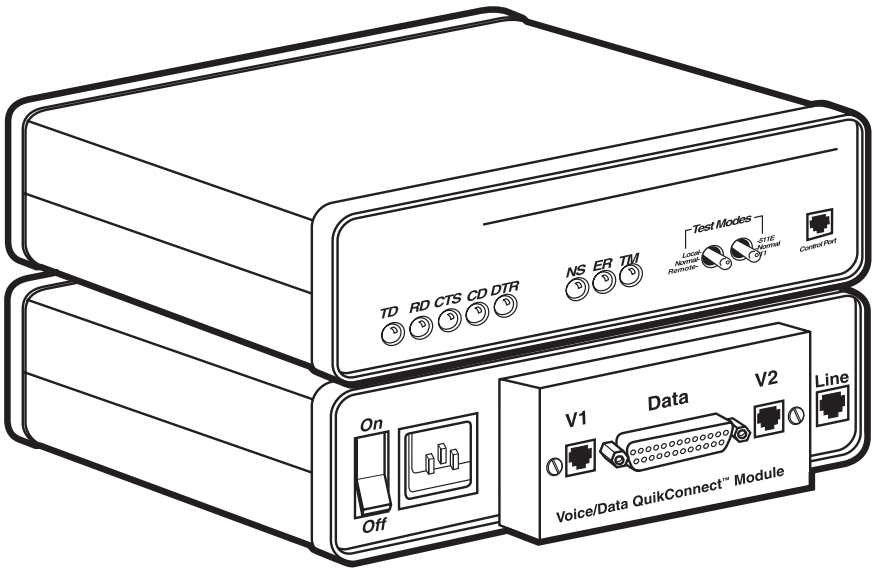




QuikConnect HDSL Line Driver



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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 B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

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

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

EUROPEAN UNION DECLARATION OF CONFORMITY

This equipment complies with the requirements of the European EMC Directive 89/336/EEC.



NORMAS OFICIALES MEXICANAS (NOM) ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

TRADEMARKS USED IN THIS MANUAL

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1. Specifications

Transmission Format: Synchronous

Transmission Line: Two-wire unconditioned twisted pair

Clocking: Internal, external, or receive recovered

Interface Modules: RS-232/530, ITU V.35, and ITU/T X.21

Line Rates: 144, 272, 400, 528, 784, 1040, and 1168 kbps

DTE Rates: 64, 128, 192, 256, 320, 384, 448, 512, 576, 640, 704, 768, 832, 896, 960, 1024, 1088, and 1152 kbps

Diagnostics: V.52-compliant bit error rate pattern (511/511E pattern) generator and detector with error injection mode; Local Line Loopback and Remote Digital Loopback, activated by front-panel switch or via serial interface

Indicators: LEDs: TD, RD, CTS, CD, DTR, NS (no signal), ER (error), and TM (test mode)

Connectors: RJ-45 on line side; RJ-45 on front of unit (control port); DB25 female, M/34 female, or DB15 female on serial interface side, depending upon which interface module is installed

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

Humidity: 5 to 95% noncondensing

Power: 100 to 240 VAC, 50 to 60 Hz (universal input), 10 watts

Size: 1.6"H x 7.3"W x 6.6"D (4.1 x 18.5 x 16.8 cm)

Weight: 2 lb. (1 kg)

2. Introduction

2.1 Description

The QuikConnect HDSL Line Driver provides high-speed 2-wire connectivity to ISPs, PTTs, and corporations using HDSL (High-Density Multi-rate Digital Subscriber Line) technology. Multi-rate DSL offers the ability to deliver the maximum bit rate that a twisted-pair line can accommodate. Supporting multiple line rates from 144 kbps to 1.168 Mbps, the QuikConnect provides “megabyte” speeds to leased line, LAN-to-LAN interconnection, and WAN access networks over 2.9 miles/4.7 km (1.152 Mbps on 24-AWG/0.5-mm wire).

The QuikConnect HDSL Line Driver standalone allows DTE speeds from 64 kbps to 1.152 Mbps in increments of 64 kbps. Features include loopback diagnostics, inband SNMP/HTTP remote management capabilities, and externally accessible configuration switches.

As a symmetric DSL NTU, the QuikConnect offers the same data rates in both directions over a single pair of regular telephone lines using 2B1Q modulation. Featuring replaceable DCE-DTE interface modules, the QuikConnect can be configured for a huge range of V.35, RS-422/530, and X.21 applications. Line connection is made by an RJ-45 jack. The standard QuikConnect HDSL Line Driver is powered by a 100- to 240-VAC (Universal) power supply.

2.2 Features

- DSL distances on just two wires using HDSL technology.
- DTE speeds n x 64 to 1.152 Mbps.
- 2-wire operation.
- SNMP network management with in-band management of remote units plus advanced diagnostics and statistics using an Managed Micro Rack SNMP/HTTP Card (part number RM261C-SNMP).
- Internal, external, or receive recovered clocking options.
- LED indicators for TD, RD, CTS, CD, DTR, TM, ER, and NS.

3. Configuration

The QuikConnect HDSL Line Driver is equipped with three sets of eight DIP switches. This chapter describes switch locations and explains all possible configurations.

3.1 Configuring the Hardware DIP Switches

The 24 external switches are grouped into three eight-switch sets. They're externally accessible from the underside of the QuikConnect (see Figure 3-1).

