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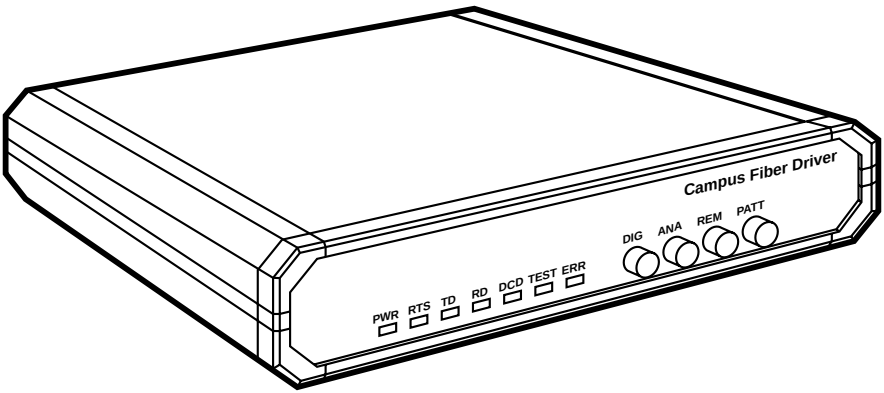
MAY 1997

ME550A-35	ME550AE-35
ME550A-X21	ME550AE-X21
ME551A-35	ME551AE-35
ME551A-X21	ME551AE-X21
ME552A-35	ME552AE-35
ME552A-X21	ME552AE-X21

Campus Fiber 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 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.

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.

DISCLAIMERS

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The manufacturer shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any legal theory.

SAFETY WARNING

Always observe standard safety precautions while installing, operating, or troubleshooting this product. To avoid the possibility of electrical shock, disconnect the unit's power cord from the power source before you remove the unit's cover.

Only a competent technician who is aware of the hazards involved should carry out adjustment, maintenance, or repairs to this product. No adjustment, maintenance or repairs should be performed by either the operator or the user.

Contents

1. Specifications

Compliance — FCC Class A, IC Class/classe A

Standards — Loopback tests: ITU-TSS V.54;
BERT: ITU-TSS V.52

Interfaces — Line side: Fiberoptic:
ME550 models: Multimode;
ME551 models: LED-source single-mode;
ME552 models: Laser-source single-mode;
Device side:
"–35" models: ITU-TSS V.35;
"–X21" models: ITU-TSS X.21

Protocol — Synchronous

Clock Source — Internal, external (from attached device), or recovered (from remote LDM-MR128)

Flow Control — Transparent to flow control, although the user can set the unit to raise or lower transmit carrier in response to the state of the RTS (V.35 models) or I (X.21 models) signal

Data Rate — 2.048, 1.544, 1.536, or 1.024 Mbps, or 768, 512, 384, 256, 128, 112, 64, or 56 Kbps (user-selectable)

Optical Wavelength — ME550 models: 850 nm;
ME551 and ME552 models: 1300 nm

Output Power — ME550 models: –18 dBm into 62.5/125 fiber
ME551 models: –18 dBm into 9/125 fiber
ME552 models: –12 dBm into 9/125 fiber

Receiver Sensitivity — ME550 models: –39 dBm;
ME551 and ME552 models: –40 dBm

Dynamic Range — 28 dBm

Link Budget — ME550 models: 21 dBm;
ME551 models: 22 dBm;
ME552 models: 28 dBm

Maximum Distance — Depends on quality of cable, how and where cable is installed, and (for Driver-to-DTE distance) interface and data rate:
Between Driver and DTE: 50 ft. (15.2 m);
Across fiber link:
ME550 models: 3.1 mi. (5 km);
ME551 models: 12.4 mi. (20 km);
ME552 models: 31 mi. (50 km)

User Controls — (4) Front-mounted pushbuttons for loopback testing and BERT;
(1) Internal data-rate screwdial;
(6) Internal jumpers for timing, testing, grounding, and other features

Diagnostics — V.54-compliant loopback tests; V.52-compliant BERT

Indicators — (7) Front-mounted LEDs: PWR (power), RTS, TD, RD, DCD, TEST, ERR (error)

Connectors — All models:
(2) ST female: (1) TX, (1) RX;
(1) IEC 320 male power inlet;
"–35" models:
(1) 34-pin M-block female;
"–X21" models:
(1) DB15 female

MTBF — 95,000 hours

Temperature Tolerance — 32 to 122˚F (0 to 50˚C)

Humidity Tolerance — 0 to 90% noncondensing

Power — From outlet through power cord and internal power supply:
Models with just "A" in product code:
Optimal Input: 115-VAC, 60 Hz, 43 mA;
Input Range: 103.5- to 126.5-VAC, 47 to 63 Hz;
Models with "AE" in product code:
Optimal Input: 230-VAC, 50 Hz, 22 mA;
Input Range: 207- to 253-VAC, 47 to 63 Hz;
Consumption: 5 VA (5 watts)

Size — 1.7"H x 9.6"W x 7.6"D (4.4 x 24 x 19.3 cm)

Weight — 3.1 lb. (1.4 kg)

2. Introduction

2.1 General Overview

The Campus Fiber Driver is a synchronous high-speed fiberoptic modem designed to enable communication between two V.35- or X.21-compliant data devices over a fiberoptic link. Pairs of Drivers extend the distance of high-speed transmission by creating a secure fiberoptic link that is immune to electrical interference and differential ground loops. Data sent across this link will not be corrupted by sparking or lightning.

The Campus Fiber Driver operates at twelve selectable data rates from 56 kbps to 2048 kbps. The different models of the Driver operate across different kinds of fiberoptic links:

- The ME550 models use an LED to transmit data into multimode fiber at 850 nm across a maximum distance of 5 km (3.1 mi.).
- The ME551 models use an LED to transmit data into single-mode fiber at 1300 nm across a maximum distance of 20 km (12.4 mi.).
- The ME552 models use a laser diode to transmit data into single-mode fiber at 1300 nm across a maximum distance of 50 km (31 mi.).

The Campus Fiber Driver features V.54 diagnostic capabilities, an internal 511-bit pseudo-random pattern generator and a BER tester. It also supports different clock sources in order to support different applications: internal (from its own oscillator crystal), external (from DTE), or recovered (from received signal from remote Driver).

