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ME521A
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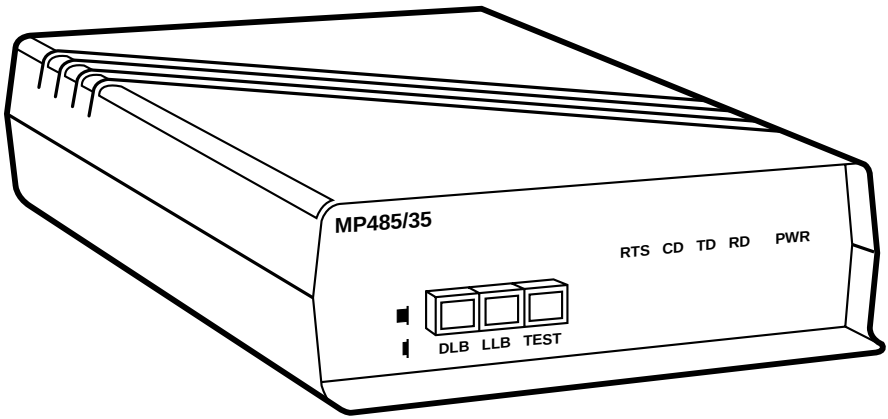
V.35 Synchronous Multiport Line Driver



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FEDERAL COMMUNICATIONS COMMISSION
RADIO FREQUENCY INTERFERENCE STATEMENT

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 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 required 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 broillage radioélectrique édicté par Industrie Canada.

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Illustrations

1. Specifications

Speed — 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 56, 64, 112, 128 or 256 Kbps

Interface —
Terminal: V.35 DCE
Line: EIA RS-485 twisted pair (26 AWG minimum), DC continuity required

Pins Supported —
V.35: CTS, DCD, DSR, ETCA, ETCB, FG, RCA, RCB, RDA, RDB, SG, TCA, TCB, TDA, TDB; Terminal Block: RXA, RXB, TXA, TXB

Range — 1 mile at 56/64 Kbps on 24 AWG unshielded twisted-pair

Connectors — (1) DB25S (25-pin sub D female) and (1) 4-screw terminal block

Operation — point-to-point or multipoint

Mode — 2-wire half-duplex, 4-wire full or half-duplex,

Clocking — Internal, external, or recovered

Carrier — Constant or Switched

Loopback — none, line, or digital

RTS/CTS Delay — 0, 11, 50, or 160 ms

Indicators — 5 LEDs (TX, RX, RTS, CD, and PWR)

Diagnostics — DLB, LLB

Operating Temperature — 32° to 122°F (0° to 50°C)

Storage Temperature — -4° to 158°F (-20 to 70°C)

Humidity — 15 to 90% relative humidity, noncondensing

Mean Time Between Failures — approximately 100,000 hrs.

Power — Wallmount transformer 115-VAC, 90 mA or 230-VAC, 45 mA

Size — Standalone: 1.8" H x 5.5"Wx 8.5" D (4.5 cm x 13.9 cm x 21.5 cm); Rackmount: 4.7"W x 7.4"D (11.9 x 18.8 cm)

Weight — Standalone: 1 lb. (.5kg); unit and transformer: 1.5 lb. (.7kg); Rackmount: 0.5 lb. (.2 kg)

ME521AE Only:

Input Voltage — 230 VAC

Input Frequency — 50 Hz

Approval — CE

Output AC — 17 VCT

Output Current — 750 mA

Output VA — 12.75

2. Introduction

The V.35 Synchronous Multipoint Line Driver provides short-haul synchronous data communication over customer-owned twisted pair cable. The Line Driver is available as a standalone unit or a rackmount card. The rackmount version is functionally identical to the standalone unit. The Card can be installed in a rackmount chassis that holds up to 16 cards.

The Line Driver has a V.35 port (configured as DCE) that connects to a host computer or terminal (DTE), and a 4-screw terminal block for RS-485 communication over a 2- or 4-wire line.

