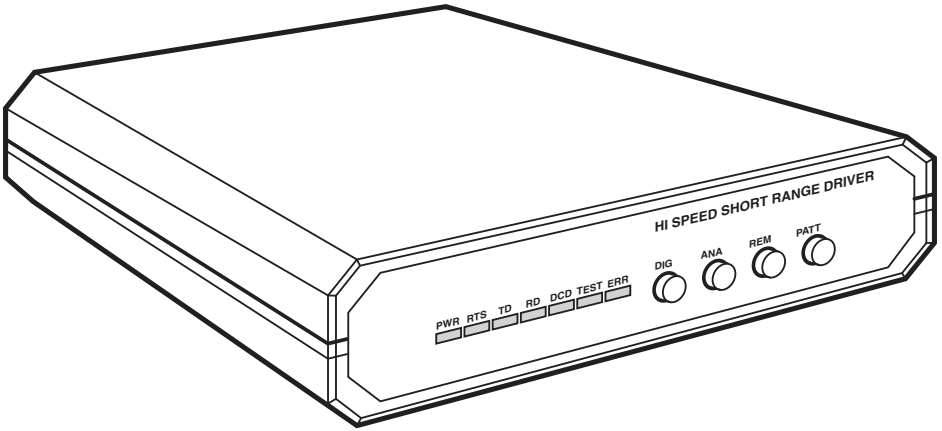
BLACK BOX®
NETWORK SERVICES

JULY 2000
ME270A-R2
ME270AE-R2
ME271AE-R2
ME272AE-R2

Hi Speed Short Range Driver
Hi Speed Short Range Driver/X.21
Hi Speed Short Range Driver/422



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FEDERAL COMMUNICATIONS COMMISSION
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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 required 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 Industrie 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.

WARNING!

Always observe standard safety precautions during installation, operation, and maintenance of this product. To avoid the possibility of electrical shock, disconnect the power cord from the power source before you remove the cover of this unit.

CAUTION

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Shielded DTE cables should be used with this unit to ensure compliance with the Class A limits mentioned above.

NORMAS OFICIALES MEXICANAS (NOM) ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.

2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.

3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.

4. Todas las instrucciones de operación y uso deben ser seguidas.

5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc.

6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.

7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.

8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.

9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

CONTENTS

1. Specifications

Line Interface

Code: Strap to HDB3 or AMI (ITU-TSS G.703 or B8ZS)

Framing: Unframed format

Transmit Level: According to ITU-TSS (CCITT) G.703

Data Rate: 2.048 Mbps, 1.544 Mbps, or 1.536 Mbps

Impedance:
100Ω for 1.544 and 1.536 Mbps balanced;
120Ω for 2.048 Mbps balanced

Return loss: Less than 15 dB

Carrier: Controlled by RTS or constantly ON

Line Type: Unloaded 4-wire twisted-pair (19- to 26-gauge preferred)

Line Attenuation: Up to 35 dB

Range: Up to 1.1 miles (1.75 km); see Table 1-1 below

Connector: Five-screw terminal block

Table 1-1. Approximate Transmission Range by Wire Gauge, in Miles (km)

Data Rate	19 AWG miles (km)	22 AWG miles (km)	24 AWG miles (km)
32 Kbps to 2.048 Mbps	1.1 (1.75)	0.75 (1.25)	0.6 (1.0)

Digital Interface

Interface:
ME270 models: ITU-TSS V.35;
ME271AE-R2: ITU-TSS X.21;
ME272AE-R2: EIA RS-530/449/422 (ITU-TSS V.36)

Protocol: Synchronous

Operation: Full- or half-duplex over unloaded 4-wire twisted-pair cable

Data Rates: 32, 64, 128, 256, 384, 512, or 768 Kbps, or 1.024, 1.536, 1.544, or 2.048 Mbps

RTS/CTS delay: 30 msec

Connector:
ME270 models: 34-pin M-block female;
ME271AE-R2: DB15 female;
ME272AE-R2: DB25 female (EIA RS-530; DB25-to-DB37 adapter cable included for EIA RS-449/422 [ITU-TSS V.36] interfaces)

Test Switches/Diagnostics

Standards: Loopbacks: ITU-TSS V.54; BERT: ITU-TSS V.52

Digital Loopback: Local (DIG), activated by a manual switch; Remote (REM), activated by a manual switch or by electronic signals from the DTE

Analog Loopback: Local (ANA), activated by a manual switch or by electronic signals from the DTE

Test Pattern: Activated by a manual switch (PATT)—initializes internal Bit Error Rate Tester (BERT) unit (511-bit V.52-compliant test pattern)

Timing Elements

Receive clock: Derived from the receive signal

Transmit clock: Derived from three alternative sources:
1. Internal oscillator
2. External from the DTE
3. Loop clock (receive clock) derived from the receive signal, looped back as a transmit clock

LED Indicators

Transmit Data .....(TD)
Receive Data.....(RD)
Request to Send .....(RTS)
Data Carrier Detect.....(DCD)
Test .....(TEST)
Power .....(PWR)
Bit Errors .....(ERR)

Power Supply

Voltage/Frequency:
115 VAC ±10%, 47 to 63 Hz
230 VAC ±10%, 47 to 63 Hz

Consumption: 5 watts

Fuse: 0.1-amp "slow-blow" for all models

Protection:
AC/DC overvoltage-protection circuits are connected through transformers to Transmit and Receive lines

Environmental

Temperature: 32 to 122° F (0 to 50° C)

Humidity: 0 to 95% noncondensing

Physical

Dimensions:
1.6"H x 9.6"W x 7.6"D
(4.1 x 24.4 x 19.3 cm)

Weight: 3.1 lb (1.4 kg)

2. Introduction

2.1 General Overview

The Hi Speed Short Range Driver is a high-speed synchronous short-range line driver. It operates full- or half-duplex over unconditioned twisted-pair cable runs in your campus network. It can also be used as a rate and interface converter. It operates at eleven user-selectable data rates up to 2.048 Mbps, with a range of up to 0.75 miles (1.21 km) over 22-AWG wire.

The unit's front-panel PATT button generates an internal 511-bit pseudo-random test pattern that conforms to ITU-TSS V.52, for direct end-to-end integrity testing. The ERR LED indicator flashes for each bit error detected.

