

User Manual and Installation Guide



RAD-0002-ZR

Oxygen O2 Deficiency Safety Alarm



CO2METER
GAS MEASUREMENT SPECIALISTS

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Revision 00.02

Warning!

This product should only be used as described in this manual. If the equipment is used outside of the manner specified by CO2Meter, the protection provided by the equipment may be diminished. This equipment should be installed/serviced by qualified personnel only.

Please contact Support@CO2Meter.com for more information.

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GENERAL INFORMATION ON

Oxygen SAFETY

Oxygen deficiency and oxygen enrichment in any confined space may not be noticeable, but that does not mean it isn't dangerous. Failing to properly monitor spaces that are using or storing hazardous gases could lead to severe health and fire hazards. It's important to prioritize gas detection safety monitoring, to safeguard yourself and employees as well as properly understand the hazard when working near dangerous gases.

O2 SAFETY STANDARDS



CGA G-4.1-2018

Any surface or environment that encounters oxygen concentration higher than **23.5%** should adhere to the cleaning standards promoted.



29 CFR 1910.101

Standards are set for the handling, use, and storage of compressed gas cylinders in applications other than welding and cutting.



An oxygen deficient atmosphere is further defined as any environment that holds less than 19.5% available oxygen. This environment is noted to not be entered without an approved oxygen safety monitor or self-contained breathing apparatus.

PHYSICAL SYMPTOMS



19.5% - 11%

Increased breathing, accelerated heart rate, impaired thinking



10% - 6%

Nausea, vomiting, lethargy, leading to unconsciousness



< 6%

Convulsions, cessation of breathing, coma, and fatalities



19.5%

Minimum "safe level" per OSHA and often the low level alarm of most O₂ detectors

HAZARD AREAS



Anywhere hazardous gases or "Liquid Nitrogen/Liquid Helium is stored or used



Areas where compressed gases are transported or used



Rooms containing tanks of stored gases such as laboratories, food production facilities, and cryogenic chambers.



Venting from Cryogenic Gas Cylinders



Oxygen use in cutting and welding

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Introduction to the RAD-0002-ZR

Thank you for selecting the RAD-0002-ZR Low-Oxygen Depletion Safety Alarm. This monitor is designed to detect oxygen depletion 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.



Key Features

- (3) Safety alarms (Audible and Visible)
- NDIR sensor with extended lifespan
- Push button configuration
- 4-20mA output for communication with **B**uilding **M**aintenance **S**ystems
- (2) Dry contact relays triggered by each alarm level (NO or NC)
- (1) Dry contact relay triggered by power loss (NO or NC)
- Back-up battery connection available
- Easy calibration function
- Temperature compensation
- Alarm latching function
- Strobe accessories available: CM-1027 ([Click HERE](#))

Display



Icons and Symbols

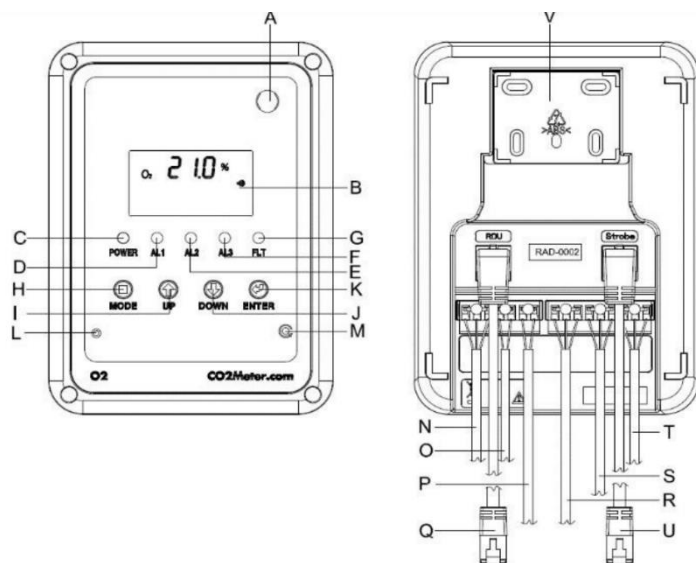
Icon/Symbol	Description
20.9%	O2 Level Icon: Displays the live ambient oxygen levels of the area being monitored. Updates every 2 seconds.
DIAG	Technician diagnostics feature. Communication test.
AL1	1 st Alarm Icon: Configurable 1 st alarm. (19.5% O2)
AL2	2 nd Alarm Icon: Configurable 2 nd alarm. (16.5% O2)
AL3	3 rd Alarm Icon: Fixed 3 rd alarm. (Default 12% O2)
CALI	Calibration Icon: (See page 13 for calibration instructions)
RCFS	Reset Factory Setting Icon: (See page 14 for reset instructions)
HI	High O2 Icon: Indicated O2 levels greater than 23%
	Alarm Icon: Appears after AL1 is triggered and will remain on display while the monitor is in alarming state
	Ventilation Icon: O2 Levels drops lower than AL2 and Relay2 has been triggered.

