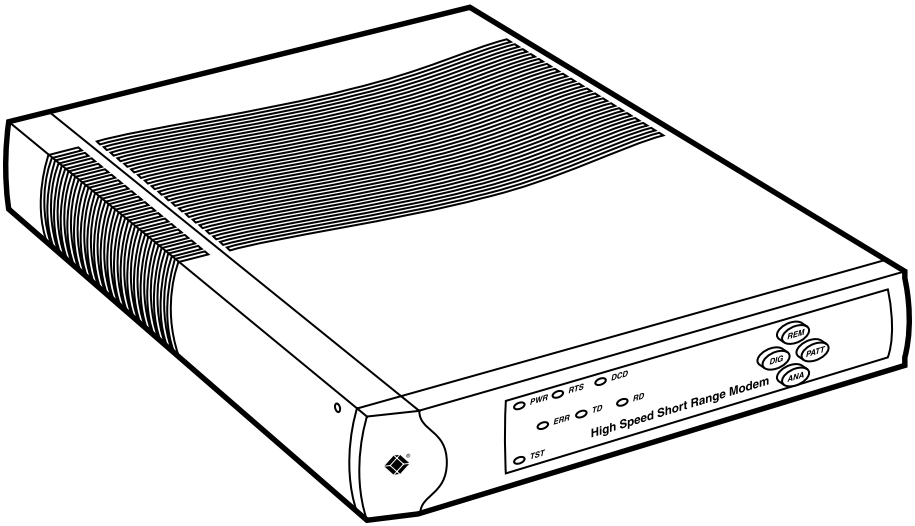
JANUARY 2003

ME270A-R3 ME271A-R3
ME270A-R3 ME272A-R3
ME270C-35-R2 ME275C-35-R2
ME270C-530-R2 ME275C-530-R2
ME275C-X21-R2

2.048-Mbps Short-Range Driver
2.048-Mbps Short-Range Driver/X.21
2.048-Mbps Short-Range Driver/422
19" Card Versions for RackNest 2/14



CUSTOMER SUPPORT INFORMATION

Order **toll-free** in the U.S.: Call **877-877-BBOX** (outside U.S. call **724-746-5500**)
FREE technical support 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mailing address: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
Web site: **www.blackbox.com** • E-mail: **info@blackbox.com**

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.

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 line driver's cover.

CAUTION

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

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.

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.

TRADEMARKS USED IN THIS MANUAL

Any trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.

Contents

Chapter **Page**

Contents (continued)

Chapter **Page**

1. Specifications

1.1 Line Interface

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

Line Code: Strap to HDB3 or AMI (both comply with ITU G.703) or B8ZS

Framing: Unframed format

Transmit Level: According to G.703

Data Rate: 2048, 1920, 1544, 1536 kbps

Impedance: 75Ω for 2048 and 1920 kbps unbalanced (BNC coax);
100Ω for 1544 and 1536 kbps balanced (terminal block or DB15);
120Ω for 2048 and 1920 kbps (terminal block or DB15)

Return loss: Better than 15 dB

Line Attenuation: Up to 40 dB

Range: Up to 1 mile (1.6 km) over 24 AWG wire

Connector: DB15 or 5-screw terminal block

1.2 DTE Interface

Interface: ME270A-R3, ME270E-R3, ME270C-35-R2, ME275C-35-R2: ITU-TSS V.35;
ME271A-R3, ME275C-X21-R2: ITU-TSS X.21;
ME272A-R3, ME270C-530-R2, ME275C-530-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, 192, 256, 384, 512, 768, 1024, 1536, 1544, 1920, or 2048 kbps

Connectors: ME270A-R3, ME270A-R3, ME270C-35-R2: (1) 34-pin M-block female, (1) 5-screw terminal block;
ME275C-35-R2: (1) 34-pin M-block female;
ME271A-R3, (1) DB15 female, (1) 5-screw terminal block;
ME275C-X21-R2: (1) DB15 female;
ME272A-R3, ME270C-530-R2: (1) DB25 female, (1) 5-screw terminal block;
ME275C-530-R2: (1) DB25 female; (EIA RS-530; DB25-to-DB37 adapter cable included for EIA RS-449/422 [ITU-TSS V.36] interfaces)

1.3 Timing

Transmit and Receive Clocks: Derived from three alternative sources:
1. Internal oscillator,
2. External from the DTE, or
3. Receive clock derived from the receive signal, looped back as a transmit clock.

1.4 Diagnostics

Buttons: (4) front-panel pushbuttons: REM, PATT, DIG, and ANA

V.54 Loopbacks: Local loopback: activated by front-panel LLB button or by the DTE interface signal (V.24, V.35, and RS-530 only);
Remote loopback: activated by front-panel REM button or by the DTE interface connector signal (V.24, V.35, and RS-530 only);
Local digital loopback: activated by front-panel DIG button

Self-Test: Driver self-test activated by front-panel pushbuttons PATT and ANA

Internal BERT: Built-in pattern generator and tester activated by front-panel pushbutton PATT, complies with ITU V.52

1.5 LED Indicators

Indicators: (7) LEDs: (1) PWR(green, Power), (1) RTS (yellow, Request to Send), (1) TD (yellow, Transmit Data), (1) RD (yellow, Receive Data), (1) DCD (yellow, Data Carrier Detect), (1) TEST (red, Test), (1) ERR (yellow, Bit Errors)

1.6 Environmental

Temperature: 32 to 122°F (0 to 50°C)

Humidity: Up to 90% noncondensing

1.7 Power Supply

AC Source: 100 to 240 VAC (±10%), 50 to 60 Hz, 6.8 VA

Power Consumption: AC: 6.8 VA; DC: 5.7 W; Card versions: 5.2 W

Fuses: Standalone models: 0.25 A slow-blow for 230 VAC;
Card versions: 1 A, 250 V slow-blow

1.8 Physical

Size: Standalone units: 1.7"H x 8.4"W x 10.1"D (4.3 x 21.3 x 25.7 cm);
Cards: 6"W x 9"L (15.2 x 22.9 cm)

Weight: Standalone units: 1.9 lb (0.9 kg); Cards: 0.9 lb. (0.4 kg)

2. Introduction

2.1 Overview

The 2.048-Mbps Short-Range Driver is a high-speed, synchronous, short-range line driver. It operates in full-duplex mode over unconditioned lines. The Short-Range Driver also functions as a baud rate and interface converter.

The 2.048-Mbps Short-Range Driver is available in both a standalone unit and a card version. The card installs in the RackNest 2/14 (RM110A), a 19-inch modem rack, which holds up to 14 cards.

2.1.1 APPLICATIONS

Figure 2-1 illustrates an interface and rate conversion application.

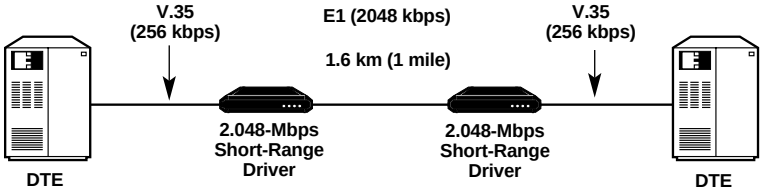


Figure 2-1. Point-to-point interface and rate conversion application.