The Hi Speed Short Range Driver incorporates interface circuits for the terminal/computer, an automatic equalizer, and a modulator/demodulator. The unit is coupled to the line or coax cable through isolation transformers that, in conjunction with other circuitry, protect against AC or DC overvoltages. This protection enables the unit to operate even if the line is connected to DC.

For the unit's dimensions, weight, and other physical characteristics, see **Chapter 1**.

2.2 Functional Description

Refer to Figure 2-1 for a block diagram of how the Hi Speed Short Range Driver handles data signals. The driver transmits data to the line at one of three data rates— 2.048 Mbps, 1.544 Mbps, or 1.536 Mbps— depending on the selected DTE data rate (see Table 2-1 below).

Table 2-1. Transmission Rates of Data at Selected DTE Data Rates

DTE Data Rate	Transmission Rate
32, 64, 128, 256, and 512 Kbps; 1.024 and 2.048 Mbps	2.048 Mbps
1.544 Mbps	1.544 Mbps
384 and 768 Kbps; 1.536 Mbps	1.536 Mbps

The Driver's line interface can be coded using HDB3 or Alternate Mark Inversion (AMI) according to ITU-TSS G.703, or using Bit Eight Zero Suppression (B8ZS). The digital-side interface complies with ITU-TSS V.35 recommendations. Thus, the driver can operate as an interface converter.

The Driver features V.54-compliant diagnostic capabilities to perform a local analog loopback and local and remote digital loopbacks. An operator at either end of the line can test both Drivers and the transmisson line in the digital-loopback mode. You can control loopbacks with a manual switch or through the DTE interface.

The following subsections detail the functions of the Driver. Refer to Figure 2-1 on the next page as you read.

2.3.1 Timing Generator

This circuit is a PLL/VCXO. The Driver can transmit data to the line at one of three selectable data rates: 2.048 Mbps, 1.544 Mbps, or 1.536 Mbps, as shown in Table 2-1. The driver can be used as a data-rate converter.

Transmit timing is either provided internally or derived externally from the data terminal or from the receive signal. Receive timing is regenerated from the data. Set the XMT CLK (Transmit Clock) jumper to select one of these three available clock sources:

- INTERNAL CLK (from the driver's internal crystal oscillator)
- EXTERNAL CLK (from the DTE)
- RECEIVE CLK (recovered from receive signal)

Refer to **Figures 2-2** and **2-3**.

One Driver should be strapped to the INT or EXT clock, and the other to the RCV clock (except when both DTEs are using one master clock). Internal first-in, first-out buffers (FIFOs) with Phase Loop Lock (PLL) provide jitter attenuation and/or phase-difference correction from either the incoming line signal (line side) or from the external clock on the DTE side.

CAUTION!

Do not strap both units to INT clocking.

2.3.2 Encoder/Decoder

The unit's encoder/decoder can convert from NRZ to HDB3, AMI, or B8ZS on the transmission side, and back to NRZ on the receive side.

2.3.3 Line Driver

The Line Driver provides a three-level Alternate Mark Inversion (AMI) signal according to the ITU-TSS G.703 standard.

2.3.4 Receiver

An AGC-end equalizer provides the received signal for the clock and data-recovery circuitry.

2.3.5 NRZ Interface

The digital-side interface is fully compliant with ITU-TSS V.35 recommendations.

2.3.6 Error Corrector

The Hi Speed Short Range Driver incorporates forward error correction up to 1.024 Mbps, and is user-selectable for either random or burst error correction, according to the specific noise characteristics of the application. Error correction can also be disabled.

Data is encoded/decoded with the Golay (23, 12) error-correction mode, which allows random error correction of up to 3-bit errors in a 23-bit frame, or single-burst correction of up to 9 bits in a 72-bit frame. For data rates of 1.536 Mbps, 1.544 Mbps, and 2.048 Mbps, the error corrector is disabled automatically.

2.3.7 V.54-Compliant Diagnostics

The Driver provides remote digital loopback and local analog loopback in compliance with the V.54 standard. Remote digital loopback on the nearby unit is activated manually from the front panel. Remote digital loopback and local analog loopback can be activated manually from the front panel or through the DTE interface (V.35 Pins HH and JJ; RS-530 Pins 18 and 21; and RS-449 [V.36] Pins 10 and 14). These pins can be enabled or disabled separately by the Driver's DTE-command jumpers ALB and RLB.

If you're using the Driver as a tail end to a digital network or multiplexor, set the V.54 DELAY jumper (in the Drivers located close to the digital network) to ON, to prevent multiple loopbacks upon activation of RLB. The delay jumper prevents the digital Drivers at the remote network side from receiving the total V.54 data sequence and, in turn, being induced into a loop.

2.3.8 Test-Pattern Generator and Receiver

The Test-Pattern Generator and Receiver allow for easy testing of the local Driver and the communi-cation link. When you press the PATT button, the circuit sends and checks a 511-bit pseudo-random pattern. If errors are encountered, the ERR indicator lights.

The test can be performed in local analog loopback or in remote digital loopback. It can also be run in normal point-to-point operation opposite a remote Driver. To do this, press the PATT button on the remote unit, or connect a Bit Error Rate Tester (BERT) that uses a standard 511-bit pattern to the remote unit.

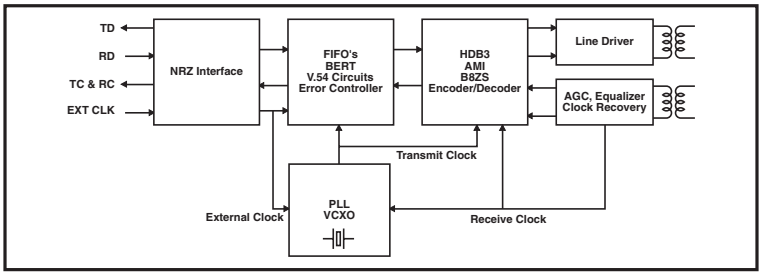

Figure 2-1. Block diagram of the Hi Speed Short Range Driver.

2.4 Networking Suggestions

The Hi Speed Short Range Driver is one of the fastest line drivers you'll find on today's datacomm market. Use this Driver to get the top data speeds from your data-communications and local networking equipment.

