Leak Detection

LD2000

User Guide

SeaHawk

RLE Technologies

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Revision History

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Product Registration

Product registration helps RLE Technologies inform owners of:

- Product upgrades
- Firmware enhancements
- New products and technologies
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The following information is located on the bottom of each LD2000 unit. Please have this information available whenever a technical support call is placed:

Product Model Number _____

Product Serial Number _____

Product Manufacture Date _____

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Seller warrants to the Ultimate Purchaser (the purchaser who buys for use and not for resale) that all products furnished under this order and which are manufactured by Seller will conform to final specifications, drawings, samples and other written descriptions approved in writing by Seller, and will be free from defects in materials and workmanship. These warranties shall remain in effect for a period of twelve (12) months after shipment. If the Seller installs the equipment or supplies technical direction of installation by contract, said one year shall run from the completion of installation, provided installation is not unreasonably delayed by Ultimate Purchaser. Parts replaced or repaired in the warranty period shall carry the unexpired portion of the original warranty. A unit placed with the purchaser on consignment and then later purchased will be warranted for twelve (12) months from the time the Seller receives notification of the Purchaser's intent to purchase said consigned item. The foregoing is in its entirety is subject to the provision that in no case will the total warranty period extend beyond 18 months from date Seller ships equipment from point of manufacture.

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1

PRODUCT OVERVIEW

1.1. Description

The LD2000 is a complete monitoring system that detects and reports the presence of water and other conductive liquids. The LD2000 couples the SeaHawk Leak Detection Cable (sensing cable) with an advanced control panel. Each LD2000 monitors up to 2000 feet (609m) of sensing cable. When a conductive liquid comes in contact with the sensing cable, the distance to the leak is shown on the LD2000's front panel display. Alarm notifications are distributed via user-configurable Modbus (EIA-485 or TCP/IP), BACnet (IP), SNMP, SMTP (email), or Relay output.

1.2. Operation

When the LD2000'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 summary relay has one output. The LD2000 provides a webpage interface to allow users to check updates on the unit's conditions via the Internet or local area network. The LD2000 also provides Modbus outputs via EIA-485, twisted-pair wire, or TCP/IP.

The LD2000 is a supervised system—it continually monitors the cable for continuity. A cable break or excess contamination of the cable causes a cable break indication and activates a relay. The LD2000 sends alarm notifications to predetermined recipients when an alarm sounds. The LD2000 produces an alarm during the following conditions:

- Leak detection
- Cable break
- Cable contamination

1.3. Mechanical Description

The LD2000 is built with one circuit board. The **main board** is mounted inside of the enclosure. A reset switch is provided inside of the enclosure on the board to reset the microprocessor without cycling power to the unit.

1.4. Installation

The LD2000 is a wall-mounted device. Before applying power to the unit, ensure that all connections are correct and all screw terminals are secure. The LD2000 is powered by 24 VAC or 24 VDC power. **DO NOT** connect 120/230 VAC to the unit, or damage will occur to the circuitry.

1.5. Reference Map

Users are advised to purchase a framed reference map (part #FM1114) for use with the LD2000 to help locate any detected leaks along the sensing cable; to view a sample map, go to the SeaHawk Accessories webpage at www.rletech.com. 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 LD2000's webpage interface provides remote information updates via network communications. The interface's menu structure is as follows:

- Home
  - Alarm Status
  - Cable Length
  - Cable Current
  - Leg 1 Resistance
  - Leg 2 Resistance
  - Alarm Delay Counts
  - Last Alarm Time
  - Model
  - Flash Application
  - Flash Appl. Size
  - Bootloader Version
  - MAC Address
  - IP Address

- Net Mask
- Def Route
- Current Time
- §septum

Further webbed interface information can be found in Chapter 4, “Web Interface” on page 29.

Notes:

CHAPTER

2

CONNECTIONS AND SETTINGS

The LD2000 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 Figure 2.1, are labeled TB1 through TB4 and P1 through P4.

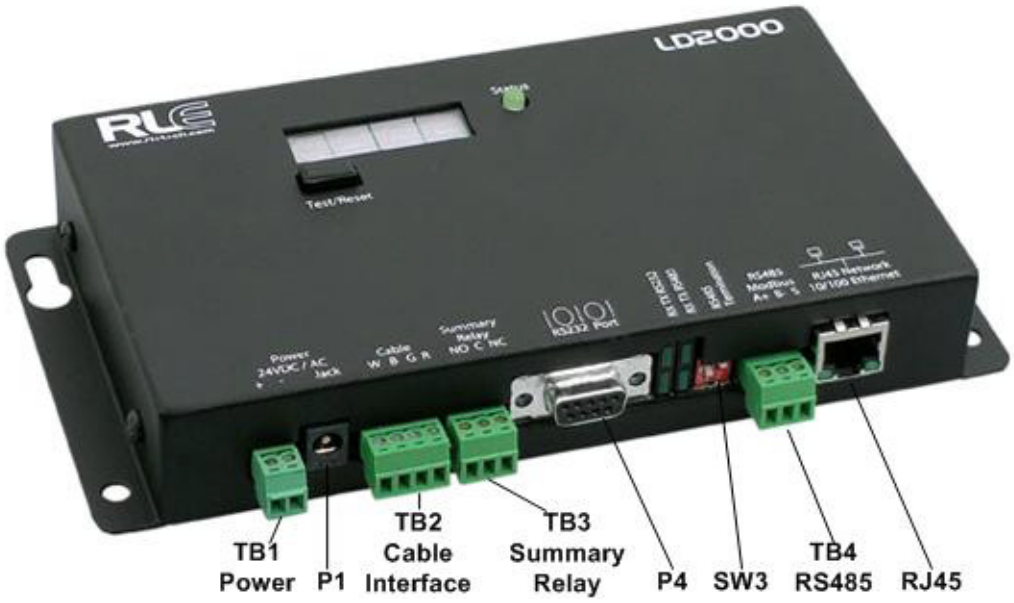


Figure 2.1 LD2000 Connections

2.1. Reset

When held this button will reset the unit and clear any alarms. The LD2000 will then recheck for any alarm conditions.

2.2. Connections

2.2.1 TB1: Input Power

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

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

2.2.2 P1: Input Power

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

Inside positive (+)
Outside negative (-)

Power is recommended to be supplied by a 24VDC wall adapter power supply (part #WA-DC-24-ST), which is not included with the LD2000 and can be purchased separately. For more information on RLE power supplies, visit the SeaHawk Accessories webpage at www.rletech.com, or contact RLE.

2.2.3 TB2: Cable Interface

The SeaHawk Water Leak Detection Cable (sensing cable) connects to TB2. A 15 foot (4.57m) non-sensing leader cable is required to connect the LD2000 to the sensing cable. The non-sensing cable is included in a leader cable kit (part #LC-KIT; purchased separately). Connect the cable wires to TB2 as follows:

TB2-1 White wire
TB2-2 Black wire
TB2-3 Green wire
TB2-4 Red wire

2.2.4 TB3: Summary Relay

Terminal TB3 is a Form C Relay Output. This relay provides alarm notification when a leak is detected, a cable fault is detected, or a cable contamination is detected.

The three contacts on TB3 are labeled NO, C, and NC. Connect the alarm relay wires to TB3 as follows:

TB3-1 Leak alarm normally open (NO)
TB3-2 Leak alarm common (C)
TB3-3 Leak alarm normally closed (NC)

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; see 4.3.1, “Leak Settings” on page 33 for configuration instructions.

2.2.5 P4: EIA-232 Connector

The EIA-232 uses a baud rate of 9600. The EIA-232 port is set to 8 databits, no parity, and 1 stop bit (8, N, 1). A straight through cable should be used to connect a terminal or PC to the LD2000. This connection should only be used for setting the IP address, advanced diagnostics, uploading firmware, and troubleshooting.

2.2.6 SW3: EIA-485 Termination

Switch SW3, when switched on (down position), places a termination resistor across the + and - terminals of the EIA-485 port. This is used when the LD2000 is the last unit on a EIA-485 network.

2.2.7 TB4: EIA-485 Modbus Port

TB4 connects to a 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 is set to 8 databits, no parity, and 1 stop bit (8, N, 1). Connect the EIA-485 wires to TB4 as follows:

TB3-1 A (+)
TB3-2 B (-)
TB3-3 Shield

2.2.8 P3: RJ45 Network

A 10/100 BaseT Ethernet connection is available to connect the LD2000 on a local area network. Use a crossover cable (shipped with the LD2000; blue cable with yellow ends) for initial connection and configuration. The default settings are as follows:

IP Address: 10.0.0.188
Subnet Mask: 255.255.255.0

Notes:

CHAPTER

3

INSTALLATION

3.1. Installing the LD2000

The LD2000 is a wall mounted device. The four mounting holes on the sides of the unit are spaced 7.5 inches (.19m) apart. Use drywall anchors if securing the unit to drywall.

3.2. Connecting the SeaHawk Leak Detection Cable

The LD2000 is shipped with a 15-foot (4.57m) leader cable. One end of this leader cable connects to the LD2000 controller, and the other end connects to the SeaHawk leak detection cable (sensing cable). Connect each end of the leader cable as follows:

1 With the screws of the terminal block connector on the LD2000 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.

Note 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.

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.

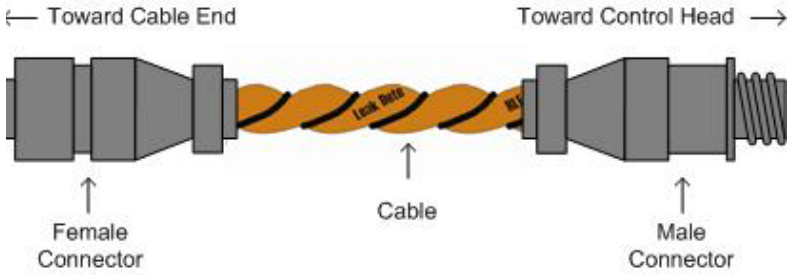


Figure 3.1 SeaHawk Water Leak Detection Cable (Sensing Cable)

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.

3.2.1 Securing Cable to the Floor

Secure the sensing 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 sensing cable, J-clips (part #JC) 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, 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 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.

- Finish the end of the SeaHawk leak detection cable (sensing cable) with the end terminator (EOL) that is shipped with the LD2000. 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.

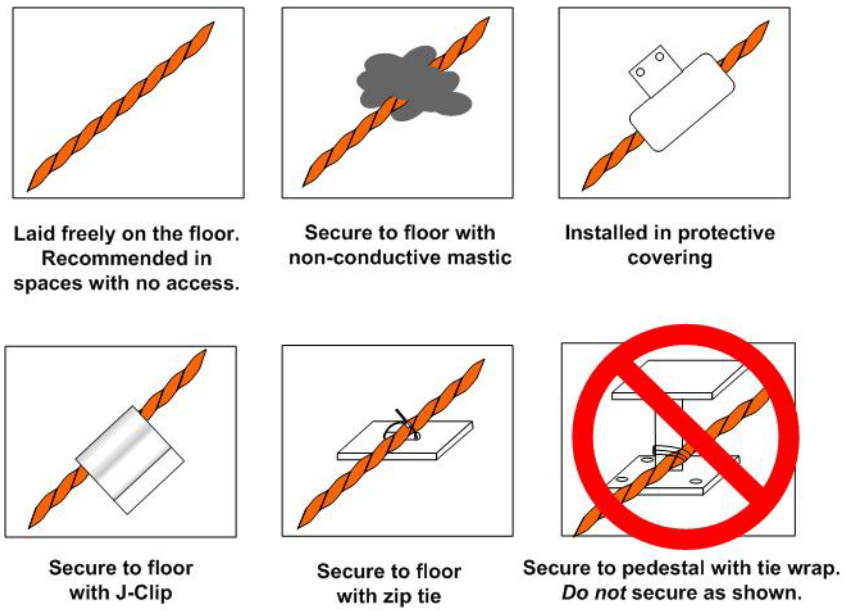


Figure 3.2 Cable Installation Methods

3.2.2 Applying Power to the LD2000

Once the SeaHawk leak detection cable (sensing cable) is connected to the unit, power can be applied. The LD2000 operates on 24VDC or 24VAC power. A power supply is not included with the LD2000. RLE recommends its 24VDC power supply (part #PSWA-DC-24), which can be purchased separately. For more information on RLE power supplies, visit www.rletech.com, or contact RLE.

