

# Leak Detection



## LD1500 User Guide

Version 3.6a



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## Revision History

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3.1	August 2014		
3.2	September 2015		
3.3	December 2016		

## Manufacturer's Notes

This product is manufactured by RLE Technologies, 104 Racquette Drive, Fort Collins, CO, 80524. If this product is used in any manner other than that specified by the manufacturer, the protection provided by the equipment may be impaired.

## Product Registration

Product registration helps RLE Technologies inform owners of:

- Product upgrades
- Firmware enhancements
- New products and technologies
- Special offers available only to registered users

Any information provided to RLE Technologies through the registration form will be regarded as confidential. RLE will not sell or distribute any of the information to third parties.

## Technical Support

Before you install an LD1500, refer to RLE Technologies' website, [www.rletech.com](http://www.rletech.com), to ensure you are using the most recent version of all documentation.

Personal assistance is available Monday through Friday, from 8:00 a.m. to 5:00 p.m. MST.

A request for assistance may be sent to [support@rletech.com](mailto:support@rletech.com)

Otherwise, please call us directly at: **800.518.1519**.

The following information is located on the bottom of each LD1500 unit. Please have this information available whenever a technical support call is placed:

Product Model Number \_\_\_\_\_  
Product Serial Number \_\_\_\_\_  
Product Manufacture Date \_\_\_\_\_

The LD1500 is not a field-serviceable item and must be sent back to RLE Technologies for mechanical repair. Power must be disconnected (unplugged) from the LD1500 any time the unit is mechanically serviced. Physically unplug power from the unit any time you are making wiring connections to or from the LD1500.

RLE cannot accept an item for repair without a Return Materials Authorization number, which must be provided by RLE.

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# PRODUCT OVERVIEW

## 1.1. Description

The LD1500 is a complete monitoring system that detects and reports the presence of water and other conductive liquids. The LD1500 couples SeaHawk Leak Detection Cable (sensing cable) with an advanced control panel. Each LD1500 monitors up to 1,500 feet (457.2m) of sensing cable. When a conductive liquid comes in contact with the sensing cable, an Alarm LED is illuminated red on the front panel, the distance to the leak is shown on the LD1500's web page, and alarm notifications are distributed via user-configurable Modbus (EIA-485 RTU or TCP/IP), BACnet (EIA-485 MS/TP or IP), or SNMP.

## 1.2. Operation

When the LD1500'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 LD1500 provides a webpage interface to allow users to get updates on the unit's conditions via the Internet or local area network. The LD1500 also provides Modbus and BACnet outputs via EIA-485, twisted-pair wire or TCP/IP.

**Note** The LD1500 produces an alarm in the following conditions:

- ◆ Leak detected
- ◆ Cable break (or cable fault)
- ◆ Cable contamination
- ◆ Loss of communications

The LD1500 is a supervised system; it continually monitors the cable for continuity. A cable break or excess contamination of the cable causes an Alarm indication and notification.

## 1.3. Mechanical Description

The LD1500 is built with one circuit board. The main board is mounted inside of the enclosure.

## 1.4. Installation

The LD1500 is a wall mounted device. Before applying power to the unit, ensure that all connections are correct and all screw terminals are secure. The LD1500 requires and isolated power supply and is powered by 24 VAC or 24 VDC power. A power supply is not included with the LD1500. Purchase an RLE power supply, either the PSWA-DC-24 (24VDC isolated power) or the WA-AC-24 (24VAC isolated power). DO NOT connect 115/230 VAC to the unit; damage will occur to the circuitry.

## 1.5. Reference Map

Users are advised to purchase a framed reference map (FM1114) for use with the LD1500 to aid in locating any detected leaks along the sensing cable. Once all the sensing 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 map is revised.

## 1.6. Web Interface

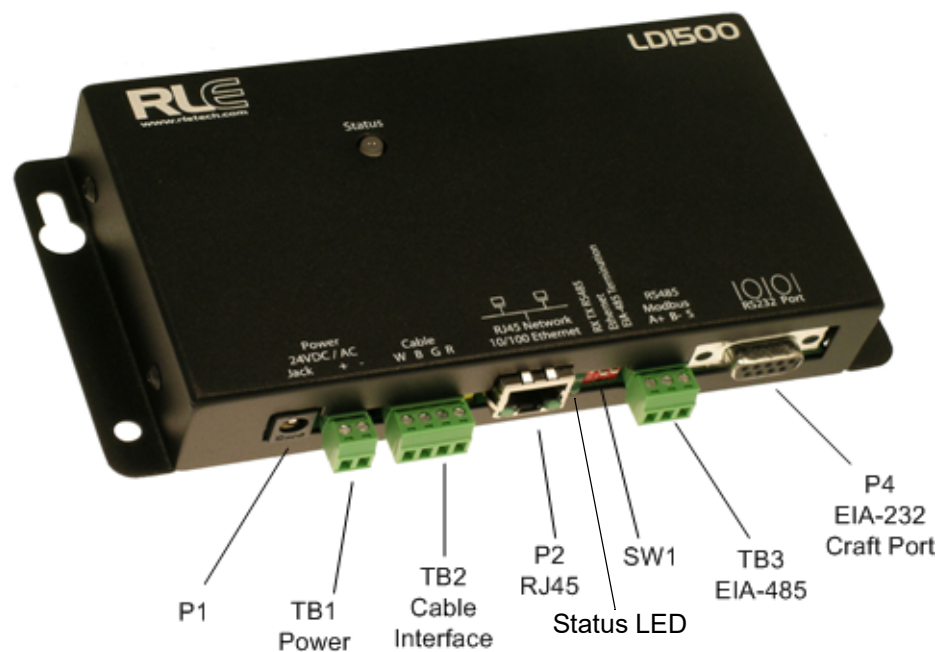
The LD1500's web page interface provides remote information updates via network communications.

A more detailed description of the web page interface can be found in Chapter 4, “Web Interface” on page 19.



## CONNECTIONS AND INDICATORS

The LD1500 contains one circuit board. All connections are accessible when the unit is inside of its enclosure. The connectors on the main board, found at the bottom of the following photograph, are labeled TB1 through TB3 and P1 through P4.



**Figure 2.1** LD1500 Connections and Indicators

## 2.1. Connections and Default Settings

### 2.1.1 P1: Input Power

This is an optional barrel connection for input power (as you may also use TB1 for input power) with the following connection:

Inside positive (+)

Outside negative (-)

The LD1500 requires an isolated power supply. Power supplies are available from RLE and are not included with the LD1500. Contact RLE directly to purchase either RLE part number PSWA-DC-24 (24VDC isolated power supply) or WA-AC-24 (24VAC isolated power supply).

### 2.1.2 TB1: Input Power

This is an optional two position connector (as you may also use P1 for input power) with the following connections:

TB1-1 24VDC positive (+)

TB1-2 24VDC negative (-)

The LD1500 requires an isolated power supply. If you have purchased a PSWA-DC-24 or WA-AC-24 from RLE Technologies, you may need to snip off the barrel connector and strip the ends of the wires so they can be placed into TB1.

Polarity suggestions are optional, as the LD1500 power inputs are connected directly to an internal bridge rectifier. 24VAC uses the same power connector as 24VDC.

### 2.1.3 TB2: Cable Interface

SeaHawk Sensing Cable connects to TB2. Since sensing cable cannot connect directly to a controller, a 15 foot (4.57m) non-sensing leader cable is required (included in a leader cable kit: part #LC-KIT). Connect the leader cable wires to TB2 as follows, and connect the sensing cable to the leader cable.

