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NETWORK SERVICES

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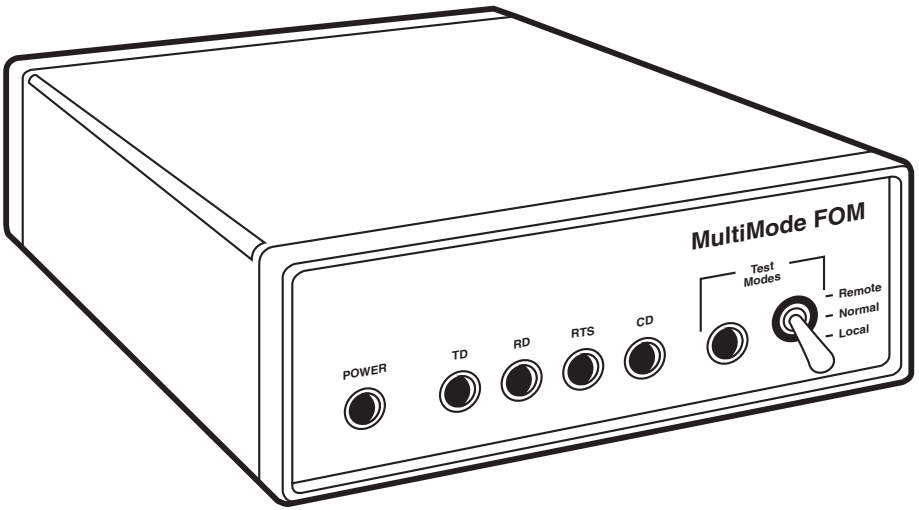
MD640A-ST-R2
MD640A-SMA-R2
MD640AE-ST-R2
MD640AE-SMA-R2

MultiMode FOMs -ST and -SMA



CUSTOMER SUPPORT INFORMATION

Order **toll-free** in the U.S. 24 hours, 7 A.M. Monday to midnight Friday: **877-877-BBOX**
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Contents

TRADEMARKS USED IN THIS MANUAL

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1. Specifications

Cable Required — (1) Multimode fiberoptic cable, 62.5-µm core

Interface — EIA RS-232/CCITT V.24, DCE

Protocols — Asynchronous or synchronous

Clock — Internal or external from attached RS-232 device

Flow Control — Transparent hardware (RTS/CTS and DTR/DSR passed through from DTE) or local hardware or software (RTS/CTS or X-ON/X-OFF), user-selectable

Operating Mode — Point-to-point

Speed — Asynchronous: Up to 38.4 Kbps;
Synchronous: 2.4, 9.6, 19.2, 38.4, 56, 64, 192, or 256 Kbps

Maximum Distance — 2.5 km (1.5 mi.) at all data rates,
5 km (3.1 mi.) at data rates of 64 Kbps or below

Modulation — 3B4B

Wavelength — 880 nm

Attenuation — 14 dB

LED-Responsivity Minimum — 0.12 amps per watt

User Controls — (2) External:
(1) Front-mounted rocker switch: Test;
(1) Bottom-mounted 8-position DIP switch: Async/sync operation, data rates, clock source, flow control

Indicators — (6) Front-mounted LEDs: TD, RD, RTS, CTS, Power, Test

Diagnostics — Local and remote loopback

Connectors — (3) Rear-mounted:
(1) DB25 female;
(1) Barrel-type power jack;
Units with "-ST" suffix: (1) ST female;
Units with "-SMA" suffix: (1) SMA female

Power — *For 120-VAC, 60-Hz operation:*
From wallmount power supply:
Input: 115 VAC, 60 Hz, 100 mA;
Output: 10 VAC, 700 mA;
For 240-VAC, 50-Hz operation:
From desktop power supply:
Input: 230 VAC, 50 Hz, 100 mA;
Output: 10 VAC, 700 mA

MTBF — 125,000 hrs.

