# LDM35

## Signal Powered Limited Distance Modem

### Description

The LDM35 series of products is designed to allow video display terminals (VDTs) and other RS-232 devices to be connected over distances sufficient to cover any industrial or institutional complex of buildings. These modems feature a rugged enclosure small enough to mount on the back panel of VDT units, saving valuable desk and floor space.

The LDM35 series does not require a power supply for operation. The use of low power circuits and a sensitive optical receiver allows the devices to derive all necessary power from the RS-232 data and control signal. They are designed for full-duplex, asynchronous operation over two, DC-continuity, non-loaded, twisted-wire pairs. Two-wire simplex operation may be accomplished over two wires. The modem circuits and, consequently, the host device are protected from electrical transients due to lightning strikes or operation of heavy industrial equipment.

Each device features a convenient Data-Communication Equipment (DCE) to Data-Terminal Equipment (DTE) switch which reverses pins 2 and 3 of the RS-232 connector. For installation and troubleshooting, each unit has diagnostic Light-Emitting Diodes (LEDs) on the transmit and receive lines.

The RS-232 connector may be ordered as a male or female 25-pin connector. Field connection is made through a modern, solderless, screw-termination assembly. Alternatively, a convenient four-wire modular phone jack (RJ-11) is available.

### ▶ Features

- Signal-powered: No Power Source Required
- Optical Isolation: Breaks Ground Loops
- Heavy Duty Surge Protectors: Prevents Lightning Damage
- LED Diagnostic Indicators: Simplifies Installation and System Troubleshooting
- Operation to Two Miles (3.3km) at 9600 Baud, One-Half Mile (0.8km) at 19,200 Baud, Seven Miles (11.7km) at 1200 Baud
- Four-Wire Full Duplex, Two-Wire Simplex
- Selection of Connectors
- Wide Operating Temperature Range, 0°C to +70°C
- Null Modem Switch
- CE Compliant

Dataforth does not authorize or warrant its products for use in life support/critical applications.

### Specifications

| Model | LDM35 |
|---|---|
| Baud Rate Range | 0-19.2K |
| Baud Rate | 19.2K 9.6K 4.8K 2.4K 1.2K-0 |
| Distance(miles) | 0.5 2.0 3.0 5.0 7.0 |
| Distance(km) | 0.8 3.2 4.8 8.1 11.3 |
| Common Mode Isolation | Surge: 500V<br>Continuous: 300V |
| Differential Mode Surge Protection (3 devices) | ANSI/IEEE C37.90.1 |
| Modes | Asynchronous 4-wire full-duplex, 2-wire simplex |
| Channel Lines(1) | TD, RD |
| Control Lines(1) | RTS, CTS, DTR, DSR, RLSD |
| Power | RS-232 data and control signals |
| RS-232 Data | ±5V to ±15V, 3.0mA to 10.0mA |
| RS-232 Control Signals | ±6V to ±15V, 3.0mA to 10.0mA |
| Environmental: | |
| Operating Temperature Range | 0°C to +70°C |
| Storage Temperature Range | -10°C to +85°C |
| Relative Humidity | 0-95%, non-condensing |
| Dimensions | 3.6" x 2.1" x 1"<br>(91.4mm x 53.3mm x 25.4mm) |
| Weight | 3.2 oz (91g) max |
| MTTF(2) | >150,000 hrs |

NOTES:
(1) TD = Transmit Data, RD = Receive Data, RTS = Request To Send, CTS = Clear To Send, DTR = Data Terminal Ready, DSR = Data Set Ready, RLSD = Received Line Signal Detect.
(2) Ground-benign environmental conditions (no salt atmosphere, <50°C ambient temperature).