TB2-1 White wire

TB2-2 Black wire

TB2-3 Green wire

TB2-4 Red wire

### 2.1.4 P2: RJ45 Network

A 10/100 Ethernet connection is available to connect the LD1500 on a local area network. Use a crossover cable for initial connection and configuration. The default settings are as follows:

IP Address: 10.0.0.188

Subnet Mask: 255.255.255.0

## 2.1.5 SW1.1: Ethernet Port Configuration

Switch SW1.1, when switched DOWN, enables 10/100BASE-T Auto Negotiate. When switched UP, it locks the Ethernet port in 100BASE-T. Auto Negotiate does not work with some gigabit switches; therefore, the LD1500 ships with switch SW1.1 in the UP, 100BASE-T locked, position.

## 2.1.6 SW1.2:EIA-485 Termination

Switch SW1.2, when switched ON (DOWN), places a termination resistor across the + and - terminals of the EIA-485 port. This is used when the LD1500 is the last unit on an EIA-485 network.

## 2.1.7 TB3: EIA-485 Modbus Port

TB4 connects to an EIA-485 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 EIA-485 port has a selectable baud rate (1200, 2400, 9600, 19200, or 38400) and selectable parity (none/even/odd) and is set to 8 data bits and 1 stop bit. Connect the EIA-485 wires to TB4 as follows:

TB3-1 A (+)

TB3-2 B (-)

TB3-3 Shield

## 2.1.8 P4: EIA-232 Connector

The EIA-232 uses a baud rate of 9600. The EIA-232 port is set to 8 data bits, no parity, and 1 stop bit (8, N, 1). A straight through cable should be used to connect a terminal or PC to the LD1500. This connection should only be used for Setting of the IP address, advanced diagnostics, firmware uploading, and troubleshooting only.

## 2.2. Indicators

### 2.2.1 Status LED

The front panel of the LD1500 features a status LED. This LED blinks once every two seconds to indicate the firmware on the LD1500 is running and active.



## INSTALLATION

### 3.1. Installing the LD1500

The LD1500 is a wall mounted device. There are four mounting holes on the sides of the unit spaced 6.6 inches (.167m) apart. Use drywall anchors if securing the unit to drywall.

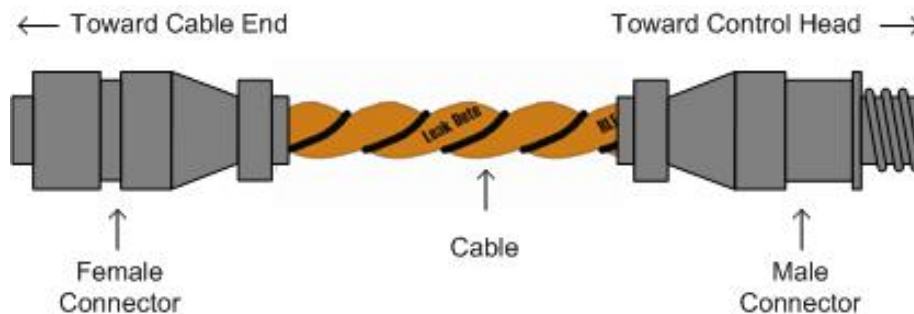
### 3.2. Connecting the Leak Detection Cable

The LD1500 is shipped with a 15-foot (4.57m) leader cable. One end of this leader cable connects to the LD1500 controller, and the other end connects to the SeaHawk sensing cable. Connect each end of the leader cable as follows:

- 1 With the screws of the terminal block connector on the LD1500 facing up, connect the four stripped, bare wires of the leader cable to the terminals in this order, from left to right: white, black, green, red. Tighten the screws to secure the ends of the leader cable, and plug the connector into TB2. Make sure the wires, from left to right, are in the white-black-green-red order.

**Note** If the terminal connector is removed from the end of the cable, make sure the wires are in white-black-green-red order when the connector is reapplied.

- 2 Unscrew the end-of-line (EOL) terminator from the other end of the leader cable.
- 3 Attach the first length of leak detection cable (sensing cable) to the leader cable.



**Figure 3.1** SeaHawk Sensing Cable

- 4 Route the sensing cable according to a cable layout diagram, if provided.
- 5 Secure the EOL terminator on the unoccupied end of the sensing cable.

**Note** It is important to finish the end of the SeaHawk Water Leak Detection Cable (sensing cable) 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.

### 3.2.1 Securing Cable to the Floor

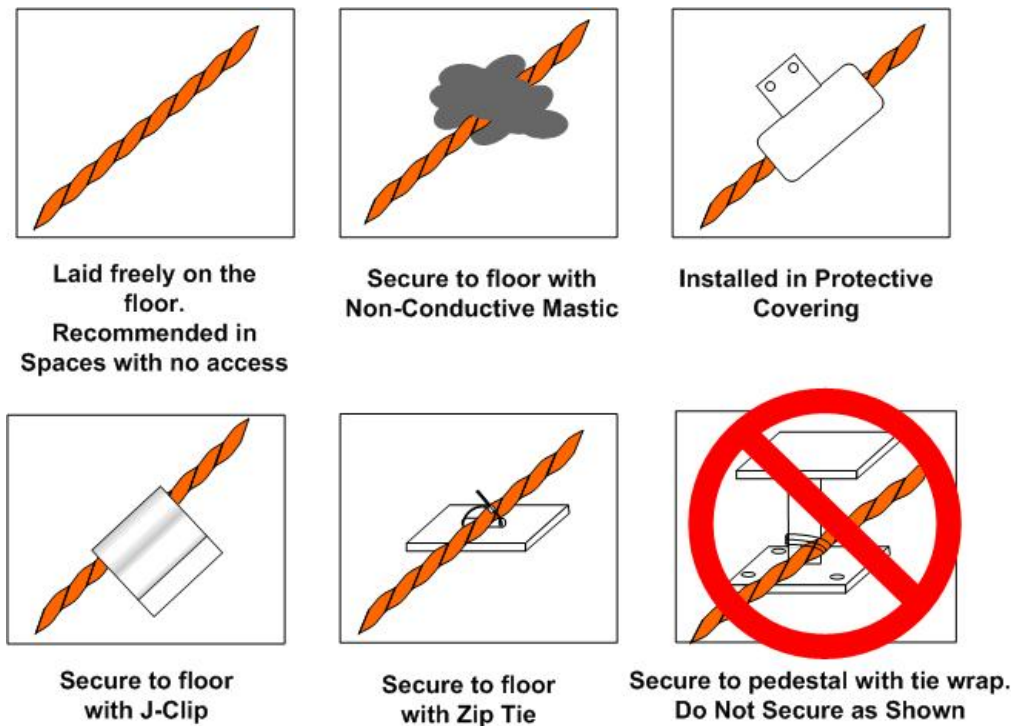
Secure the sensing cable to the floor with either J-clips, or one of the other approved methods shown in Figure 3.2. J-clips, available from RLE and designed specifically for use with sensing cable, are the manufacturer's recommended installation method and can be installed as follows:

- ◆ Place one J-clip every 5 to 6 feet (1.52 to 1.83m) along the length of the sensing cable and one at each turn of the cable. Use more J-clips if a “tighter” configuration is required.
- ◆ If the cable is installed over an obstruction, place a J-clip on 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 4 to 6 feet (1.22 to 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 12 to 18 inches (.305 to .457m) apart.