Maximum Altitude — 10,000 ft. (3048 m)

Temperature — 32 to 140˚ F (0 to 60˚ C)

Humidity — Up to 95% noncondensing

Size — 1.5"H x 4.1"W x 5"D (3.9 x 10.5 x 12.7 cm)

Weight — 5 lb. (2.3 kg)

2. Introduction

MultiMode FOMs are fiberoptic short-range modems with a special money-saving edge. Many other fiberoptic modems can't transmit and receive data through the same port, so they use cables with two fibers. MultiMode FOMs communicate with each other over a much less expensive *single-fiber* cable, across distances of as much as 5 km (3.1 miles).

2.1 Features

- Synchronous or asynchronous operation
- Communicates point-to-point over a single optical fiber
- Local and remote test modes
- Asynchronous data rates up to 38.4 Kbps
- Synchronous data rates up to 256 Kbps
- Distances up to 2.5 kilometers (1.5 miles) at any speed
- Distances up to 5 kilometers (3.1 miles) at speeds of 64 Kbps or less
- Internal or external clocking
- Support for transparent hardware, or local hardware, or local software flow control
- Available with ST® or SMA connectors
- Tri-state front-panel LED indicators

2.2 Description

The MultiMode FOM is a fiberoptic short-range modem for point-to-point RS-232 communication over a single 62.5-µm fiber, such as one of those bundled into our bulk multifiber cables EFN1004 and EFN1006. The FOM supports synchronous data rates up to 256 Kbps, and asynchronous data rates up to 38.4 Kbps. It can also support transparent hardware flow control or local flow control; in the local setting, it automatically adapts to either hardware or software flow control. Synchronous timing can be set for internal or external (from attached RS-232 device) clock.

The MultiMode FOM features extended-data-rate circuitry that allows for single-fiber distances between 1.5 and 3.1 miles (2.5 and 5 km). Depending on which model you have, you can connect optical cable with ST or SMA connectors to the FOM. The MultiMode FOM encodes your data signals using 3B4B modulation, then converts them to an 880-nm optical signal.

The MultiMode FOM features two test modes: local and remote loopback. You can activate either of these tests with the FOM's front-panel toggle switch. The local loopback test is used to evaluate the DTE-to-modem connection. The remote loopback test is used to evaluate the condition of the connection between the modems.

3. Configuration

With the MultiMode FOM's external DIP switch, you can configure the unit for many different combinations of data rates and clocking methods for synchronous or asynchronous applications. (Since the FOM has no internal jumpers or other internal controls, you don't have to open the unit's case to configure the unit.) Figures 3-1 and 3-2 below and Table 3-1 on the next page show the location of the switch and the switch positions' identities, settings, and functions.

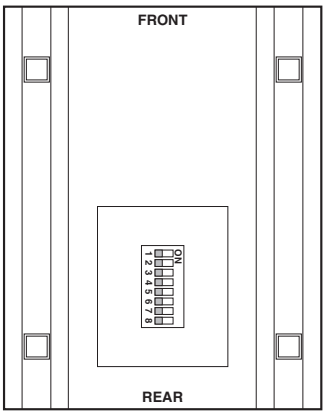


Figure 3-1. The location of the DIP switch on the underside of the unit.

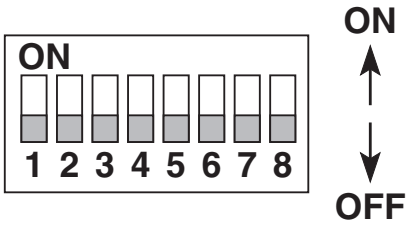


Figure 3-2. Closeup of the DIP switch positions showing ON/OFF settings and position numbers.

Table 3-1. Summary of Switch Settings, Showing Factory Defaults

Position	Function	Factory Default
1	RESERVED	OFF
2	Data Rate (Sync Mode)	ON
3	Data Rate (Sync Mode)	OFF
4	Data Rate (Sync Mode)	OFF
5	Data Rate (Sync Mode)	ON
6	Reset	OFF Operating Mode
7	Handshaking	ON Control Signal Mode
8	Clocking Method	OFF Internal Clock

0 to 19.2 Async (2X)

This section provides detailed information about the function of each DIP switch position, and lists all possible settings. Use this section as a configuration guide for applications where the FOM's default settings would not provide correct results. (Position 1 is reserved for future use.)

