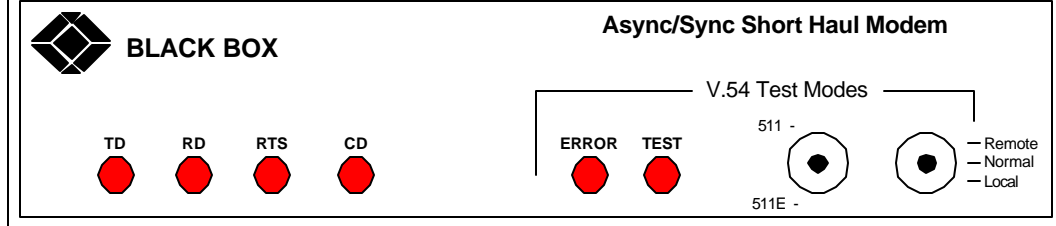


# ME475A



## 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 to 26 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, 57.6, (Switch-selectable)

**Clocking:** Internal, External, or Receive Recover.

**Controls:** Carrier Constantly ON or Controlled by RTS; RTS/CTS delay set to no delay, 7 ms, or 53 ms.

**Applications:** Point-to-Point or Multipoint.

**Indicators:** Bicolor LED's for TD, RD, RTS, and CD; Single LED's for Test, and Error.

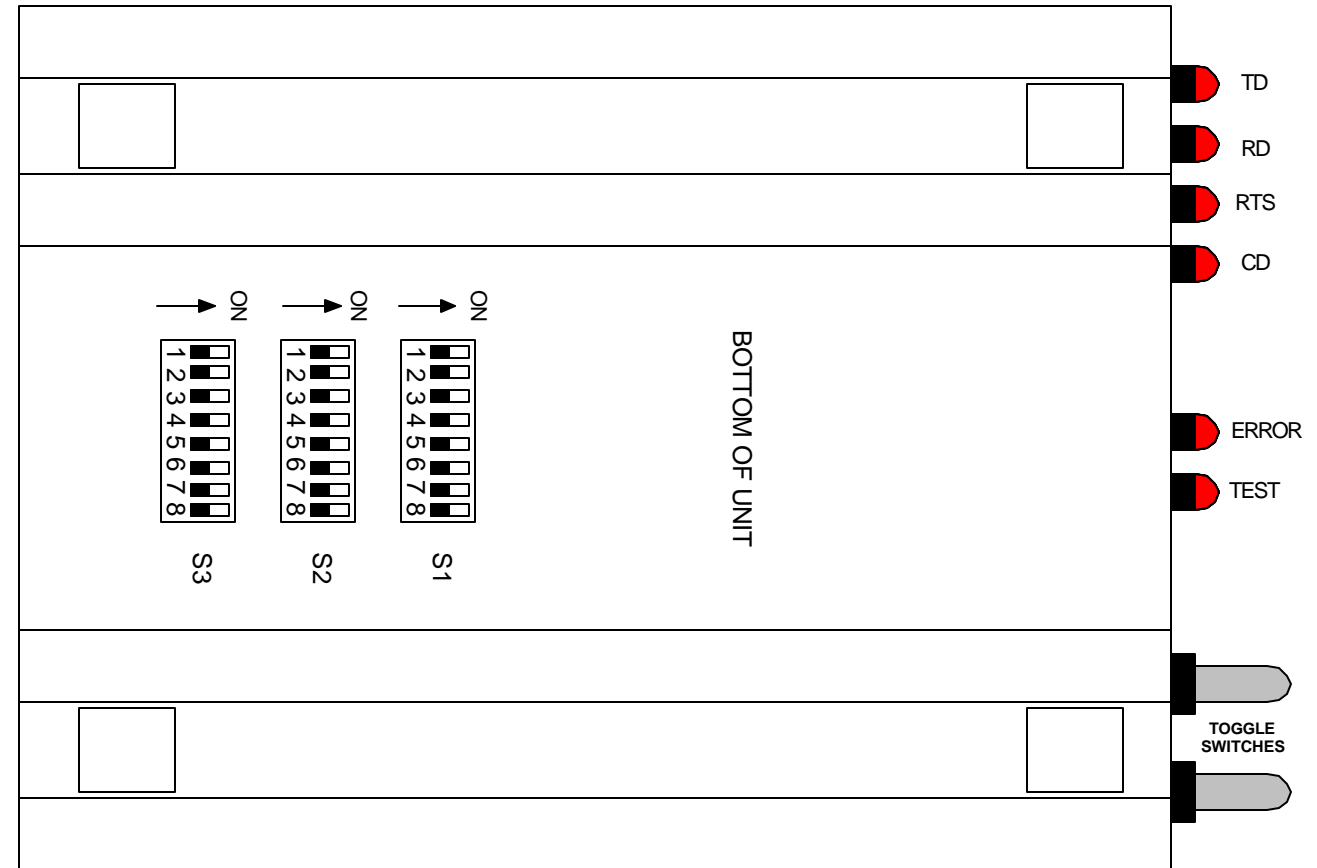
**RTS Anti-Stream Timer:** 12.5 sec., 50 sec., or disabled (switch-selectable); Tolerance: +50%, -0.

