LDRA6 USER GUIDE

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SEAHAWK LDRA6

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The following information is located on the bottom of each LDRA6 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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CHAPTER 1: PRODUCT OVERVIEW

1-1 DESCRIPTION

The LDRA6 is a complete monitoring system that detects and reports the presence of water and other conductive liquids, as well as monitors dry contact alarm points. The LDRA6 couples SeaHawk Water Leak Detection Cable (SC) with an advanced control head to monitor six individual zones. When a conductive liquid comes in contact with the SC cable, an alarm sounds and the summary alarm relay and zone relay activate. The LED that corresponds with the appropriate zone also illuminates and an audible alarm is activated. Each LDRA6 input can also be configured to detect a dry contact's change of state (*NO or NC*) and annunciate the alarm on the front panel.

The LDRA6 is a supervised system - it continuously monitors the cable for leaks and cable integrity. A cable break causes a cable fault indication. An alarm sounds and the appropriate zone relay and the summary alarm relay activate. The appropriate LED changes to indicate a cable fault has occurred.

The dry contact relays in the LDRA6 may be configured as supervised or unsupervised (*see section 2-2 for configuration options*). Each zone can be configured with unique, individual settings. When the user specified alarm condition occurs, the LDRA6 activates the appropriate relay and alarm LED.

***NOTE*:**

The LDRA6 produces an alarm in the following conditions:

- **Leak Detected**
- **Cable Fault**
- **Dry Contact Alarm Condition (User Specified)**

1-2 LDRA6 FRONT PANEL INDICATORS

1-2.1 Zone LEDs

One tri-color LED for each zone.

Default Leak Detection Cable Setting:

On solid and green for normal cable conditions.
Flashes quickly and turns red if a leak is detected in the zone.
Flashes quickly and turns yellow if a cable fault is detected in the zone.
On solid once an alarm is silenced.

Default Dry Contact Setting:

On solid and green for normal, non-alarm conditions.
Flashes quickly and turns red (by default) if an alarm condition is detected in the zone.
On solid once an alarm is silenced.

1-2.2 Power LED

On (green) as long as power is on.

1-2.3 Audible Alarm

Activates when an alarm condition is detected. Silenced with the Quiet/Test/Reset switch.

1-2.4 Quiet/Test/Reset Switch

During alarm, the audible alarm is silenced, and any LED(s) in alarm will glow solidly. If the alarm goes away, the LED(s) will flash slowly. Hold down the Quiet/Test/Reset switch to reset all alarms and complete and self test cycle. If any alarms still exist, the unit will not reset the corresponding zones.

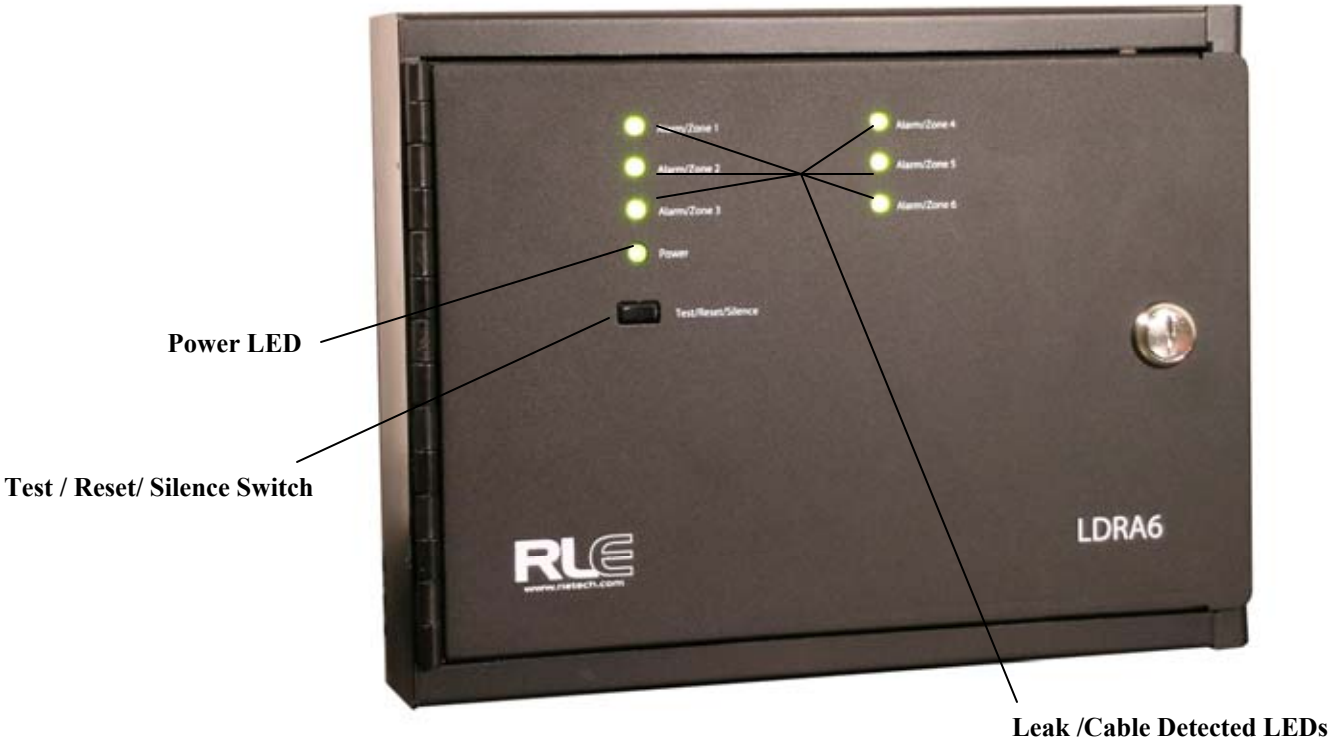

Figure 1-1: LDRA6 Front Panel Indicators

CHAPTER 2: CONNECTIONS & SETTINGS

2-1 LDRA6 BOARD

The LDRA6's zone connectors, labeled TB2, are found at the bottom of the board on the double-stacked terminal block. The switches on the board are labeled SW1 and SW2. The unit has one dial, labeled R1, which is used to manually adjust the sensitivity for all zones. Sensitivity for individual zones may be configured through the LDRA6's RS232 Craft Port configuration, labeled P2. The switches for configuring Dry Contact or Leak Detection monitoring for zones are labeled SW4 through SW9.

