

# USER GUIDE

INDUSTRIAL DATA COMMUNICATIONS

## LCM100 Line Carrier Modem



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

## FCC Information

Appropriate FCC info

# LCM100

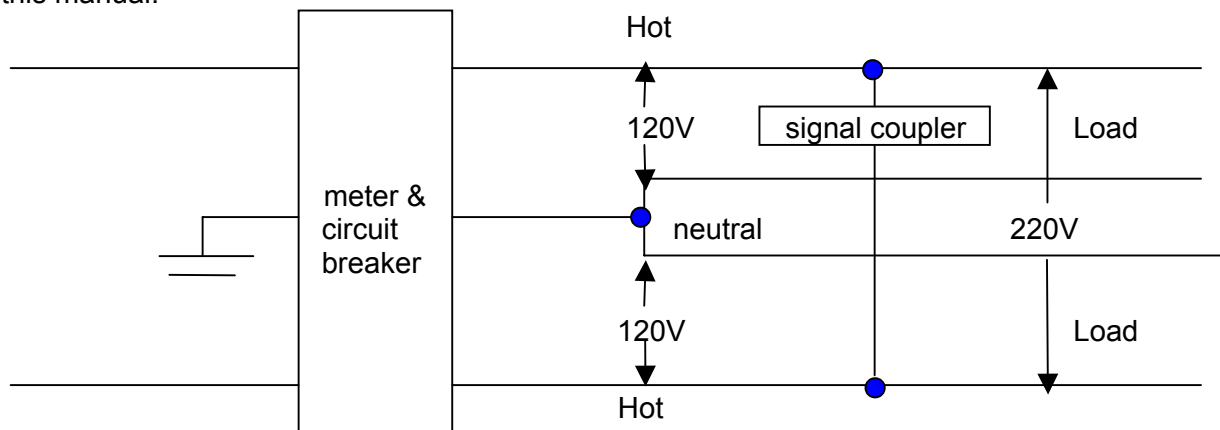
## Line Carrier Modem

### Introduction

In the line carrier system, the hot line supplies current to connected loads and is also used as a *carrier* for data communication between modules. The Data-Linc LCM100 can communicate over the same line in a 240 volt single phase system or on any individual phase of a three-phase system.

**Note:** It will be necessary to have a signal coupler installed to ensure communications over different lines of the 240 volt, single phases system.

In the three-phase power environment, communication will occur freely if both devices are connected on the same phase, but cross-phase communication will require line conditioning by installation of a signal coupler between phases. As shown in Figure 1 below, two signal couplers are sufficient for all cross-plane combinations in a three-phase system. Installation of a signal coupler at the power distribution panel is fully described under the line conditioning section of this manual.



**Figure 1:** Connecting a Signal Coupler, Single Phase System

The green wire is reference (earth) ground. It serves also as chassis ground and reduces equipment susceptibility to RF current, static discharge and interference from fluorescent lamps. The LCM100 system is designed to operate with a reference ground located at the power distribution panel. Reference ground is usually connected to the copy ground bus or to the distribution panel frame.

When the power cord is connected to a three-wire AC power outlet, the bottom round connector serves to ground the chassis, protecting against shock hazard, susceptibility to electro-magnetic interference and possible spurious emissions.

**Note:** If a three-to-two-wire adapter is used to connect to a two-wire AC outlet, the ground lead of the adapter must be connected to earth ground to complete the ground system. An open ground connection may cause a communications defect and/or shock hazard.

Line conditioners in the form of isolators, regulators and surge protectors may be present in the computer system in order to provide clean power, especially on non-dedicated lines. The LCM100 has integral surge protection.

**Note:** The LCM100 should not be plugged into isolator or surge protector devices as this may cause signal degradation. If Detect indicators do not illuminate with both units connected to line power, a coupling capacitor may be required for cross-phase communication (see appendix B).

## Initial Operation

The LCM100 is completely transparent. This means that once the system is correctly installed, it will not be apparent to the system. Like a cable, it requires no attention other than a reliable connection.

With the modules connected to their respective equipment as previously described, ensure that both module's, Detect and Power indicators are illuminated. Data transfer will occur in both directions as commanded by the interconnected equipment.

Sometimes a random glitch on power lines will cause erroneous data characters to appear at either end of the communications line. This is to be expected, especially during periods when the equipment is idle. Error correction procedures appropriate to your computer operating system can be taken to remove the spurtic characters.

