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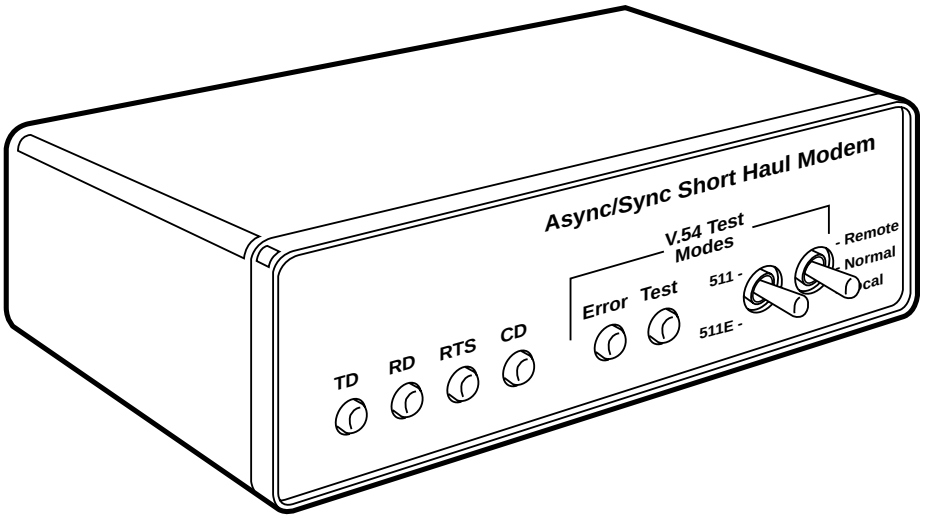
DECEMBER 1995
ME475A
ME475AE

Async/Sync Short Haul Modem



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RADIO FREQUENCY INTERFERENCE STATEMENTS

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

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

TRADEMARKS

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Contents

Chapter Page

1. Specifications

Transmission Format— Synchronous or asynchronous, 2-wire half-duplex or 4-wire full- or half-duplex

Interface—RS-232 (CCITT V.24) connection via DB25 female; twisted-pair connection via RJ-45 or terminal block

Transmission Line—2- or 4-wire UTP, 19-24 AWG

Data Rates—Synchronous or asynchronous at 1.2, 1.8, 2.4, 3.6, 4.8, 7.2, 9.6, 14.4, 19.2, 28.8, 38.4, and 57.6 Kbps (switch-selectable)

Clocking—Internal, external or receive recover

Controls—Carrier constantly ON or controlled by RTS, RTS/CTS delay set to no delay, 7 or 53 ms

Applications—Point-to-point or multipoint

Indicators—Bicolor LEDs for TD, RD, RTS, DCD; single-color LEDs for Test and Error

RTS Antistream Timer—12.5 sec., 50 sec., or disabled (switch-selectable); Tolerance: +50%, -0%

Diagnostics—V.52-compliant bit-error-rate pattern (511/511E pattern) generator and detector with error-injection mode; V.54-compliant Local Analog Loopback and Remote Digital Loopback, activated by front-panel switch or via RS-232 interface

Transformer Isolation—1500 V RMS

Surge Protection—Silicon Avalanche Diodes, 600 watts RMS power dissipation @ 1 ms, with response time of less than 1 ps

Temperature—32° to 122°F (0° to 50°C)

Humidity—0-95%, noncondensing

Power—Wallmount power supply: ME475A: 120 VAC; ME475AE: 230 VAC

Size—4.2"H x 6.2"W x 1.5"D (10.6 x 15.7 x 3.8 cm)

Weight—3 lb. (1.4 kg)

2. Introduction

2.1 Description

The Async/Sync Short Haul Modem operates 2-wire (half-duplex) or 4-wire (full- or half-duplex), in synchronous or asynchronous modes, over unconditioned telephone lines. The Modem has an extended range of 20 miles (32 km). It operates at 12 switch-selectable data rates to 57.6 Kbps. The modem always operates in sychronous mode between the local and remote modems; when connected to an asynchronous RS-232 device, the modem converts the asynchronous data to synchronous data.

The modem has several features to enhance overall performance: automatic equalization, automatic gain control, antistreaming timer, transformer isolation to guard against data loss because of ground-potential differences, and Silicon Avalanche Diode surge protection to guard against data-line transients.

The modem features V.52-compliant bit-error-rate pattern tests and two V.54 test modes: local analog loopback and remote digital loopback. The operator at the local end may test both local and remote modems, plus the line, in the digital loopback mode. Both RDL and LAL modes can be controlled by a manual switch or via the V.24/ RS-232 interface.

