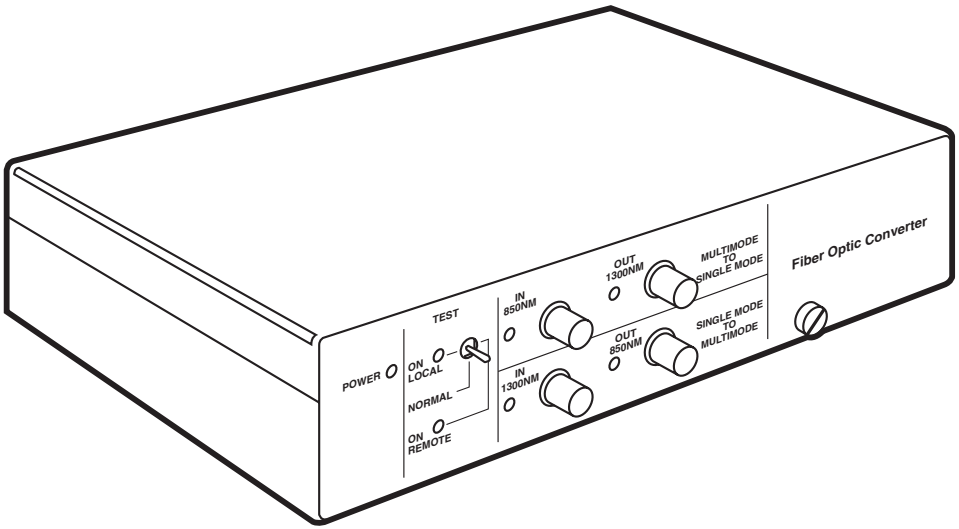
BLACK BOX®
NETWORK SERVICES

MARCH 2000
IC350A
IC351A

Fiber Optic Converters



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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.

SAFETY WARNING

Always observe standard safety precautions during installation, operation, and maintenance of this product. If you attempt to remove the power-supply fuse, be sure to disconect the power cord from the power source first, in order to avoid the possibility of electric shock.

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

Compliance — FCC Part 15 Class A, IC Class/classe A

Interfaces — Single-mode and multimode

Protocols — Transparent to all protocols

Coding — Supports unipolar two-level codes such as NRZ, NRZI, RZ, or biphase (CDP or Manchester); does *not* support bipolar (multi-level) codes (such as AMI or HDB3) or uncoded signals

Data Rate — Transparent to all data rates from 100 kbps to 250 Mbps

Wavelength — Single-mode side: 1300 nm;
Multimode side:
IC350A: 850 nm;
IC351A: 1300 nm

Optical Output — Single-mode side: –18 dBm into 9/125 fiber;
Multimode side:
–22 dBm into 50/125 fiber;
–18 dBm into 62.5/125 fiber;
–14 dBm into 100/140 fiber

Receiver Sensitivity — –32 dBm on both interfaces

Dynamic Range — 20 dB for both interfaces

User Controls — (1) Rear-mounted POWER rocker switch;
(1) Front-mounted TEST toggle switch

Diagnostics — V.54-compliant loopback tests

Indicators —	(9) Front-mounted LEDS: (1) POWER, (1) ON LOCAL, (1) ON REMOTE, (4) Activity
Connectors —	(4) Front-mounted ST female for data; (1) Rear-mounted IEC 320 male for power
MTBF —	Approx. 80,000 hours
Temperature Tolerance —	32 to 104˚F (0 to 40˚C)
Humidity Tolerance —	Up to 90% noncondensing
Maximum Altitude —	8,000 ft. (2438.4 m)
Power —	From internal power supply through included or alternate 5-ft. (1.5-m) power cord: Input: 90 to 260 VAC, 47 to 63 Hz (autosensing); Consumption: 6 watts
Size —	1.7"H x 8.5"W x 9.5"D (4.4 x 21.7 x 24 cm)
Weight —	2.4 lb. (1.1 kg)

2. Introduction

The Fiber Optic Converters pass data transmissions between the two standard types of optical fiber. Transmission lines used to carry fiberoptic signals over short distances are constructed of a relatively thick fiber called “multimode (graded index).” A much thinner fiber, “single-mode (graded index),” is used for transmitting light signals over longer distances. Signal dispersion observed in multimode fibers is substantially greater than that in single-mode lines because the size of the fiber and the properties of the light source used.