## Troubleshooting

The following are methods of eliminating the cause of communication difficulties, which may occur with the LCM100.

### Fuses

Each module has a fuse located internally. Replace only with a fuse of similar rating of ½ amp 3 AG.

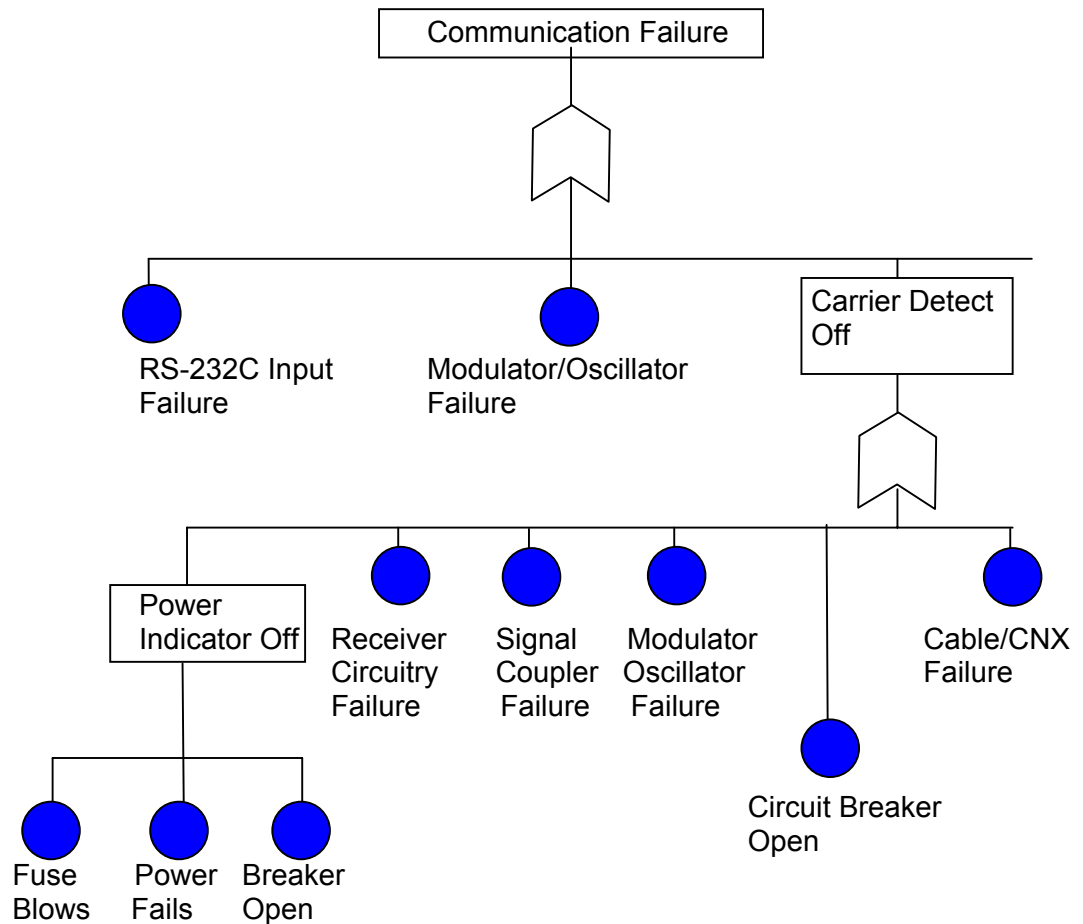
### Troubleshooting Technique

If communication difficulties are encountered, first check for proper cable connections at the power receptacles, and at both RS-232C interface cables. An indication of faulty FSK communication between modules is a missing Detect indicator at either module. An indication of faulty power line connection is the missing power indicator at either module.

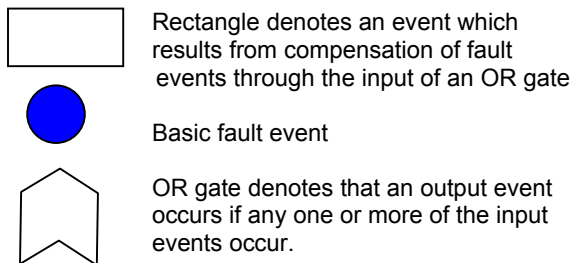
To isolate a communications problem from the RS-232C interface, simply connect the equipment directly, without going through the LCM100 modules. If the problem persists, then the defect probably lies within the equipment and not the LCM100.