2.2 Features

- Synchronous or asynchronous operation
- Two-wire/half-duplex or four-wire/full-duplex
- V.52 and V.54 test modes
- Automatic equalization and gain control
- Anti-streaming timer
- Data rates to 57.6 Kbps
- Distances up to 20 miles (32 km)
- Point-to-point or multipoint
- Internal, external, or received loopback clocking
- Hardware and software flow-control support
- Built-in transformer isolation and high speed surge protection
- External AC power
- Bicolor LED indicators
- Lights Error LED to show broken or inferior cable

3. Configuration

The Async/Sync Short Haul Modem is fairly simple to install and is ruggedly designed for excellent reliability: Just set it and forget it. The following instructions will help you set up and install the modem properly. If you have any questions, call for technical support.

3.1 Configuration Switches

The Async/Sync Short Haul Modem uses a unique set of 24 external mini DIP switches that allow configuration to an extremely wide range of applications. These 24 DIP switches are grouped into three eight-switch sets, and are externally accessible from the underside of the modem (see **Figure 3-1**). Since all configuration DIP switches are externally accessible, there is no need to open the modem's case for configuration.

The configuration switches allow you to select data rates, clocking methods, V.52 and V.54 tests, word lengths, extended signaling rates, async or sync mode, 2- or 4-wire operation, antistream control, and input impedance. The following pages describe all switch locations, positions, and functions.

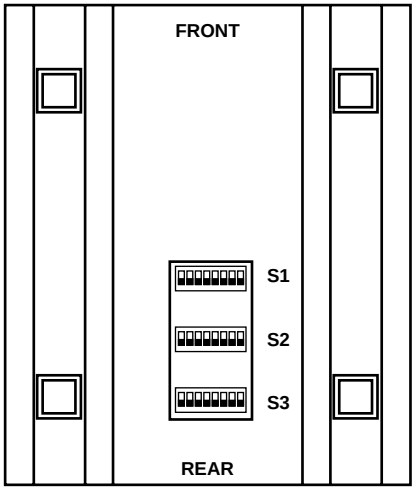

Figure 3-1. Underside of Modem, Showing Location of DIP Switches.

The Async/Sync Short Haul Modem has three sets of eight switches, yielding 24 total DIP switches. The three sets will be referred to as 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.

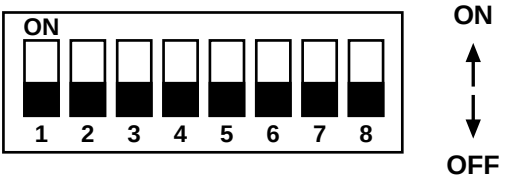

Figure 3-2. Closeup of DIP Switches Switches Showing "ON" and "OFF" Positions.

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 in **Table 3-1**.

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 SETTING

Switches S1-1 through S1-4 are set in combination to determine the asynchronous and synchronous data rate for the Async/Sync Short Haul Modem.

Table 3-2. Data Rate Setting DIP Switches.

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
Off	On	Off	Off	57.6 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 Short Haul Modem.

Table 3-3. Clock Source.

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 modem is in asynchronous or synchronous operating mode.

Table 3-4. Operating Mode.

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.

S1-8	Setting
Off	Constantly on*
On	Controlled by RTS

*Default

3.3 Configuration Switch Set "S2"

The DIP switches on S2 set word length, extended signaling rate, RTS/CTS delay, V.52 and V.54 diagnostic test, and 2- and 4-wire operation.

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 1%
S2-4	RTS/CTS Delay	On	7 ms
S2-5	RTS/CTS Delay	On	7 ms
S2-6	V.52/V.54 Tests	Off	Normal Operation
S2-7	2-Wire/4-Wire	Off	4-Wire
S2-8	Not Used	N/A	

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.

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 modem looks for in asynchronous data rates (i.e., the actual variance from a given frequency level the modem will tolerate).

Table 3-8. Extended Signaling Rate.

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

*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.

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: V.54 LOOPBACK TEST ENABLE

To reset the V.54 circuit, set switch S2-6 to the ON position, then back to the OFF position.

Table 3-10. V.54 Loopback Test Enable.

S2-6	Setting
Off	V.54 Normal Operation*
On	V.54 Testing Disabled

*Default

3.3.5 S2-7: 2-Wire/4-Wire Mode Selection

The setting for switch S2-7 determines whether the modem is operating in 2-wire or 4-wire mode.

Table 3-11. 2-Wire/4-Wire Mode.

S2-7	Setting
Off	4-wire (full- or half-duplex)*
On	2-wire (half-duplex only)

*Default

3.4 Configuration Switch Set "S3"

The DIP switches on S3 set the antistream control, local loopback enable, remote loopback enable, and receive (input) impedance levels for the modem.

