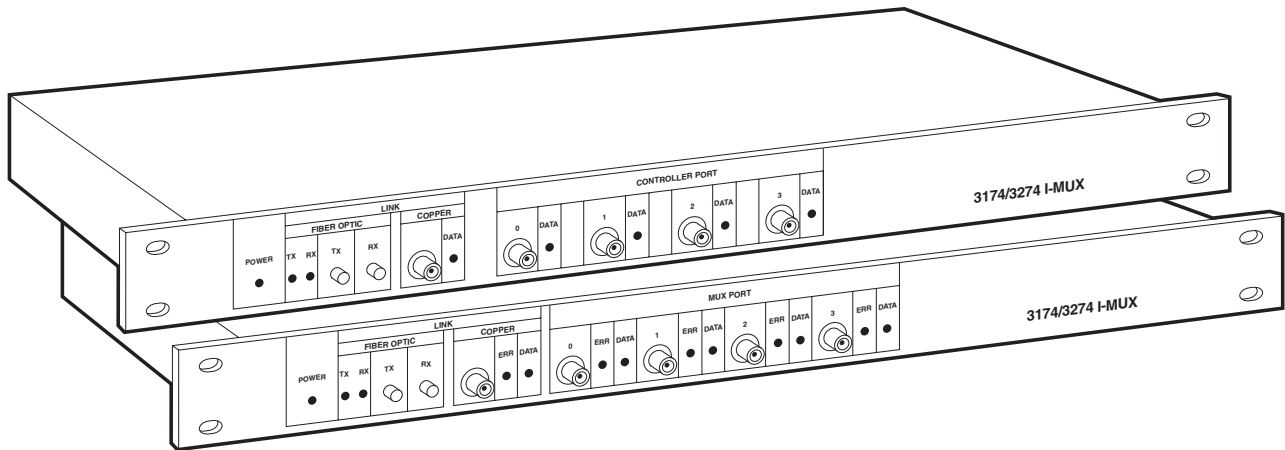




3174/3274 I-Mux



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1. Specifications

User Channels —	32
Speed —	2.3587 Mbps
Data Format —	3174/3274
Maximum Distance —	Fiberoptic: 1.9 miles (3 km); Copper: Coax: 0.9 miles (1.5 km), Type 1: 0.7 miles (1.2 km)
Indicators—	MX330A-C: (5) LEDs: Power, F/O TX, F/O RX, (1) DATA on the Link side, (1) DATA on the Controller Side MX330A-D: (7) LEDs: Power, F/O TX, F/O RX, (1) ERR and (1) DATA on the Link side; (1) ERR and (1) DATA on the Mux port
Connectors —	Channel: DPC, female Composite: Copper, DPC female; Optical, ST®
Power —	105 to 250 VAC, 20 W max, 47 to 63 Hz
Size —	1.7"H x 19"W x 5.7"D (4.4 x 48.3 x 14.4 cm)
Weight —	4.2 lb. (1.9 kg)

2. Introduction

2.1 General Description

The 3174/3274 I-Muxes are 19-inch rack-mountable units designed for use with IBM® 3174 and IBM 3274 32-port cluster controllers.

The **Controller Side Mux** accepts up to four IBM 3174 or 3274 RPQ coaxial lines, each carrying an eight-to-one multiplexed signal. This Mux *provides* a single multiplexed output on fiberoptic, coax, or twisted-pair cable. That output can be recovered for a total of up to 32 terminal signals. Figure 2-1 shows the Controller Side Mux (MX330A-C).

The **Device Side Mux** works in conjunction with the Controller Side Mux. It *receives* a single multiplexed output on fiberoptic, coax, or twisted-pair cable and provides one-to-four demultiplexing to recover up to four IBM 3174 or 3274 multiplexed lines carrying a total of up to 32 terminal signals. Figure 2-2 shows the Device Side Mux.