Transmission can be two-wire half duplex, four-wire half-duplex, or four-wire full-duplex. The switch-selectable baud rates range from 2400 to 256,000 bps.

LEDs on the unit's front panel indicate flow control (TX, RX, RTS, CD). Three pushbuttons on the front panel select line and digital loopback tests. Internal switches or jumpers determine these characteristics:

- Speed
- Carrier: constant or switched with selectable RTS/CTS delay
- Operation: full- or half-duplex
- TX data clock select
- Node termination

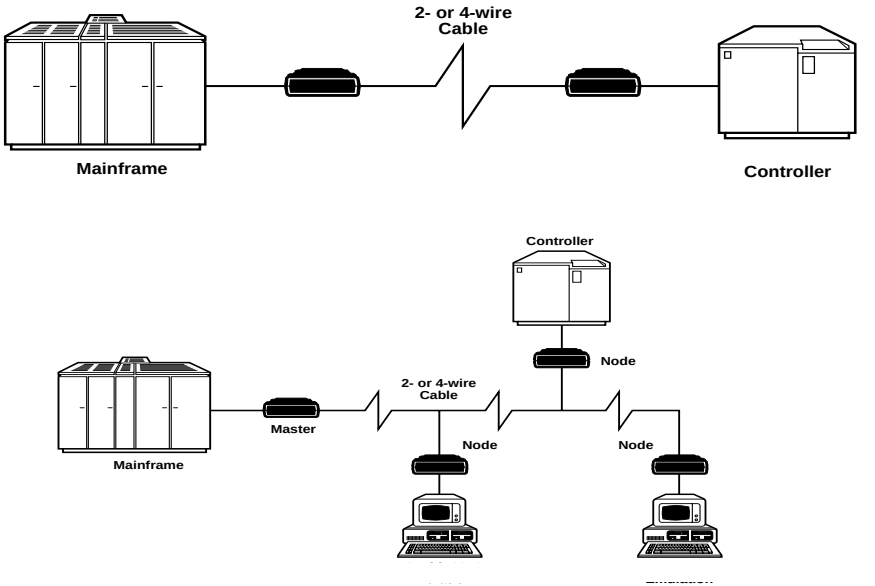


Fig. 2.1 Point-to Point and Multipoint Synchronous Applications

3. Components

3.1 Contents

Your line driver package should include the driver unit (in card form or as a standalone with power supply), a DB15 to V.35 adatpter, and, of course, this manual. If any of these items are missing, check with your sales or technical representative for replacements.

3.2 Front-Panel Indicators and Buttons

The front panel of the Line Driver has five status indicators (LEDs):

TD Lights when data is transmitted by the local attached V.35 device (TDA, TDB are active).

RD Blinks as data is received from the remote V.35 device (RDA, RDB are active).

RTS Lights when V.35 device raises RTS to request data transmission.
In Constant Carrier mode the RTS LED will always be on (Note that the Driver should assume Constant Carrier mode only when in full-duplex or simplex operation.)
In Switched mode the RTS LED will be on only if RTS is asserted.

CD Indicates status of remote Line Driver's RTS signal.
If the remote Line Driver is in Constant Carrier Mode, the local Line Driver's CD LED will always be on.
If the remote Line Driver is in Switched Mode, the local Line Driver's CD LED will light when the remote device asserts RTS.

PWR Shows that the unit is receiving power.

Three pushbuttons are located on the front panel used for various testing operations as follows:

TST End-To-End Continuity Test (button provides test pattern for all test operations)

LLB Line Loopback Test

DLB Digital Loopback Test

See **Section 6** for instructions on the tests.

3.3 Back Panel Connectors

Two connectors are located on the rear panel of the Line Driver:

- One DB25S connector: configured as DCE; connects the line driver to a V.35 M-block device.

