Leak Detection

LD5100

User Guide

SeaHawk

RLE Technologies

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Revision History

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CHAPTER

1

PRODUCT OVERVIEW

1.1. Description

The LD5100 is a complete monitoring system that detects and reports the presence of water and other conductive liquids. The LD5100 couples SeaHawk Water Leak Detection Cable (SC) with an advanced control panel. Each LD5100 monitors up to 5000 feet (1,524m) of SC cable. When a conductive liquid comes in contact with the SC cable an alarm sounds and the distance to the leak is shown on the LD5100's LCD front panel display.

The LD5100 allows a single person to perform the mapping of the cable - the process of determining the relationship between a known point along the cable and the value as measured by the LD5100.

1.2. Operation

When the LD5100's analog circuitry measures a current in excess of the user-defined leak threshold, the unit's microprocessor computes the distance to the leak. The unit then annunciates the leak and logs the alarm in its event log. The leak relay and fault relay each have two outputs. An additional 4-20mA output allows the device to interface with third party management systems.

The LD5100 is a supervised system - it constantly monitors the cable for continuity. A cable break or excess contamination of the cable causes a cable break indication and activates a relay. The LD5100 sends alarm notifications to predetermined recipients when an alarm sounds. The LD5100 produces an alarm in the following conditions:

- Leak Detected
- Cable Break (or Cable Fault)
- Cable Contamination
- Loss of Communications

1.3. Mechanical Description

The LD5100 is built with two circuit boards:

- The **display board** is connected to the main board with a 20 wire ribbon cable and two power wires. The display board is mounted on the inside of the unit's door.
- The **main board** is mounted inside and on the back of the enclosure. A reset switch is provided to reset the microprocessor without cycling power to the unit.

1.4. Installation

The LD5100 with LCD is a wall mounted device. Before applying power to the unit, ensure that all connections are correct and all screw terminals are secure.

1.5. Cable Reference Map

Users may purchase a Water Leak Detection Cable Reference Map (part # FM1114) with their LD5100. Once all the SC cable is installed, compare this reference map with the actual cable installation. Note any discrepancies and return the map to the original author for correction. Keep a copy for use until the updated map can be reinstalled near the control panel.

1.6. LCD User Interface

The LD5100's LCD is a 160x160 pixel resolution backlit display with a five button keypad. The default password for the system setup is 1234. The interface's menu structure is as follows:

- Main Menu
  - View Zones
  - Cable Status
  - Alarm History/Trend
    - Alarm History
    - Trend
    - Erase Alarm History
    - Erase Trend Log
- Comm Port Status
- View Map
- System Setup - *Password Protected*
    - Leak TripPoint
    - Contam TripPoint
    - Leak Delay
    - Contam Delay

  - Re-Alarm Delay
  - Latching Alarms
  - 4-20MA Max Range
  - Feet/Meters
  - Language
  - Cable Test Relay
  - Restore Defaults
  - Clock
  - Res/Ft
- Zone Setup
- Point Mapping
- Comm Port Settings
  - Port1 Type
  - Port1 Addr
  - Port1 Baud
  - Port2 Type
  - Port2 Addr
  - Port2 Baud
- Reset

Navigate through the menu(s) with the **up**, **down**, **left** and **right** arrows. Where indicated on the LCD submenus, the **left** arrow navigates left on menus or cancels any action and returns to the previous menu. The **enter** arrow selects a submenu and commits changes. Further LCD interface information can be found in Chapter 5, “LCD Interface” on page 31.

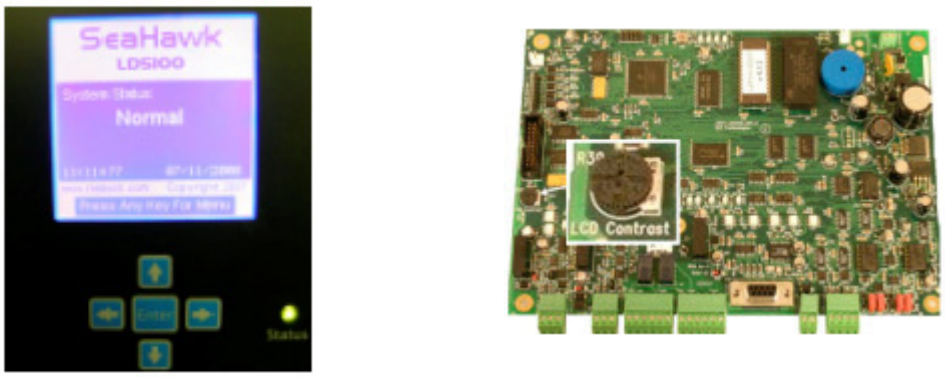

Figure 1.1 LD5100 LCD Interface and the R39 Contrast Adjustment *(left to right)*

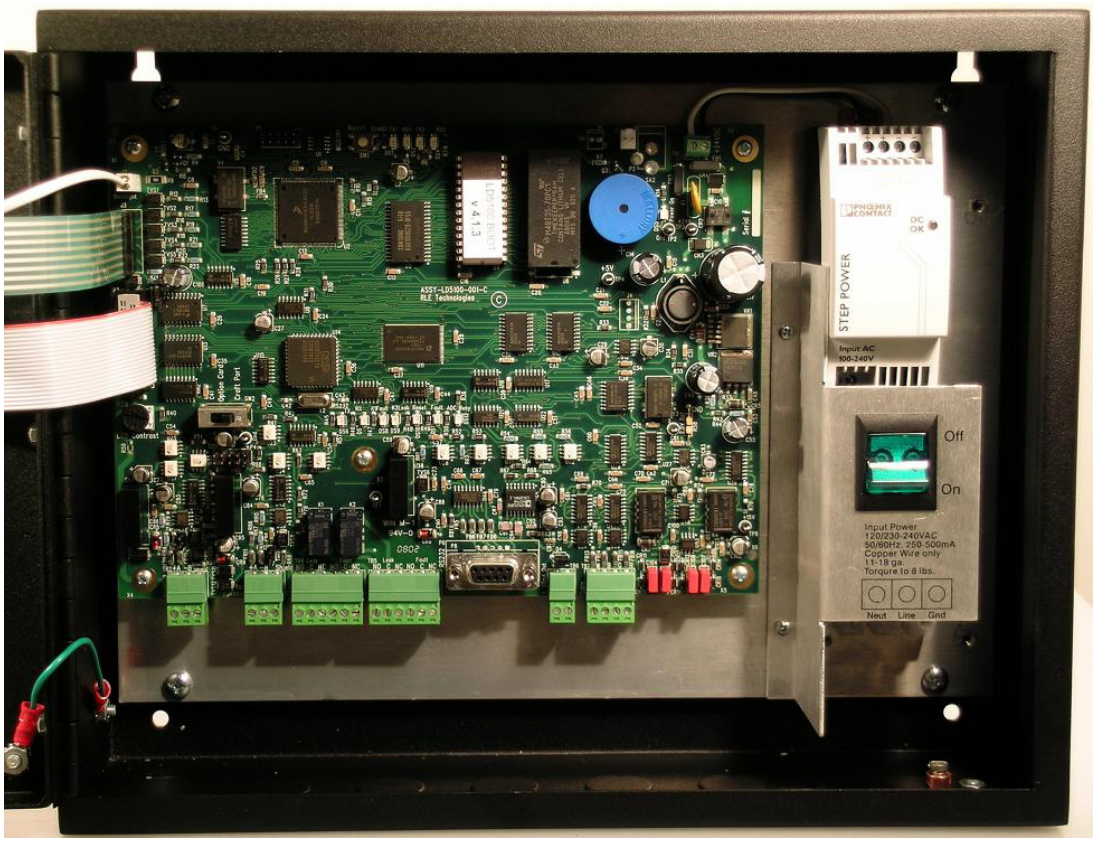

Figure 1.2 LD5100 Enclosure Interior

WARNING

A dedicated circuit breaker must be provided in the building within close proximity to the LD5100 and be clearly marked as the disconnecting device for this unit.

CHAPTER

2

CONNECTIONS AND SETTINGS

The LD5100 is comprised of two boards. The two boards are accessed when the device's front cover is opened. The display board is located on the inside of the door. The main board is the large board on the left side of the enclosure.

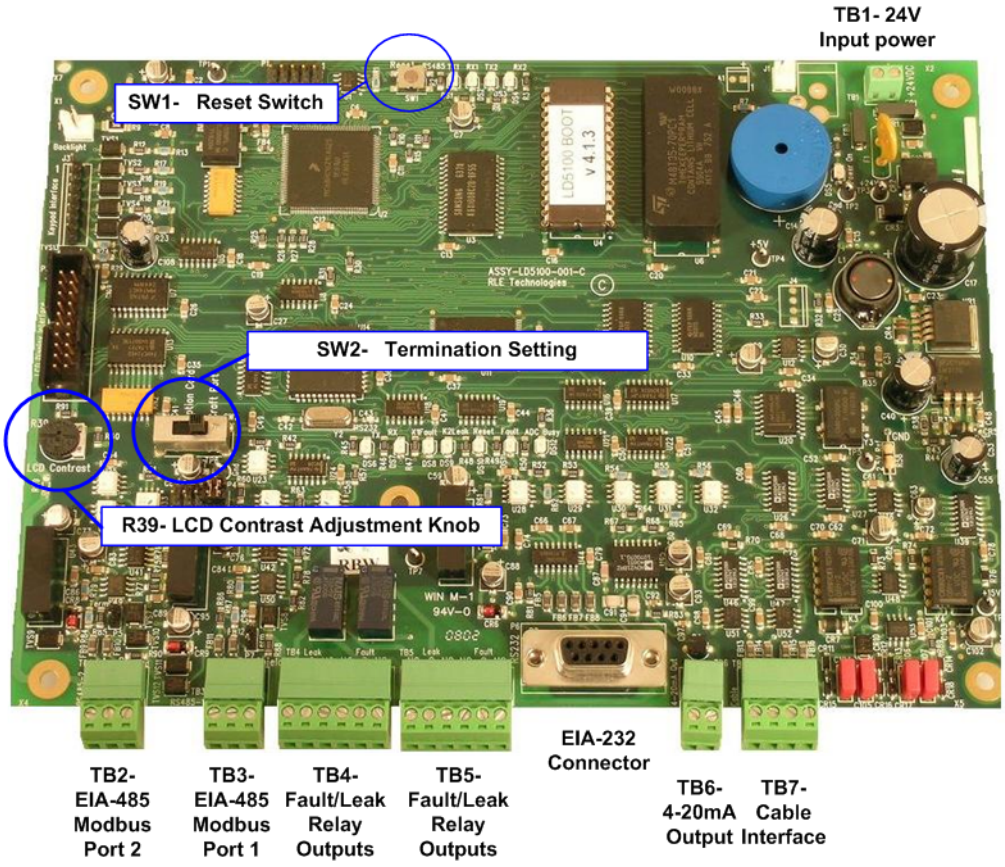

Figure 2.1 LD5100 Main Board

2.1. Main Board

The connectors on the main board, found at the bottom of Figure 2.1, are labeled TB2 through TB7. The connector on the power board is labeled TB3. The reset switch on the main board is labeled SW1. The termination setting on the main board is labeled SW2.

