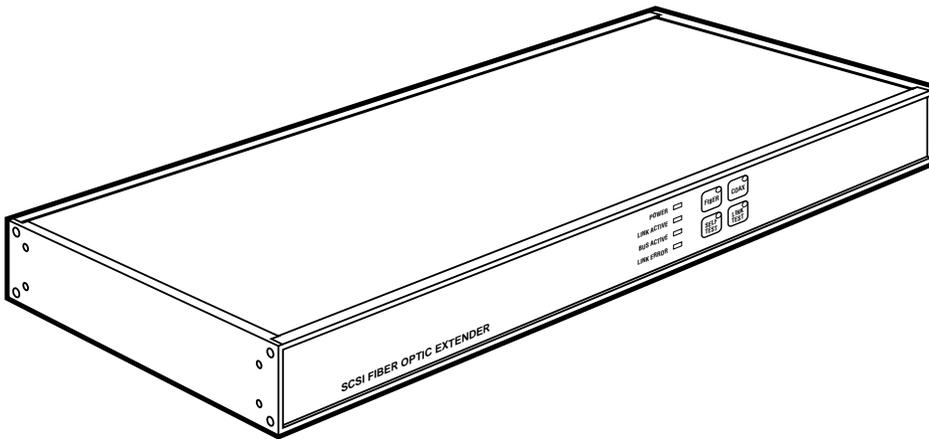
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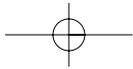
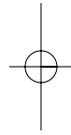
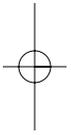
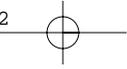
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IC500A
IC501A

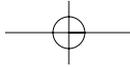
SCSI Fiber Optic Bus Extenders



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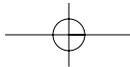
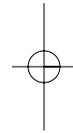
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SCSI FIBER OPTIC BUS EXTENDERS**FEDERAL COMMUNICATIONS COMMISSION
AND
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This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict 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 J 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 necessary to correct the interference.

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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 publié par le ministère des Communications du Canada.

NOM STATEMENT**NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT****INSTRUCCIONES DE SEGURIDAD**

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

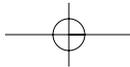
SCSI FIBER OPTIC BUS EXTENDERS

12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

TABLE OF CONTENTS

Contents

Chapter	Page
1. Specifications	6
2. Introduction	8
2.1 Description.....	8
2.2 Features	8
3. Installation	11
3.1 Unpacking Your Extender	11
3.2 AC Line Voltage.....	11
3.3 Placement.....	11
3.4 Cable Recommendations	11
3.5 Connecting the SCSI Fiber Optic Bus Extender to the SCSI Bus	12
3.6 Ensuring Proper SCSI Bus Termination	12
3.7 Connecting a Fiberoptic Cable	12
3.8 Connecting a DB9 Coax Cable.....	13
3.9 Verify Communications	14
4. Operator Controls and Indicators	15
4.1 AC Switch	15
4.2 Indicators	15
4.3 Front-Panel Keypad.....	16
5. Interfacing Requirements	17
5.1 SCSI Cable Interface Requirements	17
5.2 Internal/External Terminator Options.....	18
5.3 Internal Terminator Power and Fuse	18
5.4 Selecting Internal Terminator Power	19
5.5 RS-232 Interface Pin Assignment	19
5.6 Internal RS-232 Jumper Block	20
5.7 Rear-Panel Option Switches	20
5.8 RS-232 Remote Operation Commands	21
5.9 ASCII Character Reference for SCSI Fiber Optic Bus Extender Box Selection.....	23
5.10 Windows Software	24
5.11 Connecting Multiple SCSI Fiber Optic Bus Extenders	24
5.12 Rack Mount Installation	25
5.13 Fiberoptic Cable Requirements	26
6. Operation	27
6.1 SCSI Fiber Optic Bus Extender Operation	27
6.2 System Performance	27
6.3 System Configuration Options.....	27
7. SCSI Technical Information	29
7.1 SCSI Basics	29
7.2 SCSI Installation Tips	30
7.3 SCSI Interface Signal Descriptions	31



SCSI FIBER OPTIC BUS EXTENDERS

1. Specifications

SCSI Interface

Maximum Data Rate.....40 MB per second
 Wide SCSI Connector68-pin
 Narrow SCSI Connector.....50-pin
 SCSI to Fiber to SCSI Conversion Delay.....125 ns
 Internal Terminator Power1 amp
 Asynchronous and synchronous compatible
 Conforms to ANSI X3.131 and X3T9.2 specifications
 SCSI 1, 2, and SCSI 3 compatible
 Resettable internal TERMPWR fuse

IC500A.....Single-ended SCSI
 Maximum Cable Length.....19.7 feet (6 meters)
 Maximum Slew Rate3 ns
 Active Internal Bus Termination

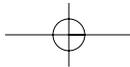
IC501A.....Differential SCSI
 Maximum Cable Length.....82 feet (25 meters)
 Maximum Slew Rate3 ns
 Passive Internal Bus Termination

Fiber optic Link Interface

Maximum fiber cable length (both models):
 6500 feet (2 km) with 8/125- μ m single-mode fiber
 1800 feet (550 meters) with 62.5/125- μ m multimode fiber
 Fiberoptic Serial Data Rate1.0625 Gigabits per second
 Fiberoptic Connector TypeSC
 Optical Wavelength850/1300 nm
 Typical BER (Bit Error Rate).....10 to 14

