DATA-LINC GROUP

USER GUIDE

INDUSTRIAL DATA COMMUNICATIONS

LLM1100

Bell 202 / V.23 - 1200 Baud Modem

It is essential that all instructions contained in the User Guide are followed precisely to ensure proper operation of equipment.

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Introduction

The Data-Linc Group LLM1100 is a Bell 202 (CCITT V.23 optional) voice band, 1200 baud modem. The LLM1100 is designed for use on private, leased un-switched telephone lines or any dedicated 2 or 4 conductor wire (twisted or untwisted, shielded or unshielded). It has a range of up to 20 miles on any ordinary wire pairs or unlimited on “loaded” telephone company voice grade (VG-6) leased lines.

Note: Line condition and/or quality can effect the modems range and capability.

The LLM1100 has the ability to operate without handshake lines using the proprietary DataSense™ (DSCC) microprocessor firmware. This feature detects and buffers incoming RS232 data to allow the assertion and stabilization of the FSK carrier before transmitting the buffered characters.

The nominal operating supply voltage for the LLM1100 is 12VDC. An isolated or ungrounded supply, such as a wall plug-in 120VAC to 12VDC power supply (provided as standard) is normally used but the unit can be supplied with an optional 2 conductor screw terminal power connector for use with other external DC supplies.

Bell 202 and V.23 Versions

The LLM1100 is manufactured in two versions for compatibility with either Bell 202 or V.23 lease line modems operating at 1200 baud. If using only Data-Linc Group modems, then either version is interchangeable. Some non Data-Linc Group modems are specific about FSK frequencies that must be used to be compatible.

The LLM1100 will correctly receive both Bell 202 and V.23 frequencies. In the LLM1100, alternate FSK frequencies are selected by choosing the appropriate modem integrated circuit. To produce Bell 202 transmission frequencies (1200 and 2200 Hz), U6 should be a MX614. To produce V.23 transmission frequencies (1300 and 2100 Hz), U6 should be a MX604.

Modem User Configurations

Full Duplex 4 Wire Mode

To operate in full duplex, the LLM1100 must use a 4 wire connection and can have only two units in a point-to-point connection. In full duplex, there is no need for carrier control as both modems will have their carriers transmitting at all times. No handshake signals are used by the modems, but the signals can be asserted by the users equipment and fed back to the connecting equipment if needed.

Half Duplex 2 Wire Mode

The LLM1100 can operate in half duplex 2 wire mode with one master and one or more remote modems. The setup configuration is the same for the master and remote modems. It is the users systems responsibility to provide a timing delay between a received message and a transmitted answer to allow the FSK carrier time to switch directions.

The data flow control can be either DataSense (DSCC) or the RTS line from the connected equipment.

In DSCC mode, the modem senses the characters from the users equipment, turns on the FSK carrier and then sends the buffered characters. All receiving modems detect the carrier, then send the received data out the RS232 port to the users equipment. In DSCC mode, a minimum line turnaround delay of 40 milliseconds is required.

With RTS control, the assertion of the RTS line by the users equipment tells the modem to turn on the transmission carrier. Only the carrier at one modem can be on at any time in a half duplex system or carrier collision will occur and no data can be transferred. The minimum RTS timings are 20 milliseconds pre-transmit delay, 60 milliseconds RTS to data and zero (0) milliseconds RTS off delay at end of data. If adding LLM1100s to an existing system with LLM1000s, a minimum of 100 milliseconds RTS to data delay is required.

In any half duplex system the users system must recognize that incoming data is for this equipment and to respond with data (DSCC) or RTS handshake line to provide the correct timing delays to prevent carrier collisions.

In two wire systems, only the left connector marked “2 WIRE” is used to interconnect all the modems in the system wired in parallel.

When a modem is transmitting data, the local Data In LED (Yellow), the Carrier Detect (Amber) and the Data Out (Green) LEDs on all other modems in the system should be flashing. If they are not, then there is no data flowing between modems.

