**BLACK BOX**®
NETWORK SERVICES

# 4 x 2 SCSI Matrix Switch



4x2 SCSI Matrix Switch

**FEDERAL COMMUNICATIONS COMMISSION
AND
INDUSTRY CANADA
RADIO FREQUENCY INTERFERENCE STATEMENTS**

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.

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 Industry Canada.*

*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 Industrie Canada.*

## 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 connectado 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 fisica 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 lineas de energia.

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 objectos liquidos 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:  Objectos 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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# Contents

# 1. Specifications

## SCSI Interface

**Maximum Port Switching—**Delay 3 ns

**Maximum Signal Skew—**2 ns

**Internal Terminator Power—**1 amp

SCSI-1, SCSI-2, & SCSI-3, SPI-2 compatible; Asynchronous and synchronous compatible; Conforms to ANSI X3.131 and X3T9.2

## Single-Ended SCSI (SE)

**Maximum Data Rate (8-bit Narrow)—**20 MBps

**Maximum Data Rate (16-bit Wide)—**40 MBps

**Maximum Port Cable Length—**6 meters (19.7 ft.)

**Internal Terminator Impedance—**100 ohms

**Terminator Disconnect Capacitance—**3 pF

Active Internal Bus Termination

## Differential SCSI (DE)

**Maximum Data Rate (8-bit Narrow)—**20 MBps

**Maximum Data Rate (16-bit Wide)—**40 MBps

**Maximum Port Cable Length—**25 meters (82 ft.)

**Internal Terminator Impedance—**110 ohms

**Terminator Disconnect Capacitance—**5 pF

Passive Internal Bus Termination

## 4 X 2 SCSI MATRIX SWITCH

### Low-Voltage SCSI (LVD)

**Maximum Data Rate (8-bit Narrow)—**40 MBps

**Maximum Data Rate (16-bit Wide)—**80 MBps

**Maximum Port Cable Length—**25 meters (82 ft.)

**Internal Terminator Impedance—**105 ohms

**Terminator Disconnect Capacitance—**3 pF

Active Internal Bus Termination

### Serial Interface

**Baud Rate—**9600 or 19,200 baud

**Mode—**No parity, 8 bits, 1 stop bit

**Maximum Cable Length—**15 meters (50 ft.)

**Rear-Panel Connectors—**DB9

### LAN Port (Optional)

**Protocol—**TCP/IP

**Interface—**Ethernet

**Data Rate—**10 MBps

**Rear-Panel Connector—**RJ-45

### Agency Approvals

UL®, CUL, FCC Class A, CE

### Physical

**Temperature—**32 to 149° F (0 to 65°F)

**Humidity—**Up to 90% noncondensing

**Power—**105 to 240 VAC ± 10% (25 watts)

**Size—**4.5"H x 11.3"W x 9.7"D (11.4 x 28.7 x 24.6 cm )

**Weight—**5.1 lb. (2.3 kg)

# 2. Introduction

## 2.1 About the SCSI Switch

The 4 x 2 SCSI Matrix Switch is a high-performance electronic crosspoint switch for use with the SCSI (Small Computer System Interface) bus. It enables four independent SCSI buses to be selected and electrically connected in any combination via internal electronic switching circuits. The 4 x 2 SCSI Matrix Switch eliminates the need to swap and reconfigure SCSI cables and bus terminators when alternate system configurations are required.

In conjunction with the 4 x 2 SCSI Switch dual RS-232 serial interface, a Graphic User Interface (GUI) allows the system administrator to remotely operate and control SCSI port configuration and termination, report SCSI bus activity, gather performance statistics, and set internal temperature points for alarm notification. Standard DOS or modem software can also be used to control the switch using simple ASCII control commands.

Up to 32 SCSI Switches can be connected together and controlled by one serial port.

## 2.2 Features

- Ultra2, Ultra, and Fast SCSI compatible.

- 80 MBps throughput (LVD).

- Easy-to-use LCD panel.

- Daisy chain up to 32 switches.

- Share up to 60 SCSI peripherals.

- Supports single-ended, differential, LVD SCSI.

- Transparent electronic switching.

- Optional LAN Port.

- Does not require SCSI bus ID.

- User-installable.

**2.2.1 LCD PANEL**

The 4 x 2 SCSI Matrix Switch features an easy-to-use, menu-driven LCD panel with soft-touch MENU, ENTER, and directional keys. The LCD is lighted, which allows for easy viewing and operation.

**2.2.2 FRONT-PANEL CONTROLS**

- Set and configure SCSI ports

- Set termination

- Set switch number

- View power supply status

- View internal temperature

- Set internal temperature alarm

- Set serial port configuration

- Display SCSI bus busy status

- Display port configuration

## 2.3 Technical Description

**2.3.1 AVAILABLE SCSI SWITCH INTERFACES**

The 4 x 2 SCSI Matrix Switch is available in the following configurations:

- Single-ended/LVD interface (SC122A)

- Differential interface (SC123A)

## NOTE

**Make sure that the SCSI Switch you're installing is used with the appropriate interface. Single-ended/LVD and differential SCSI devices cannot be installed on the same switch unless a SCSI differential converter is used.**

### 2.3.2 GENERAL HARDWARE DESCRIPTION

The 4 x 2 SCSI Matrix Switch's rear panel identifies each of the independent SCSI ports. SCSI ports A and B have two daisy-chained connectors per port, and SCSI ports 1, 2, 3, and 4 have single connectors for installation of SCSI devices. You can install the SCSI Switch at any point on the SCSI bus.

Each port has internal termination that can be turned on or off from the LCD panel. External "termination power" for devices and terminators are provided by internal resettable fuses.

The SCSI Switch does not require a device ID and is completely transparent to all computers and peripherals on the SCSI bus. No additional software is needed for installation and operation. A universal switching power supply auto ranges input voltages between 105 VAC and 240 VAC.

### 2.3.3 ULTRA2 SCSI COMPATIBILITY

The SCSI Switch supports Ultra2 SCSI, 80-MBps (wide) SCSI host adapters, computers, and peripherals in asynchronous and synchronous mode. The SCSI Switch conforms to ANSI X3.131 and X3T9.2 specifications for single-ended devices. Disconnect and reselect functions are fully supported to ensure complete SCSI compatibility.

