ME500A

BLACK BOX

**Async ↔ Sync
Industrial Line Driver**

PWR   TX RX RTS CD   ERROR TEST   511   Remote
                                                        Normal
                                              511E   Local

**DB25
Female
Conn.**

12345678   12345678   12345678   ON

BOTTOM OF UNIT

**TOGGLE
SWITCHES**

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

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, and 64 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 ms, or 53 ms.

Applications: Point-to-Point or Multipoint.

Indicators: Mono-color LED's for TX, RX, RTS, and CD; Single LED's for Power, 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: 2000 V RMS.

Surge Protection: Immune to IEC-801-5 Level 2, 1kv.

Power Supply: 100 to 242 VAC Universal Interface.
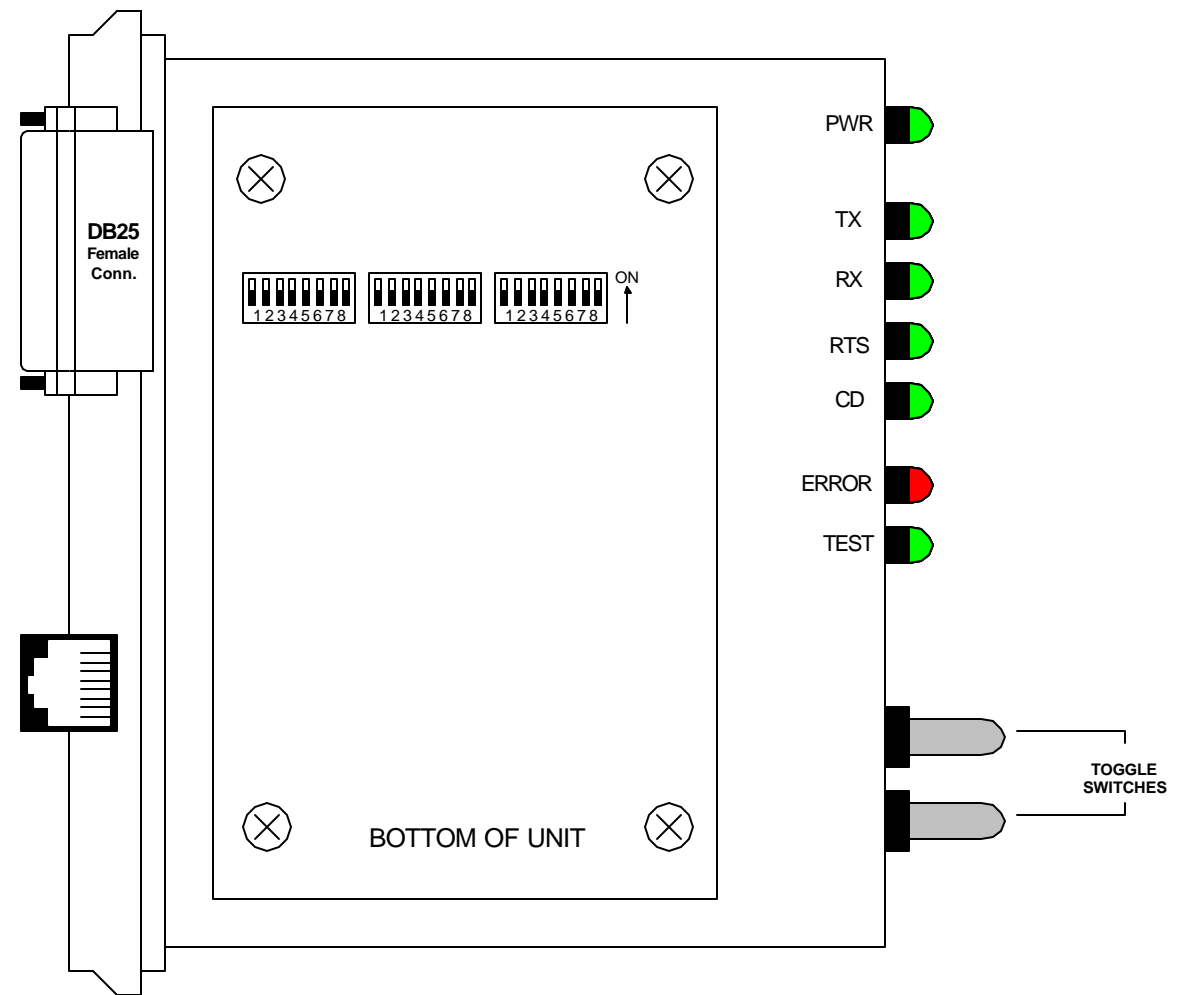
INTRODUCTION:

The Async/Sync Industrial Line Driver operates 2-wire (half-duplex) or 4-wire (full- or half-duplex), in synchronous or asynchronous modes, over unconditioned telephone lines. The Line Driver supports data rates up to 64 kbps. It operates in synchronous mode between the local and remote modems; when connected to an asynchronous RS-232 device, the Line Driver converts the asynchronous data to synchronous data.

