4.0 Material Safety Data Sheet

4.1 Product Identification

Product Name : Micro-Fuel Cells T-7 & R-17
Manufacturer : Teledyne Brown Engineering
Address : 16830 Chestnut Street,
City of Industry,
CA 91749
Phone : 0101 818 961 9221

Date Prepared or Last Revised : 08/08/91
Emergency Phone Number : 0101 818 961 9221

4.2 Physical and Chemical Data

Chemical and Common Names : Potassium Hydroxide (KOH), 15% (w/v)
Granular Lead (Pb), pure
CAS Number : KOH 1310-58-3
Pb 7439-92-1

	KOH	Pb
Melting Point/Range:	10 to 0 C	328 C
Boiling Point/Range:	100 to 115 C	1744 C
Specific Gravity:	1.09 @ 20 C	11.34
pH:	14	N/A
Solubility in Water:	Completely soluble	Insoluble
Percent Volatiles by Volume:	None	N/A
Appearance and Odour :	Colourless, Odourless	Grey metal, Odourless
	Solution	Physical Hazards

4.3 Potential for fire and explosion

The electrolyte in the Micro-Fuel Cells is not flammable. There are no fire or explosion hazards associated with Micro-Fuel Cells.

4.4 Potential for reactivity: The sensors are stable under normal conditions of use. Avoid contact between the sensor electrolyte and strong acids.

5.0 Health Hazard Data

Primary route of entry	:	Ingestion, eye/skin contact
Exposure limits:OSHA PEL	:	.05 mg/cu.m (Pb)
ACGIH TLV	:	2 mg/cu.m. (KOH)

Effects of over-exposure

Ingestion	:	The electrolyte could be harmful or fatal if swallowed.
Eye	:	The electrolyte is corrosive; eye contact could result in permanent loss of vision.
Dermal	:	The electrolyte is corrosive; skin contact could result in a chemical burn.
Inhalation	:	Liquid inhalation is unlikely.

Signs/symptoms of exposure: Contact with skin or eyes will cause a burning sensation and/or feel soapy or slippery to touch.

Medical conditions aggravated by exposure : None

Carcinogenity: NTP Annual Report on Carcinogens Not Listed LARC Monographs: Not Listed, OSHA: Not Listed

Other health hazards : Lead is listed as a chemical known to the State of California to cause birth defects or other reproductive harm.

How to use this Operators manual

This manual is written as a compilation of information pertaining to Oxygen monitoring. It is intended not only to help you through the initial set up of the VN202 but as a reference manual to help you understand the reasons behind the cautions.

It is advisable to read this manual before you turn on the VN202 and familiarize yourself with it use before attempting to measure breathing gases.

Although every attempt has been made to ensure the information contained in this manual is correct Vandagraph Ltd accept no liability for errors or the misinterpretation of this material.

Contents

VN202 Oxygen Ananlyser

1.1 Introduction

The VN202 Oxygen Analyser is designed to analyze Oxygen in gas mixtures.

It utilizes the Teledyne R-17 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%.

The upper left hand corner of the display indicates a battery symbol when batteries are low.

The front panel contains the ON/OFF button and the calibration control. The instrument has incorporated an auto switch off.

1.2 Application of the VN202

The VN202 is designed to analyze oxygen concentrations in a variety of gas mixtures including Nitrox and Trimix. 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.

NOTE

Upon receipt inspect the entire unit for damage. If damaged do not use. Notify the supplier or consult Vandagraph.

1.3 Setting Up

Install battery, (Section 1.4)
Install the sensor, (allow to stabilise from sealed bag)
Calibrate the unit in Air 20.9% (Section 1.7)

1.4 Battery Installation or replacement

A 9 volt Alkaline Battery Type MN1604 or similar must be installed in the VN202 to enable it to operate.

1) Slide off the compartment cover on the lower portion of the rear of the Analyser.
2) Clip in the battery. The Battery snap connector will accept a battery only one way, so do not use excessive force.
3) Only use alkaline batteries as other batteries may give erroneous readings.
4) Batteries must be replaced immediately the battery symbol appears in the LCD window. Accuracy of the VN202 can not be guarantee whilst this symbol is visible.

Bigger Bold

NB
Due to the high accuracy (0.1%) the internal temperature of the VN202 integrated circuits require a short period to warm up when a new battery is installed. It is advisable to allow 1 hour after replacing batteries for the VN202 to stabilize.

Failure to observe this may result in a very slow drifting in reading during calibration.

1.5 Sensor Installation

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

1) Remove the sensor from its protective bag and visually inspect the sensor for damage or electrolyte leakage.
   Never use a defective or suspect sensor.
2) The R-17 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.
3) 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.
   This is usually similar to the disposal of batteries batteries
   Consult the material safety data sheet.
4) Plug the jack on the coiled cable gently into the sensor and tighten locking ring with fingers.

1.6 Storage of Sensors

Do Not
Store sensors for long periods before use.
Subject sensors to High Temperatures i.e. (Car rear shelf)
Freeze sensors (left in cars overnight)
Subject sensors to physical shocks.
Subject sensors to vacuum
Submerge sensors in liquids
Attempt to open a sensor.

Sealed bag - stabilizing rules?