### 2.3.4 SCSI SWITCH INSTALLATION

Ports A and B are fully bi-directional to ports 1, 2, 3, and 4 (see **Figure 2-1**). You determine where to connect computers, host adapters, and peripherals. In general, if daisy-chained ports are required for connection to external peripherals, use ports A or B. See **Figure 2-2** for a typical installation.

**SCSI Switch Ports**
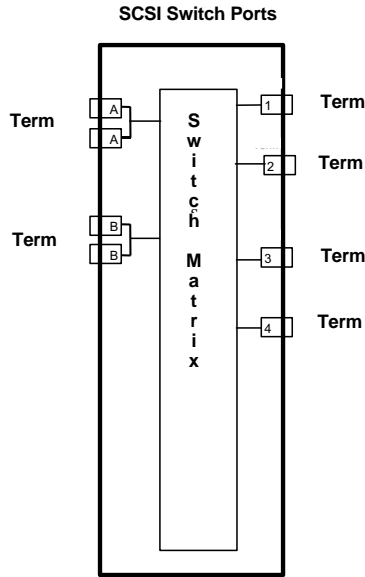


**Figure 2-1. SCSI Matrix Switch block diagram.**
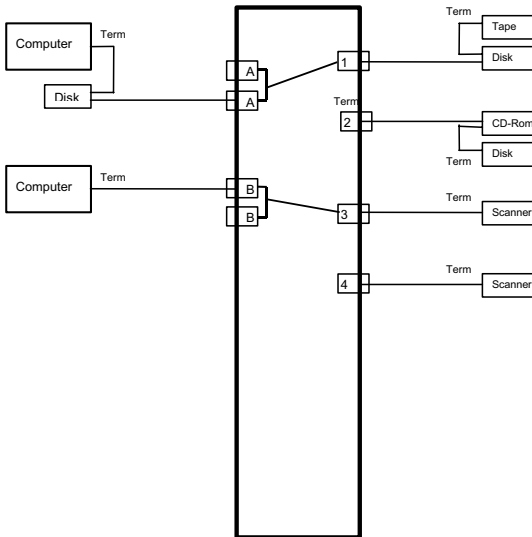


**Figure 2-2. Typical installation.**

## NOTE

**1. Connections can be made to either connector on the appropriate port.**

**2. "Term" indicates where terminators should be installed.**

The LCD panel is used to select port connections and enable or disable each internal SCSI port terminator. Refer to **Chapter 4** for complete instructions on operating the LCD keypad.

You can selectively enable or disable any internal terminator to meet system configurations and requirements.

## NOTE

**For proper operation of any SCSI bus, there must not be a "hanging" line or cable. Termination should be enabled on active SCSI ports that are not connected through to another port.**

# 3. Installation

## 3.1 What's Included

- This users' manual

- (1) 4 x 2 SCSI Matrix Switch

- (1) AC power cable (110 or 220 V)

- (1) 10-ft. (3.1-m) 9-Pin-male-to-9-pin-female RS-232 cable

- (1) 9-pin-male-to-25-pin-female RS-232 adapter

- (2) SCSI Matrix Switch control software disks

- Rackmount handles and screws

- Bottom feet

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

## 3.2 AC Line Voltage

You can connect the Switch to any AC input voltage between 105 to 240 volts. Unless otherwise specified, the Switch will be shipped with a 110-volt power cord for use in the USA. For a power cord that will work in your country (outside the USA), call Black Box Technical Support.

## 3.3 Switch Placement

Place the Switch in a convenient location near the host computer or peripherals. Keep SCSI cable lengths short to provide the best performance and reliability. Make sure that the dual fans and ventilation slots on the sides of the Switch receive adequate airflow. Do not place the Switch on any devices that generate excessive heat.

## 3.4 Power Equipment Off

Power off all equipment and peripherals connected to the SCSI interface before installing cables or terminators.

## 3.5 SCSI Interface Cabling

Both versions of the 4 x 2 SCSI Matrix Switch have 68-pin shielded high-density SCSI-2 connectors. Single-ended devices can have cable lengths up to 19 ft. (6 m). Differential devices can be connected with up to 82 feet (25 meters) of cable. Low-voltage differential devices can support up to 82 feet (25 meters) of cable.

Connect the host adapter or peripheral to the rear-panel connector using a proper SCSI cable. **Section 6.1** describes standard SCSI cable interface requirements.

## NOTE

**Do not intermix single-ended and differential devices on any SCSI chain unless a SCSI differential converter is used to convert from one bus type to the other.**
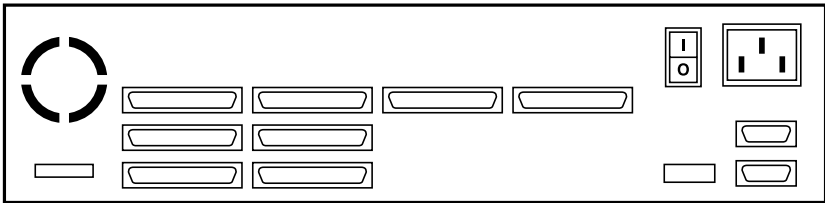
**Figure 3-1. The SCSI Switch's rear panel.**

# 4. Operator Controls and Indicators

## 4.1 AC Power Switch

The AC power switch is located on the Switch's rear panel. Putting the switch in the "1" position applies power to the SCSI Switch.

## NOTE

**Always apply AC power to the SCSI Switch before powering SCSI devices and computers. This will ensure that devices are found on system bootup.**

## 4.2 LCD Display, Keypad, and Indicators

### 4.2.1 LCD DISPLAY

The LCD display shows the selection parameters available.

```
          SET PORTS
    >     SET TERMINATION
          DISPLAY PORTS
          DISPLAY ACTIVITY
```

```
          DISPLAY POWER TEMP
          FRONT PANEL LOCK
    >     SET SERIAL PORTS
          SET SWITCH NUMBER
```

```
    >     SET TEMP LIMIT
          DISPLAY VERSION
```

**Figure 4-1. LCD display main menu.**

### 4.2.2 KEYPAD

The Keypad enables the selection of menu and set-up parameters for the SCSI Switch.