Coax Link Interface

Maximum coax cable length100 feet (30 meters)
 Impedance150 ohms
 Recommended CableGore FCN 1008-L



CHAPTER 1: Specifications

Serial-Port Interface—SCSI Fiber Optic Bus Extender Control

Data Rate9600/19200 baud
 ModeNo parity, 8 bits, 1 stop bit
 Maximum Cable Length50 feet (15 meters)
 Rear-Panel ConnectorDB9 female

Serial-Port Interface—Extension

Data Rate1200 bps to 112 kbps
 ModeAll modes
 Maximum Cable Length50 feet (15 meters)
 Rear-Panel ConnectorDB9 female

Physical

Temperature32 to 131°F (0 to 55°C)
 HumidityUp to 90% relative humidity
 Power90 to 260 VAC, 15 W, 48 to 65 Hz
 Size1.7"H x 14.7"W x 8.1"D
 (4.3 x 37.3 x 20.6 cm)
 Weight3 lb. (1.4 kg)

Maximum Fiber Cable

<u>Code</u>	<u>Description</u>	<u>Maximum Fiber Cable</u>
IC500A	Single-ended/Wide	2 km
IC501A	Differential/Wide	2 km

Agency Approvals

UL®, CUL, CE, FCC Class A

SCSI FIBER OPTIC BUS EXTENDERS

2. Introduction

2.1 Description

The SCSI Fiber Optic Bus Extender lets you surpass the distance limitation of the single-ended and differential SCSI bus. The SCSI bus is one of the most popular interfaces used to connect additional devices to a computer system. With the SCSI Fiber Optic Bus Extender, SCSI components such as disk drives, CD-ROM memory systems, RAID arrays, tape backups, and SCSI laser printers can be located up to 6500 feet (2 km) from the host computer.

Because the SCSI Fiber Optic Bus Extender is completely transparent to your SCSI system, additional computer software is not needed for installation or operation.

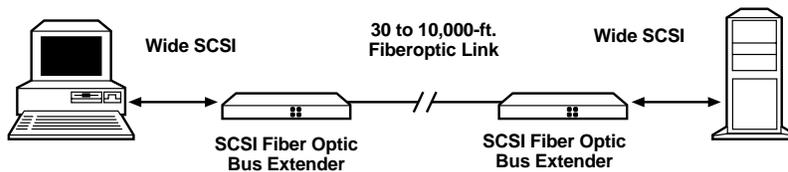


Figure 2-1. Typical SCSI Fiber Optic Bus Extender Configuration.

2.2 Features

- Extends SCSI bus to 6500 feet (2 km)
- 40 MB per second throughput
- Ultra SCSI compatible
- 30-foot (100-meter) coax link standard
- RS-232 serial-port passthrough
- SCSI 1, SCSI 2, SCSI 3 compatible
- Single-ended or differential SCSI interface

CHAPTER 2: Introduction

- Fiber-channel-compatible optical link
- Standard SC connectors
- Internal bus termination
- No additional software required
- Advanced SCSI Fiber Optic Bus Extender Control software for remote control
- Transparent to the SCSI system
- Does not require a SCSI bus ID

The SCSI Fiber Optic Bus Extender supports Ultra SCSI, 40-MB-per-second, wide and narrow devices in asynchronous or synchronous mode. The Extender gives you the Ultra and Fast SCSI performance available in top-of-the-line computers and peripheral devices. Its advanced proprietary design enables the Extender to maintain complete SCSI command functionality while remaining transparent to you.

The Extender includes 68- and 50-pin high-density SCSI-2 connectors for narrow and wide devices.

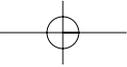
Internal bus terminators are switch-selectable to support flexible installations.

A standard SC duplex fiberoptic connector supports a fiberoptic interface between local and remote units.

The SCSI Fiber Optic Bus Extender also includes two duplex coaxial interfaces to support shorter SCSI extender distances.

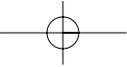
The SCSI Fiber Optic Bus Extender can be operated and controlled via the remote RS-232 interface using the included SCSI Fiber Optic Bus Extender Control software. Standard modem software can also be used to control the Extender. Up to 8 units can be connected together and controlled from one serial port using the internal RS-485 multidrop interface. Simple ASCII commands control SCSI Fiber Optic Bus Extenders in addition to the supplied Windows software.

The RS-232 serial port can also be configured to pass-through the interface to a remote SCSI Fiber Optic Bus Extender, thus letting you operate a remote RS-232 device. This feature is often used in tape-storage systems where control information is provided on a separate RS-232 interface.



SCSI FIBER OPTIC BUS EXTENDERS

The SCSI Fiber Optic Bus Extender also contains a universal power-cord receptacle, and it auto-switches any AC input voltage between 100 and 240 VAC.