Note RLE recommends that an **isolated power supply** be used.

Before applying power to the unit, ensure all cable and communication connections are complete. The LD2000 begins booting once power is applied. Wait approximately one minute. No alarm should be present.

On the webpage interface, the cable length is displayed. If this reading varies by more than ±5% of the actual length of cable installed, verify the installation. The LD2000 should not require any calibration. If any calibration is required, verify that the cable current is zero before calibrating or false, inaccurate readings will occur.

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

3.2.3 Communication

IMPORTANT Consult your IT administrator before performing these steps.

3.2.3.1 Accessing the Configuration Menu

You will use the Configuration Menu to configure communications for the LD2000.

1 Plug the crossover cable (included with the LD2000) into the computer that will be used to configure the LD2000.

Note This cable is not intended to be connected to a network hub.

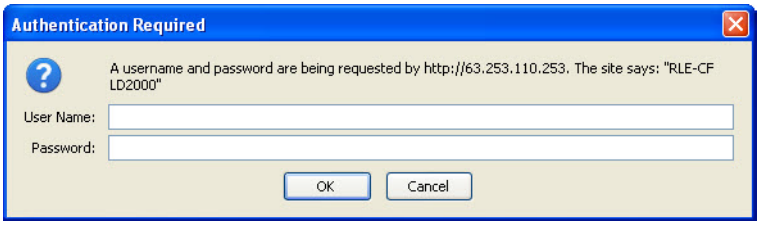
2 Connect the other end of the crossover cable to the Ethernet port on the back of the LD2000.

Note Alternatively, you could use the LD2000's EIA-232 interface to access the LD2000. Refer to the *LD2000 User Guide* (available at http://www.rletech.com) for instructions.

3 Write down the computer's current IP address, subnet mask, and default gateway. Change these items temporarily so that the computer can communicate with the LD2000.

LD2000 default IP address: 10.0.0.188
LD2000 default subnet mask: 255.255.255.0

4 Access the LD2000 through a Web browser by typing the LD2000's default IP address (10.0.0.188) into the location bar and pressing Enter.



5 Enter the following:

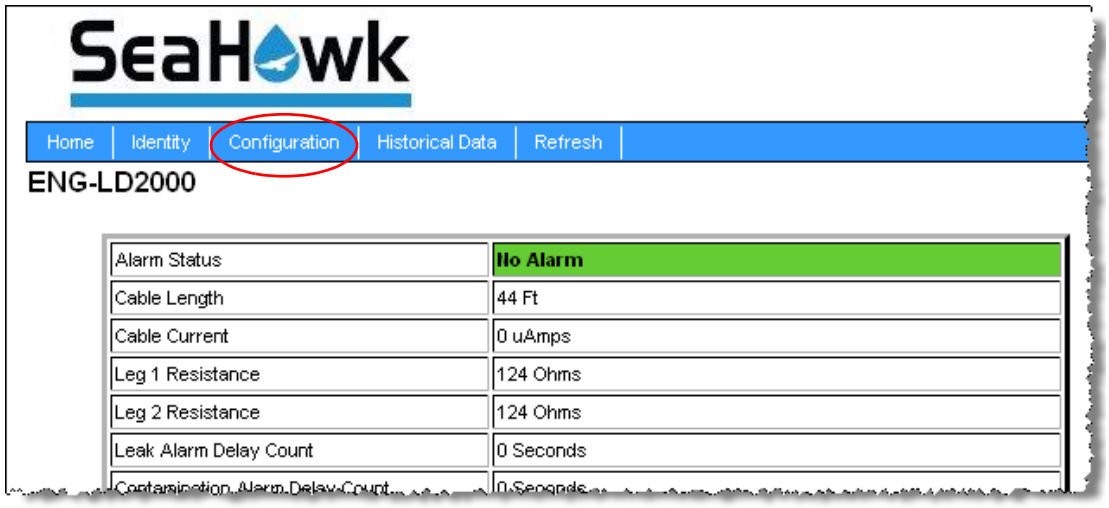
Default User Name: ld2000 (case sensitive)
Default Password: (No default password. Leave this field blank.)

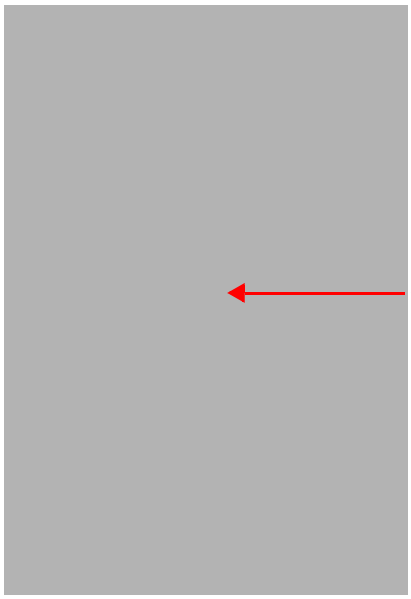
Once you enter this information, the home page for the LD2000's web interface displays.

6 Continue to the following section to configure network communication for the LD2000.

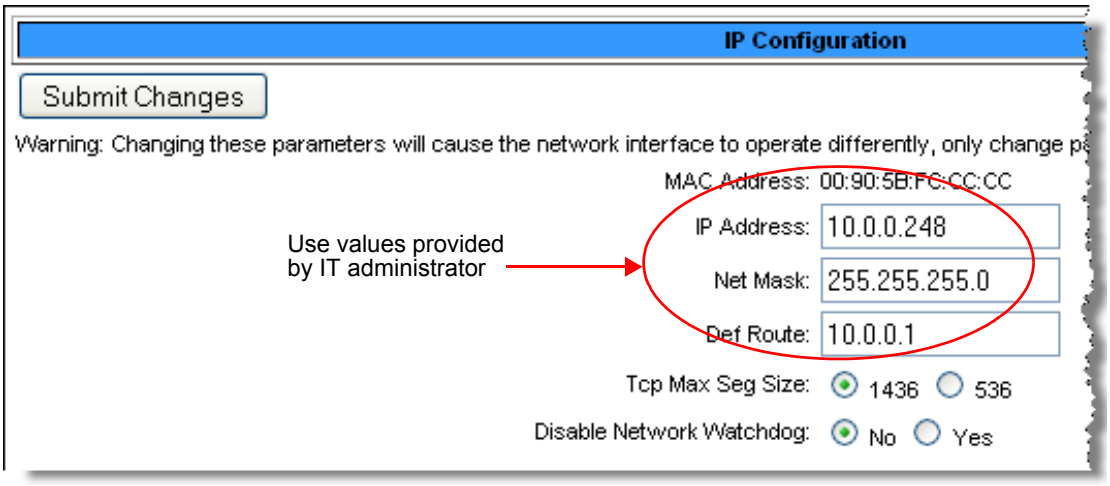
3.2.3.2 Configuring Network Communication

1 From the home page of the LD2000's web interface, select the Configuration Menu link. Then, select Network/IP Settings from the Configuration Menu.





The Network/IP Configuration page displays.



LD2000 Default Values
IP address: 10.0.0.188
Subnet mask:

2 Enter the values for IP Address, Net Mask (subnet mask), and Def Route (default gateway) provided by your IT administrator.

Once you enter the values and click the Submit Changes button, the LD2000 saves the changes and reboots. The system status LED on front of the LD2000 stops flashing.

3 Reset the computer to its original IP address and subnet mask.

Note This step might require assistance from your IT administrator.

The computer and the LD2000 are now both configured to communicate on the network.

4 From the computer's Web browser, go to the new IP address of the LD2000.

5 When prompted, enter the user name and password to verify network access to the LD2000 (as you did in step 4 in the previous section).

If the login window for the LD2000 does not display:

a Verify that the cables are firmly attached.

b Verify that you entered the correct IP address for the LD2000.

c Verify that the Status light on the top of the LD2000 is green.

For troubleshooting and additional configuration information, consult the *LD2000 User Guide* available at www.rletech.com

Set the LD2000's IP Address using an EIA-232 Connection

To use the EIA-232 interface:

1 Connect the EIA-232 port (P4) on the LD2000 to a terminal or PC running terminal emulation software (HyperTerminal) with a 9-pin male-female straight through serial cable.

6 2. Set the appropriate communication port to **9600 baud**, **NO parity**, **8 data bits**, **1 stop bit**, **(9600/N/8/1)**, and **no software or hardware flow command**.

7 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.

8 From the Main Menu type **netcfg** to select the Network Configuration Menu.

9 Enter the new IP address for the LD2000 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>.

- The LD2000 erases a memory block and copies data to flash memory before rebooting.
- The LD2000 IP address is now set and the LD2000 can be accessed through a Web browser using the new IP address.

10 Repeat steps 8–9 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.

Notes:

CHAPTER

4

WEB INTERFACE

The LD2000's network connection allows users to configure and view current information from the LD2000. To log in to the LD2000:

1 Navigate to the unit's IP address in a Web browser.

A login prompt asks for a username and password.

2 Enter in the appropriate information.

Default Settings:
IP: 10.0.0.188
Username: ld2000
Password: *(leave this field blank)*

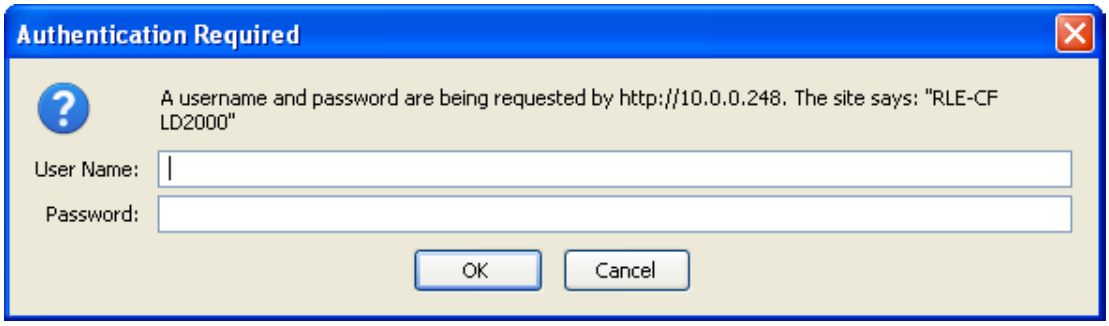


Figure 4.1 LD2000 Log In Prompt

4.1. Home

When logging into the LD2000, the first page display is the **Home page**. All vital information is display in the main table. From the main page, four links are available in the top right section: Refresh, Home, Historical Data, and Configuration. Refresh allows the user to refresh the webpage and update all data in the table. **Home** is a link to the Home page currently being viewed. **Historical Data** and **Configuration** are links to their appropriate webpages.

Figure 4.2 LD2000 Home Page0

4.2. Historical Data

The **Historical Data** page displays a table of Alarm History and also provides a link to the Trend Log (located in the upper right). The Alarm History table displays Alarms and events recorded in the unit's memory log. The alarms are displayed as follows:

AHxxx-yy-zzz – DATE TIME DESCRIPTION
xxx is the log entry number for the alarm/event.
yy is the event code and varies depending on the event (03 - Cable Fault, 04 - Leak Detected, 05 - Contamination Detected, 06 - Reset/Power Up)
DATE and **TIME** are displayed as MM/DD/YY and HH:MM:SS (24 hour) format.
DESCRIPTION provides details about the current alarm/event.