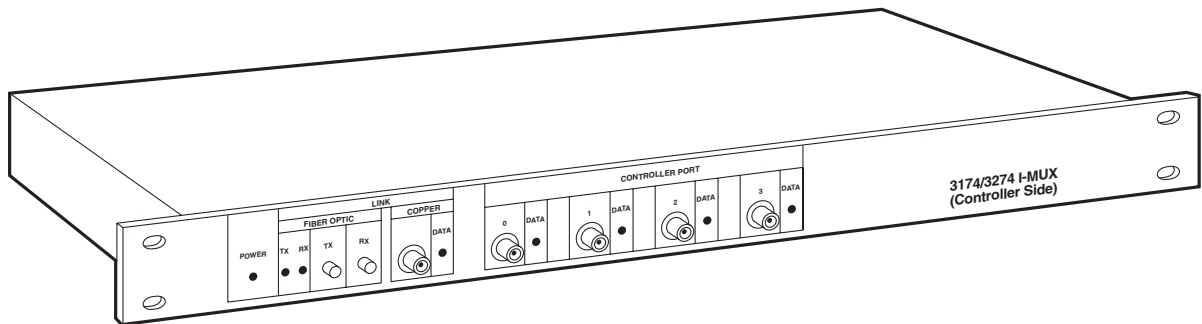


Figure 2-1. Controller Side Mux (MX330A-C).

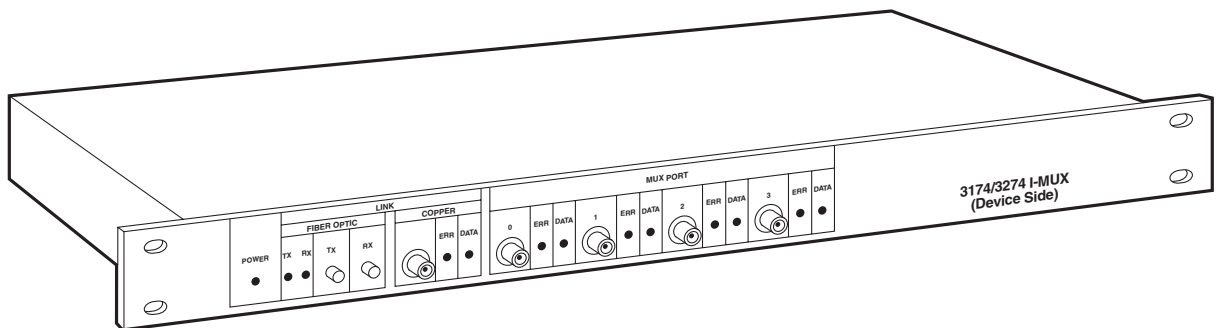


Figure 2-2. Device Side Mux (MX330A-D).

2.2 Features

Here's what you can expect from both Muxes:

- Both units are designed for use with IBM 3174 and IBM 3274 controllers (with the RPQ 9901 connection option). The Controller Side Mux will accept up to four IBM 3174 or 3274 RPQ 9901 coaxial lines.
- Both units are fully compatible with the 3299 protocol and 3270 terminals.
- When used together, the Muxes can extend transmission distance for IBM controllers to 3270 terminals up to about 4.7 miles (7.5 km) (subject to polling and timing limitations).
- Both units are based on advanced VLSI technology and offer high reliability, low power consumption, and synchronous operation through an independent clock. In addition to the multiplexor functions, they provide data signal reclocking, regeneration, and jitter attenuation.
- When the Muxes are configured for fiberoptic input/output, copper cable can be connected (coax or Type 1), to provide a cold backup line. A slide switch on the rear panel selects fiberoptic or copper mode.
- Built-in baluns provide impedance matching when different cable types are used (coax [93 ohm] or Type 1, 2, 6, or 9 [150 ohm]).
- No operator intervention is required during normal operation. The LEDs on the front panel provide diagnostic indications for each port.

2.3 Applications

The Controller Side Mux (MX330A-C) can be used in two basic configurations. The Device Side Mux (MX330A-D) can be used only in conjunction with the MX330A-C.

Configuration 1:

In this configuration, the MX330A-C is used with the MX330A-D and eight-port multiplexors. The MX330A-C and MX330A-D are connected by fiberoptic cable. A coaxial or twisted-pair cable (Type 1, 2, 6, or 9) can be connected instead of the fiberoptic cable or as a cold backup line. The MX330A-C accepts up to four 3174 or 3274 coaxial lines and combines them into a single multiplexed output on fiberoptic, coax or twisted-pair cable. The MX330A-D provides one-to-four demultiplexing. Each line is connected to an 8-port multiplexer.