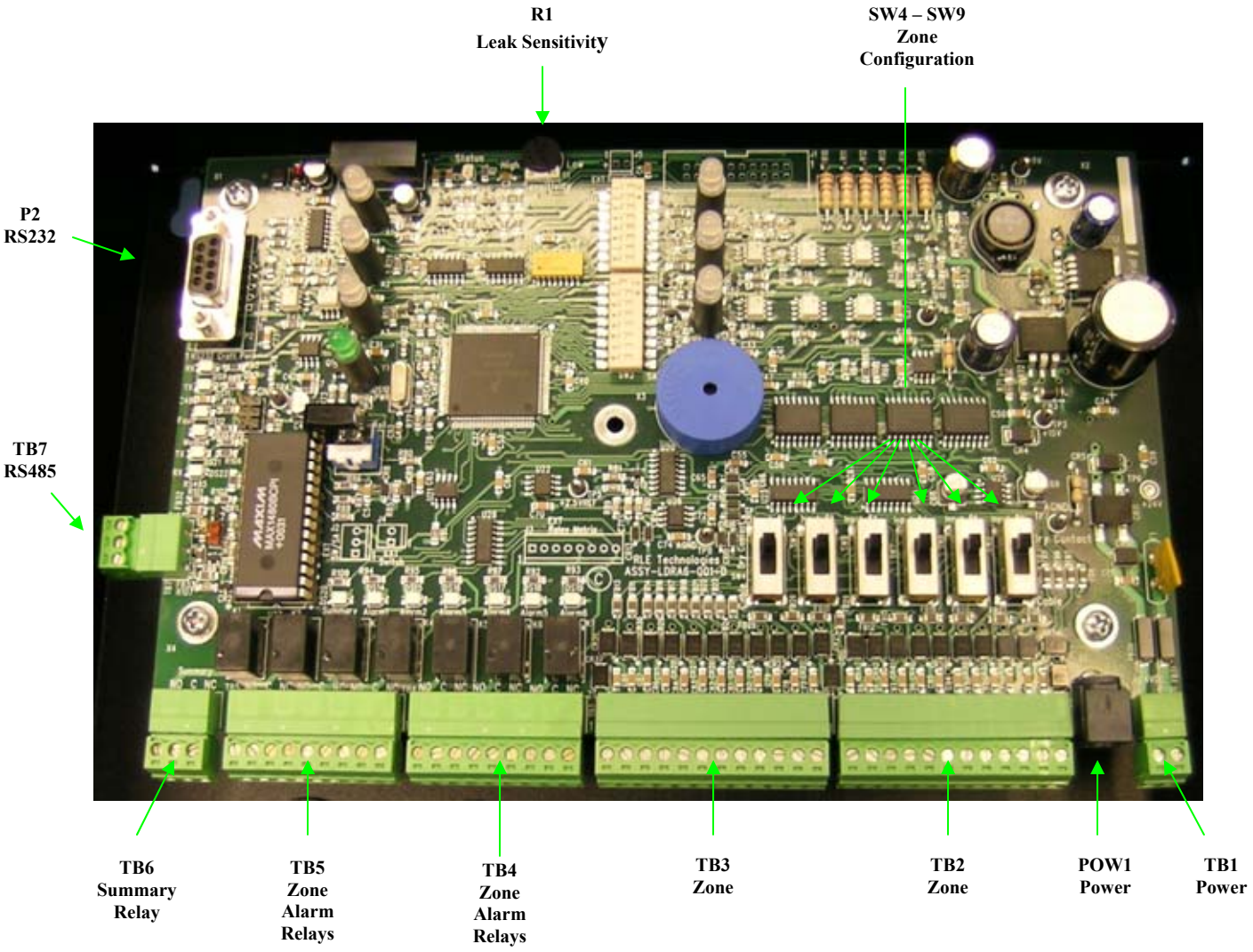

Figure 2-1: LDRA6 Board

2-1.1 TB1 – Power

The LDRA6 connects to a 24VDC power supply using TB1, a two position connector labeled 24VDC.

2-1.2 POW1 – Power

Power can also be supplied to the unit through POW1. This is a wall adapter plug connection. This also requires 24VDC.

2-1.3 TB2, TB3 – Zone Inputs

SeaHawk Leak Detection Cable (SC) and/or dry contact wires connect to the LDRA6 through TB2. Fifteen foot (4.57m) leader cables (one is included in each leader cable kit, part #LC-KIT) are required for leak detection cable connections only. Dry contact wires must be user supplied or may be supplied with your dry contact device. Connect cables/wires as follows:

Position	Leak Detection Cable	Dry Contact Wire
TB3-1	Zone 1 White	Zone 1 Input-1
TB3-2	Zone 1 Black	Zone 1 Input-2
TB3-3	Zone 1 Green	N/A
TB3-4	Zone 1 Red	N/A
TB3-5	Zone 2 White	Zone 2 Input-1
TB3-6	Zone 2 Black	Zone 2 Input-2
TB3-7	Zone 2 Green	N/A
TB3-8	Zone 2 Red	N/A
TB3-9	Zone 3 White	Zone 3 Input-1
TB3-10	Zone 3 Black	Zone 3 Input-2
TB3-11	Zone 3 Green	N/A
TB3-12	Zone 3 Red	N/A
TB2-1	Zone 4 White	Zone 4 Input-1
TB2-2	Zone 4 Black	Zone 4 Input-2
TB2-3	Zone 4 Green	N/A
TB2-4	Zone 4 Red	N/A
TB2-5	Zone 5 White	Zone 5 Input-1
TB2-6	Zone 5 Black	Zone 5 Input-2
TB2-7	Zone 5 Green	N/A
TB2-8	Zone 5 Red	N/A
TB2-9	Zone 6 White	Zone 6 Input-1
TB2-10	Zone 6 Black	Zone 6 Input-2
TB2-11	Zone 6 Green	N/A
TB2-12	Zone 6 Red	N/A