2.1.1 SW1: Reset Switch

The Reset switch is provided to reset the microprocessor without cycling power to the unit.

2.1.2 SW2: Termination Setting

The Termination Setting switch must ALWAYS be set to the far right. This enables the RS232 port to work properly.

2.1.3 R39: Contrast

This adjustment knob adjusts the 160x160 LCD's contrast. Turn the adjustment knob clockwise or counterclockwise to adjust the contrast as necessary.

2.1.4 TB1: Input Power

This is a factory wired two position connector with the following connections (for reference only):

TB1-1 24VDC negative (-)
TB1-2 24VDC positive (+)

2.1.5 TB2 and TB3: RS485 Modbus Port 2 and 1

Terminals TB2 and TB3 connect to a RS485 network. A grounded shield contact is provided for connection to shielded cable. If the shield contact is used, verify the power connector is properly grounded and there is no voltage potential between units on the network. The RS485 ports are set to no parity, 8 databits, 1 stop bit (n, 8, 1). Connect the RS485 wires to TB2 or TB3 on the main board as follows:

TB2-1 A (+)
TB2-2 B (-)
TB2-3 Shield

2.1.6 TB4 & TB5: Relays

Terminals TB4 and TB5 are Form C Relay Outputs. Each terminal has two outputs. TB4 provides a connection to one of the leak alarm relay outputs and one of the fault relay outputs; TB5 provides a second set of contacts for the same leak and fault alarms.

The six contacts on TB4 and TB5 are labeled **Leak NO**, **Leak C**, **Leak NC**, **Fault NO**, **Fault C**, and **Fault NC**. Connect the alarm relay wires to TB4 and TB5 as follows:

TB4-1 Leak alarm normally open (NO)
TB4-2 Leak alarm common (C)
TB4-3 Leak alarm normally closed (NC)
TB4-4 Fault alarm normally open (NO)
TB4-5 Fault alarm common (C)
TB4-6 Fault alarm normally closed (NC)
TB5-1 Leak alarm normally open (NO)
TB5-2 Leak alarm common (C)
TB5-3 Leak alarm normally closed (NC)
TB5-4 Fault alarm normally open (NO)
TB5-5 Fault alarm common (C)
TB5-6 Fault alarm normally closed (NC)

Two LEDs, labeled **K1Fault** and **K2Leak**, are located above TB4 and TB5 in the LED status strip near the center of the main board. They indicate the status of the relays On/Off. The leak detection relay is activated when a leak is detected. The cable break relay is activated when a cable fault is detected.

These relays are set to factory defaulted to Unsupervised; see 5.8.7, “Supervised Relays” on page 37, for Supervised Relays function.

Both relays (all alarms) can be configured to be latched or unlatched. A latched alarm requires a manual reset of the system once a leak or cable problem is no longer present.

2.1.7 RS232 Connector

The RS232 port uses only the transmit, receive, and ground pins (2, 3 and 5). The baud rate is 9600. The RS232 port is set to no parity, 8 databits, 1 stop bit (n, 8, 1). A straight through cable should be used to connect a terminal or PC to the LD5100.

2.1.8 TB6: 4-20mA Output

A 4-20mA loop powered output is provided on TB6. The maximum range (20 mA) can be set to 1000, 2500, or 5000 feet. Connect the 4-20mA wires to TB6 as follows:

TB6-1 4-20mA positive (+)
TB6-2 4-20mA negative (-)

2.1.9 TB7: Cable Interface

The SeaHawk Water Leak Detection Cable (SC) connects to TB7. A 15 foot (4.57m) non-sensing leader cable (part # LC-KIT) is required to connect the LD5100 to the SC cable. Connect the cable wires to TB7 as follows:

TB7-1 White wire
TB7-2 Black wire
TB7-3 Green wire
TB7-4 Red wire

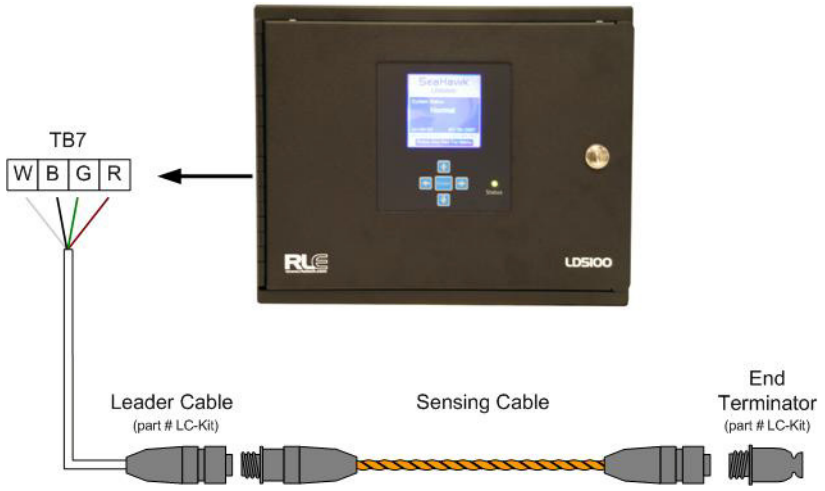

Figure 2.2 Cable Connections to the Sensing Cable

2.1.10 AC Power Input

The LD5100 mounted in the metal enclosure requires either a 120 VAC (105-125 VAC) or 230 VAC (205-250 VAC) connection (2 wire & ground). Connect the ground and power wires to the AC power terminal block. Connect the AC power input as follows:

AC Power Block TB1-1Neutral
AC Power Block TB1-2Line
AC Power Block TB1-3Ground

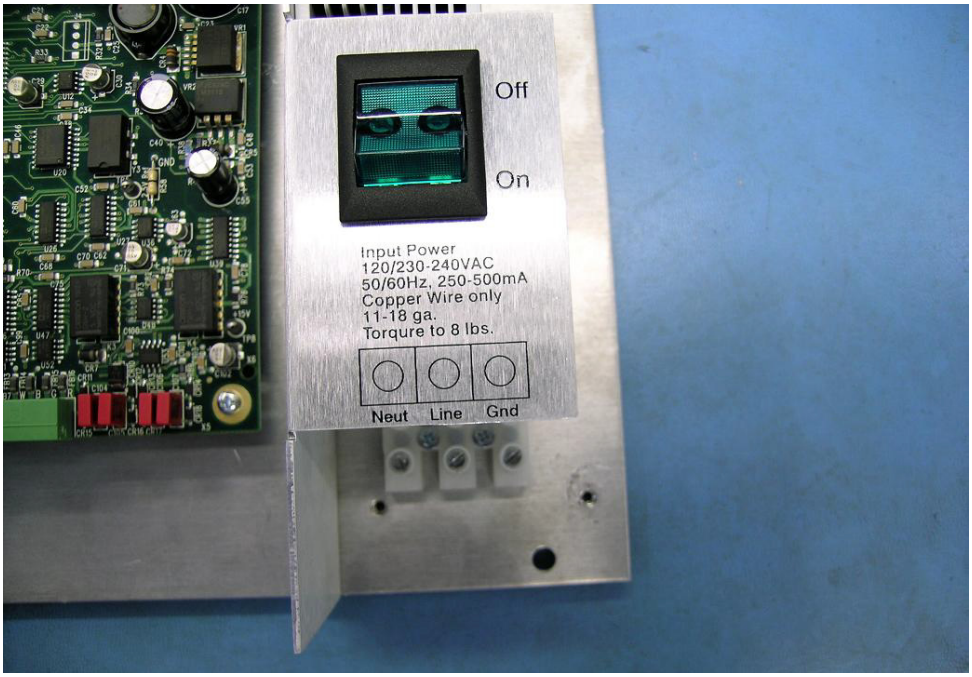

Figure 2.3 AC Power Input

WARNING

Make sure the dedicated breaker is in the off position before connecting the AC power wires to the LD5100.

Notes:

CHAPTER

3

INSTALLATION

3.1. Installing the Unit

The LD5100 is a wall mounted device. To secure the device to the wall, first remove the aluminum back panel and all electronics from the enclosure. There are knockouts on the top and bottom of the enclosure designed to accommodate. 5 inch (12.7mm) conduit. Remove as many as necessary. There are two holes in the top back of the unit spaced 11 inches (.28m) apart. Use drywall anchors or suitable anchors depending on the wall construction, to secure the unit to the wall. Put two more anchors through the two holes in the bottom back of the unit. Reinstall the back panel and reconnect the electronics.

3.2. Connecting the SeaHawk Water Leak Detection Cable (SC)

The LD5100 requires a leader cable kit (part #LC-KIT; purchased separately) which includes a 15 foot (4.57m) leader cable. One end of this leader cable connects into the LD5100. This end of the cable has four stripped, bare wires. The other end features a mating connector which connects with the Sea Hawk Leak Detection Cable (SC). The end of the cable is finished with a removable end terminator (EOL).

Note A Leader Cable Kit (part #LC-KIT) is required to connect the LD5100 to the SeaHawk Leak Detection Cable (SC). The kits are not included with the LD5100 and can be purchased separately.

Connect the 15 foot (4.57m) leader cable to the LD5100. From left to right, with the screws of the terminal block connector facing up, the wires that screw into the terminal connector should be colored white, black, green, and red. If the terminal connector is removed from the end of the cable, make sure the wires are in this same order when the connector is reapplied.

