Operation Manual

Pro CO™

Carbon Monoxide Analyzer

If you have any questions on this equipment please contact Technical Support at:

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Email: info@nuvair.com

Hours: Monday through Friday
8:00 AM to 5:00 PM PST USA

WARNING

This Operation Manual contains important safety information and should always be available to those personnel operating this equipment. Read, understand, and retain all instructions before operating this equipment to prevent injury or equipment damage.

Every effort was made to ensure the accuracy of the information contained within this manual; however, we retain the right to modify its contents without notice. If you have problems or questions after reading the manual, stop and call for information.

Table of Contents

1.0 Introduction

This manual will assist you in the proper set-up, operation and maintenance of the Pro CO™ Carbon Monoxide Analyzer. Be sure to read the entire manual.

Throughout this manual we will use certain words to call your attention to conditions, practices or techniques that may directly affect your safety. Pay particular attention to information introduced by the following signal words:

DANGER

Indicates an imminently hazardous situation, which if not avoided, will result in serious personal injury or death.

WARNING

Indicates a potentially hazardous situation, which if not avoided, could result in serious personal injury or death.

CAUTION

Indicates a potentially hazardous situation, which if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTICE

Notifies people of installation, operation or maintenance information which is important but not hazard-related.

2.0 System Description

The Pro CO™ Carbon Monoxide Analyzer measures carbon monoxide (CO) levels in gases in the range of 0 to 100 parts per million (ppm). It can be used to measure the CO content in gas mixes that may be contaminated due to the introduction of CO from internal combustion engines or other devices where CO is a byproduct. The Analyzer is designed to verify CO concentration in stored gas cylinders as well as to monitor enclosed spaces. The Analyzer is a water and impact resistant unit compatible with outdoor and marine environments.

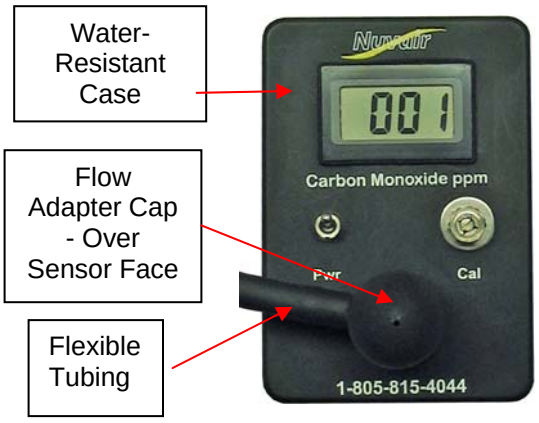
DANGER

Carbon monoxide is a colorless, odorless, tasteless gas that will not support life. Exposure to carbon monoxide can lead to unconsciousness and death.

The Analyzer is battery powered and includes an internally mounted Sensor with audible alarm. The Water-Resistant Case includes a Digital Display and controls that are environmentally sealed

The Analyzer uses a Flow Adapter Cap and Flexible tubing to deliver sample gas to the Sensor. Pressurized gases must be regulated to avoid damage to the analyzer. Use of this Analyzer in a hyperbaric chamber will void the owner's warranty.

The Analyzer comes in a high impact storage case. It is ready for use after calibration with an appropriate certified calibration gas.



WARNING

This analyzer is designed for use at atmospheric pressures only. It is not designed for exposures in a hyperbaric chamber. Use of this analyzer in a hyperbaric chamber will result in incorrect readings and may damage the unit.

WARNING

Although the Analyzer is a rugged instrument, careless handling or abuse may result in damage to the Analyzer resulting in inaccurate gas analysis. Inaccurate gas analysis can lead to serious personal injury or death.

2.1. Controls

2.2. Display

2.3. Alarm

The Analyzer includes an audible alarm that is activated when the Sensor reaches 10 ppm CO. The alarm will not clear until the concentration of CO drops below 10 ppm.

