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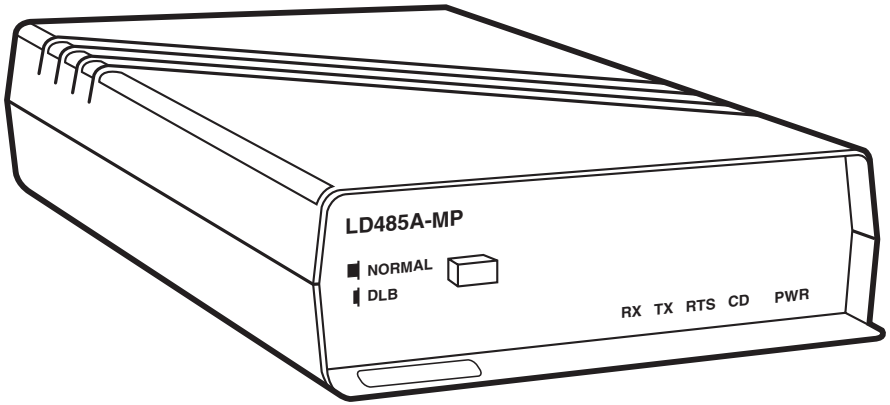
RS-232 Asynchronous Multipoint Line Driver (LD485A-MP)



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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.

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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.

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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

1. Specifications

Interface—(1) asynchronous RS-232 port (DTE/DCE selectable), (1) asynchronous RS-584 port

Connectors—(1) DB25S, female RS-232 port, (1) four-wire terminal block RS-485 port

Pins Supported—RS-232 port: TD, RD, RTS, CTS, CD, DTR, DSR, SG, and FG, RS-485 port: TXA, TXB, RXA, RXB

Data Rate—0 to 64 Kbps, transparent to data

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

Temperature—*Operating*: 32 to 122 °F (0 to 50 °C), *Storage*: -4 to 158 °F (-20 to 70 °C)

Humidity—0 to 95% relative humidity, non-condensing

Mean Time Between Failures—Approximately 180,000 hours (ground benign environment)

Operation—Point-to-Point or Multipoint, Half or Full Duplex, Transparent to data, Selectable RTS to CTS delay, DTE or DCE configurable RS-232 port, Normal or loopback operation

Timeout Delay—1 msec, 100 msec, or 1 sec (for the RS-485 driver enabled by data feature)

Power—Wall-mount transformer, 115 VAC, 8.5 watts or 230 VAC, 8.5 watts

Size—Standalone unit: 1.8”H x 5.5”W x 8.5”D (4.5 x 13.9 x 21.5 cm), Rackmount card: 4.7”H x 7.4”L (11.9 x 18.8 cm)

Weight—Standalone unit (unit only): 1 lb. (454 g), Power supply only: 0.5 lb. (227 g)

Typical Speed Versus Distance —(4-wire point-to-point 26 AWG twisted pair)

Speed	Distance
1,200 bps	4.0 miles
2,400 bps	3.0 miles
4,800 bps	2.3 miles
9,600 bps	1.7 miles
19,200 bps	1.2 miles
38,400 bps	0.9 miles
64,000 bps	0.75 miles

NOTE

Speed and distances will depend on actual operating conditions.

2. Introduction

The LD485A-MP Line Driver is an RS-232 to RS-485 interface converter that operates in much the same way as a modem. It allows an RS-232 device to transmit data over much longer distances than is normally possible (up to 4 miles at 1200 bps). The advantage of the LD485A-MP over other line drivers and modems is that it can also operate in multipoint applications. Depending on the operating environment, as many as 64 devices can be linked together using twisted-pair cable.

The LD485A-MP can be jumpered for a user-selectable port timeout. After the last character is sent from one of the ports and a specified period of time passes (1 msec, 100 msec, or 1 second), the LD485A-MP disables any transmission from that port. This timeout would be used in a multipoint application to prevent one port from monopolizing the line. For example, if one line driver was still enabled and no data was being sent, the other line drivers would not be able to transmit or receive data until the one driver was disabled. Thus, the line would be tied up, with no useful data communication taking place. The port timeout feature keeps the line free by disabling inactive ports.