Delayed CTS Mode (Required when using Modicon equipment)

This mode is selected by setting SW3 to 2 wire mode, and setting dip switch SW2 positions 5 Off and 6 On. This will take the incoming RTS line, delay it by 50 milliseconds, and then assert the CTS line high back to terminal equipment. The data terminal equipment (DTE) must be set to use RTS-CTS handshaking mode. Note that Windows 2000 and beyond does not allow the user to control the RTS line. This mode is normally intended to connect to PLC’s and DTE’s that have normal RTS-CTS controls.

When using delayed CTS mode, move the internal 2 pin jumper at JP3 from position 4 and 5 to 5 and 6. The orange ‘C’ LED on the front of the unit now shows the status of the CTS line out, rather than the received FSK carrier status.

The cable connecting the LLM1100 to the data terminal equipment cannot have RTS tied to CTS at either end.

Half Duplex 4 Wire Mode
The LLM1100 will operate in half duplex 4 wire mode with one master and one or more remote modems.

The master's carrier transmitter "4 wire" line must be connected to the remote's receiver line "2 wire" and vise versa. The master modem's carrier is being transmitted at all times so the remote(s) carrier (Amber) LED will always be on. The remote modem's carrier is only transmitted when a remote modem is actively sending data to the master.

No data flow control is needed at the master as its carrier is always on and ready to transfer data. The data flow control at the remotes can be either DataSense or the RTS line from the connected equipment.

In DSCC mode, the modem senses the RS232 characters from the users equipment, turns on the FSK carrier and then sends the characters. The master modem detects the carrier then the data and sends the received data out their RS232 port to the users equipment.

With RTS control, the assertion of the RTS line by the users equipment tells the remote modem to turn on the transmission carrier. Only one remote carrier can be on at any time in a half duplex system or carrier collision will occur and no data can be transferred. At a remote modem the users system must recognize that incoming data is for this unit and to respond with data (DSCC) or RTS handshake line to provide the correct timing delays to prevent carrier collisions. The minimum RTS timings are 20 milliseconds pre-transmit delay, 60 milliseconds RTS to data and zero (0) milliseconds RTS off delay at end of data. If adding LLM1100s to an existing system with LLM1000s, a minimum of 100 milliseconds RTS to data delay is required.

The Carrier Detect (Amber) LED on all remote modems in the system should be on at all times. FSK data received at the remote will flash the Out (Green) LED when data is sent out its RS232 port. When a remote modem is transmitting data In (Yellow) flashing, the master's Carrier Detect and Data Out (Green) LED will flash.

Simplex or Bits Mode
In Bits mode, the LLM1100 sends data from a master to a remote(s) in one direction only. In this mode, the modem is protocol or format transparent and will only operate in 2 wire mode. The data line is either a binary 1 or a 0 producing a 1 or 0 at the receiving modem(s).

When connecting the modems to each other, make sure to use only the "2 wire" connector terminal block on all modems in the system.

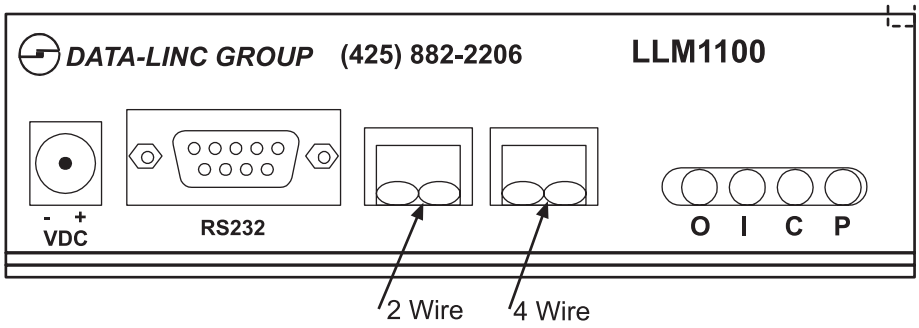
With the modems connected, the Carrier detect LED on the remote modem(s) should be on at all times. The Carrier LED on the master will never be on. When data is moving from the master to the remote modem(s), the Data In (Yellow) LED on the master and Data Out (Green) LED on the remote(s) will flash with the data.