This configuration allows a maximum total distance between controller and device of 7.5 km (see Figure 2-3). To extend drive distance, an additional multiplexor can be connected between the MX330A-C and MX330A-D.

NOTE

Maximum distance is subject to controller timeout. For maximum distance calculations, see Section 2.4.1.

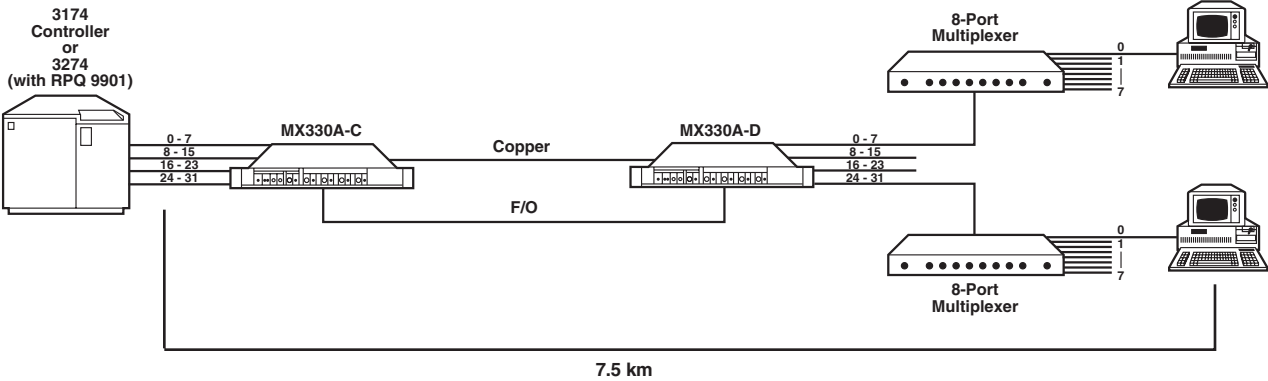


Figure 2-3. Configuration 1 Using the MX330A-C and MX330A-D.

Configuration 2:

This configuration consists of the MX330A-C and an IBM 3299/32 thirty-two port terminal multiplexer connected by a coaxial or twisted-pair cable (Type 1, 2, 6, or 9).

NOTE

This configuration does not support fiberoptic connection.

The MX330A-C accepts up to four 3174 or 3274 coaxial lines and combines them into a single multiplexed output on coax or twisted-pair cable. This output is received by the IBM 3299/32, which provides 1-to-32 demultiplexing. Each port is connected to a device.

This configuration allows a maximum total distance between controller and device of about 2.8 miles (4.5 km)—see Figure 2-4.

NOTE

Maximum distance is subject to controller timeout. For maximum distance calculations, refer Section 2.4.2.

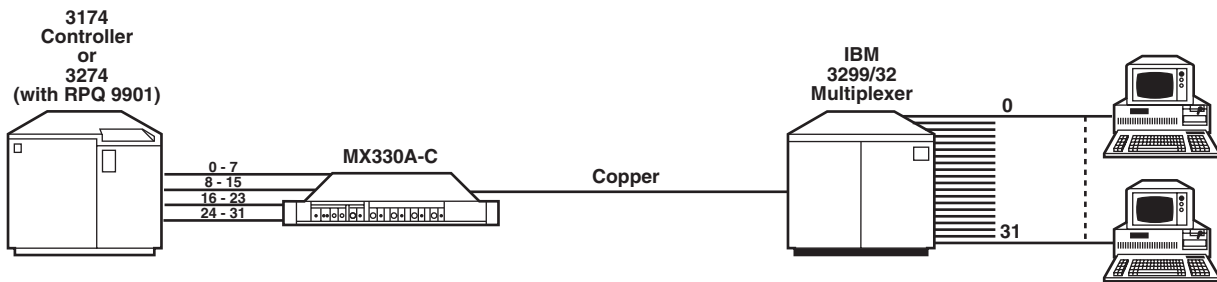


Figure 2-4. Configuration 2 Using the MX330A-C.