- MENU: Returns to the SCSI Switch set-up and configuration menu.

- ENTER: Selects the highlighted set-up parameter.

- UP, DOWN, RIGHT, LEFT Arrows: Scrolls the cursor to enable menu selection.

### 4.2.3 INDICATORS

The indicators provide SCSI Switch status information.

- POWER: Identifies that the SCSI Switch is powered.

- BUSY: Identifies that there is SCSI activity on one or more SCSI ports.

- ALARM: A visual and audible alarm identifies a failure of an internal power supply or that the SCSI Switch has exceeded the set temperature limit.

## NOTE

**To disable the audible alarm, press the front-panel MENU key. The ALARM light will remain lit until the condition is corrected.**

## 4.3 LCD Display Control Menus

**SET PORTS**

```
        SET PORTS
        1              2              3              4
A |     *      |              |              |              |
B |            |      *       |              |              |
```

**SET TERMINATION**

```
        SET TERMINATION

|     A *    |      B      |       |      3 *    |      4      |
|     1      |      2      |       |             |             |
```

**DISPLAY PORTS**

```
DISPLAY PORTS
| A 1 | A 2 | A 3 | A 4 |
| B 1 | B 2 | B 3 | B 4 |
```

**SET SERIAL PORTS**

```
SET SERIAL PORTS

COM  1         9600 *          19200
COM  2         9600 *          19200
DAISY CHAIN  Y *              N
```

**SET SWITCH NUMBER**

```
SET SWITCH NUMBER
        01
USE UP/DOWN KEYS
```

**DISPLAY POWER, TEMPERATURE**

```
DISPLAY POWER TEMP

PWR SUPPLY GOOD
+25.5°C
```

**SET TEMP LIMIT**

```
SET TEMP LIMIT
MAX +40°C

CURRENT TEMP +26.0°C
```

**DISPLAY BUS ACTIVITY**

```
    DISPLAY ACTIVITY


        1            2            3            4
```

**FRONT PANEL LOCK**

```
            FRONT PANEL UNLOCKED

              ENTER PASSWORD
              TO LOCK 0 0 0 0
```

**DISPLAY VERSION**
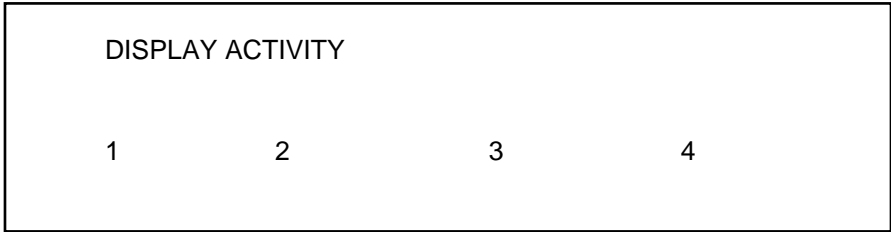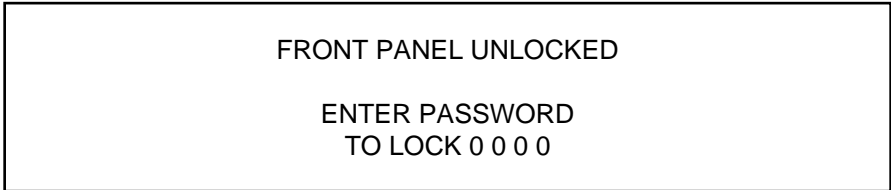
```
                  BLACK BOX
                   SC123A
                S/N 2 1 0 0 3 0 3
            H V D   V E R 2 1 1 2 1 2 4   L A N
```
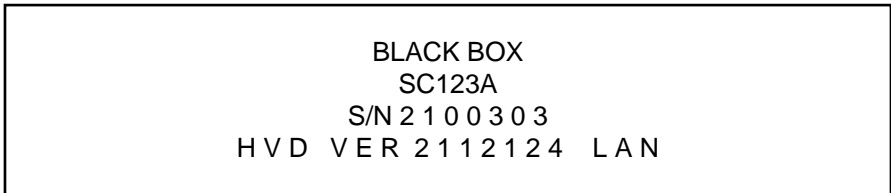
HVD/ LVD/SE: Indicates current SCSI bus interface mode.

x: Indicates Serial Port Locked.

LAN:  Indicates LAN Port installed and active.

## 4.4 SCSI Switch Port Configuration

The SCSI Switch has an internal memory device that retains the last configuration and set-up information. Switch port, termination, serial port, and control parameters are saved as they are entered on the front panel.

## 4.5 SCSI Switch Default Configuration

The SCSI Switch default configuration as shipped from the factory is defined below.

PORTS: A1, B2

TERMINATION: All Off

SERIAL PORTS: 9600 Baud, Daisychained

SWITCH NUMBER: 01

TEMPERATURE ALARM: 40° Celsius

FRONT PANEL: Unlocked, Password 0000

# 5. Configuration and Operation

## 5.1 SCSI Cable Interface Requirements

The 4 x 2 SCSI Matrix Switch can be installed at any point on the SCSI bus. Always use high-quality SCSI-2 or SCSI-3 cables for optimum computer performance and reliability.

The SC123A differential switch contains 68-pin high-density SCSI-2 connectors for 40MBps wide Ultra SCSI computers and peripherals. The maximum cable distance should not exceed 82 ft. (25 m).

The SC122A single-ended/low-voltage differential switch contains 68-pin high-density SCSI-2 connectors.

*Low-Voltage Differential (LVD):*

When operating with LVD devices, 80-MBps wide Ultra2 SCSI computers and peripherals are supported. The maximum cable distance for LVD should not exceed 25 meters (82 feet) total length.

*Single-ended (SE):*

When operating with SE devices, 40-MBps wide Ultra SCSI computers and peripherals are supported. The maximum cable distance for SE should not exceed 6 meters (19.7 feet) total length.