Figure 2-2 shows a tail-end application.

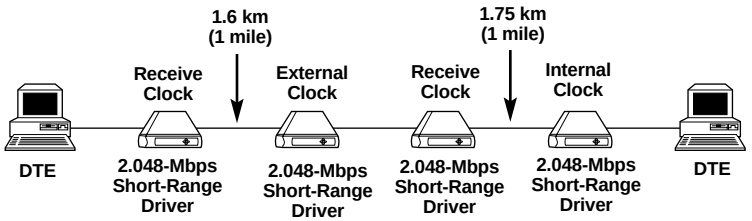


Figure 2-2. Tail-end application for DDS service.

2.1.2 FEATURES

The 2.048-Mbps Short-Range Driver operates at 13 selectable rates of up to 2048 kbps, for a line attenuation of up to 40 dB on twisted-pair or coax cable. This provides an approximate operating range of up to 1.6 km (1 mile).

The 2.048-Mbps Short-Range Driver incorporates interface circuits for the terminal/computer, an automatic equalizer, a modulator, and a demodulator. Coupling to the line or coax cable is protected by isolation transformers, which, in conjunction with other circuitry, guard against AC or DC voltage surges. The protection circuitry enables operation even when a DC power source is connected to the line.

Zero suppression on the link is switch-selectable for either AMI, HDB3, or B8ZS coding, according to the ITU G.703 standard.

DTE Interface

The DTE port has modular, field-changeable interfaces: V.35, X.21, or RS-530/449/422, V.36.

Timing

Transmit and receive timing can be provided internally *or* derived externally from the data terminal or receive signal. Internal FIFOs provide jitter attenuation or phase difference correction either from the incoming analog signal (line side) or from the external clock on the DTE side.

Diagnostics

The 2.048-Mbps Short-Range Driver provides local analog, remote digital, and local digital loopbacks in compliance with the V.54 standard. The loopbacks are activated manually via the front-panel buttons. In addition, the local analog and remote digital loopbacks are initiated via the DTE interface pins (“HH” and “JJ” for V.35 or 18 and 21 for RS-530 or V.24).

The driver includes an internal Bit Error Rate Tester (BERT) for complete testing of the local and remote modem and the link quality. There’s no need for external test equipment. The driver runs an internal pseudo-random 511-bit test pattern in accordance with the ITU V.52 standard.

2.2 Functional Description

This section contains functional descriptions of the 2.048-Mbps Short-Range Driver's circuit blocks. A block diagram of how the driver works is shown below.

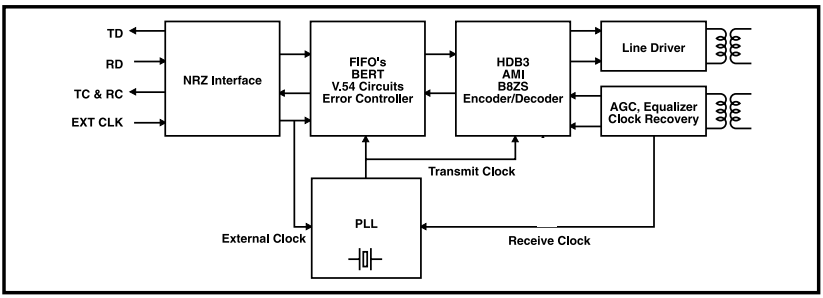


Figure 2-3. Driver's block diagram.

2.2.1 Timing Generator

The driver transmits data to the line at the following baud rates: 2048, 1920, 1544, or 1536 kbps. The baud rates support different data rates, which enable the Driver to be used as a rate converter.

Table 2-1. Line rates and DTE data rates.

Baud Rates	DTE Data Rates
2048 kbps	32, 64, 128, 256, 512, 1024, and 2048 kbps
1920 kbps	1920 kbps
1544 kbps	1544 kbps
1536 kbps	192, 384, 768, and 1536 kbps

Transmit and receive timing are derived from the following sources:

- Internal—Supplied by the internal crystal oscillator.
- External—Supplied by the DTE.
- Receive—Recovered from receive signal.

If the DTE interface is a G.703-HDB3 interface, then the recovered clock from this interface is used as the external clock.

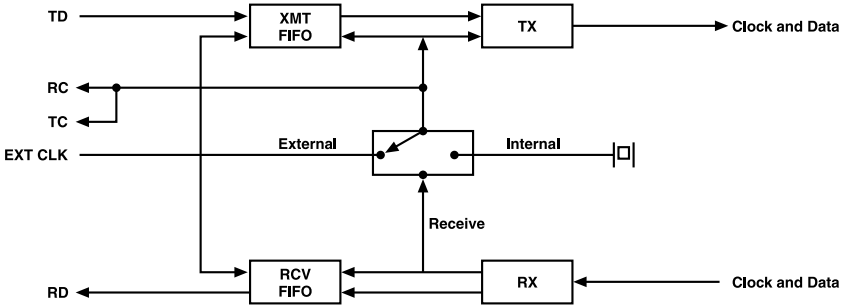


Figure 2-4. Driver's clocking diagram.

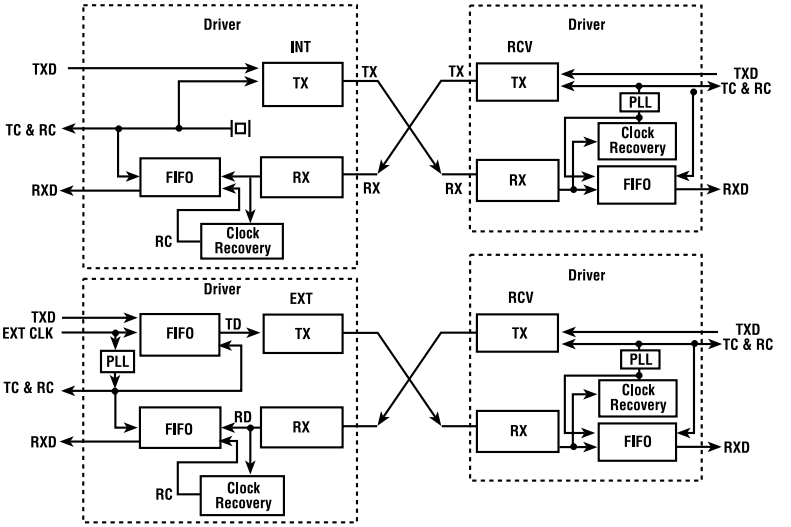


Figure 2-5. Driver's clock configuration.

2.2.2 G.703-HDB3 Interface Timing

The received data from the analog side is output on the DTE interface with a jitter-free clock for TC and RC (see Figure 2-6 and 2-7). The transmit data on the analog side is the input data from the DTE interface. The G.703-HDB3 recovered clock (from the input data) is used as an input clock for the transmit FIFO, as shown in Figure 2-6. The same FIFO used for external clock is always present when using the G.703-HDB3 interface.

