



Operation Manual

Pro O₂TM Pro O₂ RemoteTM

Oxygen Analyzers

Rev 08.17

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

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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.

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1.0 Introduction

This manual will assist you in the proper set-up, operation and maintenance of the Pro O₂TM and Pro O₂ RemoteTM Oxygen Analyzers. 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 O₂TM and Pro O₂ RemoteTM Oxygen Analyzers (“the Analyzer”) measure oxygen (O₂) levels in gases in the range of 0.1 - 100.0% O₂. The choice of Analyzer depends on the application:

- Pro O₂TM – where pressurized gas must be analyzed and the pressure and flow of the sample flow can be regulated
- Pro O₂ RemoteTM - where non-pressurized gas must be analyzed or for pressurized gas applications where the Analyzer must be located remote to the sensor



The Analyzer is a water and impact resistant unit compatible with outdoor and marine environments. Pressurized gases must be regulated to one atmosphere absolute (0 P.S.I.) prior to analyzing.

When used in breathing gas applications, redundant Analyzers must be used for verification. In diving, for example, one Analyzer must be used to monitor oxygen during breathing gas production and a second independent Analyzer must be used to verify the oxygen content of the breathing gas prior to diver use.



WARNING

When using the Analyzer for diving applications with mixed gases other than air, you must first obtain proper instruction from a certified diving instructor with a nationally recognized training agency qualified in mixed gas diving. Improper use of this analyzer may result in incorrect gas analysis which can lead to serious personal injury or death.



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.



WARNING

Breathing gas must always be analyzed by two separate Analyzers, with one used for production and one used for analysis after production. Never depend on a single Analyzer during both gas production and delivery. If the Analyzer readings do not agree, both units must be recalibrated. Inaccurate gas analysis can lead to serious personal injury or death.

2.1. Controls



2.2. Display

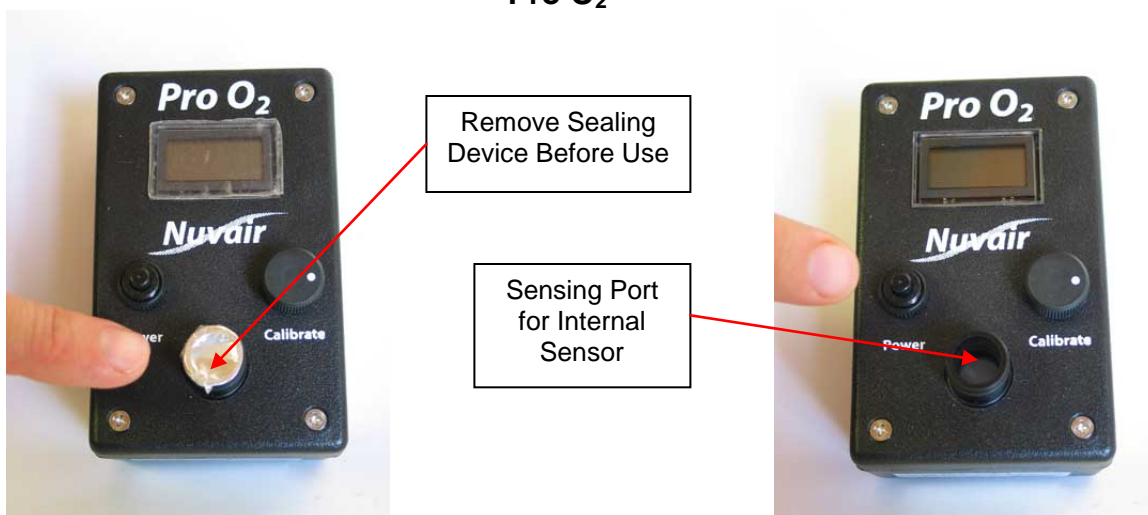
2.3. Oxygen Sensor



The Analyzer uses an electrochemical O₂ Sensor to measure O₂ content in gases. The Sensor is disposable and user-replaceable, with a life expectancy of up to 36 months depending on usage. The Sensor is designed for use at one atmosphere absolute (0 P.S.I.) pressure. The gas mixture to be analyzed must be regulated accordingly, and any potential for pressure or vacuum must be avoided.

