VN202 mkII
Oxygen Analyser
Users Manual

These instructions should be read before using the VN202 mkII

Mixed gas diving should only be undertaken by divers trained by a recognised training organisation.

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Thank you for purchasing the VN202 mkII

Please register your purchase on

www.Vandagraph.co.uk.

Please click register and follow the instructions

If you have need of future assistance and have registered by using your units serial number you can access our help line.

If you have any comments or queries regarding any Vandagraph product including the VN202 mkII and sensors please contact us either by telephone, Fax,email or by visiting our website

Warranty

Vandagraph warranty ensures that goods are free from defects of manufacture for a period of one year from the date of shipment from Vandagraph. Liability shall be limited solely to the replacement and repair of the goods and shall not include shipping costs or other incidental costs.
This warranty is null and void if any items are subjected to misuse, negligence, accident, or repairs other than those performed by Vandagraph or a Vandagraph authorise service centre.
Cables are not included.

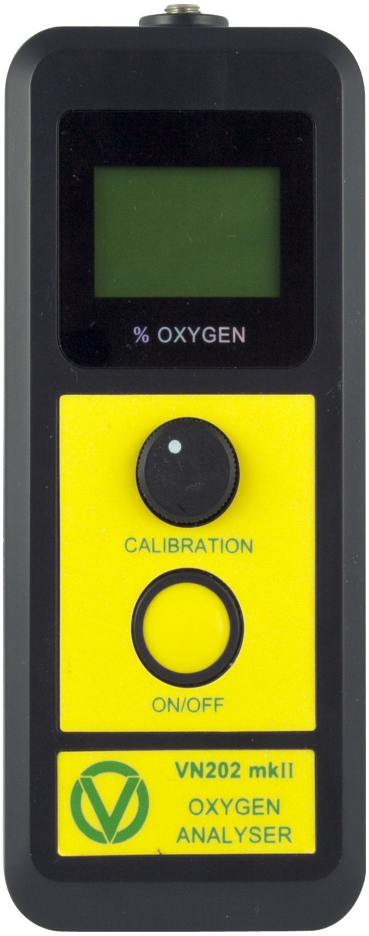
Although every attempt has been made to ensure that the information contained in this document is correct,Vandagraph Ltd. Accept no liability for errors or the misrepresentation of this material. This monitor should only be used by trained and certified Nitrox divers or mixed gas blenders

Contents

1) Introduction

The VN202 mkII Diving Oxygen Analyser has been designed to measure the Oxygen content in a variety of gas mixtures including Nitrox and Trimix incorporating the latest in state of the art technology

It is recommended that the instrument only be used a secondary measuring device to verify the concentration of Oxygen in gas mixtures prepared using other recommended methods of mixing, i.e. blending, partial pressure mixing, mixing by weight.



The instrument utilizes the Vandagraph R-17VAN Micro Fuel Cell which is a self contained galvanic cell requiring no routine maintenance.

The Liquid Crystal Display (LCD) provides an easy to read indication of the Oxygen content of the gas being monitored with a resolution of 0.1%.

There only two controls the **On/Off** switch and the **Calibration** control which can be operated with either hand.

The left hand corner of the display indicates a battery symbol when batteries are low. The instrument incorporates an auto-switch off. **approx 3 minutes**

The analyser can be supplied on request with the auto-switch off disabled. This will have a Green switch. On Switch on the LCD will display the software version then the % oxygen in the gas.

2) Setting Up the VN202 mkII Oxygen Analyser

Upon receipt inspect the package and ensure you have the following items

VN202 mkII Analyser
Batteries two AA Alkaline (may already be installed.) Sensor R-17VAN
Quick start guide Carrying case. Neck strap
Quick-Ox or DINKIT or BC adapter

VN202 with Quick-Ox

VN202 with DINKIT

VN202 with BC adapter

IMPORTANT Check the entire unit for damage. If damaged do not use. Notify the supplier or consult Vandagraph Ltd .