Black Box offers standard and custom SCSI cables for connecting the SCSI Switch to host devices and peripherals. Call Black Box Technical Support for details.

## 5.2 Internal Terminator Selection

The SCSI Switch contains internal SCSI bus terminators for each port. Termination is required at both ends of a SCSI bus for proper operation. Each port can have their internal terminator enabled or disabled from the front-panel display and keypad.

Refer to **Figure 5-1** to select internal termination.

## NOTE

**Data errors will result if more than two sets of terminators are installed on any SCSI bus (See Figures 2-1 and 2-2).**

## 5.3 Selecting Internal Terminator Power

On-board SCSI Switch terminators can be powered by internal 5-volt power or externally from SCSI bus "termination power."

**Internal 5V**                    **E1-E8**

**External
Termination
Power**
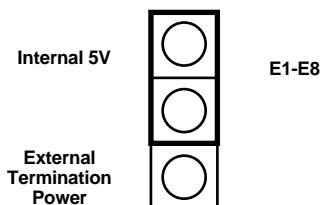
**Figure 5-1. Internal terminator power jumpers.**

**Table 5-1. Jumper settings for internal termination**

| E1-Port A | E5-Port 1 | E7-Port 3 |
|-----------|-----------|-----------|
| E2-Port B | E6-Port 2 | E8-Port 4 |

## NOTE

**The standard factory default connects internal terminators to internal 5 volts.**

## 5.4 Selecting External Terminator Power

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

**E19-E28**

**Figure 5-2. External terminator power jumpers.**

## NOTE
**Factory Default is "Enabled" on all ports.**

**Table 5-2. Jumper settings for external termination**

| E19-Port A | E20-Port 1 | E24-Port 3 |
| E21-Port B | E22-Port 2 | E26-Port 4 |

# NOTE

**The standard factory default connects internal terminators to internal 5 volts.**

## 5.5 Serial Port Interface Pinout

The SCSI Switch contains two RS-232 serial ports, using DB9 female connectors; these allow external control of the switch. The connectors are compatible with standard RS-232 modem cables. The serial ports can be configured to operate separate communications ports or as daisy-chained ports.

Daisy-chained mode allows one computer or terminal to communicate with multiple SCSI Switches.

**Table 5-3. Rear-panel RS-232 connector pinout**

| 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 |
| RI | Ring Indicator | 9 | 22 |

## 5.6 Internal RS-232 Jumper Block

### RS-232 PORT 1

Jumper block E9, E10, E1, E12, and E13 configure the Port 1 serial interface for normal and null-modem serial cables. The SCSI Switch default configuration operates with standard modem cables.
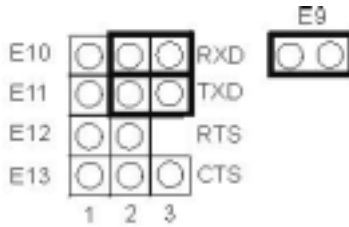
**Figure 5-3. RS-232 Port 1.**

**NOTE**

**To bypass RTS and CTS control signals, jumper E12-1 and E13-1. (This may be required in some DOS applications.)**

**RS-232 PORT 2**

Jumper block E14, E15, E16, E17, and E18 configure the Port 2 serial interface for daisychained or dual serial ports. The SCSI Switch default configuration operates with standard modem cables.



DAISY CHAINED                    DUAL SERIAL PORTS
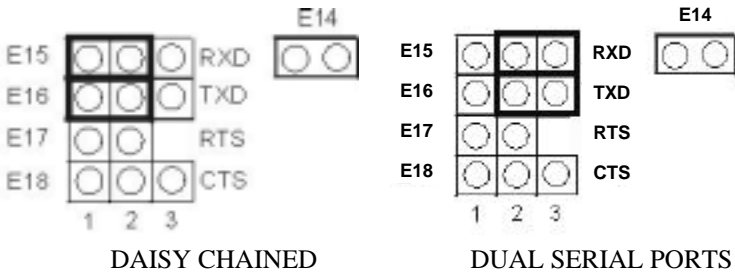
**Figure 5-4. RS-232 Port 2.**

**NOTE**

**To bypass RTS and CTS control signals, jumper E17-1 and E18-1. (This may be required in some DOS applications.)**

## 5.7 RS-232 Serial Port Commands

The SCSI Switch can be controlled via the RS-232 interface using simple ASCII control characters. The following information provides the parameters necessary to control and select SCSI ports using any standard serial interface.

a. Baud rate internally selected for 9600 or 19200 baud. (Factory default is 9600 baud.)

b. Transmit and receive set for 8 data bits, 1 stop bit, no parity.

c. Serial interface operates in half-duplex mode.

d. i.e.: MODE COMx 9600,N,8,1

The sequence for communicating with the SCSI Switch is defined as:

a. Start sequence:

ascii "cr","/", "/"

b. Switch box number:

Box 1 - "7C" ( | )     Box 3 - "7E" ( ~ )

Box 2 - "7D" ( } )     Box 4 - "7F" ( del )

c. Port Select:

Port A1 - "A1"     Port B1 - "B1"

Port A2 - "A2"     Port B2 - "B2"

Port A3 - "A3"     Port B3 - "B3"

Port A4 - "A4"     Port B4 - "B4"

## NOTE

**1. More than one port can be selected when transmitting to port A or B. (For example, to select A1, A3, B2, and B4, transmit "A13B24".)**

**2. "0" clears all ports (for example, "A0" clears all ports connected to port A).**

d. Transmit Data to SCSI Switch:

Ascii "K" - Selects desired ports.

## NOTE

**If a port (A or B) is not specified, no action will be taken to that port. If a port is selected (A1), that port will be selected and other A ports (2, 3, and 4) will be turned off.**

Ascii "N" - Turns specified port ON.