Once the leader cable is plugged into the terminal block, it is ready to be connected to the SC cable. To do this, unscrew the EOL terminator from the end of the leader cable. Attach the first length of the SC cable to the leader cable. Route the SC cable according to a cable layout diagram, if provided. Lay the cable according to the cable installation guidelines on pages 9-10. Secure the EOL terminator on the unoccupied end of the last section of SC cable.

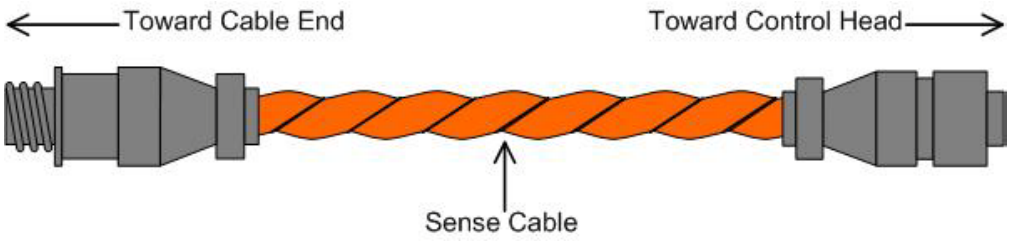

Figure 3.1 Water Leak Detection Cable (SC)

3.2.1 Securing Cable to the Floor

Secure the SC cable to the floor with either J-clips (Part #JC) or one of the other approved methods shown in Figure 3.2. Available from RLE and designed specifically for use with the SC cable, J-clips are the manufacturer's recommended installation method and can be installed as follows:

- Place one J-clip every 3 feet (.914m) along the length of the SC cable and one at each turn of the cable.
- If the cable is installed over an obstruction, clip the cable on both sides, as close to the obstruction as possible.

WARNING

Do not install the cable directly in front of an air conditioner. Allow a minimum of 6 feet (1.83m) between the unit and the cable. If the cable is too close to the air conditioning unit's air stream, the moisture from the humidifier may cause false leak readings. If the cable must be installed in front of an air conditioning unit, place the J-clips 3 feet (0.914m) apart.

Note It is important to finish the end of the SeaHawk Water Leak Detection Cable (SC) with the end terminator (EOL). If the EOL terminator is not present, a cable fault will register. Note any variances between the cable layout diagram and the actual cable installation.

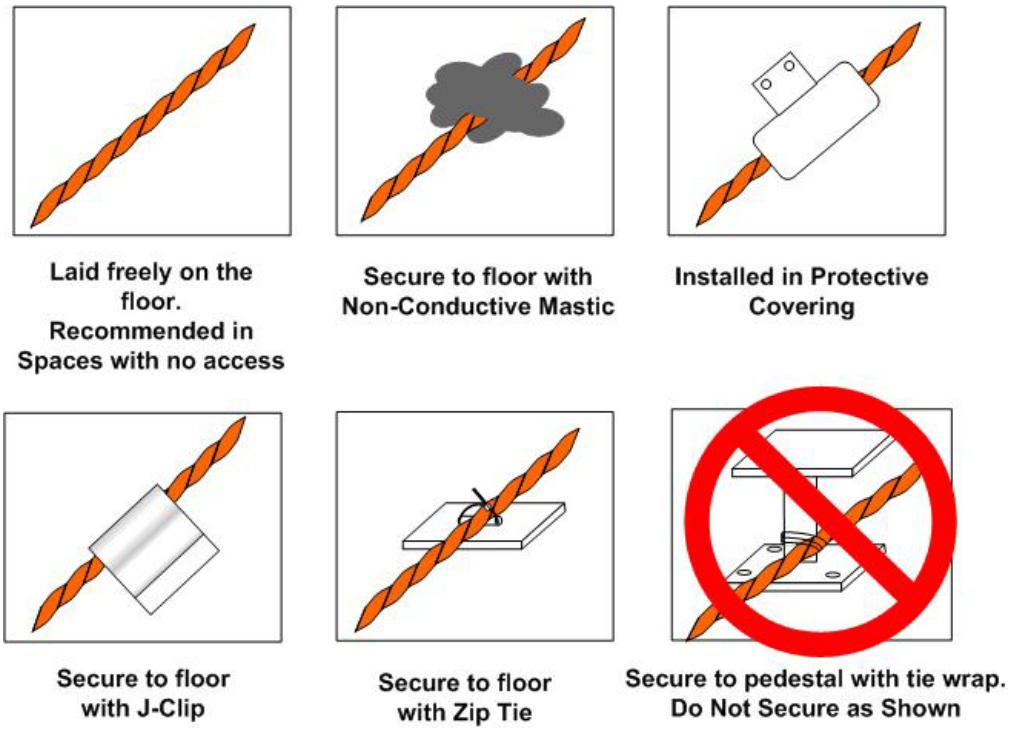

Figure 3.2 Cable Installation Methods

3.3. Apply Power to the Unit

Once the SC is connected to the unit, power may be applied

WARNING

A dedicated circuit breaker must be provided in the building within close proximity to the LD5100 and be clearly marked as the disconnecting device for this unit.

The LD5100 operates between100 - 240 VAC power. An AC power supply should be run to the location of the unit. Before applying power to the unit, make sure the AC breaker switch is turned off.

Once the power is turned off, strip the end of the AC supply so the three wires inside are exposed. Strip the end of the line and neutral wires and feed the ends to the power supply inside the LD5100 enclosure. The two power wires must now be inserted into the terminal block in the lower right corner of the enclosure (Power Supply TB1). As indicated in the enclosure, the line power wire is positioned on the center side of the terminal block (Line). The neutral wire is placed into the opening on the left side of the terminal block (Neut). The earth ground line is placed the right side of the terminal block (Gnd).

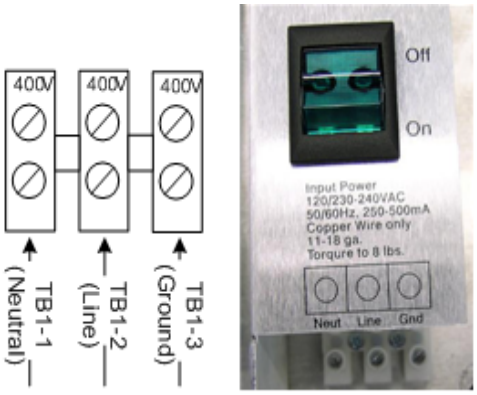

Figure 3.3 Lower Right Terminal Block

Once the three wires are connected inside the terminal block, turn the AC power supply back on. The LD5100 should begin booting up. Wait approximately one minute. No alarm should be present.

On the LCD, press any key for the main menu. Enter the Cable Status menu. The cable length is displayed. If this reading varies by more than ±5% of the actual length of cable installed, verify the installation.

Through the LCD submenus, you may set the clock, system name, alarm configuration, feet/meters, etc.

Wait at least 30 minutes before calibrating the LD5100. Calibrate the LD5100 through the front panel System Setup menu.

Map the cable per the instructions in Chapter 6, “Mapping the Cable” on page 41.

CHAPTER

4

4-20MA OUTPUT TESTING

The LD5100's 4-20mA output is loop powered and tested by the manufacturer. The manufacturer guarantees its performance upon delivery. Should the 4-20mA output need to be tested in the field, follow these steps. The following procedure is performed with the cable connected, unless otherwise indicated.

1. Remove the two position plug from TB6.
2. Remove any wires from the terminal and install a 200Ohm resistor to TB6-2. Then apply +24V to TB6-1 and ground of the 24V supply to the other side of the resistor.
3. Reinstall the plug on TB6.
4. With the system on and no alarms present, measure the DC voltage across the resistor. A value of 0.8VDC should register. This equates to 4mA, or normal operation.

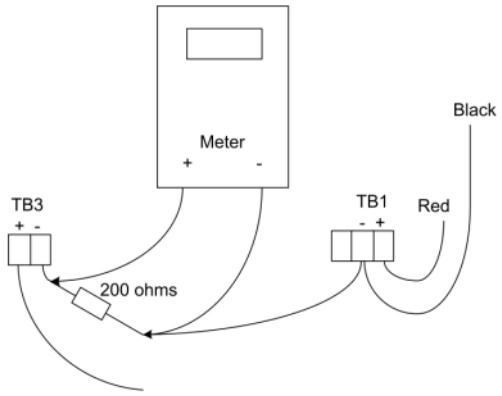

Figure 4.1 4-20mA Testing

5. Remove the SeaHawk Leak Detection Cable (SC) and wait for the unit to activate its cable trouble alarm. Measure the DC voltage across the resistor. A value of approximately 4.0VDC should be measured. This equates to 20mA, or a fault alarm. Reconnect the SC cable.
6. Place water on the end of the SC cable. Measure the DC voltage across the resistor. The value will be proportional to the length of cable measured by the LD5100. A value of approximately 4.0V, which equates to 20mA, will be read if the length of the cable is identical to the length read by the LD5100. Dry the cable.
7. Place water on the start of the cable. Measure the DC voltage across the resistor. A measurement of approximately 0.8VDC, or 4mA, should be measured. This corresponds to a leak at zero distance. Dry the cable.
8. Remove the resistor from the plug and reattach any wires as necessary.

Notes:

CHAPTER

5

LCD INTERFACE

5.1. Default/Idle Display

When the LD5100 is powered up, diagnostics are performed. The boot ROM and flash program code are verified. While these diagnostics are being performed, the following text is displayed on the LCD:

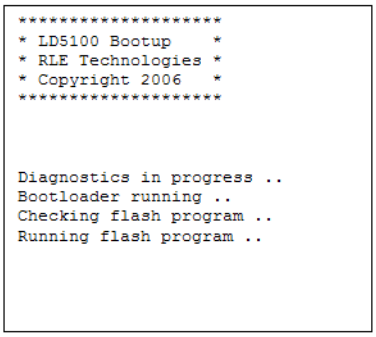

Figure 5.1 LD1500 Bootup Screen

Once the diagnostics are complete, the LCD displays the following screen:

Figure 5.2 LD5100 Main Screen

Any time a screen within the LCD interface is left idle for more than one minute, it will return to this default display.

The LCD is accompanied by a five button control panel. The **up**, **down**, **left** and **right** arrow keys are used to move the cursor through the display and change corresponding values. Key legends are displayed at the bottom of the LCD in submenus. The **left** arrow key is often used as a "back" button to navigate to a previous screen. The **Enter** key selects an option and commits changes.