With a Fiber Optic Converter, you can connect multimode devices such as RS-232 multiplexors or LAN, ATM (SDH), SONET, or ESCON networks to the single-mode lines typical of Post, Telephone, and Telegraph companies (PTTs). This enables these devices to communicate over much greater distances than those achievable with multimode lines alone.

The Converter module that converts incoming transmissions is entirely separate from the module performing conversion of outbound signals. This feature makes the Converters suitable for all applications requiring unidirectional or bidirectional half-duplex data transmission. You can use a pair of Converters to connect two devices that have multimode interfaces across a single-mode line, as shown in Figure 2-1 below, or use one Converter to connect a multimode device to single-mode equipment, as shown in Figure 2-2 on the next page.

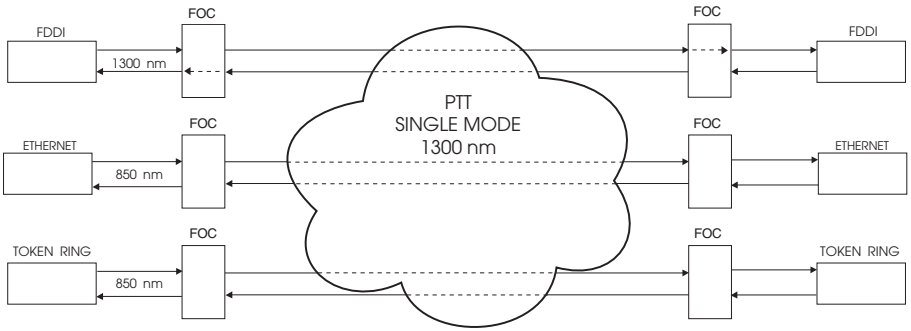

Figure 2-1. Applications using pairs of Fiber Optic Converters.

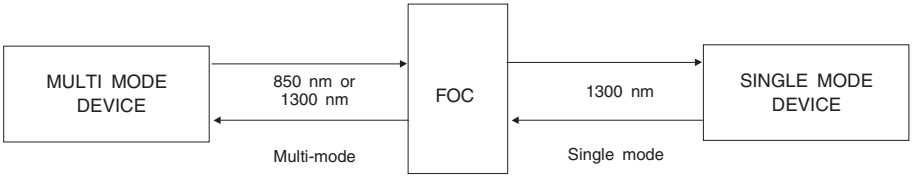

Figure 2-2. Application using a single Fiber Optic Converter.

The Fiber Optic Converters can achieve a data rate of up to 250 Mbps. They also have built-in diagnostic procedures (local and remote loopback) that comply with the ITU-TSS (CCITT) V.54 standard. Use the front-panel switch to determine which type of loopback you want and perform these procedures with a Bit Error Rate Tester (BERT) connected to the Converter in place of the local device.

The Converters support unipolar two-level codes, such as NRZ, NRZI, RZ, and biphase (CDP, Manchester), but not bipolar (multi-level) codes (such as AMI or HDB3) or uncoded signals.

CAUTION!

Use the Fiber Optic Converter-850NM (our product code IC350A) to convert to and from multimode cable carrying light at 850 nm. Use the Fiber Optic Converter-1300NM (our product code IC351A) to convert to and from multimode cable carrying light at 1300 nm. *Neither type of Converter will work with multimode cables designed for the other type's wavelength.*

3. Installation

3.1 Unpacking

Carefully remove the Fiber Optic Converter and included equipment from the container it came in and place the unit securely on a clean surface. Inspect the container and everything that was in it for damage, and immediately report any damage you find.

3.2 Placement

Place the Fiber Optic Converter in an area whose temperature is always within the range of 0 to 40˚C (32 to 104˚F) and whose relative humidity does not exceed 90% noncondensing.

The Converter should be installed within 5 ft. (1.5 m) of an easily accessible grounded AC outlet. (The unit's universal power supply can accept utility power ranging from 90 to 260 VAC.) Allow at least 3 ft. (90 cm) of clearance at the front of the unit for operator access. Allow at least 4" (10 cm) clearance at the rear of the unit to connect and disconnect its power cord.