Positions 2 though 5: Data Rate (Sync. Mode)

Switches 2 through 5 determine two configuration parameters: synchronous or asynchronous data rate and the mode of synchronization (Sync. Mode) between two FOMs. Here's how the packet-spacing option works: The "2X" setting doubles the space between data packets compared to the "1X" setting, so that each packet is more easily distinguishable from those before and after it. This offsets some of the effects of signal degradation over distance, and allows communication over as much as 5 km (3.1 miles) as opposed to the "1X" setting's limit of 2.5 km (1.5 miles). Table 3-2 at the top of the next page shows every possible setting for these four switch positions.

Position 6: Reset

You can use position 6 to reset the MultiMode FOM without powering down the unit. Move position 6 to ON to put the FOM in "reset conditon," then move position 6 back to OFF (the default setting) to put the FOM back in "operating condition" (resume normal operation). Don't leave position 6 ON: the FOM will not work properly unless this switch position is OFF.

Table 3-2. Possible Settings of DIP Switch Positions 2 Through 5

Pos. 2	Pos. 3	Pos. 4	Pos. 5	Data Rate (Sync. Mode)
ON	OFF	OFF	ON	Async 0 to 19.2 Kbps (2X)
ON	OFF	OFF	OFF	Async 0 to 38.4 Kbps (1X)
ON	ON	ON	OFF	Sync at 2.4 Kbps (1X)
OFF	ON	ON	OFF	Sync at 9.6 Kbps (1X)
OFF	ON	ON	ON	Sync at 9.6 Kbps (2X)
ON	ON	OFF	OFF	Sync at 19.2 Kbps (1X)
ON	ON	OFF	ON	Sync at 19.2 Kbps (2X)
OFF	ON	OFF	OFF	Sync at 38.4 Kbps (1X)
OFF	ON	OFF	ON	Sync at 38.4 Kbps (2X)
ON	OFF	ON	OFF	Sync at 48 Kbps (1X)
ON	OFF	ON	ON	Sync at 48 Kbps (2X)
OFF	OFF	ON	OFF	Sync at 56 Kbps (1X)
OFF	OFF	OFF	OFF	Sync at 64 Kbps (1X)
OFF	OFF	OFF	ON	Sync at 64 Kbps (2X)
OFF	OFF	ON	ON	Sync at 192 Kbps (1X)
ON	ON	ON	ON	Sync at 256 Kbps (1X)

Position 7: Handshake Mode

Use position 7 to set the type of flow control. (This switch position must be moved to the same setting on both FOMs.) If position 7 is set to ON (the default setting), the Multimode FOMs perform transparent hardware flow control by passing the RTS/CTS and DTR/DSR signal pairs from the attached DTEs across the modem link. In this setting, when one FOM drops the RS-232 "RTS" signal, the other FOM drops the "CTS" signal, and when one FOM drops the "DTR" signal, the other drops the "DSR" signal.

If position 7 is set to OFF (the "standard modem" setting), each FOM independently performs flow control between itself and the local DTE, automatically adapting to either hardware (RTS/CTS) or software (X-ON/ X-OFF) flow control.

Position 8: Clock Source

Use position 8 to set the clock source. The MultiMode FOM works from an internal clock if position 8 is set to OFF (the default setting) and provides this clock signal on RS-232 Pin 15. The FOM receives an external clock from the attached RS-232 device on RS-232 Pin 24 if position 8 is set to ON.

4. Installation

The MultiMode FOM is easy to install. After configuring the DIP switch, simply connect the single-fiber and RS-232 cable to the FOM, plug the power supply's output cord into the unit, and plug the power supply into an outlet. Figure 4-1 shows the location of the interface connections on the MultiMode FOM's rear panel.