2-1.4 TB5, TB4 – Zone Alarm Relays

These are the Zone Alarm Relay output terminal blocks (Form C). A status LED is located above each relay, which will indicate the state of the relay (on/off). These relays can be configured as supervised or unsupervised, latched or unlatched (*unsupervised and unlatched by factory default*). Connect the Zone Alarm Relay wires to TB3 and TB4 as follows:

TB5-1 Zone 1 alarm relay normally open (NO)
TB5-2 Zone 1 alarm relay common (C)
TB5-3 Zone 1 alarm relay normally closed (NC)

TB5-4 Zone 2 alarm relay normally open (NO)
TB5-5 Zone 2 alarm relay common (C)
TB5-6 Zone 2 alarm relay normally closed (NC)

TB5-7 Zone 3 alarm relay normally open (NO)
TB5-8 Zone 3 alarm relay common (C)
TB5-9 Zone 3 alarm relay normally closed (NC)

TB4-1 Zone 4 alarm relay normally open (NO)
TB4-2 Zone 4 alarm relay common (C)
TB4-3 Zone 4 alarm relay normally closed (NC)

TB4-4 Zone 5 alarm relay normally open (NO)
TB4-5 Zone 5 alarm relay common (C)
TB4-6 Zone 5 alarm relay normally closed (NC)

TB4-7 Zone 6 alarm relay normally open (NO)
TB4-8 Zone 6 alarm relay common (C)
TB4-9 Zone 6 alarm relay normally closed (NC)

2-1.5 TB6 - Summary Relay

This is the Summary Relay output terminal block (Form C). A status LED is located to the right of the relay, which will indicate the state of the relay (on/off). This relay can be configured as supervised or unsupervised, latched or unlatched. Connect the Summary Relay wires to TB5 as follows:

TB6-1 Summary alarm normally open (NO)
TB6-2 Summary alarm common (C)
TB6-3 Summary alarm normally closed (NC)

2-1.6 TB7 – RS485 Connection

The LDRA6 can communicate with other devices through the RS485 terminal block. Wire as follows:

TB7-1 + or A wire
TB7-2 – or B wire
TB7-3 Shield or GND wire

2-2 SW1 - RELAYS AND ALARM

2-2.1 SW1, Position 1: Summary Relay Supervised / Unsupervised

Configures the Summary Alarm relay as supervised or unsupervised. If a relay is supervised, the relay picks until power goes off or until an alarm is detected. The alarm then releases to announce a change in state. An unsupervised relay picks only when an alarm is detected.

1 = Supervised
0 = Unsupervised (factory default)

2-2.2 SW1, Position 2: Relays Latched / Unlatched

Configures all relays as latched or unlatched. If a relay is latched, the relay will remain in an alarm condition until the Reset switch is pressed. If a relay is unlatched, the relay will remain in alarm until either the Reset switch is pressed, or the condition that tripped the relay goes away.

1 = Latched
0 = Unlatched (factory default)

2-2.3 SW1, Position 3: Zone Relay Linkage

Configures all Zone Alarm Relays to link together and pick simultaneously upon alarm. When this switch is turned on, if a zone goes into alarm, all six zone alarm relays and the summary alarm relay will pick. When this switch is turned off, if a zone goes into alarm, only the zone alarm relay for the zone that is in alarm and the summary alarm relay will pick.

1 = Individual Zone Alarm Relays Linked
0 = Individual Zone Alarm Relays Not Linked (factory default)

2-2.4 SW1, Position 4: Zone Relays Supervised / Unsupervised

Configures the individual Zone Alarm Relays as supervised or unsupervised. If a relay is supervised, the relay picks until power goes off or until an alarm is detected. The alarm then releases to announce a change in state. An unsupervised relay picks only when an alarm is detected.

1 = Supervised
0 = Unsupervised (factory default)

2-2.5 SW1, Positions 5: Leak Alarm Delay

Designates the unit's leak delay time. Setting this switch to off uses the default leak alarm delay of 15 seconds. Setting this switch to on designate the leak alarm delay to use the value specified through the unit's craft port.

1 = Leak Alarm Delay set through Craft Port
0 = Leak Alarm Delay set at 15 seconds (factory default)

2-2.6 SW1, Positions 6: Summary Relay Silence-Ability

Configures the Summary Alarm Relay as silence-able or not silence-able. If the Summary Alarm Relay is silence-able, the relay returns to normal when the Quiet/Test/Reset button is pressed. If the Summary Alarm Relay is not silence-able, the relay stays picked until the alarm condition is cleared.

1 = Summary Alarm Relay is Silence-Able
0 = Summary Alarm Relay is Not Silence-Able (factory default)

2-2.7 SW1, Positions 7 and 8: Re-alarm Time

Configures the unit's re-alarm time. Set the switches as below for desired (*approximate*) re-alarm times:

1 1 = 24 hours
0 1 = 16 hours
1 0 = 8 hours
0 0 = Disabled; no re-alarming once silenced (factory default)

2-3 SW2 – MODBUS ADDRESSING

Configures the unit's RS485 address. The unit's address is set in bits and can range from 00000001 to 11111110 (1-254 in decimal notation).