5.2. Main Menu

From the **Main Menu**, use the **up** and **down** arrow keys to position the arrow on the LCD in front of the appropriate menu choice. Press the **Enter** key to select a menu.

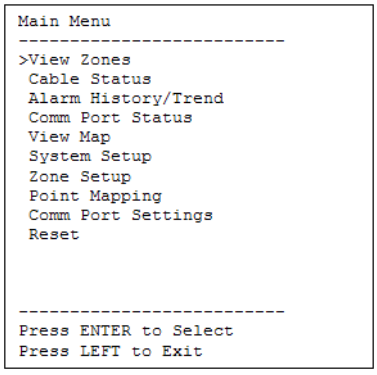

Figure 5.3 LD5100 Main Menu Screen

5.3. View Zones

The **View Zones** menu will display the available (or user configured) 12 zones of cable and their appropriate labels. These zones are lengths of cable that a user may configure for the LD5100 to display during an alarm.

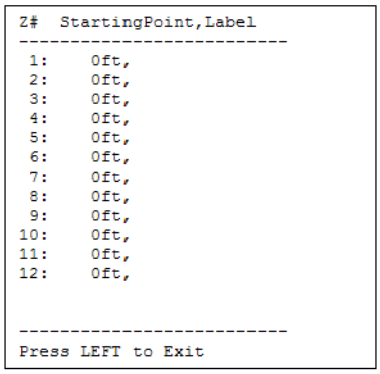

Figure 5.4 LD5100 Default/Unconfigured View Zones Menu

5.4. Cable Status

The **Cable Status** option displays the Cable Status screen. This screen shows information about the SeaHawk Leak Detection Cable (SC) attached to the LD5100.

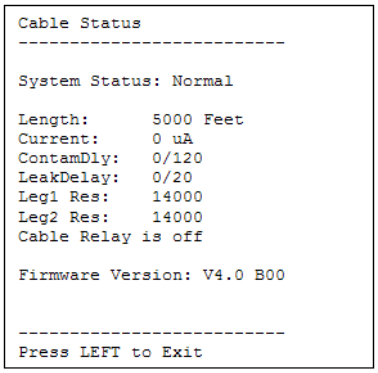

Figure 5.5 LD5100 Cable Status Screen

5.4.1 System Status

During a no alarm condition, the System Status will display Normal. The System Status will change during an alarm condition and display either a Leak or Cable Break alarm.

5.4.2 Cable Length

The length of cable installed on the LD5100, in either feet or meters. To change units refer to 5.8.9, “Feet / Meters” on page 37.

5.4.3 Current

This label shows the current on the SC cable. A current will register if there is any conductive material (e.g., water) detected on the cable.

5.4.4 Contamination Delay (ContamDly)

The Contamination Delay is a counter that begins when the contamination trip point is passed; see 5.8.4, “Contamination Delay” on page 37 for configuration.

5.4.5 Leak Delay (LeakDly)

The Leak Delay is a counter that begins when the Leak Trip Point is passed; see 5.8.3, “Leak Delay” on page 37 for configuration.

5.4.6 Leg 1 Resistance (Leg1 Res)

The resistance measured on the first of two legs of the SC cable. Primarily used for advanced diagnostic purposes.

5.4.7 Leg 2 Resistance (Leg2 Res)

The resistance measured on the second of two legs of the SC cable. Primarily used for advanced diagnostic purposes.

5.4.8 Cable Relay or Cable Test Relay

The Cable Relay is used to simulate 2500 feet (762m) of cable on the LD5100. This is used when the SC cable must be disconnected from the LD5100 unit for maintenance or adjustments without causing a cable break alarm, see 5.8.11, “Cable Test Relay” on page 38 for configuration.

5.4.9 Firmware Version

This is the version of the firmware that is currently installed and running on the LD5100.

5.5. Alarm History/Trend Log

The **Alarm History/ Trend** Log Screen allows users to view the alarm history, trend log, and erase data from both.

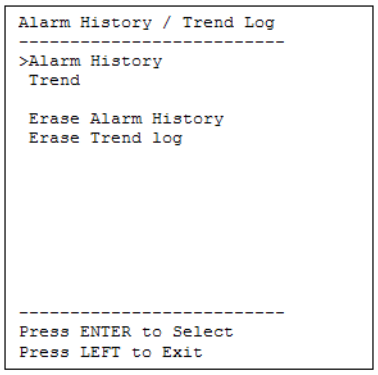

Figure 5.6 LD5100 Cable Status Screen

5.5.1 Alarm History Log

The Alarm History Log displays the most recent 100 events recorded by the unit. Events are displayed in the following manner:

Date Time

Description *whereas*:

Date is the date the event occurred.
Time is the time at which the event occurred.
Description is a detail of the nature of the event.

5.5.2 Trend Log

The Trend Log displays the leakage current on the cable. One measurement is taken at the user set interval (1 min - 1440 min; factory default is 1440 min, or 1 day). The log retains the 288 most recent entries. Analyzing the trend data can help determine the location of long term contamination build up, or degradation, on the cable.

5.5.3 Erase Alarm History

Erase Alarm History will clear all events log in the history table.

5.5.4 Erase Trend log

Erase Trend log will clear all trend data logged in the trend table.

5.6. Comm Port Status

The **Comm Port Status** menu displays the settings and diagnostics of both of the LD5100's RS485 Modbus ports. This screen will display each port's Modbus address and packets counters. Press **Enter** to reset all packet counters displayed.

```
Comm Port Status
--------------------------
** Port 1 **
MB-Slave Adr: 000 9600b
InPkts:    0
MyPkts:    0
!MyPks:    0
OutPkts:   0
CRC errs:  0
Misc errs: 0
** Port 2 **
MB-Slave Adr: 000 9600b
InPkts:    0
MyPkts:    0
!MyPks:    0
OutPkts:   0
CRC errs:  0
Misc errs: 0
--------------------------
LEFT = Exit/ENTER = Reset
```

Figure 5.7 Comm Port Status Screen

5.7. View Map

The View Map option displays all currently mapped points of the LD5100; see Chapter 6, “Mapping the Cable” on page 41.

5.8. System Setup

The System Setup option displays the System Setup menu. This screen is password protected. The default password is 1234.

```
Setup Menu
--------------------------
>LeakTripPoint:    150 ua
 ContamTripPoint:   50 ua
 Leak Delay:        20 S
 Contam Delay:     120 S
 Re-Alarm Delay:     0 Hrs
 Latching Alarms:  No
 Supervised Rlys:  No
 4-20MA Max Range: 5000 ft
 Feet/Meters:      Feet
 Language:         English
 Cable Test Relay: Off
 Restore Defaults: Cancel
 Clock:  01/01/07 12:34:56
 Res/Ft:
  5000 Feet/2.800 Ohms/Ft
--------------------------
Press ENTER to Select
Press LEFT to Exit
```

Figure 5.8 System Setup Menu

5.8.1 Leak Trip Point

The Leak Trip Point option allows users to modify the leak detection trip point for the LD5100. This trip point helps the system avoid false alarm readings.

5.8.2 Contamination Trip Point

The Contamination Trip Point option allows users to modify the contamination trip point for the LD5100. This trip point helps the system avoid false alarm readings.

5.8.3 Leak Delay

The Leak Delay is a timer that begins to count down when a leak alarm condition is met. This timer delays the alarm from registering for a set amount of time. The timer can be set from 5 to 990 seconds.

5.8.4 Contamination Delay

The Contamination Delay is a timer that begins to count down when a leak alarm condition is met. This timer delays the alarm from registering for a set amount of time. The timer can be set from 5 to 990 seconds.

5.8.5 Re-Alarm Delay

The Re-Alarm Delay is a counter that, upon expiring, will re-annunciate the last silenced alarm condition. This counter can be set from 0 (disable) to 24 hours.

5.8.6 Latching Alarms

The Latching Alarms option allows the alarm relays to be set as latching or non-latching. A latched alarm requires a manual reset of the system once a leak or cable problem is no longer present.

5.8.7 Supervised Relays

The Supervised Relays option allows users to configure the Leak and Fault relays to be supervised or unsupervised. A supervised relay is normally activated and will deactivate upon alarm or loss of power.

5.8.8 4-20MA Max Range

The 4-20mA Max Range allows the user to select the cable range for the 4-20mA output. This value can be set to 1000, 2500, or 5000 feet (305m, 762m, and 1524m).

5.8.9 Feet / Meters

The Feet/Meters option designates whether the LD5100's distance readings are displayed in feet or meters.

5.8.10 Language

The Language option designates whether the LD5100's LCD menus are displayed in English or French.

5.8.11 Cable Test Relay

The Cable Test Relay option activates the internal test circuit to simulate 2500 feet (762m) cable. This allows the SC cable to be removed from the LD5100 without causing alarms. The Cable Test Relay will stay on for 300 seconds and a counter will be displayed.

5.8.12 Restore Defaults

The Restore Defaults option will reset all configurations back to the original factory defaults.

5.8.13 Clock

The Clock option allows users to set the time and date for the LD5100.

5.8.14 Resistance/Foot (Res/Ft)

The Res/Ft option allows users to precisely calibrate the LD5100. Users can adjust the ohms per foot until the cable length displayed matches the actual cable length installed. The default value is 2.800 ohms per foot.

5.9. Zone Setup

The **Zone Setup** menu will display a table of configured zones. A zone is a set length of cable that may have a name or description assigned to it. Upon alarm, if a leak distance falls within a zone's boundary, the zone's description will appear on the main screen. Zones are configured by entering the starting distance for the zone, followed by the zone label. The zone's end boundary is set by the next zone's starting distance.

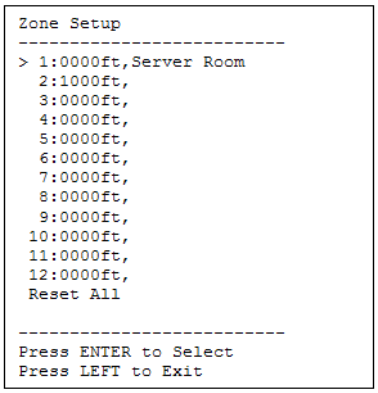

Figure 5.9 Example Configuration for Zone 1

Note Zone 1 starts at 0 feet/meters and ends at Zone 2's starting distance.