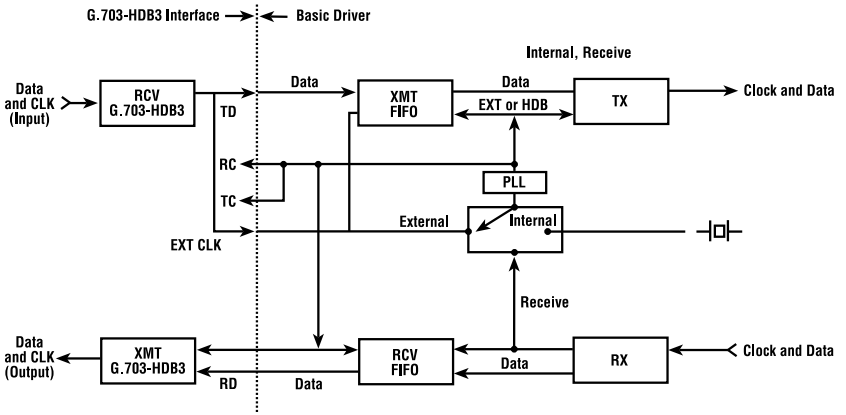


Figure 2-6. G.703/HDB3 clock diagram, DTE interface.

Using the internal or receive clock, provisions must be made to loop back (on the DTE side) the incoming clock (data and clock out) to the transmit data (data and clock inputs). Refer to Figure 2-7 for clock configuration.

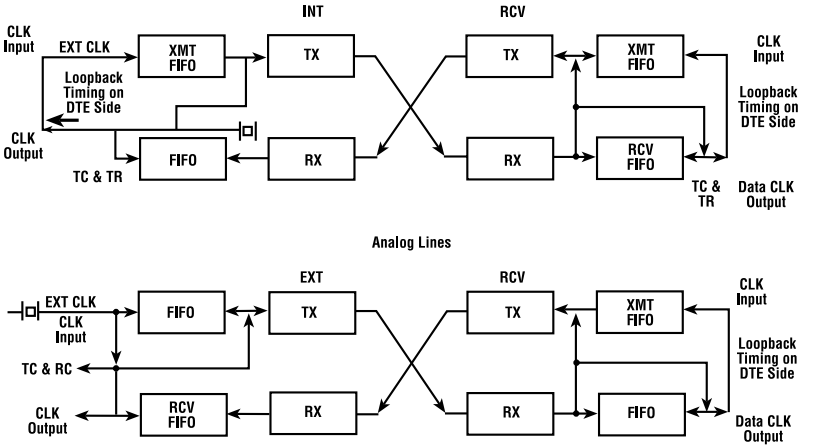


Figure 2-7. G.703-HDB3 clock configurations, DTE interface.

Encoder/Decoder

The 2.048-Mbps Short-Range Driver encoder/decoder converts from NRZ to HDB3, AMI, or B8ZS on the transmission side and converts back to NRZ on the receive side.

Line Driver

The line driver provides a three-level alternate mark inversion signal according to the ITU-G.703 standard.

Receiver

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

NRZ Interface

The digital side provides an interface choice of V.35, X.21, RS-232, RS-530, or V.36 (via adapter cable).

The 2.048-Mbps Short-Range Driver with G.703-HDB3 on the digital side for data rates 2048, 1024, 512, 256, or 128 kbps enables operation as a baud rate converter or repeater for G.703.

3. Installing the Standalone Unit

The driver is pre-assembled. It's designed for tabletop or 19-inch rack installation. For rack installation instructions, refer to your rack user's manual.

After installing the driver, refer to **Chapter 5** for operating instructions.

WARNING

Internal settings, adjustment, maintenance, and repairs should be performed only by a skilled technician who is aware of the hazards involved. Always observe standard safety precautions during installation, operation, and maintenance of this product.

3.1 Site Requirements and Prerequisites

An AC-powered driver should be installed within 5 ft. (1.5 m) of an easily accessible grounded AC outlet. The outlet should supply 100 VAC to 230 VAC.

The trunk circuit which supplies power to the unit must be protected by a circuit breaker of 16 A maximum.

Allow at least 36" (91.4 cm) of frontal clearance for operating and maintenance accessibility. Allow at least 4" (10.2 cm) clearance at the rear of the unit for signal lines and interface cables.

3.2 Package Contents

Your package should include the following items:

- (1) 2.048-Mbps Short-Range Driver
- (1) AC power cord
- (1) CD-ROM containing this users' manual

The ME272A-R3 also includes:

- (1) RS-530 male to RS-449 female cable

If anything is missing or damaged, please contact Black Box at 724-746-5500.

3.3 Installation and Setup

The 2.048-Mbps Short-Range Driver is intended for tabletop or bench installation. No provision is made for bolting the unit on the tabletop.

To install the driver:

1. Determine the required configuration (according to your application) and set the DIP switches accordingly.
2. Connect the line.
3. Connect power.

3.3.1 Configuring the Driver

This section describes how to configure the driver for a typical application. Figure 3-1 shows the DIP switch location. Table 2-1 describes DIP switch functions and default settings.

WARNING

Make sure that the power cord is disconnected before setting the DIP switches.

1. Open the lid on the driver's bottom panel.
2. Select the data rate (see SW2 in Table 3-1 for the proper switch settings). By selecting the data rate, you also define the Driver's line coding.
3. Select the line code (see SW4 in Table 3-1). The line code must be the same for both local and remote units.

- HDB3—Select 32, 64, 128, 256, 512, 1024, 1920, or 2048 kbps for the data rate. In this case, the B8ZS and AMI section settings are irrelevant.
- B8ZS—Select 192, 384, 768, 1536, or 1544 kbps for the data rate. Set B8ZS to ON, and AMI to OFF.
- AMI—Select 192, 384, 768, 1536, or 1544 kbps for the data rate. Set AMI to ON, and B8ZS to OFF.

4. Select the clock source (see SW4 in Table 3-1). One of the modems should be set to external or internal clock, another modem to receive.

   - External—Set EX/R and INT to OFF.
   - Internal—Set INT to ON. EX/R is disabled.
   - Receive—Set EX/R to ON and INT to OFF.

5. Set the line impedance (see SW3 in Table 3-1). The driver supports 75Ω unbalanced and 120Ω balanced impedance for 32, 64, 128, 256, 512, 1024, 1920, and 2048 kbps. In addition, the driver supports 100 Ω impedance for 192, 384, 768, 1536, and 1544 kbps.

   - 75Ω—Set B/UB to ON.
   - 120Ω—Set B/UB to OFF.
   - 100Ω—Set the driver to 192, 384, 768, 1536, or 1544 kbps. In this case, the B/UB section of SW3 switch is disabled.

6. Close the bottom panel lid.

Proceed with the line, DTE, and power connections as described in **Sections 3.3.2** and **3.3.3**.

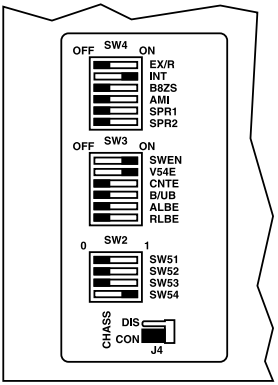


Figure 3-1. Bottom-panel jumper and DIP switches.

Table 3-1. Jumper and DIP switch functions and settings.

