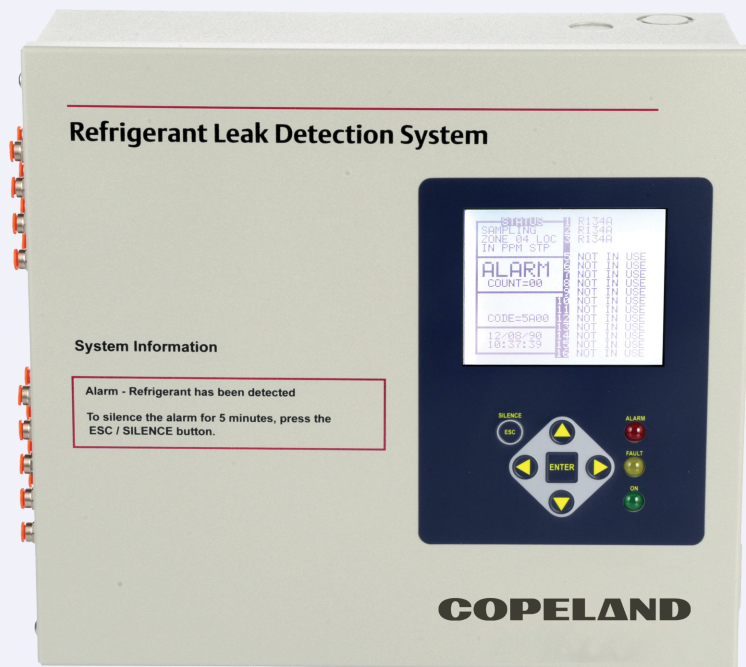


Refrigerant Leak Detection System (RLDS)

Installation and Operation User Manual



Copeland
1065 Big Shanty Road NW, Suite 100
Kennesaw, GA 30144 USA
770-425-2724 • 1-800-829-2724
www.copeland.com
Email: ColdChain.TechnicalServices@copeland.com

CE/FCC Compliance Notice Information

Class A compliance for RLDS under CE Requirements. Meets Part 15 Subpart B requirements of the FCC Rules. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures. ETL, report no 3151009LAX-001 to:

ANSI/UL 61010-1

CAN/CSA 22.2 No 61010-1 & CE Mark

READ ALL INSTRUCTIONS CAREFULLY

If the equipment is not used in the manner specified by the manufacturer, the protection provided by the equipment may be impaired.

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1 Introduction

1.1 How to Use This Manual

Thank you for investing in Copeland's Multi-Zone Gas Monitor. To assure operator safety and the proper use of the monitor, please read this manual. It provides important information on the installation, operation, maintenance, and servicing of the monitor and display module. This manual provides important information on how to install, operate, and service the RLDS.

Please read this manual carefully before use.

If you have a working knowledge of refrigerant monitors, you will find this manual useful as a reference tool. If you are new to the use of refrigerant monitors, this document is educational in the principles of gas detection and the proper operation of this device.

1.2 Notes

Copeland reserves the right to change the operation or specifications of this instrument at any time without notice.

If any errors or ambiguities are discovered in this manual, promptly inform Copeland.

No part of this manual may be reproduced or recreated, in any form or by any means, without the express prior permission of Copeland.

1.3 Safety Precautions

1.3.1 AC Power Supply

Ensure the source voltage matches the voltage of the product before energizing the equipment.

The RLDS uses a universal power supply that is capable of accepting inputs of 100 to 240 VAC, 50/60 Hz. The monitor's power consumption is 20 Watts.

It is highly recommended that the RLDS be placed on a separate circuit (with UPS or surge protection) and be connected directly to the AC power source.

A switch or circuit breaker rated 1.0 A, 250 VAC, with a minimum terminal spacing of 3.0 mm must be attached to the monitor's AC power leads. This switch must also be located in close proximity to the monitor, and be within easy reach of the operator. This switch should also be clearly marked as the monitor's type of equipment.

- A switch or circuit-breaker must be included in the building installation
- The switch must be in close proximity to the equipment and within easy reach of the operator
- The switch must be clearly marked as the disconnecting device for the equipment

1.3.2 Protective Grounding

Under no circumstances should the RLDS be operated without connection to a protective ground. Doing so poses a potential shock hazard and is also a violation of electrical safety standards applicable to this type of equipment.

1.3.3 Explosive Atmosphere

Do not operate this equipment in the presence of flammable liquids, vapors, or aerosols. Operation of any electrical instrument in such an environment constitutes a safety hazard.

1.3.4 Proper Exhaust Venting

It is imperative that the exhaust port on this instrument be properly vented as described in this manual. Failure to do so constitutes a safety hazard.

1.3.5 Working Inside Instrument

Extreme care should be exercised when accessing the interior of the monitor. Only qualified electrical maintenance personnel should perform connections and adjustments. Always de-energize the power supply before opening the monitor's enclosure.

1.3.6 Misuse and Modifications to the Instrument

The protection provided by the monitor may be impaired if the monitor is used in a manner not specified by Copeland. Modifications to this monitor, not expressly approved, will void the warranty.

1.3.7 In Case of Malfunction

Do not continue to use this equipment if there are any symptoms of malfunction or failure. In the case of such occurrence, de-energize the power supply and contact a qualified repair technician or the nearest Service Center. ONLY the provided knockouts are to be used for electrical and communication wiring. Drilling into the box will void the warranty.

1.3.8 RLDS Fusing

Table 1-1 - Fusing Requirements

F1, F2	1AMP, 250VAC FAST ACTING (Type "F")
--------	---

1.3.9 Installation Category

Installation Category II, Pollution Degree II, as defined by UL.

1.3.10 Altitude Limit

RLDS	6,562 ft (2,000 m)
------	--------------------


1.3.11 Cleaning

If, during period maintenance inspection it becomes necessary to clean the outside of the case, use a **DRY CLOTH**. To avoid shock hazard and/or equipment damage, **DO NOT USE SOAP AND WATER**.


1.4 Warning and Caution Conventions

When used in this manual or as labeled on the gas monitor, the following hazard symbols and/or associated words are defined as follows.

1.4.1 Warning

 WARNING	This symbol and/or the use of the word WARNING indicates a potential hazard from electrical shock associated with the use of this equipment. It calls attention to a procedure, practice, condition, or the like, which if not correctly performed or adhered to, could result in death or serious injury.
--	--

1.4.2 Caution

 CAUTION	This symbol and/or use of the word CAUTION in this manual denotes a potential hazard associated with the use of this equipment. It calls attention to a procedure, practice, condition, or the like, which if not correctly performed or adhered to, could result in minor or moderate bodily injury, and damage to the equipment.
--	--

1.4.3 Important

IMPORTANT	The use of the word IMPORTANT in this manual calls attention to a procedure, practice, condition, or the like, which if not correctly performed or adhered to, could result in incorrect performance of or damage to the equipment and may void the warranty.
------------------	---

2 Functional Overview

2.1 General Description

Gas monitors are specified to support compliance to federal, state and local safety codes governing emissions. Avoiding significant refrigerant loss reduces equipment replacement costs, maintains equipment efficiency, promotes safety, and protects the environment.

The RLDS provides for the continuous monitoring of refrigerant gas levels in up to 16 separate test *zones* or *channels*. The instrument is easily programmed to monitor a variety of gases (dependent on the particular model) and independent leak (small), spill (medium), and evacuation (large) levels may be designated for each zone. The instrument also retains a log of previous readings that can be easily accessed for analysis.

An audible alarm and front panel indicators are provided to signal alarm and fault conditions, and relay contacts are provided that can be used to trigger external alarm devices in the event of a system fault, or if a leak (small), spill (medium), or evacuation (large) level of gas is detected. The system also may be fitted with an optional two-channel 4-20mA current loop board for connection to remote monitoring equipment.

The RLDS requires only minor periodic maintenance such as the occasional replacement of filters. The monitor incorporates active diagnostics that continuously check the system for proper operation. A front panel indicator is provided to alert an operator of system malfunctions, and fault codes are generated that enable the user to identify the cause of the fault. All 800# models of the RLDS come with the number of line-end filters (plus one extra) to match the number of zones for each model.

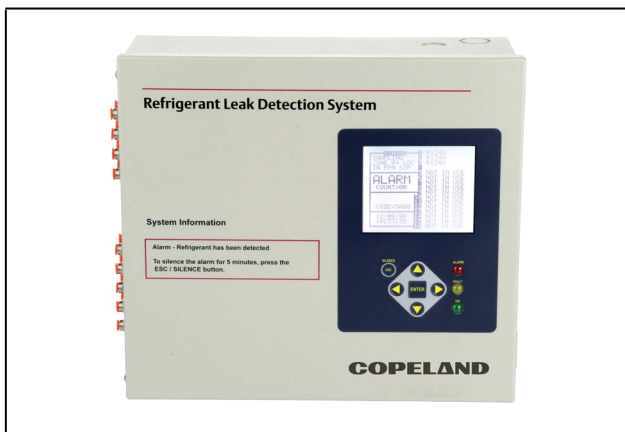


Figure 2-1 - RLDS Front View

2.2 Communication Options

The RLDS features full two-way communications via an RS485 interface. MODBUS RTU is the communication protocol standard and can be connected directly to an E2 or Supervisor controller.

The instrument can be connected directly to a Building Management System or it may be operated as a stand-alone system. An RS-232C port is also provided for connection to a PC. This enables the monitor to be set up from a personal computer.

Please refer to **Section 4, Connecting Communication Devices** for a more complete discussion of communication protocols.

2.3 Understanding Monitoring Levels

Effective use of this instrument requires an understanding of what constitutes reasonable alarm setpoints for the type of gases being monitored.

All AC&R systems leak some refrigerant. Refrigerant manufacturers define allowable exposure levels and threshold limit values in units of parts per million (PPM). In a good "tight" installation these background levels will be acceptably low and often do not require corrective action. You can reduce nuisance alarms and needless service calls if the alarm levels are set at practical limits.

Recommended monitoring levels based on compliance to ANSI/BSR ASHRAE 15-2007 and ASHRAE Safety Code 34-2007 have been developed and are listed in **Appendix A: Recommended Refrigerant Gas Alarm Settings on page 68**.

Setting the unit at these recommended alarm levels will satisfy the needs of most users. However, the PPM levels generated by system leaks into the environment are greatly influenced by the volume of air in the sampling area, air circulation, size of the leak, distance to the monitoring point, and a host of other variables. In some cases the set points may need to be adjusted either up or down to achieve effective monitoring. Please contact your representative (770-425-2724) for assistance in obtaining these levels.

2.4 Response to the Presence of Multiple Refrigerants

The RLDS is a refrigerant level monitor, not a gas analyzer. You must program the monitor to test for a specific refrigerant in each zone, and it will only return accurate concentration readings for that particular refrigerant. If a leak occurs of another refrigerant gas type, the monitor may return incorrect readings.

Most applications only require detection of a single refrigerant and the problems that are associated with monitoring multiple gases are rarely an issue. If there is a possibility of multiple refrigerants leaking in the same sampling zone, you should carefully consider which refrigerant compound you program the unit to monitor.

2.5 Suggested Location of Sampling Points

At the point of origin of a refrigerant leak, the gas is nearly pure (highly concentrated). As the refrigerant is dispersed into the air, the gas molecules diffuse, causing a dilution of the original concentration. The RLDS measures the refrigerant concentration at the sample collection point, so if the termination of the collection line is not at the exact point of the refrigerant leak, the unit will read a diluted mixture of the refrigerant gas and air.

Gases of interest may be heavier or lighter than air and may collect above or below the point of the leak. Therefore sampling point placement is critical and must take into account properties of the target gas and air flow within the space.

Table 2-1 - Sampling Point Locations

Leak Detector Gas Type	Sampling Point Location
Multi-Zone Halogen	Mount sampling points 6-18 inches above floor
Multi-Zone CO2 (Carbon Dioxide)	Mount sampling points 4-6 feet above floor (breathing zone)

DO NOT block any of the zones. Unused zones may be disabled by setting the distance parameter to zero feet in the zone setup screen.

The RLDS should be centrally located in the mechanical room and be readily accessible for easy visual monitoring and servicing. The combined length of sample tubing, plus exhaust tubing, should not exceed 1200 feet (366 meters) for any zone. The fresh air purge line should draw from an area that does not contain any gas other than fresh air. The exhaust line should run to an outside location if possible.

NOTE

The combined length of the purge line and the exhaust line cannot exceed 500 feet (152.4 meters).

Ideally, two to three pick up points spaced around each chiller will provide sufficient coverage. It may be necessary to perform a "smoke" test of the mechanical room to determine the best locations. The smoke test would provide the pattern of air currents present in the mechanical room.

The RLDS should be kept dry. When used in a wet or humid area, it is highly recommended to use the optional water stop accessory to avoid internal damage.

NOTE

For information about using the RLDS in wet locations, see **Section 3.2.6, Considerations**.

2.6 RLDS Hardware Specifications

Table 1 - RLDS Specifications

Hardware Specifications	
Product Type	Multiple refrigerant gases and multiple area monitoring system for low level continuous monitoring of CFC, HCFC, and HFC refrigerant gases used in most commercial refrigeration systems. System design supports compliance to the refrigerant monitoring requirements of ANS/BSR ASHRE 15-2007 and ASHRAE Safety Code 34-2007
Coverage	4-point standard, expandable to 16 points in 4-point increments
Detector Type	Infrared Non-Dispersive
Gas Library:	<p>CFC: R-11, R-12, R-113, R-114, R-502, HFP</p> <p>HFC: R125, R-134a, R236FA, R245Fa, R32, R-404a (HP62), R-407a, R-407c (AC9000), R-407F, R-448A, R-410a (AZ20), R422a, R422d, R427a, R-507 (AZ50), R-508b (SUVA95)</p> <p>HCFC: R-123, R-124, R21, R-22, R227, R-23, R-401a (MP39), R-402a (HP80), R-402b (HP81), R-408a, R-409a, R-500, R-503</p> <p>Halon: H1211, H1301, H2402</p> <p>Other: FA188, FC72, H1234YF, H1234ZE, N1230, N7100, N7200, N7300, N7600, R424A, R426A, R438A, CUSTOM</p>
Sensitivity	All gases 1 PPM
Measuring Range	All gases 0 to 10,000 PPM
Accuracy*	Most gases $\pm 1\text{PPM} \pm 10\%$ of reading from 0-1000 PPM (R11, R22, and R113 $\pm 10\text{ PPM} \pm 15\%$ of reading 0-1000 PPM) *At reference environmental conditions (77°F/25°C, 45% RH non-condensing, 1 ATM)
Front Panel	3 Indicator lights: Green = Monitor is powered on. LED glows during normal operation; flashes when unit is in warm-up mode Red = Alarm. LED flashes when any point has exceeded the alarm setting Yellow = Fault. LED flashes when there is a system fault
Size/Weight	12.23"H x 13.7"W x 4.96"D (31.06 cm x 34.80 cm x 12.60 cm) / 15 lbs.
Temperature Drift	$\pm 0.3\%$ of reading per degrees C
Sampling Mode	Automatic or manual (hold)
Re-Zero	Auto or on zone change
Response Time	5 to 315 seconds - depending on air line length and number of zones
System Noise	Less than 40dB(A) @ 10 feet (3 meters)
Monitoring Distance	1200 ft. (365 meters) maximum for combined length of sample + exhaust tubing (each zone)
Conditioned Signal	Dual optional 4-20mAdc isolated outputs. Channel 1 = zone area, Channel 2 = PPM
Alarms	Four SPDT alarm contacts rated 2A at 250 VAC (inductive) 5 A at 250 VAC (resistive). Three are assigned to PPM level alarms, one assigned to system faults.
Communications	Full two-way communication with Building Management System via RS-485 serial interface. RS-232C communication port standard.
Power Safety Mode	Fully automatic system reset. All programmed parameters retained
Operating Temp	32°F to 122°F (0°C to 50°C)

Table 1 - RLDS Specifications

Hardware Specifications	
Ambient Humidity	5% to 90% RH (non-condensing)
AC Power	100 to 240 VAC, 50/60 Hz, 20 W
Certification	UL 61010-1, CAN/CSA 22.2 No. 61010 & CE Mark
Warranty	2 years from date of shipment
Altitude Limit	6,562 ft (2,000 m)

Table 2 - RLDS-CO2 Specifications

RLDS-CO2 Hardware Specifications	
Product Type	The RLDS-CO2 provides multiple area monitoring for low level continuous monitoring of carbon dioxide gases used in most commercial systems. System design supports compliance to the gas monitoring requirements of ANS/BSR ASHRE 15-1994.
Gas Library:	Carbon Dioxide (CO2)/R-744
Sensitivity	10 PPM
Measuring Range	300-8,000 PPM
Accuracy*	Most gases ± 5 PPM $\pm 5\%$ of reading from 300-1000 PPM, $\pm 10\%$ of reading from 1001-3000 PPM *At reference environmental conditions (77°F/25°C, 45% RH non-condensing, 1 ATM)

3 RLDS Installation

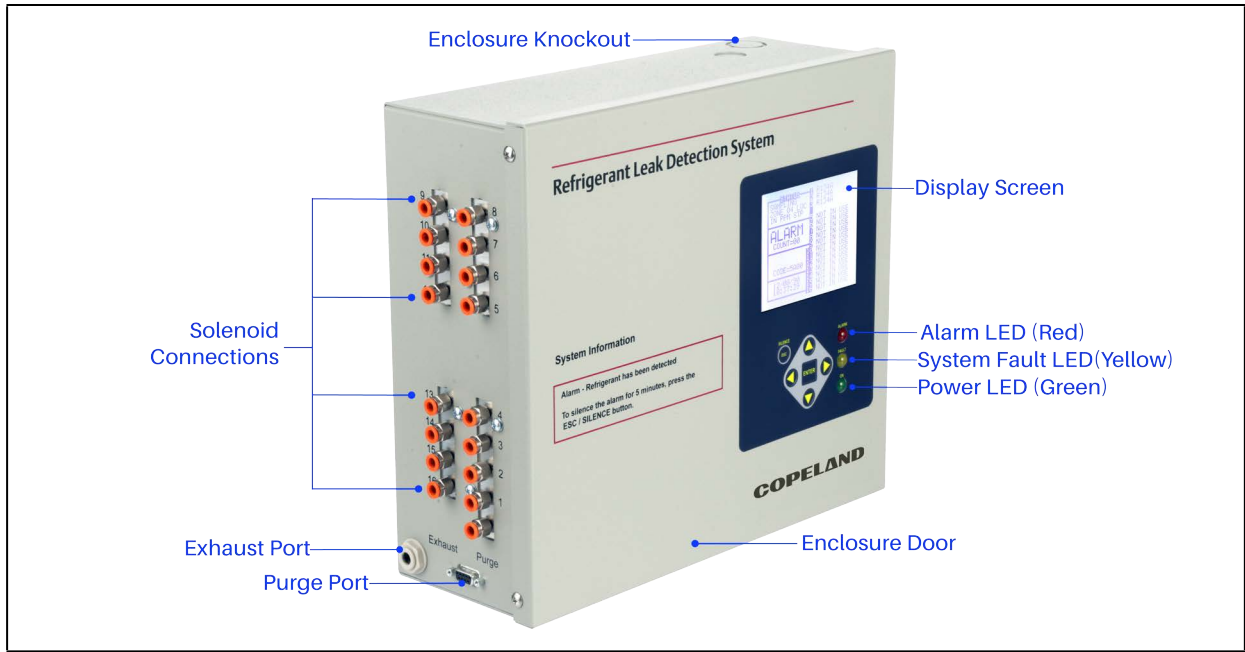


Figure 3-1 - RLDS Diagram

Standard accessories needed for a four (4)-point System:

Table 3-1 - RLDS Accessories and Part Numbers

Accessory	Part Number
Five (5) Line-End Filters (Assembly)	275-0300
Charcoal Filter	275-0275
RLDS Instruction Manual	026-1309

3.1 RLDS - Installation Considerations

3.1.1 Warnings and Cautions

WARNING Explosion hazard! Do not mount or operate this equipment in an area that may contain or in the presence of flammable liquids, vapors, or aerosols. Operation of any electrical equipment in such an environment constitutes a safety hazard.

WARNING Shock hazard! Always disconnect the AC power before working inside the equipment.

CAUTION Drilling holes in the RLDS enclosure may damage the unit and will void the warranty. Please use the knockouts provided for electrical connections.

CAUTION The RLDS contains sensitive electronic components that can be easily damaged. Do not touch nor disturb any of these components.

3.1.2 Inspection

The RLDS has been thoroughly inspected and tested prior to shipment from the factory. Nevertheless, it is recommended that the monitor be re-checked prior to installation. Inspect the outside of the enclosure to make sure there are no obvious signs of shipping damage. Open the enclosure and inspect the interior of the unit for loose components that may have become dislodged during shipment. If damage is discovered, please contact Technical Support for assistance (770-425-2724).

3.1.3 Monitor Location

The RLDS should be centrally located in the facility and should be easily accessible for visual monitoring and servicing. Combined length of the intake sample line and the exhaust line cannot exceed 1200 feet (366 m) in length, but it is important to remember that sampling cycle time is proportional to the total number and length of individual sample lines.

Dirt, grease, and oils can adversely affect the operation of the RLDS. The monitor should be installed out of direct sunlight in a clean, dry area that is not subject to temperature or humidity extremes. Installation of the monitor in a mechanical room is acceptable provided reasonable environmental conditions exist. If there is a question, consider installing the unit outside of the mechanical room in a cleaner area of the facility.

NOTE

The mounting location of the monitor should allow it to be easily accessible for visual monitoring and servicing.

3.1.4 Mounting Instructions

NOTE

The RLDS should be installed plumb and level and securely fastened to a rigid mounting surface.

The enclosure utilizes keyhole mounting brackets designed for 1/4" (6.35 mm) fasteners. Locate the four screws as shown in the diagram below and allow the screw heads to protrude approximately 1/4" (6.35 mm).

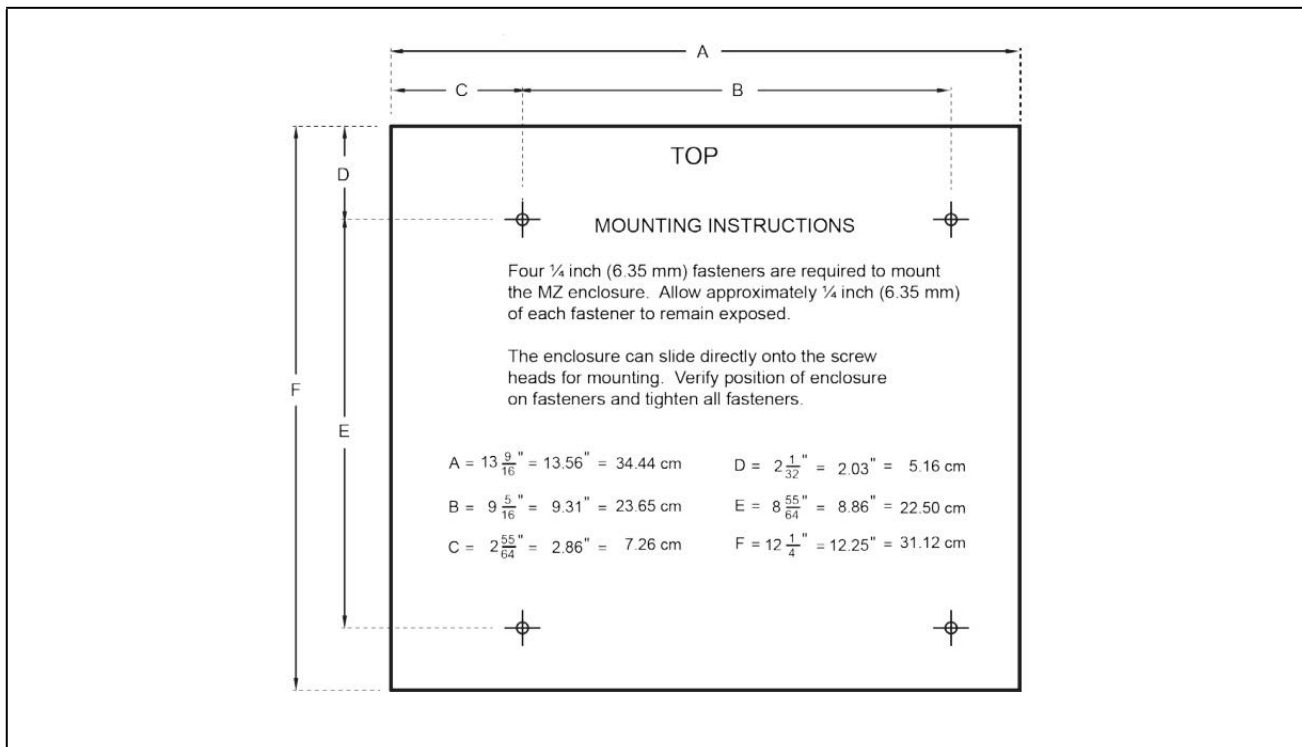


Figure 3-2 - RLDS Mounting Dimensions

Hold the monitor flat against the mounting surface and allow it to slide down, engaging the screw heads in the keyhole slots of the mounting brackets. Adjust the screws as necessary to hold the monitor securely against the mounting surface.

3.2 RLDS - Connecting Gas Sample Lines

3.2.1 Overview

Individual sample lines are run from the RLDS to each area of the facility to be monitored. Additionally, a purge line is installed to provide clean air for resetting the infrared zero baseline. An exhaust line is installed to vent residual gas away from the monitor. All air line connections, located on the left side of the enclosure, are indicated in **Figure 3-3**.

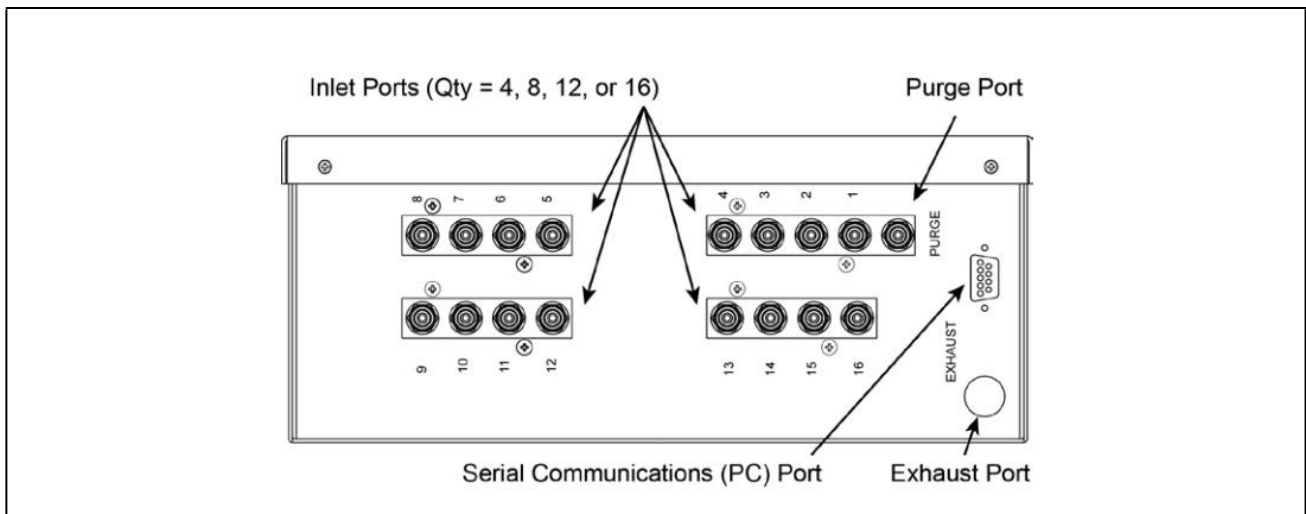


Figure 3-3 - RLDS Side View (Tubing Connections)

3.2.2 Tubing Considerations

Use 1/4" (6.35 mm) outside diameter (0.04" wall) (1.02 mm wall) flex tubing for all air lines or equivalent. The tubing should be clean and free of residual moisture or other contaminants. The tubing should be cut cleanly with a sharp knife and care should be taken not to distort the tubing end.

To connect the air lines to the monitor simply push the tubing firmly onto the connector. To remove a line, press the plastic ring on the connector with one hand while withdrawing the tube with your other hand.

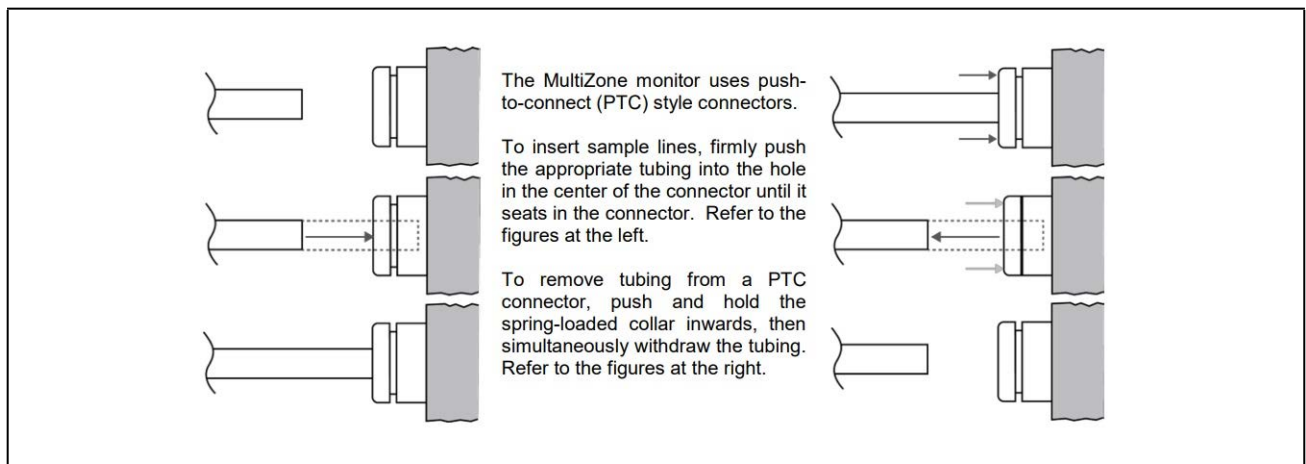


Figure 3-4 - Using PTC Connectors: Connecting (Left) and Disconnecting (Right)

All tubing bends should have a radius of no less than 5" (12.7 cm) to ensure proper airflow. If kinks or obstructions occur in any of the air lines, the instrument may not function properly.

3.2.3 Connecting Purge Line

A purge line is an intake line that is required to draw fresh air into the instrument and should not exceed 300 feet (91.44 m) in length. It is advisable to terminate the purge line outdoors, provided the input is not exposed to rain, snow, ice, exhaust fumes, or other airborne contaminants. If an outdoor installation is impractical, the line should be run to an area inside the facility that you are certain is not contaminated with ambient gas. If this is not possible, an optional charcoal filter assembly (P/N) can be used with the RLDS to filter refrigerant from the purge line. It may be mounted adjacent to the monitor. A line-end filter (P/N) should be attached to the end of the purge line when the charcoal filter is not used. Note that the charcoal filter option must NOT be used in ammonia or CO₂ applications.

IMPORTANT

(CO₂ Only): Because CO₂ is present in ambient air, the purge line MUST BE run outside, away from any known sources of CO₂ gas. An atmospheric CO₂ concentration value can be manually entered by the user in the CAL screen. CO₂ is supported by RLDS-CO₂ units. See **Section 7.9.2, Navigating to the Calibration Screen**.

3.2.4 Connecting Exhaust Line

An exhaust line (¾" OD tubing) (6.35 mm) can be used when it is required to vent gas samples away from the instrument and should not exceed 300 feet (91.44 meters). The exhaust line should terminate in a location that is completely isolated from the purge line termination point and other areas of the facility that will be monitored. Ideally this line should terminate outdoors in a location that is not exposed to the elements. This line does not require a line-end filter. If the exhaust line terminates outside the building, position the tubing so that no water or moisture can enter it.

3.2.5 Connecting Sample Intake Lines

The RLDS is designed to accommodate up to 16 separate sample intake lines. The standard configuration of the unit includes one manifold of four intake connectors and one purge connector. Additional manifolds can be easily installed to increase monitoring capacity. Please contact Technical Assistance (770-425-2724) for more information. Additional manifolds can be easily installed to increase monitoring capacity (field installation kit and four zone line end filter kit) zone line end filter kit.

Sample intake lines can be up to 1,200 feet (366 m) when no exhaust tubing is used. Otherwise, the combined length of the sample line and the exhaust line cannot exceed 1,200 ft (366 m). All line terminations should be positioned to reduce the possibility of mists, aerosols, oil, water, dust, or other contaminants being drawn into the instrument. A line-end filter (P/N 275-0315) should be attached to the end of each sample intake line. General placement guidelines are shown below, but air-flow dynamics should also be considered (e.g., consider the effects of exhaust fans which tend to draw target gas from the space).

Leak Detector Gas Type	Sampling Point Location
Multi-Zone Halogen	Mount sampling points 6-18 inches above floor
Multi-Zone CO ₂ (Carbon Dioxide)	Mount sampling points 4-6 feet above floor (breathing zone)

IMPORTANT: DO NOT block any of the zones. Unused zones may be disabled by setting their length parameter to zero feet in the **Zone Setup** screen (**Section 7.2, The Zone Setup Screen**).

Depending on type of use and location of lines, the end-of-line water stop filter assembly can be used to prohibit moisture from entering the intake lines. Three (3) end-of-line water stop filters are supplied with a standard unit. Place the end of the intake line into the blue receiver of the end of line water stop and tighten sufficiently.

Note that only filter assembly, either the line-end filter or end-of-line water stop, should be used for each line.

Please refer to the earlier section (**Section 2.5, Suggested Location of Sampling Points**) to learn more about where to locate the monitoring points.

CAUTION

The introduction of contaminants through the air intake lines can result in serious and permanent damage to the monitor.

3.2.6 Considerations

For maximum protection, the RLDS may be shut down when a System Fault occurs. This might be desired, for example, when the RLDS is used in wet locations such as meat preparation rooms. When water is pulled into the system, a System Fault will occur, closing the fault relay located at the bottom of the main control board. To turn power off to the RLDS when this occurs, wire the fault relay into a spare 16AI input. Route the power supply to the RLDS through an 8RO output using the normally closed contacts. Program the E2/Einstein to alarm the fault input on a contact closure and turn on the 8RO output when this occurs. This can be done using a Digital Sensor Control application in the E2/Einstein. Refer to the E2 Installation and Operation manual (P/N 026-1614) for details on setting up a Digital Sensor Control application.

3.3 Installing an Optional Splitter Kit

Splitter kits are made available which allow the RLDS unit to take gas sample readings from several sample points while utilizing just a single zone. These kits are designed for use **ONLY** in confined/defined spaces with high potential for leaks, such as food cases, cold rooms, refrigeration rack rooms, etc. 2-way (P/N 275-0304) and 3-way (P/N 275-0305) splitter kits are available as optional accessories. Refer to instructions (supplied with the kit) for detailed installation instruction.

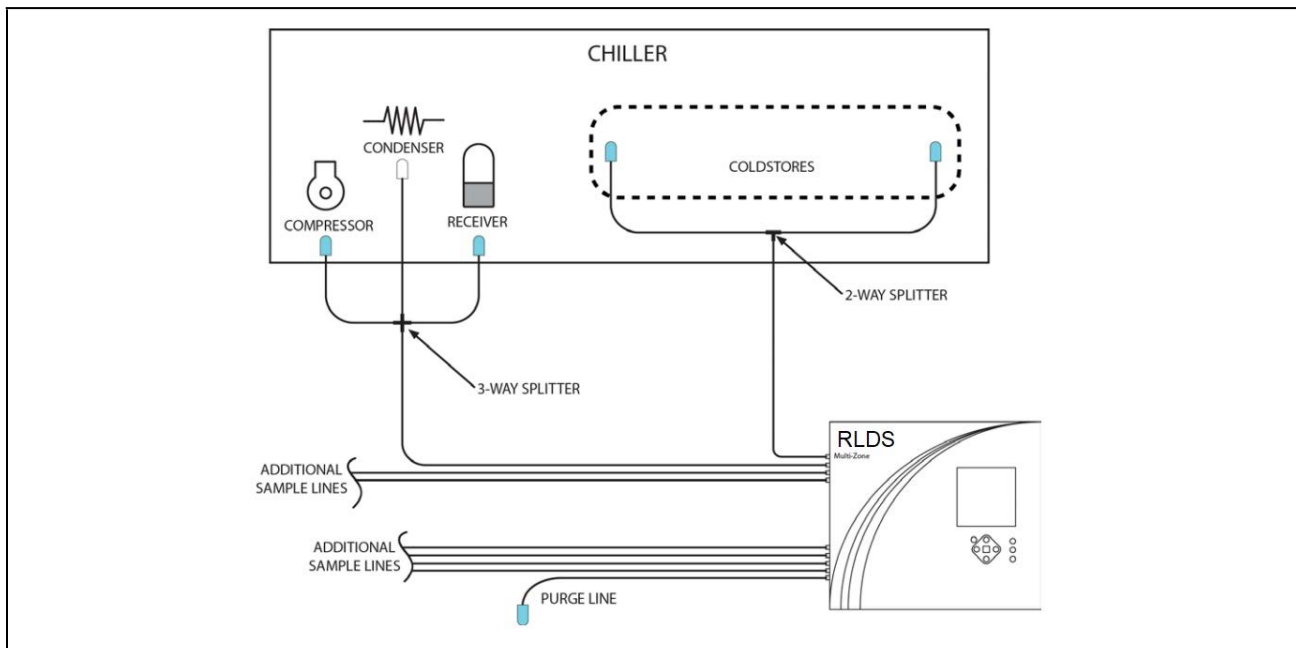


Figure 3-5 - Splitter Kit Installation

3.3.1 Connecting the Water Trap

The water trap is an optional accessory for applications that result in water or condensation frequently entering the intake lines. This is available in a manual style trap (P/N 275-0234) which is manually emptied once it has become filled. Install the water trap close to the unit for the most effective results. The intake line may be cut where the user finds appropriate (preferably close to monitor). Each side of the intake line should be inserted into the receivers on either side of the water trap. Secure tightly. A replacement filter (P/N 275-0235) for the water trap is available and is replaced by unscrewing the clear plastic cup of the water trap, pulling the filter directly out (do not unscrew), and inserting the new filter into place. Replace the cup of the water trap. If desired, an optional mounting bracket (275-0236) may be used to secure the water trap in place.

NOTE

The termination filter (P/N) or end-of-line water stop filter (P/N) should be used, regardless of the presence of a water trap.

NOTE

Extreme or humid temperatures may cause water to condense in the tubes. A water trap is highly recommended for use in these scenarios.

3.4 RLDS Interior Components

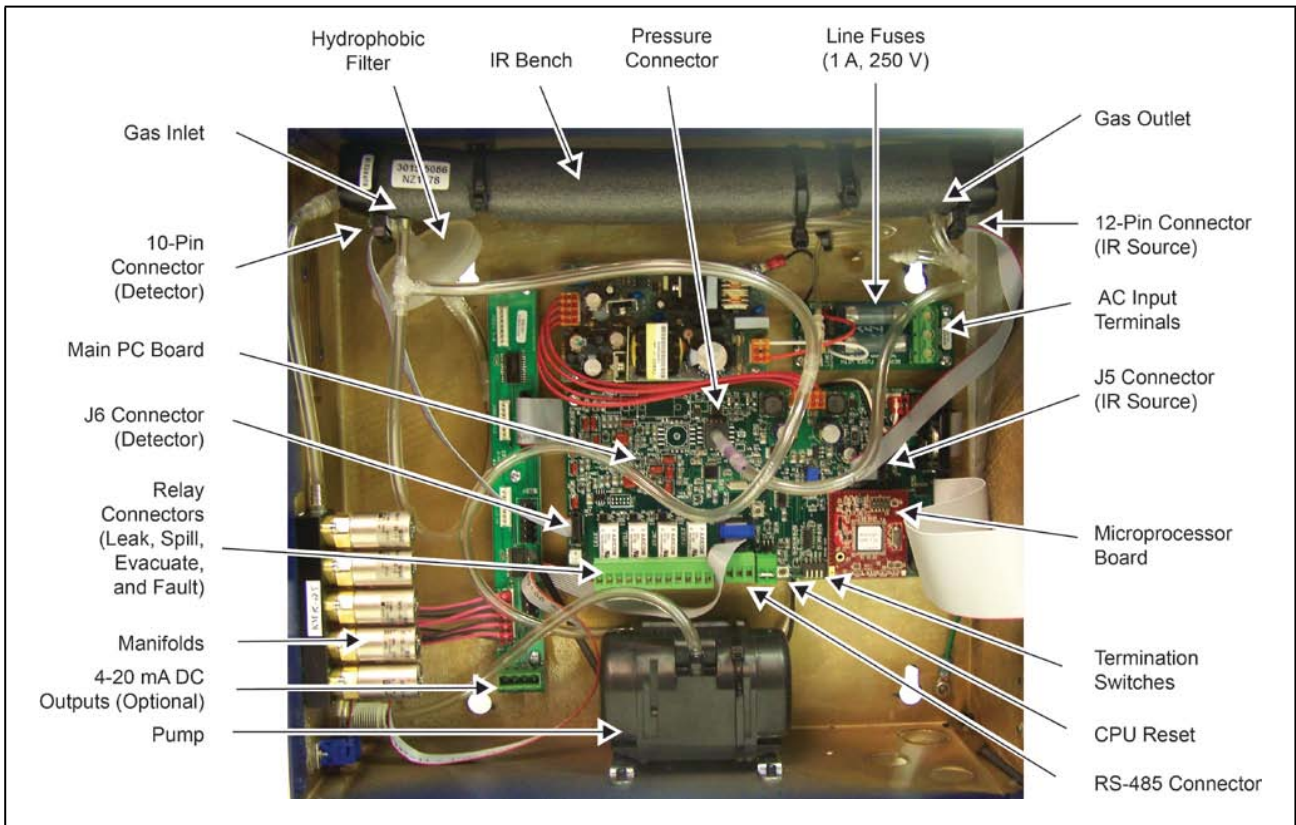


Figure 3-6 - Diagram of RLDS Interior

NOTE

The plastic cable ties surrounding the air pump are to ensure safe handling during shipment. Remove before operating the unit. Reinstall a plastic cable around the air pump if the unit is shipped back to Copeland for service or repair. This prevents damage during shipment.

3.5 RLDS Electrical Wiring

The RLDS uses a universal power supply that is capable of accepting inputs of 100 to 240 VAC, 50/60 Hz. The monitor's power consumption is 20 Watts. It is highly recommended that the monitor be connected directly to the AC power source, preferably on its own circuit. The AC power connection should be completed with UL approved 3-conductor wire (minimum 16 AWG), rated 300 VAC at 221°F (105°C).

Locate a convenient service knockout and install electrical conduit in the typical manner.

Locate the AC Input Terminals and Ground Stud on the inside of the monitor (**Figure 3-6**). Secure the incoming AC power neutral (white/blue) and live (black/brown) wires to the LINE 1 and LINE 2 terminals.

Using the supplied crimp-on ring terminals, washers, and nuts, connect the incoming AC power ground wire (green) to the monitor's AC input ground stud, and then install a separate wire between the ground stud and the GND terminal.

NOTE

For more information on power specifications, contact your Copeland representative for more information..

3.5.1 Warnings and Cautions

⚡ WARNING

Electrical installation should be performed by a certified electrician and must comply with all applicable local, state, and federal electrical safety codes.

⚡ WARNING

The AC power ground wire must first be connected to the monitor's ground stud. Under no circumstances should this monitor be operated without a protective ground. Doing so poses a potential shock hazard, and is also a violation of electrical safety standards applicable to this type of equipment.

⚡ WARNING

Drilling holes in the RLDS enclosure may damage the unit and will void the warranty. Only use the knockouts provided for electrical connections.

- A switch or circuit breaker rated 1.0 A, 250 VAC must be attached to the unit's AC power leads.
- This switch must also be located in close proximity to the monitor, and be within easy reach of the operator.
- This switch should also be clearly marked as the unit's main AC disconnect device. The circuit breaker or switch must disconnect all current-carrying conductors (i.e., Live and Neutral).

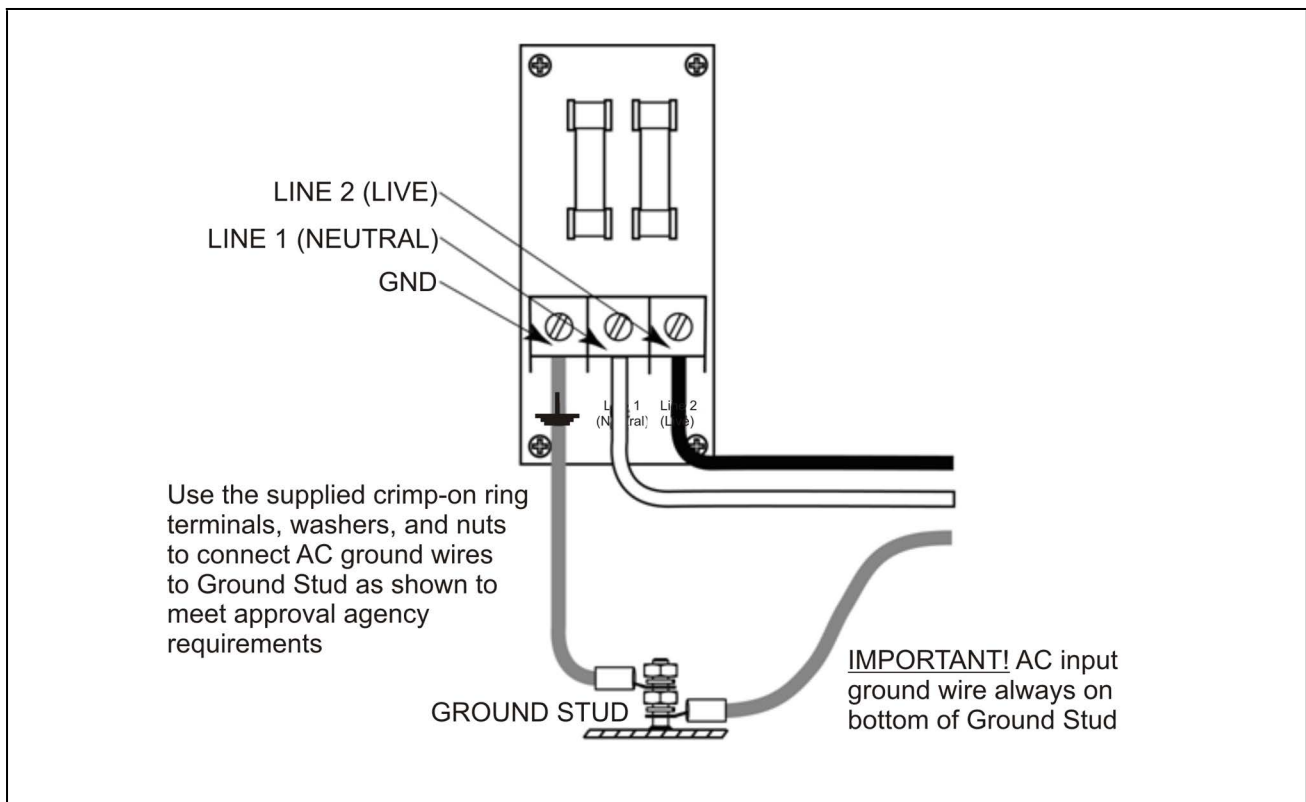


Figure 3-7 - RLDS AC Input Power and Ground Connections

4 Connecting Communication Devices

4.1 E2 MODBUS Direct Support for RLDS

4.1.1 Network Connection to E2

Connecting an RLDS to an E2 unit requires the E2 version 3.01 and above. Contact Copeland for upgrade information if the controller is a version prior to 3.01.

4.1.1.1 COM Port Associations - E2 Versions 3.xx and Below

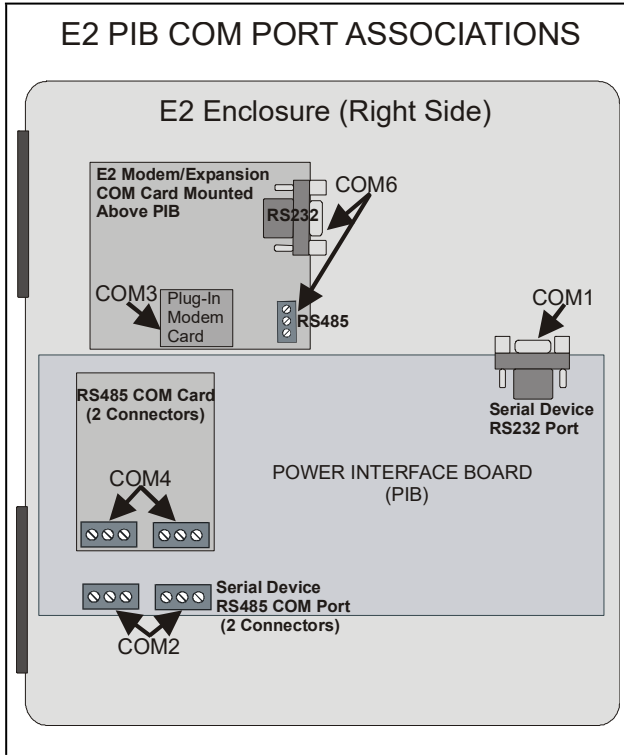


Figure 4-1 - Location of E2 COM Ports - E2 PIB Board (E2 version 3.xx and below)

An E2 has up to three COM ports that can be assigned for MODBUS communication (COM2, an RS485 port on the E2 power interface board, and COM4 and COM6, which are optional ports requiring expansion cards). COM ports can only be used for one function; in other words, if COM2 is set up as the I/O network, you cannot connect MODBUS devices to COM2. Ensure your E2 is equipped with an RS485 COM Card (P/N 637-4890) and configured in E2 General Services (Menu **& 7 3 1**, **Serial tab**) to enable COM4 or an E2 Expansion COM Card (P/N 637-4871) to enable COM6.

Connect the MODBUS network cable to the three-terminal connector on the COM port you wish to assign as MODBUS. Wire RS485+ to the RLDS+ RS485- to the RLDS- and the shield cable to the RLDS GND.

4.1.1.2 COM Port Associations - E2 Versions 4.0 and Above

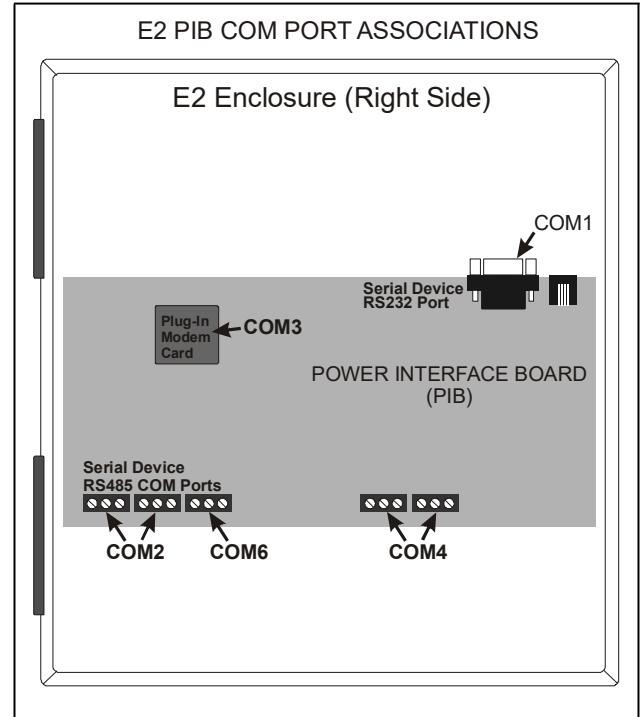


Figure 4-2 - Location of E2 COM Ports - E2 PIB Board (E2 version 4.0 and above)

An E2 has three COM ports that can be assigned for MODBUS communication (COM2). COM ports can only be used for one function; in other words, if COM2 is set up as the I/O network, you cannot connect MODBUS devices to COM2. Ensure your E2 is configured in E2 General Services (Menu **& 7 3 1**,

Serial tab) to enable COM4 or COM6.

Connect the MODBUS network cable to the three-terminal connector on the COM port you wish to assign as MODBUS. Wire RS485+ to the RLDS+ RS485- to the RLDS- and the shield cable to the RLDS GND.

4.1.1.3 E2 Termination

For E2 versions 3.xx and below, if the E2 will be the first device in the daisy-chain, set the port's termination jumpers to the TERMINATED & BIASED position (all three jumpers UP); otherwise, set all jumpers DOWN if not the first device.

For E2 versions 4.0 and above, if the E2 is the beginning of all RS485 I/O or MODBUS Networks, all three of these jumpers should be set to the UP position. For MODBUS, the jumpers should all be in the top-most position (**MOD**). For I/O Net, the jumpers should be in the middle position (I/O). For no termination, set the jumpers to the down position (**NO**).

4.1.2 E2 Setup of RLDS

4.1.2.1 Set Up Network Ports

Before setting up a RLDS, the port on the E2 that has the MODBUS cable connected must be set up as a MODBUS port.

1. Log in to the E2 with Level 4 access.
2. Press followed by **&7 # 1** - **General Controller Info**.
3. Press **Ctrl + # 3** to open the **Serial** tab of the **General Controller Info setup** screens:

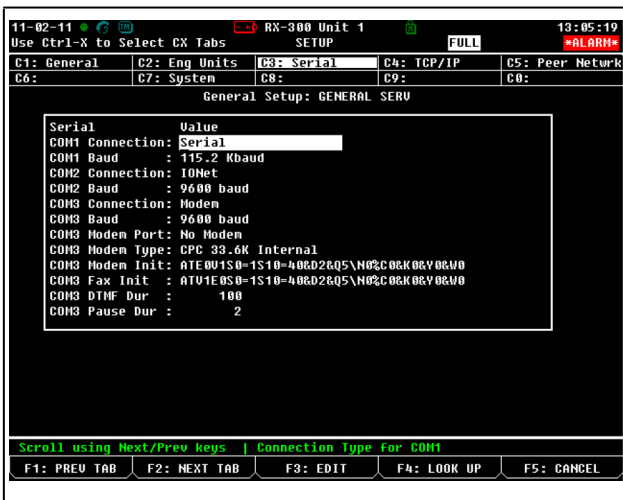


Figure 4-3 - Serial Communications Manager Screen

4. This screen will have a **Connection** field for all COM ports on the E2. Highlight the **COM port connection** field that will be used, and press **F4** - **LOOK UP**. From the list of network types, select **MODBUS**.
5. Four fields will become visible underneath the **COM port connection** field, which pertain to the way the device communicates:
 - **Baud** - Default setting is **19200**. Leave this field at the default value.
 - **Data Size** - Leave this field at the default value (**8**).
 - **Parity** - Leave this field at the default value (**None**).
 - **Stop Bits** - RLDS value is one (**1**).
6. Press to save changes and exit.

4.1.2.2 Add and Connect RLDS

To enable communications between E2 and the RLDS, the devices must be added and addressed in E2.

1. Log in to the E2 with Level 4 access.
2. Press **&7 &7 @ 2** - **Connected I/O Boards and Controllers**.

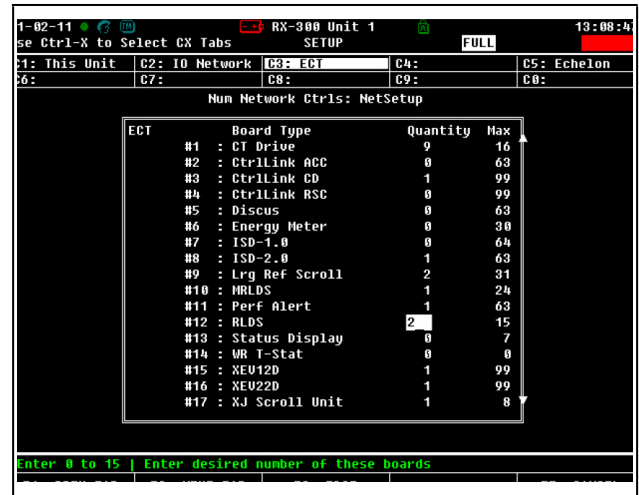


Figure 4-4 - Connected I/O Screen

3. On the **ECT** tab screen enter the number of RLDS Panels in the **RLDS** number field.
4. Press to return to the **Network Setup** menu, then select **1** - **Network Summary** (Figure 4-5).

- Locate the RLDS you added to the network list (press **Page Up** and **Page Down** to scroll through the list) and highlight with the cursor. Press **F5** for **Setup**.

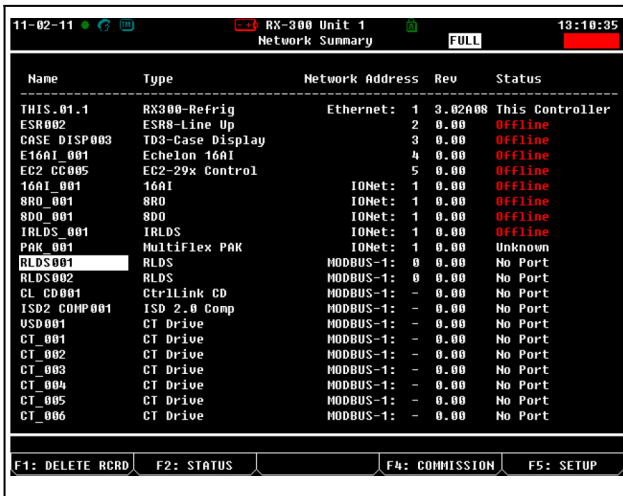


Figure 4-5 - Network Summary Screen

Each RLDS is assigned a MODBUS address automatically when it is created.

- Locate the RLDS you set up, and look at each device's status in the **Status** field. You will see one of the following messages:
 - Online** - The RLDS is communicating normally.
 - Offline** - The RLDS is not communicating, has not been commissioned, is not functional, or is not powered up. Verify the RLDS is powered up, wired correctly, and has the proper network address, baud rate, and parity.
 - No Port** - No port is set up in the E2 Serial Configuration Manager to be a MODBUS port.
- To commission the device, select **F4** - **Commission** and choose the MODBUS network address.

4.2 E2, Einstein, and REFLECS Controllers (The RLDS Gateway Board)

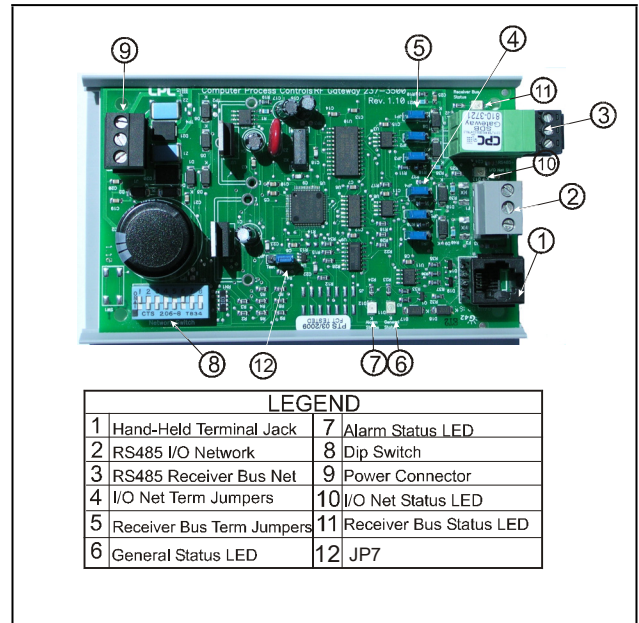


Figure 4-6 - RLDS Gateway Board Layout (P/N 810-3760)

NOTE

Before installing the Gateway board, verify that jumper JP7 (if present on the board) is set to the "NORMAL" position (not the "TEST" position). Operating the Gateway with the jumper in TEST position may cause board damage.

The RLDS may be connected to a Copeland controller using a Gateway Board. The Gateway Board is a special interface device that allows an E2, Einstein, or REFLECS site controller to communicate with up to three RLDS units as if each of them were a standard 16AI Analog Input board, and allows for programming with the Hand-Held Terminal (HHT).

The Gateway Board communicates with the RLDS units via the MODBUS network, which is connected to the Gateway's "Receiver Bus" network terminal. The Gateway communicates with site controllers (E2, Einstein, or REFLECS) via the RS485 I/O Network (COM A & COM D for REFLECS).

In addition to being an interface with the site controller, the Gateway Board also allows you use a Hand-held Terminal (HHT) device to program the RLDS and view status.

4.2.1 Powering the Gateway Board

Table 4-1 - Gateway Power Requirements

Input Voltage	• 24VAC, Class 2, 50/60Hz
Power	• 5VA

The Gateway board requires 24VAC power from a Class 2 center-tapped transformer.

Copeland supplies several sizes of center-tapped transformers for powering multiple 16AIs, 8ROs, and other RS485 peripheral boards of the E2, Einstein, and REFLECS systems.

Refer to your controller's user manual for information on how to use the center-tapped transformers listed in **Table 4-2** to power multiple RS485 I/O devices.

Figure 4-7 shows how to connect the 56VA and 80VA transformers to the Gateway power connector.

Table 4-2 - Power Ratings for Copeland Transformers

	Three-Board	Six-Board
P/N	640-0056	640-0080
Power Rating	56 VA	80 VA

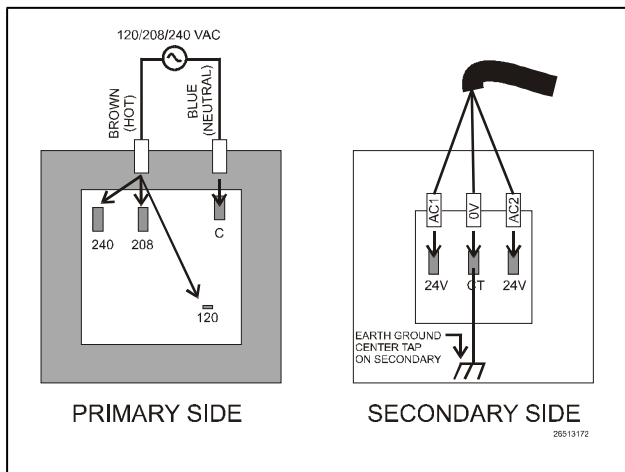


Figure 4-7 - Pinout for the 56VA (640-0056) and 80VA (640-0080) Transformers

4.2.2 Gateway Board Networking

To connect the Gateway to an RLDS, punch out one of the remaining service knockouts to gain access to the interior of the RLDS monitor. Locate the RS485 connector and remove it from the circuit board.

Secure the wire leads to the connector orienting them as shown in **Figure 4-8**. When you are through securing the connections, carefully plug the connector back onto the circuit board.

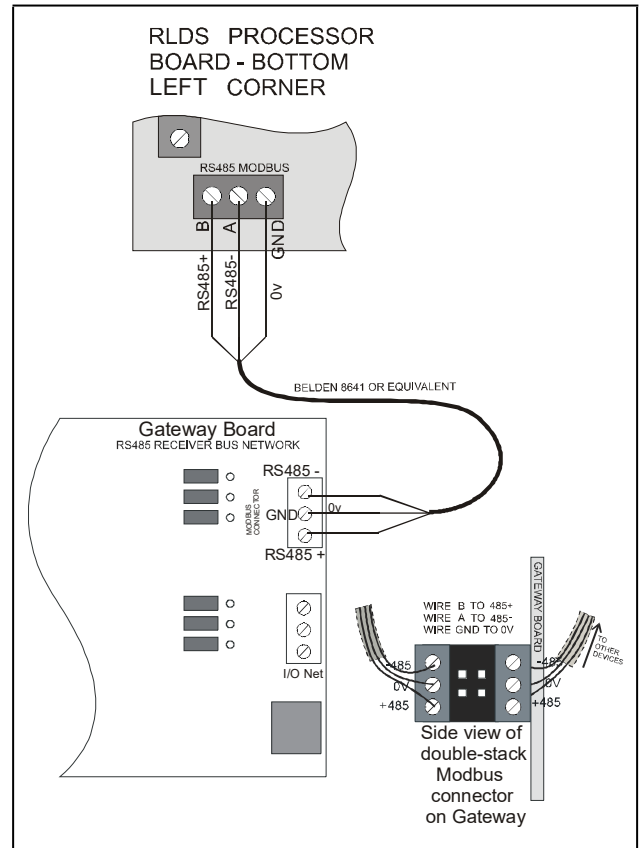


Figure 4-8 - RLDS and Gateway Board Wiring

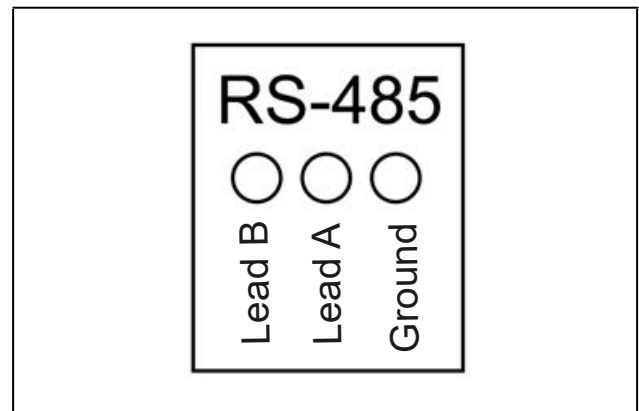


Figure 4-9 - RS485 Connector - RLDS

Network Wiring

For network wiring, use Belden #8762 or #8641 cable or equivalent. The total length of network cable in this configuration may not exceed 4921 feet (1499 meters).

4.2.4 Connecting the Gateway Board to the E2, Einstein, or REFLECS Network

Each E2, Einstein, or REFLECS site controller that will communicate with one or more RLDS must have a Gateway Board installed on its RS485 I/O Network. For E2 and Einstein controllers, this means the Gateway will be installed on the RS485 I/O Network; for RMCC, BEC, BCU, and other REFLECS products, the Gateway will be installed on the COM A or COM D network.

4.2.4.1 Wire Connection

Using shielded three-conductor network cable (Belden #8641 or equivalent), connect the RS485 I/O Network wire to the three-terminal connector on the Gateway board as shown in **Figure 4-13**. For further information about how RS485 networks are configured, refer to your site controller's user manual.

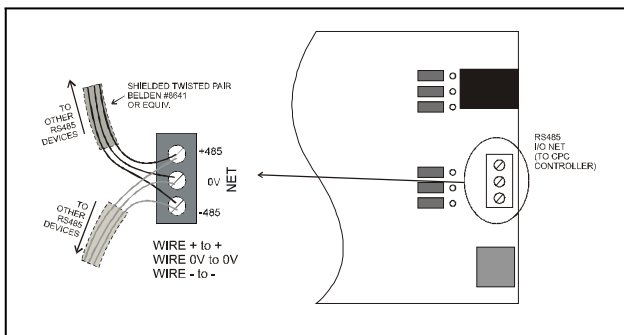


Figure 4-13 - Connecting the Gateway to the RS485 Network

4.2.4.2 Setting the Board Numbering Dip Switch

The first step is to determine whether the RLDS Gateway should emulate 16AI boards – known as the REFLECS mode, or if the RLDS Gateway should emulate IRLDS units in Einstein/E2 – known as the Einstein mode. When dip switch 8 is in the ON position it selects the REFLECS mode, and when dip switch 8 is in the OFF position it selects the Einstein mode.

REFLECS Mode

In the REFLECS mode the Gateway board responds as a series of three 16AI Analog Input boards numbered in succession. Addressing the “boards” represented by the Gateway is achieved by setting dip switches 1 through 4 to the first board number to be used. When this number is set, the Gateway will also use the next two board numbers above the first board number. For example, if a Gateway dip switch is set to board number 3, the Gateway will use board numbers 3, 4, and 5 on the I/O Network.

Once the RLDS Gateway has been added to the network, the **I/O Board Device Numbers** screen in REFLECS (from the **REFLECS Home** screen press **7,7,2**) will also need to be adjusted to show the correct number of input boards. This number should be the total number of input boards plus the number of RLDS units.

Since the RLDS Gateway can support up to three (3) RLDS units, the first RLDS unit maps to the first RLDS Gateway address, and the second RLDS unit maps to the second RLDS Gateway address; therefore, if the RLDS Gateway address = 3, then RLDS unit #1 will appear on 16AI #3 and so forth.

If you are not using all three RLDS units, you can disable them on the Gateway (see **Section 11.2., RLDS Enable Screen**). If they are disabled on the RLDS Gateway, then the corresponding addresses are free to be used by other 16AI boards.

Note that because the Gateway reserves three 16AI Board numbers for its own use, an I/O Network with a Gateway is limited to thirteen (13) 16AI boards. Note also that since 16 is the highest board number possible, a Gateway's dip switch may not be set to any number above 14.

Einstein Mode

In the Einstein mode the Gateway board responds as a series of three IRLDS units numbered in succession. Addressing the “boards” represented by the Gateway is achieved by setting dip switches 1 through 4 to the first unit number to be used. When this number is set, the Gateway will also use the next two board numbers above the first board number. For example, if a Gateway dip switch is set to board number 4, the Gateway will use IRLDS numbers 4, 5, and 6. Once the RLDS Gateway has been added to the network, the **Connected I/O Boards and Controllers** screen in E2 (from the **E2 Main Menu** press **7,7,2**) will also need to be adjusted to show the correct number of IRLDS units. This number should be the total number of RLDS, IRLDS II, and MRLDS (up to 16 can be mapped to one IRLDS) units being used on that Einstein/E2.

Since the RLDS Gateway can support up to three (3) RLDS units, the first RLDS unit maps to the first RLDS Gateway address, and the second RLDS unit maps to the second RLDS Gateway address; therefore, if the RLDS Gateway address = 4, then RLDS unit #1 will appear on IRLDS #4 and so forth.

If you are not using all three RLDS units, you can disable them on the Gateway (see **Section 10.2., RLDS Enable Screen**). If they are disabled on the RLDS Gateway, then the corresponding addresses are free to be used by other Gateways mapping in other RLDS, IRLDS II, or MRLDS units.

For example, if you had an IRLDS II Gateway with two IRLDS II units, and an RLDS Gateway with one RLDS, then you could set the IRLDS II for address 1 and disable the third IRLDS II unit on the Gateway. Then set the RLDS Gateway for address 3 and disable the second and third RLDS units on this Gateway. In E2 you would select three IRLDS controllers. IRLDS units 1 and 2 would map to the IRLDS II Gateway and the third IRLDS would map to the RLDS on the RLDS Gateway.

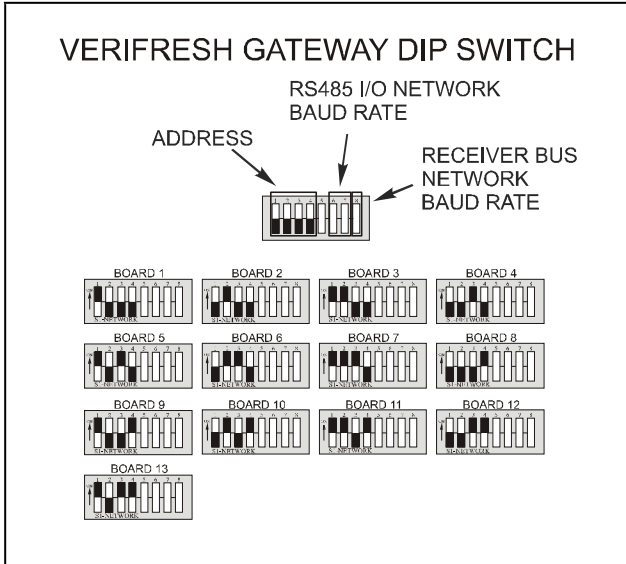


Figure 4-14 - Gateway Dip Switch Numbering

4.2.4.3 Setting the Baud Rate Dip Switches

Dip switches 6 and 7 control the baud rate at which the Gateway communicates with the site controller on the RS485 Network. These switches must be set to the same baud rate setting as the E2, Einstein, or REFLECS (usually 9600 baud). All Gateways and RLDS units on the network must have the same baud rate dip switch setting.

Dip switch 8 must be set to the ON position for REFLECS controller mode and OFF for E2, Einstein controller mode.

Baud rate for the RLDS is set by software, either through the RLDS, or on the Gateway Board via Hand-Held Terminal. It is recommended you use 19200 baud as the MODBUS Network baud rate, as it is the default baud rate used by the RLDS. Set dip switch 5 to OFF.

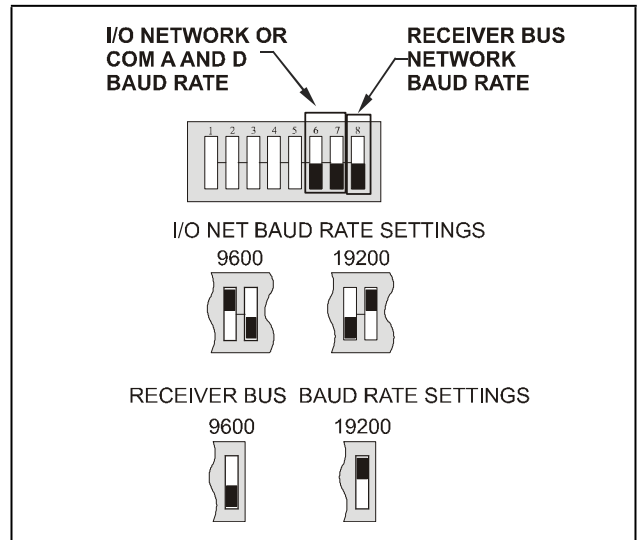


Figure 4-15 - Dip Switch Setting for Numbering Gateway

4.2.4.4 Setting the RS485 I/O Termination Jumpers

As part of an area controller’s RS485 I/O (COM A or COM D) Network, a Gateway must be terminated if it is the end device of a daisy chain. Refer to the controller’s user manual for information about daisy chain networks and how they are terminated.

To terminate the Gateway, set the I/O Network Jumpers to the right position as shown in **Figure 4-16**. To un-terminate the Gateway, set the jumpers to the left position.

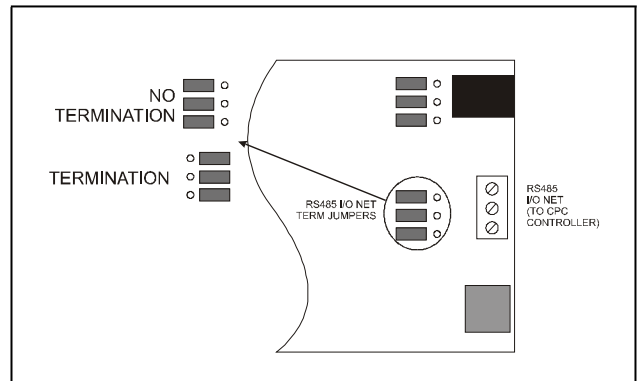


Figure 4-16 - Gateway RS485 I/O Network Termination

4.2.5 Gateway Board Status LEDs

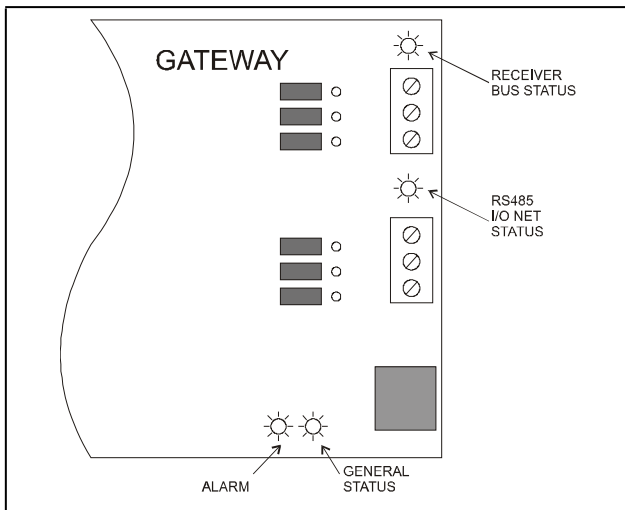


Figure 4-17 - Gateway LED Locations

The Gateway has four LEDs: a General Status LED, an Alarm LED, an RS485 I/O Net Status LED, and a Receiver Bus Status LED (Figure 4-17).

4.2.5.1 The General Status LED

The General Status LED light flashes green once every second to indicate it is powered up.

4.2.5.2 The Alarm LED

The Alarm LED (red) indicates when an alarm condition exists for the Gateway. There are five possible LED states, each of which indicates a different condition.

- **OFF** - No alarm conditions are active, and the Gateway is functioning normally.
- **Flashes 4 times/second** - There is a problem with the physical hardware (ROM) of the Gateway board. The board may need to be replaced.
- **Flashes 2 times/second** - There is no user configuration on this Gateway, no RLDS units are commissioned in its memory, and it is essentially in an empty state. This LED state will occur when the board is first powered up on-site.
- **Flashes 1 time/second** - The Gateway is not communicating with the area controller due to a possible RS485 I/O Network or controller failure.
- **ON with no flashing (steady)** - One or more of the RLDS units is offline. If all are offline, check the wiring. If just one is offline, check the RLDS controller.

4.2.5.3 RS485 I/O Network Status LED

The RS485 I/O Network Status LED flashes orange to indicate traffic on the I/O Network (between the Gateway and the site controller). If this light does not come on at all and the Alarm LED is flashing once per second, there is a problem with the RS485 I/O Network or the area controller.

4.2.5.4 Receiver Bus Network Status LED

The Receiver Bus Network Status LED blinks orange each time the RLDS Gateway sends a message on MODBUS. However, when the Gateway receives a message from the RLDS units, the LED will flash brightly for 1/2 second.

If the Gateway has RLDS configurations in memory and is communicating properly, you should see this LED flash brightly several times within the course of a few minutes.

4.3 Integrating with Building Management Systems

The RLDS may be connected directly to a Building Management System using a shielded twisted pair cable. The cable from the Building Management

NOTE

For multiple RLDS, the last RLDS on either end of the network must have its terminator in the "IN" position, and all other units must have their terminators in the "OUT" position.

NOTE

For multiple RLDS, the total length of the RS-485 cable cannot exceed 4500 feet (1372 m). (Use instrument cable 20 gauge multi-strand shielded and twisted pair – similar or equal to Belden cable #8762.)

4.4 Connecting to a Building management System

The RLDS may be connected to a Building Management System via the RS-485 connector. The node address on each RLDS may be set from 1 to 15 in order to identify itself to the Building Management System.

NOTE

User must have two (2) dedicated ports to successfully complete the required setup.

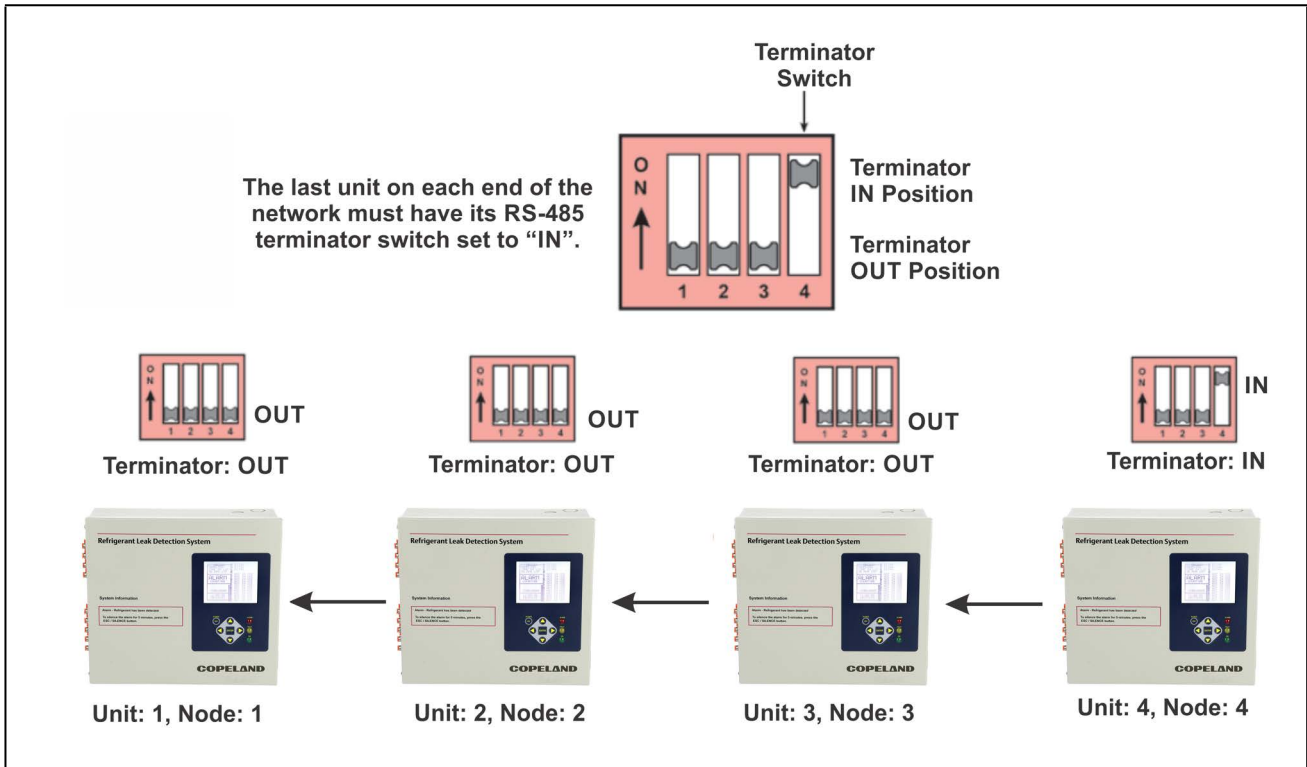


Figure 4-18 - Termination Settings for Multiple Monitors Connected to a BMS (Two Trunks)

4.5 Terminating Multiple Monitors

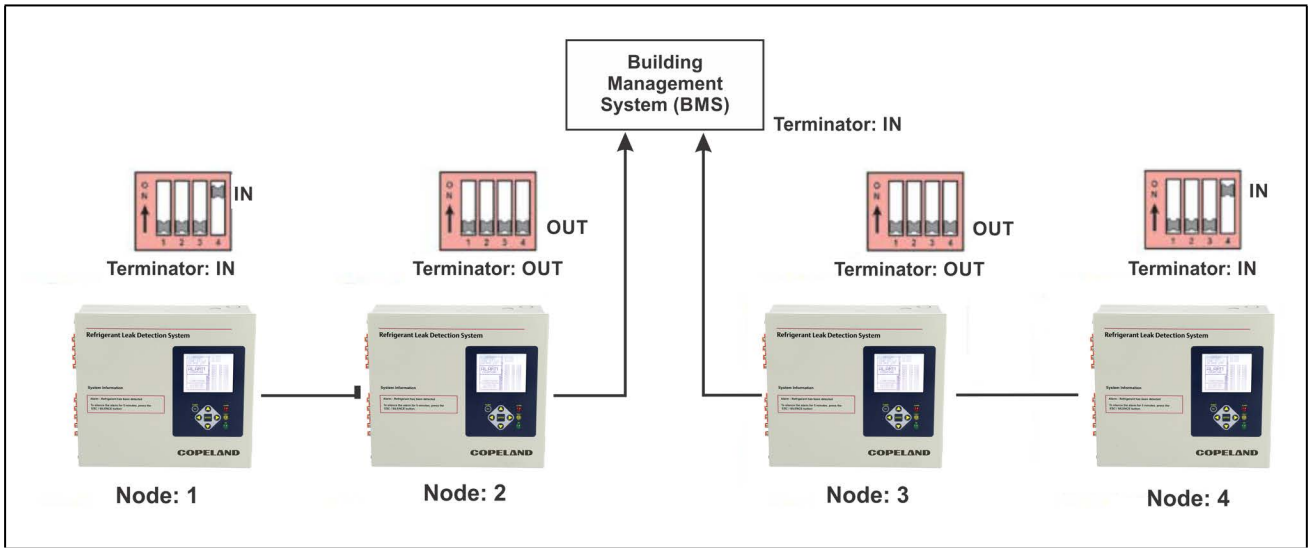


Figure 4-19 - Termination Settings for Multiple Monitors Connected to a BMS (Two Trunks)

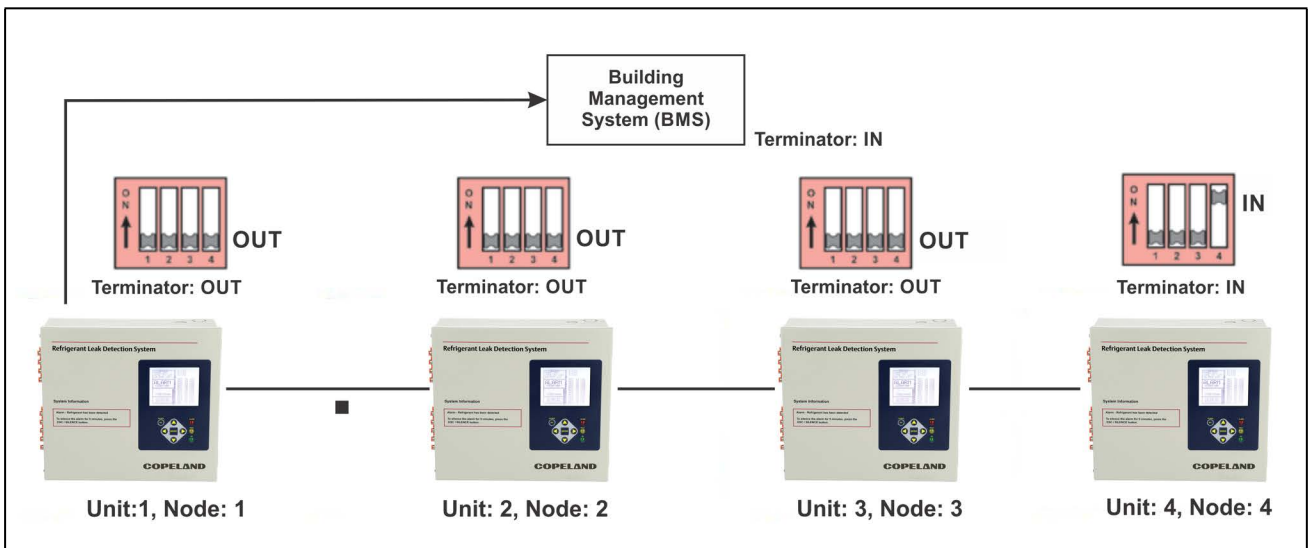


Figure 4-20 - Termination Settings for Multiple Monitors Connected to a BMS (Daisy Chain)

4.6 PC Software

4.6.1 Operation

NOTE

The RLDS is compatible with PC software version 1.52 or higher. However, calibration data can only be edited on the front panel of the RLDS, not through the PC Software.

NOTE

The PC software is not compatible with 64-bit (or newer) computers.

NOTE

The PC software uses COM1 by default. Therefore, the interface cable should be connected to the port configured as COM1 on the PC. Also, no other software drivers or devices in the computer may control COM1 when the RLDS software is in use. Alternatively, COM2 (for example) may be used by adding a space and the number 2 to the command line.

When using a USB to serial converter, be sure it has been mapped to COM1 or COM2.

The connection is made through a standard "straight through" serial port connection. A three-wire connection is used (RXD, TXD, and GND). No hardware flow control is used. The RLDS software automatically configures COM1 to match the RLDS RS-232 communications parameters.

NOTE

Occasionally, the laptop connection will not connect properly and only two beeps are heard and the program times out. To resolve this, disconnect the RS-232 cable and cycle power on the RLDS and the laptop. After both are operational, connect the RS-232 cable and start the software program.

1. Apply power to RLDS monitor and allow it to warm up. **Note that on CO2 models, a "Clearing Purge Line" message is displayed for approximately 2.5 minutes before warm up begins.**
2. Connect RS-232 interface cable to the PC and RS-232 port on the RLDS monitor.
3. Insert software disk into the PC.
4. Open the RLDS software using Windows Explorer.
5. Upon start up, the program will immediately attempt to download data from the RLDS, as indicated by several beeps.

Navigate using your PC keyboard:

- Use the up, down, left, and right arrow keys to navigate through the screen options.
 - Use the **Enter** key to select options.
 - Use the **Esc** key to go back one step.
6. Go to **EDIT**. From the **EDIT** Menu, select **SYSTEM**. The monitors' **LOCATION** becomes highlighted. Press **Enter** to move to the **TAG** area. Use the Backspace key to remove the existing tag. Enter a new tag. Press **Enter** to return to **LOCATION**. Select the next item to be addressed. **Note that you cannot change the "SN" or "FIRMWARE" items. Press the Esc key to return to the menu bar.**
 7. Go to **EDIT**. From the **EDIT** Menu, select **ZONES**. Select a specific zone to identify and set parameters. When **REFRIGERANT** is selected (Halogen Monitor), scroll through the gas library to locate and select the gas type for that zone.
 8. Setting the Alarms: Select **EVAC LEVEL**. Use the **Backspace** key to clear previous setting. Type in the new PPM level. Use the same method to set the spill level and leak level.
 9. To close or bypass a zone: Set the **DISTANCE** to **0** feet.

IMPORTANT

When a modified parameter (zone, system, or calibration) is sent to the RLDS monitor, please wait for the computer software to indicate that the download is complete before continuing with any further edits.

4.6.2 Saving and Sending Programs

- When saving to your computer, the program will automatically add “.cfg” to the filename you have entered.
- To send a saved program to the RLDS, open the program and connect the PC to the RLDS. From the monitor, select **SEND SETUP** and press **Enter**. The saved program will be sent to the RLDS.

4.6.3 Trend Data

NOTE

Creating a trend data file must be done while connected to the RLDS.

From the computer, select **GET TREND DATA**. Select the zone that you want to trend and press **Enter**. The trend data will appear in a list format. Press **Enter** again to access the file name screen. Type the file name in for that particular zone. Press **Enter**. The file will be saved as a text file that can be converted to an Excel file or printed as is.

NOTE

The TREND file must be saved zone by zone, with a filename per zone.

4.6.4 Converting the TREND Text File to a Microsoft Excel File

Open Excel and the desired file. Select “**Delimited**” format and “**Space**” as the delimiter. Select “**General**” as the column data format. The text file will display as an Excel file. When saving, change the file name extension to “.xls”. Comments or notes may be added to this file as needed and saved.

4.6.5 Saving and Printing Screens and Logs

Open the software while connected to the RLDS. After the software receives the program, open the desired screen (e.g., software screen, alarm log, fault log, diagnostic screen, etc.). Use the **Alt** and **Print Screen** key combination on the PC keyboard to capture the image and paste it into a Word document. Save and print. This is the last thing that needs to be done.

4.6.6 USB Type Laptops

Some laptops have USB ports and no RS-232 9-pin ports. A USB-to-serial converter or PCMCIA-to-serial converter will be required if a PCMCIA slot is available. You will be required to purchase a PCMCIA card that provides an RS-232 output. This is necessary for Windows Vista and higher versions.

4.7 Optional Current Loop Interfaces

NOTE

The two-output, current loop interface is an option that **MUST** be ordered separately.

4.7.1 Optional 4–20 mA DC Outputs

Upon installation of the optional 4–20 mA DC Interface Board (P/N 275-0030), the RLDS has the capability of providing dual 4-20 mA DC scrolling current loop outputs for connection to external monitoring devices (e.g., a local loop-powered display or a building management system [BMS]).

IMPORTANT

Loop outputs are powered internally. Do not use an external power supply as this can damage the loop card.

NOTE

Optional remote loop-powered displays are available to view the 4-20 mA outputs.

The interfaces are set up as follows:

- Loop 1 indicates zone area
- Loop 2 indicates PPM.

The 4-20 mA outputs are scaled to correspond to individual zone numbers and PPM concentrations. Scaling for the 16 (maximum) zone numbers is fixed. The default scaling for the PPM concentrations provides a 0-1000 PPM range for the 4-20 mA output, although it can be adjusted through the **LOOP2 FACTOR** option in the **System Setup** screen. Refer to **Table 4-3** and **Table 4-4**.

Loop 1 = Zone

Table 4-3 - Loop 1 (Zone Area)

Output	Zone
4 mA DC	n/a
5 mA DC	1
6 mA DC	2
7 mA DC	3
8 mA DC	4
9 mA DC	5
10 mA DC	6
11 mA DC	7
12 mA DC	8
13 mA DC	9
14 mA DC	10
15 mA DC	11
16 mA DC	12
17 mA DC	13
18 mA DC	14
19 mA DC	15
20 mA DC	16

Loop 2 = PPM (Default: 0.016 mA DC = 1 PPM)

Table 4-4 - Loop 2 (PPM)

Output	PPM Default
4 mA DC	0 PPM
5 mA DC	63 PPM
6 mA DC	125 PPM
7 mA DC	188 PPM
8 mA DC	250 PPM
9 mA DC	313 PPM
10 mA DC	375 PPM
11 mA DC	438 PPM
12 mA DC	500 PPM
13 mA DC	563 PPM
14 mA DC	625 PPM
15 mA DC	688 PPM
16 mA DC	750 PPM
17 mA DC	813 PPM
18 mA DC	875 PPM
19 mA DC	938 PPM
20 mA DC	1000 PPM

4.7.2 4-20 mA DC Connections

External devices are connected to the RLDS using a shielded dual twisted pair cable. Use any of the remaining service knockouts to gain access to the interior of the monitor. Locate the dual 4-20 mA DC output connector (see below) and remove it from the circuit board. Secure the wire leads to the connector orienting them as shown in the diagram below. Check to make sure the polarity matches the wiring at the external device. When you are through securing the connections, carefully plug the connector back onto the circuit board.

NOTE

The ground connections of the 4-20 mA DC output connector are common.

NOTE

The 4-20 mA DC output connector are SIGNAL OUT ONLY. DO NOT APPLY POWER.

NOTE

It is highly recommended that a current loop isolator is used when connecting to the 4-20 outputs.

NOTE

When one or both current loop outputs are not used, install a jumper wire between the ground and the unused loop terminal(s) to prevent the system from generating a current loop fault.

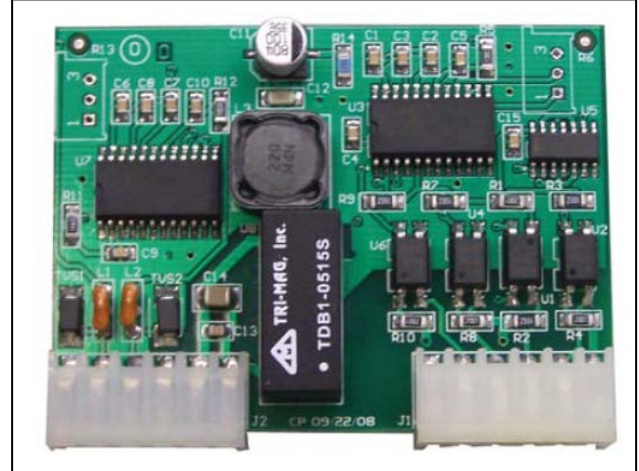


Figure 4-21 - Optional Dual 4-20 DC Output Board for Multi-Zone

CAUTION

The loop outputs have isolated grounds. Therefore the cable shield should be terminated at the receiver and not the RLDS monitor. The signal for both current loops must be returned to the RLDS monitor.

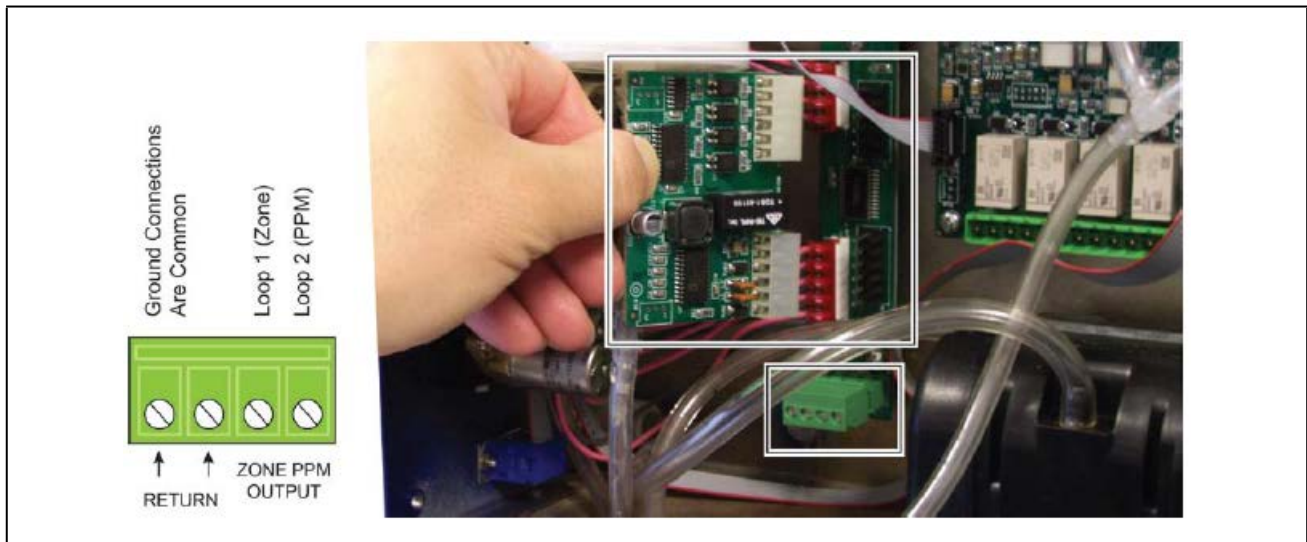


Figure 4-22 - Connecting the Gateway to the RS485 Network

5 RLDS - Connecting External Alarms

5.1 Overview

The RLDS includes four SPDT relays whose contacts are rated 2 A at 250 VAC (inductive) and 5 A at 250 VAC (resistive). These relays are used for the connection of external alarm devices that are activated when the relay is energized. The relays are factory assigned to energize under the following conditions:

Relay #1	Leak	Alarm Point 100 ppm
Relay #2	Spill	Alarm Point 300 ppm
Relay #3	Evacuate	Alarm Point 500 ppm
Relay #4	Fault	System Fault Event

5.2 Connection

Use the conduit or any of the remaining service knockouts to gain cable access to the interior of the monitor. Locate the relay connector (see **Figure 3-4**) and remove it from the circuit board. Secure the leads to the connector orienting them as shown in **Figure 5-1**. When you are through securing the connections, carefully plug the connector back onto the circuit board.

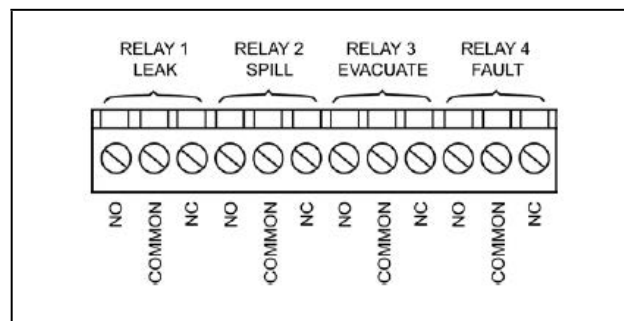


Figure 5-1 - RLDS Relay Connector

NOTE

Each relay may be connected as normally open (NO), or normally closed (NC).

1. The relay contacts are rated 2 A at 250 VAC (inductive) and 5 A at 250 VAC (resistive).
2. Power for the alarm devices connected to the relay contacts may be supplied by an external 24 VDC power source or the monitor's AC input terminals. Wiring diagram in **Figure 5-2** shows the power to this device is being tapped off the monitor's AC input. Wiring diagram in **Figure 5-3** power is supplied from an external power source.
3. Jumper the "Live/Positive" line of an external power source (DC devices) or the monitor's AC input (AC devices) to the "Common" terminal on the relay connector.
4. Connect the "Live/Positive" end of the strobe or horn to the "NO" terminal of whichever level of alarm is appropriate for the application.
5. For protection, install an in-line fuse of the appropriate size and design for the external alarm device being used.
6. The other end of the strobe or horn is connected to the "Neutral/Negative" leg of the external power source (DC devices) or monitor's AC input (AC devices).

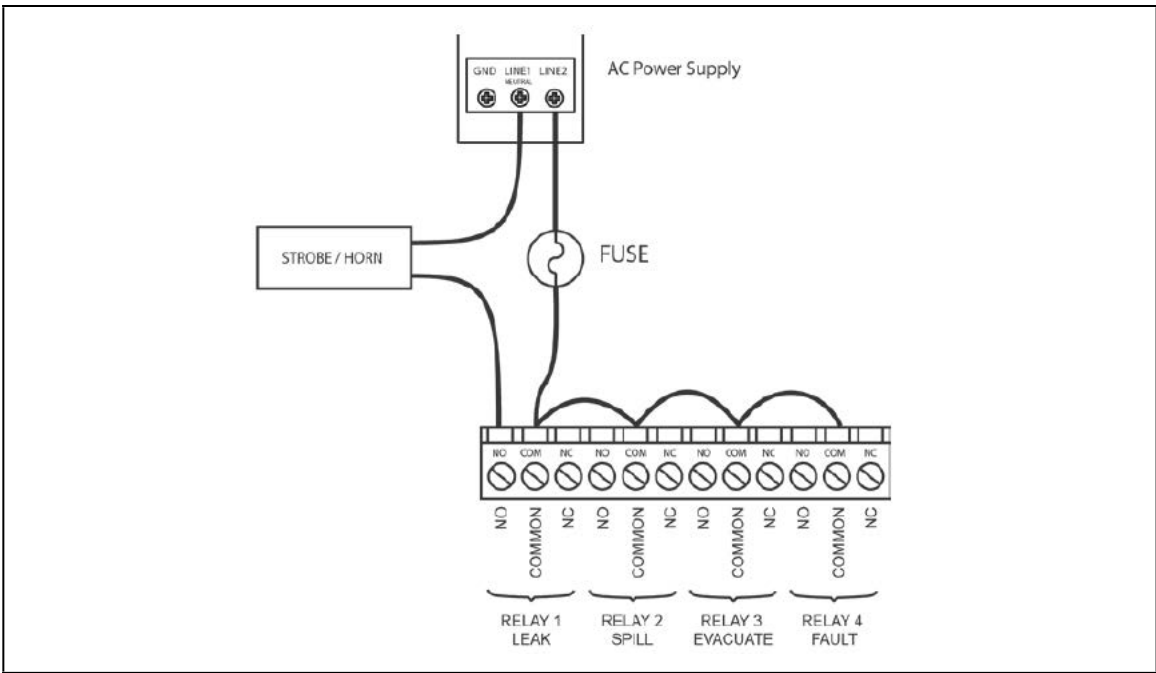


Figure 5-2 - Typical AC External Alarm Relay 1 Wiring

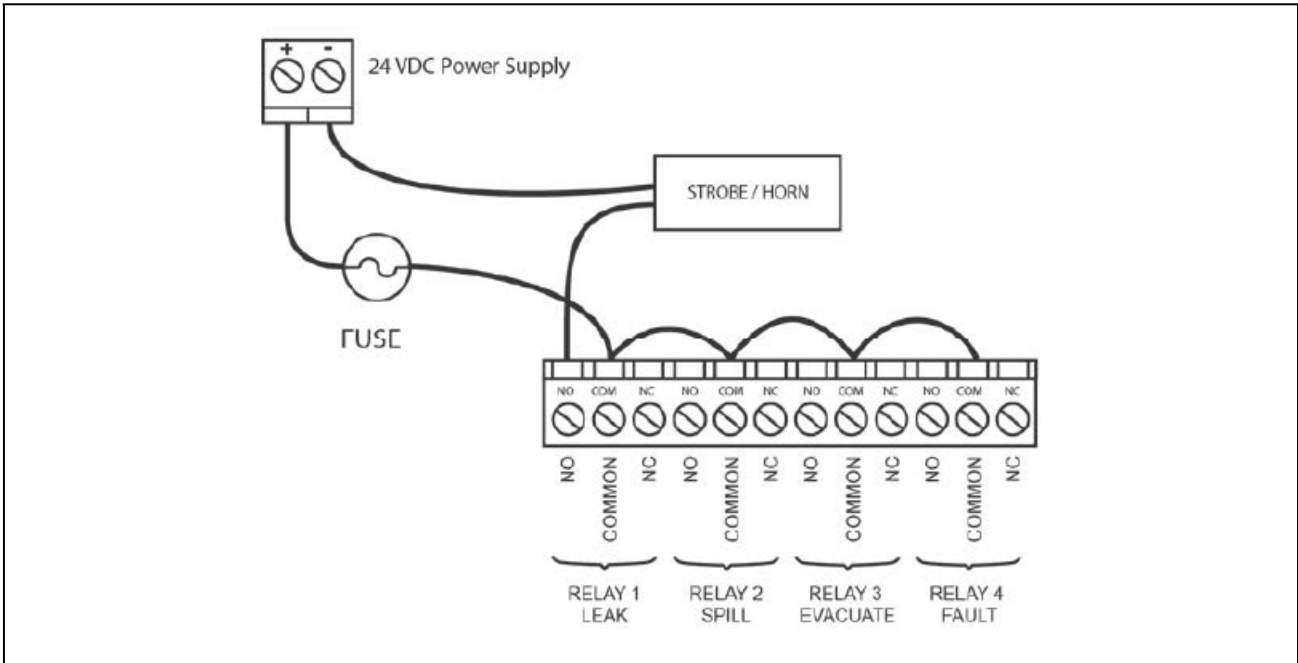


Figure 5-3 - Typical DC External Alarm Relay 1 Wiring

6 Programming Setup and UI Navigation for RLDS - Display Screens

6.1 Initial Power Up

When the RLDS is first powered up, all front level panel LEDs will illuminate, and a splash screen will appear and display the monitor's firmware version level. Note that on CO₂ models, a "Clearing Purge Line" message is displayed for approximately 2.5 minutes before warm up begins. After a moment, the **Warm Up** screen will be displayed and the green **MONITOR ON** light will blink.

After a 15-minute warm up cycle, the **MONITOR ON** light will glow steadily and the **Data Display** screen will be displayed.

6.2 Data Display Screen

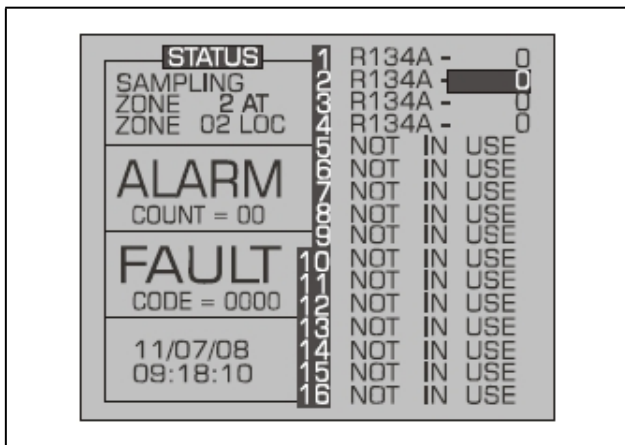


Figure 6-1 - Data Display Screen

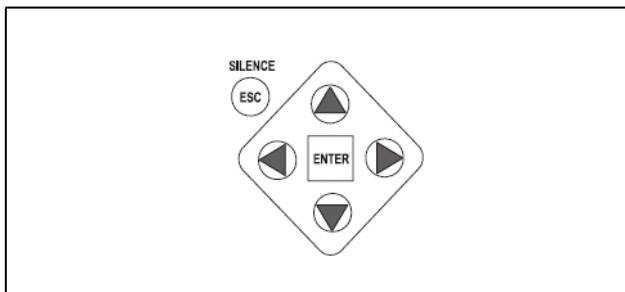


Figure 6-2 - RLDS Front Panel Navigation Keys

- Use the arrow/cursor keys for multi-directional movement in making selections and moving the cursor.
- Use the **ENTER** key to initiate and complete a selection.
- Use the **ESC** key to go back during programming or silence an alarm in alarm mode

6.3 Navigate to the First Setup Screen

1. From the **Data Display** screen, press the **UP** or **DOWN** arrow key. **SETUP** will be highlighted in the first box.
2. Press **ENTER** to select this option and display the **Setup** screen.

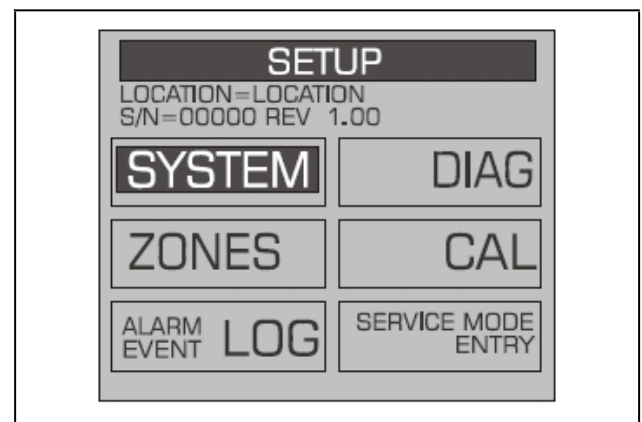


Figure 6-3 - Setup Screen 1

NOTE

Refer to **Appendix D: System Menu Map on page 94**.

6.4 Navigate to the Second Setup Screen

1. From **RLDS System Setup screen 1** select the **SYSTEM** option to go to **System Setup screen 2**.
2. Press the **ESC** key to return to the **System Setup screen 1**.

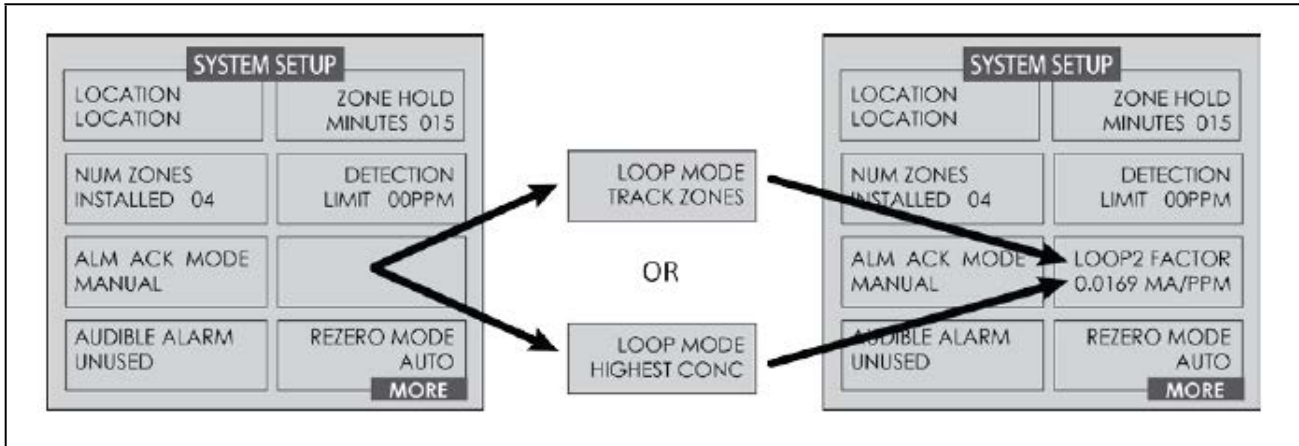


Figure 6-4 - Setup Screen 2

6.5 Location

This is the name you assign to the RLDS monitor to identify its location. It may have up to 12 alphanumeric characters.

1. Press the **ENTER** key to adjust the setting.
2. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual characters.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

6.6 Number of Zones Installed

IMPORTANT: DO NOT change the number of zones to deactivate unused zones. Changing the number of installed zones is only necessary when manifold blocks are added or removed. Go to the individual zone that you wish to disable and set its distance to zero.

1. Press the **ENTER** key to adjust the number.
2. Use the **UP/DOWN** cursor keys to modify the number (must be 4, 8, 12, or 16).
3. Press **ENTER** to accept the new number or **ESC** to revert to the previous setting.

IMPORTANT

Do not change the number of zones to deactivate unused zones. Changing the number of installed zones is only necessary when manifold blocks are added or removed. Go to the individual zone that you wish to disable and set its distance to zero.

6.7 Alarm Acknowledge (Ack) - Mode

This function programs the relays in the RLDS unit for latching or non-latching operation.

1. Press the **ENTER** key to adjust the setting.
2. Use the **UP/DOWN** cursor keys to toggle between settings.

AUTO - Non-latching (Alarm relay will automatically de-energize when the gas level drops below its alarm point).

MANUAL - Latching (Alarm relay remains energized, and will not release until the alarm condition has been manually acknowledged). Refer to **Section 7.6.4, Acknowledging Alarms**.

3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

6.8 Audible Alarm

This parameter selects the function of the RLDS monitor's internal audible alarm device.

1. Press the **ENTER** key to adjust the setting.
2. Use the **UP/DOWN** cursor keys to select unused, monitor on, evacuate, spill, leak, fault, or alarm.
3. Press **ENTER** to accept the new entry or select **ESC** to revert to the previous setting.

NOTE

In "Monitor On" mode, the unit will only give audible alarms on a critical fault that stops the unit from monitoring.

6.9 Zone Hold

Zone hold sets the length of time a zone will be monitored when the zone hold feature is activated. The default is **15 minutes**. The range is **1 to 999 minutes**.

1. Press the **ENTER** key to adjust this setting.
2. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual members.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

6.10 Detection Limit

The Detection Limit is essentially a squelch setting that instructs the instrument to interpret PPM readings below the designated level as **0**. The range is **1 to 99 PPM**.

1. Press the **ENTER** key to adjust the setting.
2. Use the **UP/DOWN** cursor keys to modify the setting.
3. Press **ENTER** to accept the new entry or select **ESC** to revert to the previous setting.

6.11 Loop Mode

Loop Mode sets the loop mode of the two optional 4-20 mA outputs. Options are:

- track zones mode (default)
- highest PPM concentration mode

NOTE

Both LOOP MODE (for selecting track zones or highest PPM mode) as well as the LOOP2 FACTOR (for scaling the PPM output) are configured from the SETUP menu. Configure one, then press ENTER to access the other.

In track zones mode the RLDS adjusts the ZONE and PPM outputs to correspond to the latest sampled zone number and its corresponding PPM concentration, respectively. For example, if the RLDS samples zone #9 at 63 PPM, the ZONE and PPM outputs would read 13 mA (corresponds to zone #9) and 5 mA (corresponds to 63 PPM), respectively, until the next zone is sampled. This continues in a cyclic fashion through each zone. Note that this example assumes **LOOP2 Factor** was left at its default value (0.016). This can be adjusted through the LOOP2 FACTOR option in the **System Setup** screen.

In *highest concentration (PPM)* mode the RLDS adjusts the two current outputs to correspond to the zone number that has the highest PPM concentration and the corresponding value of that concentration, respectively. Unlike *track zones mode*, this mode will adjust the two outputs to correspond to whichever zone has the highest PPM concentration. For example, if zone #9 is sampled at 125 PPM, the two 4-20 mA outputs will read 13 mA and 6 mA, respectively, as long as it continues to sample at 125 PPM or until a different zone samples a concentration greater than 125 PPM.

6.12 Loop2 Factor

Loop2 Factor sets the PPM scale factor for current loop number 2. To calculate the current output, multiply the scale factor by the PPM and add four (4). For example, at the default scale factor of 0.016, a measurement of 100 PPM would generate a current output of 5.6 mAdc. The current output cannot exceed the 20 mAdc capacity of the interface.

1. Press the **ENTER** key to adjust the setting.
2. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual characters.
3. Press **ENTER** to accept the new entry or select **ESC** to revert to the previous setting.

NOTE

Both LOOP MODE (for selecting track zones or highest PPM mode) as well as the LOOP2 FACTOR (for scaling the PPM output) are configured from the SETUP menu. Configure one, then press ENTER to access the other.

6.13 Re-Zero Mode

This parameter defines the frequency at which the instrument re-zeros the optical sensor.

1. Press the **ENTER** key to adjust the setting.
2. Use the **UP/DOWN** cursor keys to toggle between settings.
 - AUTO** - sets the instrument to re-zero every 10 minutes.
 - ZONE CHANGE** - sets the instrument to re-zero at each zone change. This is the most accurate setting, but increases the time interval between measurement cycles.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

6.14 Navigating to the Third Setup Screen

From the second **System Setup screen 2**, select the **MORE** option to go to the **System Setup screen 3**. Select the **BACK** option to return to the **System Setup screen 2**.

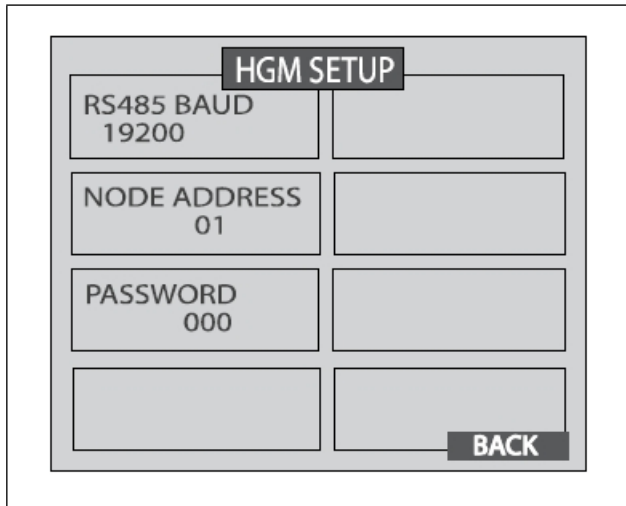


Figure 6-5 - Setup Screen 3

NOTE

The RS485 BAUD rate text will be replaced by "Service Timeout" when in Service Mode.

6.15 Baud Rate

This parameter defines the baud rate for the RS-485 communications port.

1. Press the **ENTER** key to adjust the setting.
2. Use the cursor keys to scroll through a list of available baud rates to select the desired baud rate.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

6.16 Node Address

Each RLDS on the network must have a distinct node address. The node address may be set from **1 to 64**.

1. Press the **ENTER** key to adjust the setting.
2. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual numbers.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

6.17 Password

- This field is used to define a system password. The default setting is **000**, which provides no password protection.
1. Press the **ENTER** key to adjust the password.
 2. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual alphanumeric characters.
 3. Press **ENTER** to accept the new password or **ESC** to revert to the previous setting.

6.18 Additional Service Features

The Service Mode option is located on the System Setup Screen in the bottom right corner. When activated, the Service Mode will disable the RLDS unit for a specified length of time. The default is 5 minutes. This time interval can be changed as described in **Section 6.16, Node Address**

IMPORTANT

Note that while in the Service Mode no measurements are made, nor are any alarms activated.

Access the service mode options from the initial **Data Display Screen**. Press the **SERVICE MODE ENTRY** option twice within 3 seconds. To exit the **Service Mode**, again press the **SERVICE MODE ENTRY** option twice within **3 seconds**.

Several features can be viewed on the **System Setup Screen 3** when the monitor is placed in service mode. While in service mode, the user can identify the model number, set digipot values and sensor temperature, and acquire the temperature coefficient.

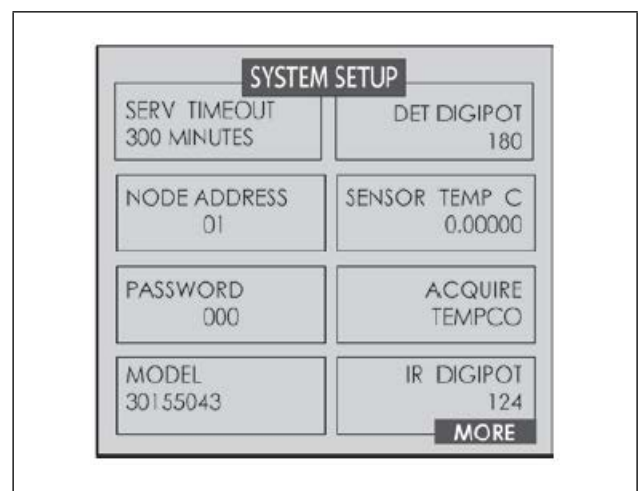


Figure 6-6 - System Setup Screen 3 - Service Mode

6.19 Service Timeout

Displayed in Service Mode. Sets the length of time the Service Mode is in effect. Stops the monitor for up to 300 minutes (5 hrs) to allow for servicing the unit.

1. Press the **ENTER** key to adjust the setting.
2. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual numbers.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

6.20 DEG Digipot

The DIGIPOT function allows a manual and more precise adjustment of the digital potentiometer, which controls the voltage of the IR Detector. The DIGIPOT is auto-tuned at every power up.

1. Press the **ENTER** key to adjust the setting. Once the option is selected the screen will also display the voltage.
2. Use the **UP/DOWN** cursor key to modify the Digipot value.

6.21 Node Address

Each RLDS on the network must have a distinct node address. The node address may be set from 1 to 64.

1. Press the **ENTER** key to adjust the setting.
2. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual numbers.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

6.22 Sensor Temperature Coefficient (For Factory Use Only)

This field is typically for factory use only. A customer may need to enter a temperature coefficient if the IR bench is replaced and a new temperature coefficient is supplied with the replacement bench.

Note that changing this setting will void the calibration.

6.23 Password

This field is used to define a system password. The default setting is **000** (no password protection).

1. Press the **ENTER** key to adjust the password.
2. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual alphanumeric characters.
3. Press **ENTER** to accept the new password or **ESC** to revert to the previous setting.

6.24 Acquiring Temperature Coefficient (Factory Use Only)

This field is for factory use only. Changing this setting will void the calibration.

6.25 R Digipot

This option indicates the electrical parameters of the infrared emitter.

6.26 Establishing the CO₂ Baseline

At power up, an automatic zeroing sequence establishes the CO₂ sensor baseline. At that time, the RLDS assumes the default ambient CO₂ level of 386 ppm. However, if:

- the purge line wasn't connected to the instrument, or
 - the purge line was not terminated in fresh air, then the sensor baseline may be compromised. If you suspect that the baseline was compromised, then you can re-establish the proper CO₂ sensor baseline by ensuring the purge line is properly installed and following the procedure below.
1. Restart the RLDS by either (a) cycling the power, or (b) pressing the CPU reset switch on the main printed circuit board (see **Figure 6-7**).

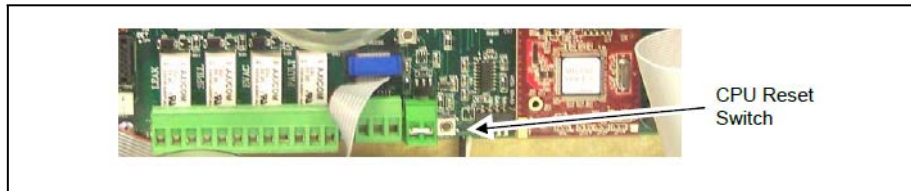


Figure 6-7 - Location of CPU Reset Button

WARNING

If using the CPU reset switch to restart the instrument, extreme care should be exercised when accessing the interior of the monitor. This includes touching a non-painted area of the RLDS chassis to provide proper grounding prior to touching the CPU reset switch or any other internal components. Failure to touch a grounding area can allow static electricity on your clothing or body to damage the RLDS. Such damage is not covered under warranty.

2. After the restart and the warm-up have completed, the instrument is ready for use.

7 General Operation of RLDS - UI

7.1 Functional Overview

Normally each RLDS will perform measurements on its active zones sequentially and without user input. The total time it takes an RLDS to complete a measurement cycle is directly proportional to the number of active zones and the physical length of the air lines. Monitors linked together on a network operate independently of each other and consequently complete their respective measurement cycles at different rates.

7.2 The Zone Setup Screen

From the **System Setup screen 2 (Figure 6-4)**, scroll down and select the **ZONES** option.

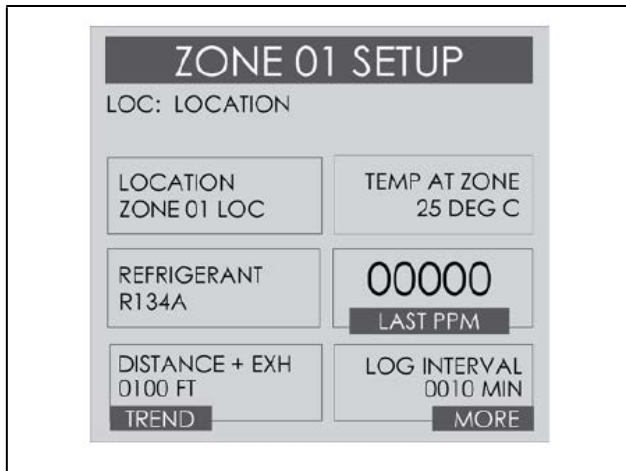


Figure 7-1 - Zone Setup Screen 1

7.2.1 Location

This is the name you assign to the RLDS to identify the zone location. It may have up to 12 alphanumeric characters.

1. Press the **ENTER** key to adjust the setting.
2. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual characters.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

7.2.2 Gas/Refrigerant Type

This displays the kind of gas the RLDS is detecting.

1. Press the **ENTER** key to adjust the setting.
2. Use the **LEFT/RIGHT** cursor keys to select the type of refrigerant you want the device to detect.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

7.2.3 Distance + EXH

This displays the combined length of the sample tubing plus any tubing on the exhaust port. Total length should not exceed 1200 feet (365 meters).

1. Press the **ENTER** key to adjust the setting.
2. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual characters.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

7.2.4 Temperature at Zone

This is used to set the expected temperature of the air at the zone being sampled. The value is used to calculate the STP PPM value shown in the diagnostic screen only.

1. Press the **ENTER** key to adjust the setting.
2. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual characters.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

7.2.5 Current Detection Reading

This reading displays the current PPM level of the selected gas.

7.2.6 Log Interval

The RLDS retains a data log of 100 measurements for each zone. The log interval is the number of minutes from 1 to 1440 between each log point. This parameter can be changed from **Zone Setup screen 1** (**Figure 7-1**).

The default setting for this parameter is 10 minutes. If the log interval time is set to 0, then a measurement is recorded in the trend log after *every measurement cycle*. Therefore, after the trend log is filled, it will contain the last 100 measurement points for a zone. If you want the data logged less frequently, increase this value.

It is important to remember that cycle time is dependent on many factors, including the number of zones being monitored, input line length, and the run zeroing mode selected. Before changing this value it may be useful to review the log data first using the **Trend** screen to determine the nominal cycle time.

7.3 Navigating to the Second Zone Setup Screen

Select the **MORE** option at the bottom right side of the screen (**Figure 7-1**) to continue to the next screen containing more options. This screen displays the peak PPM value in the upper left side of the screen.

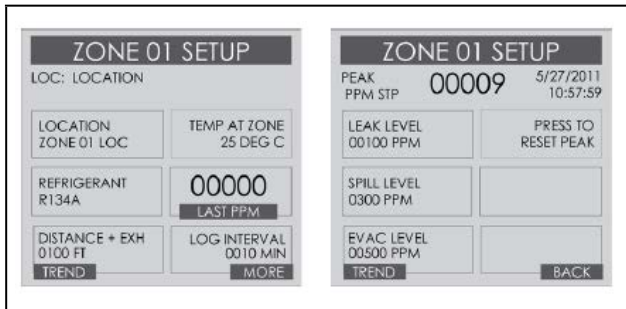


Figure 7-2 - Navigating from the First to the Second Zone Screen

7.3.1 Leak Level

This is the concentration level in PPM that will activate a leak alarm condition.

1. Press the **ENTER** key to adjust the value.
2. Use the **UP/DOWN** cursor keys to modify the setting.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

NOTE

This value must be less than the spill level.

7.3.2 Spill Level

This is the concentration level in PPM that will activate a spill alarm condition.

1. Press the **ENTER** key to adjust the value.
2. Use the **UP/DOWN** cursor keys to modify the setting.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

NOTE

This value must be less than the evacuate level and greater than the leak level.

7.3.3 Evacuation Level

This is the concentration level in PPM that will activate an evacuate alarm condition.

1. Press the **ENTER** key to adjust the value.
2. Use the **UP/DOWN** cursor keys to modify the setting.
3. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

NOTE

This value must be greater than the spill level.

7.3.4 Resetting the Peak PPM Value

Pressing this key resets the current peak PPM level stored in memory and displays it at the top of the screen.

7.4 Alarm Conditions

When an alarm condition is detected anywhere on the network, the red ALARM LED will glow on the front of the unit. Additionally, an external alarm device may activate and an audible alarm may sound if those features have been enabled (**Section 4.2, E2, Einstein, and REFLECS Controllers (The RLDS Gateway Board)**).

An inverse flashing box indicates an alarm condition in the affected zone.

You can investigate the status of the affected zone further by selecting the **ALARM** option on the **Status** screen (**Figure 6-1**).

7.5 Fault Conditions

If a system malfunction occurs, the yellow FAULT LED will glow. Additionally, an external alarm (**Section 4.2, E2, Einstein, and REFLECS Controllers (The RLDS Gateway Board)**) device may activate and an audible alarm may sound if those features have been enabled (**Section 6.8, Audible Alarm**).

7.6 Alarms

7.6.1 Functional Overview

If the PPM level for any zone exceeds its designated spill, leak, or evacuate thresholds, an alarm condition will be created. Once the RLDS completes a measurement cycle in the affected zone the alarm condition will be indicated. At that time the red ALARM LED on the RLDS will glow. Additionally, an external alarm device may activate and an audible alarm may sound if those features have been enabled (**Section 6.8, Audible Alarm**).

7.6.2 Responding to Alarms

An operator can respond to alarms by accessing the **Alarm Summary** screen. Navigate to this screen by selecting **ALARM** on the **Data Display** screen (**Figure 6-1**).

7.6.2.1 Alarm Summary Screen

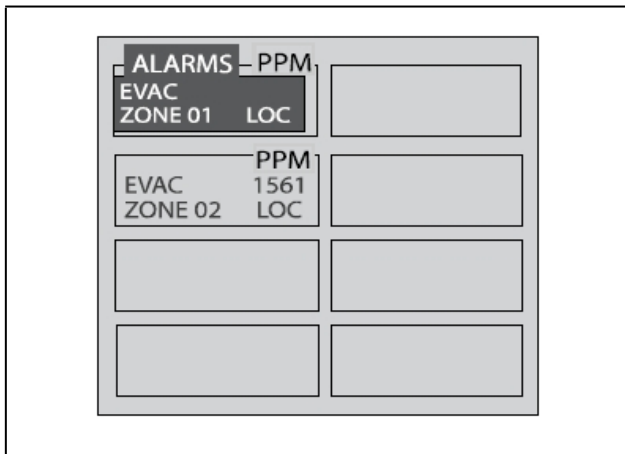


Figure 7-3 - Alarm Summary Screen

The **Alarm Summary** screen displays a list of all alarm conditions pending across the network. The screen is divided into eight (8) boxes, and each box represents a single alarm. If more than eight (8) alarms are pending, the MORE option will be displayed at the bottom of the screen to permit access to that additional information.

Each box displays the zone number, zone name, and the current PPM reading. A flashing box indicates an alarm that has not been acknowledged. A static box represents an alarm that has been acknowledged but has not yet been cleared from the system.

7.6.3 Alarm Detail Screen

To further investigate an alarm, press the s key to go to the **Alarm Detail** screen.

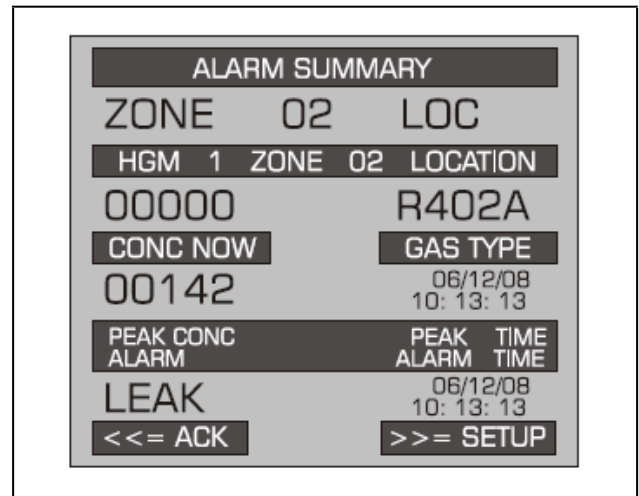


Figure 7-4 - Alarm Detail Screen

The **Alarm Detail** screen displays more comprehensive information about the nature of the alarm including:

- Complete location information
- Gas type and current concentration (CONC NOW)
- Peak concentration and peak time
- Type of alarm, alarm time, and date

This screen provides the following navigation options at the bottom of the display:

- **ACK** - using the left arrow key, ACK will acknowledge the alarm as described in the next section.
- **SETUP** - using the right arrow key, navigate to the **Zone Setup screen 1 (Figure 7-1)**. This enables review of the zone setup parameters and accesses the **Trend** screen.

Use the **ESC** button on the RLDS unit to go back to the previous menu.

7.6.4 Acknowledging Alarms

Each pending alarm may require, depending upon selected alarm mode, acknowledgment before the system returns to normal operation **Section 6.7, Alarm Acknowledge (Ack) - Mode**. To acknowledge an alarm, navigate to the **Alarm Detail** screen and select the **ACK** option as previously described. You will then be returned to the **Alarm Summary** screen and the box associated with that alarm will no longer be blinking, indicating that the alarm has been acknowledged. Repeat this procedure to acknowledge any remaining alarms

Once all the alarms associated with a given RLDS are acknowledged, its red LED will turn off, and any external alarms connected to the RLDS relays will deactivate.

Keep in mind that the system will continue to generate new alarms if PPM values above the alarm thresholds are detected.

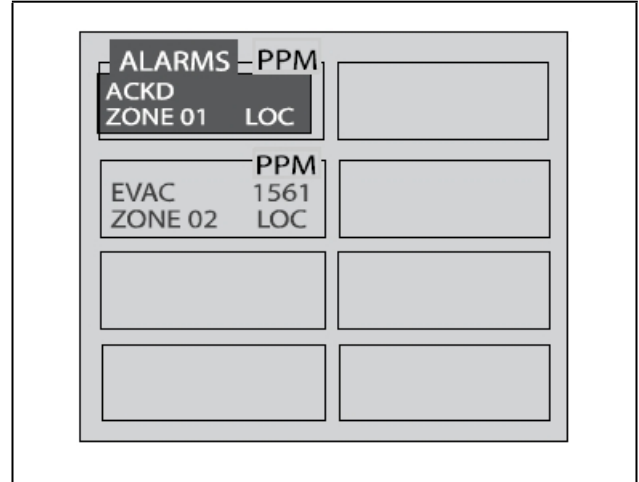


Figure 7-5 - Alarm Summary Screen - Acknowledge Mode

7.6.5 Silencing an Alarm

When alarms are active, the **ESC** key functions as a silence key. During an active alarm and with the main screen displayed, press the **ESC** key. This will generate a prompt to **“PRESS ENTER TO CONFIRM SILENCE”**. When **ENTER** is pressed, the LEAK relay will open and the internal audible alarm (if enabled) will turn off. In this way, when the LEAK relay is used to operate strobes and horns, they can be quickly silenced without effecting the SPILL or EVAC, which may be controlling fans or ventilation equipment. This “silence” mode will be indicated by a reverse flashing “S” in the alarm window. “Silence mode” will be automatically canceled if the alarm condition of any zone changes by clearing or elevating to a higher level.

7.6.6 Clearing the Alarm Even Log

A data log of the last 20 alarm events is retained in memory.

- From the **Data Display** screen, press the **UP** or **DOWN** arrow key. **SETUP** will be highlighted in the first box.
- Press the **DOWN** arrow key until **Alarm Event Log** is highlighted, then press **ENTER** to select this option and display the **Alarm Event Log** (see **Figure 7-6**)

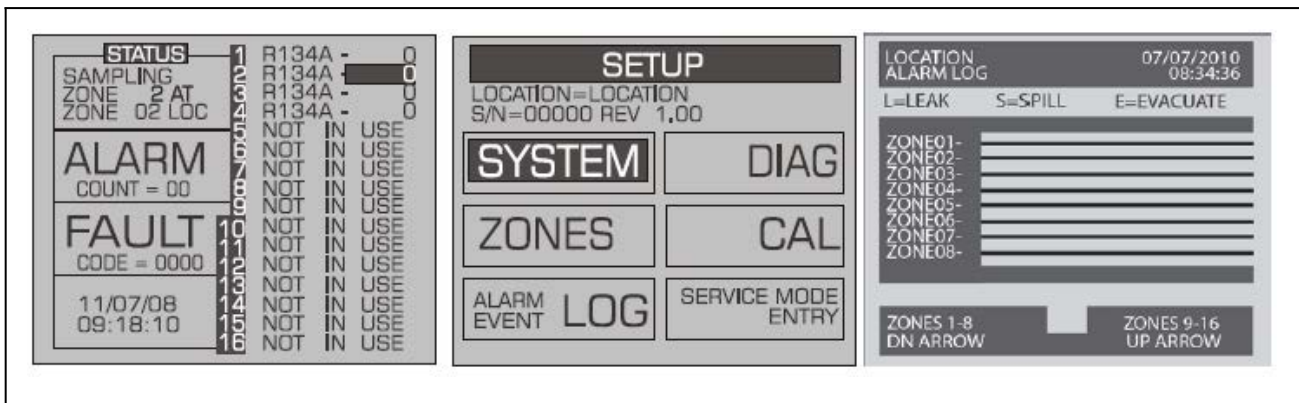


Figure 7-6 - Accessing the Alarm Log

This screen lists zones in the left column and displays which alarms were associated with each zone as represented by the vertical cursor bar. As you move the bar horizontally using the **LEFT/RIGHT** cursor keys, the date and time the alarm condition was detected is displayed in the upper right hand corner of the display window.

NOTE

The Alarm Event Log can be reset by pressing a combination of the **ENTER** and **RIGHT** arrow buttons while viewing the log.

7.7 System Faults

7.7.1 Functional Overview

If a system malfunction occurs, the yellow FAULT LED to glow. Additionally, an external alarm device may activate and an audible alarm may sound if those features have been enabled (**Section 6.8, Audible Alarm**).

Depending on the nature of the fault, the RLDS may or may not continue to operate normally. Under a non-critical fault condition, the RLDS will continue to measure and log data, but some peripheral functions may be compromised. Under a critical fault condition, action is required for the RLDS to operate normally.

Various fault conditions are listed and explain what action should be taken to correct the problem in **Section 7.7.2.1, Critical Faults**. Note that the fault codes are cumulative. For example, a code <4200> is both a <4000> "REZERO VOLT

TOL" and <0200> "GAIN SET FAULT" combined, indicating two simultaneous faults.

7.7.2 Navigating to the Fault Screen

Displayed on the initial **Data Display** screen (**Figure 6-1**) is a Fault option. Scroll down with the cursor key and select this option, and the **Fault screen** will display:

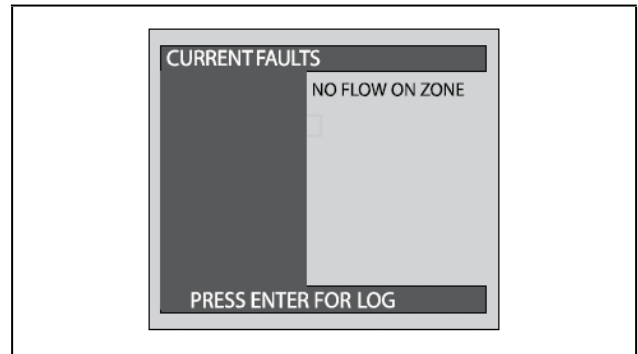


Figure 7-7 - Fault Screen

7.7.2.1 Critical Faults

Fault	Code	Description/Possible Cause
NO FLOW ON ZONE	<0800>	Go to the Data Display screen (Figure 6-1) and select FAULT . This will display a NO FLOW message in each individual zone affected. Check for a blockage in the air sample line or at the line-end filter. Once the blockage has been cleared, the RLDS will return to normal operation after the zone has been sampled.
		<div style="background-color: black; color: white; padding: 5px; display: inline-block;">NOTE</div> This can take several minutes since it is dependent upon how many zones there are and their lengths. The RLDS will clear the fault the next time it polls the affected zone.
NO FLOW ON PURGE	<1000>	Check the purge line for a blockage. Verify that the length of the purge line and exhaust line do not exceed 500 feet (152 meters) in length.
CLIPPING FAULT	<8000>	The detector voltage may be out of tolerance.
REZERO VOLT TOL	<4000>	The detector output voltage is out of tolerance.
OVER RANGE DETECTED	<2000>	This indicates that the measured concentration on one or more zones have exceeded the measurement range.
ZERO FILTER FAULT	<0100>	Indicates contamination in the purge air, or if a charcoal filter is in use, the filter may need to be changed.
GAIN SET FAULT	<0200>	Indicates sensor gain (digipot) is outside acceptable range.
A2D FAULT	<0400>	Analog to digital converter not working.

7.7.2.2 Non-Critical Faults

Fault	Code	Description/Possible Cause
BOX TEMP FAULT	<0001>	Enclosure's internal temperature is outside normal range (or IR sensor has failed). Check the installation to verify that the monitor is not being subjected to extreme temperatures. Verify that the ventilation holes are not obstructed. Check the Diagnostic screen (Figure 7-14) for the ZERO temperature, BNCH temperature and BOX temperature. Contact Technical Support with this information for further instructions.
BENCH TEMP FAULT	<0002>	Optical bench is outside of normal operating range (or sensor has failed). Check the installation to verify that the monitor is not being subjected to extreme temperatures. Check the Diagnostic screen (Figure 7-14) for the ZERO temperature, BNCH temperature and BOX temperature. Contact Technical Support with this information for further instructions.
RESSURE SENSOR	<0004>	Manifold pressure is outside normal operating range (or sensor has failed). Check the Diagnostic screen record ALL data (Figure 7-14). Contact Technical Support with this information for further instructions.
RS485 FAULT	<0008>	RS-485 Communications Error.
LOOP FAULT	<0010>	This would only be displayed if the dual 4-20 mAdc option was installed and one or both current loops are open. Check the wiring to load/ monitoring circuit on both 4-20 mA loops.
CONFIG FAULT	<0080>	There is an error in the RLDS Setup screen 2 - NUMBER ZONES INSTALLED field (Figure 6-4). Check that the number of zones installed for each RLDS unit and the number of RLDS units on the network are properly programmed. Check to ensure that the manifold solenoid cable connector in each RLDS unit is securely fastened to its terminal connector. Check for an illegal parameter. If necessary, reset to the factory default settings.

7.7.3 Reset to Factory Default Settings

IMPORTANT: Performing this function ERASES all program parameters, alarms, faults, trends, and log files.

1. Press and hold down the up and down arrow keys on the RLDS (**Figure 3-6**).
2. Cycle AC power OFF then ON.
3. Hold the keys until the second beep is heard.
4. The screen will indicated "This unit has been reset to the factory default conditions".
5. Release the keys.
6. Reprogram the RLDS as described in **Section 6, Programming Setup and UI Navigation for RLDS - Display Screens**.

7.7.4 Clearing System Faults

If the fault condition is associated with an RLDS, the monitor will return to normal operation soon after the problem is corrected. At that time the yellow LED will turn off and any external alarms connected to the monitor's alarm relays will also turn off.

Once the system malfunction has been corrected, it may take some time for the fault condition to clear completely. If the fault is associated with a specific zone, the RLDS must first cycle back to the affected zone before it returns to normal operation. At that time the yellow LED will turn off and any external alarms connected to the monitor's alarm relays will also turn off.

7.7.5 Viewing Fault Log

A data log of the last 20 fault conditions is retained in memory. On the **Fault** screen (**Figure 7-7**) select the **LOG** option to view a display of the Fault Log:

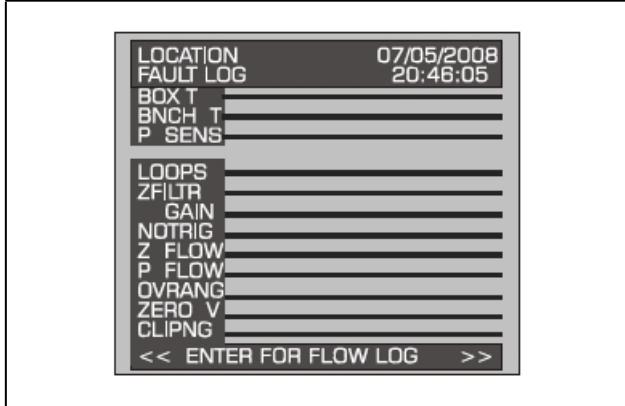


Figure 7-8 - Fault Log Screen

This screen lists potential fault conditions in the left column and displays a check mark indicating which problems were associated with each fault condition as represented by the vertical cursor bar. As you move the bar horizontally using the left/right cursor keys, the date and time the fault condition was detected are displayed in the upper right hand corner of the display window.

Anytime the fault status changes, there is an entry in the fault log, both when the fault occurs and when it is cleared.

The Fault Log can be reset by pressing a combination of the **ENTER** and right arrow buttons while viewing the log.

7.7.6 Viewing Flow Log

On the **Fault Log** screen, press **ENTER** (as shown in **Figure 7-8**) to access the **Flow Log** screen. The Flow Log displays the last 20 flow events for all zones and the purge port.

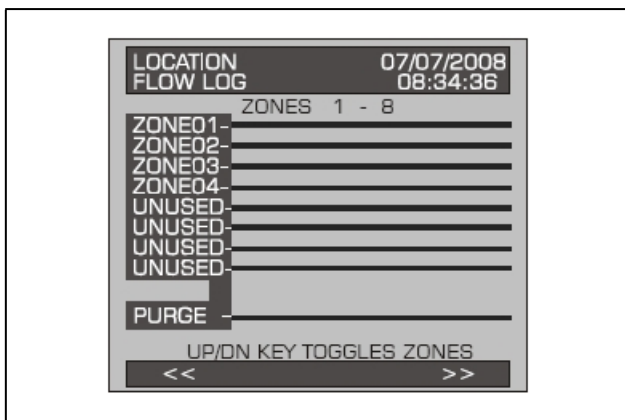


Figure 7-9 - Flow Log Screen

This screen lists the zones in the left column and displays flow data. Use the up/down buttons to scroll through the zones and the left/right to scroll through the log data. As you move the bar horizontally, the date and time of the condition are displayed in the upper right hand corner.

The Flow Log can be reset by pressing a combination of the **ENTER** and right arrow buttons while viewing the log.

7.8 The Trend Screen

7.8.1 Navigating to the Trend Screen

From the **Zone** screen (**Figure 7-1**), select the **Trend** option on the bottom left side. This will open the **Trend** screen:

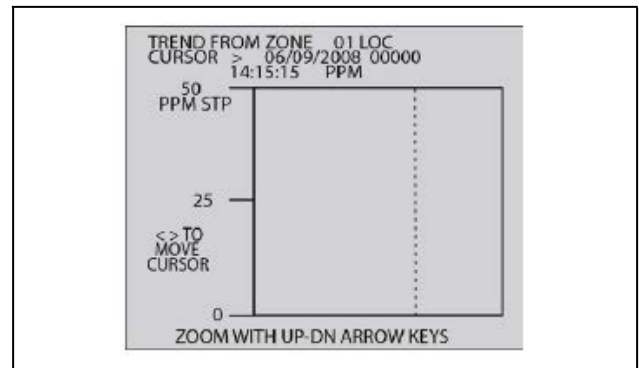


Figure 7-10 - Trend Screen

The trend graph opens with the cursor located over the most recent data point. Use the LEFT/RIGHT cursor keys to move the cursor to different data points. Holding a key down will cause the cursor to move rapidly across the screen. As you move the cursor position, the date and time of that reading, along with the PPM value, are displayed at the top of the screen above the graph. The trend graph is automatically scaled to accommodate the largest PPM value displayed. The ZOOM OUT and ZOOM IN options allow you to adjust the vertical scale of the graph.

The trend data is stored on a first-in, first-out basis. After 100 trend values have been stored, the 101st value will replace the first value stored; therefore, in normal operation, when entering trend mode the cursor will be located at the most recent data point. The data points to the left of the initial cursor location will be the next most recent. The data point to the right will be the oldest data point in the buffer and will be overwritten by the next data point.

The Trend Data Log can be reset by pressing a combination of the **ENTER** and right arrow buttons while viewing the log.

When finished, press the **ESC** key to revert to the previous screen.

7.9 The Calibration Screen

7.9.1 Overview

The Calibration Screen is used to adjust the calibration factor for each refrigerant gas. It is also used to program the instrument for new gases.

IMPORTANT: Changing information on CAL FACTOR will VOID the factory calibration. Typically, the unit will remain within the factory-calibrated accuracy indefinitely and no calibration is required. Complex software algorithms adjust for temperature drift, IR source aging, and pressure changes in order to keep the unit within factory accuracy specifications.

7.9.2 Navigating to the Calibration Screen

On the **System Setup** screen (**Figure 6-3**), select the **Calibration** option abbreviated **CAL**.

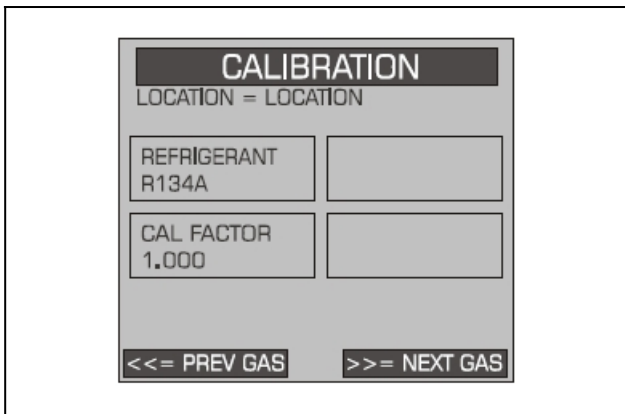


Figure 7-11 - Calibration Screen

7.9.3 Calibration Procedure

The CAL FACTOR is determined by sampling a known dilution of the type of gas to be sampled. Calibration is best performed at or near full scale. It can, however, be done at any concentration, and ideally in the range where maximum accuracy is desired down to, but not below, 100 PPM.

A cylinder of the desired gas at a certified PPM level must be used to assure sampling occurs at ambient conditions. A minimum sample size of 5 liters is required.

The RLDS monitor should be operating for at least one hour prior to performing a calibration.

Prepare the RLDS for sampling by initially setting its CAL FACTOR to 1.000. Next, set up the RLDS for a logging interval of zero minutes (**Section 7.2.6, Log Interval**), and place the RLDS in its zone hold mode for the zone you wish to use for calibration purposes (**Section 6.13, Re-Zero Mode**).

Connect the sample bag directly to the intake port for the zone you have set up and allow the RLDS to sample the entire bag. When sampling is complete, view the trend data for the zone used to sample (**Section 7.8, The Trend Screen**). Read the measured PPM by placing the cursor on the spikes caused by the sample. If the bag was large enough for multiple samples, average the most stable ones.

The new CAL factor is computed by dividing the known gas value by the measured value. Typically this value will be between 0.95 and 1.05. This value is stored in non-volatile memory.

7.9.4 Adjusting Calibration Factor

The factory default CAL factor for standard units is 1.000. This value may be different if the high accuracy option is ordered. Proceed as follows to adjust the current calibration factor:

1. Use the **PREV GAS** or **NEXT GAS** options to scroll through the list of refrigerants until the gas you wish to work with is displayed.
2. Select the **CAL FACTOR** option to edit the value.
3. Use the **LEFT/RIGHT** cursor keys to move across the entry field and the **UP/DOWN** cursor keys to modify the individual numbers.
4. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

NOTE

The CO₂ calibration is a more complex, 2-point calibration. CO₂ units are factory calibrated and not intended to be calibrated in the field. Refer to screens in **Section 7.9.5, CO₂ Atmospheric Concentration (RLDS-CO₂ Units Only)**

7.9.5 CO₂ Atmospheric Concentration (RLDS-CO₂ Units Only)

CO₂ is supported by RLDS-CO₂ units. Because CO₂ is present in ambient air, a relative reading is used to determine the amount of CO₂ coming from a leak. The CAL screen offers the ability to enter the atmospheric CO₂ concentration manually. This value is typically in a range of 380-400 PPM, however concentrations may vary slightly based on geographic locations or other factors (the factory default setting is 386 ppm).

IMPORTANT

The ambient CO₂ level is set at the factory to 386 ppm and will likely not need to be changed. If, however, the ambient CO₂ concentration at your location is known to be a value other than this default value, then the instrument's ambient CO₂ setting may need to be changed.

Adjust the ambient CO₂ concentration as follows:

1. From the **SYSTEM SETUP** menu, navigate to the **CAL** screen.
2. Ensure the **GAS TYPE** setting is selected (see **Figure 7-13**) and press **ENTER**.
3. CO₂ calibration curve options are displayed. Simply press **ENTER** to access the ambient CO₂ concentration setting (PPM IN PURGE). See **Figure 7-12**.
4. Use the **UP/DOWN** cursor keys to modify the numbers to set to the appropriate value.
5. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.
6. After selecting CO₂ as the desired gas and setting the **CAL FACTOR**, you will be prompted to enter the CO₂ concentration value.
7. Use the **UP/DOWN** cursor keys to modify the numbers to set to the appropriate value.
8. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.

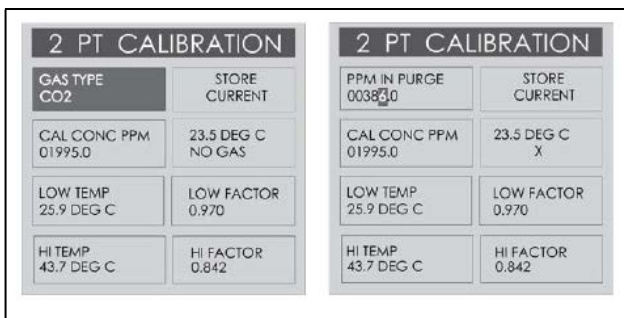


Figure 7-12 - Accessing the CO₂ Atmospheric Concentration Setting (PPM IN PURGE)

IMPORTANT

Do not alter any other parameters within the Calibration Menu as this will alter the factory calibration.

7.9.6 Programming New Gases

As new gases come into use, the RLDS allows the addition of these new gases to its on-board gas library. At the end of the gas library list is an option labeled **CUSTOM** for adding new gases. From the **Calibration** screen use the left/right arrows to select **CUSTOM** from the list of refrigerants. Next, press **ENTER**, and use the up/down arrow keys to enter the calibration factor.

The selection of the matching gas and CAL factor is performed by analyzing the new refrigerant. Once the matching gas is determined, field calibration is possible by using the same procedure as for other refrigerants. When the new gas entry is complete, simply set up the appropriate zone for **CUSTOM**.

Program the instrument for a new gas as follows:

1. From the **Calibration** screen, use the **PREV GAS** or **NEXT GAS** options to scroll through the list of available choices until the **CUSTOM** option is displayed.

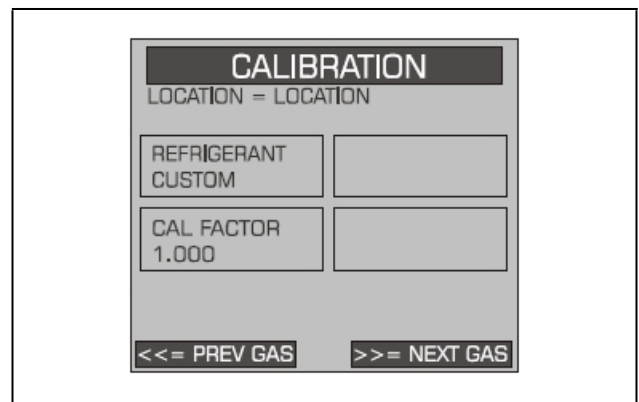


Figure 7-13 - Custom Gas Screen

2. Select the **CUSTOM** option. Press **ENTER** to accept the new entry or **ESC** to revert to the previous setting.
3. Enter the new **CAL** Factor as received from Copeland.

7.10 Zone Hold Mode

A zone can be placed on hold and continuously monitored for a length of time determined by the Zone Hold Time value. To place a zone on hold, select the zone at the main run screen, then press and hold down the **ENTER** key until the unit beeps. The word **"HOLDING"** will appear in the status box.

While in the hold mode, further investigation of the zone's status can be made by navigating to that **Zone's Setup Screen #1**. To release the zone from the hold mode, press and hold down the **ENTER** key until the unit beeps and the screen display returns to normal.

7.11 The Diagnostic Screen

7.11.1 Navigating to the Diagnostic Screen

On the System Setup screen (Figure 6-3), select the Diagnostic option (DIAG).

7.11.1.1 Diagnostic Screen

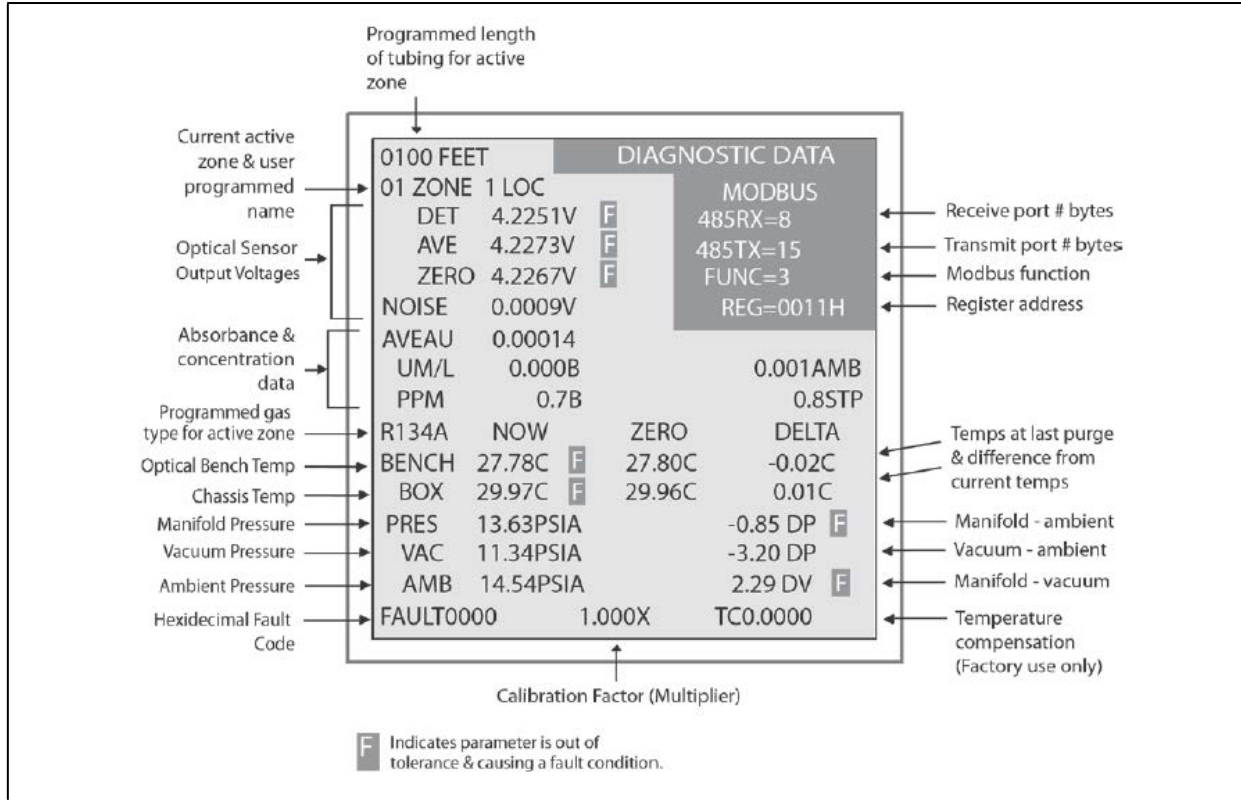


Figure 7-14 - Diagnostic Screen Layout

7.11.1.2 Diagnostic Options and Controls

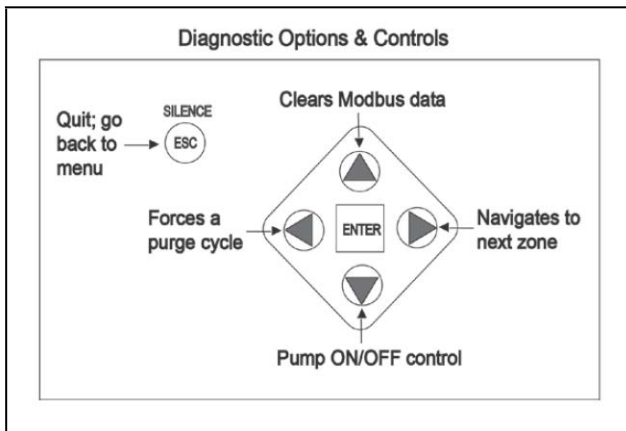


Figure 7-15 - Diagnostic Screen

7.11.2 Diagnostic Screen Overview

The **Diagnostic** Screen contains sensor data and status information useful for trouble shooting various fault conditions. An explanation of each line is given below along with normal operating ranges.

Table 7-1 - Diagnostic Screen Sensor Data and Status

Field Name	Description
xxxx FEET	Programmed length of tubing for an active zone.
xx ZONE name	Current active zone and user-programmed name. This field may also show “WARM UP” during warm up mode.
DET	Detector Voltage - Peak-to-peak output of the IR sensor, in the absence of gas this value can range from 4.100V to 4.300V.
AVE	Average Detector Voltage - Running average of the values displayed in line 1 (DET).
ZERO	Zero Voltage - IR sensor output that was stored during the last purge cycle and has the same range as line 1 (DET).
NOISE	A 16-point running average of the noise portion of IR bench output. This reading is valuable mainly when refrigerant is <u>not</u> present.
AVEAU	Average Absorbency - Optical absorbency computed from the Average Detector Voltage and Zero Voltage. In the absence of selected gas, the absorbency is 0.000AU. When sampling desired gas, its value varies proportionally with the refrigerant concentration.
UM/L	uMoles/L - Absolute concentration in micro-moles per liter of gas based on NOISE and the internal calibration. There are two figures displayed: the first (annotated by a B) is the actual measurement at the IR bench. The second is the calculated value corrected to ambient conditions (temperature + pressure).
PPM	Parts Per Million is the volume concentration referenced to standard temperature and pressure and is computed from the Average Absorbency, Zero Temperature, and Ambient Pressure. There are two figures displayed. The first (annotated by a B) is the actual PPM at the IR bench. The second is a PPM reading normalized to standard temperature and pressure.
ZERO	Zero Temperature - Displays the sensor and enclosure temperature measured and stored during the last purge cycle in degrees C.
BENCH	Bench Temperature - Current IR sensor temperature in degrees C as well as the raw voltage coming from the temperature sensor. This value can range from ambient to ambient + 15 degrees C.
BOX	Box Temperature - Current internal enclosure temperature along with the raw voltage from the temperature sensor, and has the same range as Bench Temperature.
PRESS	Pressure - Current absolute manifold pressure in PSIA along with the output voltage of the pressure sensor. This value should always be 0.2 to 1.0 PSIA below Ambient Pressure (AMB).
VAC	Vacuum - The vacuum pressure is measured every purge cycle by closing all sample valves. Its value is typically 2.5 to 4.0 PSIA below Ambient Pressure (AMB).
AMB	Ambient - Ambient pressure is measured every purge cycle with the sample pump off and the manifold open. Its value is weather and altitude dependent and can range from 10.0 to 15.5 PSIA.
FAULT CODE	For fault code information, see the fault code list (Appendix C: Fault Codes on page 87).
y.yyyX	Calibration multiplier used when measuring concentration.
TCx.xxxx	Temperature Compensation - magnitude of voltage applied to sensor output (in volts). Factory use only.
MODBUS data	485 RX=x - Receive port number of bytes FUNC - Function 485 TX=x - Transmit port number of bytes REG=xxxxx - Register address

8 Quick Setups for Hand-Held Terminal (HHT)

Summaries of Zone Setup and Date/Time Setup have been included here for your convenience. For more detailed information about these setup procedures, please refer to their respective sections in this manual.

8.1 Time/Date Setup

Time and date is set from the **CONFIG OPTION** screen.

1. From the **Home** screen (**F1**), press the down arrow key three (3) times to display the **OPTION** screen:

NOTE

There is a short interval after the message WAITING ON READ FROM RLDS.

```
OPTION: 1
  1 = RLDS STATUS
  2 = RLDS FAULTS
  3 = RLDS CONFIG
```

2. Press the right arrow key and select **3**.
3. Press the down arrow key twice to display the **CONFIG OPTION** screen:

```
CONFIG OPTION: 1
  1 = RLDS CTRL
  2 = TIME/DATE
  3 = CALIB GASES
```

4. Press the right arrow key and select **2**.
5. Press the down arrow key twice to open the **TIME/DATE** screen:

```
1-DATE:  XX-XX-XX
1-TIME:  XX:XX:XX
```

NOTE

For TIME, enter military time only.

A change in the Time/Date on any one of the RLDS controllers changes ALL of the RLDS controllers on the network.

1. Press the right arrow key to edit the fields. The right and down arrow keys scroll downward through the list, while the left or up arrow keys will backspace the arrow so you may go back to change a field.
2. Press the up arrow key to scroll back up to the **CONFIG OPTION** screen to calibrate gases. Your changes are saved and the data is written when you scroll back up to the **CONFIG OPTION** screen.

8.2 Zone Setup

8.2.1 General Configuration 1 Screen

1. From the **CONFIG OPTION** screen, press the right arrow key and then press the **1** key for **RLDS CTRL**.
2. Press the down arrow key twice to display the **General Configuration 1** screen:

```
Ux:  ENABLED:DISABLED
Ux-  ZONES:  8
Ux-  MODEL:  300
Ux-  REV   :  1.12
```

NOTE

x is the RLDS currently being accessed.

3. Press the down arrow key to display the **General Configuration 2** screen:

8.2.2 General Configuration 2 Screen

```
U1:  NAME OF CONTROLLER

1 -  BUZZER:  NONE
1 -  AL  ACK:  MANUAL
```

NOTE

The "blank" line is used to provide a cursor so the user knows which character they are editing. The "." and "-" keys are used to scroll an individual character selection or numeric numbers can be entered directly.

1. Press the right arrow key to activate the **U1** field so you can change the name of the controller. Use the right and left arrow keys to move across the field to select each letter, and remember to use the "." and "-" keys to toggle letters.
2. Press the down arrow key to move from the **U1** field to the **BUZZER** field. The default for this field is set to **NONE**. Use the "." and "-" keys to scroll through the choices: NONE, ALARM, FAULT, LEAK, SPILL, EVAC, or MN OFF (monitor is offline and is no longer monitoring the refrigerant lines).

- Press the down arrow key to move from the **BUZZER** field to the **AL ACK** field. The default for this field is set to **MANUAL**, but it is recommended the setting be changed to **AUTO** so the zone can automatically reset itself after the condition clears.

NOTE

In MANUAL mode an alarm will not clear until it is acknowledged and the alarm condition is no longer active. Even if the alarm is no longer active and it has been acknowledged, it is not cleared until the next time that zone is read. On a 16-zone device this will take at least four (4) minutes.

- Press the down arrow key to scroll you to the next screen:

8.2.3 Zone Config Screen 1

The **Zone Configuration Screen 1** is used to configure an individual zone:

01: ZONE 01 LOC

01 - REFRIG:
01 - LENGTH:

- ZONE** (name) can be 1-12 characters and is an alphanumeric representation of the location of the zone.
- REFRIG** (refrigerant) is the gas being detected in that zone. The default is set to R134a and must be changed using the "." and "-" keys to select the appropriate refrigerant.
- LENGTH** (tubing length) is the total tubing length for that zone. Length is 500 feet for an active zone and 0 (zero) for a deactivated zone. The tubing range is 0-500 feet.

NOTE

The "blank" line is used to provide a cursor so the user knows which character they are editing. The "." and "-" keys are used to scroll an individual character selection or numeric numbers can be entered directly.

- Press the right arrow key to activate the **ZONE** (name of zone) field so you can change the name of the zone. Use the right and left arrow keys to move across the field to select each letter, and remember to use the "." and "-" keys to toggle letters.
- Press the down arrow key to move from the **ZONE** field to the **REFRIG** field. The default for this field is set to **R134a**, but use the "." and "-" keys to scroll through the refrigerant choices.

- Press the down arrow key to move from the **REFRIG** field to the **LENGTH** field. Enter the length of tubing for the zone.

NOTE

Set LENGTH to 0 (zero) for any zones not being used.

- Press the down arrow key to display the **Zone Config Screen 2**:

8.2.4 Zone Config Screen 2

01-ZONE TMP: xxx
01-ALM LEAK: xxx
01-ALM SPIL: xxx
01-ALM EVAC: xxx

This zone screen is where alarm levels for each zone are set. Each zone can be set to a different level for each of the values, and the values activate the relays inside the RLDS.

- 01** is the variable indicating which zone number you are working with. Use the up and down arrow keys to cycle through the active zones for each RLDS. Continue for the remaining zones until all zones are configured.
- ZONE TMP** is in degrees C
- ALM LEAK**= LEAK Level: Level to trigger a leak alarm in PPM. (Default is 100 with a range of 1-1000 PPM)
- ALM SPIL**= SPILL Level: Level to trigger a spill alarm in PPM. (Default is 300 with a range of 1-1000 PPM)
- ALM EVAC**= EVACUATE Level: Level to trigger an evacuate alarm in PPM. (Default is 500 with a range of 1-1000 PPM)

Press the down arrow from the **Zone Config Screen 2** to display the RLDS Configuration Option (CONFIG OPTION) screen. (**Section 11.4.3., RLDS Configuration Option (CONFIG OPTION) Screen**)

The **WAITING ON WRITE TO RLDS** message displays, and after a short interval prompts you to the **CONFIG OPTION** screen.

8.3 STATUS OPTION Screen

From the **STATUS OPTION** screen, you are able to check zone status (individual zones), ctrl status (overall controller status), and diagnostics (diagnostic zone data).

```
STATUS OPTION:
  1 = ZONE STATUS
  2 = CTRL STATUS
  3 = DIAGNOSTICS
```

To display **ZONE STATUS**: (individual zones), press the right arrow key and press **1**. Press the down arrow key twice. The **ZONE STATUS** screen displays:

8.3.1 Zone Status Screen

```
01: ZONE 01 LOC
1-01: 0 LEAK A
02: ZONE 02 LOC
1-02: A
```

ACKNOWLEDGING ALARMS:

Each status will be listed for each individual zone, and any alarms can be noted from here.

Press the down arrow key from the **Zone Status** screen to scroll through the status concentration for each of the zones in use. The PPM concentration will be shown, alarm/failure indication, and if the alarm is acknowledged. If the zone is normal (no alarm detected), the alarm/failure fields and alarm acknowledge field (where LEAK A appears) should be blank. In order to acknowledge the alarm, press the **CANCEL** key so the A appears next to the alarm.

LEAK, SPIL(L), or EVAC(UATE) will display if there is an alarm. If there is a flow problem (failure) for the zone, FLOW displays. A failure cannot be acknowledged--only LEAK, SPIL, or EVAC alarms can be acknowledged.

Press the down arrow key to scroll through and view all of the zones.

NOTE If the user selects a specific channel that is an alarm and presses the **CANCEL** key, the alarm will be acknowledged.

To display **CTRL STATUS**: (overall controller status), press the right arrow key and press **2**. Press the down arrow key twice. The **General Controller (CTRL STATUS)** screen displays:

8.3.2 General Controller (CTRL STATUS) Screen

```
Ux-MODE: NORMAL
Ux-STAT: <ZEROING: SAMPLE>
Ux-ALARM CNT:
Ux-ACT ZONE:
```

NOTE x is the RLDS.

If the user selects the **MODE** field they will be able to change the mode the zone is in. If the user selects the **ACT ZONE** field, the current zone being sampled can be changed.

The user can toggle the zone mode (in the **MODE** field) by pressing the right arrow key to activate the field and using the "." and "-" keys to select between **NORMAL, HOLD, and SERVICE**. If the zone is set to **HOLD** mode, the zone is continuously sampled.

Press the down or up arrow key to go back to the **STATUS OPTION** screen. Your changes are saved and data written upon scrolling back to the **STATUS OPTION** screen.

NOTE When setting up multiple zones in one area (such as a motor room), stagger these zones as they enter the RLDS. For example, if there are two motor rooms served by one RLDS, each motor room has three sensing zones. Make the first motor room zones 1, 3, and 5, and make the second motor room zones 2, 4, and 6. This will allow the leak detection system to return to that area being sensed more regularly. If the zone exists in a location where air flow will affect the dispersion of refrigerant, reduce the alarm limits to a lower level than usual. This will allow for dispersion of the refrigerant in the air.

9 *Hand-Held Terminal (HHT) for use with the Gateway and RLDS Controller*

The Hand-Held Terminal (HHT) connects directly to the Gateway and is used for the initial setup and to run the system. The HHT allows the user to make setpoint and setup adjustments during system start-up, and changes for routine or emergency maintenance. The HHT displays several screens for viewing leak system status, making control setpoint adjustments, and adjusting at what PPM an alarm should sound. Setpoint changes made through the HHT are transferred to the RLDS controller and overwrite any existing set points.

The HHT shares the communication port with the I/O Net, and while the HHT is plugged in you can get a momentary loss of communication on the I/O Net. This may result in concentrations, showing NONE momentarily.

9.1 HHT Key Operations

The arrow keys will be used to move between fields and screens.

Special Keys:

- **F1** - Save current changes and go back to Screen 1 (Home screen).
- **F2** - Save current changes and go back to Screen 3 (SELECT RLDS screen).
- **CANCEL** - Clear an edit field or acknowledge an alarm on the status screen.
- **ENTER** - Checks if the entry is valid.
- **Right arrow key** - moves to the next editable field or moves right one character in alpha name fields.
- **Left arrow key** - moves to the previous edit field or moves left one character in alpha name fields.
- **Down arrow key** - moves to the next edit field if one is selected or advances to the next screen if no edit field is selected.
- **Up arrow key** - moves to the previous edit field if one is selected or moves back to the previous screen if no field is selected.
- **."** - Toggle option select fields or scroll alpha characters for names, and acts as a decimal point for floating point numbers.

The period key is the lower-most button on the bottom left of the HHT.

- **"—"** - Toggle option select fields or scroll alpha characters for names, and acts as a minus sign for numeric entry.

The dash key is the lower-most button on the bottom right of the HHT.

NOTE

Editable fields are activated when the right arrow appears next to them.

10 Main Screens

10.1 Home Screen (F1 Screen)

Press **F1** at any point to save changes and display the **Home** screen:

```
RLDS GW-810-3760
VER: 1.10B04
FAIL: I/O NET
(PRESS DOWN ARROW)
```

The HHT is used to display the following on the **Home** screen:

- **RLDS GW-810-3760:** Model information
- **1.10B04:** Version number
- **FAIL: I/O NET:** Displays the operation mode on the third line of the HHT screen. This indicates which type of area controller the RLDS Gateway is attached to. The dip switch 8 is set to ON or OFF. ON = REFLECS, OFF = E2, Einstein. If a failure condition exists with the RLDS Gateway, this line shows one of the following failure messages:
 - **FAIL: I/O NET** indicates that no communication with the I/O Net exists, and that communication between the controllers is down.
 - **FAIL: FLASH/CLK** indicates the hardware is bad and the Gateway should be replaced.
 - **FAIL: USER CFG** indicates that no RLDS units have been found on the network, and have not been configured by the user.
 - **FAIL: RLDS CTRL** indicates that one or more RLDS controllers are down.
- **PRESS DOWN ARROW** indicates what to do next

NOTE

Pressing the down arrow scrolls you to the next screen.

10.2 RLDS Enable Screen

The second screen will show whether a particular unit is enabled, disabled, or unknown. When the RLDS Gateway first powers up it will show UNKOWN for all units. It will then start scanning for each unit. If it finds a unit, it marks it as ENABLED.

If an RLDS is not present on the network, the user can mark that RLDS as DISABLED to prevent the Gateway from scanning for that unit. When the unit is disabled, the Gateway stops trying to access the RLDS controller and does not respond to the association request on the I/O Network.

```
RLDS LIST:
RLDS1: ENABLED
RLDS2: DISABLED
RLDS3: DISABLED
```

Press the down arrow to go to the next screen:

10.3 SELECT RLDS Screen (F2 Screen)

Press **F2** at any point to save changes and display the **SELECT RLDS** screen:

```
SELECT RLDS: 1
LDS1: ONLINE
RLDS2: DISABLED
RLDS3: DISABLED
```

NOTE

SELECT RLDS: 1 defaults to 1.

The **F2 screen** allows you to select the desired RLDS. The F2 screen shows the general **ONLINE** or **OFFLINE** status for the enabled RLDS controllers. **ONLINE** means the Gateway is successfully communicating with an enabled RLDS controller. If it is unknown whether an RLDS is present on the network, the screen will display **UNKNOWN**.

Select the desired RLDS by pressing the right arrow key and selecting the desired RLDS number. Press the down arrow key to prompt you to the **Operation Select (OPTION)** screen.

The **WAITING ON READ FROM RLDS** message displays, and after a short delay prompts you to the Operation Select (OPTION) screen.

10.4 Operation Select (OPTION) Screen

The **Operation Select (OPTION)** screen enables the user to select the following entry points:

OPTION: 1
1 = RLDS STATUS
2 = RLDS FAULTS
3 = RLDS CONFIG

NOTE

OPTION: 1 defaults to 1.

Press the right arrow key to enable you to change the number selection next to **OPTION**. When a right arrow appears after **OPTION**, press the number key of the desired screen (**1, 2, or 3**). Press the down arrow key twice to display the selected screen.

- Select **1** to access the **RLDS STATUS** screen. See **Section 10.5, STATUS OPTION Screen**.
- Select **2** to access the **RLDS FAULTS** screen. See **Section 10.4.2, RLDS FAULTS (SYSTEM FAULTS) screen**.
- Select **3** to access the **RLDS CONFIG** screen. See **Section 10.4.3, RLDS Configuration Option (CONFIG OPTION) Screen**.

10.4.1 RLDS STATUS (STATUS OPTION) Screen

The **STATUS OPTION** screen allows you to check individual zones, overall controller status, and diagnostic data. Refer to **Section 10.5, STATUS OPTION Screen** to find out more information about accessing these screens.

STATUS OPTION:
1 = ZONE STATUS
2 = CTRL STATUS
3 = DIAGNOSTICS

- **ZONE STATUS** gives status on individual zones. See **Section 10.5.1, Zone Status Screen**.
- **CTRL STATUS** is overall controller status. See **Section 10.5.2, General Controller (CTRL STATUS) Screen**.
- **DIAGNOSTICS** is diagnostic zone data. See **Section 10.5.3, DIAGNOSTICS Screen 1: Sensor Data Register**.

10.4.2 RLDS FAULTS (SYSTEM FAULTS) screen

From the **Operation Select (OPTION)** screen, (**Section 10.4, Operation Select (OPTION) Screen**) select **RLDS FAULTS** by pressing the right arrow key, selecting **2**, and pressing the down arrow key twice.

The **RLDS FAULTS** screen will display a list of the system failures associated with the selected RLDS. One failure will be displayed on each line.

NOTE

Once a fault is detected and repaired, the unit will go through an entire cycle and the fault will clear itself and return to normal.

SYSTEM FAULTS

The following are failure messages that are used:

- **CLIPPNG FAULT** - A/D out of range
- **ZERO FAULT** - Zero voltage outside factory limits
- **NO FLOW** - No flow on any zone
- **PURGE FLOW** - No flow on purge
- **ZONE FLOW** - No flow on one or more zones
- **TRIGGER FAULT** - IR Source clock trigger missing
- **CONFIG FAULT** - No zones enabled
- **LOOP FAULT** - Open current loop
- **PRESSURE RANGE** - Pressure out of range
- **BENCH TEMP** - Bench temperature out of range
- **BOX TEMP** - Box temperature fault

10.4.3 RLDS Configuration Option (CONFIG OPTION) Screen

From the **Operation Select (OPTION)** screen, (**Section 10.4**) select **RLDS CONFIG** by pressing the right arrow key, selecting **3**, and pressing the down arrow key twice. The **CONFIG OPTION** screen displays and allows the user to configure the selected RLDS:

```
CONFIG OPTION: 1
  1 = RLDS CTRL
  2 = TIME/DATE
  3 = CALIB GASES
```

Press the right arrow key to enable you to change the number selection that appears next to **CONFIG OPTION**. When a right arrow appears after **CONFIG OPTION**, press the number key of the desired screen (**1, 2, or 3**). Press the down arrow key twice to display the selected screen.

- Select **1** to access the General Configuration 1 Screen. See **Section 10.4.4, General Configuration 1 Screen**.
- Select **2** to access the Time/Date screen. See **Section 10.4.8, Time/Date Screen**.
- Select **3** to access the Calibrate/Refrigerant screens. See **Section 10.4.9, Calibrate Gas Screen 1**.

10.4.4 General Configuration 1 Screen

From the **CONFIG OPTION** screen, press the right arrow key and then press the **1** key for **RLDS CTRL**. Press the down arrow key twice to display the **General Configuration 1 (a non-editable)** screen:

```
Ux: ENABLED:DISABLED
Ux- ZONES: 8
Ux- MODEL: 300
Ux- REV : 1.12
```

NOTE x is the RLDS currently being accessed.

Press the down arrow key to display the **General Configuration 2** screen:

10.4.5 General Configuration 2 Screen

```
U1: NAME OF CONTROLLER

1 - BUZZER: NONE
1 - AL ACK: MANUAL
```

NOTE The "blank" line is used to provide a cursor so the user knows which character they are editing. The "." and "-" keys are used to scroll an individual character selection or numeric numbers can be entered directly.

Press the right arrow key to activate the **U1** field so you can change the name of the controller. Use the right and left arrow keys to move across the field to select each letter, and remember to use the "." and "-" keys to toggle letters.

Press the down arrow key to move from the **U1** field to the **BUZZER** field. The default for this field is set to **NONE**. Use the "." and "-" keys to scroll through the choices: **NONE, ALARM, FAULT, LEAK, SPILL, EVAC, or MN OFF** (monitor is offline and is no longer monitoring the refrigerant lines).

Press the down arrow key to move from the **BUZZER** field to the **AL ACK** field. The default for this field is set to **MANUAL**, but it is recommended the setting be changed to **AUTO** so the zone can automatically reset itself after the condition clears.

NOTE In **MANUAL** mode, an alarm will not clear until it is acknowledged and the alarm condition is no longer active. Even if the alarm is no longer active and it has been acknowledged, it is not cleared until the next time that zone is read. On a 16-zone device this will take at least four (4) minutes.

The down arrow key will scroll you to the next screen:

10.4.6 Zone Config Screen 1

The **Zone Configuration Screen 1** is used to configure an individual zone:

01: ZONE 01 LOC

01 - REFRIG:

01 - LENGTH:

- **ZONE** (name) can be 1-12 characters and is an alphanumeric representation of the location of the zone.
- **REFRIG** (refrigerant) is the gas being detected in that zone. The default is set to **R134a** and must be changed using the "." and "-" keys to select the appropriate refrigerant.
- **LENGTH** (tubing length) is the total tubing length for that zone. Length is **500 feet** for an active zone and 0 (zero) for a deactivated zone. The tubing length range is **0-500 feet**.

NOTE

The "blank" line is used to provide a cursor so the user knows which character they are editing. The "." and "-" keys are used to scroll an individual character selection or numeric numbers can be entered directly.

Press the right arrow key to activate the **ZONE** (name of zone) field so you can change the name of the zone. Use the right and left arrow keys to move across the field to select each letter, and remember to use the "." and "-" keys to toggle letters.

Press the down arrow key to move from the **ZONE** field to the **REFRIG** field. The default for this field is set to **R134a**, but use the "." and "-" keys to scroll through the refrigerant choices.

Press the down arrow key to move from the **REFRIG** field to the **LENGTH** field. Enter the length (**1' to 500'**) of tubing for the zone.

NOTE

Set LENGTH to 0 (zero) for any zones not being used.

10.4.7 Zone Config Screen 2

01-ZONE TMP: xxx
01-ALM LEAK: xxx
01-ALM SPIL: xxx
01-ALM EVAC: xxx

This zone screen is where alarm levels for each zone are set. Each zone can be set to a different level for each of the values, and the values activate the relays inside the RLDS.

01 is the variable indicating which zone number you are working with. Use the up and down arrow keys to cycle through the active zones for each RLDS. Continue for the remaining zones until all zones are configured.

- **ZONE TMP** is in degrees C
- **ALM LEAK**= LEAK Level: Level to trigger a leak alarm in PPM. (Default is 100 with a range of 1-1000 PPM)
- **ALM SPIL**= SPILL Level: Level to trigger a spill alarm in PPM. (Default is 300 with a range of 1-1000 PPM)
- **ALM EVAC**= EVACUATE Level: Level to trigger an evacuate alarm in PPM. (Default is 500 with a range of 1-1000 PPM)

Press the down arrow from the **Zone Config Screen 2** to display the **RLDS Configuration Option (CONFIG OPTION)** screen. (**Section 10.4.3**)

NOTE

When setting up multiple zones in one area (such as a motor room), stagger these zones as they enter the RLDS. For example, if there are two motor rooms served by one RLDS, each motor room has three sensing zones. Make the first motor room zones 1, 3, and 5, and make the second motor room zones 2, 4, and 6. This will allow the leak detection system to return to that area being sensed more regularly. If the zone exists in a location where air flow will affect the dispersion of refrigerant, reduce the alarm limits to a lower level than usual. This will allow for dispersion of the refrigerant in the air.

10.4.8 Time/Date Screen

From the **CONFIG OPTION** screen, set the time and date. Press the right arrow key and select **2**. Press the down arrow key twice to open the **TIME/DATE** screen:

```
1-DATE:  xx-xx-xx
1-TIME:  xx:xx:xx
```

NOTE For TIME, enter military time only.

A change in the Time/Date on any one of the RLDS controllers changes ALL of the RLDS controllers on the network.

Press the right arrow key to edit the fields. The right and down arrow keys scroll downward through the list, while the left or up arrow keys will backspace the arrow so you may go back to change a field.

Press the up arrow key to scroll back up to the **CONFIG OPTION** screen to calibrate gases. Your changes are saved and the data is written when you scroll back up to the **CONFIG OPTION** screen.

10.4.9 Calibrate Gas Screen 1

CAUTION The Calibrate Gas screens are rarely used. Before modifying values in the Calibration screens, contact your Copeland representative for Correction Values.

The Calibrate Data message is used to calibrate the gases used. It is read only if the user enters the configuration screen for HHT screens.

From the **CONFIG OPTION** screen, press the right arrow key and then press the **3** key for **CALIB GASES**. Press the down arrow key twice and wait for the **WAITING ON READ FROM RLDS** message to clear to display the Calibration Gas screens.

```
x - R11: xxx.x
x - R12: xxx.x
x - R22: xxx.x
x - R23: xxx.x
```

NOTE User enter a floating point number for x.

Press the down arrow key so the **Calibrate Gas Screen 1** will cycle through all gases and view the available gases in the

gas library. Press the down arrow key to cycle **Calibrate Gas screens 2 and 3** to complete the calibration process:

10.4.10 Calibrate Gas Screen 2

```
1 - CURVE 1: xxx
1 - CURVE 2: xxx
1 - CURVE 3: xxx
<blank>
```

NOTE User enter a curve number for New Gas Type 1 for x.

Use the "." and "-" keys to scroll through the supported gas/refrigerants.

Press the down arrow key:

10.4.11 Calibrate Gas Screen 3

User can select names for each new gas/refrigerants by pressing the right arrow key to activate the field and using the "." and "-" keys to toggle the letters.

```
1:  NEW GAS1
2:  NEW GAS2
3:  NEW GAS3
```

Press the down arrow key:

Calibrate Gas Screen 3 Continued

```
3:  NEW GAS3
```

The default gas name is **NEW GAS1**.

NOTE The "blank" line is used to provide a cursor so the user knows which character they are editing. The user can use "." and "-" keys to scroll an individual character selection or numeric numbers can be entered directly.

Pressing the down arrow key brings you back to the **CONFIG OPTION** screen. To move back to the **STATUS OPTION** screen, first press the up arrow key to go back to the **OPTION** screen and select **1** for **RLDS STATUS**. You should now be back at the **STATUS OPTION** screen.

10.5 STATUS OPTION Screen

From the **STATUS OPTION** screen, you are able to check zone status (individual zones), ctrl status (overall controller status), and diagnostics (diagnostic zone data).

```
STATUS OPTION:
  1 = ZONE STATUS
  2 = CTRL STATUS
  3 = DIAGNOSTICS
```

To display **ZONE STATUS: (individual zones)**, press the right arrow key and press **1**. Press the down arrow key twice. The **ZONE STATUS** screen displays.

10.5.1 Zone Status Screen

```
01: ZONE 01 LOC
1-01: 0 LEAK A
02: ZONE 02 LOC
1-02: A
```

The PPM count, alarm status, and alarm acknowledge information is displayed for each individual zone.

Press the down arrow key from the **Zone Status** screen to scroll through the status concentration for each of the zones in use. The PPM concentration will be shown, alarm/failure indication, and if the alarm is acknowledged. If the zone is normal (no alarm detected), the alarm/failure fields and alarm acknowledge field (where LEAK A appears) should be blank.

ACKNOWLEDGING ALARMS

In order to acknowledge an alarm, press the left or right arrow keys to select the zone and then press the **CANCEL** key so the **A** appears next to the alarm. When the **A** appears, the alarm has been acknowledged.

LEAK, SPIL(L), or EVAC(UATE) will display if there is an alarm. If there is a flow problem (failure) for the zone, **FLOW** displays. A failure cannot be acknowledged--only LEAK, SPIL, or EVAC alarms can be acknowledged.

Use the down arrow key to scroll through and view all of the zones.

After you have scrolled through the zones you are back at the **STATUS OPTION** screen where you can make another selection.

To display **CTRL STATUS: (overall controller status)**, press the right arrow key and press **2**. Press the down arrow key twice. The **General Controller (CTRL STATUS)** screen displays:

10.5.2 General Controller (CTRL STATUS) Screen

```
Ux-MODE: NORMAL
Ux-STAT: <ZEROING: SAMPLE>
Ux-ALARM CNT:
Ux-ACT ZONE:
```

NOTE

x is the RLDS..

If the user selects the **MODE** field they will be able to change the mode the zone is in. If the user selects the **ACT ZONE** field, the current zone being sampled can be changed.

The user can toggle the zone mode (in the **MODE** field) by pressing the right arrow key to activate the field and using the "." and "-" keys to select between **NORMAL, HOLD, and SERVICE**. If the zone is set to **HOLD** mode, the zone is continuously sampled.

Press the down or up arrow key to go back to the **STATUS OPTION** screen. Your changes are saved and data written upon scrolling back to the **STATUS OPTION** screen.

To display **DIAGNOSTICS: (diagnostic zone data)**, press the right arrow key and press **3**. Press the down arrow key twice. The first screen in a series of seven displays:

10.5.3 DIAGNOSTICS Screen 1: Sensor Data Register

NOTE

Please refer to Section 8.10.2., Diagnostic Screen Overview for a complete list of values and definitions.

DIAGNOSTIC INFO

x-PRESS :
x-P VOLT :
x-VAC P :

- **PRESS** is the current absolute manifold pressure in PSIA along with the output voltage of the pressure sensor. This value should always be **0.2 to 1.0 PSIA below ambient**.
- **P VOLT** is pressure sensor output voltage.
- **VAC P** is the current absolute manifold pressure in PSIA along with the output voltage of the pressure sensor. This value should always be **0.2 to 1.0 PSIA below ambient**.

Press the down arrow key to display the second screen:

10.5.4 Screen 2: Sensor Data Register

x-BOX T :
x-BOX V :
x-BNCH T :
x-BNCH V :

- **BOX T** is enclosure temperature in degrees C along with the raw voltage from the temperature sensor.
- **BOX V** is box temperature sensor output voltage.
- **BNCH T** is optical bench temperature in degrees C. The current IR sensor temperature in degrees C as well as the raw voltage coming from the temperature sensor itself. This value can range from **ambient to ambient + 15 degrees C**.
- **BNCH V** is bench temperature sensor output voltage.

Press the down arrow key to display the third screen:

10.5.5 Screen 3: Sensor Data Register

x-AMB P :
x-BNCH Z :
x-BOX Z :

- **AMB P** is measured every purge cycle with the sample pump off and the manifold open. Its value is weather and altitude dependent and can range from 10.0 to 15.5 PSIA.
- **BNCH Z** is optical bench temperature in degrees C at last zero interval.
- **BOX Z** is box temperature in degrees C at last zeroing.

Press the down arrow key to display the fourth screen:

10.5.6 Screen 4: Sensor Data Register

x-PEAK C :
x-PEAK V :
x-AVG V :
x-ZERO V :

- **PEAK C** is the current peak to peak A/D counts from detector.
- **PEAK V** is the current peak to peak voltage from detector.
- **AVG V** is the running average voltage from detector.
- **ZERO V** is the voltage measured at last zeroing and the IR sensor output that was stored during the last purge cycle.

Press the down arrow key to display the fifth screen:

10.5.7 Screen 5: Sensor Data Register

x-NOISE :
x-AU :
x-AVG AU :
x-BNCH P :

- **NOISE** is the largest change in running average: 16-point running average of the noise portion of IR bench output. This reading is valuable mainly when refrigerant is NOT present.
- **AU** is the current absorbance value.
- **AVG AU** is the running average of absorbance level (Average Absorbency). In the absence of refrigerant, the absorbency is **0.000AU**. When sampling refrigerants, its value varies proportionally with the refrigerant concentration.
 - **BNCH P** is PPM in bench, based on zone gas selection (uncorrected).

Press the down arrow key to display the sixth screen:

10.5.8 Screen 6: Sensor Data Register

```
x-STPPM:  
x-BNCH L:  
x-AMB L :
```

- **STPPM** is PPM corrected to STP (1 atm, 25 degrees C).
- **BNCH L** is micromoles/liter in bench (uncorrected).
- **AMB L** is micromoles/liter corrected to ambient pressure.

Press the down arrow key to display the seventh screen:

10.5.9 Screen 7: Communication Statistics

```
SENT TRY NO  
1: <ct> <ct> <ct>  
2: <ct> <ct> <ct>  
3: <ct> <ct> <ct>
```

- **SENT** is total messages sent.
- **TRY** is number of retries needed for a message.
- **NO** is no response after all four tries.
- **1: <ct> <ct> <ct>** is RLDS 1 count for each statistic.
- **2: <ct> <ct> <ct>** is RLDS 2 count for each statistic.
- **3: <ct> <ct> <ct>** is RLDS 3 count for each statistic.

Press the down arrow key to go back to the **STATUS OPTION** screen. Your changes are saved and the data is written. Statistics are cleared on reset.

11 RLDS Setup on REFLECS, E2, Einstein, and Supervisory Controllers

Dip switch 8 on the Gateway should be set to the OFF position for E2, Einstein, Supervisory controllers, and set to the ON position for REFLECS controllers.

11.1 REFLECS Setup for RLDS

Set **dip switch 8** to **ON** and follow the steps for setting up RLDS units through the REFLECS controller interface:

1. Log on.
2. Press **7** for Configuration to reach the **CONFIGURATION** screen.

Input Definitions should be set here to show how the sensor control is linked to the zone. The number of devices and RLDS units are connected to the Gateway and enabled is the number of address slots the Gateway will use.

1. Press **1** for Input Definitions to reach the **INPUT DEFINITIONS** screen.
2. Pressing the down arrow several times will get you to the input list of SENS01-48. Bd (board) is the address of the Gateway, Pt (point) is the zone and allows you to define where the sensor input comes from.

The board number for the RLDS setup is the address of the Gateway. If there are three or less RLDS controllers connected to a Gateway, the Gateway address = the RLDS address. However, if there are more than three RLDS controllers, the second Gateway address will be the one entered for the board number, but the RLDS controllers are set 1 to 3 on the second Gateway.

1. Press **0 (zero)** to go back to the **CONFIGURATION** screen.
2. Press **7** for **I/O Brd Setup** to reach the **I/O BOARD MENU** screen.
3. Press **2** to **Set Device #'s**.

The Gateway will react as three 16AI boards. The number of RLDS controllers plus the real number of 16AIs = the total number of 16AIs to enter in the next step:

1. At the **I/O BOARD DEVICE NUMBERS** screen, press the down arrow key to reach Number 16AI Boards and enter the number of how many 16AI boards and RLDS controllers there are. Press Enter.
2. Arrow down to the **I/O BOARD MENU** and press **0 (zero)** twice to go back to the **MAIN MENU** screen.
3. Press **4** for **Sensor Control**.
4. Press **2** for **Setup**—up to 48 sensor control programs are allowed. Select one of the 48 units and press **Enter** to reach the **SENSOR SETUP** screen.

5. Press the right arrow to move to the Name field to change the name, and press the down or right arrow to move to the **(sensor) Type** field. Use the “.” and “—” keys to scroll through the options and select IRLDS.
6. Use the arrow keys to move off the active fields and press **0 (zero)** twice to go back to the main screen.

11.2 E2 Version 3.01 and below Setup for RLDS (without Gateway)

Set **dip switch 8** to **OFF** and follow the steps for setting up RLDS units through the E2 controller interface

1. Log in to the E2 with Level 4 access.
2. Press **Menu** & **7** & **7** & **2** - **Connected I/O Boards and Controllers**.

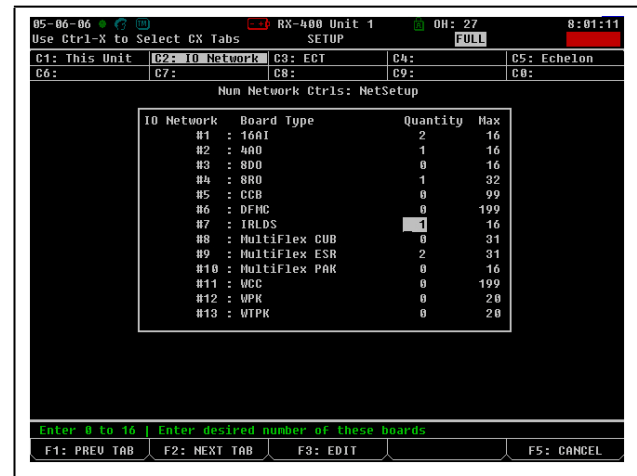


Figure 11-1 - Connected I/O Setup Screen

3. Under the I/O Network tab, set the number of desired RLDS controllers under IRLDS.
4. Press the **Home** key to return to the E2 home screen and save changes.
5. Set the **Gateway to 1**. Each Gateway can handle three RLDS controllers, so if four RLDS controllers are on the network, two Gateways are needed. The first Gateway will be address 1 and the RLDS units are numbered as 1,2,3. The second Gateway will be addressed as 4, but the RLDS is set to 1 because all units on the Gateway are numbered sequentially 1 to 3. The RLDS controllers are always numbered 1 to 3 when connected to the Gateway.

To see a summary of RLDS controllers on the network:

1. Press **Menu** **5** - **Configured Applications**.
2. Select **185**. for **IR Leak Detection**.

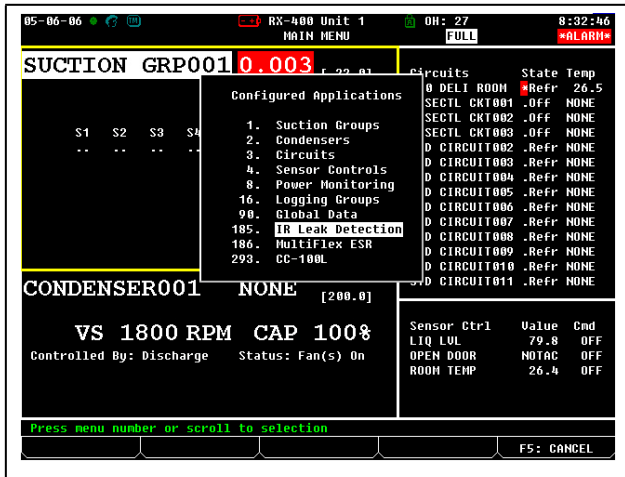


Figure 11-2 - Configured Applications

3. The leak detectors are listed on the status screen. Press the down arrow to highlight a unit and **F5** to go to the setup screen to enter channel, zone information, and more.

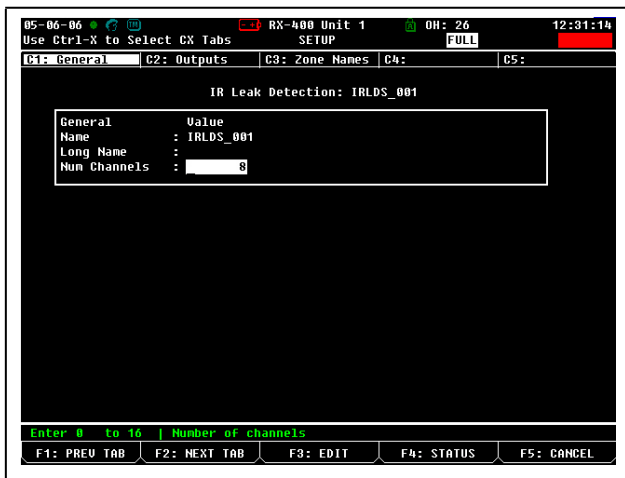


Figure 11-3 - RLDS Application Setup Screen

4. Einstein Setup for RLDS
5. Set **dip switch 8** to **OFF** and follow the steps for setting up RLDS units through the Einstein controller interface:
6. Log on.
7. Press **F8** for **ACTIONS**.
8. Press **Y** for **System Setup**.
9. Press **4** for **Network Status/Setup**.
10. Press **2** for **Connected I/O Boards & Controllers** to open the **Network Setup** screen.
11. Under **Boards on I/O Network**, set the RLDS number under IRLDS Controllers.

12. Press **F9 HOME** to go back to the **Home** screen.
13. Set the **Gateway** to **1**. Each Gateway can handle three RLDS controllers, so if four RLDS controllers are on the network, two Gateways are needed. The first Gateway will be address 1 and the RLDS units are numbered as 1, 2, 3. The second Gateway will be addressed as 4, but the RLDS is set to 1 because all units on the Gateway are numbered sequentially 1 to 3. The RLDS controllers are always numbered 1 to 3 when connected to the Gateway.

To see a summary of RLDS controllers on the network:

1. Press **F5** for **MORE**.
2. Press **L** for **Leak Detection**.
3. The leak detectors are listed under **See Summary**. Press the down arrow to highlight a unit and press **Enter** to show the summary of units listed.

The status screen for the selected RLDS controller is shown.

1. **F8** for **ACTIONS**.
2. Press **B** for **Setup**--name the RLDS in the **Name** field.
3. Press the down arrow to the **Num Channels** field to add the number of zones.
4. Press **F10** to go back and see the current status of the zones.
5. Press **F9 HOME** to go back to the **Home** screen.

11.3 Supervisory Controller Setup for RLDS

1. Click the **Control Inventory** icon.
2. Scroll down to the **Other** category and click **Add Control**.
3. Select **RLDS** to add an instance to the program.

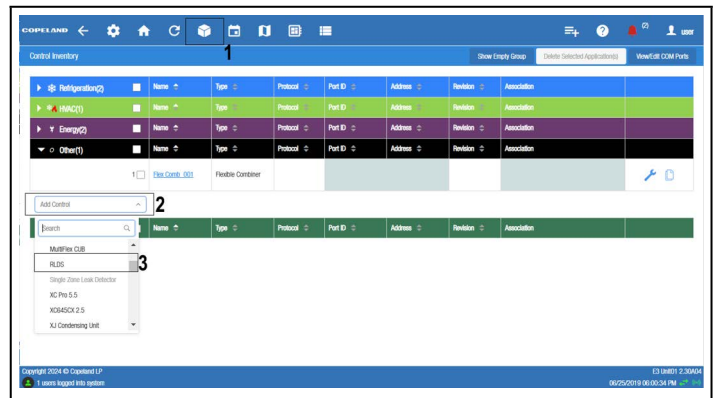


Figure 11-4 - Set up RLDS in the Supervisory Controller

11.3.1 Adding Application

1. Indicate the Name and association, Modbus port number and the address. Click **Update** or **Save Changes** to save.

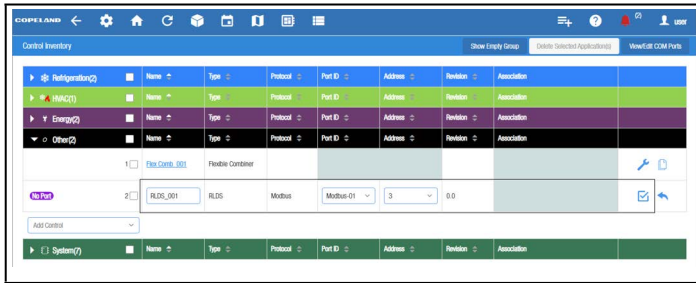


Figure 11-5 - Add the RLDS Application to the Supervisory Controller

11.3.2 Edit Application

1. Once the RLDS has been added, click the application name to view parameters.

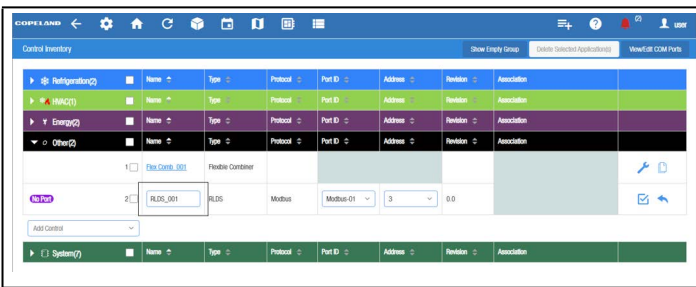


Figure 11-6 - Edit RLDS Application in the Supervisory Controller

11.3.3 General

1. Set up the RLDS Application by going to the **General** tab.
2. Click **Edit** button to configure the parameters.
3. Set the **Number of Zones**.

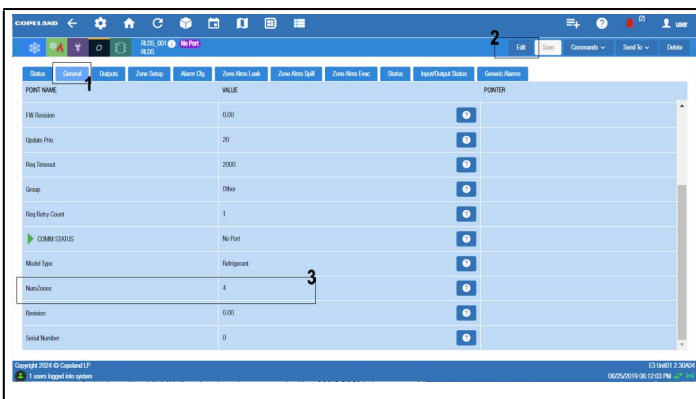


Figure 11-7 - RLDS Application General Tab

11.3.4 Zone Setup

1. Click **Zone Setup** tab.
2. Set the **Refrigerant Type**.

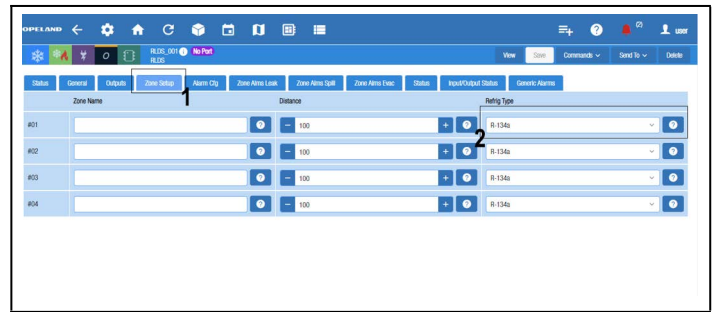


Figure 11-8 - RLDS Zone Setup Tab

11.3.5 Zone Alarms Leak/Spill/Evac

1. Click **Zone Alms Leak**, **Zone Alms Spill**, and **Zone Alms Evac** tab to configure the setpoints.
2. Set the **Leak/Spill/Evac** setpoint for each zone:
Default values are **Leak = 100**, **Spill = 300**, and **Evac = 500**.

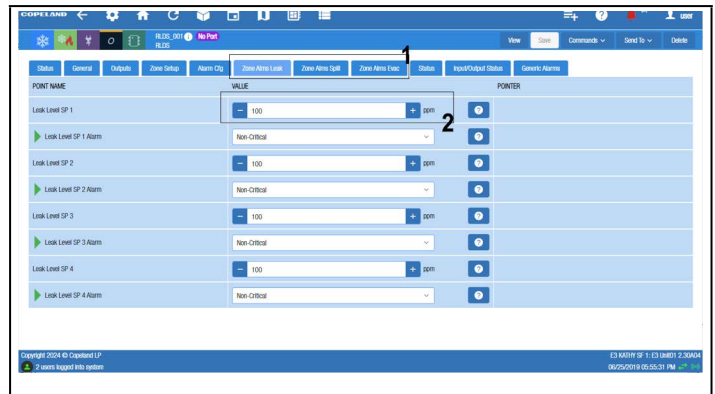


Figure 11-9 - RLDS Zone Alarms

12 RLDS Maintenance

12.1 Warnings and Cautions



WARNING

Shock hazard! Always disconnect the power supply before opening these enclosure of the monitor.



WARNING

The AC Power ground wire must first be connected to the monitor's ground stud. Under no circumstances should this monitor be operated without a protective ground. Doing so poses a potential hazard, and is a violation of electrical safety standards applicable to this type of equipment.



WARNING

Electrical installation should be performed by a certified electrician, and must comply with all applicable NEC/CEC and local safety codes.

IMPORTANT

The RLDS contains sensitive electronic components that can be easily damaged. Do not touch or disturb any components. Do not dislodge electrical wiring or pneumatic tubing.

12.2 Replacement Parts Overview

Table 12-1 - Replacement Parts



Part Name	P/N	Description	
Charcoal Filter	275-0275	The charcoal filter removes refrigerant gas from the purge-air stream during the purging process. Replace the charcoal filter (P/N 275-0275) approximately every 6 months, when a zero filter fault occurs (fault code <0100>), or after the monitor has been exposed to unusually high levels of refrigerant gas, such as after an evacuation alarm.	
Hydrophobic Filter	572-0980	The hydrophobic filter prevents water from entering the IR detector. A zone flow fault will occur (fault code <0800>) if this filter becomes blocked. Replace the hydrophobic filter as required (P/N 572-0980).	
Air Line Tubing	270-4401 250ft 270-4402 500ft 270-4403 1000ft	The gas sample line and optional exhaust line should be periodically checked for obvious signs of kinks, damage and contamination. Replace the tubing as required.	

Table 12-1 - Replacement Parts

Line End Filter Assembly	275-0242	The gas-sample line filter and purge-line termination filters prevent dust and dirt from entering the monitor. Both of the filters should be periodically checked and replaced when there are obvious signs of contamination.	
Line End Filter	275-0315	A zone flow fault will occur (fault code <0800>) if the gas-sample line filter becomes blocked A purge flow auto will occur (fault code <1000>) if the purge-line filter becomes blocked. Remove the filter from the line and replace it with a new one.	
End-of-Line Water Stop	275-0315	The end-of-line water stops prevent contaminants and moisture from entering the monitor. This filter should be periodically checked and replaced when there are obvious signs of contamination.	
Water Trap	275-0234	The water trap removes moisture that enters tubing before allowing it to enter the internal components of the RLDS unit. The water trap should be emptied often as condensate accumulates. The water trap filter should be periodically checked and replaced when there are obvious signs of contamination.	
Fuses	275-0250	The RLDS is protected from electrical damage by two, 1A, 250 V, type "F" fuses. Locate the fuse holders and carefully remove the fuses from their holders. Inspect and test the fuses with an ohm meter for continuity. Replace the fuses as required.	
Clock Battery	204-0020	The clock battery maintains the correct date and time when AC power is not applied to the monitor. Replace this battery approximately every 5 years. Battery shelf life is 10 years.	
Sample Pump	275-0263	The sample pump draws the gas sample into the monitor through the IR detector and discharges the sample via the exhaust port. To replace the pump, remove the inlet and outlet tubing, disconnect the AC power wires from the pump and remove the pump from the monitor. Install a new sample pump.	
Intake Manifold Kit	275-1000	Up to three additional intake manifolds (4 zones each) can be installed in the RLDS to increase the total capacity to 16 zones. Each manifold requires a 4-zone line end filter kit (275-0242). (Follow the instructions provided to install the manifolds. Then follow the instructions earlier in this manual to install the air lines and complete the zone programming steps. The RLDS setup must also be updated to recognize the new zones.)	
4-20 mA DC Interface Board	275-0030	The optional 4-20 mA DC Interface Board allows the operator to take advantage of the current loop interfaces provided for connection of external devices to the RLDS. The interface board plugs into the sockets provided on the valve/pump drive PCB, and the external devices are then cabled to the RLDS as described earlier in this manual.	

12.3 Replacement Parts and Optional Accessories

Replacement Parts

Item Description	Part Number
RLDS 4 Zone, 5 line-end filters, charcoal filter, t-bolt bracket, 120/240 VAC 50/60 Hz	808-2004
RLDS 4 Zone, 5 line-end filters, charcoal filter, t-bolt bracket, 120/240 VAC 50/60 Hz, with HHT and Gateway	808-2005
RLDS 8 Zone, 9 line-end filters, charcoal filter, t-bolt bracket, 120/240 VAC 50/60 Hz	808-2008
RLDS 8 Zone, 9 line-end filters, charcoal filter, t-bolt bracket, 120/240 VAC 50/60 Hz, with HHT and Gateway	808-2009
RLDS 12 Zone, 13 line-end filters, charcoal filter, t-bolt bracket, 120/240 VAC 50/60 Hz	808-2012
RLDS 12 Zone, 13 line-end filters, charcoal filter, t-bolt bracket, 120/240 VAC 50/60 Hz, with HHT and Gateway	808-2013
RLDS 16 Zone, 17 line-end filters, charcoal filter, t-bolt bracket, 120/240 VAC 50/60 Hz	808-2016
RLDS 16 Zone, 17 line-end filters, charcoal filter, t-bolt bracket, 120/240 VAC 50/60 Hz, with HHT and Gateway	808-2017
RLDS 16 Zone, 17 line-end filters, charcoal filter, t-bolt bracket, 120/240 VAC 50/60 Hz	808-2018
RLDS Gateway	810-3760
RLDS 4 Zone Expansion Kit	573-0000
Filter: Hydrophobic (Internal)	572-0980
Filter: Charcoal, Zero Air	275-0275
Filter: End of Line – Assembly (Termination/gas sample line)	275-0300
Filter: End-of-Line (Filter Only)	275-0315
Filter: End-of-line water stop	275-0233
Charcoal Filter Mounting Bracket	275-0236
Fuse: 1.0 A, 250 V, Type “F”	275-0250
Replacement Pump	275-0263
Tubing: 1/4 in OD (For RLDS and CO2; by the foot)	270-0810
IR Bench Replacement Kit (RLDS)	275-0254
IR Bench Replacement Kit (CO2)	275-0291
Universal Power Supply	275-0259
Main PC Board Replacement	275-0261
Key Pad PC Board	275-0251
Display PC Board	275-0258
Power Entry PC Board	275-0259
Solenoid Valve Manifold Drive PC Board	275-0256
5 Port Solenoid Block (for RLDS and CO2: Zones 1-4 and purge port)	275-0252
4 Port Solenoid Block (for RLDS and CO2: Zones 1-4)	275-0253

Optional Accessories

Item Description	Part Number
Interface Board, 4-20 mA	275-0030
Variable Flow Regulator	275-0283
Four Zone Expansion Kit (must order filters 275-0300 in conjunction with kit)	573-0000
Four Zone End-of-Line Filter Kit	275-0300
Splitter Kit (2-way)	275-0304
Splitter Kit (3-way)	275-0305
Annual Maintenance Kits	
4 Zone (5 line end filters, 1 charcoal filter, 1 hydrophobic, 3 end-of-line water stop filters)	275-0237
8 Zone (9 line end filters, 1 charcoal filter, 1 hydrophobic, 3 end-of-line water stop filters)	275-0238
12 Zone (13 line end filters, 1 charcoal filter, 1 hydrophobic, 3 end-of-line water stop filters)	275-0239
16 Zone (17 line end filters, 1 charcoal filter 1 hydrophobic 3 end-of-line water stop filters)	275-0240
Gases	
R-22 Gas Cylinder, 100 PPM	275-0284
R-134a Gas Cylinder, 100 PPM	275-0285
R-123 Gas Cylinder, 100 PPM	275-0286
R-22 Gas Verification Kit	275-0280
R-134a Gas Verification Kit	275-0281
R-123 Gas Verification Kit	275-0282
Water Traps	
Manual Drain Water Trap	275-0234
Manual Drain Water Trap Replacement Filter	275-0235
Manual Drain Water Trap Mounting Bracket	275-0236

12.4 Troubleshooting

Certain critical faults may be corrected by checking and adjusting the detector voltage and/or emitter power. These faults include:

CLIPPING FAULT	<8000>
REZERO VOLT TOL	<4000>
OVER RANGE DETECTED	<2000>
GAIN SET FAULT	<0200>

To troubleshoot any of the above faults, use the procedure listed below.

1. With the monitor in either Warm Up Mode (flashing green LED) or Sampling Mode (solid green LED), access the Setup Menu by pressing the **ENTER** key twice.
2. Scroll to the bottom right of the screen to select the **"Service Mode Entry"** option.
3. With the **"Service Mode Entry"** option highlighted, press ENTER twice to enter Service Mode.
4. Scroll to the **"SYSTEM"** option and press **ENTER**.
5. Scroll to the **"MORE"** option and press ENTER. Note that **"MORE"** will flash when it is selected.
6. Scroll to and select the **"IR DIGIPOT"** option (see below) and press ENTER.
7. Use the **UP** and **DOWN** arrows to adjust the MW reading to 450 (or as close as possible). When at the proper value, press ESC once.

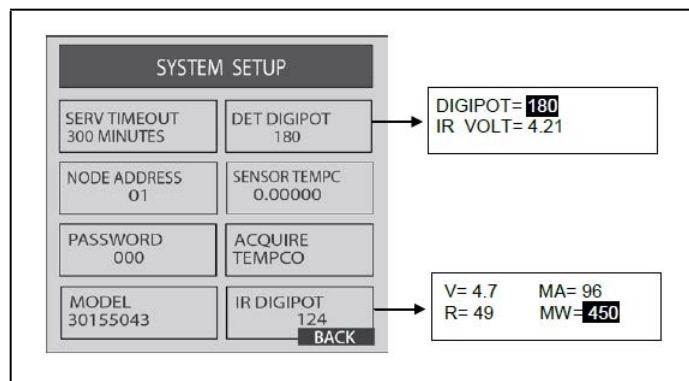


Figure 12-1 - Sample DIGIPOT Readings

8. Scroll to **"DET DIGIPOT"** option (see above) and press **ENTER**.
9. Use the **UP** and **DOWN** arrows to adjust the IR VOLT reading to 4.20 (or as close as possible). When at the proper value, press **ESC** once.

IMPORTANT

If IR VOLT does not reach 4.200 ± 0.100 volts when adjusting the DIGIPOT, return to step 6 to lower the IR emitter setting. If the IR emitter setting is 450 ± 20 mW, adjust the new IR emitter setting to 375 ± 20 mW. Repeat step 8 with the new IR emitter setting.

10. Press **ESC** to save.
11. Press **ESC** to get to the **System Menu**. Scroll to **Service Mode** and press **ENTER** twice to leave Service Mode. Press **ESC** once and allow the instrument to complete a pressure check and purge cycle (approximately 2 minutes).

If the faults cannot be cleared using the above procedure, call the factory for further assistance.

Appendix A: Recommended Refrigerant Gas Alarm Settings

Gas	Alarm Settings (PPM)		
	Leak	Spill	
CO ₂ /R-744	1500	2000	3000
FA188	100	300	500
FC72	100	300	500
H1301	100	300	500
H1211	100	300	500
H2402	100	300	500
H1234YF	100	300	500
HFP	100	300	500
N1230	100	300	500
NH3/R-717	50	150	300
R-11	100	300	500
R-12	100	300	500
R-21	100	300	500
R-22	100	300	500
R-23	100	300	500
R-32	100	300	500
R-113	100	300	500
R-114	100	300	500
R-123	25	35	50
R-124	100	300	500
R-125	100	300	500
R-134A	100	300	500
R-227	100	300	500
R-236FA	100	300	500
R-245FA	100	300	500
R-401A	100	300	500
R-402A	100	300	500
R-402A	100	300	500
R-404A	100	300	500
R-407A	100	300	500
R-408A	100	300	500
R-407C	100	300	500

Gas	Alarm Settings (PPM)		
	Leak	Spill	
R-409A	100	300	500
R-410A	100	300	500
R-422A	100	300	500
R-422D	100	300	500
R-424A	100	300	500
R-426A	100	300	500
R-427A	100	300	500
R-438A	100	300	500
R-500	100	300	500
R-502	100	300	500
R-503	100	300	500
R-507	100	300	500
R-508B	100	300	500
R-717/NH3	50	150	300
R-744/CO2	1500	2000	3000
H1234ZE	100	300	500
R407F	100	300	500
N7100	75	200	300
N7200	25	50	100
N7300	10	20	50
N7600	3	5	8
H1233zde	10	300	500
N4710	10	300	500
R-448A	10	300	500
R-449A	10	300	500
R-513A	10	300	500
R-452A	10	300	500
R-452B	10	300	500
R-514A	10	300	500
CO2/R-744	1500	2000	3000
FA188	100	300	500
FC72	100	300	500
H1301	100	300	500

Gas	Alarm Settings (PPM)		
	Leak	Spill	
H1211	100	300	500
H2402	100	300	500
H1234YF	100	300	500
HFP	100	300	500
N1230	100	300	500
NH3/R-717	50	150	300
R-11	100	300	500
R-12	100	300	500
R-21	100	300	500
R-22	100	300	500
R-23	100	300	500
R-32	100	300	500
R-113	100	300	500
R-114	100	300	500
R-123	25	35	50
R-124	100	300	500
R-125	100	300	500
R-134A	100	300	500
R-227	100	300	500
R-236FA	100	300	500
R-245FA	100	300	500
R-401A	100	300	500
R-402A	100	300	500
R-402B	100	300	500
R-404A	100	300	500
R-407A	100	300	500
R-408A	100	300	500
R-407C	100	300	500
R-409A	100	300	500
R-410A	100	300	500
R-422A	100	300	500
R-422D	100	300	500
R-424A	100	300	500

Gas	Alarm Settings (PPM)		
	Leak	Spill	
R-426A	100	300	500
H1336E	10	300	500
H1336Z	10	300	500
N5110	10	300	500
R454A	10	300	500
R454B	10	300	500
R454C	10	300	500
R455A	10	300	500
H1224YDZ	10	300	500
FC3284	10	300	500
C2H2/R1150	10	300	500

Appendix B: RS-485 Communications Protocol

Overview

The following instructions are intended as a guide for integrating the RLDS network into a Building Management System. If you are unfamiliar with complex systems of this type, it is recommended that you contact Copeland for technical assistance: 833-409-7505 or ColdChain.TechnicalServices@Copeland.com

MODBUS RTU Protocol

The RLDS monitor communicates with master devices (such as the Remote Display (if applicable) or a Building Management System) over the RS-485 serial interface. Because the monitor is configured with a two-wire RS-485 serial bus, data transmission occurs in "half-duplex" mode. Therefore, only one device may be in transmit mode at any given time.

This document specifies the MODBUS communications protocol as implemented on applicable instruments. Programmers should refer to the *MODBUS Protocol Reference Guide* for details and more comprehensive instructions. The guide is available at www.modbus.org

MODBUS RTU Operation

Overview

The RLDS and remote display (if applicable) are equipped to communicate with other equipment using the MODBUS RTU protocol. Using this communications channel, a MODBUS master device may communicate with up to 15 RLDS units on a communications network, exchanging measurement information, alarm data, fault data, history (logs and trends) and setup information. Additionally, the MODBUS master can control the operating state of an RLDS, placing the RLDS in any of its different operating modes. The network may be configured so that the RLDS units are connected directly to the MODBUS master device, or the MODBUS master device may communicate with the RLDS units through the remote display (if applicable).

Note: This document was written with the assumption that the reader is familiar with the various setup parameters and operational modes for the RLDS.

Protocol Details

A 2-wire RS-485 bus is used for transmission, therefore communications occurs in a Half-Duplex mode. The RLDS is a slave device and will respond to queries in the MODBUS RTU format from a master device.

Three MODBUS functions are supported. They are function 03 (read holding register), function 06 (write single register), and function 16 (Preset Multiple registers - for block mode only). Please refer to the *MODBUS Protocol Reference Guide* (available at https://www.modbus.org/docs/PI_MBUS_300.pdf) for protocol detail and use instructions.

In addition to the standard register groups found in the 2000 and 3000 address ranges, a block mode access is provided for OEMs who need efficient access to the complete range of system variables using the least amount of queries. The block modedata is organized into structures (internal to the RLDS), which can be accessed by the MODBUS registers defined in this document. A corresponding set of data structures should be maintained by the master device. These master device data structures become the destination for responses to read queries and sources for preset register commands. When a read holding register query is made by the master device the RLDS responds by sending the contents of the structure referenced by the specified register. After the master validates the RLDS response using the CRC bytes, it must then move the data into its matching data structure before individual items may be accessed or modified. Therefore, the master data structure should correspond to the RLDS data structure byte for byte. Note that some data structures have been divided into multiple registers due to MODBUS RTU message length constrains. To change a setting in the RLDS, the master device first reads the register structure that contains the data item to be modified, makes the desired change, then sends the structure back using the preset multiple register function. If the transaction is successful, the RLDS sends the appropriate MODBUS response. It is the responsibility of the master device, when making modifications, to ensure that all parameters transferred are within the working limits of the RLDS.

Important: Each time parameters are modified and sent back to the monitor using function 16 (preset multiple registers), the new values are written to the monitor's non-volatile FLASH memory. Due to the finite write life of the FLASH memory device (10K-100K write cycles), modifying and writing variables should be performed on an "as needed" basis and not periodically. Exceeding the FLASH write life can result in memory corruption, requiring a CPU board replacement.

RLDS Monitor Polling

Network Topologies

RLDS units may be connected directly to the MODBUS network or they may be connected to the network through a Remote Display (if applicable). In either case, each RLDS must have a unique node ID. Up to 15 RLDS units can be connected directly to the MODBUS network.

If RLDS units are accessed via a remote display (if applicable) connected to a MODBUS network, the remote display (if applicable) "BMS enabled" parameter must be set equal to "1" via the "RDM SETUP" screen on the remote display (if applicable). The same commands and registers are used to communicate with the RLDS directly or through the remote display (if applicable). If the communications are through the remote display (if applicable), it monitors each MODBUS message to determine if the message is intended for one of the RLDS units it is connected to. If it is, the remote display (if applicable) passes the message through to the RLDS units. If it is not, the message is not passed through. The remote display (if applicable) does not make any modifications to MODBUS messages. It simply passes the query through to the RLDS, and passes the response back to the MODBUS master. In other words, it allows the RLDS units to be logically connected to the MODBUS network, when physically they are connected to the local remote display (if applicable) network.

Important: It is important to understand that the remote display (if applicable) will only pass messages through to the RLDS when the remote display (if applicable) is either in the "SYSTEM" screen or the "ZONE VIEW" screen. If the remote display (if applicable) is in any other screen, it will return a MODBUS "busy" exception response (exception code 06).

All remote display (if applicable) screens, except the SYSTEM and ZONE VIEW screens, have a 10-minute timeout interval. After this, the screen will return to the SYSTEM or ZONE VIEW screen, depending on which one was last displayed. The remote display (if applicable) may also be password protected so that a password entry is required in order to view screens other than the SYSTEM or ZONE VIEW screen.

Key Comm Protocol Parameters

Parameter	Description
MODBUS Mode	RTU Only
RLDS Baud Rate	Default is 19,200 (19.2k) Programmable as defined in system data register
Parity	No Parity
Stop Bits	Default is 1. Can be set to 2 via System Data Register
Maximum Response Time	4000ms when directly accessing the RLDS 8000ms when accessing the RLDS through the remote display (if applicable)
Error Checking	CRC per MODBUS specifications

Note: All data sent out from the RLDS is in "little endian" byte order (least significant byte followed by most significant byte). This should be taken into account if the master that process the data is a "Big Endian" type. Non-data information (starting address, number of points, etc.) follows normal MODBUS protocol, which is Big Endian.

MODBUS Exception Responses

The following MODBUS exception responses are supported by the unit:

01 Illegal Function

02 Illegal Data Address

03 Illegal Data Value

06 Slave Device Busy (Occurs only when RLDS is connected to the bus through an remote display (if applicable) and the remote display (if applicable) is not in the SYSTEM or ZONE VIEW screen).

MODBUS Gas Enumeration

The following table provides decimal and hexadecimal MODBUS enumerations for supported refrigerants:

Refrigerant Gas	DEC	HEX
CO2/R-744	0	00
NH3/R-717	0	00
R-11	0	00
R-12	1	01
R-22	2	02
R-23	3	03
R-113	4	04
R-114	5	05
R-123	6	06
R-124	7	07
R-134a	8	08
R-401A	9	09
R-402A	10	0A
R-402B	11	0B
R-404A	12	0C
R-407A	13	0D
R-407C	14	0E
R-409A	15	0F
R-410A	16	10
R-500	17	11
R-502	18	12
R-503	19	13
R-507	20	14
R-508B	21	15
H1301	22	16
R-408A	23	17
FA188	24	18
R-236FA	25	19
N1230	26	1A
R-227	27	1B
HFP	28	1C
FC72	29	1D
R-21	30	1E
R-125	31	1F

Refrigerant Gas	DEC	HEX
H1211	32	20
H2042	33	21
R-245FA	34	22
R-422A	35	23
R-422D	36	24
R-427A	37	25
H1234YF	38	26
R-424A	39	27
R-426A	40	28
R-438A	41	29
4-32	42	2A
H1234ZE	43	2B
R-407F	44	2C
N7100	45	2D
N7200	46	2E
N7300	47	2F
N7600	48	30
H1233zde	49	31
N4710	50	32
R-448A	51	33
R-449A	52	34
R-513A	53	35
R-452A	54	36
R-452B	55	37
R-514A	56	38
H1336E	57	39
H1336Z	58	3A
N5110	59	3B
R454A	60	3C
R454B	61	3D
R454C	62	3E
R455A	63	3F
H1224ydZ	64	40
FC3284	65	41

Standard Register Summary

Dynamic Register Summary (2000 Series; R; Function Code 03)

Register Address	Description	Type	Range
2000	FAULT CODE	UNSIGNED INT	0-65535
2001	PPM ZONE 1	UNSIGNED INT	0-65535
2002	PPM ZONE 2	UNSIGNED INT	0-65535
2003	PPM ZONE 3	UNSIGNED INT	0-65535
2004	PPM ZONE 4	UNSIGNED INT	0-65535
2005	PPM ZONE 5	UNSIGNED INT	0-65535
2006	PPM ZONE 6	UNSIGNED INT	0-65535
2007	PPM ZONE 7	UNSIGNED INT	0-65535
2008	PPM ZONE 8	UNSIGNED INT	0-65535
2009	PPM ZONE 9	UNSIGNED INT	0-65535
2010	PPM ZONE 10	UNSIGNED INT	0-65535
2011	PPM ZONE 11	UNSIGNED INT	0-65535
2012	PPM ZONE 12	UNSIGNED INT	0-65535
2013	PPM ZONE 13	UNSIGNED INT	0-65535
2014	PPM ZONE 14	UNSIGNED INT	0-65535
2015	PPM ZONE 15	UNSIGNED INT	0-65535
2016	PPM ZONE 16	UNSIGNED INT	0-65535
2017	ALARM LEVEL ZONE 1	UNSIGNED INT	0-3
2018	ALARM LEVEL ZONE 2	UNSIGNED INT	0-3
2019	ALARM LEVEL ZONE 3	UNSIGNED INT	0-3
2020	ALARM LEVEL ZONE 4	UNSIGNED INT	0-3
2021	ALARM LEVEL ZONE 5	UNSIGNED INT	0-3
2022	ALARM LEVEL ZONE 6	UNSIGNED INT	0-3
2023	ALARM LEVEL ZONE 7	UNSIGNED INT	0-3
2024	ALARM LEVEL ZONE 8	UNSIGNED INT	0-3
2025	ALARM LEVEL ZONE 9	UNSIGNED INT	0-3
2026	ALARM LEVEL ZONE 10	UNSIGNED INT	0-3
2027	ALARM LEVEL ZONE 11	UNSIGNED INT	0-3
2028	ALARM LEVEL ZONE 12	UNSIGNED INT	0-3
2029	ALARM LEVEL ZONE 13	UNSIGNED INT	0-3
2030	ALARM LEVEL ZONE 14	UNSIGNED INT	0-3
2031	ALARM LEVEL ZONE 15	UNSIGNED INT	0-3
2032	ALARM LEVEL ZONE 16	UNSIGNED INT	0-3
2033	(STATUS) MODE	UNSIGNED INT	0-3

Register Address	Description	Type	Range
2034	(STATUS) STATE	UNSIGNED INT	0-4
2035	RESERVED	UNSIGNED INT	0
2036	(STATUS) ACTIVE ZONE	UNSIGNED INT	1-6
2037	(STATUS) MAX ALARM	UNSIGNED INT	0-3
2038	(STATUS) ACTIVE ALARM COUNT	UNSIGNED INT	0-16
2039	(STATUS) ACK'D ALARM COUNT	UNSIGNED INT	0-16
2040	RESERVED	UNSIGNED INT	0
2041	(STATUS) FAULT CODE	UNSIGNED INT	0-65535
2042	(STATUS) AUDIBLE ALARM	UNSIGNED INT	0-1
2043	(STATUS) SILENCED	UNSIGNED INT	0-1
2044	(STATUS) HIGHEST CONC ZONE	UNSIGNED INT	1-16
2045	(STATUS) HIGHEST CONCENTRATION	UNSIGNED INT	0-65535
2046	(STATUS) ZONES INSTALLED	UNSIGNED INT	4,8,12,16
2047	(SENSOR) MANIFOLD PRESSURE x100	UNSIGNED INT	0-1600
2048	(SENSOR) AMBIENT PRESSURE x100	UNSIGNED INT	0-1600
2049	(SENSOR) VACUUM PRESSURE x100	UNSIGNED INT	0-1600
2050	(SENSOR) BENCH TEMP x100	SIGNED	0-6000
2051	(SENSOR) AVE VOLTAGE x1000	UNSIGNED INT	0-5000
2051	(SENSOR) ZERO VOLTES x1000	UNSIGNED INT	0-5000
2053	(SENSOR) AVE AU x10000	UNSIGNED INT	0-30000
2054	(SENSOR) BENCH PPM	UNSIGNED INT	0-65535

Dynamic Register Summary (3000 Series; R/W; Function Code 04/06)

Register Address	Description	Type	Range
3000	REFRIGERANT TYPE ZONE 1	UNSIGNED INT	0-49
3001	REFRIGERANT TYPE ZONE 2	UNSIGNED INT	0-49
3002	REFRIGERANT TYPE ZONE 3	UNSIGNED INT	0-49
3003	REFRIGERANT TYPE ZONE 4	UNSIGNED INT	0-49
3004	REFRIGERANT TYPE ZONE 5	UNSIGNED INT	0-49
3005	REFRIGERANT TYPE ZONE 6	UNSIGNED INT	0-49
3006	REFRIGERANT TYPE ZONE 7	UNSIGNED INT	0-49
3007	REFRIGERANT TYPE ZONE 8	UNSIGNED INT	0-49
3008	REFRIGERANT TYPE ZONE 9	UNSIGNED INT	0-49
3009	REFRIGERANT TYPE ZONE 10	UNSIGNED INT	0-49
3010	REFRIGERANT TYPE ZONE 11	UNSIGNED INT	0-49
3011	REFRIGERANT TYPE ZONE 12	UNSIGNED INT	0-49
3012	REFRIGERANT TYPE ZONE 13	UNSIGNED INT	0-49
3013	REFRIGERANT TYPE ZONE 14	UNSIGNED INT	0-49
3014	REFRIGERANT TYPE ZONE 15	UNSIGNED INT	0-49
3015	REFRIGERANT TYPE ZONE 16	UNSIGNED INT	0-49
3016	LEAK LEVEL ZONE 1	UNSIGNED INT	>0<SPILL PPM
3017	LEAK LEVEL ZONE 2	UNSIGNED INT	>0<SPILL PPM
3018	LEAK LEVEL ZONE 3	UNSIGNED INT	>0<SPILL PPM
3019	LEAK LEVEL ZONE 4	UNSIGNED INT	>0<SPILL PPM
3020	LEAK LEVEL ZONE 5	UNSIGNED INT	>0<SPILL PPM
3021	LEAK LEVEL ZONE 6	UNSIGNED INT	>0<SPILL PPM
3022	LEAK LEVEL ZONE 7	UNSIGNED INT	>0<SPILL PPM
3023	LEAK LEVEL ZONE 8	UNSIGNED INT	>0<SPILL PPM
3024	LEAK LEVEL ZONE 9	UNSIGNED INT	>0<SPILL PPM
3025	LEAK LEVEL ZONE 10	UNSIGNED INT	>0<SPILL PPM
3026	LEAK LEVEL ZONE 11	UNSIGNED INT	>0<SPILL PPM
3027	LEAK LEVEL ZONE 12	UNSIGNED INT	>0<SPILL PPM
3028	LEAK LEVEL ZONE 13	UNSIGNED INT	>0<SPILL PPM
3029	LEAK LEVEL ZONE 14	UNSIGNED INT	>0<SPILL PPM
3030	LEAK LEVEL ZONE 15	UNSIGNED INT	>0<SPILL PPM
3031	LEAK LEVEL ZONE 16	UNSIGNED INT	>0<SPILL PPM
3032	SPILL LEVEL ZONE 1	UNSIGNED INT	>LEAK<EVAC PPM
3033	SPILL LEVEL ZONE 2	UNSIGNED INT	>LEAK<EVAC PPM
3034	SPILL LEVEL ZONE 3	UNSIGNED INT	>LEAK<EVAC PPM

Register Address	Description	Type	Range
3035	SPILL LEVEL ZONE 4	UNSIGNED INT	>LEAK<-EVAC PPM
3036	SPILL LEVEL ZONE 5	UNSIGNED INT	>LEAK<-EVAC PPM
3037	SPILL LEVEL ZONE 6	UNSIGNED INT	>LEAK<-EVAC PPM
3038	SPILL LEVEL ZONE 7	UNSIGNED INT	>LEAK<-EVAC PPM
3039	SPILL LEVEL ZONE 8	UNSIGNED INT	>LEAK<-EVAC PPM
3040	SPILL LEVEL ZONE 9	UNSIGNED INT	>LEAK<-EVAC PPM
3041	SPILL LEVEL ZONE 10	UNSIGNED INT	>LEAK<-EVAC PPM
3042	SPILL LEVEL ZONE 11	UNSIGNED INT	>LEAK<-EVAC PPM
3043	SPILL LEVEL ZONE 12	UNSIGNED INT	>LEAK<-EVAC PPM
3044	SPILL LEVEL ZONE 13	UNSIGNED INT	>LEAK<-EVAC PPM
3045	SPILL LEVEL ZONE 14	UNSIGNED INT	>LEAK<-EVAC PPM
3046	SPILL LEVEL ZONE 15	UNSIGNED INT	>LEAK<-EVAC PPM
3047	SPILL LEVEL ZONE 16	UNSIGNED INT	>LEAK<-EVAC PPM
3048	EVAC LEVEL ZONE 1	UNSIGNED INT	>SPILL<-10K PPM
3049	EVAC LEVEL ZONE 2	UNSIGNED INT	>SPILL<-10K PPM
3050	EVAC LEVEL ZONE 3	UNSIGNED INT	>SPILL<-10K PPM
3051	EVAC LEVEL ZONE 4	UNSIGNED INT	>SPILL<-10K PPM
3052	EVAC LEVEL ZONE 5	UNSIGNED INT	>SPILL<-10K PPM
3053	EVAC LEVEL ZONE 6	UNSIGNED INT	>SPILL<-10K PPM
3054	EVAC LEVEL ZONE 7	UNSIGNED INT	>SPILL<-10K PPM
3055	EVAC LEVEL ZONE 8	UNSIGNED INT	>SPILL<-10K PPM
3056	EVAC LEVEL ZONE 9	UNSIGNED INT	>SPILL<-10K PPM
3057	EVAC LEVEL ZONE 10	UNSIGNED INT	>SPILL<-10K PPM
3058	EVAC LEVEL ZONE 11	UNSIGNED INT	>SPILL<-10K PPM
3059	EVAC LEVEL ZONE 12	UNSIGNED INT	>SPILL<-10K PPM
3060	EVAC LEVEL ZONE 13	UNSIGNED INT	>SPILL<-10K PPM
3061	EVAC LEVEL ZONE 14	UNSIGNED INT	>SPILL<-10K PPM
3062	EVAC LEVEL ZONE 15	UNSIGNED INT	>SPILL<-10K PPM
3063	EVAC LEVEL ZONE 16	UNSIGNED INT	>SPILL<-10K PPM
3064	DISTANCE ZONE 1	UNSIGNED INT	0-1200ft
3065	DISTANCE ZONE 2	UNSIGNED INT	0-1200ft
3066	DISTANCE ZONE 3	UNSIGNED INT	0-1200ft
3067	DISTANCE ZONE 4	UNSIGNED INT	0-1200ft
3068	DISTANCE ZONE 5	UNSIGNED INT	0-1200ft
3069	DISTANCE ZONE 6	UNSIGNED INT	0-1200ft
3070	DISTANCE ZONE 7	UNSIGNED INT	0-1200ft

Register Address	Description	Type	Range
3071	DISTANCE ZONE 8	UNSIGNED INT	0-1200ft
3072	DISTANCE ZONE 9	UNSIGNED INT	0-1200ft
3073	DISTANCE ZONE 10	UNSIGNED INT	0-1200ft
3074	DISTANCE ZONE 11	UNSIGNED INT	0-1200ft
3075	DISTANCE ZONE 12	UNSIGNED INT	0-1200ft
3076	DISTANCE ZONE 13	UNSIGNED INT	0-1200ft
3077	DISTANCE ZONE 14	UNSIGNED INT	0-1200ft
3078	DISTANCE ZONE 15	UNSIGNED INT	0-1200ft
3079	DISTANCE ZONE 16	UNSIGNED INT	0-1200ft
3080	ALARM ACK ZONE 1	UNSIGNED INT	1=ACK 0=NACK
3081	ALARM ACK ZONE 2	UNSIGNED INT	1=ACK 0=NACK
3082	ALARM ACK ZONE 3	UNSIGNED INT	1=ACK 0=NACK
3083	ALARM ACK ZONE 4	UNSIGNED INT	1=ACK 0=NACK
3084	ALARM ACK ZONE 5	UNSIGNED INT	1=ACK 0=NACK
3085	ALARM ACK ZONE 6	UNSIGNED INT	1=ACK 0=NACK
3086	ALARM ACK ZONE 7	UNSIGNED INT	1=ACK 0=NACK
3087	ALARM ACK ZONE 8	UNSIGNED INT	1=ACK 0=NACK
3088	ALARM ACK ZONE 9	UNSIGNED INT	1=ACK 0=NACK
3089	ALARM ACK ZONE 10	UNSIGNED INT	1=ACK 0=NACK
3090	ALARM ACK ZONE 11	UNSIGNED INT	1=ACK 0=NACK
3091	ALARM ACK ZONE 12	UNSIGNED INT	1=ACK 0=NACK
3092	ALARM ACK ZONE 13	UNSIGNED INT	1=ACK 0=NACK
3093	ALARM ACK ZONE 14	UNSIGNED INT	1=ACK 0=NACK
3094	ALARM ACK ZONE 15	UNSIGNED INT	1=ACK 0=NACK
3095	ALARM ACK ZONE 16	UNSIGNED INT	1=ACK 0=NACK
3096	ALL ALRAM ACK	UNSIGNED INT	1=ACK 0=NACK

Block Mode Register Settings

Summary of Registers

Register Name Number	HEX	Decimal	Description
System Data	0x0010	16	R/W System Setup Data
Status	0x0011	17	R/W Operating summary of fault, alarms and status
Zone Data	0x12xx	4609-4630	R/W Setup data for up to 16 zones (xx defines zone number)
CAL Data	0x0014	20	R/W Cal Factors for all gases
Date/Time	0x0015	21	R/W Set RLDS date & time

Register Name Number	HEX	Decimal	Description
Sensor Data	0x0016	22	R Raw measurement of sensors
Rel. Hold	0x0017	23	W Release RLDS out of hold mode
Hold Zone	0x0018	24	W Put RLDS into hold mode
Fault Log	0x19xx	6400-6401	R 20 most recent fault events (xx = 00 or 01)
Flow Log	0x001F	31	R 20 most recent flow fault events
Alarm Log	0x1Axx	6656-6658	R 20 most recent alarm events (xx = 00, 01, or 02)
Serv. Mode	0x001B	27	W Puts RLDS into service mode
Rel Serv.	0x001C	28	W Release RLDS from service mode
PPM	0x001E	30	W PPM values for all zones
Zone Log	0x3yxx	0-6	Tread data for each RLDS zone {y = zone # (starting at 0), xx = 00 - 06}

Data Type Abbreviations

C	Character
Float	Floating Point
I	Integer
TIM	Time
UI	Unsigned Integer

System Data Register 0x0010 (16 Dec) (R/W, 54 Bytes)

Variable	Type	Length	Description
Type	UI	2 bytes	Indicates EEPROM has been initialized if value = 300 DO NOT MODIFY
REV	Float	4 bytes	Firmware Rev Level DO NOT MODIFY
UNUSED	UI	2 bytes	Firmware Serial Number DO NOT MODIFY
Node	UC	1 byte	Network Slave Node # (valid values are 1-15). The default is that indicated by the Node DIP Switch on main board.
Location	C	13 bytes	Array defining text name of unit.
Stop_Bits	C	1 byte	Number of stop bits used in the RLDS data stream. Default = 1. Other available value is 2.
Aud_Alarm	UC	1 byte	Sound internal board buzzer on condition; 0 = no buzzer, 1 = Alarm; 2 = Fault; 3 = Leak; 4 = Spill; 5 = Evacuate; 6 = Monitor Offline (DEFAULT = 0).
Alarm_Ack_Mode	UC	1 byte	Define Alarm Operation. Manual Acknowledge = 0; Auto Acknowledge = 1 (DEFAULT = 0).
Num_Zones	UC	1 byte	Number of install zones (Value initialized during auto detect during Power On Self Test).
UNUSED	TIM	13 bytes	UNUSED
Rezero_Mode	UC	1 byte	Defines re-zero mode. Auto Re-zero = 0; Re-zero every zone = 1 (DEFAULT = 0)

Variable	Type	Length	Description
Hold_Time	UI	2 bytes	Length of zone hold interval in minutes (DEFAULT = 15 minutes)
UNUSED	UC	1 byte	Minimum detection limit (in PPM). Concentrations less than or equal this value will read as 0 PPM (DEFAULT = 0 PPM)
Avg_Size	UC	1 byte	Size of running average used in computing PPM value. DO NOT MODIFY.
Loop2_factor	Float	4 bytes	Defines PPM current loop output. (DEFAULT = 0.16 mA/PPM)
Serv_Mode_TO	UI	2 bytes	Service Mode Timeout value (in minutes). (DEFAULT = 60 MINUTES)
RS485_BAUD	UI	2 bytes	BAUD RATE for RS-485 connection between remote display (if applicable) and RLDS or MODBUS master and RLDS depending on the Network topology). Default=9 (19.2K); other values are 8=9600, 7=4800
Mode	UI	2 bytes	UNUSED

Status Register 0x011 (17 Dec) (R/W, 10 Bytes)

Variable	Type	Length	Description
Mode	UC	1 byte	Defines Operating Mode of RLDS. 0 = normal Mode; 1 = Zone_Hold Mode; 2 = Diagnostic Mode; 3 = Service mode. DO NOT MODIFY (use zone hold register or service mode register to change this parameter)
State	UC	1 byte	Defines RLDS Current State. 0 = Idle; 1 = Sampling; 2 = Zeroing; 3 = Warm Up, 4 = Pressure Check DO NOT MODIFY
Measuring	UC	1 byte	Value = 1 if unit is acquiring detector signal for running avg. DO NOT MODIFY
Active_Zone	UC	1 byte	Current Zone being checked. 0=zone 1, 1=zone 2, etc.
Max_Alarm	UC	1 byte	Indicates highest non-acknowledged alarm level DO NOT MODIFY
Alarm_Count	UC	1 byte	Number of alarms that are currently active. DO NOT MODIFY
UNUSED	UC	1 byte	UNUSED
Loop_Card	UC	1 byte	Value = 1 if 4-20 mA card has been detected. DO NOT MODIFY
Fault	IC	2 bytes	Fault Flag Structure uses bitwise access to 16-bit word as defined in the table below.

Fault Code Table

BIT	Type	Code	Description
15	CLIPPING FAULT	0x8000	0x8000 Sensor output voltage too high.
14	ZERO RANGE FAULT	0x4000	Sensor output voltage outside limits during purge
13	OVER RANGE FAULT	0x2000	Gas concentration above measurable range
12	PURGE FLOW FAULT	0x1000	No flow detected during purge cycle
11	ZONE FLOW FAULT	0x0800	No flow detected during sample cycle
10	A2D FAULT	0x0400	Analog to digital converter not working
9	GAIN SET FAULT	0x0200	Digipot gain setting out of normal range
8	ZERO FILTER FAULT	0x0100	Charcoal filter (if used) needs replacement
7	CONFIG FAULT	0x0080	No zones are enabled

BIT	Type	Code	Description
6	UNUSED FAULT 2	0x0040	-
5	UNUSED FAULT 1	0x0020	-
4	LOOP FAULT	0x0010	Current loop is open
3	RS485 FAULT	0x0008	Communications error
2	MANIFOLD P FAULT	0x0004	Pressure sensor readings are out of range
1	BENCH T FAULT	0x0002	Sensor temperature is out of range
0	BOX T FAULT	0x0001	Chassis temperature is out of range

Zone Data Register 0x12xx (R/W, 78 Bytes)

Each zone for an RLDS has a separate zone data structure that is 78 bytes long. The zone number is the low order byte in the register address (i.e., Zone 1 data register = 0x1201h).

Variable	Type	Length	Description
Location	C	13 bytes	13 byte array, Alpha Numeric Description or Name of Zone
Flow OK	UC	1 byte	Status of Flow check. Value of 1 indicates flow check is good. DO NOT MODIFY.
Refrigerant Type	UC	1 byte	See note 1 Below (DEFAULT = R134a)
Distance	UI	2 bytes	Zone Tubing Length (in feet) (DEFAULT = 100 feet [approx. 30.5 meters])
Zone Temp	I	2 bytes	Average temperature at zone (degrees C) (DEFAULT = 25°C)
Concentration	Float	4 bytes	Last Measured concentrations (uM/L) DO NOT MODIFY
Concentration2	Float	4 bytes	Last Measured concentration (PPM) DO NOT MODIFY
Alarm Ack	UC	1 byte	Set value to 1 to acknowledge Alarm. NOTE: RLDS will reset this byte to 0 when the Alarm byte (below) is = 0 and zone in alarm is sampled. If the alarm condition/byte increases (leak>>spill or spill>>evac) the RLDS will also reset this byte to 0.
Alarm	UC	1 byte	Alarm Status; 0 = no alarm, 1 = leak; 2 = spill; 3 = evac.
Leak Level	UI	2 bytes	Level to trigger a leak alarm (in PPM) (DEFAULT = 100)
Spill Level	UI	2 bytes	Level to trigger a spill alarm (in PPM) (DEFAULT = 300)
Evac Level	UI	2 bytes	Level to trigger a evacuate alarm (in PPM) (DEFAULT = 500)
Peak PPM	UI	2 bytes	Highest Recorded PPM in zone
Peak Time	TIM	13 bytes	Date and time of highest peak (see note 2 for format)
Alarm Time	TIM	13 bytes	Date and time of last alarm (see note 2 for format)
Alarm Ack/Time		13 bytes	-
Log Interval	UI	2 bytes	Number of minutes between Log entries (DEFAULT = 1440)

Note: Refer to the Recommended Alarm Settings & Gas Enumeration table on page 84.

Note: Time Structure Format consists of 13 unsigned character types. They are 1-second digit, 10-second digit, 1-minute digit, 10-minute digit, 1-hour digit, 10-hour digit, 1-day digit, 10-day digit, 1-month digit, 10-month digit, 1-year digit, 10-year digit, last byte is unused.

Alarms and Alarm Acknowledge

The RLDS can be operated in two different alarm acknowledge modes, Auto and Manual (set via the alarm_ack_mode variable in the system data register). For purposes of this discussion, the term "Alarm" refers to an RLDS state where the alarm light is on and the appropriate alarm relay is activated. The term "Alarm condition" refers to the external condition (i.e., refrigerant leak) that initially causes the RLDS to go into an alarm. If an alarm occurs it can be handled in one of 3 ways.

- 1. Non-Latching Mode.** This mode is enabled by setting the AUTO_ACK_MODE parameter in the system register to "1". In this mode, if an alarm condition occurs an RLDS alarm will be created. If the alarm condition is subsequently removed, the RLDS alarm will automatically be cleared by the RLDS when the zone in alarm is sampled "clear." Note, in this mode of operation, it is possible for an alarm to occur and be cleared without user or MODBUS master intervention. If this is the case, the only evidence of the alarm would be contained in the RLDS alarm log.
- 2. Latching Mode with Silence.** This mode is enabled by setting the AUTO_ACK_MODE in the system register to "0". In this mode, if an alarm condition occurs, an RLDS alarm will be created. In order for the alarm to be removed the MODBUS master will write a "0" to the ALARM parameter in the ZONE register. This will cause the alarm to be "silenced" in the RLDS (i.e., the alarm relays will return to their normal state and the ALARM lamp will be extinguished). The next time the zone with the alarm condition is sampled, if the alarm condition still exists, the alarm will be reactivated and the alarm parameter will be reset to "1" in the RLDS. Otherwise, if the alarm condition has cleared, no further action is required and normal operation will resume.
- 3. Latching Mode without Silence.** This mode is enabled by setting the AUTO_ACK_MODE in the system register to "0". In this mode, if an alarm condition occurs, an RLDS alarm will be created. The RLDS MODBUS master will then write a "1" to the ALARM ACK parameter in the zone register. The alarm will continue to persist (i.e., Relays in alarm state and Alarm light on) until the offending zone is sampled and no alarm condition is detected. At that point, the ALARM ACK parameter is automatically cleared by the RLDS, as is the ALARM parameter.

Note: If the ALARM ACK parameter is set to "1" and the ALARM CONDITION is upgraded (from leak to spill, or spill to evacuate) the ALARM ACK parameter will automatically be cleared to "0" by the RLDS.

Date Time Register 0x0015 (21 Dec) (R/W, 14B)

Variable	Type	Length	Description
Date_Time	Time	14 bytes	Contains current time and date. Structure is defined as in note 2 of zone data

Time Structure Format consists of 14 unsigned character types. They are 1-second digit, 10-second digit, 1-minute digit, 10-minute digit, 1-hour digit, 10-hour digit, a day digit, 10-day digit, 1-month digit, 10-month digit, 1-year digit, 10-year digit, day of the week, last byte is unused.

Sensor Data Register 0x0016h (22 Dec) (R, 82B)

Variable	Type	Length	Description
Pressure	Float	4	Manifold Pressure is PSIA
P_Volts	Float	4	Pressure sensor output Voltage
Vacuum_P	Float	4	Pressure with all value closed and pump on in PSIA
Ambient_P	Float	4	Absolute Ambient Pressure in PSIA
Box_T	Float	4	Enclosure Temperature in Degrees C
Box_T_Volts	Float	4	Box temp sensor output voltage
Bench_T	Float	4	Optical bench temperature in Degrees C
Bench_T_Volts	Float	4	Bench temp sensor output voltage
Bench_Z_T	Float	4	Optical bench temp in degrees C at last zero interval

Variable	Type	Length	Description
Box_Z_T	Float	4	Box temp in degrees C at last zeroing
PkPk_int	UI	2	Current peak to peak A/D counts from detector
PkPk	Float	4	Current peak to peak voltage from detector
Ave_PkPk	Float	4	Running average voltage from detector
Zero_PkPk	Float	4	Voltage measured at last zeroing
Noise	Float	4	Largest Change in running average
AU	Float	4	Current absorbance value
Ave_AU	Float	4	Running Average of absorbance level
Bench_PPM	Float	4	PPM in bench based on zone gas selection (uncorrected for pressure and temperature)
STP_PPM	Float	4	PPM corrected to STP (1 atm, 25°C)
Bench_UML	Float	4	Micromoles/liter in bench (uncorrected)
Ambient_UML	Float	4	Micromoles/liter corrected to ambient pressure

Release Zone Hold Register 0x0017h (23 Dec) (W, 10B)

Variable	Type	Length	Description
ReL_Hold	*	*	See description of STATUS REGISTER

Release Zone Hold Register 0x0017h (23 Dec) (W, 10B)

Variable	Type	Length	Description
Zone_Hold	*	*	See description of STATUS REGISTER

RLDS Hold Mode

The RLDS can be made to hold or “dwell” on a particular zone if necessary. The length of the hold time is defined by the HOLD TIME parameter in the System Data Register.

Placing the RLDS into hold mode:

1. Read the RLDS Status Register (0x0011h)
2. Modify the content of the status register structure to change the MODE parameter to zone hold mode. Active zone parameter to the zone you wish to hold
3. Send this updated status register structure back to the RLDS using PRESET MULTIPLE REGISTER COMMAND to the HOLD ZONE REGISTER (0x0018h).

Releasing the Zone Hold

1. Read the RLDS Status Register (0x0011h)
2. Modify the content of the status register to change the MODE parameter to normal mode. Active zone parameter to the zone which you would like to resume normal activity on
3. Send this updated status register structure back to the RLDS using PRESET MULTIPLE REGISTER COMMAND to the RELEASE HOLD REGISTER (0x0017h).

Fault Log Register 0x1900-01 (6400-6401 Dec) (R, 302B)

These registers contain the 20 most recent fault events, the time they occurred, and a pointer to the most recent event. The data is split into 2 registers. The first register contains 200 bytes and the second register contains 102 bytes. The results of these two register reads should be recombined into the Fault Log Data Structure after both have been received.

Variable	Type	Length	Description
Fault	UI	40 bytes	20 most recent fault events. Each event is decoded as indicated in Fault Flag Structure given after the Status Register Description
Time	TIM	260 bytes	Time of each fault occurrence. TIM value as defined in NOTE 2 of Zone Data
Ptr	UC	1 byte	Pointer to most recent event
Unused	UC	1 byte	Unused

Flow Log Register 0x001F (31 Dec) (R, 142B)

Variable	Type	Length	Description
Flow Event	UI	40 bytes	20 most recent flow fault events. Each bit of the unsigned int represents a zone and a 1 indicates no flow. Zero indicates flow.
Purge Flow Event	UC	20 bytes	20 most recent flow fault events where a 1 indicates no flow. Zero indicates flow.
Time	TIM	80 bytes	Time/date stamps for 20 most recent logged flow events. This variable is an unsigned long integer formatted as seconds since Jan 1 of 1980
Ptr	UC	1 byte	Pointer to most recent event
Unused	UC	1 byte	Unused

Alarm Log Register 0x1A00-02 (6656-58 Dec) (R, 582B)

These registers contain the 20 most recent alarm events, the time they occurred, and a pointer to the most recent event. The data is split into 3 registers and should be recombined into an appropriate structure after all three registers have been received. Register 0x1A00h contain 200 bytes, Register 0x1A01h contains 200 bytes, and register 0x1A02h contains 181 bytes.

Variable	Type	Length	Description
Event	UC	320 bytes	20 most recent alarm events. Each event contains 1 byte for each zone. Each zone Byte is defined as 0=No Alarm, 1=Leak Alarm, 2=Spill Alarm, 3=Evac Alarm.
Time	TIM	260 bytes	Time of each alarm event. TIM value as defined in NOTE 2 of Zone Data
Ptr	UC	1 byte	Pointer to most recent event
Unused	UC	1 byte	Unused

Service Mode Register 0x001B (27 Dec) (W, 10B)

Variable	Type	Length	Description
Rel_Svc_Mode	*	*	See description of STATUS REGISTER

Release Service Mode 0x001C (28 Dec) (W, 10B)

Variable	Type	Length	Description
Ent_Svc_Mode	*	*	See description of STATUS REGISTER

RLDS Service Mode

The RLDS can be placed into service mode if necessary. During service mode the unit will take no measurements, any and all alarms are silenced, and all relays are opened. The unit automatically comes out of service mode after a preset interval defined by the service_mode_TO parameter in the System Data Register.

Placing the unit into Service Mode:

1. Read the RLDS Status Register (0x0011h)
2. Modify the content of the status register structure to change the MODE parameter to service mode.
3. Send this updated status register structure back to the RLDS unit using PRESET MULTIPLE REGISTER COMMAND to the SERVICE MODE REGISTER (0x001Bh).

Releasing the unit from Service Mode:

1. Read the RLDS Status Register (0x0011h)
2. Modify the content of the status register to change the MODE parameter to normal mode.
3. Send this updated status register structure back to the RLDS unit using PRESET MULTIPLE REGISTER COMMAND to the RELEASE SERVICE MODE REGISTER (0x001Ch).

PPM Register 0x001E (30 Dec) (R, 32B)

Variable	Type	Length	Description
PPM	UI	32 bytes	16 Unsigned Integers that represent the PPM values for each RLDS zone

Note: 16 values are returned independent of the number of actual zones installed in the unit. The master device is required to know how many zones are installed in the unit (available in the System Register) in order to properly interpret the data.

Zone Log Registers 0x3xyy (R, 1502B)

These registers are used to transfer the zone log data. Each zone has a circular log of 100 past data points. The period between data points is defined by the Log Interval parameter in each corresponding Zone Data Register. The data for each zone is defined by the "x" place in the above register address. For zone 1 the Register address is 0x30yyh, for zone 2 the register address is 0x31yyh, etc. The data for each zone is sent in 8 consecutive registers due to MODBUS RTU message length constrains. The addresses are defined by the "yy" place in the above address. For zone 1, all log data can be obtained by reading 0x3000h, 0x3001h, 0x3002h,, 0x3007h. The first seven registers contain 200 bytes each and the last register contains 102 bytes. After all registers have been received the data should be reassembled into the full data structure.

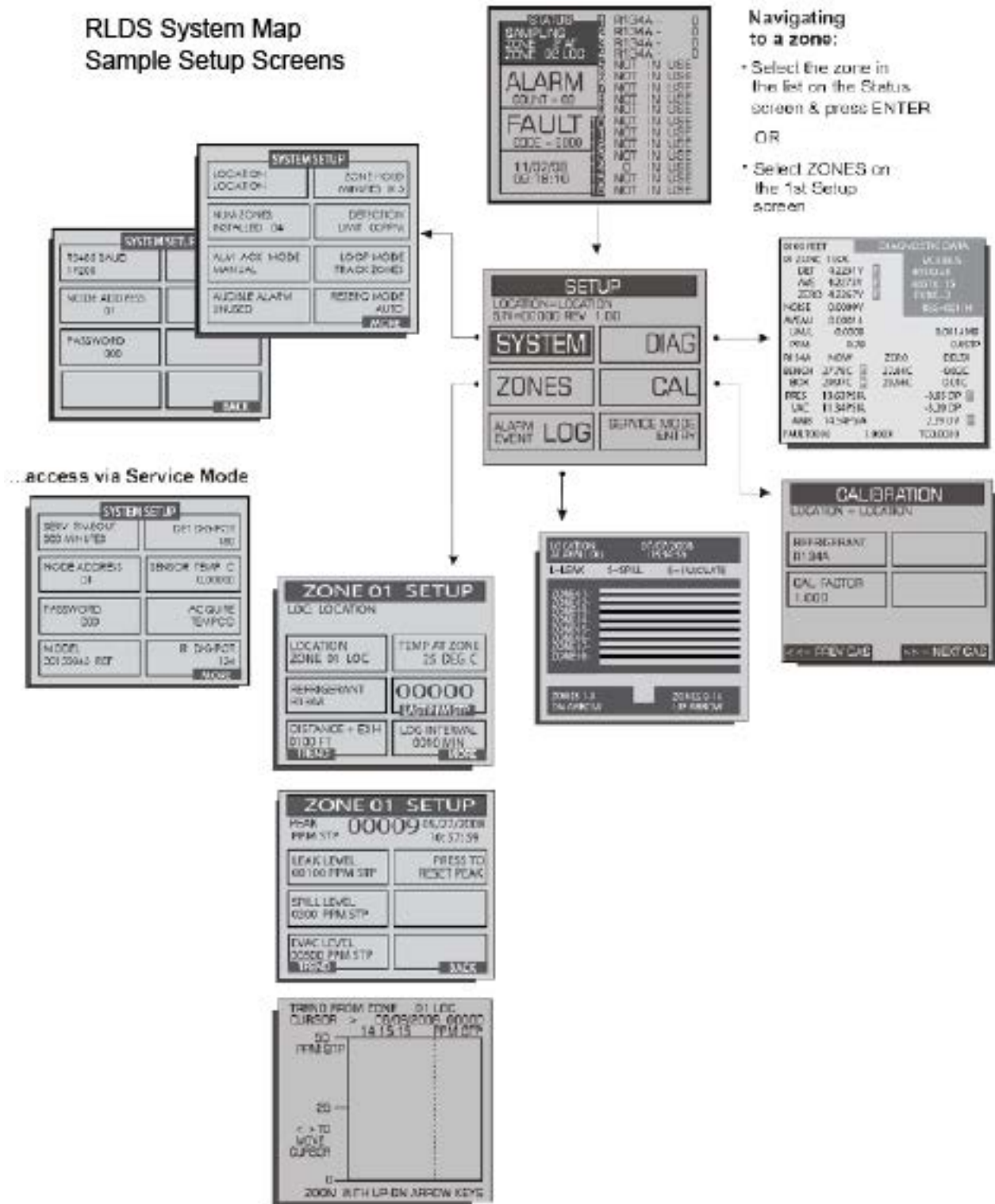
Variable	Type	Length	Description
Index	UI	2	Point to current reading
Time	TM	1300	Time record for each of the 100 log points. The format for the TIM type is defined in note 2 of zone data
PPM	UI	200	Last 100 log points (2 bytes per point)

Appendix C: Fault Codes

BIT	Fault Type	Code	Description
15	CLIPPING FAULT	0x8000	Sensor output voltage too high
14	ZERO RANGE FAULT	0x4000	Sensor output voltage outside limits during purge
13	OVER RANGE FAULT	0x2000	Gas concentration above measurable range
12	PURGE FLOW FAULT	0x1000	No flow detected during purge cycle
11	ZONE FLOW FAULT	0x0800	No flow detected during sample cycle
10	A2D FAULT	0x0400	Analog to digital converter not working
9	GAIN SET FAULT	0x0200	Digipot gain setting out of normal range
8	ZERO FILTER FAULT	0x0100	Charcoal filter (if used) needs replacement
7	CONFIG FAULT	0x0080	No zones are enabled
6	UNUSED FAULT 2	0x0040	Not used
5	UNUSED FAULT 1	0x0020	Not used
4	LOOP FAULT	0x0010	Current loop is open
3	RS485 FAULT	0x0008	Communication error
2	MANIFOLD P FAULT	0x0004	Pressure sensor readings are out of range
1	BENCH T FAULT	0x0002	Sensor temperature is out of range
0	BOX T FAULT	0x0001	Chassis temperature is out of range

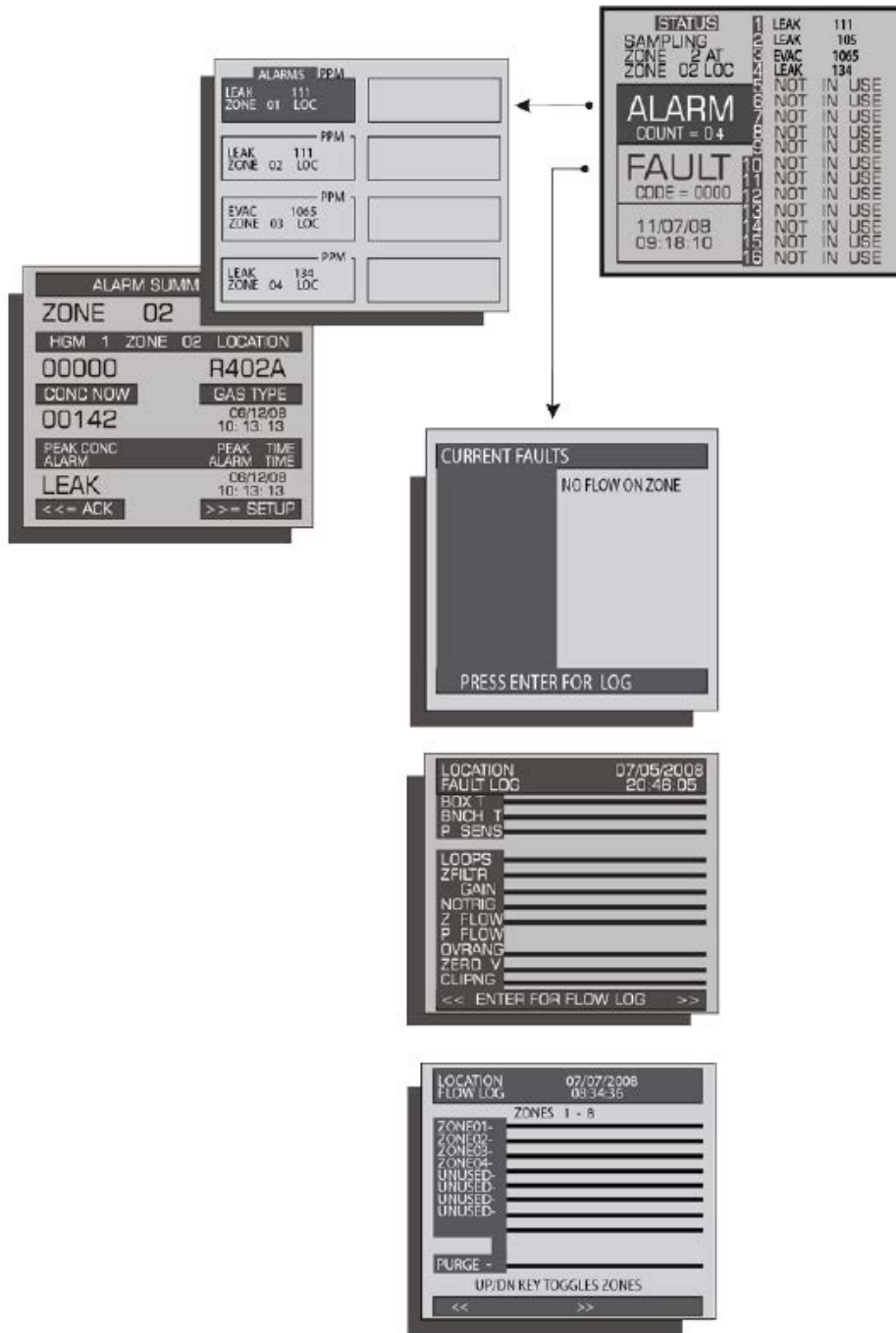
Appendix D: System Menu Map

RLDS System Map Sample Setup Screens



- Navigating to a zone:**
- Select the zone in the list on the Status screen & press ENTER
 - OR
 - Select ZONES on the 1st Setup screen

RLDS System Map Sample Alarm and Fault Screens



Navigating to a zone:

- Select the zone in the list on the Status screen & press ENTER
- OR
- Select ZONES on the 1st Setup screen

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