## Interface

Pin 4 (RTS) internally connected to pin 5 (CTS).
Pins 6 (DSR), 8 (RLSD), and 20 (DTR) are internally connected.
Either pin 4, pin 5, pin 6, pin 8, or pin 20 must be asserted (high) by the host equipment for operation.
Pins 2 (TD) and 3 (RD) are switch-reversible.
Pin 7 is signal ground.
Field connections are indicated on the unit label.
The LDM35 logic diagram is shown in Figure 1.

| RS-232 P1 Pin Descriptions | | | | Field P2 Pin Descriptions | | |
|---|---|---|---|---|---|---|
| | | | | Screw Terms | Phone Jack | |
| Pin 1 | CASE | | Case Ground | Pin 1 RD+ | Pin 2 RD+ | RJ-11 |
| Pin 2 | TD | [3] | Transmit Data | Pin 2 RD- | Pin 3 RD- | |
| Pin 3 | RD | [2] | Receive Data | Pin 3 TD+ | Pin 4 TD+ | |
| Pin 4 | RTS | [7] | Req. To Send | Pin 4 TD- | Pin 5 TD- | |
| Pin 5 | CTS | [8] | Clear To Send | | | |
| Pin 6 | DSR | [6] | Data Set Ready | | RD+ = Receive Data + | |
| Pin 7 | GND | [5] | Signal Ground | | RD- = Receive Data - | |
| Pin 8 | RLSD | [1] | Receive Line Signal Detect | | TD+ = Transmit Data + | |
| Pin 20 | DTR | [4] | Data Terminal Ready | | TD- = Transmit Data - | |

Pin numbers given are for the 25-pin connector with the 9-pin equivalent in [ ].

## Cable Capacitance Effects On Distances

Specified distances are for the wire sizes 18-24AWG (0.82-0.20mm$^2$) with a maximum capacitance of 25pF/ft (82pF/m). For higher capacitance cables, decrease distance specifications for 2400 baud and above by a proportionate amount. For example, shielded cable with 50pF/ft (164pF/m) would reduce the distances by 50%. For host-powered units, distances for 1200 baud and below are reduced proportionately. Recommended wire gauges are #18 to #24 (0.82-0.20mm$^2$).

For baud rates of 1200 and below, distances are limited by DC voltage drop. For 2400 baud and above, distances are limited by pulse distortion. The use of low-capacitance cable can extend the distances shown. Belden 9182 and 9184 are, respectively, single and dual twisted-pair cables that are especially designed for high-speed data communications applications. With these cables the distances can be extended by 50%. However, the DC-resistance-limited distance given under 1200 baud may not be exceeded.

Cable capacitance for individually shielded wire pairs is usually given by manufacturers as capacitance between wires and capacitance from each wire to the shield. The effective transmission line capacitance is approximately the interwire capacitance plus one-half of the wire-to-shield capacitance.

## Power Requirements

Model LDM35 is powered by the RS-232 data and control signals from its host computer or terminal device. It receives power from Data Terminal Ready, pin 20 or Request To Send, pin 4, and Transmitted Data, pin 2. Transmitted data may be on pin 3 when the DCE/DTE switch is in the DTE position. For proper operation, minimum required signal voltage level is ±6V at 3.0ma to 10.0ma.

When possible, power should be obtained from the control lines. A recommended operating method for computer software drivers is as follows.

1. Disable Request To Send (RTS) and do not detect Clear To Send (CTS).

2. Enable Data Terminal Ready (DTR). Data Set Ready (DSR) and Receive Line Signal Detect (RLSD) may now be detected if desired.

Some software drivers will normally enable RTS and detect CTS. For those systems with software drivers for which RTS/CTS may not conveniently be operated as described in step 1, the unit will function normally. However, transmission distance will be reduced with high capacitance cables when heavy full-duplex data traffic is expected.