To enhance overall performance, the Line Driver features equalization, anti-streaming timer, transformer isolation (to guard against data loss due to ground-potential differences), and Silicon Avalanche Diode surge protection (to guard against data-lone transients).

The Async/Sync Industrial Line Driver 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 can 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:

Configuration Switches:

The Async/Sync Industrial Line Driver uses 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 unit. Since all configuration DIP switches are externally accessible, there is no need to open the 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.

POSITION	FUNCTION	FACTORY DEFAULT	
S1-1	DATA RATE	ON	
S1-2	DATA RATE	OFF	9600 bps
S1-3	DATA RATE	OFF	
S1-4	DATA RATE	ON	
S1-5	CLOCK SOURCE	ON	
S1-6	CLOCK SOURCE	ON	INTERNAL
S1-7	ASYNC/SYNC	ON	ASYNC
S1-8	CARRIER CONTROL	OFF	Constantly ON

Switches S1-1 through S1-4 and S3-3: Data-Rate Setting are set in combination to determine the asynchronous and synchronous data rate for the Async/Sync Industrial Line Driver. Refer to Data-Rate chart to the right.

Switches S1-5 and S1-6: Clock Source are set in combination to determine the transmit clock source for the Async/Sync Industrial Line Driver.

S1-5	S1-6	Setting:
ON	ON	Internal Transmit Clock
OFF	ON	Receive Recover Clock
ON	OFF	External Transmit Clock

Switch S1-7: Asynchronous/Synchronous Mode are set in combination to determine the asynchronous and synchronous data rate for the Async/Sync Industrial Line Driver.

S1-7	Setting:
ON	Asynchronous
OFF	Synchronous

Switch S1-8: Carrier-Control Method determines whether the carrier is Constantly On or Controlled by RTS. This setting allows for operation in switched carrier, multipoint, and /or hardware-handshaking applications.

S1-8	Setting:
OFF	Constantly On
ON	Controlled by RTS

Data Rate Settings:					
S1-1	S1-2	S1-3	S1-4	S3-3	SETTING (kbps)
ON	ON	ON	ON	OFF	1.2
OFF	ON	ON	ON	OFF	1.8
ON	OFF	ON	ON	OFF	2.4
OFF	OFF	ON	ON	OFF	3.6
ON	ON	OFF	ON	OFF	4.8
OFF	ON	OFF	ON	OFF	7.2
ON	OFF	OFF	ON	OFF	9.6
OFF	OFF	OFF	ON	OFF	14.4
OFF	ON	OFF	ON	ON	16*
ON	ON	ON	OFF	OFF	19.2
OFF	ON	ON	OFF	OFF	28.8
OFF	OFF	OFF	ON	ON	32*
ON	ON	OFF	OFF	OFF	38.4
OFF	ON	OFF	OFF	OFF	57.6
OFF	ON	ON	OFF	ON	64*

* MUST HAVE SW3-3 ON.

POSITION	FUNCTION	FACTORY DEFAULT	
S2-1	WORD LENGTH	OFF	
S2-2	WORD LENGTH	OFF	10 BITS
S2-3	**Extended Signaling Rate**	OFF	-2.5% to 1%
S2-4	RTS/CTS DELAY	ON	
S2-5	RTS/CTS DELAY	ON	7 ms
S2-6	2-WIRE/4-WIRE	ON	
S2-7	2-WIRE/4-WIRE	OFF	(4-WIRE) FDX
S2-8	V.54	OFF	V.54 Enabled

POSITION	FUNCTION	FACTORY DEFAULT	
S3-1	INPUT IMPEDANCE	ON	
S3-2	INPUT IMPEDANCE	OFF	200 ohms
S3-3	**TIMING MODE**	OFF	
S3-4	**TOPOLOGY**	ON	Point-to-Point
S3-5	**LOCAL LOOPBACK**	OFF	Disabled
S3-6	**REMOTE LOOPBACK**	OFF	Disabled
S3-7	Anti-Stream Control	OFF	
S3-8	Anti-Stream Control	OFF	Disabled

Switches S2-1 and S2-2: Word Length are set in combination to determine the word length for asynchronous data, including the start and stop bits.

