BLACK BOX®
NETWORK SERVICES

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Async/Sync Fiber Optic Modem
Async/Sync FO Modem Card

FEDERAL COMMUNICATIONS COMMISSION
AND
INDUSTRY CANADA
RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

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

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

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

NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

18. Servicio por personal calificado deberá ser provisto cuando:

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

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

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

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

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

FCC REQUIREMENTS FOR
TELEPHONE-LINE EQUIPMENT

1. The Federal Communications Commission (FCC) has established rules which permit this device to be directly connected to the telephone network with standardized jacks. This equipment should not be used on party lines or coin lines.

2. If this device is malfunctioning, it may also be causing harm to the telephone network; this device should be disconnected until the source of the problem can be determined and until the repair has been made. If this is not done, the telephone company may temporarily disconnect service.

3. If you have problems with your telephone equipment after installing this device, disconnect this device from the line to see if it is causing the problem. If it is, contact your supplier or an authorized agent.

4. The telephone company may make changes in its technical operations and procedures. If any such changes affect the compatibility or use of this device, the telephone company is required to give adequate notice of the changes.

5. If the telephone company requests information on what equipment is connected to their lines, inform them of:

   a. The telephone number that this unit is connected to.

   b. The ringer equivalence number.

   c. The USOC jack required: RJ-11C.

   d. The FCC registration number.

   Items (b) and (d) can be found on the unit's FCC label. The ringer equivalence number (REN) is used to determine how many devices can be connected to your telephone line. In most areas, the sum of the RENs of all devices on any one line should not exceed five (5.0). If too many devices are attached, they may not ring properly.

6. In the event of an equipment malfunction, all repairs should be performed by your supplier or an authorized agent. It is the responsibility of users requiring service to report the need for service to the supplier or to an authorized agent.

CERTIFICATION NOTICE FOR
EQUIPMENT USED IN CANADA

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications-network protective, operation, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single-line individual service may be extended by means of a certified connector assembly (extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility—in this case, your supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION:

Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The LOAD NUMBER (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices, subject only to the requirement that the total of the load numbers of all the devices does not exceed 100.

TRADEMARKS

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Contents

1. Specifications

Transmission Line — Dual optical cable

Transmission Mode — Async or sync, half- or full-duplex

Interface — EIA RS-232, CCITT V.24

Data Rates — Up to 38.4 kbps

Distance — 2 miles (3.2 km) over continuous fiber

RTS/CTS Delay — No delay, 7 ms, 53 ms

Receiver Sensitivity — 45 dBm

Coupled Power Output — -30 to -36 dBm

Optic Wavelength — 850 nm

Indicators — (2) LEDs: Carrier Detect, Fiber Optic Output

Connectors — Standalone: DB25 male or female on RS-232 side, ST or SMA on fiber side; Card: HD DB26 female on RS-232 side, ST or SMA on fiber side

Power — No external power required; uses power from RS-232 data and control signals

Temperature — 32 to 140°F (0 to 60°C)

Maximum Altitude Tolerance — Up to 15,000 feet (4572 m)

Humidity Tolerance — Up to 95%, noncondensing

Size — 23.4"H x 2.1"W x 0.7"D (59.4 x 5.3 x 1.8 cm)

Weight — 0.1 lb. (0.05 kg)

2. Introduction

2.1 Description

The Async/Sync Fiber Optic Modem is a miniature modem that combines the noise immunity of fiber with the troubleshooting capabilities of V.52 and V.54 diagnostics. The modem operates in asynchronous or synchronous mode and supports data rates to 38.4 kbps. The standalone version plugs directly into a workstation's RS-232 port via a DB25 connector. The modem is also available in a card version. The card has a HD DB26 connector, so you'll need an HD-DB26-to-DB25 cable to connect it to the RS-232 port on a workstation.

Like all fiberoptic modems, the Async/Sync Fiber Optic Modem is inherently immune to RFI/EMI noise, ground loops, and transient surges. The carrier may be switch-selected as either Continuously On or Controlled by RTS. Two easy-to-read LEDs monitor the Error and Test modes. Drawing all necessary power from the RS-232 interface, the modem requires no AC power or batteries to operate.

This miniature modem fits into tight installation spaces. On the RS-232 side, the standalone modem comes equipped with either a male or female DB25 connector, while the card version has a female HD DB26 connector. On the fiber side, the modem comes with either SMA or ST® connectors.