**Figure 3.2** Cable Installation Methods

### 3.3. Applying Power to the LD1500

Once the SeaHawk sensing cable is connected to the unit, power can be applied. **The LD1500 requires an isolated power supply.** A power supply is not included with the LD1500. If you wish to use 24VDC power, the LD1500 requires RLE power supply PSWA-DC-24 (not included - purchase separately from RLE). If you wish to use AC power, the LD1500 requires RLE power supply WA-AC-24 (not included - purchase separately from RLE).

Run an isolated power supply to the location of the unit.

Before applying power to the unit, ensure all cable and communication connections are complete. The LD1500 begins booting once power is applied. Wait approximately one minute. No alarm should be present.

On the web page interface, the cable length is displayed. If this reading varies by more than  $\pm 5\%$  of the actual length of cable installed, verify the installation. The LD1500 should not require any calibration. If any calibration is required, verify that the cable current is 0 (zero) before calibrating or false and inaccurate readings will occur.

### 3.4. Communication

The LD1500 will not communicate over a user's network the first time it is connected to the network. The manufacturer programs the LD1500 with a default IP address: 10.0.0.188, subnet: 255.255.255.0 and gateway (Def Route): 10.0.0.1. These settings must be changed to IP addresses that correspond with the user's network before the LD1500 can communicate over the network.

#### 3.4.1 Set the LD1500's IP Address

- ◆ Via the Web browser
- ◆ Via the EIA-232 interface

##### 3.4.1.1 Set the LD1500's IP Address Using a Web Browser

- 1 Plug a crossover network cable into the laptop or workstation that will be used to configure the LD1500. This cable is not intended to be connected to a network hub.
- 2 Write down the computer's IP address and Subnet Mask. Then change the IP address and Subnet Mask of the computer from its existing address to one that will allow it to communicate with the LD1500, such as **10.0.0.190**. It may be beneficial to set the IP address to one that is one number different from the Falcon's IP address. Consult the computer's manual or your IT Department before attempting this.
- 3 Connect the other end of the network cable to the Ethernet port on the LD1500. Access the LD1500 through a Web browser by typing the IP address into the location bar. Enter the LD1500 user name and password when prompted.

**Note** The default user name is "ld1500" (use all lowercase, as user name is case sensitive). There is no default password — leave the password field empty.

- 4 Select the **Configuration Menu** link, then select the **Network Settings** link. Change the IP address, Subnet Mask, and Def Route to ones provided by the network administrator. Press the **Submit Changes** button. The LD1500 will save the new IP address and reboot. You

must now use the new IP address and reset your computer to its original IP address and Subnet Mask.

- 5 Change the IP address of your computer back to its original IP address. If the computer was configured as DHCP (the network domain controller assigns an IP address) return it to this state. This may require assistance from your IT Department, or you may need to consult the computer's manual
- 6 The computer and the LD1500 are now both configured to communicate on the network. Both should be accessible via the network. Connect the PC and the LD1500 to the network. From the PC Web browser, type in the IP address of the LD1500. Enter the user name and password as stated above to verify network access to the LD1500.

### 3.4.1.2 Set the LD1500's IP Address using an EIA-232 Connection

To use the EIA-232 interface:

- 1 Connect the EIA-232 port (P4) on the LD1500 to a terminal or PC running terminal emulation software (such as HyperTerminal) with a 9-pin male-female straight through serial cable.
- 2 Set the appropriate communication port to **9600 baud, 8 data bits, no parity, 1 stop bit (9600/N/8/1)**, and **no software or hardware flow command**.
- 3 Once the terminal emulation software starts, type ? and press ENTER on the keyboard and the Main Menu should appear. If the Main Menu does not appear, check the communication settings and make sure the unit is powered on.
- 4 From the Main Menu type "**netcfg**" to select the Network Configuration Menu.
- 5 Enter the new IP address for the LD1500 by typing **ip xxx.xxx.xxx.xxx** where xxx.xxx.xxx.xxx is the new IP address of the unit. Separate each field with a decimal point — for example, type ip 10.0.0.50 <enter>.
- 6 The LD1500 will erase a memory block and copy data to Flash memory before rebooting.
- 7 The LD1500 IP address is now set and the LD1500 can be accessed through a Web browser using the new IP address.
- 8 Repeat steps 4-7 to change the Subnet Mask and Def Route, if needed, using the commands **nm xxx.xxx.xxx.xxx** to change the Subnet Mask and **dg xxx.xxx.xxx.xxx** to change the default gateway.



## 3.5 Calibrate Cable Resistance

Distance-read leak detection systems are resistance-based. RLE's orange water sensing cable has a base resistance of 2.8 ohms/foot, while most other sensing cables, including RLE's green chemical resistant sensing cable, have a resistance of 4.0 ohms/foot.

The resistance of each length of sensing cable may be slightly more or less than the base resistance due to manufacturing variances. For this reason, the cable length displayed on the home page of the web interface may be slightly more or less than the actual length of cable installed.

A system configured using base resistance values will still be very accurate. If you wish to fine tune the resistance value of your LD1500 system to make it more precise, you may do so. This will increase the accuracy of the system, and bring the LD1500's reported installed cable length value in line with the actual length of cable installed.

- 1 Ensure the LD1500 has been powered and has all the sensing cable attached to it, with no alarms present.
- 2 Gather and record the following data from the home page of the web interface:

Cable Length (as reported by the LD1500)	
Cable Current	
Leg 1 Resistance	
Leg 2 Resistance	

Record the resistance per foot setting, as reported by the LD1500. This can be found on the Leak Configuration page of the web interface (Configuration > Leak Settings).

Reported Resistance per Foot	
------------------------------	--

- 3 Note the actual (physical + simulated) length of cable physically connected to the system. For your reference:
  - ◆ WCCS simulates 50 ft.
  - ◆ SDZ simulates 50 ft.
  - ◆ XCON simulates 150 ft.
  - ◆ Nonsensing cable does not add any length to a system

Record this sum:

Actual length of cable connected to LD1500	
--	--

- 4 Verify the current reading on the cable from your recorded values above. This value must be less than 15  $\mu\text{A}$  in order to calibrate the system. If the current is higher than 15  $\mu\text{A}$ , clean the cable. Isopropyl alcohol works well to remove any contamination that might have gotten onto the cable during installation.
- 5 To calculate the most accurate resistance value for the system, divide the reported cable length by the actual cable length, and multiply the quotient by the reported resistance.

$$\left( \frac{\text{Reported Cable Length}}{\text{Actual Cable Length}} \right) \times \text{Reported Resistance} = \text{New Resistance}$$

For example:

Cable Length (as reported by the LD1500)	391 feet
Cable Current	0 $\mu$ A
Leg 1 Resistance	1088 Ohms
Leg 2 Resistance	1095 Ohms
Reported Resistance	2.800 Ohms/foot

One 15 foot leader cable (leader cable does not count toward the total length of cable installed), one weighted cable connector (simulates 50 feet of cable), and one 330 foot section of cable are connected to the system.

Actual length of cable connected to LD1500	380 feet
0 feet + 50 feet + 330 feet	

$$\left( \frac{391 \text{ feet}}{380 \text{ feet}} \right) \times 2.800 \text{ Ohms} = 2.881 \text{ Ohms/foot}$$

The actual resistance of the cable installed with this LD1500 is 2.881 ohms per foot.

