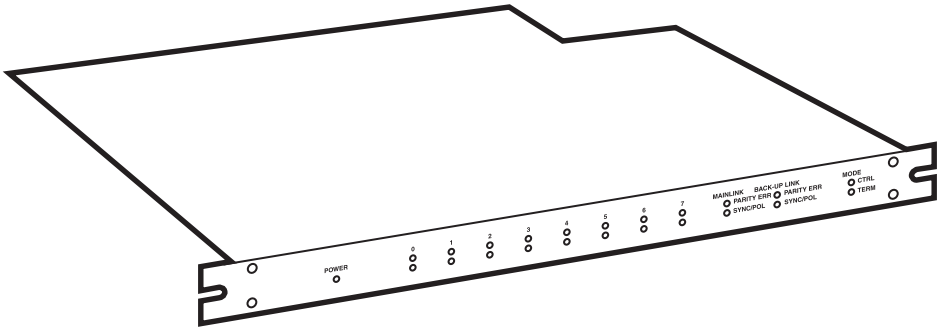
BLACK BOX®
NETWORK SERVICES

JULY 2001
IC092C
IC093C

Twin Mux Repeater Module – UTP
Twin Mux Repeater Module – Fiber



CUSTOMER SUPPORT INFORMATION

Order **toll-free** in the U.S.: Call **877-877-BBOX** (outside U.S. call **724-746-5500**)
FREE technical support 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mailing address: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
Web site: **www.blackbox.com** • E-mail: **info@blackbox.com**

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

Environment: IBM System 34/36/38 and AS/400

Devices: IBM System 3X-AS/400 controllers and compatible peripherals (such as system terminals and printers, etc.)

Data Rate: Signal Frequency: 1 MHz ± 3.69%

Cable: *Fiber*: Dual Fiber, Multimode graded index: Core/clad: 62.5/125 µm
Numerical aperture: 0.275
Attenuation: 4.5 dB/km (850 nm)
Minimum bandwidth: 160 MHz-km (850 nm)
UTP: 24 AWG (or 22 AWG) solid copper, unshielded twisted pair:
Impedance: 100 ohms at 1 MHz
Max. capacitance: 20 pF/foot
Max. attenuation: 7.5 dB/1000 feet at 1 MHz
STP: 24 AWG (or lower) shielded twisted pair:
Impedance: 100 ohms at 1 MHz
Max. capacitance: 15 pF/foot
Avg. attenuation: 6.3 dB/1000 feet at 1 MHz

Connectors: (Reverse-polarity sensitive): Ctrl/Term ports: (8) shielded RJ-45 jacks Main Link port: (1) shielded RJ-45 or (2) fiber ST®
Back-up Link port: (1) shielded RJ-45 or (2) fiber ST
(Connectors are located on the back panel)

Pin Configurations: Default setting RJ-45 Pins 4 and 5; hardware-selectable for RJ-45 pins 1 and 2 via on-board jumpers

Switches: 2-position DIP switch, controlling: RJ-45 pin polarity and Ctrl/Term Mode located on module board

LEDs (Status and Diagnostics): (1) Green Power LED, (8) Green Line Sync/Polarity LEDs for Ctrl/Term ports. (2) Green Line Sync/Polarity LEDs for Link ports (Main and Backup); (8) Red Parity Error LEDs for Ctrl/Term ports; (2) Red Parity Error LEDs for Link ports (Main and Back-Up); (1) Green Term Mode LED; (1) Green Ctrl Mode LED;
(All LEDs are located along the front panel)

Distances: Ctrl distance: 2000 feet (610 m), Term distance (daisy-chain): 700 feet (213 m) to 2000 feet (610 m), Term distance (star-config.): 2000 feet (610 m), Link distance: 2500 feet (762 m); 8200 feet (2500 m) (with Fiber)Distances are calculated using Category 3 cable as specified above. Category 4 or 5 cable should improve distance performance by 5% (depends on the number of workstations attached [see balun specifications], but can not exceed 2000 feet [610 m])

Transmission: Unit is transparent to controller and workstations. The output signal is repeated in both directions

Temperature: *Operating*: 32 to 104°F (0 to 40°C), *Storage*: -40 to +185°F (-40 to +85°C)

Humidity: Up to 95% noncondensing.

Power Consumption: 4.3W. +5VDC/500 mA, -12VDC/150 mA

Chassis Interface: DIN 41612 connector

Size: IC092C: 15"H x 1.2"W x 11.5"D (38.1 x 3.1 x 29.2 cm); IC093C: 15"H x 1.2"W x 12"D (38.1 x 3.1 x 30.1 cm)

Weight: 2.1 lb. (0.95 kg)

2. Introduction

The Twin Mux Repeater Module is a hot-swappable 8-port multiplexor for the Power Cage 500 Solution (RM601A) for use in the IBM® S/3X or AS/400® environment.

