

LL Plus Modems

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FCC Requirements, Part 15

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at the user's own expense.

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May 26, 2016
Firmware Version: 2.2 – 2.5

1. DESCRIPTION

The LL Plus modems are designed for synchronous or asynchronous operation over 4-wire leased telephone lines. The modems can be set up via the LCD front panel or through the network management port.

The LL 9.6+ is a V.29 modem operating at synchronous rates of 9600, 7200 or 4800 bps or asynchronous rates of 9600 or 4800.

The LL 9.6 FP+ operates at synchronous speeds of 9600, 7200 or 4800 bps in either V.29 or fast poll mode. It will also operate at asynchronous rates of 9600 or 4800 over 2-wire or 4-wire lines.

The LL Plus modems are available in stand-alone configurations or can be installed in the DCB MR modem rack, which holds up to 8 modems.

Special features of the LL Plus modems include the following:

- Set up and control through the front panel or through the network management port.
- Remote modem control capability .
- Eprom cartridge for easy firmware upgrades.
- Sync or async operation.
- Upgrade capability of LL 9.6+ to 9.6 FP+.
- DC power options are available for 12, 24, 48 or 125 VDC.

2. SPECIFICATIONS

2.1 Product

2.1.1 Data Signaling Rates and Modulation

LL 9.6+ Modem

CCITT V.29 modulation

2400 baud modulation

QAM modulation

9600 bps

7200 bps

4800 bps

LL 9.6 FP+ Modem

Fast Train modulation mode: 11 milliseconds fast poll RTS-CTS delay

CCITT V.29 modulation same as LL 9.6+

2.1.2 Transmission Line

4 wire leased line, unconditioned

2 wire leased line, unconditioned (FP+ only)

2.1.3 Operating Mode

Full duplex

2.1.4 Transmit Levels (dBm)

0, -3, -5, -7, -9, -11, -13, -15

2.1.5 Receive Level Threshold

-26 (normal) or -43 dBm receive level sensitivity

2.1.6 Timing

Synchronous mode : Internal, external or slave timing

Asynchronous mode: 9600 or 4800 bps

2.1.7 Request to Send/Clear to Send Delay

V.29: 240-270 milliseconds

Fast Poll: 10-30 milliseconds

2.1.8 Loopbacks

- Local Digital
- Local Analog
- Line Loop
- Remote Line Loop
- Remote Digital

2.1.9 Connectors

- Telephone line connector: 4 wire, RJ-11
- Digital connector: DB-25 female, RS-232D, V.24

2.2 Environmental

- Operation: -40 to +75° C, less than 95% relative humidity, non-condensing
- Storage: -40 to 85° C, 10 to 85% relative humidity

2.3 Physical / Electrical

- 10.25" W x 9.75" D x 2.5" H
- 120 VAC external power supply
- 30 watts, .25 amps

2.4 Network Management Port Commands

- Show Configuration
- Configure Modem
- Modem Type
- Set ID
- Measure Level
- Test Line
- Testing Tools
 - Analog Loopback
 - Digital Loopback
 - Line Loopback
 - Send 1004 Hz
 - End Tests
 - Show RS-232
 - Show Eye Quality
 - Activity Counts
 - Zero Counts
- Reset to Default
- Reset Modem
- NM Parity
- Disconnect NM Port
- Help

3. INSTALLATION

3.1 Unpacking

The following is included with all LL Plus modems:

- LL Plus modem and external power supply
- 4 wire spade lug to RJ-11 modular cable
- RJ-11 to RJ-11 modular cable
- RJ-11 to RJ-45 modular cable
- manual
- information regarding warranty, maintenance contract and repair

3.2 Location

Place the modem in an uncluttered area where you can reach the front panel for set up and the rear panel to connect the cables. The LL modem has an external power supply that is plugged into a 120 VAC outlet. The total power cord length is about 10 feet.