3.3 Mounting (Optional)

With optional equipment, you can wallmount your Fiber Optic Converter or mount it on a 19-inch rack.

3.3.1 Wallmounting

To wallmount the Converter, you will require a wallmount bracket. This is not included with the Converter; call Black Box's technical support for a special quote. Once you have the bracket, take these steps, referring to Figure 3-1 below:

1. Prepare four anchored holes in the wall. Use the wallmount bracket as a drilling template.
2. Fasten the bracket to the wall with four screws.
3. Align the mounting hole on the rear of the Converter with the guide pin on the bracket, and push the Converter into place.
4. Secure the Converter with the fastening screw.

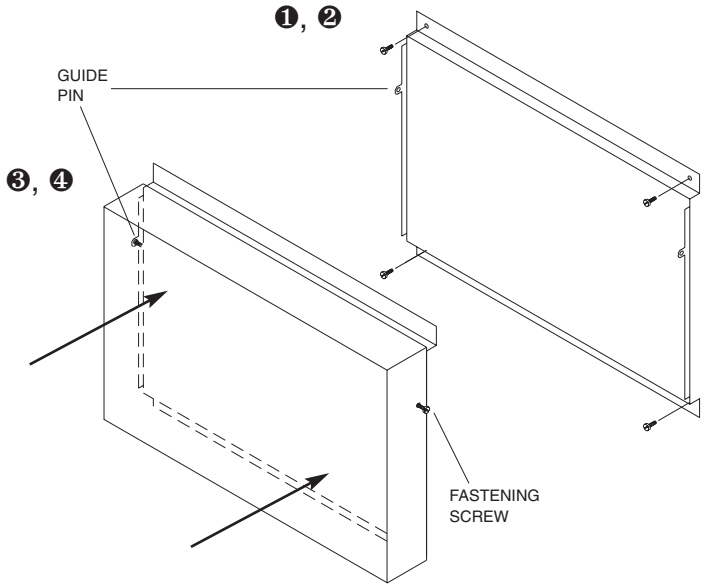

Figure 3-1. Wallmounting a Converter.

3.3.2 Rackmounting

To rackmount the Converter, you will require a rackmount tray. This is not included with the Converter; call Black Box's technical support for a special quote. The tray can hold up to two Converters, and requires 1U of rack height. Once you have the tray, take these steps, referring to Figure 3-2 below:

1. Insert the tray in a 19-inch rack and fasten it to the rack's side rails with two screws.
2. Place the Converter on either the left or the right end of the tray.
3. Align the mounting hole on the rear of the Converter with the guide pin on the tray, and push the Converter into place.
4. Secure the Converter with the fastening screw.

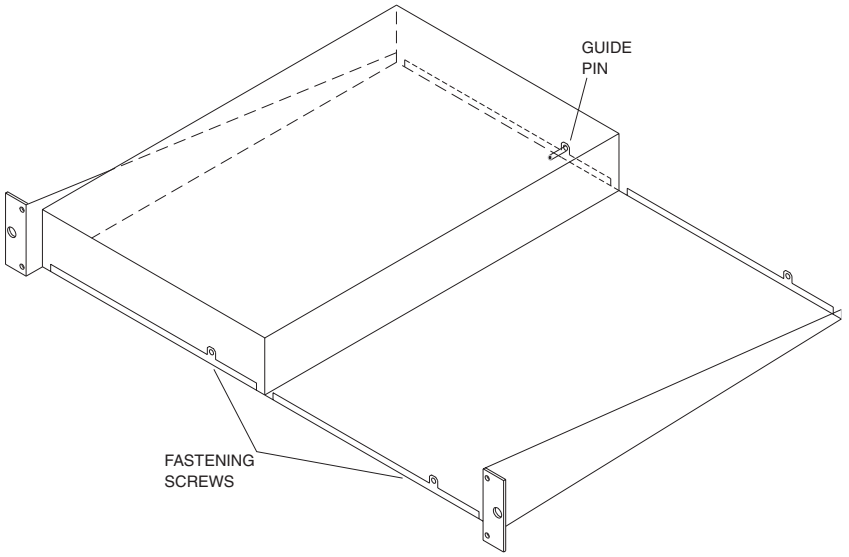

Figure 3-2. Rackmounting a Converter.