2.4. Sensor

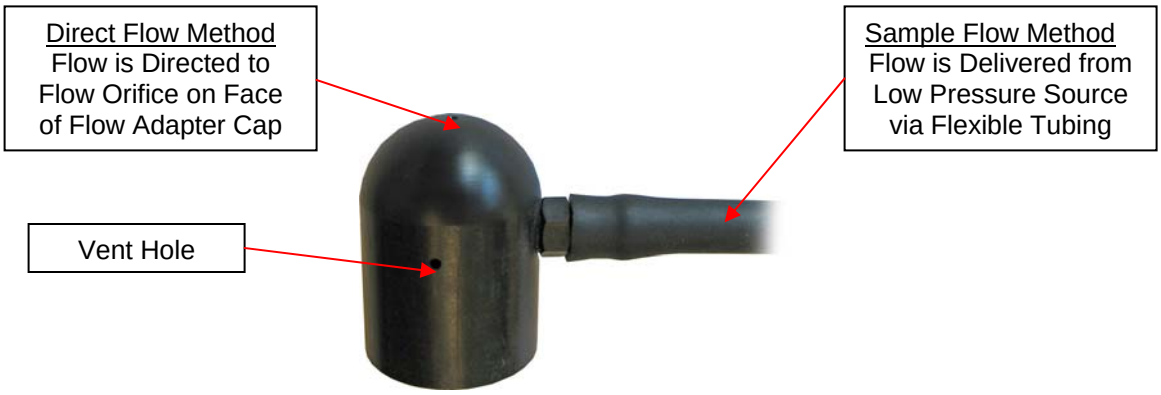
The Analyzer uses an electrochemical CO Sensor to measure CO content in gases. The Sensor is disposable and user-replaceable, with a life expectancy of up to 18 months depending on usage. The Sensor is designed for use at atmospheric pressure (0 P.S.I.). The gas mixture to be analyzed must be regulated accordingly, and any potential for pressure or vacuum must be avoided.

2.5. Batteries

Three standard AAA 1.5-volt batteries provide power. They are located inside the Analyzer and are user-replaceable. The batteries should be removed any time the Analyzer will be stored without use for extended periods of time.

2.6. Flow Adapter Cap

The Analyzer includes a Flow Adapter Cap with flexible tubing and flow orifice. It attaches to the Sensor port and is sealed by an o-ring. It can be used to direct the gas sample flow to the Sensor via one of two methods:



3.0 Calibration

WARNING

Analyzer calibration must be verified on a weekly basis. Improper calibration may result in an incorrect reading, exposing the user to dangerous levels of carbon monoxide. Exposure to carbon monoxide can lead to unconsciousness and death.

WARNING

This Analyzer must always be calibrated and used with gases regulated and supplied at atmospheric pressure (0 P.S.I.). Use of gases at higher pressures may result in incorrect readings and may damage the Analyzer. Incorrect readings may expose the user to high levels of carbon monoxide resulting in personal injury or death.

WARNING

Calibration or use of the Analyzer with a low battery may result in inaccurate readings. Inaccurate gas analysis can lead to serious personal injury or death.

NOTICE

If the Analyzer has been subjected to a recent change in ambient temperature, allow it to stabilize for one hour before calibration.

Verify calibration on a weekly basis. Breathing gas applications require the use of a certified CO calibration gas with a 10 ppm concentration and flow rate of 0.5-1 L/min. The equipment to produce this flow is available from Nuvair. See Spares and Accessories section.

To assure the greatest accuracy for other applications, use the calibration gas concentration closest to the expected concentration in the gas being measured.

Step 1. Turn Analyzer On

Step 2. Monitor Display for Low Battery Warning. If Low Battery Icon Appears, Replace Batteries.

Step 3. Attach Tubing to Calibration Gas Flow of 0.5 -1 L/min

Step 4. Expose Sensor to Calibration Gas Until Display Stabilizes

Step 5. Use 5/16” Wrench to Loosen Lock Nut. Rotate Calibrate Screw Until Display Reads Listed CO Calibration Gas Concentration. Tighten Lock Nut.

Step 6. Remove Tubing from Calibration Gas Source

4.0 Operation

Prior to each Analyzer use:

1) Turn unit on and monitor Display for low battery warning
2) Calibrate Analyzer as required.

WARNING

Never expose the sensor to pressures above atmospheric pressure (0 P.S.I.) or you may cause damage to the sensor and/or receive false readings. Damaged Sensors will not provide accurate gas analysis. Inaccurate gas analysis can lead to serious personal injury or death.