3.3 Setup

LL Plus modems will work in most applications right out of the box. The default configuration covers 90% of typical applications. The defaults are as follows:

LL 9.6+

9600 BPS
Sync
Internal Clock
-43 dBm Receive Level
0 dBm Transmit Level
RTS forced ON
Tx data NOT clamped by RTS

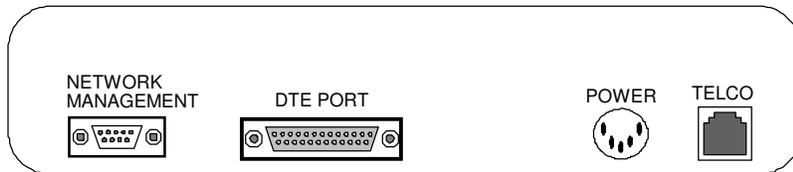
LL 9.6 FP+

| <u>Function</u> | <u>Setting</u> |
|--------------------|-------------------|
| Rate | 9600 Fast Poll |
| Modem Address | Drop #01 |
| Sync/Async | Async |
| RTS Control | From Interface |
| Tx Carrier | RTS Control |
| Clock | Normal (Internal) |
| Rx Level threshold | -43 dBm |
| Tx Level | Normal (0 dBm) |
| Tx Clamp | Normal (Off) |
| RTS-CTS Delay | Normal (10 ms) |
| RTS Holdover | Off |
| RTS Stream | Off |
| Line Type | 4-wire |

Fast Poll Plus modems will work in most applications with these settings. However, changing the modem address in each modem will enable the built-in diagnostic routines to operate properly. Each remote modem should have a different drop number address. The host modem address should be changed to HOST. This will also force carrier on in the host modem. The modem address is used only for diagnostic purposes and will not affect normal operation of the modems.

If your application requires a change, new settings can be made via the front panel or the network management port. Front panel operation is covered in Section 4. The network management port is covered in Section 5. Modem configuration options are listed in paragraph 5.4.3.

3.4 Telephone Line Connections



LL Plus Modem Rear Panel Connectors

The phone line cable supplied with the LL plus modem has an RJ-11 connector at one end, and 4 spade lug connectors at the other. The transmit pair is red and green, the receive pair is black and yellow. The pairs are not polarity sensitive. Two other cables are also supplied to accommodate different DEMARC configurations. Use the cable appropriate for your situation. For 2-wire connections a special cable is required. See paragraph 6.5 for wiring specifications.

3.5 Installation Steps

1. Plug the RJ-11 phone cable connector into the modem.
2. Connect the spade lug ends of the phone cable to the phone company supplied connector (demarc).

Connect the red and green to the phone company transmit pair.

Connect the black and yellow to the phone company receive pair.

In most cases, you can match the color pairs of the spade lug wires to the phone company wire colors.

3. Connect the DTE device cable. Refer to Section 4 for information about the modem RS-232 interface.
4. Connect the round (DIN) power supply connector to the modem and plug the power supply into a convenient AC outlet.

4. FRONT PANEL CONTROLS AND INDICATORS

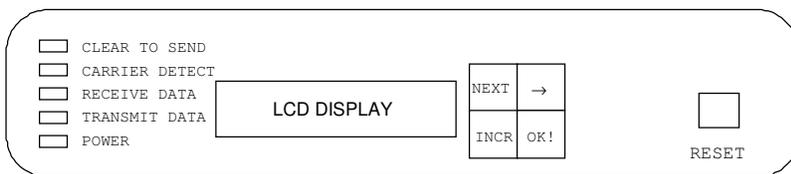
4.1 Keys

The **NEXT** key is used to cycle between the 3 top level displays, HOME, SET and TEST.

The **ARROW** key (→) switches between the top and bottom line of a display.

The **INCR** key is used to cycle through the various options available from the SET or TEST displays.

The **OK!** key is pressed to accept the selected value in the SET display or to enable/disable the selected test.



LL Plus Modem Front Panel Layout

4.2 Indicators

Clear To Send - Normally on, flashes on and off at regular 2 second intervals during retraining.