The Hi Speed Short Range Driver is built for speed. Perhaps you are running data through your network at 1.544 Mbps (the popular speed associated with T1 carrier service). You can put two of these sleek line drivers in your network and start moving data 504 Kbps faster than T1 speed. The synchronous data exchange between your DTEs will advance to 2.048 Mbps—a full 33% faster than your previous top network speed.

By increasing your network's data speed, you can improve your network's performance through reduced "data-traffic jams" and quicker file-transfer times. Your network bridges can work at their true full speed of 2.048 Mbps. Your mainframes can trade data faster than ever before. And your network users can spend less time waiting for big files to download to their terminals.

The Hi Speed Short Range Driver offers surge and line protection to shield your sync data signals from outside interference. This type of protection is critical to the integrity of your data when you're connecting networks in two different buildings (usually through network bridges). This driver moves data up to three-quarters of a mile over 22-AWG wire, as shown in Figure 2-4 on the next page. (Distances will be shorter over 24-AWG and smaller-gauge wires.)

We recommend that you contact the manufacturer(s) of your particular mainframe computer and its operating-system software for information about supported data speeds and associated limitations.

Also check with the manufacturer of your network bridges for similar information; not all network bridges are capable of supporting speeds beyond 1.544 Mbps.

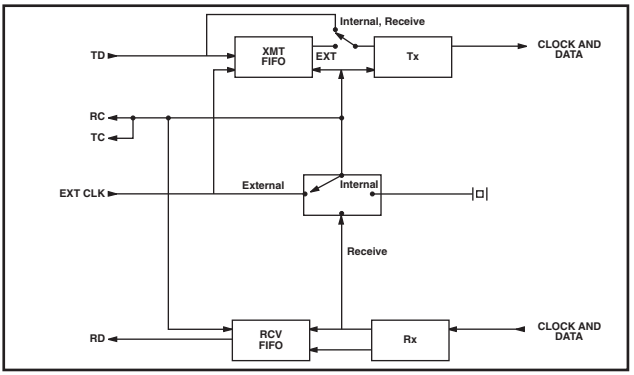

Figure 2-2. Clocking diagram.

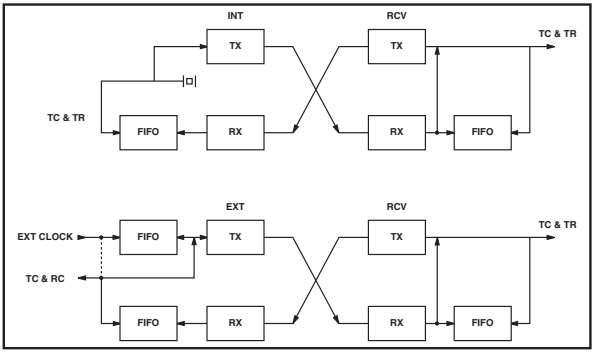

Figure 2-3. Clock configuration.

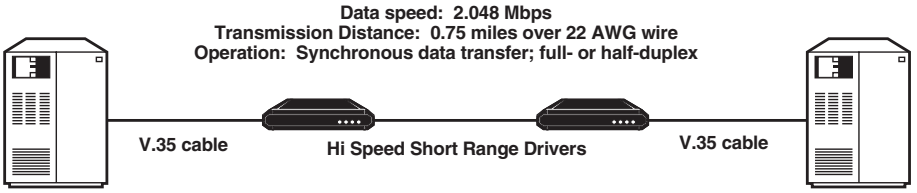

Figure 2-4. Using the Hi Speed Short Range Driver to drive sync data at 2.048 Mbps between two synchronous host computers in a campus environment.

3. Installation

3.1 General Information

This chapter provides the information required to plan and complete the mechanical and electrical installation of the Hi Speed Short Range Driver. After installation, refer to **Chapter 4** for operating information and system checkout.

3.2 Site Preparation

Install the Driver within 5 feet (1.5 m) of a grounded AC outlet furnishing 115 VAC (for ME270A models) or 230 VAC (for all other models). Place the Driver within 50 feet (15.2 m) of the associated data terminal unless you are running speeds of 1 Mbps or higher, in which case you should place the driver within 20 feet (6.1 m) of the associated data terminal.

Allow at least 36 inches (90 cm) of clearance in front of the unit for operation and maintenance accessibility. Allow at least 4 inches (10 cm) of clearance at the rear for signal lines and interface cables.

3.3 Mechanical Assembly

The Hi Speed Short Range Driver is designed to be placed on a tabletop or bench, and is delivered completely assembled. No provisions are made for bolting the Hi Speed Short Range Driver to the tabletop.

3.4 Electrical Installation

3.4.1 AC Power Cord

AC power is supplied to the Hi Speed Short Range Driver through the fused IEC 320 male inlet on its rear panel, using a detachable 5-foot (1.5-m) cord terminated by a grounded plug of the appropriate type. **Figure 3-1** on the next page shows the rear panel of the ME270A-R2.

WARNING!

This unit should always be grounded through the protective earth lead of the power cable. Before AC power is connected to this unit, the mains plug should only be inserted into a socket outlet provided with protective earth contact. The protective action must not be negated by use of an extension cord without a grounding conductor. Interrupting the grounding conductor, inside or outside the unit, or disconnecting the protective earth contact, can make this unit dangerous!

The line fuse is in an integral-type fuse holder on the rear panel (see Figure 3-1). Use only fuses of the proper rating (marked on the rear panel) as replacements. Do not use repaired fuses or short-circuit the holder. Disconnect the mains cable before removing the fuse.

3.4.2 Rear Panel

There are two connectors on the rear panel of the Hi Speed Short Range Driver. One is always a 5-screw terminal block. What the other connector is depends on the model you have ordered. The ME270A-R2 has a 34-pin M-block connector; the ME271AE-R2 has a DB15 connector; and the ME272AE-R2 has a DB25 connector.

The terminal block (TB1) provides five screws for connecting the transmit and receive communication lines to the driver. Connect the transmit pair to the terminals marked XMT, and the receive pair to the terminals marked RCV; the terminal marked GND is for optional ground connection.

Use the interface connector to connect your DTE to the Driver. This connector carries input/output data, data-rate clocks, and status/control signals according to V.35, X.21, or V.36/RS-422 specifications.