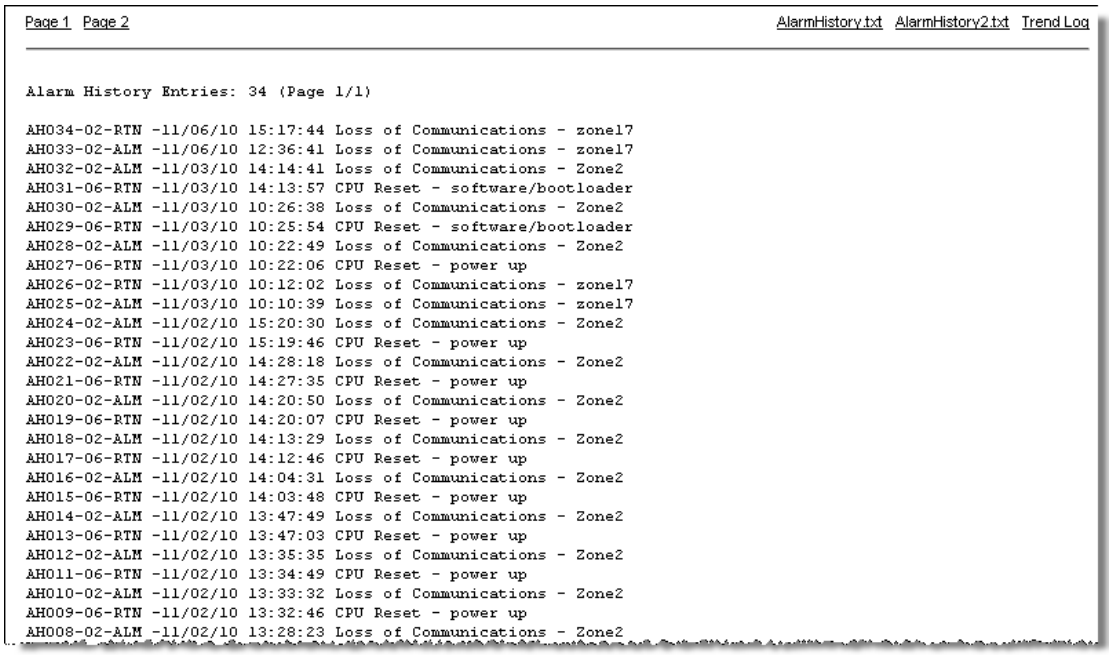


Figure 4.3 Historical Data Page

4.2.1 Trend Log

The Trend Log option provides a trending list of logged current leakage. This provides assistance in troubleshooting leaks and inaccurate readings.

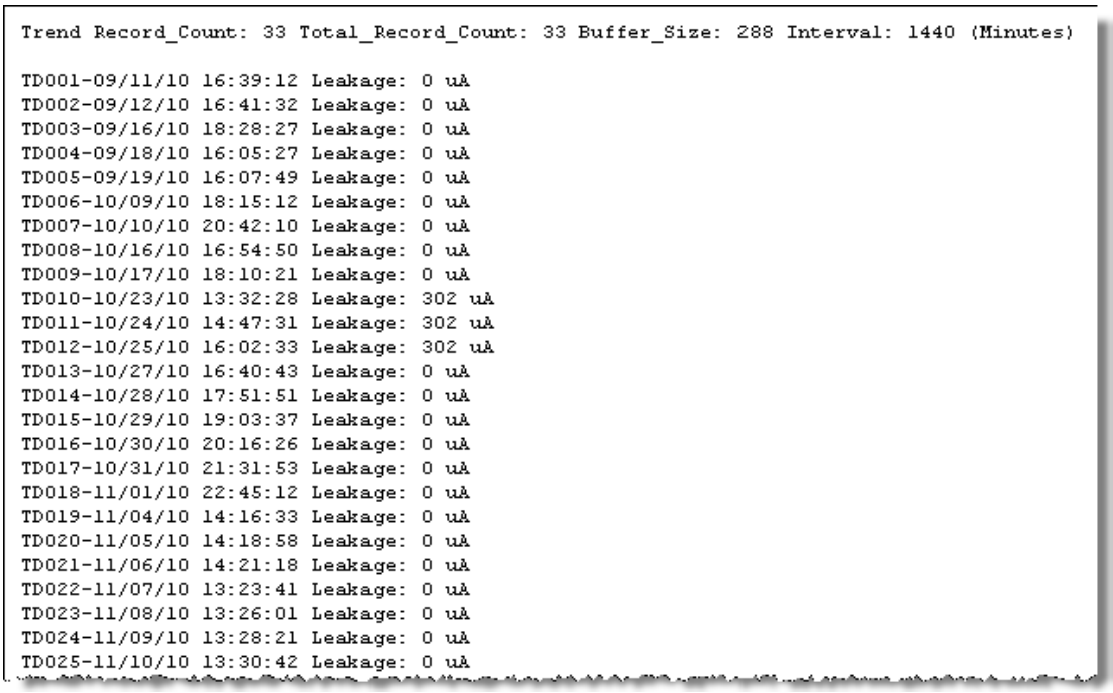


Figure 4.4 Trend Log

4.3. Configuration

The **Configuration** page gives access to a menu of available settings.

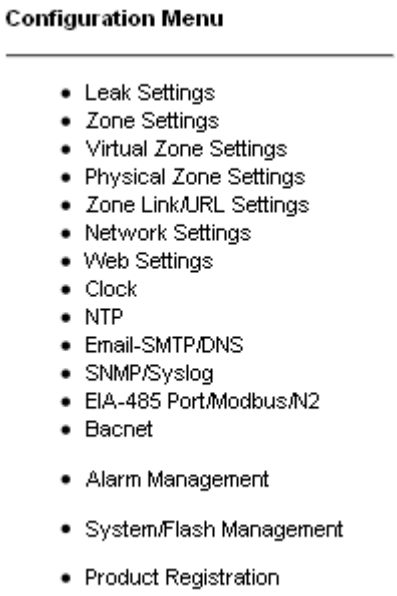


Figure 4.5 Configuration Main Menu

4.3.1 Leak Settings

The Leak Settings menu displays all current leak and cable settings.

Table 4.1 Link Settings Menu Settings

Leak Settings Menu Option	Description
Leap Trip Point	The amount of current leakage required to detect a leak. Default setting is 150uA. Adjust this number to adjust the sensitivity of the leak detection cable to leaks (higher = less sensitive, lower = more sensitive).
Contamination Trip Point	The amount of current leakage required to detect cable contamination. Default setting is 50uA. Adjust this number to adjust the sensitivity of the leak detection cable to contamination (higher = less sensitive, lower = more sensitive).
Leak Alarm Delay	The amount of time required to pass once the Leak Trip Point has been reached before declaring a leak alarm. The Leak Trip Point must also be exceeded for the duration of the delay.
Contamination Alarm Delay	The amount of time required to pass once the Contamination Trip Point has been reached before declaring a contamination alarm. The Contamination Trip Point must also be exceeded for the duration of the delay.

Table 4.1 Link Settings Menu Settings (continued)

Leak Settings Menu Option	Description
Resistance Per Foot	The resistance per foot (or meter) of cable determines the unit's ability to accurately detect the cable length installed and calculate distances to leaks. The default setting is 2.800 ohms and should not be changed for any RLE cable; parts SC-10, SC-25, SC-50, and SC-100 are all built to specifications of 2.8 ohms per foot.
Measurement Display	The type of units that are displayed on the LD2000. Select either feet or meters to calibrate the unit to the preferred unit of measure.
Latching Alarms	This option selects the latching ability for the alarm notifications of the unit. Latching alarms will hold the unit in an alarm state, even after the condition has been cleared, until someone presses the Reset button, located on the front of the physical LD2000 unit.

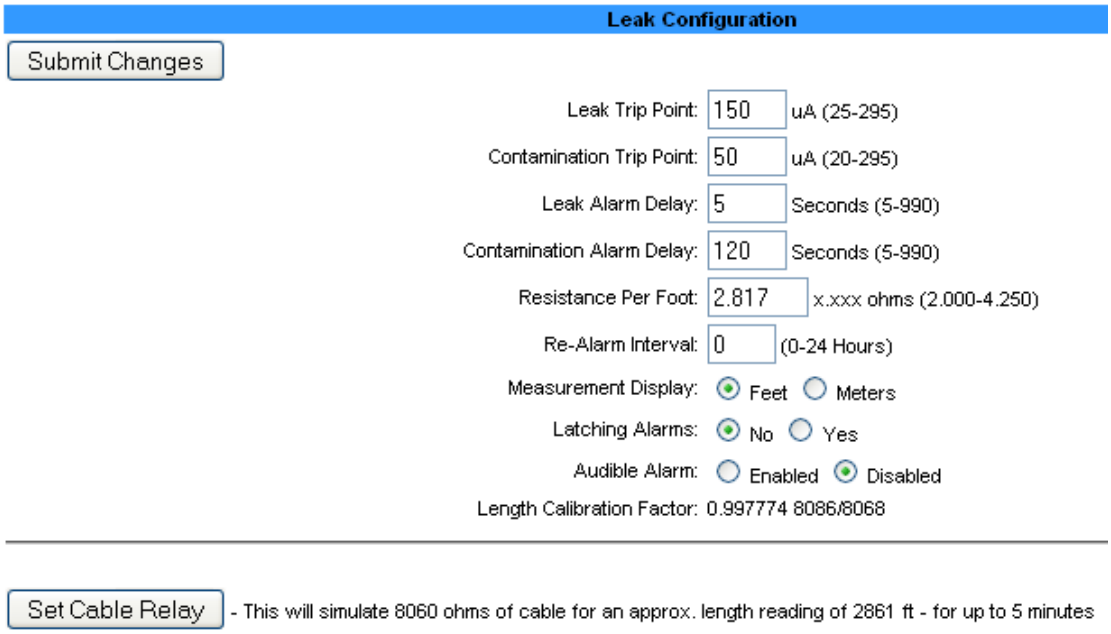


Figure 4.6 Latching Alarms/Leak Configuration

4.3.2 Zone Configuration

Table 4.2 Zone Configuration Menu Settings

Zone Configurations Settings	Description
Zones 1- 8	Allows users to set zones to be virtual or physical points. Virtual is used for labeling reference points along the leak detection cable length. Physical is for when using the LD2000 as a Leak Detection Modbus master. Physical points are described in Appendix B.
Modbus Zone Traps	You can enable or disable SNMP traps for the Leak Detection Modbus master.
Enable Alarm Relay for Modbus Slaves	The summary alarm can also be activated when a Leak Detection slave unit goes into an alarm.
Zone Links	There is a link for a reference map to the LD2000. A link has been provided for every potential slave unit that may be attached.

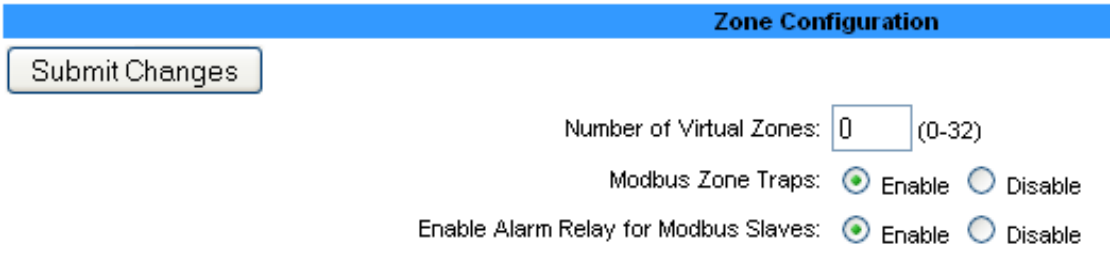


Figure 4.7 Zone Configuration

Figure 4.8 Link Configuration Page

4.3.3 Zone 1-8 Settings

Virtual Zones will display in the descriptions of any leak alarm when detected in the appropriate cable range. Labeling zone descriptions increases the speed in which a leak is physically discovered. For example, a section of cable located in the “Room A” might be labeled “Rm. A.” Because the description refers to a familiar location rather than cable distance, the alarm can be located faster. Each zone begins with previous zone's end distance and ends with its own. Zone 1 begins at zero.