Carrier Detect - Normally on, off when no signal (carrier) is being received from the far end.

Receive Data - Flashes when data is being received.

Transmit Data - Flashes when data is being sent.

Power - On when the modem has power.

4.3 Display Tree

Use the **NEXT** key to go between these displays.

HOME

Type, Speed & RX Level
Firmware Version

SET 9.6+

Rate
SYNC/ASYNC
Clock
RX Level
TX Level
RTS Control
TX Clamp

TEST

Test Line
Digital Loopback
Local Analog Loop
Line Loopback
Remote Line Loop
Remote Digital Loop
Send 1004 Hz
Remote 1004 Hz

SET 9.6 FP+

Rate
Modem Address
SYNC/ASYNC
RTS Control
Tx Carrier
Clock
Rx Level
Tx Level
Tx Clamp
RTS-CTS Delay
RTS Holdover
RTS Stream
Line Type

A fourth display (CNT:) follows the TEST display. The DSP keeps track of the number of times RTS and DCD turn ON and the number of times the modem goes into Train-on-Data (TOD) mode. Note that if normal training is successful, the modem does not increment the TOD count. This counter is only incremented when the modem must use TOD because it missed the training pulse or the EQM value hit the threshold for re-train.

```
CNT:  TOD:0000
RS:0000  CD:0000
```

The counts are captured from the DSP when this screen is selected, and the counts are in hex. The counts are not automatically updated, you need to press a key:

```
NEXT - leave the CNT: screen
ARROW - clear the counts
INCR - update counts
OK! - update counts
```

The counts can be useful for troubleshooting and can also be accessed from the Network Management Port using the AC command.

4.4 Operation

To change a setting, first press the **NEXT** key until you see the SET display.

| | | |
|-----------------------------|----------|---------------------------|
| SET: <Parameter> <Value> | Example: | SET: Rate 9,600 (V.29) |
|-----------------------------|----------|---------------------------|

The parameter will be flashing. Press **INCR** to change the parameter.

To change a value, press the → key until the value flashes on the second line. To change the value, press the **INCR** key. This will increment the value. When you have the desired value, press **OK!** to write the change into memory.

If you are on the second line and want to go back up to the first line, press the → key again. It will bring you back up to the first line.

See Section 7 for information about using the TEST display selections to troubleshoot problems.

5. NETWORK MANAGEMENT PORT

5.1 Introduction

The Network Management Port (NMP) allows you to perform all the functions of the front panel and more. In addition to the front panel functions, you can:

- Set IDs in both the local and remote modems.
- Easily re-enter the default configuration into either the local or remote modem.
- See or change the configuration of the remote modem.
- Measure the Receive Level of the remote modem.
- Reset the remote modem.
- And more!

5.2 Connections and Setup

The NMP is accessed through a DE-9S connector on the rear of the unit. To connect to the NMP, use one of the cables shown in paragraph 6.4.

5.2.1 Using a Terminal

To connect a dedicated terminal to this port set the terminal device for 9600 bps, 8 data bits, no parity, one stop bit and no flow control. Use the cable shown in paragraph 6.4 to connect the NMP to the terminal.

5.2.2 Using a Modem

To use a dial-in modem for remote access you must fix the DTE interface speed of the modem at 9600 bps, and no flow control. Refer to your modem manual for appropriate setup procedures. Connection to the modem must be made using the NMP to modem cable shown in paragraph 6.4.

5.3 Using the Network Management Port

To activate the NMP, press the ENTER key. When you see **AT YOUR COMMAND >>**, the NMP is active and ready for your commands. Type H<Enter> to display the command set. Notice the many remote modem commands. These are not available from the front panel.