3.4 Connecting the Power Supply

AC power should be supplied to the Fiber Optic Converter through a standard 5- or 6-foot (1.5- or 2-m) power cord with an IEC 320 female socket on one end and a grounded 3-wire plug of the appropriate type on the other end. Making sure that the Converter is turned off (the power switch on the rear panel is in the OFF position), plug the IEC 320 female end of the cord into the Converter's IEC 320 male power connector. Then plug the other end of the cord into a working outlet.

CAUTION!

Interrupting the protective (grounding) conductor (inside or outside the device) or disconnecting the protective earth terminal can make this device dangerous. Intentional interruption of the grounding conductor is against electrical regulations and can cause serious damage.

3.5 Connecting the Fiberoptic Cables

NOTES

All of the fiberoptic connectors on the standard Fiber Optic Converters are ST® type. If you need Converters with FC or SMA connectors, call Black Box's technical support for a special quote.

Also, if you need to transmit data across very long stretches of single-mode cable, call Black Box's technical support for a special quote on Converters with laser-diode transmitters.

3.5.1 Single-Converter Applications

If you are using a single Fiber Optic Converter between a multimode device and a single-mode device, as shown in Figure 2-2 on page 10, connect the fiberoptic cables to the Converter this way:

- Attach the multimode cable from the multimode device's *transmitter* to the Converter's Multimode to Single Mode IN 850NM or IN 1300NM connector.
- Attach the multimode cable from the multimode device's *receiver* to the Converter's Single Mode to Multimode OUT 850NM or OUT 1300NM connector.
- Attach the single-mode cable from the single-mode device's *transmitter* to the Converter's Single Mode to Multimode IN 1300NM connector.
- Attach the single-mode cable from the single-mode device's *receiver* to the Converter's Multimode to Single Mode OUT 1300NM connector.

3.5.1 Using a Pair of Converters to Establish a Single-Mode Link

If you are using two Fiber Optic Converters to connect two multimode devices across a length of single-mode cable, as shown in Figure 2-1 on page 9, connect the fiberoptic cables to *each* Converter this way:

- Attach the multimode cable from the local multimode device's *transmitter* to the local Converter's Multimode to Single Mode IN 850NM or IN 1300NM connector.
- Attach the multimode cable from the local multimode device's *receiver* to the local Converter's Single Mode to Multimode OUT 850NM or OUT 1300NM connector.
- Attach the single-mode cable from the remote Converter's *transmitter* (its Multimode to Single Mode OUT 1300NM connector) to the local Converter's Single Mode to Multimode IN 1300NM connector.
- Attach the single-mode cable from the remote Converter's *receiver* (its Single Mode to Multimode IN 1300NM connector) to the local Converter's Multimode to Single Mode OUT 1300NM connector.

3.5.1 Using a Pair of Converters to Establish a Multimode Link

If for some reason you are using two Fiber Optic Converters to connect two single-mode devices across a length of multimode cable, connect the fiberoptic cables to *each* Converter this way:

- Attach the single-mode cable from the local single-mode device's *transmitter* to the local Converter's Single Mode to Multimode IN 1300NM connector.
- Attach the single-mode cable from the local single-mode device's *receiver* to the local Converter's Multimode to Single Mode OUT 1300NM connector.
- Attach the multimode cable from the remote Converter's *transmitter* (its Single Mode to Multimode OUT 850NM or OUT 1300NM connector) to the local Converter's Multimode to Single Mode IN 850NM or IN 1300NM connector.
- Attach the multimode cable from the remote Converter's *receiver* (its Multimode to Single Mode IN 850NM or IN 1300NM connector) to the Converter's Single Mode to Multimode OUT 850NM or OUT 1300NM connector.

4. Operation

4.1 Controls and Indicators

All of the Fiber Optic Converter's controls and indicators, except for the power switch, are located on the Converter's front panel, shown in Figure 4-1 below. The power switch is located on the rear panel of the unit, immediately above the power-cord connector (see **Section 3.4**).

The Converter's complete model number is on the right side of the front panel. Below the model number is a fastening screw (see **Section 3.3**).

The table below lists the functions of these controls and indicators. The numbers under the **Item** heading refer to the identification numbers in Figure 4-1.