See Appendix B, “Leak Detection Modbus Master” on page 65 if using the LD2000 for Leak Detection Modbus Master. Appendix B describes the Physical/Modbus/485 for settings 1-8 and settings 9-16.

4.3.4 Network Settings/ IP Configuration

The Network settings allow users to change the network configuration of the LD2000. IP address, Subnet Mask, and Default Route (Gateway) may be changed from this menu.

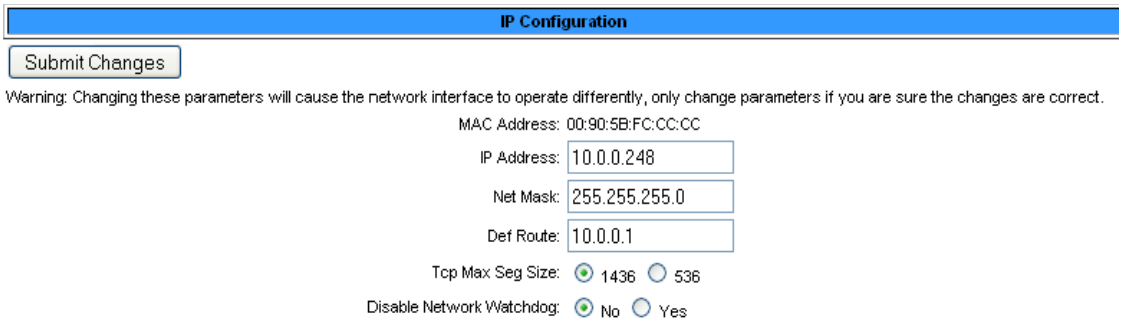


Figure 4.9 IP Configuration

4.3.5 Web Settings/ Configuration

The Web Settings menu allows users to set two different security level passwords on the LD2000. A Read-Only level password allows users to view only the information and settings of the LD2000. No settings or changes may be submitted to the unit.

The Read/Write level password allows users to change settings and configurations on the LD2000 and 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. The link URL allows a user to link a file of a reference map to the webpage interface. Use a file common to all users, such as a .jpg or .pdf.

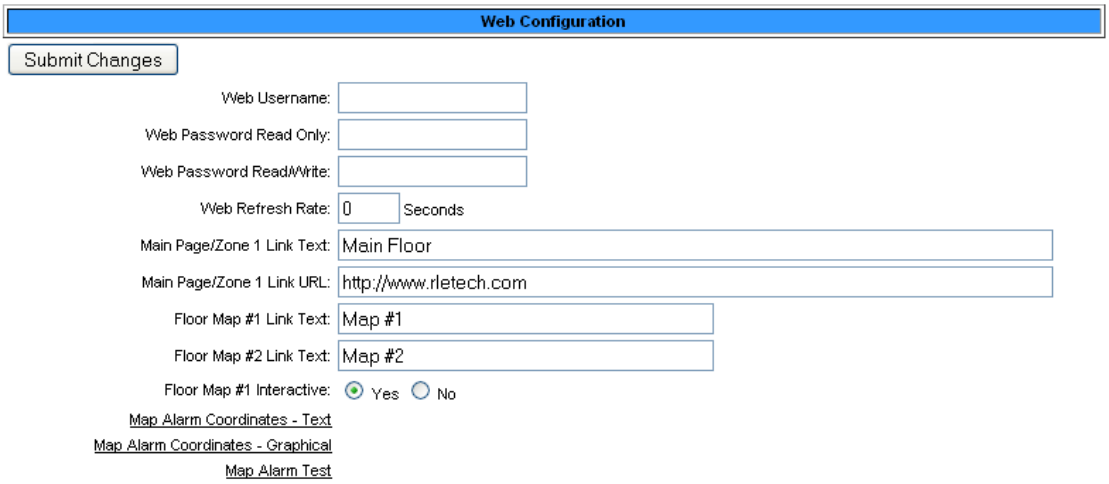


Figure 4.10 Web Configuration

4.3.6 Email/DNS

The Email page allows users to configure the LD2000 to send notification via email when the unit is in an alarm state. The LD2000 will send one email message per alarm instance to a maximum of four email recipients.

Table 4.3 Email Menu Options

Email Menu Options	Description
Access Type	Specifies whether to send the message through a local network connection or disable the email feature (none).
Email Contamination Alarms	Specifies whether to send email alarm notification upon a cable contamination alarm. Users may want to disable this feature if false alarms are often detected.
DNS Servers	Information provided by your ISP; needed to deliver the email message.
Mail (SMTP) Server	Specifies the email server used to receive and send mail.
Mail Sender Address	The address displayed in the “From” field of the email message.
Mail Subject	Displayed in the subject field of the received email messages.
Mail Recipient (1) - Mail Recipient (4)	Enter the addresses of up to four email recipients.
SMTP Authentication	Used for ESMTP; use the recommended default setting unless instructed differently by your IT Department.
SMTP User Name	Used for ESMTP; use the recommended default setting unless instructed differently by your IT Department.
SMTP Password	Used for ESMTP; use the recommended default setting unless instructed differently by your IT Department.

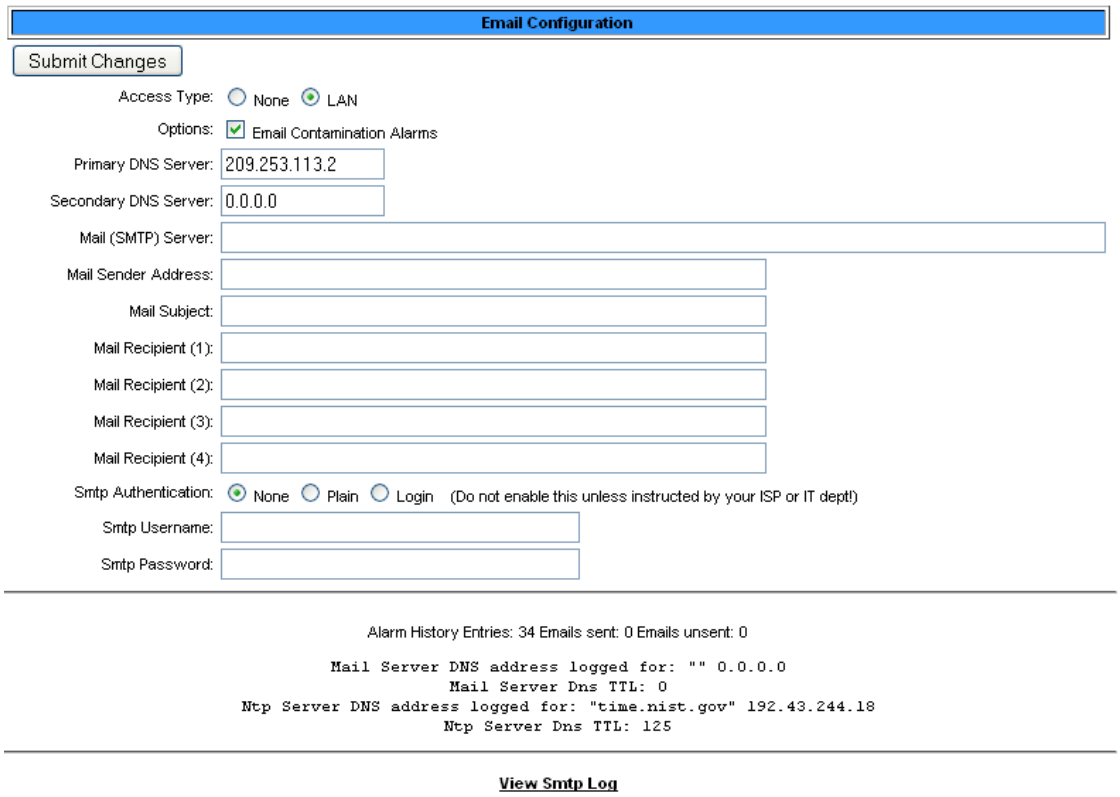


Figure 4.11 E-mail Configuration Page

4.3.7 NTP (Network Time Protocol)

Network Time Protocol (NTP) is widely used in the Internet to synchronize computer clocks to national standard time or Coordinated Universal Time (UTC). It synchronizes the time of a computer or server (in this case, the LD2000) to another server or reference time source. NTP is important in maintaining a high level of accuracy and reliability in time stamped events. This page allows users to configure the LD2000's NTP feature.

Table 4.4 NTP Menu Options

NTP Menu Options	
Network Time (NTP) Server	The IP address or hostname of the Network Time Protocol Server with which the LD2000 will synchronize. Examples of public NTP Servers include “us.pool.ntp.org” and “time.nist.gov”.
Update Interval	The time, in minutes, the LD2000 will take to request time updates from the NTP Server. This can be set from 5-1440 minutes. Enter 0 to disable.
Retry Interval	The time in seconds the LD2000 waits before retrying a failed connection to the NTP Server. This can be set from 10-120 seconds.
Select Time Zone	Enter the time zone in which the LD2000 resides.
Daylight Savings Time	Select the hour Daylight Savings Time occurs. Typically, this is 2:00 A.M. local time.
DST Begin Date	Enter the date Daylight Savings Time will begin.
DST End Date	Enter the date Daylight Savings Time will end.

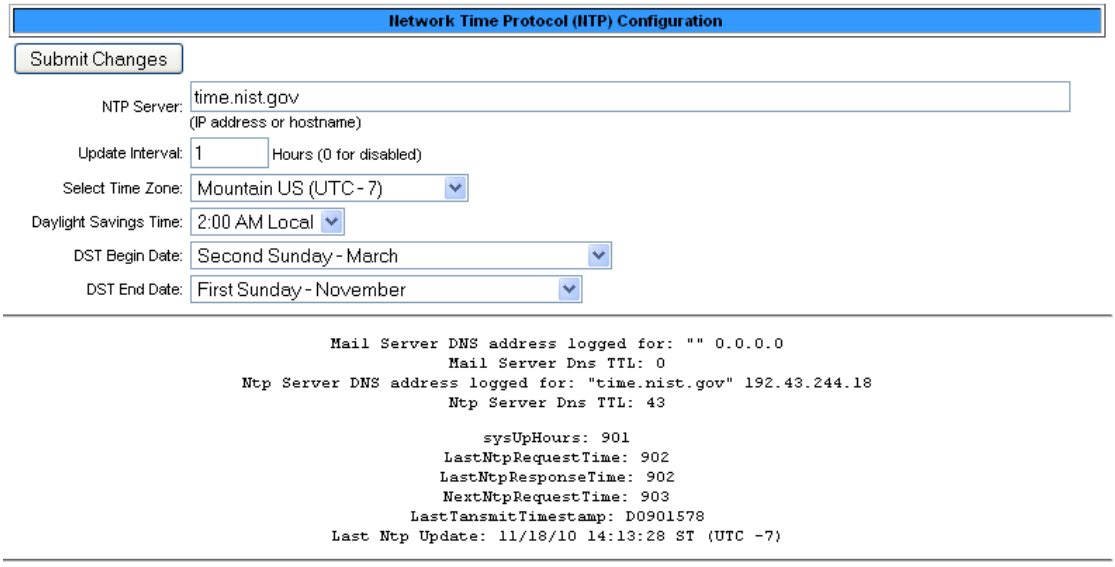


Figure 4.12 Network Time Protocol (NTP) Configuration

4.3.8 SNMP/Syslog

SNMP/Syslog allows users to configure SNMP notification options.