5.4 Commands

5.4.1 Help

| <u>COMMAND</u> | <u>LCL</u> | <u>RMT</u> | <u>PARA</u> | <u>FRONT PANEL EQUIVALENT</u> |
|--------------------|------------|------------|-------------|-------------------------------|
| Show Config | SC | RSC# | 5.4.2 | HOME / SET |
| Configure Modem | CM | RCM# | 5.4.3 | SET |
| Modem Type | TY | RTY# | 5.4.4 | HOME & ---> Key |
| Set ID | ID | RID# | 5.4.5 | None |
| Measure Level | ML | RML# | 5.4.6 | HOME |
| Test Line | TL | | 5.4.7 | TEST - Test Line |
| Testing Tools | TT | | 5.4.12 | TEST |
| Reset to Default | RD | | 5.4.8 | OK! + Reset Button |
| Reset Modem | RM | RRM# | 5.4.9 | Reset Button |
| NM Parity | P | | 5.4.10 | None |
| Disconnect NM Port | BYE | | 5.4.11 | None |

NOTE

These remote (RMT) commands are not available from the front panel.

5.4.2 Show Configuration

The Show Config (SC / RSC#) command displays the current modem configuration. All modem parameters and current settings are displayed. RSC# requires a valid Drop number.

5.4.3 Configure Modem

The Configure Modem (CM / RCM#) command allows you to configure the modem to fit your application. RCM# requires a valid Drop number. These options are available from the front panel SET menu for the local modem only.

5.4.3.1 LL 9.6+

Modem Rate

Allows you to set the modem line rate. V.29 rates of 9600, 7200 and 4800 are supported.

SYNC/ASYNC

Configures the DTE (terminal) port to run sync or async. If async is desired, the modem rate must first be set to 9,600 or 4,800 bps.

Clock

Sets the clock source to internal, external or slave.

RX Level

Sets the receive level threshold to -26 or -43 dBm.

TX Level

Sets the carrier transmit level to 0, -3, -5, -7, -9, -11, -13 or -15 dBm.

RTS Control

Normal - FORCED ON for standard point-to-point applications.
From Interface - for applications requiring DCD to follow remote RTS.

TX Clamp

Normal - OFF
Clamp on RTS OFF - Clamps transmit data low if RTS goes off.

5.4.3.2 LL 9.6 FP+

Modem Rate

Allows you to set the modem line rate. Rates of 9600, 7200 or 4800 bps are supported in both V.29 and Fast Poll modes.

Address

This is used to set the modem address for diagnostic purposes. In order for the diagnostics such as Test Line and loopback tests to work, each modem must have a different address. The host modem should be set to HOST. Each remote modem must have a unique drop address from DROP #1 to DROP #16.

The default for this parameter is DROP #01. This will allow the modems to function properly at both the host and remote locations. But diagnostic commands will not work properly.

SYNC/ASYNC

Configures the DTE (terminal) port to run sync or async. If async is desired, the modem rate must first be set to 9600 or 4800 bps.

RTS Control

Forced ON - This setting should be used at the host. If the modem address is set to HOST, this parameter is automatically selected.

From Interface - This is the default setting and must be used at remote sites in multipoint applications.

TX Carrier

Forced ON - This setting should be used at the host. If the modem address is set to HOST, this parameter is automatically selected.

RTS Control - This is the default setting and must be used at remote sites in multipoint applications.

Clock

Sets the clock source to internal, external or slave.

RX Level

Sets the receive level threshold to -26 or -43 dBm.

TX Level

Sets the carrier transmit level to 0, -3, -5, -7, -9, -11, -13 or -15 dBm.

TX Clamp

Normal - OFF

Clamp on RTS OFF - Clamps transmit data low if RTS goes off.

RTS-CTS Delay

Delays of 11, 21, 31 or 41 milliseconds are supported. This setting will not normally require a change.

RTS Holdover

This setting is used for applications using radio links. If you are using radios in place of telephone lines you will need to set this parameter to 10, 20 or 30 milliseconds.

RTS Stream

This command is used at remote sites to set the MAXIMUM time the drop can use the line. Settings are OFF, 5, 10, 30 or 60 seconds. This can prevent equipment failures from "hogging" the line.

Line Type

Selects 4-wire or 2-wire line.