For the ME270 models, attach your DTE to the Driver's interface connector using a cable with a male 34-pin M-block connector pinned according to V.35 specifications, as shown in Figure 3-2 on the next page. Refer to Table 3-1 (on pages 17 through 19) and Table 3-2 (on page 20) for the proper pinout specifications for all model types.

[text continues on page 22]

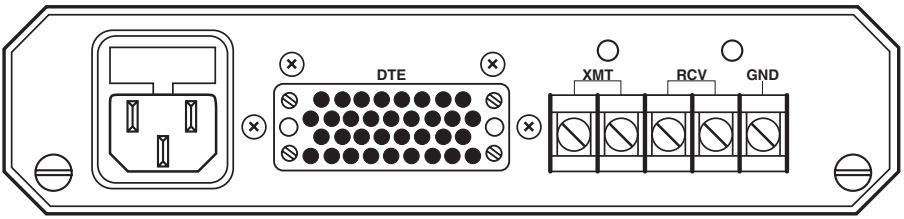

Figure 3-1. Rear-panel view of the ME270A-R2.

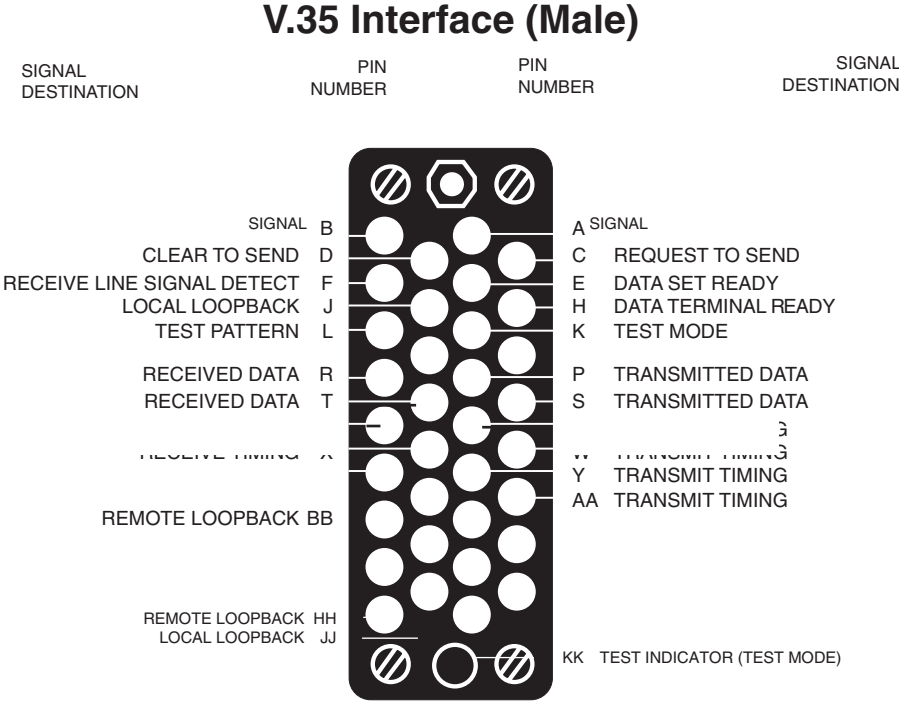

Figure 3-2. Pinout specifications for the V.35 interface (male connector shown).

Table 3-1. DTE-Interface Signal Assignments

	V.35 (ME270)		RS-530 (ME272)	X.21 (ME271)		
	DB25 Frame	34-Pin Standalone	DB25 Standalone &Frame	DB25 Frame	DB15 Standalone	
Signal Function		**Pin Circuit**	**Pin Circuit**		**Pin Circuit/ [Function]**	**Description**
Protective Ground	1	A Frame 101	1	1	1 — [SHIELD]	Chassis ground. May be isolated from Signal Gnd.
Signal Ground	7	B Signal 102 GND	7 AB	7	8 — [GND]	Common Signal and DC power supply ground.
Trans-mitted Data	11 9	S TD(B) 103 P TD(A) 103	2 BA(A) 14 BA(B)	2 14	2 T(A) 9 T(B) [TRANSMIT]	Serial digital data from DTE. The data trans-itions must occur on the rising edge of the transmit clock.
Received Data	12 13	R RD(A) 104 T RD(B) 104	3 BB(A) 16 BB(B)	3 16	4 R(A) 11 R(B) [RECEIVE]	Serial digital data at the output of the modem receiver. The data transitions occur on the rising edge of the clock.
Request to Send	4	C RTS 105	4 CA(A) 19 CA(B)	4 19	3 C(A) 10 C(B)	A positive level to the unit when data transmission is desired.
Clear To Send	5	D CTS 106	5 CB(A)			A positive level from the unit without delay, after receipt of RTS, and when the unit is ready to transmit.

Table 3-1 (continued). DTE-Interface Signal Assignments

Signal Function	V.35 (ME270) DB25 Frame	V.35 (ME270) 34-Pin Standalone Pin Circuit	RS-530 (ME272) DB25 Standalone &Frame Pin Circuit	X.21 (ME271) DB25 Frame	X.21 (ME271) DB15 Standalone Pin Circuit/ [Function]	Description
Data Set Ready	6	E DSR 107	6 CC(A) 22 CC(B)			A positive level from the unit when the power is on, and the unit is not in the DIGITAL LOOP mode, or has not received a REMOTE LOOPBACK signal from the remote unit.
Data Terminal Ready	20	H DTR 108	20 CD(A) 23 CD(B)			Not used.
Carrier Detect	8	F DCD 109	8 CF(A) 10 CF(B)	8 10	5 I(A) 12 I(B) [INDICATION]	A positive level from the unit, except when a loss of the received carrier signal is detected, or when DSR is negative.
External Transmit Clock	19 16	U SCTE(A) 113 W SCTE(B) 113	24 DA(A) 11 DA(B)	24 11	7 (A) 14 (B)	A serial data-rate clock input from the data source. Positive clock transitions must correspond to data transitions. Not a standard option for X.21.