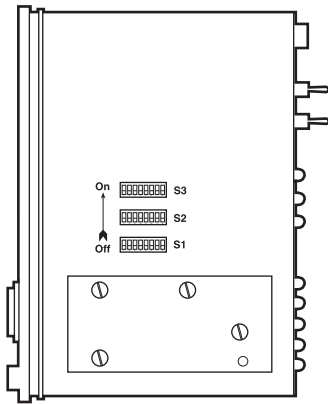


Figure 3-1. Underside of the QuikConnect, showing the location of the DIP switches.

The three sets of DIP switches on the underside of the QuikConnect are called S1, S2, and S3. As Figure 3-2 shows, the orientation of all DIP switches is the same with respect to ON and OFF positions.

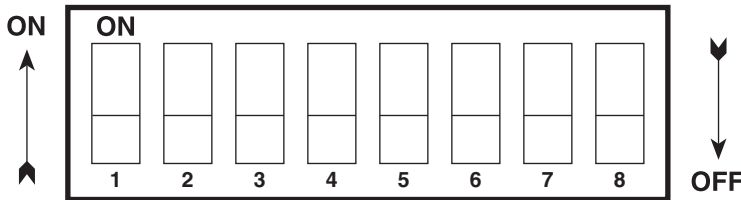


Figure 3-2. Close-up of configuration switches (all sets are identical in appearance).

3.1.1 DIP-SWITCH S1

All Switches in Switch S1 are reserved for future use. These switches should remain in the On position.

3.1.2 DIP-SWITCH S2

The configuration switches on S2 allow you to specify the clocking mode and response to DTE loop enable. Default settings of S2 are shown in Table 3-1.

Table 3-1. S2 summary.

Position	Function	Factory Default
S2-1	Reserved	Off
S2-2	Reserved	Off
S2-3	Reserved	Off
S2-4	Reserved	Off
S2-5	Reserved	Off
S2-6	Clock Mode	On
S2-7	Clock Mode	Off
S2-8	Enable Loop from DTE	Off

} Receive
} Recover
Disable

Switches S2-1, S2-2, S2-3, S2-4, and S-5

These switches are reserved for future use and should remain in the Off position.

Switches S2-6 and S2-7: Clock Mode

Use Switches S2-6 and S2-7 to configure the QuikConnect for internal, external, or receive recover clock mode.

Table 3-2. Clock mode.

CO/CP Unit	S2-6	S2-7	Clock Mode	Description
CO	On	On	Internal	Transmit clock generated internally
CO	Off	On	External (DTE)	Transmit clock derived from terminal interface
CP	On	Off	Receive Recover	Transmit clock derived from the received line
—	Off	Off	—	Reserved

Switch S2-8: Enable/Disable Loop Tests from DTE

Use Switch S2-8 to allow the QuikConnect to enter loopback tests when the DTE raises the appropriate loop request pin.

Table 3-3. Enable/disable loop tests.

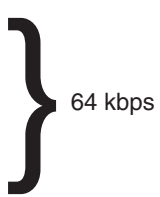
S2-8	Setting
On	Response to DTE loopback request enabled
Off	Response to DTE loopback request disabled

3.1.3 DIP-SWITCH S3

Use the eight DIP switches in Switch S3 to enable the DTE connection rate. Table 3-4 summarizes default positions of DIP-switch S3. Detailed descriptions of each switch follow the table.

Table 3-4. S3 summary.

Position	Function	Factory Default
S3-1	DTE Rate	Off
S3-2	DTE Rate	Off
S3-3	DTE Rate	On
S3-4	DTE Rate	On
S3-5	DTE Rate	On
S3-6	DTE Rate	On
S3-7	Reset Software Defaults	On
S3-8	Transmit Data Sample Point	On



Normal Operation
 Normal Operation

Switch S3-1: DTE Rate

Use Switches S3-1 through S3-6 to set the DTE bit rate.

Table 3-5. DTE bit rate.

S3-1	S3-2	S3-3	S3-4	S3-5	S3-6	DTE Rate (kbps)
Off	Off	On	On	On	On	64
On	On	Off	On	On	On	128
Off	On	Off	On	On	On	192
On	Off	Off	On	On	On	256
Off	Off	Off	On	On	On	320
On	On	On	Off	On	On	384
Off	On	On	Off	On	On	448
On	Off	On	Off	On	On	512
Off	Off	On	Off	On	On	576
On	On	Off	Off	On	On	640
Off	On	Off	Off	On	On	704
On	Off	Off	Off	On	On	768
Off	Off	Off	Off	On	On	832

Table 3-5 (continued). DTE bit rate.

S3-1	S3-2	S3-3	S3-4	S3-5	S3-6	DTE Rate (kbps)
On	On	On	On	Off	On	896
Off	On	On	On	Off	On	960
On	Off	On	On	Off	On	1024
Off	Off	On	On	Off	On	1088
On	On	Off	On	Off	On	1152

NOTE

The actual line rate of the QuikConnect is determined by the selection of the DTE rate. To see the line rate associated with various DTE rates, refer to the distance chart in Appendix B.

Switch S3-7: Reset Software Defaults

Switch S3-7 allows you to reset the software configured factory defaults. This will only be needed when using the Managed Micro Rack SNMP/HTTP Card (part number RM261C-SNMP) to SNMP manage your units. For more information, please refer to the *Managed Micro Rack SNMP/HTTP Card Users' Manual*.

Table 3-6. Reset software defaults.

S3-7	Setting
On	Normal Operation
Off	Reset

Switch S3-8: Transmit Data (TD) Sampling Point

Table 3-7. Transmit Data (TD) sampling point.