**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.

**Power Supply:** Wallmount power supply: 120 VAC



## INTRODUCTION:

### 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 synchronous 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, anti-streaming 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.

**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.

**Configuration Switches:**

The 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. 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, anti-stream control, and input impedance.

<u>POSITION:</u>	<u>FUNCTION:</u>	<u>FACTORY DEFAULT:</u>	
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

<u>POSITION:</u>	<u>FUNCTION:</u>	<u>FACTORY DEFAULT:</u>	
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	

**S1-1 through S1-4: Data Rate Setting** are set in combination to determine the asynchronous and synchronous data rate for the Short Haul Modem.

<u>S1-1:</u>	<u>S1-2:</u>	<u>S1-3:</u>	<u>S1-4:</u>	<u>Setting:</u>
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

**S1-5 and S1-6: Clock Source** are set in combination to determine the transmit clock source for the Short Haul Modem.

<u>S1-5</u>	<u>S1-6</u>	<u>Setting:</u>
ON	ON	Internal Transmit Clock
OFF	ON	Receive Recover Clock
ON	OFF	External Transmit Clock

**S1-7: Asynchronous/Synchronous Mode** determines whether the modem is in asynchronous or synchronous operating mode.

<u>S1-7</u>	<u>Setting:</u>
ON	Asynchronous
OFF	Synchronous

**S1-8: Carrier Control** determines whether the carrier is "constantly ON" or "controlled by RTS". This setting allows for operation in switched carrier, multipoint, and hardware-handshaking applications.

<u>S1-8</u>	<u>Setting:</u>
OFF	Constantly ON
ON	Controlled by RTS

**S2-1 and S2-2: Word Length** are set in combination to determine the word length for asynchronous data.

<u>S2-1</u>	<u>S2-2</u>	<u>Setting:</u>
OFF	ON	8 bits
ON	ON	9 bits
OFF	OFF	10 bits
ON	OFF	11 bits

**S2-3: Extended Signaling Rate** 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).

<u>S2-3</u>	<u>Setting:</u>
OFF	-2.5% to +1%
ON	-2.5% to +2.3%

**S2-4 and S2-5: RTS/CTS Delay** sets the amount of delay between the time the modem sees RTS and when it sends CTS. Options are no delay, 7 ms, or 53 ms.

<u>S2-4</u>	<u>S2-5</u>	<u>Setting:</u>
ON	ON	7 ms
OFF	ON	53 ms
ON	OFF	No Delay
OFF	OFF	No Delay

**S2-6: V.54 Loopback Test**

<u>S2-6</u>	<u>Setting:</u>
OFF	V.54 Normal Operation
ON	V.54 Testing Disabled

**S2-7: 2-Wire/4-Wire Mode Selection** determines whether the modem is operating in 2-wire or 4-wire mode.

<u>S2-7</u>	<u>Setting:</u>
OFF	4-Wire (full- or half-duplex)
ON	2-Wire (half-duplex ONLY)

<b>POSITION:</b>	<b>FUNCTION:</b>	<b>FACTORY DEFAULT:</b>	
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	Anti-Stream Control	OFF	Disabled
S3-8	Anti-Stream Control	OFF	Disabled

**Switches S3-1 and S3-2: Input Impedance** 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.

<u>S3-1</u>	<u>S3-2</u>	<u>Setting:</u>
ON	ON	130 ohms
ON	OFF	200 ohms
OFF	ON	320 ohms
OFF	OFF	High Impedance (minimum 2k ohms)

**S3-3: Not Assigned Yet.**

**S3-4: Mode Selection** allows the user to choose the appropriate setting for point-to-point or multipoint applications.

<u>S3-4</u>	<u>Setting:</u>
ON	Point-to-Point
ON	Multipoint application as "Master"
OFF	Multipoint application as "Slave"

**S3-5: RS-232 Initiation of Local Loopback Test** determines whether or not the modem's local analog loopback test can be initiated by raising pin 18 on the RS-232 interface.

<u>S3-5</u>	<u>Setting:</u>
ON	RS-232 initiation enabled
OFF	RS-232 initiation disabled

**S3-6: RS-232 Initiation of Remote Loopback Test** determines whether or not the modem's remote digital loopback test can be initiated by raising pin 21 on the RS-232 interface.