Table 3-1 (continued). DTE-Interface Signal Assignments

Signal Function	V.35 (ME270) DB25 Frame	V.35 (ME270) 34-Pin Standalone Pin Circuit	RS-530 (ME272) DB25 Standalone &Frame Pin Circuit	X.21 (ME271) DB25 Frame	X.21 (ME271) DB15 Standalone Pin Circuit/ [Function]	Description
Transmit Clock	14 10	Y SCT(A) 114 AA SCT(B) 114	15 DB(A) 12 DB(B)	15 12	6 S(A) 13 S(B) [SIGNAL TIMING]	A transmit data rate clock for use by an external data source. Positive clock transitions correspond to data transitions.
Receive Clock	22 23	X SCR(B) 115 V SCR(A) 115	17 DD(A) 9 DD(B)			A receive data rate clock output for use by external data sink. Positive clock transitions correspond to data transitions.
Local Loopback	18	JJ	18 LL			A control signal input; when on, commands the unit into local analog loopback.
Remote Loopback	21	HH	21 RL			A control signal input; when on, commands the unit to send a remote Loopback Command to the remote unit.
Test Indicator	25	KK	25 TM			A Control signal output from the unit; positive during any test mode.

Table 3-2. ME272AE-R2 Only: Interface Pin Assignments for Attaching RS-449 (V.36) DTE to Unit's RS-530 Connector

Signal Function	RS-449 (RS-422/423) 37 pins		RS-530 DB25 Female Standalone & Frame	
	Pin	Circuit	Pin	Circuit
Protective Ground	1	Shield	1	
Signal Ground	19, 37, 20		7	AB
Transmitted Data	22 4	SD (B) SD (A)	2 14	BA(A) BA (B)
Received Data	6 24	RD(A) RD(B)	3 16	BB(A) BB(B)
Request to Send	7 25	RS(A) RS(B)	4 19	CA(A) CA(B)
Clear to Send	9 27	CS(A) CS(B)	5 13	CB(A) CB(B)
Data Set Ready	11 29	DM(A) DM(B)	6 22	CC(A) CC(B)
Data Terminal Ready	12 30	TR(A) TR(B)	20 23	CD(A) CD(A)
Carrier Detect	13 31	RR(A) RR(B)	8 10	CF(A) CF(B)
External Transmit Clock	17 35	TT(A) TT(B)	24 11	DA(A) DA(B)
Transmit Clock	5 23	ST(A) ST(B)	15 12	DB(A) DB(B)
Receive Clock	26 8	RT(B) RT(A)	17 9	DD(A) DD(B)
Local Analog Loopback	10	LL	18	LL
Remote Loopback	14	RL	21	RL
Test Indicator	18	TM	25	TM

Table 3-3: Strap Selection

Strap Identity	Function	Possible Settings	Standard Factory Setting
1 **DATA RATE (Kbps)**	Selects the data rate; settings are shown here in (Kbps).	**0**—2048 **5**—512 **1**—1544 **6**—384 **2**—1536 **7**—256 **3**—1024 **8**—128 **4**— 768 **9**— 64 **A**— 32	256 Kbps
2 **XMT CLK**	Selects the transmit timing signal from either: internal clock, external clock, or receive clock.	INT EXT RCV	INT
3 **LINE CODE**	Selects the line code.	AMI HDB3 B8ZS	HDB3
4 **DTE Command ALB**	Enables analog loopback test from the DTE via Pin J for V.35.	EN DIS	DIS
5 **DTE Command RLB**	Enables remote loopback from the DTE via Pin H for V.35 interface.	EN DIS	DIS
6 **V.54 DLY**	When set to ON the V.54 delay is activated, preventing multiple loopback of tail-end circuits. Refer to *Section 2.3.7, V.54-Compliant Diagnostics* on page 9.	ON CNTRL	ON
7 **ERR. CORR**	Selects the error correction option. BYPASS disables error correction.	BYPASS BURST RANDom	BYPASS
8 **SW EN[able]**	Enables activation of DIG, ANA, and REM loopback via the front-panel pushbuttons.	ON OFF	ON
9 **LINE FREQUENCY SW**	Sets bandwidth for selected data rate. Move switch to pos. next to lit LED. See Figure 3-4.	—	
10 **T1/E1 SW (Impedance)**	Sets impedance levels for T1 or E1. Move switch to pos. next to lit LED. See Figure 3-4.	—	

NOTE: If the DTE does not provide the test pins for analog and remote loopback, the DTE command jumper for ALB and RLB must be always set to DIS.

NOTE

Connect the ALB and RLB jumpers only if you want to be able to control loopback testing through the DTE interface. The DIG, ANA, and REM pushbuttons on the unit's front panel aren't connected to the ALB and RLB jumpers; you can use the buttons to control loopbacks no matter how these jumpers are set.