2.2 Features

- Supports async or sync communication over dual optical fibers.

- V.52 and V.54 diagnostics.

- Data rates to 38.4 kbps.

- Range of up to 2 miles (3.2 km).

- Immune to RFI/EMI noise, ground loops, and transient surges.

- Easily accessible diagnostic and configuration switches.

- Jumper-selectable carrier control.

- Requires no AC power or batteries.

- Two easy-to-read status indicators.

3. Configuration

The Async/Sync Fiber Optic Modem is fairly simple to install and easy to operate: just set it and forget it. The instructions in this chapter will help you set up the modem properly. If you have questions, call Black Box Technical Support at 724-746-5500.

3.1 Configuration Switches

The Async/Sync Fiber Optic Modem uses a unique set of two 8-position external mini DIP switches that allow configuration to an extremely wide range of applications. These 16 DIP switches are externally accessible from the underside of the modem (see Figure 3-1), so there is no need to open the modem case for configuration.

The configuration switches select data rates, clocking methods, V.52 and V.54 tests, word lengths, extended signaling rates, and async or sync mode. The following pages describe all switch locations, positions, and functions.
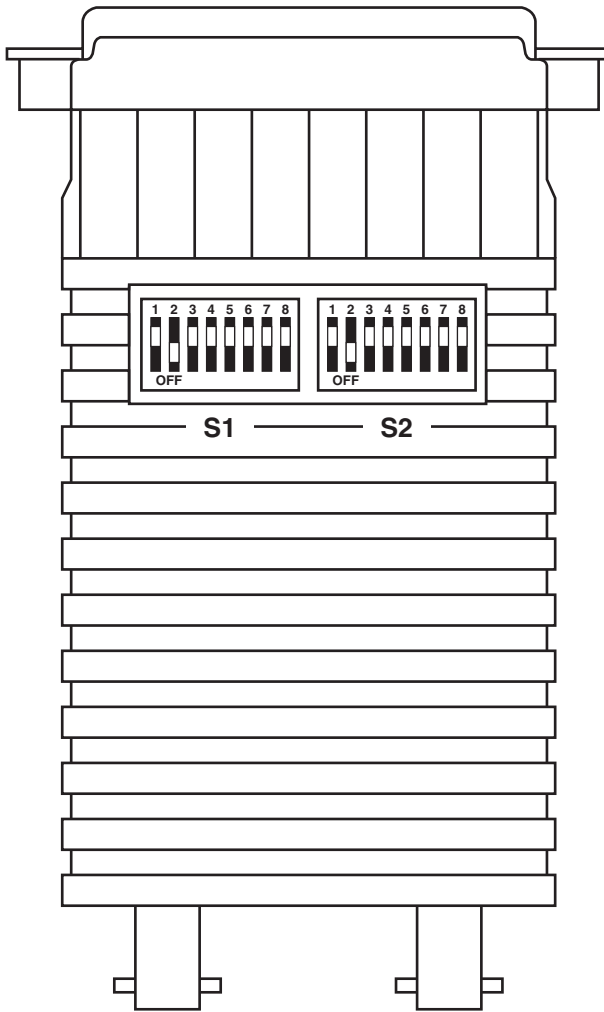
Figure 3-1. DIP Switches on the Async/Sync Fiber Optic Modem.

The Async/Sync Fiber Optic Modem has two 8-position DIP switches (S1 and S2) for configuration. As Figure 3-2 shows, the orientation of all DIP switches is the same with respect to "ON" and "OFF" positions.
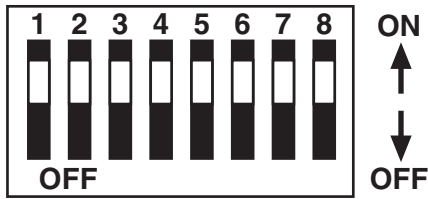
Figure 3-2. Close-up of DIP Switches Showing "ON" and "OFF" Positions.

3.2 Configuration Switch Set S1

The DIP switches on S1 set data rate, clock source, async/sync mode, and carrier-control method. The default settings are summarized below.

Table 3-1. S1 Summary Table.