<u>S3-6</u>	<u>Setting:</u>
ON	RS-232 initiation enabled
OFF	RS-232 initiation disabled

**S3-7 and S3-8: Anti-stream Control** are set in combination to determine the timeout period for the modem's antistream control timer.

<u>S3-7</u>	<u>S3-8</u>	<u>Setting:</u>
OFF	OFF	Disabled
OFF	ON	12.5 seconds
ON	OFF	50 seconds
ON	ON	12.5 seconds

Cable Gauge	Data Rate (Kbps)							
	1.2	1.8	2.4	3.6	4.8	7.2	9.6	14.4
19	320	320	200	200	200	200	200	130
22	320	320	320	200	200	200	200	200
24	320	320	320	320	200	200	200	200
26	320	320	320	320	320	200	200	200

Cable Gauge	Data Rate (Kbps)			
	19.2	28.8	38.4	57.6
19	130	130	130	130
22	130	130	130	130
24	200	130	130	130
26	200	200	130	130

## 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. Dial-up 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 Short Haul Modem offers two methods of twisted-pair connection: RJ-45 jack and terminal blocks. Connect the wire to each Short Haul Modem. The "+" and "-" indicators are for reference only; the modem is not sensitive to polarity.

### **Two-Wire Installation:**

When communicating over a single-twisted-pair circuit, the 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 a 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.

### **Two-Wire Cable Connection via RJ-45:**

The RJ-45 jack on the Short Haul Modem is prewired for a standard telco wiring environment. To be sure you have the right wiring, use the Table below.

### **Two-Wire Cable Connection via 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.

### **NOTE:**

**The "+" and "-" indicators are for reference ONLY.  
The Short Haul Modem is not sensitive polarity.**

2. Connect one wire of the pair to a Transmit lug (TX+ or TX-) 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.

### **Four-Wire Installation:**

When communicating over a two-twisted-pair circuit, the 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.

### **Four-Wire Cable Connection via RJ-45:**

The RJ-45 jack on the Short Haul Modem is prewired for a standard telco wiring environment. To be sure you have the right wiring, use the Table below.

### **Four-Wire Cable Connection via 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.
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.

### **Note:**

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

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.

### **Four-Wire Multipoint Installation:**

Multipoint operation involves the connection of several terminals to one host port. In such an application, one local 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 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 = ON).

### **Multipoint Twisted-Pair Connection:**

The 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.

## OPERATION:

Once you have configured each Short Haul Modem properly and connected the twisted pair and RS-232 cables, you are ready to operate the units.

### **LED Status Monitors:**

The Short Haul Modem features six front panel status LED's that indicate the condition of the modem and communication link.

### **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.

### **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 n RS-232 pin 4. CD lights for an incoming signal on the line side, and the resulting output signal on the RS-232 pin 8.

### **The Test Indicator:**

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

### **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.
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 LED's are lit red.
2. Set input impedance of both modems to 200 ohms. (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.

### **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.

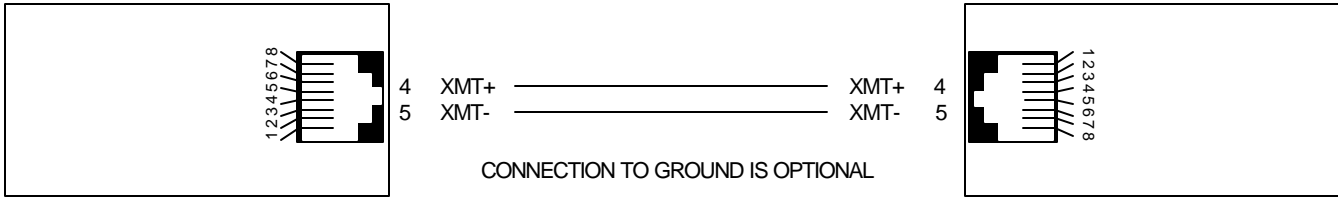
### **NOTE:**

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

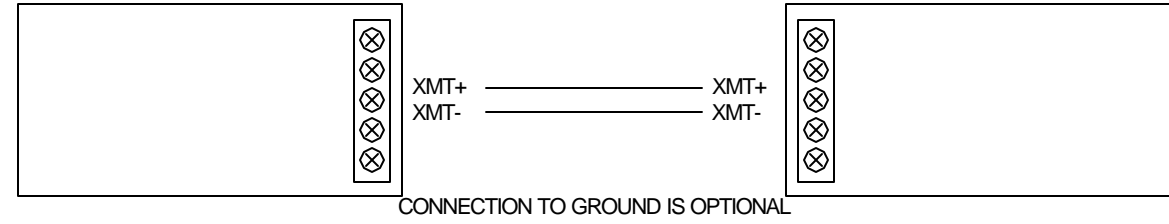
### **Anti-Streaming Error Indicator:**

When not in test mode (green Test LED is off), the front-panel Error LED is used to indicate a streaming error. When the Short Haul Modem's anti-streaming 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 present time-out period, the anti-stream 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 anti-streaming timer is automatically reset, and the front-panel Error LED turns off. The time-out period is DIP-switch-selectable for 12.5 or 80 seconds.