5.4.4 Modem Type

The Modem Type (TY / RTY#) command displays information about the local or remote modem including firmware version and modem ID. RTY# requires a valid Drop number.

5.4.5 Set ID

The Set ID (ID / RID#) command allows you to assign an identifier to the local or remote modem. RID# requires a valid Drop number.

5.4.6 Measure Level

The Measure Level (ML / RML#) command is used to see the receive carrier level. The normal carrier level is -16 dBm. This information is also displayed on the front panel HOME screen. RML# requires a valid Drop number.

5.4.7 Test Line

The Test Line (TL) command is used to verify the integrity of the phone line. When this command is activated, a message is sent to the remote modem and the units exchange information about receive levels. If the test passes, the phone line is probably okay. This command is also available from the front panel TEST menu.

5.4.8 Reset to Default

The Reset to Default (RD) command resets all modem parameters to factory default (see paragraph 3.3). The modem ID will not be changed. This can also be done from the front panel by holding the OK! key down while pressing the Reset button.

5.4.9 Reset Modem

The Reset Modem (RM / RRM#) command performs a hard reset of the modem. This is equivalent to pressing the Reset button on the front panel. RRM# requires a valid Drop number. Modem configuration will not be changed.

5.4.10 NM Parity

The Parity command (P) sets the parity for the network management port. The factory default is SPACE.

5.4.11 Disconnect NM Port

The Bye command toggles the CTS output from the Network Management Port. This is used to disconnect equipment such as dial-up modems or the DCB Access Switch.

5.4.12 Testing Tools

| <u>COMMAND</u> | <u>LCL</u> | <u>RMT</u> | <u>PARA</u> | <u>FRONT PANEL EQUIVALENT</u> |
|------------------|------------|------------|-------------|-------------------------------|
| Analog Loopback | AL | | 5.4.13 | TEST - Loc Analog |
| Digital Loopback | DL | RDL# | 5.4.14 | TEST - Digital LB |
| Line Loopback | LL | RLL# | 5.4.15 | TEST - Line LB |
| Send 1004 Hz | 1004 | R1004# | 5.4.16 | TEST - Send 1004 |
| End Tests | END | REND# | 5.4.17 | OK! Key or Timeout |
| Show RS-232 | SR | | 5.4.18 | None |
| Show Eye Quality | SQ | | 5.4.19 | None |
| Activity Counts | AC | | 5.4.20 | CNT: |
| Zero Counts | Z | | 5.4.20 | CNT: Arrow Key |

NOTE

These remote (RMT) commands are also available from the front panel.

5.4.13 Analog Loopback

Analog Loopback (AL) loops the line back toward the local DTE. This loopback is not bi-directional.

5.4.14 Digital Loopback

Digital Loopback (DL / RDL#) loops the DTE interface in both directions. RDL# requires a valid Drop number.

5.4.15 Line Loopback

Line Loopback (LL / RLL#) loops the phone line back toward the remote modem only. RLL# requires a valid Drop number.

5.4.16 Send 1004 Hz

The Send 1004 Hz (1004 / R1004#) command causes the modem to send a 1004 Hz tone to the other end of the link. This is the same tone the phone company uses to test the line and can be useful to assist them in locating problems. R1004# requires a valid Drop number.

5.4.17 End Tests

The END / REND# command is used to disable loopback tests prior to the 15 minute timeout period. REND# requires a valid Drop number.

5.4.18 Show RS-232

The Show RS-232 (SR) command displays the current status of RTS, CTS, DCD and DTR on the DTE port.

5.4.19 Show Eye Quality

The Show Eye Quality command (SQ) displays the modem EQM value. When things are properly trained, this number is typically less than 30 hex. If the EQM value goes above 200 hex, the modem will start re-training.

5.4.20 Activity Counts / Zero

The DSP keeps track of the number of times RTS and DCD turn ON and the number of times the modem goes into Train-on-Data (TOD) mode. Note that if normal training is successful, the modem does not increment the TOD count. This counter is only incremented when the modem must use TOD because it missed the training pulse or the EQM value hit the threshold for re-train.