To extend sensor life, the Analyzer is supplied with the Sensor in a sealed condition. When first received, please verify that sealing device is intact. If the sealing device is torn or missing, contact your supplier for assistance. The sealing device must be removed prior to initial use and is not necessary to reuse.

Pro O₂TM



Pro O₂ RemoteTM

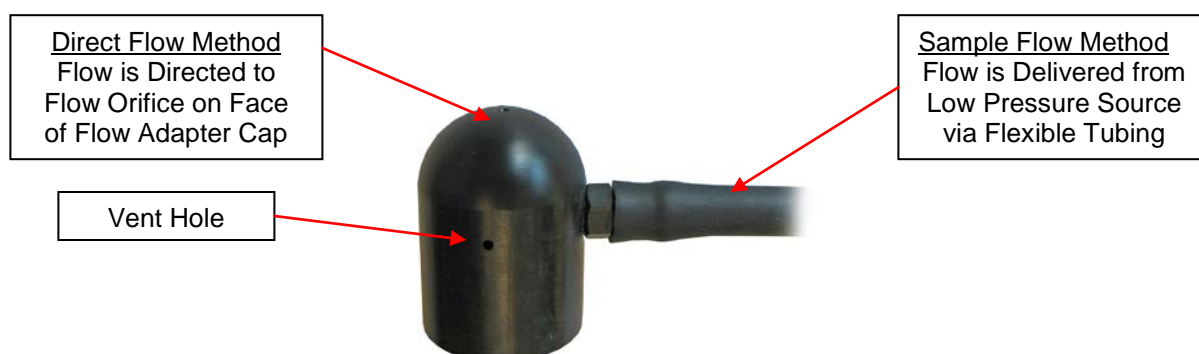


2.4. Battery

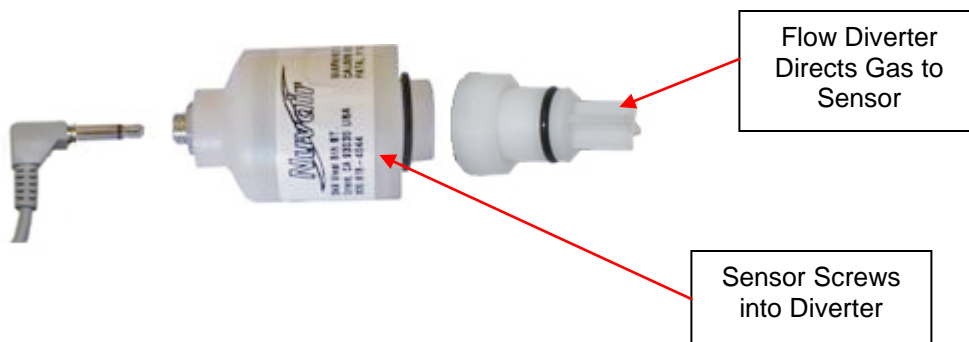
Power is provided by a standard alkaline 9-volt battery. It is located inside the Analyzer and is user-replaceable.

2.5. Flow Adapter Cap (Pro O₂TM)

The Flow Adapter Cap with flexible tubing and flow orifice attaches to the Pro O₂TM 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:



2.6. Flow Diverter (Pro O₂ RemoteTM)



The Flow Diverter is installed to the user's non-pressurized device to direct gas flow to the Sensor:

- Slip Fit Method – Install optional Tee Adapter (see Spares and Accessories section) in-line with gas flow path. Insert Flow Diverter with o-ring into small bore of Adapter.
- Press Fit Method – Remove the Flow Diverter o-ring and press fit the Diverter into a 9/16 inch diameter cylindrical bore in gas flow path.

3.0 Calibration



WARNING

Oxygen Analyzers must be calibrated before each use. Improper calibration may result in the use of incorrect breathing gas mixtures, which may cause serious injury or death to the person using the gas mixture.



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.



WARNING

When Analyzer calibration is performed at different atmospheric conditions than the gas being measured, a calibration correction value may be required. Improper calibration may result in the use of incorrect breathing gas mixtures, which may cause serious injury or death to the person using the gas mixture.