Specifications

O2 Specification	
Measurement Range	0-23% display
Display Resolution	0.1%
Accuracy	Better than 2%FS
Pressure Dependence	Not pressure dependent
Response Time	O2: <2min by 90%
O2 AL1	<u>19.5% Default</u> (15.5%, 16%, 16.5%, 17%, 17.5%, 18%, 18.5%, 19%, 19.5%, 20%)
O2 AL2	<u>16.5% Default</u> (12.5%, 13%, 13.5%, 14%, 14.5%, 15%, 15.5%, 16%, 16.5%)
O2 AL3	<u>Default 12.0%</u> (Fixed)
Sound Alarm	80db@10cm
Warm-Up Time	600 seconds (10 minutes) for full operating temperature range
Monitor Specification	
Power Input	9~32VDC (12~24VDC recommended),2A.
Backup Battery	6VDC (5.4V~7.0V), recommended capacity is 12AH
Relay 1	Dry contact relay controlled by AL1 (2Amp) (NO or NC)
Relay 2	Dry contact relay controlled by AL2 (2Amp) (NO or NC)
Relay 3	Dry contact relay (Triggered by power loss to monitor)
4-20mA O2	O2: Range 0-23%
Dimensions	8.25-inch x 7.8-inch x 3-inch
Weight	1.5lbs (Monitor only)
Operating Conditions:	
Temperature	-58°F to 122°F (-50°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)

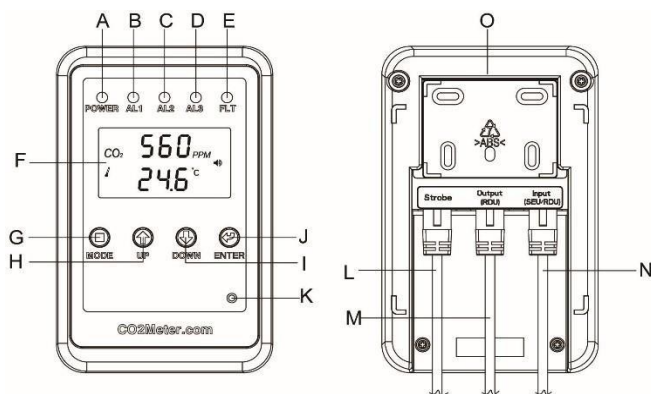
Layout

SEU (Sensor Unit)



- | | |
|-----------------------|------------------------|
| A. O2 Sensor | L. Buzzer |
| B. LCD display | M. Reset Button |
| C. Power (Green LED) | N. 4-20mA Output |
| D. AL1 (Red 1 LED) | O. Battery |
| E. AL2 (Red 2 LED) | P. DC Power Supply |
| F. AL3 (Red 3 LED) | Q. RDU Cable (RJ45) |
| G. Fault (Yellow LED) | R. Relay 3 (AL3) |
| H. Mode Button | S. Relay 2 (AL2) |
| I. UP Button | T. Relay 1 (AL1) |
| J. Down Button | U. Strobe Cable (RJ45) |
| K. Enter Button | V. Panel Holder |

RDU (Remote Display Unit)



- | | |
|-----------------------|------------------------|
| A. Power (Green LED) | I. Down Button |
| B. AL1 (Red 1 LED) | J. Enter Button |
| C. AL2 (Red 2 LED) | K. Buzzer |
| D. AL3 (Red 3 LED) | L. Strobe Cable (RJ45) |
| E. Fault (Yellow LED) | M. Output Cable (RJ45) |
| F. LCD display | N. Input Cable (RJ45) |
| G. Mode Button | O. Panel Holder |
| H. UP Button | |

SEU (Sensor Unit)

The large LCD displays the ambient O2 concentration.