Ascii "F" - Turns specified ports OFF.

e. End sequence:

Ascii "cr"

**Table 5-4. SCSI Switch commands**

| Command | Command Character | Example | Response |
|---|---|---|---|
| Select Port | K | <cr>//|A1K<cr> | |
| Report Port Status | S | <cr>//|S<cr> | <abcdefgh> |
| Select Terminator | k | <cr>//}A1k<cr> | |
| Report Terminator Status | s | <cr>//|s<cr> | <ABCD123456> |
| Lock Front Panel | L | <cr>//|L<cr> | |
| Unlock Front Panel | U | <cr>//|U<cr> | |
| Report Model, S/N, and date of manufacture | ? | <cr>//|?text…<cr> | <text…> |
| Report Alarm Status | A | <cr>//|A<cr> | <axyz> |
| Report Temperature | T | <cr>//|T<cr> | <t+23.5> (Celsius) |
| Report Performance | P | <cr>//|P<cr> | <PAABBCCDD> 112233445566 |
| Report SCSI Bus Inactivity | I | <cr>//|I<cr> | <xxxx> |
| Yank on SCSI Reset line | Y | <cr>//|AC3Y<cr> | |

**Table 5-4 (continued). SCSI Switch commands**

| Command | Command Character | Example | Response |
|---------|-------------------|---------|----------|
| Disable Audible Alarm | OA | <cr>//\|OA<x><cr> | |
| Set Baud Rate | OB | <cr>//\|OB<xy><cr> | |
| Set Serial Port Mode | OC | <cr>//\|OC<x><cr> | |
| Set Switch Number | OD | <cr>//\|OD<xx><cr> | |
| Set Lock/Unlock Password | OP | <cr>//\|OP<xxxx><cr> | |
| Set Temperature Limit | OT | <cr>//\|OT<xx><cr> | |
| Report Revision | R | <cr>//\|R<cr> | <2024610> |
| Lock Serial Ports (LAN) | OL | <cr>//\|OLxxxx<cr> | //\|OL1<cr>pass<br>//\|OL0<cr>fail |
| Unlock Serial Ports | OU | <cr>//OUxxxx<cr> | //\|OU1<cr>pass<br>//\|OU0<cr>fail |
| Report Serial Port Lock Status | OS | <cr>//\|OS<cr> | //\|OS1<cr>lock<br>//\|OS0<cr>open |

**EXPANDED LIST OF COMMANDS**

a. Select SCSI Port Matrix:

command: <cr>//|<AB1234K><cr>

report: none

# NOTE

**K - Forces switch patterns to outputs.**

**N - Turns the specified switches ON.**

**F - Turns the specified switches off.**

b. Report SCSI Port Matrix Assignment Status

command: <cr>//|S<cr>

report: //|A1234B1234K<cr>

c. Select SCSI Terminator Matrix:

command: <cr>//|<AB1234k><cr>

report: none

d. Report SCSI Terminator Status

command: <cr>//|s<cr>

report: //|AB1234k<cr>

e. Report Model, Serial Number, and Date of Manufacture:

command: <cr>//|?<cr>

report: //SC121A 20241150 01/15/2000

SC122A = model number

20241150 = serial number

01/15/2000 = date of manufacture

f. Report Alarm Status:

command: <cr>//|a<cr>

report: //|axyz<cr> (xx- 8-bit hexadecimal value)

x:   1 = Over temperature

y:   1 = Power supply 2 failure

z = Power supply 1 failure

g. Report SCSI Bus Performance:

command: <cr>//|P<xy><cr>

report: //|P<aabb11223344<cr>

aa: hex 00-FF Port A

bb: hex 00-FF Port B

hex 00 = 0% Busy

hex FF = 100% Busy

h. SCSI bus Inactivity to SCSI report:

command: <cr>//|I<cr>

report: xxxx: hex inactive time in tenths of seconds

i. Yank on SCSI Reset line:

command: <cr>//|<AB1234Y><cr>

report: none

j. Disable Audible Alarm:

command: <cr>//|OA<x><cr>

x: 0= don't disable

x: 1=disable alarm

report: none

k. Set Serial Port Baud Rate:

   command: <cr>//|OB<xy><cr>

   x: 0= COM1

   x: 1=COM2

   y: 0=9600 Baud

   y: 1=19200 Baud

   report: none

l. Set Serial Port Mode:

   command: <cr>//|OC<x><cr>

   x: 0= daisy chain serial ports

   x: 1= dual comm serial ports

   report: none

m. Set Switch (Device) Number:

   command: <cr>//|OD<xx><cr>

   xx: 01 thru 32

   report: none

n. Set Lock/Unlock Front Panel Password:

   command: <cr>//|OP<xxxx><cr>

   xx: 000 thru 9999

   report: none

o. Set Temperature Limit:

   command: <cr>//|OT<xx><cr>

   xx: 15 thru 55 (degrees C)

   report: none

## 5.8 ASCII Character Reference for SCSI Switch 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 | { |

## 5.9 Graphical User Interface (GUI)

Your SCSI Switch is supplied with control software that is compatible with Windows® 95, 98, and Windows NT® operating systems to allow remote control of the switch. Follow instructions on the disks to install the software.
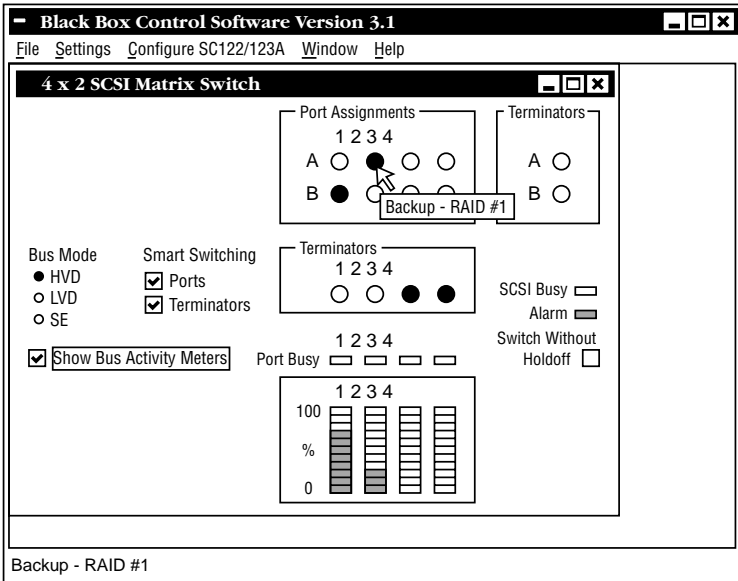