Position	Function	Factory Default	
S1-1	Data Rate	On	(9600 bps)
S1-2	Data Rate	Off	(9600 bps)
S1-3	Data Rate	Off	(9600 bps)
S1-4	Data Rate	On	(9600 bps)
S1-5	Clock Source	On	(Internal)
S1-6	Clock Source	On	(Internal)
S1-7	Async/Sync	On	(Async)
S1-8	Carrier Control	Off	(Constantly On)

3.2.1 S1-1 THROUGH S1-4: DATA RATE

Switches S1-1 through S1-4 are set in combination to determine the data rate for the Async/Sync Fiber Optic Modem.

Table 3-2. Data Rate Settings.

S1-1	S1-2	S1-3	S1-4	Setting
On	On	On	On	1.2 kbps
Off	On	On	On	1.8 kbps
On	Off	On	On	2.4 kbps
Off	Off	On	On	3.6 kbps
On	On	Off	On	4.8 kbps
Off	On	Off	On	7.2 kbps
On	Off	Off	On	9.6 kbps*
Off	Off	Off	On	14.4 kbps
On	On	On	Off	19.2 kbps
Off	On	On	Off	28.8 kbps
On	On	Off	Off	38.4 kbps

*Default

3.2.2 S1-5 AND S1-6: CLOCK SOURCE

Switches S1-5 and S1-6 are set in combination to determine the transmit clock source for the Async/Sync Fiber Optic Modem.

Table 3-3. Clock-Source Settings.

S1-5	S1-6	Setting
On	On	Internal transmit clock*
Off	On	Receive recover clock
On	Off	External transmit clock

*Default

3.2.3 S1-7: ASYNCHRONOUS/SYNCHRONOUS MODE

The setting for switch S1-7 determines whether the Async/Sync Fiber Optic Modem is in asynchronous or synchronous operating mode.

Table 3-4. Async/Sync Settings.

S1-7	Setting
On	Asynchronous*
Off	Synchronous

*Default

3.2.4 S1-8: CARRIER-CONTROL METHOD

The setting for switch S1-8 determines whether the carrier is Constantly On or Controlled by RTS. This setting allows for operation in switched-carrier, multipoint and hardware-handshaking applications.

Table 3-5. Carrier-Control Settings.

S1-8	Setting
Off	Constantly On*
On	Switched Carrier

*Default

3.3 Configuration Switch Set S2

The DIP switches on S2 set word length, extended signaling rate, RTS/CTS delay, and V.52 and V.54 diagnostic tests.

Table 3-6. S2 Summary Table.

Position	Function	Factory Default
S2-1	Word Length	Off (10 bits)
S2-2	Word Length	Off (10 bits)
S2-3	Extended Signaling Rate	Off (-2.5% to +2.3%)
S2-4	RTS/CTS Delay	On (7 ms)
S2-5	RTS/CTS Delay	On (7 ms)
S2-6	Future Use	—
S2-7	Future Use	—
S2-8	V.52/V.54 Tests	Off (Enable)

3.3.1 S2-1 AND S2-2: WORD LENGTH

Switches S2-1 and S2-2 are set in combination to determine the word length for asynchronous data.

Table 3-7. Word-Length Switch Settings.

S2-1	S2-2	Setting
Off	On	8 bits
On	On	9 bits
Off	Off	10 bits*
On	Off	11 bits

*Default

3.3.2 S2-3: EXTENDED SIGNALING RATE

The setting for switch S2-3 determines the range of variability the Async/Sync Fiber Optic Modem looks for in asynchronous data rates (that is, the actual variance from a given frequency level the modem will tolerate).

Table 3-8. Extended Signaling-Rate Settings.

S2-3	Setting	
On	-2.5% to +1%	Basic
Off	-2.5% to +2.3%	Extended*

*Default

3.3.3 S2-4 AND S2-5: RTS/CTS DELAY

The combined settings for switches S2-4 and S2-5 determine the amount of delay between the time the modem sees RTS and when it sends CTS. Options are no delay, 7 ms, and 53 ms.

Table 3-9. RTS/CTS-Delay Settings.

S2-4	S2-5	Setting
On	On	7 ms*
Off	On	53 ms
On	Off	No delay
Off	Off	No delay

*Default

3.3.4 S2-6 AND S2-7: NOT USED

S2-6 and S2-7 are reserved for future use.

3.3.5 S2-8: V.54 LOOPBACK TEST ENABLE

To reset the V.54 circuit, set switch S2-8 to the "On" position, then back to the "Off" position.