The Twin Mux Repeater Module lets you combine eight host ports over one fiber, UTP, or STP cable pair for more cost-effective cabling installations. Distances of up to 2500 feet (762 m) via UTP or 8200 feet (2500 m) via fiber may be achieved between one Twin Mux Repeater Module and another. Up to eight Twin Mux Repeater Modules may be housed in one Power Cage for a total of 64 host ports.

True repeater technology restores signal timing, amplitude, and frame information damaged by other peripherals. Because its a repeater, the Twin Mux Repeater Module can be cascaded with other booster or repeater-based products.

For added security, the Twin Mux Repeater Module has a redundant multiplex port that may be used as a backup in case of a link failure. If the primary link fails, the second port maintains communication without disrupting the users.

The Twin Mux Repeater Module can be configured as a controller-side multiplexor/demultiplexor (Ctrl Mode) or as a workstation-side multiplexor/demultiplexor (Term Mode) via DIP-switch control.

The Twin Mux Repeater Module integrates seamlessly with the Multiple Twinax Repeater III (IC106C) star wiring hub for total cabling solution. Or, it can allow seven workstations to be daisychained to each of the eight workstation ports of the terminal-side Twin Mux Repeater Module. One pair of modules can support up to forty AS/400 twinax devices via a single cable pair.

The Twin Mux Repeater Module automatically checks polarity and line sync. LED diagnostics indicate if a true IBM System 3X or AS/400 signal is received in the correct polarity, and also analyzes the data on the line to check for parity errors.

The Twin Mux Repeater Module may be used with patch panels, punchdown blocks, and other premise-wiring products for improved cable management.

Features

- Hot-swappable 8-port multiplexor.
- Same unit can be used on controller or workstation side (switch-selectable).
- Doubles the distance between each workstation and the controller.
- True repeater technology; bi-directional.
- Data amplitude, timing and duty cycle corrected to remove jitter.
- Missing frame sync bits at the input side are regenerated on the output side.
- Supports cascading with Multiple Twinax Repeater III.
- Supports a star configuration on the workstation side with Multiple Twinax Repeater III.
- Supports daisy-chaining on workstation side.
- Compatible with System 3X or AS/400 controllers and workstation terminals/printers operating at 1 MHz, including 3196, 3476 and others operating at 1.0368 MHz.
- Controller/workstation ports use RJ-45 for ease of connection.
- Fiber or RJ-45 available on the link port.
- Reverse polarity supported via DIP switch on module board.
- Shielded RJ-45 connectors supports UTP and STP cable.
- Standard RJ-45 pins 4 and 5 configuration. May be modified to pins 1 and 2 via on-board jumpers.
- Redundancy feature on the link port (Main and Backup).
- Power-on self-test.
- Power LED.
- Line Sync/Polarity LED on each controller (Ctrl), workstation (Term) and link port.
- Status Ctrl/Term Mode LEDs.

- Diagnostic Parity Error LED on each controller (Ctrl), workstation (Term) and link ports.
- Intelligent Line Sync/Polarity LEDs will light only for a true IBM System 3X or AS/400 signal received in the correct polarity.
- Intelligent Parity Error LEDs will light only if the signal frame is OK (Line Sync and Polarity OK). Parity errors are detected in the incoming signal data and address portions.
- High cross-talk rejection margin.
- Short-circuit protection.
- Ctrl/Term and Link connections on rear panel for neater wiring with Multiple Twinax Repeater III.

3. Installation

3.1 Basic Installation

Follow the steps below to properly install the Twin Mux Repeater Module.

NOTE

The RJ-45 connectors of the Twin Mux Repeater Module are designed for use with (part number IC065) 3X or AS/400 baluns. If you use other balun, you might have to reverse the polarity of the Twin Mux Repeater Module via the polarity DIP switch.