2.2 Features in Detail

This section describes some of the main features of the Campus Fiber Driver, especially those involving uts configuration and its electronic circuitry. Refer to the block diagram in **Figure 2-1** below.

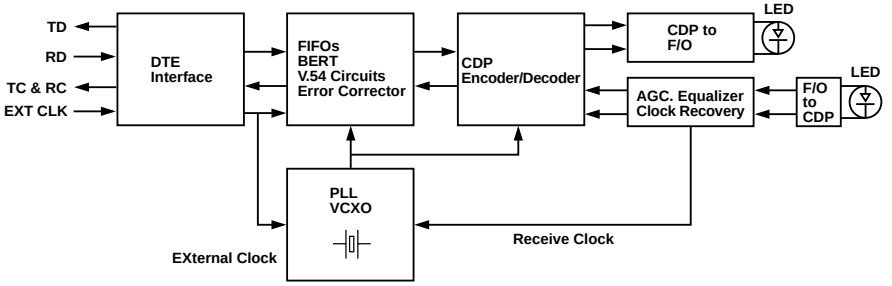

Figure 2-1. Block diagram for the Campus Fiber Driver.

2.2.1 Data Communication

The Campus Fiber Driver is a high-speed data link between computers, routers, or multiplexors. The twelve selectable data rates are: 56, 64, 112, 128, 256, 384, 512, and 768 Kbps; 1.024 and 1.536 Mbps; 1.544 Mbps (T1 speed); and 2.048 Mbps (E1/CEPT speed).

The electrical signals from the attached DTE are converted into an optical signal using an infrared light-emitting diode (LED) at 850 nm (ME550 models) or 1300 nm (ME551 models), or a laser-emitting diode at 1300 nm (ME552 models). At the opposite end of the fiber, the optical signal is converted back into the original electrical signal.

The Driver utilizes a Phase Locked Loop (PLL) circuit to recover jitter-free data and clock from the optical signal.

Different models of the Driver have the ITU-TSS V.35 DTE interface ("-35" product codes) or the ITU-TSS X.21 DTE interface ("-X21" product codes).

2.2.2 Diagnostics

If you need to test your Campus Fiber Driver system, you can activate various V.54-compliant loopbacks by pressing buttons on the Driver's front panel or by toggling the signals on certain pins of the DTE interface.

When you use the Campus Fiber Driver as a tail end to a digital network or multiplexor, set the V.54 DELAY jumpers ON in the Drivers located close to the digital network. This will prevent multiple loopbacks from occurring when you activate remote loopback, because the delay triggered when the jumper is ON causes keeps the remote Drivers from receiving the complete V.54 data sequence and, in turn, being induced into a loop.

2.2.3 Test-Pattern Generator and Receiver

The Campus Fiber Driver has a test-pattern generator and receiver that can be used to easily test the local and remote Drivers and the fiber link between them. When you press the PATT button on the Driver's front panel, this circuit sends and checks a standard 511-bit pseudo-random pattern. If it finds any errors, it causes the ERROR LED to light or blink.

The test can be carried out when the local Driver is in local analog loopback, in remote digital loopback, or in normal point-to-point operation opposite a remote Driver (press the PATT button on the remote unit or connect a Bit Error Rate Tester which uses the standard 511-bit pattern).

2.3 Sample Applications

Figure 2-2 below and **Figure 2-3** on the next page show typical applications for a pair of Campus Fiber Drivers.

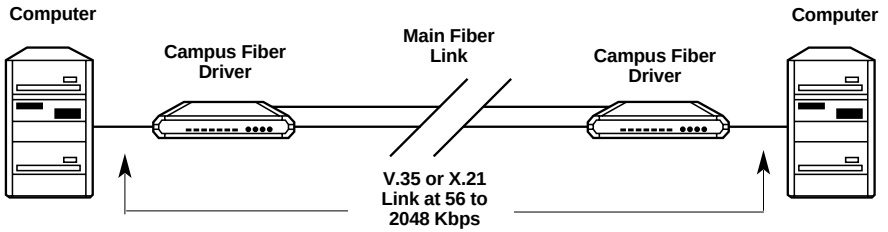

Figure 2-2. Direct link between two computers.

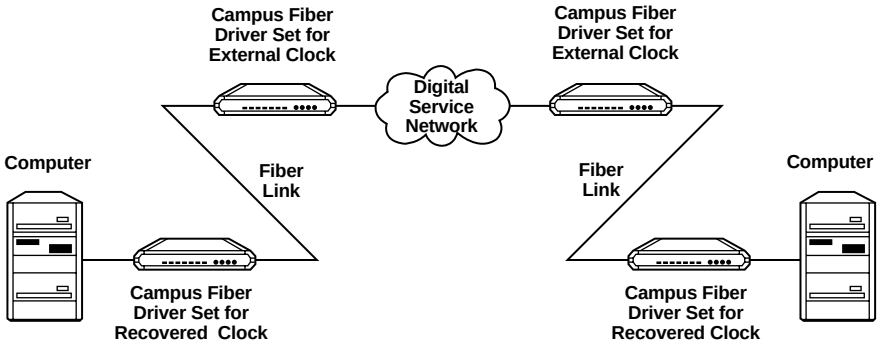

Figure 2-3. Tail-end application.

3. Installation

This chapter explains how to install your Campus Fiber Driver. After you install it, see **Chapter 4** for how to operate it and **Chapter 5** for how to test the system.

3.1 Placement

Install the Campus Fiber Driver within 5 ft. (1.5 m) of an easily accessible, grounded AC outlet. The outlet should furnish 115-VAC (for "-A-" models) or 230-VAC (for "-AE-" models).

Allow at least 3 ft. (91 cm) of frontal clearance for operating and maintenance accessibility. Allow at least 4 in. (10.2 cm) clearance at the rear of the unit for signal lines and interface cables.

The Driver is designed for tabletop or bench installation, and is delivered completely assembled. No provisions are made for bolting the Driver to the tabletop.

3.2 Configuration

Before attaching anything to the Campus Fiber Driver, determine which data rate you're going to use, what the system's clock source should be, and how you want to set all of the other user-configurable options on the Driver. (Refer to **Table 3-1** on the next page for a list of all of these options; the SW*n* and J*n* numbers in the table's "Element" column correspond to the locations with the same numbers in **Figure 3-1** on **page 15**.)