DIP Switch	Function	Possible Settings	Factory Setting
EX/R and INT sections, SW4	Select the transmit clock.	INT—ON, internal clock; EX/R section is disabled.	INT—ON EX/R—OFF
		EX/R—ON, INT—OFF; receive clock.	
		EX/R—OFF, INT—OFF; external clock.	
NOTE **When set to external clock, the driver automatically configures itself to the DTE data rate, disabling SW3 (baud rate).**			
B8ZS and AMI sections, SW4	Select the line code.	B8ZS—OFF, AMI—ON; AMI line code.	B8ZS—OFF
		B8ZS—OFF, AMI—OFF, HDB3 or B8ZS line code, depending on the selected data rate.	AMI—OFF

Table 3-1 (continued). Jumper and DIP switch functions and settings.

DIP Switch	Function	Possible Settings	Factory Setting
NOTE **When setting data rate to 32, 64, 128, 256, 512, 1024, 1920, or 2048 kbps, the HDB3 line coding is automatically selected. In this case, the B8ZS and AMI section settings are irrelevant. The B8ZS and AMI sections are in use only if the data rate is set to 192, 384, 768, 1536, or 1544 kbps.**			
SWEN section, SW3	Enables activation of the loopbacks and internal BERT via the front-panel buttons.	ON—The diagnostic tests can be activated via the front panel.	ON
		OFF—The diagnostic tests cannot be activated via the front panel.	
V54E section, SW3	Controls activation of the local digital loopback when remote digital loopback is initiated from the remote unit.	ON—Local digital loopback activation is enabled.	ON
		OFF—Local digital loopback activation is disabled.	
CNTE section, SW3	Selects the transmit carrier mode.	ON—Carrier follows the RTS line.	
		OFF—Carrier is constantly ON.	OFF
B/UB section, SW3	Selects the line impedance: • Balanced: terminal block or DB15 • Unbalanced BNC	ON—75Ω (for 32, 64, 128, 256, 512, 1024, 1920, and 2048 kbps).	According to the connector type
		OFF—120Ω (for 32, 64, 128, 256, 512, 1024, 1920, and 2048 kbps.	

Table 3-1 (continued). Jumper and DIP switch functions and settings.

DIP Switch	Function	Possible Settings	Factory Setting
NOTE **100Ω line impedance is set by selecting one of the following data rates: 192, 384, 768, 1536, and 1544 bps. In this case, the settings of the SW3 B/UB section are ignored.**			
ALBE section, SW3	Enables local analog loopback activation from the DTE (via pin 18 for V.24, RS-530, V.36, or pin "JJ" for V.35).	ON—The local analog loopback activation from the DTE is enabled.	
		OFF—The local analog loopback activation from the DTE is disabled.	OFF
NOTE **Set this section to DIS if the DTE interface does not support the local analog loopback activation via the appropriate pin.**			
RLBE section, SW3	Enables remote digital loopback activation from the DTE (via pin 21 for V.24, RS-530, V.36, or pin "HH" for V.35).	ON—The remote digital loopback activation from the DTE is enabled.	
		OFF—The remote digital loopback activation from the DTE is disabled.	OFF
NOTE **Set this section to DIS if the DTE interface does not support the remote digital activation via the appropriate pin.**			

Table 3-1 (continued). Jumper and DIP switch functions and settings.

DIP Switch	Function	Possible Settings	Factory Setting
SW2	Selects data rate.	SW54 SW53 SW52 SW51 0 0 0 0 2048 0 0 0 1 1920 0 0 1 0 1544 0 0 1 1 1536 0 1 0 0 1024 0 1 0 1 768 0 1 1 0 512 0 1 1 1 384 1 0 0 0 256 1 0 0 1 192 1 0 1 0 128 1 0 1 1 64 1 1 0 0 32	256
J4, CHASS	Controls the connection between the driver signal ground and the from (chassis) ground.	CON—Signal ground is connected to the frame ground. DIS—Signal ground is disconnected from the frame ground.	CON

WARNING

Disconnecting the signal ground from the frame ground may render the unit unsafe for connection to unprotected telecommunication networks in some locations.

3.3.2 CONNECTING THE INTERFACES

Figure 3-2 shows the AC-powered Driver's rear panel.

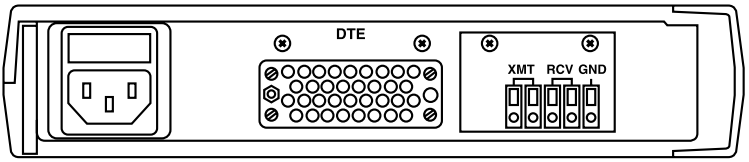


Figure 3-2. 2.048-Mbps Short-Range Driver with V.35 interface and terminal block line connector (AC version).

Connecting the line

The Driver's line connector may be optionally DB15 female or a 5-port terminal block or two BNC coax connections. Refer to the appropriate section below for the description of the connection procedures for the relevant line interface types.

To connect the DB15 balanced interface:

Attach the DB15 male cable connector to the driver's line port ("LINE").

Refer to the **Appendix** for the DB15 connector pin assignment.

To connect the terminal block:

1. Connect the transmit pair to the terminals marked XMT.
2. Connect the receive pair to the terminals marked RCV.
3. Connect the ground wire to the terminal marked GND (optional).

NOTES

The transmit and receive pairs are polarity insensitive.

The GND terminal is connected to the AC power ground wire.

To connect the BNC connectors:

1. Connect the transmit cable to the BNC connector marked XMT.
2. Connect the receive cable to the BNC connector marked RCV.

Connecting the DTE

The rear-panel DTE connector provides an interface for data input/output, clock reference, and control signal exchange between the driver and the DTE. The DTE interface may terminate in the following connectors:

- V.24/RS-232—DB25 female
- RS-530—DB25 female
- V.36/RS-449—via adapter cable converting between an RS-530 connector and a DB37 female connector
- V.35—34-pin female
- X.21—DB15 female
- G.703-HDB3—DB15 female or BNC

Pin assignments for the DTE interface options are described in the **Appendix**.

The pin assignment of the G.703-HDB3 DB15 connector is the same as of the line side DB15 connector (see the **Appendix**).

- When using the driver with an X.21 interface in the external clock mode, connect the input clock to pin 7 [EXTC(A)] and pin 14 [EXT(B)] of the 15-pin DTE connector.

We recommend using a shielded twisted-pair cable between the driver and the DTE. The receivers on the driver are 100Ω terminated (for X.21 and RS-530). If problems are encountered with the connection to the DTE interface, make sure that the DTE interface is terminated correctly.

3.3.3 Connecting the Power

WARNING

Before switching on the unit and connecting any other cable, the driver's protective earth terminals must be connected to the protective ground conductor of the mains power cord. If you are using an extension cord (power cable), make sure it is grounded as well.

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting of the protective earth terminal can make the driver dangerous. Intentional interruption is prohibited.

The line fuse is located in an integral fuse holder located on the rear panel. Make sure that only fuses of the required rating, as marked on the rear panel, are used for replacement. Do not use repaired fuses or short-circuit the fuse holder. Always disconnect the mains cable before removing or replacing the fuse. Whenever it is likely that the fuse protection has been damaged, make the driver inoperative and secure it against unintended operation.

Supply AC power to the Driver through the 5-ft. (1.5-m) standard power cable terminated by a standard 3-prong plug. The cable is included.