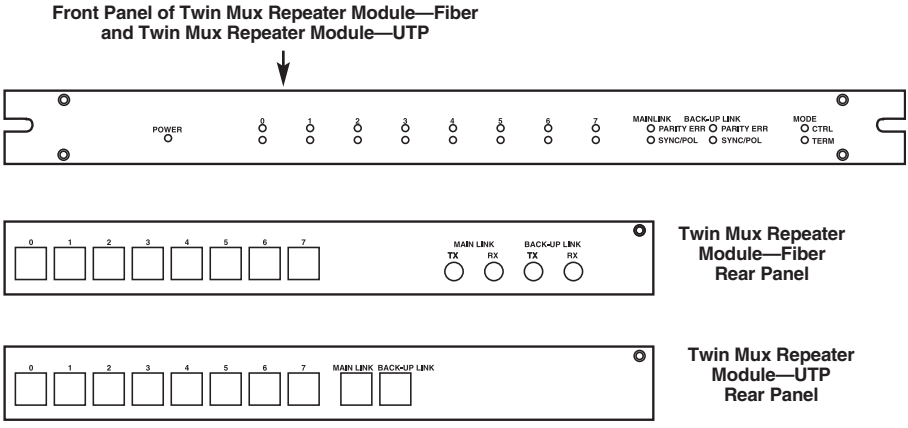


Figure 3-1. Front and Rear Panels of the Twin Mux Repeater Modules.

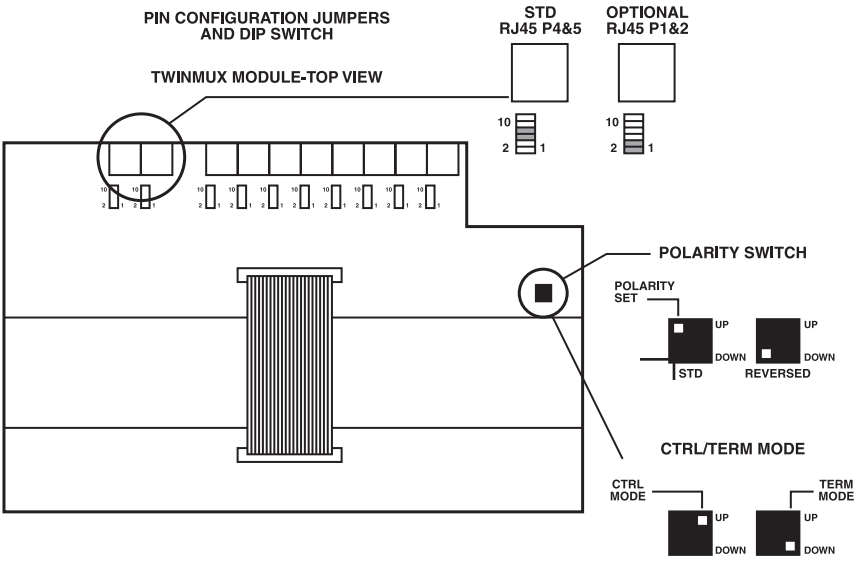


Figure 3-2. Pin Configuration Jumpers and DIP Switch.

3.1.1 Pin Configuration

You can change the pin configuration via the jumper switches on the printed circuit board. The pin configuration of each RJ-45 connector is factory-set to RJ-45 pins 4 and 5. In order to set the pin configuration to pins 1 and 2, move the jumper located beside each RJ-45 connector to the "1 and 2" position as shown in the Figure 3-2.

3.1.2 Polarity Switch

The Twin Mux Repeater Module is polarity-sensitive and is factory-set to work with IC065 twinax baluns. If the Twin Mux Repeater Module is used with baluns or star-hubs that have signal polarity opposite to that used by IC065 baluns, then the signal polarity of the Twin Mux Repeater Module may need to be reversed using the Polarity DIP switch on the module board. To change the polarity of the Twin Mux Repeater Module, set the left-hand DIP switch on the module board to the appropriate position with a narrow pointed instrument, as shown in Figure 3-2.

3.1.3 Ctrl/Term Mode Switch

The Ctrl/Term Mode Switch sets the Twin Mux Repeater Module to operate as a controller-side multiplexor (closest to the 3X or AS/400) or as a terminal-side de-multiplexor (closest to the workstations). The unit is preset at the factory to the Ctrl Mode (UP position). To change the mode of the Twin Mux Repeater Module, set the right-hand DIP switch on the module board to the appropriate position with a narrow pointed instrument, as shown in Figure 3-2.

3.1.4 Location Selection

Install the Power Cage and Power Supply Module(s) in its final location. For detailed instructions, please see the Power Cage user's manual. The location should be within the maximum distance specifications for the Twin Mux, as explained below:

Fiber Link Versions Only

Select a location for the Ctrl Twin Mux Repeater Module within 8200 feet (2500 m) of the Term Twin Mux Repeater Module. These distances assume that the cable used conforms to the fiber cable specifications given in **Chapter 1**.

RJ-45 Link Versions Only

Select a location for the Ctrl Twin Mux Repeater Module within 2500 feet (762 m) of the Term Twin Mux Repeater Module. These distances assume that the cable used conforms to the cable specifications given in **Chapter 1**.