Table 3-12. S3 Summary Table.

Position	Function	Factory Default	
S3-1	Input Impedance	On	200 Ohms
S3-2	Input Impedance	Off	200 Ohms
S3-3	Not yet assigned	N/A	
S3-4	Mode Selection	On	Point-to-Point
S3-5	Local Loopback	Off	Disabled
S3-6	Remote Loopback	Off	Disabled
S3-7	Antistream Control	Off	Disabled
S3-8	Antistream Control	Off	Disabled

3.4.1 S3-1: INPUT IMPEDANCE

The setting for switches S3-1 and S3-2 determines the modem's input impedance. This allows you to choose the optimum impedance setting for your application. In long-distance applications, the impedance of the cable must match the impedance of the load (or resistor) of the modem.

Thicker-gauge cables require a lower ohm setting, while thinner-gauge cables require a higher ohm setting. Higher speeds require a lower ohm setting, and slower speeds require a higher ohm setting. See **Table 3-14** for more details on selecting a setting.

Table 3-13. Input Impedance.

S3-1	S3-2	Setting
On	On	130 Ohms
On	Off	200 Ohms*
Off	On	320 Ohms
Off	Off	High impedance (minimum 2 kΩ)

*Default

Table 3-14. S3-1, S3-2 Selection.

Gauge of Cable	Data Rates, Kbps 1.2	1.8	2.4	3.6	4.8	7.2	9.6	14.4	19.2	28.8	38.4	57.6
19	320	320	200	200	200	200	200	130	130	130	130	130
22	320	320	320	200	200	200	200	200	130	130	130	130
24	320	320	320	320	200	200	200	200	200	130	130	130
26	320	320	320	320	320	200	200	200	200	200	130	130

3.4.2 S3-4: Mode Selection

The setting for switch S3-4 allows the user to choose the appropriate setting for point-to-point or multipoint applications.

Table 3-15. Mode Selection.

S3-4	Setting
On	Point-to-point*
On	Multipoint application as “Master”
Off	Multipoint application as “Slave”

*Default

3.4.3 S3-5: RS-232 Initiation of Local Loopback Test

The setting for switch S3-5 determines whether or not the modem's local analog loopback test can be initiated by raising pin 18 on the RS-232 interface.

Table 3-16. Initiating Local Loopback Test.

S3-5	Setting
On	RS-232 initiation enabled
Off	RS-232 initiation disabled*

*Default

3.4.4 S3-6: RS-232 Initiation of Remote Loopback Test

The setting for switch S3-6 determines whether or not the modem's remote digital loopback test can be initiated by raising pin 21 on the RS-232 interface.

Table 3-17. Initiating Remote Loopback Test.

S3-6	Setting
On	RS-232 initiation enabled
Off	RS-232 initiation disabled*

*Default

3.4.5 S3-7 AND S3-8: ANTISTREAM CONTROL

Switches S3-7 and S3-8 are set in combination to determine the timeout period for the modem's antistream control timer.

Table 3-18. Antistream Control.

S3-7	S3-8	Setting
Off	Off	Disabled*
Off	On	12.5 seconds
On	Off	50.0 seconds
On	On	12.5 seconds

*Default

4. Installation

The Async/Sync Short Haul Modem operates in four twisted-pair topologies: 2-wire/point-to-point, 2-wire/multipoint, 4-wire/point-to-point, and 4-wire/multipoint. In each of these topologies, the twisted-pair wire must be 19-26 AWG "dry," unconditioned metallic wire (see **Appendix A**). Dialup analog circuits, such as those used with a standard Hayes® compatible modem, are not acceptable. The twisted pair may be shielded or unshielded. Both types yield favorable results.

The Async/Sync Short Haul Modem offers two methods of twisted-pair connection: RJ-45 jack and terminal blocks. **Figure 4-1** shows the location of these interfaces on the rear panel of the modem. Connect the wire to each Async/Sync Short Haul Modem as described in **Sections 4.1** through **4.3**. The "+" and "-" indicators are for reference only; the modem is not sensitive to polarity.

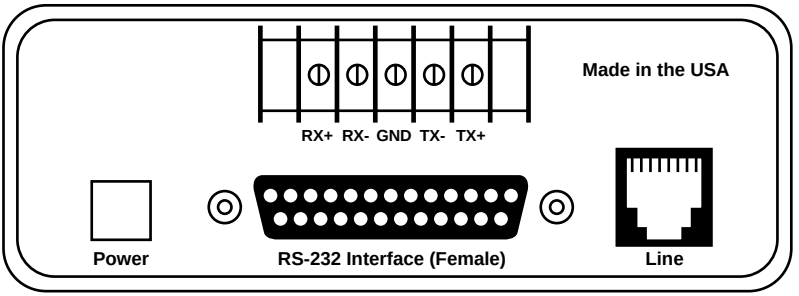

Figure 4-1. Rear View of the Async/Sync Short Haul Modem.