S2-1	S2-2	Setting:
OFF	ON	8 bits
ON	ON	9 bits
OFF	OFF	10 bits
ON	OFF	11 bits

Switch S2-3: Extended Signaling Rate determines the range of variability the Async/Sync Industrial Line Driver "looks for" in asynchronous data rates (that is, the actual variance from a given frequency level the Line Driver will tolerate).

S2-3	Setting:
OFF	-2.5% to +1%
ON	-2.5% to +2.3%

Switches S2-4 and S2-5: RTS/CTS Delay determines the amount of delay between the time the Line Driver "sees" RTS and when it sends CTS. Options are no delay 7 ms, and 53 ms.

S2-4	S2-5	Setting:
ON	ON	7 ms
OFF	ON	53 ms
ON	OFF	No Delay
OFF	OFF	No Delay

Switches S2-6 and S2-7: 2-wire/4-wire Mode Selection determines whether the Async/Sync Industrial Line Driver is operating in 2-wire or 4-wire mode.

S2-6	S2-7	Setting:
ON	ON	4-wire (half-duplex)
ON	OFF	4-wire (full-duplex)
OFF	ON	2-wire (half-duplex)

Switch S2-8: V.54 Loopback Test Enable enables or disables V.54 looping in the Async/Sync Industrial Line Driver.

S2-8	Setting:
OFF	V.54 Normal Operation Enabled
ON	V.54 Testing Disabled

Switches S3-1 and S3-2: Input Impedance determines the Line Driver'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 Async/Sync Industrial Line Driver. Thicker-gauge cables require a lower-ohm setting, while a thinner-gauge cable should receive a higher-ohm setting. If you are using higher speeds, you will need a lower-ohm setting and a higher-ohm setting for the slower speeds. Refer to Speed Selection Table.

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

Switch S3-3: Timing-Mode Selection selects the Line Driver's timing mode. To operate the Line Driver at 16, 32, or 64 Kbps, set S3-3 to the ON position. To select any other DTE rate, set switch S3-3 OFF.

S3-3	Setting:
ON	16, 32, and 64 Kbps
OFF	1.2 through 57 Kbps, excluding 16 and 32 Kbps.

Switch S3-4: Topology selects the topology of the Async/Sync Industrial Line Driver.

S3-4	Setting:
ON	Point-to-Point
ON	Master Multipoint
OFF	Slave Multipoint

Switch S3-5: RS-232 Initiation of Local Loopback Test determines whether or not the Async/Sync Industrial Line Driver local analog loopback test can be initiated by raising pin 18 on the RS-232 interface.

S3-5	Setting:
ON	RS-232 initiation enabled
OFF	RS-232 initiation disabled

Switch S3-6: RS-232 Initiation of Remote Loopback Test determines whether or not the Async/Sync Industrial Line Driver remote digital loopback test can be initiated by raising pin 21 on the RS-232 interface.

S3-6	Setting:
ON	RS-232 initiation enabled
OFF	RS-232 initiation disabled

Switches S3-7 and S3-8: Anti-Stream Control are set in combination to determine the time-out period for the Line Driver's anti-stream control timer.

S3-7	S3-8	Setting:
OFF	OFF	Disabled
OFF	ON	12.5 seconds
ON	OFF	50 seconds
ON	ON	12.5 seconds

Cable Gauge	Data Rates (kbps)								
	1.2	1.8	2.4	3.6	4.8	7.2	9.6	14.4	16
19 AWG	320	320	200	200	200	200	200	130	130
22 AWG	320	320	320	200	200	200	200	200	200
24 AWG	320	320	320	320	200	200	200	200	200
26 AWG	320	320	320	320	320	200	200	200	200

Cable Gauge	Data Rates (kbps)					
	19.2	28.8	32	38.4	57.6	64
19 AWG	130	130	130	130	**HIGH**	**HIGH**
22 AWG	130	130	130	130	**HIGH**	**HIGH**
24 AWG	200	130	130	130	**HIGH**	**HIGH**
26 AWG	200	200	200	130	**HIGH**	**HIGH**

INSTALLATION:

The Async/Sync Industrial Line Driver 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 to 26 AWG dry, unconditioned metallic wire. ***Dial-up analog circuits, such as those used with a standard Hayes-type modem, are not acceptable.*** The twisted pair may be shielded or unshielded. (Both types work well). The Async/Sync Industrial Line Driver has an RJ-45 jack for its twisted-pair line connection. Connect the wire to each Line Driver as described in the instructions.