- Replace the resistance per foot setting in the LD1500 with this newly calculated value. This can be edited on the Leak Configuration page of the web interface (Configuration > Leak Settings).

When using the web interface, remember to click the Submit Changes button to save the adjusted resistance value.

In our example, adjusting the resistance value changed the reported cable length from 391 feet to 380 feet. This improves the accuracy of the system because the reported cable length more closely matches the physical length of cable connected to the system.

## WEB INTERFACE

The LD1500's network connection allows users to configure and view current information from the LD1500. When logging on to the LD1500, navigate to the unit's IP address in a Web browser. A prompt will ask for a username and password. Enter in the appropriate information. Default settings include:

IP: 10.0.0.188


Username: ld1500

Password: *-none/blank-*

### 4.1. Home/Main Menu

When logging into the LD1500, the first page display is the **Home** page. All vital leak detection information is displayed in the main table.

Links are available on the left side of the Home page, including: Home, Alarm Log, and Configuration.

Home	
Alarm Log	
Configuration	
LD1500 - TS-LD1500	
Alarm Status:	No Alarm
sysUpTime:	1d 03:12:22
Cable Length:	493 Feet
Cable Current:	0 uA
Leg1 Resistance:	1431 Ohms
Leg2 Resistance:	1431 Ohms
Leak Alarm Count:	0
Contam. Alarm Count:	0
Remeasure Count:	0
Firmware:	LD1500 V2.3.7 (157040 bytes)
Bootloader:	LD1500 BOOT V2.4
Page loaded at: 4/11/2013 14:13:19	Refresh:32 Timeout:0

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**Figure 4.1** Home Page

Field	Description
<b>Alarm Status</b>	If the controller is in an alarm state, details regarding the alarm are noted in this field. The field is color coded to indicate the type of alarm.
<b>sysUp Time</b>	The amount of time that has passed since the system was last reset or powered on.
<b>Cable Length</b>	The length of cable connected to the controller, as calculated by the LD1500.
<b>Cable Current</b>	The amount of current running on the sensing cable.
<b>Leg 1 Resistance</b>	The resistance of Leg 1 is displayed in Ohms.
<b>Leg 2 Resistance</b>	The resistance of Leg 2 is displayed in Ohms.
<b>Leak Alarm Count</b>	The number of leak alarms detected by the system since it was last reset.
<b>Contamination Alarm Count</b>	The number of leak alarms detected by the system since it was last reset.
<b>Remeasure Count</b>	When a leak is detected, remeasure indicates how many seconds remain before the distance to the leak is measured again.
<b>Firmware</b>	The firmware version currently running on the system.
<b>Bootloader</b>	The bootloader version currently running on the system.
Bottom Row Statistics	<p>The main page of the web interface loads once, and then the data in the fields is refreshed on a regular basis. Because of the way the page loads, you will not see the entire page flash to blank and reload completely, but the data will be refreshed. Because the page refresh may be hard to detect, the bottom of the page features statistics that let you know the data you're viewing is up to date</p> <p>Page loaded at: The date and time the information on this page first loaded</p> <p>Refresh: The number of times the data within the fields has been refreshed. This number increases as the LD1500 is pinged for new data.</p> <p>Timeout: The opposite of Refresh. If the LD1500 goes down while this page is viewed, the timeout field will track how long communications are interrupted.</p>

**Figure 4.2** LD1500 Home Page

## 4.2. Alarm Log

The **Alarm Log** page displays a table of Alarm History. The Alarm History table displays Alarms and events recorded in the unit's memory log of the last 10 events. The alarms are displayed as follows:

### TYPE - SYSTEM\_TIME\_STAMP DESCRIPTION

**SYSTEM\_TIME\_STAMP** is displayed as **xxd HH:MM:SS** format since the system was powered up where **xxd** = days, **HH**=hours (01-24), **MM**=minutes (01-60) and **SS**=seconds (01-60).

**DESCRIPTION** provides details about the current alarm/event (e.g. Leak, Cable Fault, etc.).

---

```
Alarm Log Entries: 8

Current sysUpTime: 0d 18:06:53

ALARM - 0d 00:00:14 Cable Fault
RETURN - 0d 00:00:53 Cable Fault
ALARM - 0d 17:39:17 Cable Fault
RETURN - 0d 17:47:55 Cable Fault
ALARM - 0d 18:03:13 Leak Detected at 0 Feet
RETURN - 0d 18:04:20 Leak Detected at 0 Feet
ALARM - 0d 18:04:47 Leak Detected at 0 Feet
RETURN - 0d 18:05:21 Leak Detected at 0 Feet
```

[Main Menu](#)

Figure 4.3 Alarm Log Page

## 4.3. Configuration

The **Configuration** page provides access to a menu of available settings. Options for these setting are detailed below.

TS-LD1500

---

- [Leak Settings](#)
- [Web Settings](#)
- [Network/IP Settings](#)
- [SNMP](#)
- [SNMP/Syslog Community 1](#)
- [SNMP/Syslog Community 2](#)
- [SNMP Trap Test](#)
- [EIA-485/Modbus/N2](#)
- [Bacnet](#)
- [Bacnet Register-FD/BDT](#)
- [Bacnet Alarm](#)
- [System Management](#)
- [Main Menu](#)

Figure 4.4 Configuration Menu

### 4.3.1 Leak Settings

Use the **Leak Configuration** menu to fine tune system variables, including leak and contamination thresholds.

[Configuration](#) [Home](#)

**Leak Configuration**

Leak Trip Point:  uA (25-295)  
 Contamination Trip Point:  uA (20-295)  
 Leak Alarm Delay:  Seconds (5-995)  
 Contamination Alarm Delay:  Seconds (5-995)  
 Resistance Per Foot:  x.xxx ohms (2.000-4.250)  
 Measurement Display:  Feet  Meters

[Self-test](#)

**Figure 4.5** Leak Configuration Menu

Option	Description
<b>Leak Trip Point</b>	<p>The threshold for the amount of water required to trigger a leak alarm. Adjust this number to adjust the sensitivity of the leak alarm.</p> <p>A lower number yields a more sensitive system, so the system will trigger a leak alarm with less water present.                      A higher number produces a less sensitive system, so more water is required to trigger an alarm.</p> <p>Enter a value between 25 and 295 microamps.</p> <p>Default setting: 150uA.</p>
<b>Contamination Trip Point</b>	<p>The threshold for the amount of contamination required to trigger a cable contamination alarm. Adjust this number to adjust the sensitivity of the contamination alarm.</p> <p>A lower number yields a more sensitive system, so the system will trigger a contamination alarm with less contamination present.                      A higher number produces a less sensitive system, so more contamination is required to trigger an alarm.</p> <p>Enter a value between 20 and 295 microamps.</p> <p>Default setting: 40uA.</p>