Additional features include a manual loopback test to check the system wiring for both the RS-232 and RS-485 interfaces, and transient protection on the RS-485 interface to help prevent damage due to voltage transients on the data line.

Although designed specifically to connect to other LD485A-MP line drivers, the RS-485 port may be connected to any device with an RS-422 or RS-485 interface. This would be useful in an industrial application, for example, where RS-485 and RS-422 devices would be connected to the same LD485A-MP.

The LD485A-MP is available in standalone and rackmount versions. The rackmount card (part number ME836C-R3) is designed to be installed in the multi-function rack (part number RM700).

A cable and adapter are included with each Driver.

3. Installation

This section describes the jumper and switch functions for configuring the LD485A-MP. See **Figure 3-1** for the component locations. **Section 3.1** gives a description of the jumper and switch settings. For a description of the DCE setup, see **Section 3.2**. For a description of the DTE setup, see **Section 3.3**.

Installation consists of the following steps:

1. Set each of the six jumpers/switches as per your application.
2. Connect the LD485A-MP devices together as shown in **Figures 3-4** through **3-7**.
3. Apply power.

3.1 Jumper and Switch Configuration

NOTE

In order to make it easier for you to locate the jumper and switch settings in Tables 3-1 and 3-2, the following descriptions are preceded by a number. These numbers are identical to the numbers listed for that function in Tables 3-1 and 3-2.

1. DTE/DCE Configuration

A DIP shunt is used to select DTE or DCE configuration. For the LD485A-MP to appear as a DTE device, put the DIP shunt jumper in socket XW1B. For the LD485A-MP to appear as a DCE device, put the DIP shunt jumper in socket XW1A/

2. Frame Ground/Signal Ground

Jumper W7 ties signal ground to frame ground. The position is left open at the factory. If signal ground is to be connected to frame ground, solder a 100-ohm, 1/2-watt resistor in location W7. A wire jumper may also be used. Take care to ensure that ground circulating currents are limited to acceptable levels.

3. Half/Full Duplex Operation

Jumper W8 selects half-duplex or full-duplex operation. Set W8 to the HALF position for half-duplex operation. Set W8 to the FULL position for full-duplex operation.

NOTE

When the jumper W9 is in the ON position and jumper W15 is in the A-B position, the RS-485 driver is always turned on to enable transmission of data. Therefore, half-duplex transmission cannot be performed. See #5 for an explanation of the RS-485 driver.