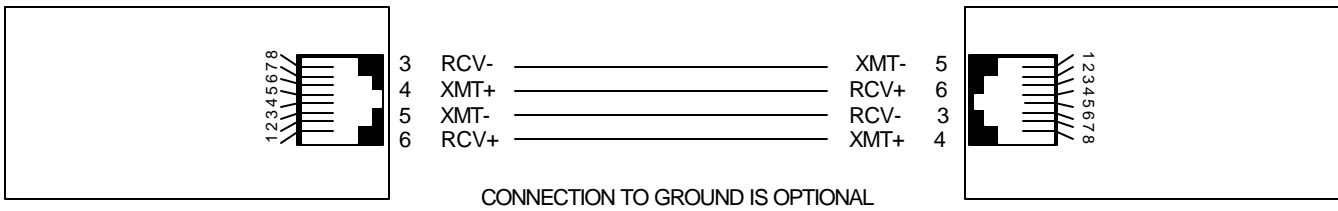
### 2-W POINT-to-POINT APPLICATION



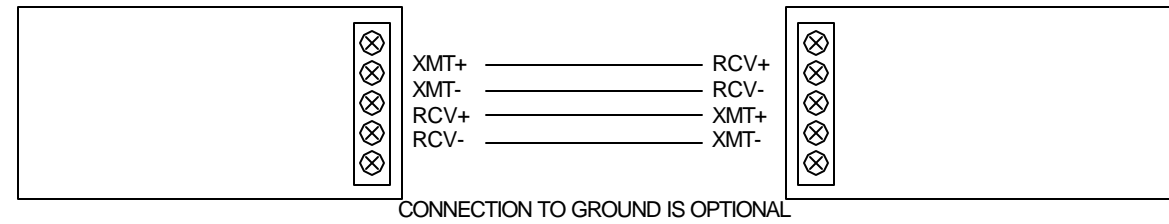
### 2-W POINT-to-POINT APPLICATION



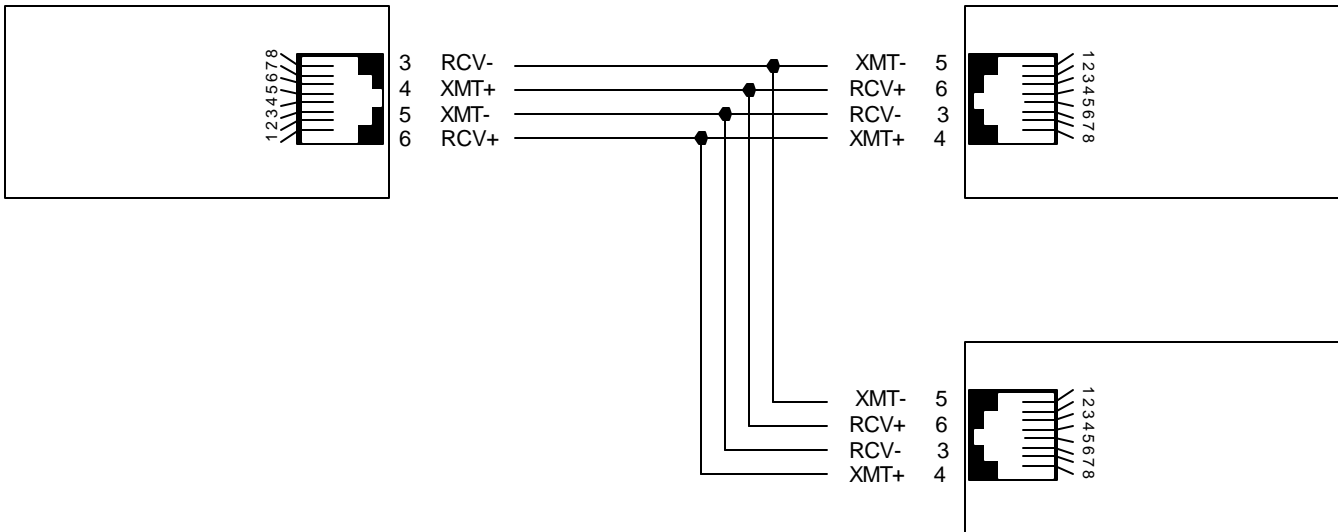
### 4-W POINT-to-POINT APPLICATION



### 4-W POINT-to-POINT APPLICATION



### 4-W POINT-to-MULTIPOINT APPLICATION



### 4-W POINT-to-MULTIPOINT APPLICATION