3.1. Calibration Methods

Calibration should always be performed at the same temperature and humidity conditions as the gas being measured. This is not always possible, for example, in a tropical environment where dry breathing gas from a high-pressure Scuba cylinder will be measured after Analyzer calibration has been performed in the warm, humid ambient air. Under these conditions a calibration correction value may be required, as detailed in the Appendix, or dry air must be used for calibration.



WARNING

Obtain proper training before attempting special calibration procedures. Improper calibration may result in the use of incorrect breathing gas mixtures, which may cause serious injury or death to the person using the gas mixture.

Calibration in air at sea level is suitable for many applications; however, the closer the oxygen content of the calibration gas is to the gas being tested, the more accurate the measurement results. The following special applications require methods and training beyond the scope of this manual:

- Analysis of gases containing greater than 50% oxygen requiring calibration with pure oxygen or certified calibration gas
- Analysis of gases at altitudes above sea level requiring correction for reduced atmospheric pressure, contact Nuair for more information.

3.2. Calibration in Air

The following pictures illustrate the steps required to calibrate the Pro O₂TM Analyzer.

Pro O₂TM

Turn Analyzer
On

Monitor Display
for Low Battery
Warning



Step 1

Remove Flow
Adapter Cap

Expose Sensor
Port to Still Air
Until Display
Stabilizes



Step 2

Adjust
Calibrate Knob
Until Display
Reads 20.9%



Step 3

Replace Flow
Adapter Cap

Do Not Disturb
Calibrate Knob



Step 4

The following pictures illustrate the steps required to calibrate the Pro O₂ RemoteTM Analyzer.

Pro O₂ RemoteTM

Turn Analyzer
On

Monitor Display
For Low Battery
Warning



Step 1



Unscrew Sensor
From Flow
Diverter

Expose Sensor Port
to Still Air Until
Display Stabilizes

Step 2

Adjust
Calibrate
Knob Until
Display Reads
20.9% O₂



Step 3

Verify
Electrical
Cord is Firmly
Attached at
Both Ends

Reinstall
Sensor to
Diverter



Step 4

4.0 Operation

Prior to each Analyzer use:

- 1) Verify that Sensor sealing device is removed
- 2) Turn unit on and monitor Display for low battery warning
- 3) Calibrate Analyzer as required.



WARNING

Never expose the Oxygen Sensor to pressure or you may cause damage and/or false readings. Damaged Sensors will not provide accurate gas analysis. Inaccurate gas analysis can lead to serious personal injury or death.

4.1. Pro O₂TM

The Pro O₂TM can be used to analyze a regulated gas sample flow, the contents of a gas cylinder, or the flow from a regulator. The flow rate of gas must equal 1 – 5 L/min. To produce this flow, a Flow Restrictor and Regulator may be required. See Spares and Accessories section.



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.

Sample Flow Method

Attach Flexible
Tubing to Gas
Sample Flow
of 1-5 L/min



Step 1

Verify that
Gas is Flowing
Out Holes in
Flow Adapter
Cap



Step 2

Allow 15 Seconds for
Display Reading to
Stabilize

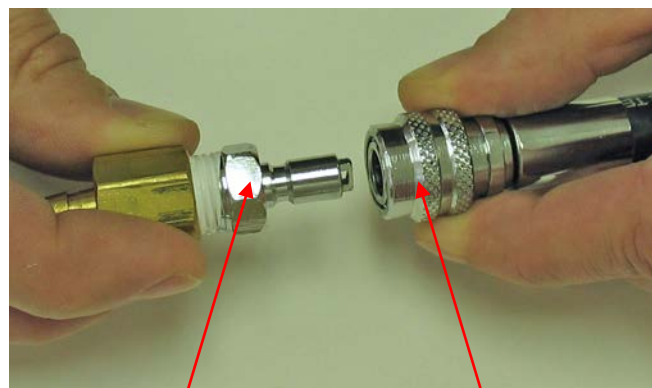
Record Reading
while Gas is Flowing



Step 3

When analyzing Scuba Cylinder gases, it is convenient to obtain the sample gas directly from the Buoyancy Compensator (BC) inflator hose attached to the Regulator first stage.