S3-8	Setting	Description
On	Normal	TD sampled on the falling edge of the QuikConnect Transmit Clock (TC)
Off	Invert	TD sampled on the rising edge of the QuikConnect Transmit Clock

3.2 Control Port

If you would like to use the Line Driver's control port to download codes, you must set all of the DIP switches to the On position.

3.3 Plug-and-Play

The Plug-and-Play application allows ISPs and PTTs to quickly upgrade the link speed for a customer without re-configuring the customer premise (CP) Line Driver. It will also allow ISPs and PTTs to set up all of the configurations at the central office (on the rack cards) before installing the standalone units, saving time spent configuring and re-configuring DIP-switch settings.

The Plug-and-Play feature allows you to configure the DTE rate for the link from the rack card at the central office (CO). The standalone unit at the customer premise (CP) site will automatically configure itself to the DTE rate of the rack card. Other configuration parameters fall to the default state. This allows changes in the configuration to be handled from a single end of the link.

When installing a CO/CP style application, the local end of the link is composed of a CO unit (HDSL Rack Card, ME0003C) set to either internal or external clocking mode and a CP unit (QuikConnect HDSL Line Driver, ME0007A-HDSL) set as a Plug-and-Play CP. The Plug-and-Play standalone will have all of its DIP switches set to the On position. See Figure 3-3.



Figure 3-3. Typical Plug-and-Play application.

When the Line Drivers are connected, the CP will come up with a pre-defined default configuration (receive recovered clocking). During the handshaking process between the Line Drivers, the CO unit will set the DTE rate/line rate of the CP unit to match its DIP-switch configuration settings. If the DTE rate for the link requires a change, the change is needed only at the CO side of the link.

The Plug-and-Play application will also work in the managed system using the Managed Micro Rack SNMP/HTTP Card (RM261C-SNMP) and HDSL Line Driver Rack Cards (ME0003C) installed in the Managed Micro Rack (RM260). In this application, the system administrator can configure the entire rack through the Network Management Station (NMS) before the standalone (CP) units are installed. For more information on the SNMP management of your rack, please refer to the *Managed Micro Rack SNMP/HTTP Users' Manual*.

4. Installation

Once the QuikConnect HDSL Line Driver is properly configured, it is ready to connect to the twisted-pair interface, to the serial port, and to the power source. This chapter tells you how to make these connections.

4.1 Connecting the Twisted-Pair Interface

The QuikConnect HDSL Line Driver supports communication between two DTE devices at distances to 4 miles (6.4 km) over 24-AWG (0.5-mm) twisted-pair wire. Two things are essential:

1. These units work in pairs. Both units at the end of the twisted pair must have the same 2-wire connection and DTE rate.
2. To function properly, the QuikConnect HDSL Line Driver needs one twisted pair of metallic wire. This twisted pair must be unconditioned, dry, metallic wire, between 19 (0.9 mm) and 26 AWG (0.4 mm); the higher-number gauges will limit distance. Standard dial-up telephone circuits, or leased circuits that run through signal equalization equipment, or standard, flat modular telephone type cable, are *not* acceptable.

IMPORTANT!

The QuikConnect HDSL Line Driver has been optimized for performance at high bit rates (DTE rates greater than 512 kbps). To ensure accurate performance at these rates, please use twisted-pair line interface cable that is at least 330 ft. (100 m) long.

The RJ-45 connector on the QuikConnect's twisted-pair interface is polarity insensitive and is wired for a two-wire interface. The signal/pin relationships are shown in Figure 4-1.

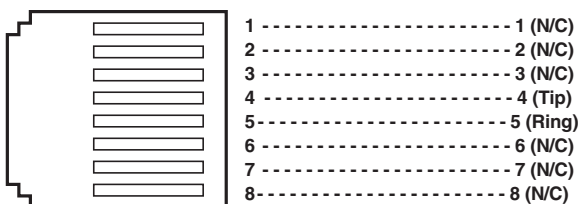


Figure 4-1. RJ-45 twisted-pair line interface.

4.2 Connecting the Serial Port

The serial port interface on the QuikConnect HDSL Line Driver uses interchangeable QuikConnect Modules. Each QuikConnect module has a 50-pin card edge connector on one side and a serial port interface on the other. Figure 4-2 shows how a QuikConnect module plugs into the back of the QuikConnect HDSL Line Driver.

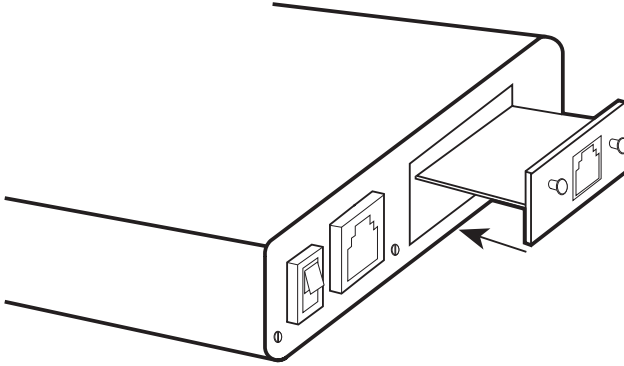


Figure 4-2. Installing the plug-in serial interface module.

4.2.1 CHANGING QUIKCONNECT MODULES

Your QuikConnect HDSL Line Driver has the appropriate QuikConnect module already installed. If you need to install a different QuikConnect module, follow these steps:

Removing the Existing QuikConnect Module

1. Turn the power switch off. Leave the power cord plugged into a grounded outlet to keep the unit grounded.
2. Loosen the two thumbscrews on the module by turning them counter-clockwise.
3. Grasp the two thumbscrews and gently pull the module from the unit. Apply equal force to the thumbscrews to keep the module straight during the removal process.