(text continues on page 16)

Table 3-1. User-Configurable Options

Element	Function	Possible Settings	Standard Factory Setting
SW1 BIT RATE Dial	Select the data rate in kilobits per second.	Opt. 1 0-1544 1-1536 2-768 3-384 4-2048 5-1024 6-512 7-256 8-128 9-64 A-112 B-56	 64 Kbps
JP1 TIMING Jumper	Select the source of the Transmit timing signal: internal clock, external clock (from DTE), or receive clock (from remote unit).	EXT INT RCV	 INT (Internal)
JP2 CARR Jumper	Select the Transmit-carrier mode. When you set this jumper to “ON,” Transmit carrier is constantly ON. When you set this jumper to jumper to “CNT,” Transmit carrier is ON only when RTS (V.35) or I (X.21) is high.	CNT ON	 ON
JP3 V54 DELAY Jumper	Turn V.54 delay ON (YES) or OFF (NO). When you turn it ON, V.54 delay prevents multiple loopback of tail-end circuits.	NO YES	NO
JP4 CHASS GND Jumper	Select CON to tie Signal Ground to Chassis Ground (Frame Ground). Select DIS to isolate the two grounds from each other.	DIS CON	 CON
JP5 LLB Jumper	Select EN to enable the triggering of local analog loopback when the DTE raises the signal on the corresponding interface pin. Select DIS to disable this feature and force manual control of local analog loopback.	EN DIS	 DIS
JP6 RLB Jumper	Select EN to enable the triggering of remote digital loopback when the DTE raises the signal on the corresponding interface pin. Select DIS to disable this feature and force manual control of remote digital loopback.	EN DIS	 DIS

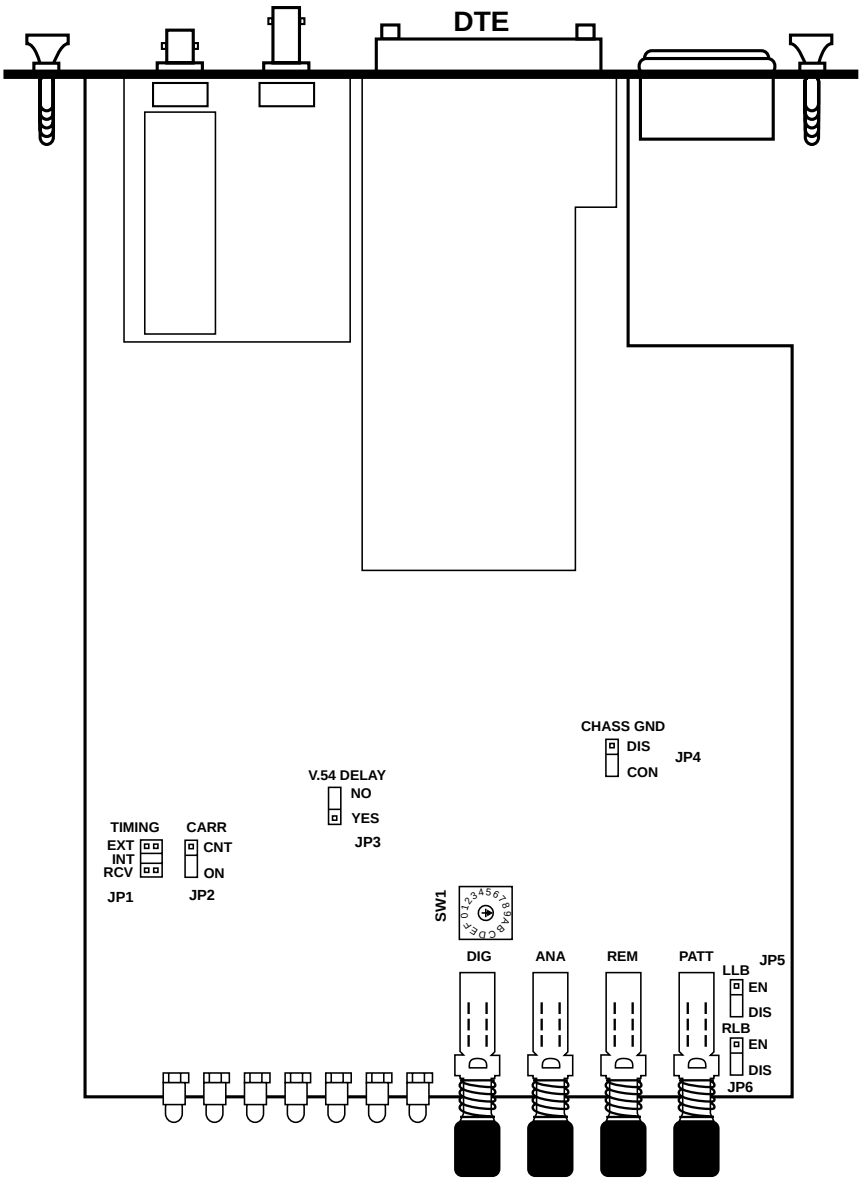

Figure 3-1. Circuit board of the Campus Fiber Driver.

(text continued from page 13)

When you have everything at least tentatively decided, take these steps to set the unit's internal controls:

CAUTION!

Make sure the Driver is disconnected from AC power before removing it from its housing.

WARNING: HIGH VOLTAGE!

Any adjustment, maintenance, and repair of the open instrument under voltage should be avoided as much as possible, and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved. Capacitors inside the instrument may still be charged even after the instrument has been disconnected from the power source.

1. If the Driver's AC power cord is plugged into an AC mains outlet, unplug it.
2. Unscrew the two rear-panel screws until the rear panel becomes loose. This releases the Driver's "drawer" mechanism; now you can pull the screws as if they were the knobs on a drawer and expose or remove the unit's circuit board.
3. Identify the control(s) (refer to **Figure 3-1** on **page 15**).
4. Move the control(s) to your desired position(s).
5. Replace the circuit board and screw the rear-panel screws back in.