The Pro CO™ can be used to monitor an enclosed space or to analyze a regulated gas sample flow, the contents of a gas cylinder, or the flow from a regulator:

- If monitoring an enclosed space, simply remove the Flow Adapter Cap to expose the Sensor face to the atmosphere and allow 15 seconds for the Display reading to stabilize.
- If analyzing a gas flow, the Sample Flow Method is the preferred method. The flow rate must equal 0.5 to 1 L/min at atmospheric pressure. To produce this flow, a Flow Restrictor and Regulator may be required. Contact Nuvair if you need assistance.

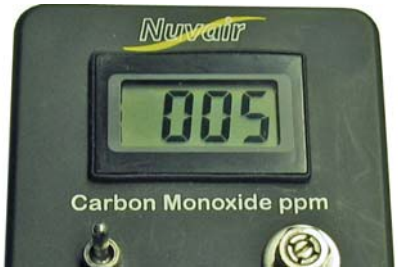
4.1. Sample Flow Method (Preferred)

Step 1. Attach Flexible Tubing to Gas Sample Flow of 0.5 to 1 L/min

Step 2. Verify that Gas is Flowing Out Holes in Flow Adapter Cap

Step 3. Allow 15 Seconds for Display Reading to Stabilize

Step 4. Record Reading while Gas is Flowing



4.2. Direct Flow Method – Gas Cylinder

WARNING

Do not test cylinders suspected of containing carbon monoxide in a confined space that does not have good ventilation. Exposure to carbon monoxide can lead to unconsciousness and death.

WARNING

Gas, even under moderate pressures, can cause extreme bodily harm. Never allow any gas stream to be directed at any part of your body.

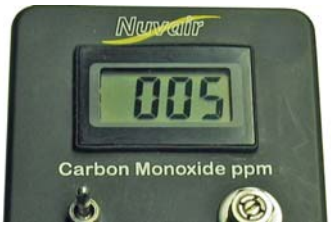
Step 1. Slowly Open Cylinder Valve until Slight Hiss of Gas is Heard

Step 2. Hold Face of Flow Adapter Cap up to Gas Flow

Step 3. Verify that Gas is Flowing Out Tubing

Step 4. Allow 15 Seconds for Display Reading to Stabilize

Step 5. Record Reading While Gas is Flowing



Step 6. Remove Analyzer & Verify that Gas Continues to Flow from Valve. If Not, Repeat Procedure

Step 6. Close Cylinder Valve

4.3. Direct Flow Method – Scuba Regulator

Step 1. Attach Scuba Regulator to Cylinder Valve

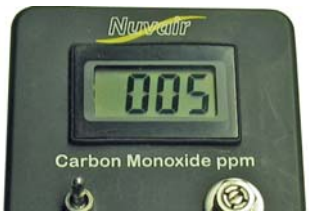
Step 2. Open Cylinder Valve

Step 3. Lightly Press Regulator Purge Button to Get Very Low Flow of Gas

Step 4. Hold Face of Flow Adapter Cap Up to Gas Flow

Step 6. Allow 15 Seconds for Display Reading to Stabilize

Step 7. Record Reading while Gas is Flowing



5.0 Maintenance

5.1. Analyzer Care

WARNING

Analyzers immersed in liquid or stored in wet environments may not operate properly. This may result in incorrect readings. Incorrect gas analysis may result in personal injury or death.

WARNING

Protect the analyzer from excessive shock and impact. Excessive shock and impact may result in incorrect readings. Incorrect gas analysis may result in personal injury or death.

WARNING

Protect the analyzer from exposure to hyperbaric environments. Exposure to hyperbaric environments may result in incorrect readings. Incorrect gas analysis may result in personal injury or death.

- Do not clean Analyzer with anything other than a damp soft cloth.
- Do not immerse in liquid, leave unprotected outside, or store in a wet environment.
- Protect Analyzer from excessive shock and impact.
- Protect Analyzer from excessive exposure to sunlight and extreme temperatures.
- Do not use the Analyzer in a hyperbaric environment.

5.2. Battery Replacement

NOTICE

Be sure to dispose of spent, leaking, or damaged Batteries properly, according to local regulations.

The following pictures illustrate the steps required to replace the batteries in the Analyzer.

