BLACK BOX®
NETWORK SERVICES

Async Fiber Optic Mux–24 (ST)
Async Fiber Optic Mux–24 (SM)
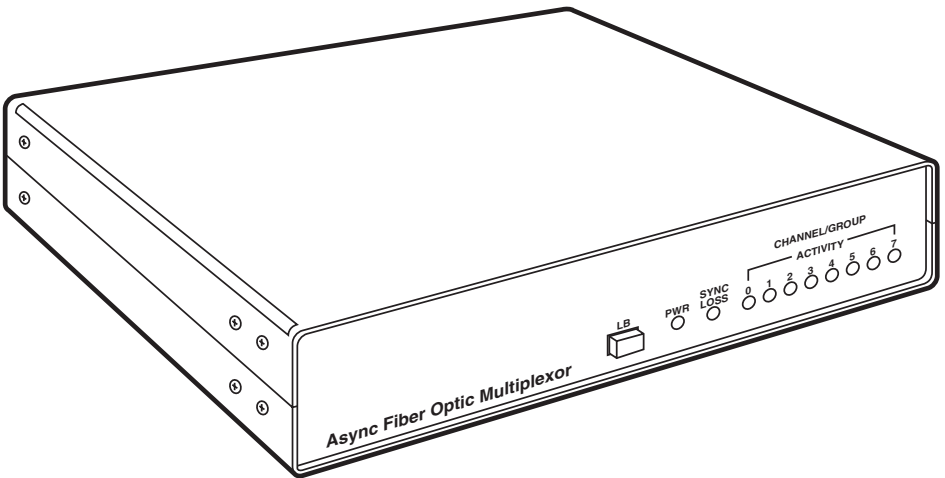
FEDERAL COMMUNICATIONS COMMISSION
AND
INDUSTRY CANADA
RADIO FREQUENCY INTERFERENCE STATEMENTS

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 classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

TRADEMARK USED IN THIS MANUAL

ST is a registered trademark of AT&T.

Any other trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.

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.

Contents

1. Specifications

Cable Required —   Between MX512 units: Multimode fiberoptic, graded
index, with a core diameter of 100, 62.5, or 50 µm;
Between MX512 and DTEs: Standard RS-232 cable
(for 8 data channels with control leads) or 3-to-1
Adapter Cable EYN512 (for 24 data channels
without control leads)

Interfaces —   Channel: EIA RS-232C
Composite: Multimode fiberoptic:
    Models with "-ST" suffix: ST (bayonet) style
    Models with "-SM" suffix: SMA 905 (threaded) style

**Multiplexing
Method —**   Time division

User Channels —   8 with handshaking using normal RS-232 cable,
24 without handshaking using 3-to-1 Adapter Cable
(EYN512)

Data Rates —   Each channel: Up to 142 Kbps;
Composite: 40 Mbps

**Maximum
Range —**   Depends on core diameter of fiberoptic cables:

Core Diameter (µm)	Launch Power* (dBm)	RX Sensitivity (dBm)	Typical Maximum Range
100	−10.2	−30	3 km (1.9 mi.)
62.5	−13.3	−30	3 km (1.9 mi.)
50	−21	−30	2 km (1.2 mi.)
*Includes typical losses in connectors at both ends.			

Wavelength — 820 nm (multimode fiberoptic)

User Controls — Front-mounted loopback pushbutton

Indicators — (10) Front-mounted LEDs:
(1) Power ("PWR"), (1) Data Synchronization Loss
("SYNC LOSS"), (8) Data Transmit/Receive
Activity ("ACTIVITY")

Diagnostics — Bidirectional composite loopback

Connectors — (10) Rear-mounted:
(8) DB25 female for RS-232 channels;
Models with "-ST" suffix: (2) ST female for
fiberoptic composite line;
Models with "-SM" suffix: (2) SMA female for
fiberoptic composite line

Power — From desktop power supply:
MX512A models: 115 VAC, 60 Hz;
MX512AE models: 230 VAC, 50 Hz;
All models: Consumption: 20 watts