Table 3-10. V.54 Settings.

S2-8	Setting
Off	V.54 Enable*
On	V.54 Disable

*Default

4. Installation

The Async/Sync Fiber Optic Modem is easy to install. After configuring the DIP switches, simply connect the two fiber cables and then connect the RS-232 interface. Figure 4-1 shows the location of the fiber connections on the rear panel.
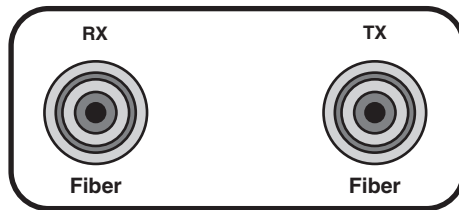

Figure 4-1. Rear Panel.

4.1 Fiber Connections

The Async/Sync Fiber Optic Modems are designed to work in pairs. You will need one at each end of a dual-fiber cable. This cable connects to each modem using either an ST or an SMA connector. Figure 4-2 shows a close-up of each of these connector types.
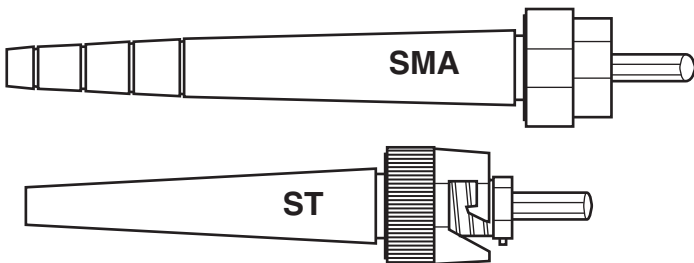

Figure 4-2. SMA and ST Connectors.

4.2 RS-232 Connection

The Async/Sync Fiber Optic Modem is designed to act as a DCE device. Always use a straight-through RS-232 cable when connecting to a DTE device.

5. Operation

Once you have configured each Async/Sync Fiber Optic Modem properly and connected the fiber and RS-232 cables, you are ready to operate the Modems.
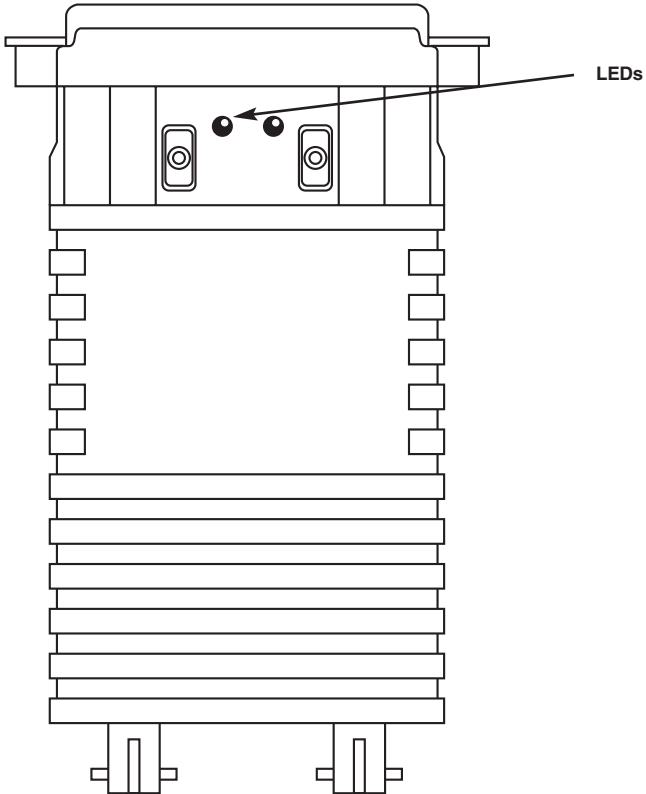

Figure 5-1. LEDs.

5.1 Test Modes

The Async/Sync Fiber Optic Modem offers two V.54 test modes to evaluate the condition of the modems and the communication link. These tests can be activated from the front panel or via the interface.

NOTE

V.54 test modes on the Async/Sync Fiber Optic Modem are available for point-to-point applications only.

