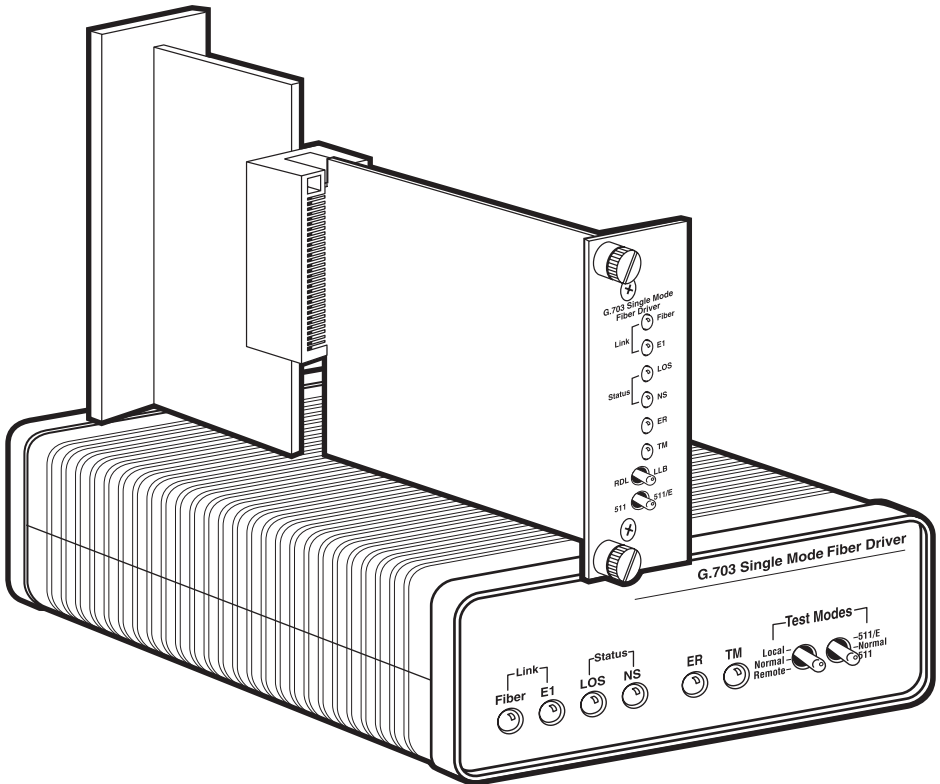




# Single-Mode G.703/E1 Fiber Line Drivers



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

**EUROPEAN UNION DECLARATION OF CONFORMITY**

This equipment complies with the requirements of the European EMC Directive 89/336/EEC as well as the Low Voltage Directive.



**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 conectado 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 física 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 líneas de energía.
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 objetos líquidos 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: Objetos 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.

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# 1. Specifications

<b>Compliance:</b>	CE; FCC Part 15 Subpart B Class A, IC Class/class A; CTR 12
<b>Interfaces:</b>	Network: ITU G.703/G.704 E1, either 120-ohm modular or 75-ohm coaxial, user-selectable; Fiber line: 1310-nm single-mode fiberoptic into simplex (single-strand) 9/125- $\mu$ m cable; ME401C models only: Proprietary MicroRACK power and data bus
<b>Protocol:</b>	Synchronous
<b>Clock Source:</b>	Internal, recovered from received line signal, or external from G.703/G.704 network
<b>Data Rate:</b>	2.048 Mbps on both line and network interfaces
<b>Line Coding:</b>	Network: AMI or HDB3, user-selectable; Fiber line: 8B10B
<b>Operation:</b>	Fiber line: Full duplex
<b>Transmitter Launch Power:</b>	From 0 to -10 dBm
<b>Receiver Sensitivity:</b>	-18 dBm
<b>Optical Budget:</b>	15 dB
<b>Maximum Coupling Loss:</b>	1.5 dB per connector
<b>Maximum Distance:</b>	Network cabling from Line Driver to next device: 1.6 km (1 mile) of 24-AWG wire; Fiber line between two Line Drivers: 50 km (31 miles)