2.4 Controller-to-Terminal Distance Limitations

The IBM controller has a timeout value after transmitting a message to a terminal. If the response from the terminal is not received within this timeout, the controller ignores it and sends the message to the next terminal.

2.4.1 DELAY CALCULATIONS FOR CONFIGURATION 1

The round-trip propagation time is equal to twice the time it takes the signal to travel from the controller (T_c) through segments X1, X2, X3, and X4, and through multiplexers T1, T2, and T3, plus terminal response time (see Figure 2-5).

Maximum cable length is calculated as follows:

$$X1+X2+X3+X4 = [\text{Controller Timeout} - (T_c+T1+T2+T3+\text{Terminal Delay})] \times \text{Signal Propagation} \div 2.$$

When:

$$\text{Controller Timeout} = 3174 - 50 \mu\text{sec} \\ 3274 - 56 \mu\text{sec}$$

$$\text{Data Rate} = 424 \text{ nsec/bit}$$

$$T_c \text{ (Controller Delay Time)} = \\ 3174 - 3.5\mu\text{sec (8-bit start sequence)} \\ 3274 - 24\mu\text{sec (24-bit + 32-bit data stream)}$$

$$T1 \text{ (MX330A-C Delay time)} = \\ 8\text{-bit inbound, 8-bit outbound (6.78 } \mu\text{sec)}$$

$$T2 \text{ (MX330A-D Delay time)} = \\ 16\text{-bit inbound, 8-bit outbound (10.1 } \mu\text{sec)}$$

$$T3 \text{ (Multiplexor Delay time)} = \\ 16\text{-bit inbound, 8-bit outbound (10.1 } \mu\text{sec)}$$

$$\text{Terminal Delay (IBM max.)} = 5.5 \mu\text{sec.}$$

$$\text{Signal Propagation} = 200 \text{ m}/\mu\text{sec}$$

Applications using cable exceeding the maximum calculated length require changing the controller timeout. Timeout can be increased to 98 μsec or 200 μsec using an RPQ diskette, which can be ordered from IBM.

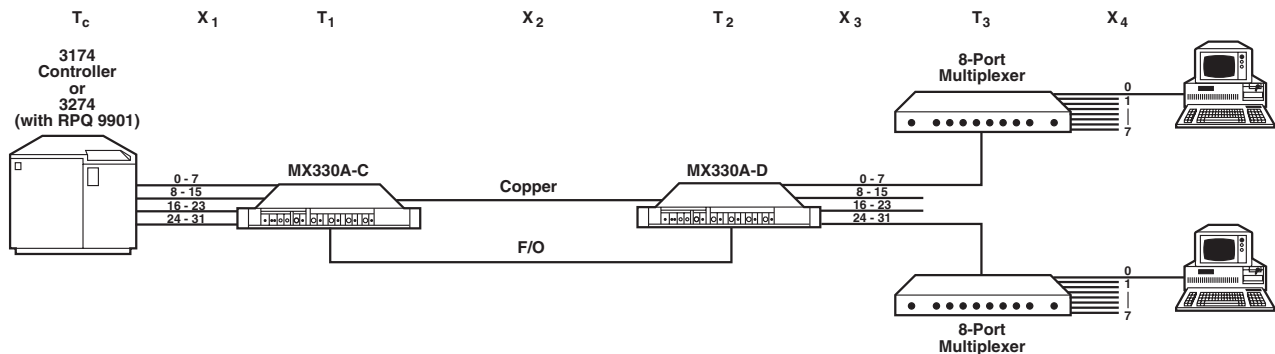


Figure 2-5. Delay Calculations for Configuration 1.

2.4.2 DELAY CALCULATIONS FOR CONFIGURATION 2

The round-trip propagation time is equal to twice the time it takes the signal to travel from the controller (T_c) through segments X1, X2, and X3, and through multiplexers T1 and T2, plus terminal response time (see Figure 2-6).