The SEU has the "DIAG", "O2 AL1", "O2 AL2", "O2 AL3", "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 three alarm levels AL1 / AL2 / AL3 for O2 depletion monitoring, these alarm levels are adjustable.

- **The AL1 is 19.5%. (Configurable to 15.5, 16, 16.5, 17, 17.5, 18, 18.5, 19, 19.5, 20).**
- **The AL2 is 16.5%. (Configurable to 12.5, 13, 13.5, 14, 14.5, 15, 15.5, 16, 16.5).**
- **The AL3 is 12%.**

When the RAD-0002 Monitor detects O2 value lower than the O2 AL1 set value, Alarm 1 LED, Fault LED, Relay 1, Audible, and connected strobe will trigger, until RESET on SEU.

When O2 levels continue depleting and drop below O2 AL2 set value: Alarm 1 LED, Alarm2 LED, Relay 1, Relay2, Audible, Strobe, Fault LED will trigger, until RESET on SEU.

When O2 levels continue to deplete, and below O2 AL3: operate Alarm 1 LED, Alarm2 LED, Alarm3 LED, Fault indicator LED, Relay 1, Relay2, Audible, Strobe, till RESET on SEU.

If the communication cable between the SEU & RDU is not connected properly, the fault LED of SEU will blink, this is an indication that the user must reconnect the cable. If the communication cable is inserted into the wrong port on RDU, in 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.

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 has changed. The RDU is controlled and powered by the SEU. A strobe may be attached to the RDU.

Strobes

The RAD-0002-ZR can be equipped with strobes for additional visual alarms. Using CAT5 cables, connect the strobes to the correct RJ45 ports on the SEU and RDU. If O2 levels exceed AL2, the strobe will flash. If the O2 level exceeds AL3, the strobe tempo increases. Please visit www.CO2Meter.com for strobe package. Part Number: CM-1027.

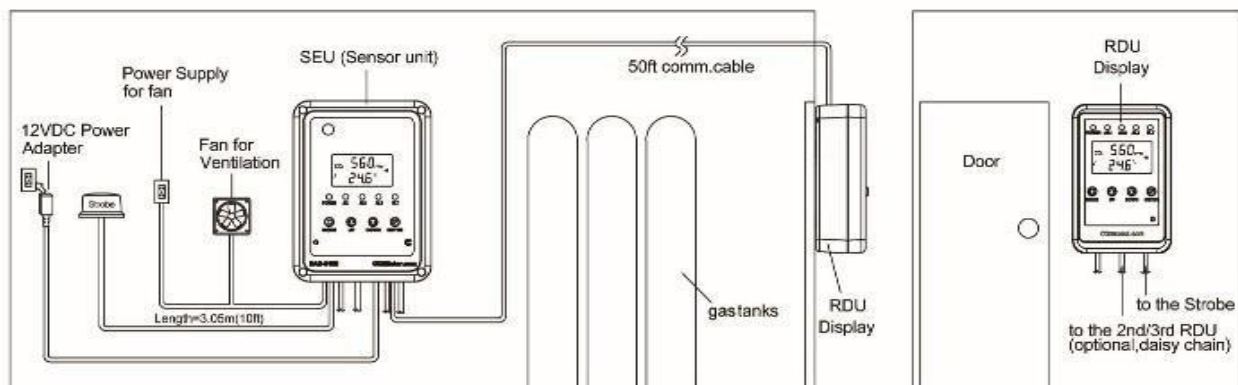
Power

The RAD-0002-ZR comes pre-wired with a 12V power supply that plugs in to a wall outlet. The 12V power supply can be removed and 24V DC can be wired directly to the monitor through the terminal block. Please use a 24V DC power converter to properly convert your AC power source.

Installation

Step-by-Step Installation Instructions:

1. Choose a suitable location to install the SEU. Fix the panel holder on the wall with the four screws. Install the SEU 12-72 inches from floor and close to the O₂ source.
2. Put the SEU on the panel holder, making sure that they are connected tightly.
3. Fix another panel holder in a suitable location outside the monitored space at eye level. Place the RDU onto panel holder and stick the warning signs next to RDU.
4. Route the 25-foot 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. Communication between the SEU and RDU is complete.
5. The RAD-0002-ZR has 2 relay outputs connected to the programmed alarm settings. All relays are normally open/closed dry contacts. Any of the relays can be used to control an external device (fan, HVAC system, etc.) or can be wired to the fire alarm panel directly. The relays will trigger when the O₂ concentration exceeds the programmed alarm level.
6. When the power has been connected, The SEU and the RDU will begin to work.
7. Please use the "DIAG" function to verify the communication between SEU and RDU, the five LED's will blink, and buzzer will sound on SEU & RDU, after that the communication is ready. The units will display the same information.