Figure 5.10 is an example of the main screen during a leak at 500 feet (152.4m), in Zone 1, labeled Server Room.

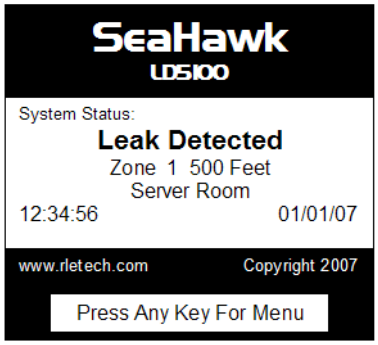

Figure 5.10 Example of the Main Screen during a Specific Condition

5.10. Point Mapping

The **Point Mapping** menu allows users to map points on the LD5100. Mapped points help users to create reference maps for a cable layout. For more details about how to map the cable on the LD5100 see Chapter 6, “Mapping the Cable” on page 41.

5.11. Comm Port Settings

The **Comm Port Settings** menu allows users to configure both of the LD5100’s RS485 Modbus ports. The LD5100 is only configurable as a Modbus slave device. Both ports may have their addresses and baud rates set in this menu. Both addresses may be different and can be configured from 0 (disabled) to 254. Both baud rates can be different and can be configured as 1200, 2400, 9600 (default), or 19200.

To set the ports, use the up and down arrows to navigate to the desired Port #. Then push the right arrow to select the field. Use the up and down arrows to select the desired setting.

The Leak Detection Master option enables slave units to activate the LD5100 when they are triggered into an alarm state. This function is beneficial when the LD5100 is a remote system that does not have personnel in the immediate vicinity to monitor the alarm status.

When using the leak detection master option, the LD5100 relays can be activated according to the slave unit alarm. If the slave has a leak alarm or a cable break alarm, the LD5100 leak or cable relay will change state, respectively (i.e. it will trigger that an alarm is present. The zone will then appear on the LCD and an alarm state will be reported to the top level of the system.

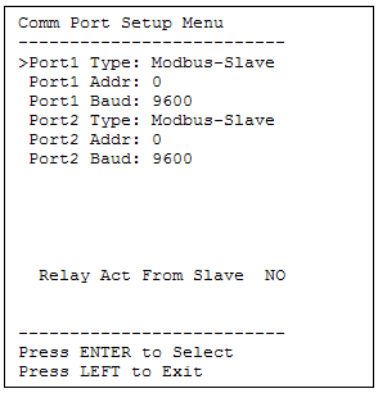

Figure 5.11 Comm Port

CHAPTER

6

MAPPING THE CABLE

After the SeaHawk Water Leak Detection Cable (SC) is laid in the desired configuration, the cable can be mapped. Mapping the cable improves the accuracy of the LD5100 reference map and makes it easier to locate a leak.

To ensure the cable has been installed properly, RLE recommends testing the cable in a few spots before mapping the system,.

The LD5100 computes the distance from the control panel to the leak along the length of SC cable attached to the unit. In most cases, the SC cable is laid in a curved or serpentine pattern. This may make it difficult to locate a leak when given a linear distance. To help alleviate this problem, identify a series of easily accessible, evenly spaced points along the cable length. Number the points, and record their locations on the cable reference map (part #FM1114) provided by RLE, or refer to the directions for creating a map below (6.1., “Mapping Directions” on page 42). Use the numbered points to map the cable. Then, when the unit detects a leak, the location of the leak can be determined by comparing the distance shown on the control panel with the known positions along the cable as recorded on the reference map.

Note Calibrate the LD5100 prior to mapping by adjusting the Resistance per Foot reading; see 5.8.14, “Resistance/Foot (Res/Ft)” on page 38 for more details. This allows the LD5100 measured cable length to accurately reflect the actual cable length installed.

6.1. Mapping Directions

1. If a cable reference map (part #FM114) was not ordered from RLE Technologies, LD5100 users must create a drawing that represents the floor plan. This drawing must include the room layout (walls, doors, and other permanent structures), the SC cable routing path, any jumper sections of non-sensing cable (NSC) and any weighted cable connectors/simulators (WCCS). Marking up a CAD drawing of the Facility works the best.

2. Physically identify points along the cable routing path. The points should be easily accessible and evenly spaced. Number the points and record their location on the reference map. Note where the connectors are located along the cable run.

3. Using the front panel of the LD5100, select **Point Mapping** and press **Enter**.

4. To test the map, wrap a wet paper towel or sponge or pour a small puddle of water around the cable at one of the previously mapped points. The LD5100 produces a short beep within approximately 30 seconds. The LCD displays the LD5100's calculated distance to the leak. Remove the paper towel and dry the cable. Within approximately 20 seconds, the LD5100 produces a long beep indicating the short is removed and the system has returned to normal.

Tip If the individual mapping the cable is not in a position to hear the audible alarm, wait two minutes between each point. This ensures the system has had time to stabilize.

WARNING

Loss of power or re-entering the Point Mapping menu will cause all mapping data to be lost (reset).

5. When mapping is complete, press the **Left** arrow key on the LD5100 to exit the mapping mode.

6. Select **View Map** on the LCD and record the LD5100's reading of each point on the reference map.

7. Mount the cable reference map alongside to the LD5100 control panel or the remote display. When a leak or cable break occurs, refer to the map and the distance displayed on the LD5100 to determine the physical location of the leak.

CHAPTER

7

EIA-232 INTERFACE

The EIA-232 Interface is used primarily for advanced diagnostic and configuration.

WARNING

The Bootloader section is designed for experienced technicians or users responsible for maintaining the system. **EXIT IMMEDIATELY** if you are not trained in the use of the Bootloader commands.

Contact the manufacturer for more information regarding the commands in this section.

7.1. Boot Up

Make sure the EIA-232 port is connected to a PC or terminal with a straight through cable (not provided). Run terminal emulation software (i.e., HyperTerminal) and make sure the settings match the LD5100 EIA-232 port configuration; *see 2.1.7, "RS232 Connector" on page 21 for port configuration details.* When the LD5100 is powered up, diagnostics are performed. The boot ROM and flash program code are verified. Output similar to Figure 7.1 should appear on the terminal or terminal emulation software.

```
LD5100 Boot V4.1.1
uP last reset by: external signal
Flash Mfg: 3030 / Device Id: 0000
AMD Flash Check: Flash Mfg: 0001 AMD / Device Id: 2258 29F800-B
Current Time: MON 01/22/07 11:31:00
Diagnostics in progress
Serials: Passed
Ram:     Passed
Clock:   Passed
Nvram:   Passed
Flash Blank Check: Boot = Data Parm1= Data Parm2= Data Prgm = Data
Flash Checksum - Calc: D7DA Actual:D7DA CS: Valid  Serial Num: 0001
PS 15V: 15.22 Passed
PS 24V: 21.4 Passed
Adc Calibrate CH1: passed CH2: passed
Test Resistor - Leg1: 1489h = 8042 ohms Leg2: 148Ch = 8046 ohms
(No Leak)    Leak)  Cable Leakage: 3DEAh = 300 uA
(Near Leak) Cable Leakage: 3DE7h = 300 uA
Cable Test Far Leak Measurement Resistance: 1F9Fh  Leak at: 8170 ohms
Cable Test Near Leak Measurement Resistance: 3FF7h Leak at: 4 ohms
Flash Code will start in 10 seconds
Press <ESC> to abort Flash Code
Checking flash program .. Running flash program 1
LD5100 V4.1 B06  01/23/07
SYSTEM BOOTED @ Mon 01/22/07 11:32:10

Copyright 2006, Raymond & Lae Engineering Inc.

Loading Block 1
DATA LOADED

<LD5100>
Cable length measured: 4700
```

Figure 7.1 EIA-232 Bootup Screen

7.2. Main Menu

Once the system is entirely booted, press the **Enter** key on your PC or terminal to display the Main Menu.

```
** LD5100 Help **
SC - System Configuration
LS - Leak Status
AR - Alarm Reset
AH - Alarm History
CH - Clear Alarm History
TD - Trend Data Table (Leakage Current)
CT - Clear Trend Data Table
TI - Display Date/Time
MT ON - Measurement Trace On
MT OFF - Measurement Trace Off
MBT - Modbus Trace On
MBS - Modbus Stats
EX - Exit
```

Figure 7.2 EIA-232 Main Menu Screen

7.3. SC – System Configuration

The **SC** function command displays a submenu that lists all items in the System Configuration Menu.

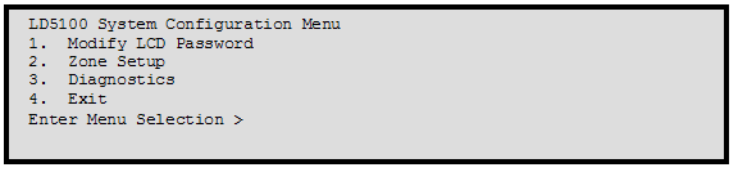

Figure 7.3 EIA-232 SC Function Screen

7.3.1 Modify LCD Password – 1

Selection **1**, Modify LCD Password, will allow users to set a new LCD password for the System Setup LCD menu. A four digit number must be entered in place of the default 1234 password. A password of 0000 will disable all password protection on the LD5100.

7.3.2 Zone Setup – 2

Selection **2**, Zone Setup, will allow users to configure zones. Zones are lengths of cable that may have a label, or description, associated with them.

Zones begin by the **Zone Distance**, or starting length, and end with the next zone's beginning Zone Distance; *Note: Zone 1 always starts with Zone Distance of 0 ft.* Enter a Zone Distance in the format **dxx** where xx is the zone number. A user will then be prompted to enter the beginning length for the zone. For example, to set Zone 2 to begin at 1000 feet (305m), type **d2** and press **Enter**. Then type **1000** and press **Enter** when prompted for zone distance.

Enter a zone's description in the format **lxx** where xx is the zone number. A user will then be prompted to enter the description for the zone. A description can be up to fifteen characters in length.