**Operating
Temperature —** 32 to 122˚F (0 to 50˚C)

**Storage
Temperature —** –4 to 158˚F (–20 to 70˚C)

Humidity — 15 to 90% noncondensing

Enclosure — Steel

Size — 2.5"H x 12.1"W x 11.1"D (6.4 x 30.7 x 28.2 cm)

Weight — 9.3 lb. (4.2 kg) including power supply

2. Introduction

2.1 Overview

The Async Fiber Optic Mux-24 combines twenty-four channels of asynchronous RS-232 information and transmits them across a single pair of fiberoptic cables. Each RS-232 channel is independent and operates in full duplex over the fiberoptic circuit. Your Mux-24 is designed to:

- reduce wiring costs,

- simplify network-cable layouts,

- increase data security, and

- provide electrically isolated, relatively high-speed connectivity between personal computers, terminals, modems, and other asynchronous RS-232 devices.

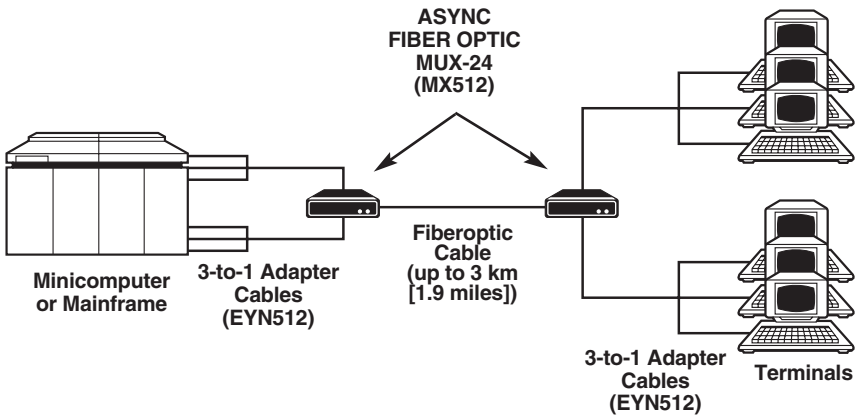A typical Mux-24 application is shown below in Figure 2-1.

Figure 2-1. Typical Async Fiber Optic Mux-24 application.

2.2 Physical Features

2.2.1 FRONT PANEL

There are ten LED indicators on the front panel of the Mux-24:

- When the "PWR" (power) LED is **lit**, the Mux-24 is getting enough electricity to operate. When this LED is **dark**, the Mux-24 is unplugged or is not getting enough power to operate for some other reason.

- When the "SYNC LOSS" (data-synchronization loss) LED is **dim**, the unit is not having any synchronization problems. When this LED is **brightly lit**, the Mux-24 doesn't recognize the composite signal it's receiving and has lost data synchronization (see **Section 4.1**). While the Mux-24 is ON, this LED is never completely dark.

- For any of the eight "ACTIVITY" LEDs:
  When the LED is **dark**, no data is being transmitted or received on the corresponding port.
  When the LED is **lit** and you **haven't "tripled"** the corresponding port (see the next section), data is being transmitted or received on the corresponding port's single channel.
  When the LED is **lit** and you **have "tripled"** the corresponding port, data is being transmitted or received on one or more of the corresponding port's three channels.
  These indicators aren't affected by activity on the corresponding port's handshake lines unless you've "tripled" the port: Special pinning in the 3-to-1 Adapter Cable used for this purpose brings the substituted TD/RD lines into the ACTIVITY LED's circuit.

There is also a pushbutton "LOOPBACK" switch on the front panel. When you press this button, so that the button is in the "in" (recessed) position, the Mux-24 takes the signals it receives through its internal fiber RX circuit, loops them all back into its internal fiber TX circuit, and sends them back to the Mux-24 at the other end. It also loops back all RS-232 signals it receives from the attached DTEs on each of the eight rear-panel DB25 connectors: the signal on Pin 2 to Pin 3, the signal on Pin 4 to Pin 8, and the signal on Pin 20 to Pin 6. (This operating condition of DCE devices is commonly referred to as "line loopback.") If data communication should ever go wrong somewhere in your Mux-24 system, observing these reflected signals will help you pinpoint the cabling, hardware, or software problem. To end loopback and return the Mux-24 to normal operation, press the LOOPBACK button again to return it to the "out" (protruding) position.