Operation

Start-up

Verify that the RAD-0002-ZR is properly wired, and 12-24VDC power is being supplied to the correct pin positions in the mating connector (see page 10). Check all wiring connections before powering. After power-up, the monitor provides accurate O₂ measurements after a 10-minute warm up (Sensor requires brief warm-up period).

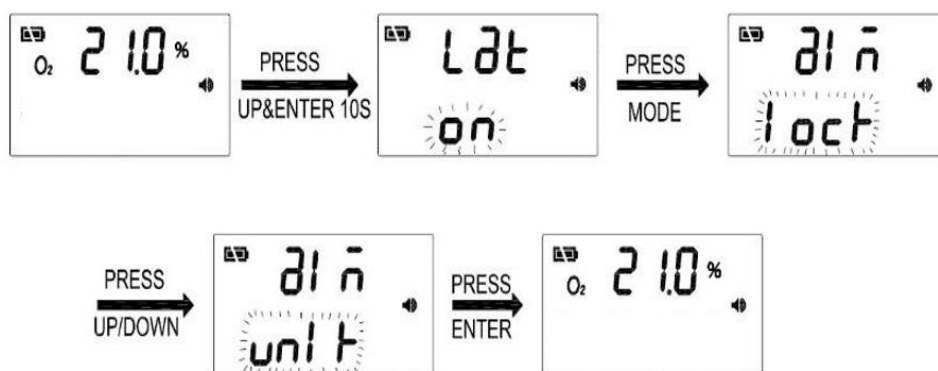
Quick Test the System

- 1) Apply 100% Nitrogen to the sensor port on the front of the monitor. Check that all alarms trigger and the oxygen levels begin to drop.
- 2) AL1 will trigger Relay 1.
- 3) AL2 will trigger Relay 2.
- 4) AL3 will alarm.
- 5) The monitor will sound and flash (audible and visible) alarms.
- 6) If a CM-1027 Strobe is connected, it will flash.

Allow 5 minutes for the monitor to come out of O₂ alarm status.

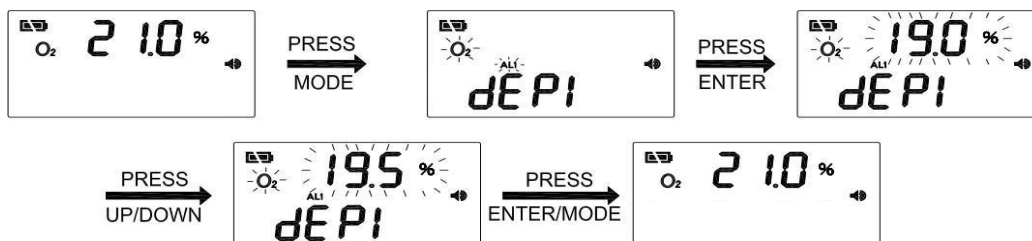
Unlocking/Locking Settings

- 1) Press and hold Up & Enter button for 10 seconds.
- 2) Press Mode until Aln is displayed.
- 3) Use Up/Down arrow to change lock to unlock.
- 4) Press Enter to save.



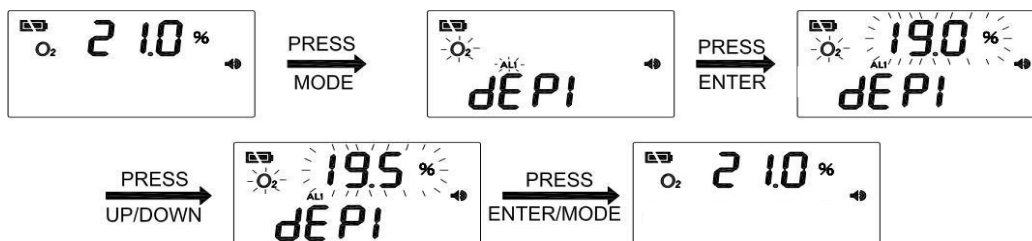
Configuring AL1

1. Press Mode until the "AL1" & "O2" icon flash
2. Press Enter to select. AL1 level will flash.
3. Use Up/Down arrow to select new alarm level.
4. Press Enter to confirm.