Maximum cable length is calculated as follows:

$$X1+X2+X3 = [\text{Controller Timeout} - (T_c + T1 + T2 + \text{Terminal Delay})] \times \text{Signal Propagation} \div 2.$$

When:

$$\text{Controller Timeout} = \begin{matrix} 3174 - 50 \mu\text{sec} \\ 3274 - 56 \mu\text{sec} \end{matrix}$$

$$\text{Data Rate} = 424 \text{ nsec/bit}$$

$$T_c \text{ (Controller Delay Time)} = \begin{matrix} 3174 - 3.5 \mu\text{sec (8-bit start sequence)} \\ 3274 - 24 \mu\text{sec (24-bit + 32-bit data stream)} \end{matrix}$$

$$T1 \text{ (MX330A-C Delay time)} = \begin{matrix} 8\text{-bit inbound, 16-bit outbound (6.78 \mu\text{sec})} \end{matrix}$$

$$T2 \text{ (MX330A-D Delay time)} = \begin{matrix} 19\text{-bit inbound, 13-bit outbound (13.56 \mu\text{sec})} \end{matrix}$$

$$\text{Terminal Delay (IBM max.)} = 5.5 \mu\text{sec}.$$

$$\text{Signal Propagation} = 200 \text{ m}/\mu\text{sec}$$

Applications using cable exceeding the maximum calculated length require changing the controller timeout. Timeout can be increased to 98 μsec or 200 μsec using an RPQ diskette, which can be ordered from IBM.

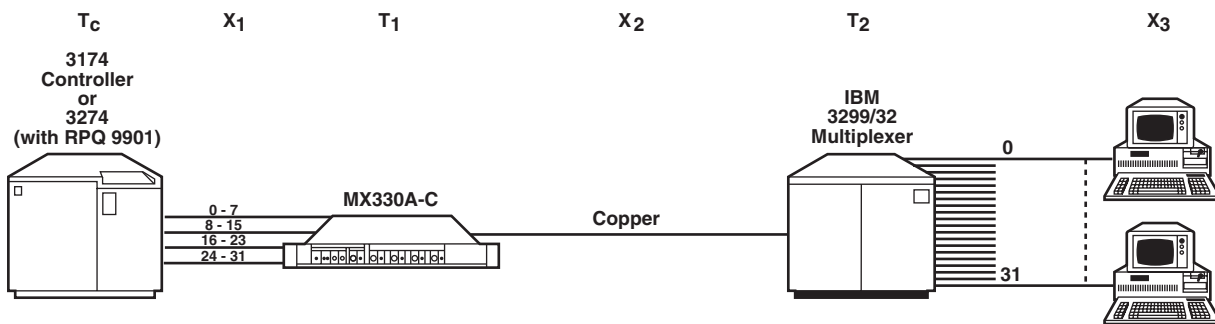


Figure 2-6. Delay Calculations for Configuration 2.

3. Installation

3.1 Connection to the Controller

Connect coaxial cables or twisted-pair cables (Type 1, 2, 6, or 9) between the IBM 3174 or 3274 controller terminal ports and the four controller ports 0 to 3, on the MX330A-C front panel.

NOTE

The maximum drive distance for copper cable is 1.5 km on coax cable and 1.2 km on Type 1 cable. For maximum cable length, see Section 2.4.

Distance characteristics are affected by cable type. Cable types 6 and 9 have higher attenuation than types 1 and 2.

Controllers equipped with BNC connectors, instead of DPC, require the use of red baluns. For each red balun, subtract 100 m.

3.2 Fiberoptic Connection (Configuration 1 Only)

Connect the fiberoptic cable between the TX and RX connectors of the MX330A-C and the fiberoptic TX and RX connectors of the MX330A-D.

WARNING

Fiberoptic connectors contain LEDs which can cause irreversible eye damage if inspected with a magnifying lens or too closely with a naked eye.

Covers must be kept on any fiberoptic ports that are not used.

CAUTION

For all fiberoptic connections, use only the ST® connectors supplied with the units. The use of other connectors may damage the LEDs.

NOTE

Fiberoptic connector pairs between the units must be connected crosswise (TX to RX, or RX to TX).

3.3 Copper Connection

NOTE

The maximum drive distance for copper cable is 1.5 km on coax cable and 1.2 km on Type 1 cable. For maximum cable length go to Section 2.4.

Distance characteristics are affected by cable type. Cables Type 6 and 9 have higher attenuation than Types 1 and 2.

3.3.1 COPPER CONNECTION FOR CONFIGURATION 1

Connect the coax or twisted-pair cables (Types 1, 2, 6, or 9) between the COPPER DPC connector of the MX330A-C and the COPPER DPC connector of the MX330A-D.