2.2.2 REAR PANEL

The Mux-24 has eight RS-232 ports (the eight DB25 connectors on its rear panel). It multiplexes a total of 24 discrete channels of information: three channels on each port. Table 2-1, below, shows how the signals flow on each port; you can see that a pair of Mux-24s effectively functions as eight DTEs wired to eight DCEs.

The Mux-24 samples all 24 (8 x 3) signals presented to it on Pins 2, 4, and 20 at the same speed. Therefore, with special cabling, you can substitute a TD/RD signal path for any of the RTS/DCD or DTR/DSR lines provided by

Table 2-1. DB25 Connector Pinout

RS-232 DTE Site A	Mux-24 Site A	Composite Fiber Link	Mux-24 Site B	RS-232 DTE Site B
(TD) Pin 2 ⟶	Pin 2	| Fiber Link |	Pin 3 ⟶	Pin 3 (RD)
(RTS) Pin 4 ⟶	Pin 4	| |	Pin 8 ⟶	Pin 8 (DCD)
(DTR) Pin 20 ⟶	Pin 20	| |	Pin 6 ⟶	Pin 6 (DSR)
(SGD) Pin 7 ——	Pin 7		Pin 7 ——	Pin 7 (SGD)
(RD) Pin 3 ⟵	Pin 3	| |	Pin 2 ⟵	Pin 2 (TD)
(DCD) Pin 8 ⟵	Pin 8	| |	Pin 4 ⟵	Pin 4 (RTS)
(DSR) Pin 6 ⟵	Pin 6	| |	Pin 20 ⟵	Pin 20 (DTR)

each connector. You can add up to 16 additional TD/RD "channels" this way, at the expense of the corresponding RTS/DCD and DTR/DSR handshake lines. Table 2-2 on the next page shows what happens when you "triple" a connector on a Mux-24.

The Mux-24 multiplexes all RS-232 signals from the attached DTEs into a single composite fiberoptic signal. It conducts fiberoptic communication with another Mux-24 using the fiberoptic TX and RX ports on its rear panel. For Mux-24 models whose product codes end with "-ST" suffixes, these fiberoptic ports are ST® (bayonet) style female connectors. For Mux-24 models whose products codes end with "-SM" suffixes, these fiberoptic ports are SMA 905 (threaded) style female connectors.

Table 2-2. "Tripled" DB25 Connector Pinout

RS-232 DTEs Site A	Mux-24 Site A		Mux-24 Site B	RS-232 DTEs Site B
		Composite		
(TD) A Pin 2 ⟶	Pin 2	| Fiber Link |	Pin 3 ⟶	Pin 3 (RD) A
(TD) B Pin 2 ⟶	Pin 4	| |	Pin 8 ⟶	Pin 3 (RD) B
(TD) C Pin 2 ⟶	Pin 20	| |	Pin 6 ⟶	Pin 3 (RD) C
(RD) A Pin 3 ⟵	Pin 3	| |	Pin 2 ⟵	Pin 2 (TD) A
(RD) B Pin 3 ⟵	Pin 8	| |	Pin 4 ⟵	Pin 2 (TD) B
(RD) C Pin 3 ⟵	Pin 6	| |	Pin 20 ⟵	Pin 2 (TD) C
	3-to-1 Adapter Cable (EYN512)		3-to-1 Adapter Cable (EYN512)	

NOTE: Pin 7 of the 3-to-1 Adapter Cable is tied common. See the **Appendix**.

2.2.3 INTERNAL JUMPERS

The Async Fiber Optic Mux-24 also has 16 internal configuration jumpers (labeled "W1" to "W16") for each port's two handshake-line outputs. When a given jumper is in the "Switched" position, the signal on the corresponding pin (Pin 6 or 8) of a given port will follow the state of its matching signal from the other Mux-24's Pin 20 or 4. When a given jumper is in the "ON" position, the corresponding pin's signal will be held high no matter what the state of the matching signal is. This is useful when devices attached to the receiving Mux-24 need to see DSR or DCD asserted in order to transmit, but the DTE attached to the sending Mux-24 doesn't support DTR or RTS. See Table 2-3 on the next page for a complete listing of these configuration jumpers and Figure 2-2 on page 8 for their locations on the Mux-24's circuit board.