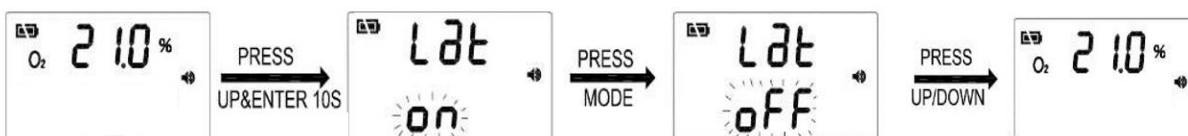
Configuring AL2

1. Press Mode until the "AL2" & "O2" icon flash
2. Press Enter to select alarm 2. AL2 level will now flash.
3. Use Up/Down arrow to select new alarm level.
4. Press Enter to confirm.



Latch ON/OFF

1. Press and hold Up & Enter button for 10 seconds
2. Change to Advance Mode by pressing Mode, and choose Lat Mode
3. Press Up/Down to set Latch Mode On or Off.
4. Press Enter to Save



(Fault light will keep flashing if AL3 is activated, indicating unit went into alarm status.)

Calibration

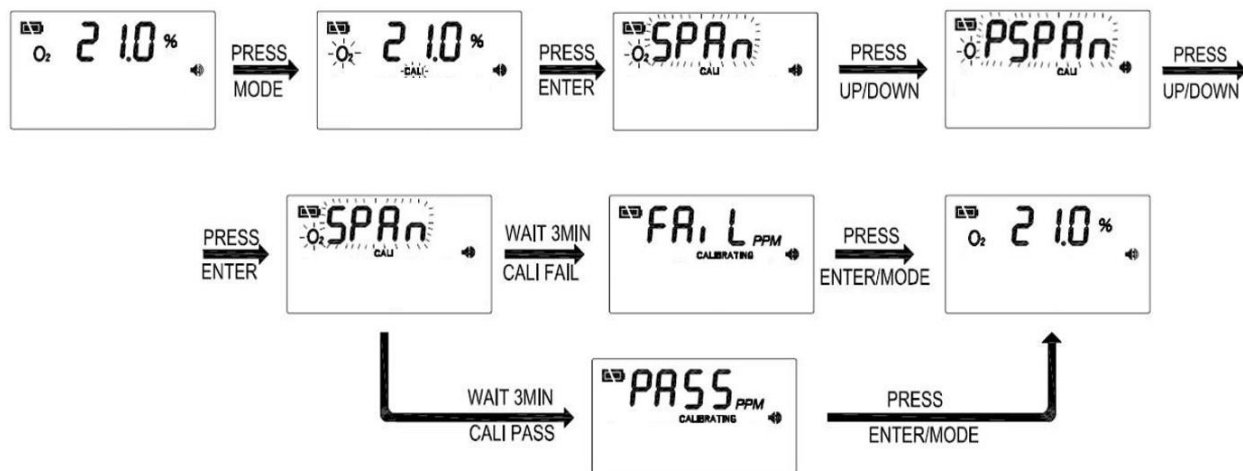
1. Flow certified 21% Oxygen calibration gas into the sensor port on the front of the monitor. Wait 3-5 minutes before starting calibration, then execute the "SPAn" calibration.

(Continue to flow calibration gas through entire process)

2. Press Mode until CALI is flashing in small print under the O2 reading.
3. Press Enter to view the calibration settings.
4. "SPAn" and "O2" will be flashing.
5. Press Enter again to begin the calibration. "CALIBRATING" will begin flashing.

(Continue to flow calibration gas throughout entire process)

6. After approximately 3 minutes, the display either "PASS" or "FAIL".
7. If "PASS" press enter to save.
8. If "FAIL" repeat the process.
9. If "FAIL" more than twice, contact CO2Meter technical support.