## SINGLE-MODE G.703/E1 FIBER LINE DRIVERS

<b>User Controls:</b>	(2) Front-mounted toggle switches for loopback and BER testing; (1) 8-position DIP switch for clock source and line coding (bottom-mounted on ME401A models, board-mounted on front card of ME401C models); (4) Jumpers for network-interface type (internal on ME401A models, board-mounted on rear card of ME401C models)
<b>Indicators:</b>	(6) Front-mounted LEDs for various conditions (see <b>Section 5.2</b> )
<b>Diagnostics:</b>	ITU V.54-compliant local (to G.703/G.704 network) or remote (to fiber line) loopback testing, user-controlled; ITU V.52-compliant 511/511E BER testing, user-controlled
<b>Connectors:</b>	(1) Rear-mounted RJ-48C for 120-ohm twisted-pair network connection; (2) Rear-mounted BNC female ([1] TX, [1] RX) for 75-ohm coaxial network connection; ME401A-FC, ME401C-FC: (1) Rear-mounted FC female; ME401A-SC, ME401C-SC: (1) Rear-mounted SC female; ME401C models only: Matching 50-pin card-edge connectors on front and rear cards
<b>Leads/Signals Supported:</b>	RJ-48C: Pins 1, 2, 4, and 5 (Rx+, Rx-, Tx+, and Tx- respectively)
<b>Isolation:</b>	G.703/G.704 interface: Transformer coupled, 1500 VAC RMS
<b>Temperature Tolerance:</b>	Operating: 32 to 122°F (0 to 50°C); Storage: -40 to +185°F (-40 to +85°C)
<b>Humidity Tolerance:</b>	5 to 95% noncondensing
<b>Enclosure:</b>	ME401A models: High-impact plastic

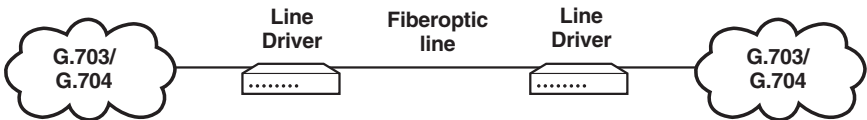
<b>Power:</b>	ME401A models: From utility-power (mains) outlet, through external power-supply transformer: Input (autosensing): 100 to 240 VAC, 50 to 60 Hz, at up to 10 watts; Output: 5 VDC at up to 1 amp; ME401C models: 5 VDC from the midplane bus of the MicroRACK it's installed in
<b>Size:</b>	ME401A models: 1.5"H x 4.1"W x 5"D (3.8 x 10.4 x 12.7 cm); ME401C models: Rear card: 3.3"H x 1.5"W x 2.25"D (8.4 x 3.8 x 5.7 cm); Front card: 3.3"H x 1.5"W x 5"D (8.4 x 3.8 x 12.7 cm)
<b>Weight:</b>	ME401A models: Net plus power supply: 1 lb. (0.5 kg); Shipping: Approx. 1.7 lb. (0.8 kg); ME401C models: Net, rear card: 3.5 oz. (99 g); Net, front card: 2.7 oz. (77 g); Shipping: Approx. 0.6 lb. (0.3 kg)



## 2. Introduction

### 2.1 Overview

The Single-Mode G.703/E1 Fiber Line Drivers can extend E1 (G.703/G.704) service over single-mode fiberoptic cabling. A pair of these Line Drivers provides G.703/G.704 network extension between remote locations, as shown in Figure 2-1.

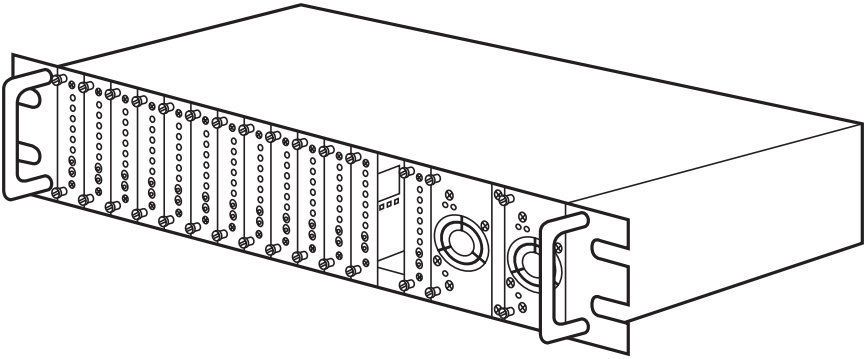


**Figure 2-1. Using Line Drivers to extend E1 (G.703/G.704).**

The Line Driver is designed to transmit/receive G.703/G.704 data over 9/125- $\mu$ m single-mode fiberoptic cable across distances up to 50 km (31 miles). Unlike most devices of its type, it needs only one fiber rather than two.

The Line Driver can use either internal clock, the external clock from the G.703/G.704 network, or “receive recovered” clock transmitted across the fiber link from the other Line Driver. It also incorporates V.54-compliant local/remote loopbacks and V.52-compliant 511/511E test patterns that can be activated with front-panel switches. LED status indicators monitor the fiber and G.703/G.704 links.