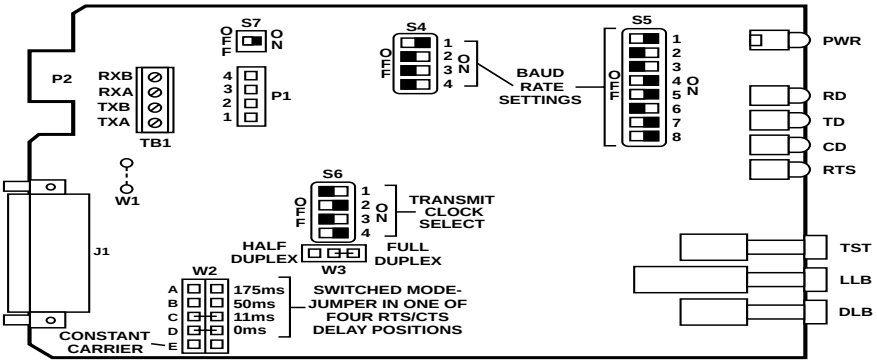
- One 4-screw terminal block: for RS-485 communication between two or more Line Drivers over two or four wires.

4. Configuration

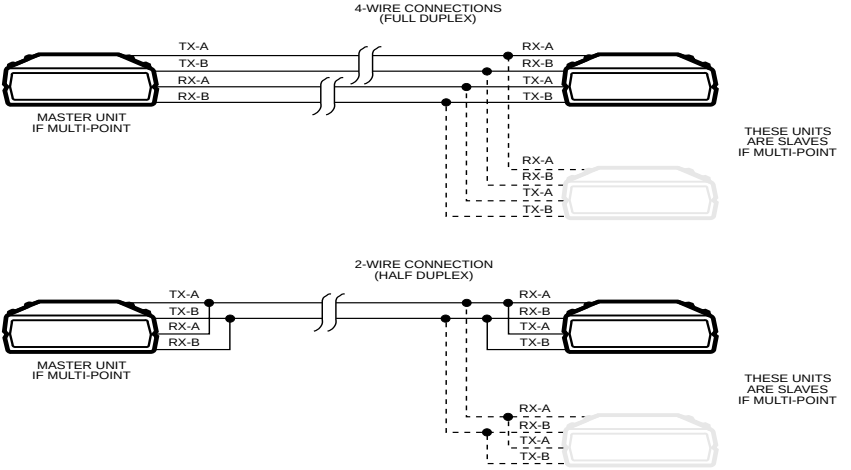
4.1 Introduction

You'll use the two figures below to set and wire your unit. Figure 4.1 shows the details of the circuit board of your Line Driver, while fig. 4.2 shows wiring diagrams for both 2-wire and 4-wire operation.

Fig. 4.1 Line Driver Board Layout



4.2 Point-to-point and Multipoint Wiring



4.2 DIP Switch Banks

You'll use the DIP switch banks (at board locations S4, S5, S6, and S7) to set these characteristics:

- Baud rate
- Transmit data clock
- Node termination

4.2.1 Speed

The ten available speeds are: 2.4, 4.8, 9.6, 19.2, 38.4, 56, 64000, 112, 128, and 256 Kbps. The factory setting is 56 Kbps.

The maximum transmission distance is dependent on the data rate selected. The typical range for data transmission is 1 mile (1.6 km) at 56 or 64 Kbps. See Table A.2 (**page 15**) for a list of baud rates and maximum transmission distances.

If you are resetting the speed switch banks once the Driver has been on, you may notice that the heat sinks nearby are quite warm, This is normal, and occurs because of the power dissipated in V.35 transmission

NOTE: The data rate should be set to match the rate of the attached DTE.