7.3.3 Diagnostics – 3

Selection **3**, Diagnostics, will allow users to open the LD5100's Diagnostic menu. This menu is primarily used for advanced diagnostics and troubleshooting.

```
LD5100 Diagnostics Menu
1.  Cable Readings
2.  Set 4-20mA Output
3.  Cable Relay On
4.  Cable Relay Off
5.  Output Relay K1 On
6.  Output Relay K1 Off
7.  Output Relay K2 On
8.  Output Relay K2 Off
9.  Exit
Enter Menu Selection >
```

Figure 7.4 EIA-232 Diagnostics Menu

The options available on the Diagnostics Menu are described in Table 7.1.

Table 7.1 Diagnostic Menu Options

Option	Description
Cable Readings – 1	Selection **1** displays the current cable readings, including both cable length and any present current leakage.
Set 4-20mA Output – 2	Selection **2** allows a user to manually set the 4-20mA output to test its function.
Cable Relay On – 3	Selection **3** turns the internal cable test relay on.
Cable Relay Off – 4	Selection **4** turns the internal cable test relay off.
Output Relay K1 On – 5	Selection **5** turns the Leak relay on.
Output Relay K1 Off – 6	Selection **6** turns the Leak relay off.
Output Relay K2 On – 7	Selection **7** turns the Fault relay on.
Output Relay K2 Off – 8	Selection **8** turns the Fault relay off.

7.4. Other Main Menu Functions

The remainder of the functions available from the Main Menu of the EIA-232 interface are described in Table 7.2.

Table 7.2 Other Main Menu Functions

Option	Description
LS – Leak Status	**LS** displays the current cable readings, including both cable length and any present current leakage.
AR – Alarm Reset	**AR** resets all alarm relays. This command forces all alarms off. If an alarm condition is still present after the **AR** command is executed, the alarm is reactivated. If an alarm is still active after the **AR** command is executed, it will not be re-entered in the Alarm History Log.
AH – Alarm History	**AH** displays the Alarm History Log.
CH – Clear Alarm History	**CH** clears the Alarm History Log.
TD – Trend Data Table	**TD** displays the Trend Data Table, which monitors and displays leakage current.
CT – Clear Trend Data Table	**CT** clears all records from the Trend Data Table.
TI – Display Date/time	**TI** displays the LD5100's current date and time
MT ON – Measurement Trace On	**MT ON** displays advanced manufacturer diagnostics of the microprocessor.
MT OFF – Measurement Trace Off	**MT OFF** turns off the display of advanced manufacturer diagnostics of the microprocessor.
MBT – Modbus Trace On	**MBT** shows Modbus trace.
MBS – Modbus Stats	**MBS** shows Modbus stats.
EX – Exit	**EX** is used to enter the Bootloader command section. The unit will stop monitoring cable and allow firmware updates to be loaded. To restore normal operation after updating firmware, type **RUN** and press the **Enter** (<-|) key on the keyboard, or power the unit off and then back on again.

Notes:

CHAPTER

8

MODBUS COMMUNICATION

This document describes the Modbus communications protocol as supported by the LD5100 Water Leak Detection System. It includes details and information on how to configure the LD5100 for communications via Modbus network.

8.1. Implementation Basics

The LD5100 is capable of communicating via the half-duplex RS485 serial communication standard. The LD5100 is configured to act as a slave device on a common network. The RS485 medium allows for multiple devices on a multi-drop network. The LD5100 is a slave only device and will never initiate a communications sequence.

8.1.1 Modes of Transmission

The Modbus protocol uses ASCII and RTU modes of transmission. The LD5100 supports only the RTU mode of transmission, with 8 data bits, no parity and one stop bit. Every Modbus packet consists of four fields:

- Slave Address Field
- Function Field
- Data Field
- Error Check Field (Checksum)

8.1.1.1 Slave Address Field

The slave address field is set by the going into local 160x160 display on the front panel. Go to COMM PORT SETTINGS from the Main Menu screen. Select the Modbus Slave address and the baud rate to be used for either/or EIA-485 Port1 and EIA-485 Port2.

8.1.1.2 Function Field

The function field is one byte in length and tells the LD5100 which function to perform. The supported functions are 03 (Read 4xxxx output registers), 04 (Read 3xxxx input registers), 06 (Preset single register) and 16 (Preset multiple registers).

8.1.1.3 Data Field

The data field of the request is a variable length depending on the function. The data fields for the LD5100 are 16-bit registers, transmitted high order byte first (big-endian).

8.1.1.4 Error Check (Checksum) Field

The checksum field lets the receiving device determine if the packet has transmission errors. The LD5100 RTU mode uses a 16-bit cyclic redundancy check (CRC-16).

8.1.2 Exception Responses

If a Modbus master sends an invalid command to the LD5100 or attempts to read an invalid register, an exception response is generated. The response packet will have the high order bit of the function code set to one. The data field of the exception response contains the exception error code.

Table 8.1 Exception Codes

Code	Name	Description
01	Illegal Function	The function code is not supported
02	Illegal Data Address	Attempt to access an invalid address
03	Illegal Data Value	Attempt to set a variable to an invalid value

8.2. Packet Communications For The LD5100

This section covers the registers, their names, and a brief description of what they refer to.

8.2.1 Function 03: Read Output Registers

To read the LD5100 parameter values, the master must send a Read Output Registers request packet. The Read Output Registers request packet specifies a start register and the number of registers to read. The start register is numbered from zero (40001 = zero, 40002 = one, etc).

Table 8.2 Read Output Registers Packet Structure

Read Registers Request Packet	Read Registers Response Packet
Slave Address (1 byte)	Slave Address (1 byte)
03 (Function code) (1 byte)	03 (Function code) (1 byte)
Start Register (2 bytes)	Byte count (1 byte)
# of registers to read (2 bytes)	First register (2 bytes)
Crc Checksum (2 bytes)	Second register (2 bytes)
	…
	Crc Checksum (2 bytes)

Table 8.3 Output Registers

Register	Name	Description	Units	Range
40001	Leak Threshold	Trip current for leak alarm	μAmps	0-65535
40002	Contamination Threshold	Trip current for contamination alarm	μAmps	0-65535
40003	Re-Alarm	Re-Alarm delay	Minutes	0-65535
40004	Latched Alarm	Latching Alarms	0=No 1=Yes	0-65535
40005	Silence Alarm	Set to 1 to silence audible alarm	1=Silence	0-65535
40006	Reset Alarm	Set to 1 to reset alarms	1=Reset Alarm	0-65535
40007	Spare			0-65535
40008	Spare			0-65535
40009	Spare			0-65535
40010	Month	Clock	1-12	0-65535
40011	Day	Clock	1-31	0-65535
40012	Year	Clock	00-99	0-65535
40013	Hour	Clock	0-23	0-65535
40014	Minutes	Clock	0-59	0-65535
40015	Seconds	Clock	0-59	0-65535
40016	Seconds	Leak Alarm Delay	20-3600	0-65535
40017	Seconds	Contamination Alarm Delay	20-3600	0-65535

8.2.2 Function 04: Read Input Registers

To read the LD5100 input values, the master must send a Read Input Registers request packet.

The Read Input Registers request packet specifies a start register and the number of registers to read. The start register is numbered from zero (30001 = zero, 30002 = one, etc).

Table 8.4 Read Input Registers Packet Structure

Read Registers Request Packet	Read Registers Response Packet
Slave Address (1 byte)	Slave Address (1 byte)
04 (Function code) (1 byte)	04 (Function code) (1 byte)
Start Register (2 bytes)	Byte count (1 byte)
# of registers to read (2 bytes)	First register (2 bytes)
Crc Checksum (2 bytes)	Second register (2 bytes)
	…
	Crc Checksum (2 bytes)

Table 8.5 Input Registers

Register	Name	Description	Units	Range
30001	Status	Bit level status	None	0-65535
30002	Leak Distance	Location of leak	Ft/Meters	0-65535
30003	Units	Unit of measure	1=Ft 0=Meters	0-65535
30004	Leak Current	Leakage current on cable	μAmps	0-65535
30005	Cable Length	Installed cable length	Ft/Meters	0-65535
30006	Loop1 Res	Resistance of cable	Ohms	0-65535
30007	Loop2 Res	Resistance of cable	Ohms	0-65535
30008	Res/Ft	Resistance of cable	Ohms x1000	0-65535
30009	Version	Firmware version	xx.xx X 100	0-65535
30010	Virtual Zone Alarm Status	Bit Level Status	None	0-65535
30011	Modbus Zone Enabled Flags	Bit Level Status	None	0-65535
30012	Modbus Zone2 Status	Bit Level Status	None	0-65535
30013	Modbus Zone2 Distance	Location of leak	Ft/Meters	0-65535
30014	Modbus Zone3 Status	Bit Level Status	None	0-65535
30015	Modbus Zone3 Distance	Location of leak	Ft/Meters	0-65535
30016	Modbus Zone4 Status	Bit Level Status	None	0-65535
30017	Modbus Zone4 Distance	Location of leak	Ft/Meters	0-65535
30018	Modbus Zone5 Status	Bit Level Status	None	0-65535
30019	Modbus Zone5 Distance	Location of leak	Ft/Meters	0-65535
30020	Modbus Zone6 Status	Bit Level Status	None	0-65535
30021	Modbus Zone6 Distance	Location of leak	Ft/Meters	0-65535
30022	Modbus Zone7 Status	Bit Level Status	None	0-65535
30023	Modbus Zone7 Distance	Location of leak	Ft/Meters	0-65535
30024	Modbus Zone8 Status	Bit Level Status	None	0-65535
30025	Modbus Zone8 Distance	Location of leak	Ft/Meters	0-65535
30026	Modbus Zone9 Status	Bit Level Status	None	0-65535
30027	Modbus Zone9 Distance	Location of leak	Ft/Meters	0-65535
30028	Modbus Zone10 Status	Bit Level Status	None	0-65535
30029	Modbus Zone10 Distance	Location of leak	Ft/Meters	0-65535
30030	Modbus Zone11 Status	Bit Level Status	None	0-65535
30031	Modbus Zone11 Distance	Location of leak	Ft/Meters	0-65535
30032	Modbus Zone12 Status	Location of leak	None	0-65535
30033	Modbus Zone12 Distance	Bit Level Status	Ft/Meters	0-65535

Registers 30011 through 30033 are dedicated registers for modbus master; see Appendix B, “Leak Detection Modbus Master” on page 61.