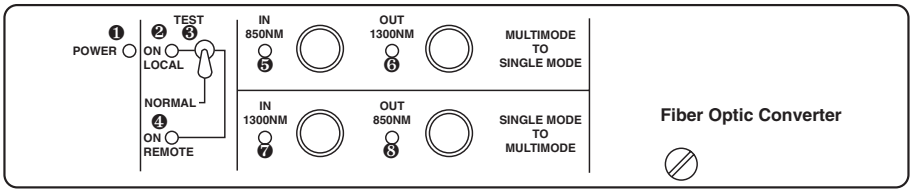

Figure 4-1. The front panel of a Converter.

Item	Control/Indicator	Function
1	POWER LED	Lights when the Converter is on and receiving power.
2	ON LOCAL LED	Lights when the TEST switch (item 3) is not in the center position (a loopback test is underway).
3	TEST Switch	Toggle this switch to select normal operation (center position), local loopback (left-hand position), or remote loopback (right-hand position).
4	ON REMOTE LED	Lights when the TEST switch (item 3) is in the right-hand position on either the local or remote Converter (a remote loopback test is underway).
5–8	Activity LEDs	Light when traffic passes through the adjacent connector.

The Converters also have several important internal components (these are schematically represented in Figure 4-2 below):

- Multiplexor for converting single-mode signal to multimode (MUX SM/MM)
- Multiplexor for converting multimode signal to single-mode (MUX MM/SM)
- Remote loop generator
- Remote loop detector

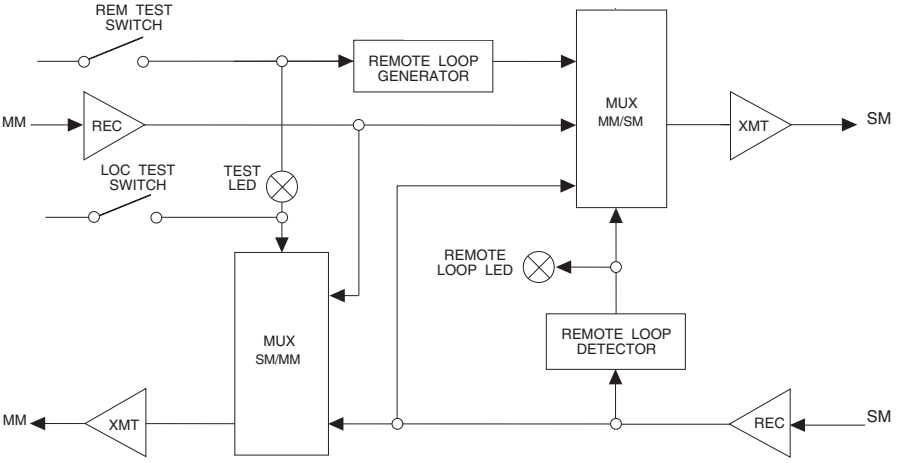

Figure 4-2. Schematic of a Converter's internal components.

4.2 Power-Up, Normal Operation, and Power-Down

To turn on the Fiber Optic Converter, move the POWER switch on the rear panel to the ON position. The POWER LED on the front panel should light.

Once powered on, the Converter operates unattended. Operator intervention is required only for testing or when an error occurs.

To turn off the Converter, move the POWER switch to the OFF position. The POWER LED should go dark.

4.3 Diagnostic Testing

To test one Fiber Optic Converter or a pair of Converters, as well as the attached fiberoptic lines, first connect a Bit Error Rate Tester (BERT) in place of the local device. Then follow the steps in **Section 4.3.1** or **Section 4.3.2**, as appropriate.

4.3.1 Local Loopback Test

Move the TEST switch on the front panel of the local Converter to the LOCAL (left-hand) position. The ON LOCAL LED will light and the MUX SM/MM will no longer accept signals from the Single Mode to Multimode IN 1300NM connector.

Begin sending test data from the BERT to the local Converter. The data will travel along this path (minimally illustrated in Figure 4-3 below):

- Into the local Converter's Multimode to Single Mode IN 850NM or IN 1300NM connector;
- Through the local Converter's MUX SM/MM;
- Out of the local Converter's Single Mode to Multimode OUT 850NM or OUT 1300NM connector; and
- Back into the BERT.

The tester will compare the data received with the data stream sent and report any discrepancies it finds.