3. Installation

3.1 Unpacking Your Extender

Unpack your SCSI Fiber Optic Bus Extender from its original shipping carton and check the contents. The package should include:

- (1) SCSI Fiber Optic Bus Extender
- (1) AC power cord (115 or 230 VAC, depending on what you ordered)
- This user's manual
- 10-ft. (3-m) 9-pin male to 9-pin female RS-232 cable
- 9-pin male to 25-pin female RS-232 adapter
- SCSI Fiber Optic Bus Extender Control software
- Rackmount rails
- Desk-mount rubber feet
- Two loopback connectors

3.2 AC Line Voltage

The Extender can be externally connected to any AC input voltage between 100 and 240 volts. Unless otherwise specified, the Extender will be shipped with a 110-volt power cord. Black Box offers a complete source of replacement power cords for most countries and appropriate voltages.

3.3 Placement

Place the Extender near the host computer and peripherals. Make sure the ventilation slots on the sides of the unit obtain adequate airflow. Do not place the Extender on any devices that generate excessive heat.

3.4 Cable Recommendations

High-quality shielded SCSI cables will provide the greatest noise immunity and distance from the Extender to your peripherals. But in any case, no cables connected to the Extender may exceed 19.7 feet (6 meters) for single-ended or 82 feet (25 meters) for differential devices.

SCSI FIBER OPTIC BUS EXTENDERS

3.5 Connecting the SCSI Fiber Optic Bus Extender to the SCSI Bus

NOTE

The IC501A supports a differential SCSI interface only. Do not attach this unit to a single-ended SCSI system or it may damage your system.

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

You may install the SCSI Fiber Optic Bus Extender at any point on the SCSI bus. The IC501A can be operated with another IC501A or an IC500A.

3.6 Ensuring Proper SCSI Bus Termination

SCSI buses require proper termination to ensure reliable operation. Since the SCSI Fiber Optic Bus Extender is used in the middle of a SCSI chain, additional termination is needed at each Extender, in addition to the standard terminators at each end of the link.

That's a total of four terminators, two on each side of the SCSI Fiber Optic Bus Extender. Note too that *your system will fail if more than two terminators are installed on any one side of the Extender.*

You have the option of disabling the internal SCSI Fiber Optic Bus Extender termination to meet system configurations and requirements.

NOTE

Sections 5.1 and 5.2 provide detailed information on SCSI Fiber Optic Bus Extender termination option settings.

3.7 Connecting a Fiberoptic Cable

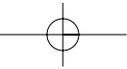
A duplex fiberoptic cable with standard SC plugs interconnects two SCSI Fiber Optic Bus Extenders.

LOCAL SCSI FIBER OPTIC BUS EXTENDER

Insert one plug into each fiberoptic socket on the rear of the local Extender. Measure that the "key" on each plug is facing the top of the Extender before insertion.

NOTE

Make sure that the plug is properly aligned with the connector before inserting. Do not force the plug into the connector or you may damage it.



CHAPTER 3: Installation

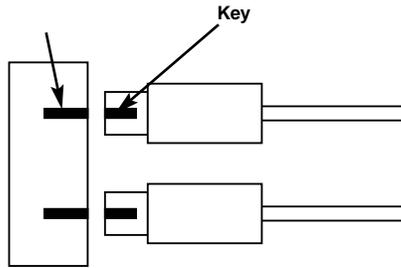


Figure 3-1. Installing SC Fiber optic Plugs.

REMOTE SCSI FIBER OPTIC BUS EXTENDER

For proper operation, the fiberoptic transmitter (XMT) on the local unit must be connected to the remote fiberoptic receiver (RCV), and the local fiberoptic receiver (RCV) must be connected to the remote fiberoptic transmitter (XMT).

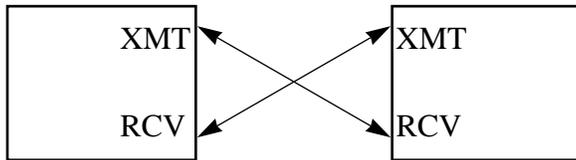


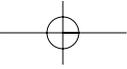
Figure 3-2. Connecting Two SCSI Fiber Optic Bus Extenders.

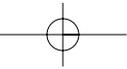
3.8 Connecting a DB9 Coax Cable

A fiber-channel-compatible DB9 coax interface supports a maximum distance of 100 feet (30 meters).

A high-quality duplex coax cable with standard fiber-channel compatible DB9 connectors can be used to connect two SCSI Fiber Optic Bus Extenders up to 98.4 feet (30 meters) apart. Impedance for this cable is 150 ohms. We recommend using cables similar to W. L. Gore & Associates Model FCN-1008.

Connect each plug into the connector on the rear of the SCSI Fiber Optic Bus Extender labeled **Coax Interface**. Select **Coax** from the Extender's front-panel keypad on both SCSI Fiber Optic Bus Extenders. The **Link Active** indicator on the front panel will signify a complete link.





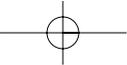
SCSI FIBER OPTIC BUS EXTENDERS

NOTE

Make sure that the connector is installed in the Coax Interface and *not* the Serial Interface. Damage to the internal circuitry may result from an improper connection.

3.9 Verify Communications

Turn on AC power to both SCSI Fiber Optic Bus Extenders and verify that the **Link Active** indicators are lit. This indicates that the local and remote Extenders are communicating. Other computer equipment can now be powered up.



CHAPTER 4: Operator Controls and Indicators

4. Operator Controls and Indicators

4.1 AC Switch

The Extender's power switch is located on the rear panel.

NOTE

Always turn on the SCSI Fiber Optic Bus Extender before turning on SCSI devices and computers. This will ensure that devices are found when the computers boot up.

4.2 Indicators

Four front-panel indicators provide status information for the Extender.

Power—Indicates that power is applied to the unit.

Link Active—Shows that SCSI Fiber Optic Bus Extenders are communicating over the fiberoptic link.

NOTE

The SCSI Fiber Optic Bus Extender will electronically disconnect itself from the SCSI bus when the link is not active.

Bus Active—A visual indication of the busy signal on the SCSI bus interface. This indicator provides a general indication of devices communicating on the SCSI bus.

Link Error—Notifies the user that the integrity of the fiberoptic link is below specification and data-transfer errors will occur if not corrected. The Extender will disconnect from the SCSI bus when a Link Error is detected.

SCSI FIBER OPTIC BUS EXTENDERS

4.3 Front-Panel Keypad

The front-panel keypad selects the SCSI Fiber Optic Bus Extender interface and test modes.

Fiber—Selects the fiberoptic link as the communications interface.

Coax—Selects the coaxial link as the communications interface.

Self-Test—Initiates a SCSI Fiber Optic Bus Extender self-test. For proper operation, either the self-test loopback plug or connection to a remote SCSI Fiber Optic Bus Extender Coax interface must be installed.

Link Test—Initiate a SCSI Fiber Optic Bus Extender link test. When **Fiber** is selected, the test will be performed over the fiberoptic interface. When **Coax** is selected, the test will be performed over the coax interface.

NOTE

The **Self-Test** or **Link Test**, when pressed, will blink yellow for approximately 5 seconds. A “green” indicates the test was completed without error. A “red” indicates that the test failed. A failed test may indicate a bad connection or excessive fiber or coax cable length.

5. Interfacing Requirements

5.1 SCSI Cable Interface Requirements

The SCSI Fiber Optic Bus Extender can be installed at any point on the SCSI bus. The Extender provides an optically isolated SCSI bus over extended distances. Terminators must be installed on both the local and extended bus. Make sure that *a maximum of two terminators* are installed on each bus.

The Extender has a 50-pin and a 68-pin connector for narrow and wide SCSI devices, respectively.

5.1.1 SINGLE-ENDED SCSI FIBER OPTIC BUS EXTENDER

The IC500A supports a maximum cable length of 19.7 feet (6 meters) at standard SCSI data rates (5 Mbps, narrow), or 9 feet (2.7 meters) at “Fast” SCSI data rates (10 Mbps).

5.1.2 DIFFERENTIAL SCSI FIBER OPTIC BUS EXTENDER

The IC501A supports a maximum cable length of 82 feet (25 meters) at standard or “Fast” SCSI data rates.

NOTE

Do not connect devices to both the Wide and Narrow connectors at the same time. This will cause termination and noise problems in your system.

Do not intermix single-ended and differential devices on any one side of the SCSI chain unless a SCSI differential converter is used to convert from one bus type to the other.

SCSI FIBER OPTIC BUS EXTENDERS

5.2 Internal/External Terminator Options

The SCSI Fiber Optic Bus Extender contains internal SCSI bus termination to improve the cable-matching characteristics between multiple SCSI devices. Each SCSI Fiber Optic Bus Extender requires a terminator either internally selected or externally connected. To enable the internal termination, move the Rear Panel Options Switch, **TERM**, to “ON.” (The default is ON.)

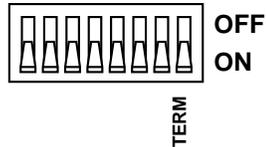


Figure 5-1. Terminator Selection.

NOTE

Data errors will result if more than two sets of terminators are installed on any SCSI bus.

5.3 Internal Terminator Power and Fuse

The SCSI Fiber Optic Bus Extender can supply external terminator power via an internal resettable fuse. This fuse supplies 1 amp at 5 volts to the TERMPWR signal. The SCSI Fiber Optic Bus Extender contains internal protection and will not be affected if other SCSI devices provide terminator power.

To enable external terminator power, place a jumper pin in location **E2**.

NOTE

Default is **INSTALLED**.

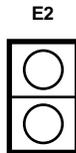


Figure 5-2. Enable External Terminator Power.

NOTE

Replace all fuses with similar type and rating.

CHAPTER 5: Interfacing Requirements

5.4 Selecting Internal Terminator Power

Internal SCSI Fiber Optic Bus Extender termination can be powered by internal 5-volt power or externally from the SCSI bus TERMPWR line. Depending on system applications, it may be advantageous to power the internal terminators by the SCSI peripheral or computer. Note: Default is "INTERNAL 5V."



Figure 5-3. Terminator Power Jumper Locations.

5.5 RS-232 Interface Pin Assignment

The SCSI Fiber Optic Bus Extender has a DB9 female connector for external control of the unit. The connector is compatible with standard RS-232 modem cables.

Table 5-1. RS-232 Connector Pin Assignment

Signal	Description	DB9 Pin	DB25 Pin
DCD	Data Carrier Detect	1	8
RXD	Receive Data	2	3
TXD	Transmit Data	3	2
DTR	Data Terminal Ready	4	20
GND	Signal Ground	5	7
DSR	Data Set Ready	6	6
RTS	Request To Send	7	4
CTS	Clear To Send	8	5
	Not Used	9	22

SCSI FIBER OPTIC BUS EXTENDERS

5.6 Internal RS-232 Jumper Block

NOTE

To access jumper options, remove the two rear-panel screws and slide the top cover off the Extender.

Jumper block E7 through E10 configures the RS-232 interface for normal and null-modem serial cables. The SCSI Fiber Optic Bus Extender default configuration operates with standard modem cables.

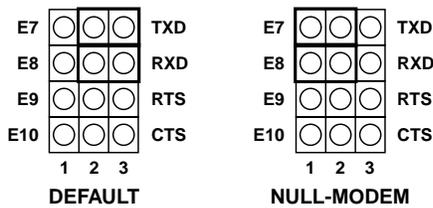


Figure 5-4. Signal Control Jumper Block.

NOTE

To bypass RTS and CTS control signals, jumper E9-1 and E10-1. (This may be required in some DOS applications.)

5.7 Rear-Panel Option Switches

The rear-panel option switches select the SCSI Fiber Optic Bus Extender box number and RS-232 serial baud rate, and lock the front-panel keypad.

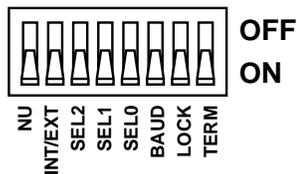


Figure 5-5. Rear-Panel Option Switches.

INT/EXT	Serial Port	LOCK	Front Panel	BAUD	Rate
ON	Internal	ON	Unlocked	ON	9600
OFF	Extended	OFF	Locked	OFF	19,200

CHAPTER 5: Interfacing Requirements

Table 5-2. SCSI Fiber Optic Bus Extender Box Selection

Sel 2	Sel 1	Sel 0	Box No:	Sel 2	Sel 1	Sel 0	Box No:
ON	ON	ON	1	OFF	ON	ON	5
ON	ON	OFF	2	OFF	ON	OFF	6
ON	OFF	ON	3	OFF	OFF	ON	7
ON	OFF	OFF	4	OFF	OFF	OFF	8

5.8 RS-232 Remote Operation Commands

The SCSI Fiber Optic Bus Extender can be controlled via the RS-232 interface using simple ASCII control characters. Any standard serial interface will work if you set it to these parameters:

- a. Baud rate internally selected for 9600 or 19200 baud.
(Factory default is 9600 baud.)
- b. Transmit and receive is set for 8 data bits, 1 stop bit, no parity.
- c. Serial interface operates in half-duplex mode.

So, for example, this would be the DOS command to set a PC for communication with the Extender: `MODE COMx 9600,N,8,1`

The sequence for communicating with the SCSI Fiber Optic Bus Extender is defined as:

- a. Start sequence:
ASCII "CR", "/" , "/"
- b. Extender number:
Box 1 - "7C" (|) Box 3 - "7E" (~)
Box 2 - "7D" (}) Box 4 - "7F" (DEL)
- c. Command :
Select Coax - "C"
Select Fiber - "F"
- d. Transmit Data to SCSI Fiber Optic Bus Extender:
ASCII "K" - Selects desired ports.
- e. End sequence:
ASCII "CR"

Typical **Transmit Data** sequence:

- <cr> / / | FK <cr> (selects Fiber, Box 1)
- <cr> / / } CK <cr> (selects Coax, Box 3)

SCSI FIBER OPTIC BUS EXTENDERS

Table 5-3. List of Commands

Command	Command Character	Example	Response
Select Coax	C	<CR> C<CR>	
Select Fiber	F	<CR> F<CR>	
Lock Front Panel	L	<CR> L<CR>	
Unlock Front Panel	U	<CR> U<CR>	
Zero self-test and link test statistics	Z	<CR> Z<CR>	
Yank on SCSI Reset line	Y	<CR> Y<CR>	
Initiate Self-Test	s	<CR> s<CR>	<pass>, <fail>
Initiate Link Test	l	<CR> l<CR>	<pass>, <fail>
Report S/N and data of manufacture	?	<CR> ?text...<CR>	<text.....>
Report Status	S	<CR> S<CR>	<abcdefgh>
Report SCSI Bus Inactivity	I	<CR> I<CR>	<xxxx>
Report Test Statistics	T	<CR> T<CR>	<abcdefgh>
Report Performance	P	<CR> P<xy><CR>	<xy>
Report Revision	R	<CR> R<CR>	<2030316>
Report Temperature	t	<CR> t<CR>	<30> (celsius)

EXPANDED LIST OF COMMANDS

- a. Report **SCSI Performance**:
 command: <CR>||P<xy><CR>
 report: xy: hex 00-FF

- b. SCSI bus **Inactivity** to SCSI report:
 command: <CR>||I<CR>
 report: xxxx: hex inactive time in tenths of seconds

- c. Report **Serial Number** and **Date of Manufacture**:
 command: <CR>||?<CR>
 report: //?20301150 12-15-94
 20301150 = serial number
 4-15-97 = date of manufacture

CHAPTER 5: Interfacing Requirements

d. Report Test Statistics

command: <CR>//IT<abcdefgh><CR>
 report: ab: # of link tests performed
 cd: # of link tests failed
 ef: # of self-tests performed
 gh: # of self-tests failed

e. Report Status

command: <CR>//IS<abcdefgh><CR>
 report: abcdefgh: bit 7,6,5,4,3,2,1,0
 bit 7: (msb) not used (always 0)
 bit 6: loss of sync (1 = sync lost)
 bit 5: terminator on (1 = terminator on)
 bit 4: front panel locked (1 = locked)
 bit 3: link active status (1 = link active)
 bit 2: fiber power (1 = fiber power on)
 bit 1: fiber/coax selection (1 = fiber, 0 = coax)
 bit 0: (lsb) current busy status
 (1 = bus busy, 0 = bus not busy)

5.9 ASCII Character Reference for SCSI Fiber Optic Bus Extender Box Selection

switch	1	2	3	4	5	6	7	8
ASCII		}	~	(DEL)	`	a	b	c
switch	9	10	11	12	13	14	15	16
ASCII	d	e	f	g	h	i	j	k
switch	17	18	19	20	21	22	23	24
ASCII	l	m	n	o	p	q	r	s
switch	25	26	27	28	29	30	31	32
ASCII	t	u	v	w	x	y	z	{

SCSI FIBER OPTIC BUS EXTENDERS

5.10 Windows Software

Your SCSI Fiber Optic Bus Extender is supplied with Windows® 3.1, Windows 95, and Windows NT™ compatible software to allow remote control of the SCSI Fiber Optic Bus Extender. Follow instructions on the disks to install the software.

5.11 Connecting Multiple SCSI Fiber Optic Bus Extenders

Up to 8 SCSI Fiber Optic Bus Extenders can be controlled by a single RS-232 serial interface.

5.11.1 USING THE SCSI FIBER OPTIC BUS EXTENDER RS-485 INTERFACE

The SCSI Fiber Optic Bus Extender RS-485 interface is available on the rear-panel connector labeled **Coax**. Units are connected in parallel and connected to a modem on the computer serial port.

Table 5-4. Rear-Panel DB9 Coax RS-485 Connector Assignment

Signal	Description	Pin
GND	Ground	3
+SIO	RS-485 (+IO)	7
-SIO	RS-485 (-IO)	8

CHAPTER 5: Interfacing Requirements

5.11.2 USING THE SCSI FIBER OPTIC BUS EXTENDER RS-232 SERIAL INTERFACE

To operate in this configuration, external modems must be used to convert the each RS-232 serial port into a RS-485 interface. This RS-485 interface is then daisychained to each SCSI Fiber Optic Bus Extender.

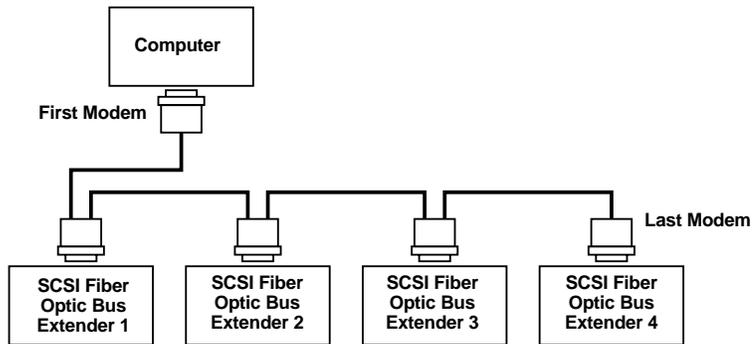


Figure 5-6. Multiple SCSI Fiber Optic Bus Extenders with Modems.

5.12 Rack Mount Installation

The SCSI Fiber Optic Bus Extender can be installed in a standard 19-inch (EIA unit) rack.

5.12.1 INSTALLATION IN A RACK

Attach the two mounting brackets to each side of the SCSI Fiber Optic Bus Extender enclosure using the screws provided. Set the unit into position on the rack, aligning the mounting bracket holes with the rack holes. Use $\frac{3}{8}$ " 10-32 or 12-24 screws to install in the rack.

5.12.2 RACKMOUNT CONSIDERATIONS

1. For proper operation, make sure that the maximum recommended operating ambient temperature of 149°F (55°C) is not exceeded. Remember that, if this unit is installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient.
2. Make sure when the SCSI Fiber Optic Bus Extender is installed in its rack that the amount of air flow required for safe operation is not compromised.

SCSI FIBER OPTIC BUS EXTENDERS

3. Make sure that mounting the SCSI Fiber Optic Bus Extender in a rack does not cause a hazardous condition due to uneven mechanical loading.
4. Make sure that adding the Extender doesn't overload the rack's power circuit.
5. Make sure the power connection is properly grounded.

5.13 Fiberoptic Cable Requirements

The SCSI Fiber Optic Bus Extender fiberoptic interface incorporates industry-standard SC optical connectors. Standard full-duplex multimode fiberoptic cables can be used with this system. Typical cable types include 62.5/125- μm , 50/125- μm , and 8/125- μm fiberoptic cable.

High-quality connectors and low-loss cable will provide the greatest operating distance between units. The maximum achievable distance between units will vary depending on the type of fiberoptic cable used.

Improper connector termination, splicing of the fiberoptic cable, and use of other cable diameters may result in reduced link distances and more data errors.

The maximum fiber cable lengths are listed below.

Maximum fiber cable length:

6500 feet (2 km) with 8/125- μm single-mode fiber

1800 feet (550 meters) with 62.5/125- μm multimode fiber

Keep fiberoptic connectors and SCSI Fiber Optic Bus Extender optical components free of dust and dirt. Whenever cables are not mated to the SCSI Fiber Optic Bus Extender, cover them with the protective plastic caps included with the system.

6. Operation

6.1 SCSI Fiber Optic Bus Extender Operation

The SCSI Fiber Optic Bus Extender converts SCSI data and command information into a high-speed (1.06-GHz) serial data stream which is transmitted over a fiberoptic interface to another remote SCSI Fiber Optic Bus Extender. The remote Extender decodes the data stream and re-converts it to the proper SCSI signals.

The fiberoptic serial link conforms to the ANSI X3T9.5 encoding scheme specified in the Fibre Channel specification. Fiber optics are virtually immune to all forms of radio frequency and electromagnetic interference (RFI/EMI). An unauthorized tap of the link is nearly impossible without detection. Fiberoptic cable is also lighter and smaller than standard wire cable, allowing easier installation.

SCSI bus signals are routed through proprietary switching logic, which enables the SCSI Fiber Optic Bus Extender to appear “transparent” to devices on the SCSI bus. The SCSI Fiber Optic Bus Extender will disconnect from the SCSI bus interface in the event of a fiberoptic link failure or disconnection from power source.

6.2 System Performance

The SCSI Fiber Optic Bus 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.

6.3 System Configuration Options

The SCSI Fiber Optic Bus Extender supports a maximum data rate of 40 mbps using wide SCSI devices. This data rate is often referred to as “ULTRA/WIDE SCSI.”

To ensure optimum system performance, some system configurations may require a secondary SCSI channel to interface with the SCSI Fiber Optic Bus Extender.

In this configuration the primary SCSI bus would be connected to the local high-speed peripherals.

The secondary SCSI bus would be used exclusively as the extended SCSI bus.

SCSI FIBER OPTIC BUS EXTENDERS

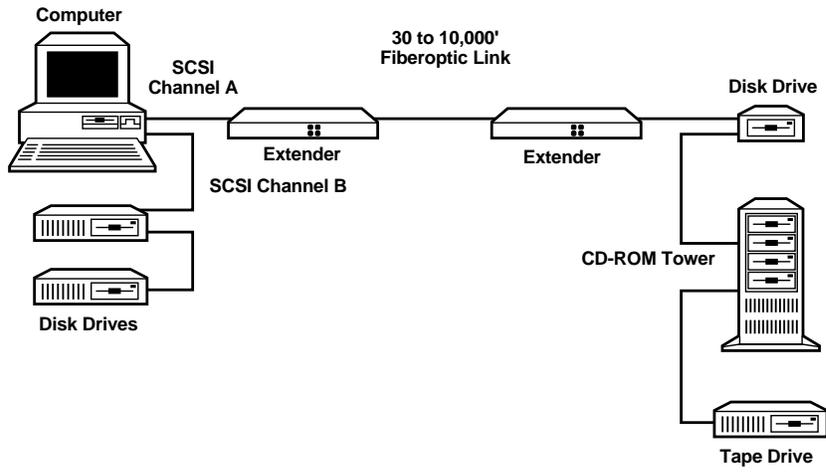


Figure 6-1. Alternate System Configuration.

7. SCSI Technical Information

7.1 SCSI Basics

SCSI-1

The original specification supports data transfers up to 5 MB per second on an 8-bit wide parallel data bus. SCSI 1 standards had some incompatibility problems between host adapters and peripheral devices. The need to improve compatibility, increase transfer rates, and add other features for better performance required a review of the specifications.

SCSI-2

Improved compatibility and higher transfer rates were provided in this enhancement. The addition of Wide SCSI permits 16 or 32 bits to be transferred in parallel, the latter requiring two cables. In combination with the “Fast SCSI” option, synchronous data transfers up to 10 MB per second for 8-bit, 20 MB per second for 16-bit, and 40 MB per second for 32-bit were achieved.

SCSI-3

The most significant additions include the ability to address up to 32 devices, a 16-bit single cable data bus, and serial SCSI protocol. The SCSI-3 standard has been split into several subdocuments, including the SCSI Parallel Interface (SPI) which is based on a layered protocol and the SCSI Interlocked Protocol (SIP), a software link protocol.

Signal Wiring

The signal wire used in a SCSI bus has an impact on bus performance. The two wiring techniques generally used for SCSI are single-ended and differential.

With single-ended wiring, a single wire carries the signal from initiator to target. Single-ended circuitry is not noise-resistant and is generally limited to about 6 meters at data-transfer speeds of 10 MB per second.

Differential wiring uses two wires for each signal and offers exceptional noise resistance because it does not rely on a common ground. This allows cables up to 25 meters and reliable operation at 10 MB per second or faster. Differential wiring and circuitry is more complex than single-ended and generally tends to be more expensive to implement.

Common Problems

The majority of problems encountered with SCSI bus installations are due to unbalanced or improper impedances on the SCSI bus transmission cables caused

SCSI FIBER OPTIC BUS EXTENDERS

by varying manufacturers' peripheral devices. SCSI terminators compensate for these inherent impedance mismatches on a SCSI bus where peripheral devices such as hard drives, CD-ROM drives, scanners, or printers are used.

Passive Terminators

The most basic is a passive-resistance style terminator. This is usually supplied with peripherals and frequently does a poor job of balancing the impedance of the SCSI bus. Passive terminators are resistor networks that allow signal voltages to vary with the load and terminator power supplied, resulting in unstable signals from end to end on the bus and causing data errors. Passive terminators are no longer recommended by ANSI for designs.