1. Connect the power cable to the power connector on the driver's rear panel.
2. Connect the power cable to the mains outlet. The driver turns on automatically upon connection to the mains.

4. Installing the 19" Card Versions in the RackNest 2/14

This chapter describes the 2.048-Mbps Short-Range Driver card version, designed for installation in the RackNest 2/14 (RM110A or RM110A-2PS).

4.1 The RackNest 2/14

The RackNest 2/14 holds one or two power supplies and any combination of up to 14 plug-in cards. For each of the 14 cards, the rear panel (see Figure 4-1) contains a male connector for the terminal block and a DB25 connector. A protection cover protects the terminal block connectors.

4.1.1 Line Connector

The terminal block (see Figure 4-1) attaches to the rear-panel terminal block connectors. It contains screws for connecting the transmit and receive pairs and ground, if present. When operating the driver with an unbalanced E1 interface, use an adapter that converts the terminal block connector into two coaxial BNC connectors (see Figure 4-1).

4.1.2 DB25 DTE Connector

The DB25 female interface connector provides all interface signals for the digital interfaces. Modems with X.21 or V.35 interfaces require an external mechanical adapter. Two optional interface attachments, CIA/X21/1 and CIA/V.35/1, can be ordered separately. CIA/X.21/1 converts one DB25 connector to an X.21 15-pin connector. CIA/V.35/1 converts one DB25 connector to a V.35 34-pin connector.

V.36 modem cards are supplied with an adapter cable, which converts between the DB25 connector and a V.36 37-pin connector.

The card with one of the Ethernet interfaces uses an interface adapter that converts one DB25 connector to an RJ-45 connector.

The adapter cable and interface attachments are shown in Figure 4-1.

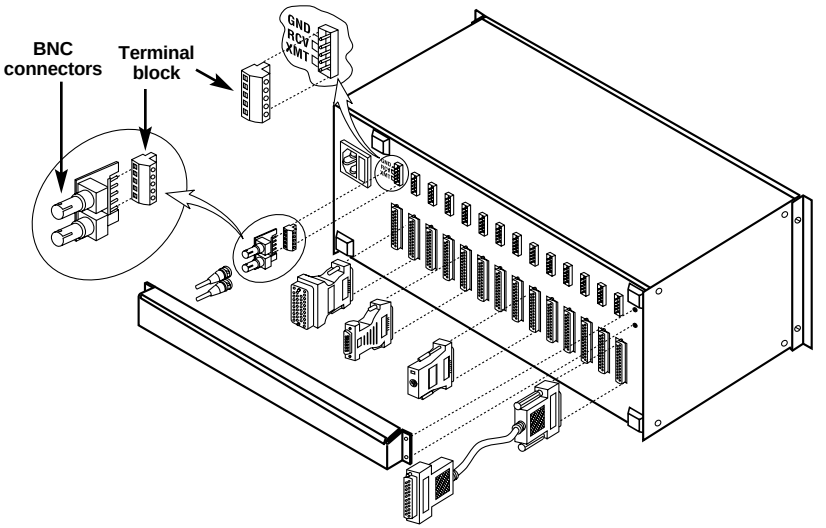


Figure 4-1. RackNest 2/14 rear panel.

4.2 Power Supply

Power is supplied to the 2.048-Mbps Short-Range Driver card from the RackNest 2/14 power supply via the chassis. Each 2.048-Mbps Short-Range Driver card has two fuses (F1 and F2) that protect the entire system against power failure resulting from a short circuit in one card. The rating of the fuses is 1 A, 250 V, slow-blow (see Figure 4-4).

The RackNest 2/14 can accept both AC or DC power supplies. LED indicators located on the RackNest's front panel show activity when the power supply is connected to the mains plug. The power supply supports the full card cage with any combination of cards.

NOTE

The RackNest has no power switch. Operation starts when the power is applied to the rear panel Power connector. When applying power, first connect the plug of the power cord to the RackNest's Power connector and then to the mains power source (outlet).

4.2.1 AC Supply

The RackNest 2/14's AC power supply is 100, 115, or 230 VAC, ±10%, and 47 to 63 Hz.

4.2.2 Power Supply with Redundancy

The RM110A-2PS is equipped with two separate power supplies, operating together and sharing the load of the whole card cage. If either of the power supplies fails, the other one will continue to supply power to the full card cage.

Two LED indicators show activity of each power supply. They should both light when mains power is provided.

NOTE

It is possible to combine AC and DC power supplies in the same cage.

4.3 The 2.048-Mbps Short-Range Driver Card's Front Panel

Figure 4-2 shows the card's front panel. The LEDs and buttons on the card are identical to those on the standalone versions. For more on the LEDs and buttons, refer to **Chapter 3**.

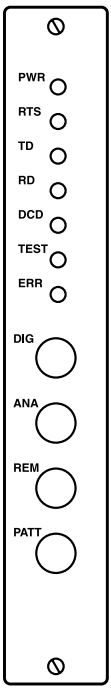


Figure 4-2. The Card's front panel.

4.4 Installing the Card

4.4.1 Setting Internal Jumpers and Switches

The 2.048-Mbps Short-Range Driver card's switches are the same as the standalone version's switches. The configuration DIP switches are located on the print side of the modem card. The J5 jumper is located on the component side of the card; it is identical to the J4 jumper of the standalone driver. For the details on the configuration DIP-switch settings, refer to Figure 3-1 and Table 3-1. Figure 4-3 shows the card's printed circuit board (PCB) layout.

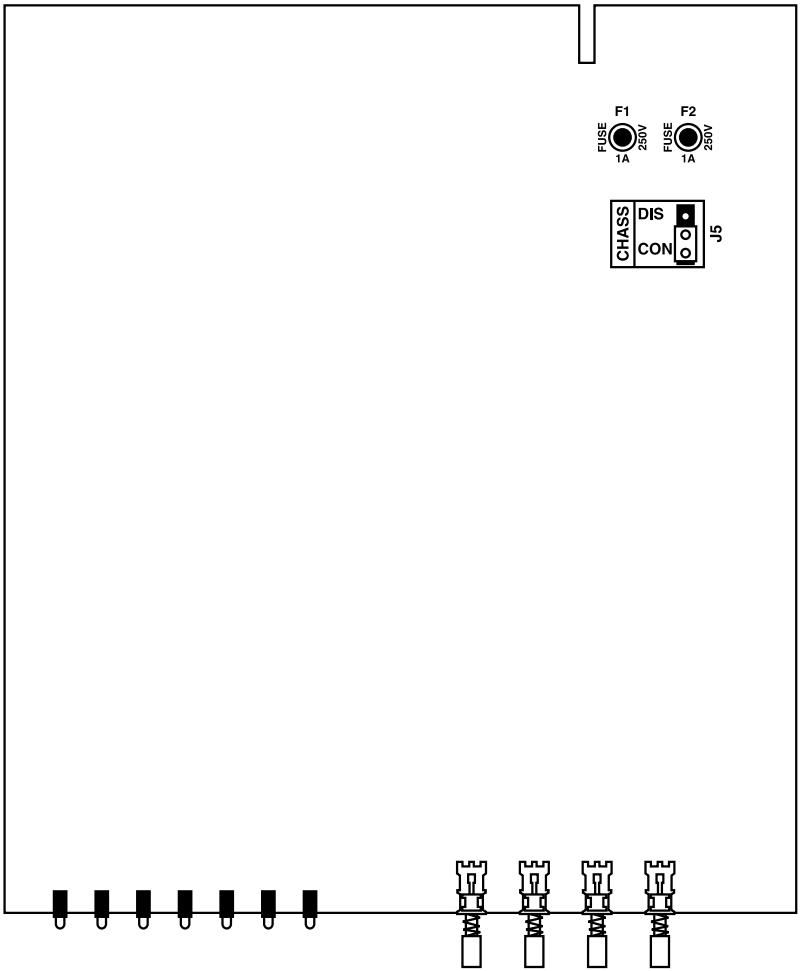


Figure 4-3. Card PCB layout, component side.