3.3.2 COPPER CONNECTION FOR CONFIGURATION 2

Connect the coax or twisted-pair cable (Type 1, 2, 6, or 9) between the COPPER DPC connector of the MX330A-C and the copper connector of the IBM 3299/32.

3.4 Slide Switch Setting

Set the slide switch on the unit's rear panel to the COPPER or FIBER position, according to the cabling you used.

3.5 Connecting to a Power Source

NOTE

The units' power supply adjusts automatically for operation in the 105 VAC to 230 VAC range.

Connect an appropriate power plug to the three power cable wires:

- Connect the brown wire to the live terminal.
- Connect the blue wire to the Neutral terminal.
- Connect the green/yellow wire to the Ground terminal.

Connect the unit to the power source. Turn the power switch on the unit's rear panel to ON. Make sure the POWER LED lights. If the POWER LED does not light, go to Chapter 5.

4. Operation

After installation, the units should operate unattended. The operational status of the unit is indicated by the LEDs on the front panel.

The front panel of the MX330A-C is shown in Figure 4-1, and the functions of the front panel components are explained in Table 4-1.

The front panel of the MX330A-D is shown in Figure 4-2, and the functions of the front panel components are explained in Table 4-2.

The rear panels of the units are identical, as shown in Figure 4-3. The functions of the rear-panel components are explained in Table 4-3.

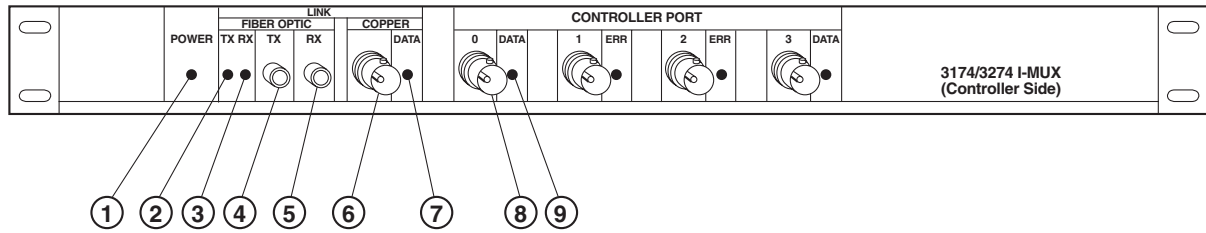


Figure 4-1. Front Panel of the MX330A-C.

Table 4-1. Front-Panel Components of the MX330A-C.

NUMBER	DESCRIPTION	FUNCTION
1	POWER LED (Red)	Lights when the MX330A-C is receiving power.
LINK		
2	F/O TX LED (Green)	Lights during data transmission through the fiberoptic channel.
3	F/O RX LED (Green)	Lights during data reception through the fiberoptic channel.
4	F/O TX Connector	Fiberoptic transmission connector.
5	F/O RX Connector	Fiberoptic reception connector.
6	COPPER Connector	Female DPC output to MX336A-C or IBM 3299/32.
7	DATA Indicator	Lights during data transmission through the copper channel.
CONTROLLER PORT		
8	Controller Port Connector (0-3)	Female DPC input from 3174 or 3274 (with RPQ 9901).
9	DATA Indicator (0-3)	Lights when data signals from 3174 or 3274 are being received by the port.

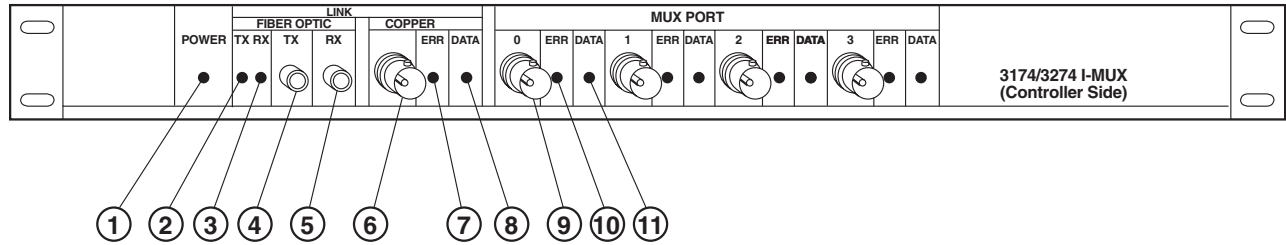


Figure 4-2. Front Panel of the MX330A-D.