Table 8.6 Status Flags (Register 30001)

Bit	Description
00	1 = Leak is Detected
01	1 = Cable Break Alarm
02	1 = Contamination is detected
03-15	Spare

Table 8.7 Status Flags (Register 30010)

Bit	Description
00	1 = Zone1
01	1 = Zone2
02	1 = Zone3
03	1 = Zone4
04	1 = Zone5
05	1 = Zone6
06	1 = Zone7
07	1 = Zone8
08	1 = Zone9
09	1 = Zone10
10	1 = Zone11
11	1 = Zone12

Table 8.8 Status Flags (Register 30011)

Bit	Description
00	1 = Not enabled
01	1 = Enabled, b1=MBZ2
02	1 = MBZ3
03	1 = MBZ4
04	1 = MBZ5
05	1 = MBZ6
06	1 = MBZ7
07	1 = MBZ8
08	1 = MBZ9
09	1 = MBZ20
10	1 = MBZ11
11	1 = MBZ12

Table 8.9 Status Flags (Register 30012 - 30033)

Bit	Description
00	1= Leak Detected
01	1 = Cable Break
02	1 = Contamination
07	1 = Communication Loss

8.2.3 Function 06: Preset Single Register

To set the LD5100 parameter value, the master must send a Preset Single Register request packet. The Preset Single Register request packet specifies a register and the data to write to that register. The register is numbered from zero (40001 = zero, 40002 = one, etc).

Table 8.10 Preset Single Register Packet Structure

Preset Register Request Packet	Preset Register Response Packet
Slave Address (1 byte)	Slave Address (1 byte)
06 (Function code) (1 byte)	06 (Function code) (1 byte)
Register (2 bytes)	Register (2 byte)
Data (2 bytes)	Data (2 bytes)
Crc Checksum (2 bytes)	Crc Checksum (2 bytes)

8.2.4 Function 16: Preset Multiple Registers

To set multiple LD5100 parameter values, the master must send a Preset Multiple Registers request packet. The Preset Multiple Register request packet specifies a starting register, the number of registers, a byte count and the data to write to the registers. The register is numbered from zero (40001 = zero, 40002 = one, etc).

Table 8.11 Preset Multiple Registers Packet Structure

Preset Registers Request Packet	Preset Registers Response Packet
Slave Address (1 byte)	Slave Address (1 byte)
16 (Function code) (1 byte)	16 (Function code) (1 byte)
Start Register (2 bytes)	Start Register (2 bytes)
# of registers to write (2 bytes)	# of registers (2 bytes)
Byte Count (1 byte)	Crc Checksum (2 bytes)
Data (2 bytes)	
…	
…	
Crc Checksum (2 bytes)	

8.3. RTU Framing

The example below shows a typical Query/Response from the LD5100 module.

Table 8.12 Query Sample

Slave Address	Function Code	Starting Register "Msb"	Starting Register "Lsb"	Numbers of Registers "Lsb"	Number of Registers "Lsb"	CRC 16 "Lsb"	CRC "Msb"
02	04	00	00	00	03	B5	A3

Table 8.13 Response Sample

Slave Address	Function Code	Count Bytes of Data	Register Data Msb Lsb	Register Data Msb Lsb	Register Data Msb Lsb	CRC 16 "Lsb"	CRC 16 "Msb"
02	04	06	00 00	00 00	00 01	B5	A3

Slave address 2 responds to Function Code 4 with 6 bytes of hexadecimal data and ends with CRC16 checksum

Register Values:

40001 = 0000 (hex)
40002 = 0000 (hex)
40003 = 0001 (hex)

APPENDIX

A

UPDATING FIRMWARE

Firmware updates are available on the Documentation/Files section of the LD5100 webpage at www.rletech.com. Download the appropriate firmware to an accessible place to upload via RS232 (9600 baud, 8, N, 1) port through a PC or terminal (see Chapter 7, "EIA-232 Interface" on page 43).

A.1. Updating the Flash Firmware

To start the update process, wait for the ten second delay window during power up and press "**ESC**" to stop the Flash Main Program from executing. Or if the Flash Main Program is already running, type "**EX**" to exit.

The Flash Main Program must be erased before an upload can be preformed. To erase the code, type the "E**RASE PRGM**" command. After a second or so, the screen will display "**OK**."

Next, type the "**LOAD PRGM XMODEM**" command. This will upload the new firmware file using X-Modem-1k protocol. Go to the top of the screen and left click on transfer, then click on send file. Select 1K X Modem from the protocol selection and then browse to where the firmware files are saved. The file must be binary with a.bin extension. Once the proper file is selected, click open. Then click "**send**." This might have to be repeated if this is the first time uploading firmware.

After the file has been uploaded, enter the "**RUN**" command, or power down the LD5100 and then turn it back on.

Note Go to the Products/LD5100 section on the LD5100 webpage of our website at www.rletech.com for the latest LD5100 firmware file.

Notes:

APPENDIX

B

LEAK DETECTION MODBUS MASTER

This feature allows the LD5100 to act as a Modbus master, so it can talk to other RLE distance read panels. Up to 11 RLE distance read panels can be connected to the EIA-485 port#1 on the LD5100. The system status can be viewed by using the view zones menu. The LD5100 will display leak, cable break, cable contamination, and loss of communications alarms from the slave units connected to it.

B.1. Connecting Distance Read Panels to the LD5100

When using the LD5100 as a Modbus master, the slave unit(s) must be wired to the EIA-485 port #1 (TB3). Port #2 (TB2) on the LD5100 can only be used as a Modbus slave output. Using a two wire configuration, connect the slave units in a 485 daisy chain. You will have to set the EIA-485 slave address in each Leak detection unit. The first unit connected must be set to address 2. The following units will increase in numeric order by one unit (e.g., the next unit would be set to address 3, the following would be set to address 4, etc.; see Figure B.1.)

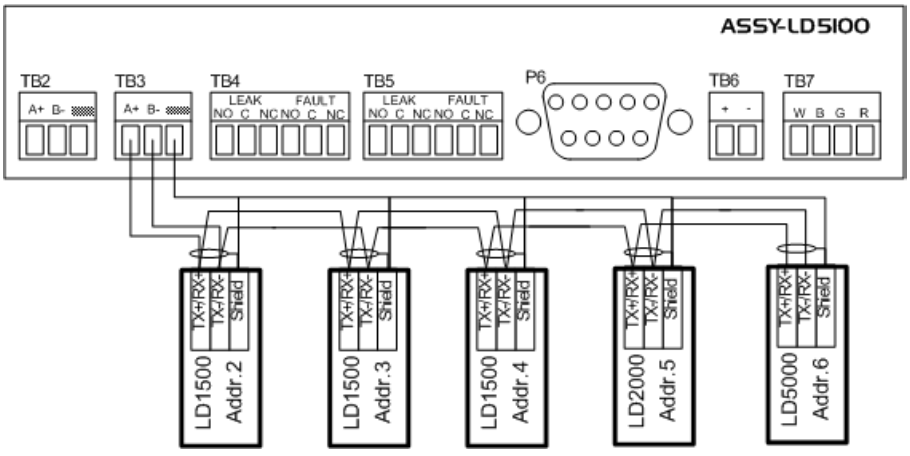

Figure B.1 LD5100 Connection Diagram

B.2. Configuring the LD5100 Via the Local Display (LCD)

First, the Com Port Setting must be configured on the LD5100:

1. From the main menu, press any of the buttons. Move the cursor down and select the Com Port Settings, press Enter to the access menu.
2. The cursor will be to the left of Port1, press the Enter. Push the DOWN arrow to change the type from Modbus-Slave to Modbus-Master, press Enter to save the change.
3. Push the LEFT arrow to get out of the Com Port Settings menu.
4. Select the Zone Setup menu and press Enter.
5. Zone #1 will be set as Master. If desired, assign a name to the Master. The labels for the Zones can be up to 15 characters long, including spacing.
6. Move the cursor down one space to the number two position, press Enter.
7. Press either the UP or DOWN arrow to select the Slave option for the address.
8. Press the RIGHT arrow to move the cursor in the label field, then enter you label, press Enter once complete to save your changes.
9. Follow steps 6-8 for configuring Zones 3-12, as needed.
10. Once completed configuring the zones, you can go to the View Zones screen and view the status.
11. RLE recommends generating alarms from each panel to ensure proper communication.
12. You can configure the LD5100 relays to change state according to the slave unit alarm. If the slave has a leak alarm or a cable break alarm, the leak or cable relay, will change state, respectively.

Note You can only have fifteen characters per label field; this includes spaces.

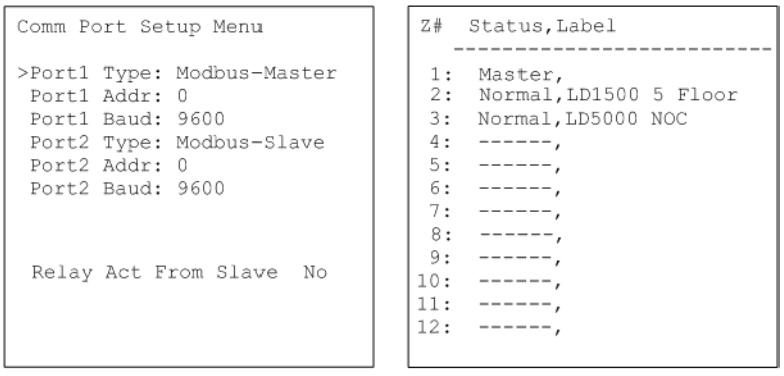

Figure B.2 Sample Set-up Screens

B.3. Configuring the LD5100 Via the EIA-232 (Craft) Port

First, the Com Port Setting must be configured on the LD5100:

1. Using the Local display (LCD) on the LD5100 press any of the buttons. Move the cursor down and select the Com Port Settings, press Enter to access the menu.
2. The cursor will be to the left of Port1, press the Enter key.
3. Push the DOWN arrow to change the type from Modbus-Slave to Modbus-Master, press Enter to save the changes.
4. Connect the straight through male-female DB-9 serial cable from your laptop, or PC, to the EIA-232 port on the LD5100.
5. Open the terminal emulation program (HyperTerminal) with a connection of 9600 Baud, 8 Data bits, Parity None, 1 Stop bit and Flow control set to off.
6. Press the Enter key on your laptop, or PC, to view the LD5100 Help menu.
7. Type “SC” to access the System Configuration menu (see Figure B.3).