Installing the New QuikConnect Module

1. Make sure the power switch is off. Leave the power cord plugged into a grounded outlet to keep the unit grounded.
2. Hold the module with the faceplate toward you and align the module with the guide slots in the rear panel of the QuikConnect HDSL Line Driver.
3. While keeping the module's faceplate parallel with the Line Driver's rear panel, slide the module straight in, so that the card edge contacts line up with the socket inside the chassis.
4. With the card-edge contacts aligned with the socket, firmly seat the module by using your thumbs to apply pressure directly to the right and left edges of the module faceplate. Applying moderate and even pressure should be sufficient to seat the module. You should hear it "click" into place.
5. To secure the module in place, push the thumbscrews into the chassis and turn the screws clockwise to tighten.

4.2.2 CONNECTING TO A DTE DEVICE

The serial port on most QuikConnect interface modules (all except the X.21 module) is hard-wired as a DCE. Therefore these modules "want" to plug into a DTE such as a terminal, PC, or host. When making the connection to your DTE device, use a straight-through cable of the shortest possible length—we recommend 6 feet (1.8 m) or less. When purchasing or constructing an interface cable, please refer to the pin diagrams in **Appendix A** as a guide.

4.2.3 CONNECTING TO A DCE DEVICE

If the Line Driver's QuikConnect interface module is hard-wired as a DCE (all except the X.21 module), you must use a null-modem cable when connecting to a modem, multiplexor, or other DCE device. This cable should be of the shortest possible length—we recommend 6 feet (1.8 m) or less. When purchasing or constructing a null-modem interface cable, use the pin diagrams in **Appendix A** as a guide.

NOTE

Pinout requirements for null-modem applications vary widely between manufacturers. If you have any questions about a specific application, call Black Box Technical Support at 724-746-5500.

4.2.4 CONFIGURING THE X.21 QUIKCONNECT MODULE

The serial port on the X.21 QuikConnect module is default wired as a DCE, but may be switched to a DTE. This is done by reversing the orientation of the DCE/DTE strap, as described below.

To reverse DCE/DTE orientation, remove the module according to the instructions in **Section 4.2.1**. The DCE/DTE strap is located on the bottom side of the module's PC board. The arrows on the top of the strap indicate the configuration of the X.21 port (for example, if the DCE arrows are pointing toward the DB15 connector, the X.21 port is wired as a DCE). Reverse the DCE/DTE orientation by pulling the strap out of its socket, rotating it 180°, then plugging the strap back into the socket. You will see that the DCE/DTE arrows now point in the opposite directions, showing the new configuration of the X.21 port. Reinstall the module according to the instructions in **Section 4.2.1**.

4.3 Connecting Power

The QuikConnect HDSL Line Driver comes with a 100- to 240-VAC universal power supply. No re-configuration is required. The universal interface AC supply is equipped with a male IEC-320 power connection. To connect the standard or universal power supply, follow these steps:

1. Attach the power cord (supplied) to the shrouded male IEC-320 connector on the rear of the QuikConnect HDSL Line Driver.
2. Plug the power cord into a nearby AC power outlet.
3. Turn the rear power switch ON.

WARNING

There are no user-serviceable parts in the power supply section of the Line Driver. Only qualified service personnel should replace the fuse. Contact Black Box Technical Support at 724-746-5500 for more information.

5. Operation

Once the QuikConnect HDSL Line Driver is properly configured and installed, it should operate transparently. This chapter describes power-up, reading the LED status indicators, and using the built-in loopback test modes.

5.1 Power-Up

To apply power to the QuikConnect, first be sure that you have read **Section 4.3**. Then power-up the unit via the rear-panel power switch.

5.2 LED Status Indicators

The QuikConnect HDSL Line Driver features eight front-panel LEDs that monitor power, the DTE signals, network connection, and test modes. Figure 5-1 shows the location of each LED. Following Figure 5-1 is a description of each LED's function.

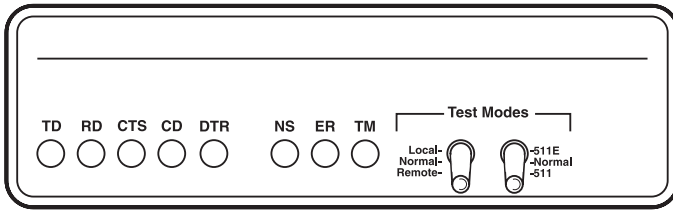


Figure 5-1. Front panel.

- TD and RD: Glows yellow to indicate an idle condition of Binary “1” data on the respective terminal interface signals. Green indicates Binary “0” data
- CTS: Glows green to indicate that the Clear to Send signal from the Line Driver is active.
- CD: Glows yellow if no carrier signal is being received from the remote Line Driver. Green indicates that the remote Line Driver’s carrier is being received.
- DTR: Glows green to indicate that the Data Terminal Ready signal from the terminal is active.

- ER: blinks ON/OFF after a 511/511E test has timed out. See **Section 5.3.3** for more information.

ER flashes once to indicate that a CRC error has occurred (during normal operation) or bit errors have occurred (during 511/511E tests).

Only at power up, ER blinks once every 200 ms if the DTE Rate is set to unsupported settings.