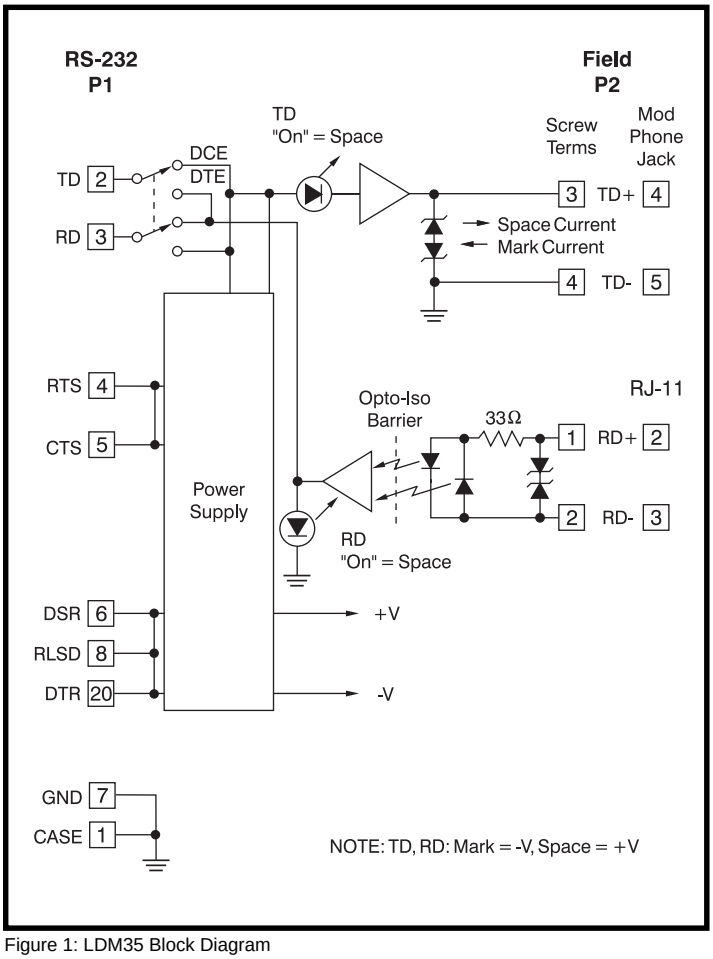


Figure 1: LDM35 Block Diagram

## Installation

Installation of the LDM35 consists of attaching it to its mating 25-pin connector on the terminal or host computer.

In some cases an RS-232 cable will be used to connect to the RS-232, 25-pin connector of the LDM35. Mounting screws are provided for the male connector, and the female connector has threaded standoffs for connection to cables.

The DCE/DTE switch must be set to be complementary to the terminal or computer port (DCE connects to DTE and DTE to DCE). For example, a terminal connector will most likely be DTE-wired; thus LDM35 must be set to DCE to work with the DTE-wired connector. Since the LDM 35 is a data communication device, its normal switch setting will be DCE. The DTE position is provided as a convenience when it must be connected to DCE equipment, such as computer ports or other modems.

In the event that the wiring of the host port is not known, the LED indicators will indicate the proper setting. The LED indicators come on during the occurrence of "SPACE" conditions on the transmit and receive lines. The "MARK" condition is the standby condition when the DCE/DTE switch is properly set on both ends of the correctly wired communications cable. Cable connections are shown in Figure 2. The LEDs will most often be off, coming on momentarily during the passage of a burst of data.

If the correct setting of the DCE/DTE switch is not known, change the setting to the position that causes the transmit (TD) LED to come on as described above. The repeat key on some terminals is convenient for sending continuous data, causing the TD LED to come on.

A self-test of the LDM35 may be accomplished by connecting TD+ to RD+ and TD- to RD- on the same unit; then a terminal or computer may transmit data to itself as a test. Both the TD and RD LEDs should be off when data is not being transmitted and come on during data transmission. This test verifies that the LDM unit is working properly.