Table 4-2. Front-Panel Components of the MX330A-D.

NUMBER	DESCRIPTION	FUNCTION
1	POWER LED (Red)	Lights when the MX330A-C is receiving power.
LINK		
2	F/O TX LED (Green)	Lights during data transmission through the fiberoptic channel.
3	F/O RX LED (Green)	Lights during data reception through the fiberoptic channel.
4	F/O TX Connector	Fiberoptic transmission connector.
5	F/O RX Connector	Fiberoptic reception connector.
6	COPPER Connector	Female DPC output to MX336A-C or IBM 3299/32.
7	ERR Indicator	Lights when there is a parity error in link input data.
8	DATA Indicator	Lights during data transmission through the copper channel.
MUX PORT		
9	DPC Connector	DPC connection to four terminal multiplexer units.
10	ERR Indicator (Red)	Lights when there is a parity error in MUX PORT input data.
11	DATA Indicator (Green)	Lights during data transmission through the MUX PORT channel.

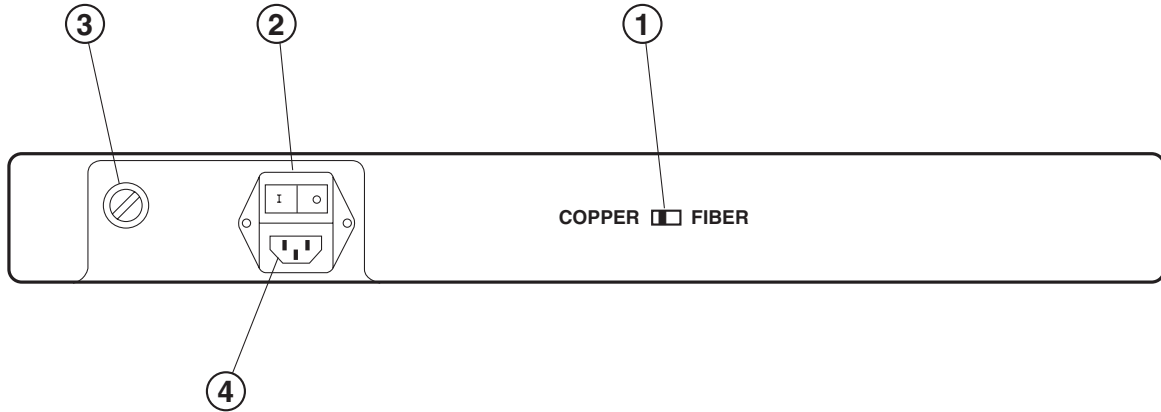


Figure 4-3. Rear Panel.

Table 4-3. Rear-Panel Components.

NUMBER	DESCRIPTION	FUNCTION
1	Fuse 0.5A, SloBlo	Overload protection.
2	Power Socket	Connection to AC power source.
3	POWER Switch	Turns power on/off: I = ON, O = OFF.
4	COPPER/FIBER Slide Switch	Selects Fiberoptic or Copper (coaxial/twisted pair) mode. The switch is slightly recessed to prevent accidental switching.

5. Troubleshooting

The troubleshooting procedures in this chapter are arranged according to system configuration.

5.1 Configuration 1

In Configuration 1, you have fiberoptic and/or copper cable connecting the MX330A-C to the MX330A-D.

NOTE

If you change the position of a slide switch or disconnect and then reconnect a cable during operation, an abnormal indication results. Make sure that at least one terminal connected to each terminal multiplexor is on-line and active.

5.1.1 GENERAL MALFUNCTIONS

All LEDs are off except for the power LED.

- *The controller is turned off or not operating properly.* Make sure the controller is on and functional.
- *Faulty copper link between the controller and the MX330A-C.* Check the copper cables and connectors between the controller and the MX330A-C. Be sure the cable length does not exceed the maximum length.

One or more of the four controller port DATA LEDs in use is off.