**Figure 5-5. Screen shot of GUI control panel.**

## 5.10 Connecting Multiple SCSI Switches

Up to 32 SCSI Switches can be controlled by a single RS-232 serial interface. To operate in this configuration, set the serial ports to operate in daisy-chained mode.
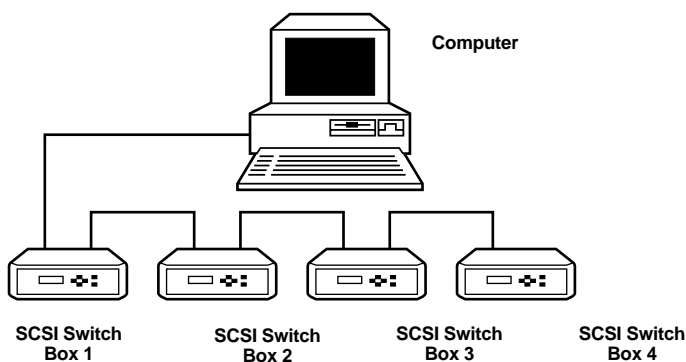


**Figure 5-6. Multiple SCSI Switch configuration.**

## 5.11 Rackmount Installation

The SCSI Switch can be installed in a standard 19-inch (EIA unit) rack.

### 5.11.1 INSTALLATION IN RACK

Attach the two mounting brackets to each side of the SCSI Switch enclosure using the screws provided. Set the unit into position on the rack, aligning the mounting bracket holes with the rack holes. Use ⅜-inch 10-32 to 12-24 screws to install the Switch in the rack.

### 5.11.2 RACKMOUNT CONSIDERATIONS

1. For proper operation, ensure that the maximum recommended operating ambient temperature of 149°F (65°C) is not exceeded.

2. If the 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. Install the rack in an environment compatible with SCSI Switch maximum rated operating temperature.

3. Make sure the amount of airflow around the SCSI Switch required for safe operation is not compromised.

4.  Mounting the SCSI Switch in a rack should not cause a hazardous condition of uneven mechanical loading.

5.  Do not overload the SCSI Switch supply circuit.

6.  Make sure the rackmount equipment is connected to earth ground.

## 5.12 SCSI Switch Typical Applications

The following illustrations provide sample application and configuration information. Many other configurations are possible with the SCSI Switch.
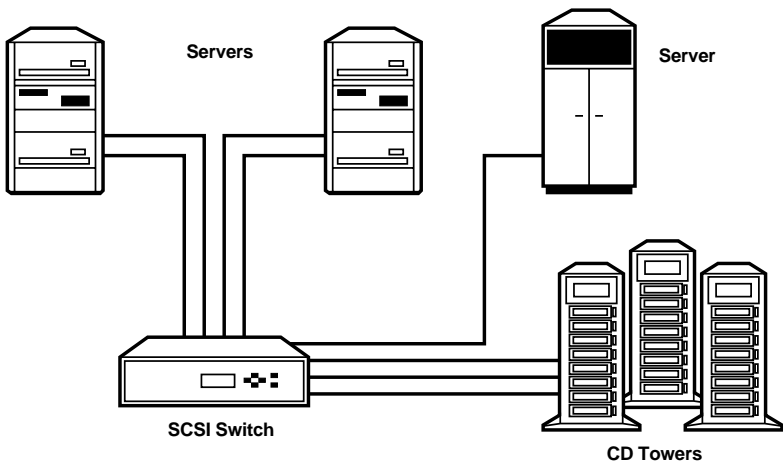


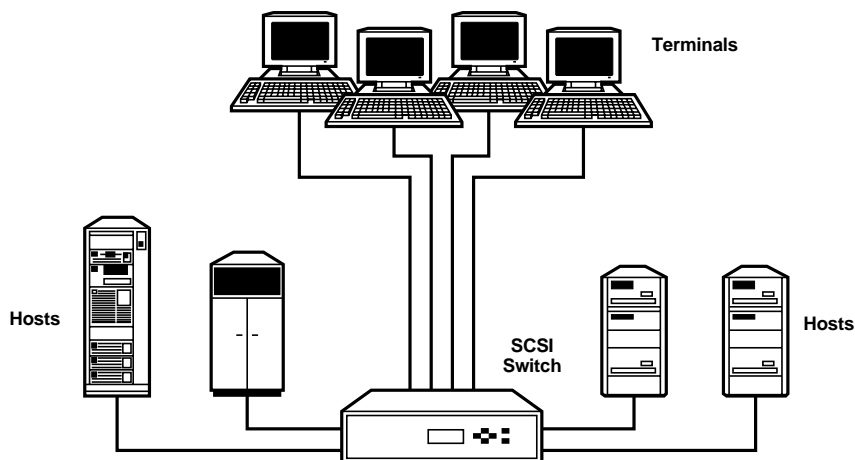**Figure 5-7. Sample application #1.**

**Figure 5-8. Sample application #2.**

## 5.13 Network Control of SCSI Switch (Optional)

The 4 x 2 SCSI Matrix Switch may be controlled over a TCP/IP network using the optional LAN port.

### 5.13.1 LAN PORT CONFIGURATION

If the SCSI Switch is equipped with the optional LAN port, you can remotely control the SCSI Switch via a standard 10-Mbps Ethernet connection running TCP/IP. The RS-232 COM2 port (which is used for daisy chaining SCSI Switches) has been disabled (it is being used internally by the LAN card). If you wish to daisy chain SCSI Switches you'll need to disable the LAN port and enable the COM2 port. To do this, you'll need to configure jumper block E15 and E16 as shown in **Figure 5-9** (RS-232 ENABLED) and remove the ribbon cable from J14 (see **Figure 5-10**) as shown in following configurations.