4.1 Two-Wire Point-to-Point Installation

When communicating over a single-twisted-pair circuit, the Async/Sync Short Haul Modem operates half-duplex; that is, it transmits in only one direction at a time. This method of operation is effective for both point-to-point and multipoint applications.

In single-pair point-to-point applications, you will need a pair of modems for each circuit—one at each end of the single-pair wire. In single-pair multipoint applications, you will need three or more modems. These can be connected using a star topology, although a daisychain topology is usually used.

4.1.1 Two-Wire Cable Connection with RJ-45

The RJ-45 jack on the Async/Sync Short Haul Modem is prewired for a standard telco wiring environment. To be sure you have the right wiring, use **Table 4-1** as a guide.

Table 4-1. RJ-45 Jack Wiring.

RJ-45	Signal
1	NC
2	GND[1]
3	RCV
4	XMT
5	XMT
6	RCV
7	GND
8	NC

[1]Connection to ground is optional.

Proper wiring of pairs between the two modems is as follows:

Table 4-2. Wiring Pairs Between the Two Modems.

Signal	Pin#	Color*	Color*	Pin	Signal
XMT	4	Green	Green	4	XMT
XMT	5	Red	Red	5	XMT

*Standard color codes—yours may be different.

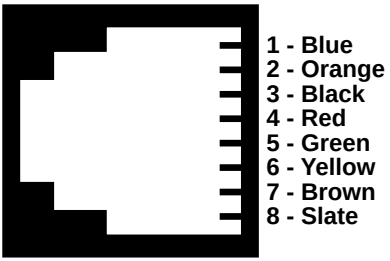

Figure 4-2. AT&T® Standard Modular Color Codes.

4.1.2 Two-Wire Cable Connection with Terminal Blocks

If you are not going to use the modular jacks, follow the instructions below.

1. Locate the terminal block on the back of the unit. It should look like **Figure 4-3**.

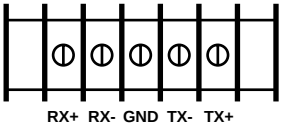

Figure 4-3. Terminal Block.

NOTE

The "+" and "-" indicators are for reference only. The Async/Sync Short Haul Modem is not sensitive to polarity.

2. Connect one wire of the pair to a Transmit lug (TX+ or TX-) on both the local and the remote modem.

3. Connect the other wire of the pair to the other Transmit lug on both the local and the remote modem.

4. If there is a shield around the telephone cable, it may be connected to GND on the terminal block. We recommend connecting the shield at the computer end only to avoid ground loops. A ground wire is not necessary for proper operation of these units.

5. When you finish connecting the telephone line to units at both ends, it should look like the following diagram:

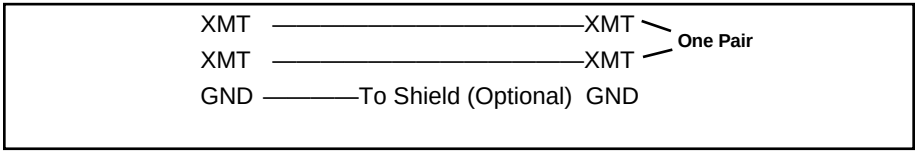

Figure 4-4. Telephone Line Connection.

4.2 Four-Wire Point-to-Point Installation

When communicating over a two-twisted-pair circuit, the Async/Sync Short Haul Modem can operate full- or half-duplex, point-to-point or multipoint. In two pair point-to-point applications, you will need a pair of modems for each circuit—one at each end of the two-pair wire. In two-pair multipoint applications, you will need three or more modems. These can be connected using a star topology, although a daisychain topology is usually used.

4.2.1 Four-Wire Cable Connection via RJ-45

The RJ-45 jack on a Async/Sync Short Haul Modem is prewired for a standard telco wiring environment. To be sure you have the right wiring, use **Table 4-3** as a guide.

Table 4-3. RJ-45 Jack Wiring.

RJ-45	Signal
1	NC
2	GND[1]
3	RCV
4	XMT
5	XMT
6	RCV
7	GND
8	NC

[1]Connection to ground is optional.

Table **4-4** showsproper crossing of pairs between the two modems:

Table 4-4. Crossing of Pairs Between the Two Modems.

Signal	Pin#	Color*	Color	Pin#	Signal
GND[1]	2	Orange	Brown	7	GND
RCV	3	Black	Green	5	XMT
XMT	4	Red	Yellow	6	RCV
XMT	5	Green	Black	3	RCV
RCV	6	Yellow	Red	4	XMT
GND	7	Brown	Orange	2	GND

*Standard color codes—yours may be different.