Table 4.1 DIP Bank Speed Settings

Bank	Switch	Speed (in Kbps)									
		2.4	4.8	9.6	19.2	38.4	56	64	112	128	256
4	1	On	On	On	On	Off	Off	Off	Off	Off	Off
4	2	Off	On	On	Off	Off	Off	Off	Off	Off	Off
4	3	Off	On	Off	Off	Off	Off	Off	Off	Off	Off
4	4	On	Off	Off	Off	Off	Off	Off	Off	Off	Off
5	1	On	On	On	On	On	On	On	Off	Off	Off
5	2	Off	Off	Off	Off	Off	Off	Off	On	On	On
5	3	On	Off	Off	Off	Off	On	On	Off	Off	Off
5	4	On	On	On	On	On	Off	Off	Off	Off	Off
5	5	On	On	On	On	On	On	On	On	On	Off
5	6	On	Off	Off	Off	Off	On	Off	On	Off	On
5	7	On	On	On	On	On	On	On	On	On	On
5	8	On	On	On	On	On	On	On	On	On	Off

4.2.2 Transmit Data Clock

Data timing is synchronized among all connected devices in one of three ways:

- Internal Clock (factory setting)
- Recovered Clock
- External Clock

DIP Bank S6 controls the selection of the clock timing.

Internal Clock—The Line Driver generates Transmit Data clock and presents clock to the attached DTE on TCA and TCB. The DTE then presents synchronized data to the Line Driver on pins TCA and TCB.

Recovered Clock—The Transmit Data clock presented to the DTE is synchronized with the timing of data received from the remote device.

Table 4.2 Clocking Settings

Data Clock	Switch		
	1	2	3
Recovered	On	Off	Off
Internal	Off	On	Off
External	Off	Off	On

External Clock—The local DTE determines clocking. The clock is presented to the Line Driver on Pins ETCA and ETCB, and returned as TCA and TCB.
To create a master clock, one of the Line Drivers should be set to internal or external clocking and the other Line Driver(s) set to recovered clock.

4.2.3 Node Termination

The user can select whether the termination network for the receiver is to be connected to the line. Terminating the devices at the extreme ends of the line reduces distortion and improves overall signal quality in most applications. (Factory setting: Switch 7 in the TERM position.)

In point-to-point applications, both devices should have the node termination option enabled.

In multipoint applications, only the two devices at the extreme ends of the line should be terminated. Configuring any of the other devices on the line for node termination would result in an increase in the amount of distortion and possible data errors.

4.3 Jumpers

The internal jumpers (at W2 and W3) determine:

- Carrier—Constant/Switched
- RTS/CTS Delay (for Switched Mode)
- Full-/Half-Duplex

4.3.1 Carrier—Constant/Switched

Jumper W2 is used to select Constant Carrier or Switched Mode. This option determines the transmission of the Request To Send signal.

To set your units, use Table 4.3 below.

When the jumper block is in the Constant Carrier position, Constant Carrier mode is selected. If Switched mode is desired, the jumper block would be placed in one of the four RTS/CTS delay positions. See Fig. 4.1 for the jumper's location on the printed circuit board. Each mode is discussed below.

Constant Carrier Mode— the unit functions as if RTS is constantly asserted. The EIA 485 transmitter is always on, and the unit CTS signal remains high. Any data sent by the attached V.35 device is automatically transmitted by the Line Driver. The RTS LED on the unit's front panel will always be on, and the CD indicator of the remote Line Driver(s) will remain lit.

Constant Carrier mode is most commonly used in multipoint applications that have a "master" device communicating with two or more "slaves". The master DTE is configured for Constant Carrier mode, while the slave devices are set to Switched mode.

Note: Constant Carrier Mode pertains to full-duplex or simplex operation only, not half-duplex. In Constant Carrier mode the RTS signal is constantly held high, preventing any other signals from being raised inthe sequential fashion required by half duplex operation.

Table 4.3 Mode Selection

For	Use
2-wire operation	Switched mode for all units.
4-wire, point-to-point	Either mode (same setting for both units).
4-wire, multipoint	Switched for slaves, either mode for master.