4.4.2 Installing the Card in the RackNest 2/14

1. Install the RackNest 2/14 in the 19-inch rack.
2. Slide the card into one of the RackNest's slots.
3. Gently push the card into the cage until it finally connects with the edge connector inside the rack. (See Figure 4-4.)
4. Tighten the screws on the card's front panel.

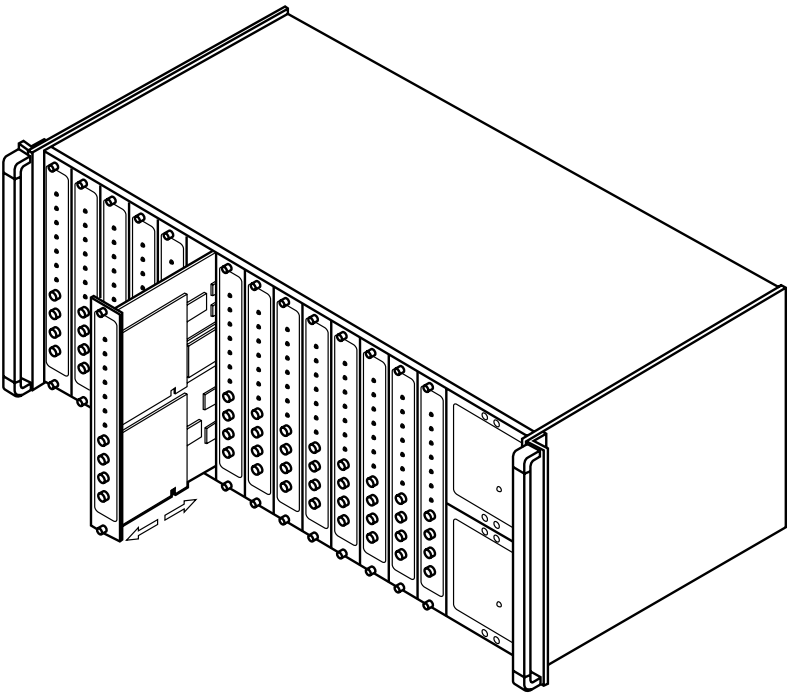


Figure 4-4. The RackNest 2/14's front panel.

4.4.3 Connecting the Interfaces

The Card uses the RackNest's rear panel terminal block ports for the line connections. The DB25 female connector serves as a DTE port.

1. Remove the protective covers from the terminal block connectors.
2. Connect the terminal block to the RackNest's terminal block connectors.

3. Connect the line to the terminal block as follows: connect transmit pair to the terminals marked XMT, the receive pair to the terminals marked RCV, and the fifth screw to ground.

4. When operating the card with an unbalanced interface, you will need an adapter that converts the terminal block connector into two coaxial BNC connectors.

5. If required, attach the appropriate V.36 adapter cable to the DB25 connector on the card cage's rear panel.

6. Connect the DTE cable to the DB25 connector.

7. Connect power to the RackNest.

   - To connect AC power, see **Section 4.2**.

5. Operation

The installation procedures in **Chapter 3** or **4** must be completed before you attempt to operate the driver.

5.1 Front-Panel Controls and Indicators

Figure 5-1 shows the driver's front panel. Table 5-1 lists controls, indicators, and their functions.

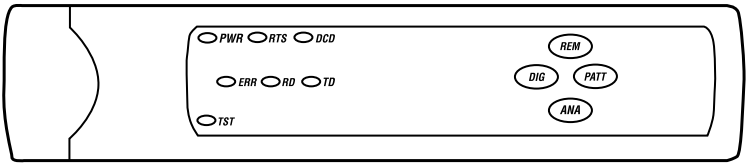


Figure 5-1. Front-panel view of the 2.048-Mbps Short-Range Driver.

Table 5-1. Controls and indicators.

Name	Type	Function
PWR	Green LED	ON—Power is on.
RTS	Yellow LED	ON—The DTE activates Request to Send.
TD	Yellow LED	ON—Steady SPACE is being transmitted.
		Blinking—Data is being received.
RD	Yellow LED	ON—Steady SPACE is being received.
		Blinking—Data is being received.
DCD	Yellow LED	ON—A valid receive signal is present.
TST	Red LED	ON—The driver is in any of the three loopback modes, or when PATT is pressed.

Table 5-1 (continued). Front panel controls and indicators.

Name	Type	Function
ERR	Yellow LED	ON or blinks if errors are present in the test pattern.
		Lights up momentarily when PATT is pressed.
DIG	Button	The digital loopback pushbutton causes the local driver to loop received data to its transmitter. Data Set Ready changes to OFF.
ANA	Button	The local loopback (V.54 loop 3) pushbutton causes the local driver to loop its transmitter output back to its receiver. The transmitter continues to send data to the line. This loopback may also be activated from the DTE when the ALBE section of the SW3 switch is set to ON.
REM	Button	The remote digital loopback (V.54 loop 2) pushbutton causes the remote driver to loop received data back to its transmitter. Data Set Ready changes to OFF. This loopback may also be activated from the DTE when the RLBE section of the SW3 switch is set to ON.
PATT	Button	The PATT pushbutton causes the driver to send and receive a 511 test pattern. If errors are encountered, the ERR indicator lights up. Receive Data and Clear to Send changes to OFF. The RD LED turns off.

5.2 Operating Procedure

5.2.1 Powering On the Driver

The driver is powered on as soon as power is connected. The PWR indicator will light up and remain lit as long as the driver receives power.

The driver requires no operator attention once installed, with the exception of occasional monitoring of front-panel indicators. Intervention is only required when:

- The driver must be adapted to new operational requirements.
- Diagnostic loopbacks are performed.

5.2.2 Normal Indications

If the local and remote 2.048-Mbps Short-Range Drivers are in operation and transmitting/receiving data, the following indicator conditions exist:

- PWR: ON
- RTS: ON
- TD: Flashing or OFF
- RD: Flashing or OFF
- DCD: ON
- TEST: OFF

If the above LED indications are not obtained following initial power on, make sure none of the buttons are pressed in. If that doesn't work, refer to **Chapter 6** for diagnostic test instructions.

5.2.3 Powering Off the Driver

To power off the 2.048-Mbps Short-Range Driver, remove the power cord from the power source.