**Table 4.1** Leak Configuration Options

Option	Description
<b>Leak Alarm Delay</b>	<p>The amount of time that passes between the time a leak is detected and the annunciation of the leak alarm.</p> <p>The leak trip point must be exceeded for the duration of this delay.</p> <p>Default setting: 20 seconds</p>
<b>Contamination Alarm Delay</b>	<p>The amount of time that passes between the time a contamination is detected and the annunciation of the contamination alarm.</p> <p>The contamination trip point must be exceeded for the duration of this delay.</p> <p>Default setting: 120 seconds</p>
<b>Resistance Per Foot</b>	<p>The resistance per foot (or meter) of cable determines the LD1500's ability to accurately detect the cable length installed and calculate distances to leaks. Adjust this value to fine-tune the accuracy of a distance-read leak detection system.</p> <p>RLE's orange water sensing cable has a base resistance of 2.800 ohms per foot. Most other sensing cables, including RLE's green chemical-resistant sensing cable, have a base resistance of 4.000 ohms per foot. Consult the sensing cable's datasheet for further information.</p> <p>The resistance value must be entered as a 4-digit number between 2.000 and 4.250, with one number in the tens place and three numbers past the decimal point (x.xxx).</p> <p>Default setting: 2.800 ohms per foot.</p>
<b>Measurement Display</b>	<p>Select either feet or meters to calibrate the LD1500 to the preferred unit of measure. All distance calculations will adjust accordingly.</p> <p>Default setting: Feet</p>

**Table 4.1** Leak Configuration Options

### 4.3.2 Web Settings

The **Web Settings** menu allows users to set two different security level passwords on the LD1500. A Read-Only level password allows users to only view the information and settings of the LD1500. No settings or changes may be submitted to the unit. The Read/Write level password allows users to change settings and configurations on the LD1500 as well as view all information in the unit. The Web refresh rate changes the interval that the Home page refreshes automatically when left open in an Internet browser.

[Configuration](#) [Home](#)

**Web Configuration**

System Name:

Web Password Read Only:

Web Password Read/Write:

Web Refresh Rate:  Seconds

**Figure 4.6** Web Configuration

Option	Description
<b>System Name</b>	Designate a name for the LD1500
<b>Web Password Read Only</b>	Two separate passwords can be configured on the LD1500.  The Read Only password allows users to access the LD1500's web interface and view the conditions of the system, but does not allow users to make changes to the LD1500's configuration.
<b>Web Password Read/Write</b>	The second configurable password on the LD1500 provides users with expanded access.  The Read/Write password allows users to view the conditions of the system and make changes to the LD1500's configuration.
<b>Web Refresh Rate</b>	Decide how often the web page refreshes - checks for new data and reloads the web page - when left in an open web browser. Enter a value from 10 to 999 seconds. If you enter 0, the screen will not refresh on its own - you'll have to click the refresh button on your web browser or press F5 to refresh the screen.  Default setting: 10 seconds

**Table 4.2** Web Configuration Options



### 4.3.3 Network/IP Settings

The **Network** settings allow users to change the network configuration of the LD1500. IP address, Subnet Mask, and Default Route (Gateway) may be changed from this menu.

[Configuration](#) [Home](#)

---

**Network/IP Configuration**

Warning: Changing these parameters will cause the network interface to operate differently, only change parameters if you are sure the changes are correct.

MAC Address: 00:90:5B:04:01:69

IP Address:

Net Mask:

Def Route:

---

**Figure 4.7** Network/IP Settings

Option	Description
<b>MAC Address</b>	The MAC address is a unique identifier set by the manufacturer, and is non-editable.
<b>IP Address</b>	Set the IP address for the LD1500, so it can communicate on your network. If you do not have an IP address for the device, obtain one from your IT department.  Default IP address: 10.0.0.188
<b>Net Mask</b>	Designate the device's Subnet Mask. Contact your IT department for further information.  Default subnet mask: 255.255.255.0
<b>Def Route</b>	Designate the device's default route (default gateway). If you do not have a default route, obtain one from your IT department.  Default device route: 10.0.0.1

**Table 4.3** Network/IP Configuration Page

### 4.3.4 SNMP

Use this page to configure the LD1500 for SNMP communications.

[Configuration](#) [Home](#)

**SNMP Configuration**

System Name:

System Contact:

System Location:

Select Snmp Trap Type:  ▾

Max Inform Retries:  (0-999) (0=unlimited)

Inform Interval:  (1-999) (Minutes)

**Figure 4.8** SNMP Configuration

Option	Description
System Name	Designate a unique name for the LD1500. This name appears on the LD1500 Main Menu and is included as part of email notifications.
System Contact	Designate the individual responsible for the LD1500.
System Location	Enter of address of the LD1500's physical location.
SNMP Trap Type	Select the appropriate trap type from the drop-down menu.  V1 - Trap V2C - Trap V2C - Inform  Default setting: V1 -Trap
Max Inform Retries	The number of times the LD1500 will attempt to resend an undelivered trap. Enter a number 0 - 999. Enter 0 for an unlimited number of attempts.  Default setting: 0 (unlimited)
Inform Interval	The number of minutes that passes between inform operations. Enter a number of minutes 1 - 999  Default setting: 1

**Table 4.4** SNMP Options

## 4.3.5 SNMP/Syslog Communities 1 & 2

The **SNMP/Syslog Communities Configuration** pages identify devices that receive SNMP Traps and/or Syslog messages from the LD1500 and interact with the LD1500 over the network. To add a device to the Communities list, select a community number posted as “empty.” Enter the receiving device's IP Address and an identifier for the device in the Community field. An IP Address of 0.0.0.0 in this field allows any device to access the LD1500 through a MIB browser. Select “Write” if the device will have Read/Write network access. This allows the LD1500 to be configured over the network. Select “Traps” if the device will receive Traps from the LD1500. Select “Syslog” if the device will receive Syslog messages from the LD1500.

[Configuration](#) [Home](#)

---

### SNMP/Syslog Communities Configuration

Submit Changes

#	IP Address	Community	Write	Trap	Syslog	ArpC
1	10.0.0.197	public	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	(-)

[Configuration](#) [Home](#)

---

### SNMP/Syslog Communities Configuration

Submit Changes

#	IP Address	Community	Write	Trap	Syslog	ArpC
2	0.0.0.0	public	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	(-)

Figure 4.9 SNMP/Syslog Communities Configuration

## 4.3.6 SNMP Trap Test

The **SNMP Trap Test** page contains three buttons that allow the user to send SNMP Traps out the Ethernet port, simulating an alarm event. Buttons are available to simulate a Leak Detected, a Cable Break, and a Contamination alarm.

[Configuration](#) [Home](#)

---

### SNMP Trap Test

Send Test Trap - Leak Detected

Send Test Trap - Cable Break

Send Test Trap - Contamination

Figure 4.10 SNMP Trap Test

### 4.3.7 EIA-485/Modbus/N2

If the LD1500 will communicate via the EIA-485 port, configure the necessary options here.

[Configuration](#) [Home](#)

**Modbus/EIA-485 Configuration**

Modbus/TCP/UDP Slave Unit Identifier:  (1-254, 0 = disabled)  
 Select EIA-485 Port Function:    
 EIA-485 Slave Address:  (1-254, 0 = disabled)  
 EIA-485 Baud Rate:  1200  2400  9600  19200  38400  
 EIA-485 Parity:  None  Even  Odd

[Modbus Slave Register Display](#)

[N2 Register Display Log / Statistics](#)

**Figure 4.11** Modbus/EIA-485 Configuration Page

Option	Description
Modbus/TCP/UDP Slave Unit Identifier	Specify the slave address used on the LD1500's IP port. This designator is used for Modbus RTU over an Ethernet connection.  Set the slave unit identifier, 1-254. 0 = disabled.
Select EIA-485 Port Function	Sets the EIA-485 port for Modbus-Slave, BACnet MS/TP-Slave, or Modbus N2.
EIA-485 Slave Address	Set the EIA-485 Port's slave address, 1-254. Each device on the EIA-485 Modbus network must have a unique address.
EIA-485 Baud Rate	Sets the EIA-485 Port to 1200, 2400, 9600, 19200, or 38400 baud. All the devices connected to the Modbus network must be set to operate at the same Baud rate.
EIA-485 Parity	Sets the EIA-485 Port to None, Even or Odd Parity. All the devices connected to the Modbus network must be set to operate at the same parity.
Modbus Slave Register Display	Displays the contents of the Modbus Slave Registers. See Table 5.3, "Output Registers" on page 35 and Table 5.5, "Input Registers" on page 36 for descriptions of the register contents.
N2 Register Display Log/Statistics	Displays the contents of the Modbus N2 registers and statistics.