5.1.1 LOCAL ANALOG LOOPBACK (LAL)

The Local Analog Loopback (LAL) test checks the operation of the local modem, and is performed separately on each unit. Any data sent to the local modem in this test mode will be returned to the user device. For example, characters typed on the keyboard of a terminal will appear on the terminal screen. To perform an LAL test:

1. Activate LAL. This may be done in one of two ways: By moving the front-panel toggle switch down to LAL, or by raising pin 18 on the interface.

NOTE
Make sure DIP-switch S1-8 is OFF.

Once LAL is activated, the modem transmit output is connected to its own receiver. The Test LED should be lit.

2. Verify that the data-terminal equipment is operating properly and can be used for a test. If a fault is indicated, call Black Box Technical Support at 724-746 5500.

3. Perform a BER (bit error rate) test on each modem. If the BER test equipment indicates no faults, but the data terminal indicates a fault, follow the manufacturer's checkout procedures for the data terminal. Also, check the interface cable between the terminal and the modem.

5.1.2 REMOTE DIGITAL LOOPBACK (RDL)

The Remote Digital Loopback (RDL) test checks the performance of both the local and remote modems, and the communication link between them. Any characters sent to the remote modem in this test mode will be returned to the originating device. For example, characters typed on the keyboard of the local terminal will appear on the local terminal screen after having been passed to the remote modem and looped back. To perform an RDL test:

1. Activate RDL. This may be done in two ways: By moving the front-panel toggle switch up to RDL, or by raising pin 21 on the interface.

NOTE
Make sure DIP-switch S1-8 is OFF.

2. Perform a BER (bit error rate) test on the system.

3. If the BER test equipment indicates a fault, and the Local Analog Loopback test was successful for both modems, you may have a problem with the twisted-pair line between the modems. Check the fiber line for proper connections and continuity.

5.1.3 USING THE V.52 BER TEST INDEPENDENTLY

The V.52 BER test can be used independently of the V.54 loopback tests. This requires two operators: one to initiate and monitor the test at the local modem, and one at the remote modem. To use the V.52 BER test by itself, both operators should simultaneously follow these steps.

1. Locate the 511/511E toggle switch on the modem's front panel and move it DOWN. This activates the V.52 BER test mode and transmits a 511 test pattern to the other modem. If any errors are present, the receiving modem's red Error LED will light.

NOTE

For this test to function, the 511 switch on both modems must be on (DOWN).

2. If the test indicates no errors are present, move the V.52 toggle switch UP, activating the 511E test with errors present. If the test is working properly, the receiving modem's red Error LED will light. A successful 511E test will confirm that the link is in place, and that the modem's built-in 511 generator and detector are working properly.

5.2 Power-On

Once the Async/Sync Fiber Optic Modem is properly installed, it should operate transparently (as if it were a standard cable connection). Since operating power is derived from the RS-232 data and control signals, there is no ON/OFF switch. All data signals from the RS-232 interface are passed straight through.

Appendix: Pin Configuration

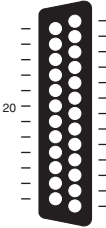**Table A-1. Pin Configuration for the DB25 Connector.**

DIRECTION	STANDARD RS-232C/V.24 "DCE" SETTING	DIRECTION
TO MODEM	DATA TERM. READY (DTR) 20 — 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 (SG) SIGNAL GROUND — 8 (DCD) DATA CARRIER DETECT	TO MODEM FROM MODEM TO MODEM FROM MODEM FROM MODEM FROM MODEM

Table A-2. Pin Configuration for the HD DB26 Connector.

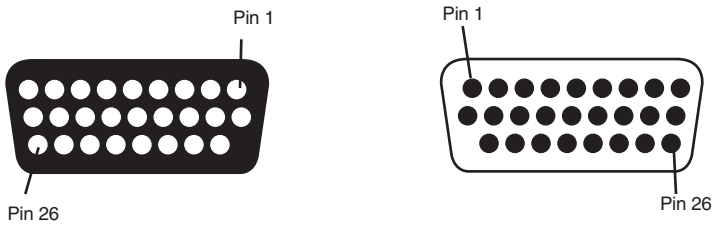| Pin: Signal	Pin: Signal
1: Frame Ground	8: CD
2: TD	15: TC
3: RD	17: RC
4: RTS	18: LAL
5: CTS	20: DTR
6: DSR	21: RDL
7: SG (Signal Ground)	24: XTC

Figure A-1. Female and Male DB26 Connectors.