Making Connections

The LLM1100 has four connection points. On the left is the DC power connection. The standard modem has a barrel jack connector for use with the supplied wall mount power supply. A two-position terminal block version is available for applications using a power source other than the standard supply. The DB9 connector is the RS232 interface. To the right of the DB9 are two connections for the carrier wire pairs marked “2 wire” and “4 wire.” These are two-position removable terminal block connectors. In 2 wire mode, the left connector acts as both the transmitter and receiver connector. For 4 wire mode, both connectors are used with one connector as the transmitter and the other as the receiver.

> **Note:** When using the LLM1100 in 4 wire configuration, the transmitter of the master “4 wire” must be connected to the “2 wire” of all of the remote(s) and all remote transmitter “4 wire” are wired in parallel to the master’s receiver connector “2 wire.”

Connection Diagram
LEDs



Red	(P) Power
Amber	(C) Carrier Detect
Yellow	(I) RS232 In
Green	(O) RS232 Out

Power Connector

The barrel jack connector is center pin positive. If optional screw terminal block is used, right terminal is positive (+) and left terminal is negative (-). DC negative is not connected to the chassis.

RS232 Serial Connector

Pin Number	Nomenclature	Function
1	DCD*	Received carrier detect out
2	Tx	RS232 Data Out of Modem
3	Rx	RS232 Data Into Modem
4	DTR	**Not Connected in Unit**
5	Gnd	Signal Ground
6	DSR*	Data Set Ready (connected to CTS)
7	RTS*	Ready to Send (transmit enabled)
8	CTS	Clear to Send (may be connected to RTS or DCD) (connected to DSR)
9	RI	**Not Connected in Unit**

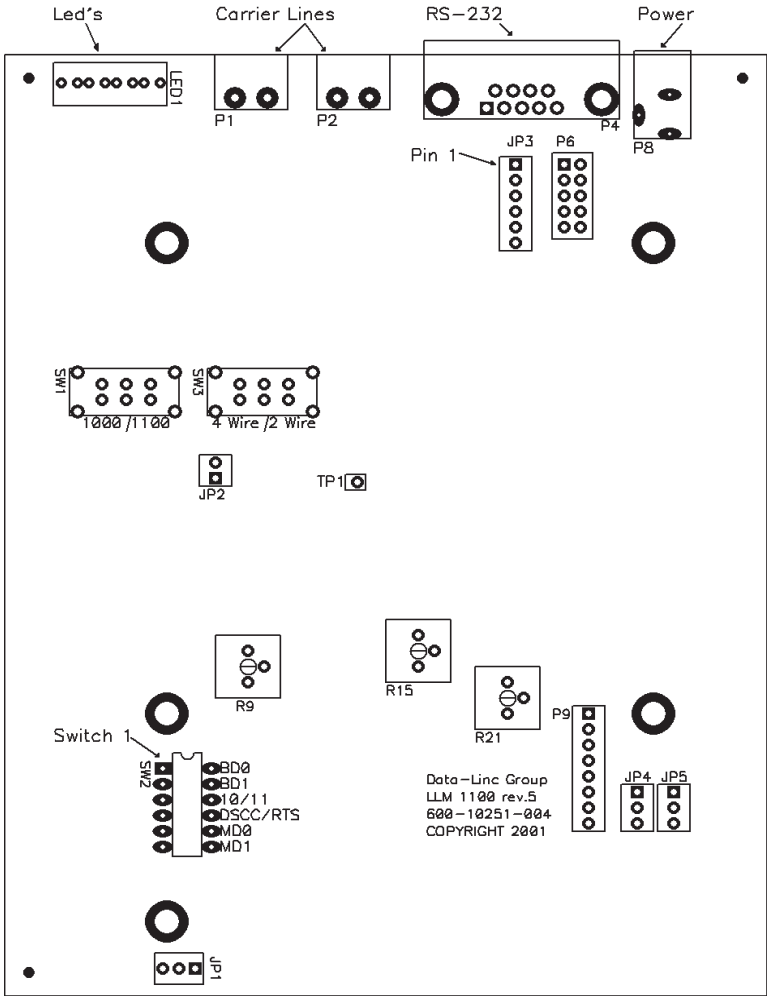
*See handshake description section. DCD via factory jumper to pin 1.