**Table 4.5** EIA-485/Modbus/N2 Menu Options

### 4.3.8 BACnet

The LD1500 can communicate via BACnet. BACnet allows building automation and control devices to communicate, regardless of the services they perform.

Before the LD1500 can communicate via BACnet MS/TP, you need to change the EIA/485 port function. This is done on the EIA-485/Modbus/N2 screen. Refer to “EIA-485/Modbus/N2” on page 28.

You also need to set the EIA-485 slave (MAC) address. This allows the device to communicate on the string. This is also done on the EIA-485/Modbus/N2 screen, highlighted in “EIA-485/Modbus/N2” on page 28. Once this is complete, configure the remaining BACnet communications parameters as follows:

[Configuration](#) [Home](#)

#### Bacnet Configuration

Bacnet Device Name:

Bacnet Device ID:

Bacnet Description:

Bacnet/IP UDP Port:  (0 = 47808)

MS/TP Max Master:  (0 = slave only)

BacnetIpPacketsIn: 110402 BacnetIpPacketsOut: 104893  
 Mstp TokenPacketsIn: 0 TokenPacketsOut: 0  
 Mstp DataPacketsIn: 0 DataPacketsOut: 0  
 TokenCount: 0

[Bacnet Information](#)

Figure 4.12 BACnet Configuration Page

Option	Description
BACnet Device Name	Designate a unique name for the LD1500, as it will appear on the BACnet network.
BACnet Device ID	The unique identifier for the LD1500 on the BACnet network.
BACnet Description	The description of the LD1500 as it will appear on the BACnet network.
BACnet UDP Port	This is the port to which the LD1500 will respond to BACnet requests. The default number of zero in this field will configure the LD1500 to listen on the standard BACnet port of 47808. See the BACnet standard for more information.
BACnet MSTP Max Master	Set the slave address, 1-127. 0 = slave only.
BACnet Information	Displays the status of the BACnet interface, including Alarm flag status, BACnet Objects, BACnet Property Identifiers, and BACnet Device Objects.

Table 4.6 BACnet Configuration Menu Options

### 4.3.9 BACnet Register FD/BDT

The BACnet BDT Configuration page allows the user to review and edit BACnet options. .

[Configuration](#) [Home](#)

**Bacnet BDT Configuration**

Bacnet Register Foreign Device at IP:  (Arp: Yes TTL Remaining: 0)  
 Registration Time-to-Live:

Bacnet BBMD-BDT:  
 LD1500 IP Address:  Mask:   
 (Primary) #1 IP Address:  Port:  Mask:  (1-32)  
 #2 IP Address:  Port:  Mask:  (1-32)  
 (FD) #3 IP Address:  Port:  Mask:  (1-32)

**Figure 4.13** BACnet Register FD/BDT Configuration

Option	Description
Register as Foreign Device at IP	Register the LD1500 as a foreign device if it has an IP subnet address that is different from the BACnet/IP network that the LD1500 seeks to join. The register foreign device message from the client to the BBMD is always from one IP device to another.
Registration Time-to-Live	The amount of time within which the foreign device must re-register with the BBMD. If the device does not re-register within this time, the BBMD removes the device from its foreign device table and discontinues forwarding messages to the foreign device.  Set this value from 1 - 9999 seconds.
BACnet BBMD-BDT, LD1500 IP Address, #1 IP Address, #2 IP Address, #3 IP Address	These fields give the user a reference and edit capabilities of the BACnet Broadcast Distribution Table. <b>You do not need to configure these fields;</b> If the LD1500 is acting as a BACnet router, these fields will automatically be populated by the BACnet network controller.

## 4.3.10 BACnet Alarm

The BACnet Alarm Configuration page allows the user to configure the BACnet alarm settings.

[Configuration](#) [Home](#)

### Bacnet Alarms Configuration

Recipient #1 IP Address:  PID:

Notification Type:  Unconfirmed  Confirmed (Ack required)

Notification Class:  Priority:

Leak Detected Alarms:  Analog  Binary

APDU\_Timeout (seconds):  Number\_of\_APDU\_Retries:

**Figure 4.14** BACnet Alarm

Option	Description
Recipient #1 IP Address	When there is a BACnet alarm, a message will be sent to this address.
PID	BACnet Process Identifier - Additional information that can be sent with an alarm to indicate what the alarm recipient should do once the alarm is received.
Notification Type	Select unconfirmed or confirmed. If you select confirmed, the recipient will be required to acknowledge the alarm.
Notification Class	A list of devices to be informed if an event enrollment object determines that a warning or alarm message needs to be sent.
Notification Priority	Designate a priority to controls where conflicting control situations may occur.
Leak Detected Alarms	Select analog or binary.
APDU Timeout	The amount of time in seconds between retransmissions of an APDU requiring acknowledgement for which no acknowledgement has been received.
Number of APDU retries	The maximum number of times an APDU is retransmitted.

**Table 4.7** BACnet Alarm Configuration Options

### 4.3.11 System Management

The **System Management** page allows users to restore the unit to factory default settings and upload firmware.

[Configuration](#) [Home](#)

---

#### System Settings

Exit To Bootloader

Restore Factory Defaults

**Figure 4.15** System Management Page

Option	Description
Exit to Bootloader	Forces the unit to stop running flash application to allow for firmware updates.
Restore Factory Defaults	Resets the configuration and settings on the unit to all factory defaults.

**Table 4.8** System Management Options



# MODBUS COMMUNICATION

This document describes the Modbus communications protocol as supported by the LD1500 Distance Read System. It includes details and information on how to configure the LD1500 for communications via Modbus network.

## 5.1. Implementation Basics

The LD1500 is capable of communicating via the half-duplex EIA-485 serial communication standard. The LD1500 is configured to act as a slave device on a common network. The EIA-485 medium allows for multiple devices on a multi-drop network. The LD1500 is a slave only device and will never initiate a communications sequence.

### 5.1.1 Modes of Transmission

The Modbus protocol uses ASCII and RTU modes of transmission. The LD1500 supports only the RTU mode of transmission and has a selectable baud rate and parity, with fixed settings of 8 data bits and 1 stop bit. Every Modbus packet consists of four fields:

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

#### 5.1.1.1 Slave Address Field

The slave address field is one byte in length and identifies the slave device involved in the transaction. The valid address range is between 1 and 254. The slave address is set from the **Modbus/EIA-485 Configuration** web page (see 4.3.7, “EIA-485/Modbus/N2” on page 28).

### 5.1.1.2 Function Field

The function field is one byte in length and tells the LD1500 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).

### 5.1.1.3 Data Field

The data field of the request is a variable length depending on the function. The data fields for the LD1500 are 16-bit registers, transmitted high order byte first (big-endian).

### 5.1.1.4 Error Check (Checksum) Field

The checksum field lets the receiving device determine if the packet has transmission errors. The LD1500 RTU mode uses a 16-bit cyclic redundancy check (CRC-16).

## 5.1.2 Exception Responses

If a Modbus master sends an invalid command to the LD1500 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 5.1** 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

## 5.2. Packet Communications for the LD1500

### 5.2.1 Function 03: Read Output Registers

To read the LD1500 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 5.2** 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 5.3** Output Registers

Register	Name	Description	Range, Units	Range
40001	Leak Threshold	Trip current for leak alarm	25-295 $\mu$ Amps	0-65535
40002	Contamination Threshold	Trip current for contamination alarm	20-295 $\mu$ Amps	0-65535
40003	Spare			0-65535
40004	Spare			0-65535
40005	Spare			0-65535
40006	Spare			0-65535
40007	Spare			0-65535
40008	Spare			0-65535
40009	Spare			0-65535
40010	Spare			0-65535
40011	Spare			0-65535
40012	Spare			0-65535
40013	Spare			0-65535
40014	Spare			0-65535
40015	Spare			0-65535
40016	Leak Alarm Delay	Leak Alarm Delay	5-995 seconds	0-65535
40017	Contamination Alarm Delay	Contamination Alarm Delay	5-995 seconds	0-65535

## 5.2.2 Function 04: Read Input Registers

To read the LD1500 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 5.4** 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 5.5** 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

**Table 5.6** Status Flags (Register 30001)

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

### 5.2.3 Function 06: Preset Single Register

To set a LD1500 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 5.7** Preset Single Register Packet Structure

<b>Preset Register Request Packet</b>	<b>Preset Register Response Packet</b>
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)

### 5.2.4 Function 16: Preset Multiple Registers

To set multiple LD1500 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 5.8** Preset Multiple Registers Packet Structure

<b>Preset Registers Request Packet</b>	<b>Preset Registers Response Packet</b>
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)	

## 5.3. RTU Framing

The example below shows a typical Query/Response from a LD1500 module.

**Table 5.9** Response Sample

Slave Address	Function Code	Count Bytes of Data	Register Data MSB LSB	Register Data MSB LSB	Register Data MSB LSB	CRC16 LSB	CRC16 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)



## FIRMWARE UPDATES

Firmware updates are available at [www.rletech.com](http://www.rletech.com). Download the appropriate firmware to an accessible location on a PC connected to the same Local Area Network (LAN) as the LD1500.

### A.1. Update the Flash Firmware Via Web Interface/ TFTP

Uploading firmware via TFTP requires a TFTP Client. It may be possible to download a free license TFTP Client from the Internet. Consult your IT department to determine a compatible client program.

Before updating the firmware, the firmware Flash application must be exited and then erased.

- 1 Navigate to the LD1500's **System Management** menu.
- 2 From the **System Management** menu, click on the “**Exit to Bootloader**” button. You must have write access to the unit in order to do this. The LD1500 will exit the application and display a **Bootloader** web page.
- 3 3. Click on the “**Erase Flash**” button. You will be prompted for a username and password. After entering the username and password, the Flash application will be erased.

**Note** To erase the flash, a special username and password are required. The username is ld1500 (the “l” and “d” are lowercase), and the password is rle2tech.

- 4 Verify that your PC and the LD1500 are on the same subnetwork (LAN).
- 5 Open your TFTP client. Configure the client as follows.
  - a **Host** = LD1500 IP Address (10.0.0.188, for example)
  - b **Port** = 69
  - c **Block Size** = 64, 128, 256, 512, or 1024
  - d **Note:** The file must be sent in binary format (not ASCII).

- 6 From the TFTP client, **Send** or **PUT** the firmware file to the LD1500. It may take up to 30 seconds to complete the firmware upload.
- 7 After one minute, refresh the LD1500 web page. Notice that the Flash field now contains the name of latest firmware. Click the “**Start Application**” button to reboot the unit.

## A.2. Update the Firmware Via X-Modem

You may encounter a situation where you need up upgrade firmware on an RLE device via X-Modem. If that should happen, these directions will walk you through the process.

- 1 Connect to the device using HyperTerminal.
- 2 Start firmware updates by either:
  - a Pressing any key after power-up when a 10 second window provides an opportunity to abort the Flash Main Program, or
  - b Typing RESET to exit to Bootloader once the Main Menu appears.
- 3 The bootloader is customized a bit for each individual RLE device. For instance, the boot prompt for the LD1500 displays on the screen as ld1500boot. The prompt for the FMS displays as FCFboot. The LD2100 boot displays as ld2100boot, and the LD5200 displays as ld5200boot. For the purposes of generalization in these instructions, the boot prompt is called \*\*\*boot. Replace the \*\*\* for the type of controller you’re working with, and you’ll have a more accurate representation of what you’ll see on your screen.
- 4 From the \*\*\*boot prompt, type ? and press Enter to see the list of available commands.
- 5 From the \*\*\*boot prompt, type ID and press Enter. Note which Flash has the lowest serial number. The Flash with the lowest serial number is the backup. The idea is to erase the backup, load the new version—which becomes the active Flash—then erase and load the other Flash.
- 6 From the \*\*\*boot Prompt, erase the back up Flash program (the one with the lowest serial number) by typing ERASE PRGM followed by Enter. After a few seconds, the screen will update with an ok and \*\*\*boot>.
- 7 From the \*\*\*boot prompt, type LOAD PRGM XMODEM (LOAD PRGM1 XMODEM or LOAD PRGM2 XMODEM if you’re updating firmware on an FMS) followed by Enter. Select the same program that was erased.
- 8 From the HyperTerminal menu select Transfer -> Send File. Use the browse button to select the firmware file from the computer’s directory. The file must be binary and have a .bin extension. Select the file and upload it using the 1K X-Modem protocol. Then click Send.
- 9 A transfer status screen will be displayed. The transfer takes just a minute or two on less complicated devices. When you upload the firmware file to an FMS, the transfer may take as many as 10 minutes. Once the transfer is complete, the transfer status window will automatically close. The HyperTerminal window will indicate that the upload is complete.
- 10 From the \*\*\*boot prompt, type RUN or power down the device and restart it to verify that the new Flash program runs.
- 11 Press Enter to display the \*\*\*Main Menu and repeat the steps above to erase and download to the other Flash program chip.



12 Once the firmware upgrade is complete, disconnect the serial cable and close HyperTerminal.

## A.3. Update the Flash Firmware Via Bootloader

Note: This option is only available on LD1500 units running bootloader version 2.5 or newer.

Before updating the firmware, the firmware Flash application must be exited and then erased.

- 1 Navigate to the LD1500's **System Management** menu.
- 2 From the **System Management** menu, click on the "**Exit to Bootloader**" button. You must have write access to the unit in order to do this. The LD1500 will exit the application and display a **Bootloader** web page.
- 3 3. Click on the "**Erase Flash**" button. You will be prompted for a username and password. After entering the username and password, the Flash application will be erased.

**Note** To erase the flash, a special username and password are required. The username is ld1500 (the "l" and "d" are lowercase), and the password is rle2tech.

- 4 Use the firmware update boxes to browse to and upload the firmware file.
- 5 Use the firmware verify boxes to ensure the firmware was properly uploaded.
- 6 After one minute, refresh the LD1500 web page. Notice that the Firmware Version field now contains the name of latest firmware. Click the "**Start Application**" button to reboot the unit.



# B

## 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 through the Web interface or BMS.
- 3 Compare the distance reading on the LD1500 to a reference map (if available) to verify that the LD1500 displays the correct leak location.
- 4 Dry the cable and verify that the LD1500 returns to normal.
- 5 Remove the End-of-Line terminator (EOL).
- 6 Verify the Cable Break alarm through the Web interface.
- 7 Reinstall the EOL.
- 8 Verify that the LD1500 returns to normal.

Monitor the cable current monthly to verify that the cable is not being contaminated. The LD1500 will alarm on cable contamination if the contamination is excessive.

- ◆ From the LD1500 Web interface, verify that the Cable Current is less than  $25\mu\text{A}$ . If the cable current is greater than  $25\mu\text{A}$ , it is recommended to troubleshoot the cables to determine which cable is contaminated. The contaminated cable should be removed, cleaned, retested and reinstalled.





## TROUBLESHOOTING

Problem	Action
Control Panel will not Power Up	<ol style="list-style-type: none"> <li data-bbox="675 894 1463 1045">1 Check with a DVOM (multi-meter) for AC or DC input power on the lower left hand terminal block on the LD1500. If no voltage is present at terminal block, check the circuit (breaker) or power supply the LD1500 control panel is powered by. If voltage is present, go to step 2.</li> <li data-bbox="675 1073 1463 1161">2 Contact RLE Technologies for unit replacement and/or evaluation. If voltage is present and no LEDs are illuminated, contact RLE Technologies for further troubleshooting.</li> </ol>
Cable Break Alarm	<ol style="list-style-type: none"> <li data-bbox="675 1182 1463 1270">1 Verify that the leader cable from the SeaHawk Water Leak Detection Cable (sensing cable) run is plugged into terminal block marked "Cable."</li> <li data-bbox="675 1297 1463 1386">2 Verify that the End-of-Line terminator (EOL) is installed on the end of the orange sensing cable run. If present at the end of the cable run, go to step 3.</li> <li data-bbox="675 1413 1463 1606">3 Remove the EOL terminator 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 sensing cable. Start moving the EOL terminator to the end of each section of sensing cable to isolate the faulty section. If the condition does not clear, go to step 4.</li> <li data-bbox="675 1633 1463 1873">4 Power down (shut off) the control panel. Remove terminal block marked "Cable" from the unit. 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.</li> </ol>

**Table C.1** Troubleshooting Problems with the LD1500

Problem	Action
Control Panel not Calculating Proper Length of Cable	<ol style="list-style-type: none"> <li data-bbox="626 243 1412 338">1 First verify the proper wiring order into terminal block marked "Cable." Wiring color code should be as follows from left to right: white, black, green, and red.</li> <li data-bbox="626 359 1412 531">2 Calibrate your cable. To do this, adjust the Resistance per Foot (Configuration menu via the Web Interface). 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.</li> </ol>
Control Panel not Calculating Proper Leak Distance	<ol style="list-style-type: none"> <li data-bbox="626 531 1412 793">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.</li> <li data-bbox="626 814 1412 1266">2 Power down (shut off) the control panel and remove the End-of-Line terminator (EOL) from the end of the sensing cable. Locate the first section of sensing cable from the LD1500 control panel. Where it joins to the second section of cable, disconnect and install the EOL terminator at the end of the first section of sensing 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 sensing cable. If the leak is calculated correctly, remove the EOL terminator; reconnect the sensing 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 LD1500 unit, please contact RLE Technologies for support.</li> </ol>
Cable Contamination Alarm	<ol style="list-style-type: none"> <li data-bbox="626 1266 1412 1371">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.</li> <li data-bbox="626 1392 1412 1581">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 (&lt;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.</li> <li data-bbox="626 1602 1412 1671">3 Retest the cable by connecting it to the LD1500 before reinstalling it under the floor.</li> </ol>

**Table C.1** Troubleshooting Problems with the LD1500 (continued)

**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.

# D

## TECHNICAL SPECIFICATIONS

**Table D.1** Technical Specifications

<b>Power</b>		<i>Requires an isolated power supply.</i> 24VDC Isolated @ 600mA max, 50/60Hz; requires RLE power supply PSWA-DC-24 (not included) 24VAC Isolated @ 600mA max; requires RLE power supply: WA-AC-24 (not included)
<b>Inputs</b>		
	<b>Water Leak Detection Cable</b>	Compatible with SeaHawk sensing cable (not included)
	<b>Cable Input</b>	Requires SeaHawk LC-KIT: 15ft (4.57m) leader cable and EOL
	<b>Recommended Maximum Length</b>	1,500ft (457.2m)
	<b>Detection Accuracy</b>	± 2ft (0.6m) +/- 0.5% of the cable length
	<b>Detection Repeatability</b>	± 2ft (0.6m) +/- 0.25% of the cable length
	<b>Detection Response Time</b>	5-995sec, software adjustable in 5sec increments; ±2sec
<b>Communications Ports</b>		
	<b>Ethernet</b>	10/100BASE-T, RJ45 connector; 500VAC RMS isolation
	<b>EIA-232</b>	DB9 female connector; 9600 baud; 8 data bits, no parity, 1 stop bit
	<b>EIA-485</b>	1200, 2400, 9600, 19200 or 38400 baud (selectable); Parity: none, even or odd, 8 data bits, 1 stop bit

**Table D.1** Technical Specifications (continued)

<b>Protocols</b>	
<b>TCP/IP, HTML, TFTP</b>	IPv4.0; webpages comply with Rehabilitation Act of 1973, sections 504 and 508, US Dept of Education (website accessibility for computer users with disabilities)
<b>SNMP</b>	V1: V2C MIB-2 compliant; NMS Manageable with Get, Set, Trap/Inform
<b>Modbus (EIA-485)</b>	Slave; RTU Mode; Supports function codes 03, 04, 06 and 16; Johnson N2
<b>Modbus TCP/IP, UDP/IP</b>	Modbus Slave; TCP/IP, UDP/IP transmission protocol
<b>BACnet/IP</b>	Conformance Level 1
<b>BACnet (EIA-485)</b>	Slave; MS/TP
<b>Terminal Emulation (EIA-232)</b>	VT100 compatible
<b>Alarm Notification</b>	
<b>Visual Alarm</b>	Bi-color status LED
<b>SNMP Traps (Ethernet)</b>	2 Community Strings
<b>Logging Capabilities</b>	
<b>Event Log</b>	Last 10 events
<b>Login Security</b>	
<b>Web Browser Access (Ethernet)</b>	1 Web password Read Only; 1 Web password Read/Write
<b>Terminal Emulation Access</b>	None
<b>Front Panel Interface</b>	
<b>LED Indicators</b>	Power/Status: 1 bi-color (Power On: green; Alarm / Cable Fault / Cable Contamination: red)
<b>Operating Environment</b>	
<b>Temperature</b>	32° to 122°F (0° to 50°C)
<b>Humidity</b>	5% to 95% RH, non-condensing
<b>Altitude</b>	15,000ft (4,572m) max.
<b>Storage Environment</b>	-4° to 185°F (-20° to 85°C)
<b>Dimensions</b>	7.075"W x 3.625"H x 1.25"D (179.7mmW x 92.07mmH x 31.75mmD)
<b>Weight</b>	1.5 lbs. (680g)
<b>Mounting</b>	Vertical wall mount
<b>Certifications</b>	CE; ETL listed: conforms to UL 61010-1, EN 61010-1; certified to CSA C22.2 NO. 61010-1; RoHS compliant