The counts are captured from the DSP when this screen is selected, and the counts are in hex. The counts are not automatically updated, press the "*" key to refresh the screen.

Use the Z command to zero the counts.

6. INTERFACE SIGNALS AND CABLING

6.1 DTE Port (DB-25S)

| <u>Pin</u> | <u>Signal</u> | <u>In/Out</u> |
|------------|-------------------------|---------------|
| 1 | Frame Ground | --- |
| 2 | Transmit Data | IN |
| 3 | Receive Data | OUT |
| 4 | Request to Send | IN |
| 5 | Clear to Send | OUT |
| 6 | Data Set Ready | OUT |
| 7 | Signal Ground | --- |
| 8 | Data Carrier Detect | OUT |
| 9 | +12 volt test voltage | OUT |
| 10 | -12 volt test voltage | OUT |
| 15 | Transmit bit clock | OUT |
| 17 | Receive bit clock | OUT |
| 18 | Local Analog Loopback | IN |
| 20 | Data Terminal Ready | IN |
| 21 | Remote Digital Loopback | IN |
| 24 | External Transmit Clock | IN |

6.2 Network Management Port (DE-9S)

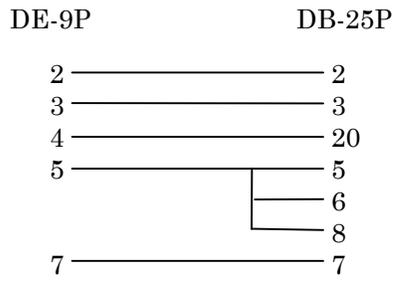
| <u>Pin</u> | <u>Signal</u> | <u>In/Out</u> |
|------------|---------------------|---------------|
| 1 | Frame Ground | --- |
| 2 | Transmit Data | IN |
| 3 | Receive Data | OUT |
| 4 | Request to Send | IN |
| 5 | Clear to Send | OUT |
| 6 | Data Set Ready | OUT |
| 7 | Signal Ground | --- |
| 8 | Data Carrier Detect | OUT |
| 9 | Not Used | |

6.3 TELCO Interface (RJ-11)

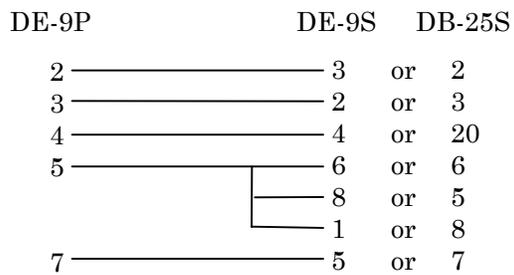
| <u>Pin</u> | <u>Signal</u> | <u>Color</u> | <u>In/Out</u> |
|------------|---------------|--------------|---------------|
| 2 | Receive Tip | Black | IN |
| 3 | Transmit Ring | Red | OUT |
| 4 | Transmit Tip | Green | OUT |
| 5 | Receive Ring | Yellow | IN |

6.4 Network Management Port Cables

To a TERMINAL



To a PC Using Terminal Emulation

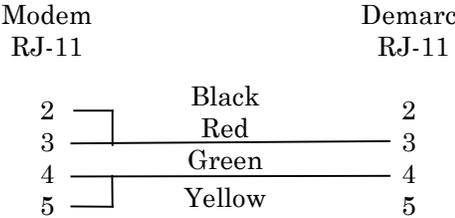


To a dial-up MODEM for remote access



6.5 Cables are included for connection to 4-wire circuits. For connection to 2-wire circuits, special wiring is required.

Modem to 2-wire TELCO Circuit



7. TROUBLESHOOTING

7.1 General Approach

When troubleshooting problems, a rational plan can save you many hours of frustration. The following is a brief outline of standard troubleshooting procedures.