Ctrl Twin Mux Repeater Module

Select a location for the Ctrl Twin Mux Repeater Module within 2000 feet (610 m) of the controller.

Term Twin Mux Repeater Module with Daisychain

The distance between each terminal and the Term Twin Mux Repeater Module varies with the number of daisy-chained terminals. Consult the table below or refer to the balun distance specifications and then select an appropriate location for the Term Twin Mux Repeater Module for each terminal, but do not exceed 2000 feet (610 m).

NOTE

Remember to only terminate the last terminal in the chain on each Term Twin Mux Repeater Module port.

Table 3-1. Distance Between Each Terminal and the Term Twin Mux Repeater.

Wire Gauge	Number of Terminals						
	1	2	3	4	5	6	7
24	2000' (610 m)	2000' (610 m)	2000' (610 m)	2000' (610 m)	1500' (457 m)	1200' (366 m)	700' (213 m)

Term Twin Mux Repeater Module with Star Configuration

Select a location for the Term Twin Mux Repeater Module within 2000 feet (610 m) of the Multiple Twinax Repeater III. The workstations can be up to 2500 feet (762 m) away from the Repeater III in a star configuration.

NOTE

Remember to terminate all the terminals and printers after the Multiple Twinax Repeater III.

These distances assume that the cable used conforms to the cable specifications given in **Chapter 1**.

Keep the Twin Mux Repeater Module away from sources of radio-frequency or electromagnetic radiation:

1. 5 inches (13 cm) from power lines of 2 KVA or less.
2. 12 inches (31 cm) from fluorescent lighting and power lines between 2 and 5 KVA.
3. 36 inches (92 cm) from power lines greater than 5 KVA.
4. 40 inches (1 m) from transformers and motors.

3.1.5 Installing the Twin Mux Repeater Module in the Power Cage

The Power Cage holds up to eight hot-swappable repeater modules and is shipped from the factory with one open repeater module slot. The remaining slots have blank panels in the front and rear to keep out dust and for optimum cooling-fan efficiency.

To install a repeater module, follow the steps below:

1. Remove the front and back blank plate of the chassis slot you will use.
2. Gently insert the repeater module in between the plastic guide rails that are on the inner sides of the chassis. Push the module firmly in, causing the board to mate with the power connector on the chassis backplane. Turn the two repeater-module fastening knobs to secure the module in place.

Since the repeater modules are hot-swappable, the power may be on while inserting or removing the modules. If the power is on, the green power LEDs of the hub modules and power-supply modules should be ON.

3. Attach the required cables to the back of the repeater modules.

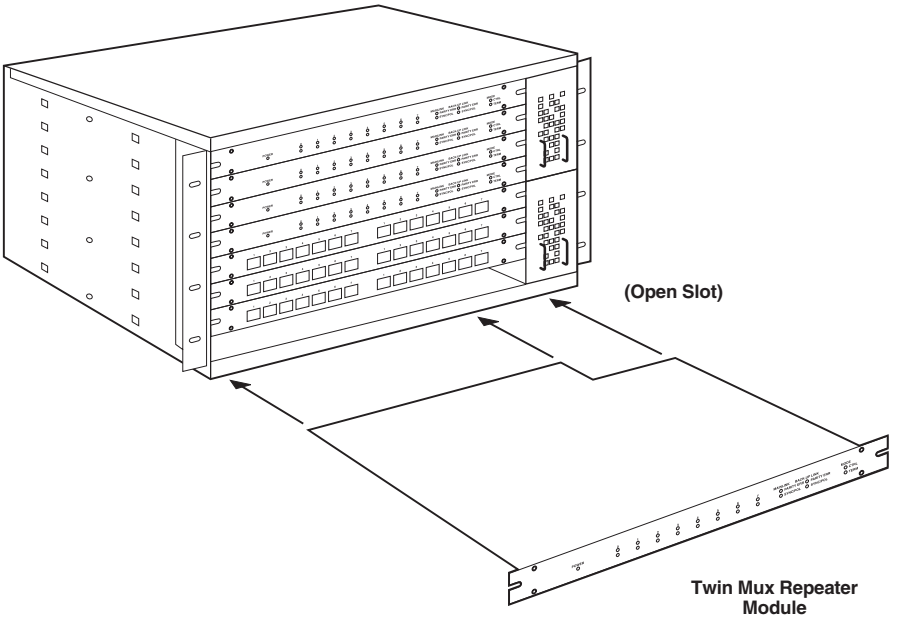


Figure 3-3. Installing the Twin Mux Repeater Module.