Table 4.5 SNMP/Syslog Menu Options

SNMP/Syslog Menu Options	Description
System Name	Appears on the LD2000 Main Menu and is included as part of email notifications.
System Contact	Lists the individual responsible for the LD2000. The System Contact is only available through SNMP Gets and is not included in email or SNMP Trap notifications.
System Location	Lists the location of the LD2000. The System Location is not included in email or SNMP Trap notifications.
Select SNMP Trap Type	Choose from three trap types: V1-Trap V2C-Trap V2C-Inform
Max Inform Retries	The number of times the LD2000 will retry an Inform operation when the original Inform is unacknowledged.
Inform Interval	The amount of time, in minutes, between Inform operations.
V1/V2C Community Names	The community name of the manager.
Trap Communities	Identifies devices that receive SNMP Traps and/or Syslog messages from the LD2000 and interacts with the LD2000 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 a string that identifies the device. An IP Address of 0.0.0.0 in this field allows any device to access the LD2000 through an MIB browser. Select “Write” if the device will have Read/Write network access. This allows the LD2000 to be configured over the network. Select “Trap” if the device will receive Traps from the LD2000. Select “Syslog Messages” if the device will receive Syslog messages from the LD2000.

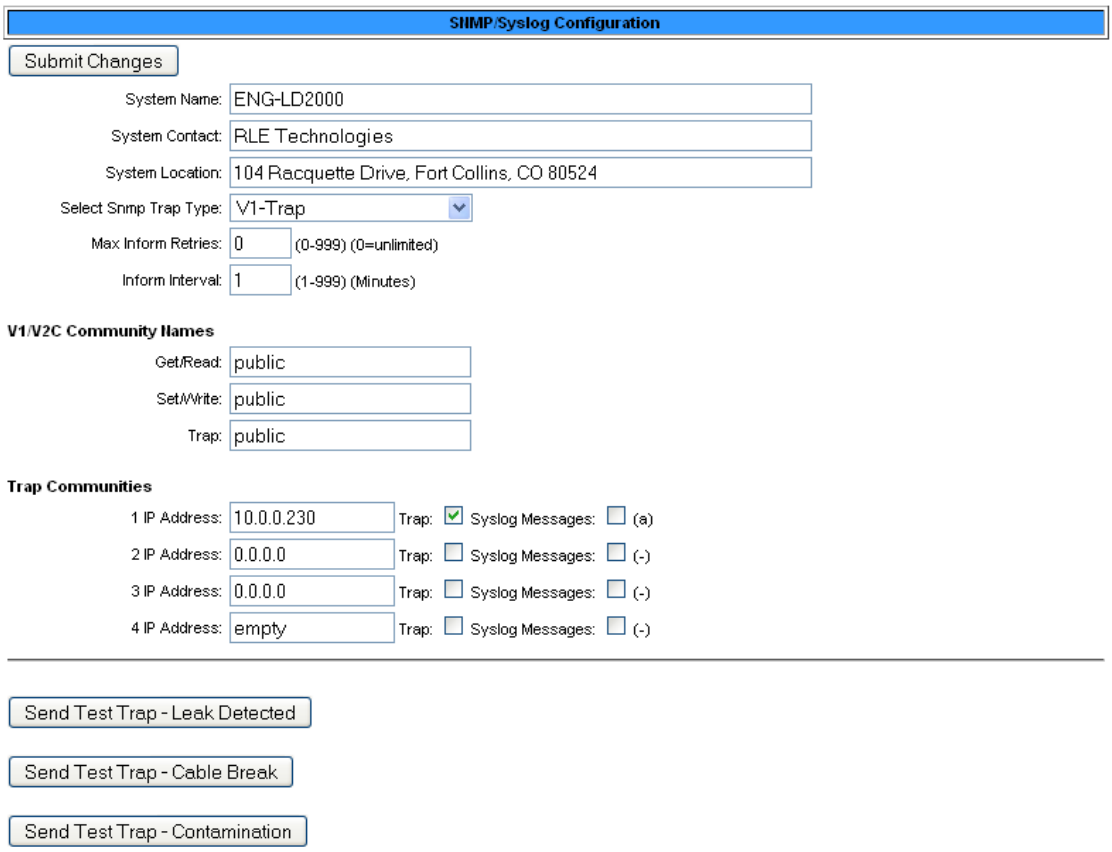


Figure 4.13 SNMP/Syslog Configuration

4.3.9 Modbus

Modbus Configuration allows users to configure Modbus (EIA-485 and/or TCP/IP) options.

//anything about N2 needed here?//

Table 4.6 Modbus Configuration Menu Options

Modbus Configuration Menu Options	Description
Modbus/TCP Slave Unit Identifier	Specify the slave address used on the LD2000's IP port (1-254).
EIA-485 Port Function	Allows users to select the function of the EIA-485 port. Selecting this option tells the LD2000 whether it is a Modbus Slave (this is the default, and most typical selection), a BACnet-MS/TP Slave, a Modbus Master (for when the LD2000 is acting as a Modbus Master for other RLE leak Detection Panels), or an LCD-240 (this is a specialized option and is not typically used; see below for configuration details).
LCD-240 Option	The LCD option refers to the text that will be displayed on the LDC screen of the LD2000. The number, 240, references the amount of text allowed for each label-2 lines of text, with 40 characters each. After selecting the LCD-240 display option, click the submit changes button. When the page refreshes there will be eight fields to configure: • LCD240 Identifier-the system name. • LCD240 Normal Text-the text that will appear when the LD2000 is in a normal state. • LCD240 Alarm Text- the text that will appear when the LD2000 is in an alarm state. • LCD240 Leak Text- the text that will appear when the LD2000 detects a leak. • LCD240 Cable Break Text- the text that will appear when the LD2000 detects a cable break. • LCD240 Contamination Text- the text that will appear when the LD2000 detects a cable contamination. Enter a time unit in the LCD240 Refresh Interval field to set the time interval for the screen to update. Check the LCD240 Refresh on Alarms only to have the display refreshes only when an alarm is triggered; see Figure 4-14: LCD-240 Option on page 18.
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. **Note**: The baud rate for Modbus N2 is always 9600 and cannot be changed.
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. **Note**: The parity for Modbus N2 is always None and cannot be changed.
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.

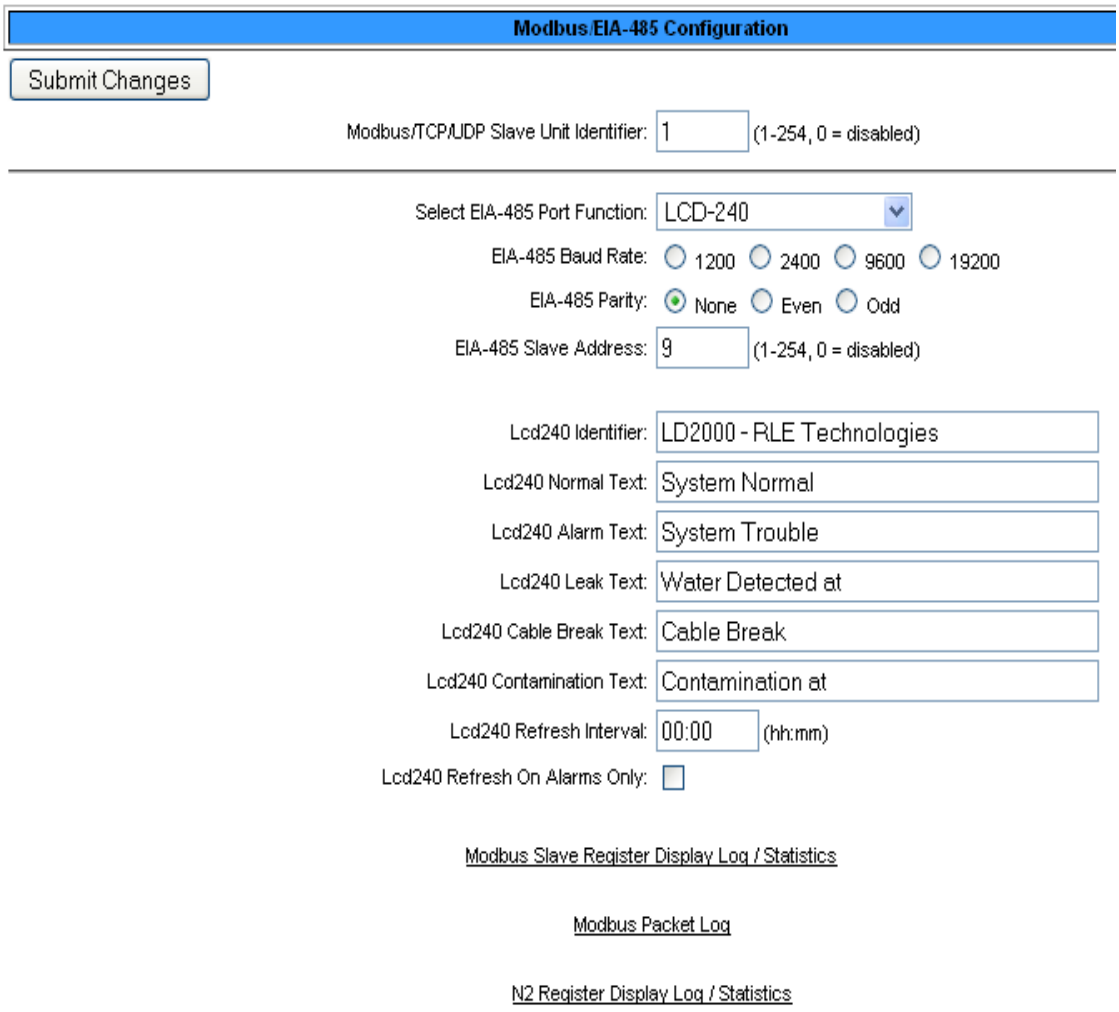


Figure 4.14 LCD-240 Option

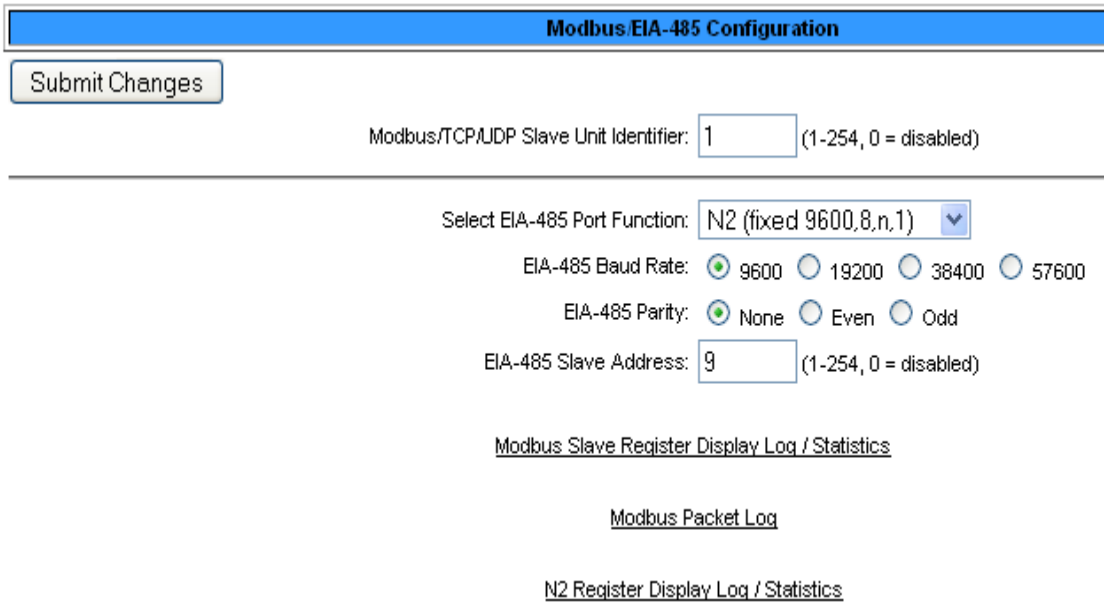


Figure 4.15 Modbus/EIA-485 Configuration (Johnson N2 Shown)

4.3.10 BACnet

The BACnet Configuration page allows the user to enable the LD2000 for BACnet slave configuration.