3.3 Installation in 19-Inch Racks (Optional)

3.3.1 Overview

The Campus Fiber Driver can be installed in 19-inch racks. It is 1U (1.75", 4.4 cm) high and is slightly less than half as wide as the available mounting area. Two rack-adapter kits are available as special quotes: One kit provides the hardware necessary to install a single unit, and the other provides the hardware necessary to install two units side by side. **Sections 3.3.2** and **3.3.3** provide step-by-step instructions for installation of single or dual units.

CAUTION!

Make sure the Driver is disconnected from AC power while you perform the following procedures.

3.3.2 Installing a Single Unit in a 19-Inch Rack

The rack-adapter kit for single-unit installation includes one short bracket and one long bracket. The brackets are fastened with screws to the two side walls of the case, as shown in **Figure 3-2** on the next page.

To prepare the Campus Fiber Driver for rack installation, attach the two brackets to the sides of the unit. Do this by inserting screws and flat washers into the two holes at the front of each side of the Driver (nuts are already in place inside the unit).

After attaching the brackets, install the unit in your 19-inch rack by fastening the brackets to the rack's side rails with four screws (not included in the kit), two on each side.

3.3.3 Installing Two Units in a 19-Inch Rack

The adapter kit includes two long side rails (one for each unit), which slide into each other to fasten the units together, and two short side brackets, which hold the two Campus Fiber Drivers side by side in a 19-inch rack. Refer to **Figure 3-3** on **page 19** when you perform the following procedure:

1. Fasten one long side rail to each Driver—one rail on the right side of one unit, the other rail on the left side of the other unit—using the four included screws and flat washers. The rails must be attached so that they "oppose" each other: The narrow flange of the first rail must face the wide flange of the second rail.

2. Using four included screws and flatwashers for each bracket, attach the two short brackets to the vacant sides of the Drivers.

3. Slide the two Drivers' side rails into each other, fastening the two units together.

4. Secure the included plastic caps to the ends of the rails, to protect the rail ends and prevent the units from moving.

5. You can now use four screws (*not* supplied with the kit), two on each side, to fasten the assembled units to the side rails of the 19-inch rack.

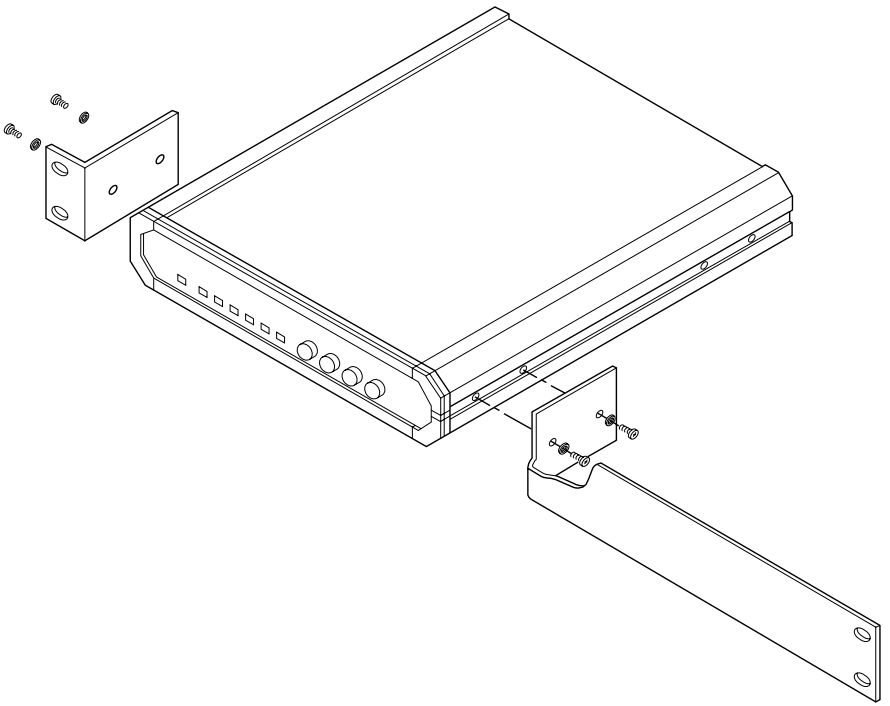

Figure 3-2. Installing a single unit in a 19-inch rack.

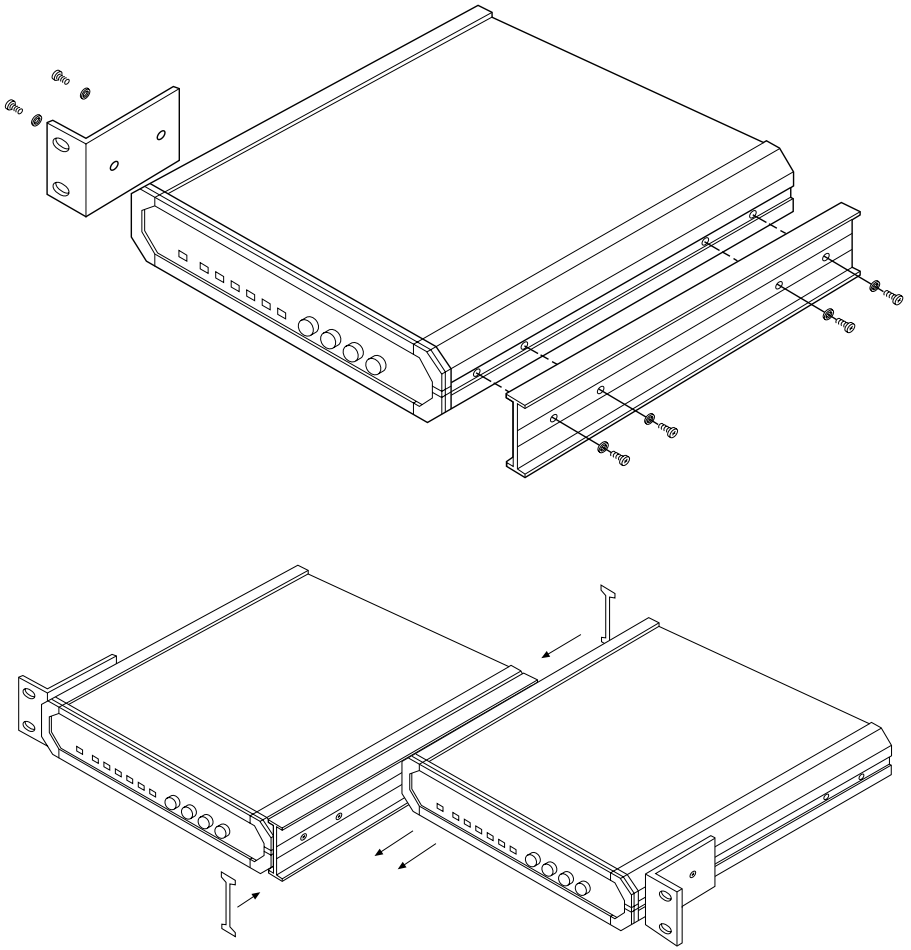

Figure 3-3. Installing two units in a 19-inch rack.

3.4 Cabling the Driver

After you set the Campus Fiber Driver's internal controls, the Driver is ready to be cabled for operation.

Its electrical and optical connectors are located on its rear panel, as shown in **Figures 3-4** and **3.5** below. These consist of a V.35 or X.21 female interface connector labeled "DTE," two ST® female connectors labeled "TX" and "RX," and an IEC 320 male AC inlet that contains an integral fuse compartment.

The V.35 or X.21 interface connector, a 34-pin M-block female or DB15 female respectively, carries input/output data, clock signals, and control signals between the Campus Fiber Driver and the attached DTE or DCE (refer to **Table 3-2** on the next page and T**able 3-3** on **page 22**).

These signals from the DTE or DCE are translated into light pulses which are transmitted between Drivers through their ST female fiberoptic connectors.

Connect power and data cables to the Driver as described in the following subsections.

(text continues on page 23)

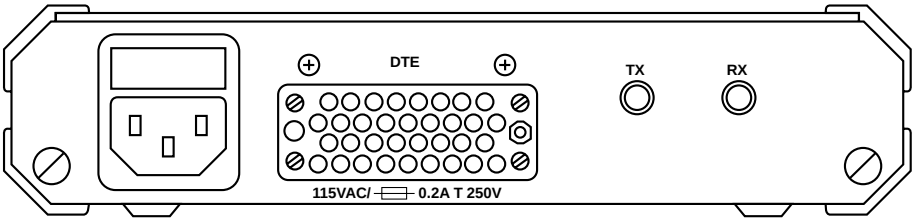

Figure 3-4. The rear panel of the V.35 Campus Fiber Drivers.

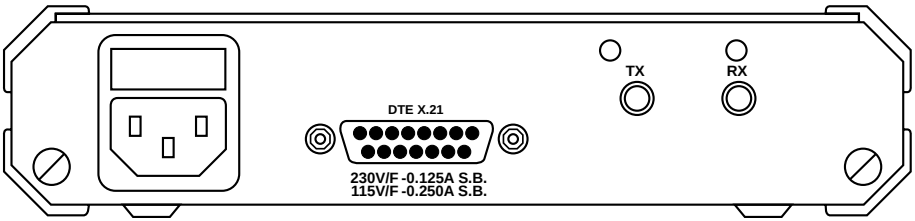

Figure 3-5. The rear panel of the X.21 Campus Fiber Drivers.

Table 3-2. Pinout of the V.35-Model Driver's DTE Connector

SIGNAL NAME (ABBREV.)	ITU-TSS CIRCUIT	LEAD TYPE	V.35 PIN
Frame (Protective) Ground (FGND)	101		A
Signal Ground (SGND)	102		B
Send Data (SD)	103	A B	P S
Receive Data (RD)	104	A B	R T
Request to Send (RTS)	105		C
Clear to Send (CTS)	106		D
Data Set Ready (DSR)	107		E
Data Terminal Ready (DTR)	108		H
Received Line Signal Detector (RLSD), a.k.a. Carrier Detect (CD)	109		F
Serial Clock Transmit External (SCTE), a.k.a. External Clock (EXTC)	113	A B	U W
Serial Clock Transmit (SCT), a.k.a. Transmit Clock (TC)	114	A B	Y AA
Serial Clock Receive (SCR), a.k.a. Receive Clock (RC)	115	A B	V X
Remote Digital Loopback (RL)	140		HH
Local Analog Loopback (LL)	141		JJ
Test Mode (TM)	142		KK

Table 3-3. Pinout of the X.21-Model Driver's DTE Connector

SIGNAL NAME (ABBREV.)	ITU-TSS CIRCUIT	LEAD TYPE	X.21 PIN
Shield (Ga)	101		1
Signal Ground (G)	102		8
Transmit Data (T)	103	A	2
		B	9
Receive Data (R)	104	A	4
		B	11
Control (C)	105	A	3
		B	10
Indication (I)	109	A	5
		B	12
External Timing (E)	113	A	7*
		B	14*
Signal Timing (S)	114	A	6
		B	13

*In true standard X.21, these pins are earmarked for the Byte Timing (B) signal, which is not normally used. On the Campus Fiber Driver, these pins carry the "external clock" signal, which is common to other interfaces but is not supported by X.21. The X.21 versions of the Driver do not support the "receive clock" or "recovered clock" signal (ITU-TSS circuit 115).

3.4.1 DTE Connection

The Campus Fiber Driver's DTE connector provides an interface for input/output data, as well as clock and control signals, between the Driver and a V.35 or X.21 DTE or DCE. This connector is a standard 34-pin M-block ("M/34") female on V.35 models or a standard DB15 female on X.21 models. The pinout of the M/34 connector is shown in **Table 3-2** on **page 21**; that of the DB15 connector is shown in **Table 3-3** on **page 22**.

NOTE

Versions of the Driver designed for any of several other DTE interfaces are available as special quotes: ITU-TSS V.24/EIA RS-232 (DB25 connector), ITU-TSS V.11/EIA RS-422/423/530 (DB25 connector), ITU-TSS V.36/EIA RS-449 (DB25 connector cabled to a DB37 connector), or ITU-TSS G.703 (5-screw terminal block). If you would like a Driver with one of these interfaces, call Black Box for technical support.

To connect the Driver to a V.35 or X.21 DTE or DCE, use an appropriate cable that is pinned correctly (straight-through for DTE, properly crossed for DCE). We recommend using shielded twisted pair, especially for higher data rates. Run this cable from the other device to the Driver and attach it to the Driver's interface connector.