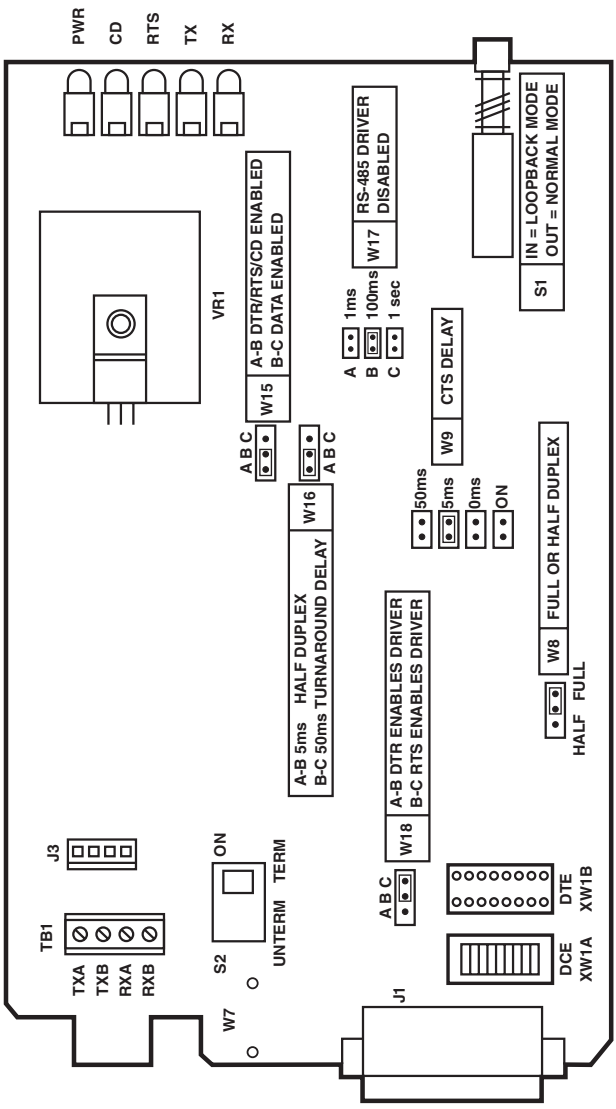


Figure 3-1. PCB Layout.

4. CTS Delay

When the transmitter of a device is first turned on, an unstable carrier signal is transmitted for several milliseconds. If data was sent during this period, it would be received as distorted information. Setting a CTS delay on the LD485A-MP allows the communications link to settle down before data can be sent.

a. LD485A-MP as DCE

When the LD485A-MP is configured as a DCE device (DIP shunt in position XW1A), jumper W9 controls the amount of delay from the time RTS (jumper W18 in the B-C position) or DTR (jumper W18 in the A-B position) is received true until CTS is asserted true. To select a CTS delay period, set jumper W9 to the 0 msec, 5 msec, or 50 msec position. Regardless of the delay setting selected, when RTS or DTR goes false, CTS will immediately go false. If jumper W9 is in the "ON" position, CTS will always be held true.

b. LD485A-MP as DTE

When the LD485A-MP is configured as a DTE device (DIP shunt in position SW18), CTS is not supported.

5. RS-485 Driver Enable

The LD485A-MP's RS-485 driver can be set to be enabled one of three ways: a. by RS-232 control signals, b. by data, or c. constantly on.

a. Driver Enabled by RS-232 Control Leads

If your equipment raises CD, DTR, or RTS, you can set the RS-485 driver to be enabled by one of these leads. If your equipment does not have the capability to raise CD, DTR, or RTS, you will need to set the RS-485 driver to be enabled by data or constantly enabled.

In order for an RS-232 control lead to enable the RS-485 driver, W15 must be in position A-B and W9 must be set for 0, 5, or 50 ms.

- When the RS-232 port is selected as DTE (DIP shunt in the XW1B position), the RS-485 driver will be enabled when CD (pin 8 of the RS-232 connector) goes true.

- When the RS-232 port is selected as DCE (DIP shunt in the XW1A position) and jumper W18 is in the A-B position, DTR enables the RS-485 driver. When jumper W18 is in the B-C position, RTS enables the driver.

b. Driver Enabled by Data

The RS-485 driver can also be enabled without requiring an RS-232 control lead to be asserted. When jumper W15 is placed in the B-C position, the driver is enabled when data is received on the RS-232 port of the LD485A-MP. As soon as the first bit of the first character is received at the RS-232 port, the RS-485 driver is enabled and an internal timer is started. Each time a "one to zero" transition occurs in the data, the timer is reset. When the timer times out, the RS-485 driver is disabled. Jumper W17 allows this timeout delay to be set for 1 msec, 100 msec, or 1 second (see #7 below).

c. Driver Constantly Enabled

The RS-485 driver can be constantly enabled by setting jumper W9 to the ON position.

6. Half-Duplex Turnaround Delay

When operating in half-duplex mode (jumper W8 in the HALF position), the LD485A-MP adds a small delay each time it stops transmitting data and prepares to receive data. This delay allows the RS-485 interface and transmission line time to stabilize, thus reducing the possibility of garbled data being received at the end of a message.

When jumper W16 is in the A-B position, 5 msec of delay is added. This amount of delay is sufficient for most applications. If you have a long transmission line or many LD485A-MP devices connected in a network, you may need to place W16 in the 50 msec (B-C) position.