3.1.6 Wiring and Polarity Switch Setting

Select a twinax balun with the same pin configuration as the Twin Mux Repeater Module. When using IC065 baluns, the modular cable must use straight through polarity (i.e., pin 4 on one end to pin 4 on the other, pin 5 to pin 5, etc.). Remember that other baluns may have a polarity opposite to IC065 baluns, so you might need to set the Twin Mux Repeater Module polarity DIP switch (Pol) to reverse polarity (DOWN position) to compensate.

Before connecting the cables, keep the maximum cable lengths above in mind. Note that every connection is equivalent to 10 feet (3 m) of cable. This must be included when you calculate the maximum cable length. If you are not sure of your cable length, you can estimate it by performing a DC resistance test with a digital ohmmeter. 1000 feet (305 m) of cable should give a reading of approximately 26 ohms (or 52 ohms back and forth, if you are measuring at one end with the opposite cable ends shorted).

Avoid using 50- and 100-pair cable when trying to achieve optimum performance, since it may add to cross-talk and capacitance problems.

Never use flat cable (cable that is not twisted, sometimes referred to as silver satin), not even for patching short runs. Flat cable will act as an antenna and pick up nearby radio-frequency or electromagnetic radiation interference that cannot be removed.

3.1.7 Verifying

Verify that the controller and workstations (terminals, printers etc.) are properly connected together, but do not connect them to the Twin Mux Repeater Module just yet.

Plug the Power Cage into the nearest AC power outlet (100 to120 VAC for North America or 220 to 240 VAC for Europe). The Power LED should light up and stay ON, while the Line Sync/Polarity and Parity Error LEDs light up only briefly during a power-on self-test, assuming the Twin Mux Repeater Module Ctrl/Term ports are not connected at this time. Both Mode LEDs should light up during the power-on self-test. After the test, only one LED will stay ON.

3.1.8 Controller Connections

Connect each of the cables coming from the eight controller ports to the back of the Ctrl Twin Mux Repeater Module ports marked "0" through "7." If the controller end of the cable is also connected, then the corresponding green port "Line Sync/Polarity" LEDs in the front of the unit should flicker ON at the poll frequency.

The polling frequency may vary depending on the controller and its configuration. These LEDs may light up and stay ON, indicating a high poll rate, or may flash once in a while, indicating a low poll rate. If any of the red port "Parity Error" LEDs light up or any of the connected green port "Line Sync/Polarity" LEDs do not light up, please refer to **Chapter 4**.

NOTE

All controller connections must come from the same controller. Do not bring signals from two or more controllers into the same Twin Mux Repeater Module; this will not work.

3.1.9 Link Connections

Connect the Main and Backup Links of the Ctrl Twin Mux Repeater Module to the Term Twin Mux Repeater Module. Begin by connecting the Main Link first. If the controller end of the cable is also connected, then the corresponding green Main Link "Line Sync/Polarity" LED in the front of the Term Twin Mux Repeater Module unit should flicker ON at the poll frequency. Next connect the Backup Link of the two Twin Mux Repeater Module units.

You can test whether or not the Backup Link is functioning properly by temporarily disconnecting the Main Link on the Term Twin Mux Repeater Module unit and verifying that its green Back-Up Link "Line Sync/Polarity" LED lights at the poll rate. Remember to reconnect the Main Link. If the red Main Link "Parity Error" LED on the Term Twin Mux Repeater Module lights up, or the connected green Main Link "Line Sync/Polarity" LED does not light up, please refer to **Chapter 4**.

NOTE

When connecting Fiber Twin Mux Repeater Module versions, connect the Main Link TX of the Ctrl Twin Mux Repeater Module to the Main Link RX of the Term Twin Mux Repeater Module, and likewise for the backup link. See the diagram below.

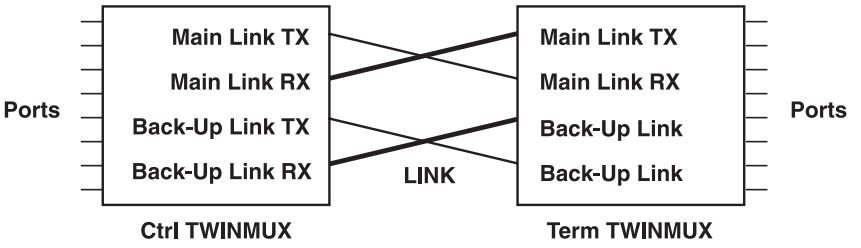


Figure 3-4. Connecting Fiber Link Versions.