Table 2-3. Configuration Jumpers for Handshake Signals

JUMPER	PORT	PIN	SIGNAL ABBREVIATION
W1	0	8	DCD
W2	0	6	DSR
W3	1	8	DCD
W4	1	6	DSR
W5	2	8	DCD
W6	2	6	DSR
W7	3	8	DCD
W8	3	6	DSR
W9	4	8	DCD
W10	4	6	DSR
W11	5	8	DCD
W12	5	6	DSR
W13	6	8	DCD
W14	6	6	DSR
W15	7	8	DCD
W16	7	6	DSR

NOTE: When you substitute a TD/RD channel for any of these handshake channels, to transmit data across a 3-to-1 Adapter Cable, make sure the channel's jumper is in the "Switched" position. Otherwise, the RD signal on that port's Pin 3 will be held in a constant "break" (spacing) condition.
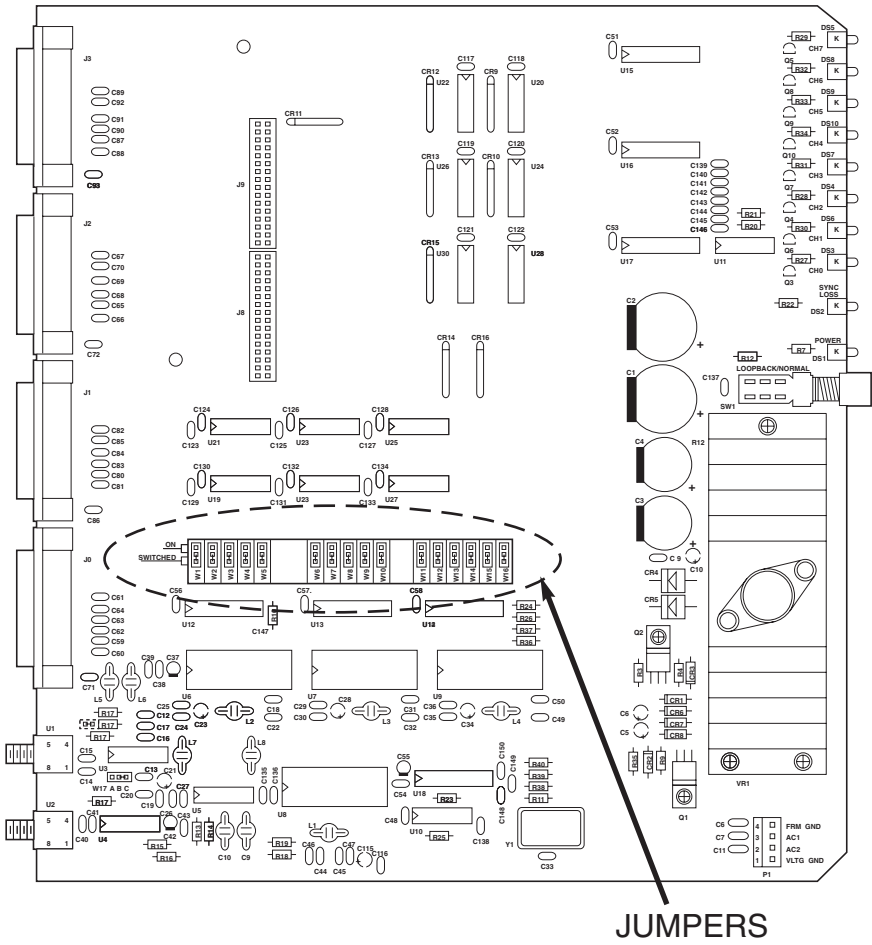
Figure 2-2. The Mux-24's circuit-board layout, showing jumper locations outlined by a dashed oval.