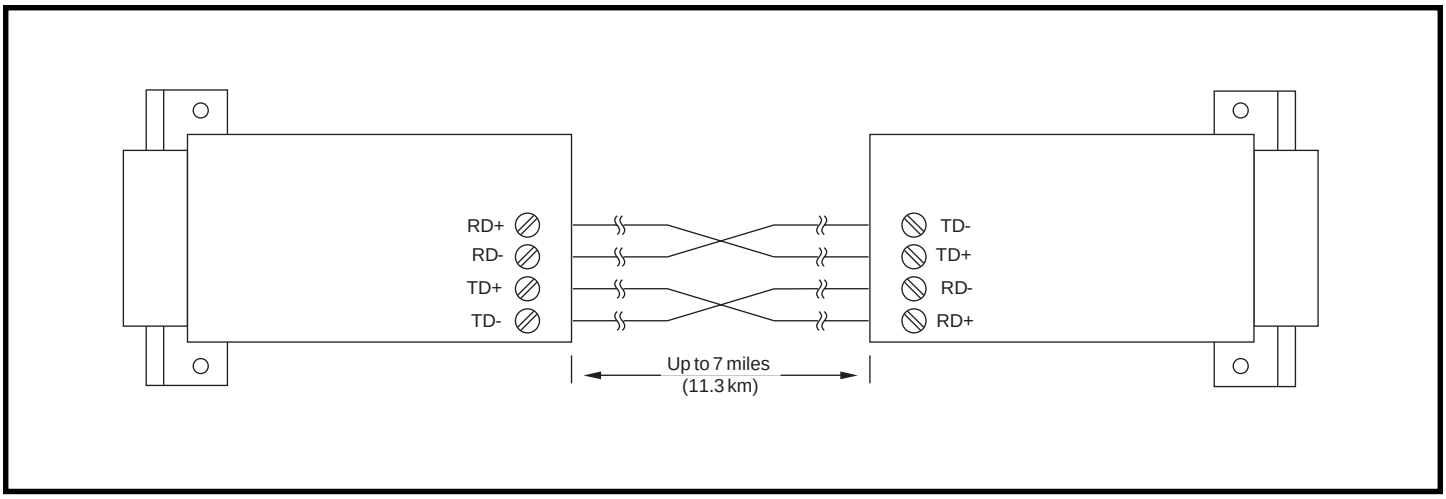


Figure 2: LDM35 Field Connections

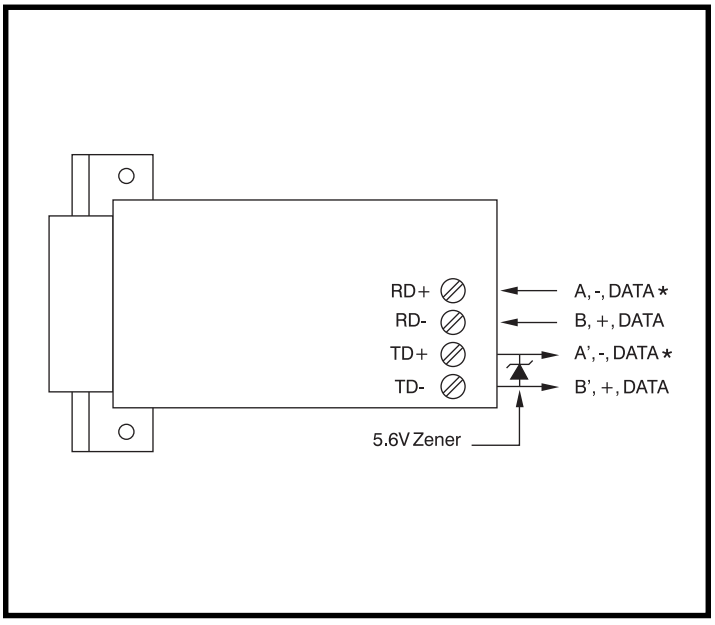


Figure 3: RS-232/RS-422 Conversion

## Application Note - RS-232 to RS-422 Conversion

The LDM35 may easily be used as a converter for the data channels of RS-232 and RS-422 interfaces. To make the LDM35 output RS-422-compatible, connect a 5.6V zener diode cathode to TD+ and anode to TD-. This may easily be accomplished on the screw terminals. The TD+ output is then connected to the RS-422 external device A' input and the TD- output to the B' input. The outputs of the RS-422 external device are connected B output to RD- and A output to RD+. If a terminating resistor is used, it should be 150Ω or greater.