- TM: glows yellow to indicate that the QuikConnect Line Driver has been placed in Test Mode. The unit can be placed in test mode by the local user or by the remote user.
- NS: (No Signal) glows red to indicate that the local QuikConnect Line Driver is not connected with the remote QuikConnect Line Driver.

5.3 Test Modes

The QuikConnect HDSL Line Driver offers two proprietary loopback test modes, plus a built-in V.52 BER test-pattern generator to evaluate the condition of the modems and the communication link. These tests can be activated physically from the front panel or via the DTE interface.

5.3.1 OVERVIEW

Figure 5-2 shows the major elements used in the loopback and pattern tests available in the Line Driver. Each block has several functions. Following Figure 5-2 are descriptions that show how the elements are used during test modes.

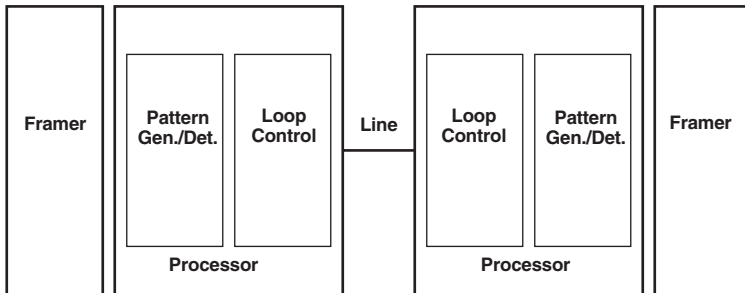


Figure 5-2. The major elements used in the loopback and pattern tests.

Framer

The framer is used to determine the status of the line. In normal operation, the framer transmits and expects to receive framed packets from the far end. If the framer receives framed packets from the far end, CTS and CD will be active. If framed packets are not received, CTS and CD will be inactive. The restart procedure uses this information to determine if a valid connection is made (cable disconnect, poor cable quality, etc). In normal data mode, if the Line Driver receives four seconds of unframed packets it will restart and begin trying to re-establish a connection with the far end. The distinction between framed packets and unframed packets becomes important when we discuss the pattern generator.

Pattern Gen./Det.

This part of the processor generates and detects the 511/511E patterns. When transmitting 511 patterns, the information is unframed (because it originates after the framer) and is intended to be evaluated only by another processor. If the units are in data mode and the pattern generator is enabled on one end of the link, the far end will begin receiving unframed packets and assume that the line has gone down. During test modes, we force the pattern generator to time out before it can cause the link to be killed.

Loop Control

This part of the processor is used to control loopbacks. In a local loop, the data is looped back towards the local DTE. In a remote loop, the data is looped back to the line, but it is also allowed to pass through to the framer and to the remote DTE.

5.3.2 RESTART PROCEDURE AND TIMEOUTS

The restart procedure is in place to allow the units to re-establish a connection after the framer begins seeing unframed packets. Table 5-1 shows the amount of time the framer must see consecutive unframed packets before the unit will restart and try to establish a new line connection. The reason that there are different Restart Times will become apparent after reading the rest of the document. The 511/511E Timeout shown refers to the amount of time the 511/511E pattern will be valid. At the end of this time, the pattern will automatically turn itself off and the normal data path will be re-established. The ER LED will flash, indicating to the user that the test has timed out. The ER LED will stop flashing once the 511/511E switch is placed into the normal position.

Table 5-1. Test mode timing.

Item	Elapsed Time (seconds)
Start-up	50
Data Mode	4
511/511E Generator Enabled	60 (The generator will stop after 45 seconds.)
Remote End of an RDL	60
511/511E Timeout	45 (The pattern generator will automatically turn off after 45 seconds. The ER LED will flash until you turn off the 511/511E switch.)

Symbol Indicators

This symbol designates the origination or the termination of a data path. The direction of the arrow connected distinguishes the two data paths.

This symbol designates an invalid data path. If there is data present, it should be ignored.

5.3.3 LOOPS AND PATTERNS

The following section describes the Test Modes used in the QuikConnect HDSL Line Driver. At the bottom of each test mode, a figure is included to show the data path.

Local Loop

There are two different modes of operation for a local loop depending on the status of the units at the time that the local loop is initiated. If the units are not linked (NS LED on) and the local loop is initiated, either by the front-panel switch or the DTE interface, the unit will enter mode 1. If the units are linked, NS LED off, then the unit will enter a mode 2 Local Loop.

A mode 1 local loop is shown in Figure 5-3. When the local loop is initiated, either by the front-panel switch or the DTE interface, the loop will be activated within the

local processor. The data present at the local DTE interface will be looped back to the local DTE by the loop control block within the processor. Any data present on the line or at the far-end DTE interface is invalid. The remote unit will remain in the Start-up mode, NS LED on, CTS LED yellow, and CD LED yellow, until the local unit is taken out of the local loop mode. After the local loop is deselected, the units will both be in Start-up mode and the link will be established.

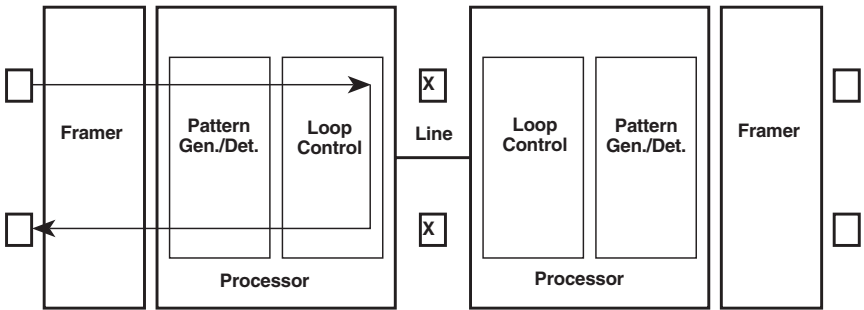


Figure 5-3. Local loop mode 1.