3) Battery Installation or replacement

Remove the battery cover by applying downward pressure to the tag on the battery cover It is gasket sealed so after a period of time may need pressure. Do not lever off with a tool.
Two AA 1.5 volt Alkaline Batteries Type MN1500, LRG 1.5 or similar must be installed in the VN202 mkII to enable it to operate.
Slide in the batteries in the correct way +ve to +ve -ve to -ve

IMPORTANT
Batteries must be replaced immediately the battery symbol appears in the LCD window. Accuracy of the Vn202 mkII can not be guaranteed whilst this battery symbol is visible

4) Sensor Installation

An R-17VAN Sensor must be installed before the VN202 mkII will operate.

Remove the sensor from its protective bag and visually inspect the sensor for damage or electrolyte leakage.
Allow sensor a few minutes to stabilize after installation**.**
Rotate the sensor around the jack plug and lock
Fit the other jack plug on the coiled cable into the socket on the VN202mkII, rotate and lock
The sensor should be allowed settle in a few minutes, after removing from the bag and at least 1 hour should be allowed for greatest accuracy

*** Never use a defective or suspect sensor.**

The R-17VAN sensor electrolyte is caustic. Do not let the electrolyte come into contact with skin, eyes or mouth. If it does, flush the affected area with fresh water. See section on First Aid (16).
Do not attempt to open or repair the sensor. Check the sensor regularly for leaks.
Leaking or exhausted sensors should be disposed of in accordance with local regulations which is usually similar to the disposal of batteries.
Consult the material safety data sheet.(section 19 Page 16)
IMPORTANT
Vandagraph offer a "Return to Vandagraph for correct disposal" service which is free.
It is extended to all types of Galvanic sensor when you purchase a new sensor for any type of analyser. Visit www.Vandagraph.co.uk for further information

5) The Flow Divertor

The Flow divertor is designed specifically to be used in conjunction with a Tee Piece or The Quick-Ox gas sampling kit. Flowing gas diverted onto the sensor face decreases the sensor response time. Failure to remove the divertor and Tee when measuring static gas will severely increase the response time and can cause substantial inaccuracies. In a stationary gas the Flow divertor traps the residual Oxygen rich gas in the area just above the sensor membrane and severely slows down the ingress of fresh air into the sensor. A sensor left in air with the Flow adapter fitted can take several minutes to return to 20.9% when removed from an Oxygen enriched gas. Calibration will be inaccurate during this period.

*** Moving gas is essential when using the Flow adapter.**

6) Calibration in Air

This method is routinely suitable for mixtures less than 50% oxygen Switch on VN202 mkII Analyser by pressing once the on/off switch. Remove the Tee Piece but leave the Flow divertor on the sensor. Hold the sensor by the jack plug. Wave the sensor through the air gently Adjust the Calibration control until the LCD reads 20.9% at sea level.

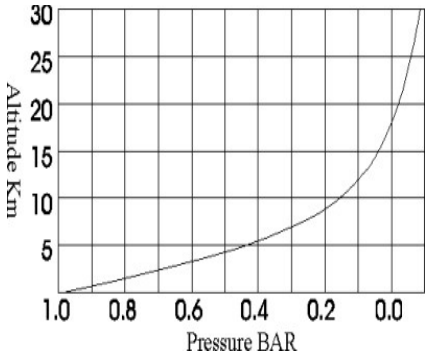
NB Altitude, ambient pressure and humidity can all effect the accuracy of gas measurement. Sensors deteriorate very slowly and near the end of their useful life may show a drift downwards or upwards soon after calibration.

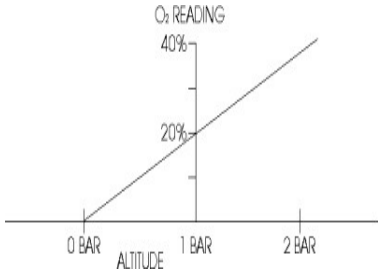
Sensors should be checked periodically with 100% Oxygen .

If analysing Nitrox below 50% an air calibration is usually sufficient.

If Analysing mixtures above 50% (e.g. decompression gases) always calibrate to 100%

7) Effects of Altitude & pressure





All galvanic Oxygen analysers measure the partial pressure and not the percentage of the gas they sense. The only time these instruments can accurately read percentages is when the pressure is atmospheric (1 Bar) and does not vary between calibration and measurement.