There are four models of the Line Driver: The standalone versions (product codes ME401A-FC and ME401A-SC) have their own enclosure, while the card versions (ME401C-FC and ME401C-SC) can be installed in the 16-Port Managed MicroRACK (RM260) shown in Figure 2-2 on the next page. The “-FC” models have an FC fiber connector, while the “-SC” models have an SC fiber connector. The card versions of the Line Driver come in two parts: a rear card (with the connectors on it) that slides into the rear of the rack and a front card (with the LEDs on it) that slides into the front of the rack.



**Figure 2-2. The MicroRACK chassis.**

## 2.2 Features

- ITU G.703/G.704 (E1) transport over single-mode fiber.
- Full-duplex operation over a single strand of fiber.
- Run single-mode fiber to a maximum distance of 50 km (31 miles).
- FC or SC style fiber connectors.
- 120-ohm (RJ-48C) and 75-ohm (dual coax) G.703/G.704 connectors.
- Can use any of these clocking options: Internal, Network (G.703/G.704), or Receive Recover (fiber link).
- User-selectable AMI or HDB3 G.703/G.704 data coding.
- Six front-panel LED status indicators: Fiber line, E1 line, LOS, TM, ER, and NS.
- Testing/troubleshooting tools: V.54-compliant local/remote loopbacks and V.52-compliant 511/511E test patterns.

## 3. Configuration

### CAUTION!

Most of the procedures described in this chapter involve moving components on the Single-Mode G.703/E1 Fiber Line Driver's circuit board. *Never* do this while the Line Driver is operating. Also, be careful not to damage the board with static electricity. You should at least wear a grounding strap when you do this.

### 3.1 Setting the Clock Source and Line Coding

The Single-Mode G.703/E1 Fiber Line Driver has an 8-position DIP switch, shown in Figure 3-1, that you can use to set the Line Driver's clock source and line coding. This DIP switch is mounted on the front card of the Line Driver Card (ME401C models), as shown in Figure 3-2; it's mounted on the underside of the standalone Line Driver (ME401A models), as shown in Figure 3-3. (There is a cover over the DIP switch that you'll have to pop open to get at it.)

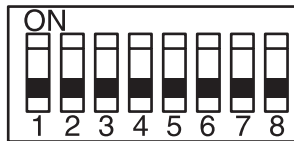


Figure 3-1. The Line Driver's DIP switch.

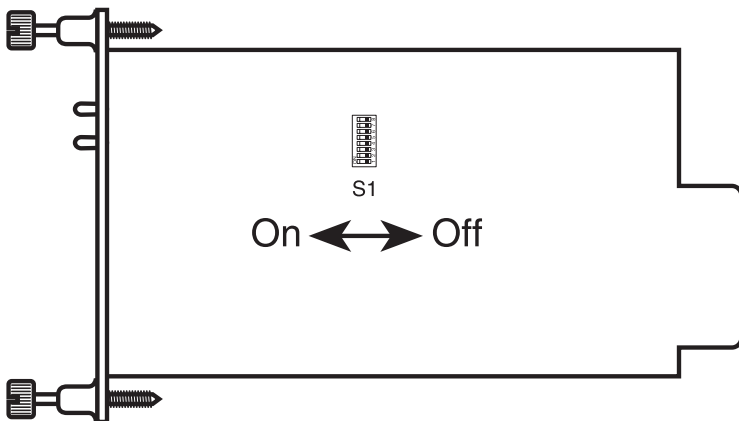
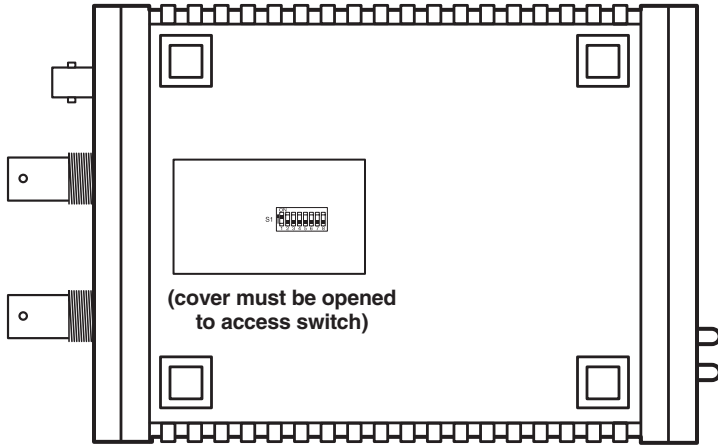


Figure 3-2. The position of the DIP switch on the front card of the Line Driver Cards (ME401C models).