00000000 = No Address (factory default)
00000001 = 1
00000010 = 2
00000011 = 3
…
11111101 = 253
11111110 = 254

2-4 SW4 THROUGH SW9

Configures each zone as a Leak Detection Cable input or a Dry Contact input. If configured as a Leak Detection Cable input, the zone requires a 4-wire leak detection cable (SC) to monitor. If configured as a Dry Contact input, the zone requires a 2-wire dry contact device to monitor. If any zone is not desired to be used, set the zone to Dry Contact and normally open (factory default) to avoid unwanted alarms.

SW4 Up	=	Zone 1 is a Dry Contact input
SW4 Down	=	Zone 1 is a Leak Detection input
SW5 Up	=	Zone 2 is a Dry Contact input
SW5 Down	=	Zone 2 is a Leak Detection input
SW6 Up	=	Zone 3 is a Dry Contact input
SW6 Down	=	Zone 3 is a Leak Detection input
SW7 Up	=	Zone 4 is a Dry Contact input
SW7 Down	=	Zone 4 is a Leak Detection input
SW8 Up	=	Zone 5 is a Dry Contact input
SW8 Down	=	Zone 5 is a Leak Detection input
SW9 Up	=	Zone 6 is a Dry Contact input
SW9 Down	=	Zone 6 is a Leak Detection input

2-5 R1 – LEAK DETECTION CABLE SENSITIVITY SETTING

This potentiometer allows users to manually adjust the sensitivity setting for all six zones. Turn the dial clockwise to make the zone less sensitive. This means a leak will be reported in that zone when a large amount of water is present. Turn the dial counterclockwise to make the zone more sensitive. This means a leak will be reported for the zone when a small amount of water is present.

This potentiometer can be overridden through the LDRA6's craft port configuration for individual zones (*see section 4-3.3 for details*).

CHAPTER 3: INSTALLATION

3-1 BEFORE YOU BEGIN

The LDRA6 is a wall mounted device. To secure the device to the wall, first open the door of the enclosure. There are knockouts on the top and bottom of the enclosure. Remove as many as necessary. Use drywall anchors and the holes in the back of the enclosure to secure the unit to the wall.

3-2 CONNECTING THE WATER LEAK DETECTION CABLE

A leader cable kit (part #LC-KIT) is required per zone to connect the LDRA6 to SeaHawk Leak Detection Cable (SC). A leader cable is included in each LC-KIT; one end of this leader cable connects into the LDRA6. This end of the cable is finished with stripped, bare wires. The other end features a mating connector which connects with the SC cable. The end of the cable zone requires a removable end terminator (EOL) which is also included in a leader cable kit (LC-KIT).

***NOTE*:**
A Leader Cable Kit (part #LC-KIT) is required per zone to connect the LDRA6 to SeaHawk Leak Detection Cable (SC). Each LC-KIT includes a 15 foot (4.57m) leader cable and an EOL terminator. The kits are NOT included with the LDRA6, and can be purchased separately.

To connect the leader cable to the LDRA6, connect the wires (4) to the appropriate zone position of the terminal block connectors (*see section 2-1.3 for more wiring details*). Adjust the appropriate zone configuration for Leak Detection input (*see section 2-4 for more details*).

Once the leader cable is plugged into the terminal block, it is ready to be connected to the SC cable. To do this, unscrew the EOL terminator from the end of the leader cable. Attach the first length of SC cable to the leader cable. Route the SC cable according to the cable layout diagram, if provided. Lay the cable according to figure 3-1 and section 3-2.1. Secure the EOL terminator on the unoccupied end of the SC cable.

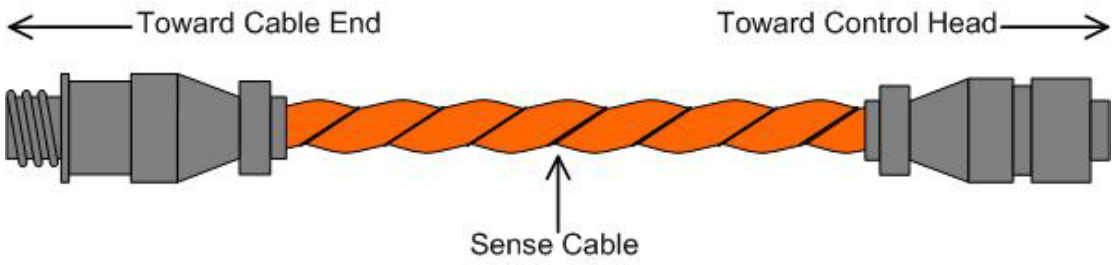

Figure 3-1: Water Leak Detection Cable

3-2.1 Secure the Cable to the Floor

Secure the cable to the floor with either J-clips (part #JC) or one of the other approved methods shown in Figure 3-2. J-clips are the manufacturer's recommended installation method.

- Place one J-clip every three feet along the length of the SC cable. Place one J-clip at each turn of the cable.

- If the cable is installed over an obstruction, clip the cable on both sides, as close to the obstruction as possible.
- Do not install the cable directly in front of an air conditioner. Allow a minimum of 6 feet (1.83m) between the unit and the cable. If the SC 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 (.305m to .457m)apart.

NOTE:
It is important to finish the end of the SeaHawk Leak Detection Cable (SC) with the end-of-line 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. Wait approximately one minute. No alarm should be present.