A mode 2 local loop is shown in Figure 5-4. When the local loop is initiated, either by the front-panel switch or the DTE interface, two separate loop paths will be started. In the first path, data presented to the local DTE interface will be looped back to the local DTE within the framer. In the second path, data presented at the far-end DTE will be transmitted to the local DTE and then looped back within the local DTE loop control block with the processor. After the Local Loop is deselected, the units will be placed back into data mode and the normal data paths will be re-established.

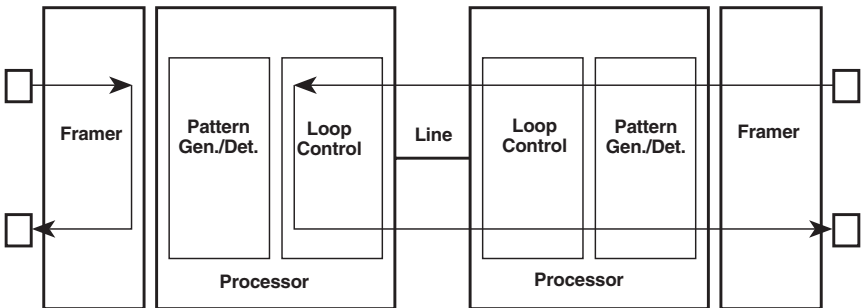


Figure 5-4. Local loop mode 2.

Local Loop with 511/511E

When the unit is placed into a mode 1 local loop and the 511/511E pattern generator is activated, the local pattern generator begins sending out a 511/511E pattern to the loop control block. The loop control block will loop this data back to the 511/511E pattern detector block, which will evaluate the data for errors. Because the 511/511E pattern generator is contained within the processor, the data is unframed so the framer will begin seeing unframed packets. The framer receives this unframed data and cannot distinguish this information from a line disconnection (this would cause the unit's restart procedure to start). What we have done to allow this mode to work is to add timeouts for the pattern generators. When the 511/511E is initiated, the line restart procedure is changed to one minute. The 511/511E pattern will timeout after 45 seconds. So if the 511/511E is turned on during a local loop, the restart procedure is set to one minute, but the 511/511E pattern will time out after 45 seconds, allowing the framer to begin seeing framed packets (and not restart the box).

After the 511/511E pattern times out, the ER LED will begin flashing. It will remain this way until the pattern generator switch is turned off. Note that the data at the local DTE and the remote DTE are not valid. Because the data is unframed there is no way for the framer to send this data out to the DTE. This is an important distinction because other units will send out the 511 pattern.

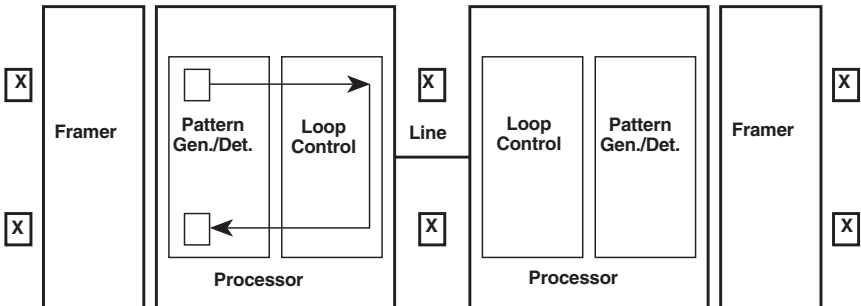


Figure 5-5. Local loop mode 1 with 511/511E.

When the unit is placed into a mode 2 local loop, the 511/511E pattern generator on the local unit is unavailable for transmission. As can be seen from Figure 5-6, the 511/511E pattern generator has no data path connections available. The 511/511E pattern generator is still available on the remote unit. For more information on the proper operation of this pattern generator, please refer to the *Remote Digital Loop with 511/511E* section.

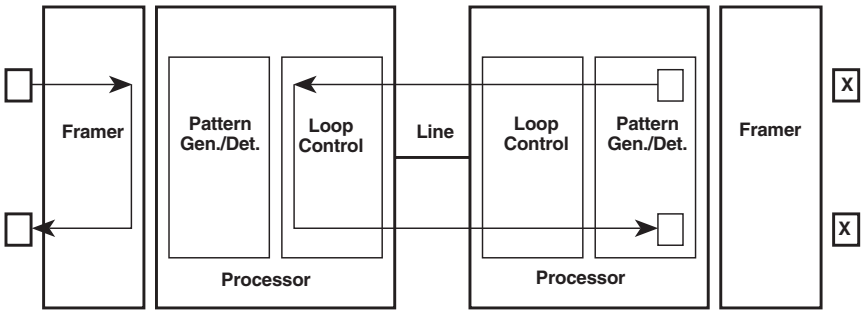


Figure 5-6. Local loop mode 2 with 511/511E.