NOTE

When both the Main and Backup Links are functioning properly, only the Main Link "Line Sync/Polarity" LED should be ON because it has priority. If the Main Link for some reason is inactive, then the Backup Link "Line Sync/Polarity" LED will come ON, indicating that a problem exists on the Main Link and that the Backup Link has taken over. This priority rule will be true only if the Main Link cable is no more than 50 feet (15.2 m) longer, in total length, than the Backup Link cable; otherwise the roles of the Main and Backup Links will be reversed.

To avoid this problem, keep the total cable lengths of the Main and Backup Links within 50 feet (15.2 m) of each other. If this is not possible, connect the shorter of the two link cables to the Main Link.

3.1.10 Workstation Connections

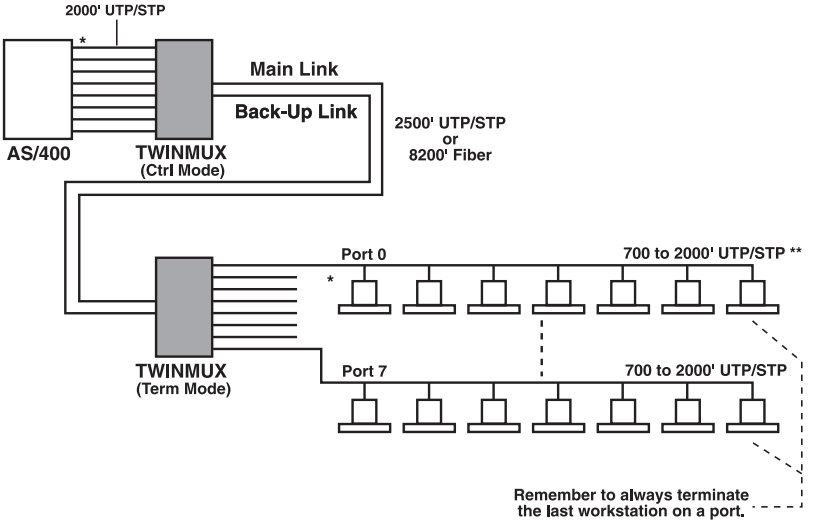
One at a time, connect the eight cables coming from the workstations or Multiple Twinax Repeaters to the back of the Term Twin Mux Repeater Module ports marked "0" through "7." If the controller, the Twin Mux Repeater Module units, and the workstations are all connected and powered ON, then the corresponding green Port "Line Sync/Polarity" LEDs in the front of the Term Twin Mux Repeater Module unit should light up and stay ON indicating that communication is established. The terminals should also display the sign-on screen.

The corresponding green Main Link "Line Sync/Polarity" LED in the front of the Ctrl Twin Mux Repeater Module unit should also light up and stay ON. If these green LEDs do not turn ON, or their corresponding red LEDs light up, please refer to **Chapter 4**.

NOTE

The LEDs flicker or turn ON whenever their corresponding ports are receiving a System 3X or AS/400 signal in the correct polarity (not based on transmission).

3.2 Typical Installations



* Baluns are used at each terminal and each controller port.

** Distances vary depending on the number of workstations (see the distance table in the INSTALLATION SECTION or refer to the balun specifications, but do not exceed 2000').

Figure 3-5. Daisychain Installation.