A special Flow Restrictor is attached to the inflator hose quick-disconnect (QD) fitting. The fitting on the other end of the Restrictor is then inserted into the tubing supplied with the Analyzer. A variety of Flow Restrictors are available to fit different types of inflator hose QD fittings. See Spares and Accessories section.



Flow Restrictor

BC Inflator Hose QD Fitting

Direct Flow Method – Gas Cylinder

Slowly Open Cylinder Valve until Slight Hiss of Gas is Heard



Hold Flow Adapter Cap Flow Orifice up to Gas Flow

Verify that Gas is Flowing Out Tubing



Step 1

Step 2

Allow 15 Seconds for Display Reading to Stabilize

Record Reading While Gas is Flowing



Close Cylinder Valve & Remove Analyzer

Verify that Gas Continues to Flow from Valve. If Not, Repeat Procedure



Step 3

Step 4

Direct Flow Method – Scuba Regulator

Attach Scuba
Regulator to
Cylinder Valve

Open Cylinder
Valve



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

Hold Flow Adapter
Cap Flow Orifice
Up to Gas Flow



Step 1

Step 2

Allow 15
Seconds for
Display Reading
to Stabilize

Record Reading
while Gas is
Flowing

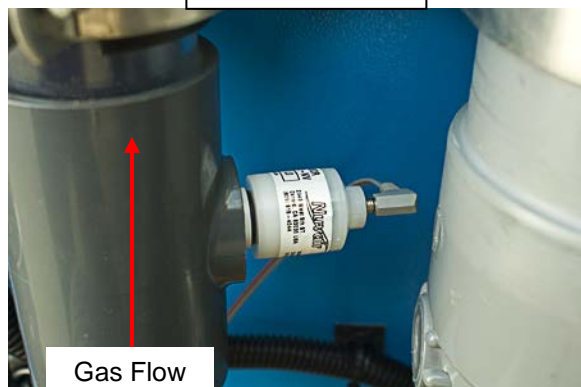


Step 3

4.2. Pro O₂ RemoteTM

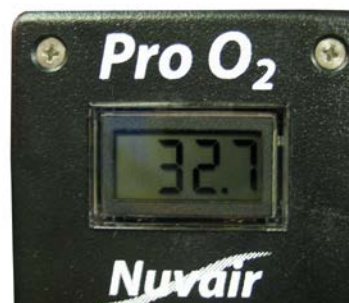
The Pro O₂ RemoteTM is used where non-pressurized gas must be analyzed or for pressurized gas applications where the Analyzer must be located remote to the sensor:

Begin Flow of
Gas Stream
Past Sensor



Allow 15
Seconds for
Display Reading
to Stabilize

Record Reading
while Gas is
Flowing



Pictured is the rear of a Nuvair Nitrox Generator with sensor placed in mixing tube.

Step 1

Step 2

5.0 Maintenance

5.1. Analyzer Care

- Do not clean Analyzer with anything other than a damp soft cloth.
- Do not immerse Analyzer 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.

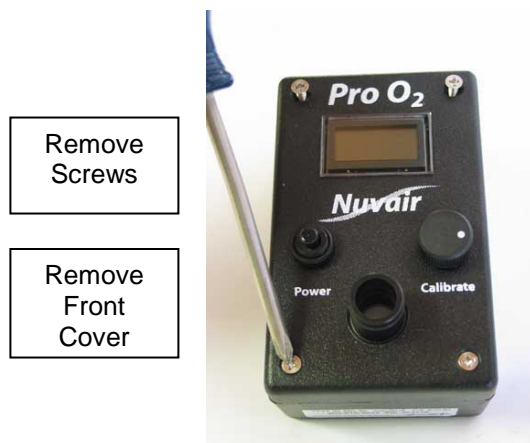
5.2. Battery Replacement



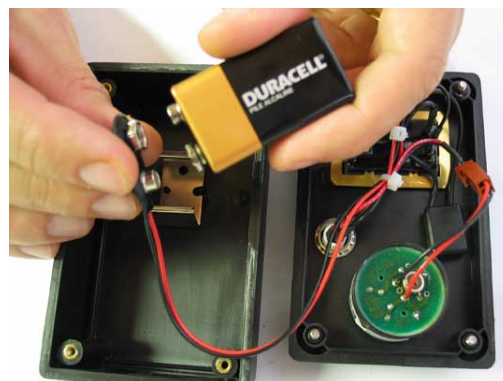
NOTICE

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 battery in the Analyzer.