It is therefore important to calibrate the VN202 mkII at regular intervals. It is recommended that the unit be calibrated prior to each use.

At sea level in air the partial pressure of Oxygen is approximately 0.21 and the percentage of Oxygen will therefore read approximately 21%. If the sensor was subjected to 2 BAR pressure in air it would read 42% (Partial pressure 0.42 Bar). Pressures of this magnitude may be experienced by the sensor if it is placed on the output of the pillar valve,or mouthpiece and therefore facing into the gas flow. If a container or bag is used to contain the gas to be measured it must have pin size vent holes and the pressure must be allowed to return to ambient before a measurement is made. Wind increases pressure and if directed on to the sensor face during air calibration can cause erratic readings. The VN202 mkII readings will be affected by altitude and re-compression chambers .

The diagrams are for illustration only and for greater accuracy ambient pressure and correct altitude should be known.

8) **Effects of Humidity**

Although not substantial humidity can effect the maximum accuracy that can be obtained. This accounts for the difference observed between ambient air calibration and calibration with dry gas from a cylinder. For calibration purposes humidity does not directly affect the Accuracy of the sensor : see humidity table for approximate values expected.

Excessive moisture or condensation on the sensor surface will block diffusion of Oxygen to the sensor and render it inoperative. The oxygen in the gas must pass into the water and then into the sensor which can take several minutes, The same effect is seen in reverse when the sensor is put back into air

In high humidity atmospheres hold the sensor facing down during calibration. Any droplets will have a chance to fall off the sensor membrane.

Using the restrictor method or the DINKIT with air from a cylinder for calibration will allow the flowing dry gas to evaporate any moisture on the sensor face

The table below is an indication of the effect of humidity. As the temperature increases the amount of water vapour the gas can hold increases. So the the worst case is high temperatures and high humidity together.

Temp/RH	RH40%	RH60%	RH80%	RH100%
0°C/32°F	20.9%	20.8%	20.8%	20.8%
10°C/50°F	20.8%	20.7%	20.7%	20.6%
20°C/70°F	20.7%	20.6%	20.5%	20.4%
30°C/90°F	20.5%	20.3%	20.1%	19.9%
40°C/100°F	20.4%	20.1%	19.8%	19.5%

9) 100% Oxygen Calibration

A DINKIT or Quick-Ox can be used for 100% Calibration

For user instructions for DINKIT see Page 10
For user instructions on Quick-Ox see XXX

DINKIT

Quick-Ox

However an alternative method is to place the sensor without the Flow Thru divertor in a plastic bag with several small pin holes.

Ensure the neck of the bag is held closed. Slowly introduce 100% Oxygen via a small tube and flush several times. When stable, set calibration to 100%.

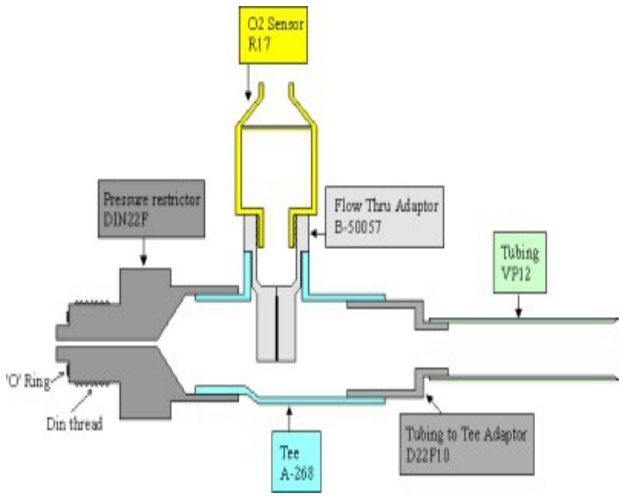
Remove the sensor from the bag. Blow gently over the sensor face.
The VN202 reading should fall to about 17% (due to the $C0_2$ in breath) and the settle at between 20% and 22%.

It can take several minutes for the reading to fall from 21.9% to 20.9%
If the sensor is outside these limits, repeat the calibration.
Ensure all the Oxygen has been flushed out of the sensor during the air calibration.