### 5.13.2 CFGSWITCH UTILITY

The cfgswitch.exe utility is used to configure the TCP/IP address. This utility is provided on the included disk. You can re-configure the IP address by using the IP Configuration Utility. Run cfgswitch.exe from the diskette provided with your 4 x 2 SCSI Matrix Switch. A "Configure Black Box Network Switch" window will appear. Enter the new IP address and switch MAC address in the appropriate fields. The MAC address can be found on a label located on the bottom of the Switch. You can search for the IP address by clicking the search button in the "Configure Black Box Network Switch." This will bring up a "Search For Black Box Network Switches" window. Enter a beginning IP address, an ending IP address, and click Search.

Command strings to control the SCSI Switch may be manually entered through certain versions of HyperTerminal to support connections to IP addresses via LAN.

## NOTE
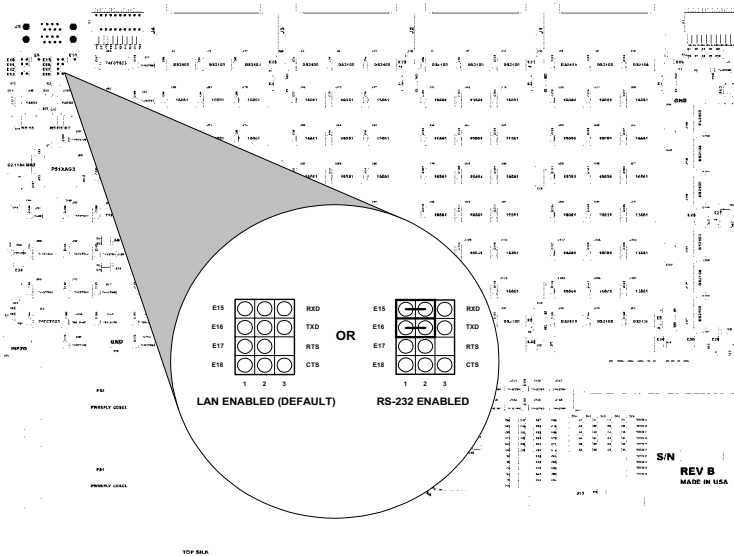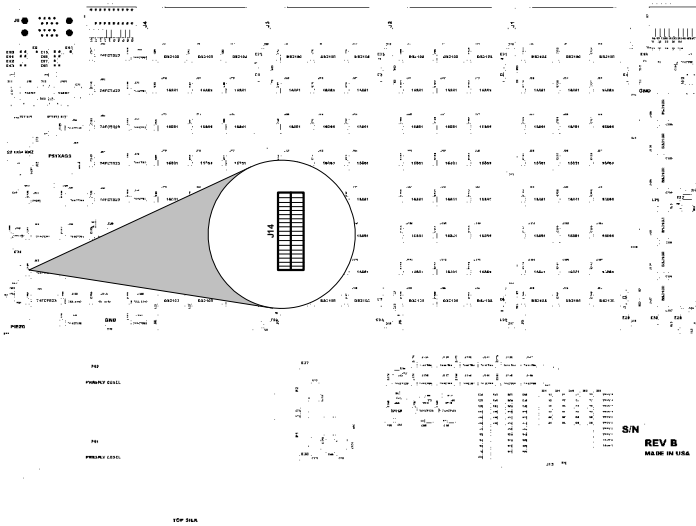**You will need to specify port #3001 when establishing the connection.**



**Figure 5-9. SCSI Switch LAN/RS-232 jumper configuration.**

**Figure 5-10. J14: LAN ribbon cable location.**



**Figure 5-11. Configure network switch screens.**

### 5.13.3 SETSWITCH UTILITY

The setswitch.exe utility enables you to set switch parameters via the LAN port. This utility is located on the diskette provided with your SCSI Switch. To change switch settings and termination for an SCSI Switch: from a DOS prompt run SETSWITCH.EXE from the diskette provided.

Usage:

setswitch [/?] [/i<IP Address>] [/c<Com Port>] [/b<baud rate>]

   [/n<Switch Number>] [/h<holdoff>] [/x] [/t<Termination>]

   [[/s]<SwitchSettings>] [/w<command>] [/r<command>]

Where:

/? = this message.

/i <IPAddress> = The IP address of the network-enabled SCSI Switch.

/c <Com Port> = The number of the Com Port to address (1 to 8;default=1).

/b <Baud Rate> = The baud rate for the com port (2400, 9600, 19200; dflt=9600).

/n <Switch Number> = The number of the switch to change (1 to 32; default=1).

/h <holdoff> = SCSI Bus holdoff, in seconds. The SCSI Switch will not change the switch settings on a bus until there has been inactivity the specified number of seconds. Valid range is 0 to 25 seconds.

/x = Ignore SCSI Bus activity. Switch settings will be changed immediately.

/t <Termination> = Termination can be turned on or off for each port (A or B, or 1 to 4). "A2NB3F" activates termination for ports A and 2 and, it deactivates termination on ports B and 3. Termination on unspecified ports will not be affected.

[/s]<Switch Settings> = The settings to be changed (/s is optional). "A1B2NB1A2F" connects ports A1 and B2 and disconnects ports B1 and A2. Switch settings on unspecified ports will not be affected.

[/w]<command> = <command> is sent to the switch with no parsing. Any response from the switch is ignored.

[/r]<command> = <command> is sent to the switch with no parsing. Any response from the switch is displayed on the console's error output.

# 6. SCSI Technical Information

## 6.1 SCSI Basics

### 6.1.1 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.

### 6.1.2 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 MBps for 16 bit, and 40 MBps for 32 bit were achieved.

### 6.1.3 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.

### 6.1.4 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.

### 6.1.5 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.

### 6.1.6 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 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.

### 6.1.7 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. 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.

## 6.2 SCSI Installation Tips

- *Keep your SCSI chain short.* Official SCSI specifications limit a SCSI chain to no more that 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.