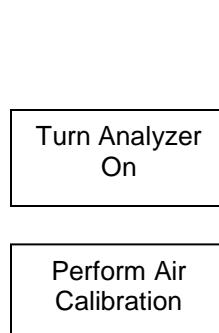
Step 1



Step 2



Step 3



Step 4



NOTICE

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

Panel Mount Analyzers require the user to open the compressor and access the rear of the analyzer for battery replacements. Once you have access to the rear of the analyzer the following instructions will help in the replacement of the battery.

The Analyzer case is made of two components the face plate mounted on the outside of the compressor and the box inside the compressor which stores the battery, wires and the remote sensor inputs.

Care should be taken when removing the box so that you do not pull apart the wiring between the front LCD face and the box.

Remove
Screws

Remove
Analyzer
Box Inside
Compress



Step 1

Remove &
Replace
Old Battery



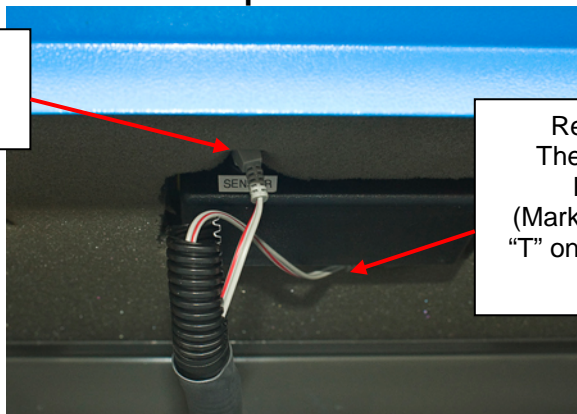
Replace
Front Cover
- Do Not
Pinch Wires

Step 2

Step 3

Replace
Sensor
Plug

Replace
Thermistor
Plug
(Marked with a
"T" on the plug)



Step 4



Once the Analyzer is put back together you need to turn on the Analyzer and Calibrate the Analyzer before operating the compressor.

5.3. Oxygen Sensor Replacement



CAUTION

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



DANGER

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



WARNING

If after handling the Oxygen 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 Pro O₂TM.