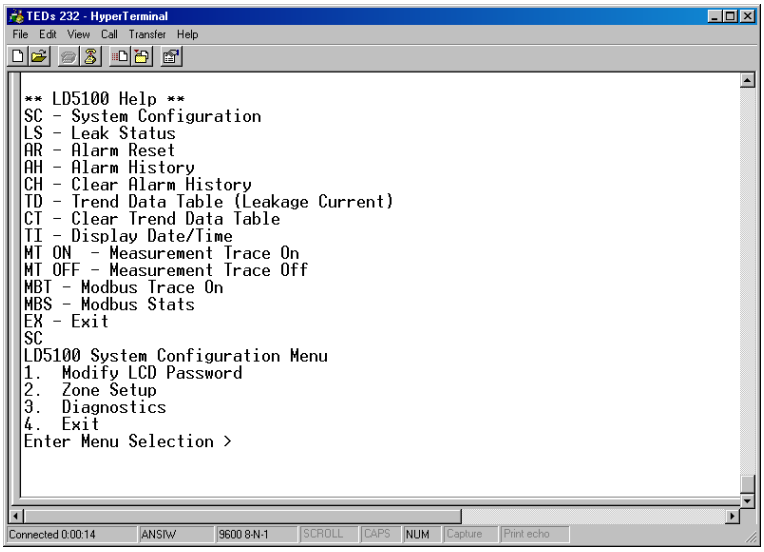

Figure B.3 Configuration Menu from EIA-232 Connection

8. Type “2” for configuring the Zone Setup.
9. To configure Input #2, type D2, then press Enter.
10. Press “1” to enable the zone then press Enter.
11. To assign a label to that field type “L2”, then press Enter. You can enter the label desired for that Slave device. You can enter 15 characters per label, including spaces.
12. Repeat steps 7-9 to configure any remaining slave devices.
13. Once completed configuring the zones, go to the View Zones screen on the local display (LCD) to view the status.
14. RLE recommends generating alarms from each panel to ensure proper communication.

APPENDIX

C

PREVENTIVE MAINTENANCE

Follow these steps monthly to test the system and ensure that the control panel is functioning properly:

1. Place water on the cable.
2. Verify the Leak Detected alarm on the control panel.
3. Compare the distance reading on the LD5100 LCD to the reference map to verify that the LD5100 displays the correct leak location.
4. Dry the cable and verify that the LD5100 returns to normal.
5. Remove the end-of-line terminator.
6. Verify the Cable Break alarm on the control panel.
7. Reinstall the end-of-line terminator.
8. Verify that the LD5100 returns to normal.

Monitor the cable current monthly to verify that the cable is not being contaminated. The LD5100 will alarm on cable contamination if the contamination is excessive.

1. From the LD5100 display, press the "**Enter**" key and navigate to the Cable Status menu.
2. Be sure the cable current is less than 25μA. If the cable current is greater than 25μA, it is recommended to troubleshoot the cables to determine which cable is contaminated. The contaminated cable should be removed, cleaned, retested and reinstalled.

Notes:

APPENDIX

D

TROUBLESHOOTING

Table D.1 Troubleshooting Problems with the LD5100

Problem	Action
Control Panel will not Power Up	1 Check with a DVOM (multi-meter) for AC input power on the lower right hand terminal block on the Power board. If the Input Selector Switch is set for 115, voltage should be between 105 and 125 VAC. If the Input Selector Switch is set for 230, voltage should be between 205 and 250 VAC. If no AC power is present at terminal block, check the circuit (breaker) the LD5100 control panel is powered by. If voltage is present, go to step 2. 2 Check for 24 VDC at terminal block TB1 pins 1 and 2. If no voltage is present across these pins, the Power board has failed. Contact RLE Technologies for replacement. If voltage is present and no LED's are illuminated, contact RLE Technologies for further troubleshooting.
Unit Powers Up without Proper Display on LCD	1 Open the front door and verify that the supply wires are connected to the display board (LCD panel). 2 Check the R39 contrast Potentiometer located on the left middle section of the main board. Adjust the dial and verify that characters are appearing on the LCD. If the LCD is still not working, go to step 3. 3 Check the ribbon cable attached to the display board. Verify that the connectors are all the way in place. If ribbon cable is in place and the LCD is still not displaying correctly, contact RLE Technologies for further support.

Table D.1 Troubleshooting Problems with the LD5100 (continued)

Problem	Action
Cable Break Alarm	1 Verify that the leader cable from the SC cable run is plugged into terminal block TB7. 2 Verify that the end-of-line terminator is installed on the end of the orange sense cable run. If present at the end of the cable run, go to step 3. 3 Remove the end-of-line terminator (EOL) from the end of the cable run and install it onto the end of the leader cable coming from the control panel. If the condition clears, there is a damaged/faulty section of SC cable. Start moving the end-of-line terminator to the end of each section of SC cable to isolate the faulty section. If the condition does not clear, go to step 4. 4 Power down (shut off) the control panel. Remove terminal block TB7 from the main board. Remove the four conductors from the leader cable wire going into the four position terminal block. Install a jumper wire between pins 1 and 2 and another jumper wire between pins 3 and 4. Reinstall the terminal block back into TB2. If the cable break condition clears, there is a problem with the leader cable. If the condition does not clear, contact RLE Technologies for further support.
Control Panel not Calculating Proper Length of Cable	1 First verify the proper wiring order into terminal block TB7. Wiring color code should be as follows from left to right: White, Black, Green and Red. 2 Calibrate your cable. To do this, adjust the Resistance per Foot (see 5-8.14: Resistance / Foot on page 19 for details). If the condition does not change, please contact RLE Technologies. The control panel is pre-calibrated from the factory. The overall footage should be within 5% of actual installed length.

Table D.1 Troubleshooting Problems with the LD5100 (continued)

Problem	Action
Control Panel not Calculating Proper Leak Distance	1 Check the distance on the cable run to verify that the control panel is monitoring. Verify there is no water along the cable run. Check to see if multiple leaks are present on the cable. The first leak should be read and latched by the system; however, if the system is updated or simultaneous leaks occur (2 or more) within 30 seconds of the initial leak, the system may display the average distance (distance of the first leak + distance of the second leak / 2). If no water is present, go to step 2. 2 Power down (shut off) the control panel and remove the end-of-line terminator (EOL) from the end of the SC cable. Locate the first section of SC cable from the LD5100 control panel. Where it joins to the second section of cable, disconnect and install the End-of-Line terminator at the end of the first section of SC cable. Turn power back on at control panel. Once the control panel runs for five to ten minutes, use a damp cloth, rag or paper towel and place it on the end of the orange SC cable. If the leak is calculated correctly, remove the end-of-line terminator; reconnect the SC cable and move down to the next section of cable. Repeat this process until a faulty reading is obtained. If the reading is off at the first section of cable, there may be miscalculations from the LD5100 unit, please contact RLE Technologies for support.
Cable Contamination Alarm Units Alarm History Displays: “Cable Contaminated @ XXXX Ft”	1 To clear a contamination alarm, the cable must be removed and cleaned. Usually the cable can be cleaned by pulling it through a clean damp rag. 2 If the cable is contaminated by oil, Glycol or chemicals, the cable can be washed. Use a mild detergent solution of 1 capful to 2 gallons lukewarm water (<105°F). Agitate the cable in a suitable container, rinse with clear lukewarm water and wipe dry with a clean towel. The cable may also be cleaned by wiping it down with Isopropyl Alcohol. 3 Retest the cable by connecting it to the LD5100 before reinstalling it under the floor.

Note Contamination and/or physical damage to the cable is not covered under warranty. For all other troubleshooting concerns and questions regarding this product, contact RLE Technologies at 970-484-6510 or go to our website at www.rletech.com.

Notes:

APPENDIX

E

TECHNICAL SPECIFICATIONS

Table E.1 Technical Specifications

Power		100-240VAC @ 500mA Max, 50/60 Hz; hardwired power supply
Inputs		
	Water Leak Detection Cable	Compatible with SeaHawk SC Cable (not included)
	Cable Input	Requires SeaHawk LC-KIT: 15ft (4.57m) leader cable and EOL (LC-KIT not included)
	Maximum Length	5,000ft (1,524m)
	Detection Accuracy	± 2ft (0.6m)+/- 0.5% of the cable length
	Detection Repeatability	± 2ft (0.6m) +/- 0.25% of the cable length
	Detection Response Time	5-990sec, software adjustable in 5sec increments; ±2sec
Outputs		
	Analog	4-20mA Loop Powered, 18-36VDC, RL = 500? max.
	Relay	2 Form C Leak Relays, 2 Form C Cable Break Relays; 1A @ 24VDC, 0.5A resistive @ 120VAC; configurable for supervised or non-supervised, latched or non-latched
Communications Ports		
	RS-232	9600 baud; No parity, 8 data bits, 1 stop bit
	RS-485	1200, 2400, 9600 or 19200 baud (selectable); No parity, 8 data bits, 1 stop bit
Protocols		
	Modbus (RS-485)	Slave; RTU Mode; Supports function codes 03, 04, 06 and 16
	Terminal Emulation (RS-232)	VT100 compatible
Alarm Notification		
	Audible Alarm	85DBA @ 2ft (0.6m); re-sound 0-999min

Table E.1 Technical Specifications (continued)

Logging Capabilities		
	Event Log	Last 500 events
	Trend Log	Cable current level every day, for the last 288 days
Login Security		
	Display Access	1 Administrator (password for configuration, no password required to view panel status)
	Terminal Emulation Access	None
Front Panel Interface		
	Display	Graphic, 160x160 pixel resolution backlit LCD, adjustable contrast
	Push Buttons	Right, left, up, down, enter
	LED Indicators	Power/Status: 1 bi-color (green=power on, red=alarm)
Operating Environment		
	Temperature	32° to 122°F (0° to 50°C)
	Humidity	5% to 95% RH, non-condensing
	Altitude	15,000ft (4,572m) max.
Storage Environment		-4° to 185°F (-20° to 85°C)
Dimensions		10.0"W x 12.6"H x 3.25"D (254mmW x 320mmH x 82.5mmD)
Weight		10 lbs. (4.53kg)
Mounting		Vertical wall mount
Certifications		CE; ETL listed: conforms to UL STD 61010-1, EN STD 61010-1; certified to CSA C22.2 STD NO. 61010-1; RoHS compliant