1. Gather the facts to determine the exact nature of the problem.
2. Draw a picture of the system showing the host computer, the modem, the phone line, the remote modem and the terminal/controller/computer at the far end. Use this as reference to note your observations, test steps and test results. A picture keeps you focused and often saves duplicate test steps.
3. Record the front panel indicators before changing anything. This is an important part of fact gathering.
4. If you change anything, change only one thing at a time.
5. Use the built-in test functions, especially the loopbacks and level measurements. Record your results.

7.2 Using the Front Panel Tests

NOTE

Tests enabled from the front panel will stay active for approximately 15 minutes unless disabled by the operator. Press OK! To start/stop the test.

The first, and often the only test required to check the telephone lines and modems is the **Test Line** test. This sends a 1004 Hz test tone to the far end where the level is checked. The far end then sends a 1004 Hz tone to the local end and this level is checked. If both levels are about -16 dBm (greater than -20 dBm) the test is passed. After a successful test, you have nearly 100% confidence that the phone line and the modems are working properly.

The **Send 1004** test sends a 1004 Hz tone to the remote modem. This is the same test tone that the phone company sends for testing. You may wish to send this tone to the phone company if you are working with them on troubleshooting a problem.

The **Rmt 1004** test sends a 1004 Hz tone from the remote modem toward the local modem.

7.3 Loopback Tests

Digital Loopback (**Digital LB**) is a bi-directional local loopback.

Analog loopback (**Loc Analog**) is a local only loopback from the analog section of the modem.

Line Loop (**Line LB**) loops the local phone line back to the far end.

Remote Line Loop (**Rmt Line**) loops the phone line at the far end back toward the local end.

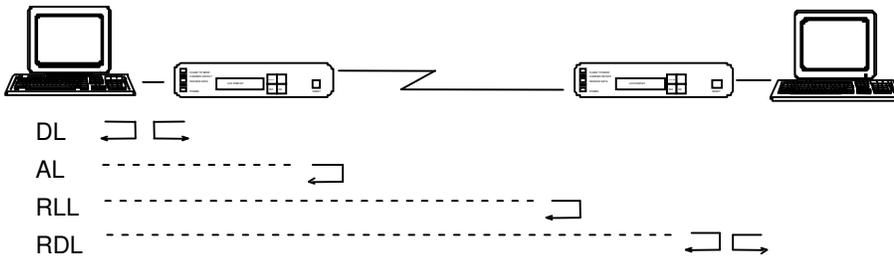
Remote Digital Loopback (**Rmt Digitl**) loops the far end modem digital section bi-directionally.

Use progressive loopbacks, starting at one end and working toward the other end of the link. As each loopback is enabled, press keys on the local DTE (terminal) and note if the characters are displayed on the screen. If your keypresses are displayed, the test passed. Use your diagram of the system to keep track of the loopbacks and the test results.

Perform loopback tests in the following order, working from the local end to the far end of the line:

- Digital Loopback
- Analog Loopback
- Remote Line Loopback
- Remote Digital Loopback

See diagram on next page.



If you send data and get it back error free using each of these loopback tests, and the line levels are correct, your modem and phone line are functional.

8. WARRANTY

All DCB products are warranted to be free of defects in materials and workmanship for two years. Data Comm for Business, Inc. will repair or replace any equipment proven to be defective within the warranty period. All warranty work is F.O.B. Dewey, IL. This warranty is exclusive of abuse, misuse, accidental damage, acts of God or consequential damages, etc. DCB liability shall not exceed the original purchase price.

All equipment returned for repair must be accompanied by a Returned Material Authorization (RMA) number. To receive an RMA number, call (217) 897-6600 between the hours of 8 AM and 5 PM central time. Equipment must be shipped prepaid to DCB and will be returned at DCB's expense.

Ship returned items to:

Data Comm for Business
RMA#
2949 County Road 1000E
Dewey, IL 61840

Data Comm for Business, Inc.
PO Box 6329
Champaign, IL 61826-6329

Tel (217) 897-6600
Fax (217) 897-1331
Email support@dcbnet.com