Step 1. Remove Screws

Step 2. Remove Back Cover

Step 3. Remove & Replace Old Batteries

Step 4. Replace Back Cover - Do Not Pinch Wires

Step 5. Reinstall Screws

Step 6. Turn Analyzer On

Step 7. Perform Calibration

5.3. Sensor Replacement

CAUTION

Be sure to dispose of spent, leaking, or damaged Sensors properly, according to local regulations.

DANGER

Do not swallow (ingest) either the electrolyte from the Sensor or the Sensor itself. The Potassium hydroxide chemical contained in the Sensor will cause severe injury or death. If electrolyte or the Sensor is swallowed, seek medical attention immediately.

WARNING

If after handling the Analyzer or Sensor, you find that your fingers or other parts of your body feel "slippery" or the skin or eyes sting, immediately flush affected area with clean, fresh water for at least 15 minutes. The stinging or slippery sensation is an indication of a leaking Sensor. The Potassium Hydroxide chemical contained in the Sensor can cause severe injury or death. Seek immediate medical attention if eye contact is made or skin stinging persists.

Handling Sensors

Replacement Sensors are supplied in sealed bags. Normally Sensors do not present a health hazard. Before opening the bag, check that the electrolyte has not leaked. However, if electrolyte leakage has occurred, do not open bag. Dispose of Sensor properly or return for replacement.

If electrolyte leakage occurs while the Sensor is in service, use rubber gloves and chemical splash goggles for handling. Rinse contaminated surfaces thoroughly with water.

Electrolyte First Aid Procedures

- Ingestion - Drink a large volume of fresh water. Do not induce vomiting. Get immediate medical attention.
- Eye Contact - Flush eyes with clean, fresh water for at least 15 minutes and get medical help immediately.
- Skin Contact - Flush the affected area with clean, fresh water for at least 15 minutes and removed contaminated clothing. If stinging persists get medical attention.

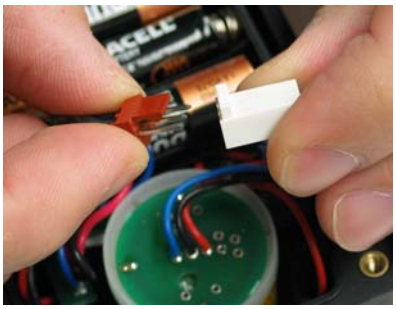
The following pictures illustrate the steps required to replace the Sensor in the Analyzer.

Step 1. Remove Flow Adapter Cap by Unscrewing CCW

Step 2. Remove Screws

Step 3. Remove Back Cover

Step 4. Disconnect Electrical Connector

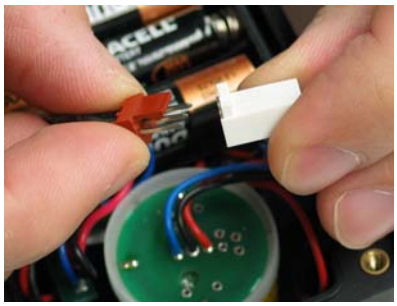


Step 5. Remove Old Sensor from Case by Unscrewing CCW

Step 6. Replace with New Sensor

Step 7. Remove Shorting Plug from Sensor Electrical Connector & Reconnect

Note: Reversing Polarity Will Cause Display to Read Negative



Step 8. Replace Back Cover - Do Not Pinch Wires

Step 9. Reinstall Screws

Step 10. Replace Flow Adapter Cap

Step 11. Turn Analyzer On

Step 12. Perform Calibration

6.0 Spares and Accessories

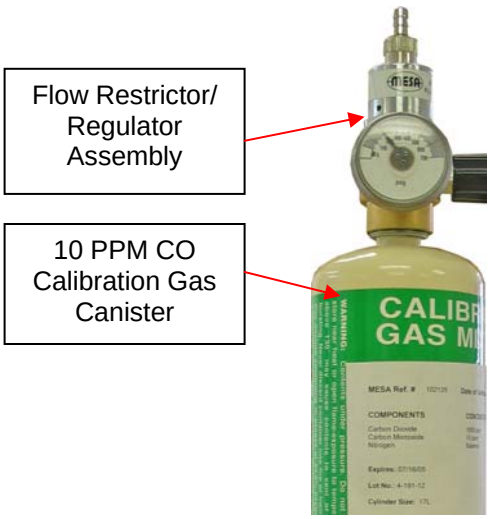
6.1. Sensors

Order replacement Sensor Part No. D-31.