- *Faulty port connection.* Check the copper cable and connectors between the controller and the MX330A-C. Be sure that at least one terminal connected to each terminal multiplexor is on-line and active.

5.1.2 FIBEROPTIC AND COPPER CONNECTION BETWEEN THE MX330A-C AND MX330A-D

NOTE

The slide switches on both units must be in the same position, according to the operating mode (F/O or COPPER).

The slide switch is set to F/O, but the F/O TX LED is off.

- *Replace the MX330A-C unit.*

The F/O TX LED is on and the RX LED is off.

- *There is a faulty fiberoptic link between the MX330A-C and MX330A-D.* Check the connection between the units. Be sure the cable length is not over the maximum length and at least one terminal connected to each multiplexor is on-line and active.

The slide switch is set to COPPER and the COPPER LED is off.

- *There is a faulty copper link between the MX330A-C and MX330A-D.* Check the copper connection between the units. Be sure the cable length is not over the maximum length and at least one terminal connected to each multiplexor is on-line and active.
- Check the copper cables and connectors between the MX330A-D and the terminal multiplexors. Be sure the cable length is not over the maximum length and at least one terminal connected to each multiplexor is on-line and active.

5.1.3 FIBEROPTIC CONNECTION BETWEEN THE MX330A-C AND MX330A-D.

TX and RX LEDs are off.

- *Incorrect slide-switch setting.* Set the slide switch on the MX330A-C and MX330A-D to the FIBER position. Make sure at least one terminal connected to each multiplexer is on-line and active and that the cabling does not exceed the maximum length.

If the problem continues, replace the MX330A-C.

Only the TX LED lights.

- *Incorrect slide switch setting.* Set the slide switch on the MX330A-D to FIBER and make sure at least one terminal connected to each terminal multiplexer is on-line and active.
- *The MX330A-C fiberoptic cable transmission line is disconnected.* Check the F/O RX LED on the MX330A-D. If it is off, check the MX330A-C cable transmission line and connectors. Make sure at least one terminal connected to each terminal multiplexer is on-line and active.
- *The AMP MX330A-D is faulty.* Verify that the F/O TX LED on the MX330A-D lights. If not, check segments T2, X3, T3, and X4. Make sure the terminals are turned on and operating properly.
- *The MX330A-C fiberoptic cable reception line is disconnected.* Check the TX LED on the MX330A-D. If it is on, check the MX330A-C fiberoptic cable reception line and connectors. Make sure at least one terminal connected to each terminal multiplexer is on-line and active.

5.1.4 COPPER CONNECTION BETWEEN THE MX330A-C AND MX330A-D.

TX LED lights

- *Incorrect slide-switch setting.* Set the slide switches on the MX330A-C to COPPER. Make sure at least one terminal connected to each terminal multiplexer is on-line and active.

5.2 Configuration 2

In this configuration, you connect copper cable between the MX330A-C and the IBM 3299/32.

NOTE

If you change the position of a slide switch or disconnect and then reconnect a cable during operation, an abnormal indication results. Make sure that at least one terminal connected to the IBM 3299/32 is on-line and active.

All LEDs are off except for the Power LED.

- *The controller is turned off or is not operating properly.* Check that the controller is turned on and functional.
- *There is a faulty copper link between the controller and the MX330A-C.* Check the copper cables and connectors between the controller and the MX330A-C. Make sure that at least one terminal connected to the IBM 3299/32 is on-line and active.

One or more of the four controller port DATA LEDs is off.

- *Faulty port connection.* Check the copper cable and connectors of the corresponding port between the controller and the MX330A-C. Make sure the terminals connected to the IBM 3299/32 are on-line and active.

The MX330A-C copper link DATA LED is off.

- *Incorrect slide-switch setting.* Set the slide switch on the MX330A-C to COPPER. Make sure the terminal connected to the IBM 3299/32 at one of the addresses corresponding to the controller port is on-line and active.
- *There is a faulty copper link between the MX330A-C and the IBM 3299/32.* Check the copper connection between the MX330A-C and the IBM 3299/32. Make sure the terminal connected to the IBM 3299/32 at one of the addresses corresponding to the controller port is on-line and active.

If you have followed the troubleshooting steps above and the problem persists, contact Black Box.



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