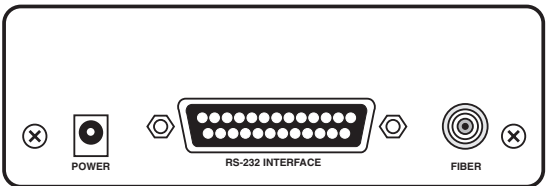


Figure 4-1. Rear panel of the MultiMode FOM.

4.1 Single-Fiber Connection

These short-range modems are designed to work in pairs. You'll need one at each end of a single 62.5-µm core, multimode fiber cable. Depending on the data-rate setting you select, your cable can be a maximum of 2.5 or 5 km long. Connect the fiberoptic cable to each MultiMode FOM using a single connector (either ST or SMA type). Figure 4-2 below shows a closeup of both connector types.

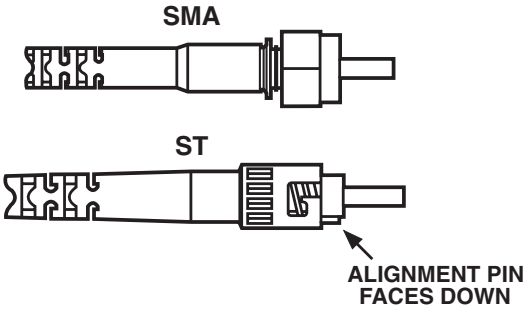


Figure 4-2. SMA and ST connectors.

4.2 RS-232 Connection

To connect the MultiMode FOM to a DTE (Data-Terminal Equipment: a PC, host, terminal, etc.), use a straight-through RS-232 cable. To connect the MultiMode FOM to a DCE (Data-Communications Equipment: a modem, multiplexor, etc.), use a cross-pinned RS-232 cable of the null-modem type. Whether the cable is straight-through or cross-pinned, it must have a male DB25 connector on the FOM end.

5. Operation

Once you have configured each MultiMode FOM properly (see **Chapter 3**) and installed them and their fiber and RS-232 cables (see **Chapter 4**), you are ready to operate the units. This chapter describes how to (a) interpret the LED indicators, (b) power the units up and down, and (c) use the built-in loopback-test modes.

5.1 LED Indicators

The MultiMode FOM's six front-panel status LEDs indicate the condition of the modem and communication link. Figure 5-1 below shows the location of each LED; after Figure 5-1 is a description of each LED's function.

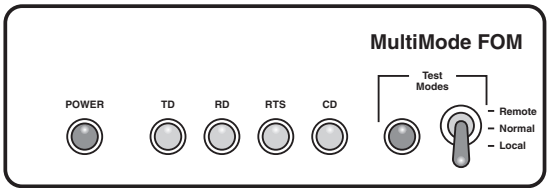


Figure 5-1. Front panel of the MultiMode FOM.

- The green "Power" LED glows if the modem is plugged in and getting power.
- The green "Test Modes" LED glows when the modem has been set to perform a local analog or remote digital test.
- The "TD" and "RD" indicators blink red or green in response to data activity (transmitting data or receiving data respectively). Red indicates a "low" level of RS-232 logic; green indicates a "high" level of RS-232 logic. These LEDs will continuously glow red if the RS-232 cable connections are correct and the RS-232 device to which the FOM is attached is not transmitting or receiving data (this is equivalent to a constant "low" state).
- The "RTS" and "CD" indicators are also tri-state and will glow red for a "low" signal or green for a "high" signal. The RTS LED lights in response an incoming signal on RS-232 Pin 4 (normally Ready to Send). The CD LED lights (a) in response to an incoming Carrier Detect signal on the line side (from the remote FOM) and (b) when, as a result, the FOM outputs the same signal on RS-232 Pin 8.