Switched Mode — the Line Driver's transmitter isn't activated until the DTE device asserts RTS. (Unlike Constant Carrier Mode, this mode does not always hold RTS high.) When the attached DTE device raises RTS, the Line Driver's RTS LED will light. The remote unit's CD LED will also light, indicating that a transmission link has been established. Once the device drops RTS, the RTS and remote CD lights will go out.

4.3.2 RTS/CTS Delay

In Switched mode, you may insert a delay after the V.35 device raises RTS to delay the return of CTS from the Line Driver to the DTE. This feature is useful in applications that require time for the remote Driver's Carrier Detect (CD) signal to activate the link between both V.35 devices before CTS is raised. If CD hasn't been asserted before CTS, the link is considered inactive and the attached DTE should not attempt data transmission.

In half-duplex operation, the RTS/CTS delay is useful because it allows time to establish which Line Driver will have control of the line to transmit data.

RTS/CTS Delay Options (Jumper W2):

- 0 msec (no delay)
- 11-msec delay (factory setting)
- 50-msec delay
- 175Δ-msec delay

4.3.3 Full or Half-Duplex Operation

Figure 4.1 shows the location of Jumper W3. This jumper allows you to select half-duplex (2-wire) or full-duplex (4-wire) operation. The factory setting is full duplex.

5. Installation

5.1 Procedure

Follow these steps to install your Line Driver:

1. Configure the Line Driver to suit your particular application. **Section 4** describes the options available for each jumper and switch.

2. Make sure the driver is working by turning it on and performing the Line Loopback Test (see **Section 6**). Repeat this procedure for each unit in your configuration.

3. Turn the Driver off. Connect it to the RS-485 line via the 4- screw terminal block on the unit's rear panel. (Refer to the interconnect wiring diagrams, Figure 4-2.)

4. To verify the communications link, turn the Driver on and perform the Digital Loopback Test (see **Section 6**). For multipoint applications, repeat the test for each connection.

5. Turn the unit off. Connect the DTE to the Line Driver's DB25S connector with a V.35 cable (male connector).

6. Turn the unit on and perform the End-To-End Continuity Test to verify the integrity of each segment of the link. This test allows you to isolate a defective circuit.

7. Test the installation as described in Section 6.

5.2 Tail Circuit Applications

In a typical Line Driver tail circuit, the Driver will be connected back-to-back with another DCE device through the V.35 interface.

To create a tail circuit, set one unit for external clock and one unit for receive clock. Then connect them with a cable that crosses the Receive clock outputs with the external clock inputs, and omits the Transmit clock lines (TCA and TCB). With TCA and TCB omitted, there is no danger of creating a short -circuit on those leads and, in turn, increasing the current that the unit will draw.

6. Test Modes

6.1 Introduction

Test configurations are set up by using the front-panel pushbuttons. These tests should be performed when the unit is first installed or if a problem occurs.

The TST pushbutton enables the Line Driver's transmitter circuitry and injects marking data into the scrambled carrier bit pattern (after resetting the scrambling circuitry). If the link is operating properly, the RD indicator on any unit receiving this pattern will turn from on to off, and remain off. This indicates the correct reception and decoding of marking data.

The two loopback switches, DLB (digital loopback) and LLB (line loopback) loop Transmit data to Receive data on the V.35 interface. They also loop Receive data to transmit data on the RS-485 interface. The only difference between the two tests is the circuitry of the line driver that is tested (Fig. 6.1).

In the line loopback mode, the RS-485 Receive data is not actively received and retransmitted. In effect, the length of the line is doubled, which may cause cause receiving errors. If you suspect this, press the DLB pushbutton at the remote end.