IMPORTANT If calibration is in a confined space and many cylinders are being tested ambient Oxygen levels may build up beyond 21%. Check in fresh air or for greater accuracy with compressed air .
Allow adequate ventilation in the measuring area.

10) Measurement using a DINKIT

The most accurate method of measuring the oxygen in a gas is to use the DINKIT
This comprises : Flow divertor, Tee Piece and tubing connected to a restrictor part number DIN22F. This method reduces substantially the effects of high flow rates and cold cylinder gas temperatures



Theory of the DINKIT

The Pressure restrictor is a large brass fitting that restricts the gas flow and reduces the effect of the cold gas being release from the cylinder The Flow divertor is a set of blades which divert a small portion the gas onto the sensor face.

The gas flow to the sensor is therefore turbulent ensuring a fast reading. When the flow has stopped the plastic tube reduces the flow of air back into the Tee giving several seconds for a reading to be taken.

The DINKIT fulfils the most important requirement of Galvanic oxygen sensor measurement in that it should take place at (1Bar) atmospheric pressure..

How to use the DINKIT
This applies to either Nitrox mixtures, compressed air, or 100% oxygen,

Calibrate in air to 20.9%

The pressure restrictor DIN22F has a standard DIN fitting which can be used directly into a DIN pillar valve or into an A clamp with a DIN Female fitting.

The pillar valve should be opened slowly until the gas can just be heard hissing through the tubing, approximately 2ltrs- 5ltrs per min.
Close the pillar valve after five seconds. Watch the VN202 mkII reading, it should rise and reach a stable level. If it reaches a maximum and then falls back, the cylinder has been opened too much creating a pressure on the sensor.
After the reading stabilizes (about 5 seconds) open valve again for 5 seconds as above.
The reading should this time peak and fall back less than 0.5%.
The stable reading is the oxygen level in the cylinder gas. If in doubt this step can be repeated as many times as necessary until a stable reading is achieved.

If the system is left in this position air will gradually find its way back up the tubing and the reading will begin to fall very slowly.

The secret of accurate fast measurement is gently opening the pillar valve enough to obtain a gas flow of about 2-5 ltrs per minute (a low level hiss) without creating a high pressure on the sensor. The pressure restrictor in conjunction with the pillar valve control is used to achieve low flow rates of gas from the cylinder.

Any poor joints will create a venturi action and suck in air giving an inaccurate reading.

If a continuous flow is used the gas will cool down the sensor and the reading will slowly rise as the sensor tries to compensate , (see Page XX on temperature compensation)

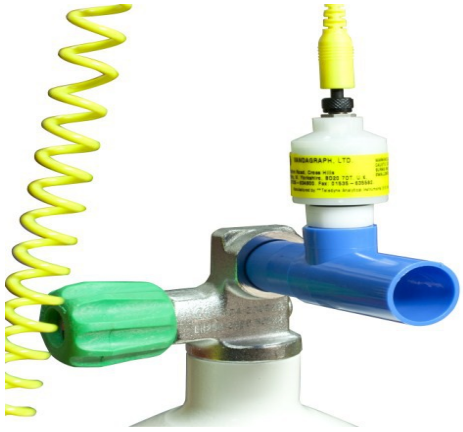
If sensor cannot be calibrated correctly do not use and consult your supplier.

Always calibrate in air prior to making a measurement as temperature changes and movement of the calibration control can all cause the calibration to accidentally move from 21%.

IMPORTANT
For mixtures below 50% and air calibration is usually adequate
For mixtures above 50% a 100% oxygen calibration should be used.

11) **Measurement of Oxygen using a Quick-Ox**

Oxygen sensors are designed to work best in very low constant flowing gas at steady temperatures. The ideal condition is therefore a still gas at 1Bar.