## 6.3 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 6-1. SCSI connector assignments single-ended (SE)**
**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 |

**Table 6-1 (continued). SCSI connector assignments
single-ended (SE) 16-bit SCSI (wide)**

| Signal Name | Pin Number | Signal Name | Pin Number |
|---|---|---|---|
| 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 |

**Table 6-1 (continued). SCSI connector assignments
single-ended (SE) 16-bit SCSI (wide)**

| Signal Name | Pin Number | Signal Name | Pin Number |
|---|---|---|---|
| Ground | 32 | -DB9 | 66 |
| Ground | 33 | -DB10 | 67 |
| Ground | 34 | -DB11 | 68 |

**Table 6-2. SCSI connector assignments differential/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 |
| Ground | 6 | Ground | 40 |
| +DB(0) | 7 | -DB(0) | 41 |
| +DB(1) | 8 | -DB(1) | 42 |
| +DB(2) | 9 | -DB(2) | 43 |
| +DB(3) | 10 | -DB(3) | 44 |
| +DB(4) | 11 | -DB(4) | 45 |

**Table 6-2 (continued). SCSI connector assignments diff./16-bit SCSI (wide)**

| Signal Name | Pin Number | Signal Name | Pin Number |
|---|---|---|---|
| +DB(5) | 12 | -DB(5) | 46 |
| +DB(6) | 13 | -DB(6) | 47 |
| +DB(7) | 14 | -DB(7) | 48 |
| +DB(P) | 15 | -DB(P) | 49 |
| DIFFSENS | 16 | Ground | 50 |
| TERMPWR | 17 | TERMPWR | 51 |
| TERMPWR | 18 | TERMPWR | 52 |
| Reserved | 19 | Reserved | 53 |
| +ATN | 20 | -ATN | 54 |
| Ground | 21 | Ground | 55 |
| +BSY | 22 | -BSY | 56 |
| +ACK | 23 | -ACK | 57 |
| +RST | 24 | -RST | 58 |
| +MSG | 25 | -MSG | 59 |
| +SEL | 26 | -SEL | 60 |
| +C/D | 27 | -C/D | 61 |
| +REQ | 28 | -REQ | 62 |

**Table 6-2 (continued). SCSI connector assignments
differential/16-bit SCSI (wide)**

| Signal Name | Pin Number | Signal Name | Pin Number |
|---|---|---|---|
| +I/O | 29 | -I/O | 63 |
| Ground | 30 | Ground | 64 |
| +DB(8) | 31 | -DB(8) | 65 |
| +DB(9) | 32 | -DB(9) | 66 |
| +DB(10) | 33 | -DB(10) | 67 |
| +DB(11) | 34 | -DB(11) | 68 |

**Table 6-3. 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 |

**Table 6-3 (continued). SCSI connector assignments
low-voltage differential (LVD)/16-bit SCSI (wide)**

| Signal Name | Pin Number | Signal Name | Pin Number |
|-------------|-----------|-------------|-----------|
| +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 |
| 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 |

**Table 6-3 (continued). SCSI connector assignments**
**low-voltage differential (LVD)/16-bit SCSI (wide)**

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

**Table 6-4. SCSI speed support map**

| STA Term | Maximum Bus Length (M) | | | Maximum Devices |
|---|---|---|---|---|
| | SE | HVD | LVD | |
| SCSI-1 | 6 | 25 | - | 8 |
| Fast SCSI | 6 | 25 | - | 8 |
| Fast Wide SCSI | 6 | 25 | - | 16 |
| Ultra SCSI | 1.5 | 25 | - | 8 |
| Ultra SCSI | 3 | - | - | 4 |
| Wide Ultra SCSI | - | 25 | - | 16 |
| Wide Ultra SCSI | 1.5 | - | - | 8 |
| Wide Ultra SCSI | 3 | - | - | 4 |
| Ultra2 SCSI | (1) | 25 | 25 | 2 |
| Ultra2 SCSI | (1) | 12 | 12 | 8 |
| Wide Ultra2 SCSI | (1) | 25 | 25 | 2 |
| Wide Ultra2 SCSI | (1) | 12 | 12 | 16 |

*To access jumper options:*

Remove the six screws on the bottom of the unit. Then lift off the cover.
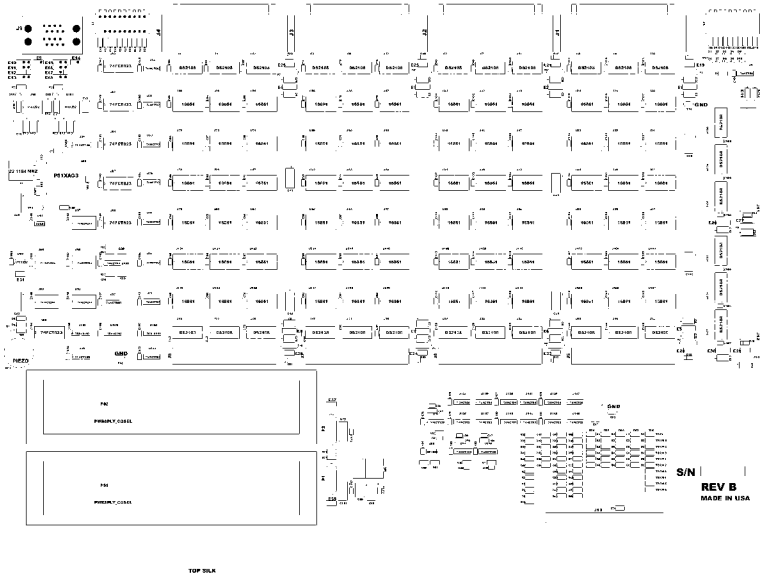
**Figure 6-1. SCSI Switch component placement.**

• RS-232 jumper block: E9 through E18

• Active terminator power select: E1 through E8, E29, E30

# 7. Troubleshooting

## 7.1 Calling Black Box

If you determine that your 4 x 2 SCSI Matrix Switch is malfunctioning, do not attempt to alter or repair the unit. It contains no user-serviceable parts. Contact Black Box at 724-746-5500.

Before you do, make a record of the history of the problem. We 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.

## 7.2 Shipping and Packaging

If you need to transport or ship your 4 x 2 SCSI Matrix Switch:

- Package it carefully. We recommend that you use the original container.

- If you are shipping the 4 x 2 SCSI Matrix Switch for repair, make sure you include everything that came in the original package. Before you ship, contact Black Box to get a Return Materials Authorization (RMA) number.