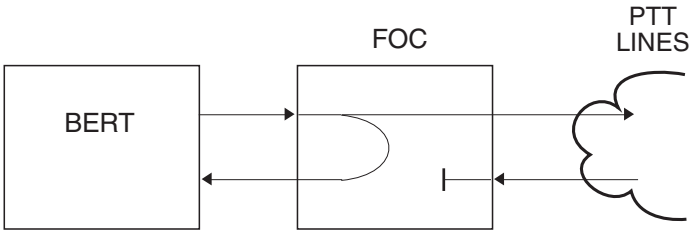

Figure 4-3. Local loopback.

4.3.2 Remote Loopback Test

This test can be done only with a pair of Converters, one on either side of the single-mode line. Move the TEST switch on the front panel of the local Converter to the REMOTE (right-hand) position. The local Converter will light its ON LOCAL and ON REMOTE LEDs; its Remote Loop Generator will contact the remote Converter's Remote Loop Detector, causing the remote unit to light its ON REMOTE LED and to stop accepting data from its Multimode to Single Mode IN 850NM or IN 1300NM connector. (The remote Converter's TEST switch should remain in the NORMAL [center] position.)

Begin sending test data from the BERT to the local Converter. The data will travel along this path (minimally illustrated in Figure 4-4 below):

- Into the local Converter's Multimode to Single Mode IN 850NM or IN 1300NM connector, through its MUX MM/SM, and out of its Multimode to Single Mode OUT 1300NM connector;
- Across the line, into the remote Converter's Single Mode to Multimode IN 1300NM connector, through its MUX MM/SM, and out of its Multimode to Single Mode OUT 1300NM connector;
- Back across the line, into the local Converter's Single Mode to Multimode IN 1300NM connector, through its MUX SM/MM, and out of its Single Mode to Multimode OUT 850NM or OUT 1300NM connector; and
- Back into the BERT.

As in the local test, the tester reports discrepancies between the sent and the received data streams. When the test is done, move the local Converter's TEST switch back to the NORMAL (center) position. It will turn off its ON LOCAL and ON REMOTE LEDs and instruct the remote unit to resume normal operation and to turn off its ON REMOTE LED.

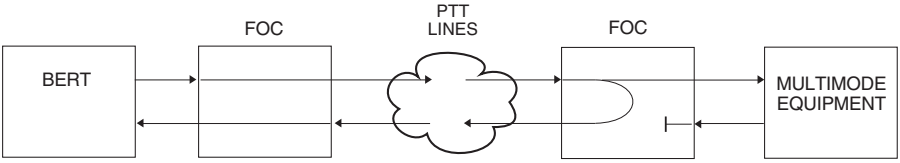

Figure 4-4. Remote loopback.

5. Troubleshooting

5.1 Common Concerns

The POWER LED does not light

1. Make sure the Fiber Optic Converter is plugged in and that its power cord is securely attached to the its rear-panel power connector.
2. Make sure that the utility (mains) outlet where the Converter is plugged in is actually providing power.
3. Call Black Box for technical support.

I'm having data-transmission problems

1. Make sure that you are using the proper type of Converter for your multimode cable's wavelength (the Fiber Optic Converter-850NM for 850-nm cable, the Fiber Optic Converter-1300NM for 1300-nm cable).
2. Make sure that the TEST switch on the Converter's front panel is in the NORMAL (center) position.
3. Make sure that the Converter's ON REMOTE LED is not lit, indicating that a remote loopback test is being performed at the remote site.
4. Make sure that all fiberoptic lines are securely attached to the proper connectors on the Converter's front panel, as described in **Section 3.5**.
5. Perform diagnostic tests as described in **Section 4.3**. If you find a malfunction, try swapping in known-good fiberoptic cables and/or Converter units if this is possible. If not, or if this does not solve the problem, call Black Box for technical support.

5.2 Calling Black Box

If you determine that your Fiber Optic Converter is malfunctioning, *do not attempt to alter or repair it.* Contact Black Box; the problem might be solvable over the phone.

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.

5.3 Shipping and Packaging

If you need to transport or ship your Fiber Optic Converter:

- Package it carefully. We recommend that you use the original container.
- Before you ship a unit for repair or return, contact Black Box to get a Return Materials Authorization (RMA) number, and make sure you include everything you received with the unit when you ship it.

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