Flowing gases above 2 litres per minute can cause back pressures and give elevated readings.
The sensor will still have a fast 7 second response with flow rates down to 100 millilitres per minute. A very gentle hiss or light pressure on the finger
When measuring from a Scuba cylinder the gas released is very cold and if left flowing can cool the sensor membrane. This can cause the output to drift.
The Quick-Ox gas sampler overcomes this problem. Unless it is subjected to extended or continuous flow
Calibrate (see Page 7) in Air. Leave Flow divertor on and move through fresh air
Calibrate to 20.9%
Turn on cylinder gently and feel gas flow
With an "O" ring type cylinder mate the dome to the O ring
With a DIN outlet gently push the dome into the DIN thread
When the reading on the analyser stops rising turn off the cylinder.
The reading may fall slightly then stop as the pressure reduces.
This is the reading of Oxygen in the cylinder
If in doubt repeat process
The reading will be maintained because the gas is trapped in the Tee
To re-calibrate remove the flow divertor from the Tee and calibrate in air

12) Other methods of measuring

Such as holding the sensor or sensor Tee against the pillar valve, or the mouthpiece of the demand valve are strongly discouraged. These methods can allow high pressures into the sensor giving inaccurate high readings or can allow air to be drawn into the gas mixture giving inaccurate low readings.

*** Excessive pressure can permanently damage the sensor membrane.**

13) Sensor Failure

All sensors have serial numbers and have a 12 month warranty from date of purchase. The Vandagraph Quality Assurance ensures traceability.

Contact your authorized distributor or Vandagraph for return instructions.

14) Instrument Failure

There are no,user, easily replaceable parts in the instrument except the batteries and the sensor. The use of modern technology and components requires trained personnel.

Contact your authorized distributor or Vandagraph for return instructions.

15) Storage of Sensors

Sensors prefer an environment similar to human beings cool and damp

Never;
Store sensors for long periods before use.
Subject sensors to high temperatures i.e. (Car rear shelf).
Freeze sensors (left in cars overnight).
Sensors should not be stored in a sealed box as when they use up the oxygen they go to sleep and can take several hours to stabilise when put back into use.
Subject sensors to physical shocks.
Subject sensors to vacuum.
Submerge sensors in liquids.
Attempt to open a sensor.
Sensors deteriorate very slowly and near the end of their useful life may show a drift soon after calibration. Sensors should be checked periodically in 100% Oxygen.

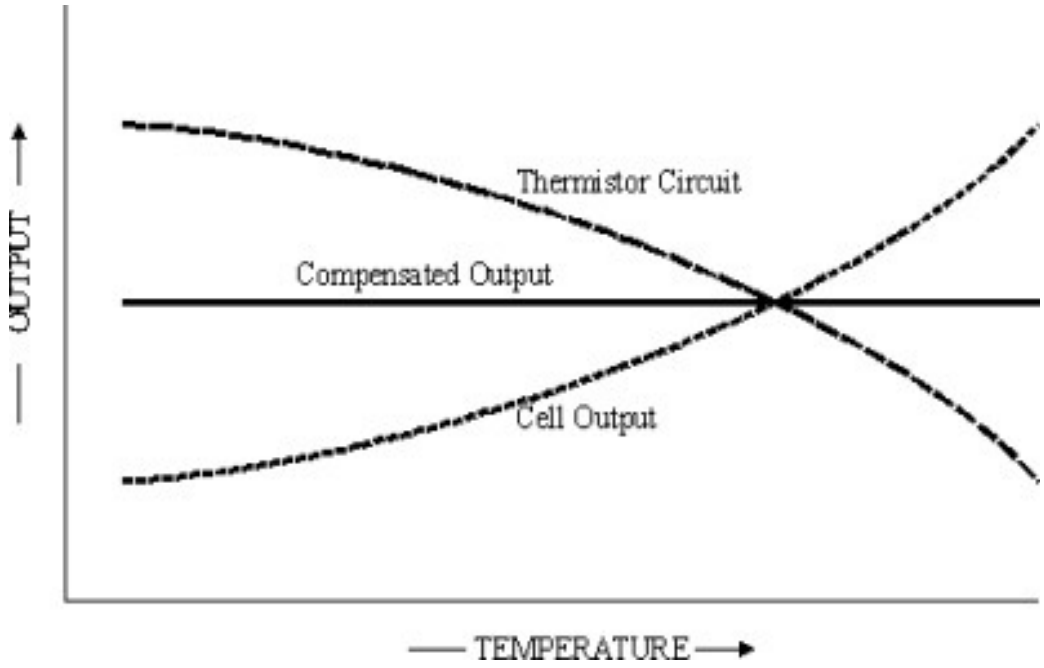
16) **Temperature**

The Vandagraph R-17 VAN is a micro-fuel cell and a galvanic electrochemical sensor.