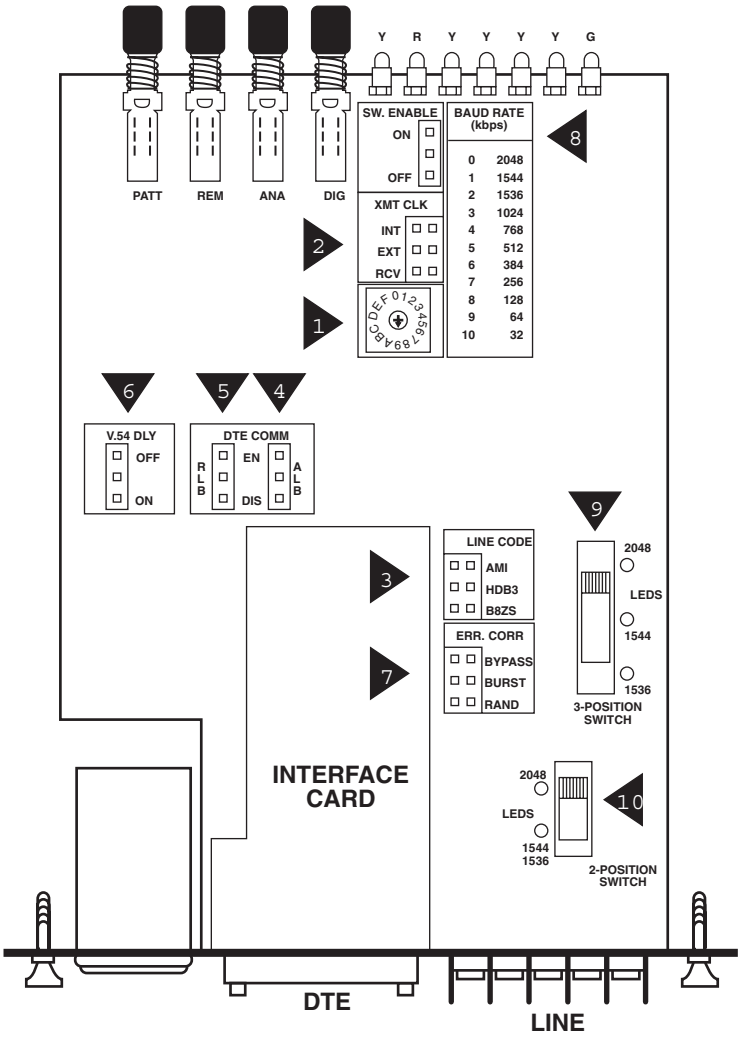

Figure 3-3. Strap locations on circuit board (overhead view).

3.5 Configuration

When installation is complete, the next step is to determine the configuration of the Driver in the data system and set the straps. Refer to Figure 3-3 on the previous page, Table 3-3 on page 21, and Figure 3-4 below to guide your strap selections and settings.

3.5.1 Clock Configuration

It is strongly recommended that one of the two Drivers be configured to RCV-Clock mode. Set the XMT CLK strap of one driver to EXT. or INT. mode, and set the other Driver to RCV.

3.5.2 Line Code

Use the AMI (Alternate Mark Inversion) code for 1.544- and 1.536-Mbps data rates and HDB3 for 2.048-Mbps data rates. The HDB3 setting is the factory default.

NOTE

For any data rate selected, one or more of the LEDs located on the PCB will be ON. Slide the appropriate switch(es) in the direction of these LEDs. See Figure 3-4 below.

3.5.3 Setting the Jumpers

To change a jumper setting, follow these steps:

WARNING!

Disconnect the power cable before opening the cover.

1. Disconnect the power cable from the AC outlet.
2. Loosen the two screws at the bottom left and bottom right of the unit's back panel (see Figure 3-1 on page 15).
3. Slide out the circuit board from the chassis enclosure of the Driver.
4. Move the jumpers and switches to the required positions.
5. Slide the circuit board back into the chassis enclosure and retighten the screws.

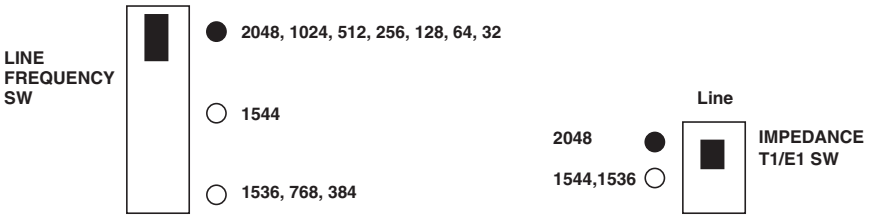

Figure 3-4. Data-rate selection switches.

4. Operation

4.1 General Information

This chapter describes:

- The Driver's controls and indicators and their functions;
- Operating procedures;
- Strapping information; and
- System-test and fault-isolation procedures.

The installation procedures in **Chapter 2** must be completed before you attempt to operate the Driver.

4.2 Controls and Indicators

There are controls (pushbutton switches) and LED indicators on the Driver's front panel (see Figure 4-1); their functions are described in Table 4-1 below and Table 4-2 and the Note on the next page. Press a button to activate the corresponding test; press and release it to return the unit to normal operation.

Table 4-1. Control Functions

Control	Function
DIG	The Local Digital Loopback button causes the local Driver to loop received data and clock to its transmitter. Data Set Ready goes low. (See Figure 4-4.)
ANA	The Local Analog Loopback (V.54 Loop 3) button causes the local Driver to loop its transmitter output back to its receiver (see Figure 4-2). This loopback can also be activated from the terminal when the ALB strap on the PCB is set to EN.
REM	The Remote Digital Loopback (V.54 Loop 2) switch causes the remote Driver to loop the received data and clock to its transmitter (see Figure 4-3). Data Set Ready goes low. This loopback may also be activated from the DTE when the RLB strap on the PCB is set to EN.
PATT	The PATT switch causes the Driver to send and receive a 511 test pattern. If errors are encountered, the ERR indicator lights. Receive Data and Clear to Send go low.

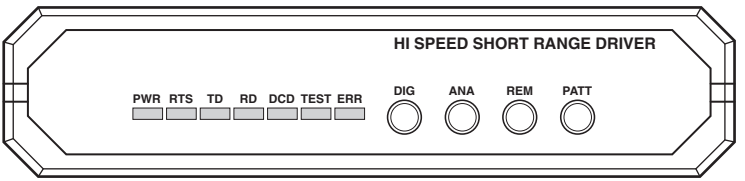

Figure 4-1. Front-panel view of the Hi Speed Short Range Driver.

Table 4–2. Indicator Functions.

Indicator	CCITT Circuit	Function
PWR	—	Green LED is ON when power is on.
RTS	105	Yellow LED is ON when terminal activates Request to Send.
TD	103	Yellow LED is ON when steady SPACE is being transmitted. It flickers when data is transmitted.
RD	104	Yellow LED is ON when steady SPACE is being received. It flickers when data is received.
DCD	109	Yellow LED is ON when a valid receive signal is present.
TEST	—	Red LED is ON when the Driver is in any of the 3 loopback modes, or when PATT is ON.
ERR	—	Yellow LED goes ON momentarily when PATT switch is activated, and then dims. If errors are present in the test pattern, this LED blinks or remains ON.

NOTE

Connect the ALB and RLB jumpers only if you want to be able to control loopback testing through the DTE interface. The DIG, ANA, and REM pushbuttons on the unit's front panel aren't connected to the ALB and RLB jumpers; you can use the buttons to control loopbacks no matter how these jumpers are set.

4.3 Operating Procedure

4.3.1 Operation

The Hi Speed Short Range Driver can operate unattended. On occasion you will need to monitor the LEDs for line performance. Intervention is required only when:

- The Driver has to be adapted to new operational requirements, or
- Diagnostic loops are required, as described in **Section 4.5**.