3. Installation

Follow these steps to install a pair of Async Fiber Optic Mux-24s:

1. If your application doesn't require that any handshake signals be held high, go to step 6.

2. Making sure its power supply is unplugged, open the cover of one of the Mux-24s. To do this, you will need to remove six screws: the upper two screws of the four on either side of the front panel and the upper screw of the two on either side of the rear panel.

3. For each signal on each port that needs to be held high, move the corresponding jumper to the "ON" position (see the text on page 6, Table 2-3 on page 7, and Figure 2-2 on page 8).

4. Close the Mux-24's cover.

5. Repeat steps 2 through 4 for the other Mux-24.

6. Attach and secure a pair of fiberoptic cables to the fiberoptic connectors labeled TX and RX on the rear panel of one of the Mux-24s. For each Mux-24, plug the connector labeled "TX" on one cable into the TX port and plug the connector labeled "RX" on the other cable into the RX port. Do *not* use a tool to tighten the connectors—hand-tighten only! Also, make sure that your fiberoptic cables aren't longer than the Mux-24 can support (see **Chapter 1**).

7. Attach the other ends of the fiberoptic cables to the other Mux-24's fiberoptic connectors. Make sure to attach the cable connected to the first Mux-24's TX connector to the second Mux-24's RX connector, and vice versa.

8. Making sure that the LOOPBACK button is in the "out" (protruding) position, plug in both Mux-24s' power supplies. Watch their SYNC LOSS LEDs. If they aren't brightly lit, go to step 10.

9. If the SYNC LOSS LEDs of one or both Mux-24s light or flicker brightly, see **Sections 4.1** and **4.2**.

10. Unplug each Mux-24's power supply. Making sure all of your DTE devices are also powered down, run regular RS-232 cables or 3-to-1 Adapter Cables from your DTEs to the DB25 connectors on the rear panels of the Mux-24s.

11. Again making sure that the LOOPBACK button is in the "out" (protruding) position, power up all of your DTEs, then plug in both Mux-24s' power supplies. Watch the SYNC LOSS LEDs. If they stay steadily dim and data is being passed as expected, your installation is complete and your Mux-24 system is ready for continuous operation. If the SYNC LEDs light or flicker brightly, see **Sections 4.1** and **4.2**.

4. Troubleshooting

4.1 Common Concerns

This section lists several problems that can occur in an Async Fiber Optic Mux-24 system and suggests possible causes and solutions.

4.1.1 A SYNC LOSS LED BECOMES BRIGHTLY LIT

Press the LOOPBACK button on the front panel of that Mux-24. If the SYNC LOSS LED doesn't go dim, that mux is probably defective. If the LED does go dim, take the steps below:

A. Check the remote Mux-24. Is it plugged into a working outlet?

B. Is the remote Mux-24's SYNC LOSS LED brightly lit? If it is, go to step C. If it isn't, and the local mux is still in loopback, something unusual is wrong with either or both Mux-24s. Call your supplier for technical support.

C. Press the LOOPBACK button on the remote Mux-24. If its SYNC LOSS LED goes dim, go to step D. If the LED doesn't go dim, the remote mux is probably defective.

D. The problem is probably in the fiberopticcabling. Check these things:

- Connections: Is either cable loose from either mux? Are the cables mispaired (cable connector labeled "TX" in Mux-24's RX port, and vice versa, at either mux)? Even if everything seems in order, try disconnecting and reconnecting the cables; connectors might be slightly misaligned.

- Integrity and Distance: Is either cable broken or a splice detached anywhere along its length? Does either cable have too many splices? Are the cables longer than the Mux-24 can support (see **Chapter 1**)? (If you have an optical power meter, and you get a reading of less than –30 dBm at 820 nm when the TX end of a cable is plugged into a Mux-24 and the RX end is plugged into the meter, one of these conditions is true.) Alternatively, try swapping in known-good cables one at a time; if the SYNC LOSS LED goes dim, the cable you just replaced is probably bad.