7. RS-485 Interface Terminated or Unterminated

Some distortion on the twisted-pair line may be caused by impedance mismatch from the different devices connected to the line. To help eliminate this type of distortion, the RS-485 interface can be terminated with a resistor network at the receiver input pins (RXA and RXB) via switch S2. When S2 is placed in the "TERM" position, the resistor network is connected across the line. When S2 is placed in the "UNTERM" position, no connection to the resistor network is made and the line is not terminated.

a. Point-to-Point

When only two devices are connected to the line in a point-to-point application, each device should have the termination network connected to the line. Set switch S2 to the "TERM" position.

b. Multipoint

For multipoint applications, switch S2 should be in the "UNTERM" position on all the LD485A-MP devices in the network except for the two units at the extreme opposite locations on the line. The extreme opposite devices are the two devices that have the greatest cable length between them, which may not necessarily be the devices that are physically located the farthest apart. These two units should be set in the "TERM" position (see **Figures 3-4** and **3-5**). If any of the other LD485A-MPs were configured as "terminated," the amount of distortion could increase—possibly causing errors in the data being transmitted.

6. Normal/Loopback Operation

The Normal/Loopback switch is a two-position pushbutton switch extending through the front panel. The Normal position permits normal operation of the LD485A-MP. The loopback position allows data coming into the LD485A-MP to be sent back out the same port. This is for testing the connection between the LD485A-MP and the device attached to each port.

a. Normal

When this switch is in the normal mode, data is passed through the LD485A-MP from the RS-232 port to the RS-485 port and vice versa.

b. Loopback

When set to the loopback mode, any data received at the RS-485 port will be transmitted back out the RS-485 port and any data received at the RS-232 port will be transmitted back out the RS-232 port.

3.2 DCE/DTE Configuration

This section contains block diagrams (**Figures 3-2** and **3-3**) and jumper and switch settings (**Tables 3-1** and **3-2**) for DCE/DTE operation. For a detailed description of the jumpers and switches, see **Section 3.1**.

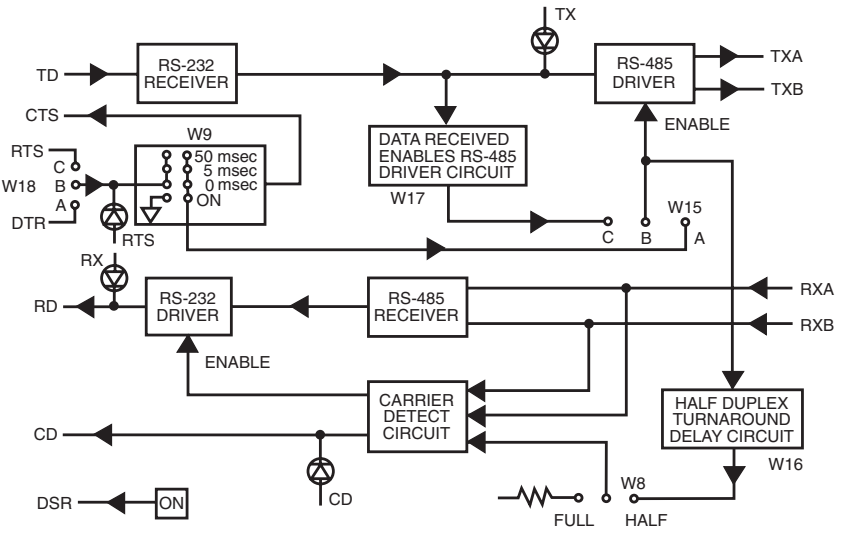


Figure 3-2. Simplified Functional Block Diagram (DCE Operation).

Table 3-1. DCE Jumper Settings.

NOTE

In order to make it easier for you to locate the jumper and switch settings in Section 3.1, the following descriptions are preceded by a number. These numbers are identical to the numbers listed for that function in Section 3.1.

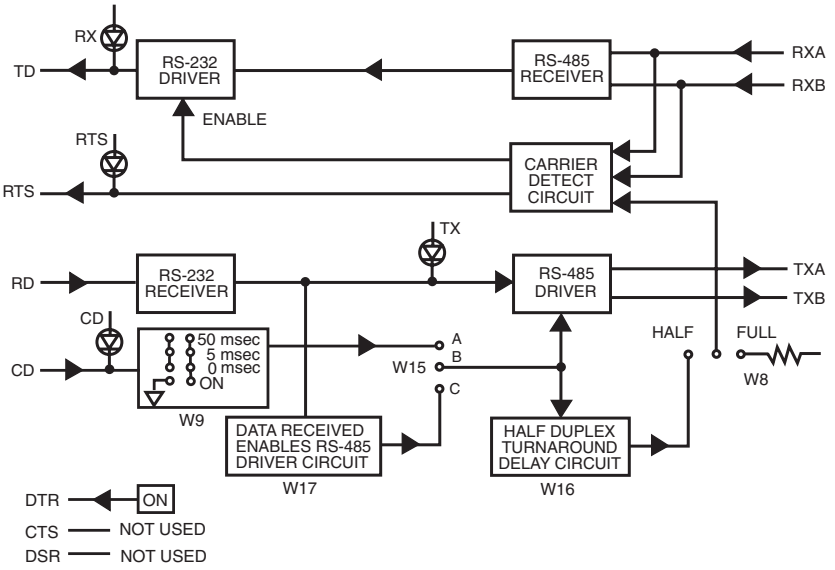
Function	Jumper Requirements
1. Configure RS-232 port as DCE	XW1 in A position
2. Signal ground connected to frame ground	
• Connected (soldered in place)	W7 is IN (100-ohm, 1/2 watt resistor)
• Not connected	W7 is OUT
3. Half or full duplex operation.	
• Full duplex	W8 in FULL position
• Half duplex	W8 in HALF position
4. CTS delay	
• Yes	W9 in 0 ms position W9 in 5 ms position W9 in 50 ms position
• No	W9 in ON position (no delay, CTS always true)

Table 3-1. DCE Jumper Settings (continued).

Function	Jumper Requirements
5. Enable RS-485 driver	
a. RS-485 driver enabled by RS-232 control leads	
• by DTR	W9 in 0 ms position
	W9 in 5 ms position
	W9 in 50 ms position
	W15 in A-B position
	W18 in A-B position
• by RTS	W9 in 0 ms position
	W9 in 5 ms position
	W9 in 50 ms position
	W15 in A-B position
	W18 in B-C position
b. RS-485 driver enabled by data	W15 in B-C position
• Disable timeout delay	1 msec—W17 in A position
	100 msec—W17 in B position
	1 sec—W17 in C position
c. RS-485 driver constantly enabled	W9 in ON position
6. Half duplex turnaround delay	
• 5 msec turnaround delay	W8 in HALF position
	W16 in A-B position
• 50 msec turnaround delay	W8 in HALF position
	W16 in B-C position

Table 3-1. DCE Jumper Settings (continued).

Function	Jumper Requirements
7. RS-485 interface terminated or unterminated	
• Terminated	S2 in TERM position
• Unterminated	S2 in UNTERM position
8. Normal or loopback operation	
• Normal mode	S1 in NORMAL position
• Loopback mode	S1 in LOOPBACK position



NOTE

The delay settings for W9 apply only to the CTS output of the LD485A-MP. Since CTS is not used when the LD485A-MP is configured as a DTE device, placing jumper W9 in either the 0, 5, or 50 msec position will allow the CD input to enable the RS-485 driver. When jumper W9 is in the ON position, the CD input has no effect on the RS-485 driver.

Figure 3-3. Simplified Functional Block Diagram (DTE Operation).

Table 3-2. DTE Jumper Settings.

NOTE

In order to make it easier for you to locate the jumper and switch settings in Section 3.1, the following descriptions are preceded by a number. These numbers are identical to the numbers listed for that function in Section 3.1.

Function	Jumper Requirements
1. Configure RS-232 port as DTE	XW1 in B position
2. Signal ground connected to frame ground	
• Connected (soldered in place)	W7 is IN (100-ohm, 1/2 watt resistor)
• Not connected	W7 is OUT
3. Half or full-duplex operation.	
• Full duplex	W8 in FULL position
• Half duplex	W8 in HALF position
4. CTS delay	CTS not supported
5. Enable RS-485 driver	
a. RS-485 driver enabled by CD	W15 in A-B position W9 in 0 ms position W9 in 5 ms position W9 in 50 ms position

Table 3-2. DTE Jumper Settings.

Function	Jumper Requirements
b. RS-485 driver enabled by data	W15 in B-C position
• Disable timeout delay	1 msec—W12 in A position 100 msec—W17 in B position 1 sec—W17 in C position
c. RS-485 driver constantly enabled	W9 in ON position W15 in A-B position
6. Half-duplex turnaround delay	
• 5 msec turnaround delay	W8 in HALF position W16 in A-B position
• 50 msec turnaround delay	W8 in HALF position W16 in B-C position
7. RS-485 interface terminated or unterminated	
• Terminated	S2 in TERM position
• Unterminated	S2 in UNTERM position
8. Normal or loopback operation	
a. Normal mode	S1 in NORMAL position
b. Loopback mode	S2 in LOOPBACK position

3.3 Typical Applications

This section describes some typical applications where the LD485A-MP might be used. The connections shown in the figures are for the RS-485 port.

Figure 3-4 shows a typical point-to-point, 4-wire, full or half duplex connection with both LD485A-MPs terminated by setting switch S2 to the TERM position. **Figure 3-5** shows a typical point-to-point, 2-wire, half duplex connection with both LD485A-MPs terminated by setting switch S2 to the TERM position.

In a 4-wire, point-to-point application, each of the drivers on the two LD485A-MPs may always be enabled without any adverse effects.

In a 2-wire, point-to-point or multipoint application, only one driver may be enabled at any one time. If more than one driver is turned ON, a situation known as contention occurs and the data from one driver interferes with the data from the other driver. This results in both sets of data being unintelligible.

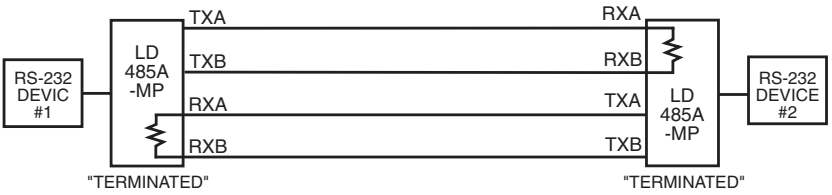


Figure 3-4. Point-to-Point, 4-Wire (Full- or Half-Duplex).

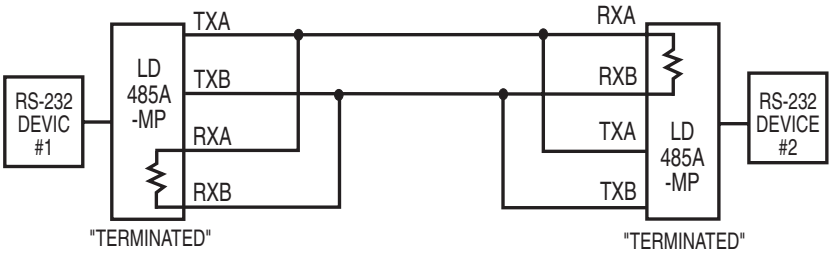


Figure 3-5. Point-to-Point, 2-Wire (Half-Duplex).

Figure 3-5 shows a typical multipoint, 4-wire, full- or half-duplex connection. **Figure 3-6** shoes a typical multipoint, 2-wire, half-duplex connection. In the multipoint applications depicted in **Figures 3-6** and **3-7**, the devices at the extreme opposite ends of the installation are terminated by setting switch S2 to the TERM position. These devices are the two devices that have the greatest cable length between them, not necessarily the devices that are physically located the farthest apart. (See **Figures 3-5** and **3-6**). A resistor shown in the circuit indicates that the termination resistor has been selected via switch S2. Please note that although **Figures 3-5** and **3-6** show only four LD485A-MP devices networked together, up to 64 units can be connected in the manner shown in **Figure 3-5**, and up to 32 units as shown in **Figure 3-6**.

Sample Multipoint Configuration

In the following application, an industrial controller is used to gather information from several remote programmable logic controller (PLC) stations (see **Figure 3-5**). A system protocol has been defined such that all the programmable logic controllers receive the information sent by the industrial controller, but only the remote station specifically addressed will respond. In this system, the industrial controller and all the remote stations are DTE devices. The step-by-step installation procedure follows **Figure 3-7**.

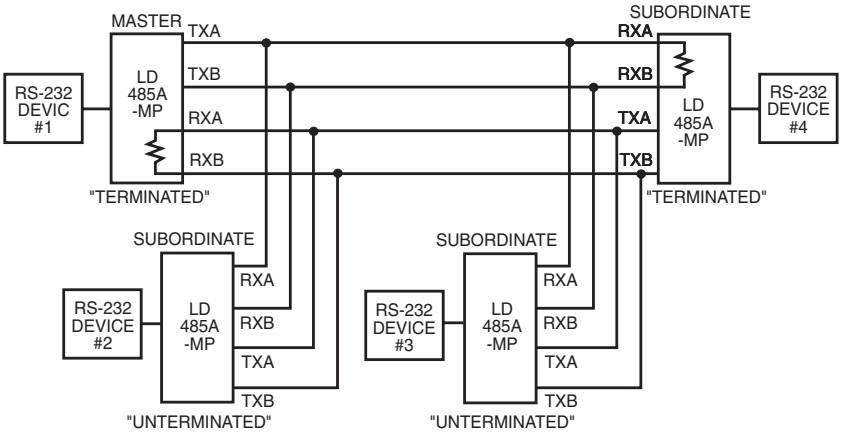


Figure 3-6. Multipoint, 4-Wire (Half- or Full-Duplex).

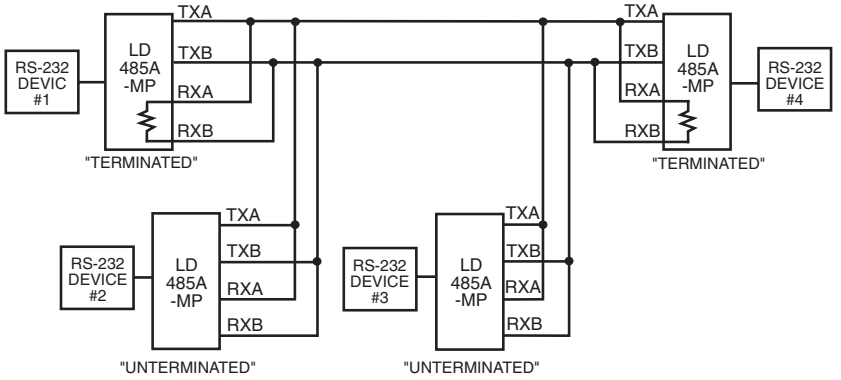


Figure 3-7. Multipoint, 2-Wire (Half-Duplex).

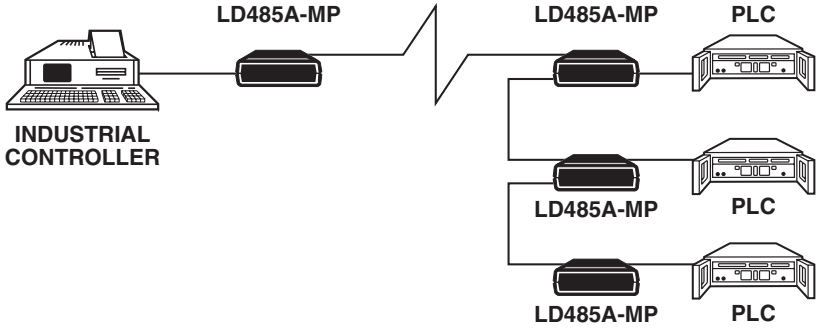


Figure 3-8. Sample Multipoint Operation.

1. Set all the LD485A-MPs for DCE operation (jumper XW1 in the A position).

2. Connect a straight-through cable from the RS-232 port on each LD485A-MP to the RS-232 port on each of the PLCs.

3. Set all the LD485A-MPs for normal operation (switch S1 in the "Normal" position).

4. After a remote station has been addressed, two-way data transmission can occur between that station and the industrial controller until the industrial controller sends a "CLEAR" command. This command causes the remote PLC to resume data logging while waiting to be addressed again. Therefore, set each LD485A-MP for full-duplex operation (jumper W8 in the "FULL" position).

5. Connect the LD485A-MPs together via a 4-wire twisted pair cable (see **Figure 3-6**).

6. Terminate (switch S2 in the TERM position) the two LD485A-MPs that have the greatest cable run between them and leave the others unterminated (switch S2 in the UNTERM position).

7. Since all the remote PLC stations must be inactive until addressed, the RS-485 driver of each remote LD485A-MP must not be constantly enabled (W9 of each remote LD485A-MP must be set to a position other than ON). The remote PLCs are fairly far from the industrial controller in our example, so it would be wise to set the CTS Delay (jumper W9) for 5 msec. This allows the line to stabilize after a remote PLC becomes active but before it starts to transmit.

8. Set jumper W9 on the LD485A-MP connected to the industrial controller to the ON position. This allows the industrial controller to transmit to the remote PLCs without having to wait for any delay period.

9. Set jumper W9 on the LD485A-MP connected to the industrial controller to the ON position. This allows the RS-485 driver to be enabled via the RS-232 control leads (when jumper W18 is in position A-B, DTR enables the RS-485 driver, and when jumper W18 is in position B-C, RTS enables the RS-485 driver).

10. Jumpers W16 and W17 are not used in this application and may be set in any position without affecting the operation of the unit.

11. This completes the configuration procedure. The system can now be activated.

Appendix A: Pinning

Table A-1. RS-232 Interface.

Pin	Circuit	Description	Signal Type	Direction
1	AA	Protective Ground	Ground	
2	BA	Transmitted Data	Data	To DCE
3	BB	Receive Data	Data	From DCE
4	CA	Request to Send	Control	To DCE
5	CB	Clear to Send	Control	From DCE
6	CC	Data Set Ready	Control	From DCE
7	AB	Signal Ground	Ground	
8	CF	Data Carrier Detect	Control	From DCE
9	—	+ DC Test Voltage		
10	—	- DC Test Voltage		
11	—	Unassigned		
12	SCF	Secondary Data Carrier Detect	Control	From DCE
13	SCB	Secondary Clear To Send	Control	From DCE
14	SBA	Secondary Transmit Data	Data	To DCE

Table A-1. RS-232 Interface (continued).

Pin	Circuit	Description	Signal Type	Direction
15	DB	Transmit Signal Element Timing (DCE)	Timing	From DCE
16	SBB	Secondary Receive Data	Data	From DCE
17	DD	Receiver Signal Element Timing	Timing	From DCE
18	—	Local Loopback	Test	To DCE
19	SCA	Secondary Request To Send	Control	To DCE
20	CD	Data Terminal Ready	Control	To DCE
21	CG	Signal Quality Detector	Control	From DCE
22	CE	Ring Indicator	Control	From DCE
23	CH	Data Signal Rate Selector (DTE)	Control	To DCE
		or		
	CI	Data Signal Rate Selector (DCE)	Control	From DCE

Table A-1. RS-232 Interface Pinning (continued).

24	DA	Transmitter Signal Element Timing (DTE)	Timing	To DCE
25	—	Test Mode	No Signal	

Table A-2. RS-485 Pinning Chart.

Pin Name	Description
TXA and TXB	Data received by the LD485A-MP at the RS-232 port is transmitted out of the unit over twisted pair wires via these two outputs. The “TX” LED indicates the state of these two leads. When the TXA lead is positive with respect to the TXB lead (a “zero” is being transmitted), the “TX” LED is lit.
RXA and RXB	These are the received data inputs for the RS-485 port. The status of these leads is monitored by the “RX” LED. When the RXA lead is positive with respect to the RXB lead (a “zero” is being received), the “RX” LED is lit.