[1]Connection to ground is optional.

AT&T standard modular color codes are shown in **Figure 4-5**.

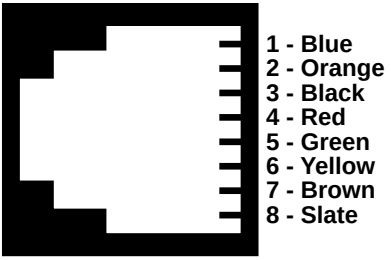

Figure 4-5. AT&T Standard Modular Color Codes.

4.2.2 Four-Wire Cable Connection with Terminal Blocks

If you are not going to use the modular jacks, then follow the instructions below.

1. Locate the terminal block on the back of the unit. It should look like **Figure 4-6**.

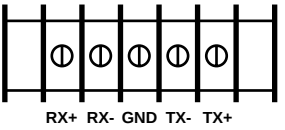

Figure 4-6. Terminal Block.

NOTE

The "+" and "-" indicators are for reference only. The modem is not sensitive to polarity.

2. Connect one pair of wires in the telephone cable to the Transmit lugs (TX+ and TX-) on the terminal block.

3. Connect the other pair of wires in the telephone cable to the Receive lugs (RX+ and RX-) on the terminal block.

4. If there is a shield around the telephone cable, it may be connected to "G" on the terminal block. We recommend connecting the shield at the computer end only to avoid ground loops. A ground wire is not necessary for proper operation of these units.

5. When you finish connecting the telephone line to units at both ends, it should look like **Figure 4-7**:

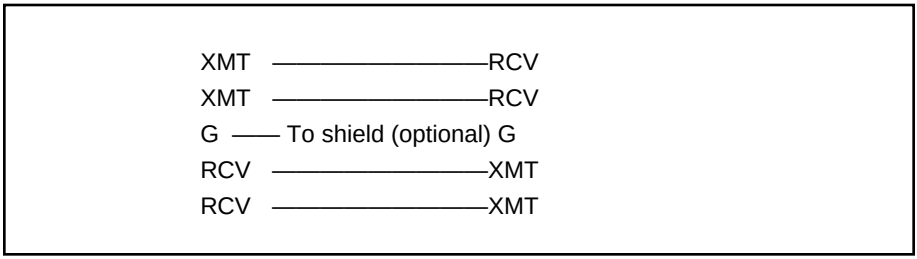

Figure 4-7. Four-Wire Pinout.

4.3 Four-Wire Multipoint Installation

Multipoint operation involves the connection of several terminals to one host port. In such an application, one local Async/Sync Short Haul Modem is used as a master unit, and it is connected to several remote modems that are acting as slaves. Up to 25 modem slaves may be connected to one host modem, provided that the computing hardware and software support that many terminal drops.

In a multipoint environment, the master Async/Sync Short Haul Modem transmits continuously. Initiation of two-way communication is carrier-controlled by each "slave" modem. To facilitate multipoint communication, the master modem should have its carrier control DIP switch set to "constantly ON" (S1-8=OFF). Each slave modem should have its carrier control DIP switch set to "controlled by RTS" (S1-8=ON). **Figure 4-8** illustrates a typical multipoint application using the Async/Sync Short Haul Modem.

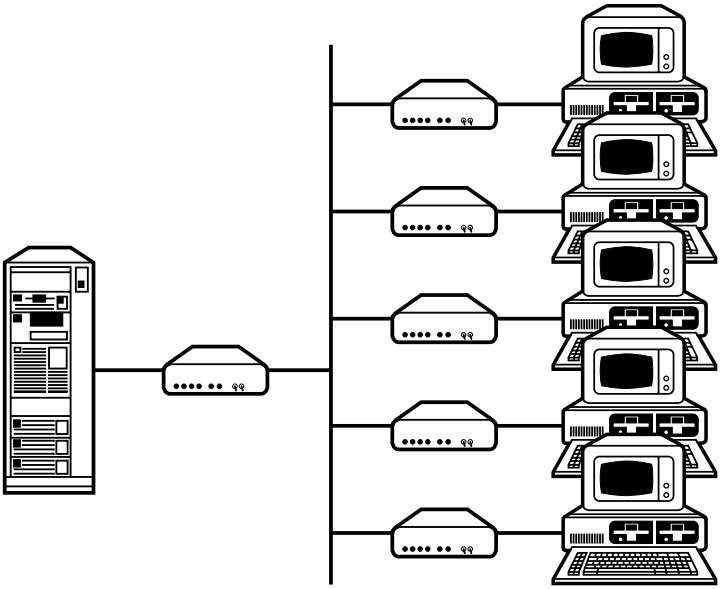

Figure 4-8. Typical Multipoint Setup.