It is sensitive to temperature changes. A thermistor in the R-17VAN Oxygen sensor adjusts for ambient changes in the range 0º- 4 0º C (31º-106º F).

Cold gas from a cylinder directed at the face of the sensor will change the temperature and affect the accuracy of the reading. Continuous flowing gas will gradually cool down the sensor causing it to drift.

A temperature compensation circuit is used in the rear of the sensor.



IMPORTANT

Holding the sensor in the palm of a hand can warm it up causing inaccuracy.

17) DO'S and DON'TS

DO

Read all of the directions before using for the first time
Calibrate before use
Keep the unit, sensor, and connections dry
Calibrate after replacing the batteries
Calibrate after replacing the sensor
Calibrate in air before every reading
Make sure the R-17VAN is properly seated in the VN202 mkII
Ensure the connector is locked
Visually inspect the sensor for leakage or water on the sensing surface before use
Use the plastic Flow divertor when using the Tee Piece
Remove the Flow divertor when measuring in static gas
Clean the case with a damp cloth and mild detergent
Remove the batteries prior to extended storage

DON'T

Use the VN202 mkII if you suspect any malfunction
Overheat or freeze the sensor
Open or try to repair a leaking or broken sensor
Immerse the sensor or instrument in any liquid
Pass hot or cold gas mixtures over the sensor
Expose the unit to radio, short wave, microwave, X-Ray,
high- frequency, or electromagnetic radiation
Use cleaning agents or liquids in the cable receptacles or around the battery compartment
Place the unit in a water vapour saturated environment
Expose the VN202 mkII or sensor to excessive sunlight
Expose the VN202 mkII or sensor to temperatures greater than 40 °C (106 °F) or less than 0 °C (-32 °F)
Use if low battery indicator shows

18) Sensor Material Safety Data Sheet

For the up to date Material Safety Data Sheet go to www.teledyne-ai.com

19) Emergency First Aid Procedures

In case of electrolyte contact with the skin or eyes,immediately flush with plenty of water for at least 15 minutes and remove all contaminated clothing. Get medical attention immediately

If ingested give large amounts of water and DO NOT INDUCE VOMITING. Obtain medical attention immediately

If inhaled, remove to fresh air and obtain medical attention immediately

20) General Care of the VN202 mkII

The VN202 mkII is a very accurate instrument and if looked after will give many years of accurate Oxygen measurement. There are very few parts to wear out and the instrument is robust and designed to be used in the diving environment.

Although the VN202 mkII is protected against water it should not be submerged or left in water or left outside unprotected against the weather. On boats keep the VN202 mkII out of sea spray

The instrument should be cleaned with warm soapy water (Not immersed).
No detergents or solvents should be used on the case or sensor.

Never use the VN202 mkII once the low battery indicator is visible. From this point the electronics quickly become unstable and will give false readings.

Do not subject the VN202 mkII to mechanical shocks. Although robust the LCD display is a glass component and can be broken. This is usually apparent by black areas spreading across the LCD screen.

The VN202 mkII should be kept in a container when not in use and should be shielded from high and low temperatures. Do not leave on the dashboard or rear window shelf of a car.

Good quality batteries should last at least one year.
Alkaline batteries are recommended because of their expected life, discharge curves and overall reliability and stability. Take care when changing the batteries & sensor not to trap the seal in the battery cover.

21) Care of the Sensor

The sensor should be checked with an air calibration a week before each dive trip (allowing time for a replacement to be obtained) and always just prior to a measurement being taken.

The sensor can be cleaned with warm water but care should be taken to follow the advice on page 12 concerning moisture

Do not use excessive force to screw the sensor into the Flow- divertor as damage can be caused to the threads**.**

22) Sensor Life

The life of a sensor in the VN202 mkII depends on the amount of Oxygen to which it is exposed and is not affected by whether the VN202 mkII is switched on or off.

An R17VAN will theoretically work for 36-48 months if left in air and 10 months if left in 100% O2. The sensor warranty is 12 months from the invoice date.