6. Troubleshooting and Diagnostics

This chapter contains procedures for performing system diagnostic tests for the 2.048-Mbps Short-Range Driver. Use the test procedures to:

- Verify normal system operation,
- isolate faulty equipment, and
- identify other sources of system malfunction.

Tests are activated by the buttons on the driver's front panel and are monitored via LED indicators. For a description of the driver's controls and indicators and their functions, see **Chapter 5**.

6.1 V.54 Loopback Tests

The driver supports several types of loopbacks for evaluating the operation of the data system equipment and line circuits. Use them to test a) communication between the attached equipment or b) internal circuitry of the local and remote drivers.

Loopback tests are best performed in the following order:

1. Local analog loopback
2. Remote digital loopback
3. Local digital loopback

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

NOTE

If you want to perform the LLB and remote digital loopback tests via the DTE interface pins, make sure that the ALBE and RLBE sections of the SW3 DIP switch are set to ON (see Figure 3-1 and Table 3-1). The loopback activation via the DTE pins is not available for the X.21 and G.703 interfaces.

6.1.1 LOCAL ANALOG LOOPBACK (LLB)

The local analog loopback (LLB) test checks the performance of the local driver, the local data terminal, and the connections between them (see Figure 6-1). The test is performed separately at both the local and remote sites.

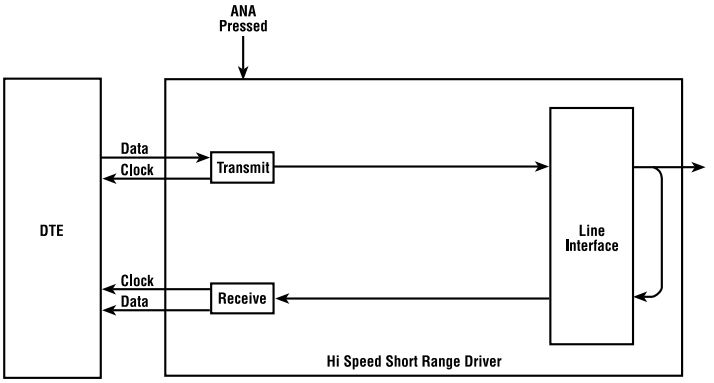


Figure 6-1. Local Analog Loopback.

- Press the ANA button. The TEST LED on the driver's front panel lights. The driver transmit output is now connected to its own receiver.
- Execute the local analog loopback with one of the following methods:

  Using the DTE and checking the echoed data stream, or

  Using an external BER tester.

  If the BER test indicates an error-free data stream, but the DTE test indicates a fault, verify that the cable between the DTE and the driver is properly connected. If the problem persists, follow the DTE manufacturer's procedures.

To isolate a communication line problem, perform the LLB loopback at the opposite end. If both LLB tests are error-free, the fault is probably in the communication line or in the line interfaces.

After completing the test or correcting the fault, press the ANA button again to restore it to the OFF position.

6.1.2 Remote Digital Loopback

The remote digital loopback test checks the performance of the local and remote drivers and their connecting lines. The remote digital loopback sets a loop at the remote driver from the DTE coupled to the local unit (see Figure 6-2).

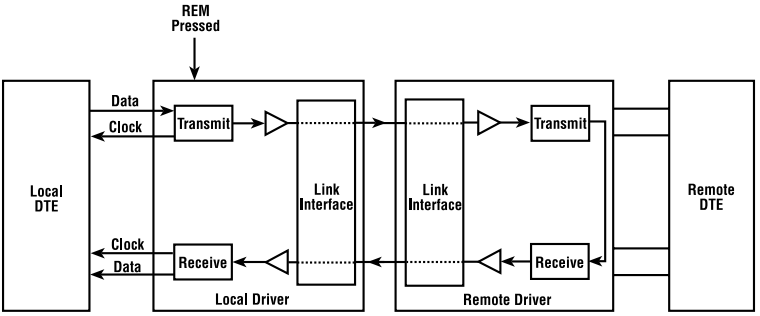


Figure 6-2. Remote Digital Loopback.

1. Press the REM pushbutton on the local driver's front panel.

   The following LEDs are ON:

   - Local unit: TEST, DCD, RTS, TD, and RD
   - Remote unit: TD and RTS

2. Perform the BERT test as explained in **Section 6.1.1** for the local analog loopback test.

3. After completing the test or correcting the fault, press the REM button again to restore it to the OFF position.

6.1.3 LOCAL DIGITAL LOOPBACK (DIG)

The local digital loopback (DIG) test allows the operator at the remote end to check the performance of the local and remote drivers and their connecting lines. The DIG test loops the received data back to the remote driver (see Figure 6-3). The local digital loopback test is equivalent to activating the remote loopback from the remote driver.

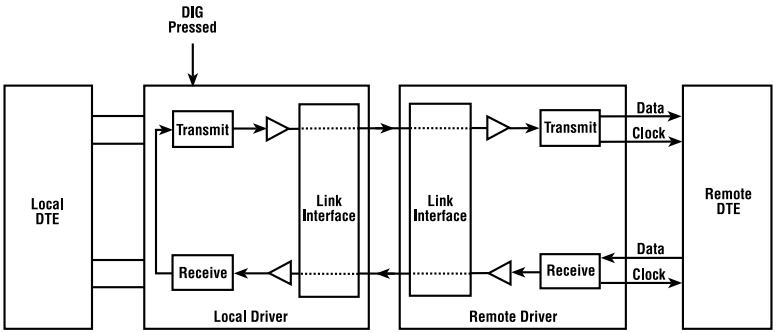


Figure 6-3. Local Digital Loopback.

Press the DIG pushbutton on the local driver's front panel.

The following LEDs are ON:

- Local unit: TEST, RTS, and TD
- Remote unit: DCD, RTS, TD, and RD

NOTE

You can activate the local digital loopback by running remote digital loopback at the remote unit. If the V54E section of the SW3 DIP switch is set to ON, the local driver closes the DIG loopback when it detects the RLB activation at the remote end.

6.2 Internal BERT

The driver has a built-in BERT circuit that consists of a pattern generator and a pattern tester. This circuit works in conjunction with the V.54 diagnostic loops and the remote BERT to verify normal system operation and identify faulty equipment in the event of the system failure.

The pattern transmitted by the BER system can be looped back for comparison (modem self-test, **Section 6.2.1**) or can be received by another driver (Two-BER test, **Section 6.2.2**).

When used opposite another driver, the complete link can be tested either when the PATT button is pressed, or with external BERT transmitting the same 511-bit pattern.

6.2.1 Modem Self-Test

The test verifies that the modem is operating correctly (see Figure 6-4).

1. Press the ANA button. The TEST and DCD LEDs light.
2. Press the PATT pushbutton. Verify that the TEST LED is lit and the ERR LED lights up momentarily.

If errors are encountered, the ERR LED will light (for continuous errors) or blink (for intermittent errors). Call Tech Support; the driver is faulty and should be replaced. If the test executes correctly, restore all buttons and switches to their normal positions.