Table 4.7 BACnet Configuration Menu Options

BACnet Configuration Menu Options	Description
BACnet Device Name	The name of the LD2000 as it will appear on the BACnet network.
BACnet Device ID	The unique identifier for the LD2000 on the BACnet network.
BACnet Description	The description of the LD2000 as it will appear on the BACnet network.
BACnet UDP Port	The port to which the LD2000 will respond to BACnet requests. The default number of zero in this field will configure the LD2000 to listen on the standard BACnet port of 47808, see the BACnet standard for more information.
BACnet MS/TP Max Master	The highest allowable address for master nodes on the MSTP network.
BACnet BBMD-BDT, LD2000 IP Address, #1 IP Address, #2 IP Address, #3 IP Address, #4 IP Address	These fields give the user a reference and edit capabilities of the BACnet Broadcast Distribution Table. These fields DO NOT need to be configured by the user. If the LD2000 is acting as a BACnet router, these fields will automatically be populated by the BACnet network controller.

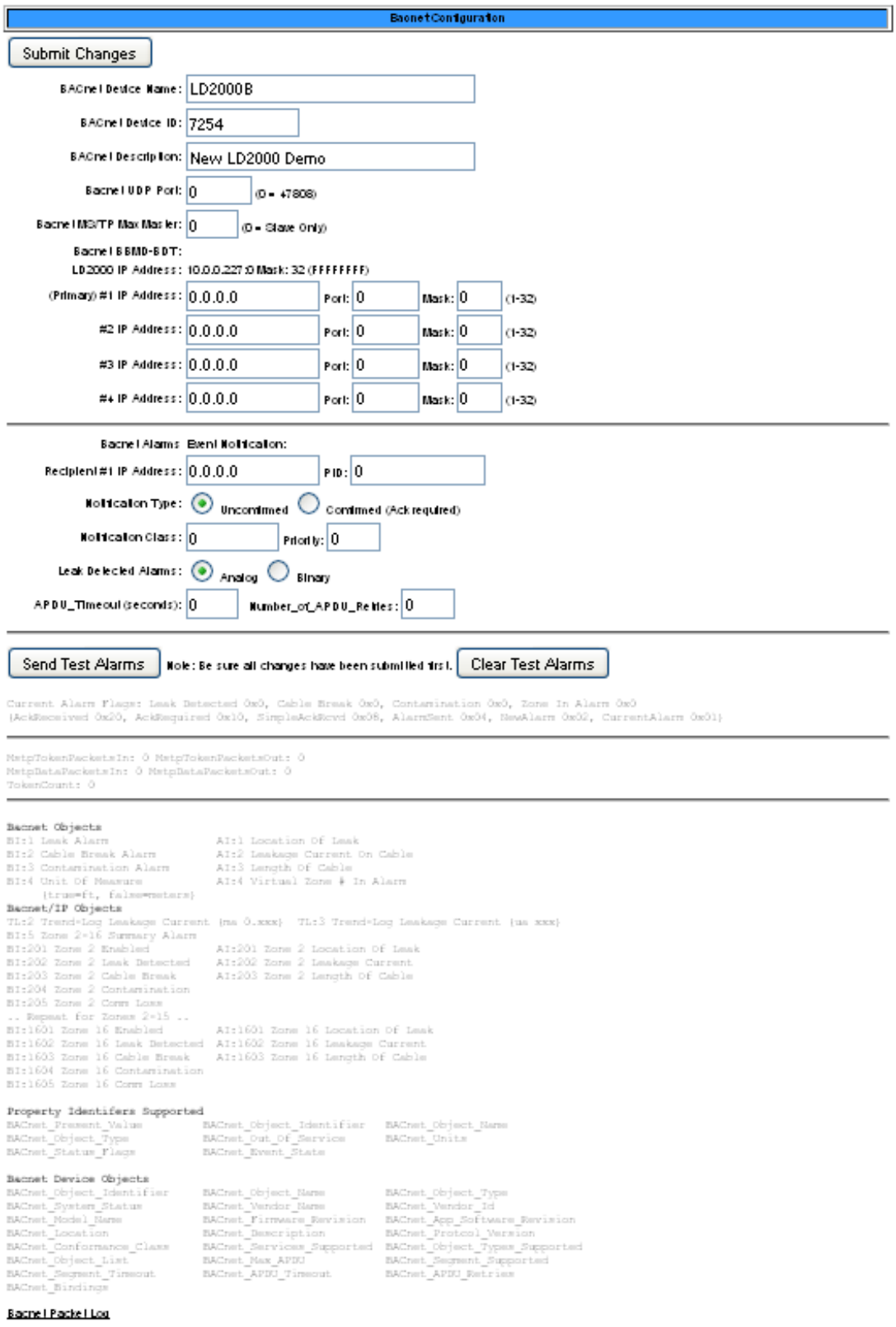


Figure 4.16 BACnet Configuration

4.3.11 Clock

The Clock Configuration page allows users to set the date and time on the LD2000's internal clock.

- Enter the date using a MM/DD/YY format, where MM is a two digit month, DD is a two digit day, and YY is a two digit year.
- Enter the time using a HH/MM/SS format, where HH is a two digit hour (1-24), MM is a two digit minute (1-60), and SS is a two digit second (1-60).

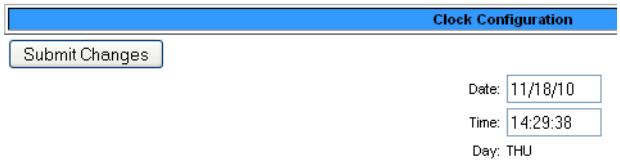


Figure 4.17 Clock Configuration Page

4.3.12 Alarm Management

The Alarm Management page allows users to acknowledge, reset, and clear alarms.

Table 4.8 Alarm Management Menu Options

Alarm Management Menu Options	Description
Acknowledge SNMP Informs	Acknowledges SNMP Informs and ceases Informs from being sent out for the current alarm condition.
Reset Leak Alarm	Resets the current leak alarm and causes the unit to recheck the current cable conditions. This will clear the alarm condition if the cable registers that the leak threshold is within an accepted range.
Clear Alarm History	Clears the alarm history table of all previous alarms.

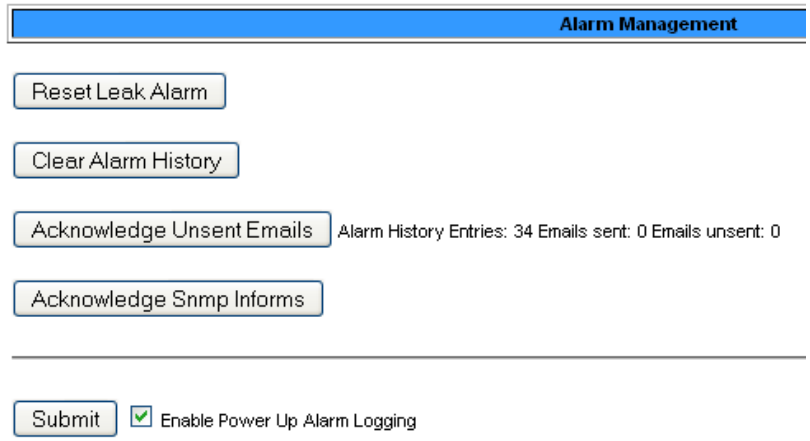


Figure 4.18 Alarm Management Configuration

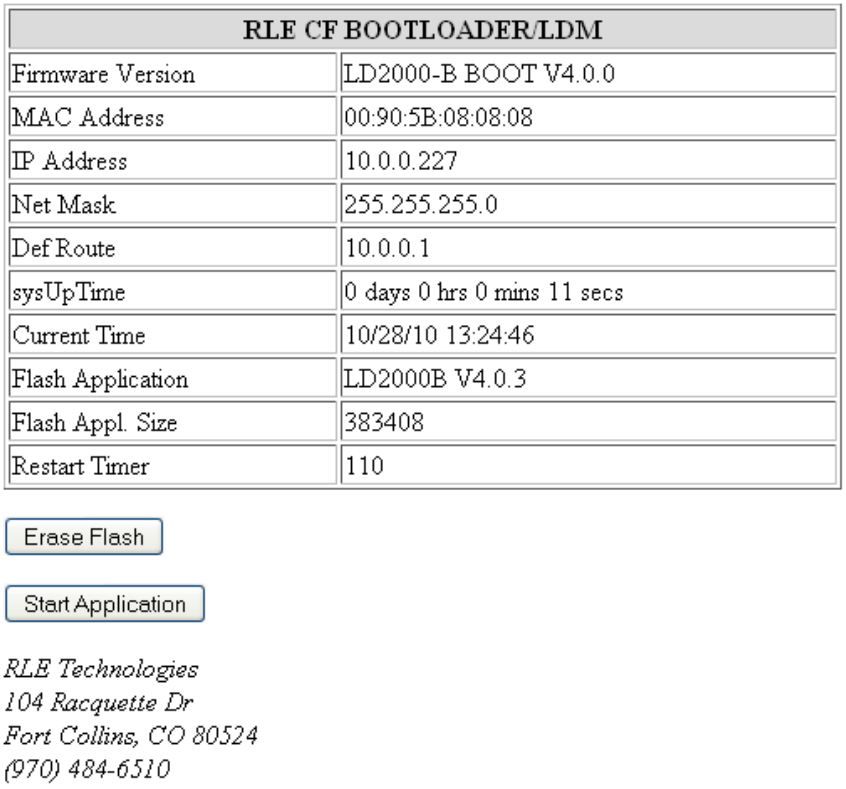
4.3.13 System Management

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

Table 4.9 System Management Menu Options

System Management Menu Options	Description
Exit to Bootloader	Forces the unit to stop running flash application to allow for firmware updates; see Appendix A, “Firmware Updates” on page 59, for more information.
Restore Factory Defaults	Resets the configurations and settings on the unit to all factory defaults.

Figure 4.19 System Management Page



RLE CF BOOTLOADER/LDM	
Firmware Version	LD2000-B BOOT V4.0.0
MAC Address	00:90:5B:08:08:08
IP Address	10.0.0.227
Net Mask	255.255.255.0
Def Route	10.0.0.1
sysUpTime	0 days 0 hrs 0 mins 11 secs
Current Time	10/28/10 13:24:46
Flash Application	LD2000B V4.0.3
Flash Appl. Size	383408
Restart Timer	110

Figure 4.20 Exit to Bootloader Page

Notes:

CHAPTER

5

MODBUS COMMUNICATION

This chapter describes the Modbus communication protocol as supported by the LD2000 Distance Read System. The content includes details and information on how to configure the LD2000 for communications via Modbus network

5.1. Implementation Basics

The LD2000 is capable of communicating via the half-duplex EIA-485 serial communication standard. The LD2000 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 LD2000 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 LD2000 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)

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. A valid address range is between 1 and 254. The slave address is set from the **Modbus/EIA-485 Configuration** webpage (see 4.3.9, “Modbus” on page 43).

5.1.1.2 Function Field

The function field is one byte in length and tells the LD2000 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 LD2000 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 LD2000 RTU mode uses a 16-bit cyclic redundancy check (CRC-16).

5.1.1.5 5-1.2 Exception Responses

If a Modbus master sends an invalid command to the LD2000 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 LD2000

This section covers the registers with the name and a brief description of each.