MULTIPOINT TWISTED-PAIR CONNECTION

The Async/Sync Short Haul Modem supports multipoint applications using a star topology. Maximum distance between the units will vary based upon the number of drops, data rate, wire gauge, etc. Call Technical Support for specific distance estimates. **Figures 4-9** and **4-10** show how to wire the one-pair and two-pair cables properly for a model star topology.

NOTE

The ground connection is not needed.

4.4 RS-232 Connection

Connect the synchronous or asynchronous output of your RS-232 device to the DB25 interface on the rear panel of the Async/Sync Short Haul Modem.

NOTE

The Async/Sync Short Haul Modem is wired to connect to a DTE. If your RS-232 output device is DCE, call Technical Support for specific installation instructions.

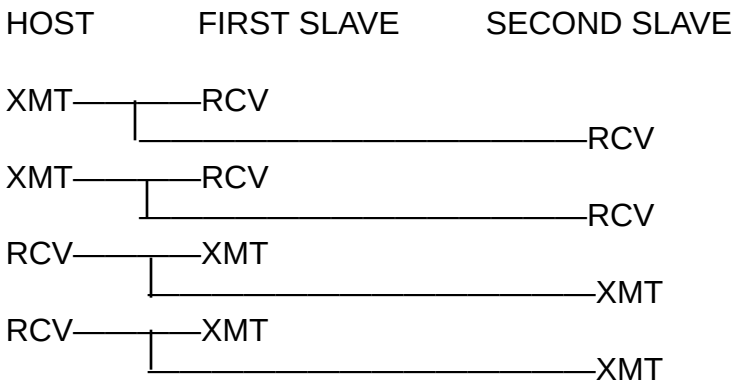

Figure 4-9. Two-pair star wiring for Async/Sync Short Haul Modem host and slaves.

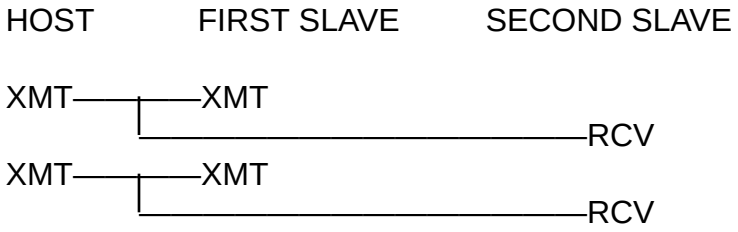

Figure 4-10. Single-pair star wiring for Async/Sync Short Haul Modem host and slaves.

5. Operation

Once you have configured each Async/Sync Short Haul Modem properly and connected the twisted pair and RS-232 cables (see **Chapter 4**), you are ready to operate the units. This chapter describes reading the LED status monitors, powering on, and using the built-in V.52 and V.54 test modes.

5.1 LED Status Monitors

The Async/Sync Short Haul Modem features six front panel status LEDs that indicate the condition of the modem and communication link (see **Figure 5-1**).

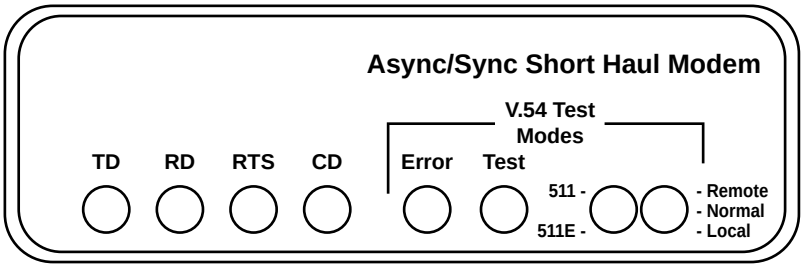

Figure 5-1. Front View of the Async/Sync Short Haul Modem.

5.1.1 The TD and RD Indicators

The TD and RD indicators are bi-color; they will glow red for a low signal or green for a high signal. RTS lights for an incoming signal on RS-232 pin 4. CD lights for an incoming signal on the line side, and the resulting output signal on RS-232 pin 8.

5.1.2 The RTS and CD Indicators

The RTS and CD indicators are bi-color and will glow red for a low signal or green for a high signal. RTS lights for an incoming signal on RS-232 pin 4. CD lights for an incoming signal on the line side, and the resulting output signal on RS-232 pin 8.

5.1.3 The Test Indicator

The green Test LED indicates that V.52 or V.54 tests are running.