Remote Digital Loop

The Remote Loop uses the EOC channel (an out-of-band signaling channel) to establish the remote link. Upon the RDL switch being thrown or DTE initiation, a RDL_ON Request signal is sent to the remote unit. The remote unit then responds with an RDL Acknowledge command and the link is established. Data originates at the local DTE and is looped at the remote processor back to the local DTE. Note that the data is also passed through to the remote DTE and is not squelched. When a Remote unit enters RDL, it changes its restart timeout to one minute (the reason will be explained in the *RDL with 511/511E* section). If the line is disconnected, the local unit will restart (NS LED activated) after 4 to 6 seconds, but the Remote unit will wait for one minute before it Restarts. Note that the transmit data at the remote DTE is ignored. When the switch is thrown or the DTE removes the RDL request, the local unit will transmit an RDL_OFF request to the remote unit. The local unit will keep its TM LED active until this request has been completely sent out. If the switch is thrown again before the completion of the termination phase, the switch will be ignored until it is placed back into the normal position.

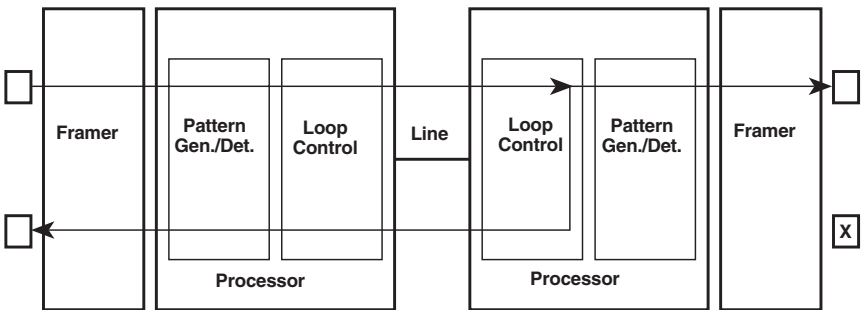


Figure 5-7. Remote loop.

Remote Digital Loop with 511/511E

The Remote Digital Loop with 511/511E is shown in Figure 5-8. After RDL is established, the remote unit's restart timer is set to one minute. This has been done because when the 511/511E generator is started on the local unit, the remote framer begins seeing unframed packets. The remote unit cannot distinguish the 511/511E pattern from the line being disconnected so the restart timer has been lengthened to allow the pattern generator to function. Once the 511/511E test is started, the local unit changes its restart timer to one minute. The pattern originates within the processor and is sent to the remote unit. It is then looped back to the local unit where it is evaluated for errors. After 45 seconds, the pattern generator will timeout and stops sending the pattern. The ER LED will begin blinking until the user turns off the 511/511E switch.

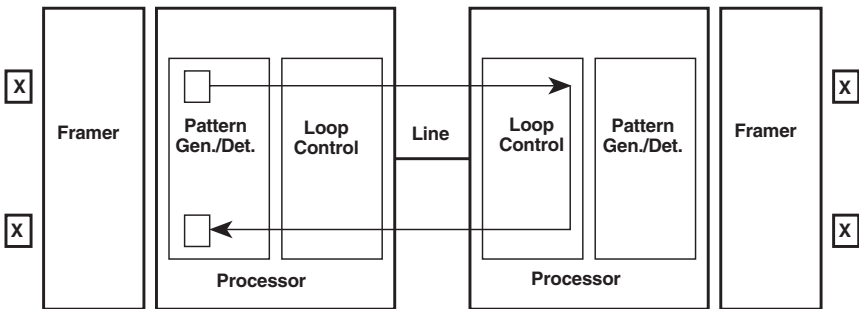


Figure 5-8. Remote loop with 511/511E.

Data Mode with 511/511E Pattern Generators

When the units enter data mode, you can turn on the pattern generators on both ends of the link. Once a 511/511E pattern is selected on one end of the link, the pattern generator will begin transmitting unframed 511/511E through the line to the remote end. A possible problem with this test can occur due to the restart procedure. Once the local 511/511E is turned on, the remote unit begins receiving an unframed 511 pattern. If the remote unit does not turn on the 511/511E-pattern generator within 4 seconds, the remote unit will restart and enter the start-up mode. Note that once the 511/511E-pattern generator is started, the restart timer is changed to one minute (only on the unit which has the pattern enabled). If both units enable the 511/511E pattern within 4 seconds of each other, both units will be transmitting and receiving the 511/511E pattern. Both framers are now receiving unframed data and will restart after one minute. The 511/511E pattern generators will timeout after 45 seconds, re-enabling the normal data path. The ER LED will begin flashing until the user terminates the test.

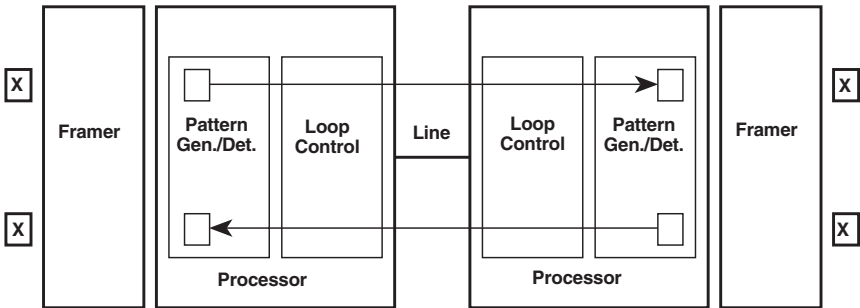


Figure 5-9. Data mode with 511/511E.