Two-Wire Installation:

When communicating over a single twisted-pair circuit, the Async/Sync Industrial Line Driver operates half duplex (that is, it transmits in only one direction at a time). This is effective for both point-to-point and multipoint applications. In single-pair point-to-point applications, you will need a pair of Async/Sync Industrial Line Drivers for each circuit (one at each end of the single-pair wire). In single-pair multipoint applications you'll need three or more Async/Sync Line Drivers. These can be connected using a daisychain or star topology.

Two-wire cable connection via RJ-45:

RJ-45	Signal:
1	N/C
2	GND
3	RCV-
4	XMT+
5	XMT-
6	RCV+
7	GND
8	N/C

Connection to ground is optional

Signal:	Pin#		Pin#	Signal:
XMT+	4	————————	4	XMT+
XMT-	5	————————	5	XMT-

Four-Wire Installation:

When communicating over a two-twisted-pair circuit, the Line Driver can operate full or half duplex, point-to-point or multipoint. In two-pair point-to-point applications, you'll need a pair of Line Drivers for each circuit (one at each end of the two-pair cable). In two-pair multipoint applications, you'll need three or more Line Drivers. These can be connected using a daisychain or star topology.

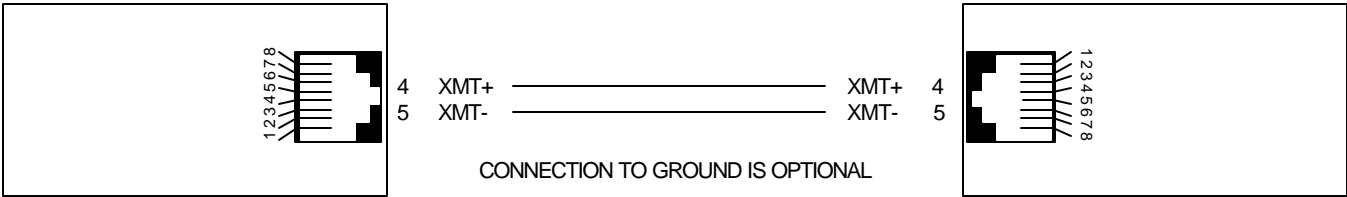#### Four-wire cable connection via RJ-45:

Signal:	Pin#		Pin#	Signal:
XMT+	4	————————	6	RCV+
XMT-	5	————————	3	RCV-
RCV+	6	————————	4	XMT+
RCV-	3	————————	5	XMT-

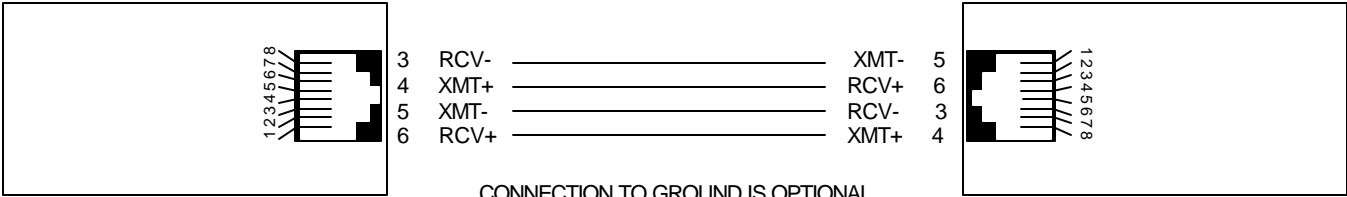Connection to ground is optional

Four-wire, Multipoint Installation:

Multipoint operation involves the connection of several terminals to one host port. In such an application, one local Async/Sync Line Driver is used as a master unit, and it is connected to several remote Async/Sync Line Drivers that are acting as slaves. In a multipoint environment, the master Line Driver transmits continually. Initiation of two-way communication is RTS-controlled by each slave Line Driver. To facilitate multipoint communication, the master Line Driver should have its carrier-control DIP switch set to Constantly ON (S1-8 = OFF). Each slave Line Driver should have its carrier-control DIP switch set to Constantly ON by RTS (S1-8 = ON). The figure on the next page shows a typical Line Driver multipoint application.
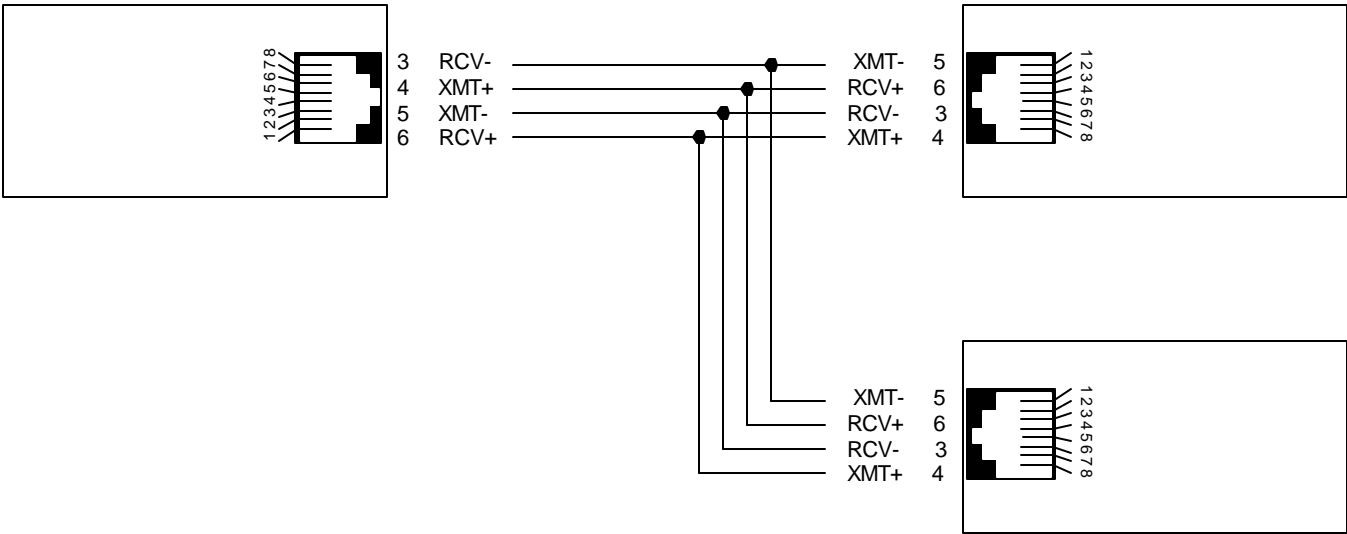
2-W POINT-to-POINT APPLICATION

4	XMT+	————————————	XMT+	4
5	XMT-	————————————	XMT-	5

CONNECTION TO GROUND IS OPTIONAL

4-W POINT-to-POINT APPLICATION

3	RCV-	————————————	XMT-	5
4	XMT+	————————————	RCV+	6
5	XMT-	————————————	RCV-	3
6	RCV+	————————————	XMT+	4

CONNECTION TO GROUND IS OPTIONAL

4-W POINT-to-MULTIPOINT APPLICATION

3	RCV-		XMT-	5
4	XMT+		RCV+	6
5	XMT-		RCV-	3
6	RCV+		XMT+	4

XMT-	5	
RCV+	6	
RCV-	3	
XMT+	4	

OPERATION:

Once you've configured each Async/Sync Line Driver and connected the twisted-pair and RS-232 cables, you're ready to operate the Line Drivers.

LED Status Monitors:
The Line Drivers have seven front-panel status LED's that indicate the condition of the Line Driver and communication link.

The power, TX, and RX Indicators:
The Power LED lights green to signal that power is present. The TX and RX indicators blink green with data activity. Off indicates a low RS-232 logic level, solid green indicates a high RS-232 logic level.

Note:
RS-232 devices idle in a low state, so the LED will be off if the
connections are correct and the RS-232 device is in an idle state.

The RTS and CD Indicators:
These indicators will be off 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 Test Indicator:
The yellow Test LED indicates that V.52 or V.54 tests are running.

The Error Indicators:
The Error indicator LED has two functions:
1. When the Line Drivers are 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 indicates an RTS streaming condition.