**Figure 3-3.** The position of the DIP switch on the underside of the standalone Line Drivers (ME401A models).

Use positions S1 and S2 of this switch to set the Line Driver's clock source:

S1	S2	Setting	Description
On	On	Internal	Transmit clock generated internally (default).
On	Off	Receive recover	Transmit clock derived from the fiber line.
Off	On	Network	Transmit clock derived from G.703/G.704 equipment interface.
Off	Off	Not used	Reserved for future use.

### NOTE

**The Single-Mode G.703/E1 Fiber Line Drivers are designed to work in pairs. When you set the clock source for your Line Drivers, the Driver at one end of the link must be set for "receive recover" and the Driver at the other end must be set for either "internal" or "network."**

Use positions S3 and S4 of this switch to set the line coding of the G.703/G.704 interface (either HDB3 or AMI). The line coding must be the same as that prescribed by the NAP (Network Access Provider). Most applications will use HDB3, but some older telecommunications equipment will use AMI:

- **High Density Bipolar 3 (HDB3):** In HDB3 coding, the transmitter deliberately inserts a bipolar violation when excessive zeros in the data stream are detected. The receiver recognizes these special violations and decodes them as zeroes. This method enables the network to meet minimum pulse-density requirements. Use HDB3 unless AMI is required in your application.

- **Alternate Mark Inversion (AMI):** AMI defines a pulse as a “mark,” a binary one, as opposed to a zero. In an E1 network connection, signals are transmitted as a sequence of ones and zeros. Ones are sent as pulses, and zeros are sent as spaces, i.e., no pulse. Every other pulse is inverted from the previous pulse in polarity, so that the signal can be effectively transmitted. This means, however, that a long sequence of zeroes in the data stream will cause problems, because the modem receiving the signal relies on the signal to recover the 2.048-Mbps clock.

If you must use AMI, make sure that the data-terminal equipment connected to the unit provides a minimally acceptable pulse density. For this reason, there are advantages to using HDB3 instead. AMI coding does not inherently account for ones density. To meet this requirement, ensure that the data inherently meets pulse-density requirements.

S3	S4	Setting
Off	Off	HDB3 (default)
On	On	AMI
On	Off	Not used (reserved)
Off	On	Not used (reserved)

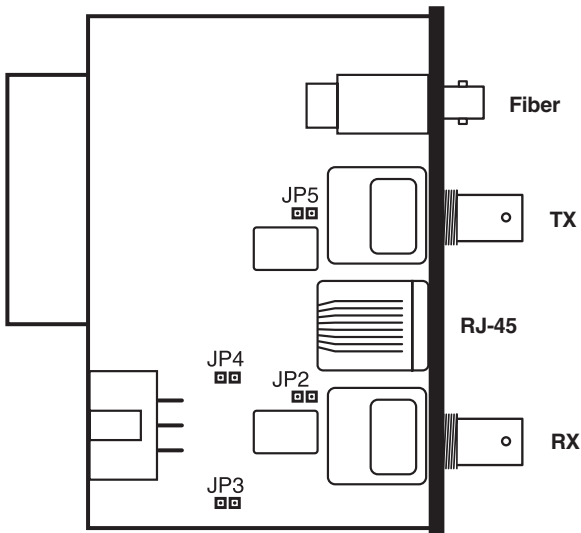
Positions S5 through S8 of this switch are reserved for future applications and should be left set to OFF.

## 3.2 Selecting the Interface/Connector

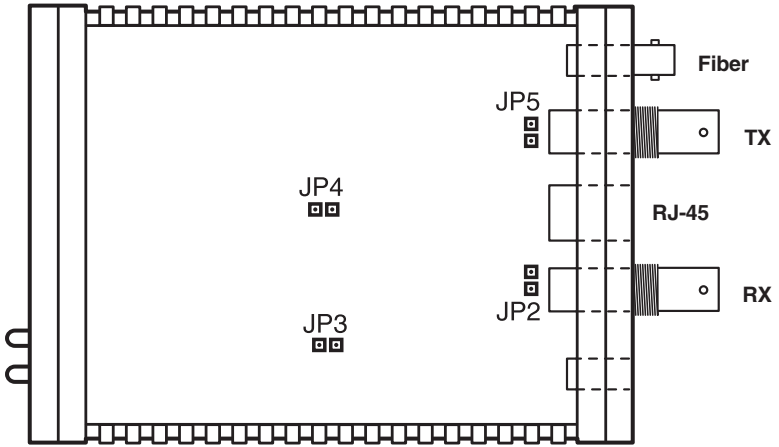
The Single-Mode G.703/E1 Fiber Line Driver is shipped configured for use with a BNC (75-ohm) connection to the G.703/G.704 network. If your network connection is using BNC, you can skip this section and proceed with **Chapter 4**.