Pro O₂TM

Remove Flow
Adapter Cap



Step 1

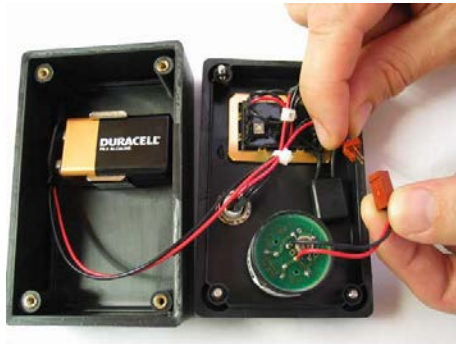
Remove
Screws

Remove
Front
Cover



Step 2

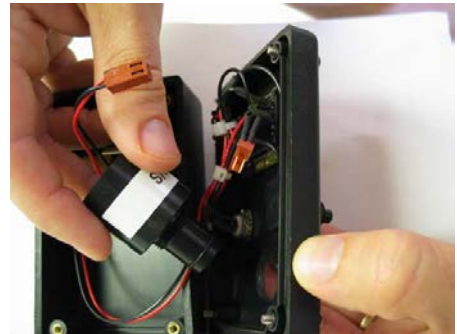
Disconnect
Electrical
Connector



Step 3

Remove Old
Sensor from
Cover by
Unscrewing
CCW

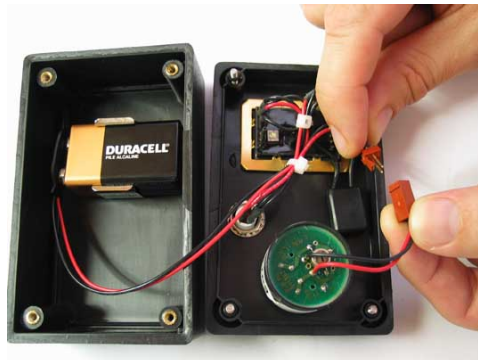
Replace
with New
Sensor



Step 4

Reconnect
Electrical
Connector

Note: Reversing
Polarity Will Cause
Display to Read
Negative



Step 5

Replace
Front Cover
- Do Not
Pinch Wires

Reinstall
Screws



Step 6

Turn Analyzer
On

Perform Air
Calibration



Step 7

The following pictures illustrate the steps required to replace the Sensor in the Pro O₂ Remote when Installed on a Nuvaire Nitrox Generator or Nitrogen Generator.

Pro O₂ RemoteTM

Disconnect
Electrical
Cord from
Sensor



Step 1

Remove and
Replace Old
Sensor



Step 2

Reconnect
Electrical
Cord to
Sensor



Step 3

Turn
Analyzer On



Step 4

6.0 Spares and Accessories

6.1. Oxygen Sensors

Order the replacement Sensor closest in appearance to your existing Sensor.

Pro O₂TM



Part No. 9510



Part No. 9505

Pro O₂ RemoteTM



Part No. 9506

6.2. Flow Restrictors and Regulators (Pro O₂TM)

A variety of Flow Restrictors and Pressure Regulators for the Sample Flow Method are available from Nuvair, all calibrated to produce a flow rate of 1 – 5 L/min with a Regulator output of 100 – 160 P.S.I.

Universal Flow Restrictors are used for most applications and are typically provided complete with Regulator.

When analyzing Scuba Cylinder gases, special Flow Restrictors can be used to obtain the sample gas directly from the BC inflator hose. A variety of BC Flow Restrictors are available to fit the different types of inflator hose QD fittings used.

Pressure
Reducing
Regulator

Universal
Flow
Restrictor



Part No. 9519



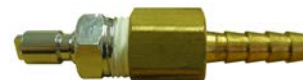
1/4" FNPT Flow Restrictor
Part - 9517



ScubaProTM Flow Restrictor
Part – 9518-SCUBAPRO



MaresTM Flow Restrictor
Part – 9518-MARES



Standard Flow Restrictor
Part - 9518-STD



HP Regulated Flow Restrictor
Part No. 9520-Int

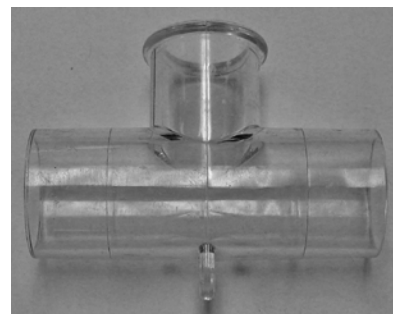


HP Regulated Flow Restrictor
Part No. 9520-DIN

6.3. Tee Adapter (Pro O₂ RemoteTM)

When using the Pro O₂ RemoteTM to analyze in-line gas flow, the Tee Adapter is used to install the Sensor and Flow Diverter in the gas path.

Tee Adaptor
Part No. 6024



7.0 Troubleshooting

SYMPTOM	REASON	SOLUTION
Battery symbol	Low Battery	Change the battery
No display	Switched off Bad connection	Switch on Check display connection Check battery connection
Zero reading	Sensor disconnected Sensor expired	Check connection Change sensor
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 Sensor not in air High altitude	Change sensor Check flow adapter Use altitude calibration procedure *
Reading drifts	Rapid temperature change	Stabilize temperature & recalibrate

*Contact Nuvair for more information.