Operating Mode Selection and Wiring

Note: SW3-4 wire with SW2-5 off & SW2-6 off is invalid combination

Wire Type	Mode	Use Connectors	SW3	SW2-5	SW2-6	Notes
2 Wire	Half Duplex Master or Remote(s)	2 wire to 2 wire parallel all units	2 Wire	Off	Off	One Master with one or more Remotes. Carriers flash.
2 Wire	Simplex (Bits) Master	2 wire is out	2 Wire	On	On	Data flows from Master to Remote(s) only. No carrier
2 Wire	Simplex (Bits) Remote	2 wire is in	2 Wire	On	Off	Data flows from Master to Remote(s) only. Carrier on.
2 Wire	Half Duplex Master or Remote(s)	2 wire to 2 wire parrallel all units	2 Wire	Off	On	RTS-CTS delay (Modicon) One Master with one or more Remotes
4 Wire	Half Duplex Master	Cross wire 4 wire to all Remote 2 wire & 2 wire from all Remote 4 wire	4 Wire	On	On	One Master with one or more Remotes.
4 Wire	Half Duplex Remote	Same a 4 wire Master. Cross wire.	4 Wire	On	Off	Remote carrier LED always on.
4 Wire	Full Duplex	Cross connect 2 wire to 4 wire between both units	4 Wire	Off	On	2 LLM1100 modems only. Both carrier LEDs on.

Component Locator Diagram



If LLM1100 is to be used with existing DLG LLM1000s, the SW1 must be set for LLM1000 mode (SW1 set away from SW3).

The LLM1100 is normally pre-configured at the factory to customer specifications. If you need to field configure an LLM1100, you will need the following information:

1. Baud rate of the serial device you are connecting with (unless using simplex).
2. Character format (1 start bit + # data bits + parity + 1 stop bit).
   This must add to 10 or 11 bits. Set SW2-3 On = 11 bits Off = 10 bits.
3. Use of RTS line from user equipment to control the flow of data into and between modems.
   If RTS use is unknown set the unit for DSCC DataSense mode.
   Off = DSCC-DataSense Set SW2-4 On = RTS
4. Either 1 wire pair (2 wire mode) or 2 wire pairs (4 wire mode) Set SW3.
5. Half or full duplex data transmission method, bi-directional or one-way data flow (Simplex).
   Set SW2-5 and SW2-6 from chart.

Note: After changing any switches, remove DC power and reapply to memorize the changes. Switches are only read during power on.

Baud Rate Selection

The LLM1100 will operate at 300, 600 and 1200 baud in a 10 or 11 bit word format. The modem is parity transparent; however, it must know if there are 8 or 9 bits of data/parity. In Bits mode, the LLM1100 is baud rate and protocol transparent. The Baud rate is set using switches SW2-1 and SW2-2.

Baud Rate	SW2-1	SW2-2
1200	Off	Off
600	On	Off
300	Off	On
Not Used	On	On

Character Format

Find the character format of the users equipment and take the number of data bits in a character. If parity used (odd, even, mark, space) add one (1). If parity is none, do not add anything. Add two (2) for one start bit and one stop bit. The result must be 10 or 11. Use SW2-3 to set the length. SW2-3 is OFF for 10 bits, and ON for 11 bits. This switch ignored in simplex mode.

Handshake Lines

If RTS handshaking mode is set the LLM1100 needs the RTS asserted when it is time to transmit data onto the FSK carrier from the users equipment. Depending upon how the modem is configured, it can provide DCD, CTS and DSR signaling back to the users equipment. JP3 is used to configure these lines.

If these lines are needed, perform the following:

Shorting pins 1 and 2 will pull DCD (pin 1) logic high at the DB9 connector
Shorting pins 2 and 3 will pass carrier status to DCD (pin 1) at the DB9 connector
Shorting pins 4 and 5 will route incoming RTS (pin 7) to outgoing CTS (pin 8) and outgoing DSR (pin 6) at the DB9 connector
Shorting pins 5 and 6 will route DSR and CTS to pin 1. If also shorting pins 2 and 3 will also connect DCD (pin 1) to outgoing CTS (pin 8) and outgoing DSR (pin 6) at the DB9 connector

Note: DSR (pin 6) and CTS pin(8) are always connected and DTR

Self-Test

The LLM1100 has a built- in test mode that can verify whether the processor is operating normally. It displays the operating configuration as set by the SW2 switches and the 2/4 wire mode switch SW3.