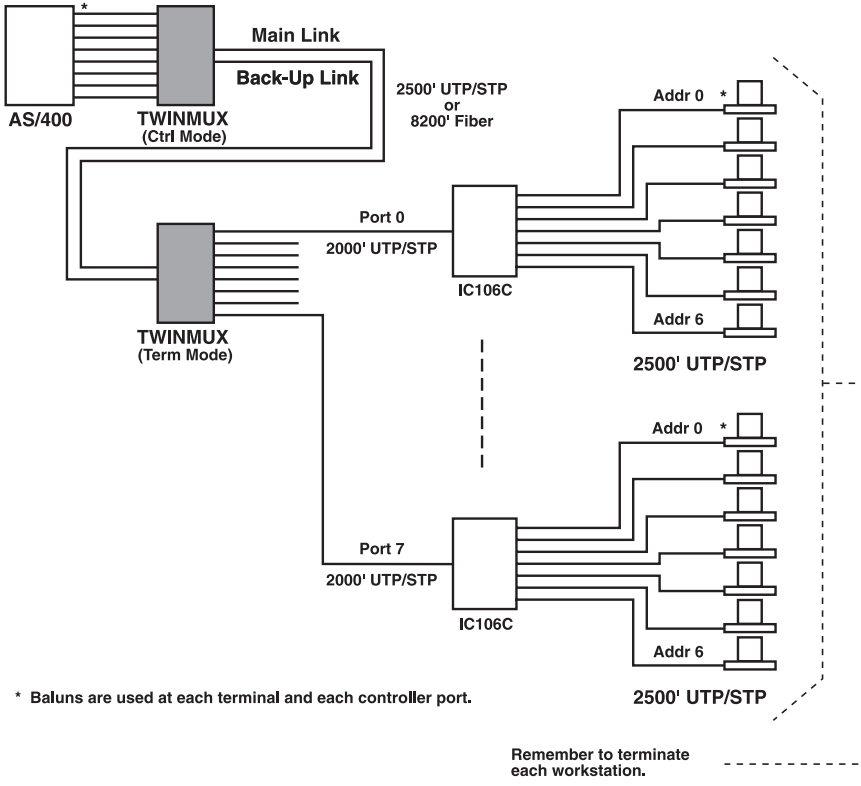


Figure 3-6. Star-Configuration Installation (Recommended).

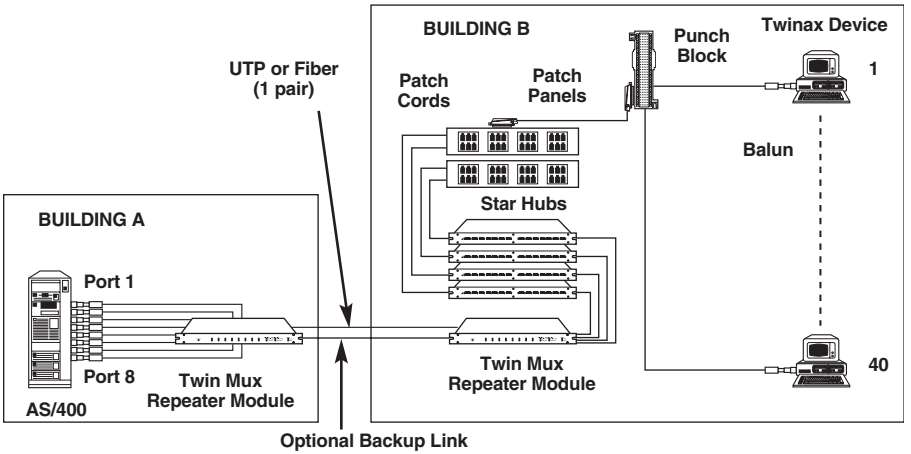


Figure 3-7. Optional Backup Link Configuration.

4. Troubleshooting

If any step in **Chapter 3** fails, please follow the procedures below before calling for assistance. If you still have trouble after following these suggestions, read the Technical Support Information at the end of this chapter before calling for technical support.

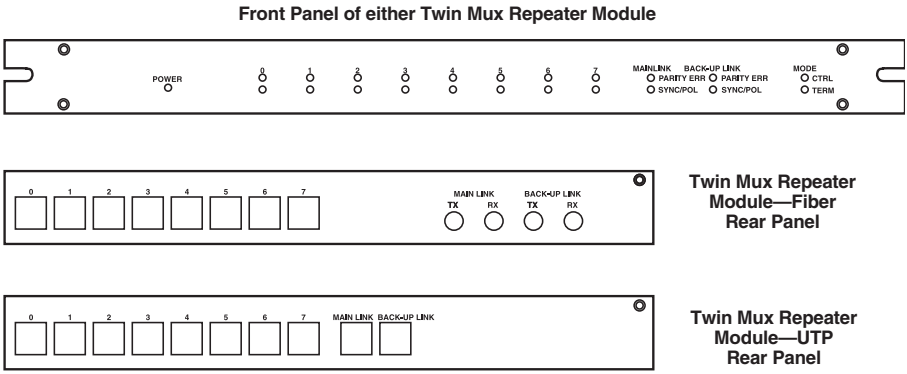


Figure 4-1. Twin Mux Repeater Modules (Front and Rear Views).

• Problem: The Power LED does not light.

• Solution:

1. Verify that the power cord is properly connected to the Power Cage.

2. Verify that the wallplate is live by plugging in some other powered device.

• Problem: Any of the Line Sync/Polarity LEDs, Mode LEDs, or Parity Error LEDs do not momentarily light up during the power-on self-test.

• Solution:

1. Verify that the power cord is properly plugged in and that the Power LED is ON. Keep in mind that the power-on self-test works only during the first few seconds after the power is turned ON. The LEDs may stay ON after the power-on self-test if the ports are connected and communicating. If the Link and Ctrl/Term ports are not connected, these LEDs should go OFF (except the Power LED and one of the Mode LEDs) once the power-on self-test has terminated.