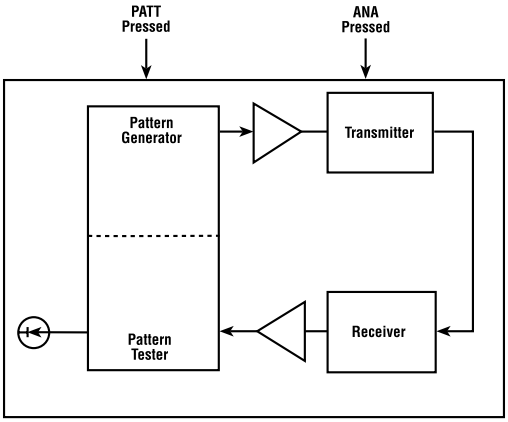


Figure 6-4. Modem self-test.

6.2.2 TWO-BER TEST

The Two-BER test checks the link between the two DTEs (Figure 6-5).

Press the PATT button on both the local and remote drivers.

If errors are encountered, the ERR LED will light (for continuous errors) or blink (for intermittent errors). Call Tech Support; the driver is faulty and should be replaced.

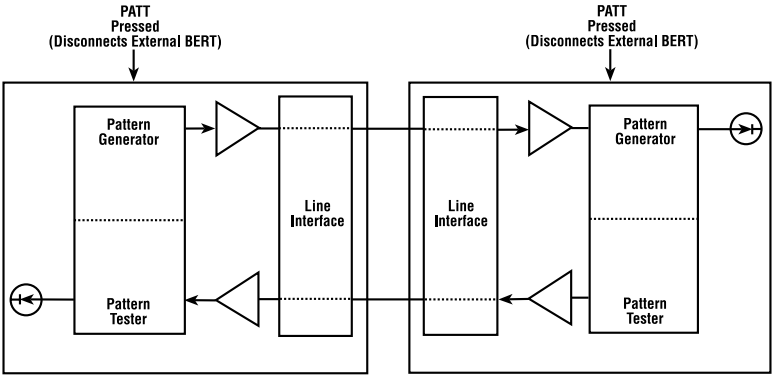


Figure 6-5. BER system test (two-BER test).

6.3 Calling Black Box

If you determine that your 2.048-Mbps 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.

6.4 Shipping and Packaging

If you need to transport or ship your 2.048-Mbps 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 Authorization (RA) number, and make sure you include everything you received with the unit when you ship it.

Appendix. Interface Connector Wiring

A.1 Pin Assignments for V.24, V.35, X.21, and RS-530 DTE Interfaces

Table A-1. DTE interface signal assignments.

Signal Function	RS-232	V.35			RS-530		X.21			Description
	DB25 Stand-alone and Card Cage	DB25 Card Cage	34-Pin Standalone	DB25	DB25 Standalone and Card Cage		DB25 Card Cage	DB15 Standalone		
			Pin	Circuit	Pin	Circuit		Pin	Circuit	
Protective Ground	1	1	A	Frame 101	1		1	1	— (Shield)	Chassis ground may be isolated from signal ground.
Signal Ground	7	7	B	Signal 102 GND	7	AB	7	8	— (GND)	Common signal and DC power supply ground.
Trans-mitted Data	2	9 11	P S	TD(A) 103 TD(B) 103	2 14	BA(A) BA(B)	2 14	2 9	T(A) T(B) (Transmit)	Serial digital data from DTE. In sync appli-cations, the data translations must occur on the rising edge of the transmit clock.
Received Data	3	12 13	R T	RD(A) 104 RD(B) 104	3 16	BB(A) BB(B)	3 16	4 11	R(A) R(B)	Serial output from the modem receiver. In sync applications, the data translations occur on the rising edge of the clock.

Table A-1 (continued). DTE interface signal assignments.

Signal Function	RS-232	V.35			RS-530		X.21			Description
	DB25 Standalone and Card Cage	DB25 Card Cage	34-Pin Standalone	DB25	DB25 Standalone and Card Cage		DB25 Card Cage	DB15 Standalone		
			Pin	Circuit	Pin	Circuit		Pin	Circuit	
Request to Send	4	4	C	RTS 105	4 19	CA(A) CA(B)	4 19	3 10	C(A) C(B)	A positive level to driver when data transmission is desired.
Clear to Send	5	5	D	CTS 106	5 13	CB(A) CB(B)				A positive level from the driver when power is on, and the driver is (a) not in digital loop mode, or (b) has not received a remote loopback signal from the remote unit.
Data Terminal Ready	20	20	H	DTR 108	20 23	CD(A) CD(B)				Not used.
Carrier Detect	8	8	F	DCD 109	8 10	CF(A) CF(B)	8 10	5 12 (Indication)	I(A) I(B)	A positive level from the driver, except when a loss of the received signal is detected or when Data Set Ready is negative.
External Transmit	24	19 16	U W	SCTE(A)113 SCTE(B) 113	24 11	DA(A) DA(B)	24 11	7 14	(A) (B)	A serial data rate clock input from the data source. Positive clock transitions must correspond to data transmissions.

Table A-1 (continued). DTE interface signal assignments.

Signal Function	RS-232	V.35		RS-530		X.21		Description
	DB25 Stand-alone and Card Cage	DB25 Card Cage	34-Pin DB25 Standalone	DB25 Standalone and Card Cage		DB25 Card Cage	DB15 Standalone	
			Pin Circuit	Pin	Circuit		Pin Circuit	
Transmit Clock	15	14 10	Y SCT(A) 114 a SCT(B) 114	15 12	DB(A) DB(B)	15 12	6 S(A) 13 S(B) (Signal Timing)	A transmit data rate for use by an external data source. Positive clock translations correspond to data translations.
Receive Clock	17	23 22	V SCR(A) 115 X SCR(B) 115	17 9	DD(A) DD(B)			A receive data rate clock output used by an external data sink. Positive clock translations correspond to data translations.
Local Analog Loop	18	18	L and j 18	LL				A control signal input, which, when on, sets the driver into Local Analog Loopback (V.54 Loop 3).
Remote Digital Loop	21	21	N and h 21	RL				A control signal input which, when on, commands the driver to send a Remote Loopback command (V.54 Loop 2) to the remote driver.
Test Indicator	25	25	n and k 25	TM				A control signal output from the driver; positive during any test mode.

A.2 V.36 Interface Converter

The V.36 interface is provided via an adapter cable converting between a 25-pin RS-530 connector and a 37-pin V.36 connector. Table A-2 lists the cable wiring.

Table A-2. Pin assignments for cable converting between RS-530 and V.36 interfaces.

Signal Function	V.36 Pin	Circuit	RS-530 Pin	Circuit
Protective Ground	1	Shield	1	—
Signal Ground	19	SG	7	AB
DTE Common Return	37	SC	—	—
DCE Common Return	20	RC	—	—
Transmitted Data	4 22	SD(A) SD(B)	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(B)

Table A-2 (continued). Pin assignments for cable converting between RS-530 and V.36 interfaces.

Signal Function	V.36 Pin	Circuit	RS-530 Pin	Circuit
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	8 26	RT(A) RT(B)	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

A.3 DB15 Line Connector (Standalone Driver)

The line interface of the standalone driver may terminate in a DB15 female connector, wired in accordance with Table A-3.

Table A-3. DB15 line connector pin assignment.

Pin	Function
11	Receive (data in)
3	Receive (data in)
9	Transmit (data out)
1	Transmit (data out)

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