6.2. Calibration Equipment

Calibration requires certified CO calibration gas to be delivered at a specific flow rate and pressure.

A variety of calibration gas canisters are available from Nuvair, with compatible Flow Restrictor/ Regulator assemblies to regulate the gas.



7.0 Troubleshooting

SYMPTOM	REASON	SOLUTION
Battery symbol	Low Battery	Change the battery
No display	Switched off Bad connection Low Battery	Switch on Check display/battery connection Change the battery
Reading erratic	Pressure on sensor Radio transmission Sensor old or faulty Condensation on sensor.	Check flow Move unit away Change sensor Dry in air
Reading does not change when calibration knob is turned	Faulty connections Sensor failure	Check connections Change sensor
Display segments missing	Display faulty	Return to dealer
Will not calibrate	Sensor faulty	Change sensor
Reading drifts	Rapid temperature change	Stabilize temperature & recalibrate

Appendix

Analyzer Specifications

Range:	0 – 100 ppm CO
Alarm Set Point:	10 ppm CO
Display Accuracy:	+/- 1%
Sensor Type:	Electrochemical
Expected Sensor Life, Room Air:	18 Months
Power:	3 AAA 1.5 Volt Batteries
Response Time:	Less Than 15 Seconds to 90% of Final Value
Stabilization Time:	15 Minutes when First Installed
Operating Temperature:	32 to 122°F (0 to 50°C)
Storage Temperature:	-4 to 140°F (-20 to 60°C)
Operating Pressure:	Not to Exceed 1 Atmosphere Absolute (0 P.S.I.)
Humidity:	10-95% RH

Note: All specifications are at ambient / sea level, 25°C

NUVAIR Pro CO™ Warranty

NUVAIR extends a limited warranty, which warrants the Pro CO™ to be free from defects in materials and workmanship under normal use and service for a limited period. The Pro CO is warranted according to the pro-rated terms as set forth below. This warranty is not transferable.

NUVAIR will, at it's discretion and according to the terms as set forth within, replace or repair any materials which fail under normal use and service and do not exhibit any signs of improper maintenance, misuse, accident, alteration, weather damage, tampering, or use for any other than the intended purpose. Determination of failure is the responsibility of NUVAIR, which will work together with the customer to adequately address warranty issues. When any materials are repaired or replaced during the warranty period, they are warranted only for the remainder of the original warranty period. This warranty shall be void and NUVAIR shall have no responsibility to repair or replace damaged materials resulting directly or indirectly from the use of repair or replacement parts not approved by NUVAIR.

Pro-Rated Terms:
NUVAIR warrants the Pro CO to be free from defects in material and workmanship for a period of twelve (12) months from date of purchase. The warranty covers parts and labor.

A warranty registration card, supplied with system documentation, must be filled out and submitted to NUVAIR for the warranty to be registered. If the warranty registration card is not received within ten (10) days of purchase, the warranty will begin with the date of manufacture by NUVAIR.

Maintenance Items:
Any materials which are consumed, or otherwise rendered not warrantable due to processes applied to them, are considered expendable and are not covered under the terms of this policy. This includes batteries.

Return Policy:
Application for warranty service can be made by contacting NUVAIR during regular business hours and requesting a Return Material Authorization number. Materials that are found to be defective must be shipped, freight pre-paid, to the NUVAIR office in Oxnard, California. Upon inspection and determination of failure, NUVAIR shall exercise its options under the terms of this policy. Warranty serviced materials will be returned to the customer via NUVAIR's preferred shipping method, at NUVAIR's expense. Any expedited return shipping arrangements to be made at customer's expense must be specified in advance.

Limitation of Warranty and Liability:
Repair, replacement or refund in the manner and within the time provided shall constitute NUVAIR'S sole liability and the Purchaser's exclusive remedy resulting from any nonconformity or defect. NUVAIR shall not in any event be liable for any damages, whether based on contract, warranty, negligence, strict liability or otherwise, including without limitation any consequential, incidental or special damages, arising with respect to the equipment or its failure to operate, even if NUVAIR has been advised of the possibility thereof. NUVAIR makes no other warranty or representation of any kind, except that of title, and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose, are hereby expressly disclaimed. No salesman or other representative of NUVAIR has authority to make any warranties.

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