5.2.1 Function 03: Read Output Registers

To read the LD2000 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 Register 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	Units	Range
40001	Leak Threshold	Trip current for leak alarm	25-295 uAmps	0-65535
40002	Contamination Threshold	Trip current for contamination alarm	20-295 uAmps	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

Table 5.3 Output Registers (continued)

Register	Name	Description	Units	Range
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 LD2000 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	uAmps	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

Table 5.5 Input Registers (continued)

Register	Name	Description	Units	Range
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
30034	Modbus Zone13 Status	Location of leak	None	0-65535
30035	Modbus Zone13 Distance	Bit Level Status	Ft/Meters	0-65535
30036	Modbus Zone14 Status	Location of leak	None	0-65535
30037	Modbus Zone14 Distance	Bit Level Status	Ft/Meters	0-65535
30038	Modbus Zone15 Status	Location of leak	None	0-65535
30039	Modbus Zone15 Distance	Bit Level Status	Ft/Meters	0-65535
30040	Modbus Zone16 Status	Location of leak	None	0-65535
30041	Modbus Zone16 Distance	Bit Level Status	Ft/Meters	0-65535
Registers 30011 through 30041 are dedicated registers for modbus master; see Appendix B for details.				

Table 5.6 Status Flags (Register 30001)

Bit	Description
00	1 = Leak is Detected
01	1 = Cable Break Alarm
02	1 = Contamination is detected
04-15	Spare

Table 5.7 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

Table 5.8 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
12	1 = MBZ13
13	1 = MBZ14

Table 5.8 Status Flags (Register 30011) (continued)

Bit	Description
14	1 = MBZ15
15	1 = MBZ16

Table 5.9 Status Flags (Even Registers 30012-30040)

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

5.2.3 Function 06: Preset Single Register

To set a LD2000 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 5.10 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)

5.2.4 Function 16: Preset Multiple Registers

To set multiple LD2000 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 5.11 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)	

5.3. RTU Framing

The example below shows a typical Query/Response from an LD2000 module.

Table 5.12 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 126 “Msb”
02	04	06	00	00	00	00	00	01	B5	A3

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

Register Values:

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

APPENDIX

A

FIRMWARE UPDATES

Firmware updates are available on the Resources page of our Web site at www.rletech.com. Download appropriate firmware to an accessible place to load it to the LD2000 using a LAN connection.

The instructions in this appendix describe how to load firmware using the LD2000's MIME (Multipurpose Internet Mail Extensions) feature. As an alternative, instructions are provided for using TFTP (Trivial File Transfer Protocol). If you are able to use MIME //Ted, what's the limitation? When would I not be able to use MIME?//, it is the more efficient method.

A.1. Preliminary Steps

To load firmware to the LD2000 using either MIME or TFTP, first locate the correct firmware:

1. Go to the RLE website Resources page at http://www.rletech.com/resources/.
2. Scroll down to the SeaHawk section and locate the firmware (a .bin file) for the LD2000.
3. *Using the same filename*, save the firmware to a local disk.

IMPORTANT Do not change the name of the firmware file when you save it. Otherwise, the LD2000 will not recognize the file.

A.2. Loading Flash Firmware Using MIME

To use MIME to load the firmware:

1 On the LD2000 interface, go to Configuration>System/Flash Management.

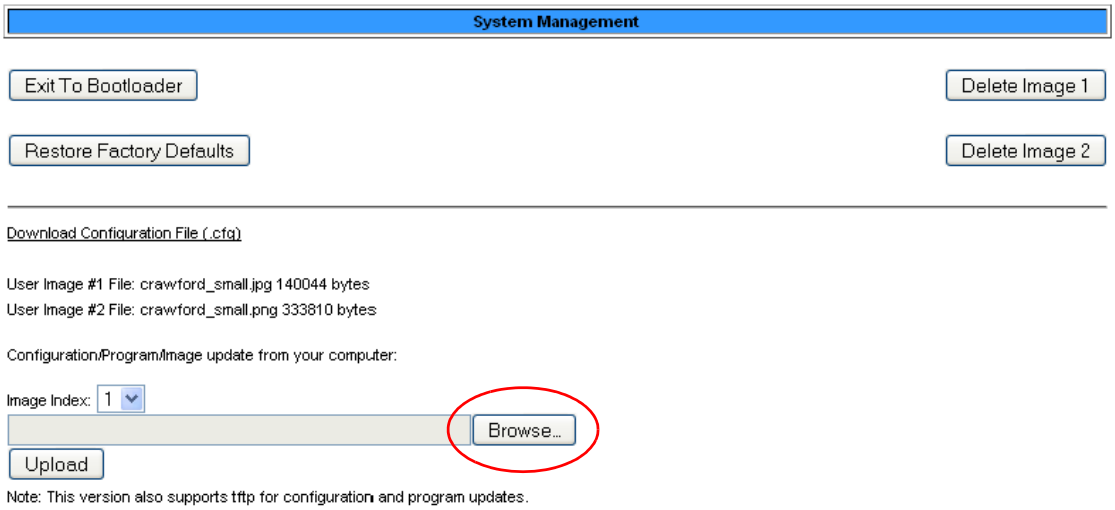


Figure A.1 System Management Page

2 Click the Browse button.

3 Locate and choose the firmware file (.bin) that you saved from the RLE website.

The path and name of the firmware file (.bin) displays in the field to the left of the Browse button.

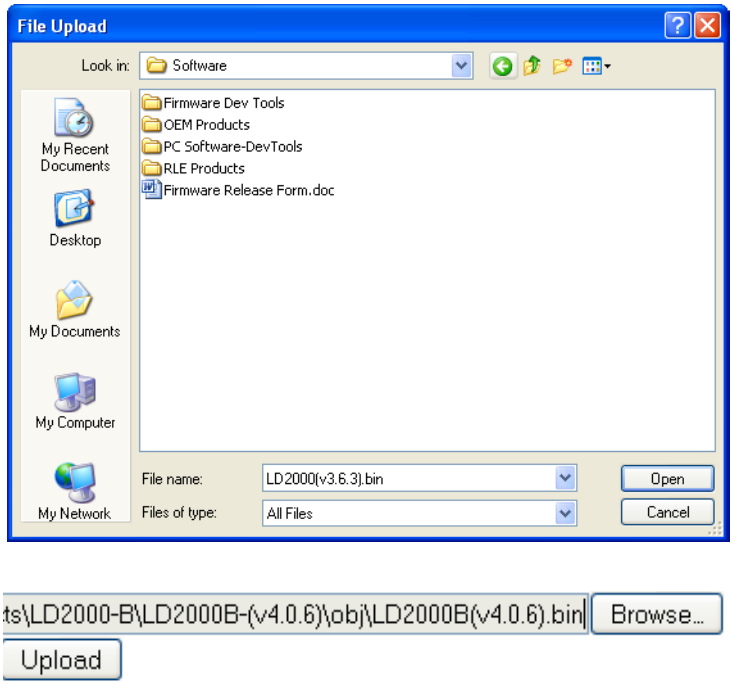


Figure A.2 Choosing a Firmware File

4 Click the Upload button.

The firmware is loaded while the LD2000 displays a message confirming that it is loading the new file.

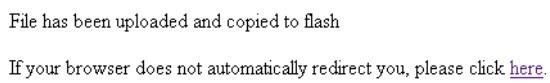


Figure A.3 Firmware Load Messages

//?? The file is loaded to the Image 2 area, which is also called the Backup area. The Image 1 area (also called the Active area) contains the current flash firmware that is in use. ??//

5 To copy the firmware you just uploaded from Image 2 to Image 1 . . . , //does this work the same way as for the FMS? These buttons are labeled differently.// The following prompt displays:

6 Click OK to start the erase and copy process.

During this process, the following messages display:

7 If the system does not reboot on its own, click the here link to display the LD2000 Home page.

8 You can verify which firmware version is loaded by clicking the Identity link on the top bar and looking for the field called Flash Application

Model	LD2000B
Flash Application	LD2000B V4.0.6
Flash Appl. Size	384640
Bootloader Version	LD2000-B BOOT V4.0.0
MAC Address	00:90:5B:FC:CC:CC
IP Address	10.0.0.248
Net Mask	255.255.255.0
Def Route	10.0.0.1
sysUpTime	15 days 23 hrs 25 mins 56 secs
System Name	ENG-LD2000
System Contact	RLE Technologies
System Location	104 Racquette Drive, Fort Collins, CO 80524

Figure A.4 Current Firmware Version As Shown in LD2000 Interface

A.3. Loading Flash Firmware Using TFTP

Before updating the firmware, the firmware flash application must be exited and then erased. To do this, navigate to the LD2000's System Management menu. Once here, click on the "Exit to Bootloader" button (you must have write access to the unit in order to accomplish this task). Once exited, you will get a bootloader webpage at the IP address of the unit. Next, click on the "Erase Flash" button. The Flash application will be erased.

Note In order to erase the flash, a special username and password are required:
Username: ld2000 (all alowercase)
Password: rle2tech (all lowercase)

1. 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.
2. Verify that your PC and the LD2000 are on the same subnetwork (LAN).
3. Open your TFTP client. Configure the client as follows.
   a. **Host** = LD2000 IP Address
   b. **Port** = 69
   c. **Block Size** = 64, 128, 256, 512, or 1024

Note The file must be sent in BINARY (not ASCII).

4. Send or PUT the firmware file to the LD2000. It may take ~10 seconds for the firmware upload to begin. This will put the new firmware into effect.
5. After one minute, refresh the LD2000 webpage. Notice that the Flash field now contains the latest firmware. Click the "Start Application" button to reboot the unit.

Notes:

APPENDIX

B

LEAK DETECTION MODBUS MASTER

This feature allows the LD2000 to act as a Modbus master to other RLE distance read panels. Up to 15 RLE distance read panels can be connected to the EIA-485 port on the LD2000. The system status can be viewed by using the home webpage. The LD2000 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 LD2000 (EIA-485 Port)

When using the LD2000 as a Modbus master, the slave unit(s) must be wired to the EIA-485 port (TB4). 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.)

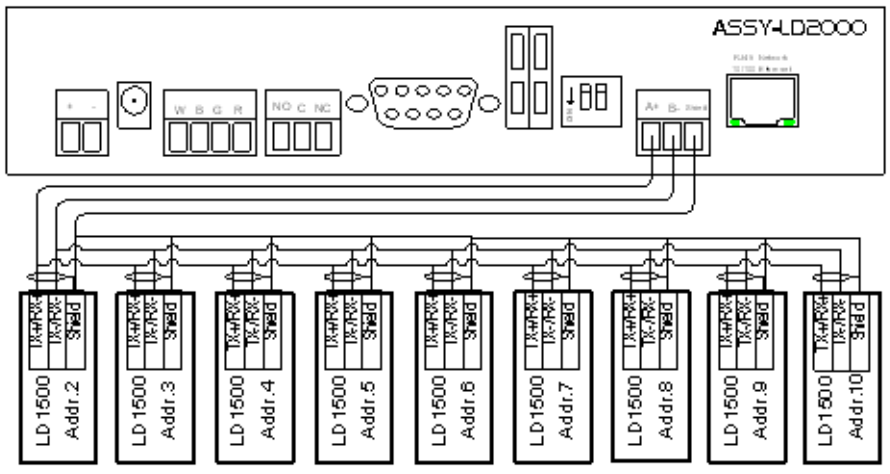


Figure B.1 LD2000 EIA-485 Connection Diagram

B.2. Connecting Distance Read Panels to the LD2000 (Ethernet)

When using the LD2000 as a Modbus master, the slave unit(s) can be connected to the LD2000 by using the local network connection, TCP/IP or UDP/IP. You will have to set the TCP/IP, UDP/IP slave address in each Leak detection unit(s) with distance read panels that have an Ethernet port. The first unit connected must be set to address 2 or higher. 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-2.)