The line receivers in the X.21 Campus Fiber Driver are 100-Ω terminated. If you have problems with your X.21 DTE connection, make sure that the DTE interface is correctly terminated at both ends.

3.4.2 Fiberoptic Connection

The Campus Fiber Driver's TX and RX connectors provide an interface for optical communication between pairs of Drivers. These are standard ST® female connectors. To run fiberoptic cable between two Drivers, first make sure you have two cables (or one duplex cable) of the proper type: 62.5/125-µm multimode if your Driver is an ME550 model, 9/125-µm single-mode if it's an ME551 or ME552, with ST male connectors. Attach one end of one of the cables or duplex-cable strands to the local Driver's TX connector; attach the other end of this cable or strand to the remote Driver's RX connector. Attach the other cable or strand to the local Driver's RX connector at one end and to the remote Driver's TX connector at the other end.

NOTE

Versions of the Driver with SMA or FC female fiberoptic connectors are available as special quotes. If you would like a Driver with one of these types of fiberoptic connectors, call Black Box for technical support.

3.4.3 Power Connection

The power connection provides AC voltage to the Campus Fiber Driver.

To make this connection on the 115-VAC ("-A-") models, first attach the IEC 320 female outlet of the included power cord to the IEC 320 male inlet on the Driver's rear panel.

To make this connection on the 230-VAC ("-AE-") models, first attach the IEC 320 female outlet of an appropriate power cord to the IEC 320 male inlet on the Driver's rear panel. (This power cord must have a plug on the other end that will fit the site's mains outlets.)

WARNING!

BEFORE PLUGGING THIS UNIT INTO AN OUTLET OR OTHER LIVE POWER SOURCE, make sure its protective earth contact is connected to the protective conductor of the (mains) power cord. The mains plug must be inserted only in a socket outlet provided with a protective earth contact. The protective action must not be negated by use of an extension cord (power cable) without a protective (grounding) conductor.

If the Driver's fuse blows (opens), make sure that you replace it only with a fuse rated for the required amount of current. You must avoid using repaired fuses or short-circuiting the fuse holders. The fuse, and one replacement fuse, are located in the top part of the mains connector on the Driver's rear panel. The nominal current value of the fuse is 0.125 A for 230-VAC operation or 0.25 A for 115-VAC operation.

Whenever it is likely that the protection offered by the fuse has been impaired, the unit must be made inoperative and secured against any unintended operation.

NOTE

Versions of the Driver that operate from –48 VDC power are available as special quotes. If you would like such a Driver, call Black Box for technical support.

After you have attached the power cord and have made sure that the cord is properly grounded, you can plug the power cord into a working mains outlet.

CAUTION!

The unit has no power switch. It starts operating as soon as power of the proper type is applied to its POWER connector.

4. Operation

This chapter contains a list of the Campus Fiber Driver's controls and indicators and their functions, as well as a brief description of how to operate the unit. Installation procedures must be completed and checked before you attempt to operate the Driver.

4.1 The Front-Panel Controls and Indicators

The front panel of the Campus Fiber Driver is shown in **Figure 4-1** below. It contains all of the unit's external controls and indicators: four pushbutton switches and seven LEDs. The functions of the controls are described in **Table 4-1** on the next page, and the meanings of the indicators are described in **Table 4-2**, also on the next page. In each of these tables, the letters and numbers under the heading "Item" correspond to the letters and numbers in **Figure 4-1**.

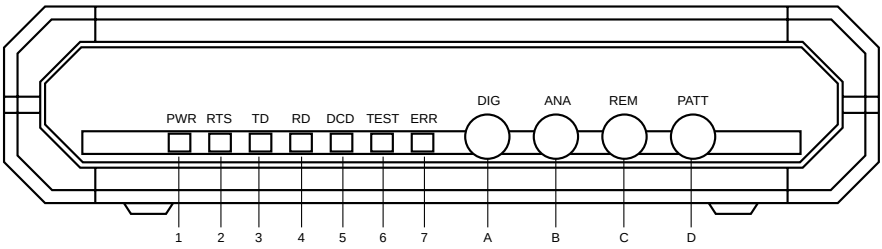

Figure 4-1. The front panel of the Campus Fiber Driver.

Table 4-1. The Controls

The Item labels in this table correspond to those in Figure 4-1.

ITEM	CONTROL	FUNCTION
A	DIG	Pressing the local digital loopback button causes the local Driver to loop received data and clock to its transmitter. Data Set Ready goes low.
B	ANA	Pressing the local analog loopback (V.54 Loop 3) button causes the local Driver to loop its transmitter output back to its receiver. This loopback may also be activated from the DTE when the “LLB” jumper is set to EN.
C	REM	Pressing the remote digital loopback (V.54 Loop 2) switch causes the remote Driver to loop received data and clock to its transmitter. Data Set Ready goes low. This loopback may be also activated from the DTE when the “RLB” strap is set to EN.
D	PATT	Pressing the PATT button causes the Driver to send and receive a 511 test pattern. If errors are encountered, the ERR LED becomes steadily lit or blinks. Receive Data and Clear to Send go low. Note: The unit’s “CARRIER” jumper should be set to ON; if it is set to CNT, the RTS (V.35) or I (X.21) signal must be high.

Table 4-2. The Indicators

The item numbers in this table correspond to those in Figure 4-1.

ITEM	INDICATOR	FUNCTION
1	PWR	Green LED is on when power is on.
2	RTS	Yellow LED is on when terminal activates Request to Send.
3	TD	Yellow LED is on when steady SPACE is being transmitted. It flickers when data is transmitted.
4	RD	Yellow LED is on when steady SPACE is being received. It flickers when data is received.
5	DCD	Yellow LED is on when a valid Receive signal is present.
6	TEST	Red LED is on when the Driver is in any of the loopback modes.
7	ERR	LED goes ON when PATT switch is activated and then dims. If there are errors in the test pattern, the LED blinks or remains ON.

4.2 Operating Procedure

The Campus Fiber Driver operates entirely unattended, although we recommend that you monitor its LEDs occasionally. To turn the unit off, you must unplug its power cord from the outlet—it has no power switch.

If you want to reconfigure the Driver for a different type of operation, *make very sure* to unplug the unit first. After the unit is powered down, change the settings of its internal controls as necessary, following the instructions in **Section 3.2**.