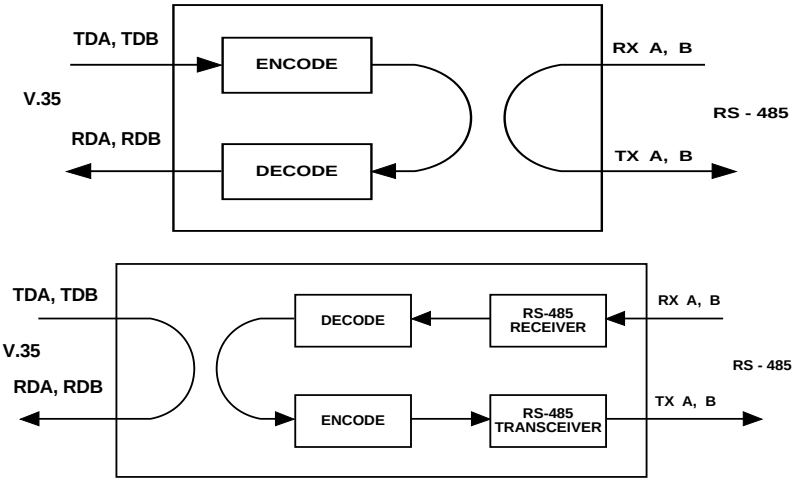


Fig. 6.1. Line and Digital Loopback Schemes

6.2 Test Procedure

Check for the simple problems first: power loss, disconnections, improper configuration, then go on to specific line tests.

Line Loopback: Press the LLB button on the units that are not operating properly. Press the Test button. As each unit's Test button is pressed, the RD indicator should switch off and remain off. This tests the internal circuitry of the line driver. If a unit does not pass this test, it is defective.

Digital Loopback: In a point-to-point application, observe the indicators at the local unit. In a multipoint configuration, observe the indicators at the master unit.

Have someone press the DLB pushbutton at only the remote unit(s) in question. Press the test button on the master unit. The RD indicator on the master unit should switch off and remain off.

6.3 Remedies for Common Flaws

The RD indicator may flash before switching off entirely. This is normal. If the RD indicator remains lit or flickers, any of the following could be causing the problem:

- The data rates of the local and remote units do not match.
- Incorrect V.35 connections.
- Lead mismatching. The TXA lead of the local unit should be wired to the RXA lead of the remote unit. The TXB lead of the local unit should be wired to the RXB lead of the remote unit. The RXA lead of the local unit should be wired to the TXA lead of the remote unit. The RXB lead of the local unit should be wired to the TXB lead of the remote unit. Polarity (A to A, B to B) must be observed.
- The maximum link distance has been exceeded. Check by selecting a lower data rate. If the units function at a lower rate, the units have been placed too far apart.
- Unsuitable link termination in multipoint configurations. Unterminate the slave unit and select another slave unit for termination. In some configurations (especially with a large number of slaves at widely varying distances), the selection of the best slave unit for link termination can be a trial-and-error process.

Transmission Speed and Distance

A.1 RS-485 Pin Assignments

Pin	Name
TX A	Transmit Data
TX B	(pair)
RX A	Receive Data
RX B	(pair)

A.2 Speed and Distance Table

Speed (bps)	Distance
2400	3.8 mi (6.1 km)
4800	2.9 mi (4.7 km)
9600	2.1 mi (3.4 km)
19200	1.5 mi (2.4 km)
38400	1.2 mi (1.9 km)
56000	1.1 mi (1.8 km)
64000	1.0 mi (1.6 km)
112000	0.8 mi (1.3 km)
128000	0.8 mi (1.3 km)
256000	0.7 mi (1.0 km)

A.3 V.35 Pin Assignments

Lead	Flow	Name	DB25 Pin	M-block Pin
Transmitted data	In	TDA	2	P
		TDB	14	S
TX data clock	Out	TCA	15	Y
		TCB	12	AA
Received data	Out	RDA	3	R
		RDB	16	T
Remote tx clock	In	ETCA	24	U
		ETCB	11	W
Signal Detect	Out	DCD	8	F
Request to Send	In	RTS	4	C
Clear to Send	Out	CTS	5	D
Signal Ground	In/Out	SG	7 or23	B
Protective Ground	In/Out	FG	1	A
Data Set Ready	Out	DSR	6	E
RX Data Clock	Out	RCA	17	V
		RCB	9	X

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