E. If both cables are good, the problem is narrowed down to the Mux-24s' fiberoptic-communication components. Use a convenient length of fiberoptic cable to connect the TX port on one of the Mux-24s to the RX port on the *same* Mux-24. (If this Mux-24 is still in loopback mode, press the LOOPBACK button again to return it to normal operation.) If the SYNC LOSS LED lights brightly, this Mux-24 is probably defective. If the LED remains dim, repeat this step for the other Mux-24. If its SYNC LOSS LED also remains dim during this test, call your supplier for technical support.

4.1.2 A SYNC LOSS LED BEGINS TO FLICKER BRIGHTLY

Press the LOOPBACK button on the front panel of the Mux-24 with the flickering LED. If the SYNC LOSS LED doesn't go dim, call your supplier for technical support. If the LED does go dim, you probably have a cabling problem. Check these things:

- Connections: Is either cable loose from either mux? Are the cables mispaired (cable connector labeled "TX" in Mux-24's RX port, and vice versa, at either mux)? Even if everything seems in order, try disconnecting and reconnecting the cables; connectors might be slightly misaligned.

- Integrity and Distance: Is either cable broken or a splice detached anywhere along its length? Does either cable have too many splices? Are the cables longer than the Mux-24 can support (see **Chapter 1**)? (If you have an optical power meter, and you get a reading of less than –30 dBm at 820 nm when the TX end of a cable is plugged into a Mux-24 and the RX end is plugged into the meter, one of these conditions is true.) Alternatively, try swapping in known-good cables one at a time; if the SYNC LOSS LED goes dim, the cable you just replaced is probably bad.

If you can't find the problem, call your supplier for technical support.

4.1.3 BOTH SYNC LOSS LEDS STAY DIM, BUT DATA IS BEING CORRUPTED

Take these steps:

A. Press the LOOPBACK button on the front panel of the nearest Mux-24. If corrupt data comes back to any DTE attached to that Mux-24, go to step B. If all the data that comes back to the DTE(s) attached to that Mux-24 is OK, go to step F.

B. Check the serial-port settings of the DTEs that are getting bad data. Are these settings correct? Also check any communication software that the affected DTE(s) might be using. Is it set correctly? Does it seem to be working properly?

C. Try replacing the RS-232 cables that run between that Mux-24 and the affected DTE(s). If the problem goes away, the cables you replaced are probably broken or defective.

D. Try replacing the affected DTE(s). If the problem goes away, the DTE(s) you replaced are probably broken or defective.

E. If the problem still doesn't go away, the Mux-24 is probably broken or defective. Call your supplier for technical support.

F. Check the serial-port settings of all the local DTEs. Are these settings correct? Also check any communication software that the affected DTE(s) might be using. Is it set correctly? Does it seem to be working properly?

G. Go to the remote mux and press its LOOPBACK button. If corrupt data comes back to any DTE attached to the remote Mux-24, repeat steps B through E for the remote equipment. If all the data that comes back to the DTE(s) attached to that Mux-24 is OK, call your supplier for technical support.

4.2 Contacting Black Box

If you determine that your Mux-24 is malfunctioning, *do not attempt to alter or repair the unit.* It contains no user-serviceable parts. Call Black Box Technical Support at (412) 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.

4.3 Shipping and Packaging

If you need to transport or ship your Mux-24:

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

• If you are returning the ServSwitch, make sure you include its manual. Before you ship the unit to Black Box for whatever reason, contact Black Box to get a Return Materials Authorization (RMA) number.

Appendix: Pinout of Adapter Cable

Shown below is the pinout for the 3-to-1 Adapter Cable, product code EYN512. Drains are tied common, as are grounds.

Pins in   Pins of Mux Port
Cable-Branch
Connectors

Branch A: 1 ————— 1 and drain
            2 ——— 2
            3 ——— 3
            7 ——— 7

Branch B: 1 ————— 1 and drain
            2 ——— 4
            3 ——— 8
            7 ——— 7

Branch C: 1 ————— 1 and drain
            2 ——— 20
            3 ——— 6
            7 ——— 7

                        ⌐ 11
                        ⌐ 12

                        ⌐ 14
                        └ 15

                        ⌐ 16
                        └ 17

                        ⌐ 18
                        └ 19