5. Troubleshooting

This chapter explains system-test and fault-isolation procedures.

The Campus Fiber Driver provides local loopback and remote digital loopback in compliance with the V.54 standard. Unless you disable them, the unit's loopback tests can be activated manually from the unit's front panel, and the local analog and remote digital loopbacks can be activated electronically through the DTE connection.

5.1 Loop Tests

The loop-test buttons (DIG, ANA, and REM) and LEDs built into the Campus Fiber Driver allow you to rapidly check the unit, the attached cables, and the attached DTEs. Use the test procedures described in this chapter to verify normal system operation and to isolate faulty equipment if a failure occurs. (Before testing the operation of the system equipment and line circuits, make sure that all devices are turned on and are properly configured.)

5.2 The Bit-Error-Rate Tester (BERT)

You can activate the Campus Fiber Driver's internal Bit Error Rate Tester in any diagnostics test in which the transmitted test pattern is looped back to the BERT for comparison. An example is shown in **Figure 5-1** on the next page.

The Driver is also capable of operating opposite any 511 BERT tester. you use one Driver opposite another, either with one or both PATT buttons pressed (see **Figure 5-2** on the next page) or with an external BERT transmitting the same V.52 (511-bit) pattern, you can test the complete link. To activate the BERT, press the PATT button. The ERR LED will light momentarily, just to confirm that the LED is working, and then the test will proceed. If errors are detected, the ERR LED will be continuously lit (if the errors are continuous) or will blink (for intermittent errors).

NOTE

For the Driver's BERT to operate correctly, the CARRIER jumper must be set to ON or the RTS (V.35) or I (X.21) signal must be high.

While PATT is depressed, the DTE interface is functionally disconnected.

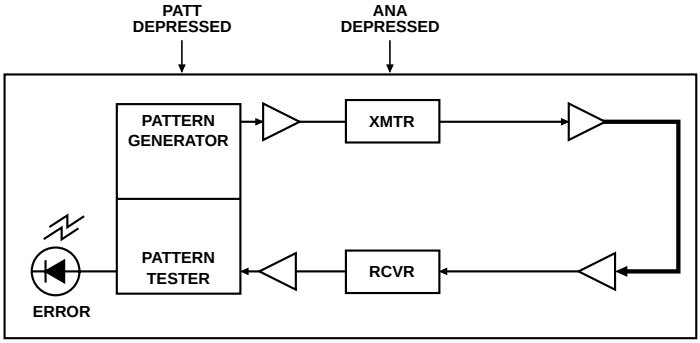

Figure 5-1. BERT using loops (modem self-test shown).

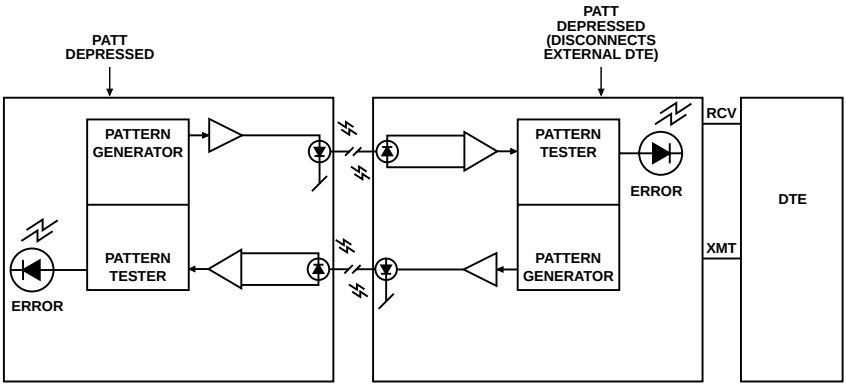

Figure 5-2. Two Drivers doing end-to-end BERT.

5.3 The Modem Self-Test

To verify that the Campus Fiber Driver itself is operating correctly, initiate the modem self-test by pressing the PATT and ANA buttons (refer to **Figure 5-1** on the previous page):

1. Press ANA to start local analog loopback. Both the TEST and DCD LEDs should light. If the DCD LED doesn't light, make sure that the RTS (V.35) or I (X.21) signal is not OFF (low) while the CARRIER jumper is OFF.

2. Press PATT to begin test-pattern transmission. Verify that the TEST and DCD LEDs are still lit, that RD lights, and that the ERR LED lights briefly.

3. If the ERR stays lit or continues to flicker after the initial flash, the Driver is faulty; call your supplier to arrange for repair or replacement. Otherwise, the unit passes the test; restore all of the buttons to their normal positions.

5.4 Local Analog Loopback

Activate the local analog loopback test by pressing the ANA button or (on V.35 models) by raising the level of the Local Loopback signal received by the Campus Fiber Driver's DTE connector (Pin JJ). This test checks the performance of the local Driver's modem, the local DTE, and the connections between them. Perform this test separately at the local and remote sites (refer to **Figure 5-4** on the next page):

1. Press ANA or raise Local Loopback to start local analog loopback. The TEST LED should light. The Driver's fiberoptic transmit output should be internally connected to its own receiver.

2. Verify that the DTE is operating properly and can be used for a test.

3. Perform the test using one of these methods:

   - Send data from the DTE and check the echoed data stream.

   - Hook up an external Bit Error Rate Test (BERT) unit in place of the DTE.

- Use the Driver's internal BERT. Press the PATT button.The ERR LED should light briefly just to confirm that the LED is working, and then the test will proceed. If errors are detected, the ERR LED will be continuously lit (if the errors are continuous) or will blink (for intermittent errors).

4. Repeat Steps 1 through 3 at the remote site.

5. If the BERT tests show no errors, but the data echoed back to either DTE is bad, check the DTE and the cable connecting it to the Driver—one of them is faulty.

6. After the test is complete or the fault has been corrected, restore the ANA button to its normal position. Proceed with the digital loopback tests.

During this loopback, the Driver ends MARK (OFF) to the TX diode, but the signal is directed only to the RX input (see **Figure 5-4** below). This is an internal test only, with no external transmission. The remote Driver functions as if it were in the "loss of signal" state, with DCD OFF and RX data MARK (OFF).

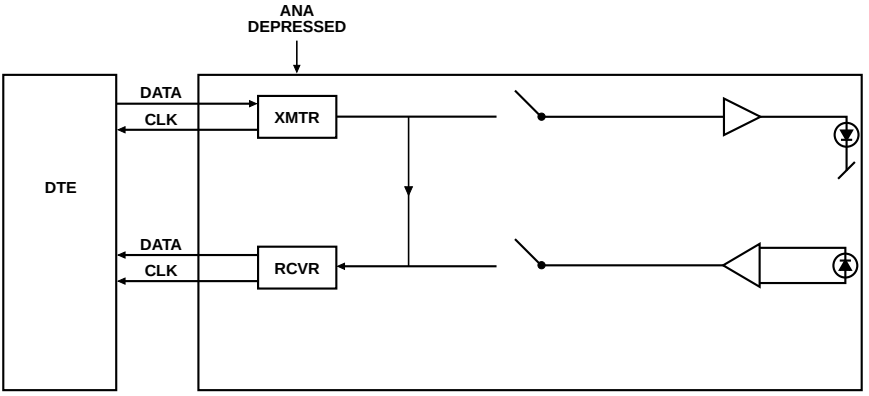

Figure 5-4. Local analog loopback.

5.5 Remote Digital Loopback

Activate the remote digital loopback test by pressing the REM button or (on V.35 models) by raising the level of the Remote Loopback signal received by the Campus Fiber Driver's DTE connector (Pin HH). This test involves creating an outbound loopback at the remote Driver (see **Figure 5-5** on the next page). The test checks the performance of the local and remote units and the line between them:

1. Press REM or raise Remote Loopback; the local Driver will signal the remote unit to start remote digital loopback. The TEST LED should light on both units. The remote Driver's receive input should be connected to its own transmitter.

2. Perform a Bit Error Rate Test (BERT). Either:

   - Hook up an external Bit Error Rate Test (BERT) unit in place of the local DTE; or

   - Use the local Driver's internal BERT. Press the PATT button. The ERR LED should light briefly just to confirm that the LED is working, and then the test will proceed. If errors are detected, the ERR LED will be continuously lit (if the errors are continuous) or will blink (for intermittent errors).

3. If the BERT test indicates a fault, but both Drivers pass their modem self-tests (see **Section 4.3.1**), there is a problem somewhere in the communication line between the units.

4. After the test is complete or the fault has been corrected, restore the REM button to its normal position. Proceed with local digital loopback.

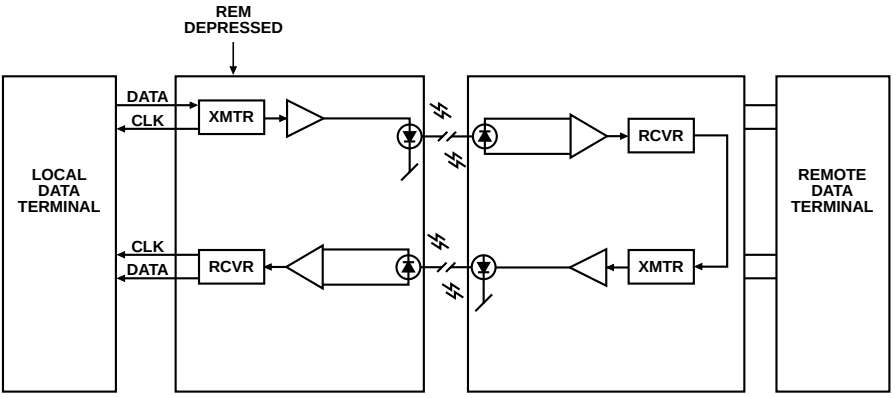

Figure 5–5. Remote digital loopback.

5.6 Local Digital Loopback

Activate the local digital loopback test by pressing the DIG button on the Campus Fiber Driver's front panel. This test involves creating an outbound loopback at the local Driver (see **Figure 5-6** on the next page). It works the same way as if the remote operator had initiated a remote digital loopback at the remote site. With this test, the remote operator can check the performance of the remote and local Drivers and the line between them:

1. Press DIG; the local Driver will signal the remote unit and will start local digital loopback. The TEST LED should light on both units. The local Driver's receive input should be connected to its own transmitter.

2. Perform a Bit Error Rate Test (BERT). Either:

   - Hook up an external BERT unit in place of the remote DTE; or

   - Use the remote Driver's internal BERT. Press the PATT button. The ERR LED should light briefly just to confirm that the LED is working, and then the test will proceed. If errors are detected, the ERR LED will be continuously lit (if the errors are continuous) or will blink (for intermittent errors).

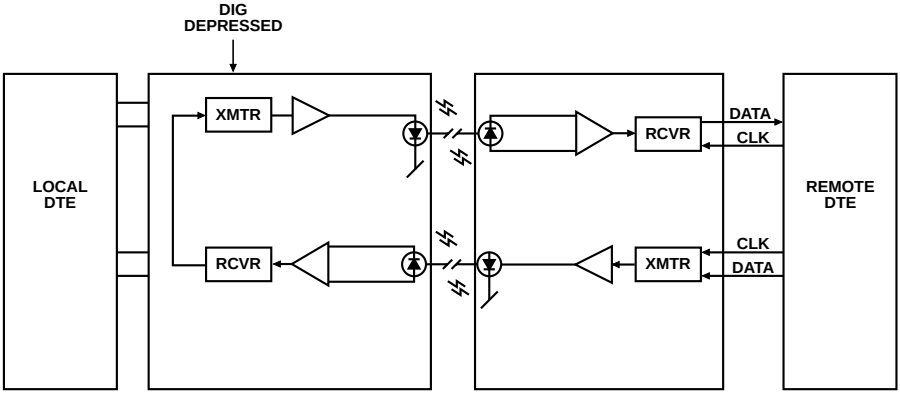

Figure 5-6. Local digital loopback.

3. If the BERT test indicates a fault, but both Drivers pass their modem self-tests (see **Section 4.3.1**), there is a problem somewhere in the communication line between the units.

4. After the test is complete or the fault has been corrected, restore the DIG button to its normal position.

5.7 Contacting Black Box

If you determine that your Campus Fiber Driver is malfunctioning, *do not attempt to alter or repair the unit.* It contains no user-serviceable parts. Call 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 involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

5.8 Shipping and Packaging

If you need to transport or ship your Campus Fiber Driver:

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

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