Note: This feature is only available with firmware version LLM1100548-10007-001A and later.

To conduct the self-test, perform the following:

1. Remove DC power and remove the cover.
2. Temporarily short together the JP1 header pins 1 and 3 while reapplying DC power. A repeating sequence will occur: the Green LED (O) will flash, followed by seven (7) flashes of the Amber LED (“C”).
3. The blinking Green LED is the processor outputting the switch setup and operating mode as serial data at 1200 baud, formatted as 8 data, no parity, 1 stop bit. To view this data, connect a PC to the 9-pin Dsub connector using 3 wires (pins 2,3,5) or a straight-thru serial cable. Start a communications program such as Procom™ or Hyperterminal™ set to 1200,n,8,1. The next set of Green flashes will put the modem configuration on the PC display.
4. The Amber LED flashes are the six positions of SW2 and the position of SW3. A short flash means the switch is in the OFF position. A long flash means it is in the ON position. For SW3 OFF is towards SW1 (4 wire) and ON is away from SW1 (2 wire).
5. Compare the ON/OFF pattern to the setup tables for baud, handshake, number of bits and user operating mode.
6. Remove DC power and any JP1 connections.
7. Reapply DC power to enter your selected operating setup mode.

Technical Specifications

Range	Up to 20 miles on unloaded lines, unlimited on loaded line, depending upon line characteristics.
Operating Frequency	1200/2200 Hz (Bell 202 or 1300/2100 CCITT V.23) FSK (Frequency Shift Key)
Data Rates	300, 600, or 1200 baud half or full duplex up to 1200 baud simplex.
Handshake Modes	DataSense (DSCC) or RTS line
Operating Temperature	14^0 to 158^0 F (-10^0 to 70^0 C)
Power Requirements	100 milliamps max. 11 to 24 VDC external supply barrel jack standard. Optional screw terminal connector.
Enclosure	Standard NEMA 1; 18-gauge steel with mounting flanges.

Technical Support

Data-Linc Group maintains a fully trained staff of service personnel who are capable of providing complete product assistance. They can provide you with technical, application and troubleshooting, spare parts and warranty assistance. Our technical staff is based in Bellevue, Washington USA and may be reached at (425) 882-2206 or e-mail support@data-linc.com

Product Warranty

Data-Linc Group warrants equipment of its own manufacture to be free from defects in material and workmanship for one year from date of shipment to original user. Data-Linc Group will replace or repair, at our option, any part found to be defective. Buyer must return any part claimed defective to Data-Linc Group, transportation prepaid.

Return Material Authorization

If a part needs to be sent to the factory for repair, contact Data-Linc Group's corporate office and request a Return Material Authorization (RMA) number. The RMA number identifies the part and the owner and must be included with the part when shipped to the factory.

Contact Information

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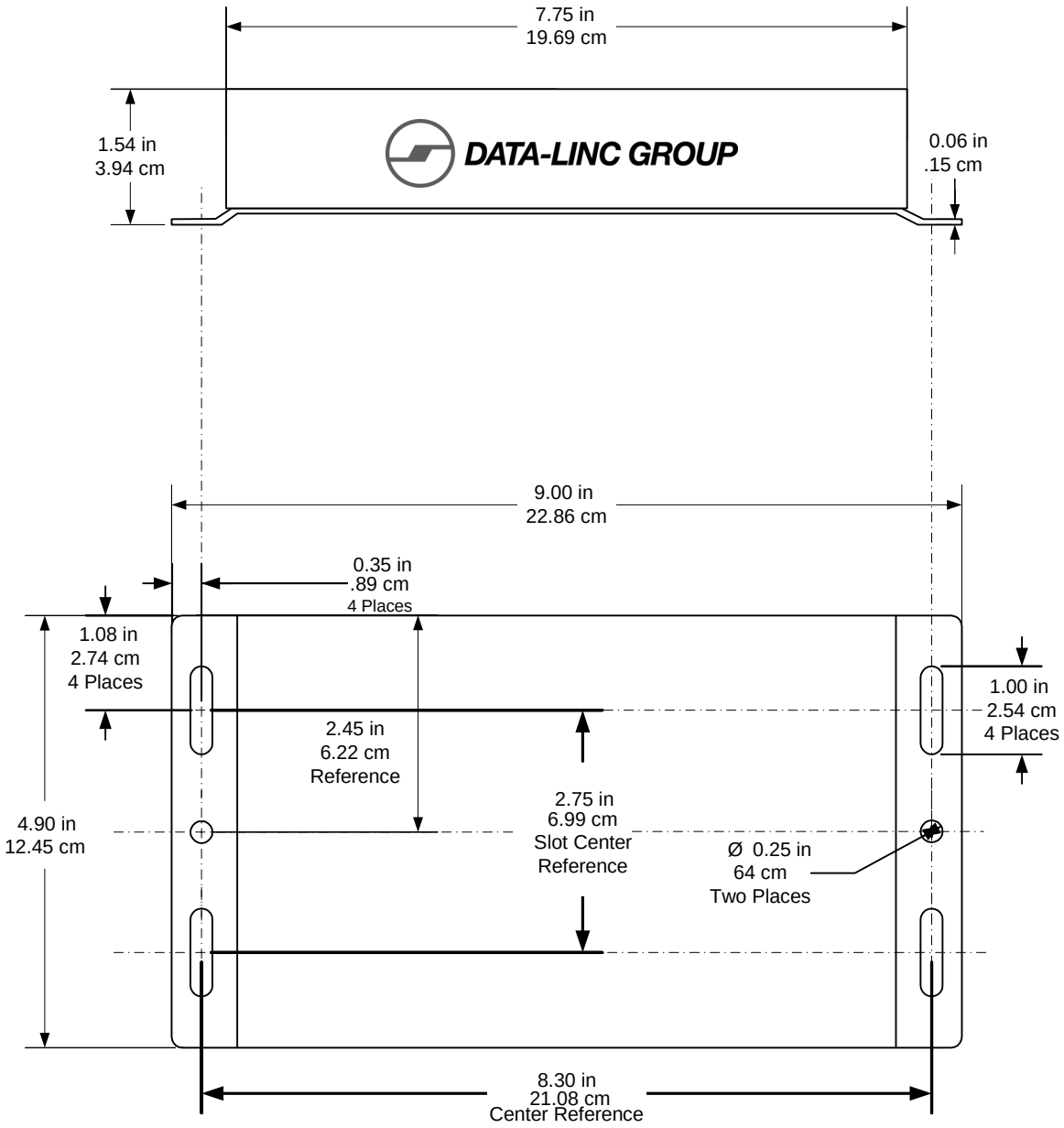
Appendix A
Enclosure Dimensions



Appendix B
AE422 and AE485 Versions

The LLM1100 can be manufactured to interface with either RS232, AE485 (2-wire) or AE422 (4-wire). LLM1100's are converted from RS232 to AE422/485 models by adding an internal converter to the rear of the unit and changing the enclosure back panel to utilize a screw terminal connection.

The AE422 model is a 4-wire, half or full duplex connection with out +/- (transmit) and in +/- (receive) terminals. The back panel has 4 screw terminals.

AE485 is a 2-wire, half duplex only connection with out+/- terminals acting as both transmit and receive connections. The back panel has 2 screw terminals.

When connecting the wire pairs to either AE422 or AE485, it is possible to connect the +/- wire polarity backwards. If you have difficulty in receiving correct data characters, invert the wire pair at one end of the cable. Do not invert both ends of the same cable.

Note: Do not use the 9 pin D-sub connector on the front of the unit when either the AE422 or the AE485 modules are connected to P9 on the circuit board. If AE422/485 cables are connected at the same time as an RS232 cable, the unit will not work.