4.3.2 Power-Up Procedure

Connect the AC power cord to an acceptable AC source. The PWR LED should light up, indicating that the Hi Speed Short Range Driver is on. If the local and remote Drivers are operating and passing data, the LEDs will be:

PWR:	On
TD:	Flashing or Off
RD:	Flashing or Off
RTS:	On or Flashing (Off if the terminal does not use RTS)
DCD:	On or Flashing
TEST:	Off
ERR:	Off

Check the LEDs after initial power-up to see if they match these conditions. If they don't, *make sure the four test pushbuttons are in the OFF position (not depressed).*

4.3.3 Self-Testing

To verify that the Driver is operating properly, use the Driver's internal BERT and loopback tests. Refer to **Section 5.1** for instructions.

4.3.4 Power-Down Procedure

To turn off the AC power to the Hi Speed Short Range Driver, simply unplug the unit's AC power cord from the AC source.

4.4 Operational Field-Strapping Changes

To reconfigure the Driver for a different type of operation, change the field straps and switches to support the new operating mode.

WARNING!

Disconnect the Driver's power cable before opening the top cover.

For guidance in repositioning the straps and switches, refer to **Chapter 3**. Straps should be changed by an experienced technician.

NOTE

If you are changing the data rate, you might need to change the setting of one or more slide switches (see Table 3-2 in Chapter 3**).**

5. Troubleshooting

5.1 Test and Diagnostic Procedures

Test switches and LED indicators built into the Driver let you easily check out the data terminals, the Drivers, and the cable. The test procedures outlined in this section verify normal system operation, and isolate faulty equipment if something goes wrong.

Before testing the operation of the data equipment and circuits, make sure that all units are powered up and correctly configured.

5.1.1 Bit Error Rate Tester (BERT) —PATT Button

Pressing the PATT button activates the unit's internal Bit Error Rate Tester (BERT). Use the BERT to transmit a test pattern to another Hi Speed Short Range Driver or to a device that can loop the pattern back to the BERT for comparison (see Figure 5-1 below).

When the Driver is used opposite another Driver, either with the PATT button depressed or with an external BERT transmitting the same V.52 (511-bit) pattern, the complete link can be tested.

To activate the BERT, depress the PATT button. If errors are detected, the ERR LED will light continously (to indicate continous errors) or blink (to indicate intermittent errors. When you depress the PATT button, the ERR LED will momentarily light up to confirm that the LED is in fact working.

NOTE

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

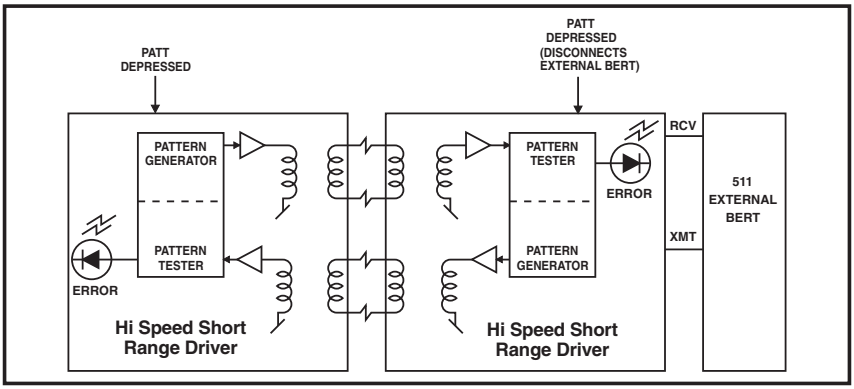

Figure 5-1. Two BERTs operating end-to-end.

5.1.2 Driver Self-Test

To verify that the Driver is operating correctly, initiate its self-test by depressing the PATT and ANA buttons (see Figure 5-2 below).

1. Depress the ANA (Analog Loopback) button. Both the TEST and DCD indicators should light. If the DCD LED does not light, verify that the CARRIER jumper is ON or the RTS signal is ON (high).

2. Depress the PATT button. Verify that:

   - DCD indicator is still lit.
   - TEST indicator is still lit.
   - RD indicator lights.
   - ERR indicator lights briefly.

If the ERR indicator is steadily lit or blinks continuously, then the Driver is faulty and should be replaced. If the self-test executes correctly, restore all the buttons and jumpers to their normal positions.

5.1.3 Local Analog Loopback

Use local analog loopback to check the performance of the local Driver, the local DTE, and the cables between them. Activate it by depressing only the ANA button. Run separate tests at the local and remote sites.

1. Push the ANA (Local Analog Loopback) button. The TEST LED should light. The Driver's transmit output is now connected to its own receiver (see **Figure 5-3** on the next page)

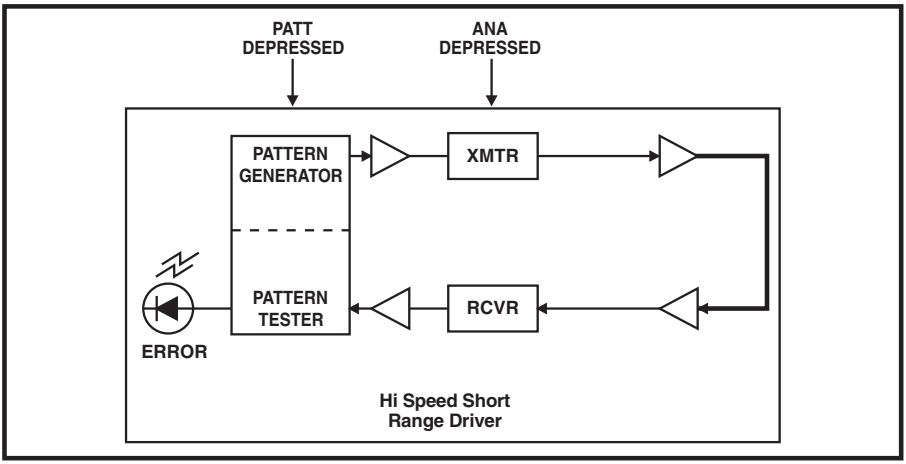

Figure 5-2. Hi Speed Short Range Driver self-test.