The Line Driver has four jumpers labeled JP2, JP3, JP4, and JP5. These jumpers are used to match input/output impedance between the Line Driver and the external line connected to its G.703/G.704 interface. By controlling the impedance, they determine which of the Line Driver's G.703/G.704 connectors can be used: Leave the jumpers installed to have the Line Driver operate at 75 ohms for a coaxial line attached to the BNC connectors (the default setting), or remove all of the jumpers to have the Line Driver operate at 120 ohms for a twisted-pair line attached to the RJ-48C connector.

These jumpers are mounted on the rear card of the Line Driver Cards (ME401C models), as shown in Figure 3-4; they're mounted on the internal circuit board of the standalone Line Drivers (ME401A models), as shown in Figure 3-5 on the next page. To open the standalone model's case, insert a screwdriver into the slots on the side of the case and twist the screwdriver head slightly. The top half of the case will separate from the lower half, so you can remove it. Be careful not to damage any of the components mounted on the circuit board.



**Figure 3-4.** The position of the jumpers on the rear card of the Line Driver Cards (ME401C models).



**Figure 3-5. The position of the jumpers on the internal circuit board of the standalone Line Drivers (ME401A models).**

# 4. Installation

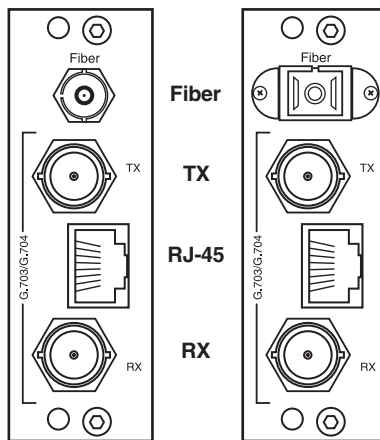
## NOTE

*Card (ME401C) models only:* Although the front and rear cards of the Single-Mode G.703/E1 Fiber Line Driver resemble those used by other cards designed for the 16-Port managed MicroRACK, they are specifically designed to work with each other only. Do not “mix and match” the front card from one MicroRACK card with the rear card of another.

Once the Single-Mode G.703/E1 Fiber Line Driver is properly configured, it is ready to be installed:

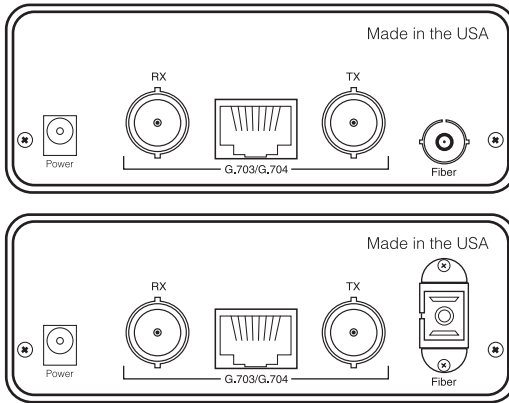
- *Card model only:* Install the front and rear cards in a 16-Port Managed MicroRACK as described in **Section 4.1**.
- Connect your G.703/G.704 equipment to the Line Driver as described in **Section 4.2**.
- Connect the fiberoptic line to the Line Driver as described in **Section 4.3**.
- Connect the Line Driver to the power source as described in **Section 4.4**.

The G.703/G.704, fiberoptic, and (on the standalone models) power connectors are located on the rear panel of the Line Driver. Figure 4-1 shows the locations of each of these ports on the Line Driver Cards. Figure 4-2 on the next page shows the locations of each of these ports on the standalone Line Drivers.



**Figure 4-1.** The location of the connectors on the rear card of the Line Driver Cards (ME401C-FC, left, and ME401C-SC, right).





**Figure 4-2. The location of the connectors on the rear panel of the standalone Line Drivers (ME401A-SC, top, and ME401A-FC, bottom).**

### 4.1 Card Models Only: Installing the Front and Rear Cards in the MicroRACK

The card models of the Line Driver (ME401C models) consist of a front card and a rear card that meet in the middle of the 16-Port Managed MicroRACK and plug into each other with mating 50-pin card-edge connectors. The MicroRACK has sixteen slots that can be used for the Line Driver if you use one power supply, or fourteen slots if you use two redundant power supplies; the Line Driver takes up a single slot.

You can install the Line Driver in any free slot except slot #17, where a power supply needs to be. It doesn't matter whether a power supply is already installed and operating or not; the Line Driver is hot-swappable and won't be damaged by installing or removing it when the MicroRACK is powered. If the rack is powered, the front and rear cards will start operating as soon as they touch the midplane of the rack.