2. Try removing the hub module, wait 5 seconds, then re-insert it and repeat the test.

• Problem: Any or all of the connected LINK or PORT "LINE SYNC/POLARITY" LEDs do not light up during normal operation (Link or Ports not communicating).

1. Verify that the Power LED is ON and that all the other LEDs are momentarily turned ON during the power-on self-test.

2. Verify that all the equipment is properly connected.

3. Do a continuity test of the cable—it may be cut somewhere.

4. Check that the Mode switch is correctly set; see **Chapter 3** for more details.

5. If you are daisychaining workstations, make sure that only the last terminal on each Term Twin Mux Repeater Module port is terminated. If you are using a star configuration, then each terminal after the Multiple Twinax Repeater III must be terminated.

NOTE

Different terminals terminate in different ways. Some have termination switches while others terminate via a self-terminating Twinax "T" or "Y" splitter cable. An improper termination setting can cause intermittent problems.

6. Verify that the balun pin-outs match that of the Twin Mux Repeater Module. Both the Twin Mux Repeater Module and the IC065 baluns should have an ohm-meter reading of less than 1 ohm across their active pins.

7. Verify that the pair of wires used are in fact twisted with each other and not with other wires (i.e., check for split pairs).

8. Verify that there are no bridge taps or T-splices along the cable runs.

9. Check that the cable distance limitations have not been violated. See **Chapters 1** and **3** for more details.

10. Make sure that the cable you are using conforms to the cable specifications given in **Chapters 1** and **3**. Also, follow the cabling guidelines provided in the **Chapter 3** to avoid cross-talk, etc.

11. When using the IC065 baluns, the modular cable should use straight through polarity cabling (pin 1 on one end to pin 1 on the other end, etc.). When not using IC065 baluns, the signal polarity may or may not have to be reversed depending on the balun used. If reverse polarity is required, continue to use straight-through cabling but reverse the signal polarity using the Twin Mux Repeater Module polarity switch (Pol), set it to the Reverse Polarity position.

• Problem:

a) The LINE SYNC/POLARITY LEDs are OK but the PARITY ERROR LEDs flash or stay ON (intermittent problems with ports), or

b) No more than 3 or 4 ports are working at any one time (adding a fifth port, for example, interferes with the others).

• Solution:

1. If you are daisychaining workstations, make sure that only the last terminal of each Term Twin Mux Repeater Module port is terminated. If you are using a star configuration, then each terminal after the Multiple Twinax Repeater III must be terminated.

NOTE

Different terminals terminate in different ways. Some have termination switches, while others terminate via a self-terminating Twinax "T" or "Y" splitter cable. Improper termination settings can cause intermittent problems.

2. Verify that the pair of wires used are in fact twisted with each other and not with other wires (i.e., check for split pairs).

3. Verify that there are no bridge taps or T-splices along the cable runs.

4. Check that the cable distance limitations have not been violated. See **Chapters 1** and **3** for more details.

5. Make sure that the cable you are using conforms to the cable specifications given in **Chapters 1** and **3**. Also, follow the cabling guidelines provided in **Chapter 3** to avoid crosstalk, etc.

• Problem: The Main and Backup Link "Line Sync/Polarity" LEDs light individually when only their respective Link is connected, but either the Backup Link functions or both the Main and the Backup Links function when both Links are connected.

1. When both Main and Backup Link cables are connected only the Main Link "Line Sync/Polarity" LED should be ON, see **Chapter 3** section for more details.

2. Keep the total cable lengths of the Main and Backup Link within 50 feet (15.2 m) of each other. If this is not possible then use the shorter of the two Link cables for the Main Link.

If after going through this chapter, you fail to resolve your problem and require further assistance, please call for technical support. Read the information on the next page.

Technical Support Information

When contacting Technical Support, please have the following information ready:

1. Unit type (fiber or copper version with pin-out information).
2. Balun type used.
3. Unit serial number.
4. Environment lay-out. Include controller and workstations used (with model numbers), estimated cable lengths (between what equipment) and type of cable used (UTP, STP, Flat, 25-pair, 50-pair or 100-pair).
5. Problem description.
6. List of tests performed.

FEDERAL COMMUNICATIONS COMMISSION
AND
CANADIAN DEPARTMENT OF COMMUNICATIONS
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 the Canadian Department of Communications.

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 le ministère des Communications du Canada.

TRADEMARKS

IBM® and AS/400® are registered trademarks of International Business Machines Corporation.

ST® is a registered trademark of American Telephone and Telegraph Company.

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

1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746