- Set the TCP/IP, UDP/IP slave address for every distance read modules connected via the Ethernet. The Modbus communications uses port #502 for the IP address assigned.

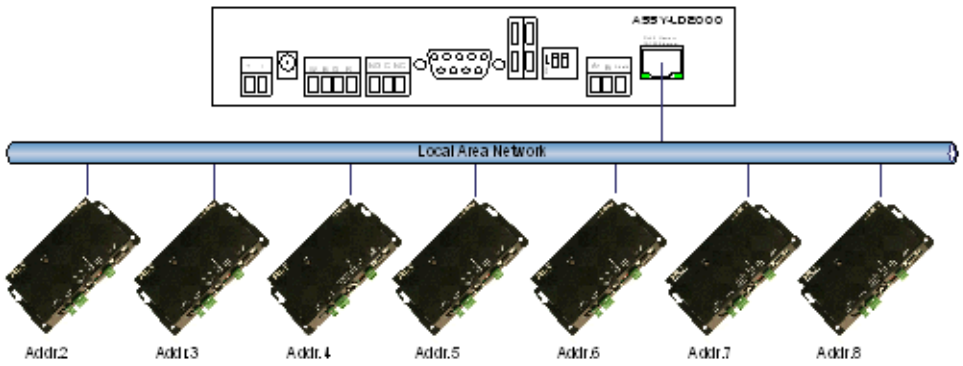


Figure B.2 Address Assignment for Units

B.3. Configuring the LD2000 Modbus Communications

Log into the LD2000 web interface and configure the unit to be a Modbus master:

1 From the Home page, click the Configuration link in the top bar. If using the EIA-485 port, click on EIA-485 Port/Modbus/N2.

2 Once on the Modbus/EIA-485 Configuration page, select Modbus-Master or N2 from the Select EIA-485 Port Function drop down. When completed, click on the submit changes tab.

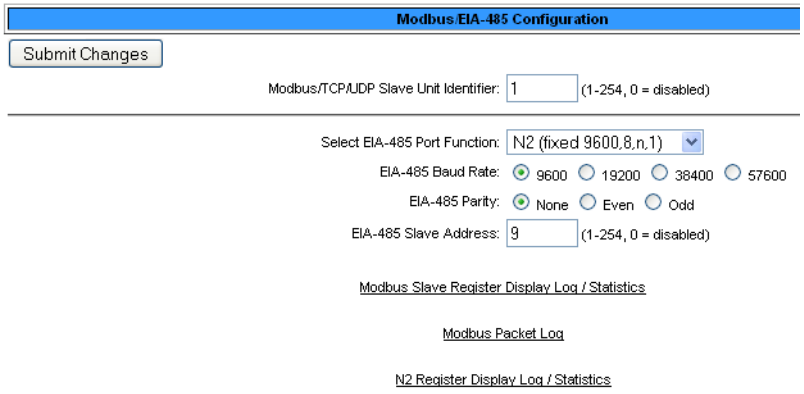


Figure B.3 Modbus/EIA-485 Configuration (Johnson N2 Shown)

Next, configure the slave units:

3 From the LD2000 Home page, click the Configuration link in the top bar. Choose from the following options based on the configuration you want to set up:

- **a** To use addresses 2 through 8, choose Zone Settings???.
- **b** If using zones 1-8 for virtual zone labeling, use Zone 9-16 Settings //what is this called now?//.
- **c** If you are *not* using the virtual zone feature, check the Physical-Modbus/485 option. Trap notifications can be enabled or disabled on individual units via the Modbus/EIA-485 Configuration page. Click the submit changes button to save changes. Return to the Configuration screen when finished.

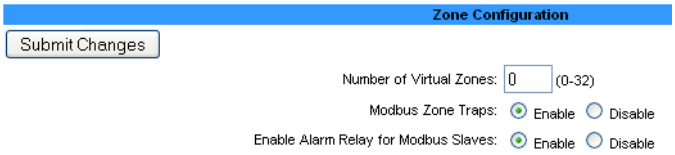
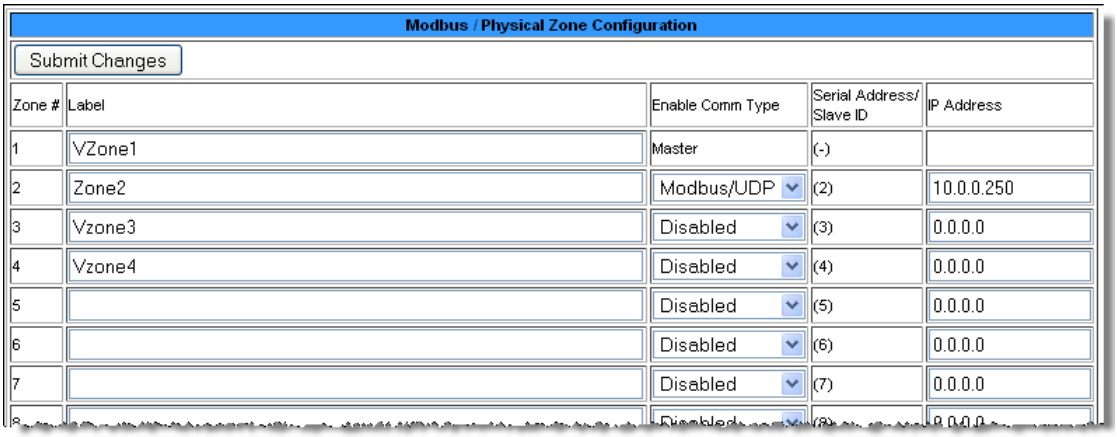


Figure B.4 Zone Configuration

4 For labeling Modbus/Physical zones, select Physical Zone Settings from the Configuration Menu.



Modbus / Physical Zone Configuration

Submit Changes

Zone #	Label	Enable Comm Type	Serial Address/ Slave ID	IP Address
1	VZone1	Master	(-)	
2	Zone2	Modbus/UDP	(2)	10.0.0.250
3	Vzone3	Disabled	(3)	0.0.0.0
4	Vzone4	Disabled	(4)	0.0.0.0
5		Disabled	(5)	0.0.0.0
6		Disabled	(6)	0.0.0.0
7		Disabled	(7)	0.0.0.0

Figure B.5 Modbus/Physical Zone Configuration Page

5 Once on the menu, you can configure the labels for the slave units as follows:

- If you are using the EIA-485 wiring for communication select RS-485 from the Enable Comm Type drop down.
- If you are using the Ethernet port, select either Modbus TCP or Modbus UPD, depending on the module. When using the Ethernet port, add the IP address of the module to the IP Address field in the right column of the table.

6 Continue the previous step for each slave unit being configured from address 2 through 32. Click on the Submit Changes tab once finished.

7 Go to the Home page of the LD2000 and verify that the system is receiving accurate communications and proper status readings from the connected slave modules

RLE recommends generating an alarm from each unit to confirm all communications are working properly.

Figure B.6 LD2000 Home Page

8 View the individual slave unit information by clicking on the Zone #x link.

Zone #17	zone17
Alarm Status	Normal
Cable Length	2352 Meters
Cable Current	0
Leg 1 Resistance	21636
Leg 2 Resistance	21614
Modbus/UDP Address	10.0.0.239 / Slave ID: 17 (arp: yes)
Comm Loss Count	0

Figure B.7 Individual Slave Unit Page

Notes:

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.

1 Verify the Leak Detected alarm on the control panel.

2 Compare the distance reading on the LD2000 to a reference map (if available) to verify that the LD2000 displays the correct leak location.

3 Dry the cable and verify that the LD2000 returns to normal.

4 Remove the End-of-Line terminator (EOL).

5 Verify the Cable Break alarm on the control panel.

6 Reinstall the EOL.

7 Verify that the LD2000 returns to normal.

8 Monitor the cable current monthly to verify that the cable is not being contaminated. The LD2000 will alarm on cable contamination if the contamination is excessive.

9 From the LD2000 Web interface, verify that 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

Notes:

APPENDIX

D

TROUBLESHOOTING

Table D.1 Troubleshooting

Problem	Action
Control Panel will not Power Up	1 Check with a DVOM (multi-meter) for AC or DC input power on the lower left hand terminal block on the LD2000. If no voltage is present at terminal block, check the circuit (breaker) or power supply the LD2000 control panel is powered by. If voltage is present, go to step 2. 2 Contact RLE Technologies for unit replacement and/or evaluation. If voltage is present and no LED's are illuminated, contact RLE Technologies for further troubleshooting.
Cable Break Alarm	1 Verify that the leader cable from the sensing cable run is plugged into terminal block marked “Cable.” 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. 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. 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.

Table D.1 Troubleshooting (continued)

Problem	Action
Control Panel not Calculating Proper Length of Cable	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. 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.
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 sensing cable. Locate the first section of sensing cable from the LD2000 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 LD2000 unit, please contact RLE Technologies for support.
Cable Contamination Alarm	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 LD2000 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.

APPENDIX

E

TECHNICAL SPECIFICATIONS

Table E.1 Technical Specifications

Power			24VAC Isolated @ 600mA max, 50/60Hz; requires power supply (not included) 24VDC@ 600mA max; requires power supply: WA-DC-24-ST (not included)
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
	Recommended Maximum Length		2,000ft (609m)
	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		5-995sec, software adjustable in 5sec increments; ±2sec
Outputs			
	Relay		Summary Relay; 1A @ 24VDC, 0.5A resistive @ 120VAC
Communications Ports			
	Ethernet		10/100 BaseT, RJ45 connector; 500VAC RMS isolation
	EIA-232		DB9 female connector; 9600 baud; No parity, 8 data bits, 1 stop bit
	EIA-485		1200, 2400, 9600, 19200, or 38400 baud (selectable); Parity: none, even or odd, 8 data bits, 1 stop bit

Table E.1 Technical Specifications (continued)

Protocols		
	TCP/IP, HTML, TFTP	IPv4.0; webpages comply with Rehabilitation Act of 1973, sections 504 and 508, US Dept of Education (website accessibility for computer users with disabilities)
	SNMP	V1: V2C MIB-2 compliant; NMS Manageable with Get, Set, Traps
	SMTP (Email)	Supports Client Authentication (plain and login); compatible with ESMTP Servers
	Modbus (EIA-485)	Slave; RTU Mode; Supports function codes 03, 04, 06 and 16; Johnson N2
	Modbus TCP/IP	Modbus Slave; TCP/IP transmission protocol
	BACnet/IP	Conformance Level 1
	Terminal Emulation (RS-232)	VT100 compatible
Alarm Notification		
	Audible Alarm	//need specs -- dB, etc.//
	Visual Alarm	Red, 4-digit; 7 Segment LED Display; Bi-color status LED
	Email (Ethernet)	4 Email recipients; email sent on Alarm and Return to Normal; each Alarm can notify any or all of the email recipients
	SNMP Traps (Ethernet)	4 Community Strings
Logging Capabilities		
	Event Log	Last 500 events
	Trend Log	Cable current level every day, for the last 288 days
Login Security		
	Web Browser Access (Ethernet)	1 Web password Read Only; 1 Web password Read/Write
	Terminal Emulation Access	None
Front Panel Interface		
	Display	Green, 4-digit; 7 Segment LED Display; Bi-color status LED
	Push Buttons	Test/Reset: 1
	LED Indicators	Power/Status: 1 tri-color (Power On: green; Alarm: red; Cable Fault: yellow)
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		8.0"W x 4.25"H x 1.25"D (203mmW x 108mmH x31.75mmD)
Weight		1.5 lbs. (680g)

Table E.1 Technical Specifications (continued)

Mounting	Vertical wall mount, or din rail mount (kit required): DIN-KIT (kit not included)
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

Notes: