

Oxygen Deficiency Safety Monitor



Version 3

ESRAD-002

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1. Product Description

Thank you for selecting the ESRAD-002 Low-Oxygen Depletion Safety Alarm. This monitor is designed to detect oxygen depletion or enrichment in enclosed spaces and to warn occupants of hazardous levels. Low concentrations of oxygen in confined spaces are dangerous and may lead to health problems ranging from headaches and fatigue to asphyxiation and death.

This monitor has both audible and visual alarms which activate when the oxygen concentration is lower than the pre-set alarm levels. Detection of low levels of oxygen will also activate relay 1 and 2 that can be used for a fan or air-handling system to ventilate the confined space and improve OXYGEN concentration in the area.

The ESRAD-002 Oxygen Depletion Safety Alarm is cost-effective and has many features including:

- Separate SEU (Main Sensor Unit) and RDU (Remote Display Unit) allow you to see warning before entering an enclosed area. Up to 3 RDUs can be used.
- Large digital LCD display clearly indicates the ambient OXYGEN concentration.
- Relay outputs to control ventilation devices.
- Relay output for power loss indication
- Audible and visual alarm indications at three separate alarm levels. Ability to add strobes for additional indication.
- Automatic barometric pressure compensation for high altitude use.

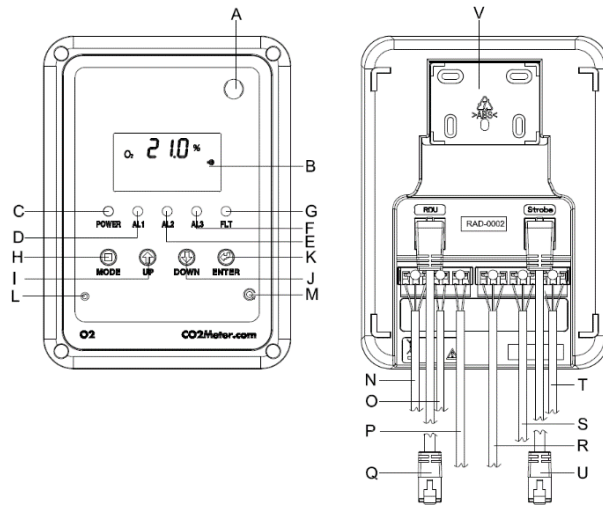
2. Package Contents & Description

The ESRAD-002 package comprises the following parts:

1. SEU (Main Sensor Unit)
2. RDU (Remote Display Unit)
3. Power Supply (Pre-Wired)
4. International Power Adaptor (3 pieces)
5. CAT 5 Communication Cable (1 piece)
6. Relay Cables (3 pieces)
7. Wall Plug Safety Strap (1 piece)
8. Warning Signs
9. User Manual (1 piece)
10. Mounting Brackets (2 pieces)
11. Screws (13 pieces)
12. Wall Anchors (12 pieces)
13. Cable Clips (10 pieces)
14. Strobes (optional)

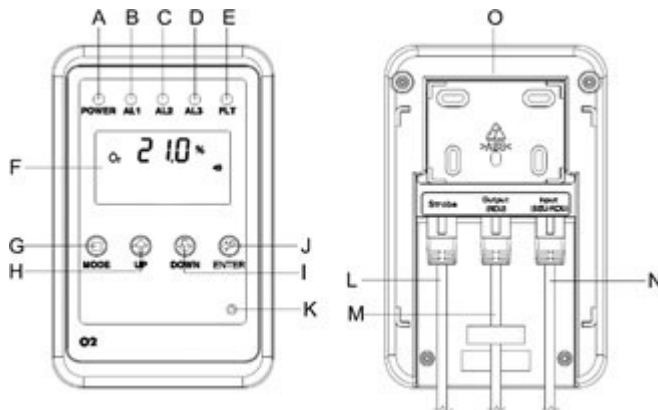
NOTE: Strobes are optional visible alarms that augment the flashing red Alarm LEDs on the SEU and RDU. They are activated when the alarms are activated. Strobes are sold in pairs. Each strobe comes with a CAT 5 cable that plugs into the SEU and RDU.

Some local jurisdictions require additional strobe units. GasLab offers two different types of add-on strobes. For more information about your area, call or email us at Sales@Gaslab.com



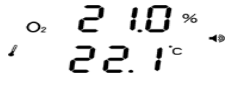


- | | | |
|-----------------------|---------------------|---------------------------------|
| A. O2 Sensor | B. LCD display | C. Power Green LED |
| D. Alarm 1 Red LED | E. Alarm 2 Red LED | F. Alarm 3 Red LED |
| G. Fault Yellow LED | H. MODE Button | I. UP Button |
| J. DOWN Button | K. ENTER Button | L. Alarm Buzzer |
| M. Reset Button | N. 4-20mA Output | O. Battery Backup Input |
| P. DC Power Supply | Q. RDU Cable (RJ45) | R. Relay 3 Power Loss Indicator |
| S. Relay 2 for AL2 | T. Relay 1 for AL1 | U. Strobe Cable (RJ45) |
| V. Mount/Panel Holder | | |

RDU (Remote Display Unit)



- | | | |
|---------------------------------------|--|------------------------|
| A. Power Green LED | B. Alarm 1 Red LED | C. Alarm 2 Red LED |
| D. Alarm 3 Red LED | E. Fault Yellow LED | F. LCD display |
| G. MODE Button | H. UP Button | I. DOWN Button |
| J. ENTER Button | K. Alarm Buzzer | L. Strobe Cable (RJ45) |
| M. Output to RDU
(RJ45 Std. Cable) | N. Input from SEU/RDU
(RJ45 Std. Cable) | O. Panel Holder |

3. LCD Display Symbols

Symbol	Meaning	Description
	O2 Concentration ppm (Parts Per Million)	ambient O2 concentration
	Alarm	alarm icon
DIAG	Diagnose	Test communications between the SEU and RDU
AL1 (Depletion)	O2	The relay 1 will be triggered when O2 concentration is lower than AL1. The Red 1 LED and Fault LEDs will flash, buzzer will sound and relay1 will be activated. If strobe is connected, the strobe will flash and this status will be latched.
AL2 (Depletion)	2 nd O2 Alarm level	The relay 2 will be triggered when O2 concentration lower than the second alarm level The Red1, Red 2 LEDs and Fault LEDs will flash, and buzzer will sound. Relay1, relay2 will be activated. If strobe is connected, the strobe will flash and this status will be latched.
AL3 (Depletion)	3 rd O2 Alarm level	When O2 concentration lower than the 3rd alarm level The Red1, Red 2, Red3, and Fault LEDs will flash, and buzzer will sound. Relay1, relay2, will be activated. If strobe is connected, the strobe will flash and this status will be latched.
AL1 (Enrichment)	O2	The relay 1 will be triggered when O2 concentration higher than AL1. The Red 1 LED and Fault LEDs will flash, buzzer will sound and relay1 will be activated. If strobe is connected, the strobe will flash and this status will be latched.
AL2 (Enrichment)	2 nd O2 Alarm level	The relay 2 will be triggered when O2 concentration higher than the second alarm level. The Red1, Red 2 LEDs and Fault LEDs will flash, buzzer will sound and relay1, relay2 will be activated. If strobe is connected, the strobe will flash and this status will be latched.
AL3 (Enrichment)	3 rd O2 Alarm level	When O2 concentration higher than the 3rd alarm level. The Red1, Red 2, Red3, and Fault LEDs will flash, buzzer will sound and relay1, relay2, will be activated. If strobe is connected, the strobe will flash and this status will be latched.
CALI	Calibration	To calibrate the O2 sensor when the accuracy deviates from the actual O2 concentration.
RCFS	Recover Factory Setting	To recover factory default settings and cancel any customized settings.
Hi	High	The O2 concentration is above 25%
	Fan Icon	Running if buzzer beeps

4. SEU (Main Sensor Unit)

The large LCD displays the ambient O₂ concentration.

The SEU has the “DIAG”, “O₂ AL1(Depletion)”, “O₂ AL2(Depletion)”, “O₂ AL3(Depletion)”, “O₂ AL1(Enrichment)”, “O₂ AL2(Enrichment)”, “O₂ AL3(Enrichment)”, “O₂ CALI”, “RCFS” function.

The “DIAG” function executes communication tests between the SEU and RDU. The user can do the calibration under the “CALI” mode when necessary. If data setting is done incorrectly, the user can use the “ReFactSet” mode back to the original factory setting.

There are “O₂ AL1(Depletion)”, “O₂ AL2 (Depletion)” “O₂ AL3 (Depletion)” three alarm levels for O₂ Depletion, these alarm levels are adjustable.

- **The AL1 (Depletion) of O₂ is with parameter: 15.5, 16, 16.5, 17, 17.5, 18, 18.5, 19, 19.5, 20. The default AL1 is 19.5%.**
- **The AL2 (Depletion) of O₂ is with parameter: 12.5, 13, 13.5, 14, 14.5, 15, 15.5, 16, 16.5.; the default AL2 is 16.5%.**
- **The AL3 (Depletion) of O₂ is 12%.**

When the RAD-0002 Monitor detects O₂ value lower than the O₂ AL1(Depletion) , operate Alarm 1 LED, Fault LED ,Relay 1, Audible, Strobe(if exist), till RESET on SEU regardless the rise of O₂ level.

When O₂ levels continue decaying, and below O₂ AL2(Depletion): operate Alarm 1 LED, Alarm2 LED, Relay 1, Relay2, Audible, Strobe, Fault LED, till RESET on SEU regardless the rise of O₂ level.

When O₂ levels continue to decay, and below O₂ AL3(Depletion): operate Alarm 1 LED, Alarm2 LED, Alarm3 LED, Fault indicator LED, Relay 1, Relay2, Audible, Strobe, till RESET on SEU regardless the rise of O₂ level.

There are “O₂ AL1(Enrichment)”, “O₂ AL2 (Enrichment)” “O₂ AL3 (Enrichment)” three alarm levels for O₂ Enrichment, these alarm levels are adjustable.

- **The AL1 (Enrichment) of O₂ is with parameter 22.0, 22.5, 23.0, 23.5. (Default setting 22.0%.)**
- **The AL2 (Enrichment) of O₂ is with parameter 24.0, 24.5, 25.0. (Default setting 24.0%.)**
- **The AL3 (Enrichment) of O₂ is with parameter 25%.**

When the RAD-0002 Monitor detects O₂ value higher than the O₂ AL1 (Enrichment), operate Alarm 1 LED, Fault LED, Relay 1, Audible, Strobe (if exist), till RESET on SEU regardless the decay of O₂ level.

When O₂ levels continue rising, and upon O₂ AL2(Enrichment): operate Alarm 1 LED, Alarm2 LED, Relay 1, Relay2, Audible, Strobe, Fault LED, till RESET on SEU regardless the decay of O₂ level.

When O₂ levels continue rising, and upon O₂ AL3(Enrichment): operate Alarm 1 LED, Alarm2 LED, Alarm3 LED, Fault indicator LED, Relay 1, Relay2, Audible, Strobe, till RESET on SEU regardless the decay of O₂ level.

If the communication cable between the SEU & RDU doesn't connect well, like the communication cable loses in the Input port, the fault LED of SEU will blink, remind user reconnect the cable. If the communication cable is inserted into the wrong port on RDU, after about one minute, the “Er7” will flash on RDU LCD.

Please plug it into the right port on RDU, the unit will work normally after corrective action.

5. RDU (Remote Display Unit)

The RDU should be placed outside the enclosed area (typically next to a door) to warn users if the oxygen level inside the enclosed area have changed. The RDU is controlled and powered by the SEU. A strobe may be attached to the RDU.

All visual and buzzer alarms on the SEU are duplicated on the RD. The SEU only has the “DIAG” function to test the communication between the SEU and RDU (see 10.3). All other functions or settings must be changed on the SEU.

6. Strobes

Strobes are add-on visible alarms. One strobe can be connected to the RDU and one to the SEU. If the oxygen level goes below Alarm Level1, the strobes will flash. The frequency of the flash cannot be changed.

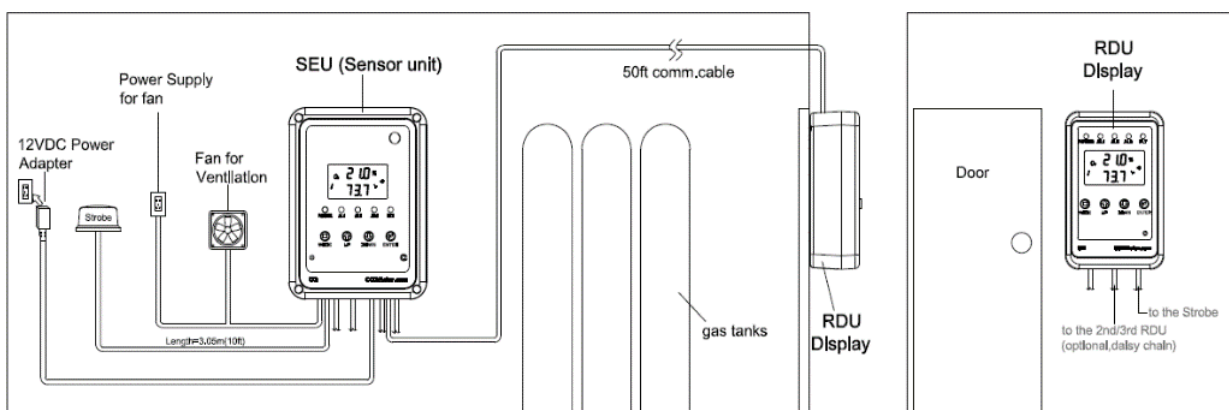
7. Power

The ESRAD-002 comes pre-wired with a 12V power supply that plugs in to a 120-240VAC wall outlet. The 12V power supply can be removed and 24VDC can be wired directly to the SEU through the terminal block. 24VAC must be converted to 24VDC for the monitor to operate.

8. Installation

1. Choose a suitable location near a wall outlet to install the SEU. Fix the panel holder on the wall with the four screws provided.
2. Put the SEU on the panel holder, making sure that they are connected tightly.
3. Fix the second panel holder in a suitable location outside the monitored space at eye level.
4. Place the RDU onto the panel holder. Display warning signs next to the RDU so they are not hidden when the door is open.
5. Route the included CAT5 cable between the SEU and RDU. CAT5 cable can be run through the wall/conduit or fixed to the wall using cable clips. Plug the CAT5 cable into the designated ports on both units. 2 additional RDUs can be connected to the first RDU as long as the total cable length between the farthest RDU and SEU is less than 300ft. (91m).
6. The ESRAD-002 has 2 relay outputs connected to the programmed alarm settings and 1 relay output used as a power loss indicator. All relays are normally open/closed dry contacts. The relays can be used to control an external device (fan, HVAC system, etc.) or can be be wired to the fire alarm panel directly. The relays will trigger when the oxygen concentration exceeds the programmed alarm level (Relay 1 or 2) or the device experience power loss (Relay 3).
7. When the power has been connected, The SEU and the RDU will perform a self-check, then begin to work. If the cable between the SEU & RDU is not securely connected, the yellow fault LED on the SEU will blink after startup. If cable is inserted into the wrong port on RDU, after about one minute, "Er7" will flash on the RDU display. Securely plug the cable into the correct port on RDU for the unit to function normally.
8. To test the system, use the DIAG function. The five LED's will blink and the buzzer will sound on both the SEU and RDU. Then both LCD screens will show the same information. This verifies that alarm is ready.

Installation Example:



9. Advanced Management Settings

These settings use a non-obvious key combination to prevent casual users from changing alarm settings. In most cases, the default settings are recommended.

1.1 Alarm Level Lock / Unlock: If the alarms are locked, an employee cannot change the alarm levels. Factory default is locked. You must unlock the alarm levels before you can change them (see Section 10).

1. Press Up & Enter buttons simultaneously for 10 seconds until BAro is displayed.
2. Press Mode button until Al n is displayed.
3. Press Up/Down arrow buttons to switch between Lock and Unlock.
4. Press Enter button to save and quit the advanced mode.

1.2 Latch Function On / Off: The alarm ships with the LATCH function off, this allows the device to work its way out of alarm status on its own. The function can be switched to on meaning alarms will continue until the reset button is pressed. Factory default is off.

1. Press Up & Enter buttons simultaneously for 10 seconds until BAro is displayed.
2. Press Mode button until LAAt is displayed.
3. Press Up/Down arrow buttons to switch between On and Off.
4. Press Enter button to save and quit the advanced mode

1.3 Barometric Compensation On / Off: Turns on automatic compensation for barometric pressure / altitude. Factory default is off.

1. Press Up & Enter buttons simultaneously for 10 seconds until BAro is displayed.
2. Press Mode button until BAro is displayed.
3. Press Up / Down arrow buttons to switch On or Off.
4. Press Enter button to save and quit the advanced mode

10. Customizing the Settings

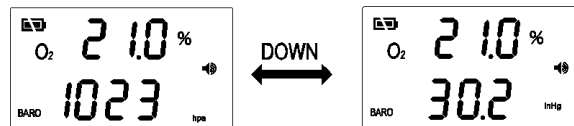
1.1 Select Temperature Units

Press the Up button to switch between °F & °C:



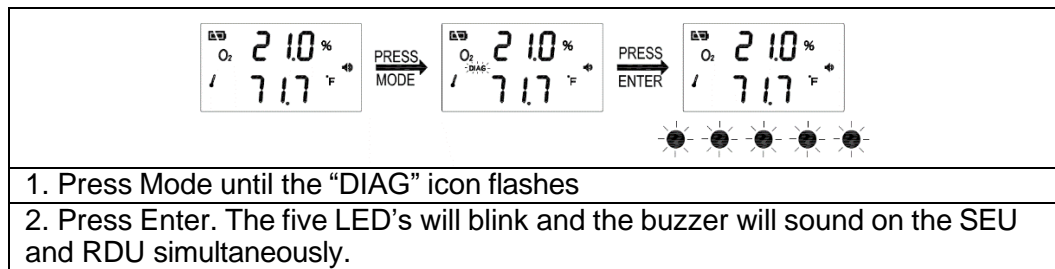
1.2 Select Barometric Units

Press the Down button to switch from hPa to inHg

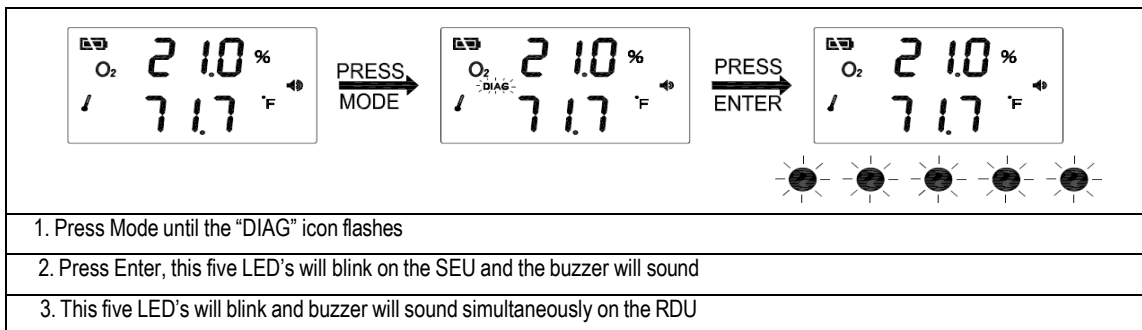


1.3 Diagnostic Test

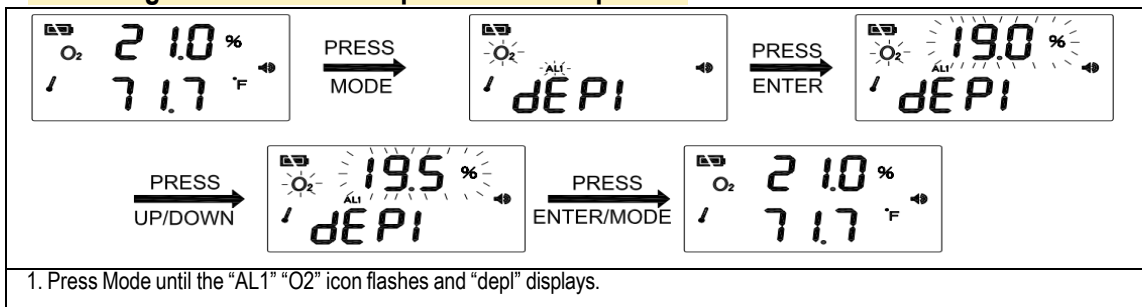
Test the communication link between the SEU & RDU.



1.4 Using the DIAG function



1.5 Setting the O2 First Alarm parameter of depletion:



2. Press Enter, the "AL1" icon shows on LCD. default AL1= 19.5%
3. Press Up/Down to go through 15.5, 16, 16.5, 17, 17.5, 18, 18.5, 19, 19.5, 20%"
4. Press Enter again(save) or press Mode (not save) quit the setting

1.1 Setting the O2 Second Alarm parameter of depletion:

1. Press Mode until the "AL2" "O2" icon flashes and "depl" displays.

2. Press Enter, the "AL2" icon shows on LCD, default AL2= 16.5%

3. Press Up/Down to go through 12.5, 13, 13.5, 14, 14.5, 15, 15.5, 16, 16.5%"

4. Press Enter again(save) or press Mode (not save) quit the setting

Setting the O2 Third Alarm parameter of depletion:

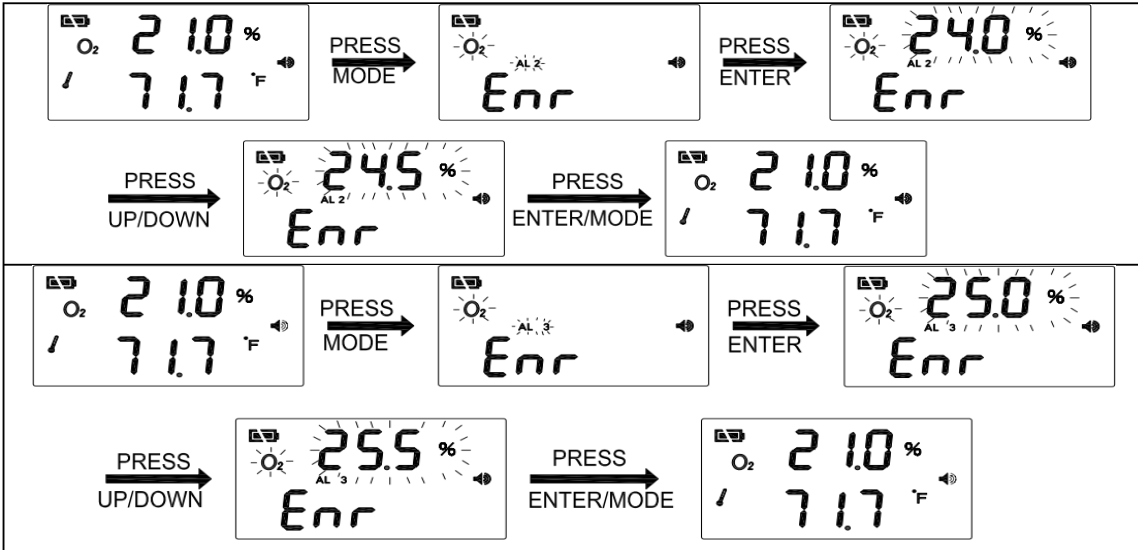
1. Press Mode until the "AL3" "O2" icon flashes and "depl" displays.

2. Press Enter, the "AL3" icon shows on LCD. Default AL3=12%

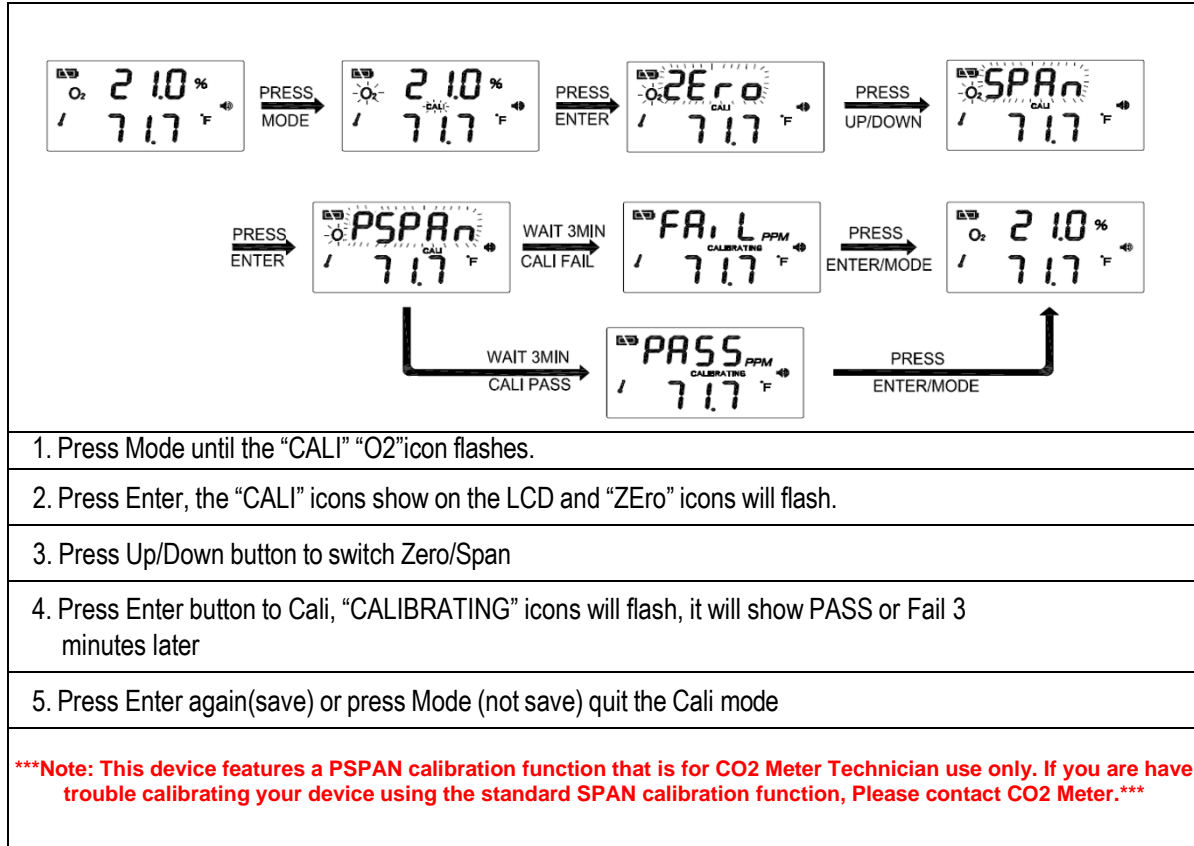
3. Press Up/Down to 12%

4. Press Enter again(save) or press Mode (not save) quit the setting

1.2 Setting the O2 Alarm parameters of enrichment:



9.1 Calibration



Span calibration should both be performed at least annually. They can be performed onsite or the SEU can be returned for factory calibration. Check your state or local code for calibration schedule requirements in your jurisdiction.

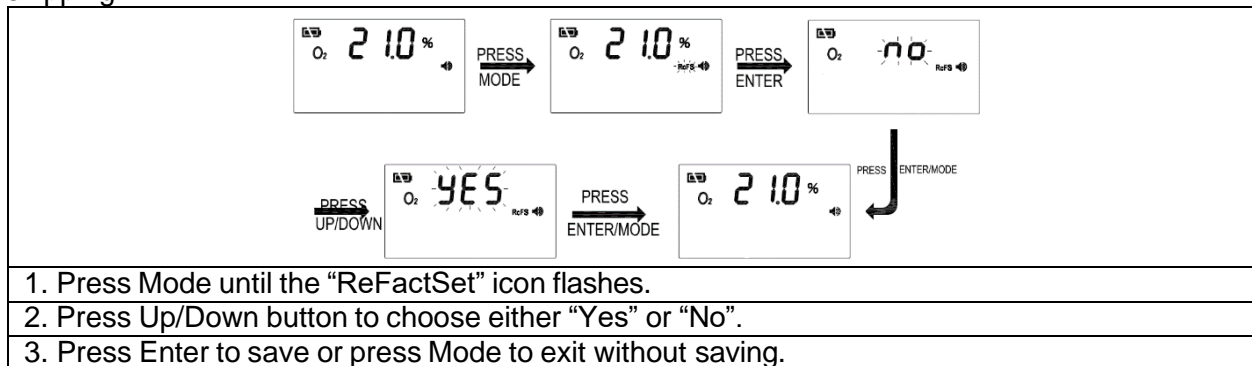
What you will need: A test gas cylinder of 21% oxygen, a test gas regulator and 3-4 ft. (1m) tubing, and a small piece of masking tape to cover the buzzer hole on the bottom right corner of the SEU. If you are calibrating in situ, first inform occupants to ignore the alarms while calibration takes place.

Span Calibration

1. Hold the tubing from the 21% oxygen gas cylinder to the oxygen sensor opening on the top right-hand corner of the SEU.
2. Open the gas regulator. Set the flow rate between 0.15-0.50 liters per minute.
3. Wait until the O2 reading on the SEU settles consistently at or near 21% O2 on the screen.
4. Press the Mode button 5 times. The “O2” and “CALI” icons will flash.
5. Press Enter to view the calibration settings. The words “O2” and “ZEro” will begin flashing on the LCD.
6. Press the Up or Down arrow key to change from “Zero” to “SPAN”.
7. Press Enter again to begin calibrating. “CALIBRATING” will begin flashing.
8. After approximately 3 minutes, the LCD will display either “PASS” or “FAIL”
9. If the LCD reads “FAIL”, repeat the steps again. If it displays “PASS”, press Enter. The display should now show 21% O2.
10. Remove the oxygen gas.
11. Press the Reset button at the bottom right-hand side of the SEU front cover.

10.8 Recover Factory Settings

If calibration or changing custom parameters has caused the ESRAD-002 to behave incorrectly, use the ReFactSet function to return the unit to its original condition at shipping.



11. Product Care

To insure you receive the maximum benefit from using this product, observe these guidelines:

- **Repair** - Do not attempt to repair the product or modify the circuitry by yourself. Please contact GasLab directly if the product needs servicing, including the replacement or calibration of sensor. See section 15 for technical support contact information.
- **Cleaning** - Disconnect the power before cleaning. Use a damp cloth. Do not use liquid cleaning agents such as benzene, thinner or aerosols, as these will damage the device.
- **Maintenance** – We recommend testing the communication between the SEU and RDU under ‘DIAG’ function. If these five LEDs blink and the buzzer of SEU and RDU sound simultaneously, it indicates that SEU and RDU work normally.

12. Safety Notes

Warning: Your safety is very important to us. To ensure to use the product correctly and safety, please read these warnings and the entire User Manual before using the product. Otherwise, the protection provided by the equipment may be impaired. These warnings provide important safety information and should be observed at all times.

1. Please handle the device carefully; do not subject the product to impact or shock. Otherwise, this may cause the accuracy drift.
2. Do not place the unit near a heat source. Heat can cause distortion of the unit, which may result in an explosion or fire.
3. Do not touch the exposed electronic circuitry of the device under any circumstances, as there is the danger of electric shocks.
4. Please take care of cable connection between SEU and RDU. Make sure the cable from SEU is connected into the INPUT port of RDU.
5. Please ensure the external power supply is normally supplied to ventilation fan while the relay is working. If there has no normally power supply to the fan, the relay will not work, which may result in potential danger with lower O2 concentration in confined space

13. Specifications

■ Oxygen & Temperature Sensor Specifications:

Oxygen Sensor Specifications	
Range	0 - 25% display
Display Resolution	0.1%
Accuracy	Better than 2%FS
Pressure Dependence	Auto pressure compensation, built in barometer. (500-1200 mbar)
Response Time	O2: <2min by 90%
O2 AL1	15.5, 16, 16.5, 17, 17.5, 18, 18.5, 19, 19.5, 20. The default AL1 is 19.5%.
O2 AL2	12.5, 13, 13.5, 14, 14.5, 15, 15.5, 16, 16.5%. The default AL2 is 16.5%
O2 AL3	15.5%, 15.0%, 14.5%, 14.0%, 13.5%, 13.0%, 12.5%, 12%. The default AL3 is 12.0%.
Sound Alarm	80db@10cm
Warm-Up Time	< 60 seconds at 72°F (22°C)
Temperature Sensor Specifications:	
Temperature Range	32°F to 122°F (0°C to 50°C)
Display Resolution	0.1°F (0.1°C)
Display Options	°F /°C
Accuracy	±2.7°F (±1.5°C) when O2 concentration is below first alarm level
Response Time	20-30 minutes
Operating Conditions:	
Operating Temperature	32°F to 122°F (0°C to 50°C)
Humidity Range	0 ~ 95% RH non-condensing
Storage Conditions:	
Storage Temperature	-4°F to 140°F (-20°C to 60 °C)

■ Power Supply

Power Supply	DC	9~32VDC (12~32VDC recommended), 2A.
	AC adapter	Input: 100~240 VAC,50/60Hz, 0.6A Output: 12VDC, 2000mA.
Battery	Voltage	6VDC (5.4V~7.0V), recommended capacity is 12AH

■ Relay Outputs

There are three relay outputs:

- Relay 1 operates at alarm1 for O2
- Relay 2 operates at alarm2 for O2
- Relay 3 is not related to alarms and depends on power on/off

The peak current for all relays are less than 2A@30 VDC or 250 VAC, SPDT.

■ 4-20mA Outputs

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CL01:420mA	O2: 0~25%
CL02:420mA	Temp: 32 to 122° F (0-50°C)

■ Weight and Dimensions

SEU	Weight	1 lb.
	Dimensions (LxWxD)	6.69 x 4.96 x 2.73 inches
RDU	Weight	0.4 lb.
	Dimensions (LxWxD)	5.51 x 3.54 x 1.89 inches

14. Fault Codes & Troubleshooting Guide

This section includes a list of Frequently Asked Questions for problems you may encounter with the ESRAD-002 OXYGEN Monitor.

No	LCD Fault Icon	Description (of the fault)	SEU Indication	RDU Indication	Suggested Actions
1	Er3	The ambient temperature has exceeded the temperature range 32°F to 122°F (0°C to 50°C)	“Er3” flash, Fault LED blink	“Er3” flash, Fault LED blink	This error will disappear when the temperature returns to the range between 32°F to 122°F (0°C and 50°C)
2	Er5	EEPROM System Problem	“Er5” flash, Fault LED blink	“Er5” flash, Fault LED blink	Power on again or press reset button, if the “Er5” always appear, please contact with the local dealer.
3	Er7	Internal Data Transmission Error	“Er7” flash, Fault LED blink,	“Er7” flash, Fault LED Blink	Check the RJ45 plug is connected into the INPUT port of RDU, if the “Er7” displays on the RDU only. Press reset button on SEU or power on again

15. Support & Warranty

The quickest way to obtain technical support is via email. Please include a clear, concise definition of the problem and any relevant troubleshooting information or steps taken so far, so we can duplicate the problem and quickly respond to your inquiry.



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