5.1.4 The Error Indicators

The Error indicator LED has three functions:

1. When the modem is in test mode (green Test LED is lit), the error LED glows red when bit errors occur.

2. When not in test mode (green Test LED is off), the error LED is used to indicate an RTS streaming condition. (See **Section 5.2** for information on the anitstreaming circuitry.)

3. The Error LED is also used to detect problems with line quality, such as:

A. The improper use of flat (non-twisted-pair) cable to connect the modems.

B. One or more broken wires in the 4-wire twisted-pair cable.

C. The use of low-quality twisted-pair cable to connect the modems.

D. A broken or corroded connector.

NOTE

In detecting line quality, the Error LED indicator is designed for 4-wire twisted pair cable only, and may not function properly with two-wire cable.

Setting Up the Error LED to Test Cable Quality

If there is any question as to the quality of your line, we recommend the following test:

1. Disconnect both local and remote modems from their RS-232 interface. Make sure TD, RD, and RTS LEDs are lit red.

2. Set input impedance of both modems to 200Ω. (S3-1 On, S3-2 Off).

3. Set data rate on both modems to 9.6 Kbps (S1-1 On, S1-2 Off, S1-3 Off, S1-4 On).

4. On the local modem, set Carrier Constantly On (S1-8 Off).

5. Set the remote modem to RTS control (S1-8 On).

6. Put both front-panel toggle switches in the neutral position (Test LED will not light).

7. Connect both modems to the 4-wire twisted pair cable to be tested (See **Section 4.2**).

Reading the Test

If line quality is good, the Error LED on both modems will not light and the CD LED will be red. On the remote modem, the Error LED will not light and the CD LED will light green.

If flat cable is used or parts of the line are not flat cable, the Error LED on the local modem will light red and the CD LED will light green. On the remote modem, the Error LED will not light and the CD LED will light green.

If one wire from the 4-wire twisted pair is broken, the Error LED will light red and the CD LED will light green on at least one modem.

NOTE

We cannot guarantee accurate detection if small pieces of flat cable are present in the line beyond 1500 feet (457 m) of the local modem.

5.2 Antistreaming Error Indicator

When not in test mode (green Test LED is off), the front-panel Error LED is used to indicate a streaming error. When the Async/Sync Short Haul Modem's antistreaming circuitry is enabled, the RTS signal from the DTE is timer-controlled. The timer begins to count when the DTE raises RTS. If the time period that RTS remains high exceeds the preset timeout period, the antistream circuit will force RTS low. The Error LED will light red, indicating a streaming condition (RTS continually on). This feature prevents a malfunctioning terminal from tying up a computer port in a multidrop or polling environment. When the DTE drops RTS, the antistreaming timer is automatically reset, and the front-panel Error LED turns off. The timeout period is DIP-switch-selectable for 12.5 or 80 seconds.

5.3 Power-On

Apply AC power to the Async/Sync Short Haul Modem by plugging the separate AC power adapter first into the rear panel of the modem, and then into an acceptable AC power outlet. There is no power switch on the modem, and the remote/normal/loopback switch should be set to normal. When the local and remote modems are both powered up and passing data normally, the following LED conditions will exist:

- TD and RD=flashing red and green
- RTS and DCD=green
- TEST=off

5.4 V.54 Test Modes

The Async/Sync Short Haul Modem offers two V.54 test modes to evaluate the condition of the modems and the communication link. These tests can be activated physically from the front panel, or via the RS-232 interface.

NOTE

V.54 test modes on the modem are available for point-to-point applications only.

5.4.1 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 echoed back (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, follow these steps:

1. Activate LAL. This may be done in one of two ways: First, by moving the front-panel toggle switch DOWN to Local. Second, by raising pin 18 on the RS-232 interface.

   ### NOTE

   Make sure DIP switch S2-6 is OFF, and DIP switch S3-5 is ON.

   Once LAN is activated, the Async/Sync Short Haul Modem transmit output is connect 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 a technician or replace the unit.

3. Perform a BER (bit error rate) test on each unit. 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 RS-232 interface cable between the terminal and the modem.

5.4.2 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, follow these steps:

1. Activate RDL. This may be done in two ways: First, by moving the front panel toggle switch UP to Remote. Second, by raising pin 21 on the RS-232 interface.

NOTE

Make sure DIP switch S3-6 is ON, and DIP switch S2-6 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. You should then test the twisted-pair line for proper connections and continuity.

5.4.3 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 front panel of the modem and move it UP. This activates the V.52 BER test mode and transmits a "511" test pattern to the other unit. If any errors are present, the receiving modem's red Error LED will blink sporadically.

NOTE

For this test to function, the "511" switch on both modems must be on.