Analyzer Specifications

Range:	0.1-100.0% Oxygen (0-1 ATA PPO ₂)
Display Accuracy:	+/- 0.1%
Sensor Type:	Electrochemical
Expected Sensor Life, Room Air:	36 Months
Power:	9V Alkaline Battery
Response Time:	Less Than 6 Seconds to 90% of Final Value
Operating Temperature:	32-104°F (0-40°C)
Storage Temperature:	32-122°F (0-50°C)
Pressure:	Sensitive to Partial Pressure
Humidity:	0-99% RH (Non-Condensing)
Warranty:	36 Months Pro-Rated

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

Appendix

Calibration Correction Values for Temperature and Humidity

Oxygen Analyzer calibration should always be performed at the same temperature and humidity conditions as the gas being measured. Where this is not possible, a calibration correction value may be required. A common example is a tropical environment where dry breathing gas from a high-pressure Scuba cylinder will be measured after Analyzer calibration has been performed in the warm, humid ambient air.

To determine if a calibration correction value is required, you must first know the temperature and relative humidity of the air in which calibration will be performed. Using the chart below, find the atmospheric oxygen percent value corresponding to these values. If the oxygen percent value falls in the shaded portion of the chart, calibrate the Analyzer to the corrected chart value.

OXYGEN COMPENSATION CHART FOR MOISTURE IN THE ATMOSPHERE

ATMOSPHERE OXYGEN PERCENT IN RELATION TO TEMPERATURE AND RELATIVE HUMIDITY										
TEMPERATURE (°F) -->	32	40	50	60	70	80	90	100	110	120
TEMPERATURE (°C) -->	0	4	10	16	21	27	32	38	43	49
RELATIVE HUMIDITY (%)	ATMOSPHERIC OXYGEN PERCENT (% O ₂)									
10	20.9	20.9	20.9	20.9	20.8	20.8	20.8	20.8	20.7	20.7
20	20.9	20.9	20.8	20.8	20.8	20.8	20.7	20.6	20.5	20.4
30	20.9	20.8	20.8	20.8	20.7	20.7	20.6	20.5	20.4	20.2
40	20.8	20.8	20.8	20.7	20.7	20.6	20.5	20.4	20.2	19.9
50	20.8	20.8	20.8	20.7	20.6	20.5	20.4	20.2	20.0	19.7
60	20.8	20.8	20.7	20.7	20.6	20.5	20.3	20.1	19.8	19.5
70	20.8	20.8	20.7	20.6	20.5	20.4	20.2	19.9	19.6	19.2
80	20.8	20.8	20.7	20.6	20.5	20.3	20.1	19.8	19.5	19.0
90	20.8	20.7	20.7	20.6	20.4	20.3	20.0	19.7	19.3	18.7
100	20.8	20.7	20.6	20.5	20.4	20.2	19.9	19.5	19.1	18.5
H ₂ O at 100% RH	0.6	0.8	1.2	1.8	2.5	3.4	4.7	6.5	8.6	11.5

If the Temperature and Relative Humidity axis meet in the shaded part of the chart, calibrate to the chart O₂ level or with dry air to maintain 0.5% O₂ accuracy in NITROX.

To use the correction value, follow the standard Calibration in Air procedure with the following exceptions:

- Make sure Oxygen Sensor port is exposed to the ambient temperature and humidity corresponding to the correction value.
- Adjust the Calibrate Knob to achieve a Display reading equal to the correction value.
- Once you have calibrated the Analyzer for temperature and humidity using the, your readings for gas analysis should be correct with no further adjustment.
- Re-calibrate Analyzer for any changes in temperature or humidity of the ambient environment or the gas being analyzed.

Note that the calibration correction value is never used when the temperature and humidity conditions of the gas being measured are the same as the conditions during calibration.

NUVAIR Pro O₂TM and Pro O₂ RemoteTM Warranty

Nuvair extends a limited warranty, which warrants the Pro O₂ and Pro O₂ Remote to be free from defects in materials and workmanship under normal use and service for one year (12 months). The Pro O₂ and Pro O₂ Remote **SENSOR** are under warranty according to the pro-rated terms as set forth below. This warranty is non-transferable.

Nuvair will, at its 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 oxygen sensor for a period of twenty-four (24) months from date of purchase. The warranty covers the sensor only and is prorated as follows:

- | | |
|------------------|---------------------|
| • 0 – 12 Months | Free Replacement |
| • 13 – 18 Months | 50% Off Replacement |
| • 19 – 24 Months | 25% Off Replacement |

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 the 9-volt battery used in the Pro O₂ and Pro O₂ Remote.

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.