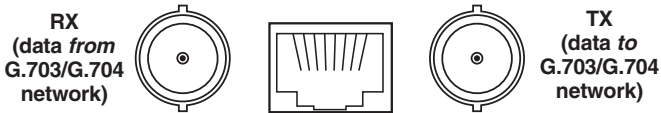
To install the Line Driver in your chosen slot, take these steps:

1. Slide the rear card into the slot from the back of the rack chassis, along the metal rails.
2. Secure the rear card in place using the provided metal screws.
3. Slide the front card into the slot from the front of the chassis. It should meet the rear card when it's almost all the way into the chassis.
4. Push the front card *gently* into the rear card's card-edge receptacle. It should "click" into place.
5. Secure the front card in place using its captive thumbscrews.

## 4.2 Connecting the G.703/G.704 Network to the Line Driver

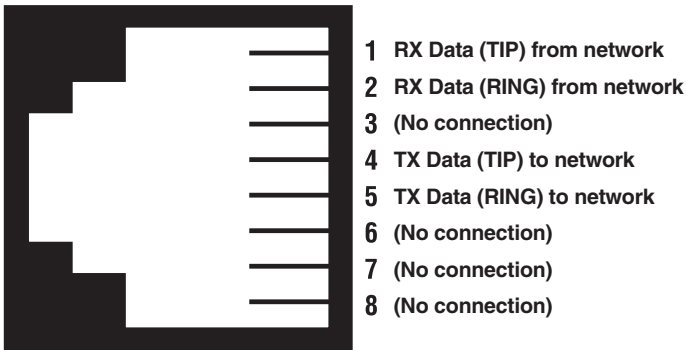
Your Line Driver should already be set to the proper impedance for your chosen interface (see **Section 3.2**); if it isn't, set it now.

If you're using the 75-ohm coaxial interface, run two coax cables from your G.703/G.704 equipment to the two BNCs on the Line Driver's rear panel. As shown in Figure 4-3, the cable carrying data *to* the G.703/G.704 equipment should be attached to the Driver's TX connector, while the cable carrying data *from* the equipment should be attached to the Driver's RX connector.



**Figure 4-3.** Connecting coax cables to the Line Driver's BNC connectors.

If you're using the 120-ohm twisted-pair interface, connect the twisted-pair cable to the RJ-48C connector on the Line Driver's rear panel. The pinout of this connector is standard for E1 and is shown in Figure 4-4.



**Figure 4-4.** Pinout of the Line Driver's RJ-48C connector.

## 4.3 Connecting the Fiberoptic Line to the Line Driver

Run 9/125- $\mu$ m single-mode fiberoptic cabling, terminated at either end with FC connectors (for “-FC” models of the Line Driver) or SC connectors (for “-SC” models), between your local and remote Line Drivers. You'll only need a simplex (one-strand) cable or a single strand of a multi-strand cable. This cabling, which can be up to 50 km (31 miles) long, should be connected to the FC or SC connector on the Line Driver's rear panel.

#### **4.4 Standalone Models Only: Connecting Power to the Line Driver**

The Line Driver comes with an autosensing power supply that accepts 100 to 240 VAC and outputs 5 VDC, 2 A (center pin carries +5V). Plug the power-supply transformer's output cord into the barrel jack on the rear panel of the Line Driver. Then plug the IEC 320 female end of the transformer's input cord into the IEC 320 male inlet on the transformer. Finally, plug the other end of the input cord into a working AC outlet. The Line Driver will start operating as soon as you complete the connection to the AC outlet; it doesn't have an on/off switch.

### **CAUTION!**

**The Line Driver's power supply contains no user-serviceable parts. Do *not* attempt to open, maintain, or repair it. The fuse can be replaced if it blows, but this should only be done by qualified service personnel.**

# 5. Operation

Once the Single-Mode G.703/E1 Fiber Line Driver is properly configured and installed, it should be transparent to local and remote users, operating continuously without requiring operator intervention.

## 5.1 Power-Up Behavior

As described in **Section 4.1**, the card models of the Line Driver will power up as soon as its front and rear cards meet at the midplane of the MicroRACK. As described in **Section 4.4**, the standalone Line Drivers will power up as soon as you plug it into a working AC outlet.

Assuming that both of its front-panel switches are set to “normal,” the Line Driver will begin operating normally. (Otherwise it will begin operating in test mode, as described in **Section 5.3**; move the switches to normal to turn test mode off.) Once both the local and remote Line Drivers are powered and operating normally, they’ll synchronize with each other and establish a communication link. The synchronization process should take only a few seconds (typically less than five). Any time one of the two Line Drivers loses power (for example, in a lightning storm), they will resynchronize when the power is restored, then resume data transmission.