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

5.5 Power-Off

Turn off the Async/Sync Short Haul Modem by simply unplugging the AC power adapter from the wall. There is no power switch on the modem.

Appendix A: Cable Recommendations

We recommend that you use twisted-pair cable with the following characteristics:

Table A-1. Recommended Cable Characteristics.

Wire Gauge	Capacitance	Resistance
19 AWG	83nF/mi or 15.72 pF/ft.	0.0163 Ω/ft.
22 AWG	83nF/mi or 15.72 pF/ft.	0.0326 Ω/ft.
24 AWG	83nF/mi or 15.72 pF/ft.	0.05165 Ω/ft.
26 AWG	83nF/mi or 15.72 pF/ft.	0.08235 Ω/ft.

We fully expect that the Async/Sync Short Haul Modems will operate on lines with specifications different from those listed above, but to reduce the potential difficulties in the field, make sure that the cable you use has similar or better characteristics (lower capacitance or lower resistance).

Table A-2. Async/Sync Short Haul Modem Distance Table (miles).

Data Rate	Wire Gauge 19	22	24	26
57,600	12.0 (19.3)	7.0 (11.3)	5.3 (8.5)	4.0 (6.4)
38,400	13.0 (20.9)	7.5 (12.1)	6.2 (10.0)	4.2 (6.8)
28,800	14.0 (22.5)	8.0 (12.9)	6.6 (10.6)	4.6 (7.4)
19,200	16.0 (25.7)	8.5 (13.7)	7.0 (11.3)	5.1 (8.2)
14,400	17.0 (27.4)	11.0 (17.7)	9.2 (14.8)	6.5 (10.5)
9,600	18.5 (29.8)	13.0 (20.9)	10.4 (16.7)	7.5 (12.1)
7,200	19.0 (30.6)	13.5 (21.7)	10.9 (17.5)	8.0 (12.9)
4,800	19.5 (31.4)	14.0 (22.5)	11.3 (18.2)	8.8 (14.2)
3,600	20.0 (32.2)	14.5 (23.3)	11.5 (18.5)	8.8 (14.2)
2,400	20.5 (33.0)	15.0 (24.1)	11.6 (18.7)	9.0 (14.5)
1,800	20.5 (33.0)	15.0 (24.1)	11.6 (18.7)	9.0 (14.5)
1,200	20.0 (32.2)	15.0 (24.1)	11.4 (18.3)	8.9 (14.5)

Wire with capacitance of 20 pF/ft. or less is suitable for the Async/Sync Short Haul Modem. Wire should be 26 AWG or larger (smaller AWG number).

The modem is designed to withstand normal environmental noise and conditions, however, other environmental factors too numerous to discuss may affect proper operation of the modem.

Appendix B: Block Diagram

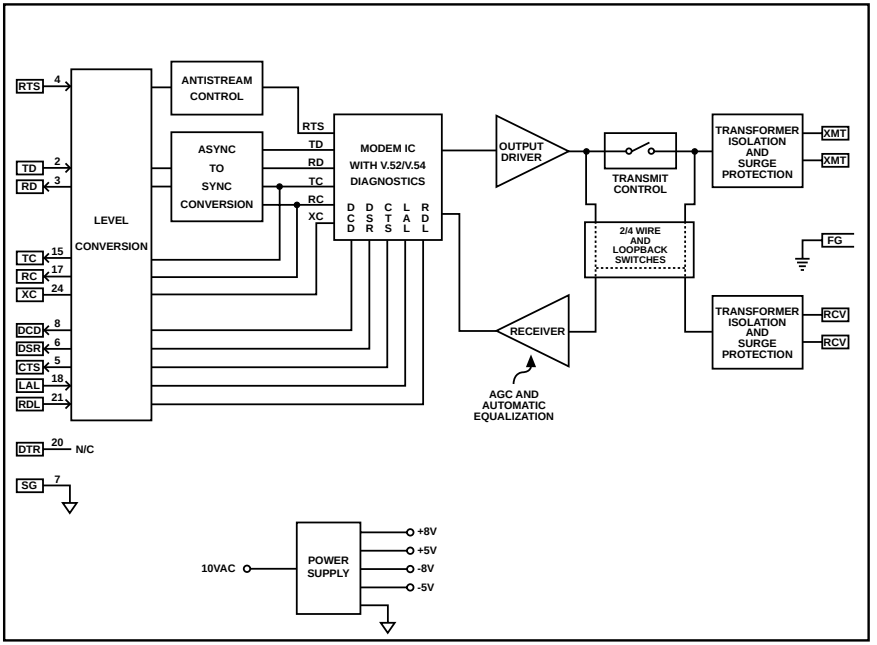

Figure B-1. Block Diagram.

NOTES

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