3-2.2 Recommended Cable Installation

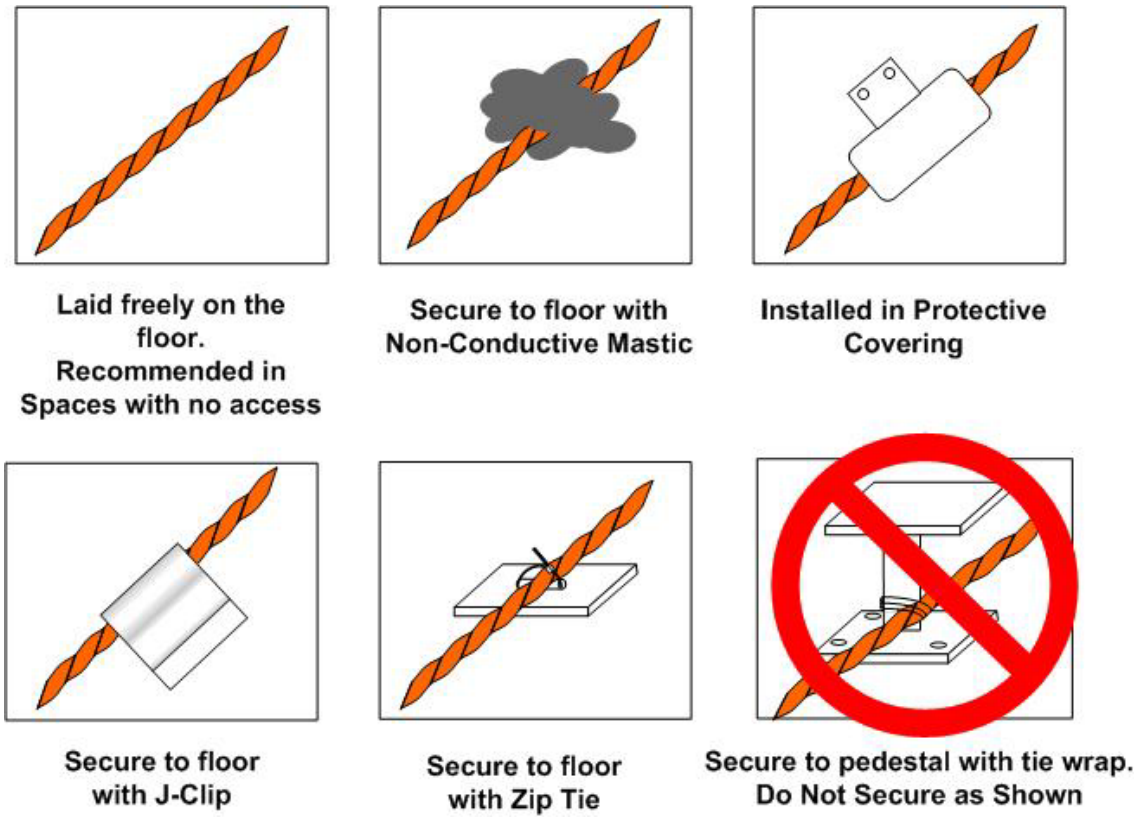

Figure 3-2: Cable Installation Methods

3-3 APPLY POWER TO THE UNIT

Once cable for all the desired leak detection zones has been connected to the unit, power may be applied. The LDRA6 operates on 24VDC power supplied by a wall adapter or a direct line. A power supply should be run to the location of the unit.

3-3.1 Power via Wall Adapter

The LDRA6 can be powered by a wall adapter. Before connecting the wall adapter to the LDRA6, unplug the adapter from the wall. If the adapter has a connector on the end, feed the cord through one of the knockouts in the enclosure and plug it directly into the 24VDC receptacle located at POW1. Plug the other end of the adapter into the wall. The LDRA6 should power up immediately.

3-3.2 Power via Direct Line

If the adapter does not have a connector on the end, strip the end of the adapter line so the two wires inside are exposed. Strip the end of each of the two wires and feed them into the enclosure. Insert the two wires into the terminal block labeled TB1. The minus, or ground, wire is placed into the right opening in the terminal block. The plus, or live, wire is placed into the left opening in the terminal block.

Once all the wires have been placed inside the terminal block, tighten the three screws across the bottom of the terminal block until the wires are securely held in place. Plug the other end of the wall adapter into the wall. The LDRA6 should power up immediately.

CHAPTER 4: START-UP

4-1 BOOT-UP

Make sure the RS-232 port is connected to a PC or terminal with a straight through cable. When the LDRA6 is powered up, the boot ROM and flash program code are verified. Output similar to the screen displayed below should appear on the terminal or terminal emulation software.

```
LDZ/Rasp6 Bootloader – LDZ6BOOT V2.1
Firmware Prgm Id: LDZ6/RASP6 V2.1
checksum valid

LDZ/Rasp6 bootup
LDZ6/RASP6 V2.1
Reading EEprom.....................................
..... ok
Modbus Addr:0 9600,8,N,1
```

4-2 DISPLAYING THE HELP MENU

Once the system reaches this point, type? and press **Enter** to display the Help Menu. The Help Menu lists the function commands for the LDRA6.

```
Help Menu – LDZ6/RASP6 V2.1
c    - view/change CC settings
ld   - view/change leak delay
sens – view/change leak zone sensitivity
e    - view eeprom data
er   - erase eeprom data – restores factory defaults
mbb - change modbus baud rate
mbp  - change modbus parity
mr   - reset modbus port/statistics
m    - view modbus port settings/statistics
t    - toggle modbus trace on/off
z    - display leak zone readings
sr   - summary relay mode
zr   - zone relay mode
x    - exit to bootloader
```

4-3 FUNCTION COMMANDS

4-3.1 c – Contact Closure Settings

c displays the current contact closure settings for each zone. To adjust a zone's configuration, use the following format: **cX/type/offcolor/oncolor/delay**

- **X** is the zone number and can range from 1-6 for each input.
- **type** is the contact closure setting; use "no" for normally open, "nc" for normally closed, or "st" for a status point.
- **off-color** is the normal condition (non-alarm) LED color.
- **on color** is the alarm condition LED color.
  - The colors for LEDs can be green, yellow or red.
- **delay** is the number of seconds the alarm must be active before annunciated and can range from 0 to 999 seconds.

```
** 1: CC / 2: CC / 3: CC / 4: CC / 5: CC / 6: CC **
cX/type/offcolor/oncolor/delay
c1/no/green/red/0
c2/no/green/red/0
c3/no/green/red/0
c4/no/green/red/0
c5/no/green/red/0
c6/no/green/red/0
```

4-3.2 ld – Leak Delay Setting

ld displays the current leak alarm delay in seconds. This is the number of seconds the leak alarm must be detected before annunciated. The leak alarm delay can range from 0 to 999 seconds.