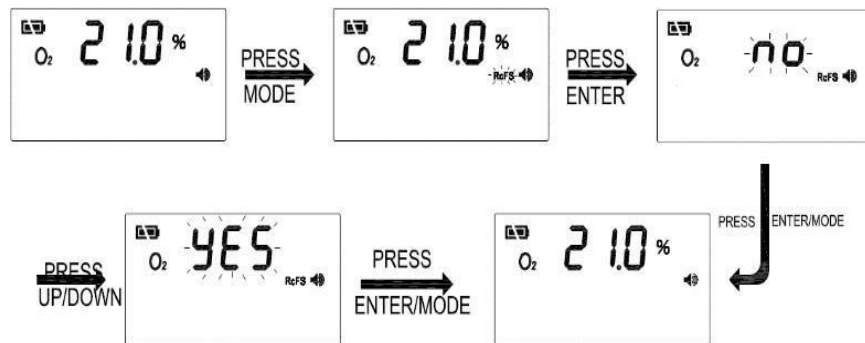
System Test

1. Press Mode until the “DIAG” icon flashes
2. Press Enter, the five LEDs will blink, and the buzzer will sound.



Factory Reset

1. Press Mode until the “ReFactSet” icon flashes.
2. Press Enter Up/Down to choose either “Yes” or “No”.
3. Press Enter again to save the setting or press Mode to quit the setting.



Maintenance

The RAD-0002-ZR is a low maintenance safety monitor that requires little maintenance after initial installation. It is recommended to calibrate the internal zirconia O2 sensor annually. This calibration can be completed in the field, or the monitor can be returned to CO2Meter to perform the calibration. A calibration certificate will be provided with every calibration service. Be sure to ask your CO2Meter technician for more information.

Fault Codes

NO.	Fault Code	Indicator	Suggested Actions
1	Er3	"Er3" flash, Fault LED blink	This error will disappear when the temperature returns to the correct operation range.
2	Er5	"Er5" flash, Fault LED blink	Power on again or press reset button, if the "Er5" always appear, please contact CO2Meter.
3	Er7	"Er7" flash, Fault LED blink	Press reset button on SEU or power cycle the unit

Warranty

CO2Meter warrants the products to be substantially free of defects in workmanship and materials when used for their intended purposes for a period of either one (1) year or ninety (90) days from the date of shipment of the applicable products as specified for each product on the individual product pages located at www.co2meter.com (the “Manufacturer’s Limited Warranty”). No employee or representative of CO2Meter may alter the terms of the Manufacturer’s Limited Warranty verbally or in writing.

To take advantage of the Manufacturer’s Limited Warranty, the product must be returned to us at your expense. If after examination, we determine that the product is defective, CO2Meter at its election will repair or replace the defective product. The foregoing is customer’s exclusive remedy in the event of a valid warranty claim.

Notwithstanding anything contained herein, the Manufacturer’s Limited Warranty shall not apply to: (i) any product that has been customized, altered, or repaired by any person not authorized to do so by CO2Meter; or (ii) any product that has been subject to misuse, neglect, or accidental damage. This warranty does not apply to calibration of any product.

In the event of an alleged warranty claim, you agree to contact us to request a return authorization prior to returning any products to us. We will only honor valid warranty claims of which we have been given notice prior to the expiration of the applicable limited warranty period. You agree to comply with all commercially reasonable rules and policies governing warranty claims which we may institute from time to time. Such rules and policies may be located at www.co2meter.com/pages/faq#warranty.

If you return a product to us, and we determine in our reasonable discretion that it falls within an exception to the Manufacturer’s Limited Warranty as described herein, we will have no obligation to You other than to return the Product(s) at your sole cost and expense.

It is our customer(s) responsibility to share your application with the CO2Meter sales team so they can help identify any potential issues your application may cause with our devices. important information to share will be: expected CO2 concentration, temperature, humidity, and any other particles or gases in your application. Applications with interfering gases can damage our sensors and devices. Those applications with high humidity can damage the electronics and the CO2 sensors beyond repair.

Product Returns

If any product fails under normal use, you may return it to us, by first submitting a customer case support ticket (submission here). Policies and procedures for returns and refunds related to the same are located at www.co2meter.com/pages/faq.

All returns for refund after thirty (30) days from shipment of the applicable product will incur a 25% re-stocking fee. No product will be accepted for return or refund after 45 days from shipment.

Non-refundable clause, if a product is refunded, and your purchase included a calibration certificate charge, due to the calibration being a service, not an actual product item your refund will not include the certification charge in your refund.

Support

If the User Manual/ Installation guide above does not contain the needed operation, installation or trouble shooting information, please contact CO2Meter at:

Support@CO2Meter.com

Contact Us

We are here to help! For information or technical support, please contact us using the information below. For further guidelines on CO2Meter Terms & Conditions, [click here](#).

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