Active Terminators

Active terminators add a voltage regulator to the circuit to regulate signal voltages with varying loads and termpower, allowing a consistent signal to be transmitted everywhere on the bus which compensates for the varying bus lengths and signal loads. Active termination is the minimum ANSI-recommended termination.

7.2 SCSI Installation Tips

Keep your SCSI chain short. Official SCSI specifications limit a SCSI chain to no more than 19.7 feet (6 meters) long. Practical experience says the shorter the better. The maximum length you should allow between devices is 3 feet (0.9 m).

Never assign the same SCSI ID number to two devices on the same bus. SCSI uses these numbers as addresses to ensure that information goes to the correct location. Giving two devices the same address can result in lost information.

Know that some SCSI-ID numbers may be reassigned. Internal boot hard drives are usually set to ID 0, while secondary hard drives are set to 1. Motherboards or host adapters are generally set to ID 7.

Always terminate the first and last devices on the chain. Drives purchased specifically for internal use nearly always arrive with terminators installed. If in doubt, call the vendor you purchased a device from.

If the last device on the chain has two SCSI connectors, attach the cable to one and a terminator to the other. Otherwise you'll have an open connector that may cause noise on the SCSI chain.

Always turn off the power to your computer and SCSI devices before swapping cables or moving devices around. SCSI cables contain sensitive data-transmission lines and one or more live power wires.

CHAPTER 7: SCSI Technical Information

Turn on your SCSI devices before you turn on the computer. Some SCSI devices will not mount if they are not running when you power up your computer. Shutting down your computer first and then the attached SCSI devices allows your system to completely “flush” itself.

7.3 SCSI Interface Signal Descriptions

A total of 18 signals are required for the SCSI interface:

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.

SCSI FIBER OPTIC BUS EXTENDERS

**Table 7-1. IC500A SCSI Connector Assignments
Single-Ended/8-Bit SCSI (Narrow)**

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

CHAPTER 7: SCSI Technical Information

**Table 7-2. IC500A SCSI Connector Assignments
Single-Ended/16-Bit SCSI (Wide)**

Signal Name	Pin Number	Signal Name	Pin Number
GROUND	1	-DB12	35
GROUND	2	-DB13	36
GROUND	3	-DB14	37
GROUND	4	-DB15	38
GROUND	5	-DBP1	39
GROUND	6	-DB0	40
GROUND	7	-DB1	41
GROUND	8	-DB2	42
GROUND	9	-DB3	43
GROUND	10	-DB4	44
GROUND	11	-DB5	45
GROUND	12	-DB6	46
GROUND	13	-DB7	47
GROUND	14	-DBP	48
GROUND	15	GROUND	49
GROUND	16	GROUND	50
TERMPWR	17	TERMPWR	51
TERMPWR	18	TERMPWR	52
RESERVED	19	RESERVED	53
GROUND	20	GROUND	54
GROUND	21	-ATN	55
GROUND	22	GROUND	56
GROUND	23	-BSY	57
GROUND	24	-ACK	58
GROUND	25	-RST	59
GROUND	26	-MSG	60
GROUND	27	-SEL	61
GROUND	28	-C/D	62
GROUND	29	-REQ	63
GROUND	30	-I/O	64
GROUND	31	-DB8	65
GROUND	32	-DB9	66
GROUND	33	-DB10	67
GROUND	34	-DB11	68

SCSI FIBER OPTIC BUS EXTENDERS

**Table 7-3. IC501A. SCSI Connector Assignments
Differential/8-Bit SCSI (Narrow)**

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

CHAPTER 7: SCSI Technical Information

**Table 7-4. IC501A. SCSI Connector Assignments
Differential/16-Bit SCSI (Wide)**

Signal Name	Shielded	Signal Name	Shielded
-DB(12)	35	+DB(12)	1
-DB(13)	36	+DB(13)	2
-DB(14)	37	+DB(14)	3
-DB(15)	38	+DB(15)	4
-DB(P1)	39	+DB(P1)	5
GROUND	40	GROUND	6
-DB(0)	41	+DB(0)	7
-DB(1)	42	+DB(1)	8
-DB(2)	43	+DB(2)	9
-DB(3)	44	+DB(3)	10
-DB(4)	45	+DB(4)	11
-DB(5)	46	+DB(5)	12
-DB(6)	47	+DB(6)	13
-DB(7)	48	+DB(7)	14
-DB(P)	49	+DB(P)	15
GROUND	50	DIFFSENS	16
TERMPWR	51	TERMPWR	17
TERMPWR	52	TERMPWR	18
RESERVED	53	RESERVED	19
-ATN	54	+ATN	20
GROUND	55	GROUND	21
-BSY	56	+BSY	22
-ACK	57	+ACK	23
-RST	58	+RST	24
-MSG	59	+MSG	25
-SEL	60	+SEL	26
-C/D	61	+C/D	27
-REQ	62	+REQ	28
-I/O	63	+I/O	29
GROUND	64	GROUND	30
-DB(8)	65	+DB(8)	31
-DB(9)	66	+DB(9)	32
-DB(10)	67	+DB(10)	33
-DB(11)	68	+DB(11)	34