5.3.4 USING THE V.52 (BER) TEST-PATTERN GENERATOR

To use the V.52 BER tests in conjunction with the remote digital loopback tests (or with local line loopback tests), follow these instructions:

1. Locate the 511/511E toggle switch on the front panel of the Line Driver and move it UP. This activates the V.52 BER test mode and transmits a 511 test pattern into the loop. If any errors are present, the local modem's red ER LED will blink sporadically.
2. If the above test indicates no errors are present, move the V.52 toggle switch DOWN, activating the 511E test with errors present. If the test is working properly, the local modem's red ER LED will glow. A successful 511E test will confirm that the link is in place, and that the Line Driver's built-in 511 generator and detector are working properly.

NOTE

The above V.52 BER tests can be used independently of the remote digital loopback tests. This requires two operators: (1) to initiate and monitor the tests at the local Line Driver, and (1) to do the same at the remote Line Driver. In this case, the test pattern sent by each Line Driver will not be looped back, but will be transmitted down the line to the other Line Driver. While one operator tests, the other monitors for errors.

Appendix A. Interface Pin Assignments

Table A-1. RS-232, RS-530 interface pin description, DB25 female connector (DCE configuration).

Pin #	Signal
1	FG (Frame Ground)
2	TD (Transmit Data)
3	RD (Receive Data)
4	RTS (Request to Send)
5	CTS (Clear to Send)
6	DSR (Data Set Ready)
7	SGND (Signal Ground)
8	CD (Carrier Detect)
9	RC/ (Receive Timing-B)
10	CD/ (Carrier Detect-B)
11	XTC/ (External Transmit Clock)
12	TC/ (Transmit Clock-B)
13	CTS/ (Clear to Send)
14	TD/ (Transmit Data-B)
15	TC (Transmit Clock-A)
16	RD (Receive Data)
17	RC (Receive Timing)
18	LLB (Local Line Loop)
19	RTS/ (Request to Send)
20	DTR (Data Terminal Ready)
21	RDL (Remote Digital Loop)
22	DSR/ (Data Set Ready)
23	DTR/ (Data Terminal Ready)
24	XTC (External Transmit Clock)
25	TM (Test Mode)

**Table A-2. V.35 interface, M/34 female connector
(DCE configuration).**

Pin #	Signal
B -----	SGND (Signal Ground)
C -----	RTS (Request to Send)
D -----	CTS (Clear to Send)
E -----	DSR (Data Set Ready)
F -----	CD (Carrier Detect)
H -----	DTR (Data Terminal Ready)
L -----	LLB (Local Line Loop)
N -----	RDL (Remote Digital Loop)
P -----	TD (Transmit Data)
R -----	RD (Receive Data)
S -----	TD/ (Transmit Data-B)
T -----	RD/ (Receive Data-B)
U -----	XTC (External Transmit Clock)
V -----	RC (Receive Timing)
W-----	XTC/ (External Transmit Clock)
X -----	RC/ (Receive Timing)
Y -----	TC (Transmit Timing-A)
AA -----	TC/ (Transmit Timing-B)

**Table A-3. X.21 interface, DB15 female connector
(DTE/DCE configuration).**

Pin #	Signal
1	Frame Ground
2	T (Transmit Data-A) (DTE Source)
3	C (Control-A) (DTE Source)
4	R (Receive Data-A) (DCE Source)
5	I (Indication-A) (DCE Source)
6	S (Signal Element Timing-A) (DCE Source)
7	BT (Byte Timing-A) (DCE Source)
8	SGND (Signal Ground)
9	T/ (Transmit Data-B) (DTE Source)
10	C/ (Control-B) (DTE Source)
11	R/ (Receive Data-B) (DCE Source)
12	I/ (Indication-B) (DCE Source)
13	S/ (Signal Element Timing-B) (DCE Source)
14	BT/ (Byte Timing-B) (DCE Source)

Appendix B. Transmission Distance Chart

The chart below lists transmission distances (with or without crosstalk) for the QuikConnect HDSL Line Driver.

No Crosstalk							
Line Rate (kbps)	DTE Rates (kbps)	26 AWG (0.4 mm)			24 AWG (0.5 mm)		
		feet	miles	km	feet	miles	km
144	64, 128	20,700	3.9	6.3	24,500	4.6	7.5
272	192, 256	17,400	3.3	5.3	24,200	4.6	7.4
400	320, 384	15,100	2.9	4.6	22,600	4.3	6.9
528	448, 512	14,900	2.8	4.5	21,000	4	6.4
784	576, 640, 704, 768	13,500	2.6	4.1	18,000	3.4	5.5
1040	832, 896, 960, 1024	11,900	2.2	3.6	15,500	2.9	4.7
1168	1088, 1152	11,000	2.1	3.3	15,200	2.9	4.6
Crosstalk (49 adjacent CAP pairs)							
Line Rate (kbps)	DTE Rates (kbps)	26 AWG (0.4 mm)			24 AWG (0.5 mm)		
		feet	miles	km	feet	miles	km
144	64, 128	18,600	3.5	5.7	22,100	4.2	6.7
272	192, 256	15,700	3	4.8	21,800	4.1	6.6
400	320, 384	12,800	2.4	3.9	19,200	3.6	5.9
528	448, 512	13,000	2.5	4	18,300	3.5	5.6
784	576, 640, 704, 768	12,200	2.3	3.7	16,200	3.1	4.9
1040	832, 896, 960, 1024	10,500	2	3.2	13,600	2.6	4.1
1168	1088–1152	9400	1.8	2.9	12,900	2.4	3.9

Appendix C. Control Port Pinout

The QuikConnect HDSL Line Driver's control port is an 8-position connector that complies with EIA/TIA-561.

Pin Function	RJ-45 Pin No.
Ground	4
Receive data (to DTE)	5
Transmit data (from DTE)	6



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