With ME270 and ME272 models, you can also activate this test by raising the signal input to the appropriate pin on the DTE interface. The Driver continues to send data to the line side. (This feature is unavailable on the ME271AE-R2 because X.21 does not support electronic loopback control.)

2. Verify that the data-terminal equipment is operating properly. If a fault is indicated, call a technician or replace the unit.

3. Execute the test using one of the methods described below:

   - Use the DTE and check the echoed data stream.
   - Use an "external" Bit Error Rate Tester (BERT) unit.
   - Use the unit's internal BERT: Depress the PATT button. The ERR LED should light briefly to indicate that it is working. If any bit errors are detected, ERR blinks or remains steadily lit.

4. *Step 3 of this test should be performed at both ends of the data connection.* If the BERT indicates correct operation, but the DTE indicates a fault, follow the manufacturer's test procedures for the DTE. Also, check the cable between the DTE and the driver.

After completion of the test (or when the fault has been corrected), press the ANA pushbutton to restore it to the OFF position. Move on to the communication-link tests.

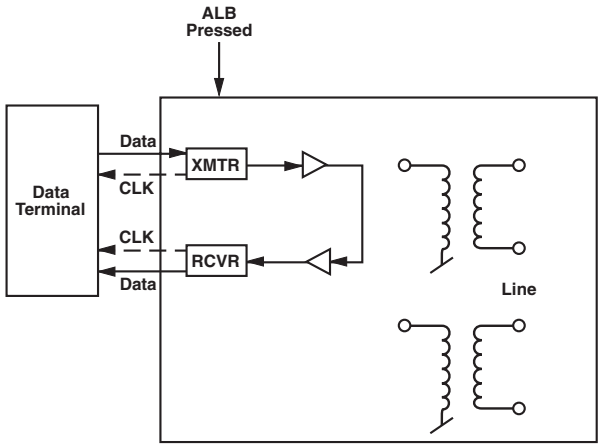

Figure 5-3. Local Driver in local analog loopback.

5.1.4 Remote Digital Loopback

Use remote digital loopback to check the performance of both the local and the remote Drivers, and the cable that connects the two units, at the *local* Driver. The test sets up a loopback at the remote Driver, as shown in Figure 5-4 below. Activate the test by depressing the REM button.

1. Push the REM (Remote Digital Loopback) button to tell the remote Driver to start looping the incoming signal back to the local Driver. The test LED should light at both the local and the remote units.

   With ME270 and ME272 models, you can also activate this test by raising the signal input to the appropriate pin on the DTE interface. (This feature is unavailable on the ME271AE-R2 because X.21 does not support electronic loopback control.)

2. Perform the internal BERT test as described in **Step 3** of **Section 5.1.3**. If this indicates a fault, *and* if *both* Drivers pass the self-test described in **Section 5.1.2**, then the line circuits are not operating properly.

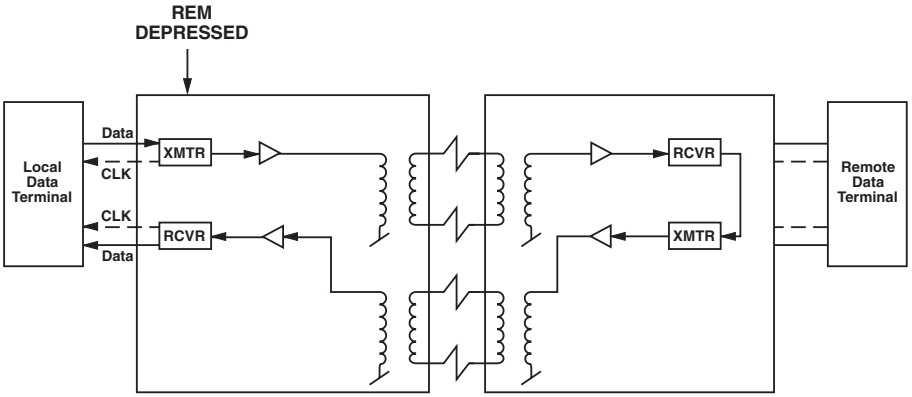

Figure 5-4. A pair of Drivers in remote digital loopback.

5.1.5 Local Digital Loopback

Use local digital loopback to check the performance of both the local and the remote Drivers, and the cable that connects the two units, at the *remote* Driver. The test sets up a loopback at the local Driver, as shown in Figure 5-5 below. Activate the test by depressing the DIG button.

This test is equivalent to activating remote digital loopback at the remote Driver. See **Section 5.1.4**.

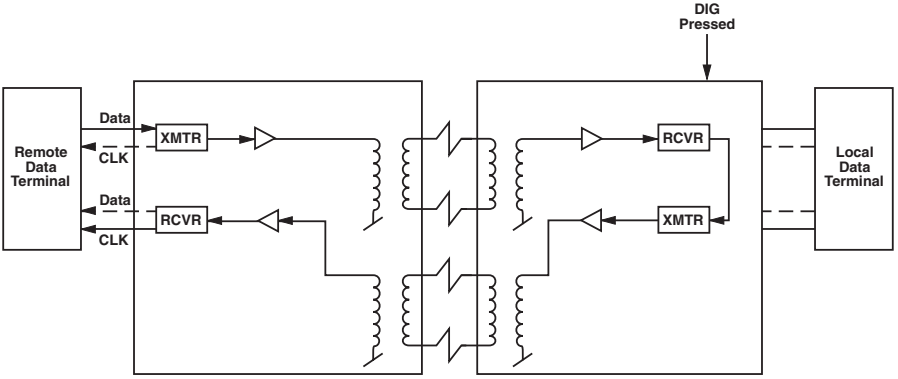

Figure 5-5. A pair of Drivers in local digital loopback.

5.2 Calling BLACK BOX

If you determine that your Hi Speed Short Range Driver is malfunctioning, *do not attempt to alter or repair it.* Contact Black Box Technical Support at 724-746-5500. The problem might be solvable over the phone.

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

- The nature and duration of the problem.
- When the problem occurs.
- The components involved in the problem.
- Any particular application that, when used, appears to create the problem or make it worse.

5.3 Shipping and Packaging

If you need to transport or ship your Hi Speed Short Range Driver:

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

NOTES

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