When the local and remote Line Drivers have established a link and are passing reliable data, their front-panel “Fiber” and “E1” LEDs should be lit green and the other LEDs should be dark. See **Section 5.2** for the meanings of the LEDs.

## 5.2 The Front-Panel LEDs and Switches

As shown in Figures 5-1 and 5-2 on the next page, the Line Driver has six front-panel status LEDs and two front-panel toggle switches. Here's what they do:

- The green **Fiber** LED lights to show that reliable data is being received on the fiber side
- The green **E1** LED lights to show that reliable data is being received on the G.703/G.704 side.
- The red **LOS** LED lights steadily to show that synchronization between the Line Drivers has been lost or has not been established. It blinks to show the presence of coding errors.
- The red **NS** LED lights to show that the signal on the fiber side is too weak to be detected, which can be caused by any of several things:
  - a break in the fiberoptic cable;
  - the fiberoptic cable being too long; or
  - a problem with Fiber LED.
- The red **ER** LED flashes to show the presence of errors in the 511 test pattern (see **Section 5.3.3**).
- The yellow **TM** LED lights to show that the Line Driver is in a test mode (local/remote loopback or 511/511E test pattern—see **Section 5.3**). This LED will be dark during normal operation.
- One switch is marked “**RDL - LLB**” on the Line Driver Cards and “**Local - Normal - Remote**” on the standalone Line Drivers. When this switch is in its middle (“Normal”) setting, the Line Driver operates normally. When this switch is in the “LLB” or “Local” position, the Line Driver operates in “local analog loopback” test mode (see **Section 5.3.1**). When this switch is in the “RDL” or “Remote” position, the Line Driver operates in “remote digital loopback” test mode (see **Section 5.3.2**).
- The other switch is marked “**511 - 511/E**” on the Line Driver Cards and “**511/E - Normal - 511**” on the standalone Line Drivers. When this switch is in its middle (“Normal”) setting, the Line Driver operates normally. When this switch is in the “511” or “511/E” position, the Line Driver begins transmitting Bit Error Rate (BER) test patterns (see **Section 5.3.3**). (This is not normally done except in conjunction with loopback testing.)

**CAUTION!**

When either of a Line Driver's front-panel switches are moved to any position other than "Normal," normal data transmission will be interrupted.

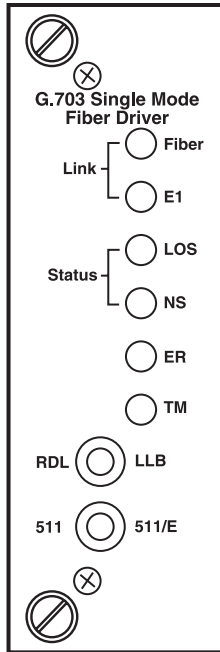


Figure 5-1. The front panel of the Line Driver Cards (ME401C models).

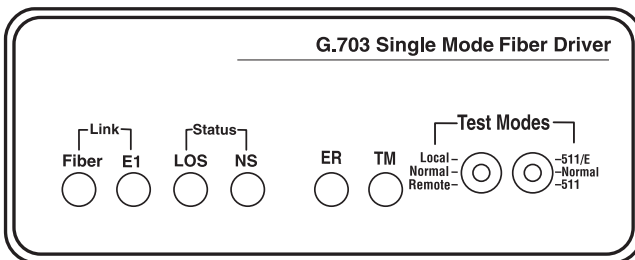


Figure 5-2. The front panel of the standalone Line Drivers (ME401A models).

## 5.3 Test Modes

The Line Driver can perform V.54-compliant local/remote loopback tests, and it also has a built-in V.52 BER test-pattern generator to help you evaluate the condition of the modems and the communication link. These tests can be activated manually using the Line Driver's front-panel toggle switches.

### 5.3.1 LOCAL ANALOG LOOPBACK (LLB)

Use the local analog loopback (LLB) test to check the operation of the local Line Driver, the local G.703/G.704 equipment, and the coaxial or twisted-pair link between them. Perform the test separately at each Line Driver. Any data sent to the local Line Driver in this test mode will be echoed (returned) back to the user (see Figure 5-3). If two Line Drivers are linked when the LLB is activated, data sent from the remote Line Driver will also be looped back to the remote terminal equipment.