5.2 Power-Up

Apply AC power to the MultiMode FOM by first plugging the output cord of the FOM's power supply into the rear-panel power jack, then plugging the power supply's input cord into a working AC power outlet. This should activate the unit immediately—the FOM has no power switch—and the "Power" LED should light. When both the local and remote MultiMode FOMs are powered up, and are passing data normally, the LEDs will look like this:

- PWR = green
- TD and RD = flashing red and green
- RTS and DCD = green
- TEST = off

5.3 Loopback-Test Modes

The MultiMode FOM can perform two types of loopback tests that will help you to evaluate the condition of the FOM pair, the communication link between them, and the link between each FOM and the attached RS-232 device. These tests are activated from the front panel.

5.3.1 Local Loopback

The local loopback test is an analog test that checks the operation of the local MultiMode FOM, and is performed separately on each unit. During this test, any data sent to the local MultiMode FOM by the attached RS-232 device will be echoed back to that device. For example, characters typed on the keyboard of a local terminal will appear on the terminal screen.

To perform a local loopback test, follow these steps:

A. Activate local loopback by moving the local MultiMode FOM's front-panel toggle switch *down* to the "Local" setting: This FOM's transmitted output is now connected to its own receiver. Its "Test" LED should glow. (Even though the local FOM cannot communicate with the remote FOM in this mode, the synchronized connection between the two modems remains intact.)

B. Verify that the RS-232 device is operating properly and can be used for a test. If you send data from the RS-232 device and the data is corrupted when it comes back, call a technician or replace the RS-232 device.

C. Perform a BERT (bit error rate) test on each FOM. If the BERT test doesn't uncover any faults, but the RS-232 device still indicates a fault, follow the manufacturer's suggested diagnostic procedures for the RS-232 device. Also, check the cable between the RS-232 device and the FOM.

5.3.2 Remote Loopback

The remote loopback test checks the performance of both the local and remote MultiMode FOMs, and the communication link between them. Any characters sent to the remote FOM in this test mode will be returned to the originating device. For example, if your local RS-232 device is a terminal, characters typed on the terminal's keyboard will appear on the terminal's screen after having been passed to the remote FOM and looped back.

To perform a remote loopback test, follow these steps:

A. Activate remote loopback by moving the remote MultiMode FOM's front-panel toggle switch *up* to the "Remote" setting: this FOM now automatically echoes data back across the fiberoptic line to the local FOM. The remote unit's "Test" LED should glow. (As with the local loopback test, the synchronized connection between the two modems remains intact during this test.)

B. Perform a BERT (bit error rate) test on the system.

C. If the BERT test equipment indicates a fault, and the local loopback test was successful for both MultiMode FOMs, this suggests a problem with the fiber cable connecting the modems. You should test the cable for proper connections and continuity.

5.4 Power-Down

To turn off the MultiMode FOM, unplug its power supply from the outlet. The FOM has no power switch.

6. Troubleshooting

6.1 Calling Black Box

If you determine that your MultiMode FOM is malfunctioning, *do not attempt to alter or repair the unit.* Contact Black Box Technical Support.

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.

6.2 Shipping and Packaging

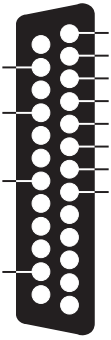
If you need to transport or ship your FOM:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the FOM for repair, make sure you include its power supply. If you are returning the FOM, make sure you include its manual as well. Before you ship, contact Black Box to get a Return Materials Authorization (RMA) number.

Appendix: RS-232 Pinout

The figure below shows the pinout of the MultiMode FOM's rear-mounted RS-232 port (DB25 female connector).

DIRECTION	STANDARD DCE SETTING	DIRECTION
	1- (FG) Frame Ground	
	2- (TD) Transmit Data	To FOM
From FOM	Transmitting Timing -15	
	3- (RD) Receive Data	From FOM
From FOM	Receiving Timing -17	
	4- (RTS) Request to Send	To FOM
	5- (CTS) Clear to Send	From FOM
	6- (DSR) Data Set Ready	From FOM
	7- (SG) Signal Ground	
To FOM	Data Term. Ready (DTR) -20	
	8- (DCD) Data Carrier Detect	From FOM
To FOM	Transmitting Timing LXC -24	



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