Use the format **ld/x** where x is the number of seconds for the leak alarm delay.

This value applies to all zones configured for Leak Detection. SW1 position 5 determines if this RS232 configured value is used (*see section 2-2.5*).

4-3.3 sens – Leak Zone Sensitivity

sens displays the current leak detection sensitivity settings for each zone. The first value displayed is the value read from R1, the sensitivity dial on the LDRA6 board. Each zone is displayed in the format **x: yyy/zzz**, where x is the zone, yyy is the value currently being used for sensitivity (*in micro amps read by the sensing cable, yyy can range from 25 to 300*), and zzz is the manually entered value through the craft port (*factory default is 0*). Values shown below uses sensitivity set to High (*fully counterclockwise*).

```
Pot: 25 1:25/0 2:25/0 3:25/0 4:25/0 5:25/0 6:25/0
```

To override the manual sensitivity dial setting, enter a new value for each desired zone. Using a value of 0 will enable desired zone to use manual sensitivity dial setting. Use the format **sensX/yyy** to override a zone's setting. Example: **sens1:300** sets Zone 1 to a sensitivity of 300 micro amps. Type **sens** and press Enter again to viewing the Leak Zone Sensitivity settings after entering new value displays the following:

```
Pot:25 1:300/300 2:25/0 3:25/0 4:25/0 5:25/0 6:25/0
```

4-3.4 e – View Eeprom Data

This function is a reserved command used for advanced diagnostic purposes only.

4-3.5 er – Erase Eeprom Data – Restores Factory Defaults

er will erase all RS232 configured settings and restore them all to factory default values.

4-3.6 mbb – View / Change Modbus Baud Rate

mbb will display modbus address, baud rate, data bits, parity, and stop bits. Default values are displayed below.

```
Modbus Addr:0 9600,8,N,1
```

To change modbus baud rate, use the format **mbb/xxxx** where xxxx is the baud rate. Valid selections for baud rate are 1200, 2400, 9600 and 19200.

4-3.7 mbp – View / Change Modbus Parity

mbp will display modbus address, baud rate, data bits, parity, and stop bits. Default values are displayed below.

```
Modbus Addr:0 9600,8,N,1
```

To change modbus parity rate, use the format **mbp/x** where x is the parity. Valid selections for parity are:

- e – even
- o – odd
- n – none

4-3.8 mr – Reset Modbus Port and Statistics

mr will reset all RS485 Modbus counters.

4-3.9 m – View Modbus Port Settings and Statistics

m will display the current RS485 Modbus port settings and logged statistics. Initial values appear as:

```
Modbus Addr:0 9600,8,N,1
overruns:        0
parity_errors:   0
noise_errors:    0
framing_errors:  0
inpackets:       0
crc_errors:      0
for me:          0
not for me:      0
```

4-3.10 t – Toggle Modbus Trace On/Off

t will toggle Modbus tracing with packet viewing from the RS485 port over the RS232 port. This is a command for advanced diagnostic purposes only.

4-3.11 z – Display Leak Zone Readings

z will display the present Leak Detection Cable readings. The Leak Zone table will display the reading for each leg of cable and the present leakage current reading for each zone.

```
Z1: Leg1: 0    Leg2: 0    Leakage: 0
Z2: Leg1: 0    Leg2: 0    Leakage: 0
Z3: Leg1: 0    Leg2: 0    Leakage: 0
Z4: Leg1: 0    Leg2: 0    Leakage: 0
Z5: Leg1: 0    Leg2: 0    Leakage: 0
Z6: Leg1: 0    Leg2: 0    Leakage: 0
```

4-3.12 sr – summary relay mode

sr will display the current configuration of the summary relay. You can select the summary relay to either change state on leak/fault or just a fault condition. Enter, sr <space> summary for notification on a leak/fault condition. Enter, sr <space> fault for notification on a fault condition.

```
sr
sr/summary (summary/fault)
sr fault
sr/fault (summary/fault)
```

4-3.13 zr – zone relay mode

zr will display the current configuration of the zone relays. You can select the zone relays to either change state on leak/fault (summary) or just a leak condition. Enter, zr <space> summary for notification on a leak/fault condition. Enter, zr <space> leak for notification on a leak condition.

```
zr
zr/summary (summary/leak)
zr leak
zr/leak (summary/leak)
```

4-3.14 x – Exit to Bootloader

x will exit the application code and only the bootloader will be running.

APPENDIX A: MODBUS COMMUNICATIONS

This document describes the Modbus communications protocol as supported by the LDRA6. It includes details and information on how to configure the LDRA6 for communications via Modbus network.

A-1 MODBUS IMPLEMENTATION OF THE LDRA6

The LDRA6 is capable of communicating via the half-duplex RS485 serial communication standard. The LDRA6 is configured to act as a slave device on a common network. The RS485 medium allows for multiple devices on a multi-drop network. The LDRA6 is a slave only device and will never initiate a communications sequence.

A-1.1 Modes of Transmission

The Modbus protocol uses ASCII and RTU modes of transmission. The LDRA6 supports only the RTU mode of transmission, with 8 data bits, even, odd or no parity and one stop bit.
Every Modbus packet consists of four fields:

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

A-1.1.1 Slave Address Field

The slave address field is one byte in length and identifies the slave device involved in the transaction. Valid address range is between 1 and 254. SW2 on the LDRA6 board sets the address. The firmware program constantly reads dip SW2. Any changes are updated on the fly. Close the SW2 positions that correspond to the binary number of the address.

A-1.1.2 Function Field

The function field tells the LDRA6 which function to perform. Function codes are designed to invoke a specific action by the LDRA6.

A-1.1.3 Data Field

The data field varies in length depending on whether the message is a request or a response to a packet. This field typically contains information required by the LDRA6 to perform the command specified or to pass back data to the master device.