To isolate line carrier problems from the power distribution circuits, connect each module's power receptacle into a common power distribution circuit—for example, at the same outlet or through an extension cord. If communications occur at one outlet, but not at another, then the problem is probably due to lack of coupling between phases.

**Note:** The LCM100 does not use the handshake lines; therefore, communication protocol codes will possibly need to be implemented in order for the LCM100 to operate effectively.



### Fault Tree Legend



**Figure 2: Fault Tree**

## LCM100 Technical Specifications

Power requirements	120 volts at +/- 10%, 50-60 Hz, 4.5 watts. Power is on when module(s) are connected
Data Rate	Up to 9600 baud
Data Formats	Any serial asynchronous format up to 9600 baud
Operation	Full Duplex
Receive Sensitivity	20 millivolts
Transmit Level	250mW into 3 ohms
Interface	EIA RS-232C Interface Standard
Mating Connectors	Female, DB-25P
FSK Carrier	Highband: Space 150 kHz, Mark, 156.5 kHz Lowband: Space 100 kHz, Mark, 106.5 kHz Bandwidth: 10 kHz
Indicators	Power: Red LED indicates power on Carrier Detect: Green LED indicates carrier signal is being received over power line from other module
Environment	Operating Temperature: 32° to 158° F (0 to 70° C) Storage: -40 to 185 F (-40° to 85 C) Humidity: Up to 90% (non-condensing)
Dimensions	7.25" x 4.85" x 2.55" (184mm x 123mm x 64mm)

## 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 are based in Redmond, Washington USA and may be reached at 425.882.2206 or email [support@data-linc.com](mailto: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

### Corporate Office

### Data-Linc Group

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Suite 100  
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Web site: [www.data-linc.com](http://www.data-linc.com)

## Appendix A

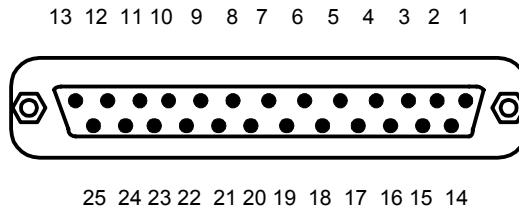
### RS-232 Connector Pin Assignments

Both modules of the LCM100 have female DB-25 connectors which can be directly connected to DTE and DCE equipment. All output levels are a minimum of +6 volts when active and a maximum of -6 volts when inactive, measured in a 3k ohm load. Inputs will sink 10Ma and have a typical turn-on threshold of +1.25 volts and a turn-off threshold of +0.8 volts.

<b>J2 Pin</b>	<b>Description</b>
1	<b>Ground</b> In the RS-232C environment, this line provides a safety frame ground for RS-232 equipment.
2	<b>Transmit Data (Output)</b> This line transfers data to the RS-232C device.
3	<b>Receive Data (Input)</b> This line accepts data input from the RS-232C device.
4	<b>Request to Send</b> Request to send output; indicates that the terminal is ready to transmit data. This line is enabled, pulled up to +12 volts through a 4.7K ohm resistor.
5	<b>Clear to Send</b> Clear to Send input; acknowledges that the terminal may begin transmission. This line is enabled, pulled up to +12 volts through a 4.7K ohm resistor.
6	<b>Data Set Ready</b> Data Set Ready input; acknowledges that the remote device is on and operational. This line is enabled, pulled up to +12 volts through a 4.7K ohm resistor.
7	<b>Signal Ground</b> This line provides a common signal connection.
8	<b>Carrier<sup>2</sup> Detect (Output)</b> This line is a high level (+12 VDC) when carrier is detected, and a low level (-12 VDC) when carrier is not detected.

### Connector J2 (Female)

Please note that male pin numbering is a mirror image of the female connector depicted below:



**Figure 3:** DB-25P J2 Connector Pins

<b>J2 Pin</b>	<b>Description</b>
9-19	Pins 9-19 are unused, open.
20	<b>Data Terminal Ready</b> Data Terminal Ready output; indicates that the terminal is on and operational. This line is enabled, pulled up to +12 volts through a 4.7K ohm resistor.

#### Notes

1. On the LCM100-1 module pin 8 is not carried at the connector through P3 because most computers provide this signal. Pin 8 may be carried to the connector, if desired.
2. On the LM100-2 module, the carrier detect signal is available at the connector because the interconnected equipment is receiving a signal. Pin 8 may be disconnected at P3, if desired.

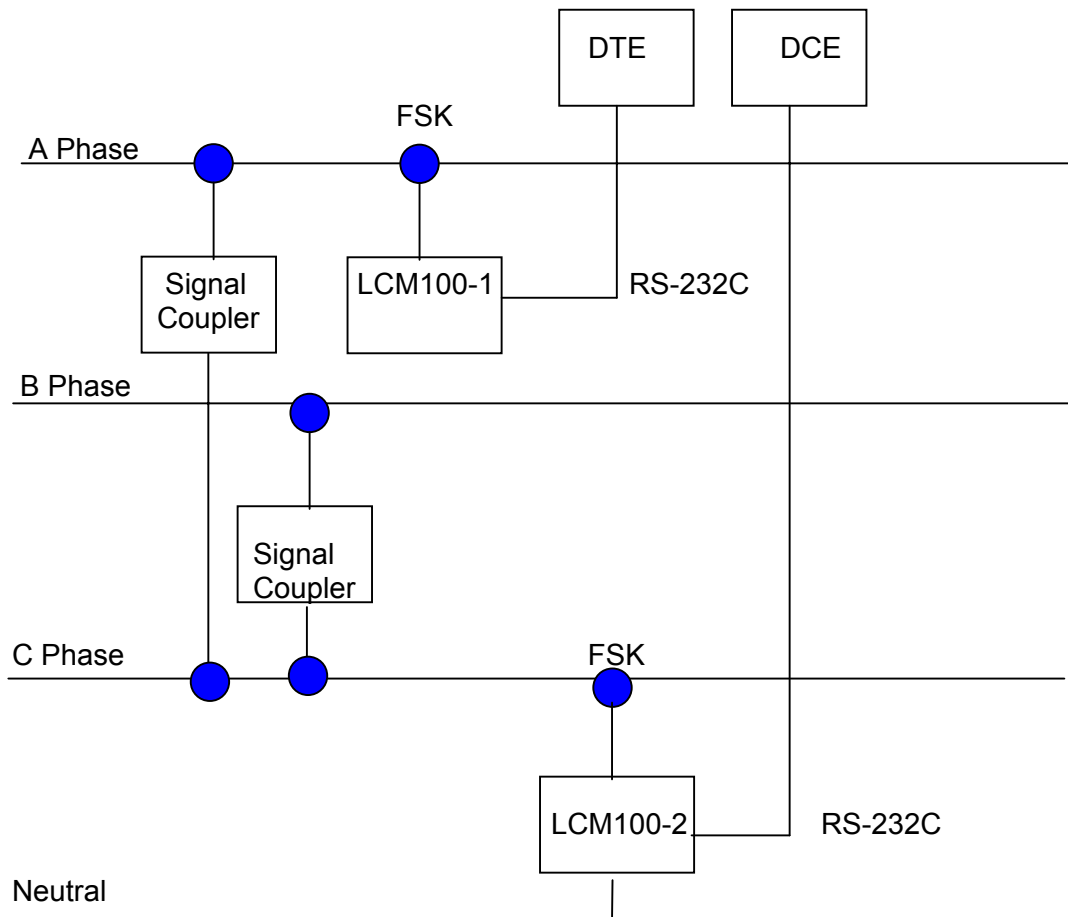
## Appendix B

### Line Conditioning

In some industrial installations, power lines must be conditioned to prevent the FSK signal from being shunted by distributed capacitance possibly associated with other loads connected to the line. Motors and transformers, for example, may have very high distributed capacitance. Adequate communication in such circumstances may require: 1) installation of signal couplers at the power distribution panel to provide a low impedance path between different hot lines; 2) isolation of noisy equipment or equipment that presents a low impedance to high frequency signals, such as some power line filters commonly used with computer equipment.

### Signal Couplers

One signal coupler is sufficient for all cross-phase communications in a signal phase system. See Figure 4 below:



**Figure 4:** Signal Coupler in Three Phase Systems

## Appendix C System Block Diagram

