

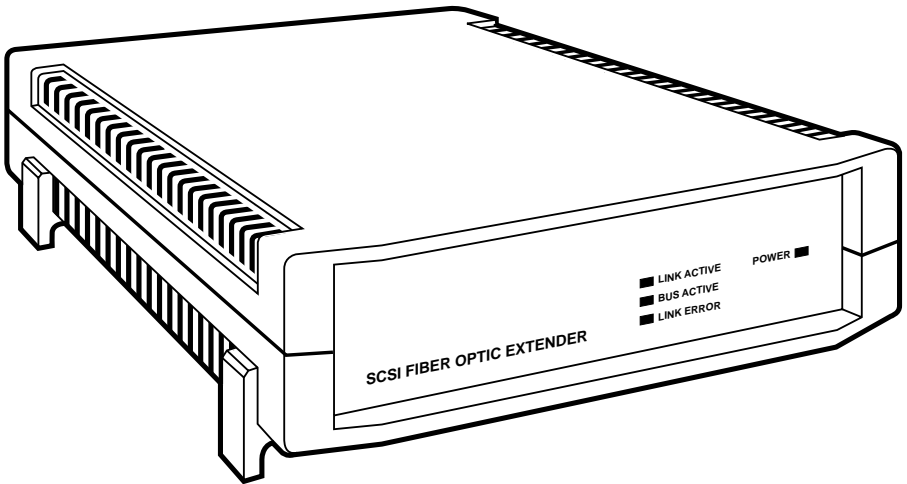


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SCSI Fiber Optic Extender



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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.

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 pellizcados 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.

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1. Specifications

SCSI Interface

Maximum Data Rate—80 MBps

Maximum Cable Length—82 ft. (25 m)

Internal Termination—Active

Slew Rate—3 ns. maximum

Connector—68-pin SCSI

Fiber Optic Interface

Maximum Fiber Cable Length—62.5/125 μm MMF: 700 ft. (213.4 m); 50/125 μm MMF: 1600 ft. (487.7 m)

Fiber Optic Serial Data Rate—1.06 GHz

Fiber Optic Connector Type—SC

Optical Wavelength—850 nm

Typical Bit Error Rate (BER)— 10^{-14}

Physical

Temperature—32 to 131°F (0 to 55°C)

Power—100 to 240 VAC $\pm 10\%$, 48 to 65 Hz, 15 W

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 Description

The SCSI Fiber Optic Extender lets you surpass the distance limitation of a Low-Voltage Differential/Single-Ended SCSI (Small Computer System Interface) bus. The SCSI bus is one of the most popular interfaces used to connect additional devices to a computer system. With the Extender, SCSI components such as disk drives, CD-ROM memory systems, RAID arrays, tape-backup peripherals, and SCSI laser printers can be located up to 1600 feet (487.7 m) from the host computer.

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

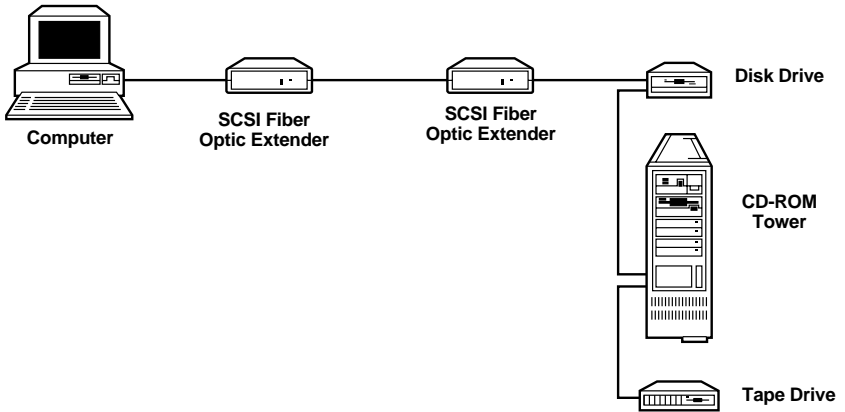


Figure 2-1. Typical SCSI Fiber Optic Extender configuration.

2.2 Features

- Extends SCSI bus to 1600 feet (487.7 m).
- 80.0 MBps maximum data rate.
- ULTRA 2/wide SCSI compatible.
- Transparent to SCSI system.
- Asynchronous and synchronous compatible.

- Supports SCSI 1, 2, and 3 specifications.
- Single-Ended/Differential SCSI interface.
- Does not require SCSI bus ID.
- 1.06 GHz fiber optic serial link.
- Standard SC fiber optic connectors.
- Compatible with standard fiber optic cables.
- Fiber optic data security.
- Internal active bus termination.
- No additional software required.
- User-installable.

The SCSI Fiber Optic Extender supports a maximum SCSI data rate of 80 MBps in asynchronous or synchronous mode. It helps you to fully take advantage of the ULTRA 2 SCSI performance available in top-of-the-line computers and peripheral devices. Proprietary switching logic lets the Extender 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. The Extender does not require a SCSI device address.

A 68-pin SCSI connector on the rear panel is provided for easy installation to the host or peripheral. Bus terminators are internally installed. These terminators can be removed for systems that require external termination.

A standard duplex fiber optic cable with SC connectors provide the interface between local and remote units. Fiber optic cable is lighter and thinner than standard wire cable, so installation is easier.

The SCSI Fiber Optic Extender contains a universal power cord receptacle and rear-panel AC switch to autorange between 100 VAC and 240 VAC.

2.3 What the Package Includes

Your package should contain the following items:

- (1) SCSI Fiber Optic Extender
- (1) AC power cord
- This users' manual

If anything is missing or damaged, please call Black Box at 724-746-5500.

3. Installation

3.1 AC Line Voltage

The SCSI Fiber Optic Extender can be externally connected to any AC input voltage between 100 and 240 volts. In the USA, your Extender will be shipped with a 110-volt power cord. Black Box offers a complete source of replacement power cords for most countries. Call Technical Support at 724-746-5500 for details.

3.2 Positioning the Extender

Place the Extender in a convenient location near the host computer and/or peripherals. Make sure that the ventilation slots on the sides of the unit have adequate airflow. Do not place the Extender on any devices that generate excessive heat.

3.3 Cable Recommendations

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

NOTE

Peripherals operating at Ultra SCSI data rates require shorter cable lengths for proper operation. The total cable length for a single-ended Ultra SCSI bus should be no longer than 1 meter (3.3 ft.) and differential cables 12 meters (39.4 ft.).

3.4 Connecting the Extender to the SCSI Bus

NOTE

Before you connect the Extender, switch off power to all computers and peripherals attached to the SCSI bus.

You may install the Extender at any point on the SCSI bus. The Extender has a SCSI connector with screw lock for secure connections.

NOTE

The SCSI Fiber Optic Extender can be operated with another differential SCSI Fiber Optic Extender to convert from one bus type to the other.

3.5 Ensuring Proper Termination

All SCSI buses require proper termination at each end of a SCSI link. Since the SCSI Fiber Optic Extender creates two optically isolated SCSI buses, termination is required on each side of the Extender, in addition to the standard terminators at each end of the SCSI chain.

That's a total of four terminators—two on each side of the Extender. If external device termination is required, make sure that the internal termination networks have been removed. See **Figures 5-1, 5-2, and 5-3** to disable or enable terminators.

NOTE

The SCSI Fiber Optic Extender is shipped with termination enabled.

3.6 Connecting a Fiber Optic Cable

A duplex fiber optic cable with standard SC plugs interconnects two SCSI Fiber Optic Extenders.

3.6.1 LOCAL SCSI FIBER OPTIC EXTENDER

Insert one plug into each fiber optic socket on the rear of the local unit. Before insertion, make sure that the “key” on each plug is facing the top of the Extender.

NOTE

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

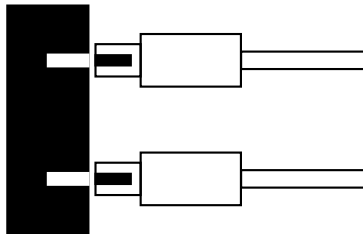


Figure 3-1. Installing SC Fiber Optic plugs.

3.6.2 REMOTE SCSI FIBER OPTIC EXTENDER

For proper operation, the fiber optic transmitter (XMT) on the local unit must be connected to the remote fiber optic receiver (RCV). In addition, the local fiber optic receiver (RCV) must be connected to the remote optic transmitter (XMT).

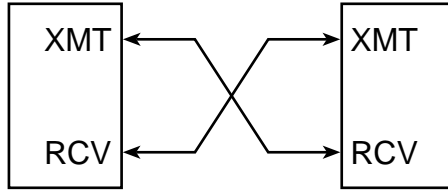


Figure 3-2. Connecting two SCSI Fiber Optic Extenders.

3.7 Verify Communications

Power on both SCSI Fiber Optic Extenders and verify that the LINK ACTIVE indicators are lit. This will verify that the local and remote Extenders are communicating. Other computer equipment can now be powered up.

NOTE

If the LINK ACTIVE indicators are not lit, reverse the fiber optic cables to one unit and verify the indicators.

4. Operator Controls and Indicators

4.1 Power Switch

The SCSI Fiber Optic Extender power switch is located on the Extender's rear panel. Operating the switch in the "1" position applies power to the Extender.

4.2 Indicators

Four indicators on the front panel provide status information for the SCSI Fiber Optic Extender.

- **POWER:** The Power lamp indicates that power is applied to the unit.
- **LINK ACTIVE:** The Link Active lamp provides visual indication that the Extenders are communicating and sending sync data over the fiber optic link. The Extender will disconnect from the SCSI bus when the link is not active.
- **BUS ACTIVE:** The Bus Active indicator provides 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:** The Link Error indicator notifies the user that the integrity of the fiber optic 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.

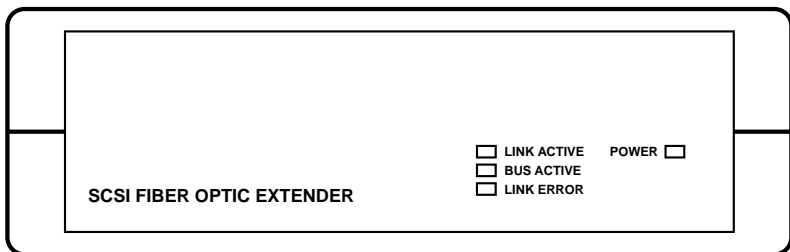


Figure 4-1. Front panel and indicators.

5. Interfacing Requirements

5.1 SCSI Cable Interface Requirements

The SCSI Fiber Optic 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 desktop SCSI Fiber Optic Extender contains a 68-pin SCSI connector.

The SCSI Fiber Optic Extender supports a maximum cable length of 25 meters (82 feet) at Ultra2 SCSI data rates (80 MBps).

NOTE

Peripherals operating at Ultra SCSI data rates require shorter cable lengths for proper operation. The total cable length for a single-ended Ultra SCSI bus should be no longer than 1 meter (3.3 ft.) and differential cables 12 meters (39.4 ft.).

NOTE

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.

5.2 Internal/External Terminator Options

The SCSI Fiber Optic Extender contains an internal SCSI bus termination. The internal terminator can be disabled by the user for added flexibility. Data errors may result if more than two sets of terminators are installed on any SCSI bus. Terminators should normally be installed on opposite ends of the SCSI bus. To disable or enable the internal terminators, remove the four screws on the bottom of the unit and configure as shown in **Figure 5-1**.

NOTE

The default setting is “INSTALLED” (internal termination enabled).

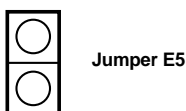


Figure 5-1. External terminator enable.

5.3 Internal Terminator Power and Fuse

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

To enable External Terminator Power, install jumper as shown in **Figure 5-2**.

NOTE

The default setting is “INSTALLED” (supply external terminator power).

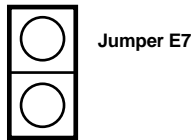


Figure 5-2. External terminator power.

5.4 Selecting Internal Terminator Power

Internal SCSI Fiber Optic Extender termination can be powered by internal 5-volt power or externally from the SCSI bus termination power line. Depending on system applications, it may be advantageous to power the internal terminators by the SCSI peripheral or computer.

NOTE

The default setting is “INTERNAL 5V.”

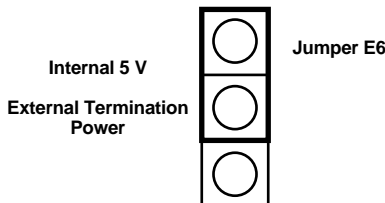


Figure 5-3. Termination power jumper locations.

5.5 Fiber Optic Cable Requirements

The Extender's fiber optic interface incorporates industry-standard SC optical connectors. Standard full-duplex multimode fiber optic cables can be used with this system. Typical cable types include 62.5/125 μm and 50/125 μm fiber optic cable. Users with prewired multimode fiber optic cable conforming to these cable parameters are compatible with this system if terminated with SC connectors.

High-quality connectors and low-loss fiber cable will provide the greatest operating distance between units. The maximum achievable distance between units is 500 meters or approximately 1600 feet for the SCSI Fiber Optic Extender. Improper connector termination, splicing of the fiber optic cable, and use of other cable diameters may result in reduced link distances and increased data error rates.

If you need to order cables that work with your Extender, call Black Box Technical Support at 724-746-5500 for details.

Keep fiber optic connectors and Extender optical components free of dust and dirt. Whenever cables are not mated to the Extender, cover them with the protective plastic caps included with the system.

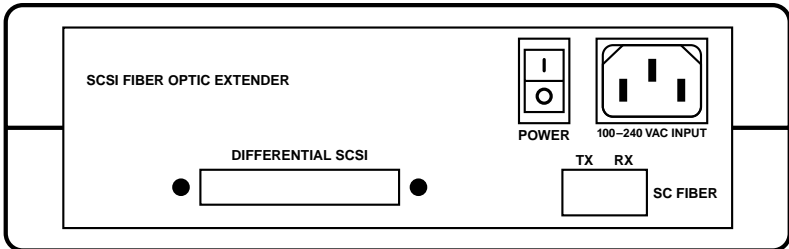


Figure 5-4. Rear panel connectors.

6. Operation

6.1 About the Extender

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

The fiber optic serial link conforms to the ANSI X3T9.5 encoding scheme specified in SCSI 3 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. Fiber optic cable is also lighter and smaller than standard wire cables, so installation is easier.

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

6.2 System Performance

The 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 to a SCSI Fiber Optic Extender system with a 100 meter (328 ft.) fiber optic link can expect to achieve aggregate data rates of 300 Kbps in asynchronous mode. In synchronous LVD mode, with a byte offset of 8, sustainable data rates of 14 MBps can be expected. A synchronous offset of 16 will provide 18-MBps data rates.

6.3 System Configuration Options

The SCSI Fiber Optic Extender supports a maximum data rate of 80 MBps using wide SCSI devices. This data rate is often referred to as ULTRA 2/WIDE SCSI.

For optimum system performance, some system configurations may require a secondary SCSI channel to interface with the 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.

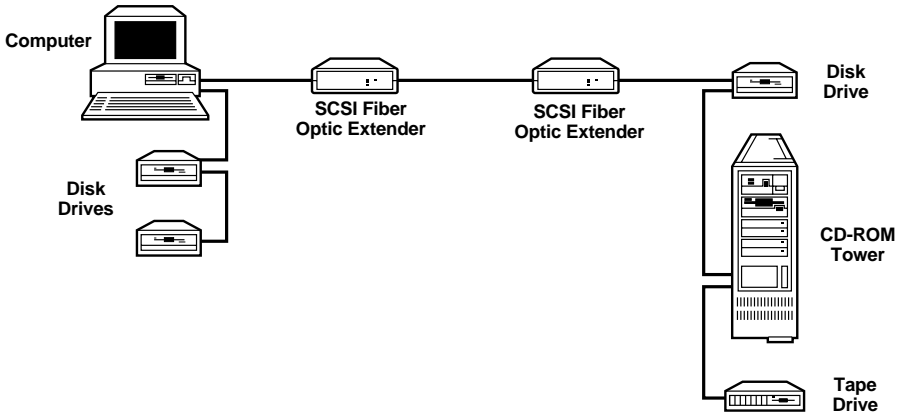


Figure 6-1. Alternative system configuration.

7. SCSI Technical Information

7.1 SCSI Basics

7.1.1 SCSI-1

The original specification supports data transfers up to 5 MBps 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.

7.1.2 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 MBps for 8-bit, 20 MB/sec for 16-bit and 40 MBps for 32-bit were achieved.

7.1.3 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.

7.1.4 SIGNAL WIRING

The signal wiring 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 (20 ft.) at data transfer speeds of 10 MB.

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 (82 ft.) and reliable operation at 10 MB or greater. Differential wiring and circuitry is more complex than single-ended and generally tends to be more expensive to implement.

7.1.5 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 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.

7.1.6 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 termination 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.

7.1.7 ACTIVE TERMINATORS

Active terminators add a voltage regulator to the circuit to regulate signal voltages with varying loads and termination power, allowing a consistent signal to be transmitted everywhere on the bus. This in turn compensates for the varying bus lengths and signal loads. All lines are terminated through 110-ohm resistors, which are applicable to all narrow and wide single-ended applications. 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 residing 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 the 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.
- *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. 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 acknowledgment 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(0 through 15,P,P1) (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.

**Table 7-1. SCSI connector assignments
low-voltage differential (LVD)/16-bit SCSI (wide)**

Signal Name	Pin Number	Signal Name	Pin Number
+DB(12)	1	-DB(12)	35
+DB(13)	2	-DB(13)	36
+DB(14)	3	-DB(14)	37
+DB(15)	4	-DB(15)	38
+DB(P1)	5	-DB(P1)	39
+DB(0)	6	-DB(0)	40
+DB(1)	7	-DB(1)	41
+DB(2)	8	-DB(2)	42
+DB(3)	9	-DB(3)	43
+DB(4)	10	-DB(4)	44
+DB(5)	11	-DB(5)	45
+DB(6)	12	-DB(6)	46
+DB(7)	13	-DB(7)	47
+DB(P)	14	-DB(P)	48

**Table 7-1 (continued). SCSI connector assignments
low-voltage differential (LVD)/16-bit SCSI (wide)**

Signal Name	Pin Number	Signal Name	Pin Number
Ground	15	Ground	49
DIFFSENS	16	Ground	50
TERMPWR	17	TERMPWR	51
TERMPWR	18	TERMPWR	52
Reserved	19	Reserved	53
Ground	20	Ground	54
+ATN	21	-ATN	55
Ground	22	Ground	56
+BSY	23	-BSY	57
+ACK	24	-ACK	58
+RST	25	-RST	59
+MSG	26	-MSG	60
+SEL	27	-SEL	61
+C/D	28	-C/D	62
+REQ	29	-REQ	63
+I/O	30	-I/O	64
+DB(8)	31	-DB(8)	65

**Table 7-1 (continued). SCSI connector assignments
low-voltage differential (LVD)/16-bit SCSI (wide)**

Signal Name	Pin Number	Signal Name	Pin Number
+DB(9)	32	-DB(9)	66
+DB(10)	33	-DB(10)	67
+DB(11)	34	-DB(11)	68