A-1.1.4 Error Check Field

The error check field consists of a 16-bit (2 byte) Cyclical Redundancy Check (CRC16). It allows the LDRA6 to detect a packet that has been corrupted with transmission errors.

A-2 PACKET COMMUNICATIONS FOR THE LDRA6

A-2.1 Read Output Registers

To read the LDRA6 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 1: 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 2: Output Registers

Register	Name	Description	Units	Range
40001	Leak Threshold Zone 1	Trip current for leak alarm	uAmps	0-65535
40002	Leak Threshold Zone 2	Trip current for leak alarm	uAmps	0-65535
40003	Leak Threshold Zone 3	Trip current for leak alarm	uAmps	0-65535
40004	Leak Threshold Zone 4	Trip current for leak alarm	uAmps	0-65535
40005	Leak Threshold Zone 5	Trip current for leak alarm	uAmps	0-65535
40006	Leak Threshold Zone 6	Trip current for leak alarm	uAmps	0-65535
40007	Reserved			
40008	Reserved			
40009	Reserved			
40010	Silence Alarm	Set to 1 to silence audible alarm	1 = Silence	0-65535
40011	Reset Alarm	Set to 1 to reset alarms	1 = Reset Alarm	0-65535
40012	Reserved			
40013	Reserved			
40014	Reserved			
40015	Reserved			
40016	Reserved			
40017	Reserved			

A-2.2 Read Input Registers

To read the LDRA6 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 3: Read Input Registers Packet Structure

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

Table 4: Input Registers

Register	Name	Description	Units	Range
30001	Status	Bit Level Status (*see Table 5*)	None	0-65535
30002	Leak Current Zone 1	Leakage current on cable	uAmps	0-65535
30003	Leak Current Zone 2	Leakage current on cable	uAmps	0-65535
30004	Leak Current Zone 3	Leakage current on cable	uAmps	0-65535
30005	Leak Current Zone 4	Leakage current on cable	uAmps	0-65535
30006	Leak Current Zone 5	Leakage current on cable	uAmps	0-65535
30007	Leak Current Zone 6	Leakage current on cable	uAmps	0-65535
30008	Input Selection	Bit Level Status (*see Table 6*)	None	0-65535
30009	Reserved			
30010	Version	Firmware version	xx.xx X 100	0-65535

Table 5: Status Flags (Register 30001)

Bit	Read Registers Response Packet
00	1 = Zone 1: Leak is Detected / Contact Closure Alarm
01	1 = Zone 2: Leak is Detected / Contact Closure Alarm
02	1 = Zone 3: Leak is Detected / Contact Closure Alarm
03	1 = Zone 4: Leak is Detected / Contact Closure Alarm
04	1 = Zone 5: Leak is Detected / Contact Closure Alarm
05	1 = Zone 6: Leak is Detected / Contact Closure Alarm
06	0
07	0
08	1 = Zone 1 Cable Break Alarm
09	1 = Zone 2 Cable Break Alarm
10	1 = Zone 3 Cable Break Alarm
11	1 = Zone 4 Cable Break Alarm
12	1 = Zone 5 Cable Break Alarm
13	1 = Zone 6 Cable Break Alarm
14	0
15	0

Table 6: Status Flags (Register 30008)

Bit	Read Registers Response Packet
00	0 = Zone 1 Configured for Leak Detection / 1 = Zone 1 Configured for Dry Contact
01	0 = Zone 2 Configured for Leak Detection / 1 = Zone 2 Configured for Dry Contact
02	0 = Zone 3 Configured for Leak Detection / 1 = Zone 3 Configured for Dry Contact
03	0 = Zone 4 Configured for Leak Detection / 1 = Zone 4 Configured for Dry Contact
04	0 = Zone 5 Configured for Leak Detection / 1 = Zone 5 Configured for Dry Contact
05	0 = Zone 6 Configured for Leak Detection / 1 = Zone 6 Configured for Dry Contact
06-15	0

A-2.3 Present Single Register

To set a LDRA6 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 7: Present Single Register Packet Structure

Preset Registers Request Packet	Preset Registers 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 bytes)
Data (2 bytes)	Data (2 bytes)
Crc Checksum (2 bytes)	Crc Checksum (2 bytes)

A-2.4 Present Multiple Registers

To set multiple LDRA6 parameter values, the master must send a Preset Multiple Registers request packet. The Preset Multiple Register request packet specifies a starting register, the number of registers, a byte count and the data to write to the registers. The register is numbered from zero (40001 = zero, 40002 = one, etc).

Table 8: Present 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)	

Table 9: Modbus Slave Address

Address	SW2 (1..8)	Address	SW2 (1..8)	Address	SW2 (1..8)	Address	SW2 (1..8)
0	00000000	16	00010000	32	00100000	48	00110000
1	00000001	17	00010001	33	00100001	49	00110001
2	00000010	18	00010010	34	00100010	50	00110010
3	00000011	19	00010011	35	00100011	51	00110011
4	00000100	20	00010100	36	00100100	52	00110100
5	00000101	21	00010101	37	00100101	53	00110101
6	00000110	22	00010110	38	00100110	54	00110110
7	00000111	23	00010111	39	00100111	55	00110111
8	00001000	24	00011000	40	00101000	56	00111000
9	00001001	25	00011001	41	00101001	57	00111001
10	00001010	26	00011010	42	00101010	58	00111010
11	00001011	27	00011011	43	00101011	59	00111011
12	00001100	28	00011100	44	00101100	60	00111100
13	00001101	29	00011101	45	00101101	61	00111101
14	00001110	30	00011110	46	00101110	62	00111110
15	00001111	31	00011111	47	00101111	63	00111111

- For address's 64-127, set SW1-7 to on, then subtract 64 from the address and use the table.
- For address's 128-191, set SW1-7 to off, #8 to on, then subtract 128 from the address and use the table.
- For address's 192-254, set SW1-7 & 8 to on, then subtract 192 from the address and use the table.