To perform a local analog loopback test, take these steps:

1. Activate LLB by moving the front-panel toggle switch marked “**RDL - LLB**” or “**Local - Normal - Remote**” to the “LLB” or “Local” position. As soon as you do this, the Line Driver's transmit output will be connected to its own receiver. The TM LED will light.
2. Perform a BER (Bit Error Rate) test on the Line Driver, using either the Driver's own internal 511/511E pattern generator (see **Section 5.3.3**) or an external BER tester. If the BER test equipment indicates no faults, but the data is corrupted, check the cable between the Line Driver and the local G.703/G.704 equipment. If this is OK, the G.703/G.704 equipment is probably malfunctioning; follow the manufacturer's instructions for troubleshooting it.
3. When the LLB test is complete, move the front-panel switch back to the “Normal” (middle) position to return the Line Driver to normal operation. The TM LED should go dark. Repeat this test at the remote site.

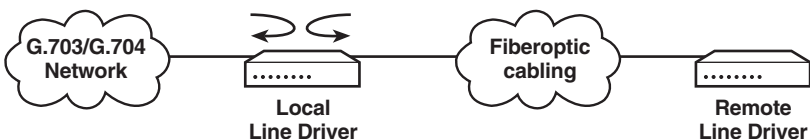


Figure 5-3. Local analog loopback.

### 5.3.2 REMOTE DIGITAL LOOPBACK (RDL)

Use the remote digital loopback test to check the performance of both the local and remote Line Drivers, and the fiber link between them. In this test, any characters sent from the originating device to the remote unit will be returned (see Figure 5-4). Any data sent from the remote DTE will be ignored.

To perform a remote digital loopback test, take these steps:

1. Activate RDL at one of the Line Drivers by moving the front-panel toggle switch marked “RDL - LLB” or “Local - Normal - Remote” to the “RDL” or “Remote” position. The TM LED on both local and remote units will light.
2. Perform a BER (Bit Error Rate) test on the system at the local end, using either the local Driver’s own internal 511/511E pattern generator (see **Section 5.3.3**) or an external BER tester.
3. If the BER test equipment indicates a fault and the local analog loopback test (see **Section 5.3.1**) was successful for both Line Drivers, there might be a problem with the fiberoptic cabling between the units.
4. When the RDL test is complete, move the front-panel switch back to the “Normal” (middle) position to return the Line Driver system to normal operation. The TM LED should go dark on both the local and remote units.

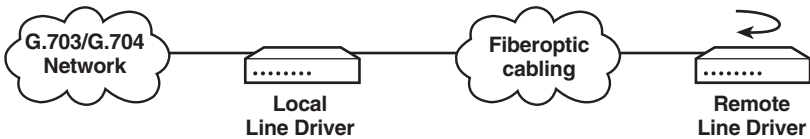


Figure 5-4. Remote digital loopback.



### 5.3.3 BIT ERROR RATE (BER) TEST-PATTERN GENERATOR

To use the Line Driver's internal V.52-compliant BER test in conjunction with local or remote loopback, take these steps:

1. Move the Line Driver's front-panel toggle switch marked "511 - 511/E" or "511/E - Normal - 511" to the "511" position. This activates the V.52 BER test mode and transmits a 511-bit pseudo-random test pattern into the loop. If any errors are present, the local Line Driver's red "ER" LED will blink intermittently.
2. If the regular 511 test indicates no errors, move the switch to the "511/E" position, activating the "511/E" test with errors present. If the test is working properly, the local Line Driver's red "ER" LED will blink once every two seconds. A successful "511/E" test will confirm that the link being tested is intact, and that the built-in 511 generator and detector are working properly.

### NOTE

**When a Line Driver is set for "Network" clocking, it must derive its timing from the G.703/G.704 interface. Failure to connect the Line Driver you are testing to G.703/G.704 equipment might result in bit errors during the 511 or 511/E test.**

# 6. Troubleshooting

If your Single-Mode G.703/G.704 Line Driver is operating but isn't doing it terribly well, the first thing to do is to check your cables and make sure that they're securely connected to your equipment and to any patch panels, etc., that might be involved. If the cables are seated properly, try to pinpoint where the problem is with the tests described in **Section 5.3**. If the results lead you to suspect that there's a problem with the Line Driver rather than the cables or other equipment, call us as described in **Section 6.1**.

## 6.1 Calling Black Box

If you determine that your Line Driver is malfunctioning, *do not attempt to alter or repair it*. It is not user-serviceable. Contact Black Box Technical Support at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem;
- when the problem occurs;
- the components (especially cables) involved in the problem;
- any particular application that, when used, appears to create the problem or make it worse; and
- the results of any testing you've already done (including the tests in **Section 5.3**).

## 6.2 Shipping and Packaging

If you need to transport or ship your Line Driver:

- Package it carefully. We recommend that you use the original container.
- If you are returning the unit, include everything you received with it. Before you ship the unit back to Black Box for repair or return, contact us to get a Return Authorization (RA) number.

## NOTES



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