These expected life figures can be drastically shortened if the sensor is physically abused or if it is heavily used in Nitrox mixes.

The sensor should be stored connected to the VN202 mkII, in the same protective case when it is not being used.

23) VN202 mkII Accuracy

The readout device has a 0.1 % resolution and can therefore only display with a maximum accuracy of +/- 0.1% anywhere on the scale.

An insignificant error is involved in matching the temperature compensation network to the sensor output curve.

Most errors contributing to inaccuracy are user or environment induced.
e.g. temperature, movement, pressure or moisture.

If care is taken to observe the correct procedures during calibration and measurement an accurate calibration at 20.9% should give a maximum error of +/- 0.5% in 100% Oxygen. Readings below 21% will have an accuracy limited to the resolution of +/-0.1%

* The overall accuracy claimed is +/- 1% of full scale.

IMPORTANT errors in calibration at 20.9% will be multiplied by 5 at 100%.
e.g. set 20% in air will cause 100% Oxygen to read 95%.

24) Water & Moisture

Water in the sensor or the VN202 mkII can render the instrument inaccurate and cause irreparable damaged.

Sea water may dry leaving a deposit on the sensor membrane.
The instrument has been constructed to reduce the effects of water splashed onto it but 100% waterproofing is not guaranteed. If the VN202 mkII is dropped in sea water quickly dry the case and shake to remove any water in the sensor. As soon as possible wipe the wet area with fresh water and leave to dry. Remove the batteries and check for water in the battery housing.

Remove the Flow divertor and check the sensor membrane. If it is wet rinse with fresh water. Remove excess water carefully with a paper tissue and leave to dry in a warm area.

* Before use check sensor calibration in both air and 100% oxygen if moisture has been a problem.

Water ingress into the VN202 mkII VN202 can be assumed if any of the following are observed. Dampness in the battery compartment
Micro droplets in the LCD window
Mist in the LCD window
Missing segments or digits.
Battery goes flat prematurely

25) Trouble shooting

Symptom	**Possible Cause & Remedies**
No Display	Not switched on Battery exhausted Batteries in wrong way
Batt Lo symbol	Replace battery
Zero Reading	Sensor exhausted Sensor disconnected Rotate sensor whilst in the instrument. There may be a deposit on the Jack plug or the sensor Jack socket
Not calibrating	Sensor nearly exhausted Check sensor in 100% then Check sensor again in Air
Reading drifts	Sensor nearly exhausted; flowing gas Temperature changing wind blowing on divertor
Inaccurate reading	Move away from RF source, Boat VHF radio Do not use flowing gas use On/Off /On/Off system: Condensation on sensor face Remove condensate by shaking

26) VN202 mkII Parts and accessories

Part Number	Description
	R-17VAN Micro Fuel Cell
9710018	DINKIT Restricter Kit
9711906	A-268 Tee Adaptor
9711002	B-50057 Flow- Divertor
971104	DM22M10 Male adapter
9730203	BS111 Viton O Ring
9711901	DIN22F Restrictor,
9730210	Quick-Ox gas sampling kit
	V mount clamp
9730065	Lanyard
	Optional Waterproof box
	Standard carrying case
	Sensor coiled cable

27) Specification

Specification	
Range	0- 100% Oxygen
Accuracy :	+/- 1% of full scale
Response Time	90% step change < 10sec
Resolution :	+/- 0.1 %
Battery Type :	MN1500 LR6 1.5v x 2
Battery Life :	12 months (typical)
Sensor Type :	R-17VAN (Galvanic)
Sensor Life in air	Expected 36-48 months (10 months in 100%O2)
Sensor output	7.5mV - 13.5 mV in air
Dimensions	60mm x 120mm x 35mm
Weight	Xxx gm incl. battery & sensor
Storage Temp	0°-50° C (recommended 10-30C)
Operating Temp	0°-40 °C
Case :	Splash proof
Waterproofing	IP65 NEMA 4
ISO Standards	ISO EN 9001:2000
EMC CE	ISO EN 60601-1-2
RoHs	Complies with RoHS
WEEE	Complies with WEEE
Specifications subject to change	