A-3 RTU FRAMING

The example below shows a typical Query/Response from a LDRA6 module.

Table 10: Query Sample

Slave Address	Functions Code	Starting Register "Msb"	Starting Register "Lsb"	Number of Registers "Msb"	Number of Registers "Lsb"	CRC 16 "Lsb"	CRC 16 "Msb"
02	03	00	32	00	03	E5	FA

Table 11: Response Sample

Slave Address	Function Code	Count Bytes of Data	Register Data Msb Lsb	Register Data Msb Lsb	Register Data Msb Lsb	CRC 16 "Lsb"	CRC 16"Msb"
02	03	06	01 58	00 FA	00 54	1B	0D

- Slave address 2 responds to Function Code 3 with 6 bytes of hexadecimal data and ends with CRC16 checksum.

Register Values:

40051 = 0158 (hex) = 344 (decimal)
40052 = 00FA (hex) = 250 (decimal)
40053 = 0054 (hex) = 84 (decimal)

A-4 MODBUS MIRRORING

A-4.1 To use the EIA-485 Modbus mirroring feature set the address on the master LDRA6 to address 255 and then set the address on the slave LDRA6 to 1. The Master unit will then repeat (mirror) any zone alarms that come into the Slave Unit. When using this feature none of the local Alarm/Zone inputs will work on the Master unit, The Master unit is only a repeater for the single slave unit being used.

APPENDIX B: TROUBLESHOOTING

Trouble	Action
No Power *Power On LED is Not On*	**Check Power Supply** Check for supply power at TB1 pins 1 and 2 on the bottom right hand corner of PCB. 1) If power is not present at TB1 pins 1 and 2, check DC input voltage to wall adapter, if used. 2) If power is not present at TB1 pins 1 and 2, check DC voltage at DC supply source distribution panel. 3) If voltage (power) is present at TB1, please contact RLE Technologies.
Cable Fault on Zone(s)	**Check for Proper Wiring to Zone Terminal Block** Wiring order should be as follows from left to right for each leak detection zone: *White, Black, Green and Red.* 1) If wiring order is correct, disconnect the End-of-Line terminator (EOL) from the end of the orange SC cable. Then connect the EOL terminator to the end of the leader cable (non-sensing). Hold down Quiet/Test/Reset for two seconds to reset control head. 2) If the cable fault condition goes away, there is a faulty or damaged section of orange SC cable. 3) If the fault condition does not clear, remove the respective zone terminal block and remove the input wires from the leader cable. Install a jumper wire between pins 1 and 2, and another jumper wire between pins 3 and 4. 4) If condition still exists, please contact RLE Technologies for extra support. If the condition clears, the leader cable or EOL terminator is faulty (open wire(s)).
Leak Detected on Zone(s)	**Be sure there is No Water Present on or around the Zone in Alarm** 1) If water is present, dry affected area and reset the controller. If the condition does not clear follow the step below. 2) Remove the End-of-Line terminator (EOL) from the end of the orange SC cable and install it onto the end of the leader cable. If the condition clears, there is a water leak or damage to the sense cable. Start moving the EOL terminator to the end of each cable section until the water-detected fault reoccurs. If the condition is still present once the EOL terminator has been placed on the end of the leader cable, follow the step below. 3) Disconnect the proper terminal block from the zone in alarm. Place a jumper wire between pins 1 and 2, and place a jumper wire between pins 3 and 4. Plug the terminal block back into the proper socket and push reset on the control head. If the condition is corrected, there is a problem with the leader cable. If the water leak condition is still present, contact RLE Technologies for support.

APPENDIX C: TECHNICAL SPECIFICATIONS

Power	24VAC Isolated @ 600mA max., 50/60Hz 24VDC@ 600mA max.; requires power supply: WA-DC-24-ST (not included)
Inputs	
Water Leak Detection Cable	Compatible with SeaHawk SC Cable or SeaHawk spot detectors (not included)
Cable Input	Each input requires SeaHawk LC-KIT: 15ft (4.57m) leader cable and EOL (LC-KIT not included)
Maximum Length	1000ft (305m) per zone
Detection Response Time	20-3600sec, software adjustable in 10sec increments; ±2sec
Outputs	
Relays	1 Form C Summary Alarm Relay, 1 Form C Alarm 1 Relay, 1 Form C Alarm 2 Relay. 1 Form C Alarm 3 Relay, 1 Form C Alarm 4 Relay, 1 Form C Alarm 5 Relay, 1 Form C Alarm 6 Relay; 1A @ 24VDC, 0.5A resistive @ 120VAC; Configurable for supervised or non-supervised, latched or non-latched
Communications Ports	
RS232	9600 baud; Parity none; 8 data bits, 1 stop bit
RS485	1200, 2400, 9600 or 19,200 baud; Parity none, odd, even (programmable); 8 data bits, 1 stop bit
Protocols	
Terminal Emulation (RS232)	VT100 compatible
Modbus (RS485) - Optional	Slave; RTU Mode; Supports function codes 03, 04, 06 and 16 (Modbus optional)
Alarm Notification	
Audible Alarm	85DBA @ 2ft (0.6m); re-sound (disabled, 8, 16, or 24 hours)
Front Panel Interface	
LED Indicators	Power: 1 green (on/off); Status (1 per zone): 6 tri-color (Power On: green; Alarm: red; Cable Fault: yellow)
Push Buttons	Quiet/Test/Reset: 1
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 158°F (-20° to 70°C)
Dimensions	10.5”W x 8.0”H x 2.0”D (267mmW x 203mmH x 51mmD)
Weight	6 lbs. (2.72kg)
Mounting	Vertical wall mount
Certifications	CE; ETL listed: conforms to UL STD 61010-1, EN STD 61010-1; certified to CSA C22.2 STD NO. 61010-1; RoHS compliant

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