## Ordering Information

| Model | 25-Pin Connector | Termination |
|---|---|---|
| LDM35-P | Male | Screw terminals |
| LDM35-S | Female | Screw terminals |
| LDM35-PJ | Male | RJ-11 phone jack |
| LDM35-SJ | Female | RJ-11 phone jack |

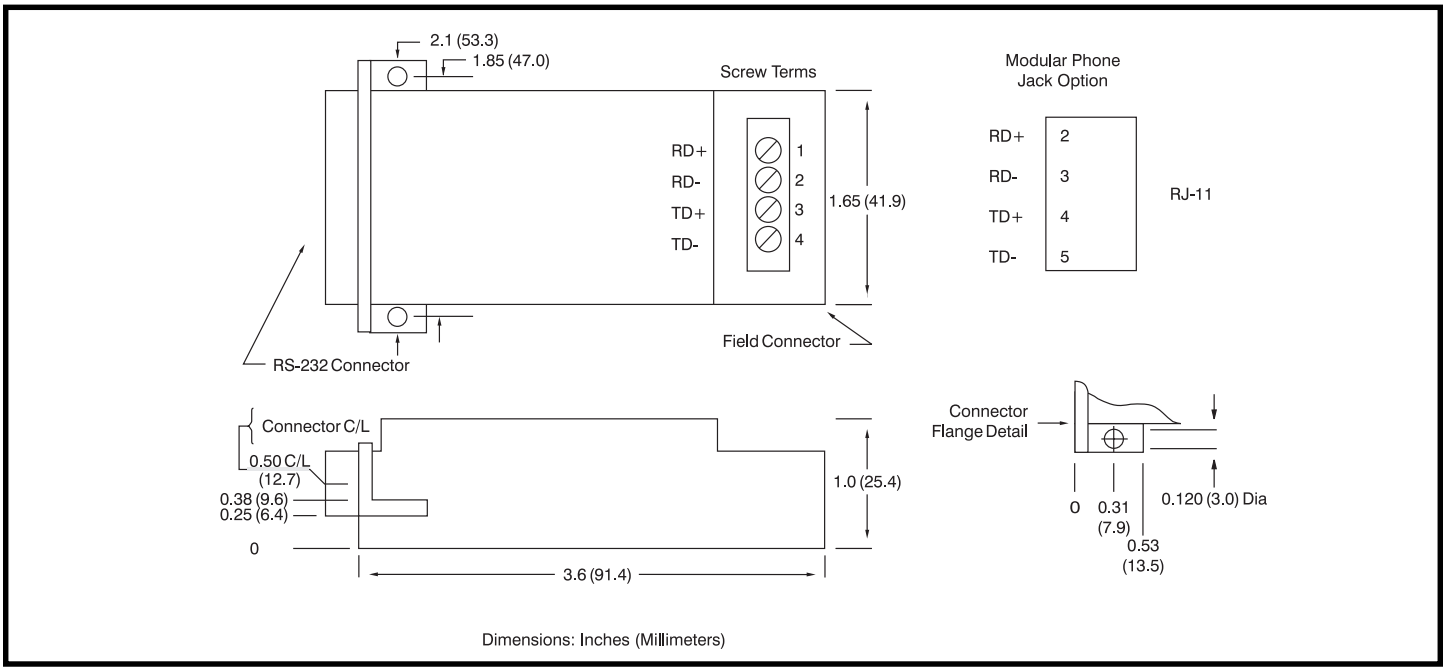


Figure 4: LDM35 Dimensions