1.7 Calibration

Switch on VN202 Monitor
Remove the Flow Divertor if fitted
Blow gently across the face of the sensor face.
Wait for the sensor to show a dip in reading, recover, and stabilize.
Do not hold the sensor in the palm of the hand as heat from the body can effect the reading.

Adjust Calibration control to 20.9% at sea level. — Graph of % reading at altitude?
The VN202 measures partial pressure so will be affected by altitude and re-compression chambers.

Sensors deteriorate very slowly and near the end of their useful life may show a drift downwards soon after calibration.
Sensors should be checked occasionally in 100% Oxygen.

1.8 100% Oxygen Calibration

Place the sensor in a plastic bag with holes and introduce 100% Oxygen Flush several times. When stable set calibration to 100%. } Define acceptable Method
Remove the sensor from the bag. Blow gently over the sensor face.
The sensor should settle at between 20% and 22%.

If the sensor is outside these limits, repeat calibration.
Ensure all the Oxygen has been flushed out of the sensor during the air calibration.

If calibration is in a confined space Oxygen levels may build up beyond 21%. Allow adequate venting. } Bold

Check in fresh air.

The most accurate method of measuring 100% oxygen is to use the Flow Divertor Tee Piece and tubing.
Flush with 100% at a flowrate not exceeding 5 Litre/minute
Set 100% with calibration control
Flush with Air. Do not exceed 5 Litre/minute
Reading should be between 20% and 22%

1.9 Flow Divertor

The flow divertor is designed to be used in conjunction with the Tee Piece and only in flowing gas. The gas is diverted onto the sensor face and decreases the response time. Failure to remove the divertor and Tee when using a bag to measure the Oxygen content will severely increase the response time and can cause substantial inaccuracies. } Bold

2.0 Pressure

Virtually all oxygen analysers measure the partial pressure not the percentage of the gas they sense. The only time these instruments can accurately read percentages is when the pressure is atmospheric and does not vary between calibration and measurement. It is therefore important to calibrate the VN202 at regular intervals. It is recommended that the unit be calibrated prior to each use.

Bold

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 can be experienced by the sensor if it is placed on the output of the pillar valve, in the direct gas flow from the second stage or demand valve. If a container or bag is used to contain the gas to be measured it must have vent holes and the pressure must be allowed to return to ambient before a measurement is made.

- Confirm with test or delete

Wind increases pressure and if directed on to the sensor face during calibration can cause erratic readings.

2.1 Humidity

Humidity does not directly affect the accuracy of the sensor however :-

Excessive moisture or condensation on the sensor surface will block diffusion of oxygen to the sensor and render it inoperative.

Humidity and water if allowed to ingress into the sensor plug or the monitor case will cause inaccurate readings and damage. If moisture ingress is suspected, remove sensor plug and check for moisture. Fresh water will dry out if the sensor is left in air but sea water will cause corrosion. Check sensor calibration in air and 100% if moisture has been a problem before use.

Bold

Water in the electronics can render the instrument inaccurate or cause irreparable damaged. Sea water may dry leaving a deposit on connectors and sensor membrane.
The instrument has been constructed to reduce the effects of water splashed onto it. Signs of water in the battery compartment should be treated as a potential instrument failure.

- Bullet point all Key notes.

2.3 Specification

Range	:	0 - 100% oxygen
Accuracy	:	+/- 2% of full scale reading at least (Typically ±1%)
Response Time	:	90% in less than 10 seconds
Resolution	:	0.1 %
Battery Type	:	9 Volt Alkaline
Battery Life	:	12 months (typical)
Sensor Type	:	R-17 (Galvanic)
Sensor Life	:	Expected 48 months in air (10 months in 100% oxygen)
Sensor output	:	7.5mV - 13.5 mV in air (10.5mV nom.)
Dimensions	:	60mm x 120mm x 25mm
Weight	:	205 gm incl battery & sensor
Cable Length	:	250mm retracted 759mm extended
Storage Temp	:	0-50 C (recommended 10-30C)
Operating Temp	:	0-40 C

Spare Parts And Accessories

R-17 Micro Fuel Cell
A-268 Tee Adaptor
B-50057 Flow-Thru Divertor
Tubing
Male adapter
Female adapter
HP flow restricter

2.4 Repair Service

In the event the VN202 requires servicing the following steps will ensure a swift response.
There are no user replaceable parts in the instrument.
The case has been sealed and the electronic section tropicalised to retard water damage.

2.5 Sensor Failure

All sensors have serial numbers and have a 12 month warranty from date of purchase. Contact your authorized distributor or Vandagraph for return instructions.
For sensors under warranty a copy of the sales invoice or proof of purchase and the sensor serial number intact must be included on return.

2.6 Instrument Failure

Contact your authorized distributor or Vandagraph for return instructions.

The main instrument (excluding) sensor is normally irreparable. In this instance a replacement service exchange unit will be shipped out to replace any damaged VN202 at a fixed low charge. Each replacement instrument will have a full 12 months warranty. Warranty does not cover physical damage, damage from liquids or physical abuse.

2.7 Temperature

A Thermistor in the R-17 oxygen sensor adjusts for ambient changes in the range 0.40 C (31-106F). Cold gas from a cylinder directed at the face of the sensor will change the temperature and affect the accuracy of the reading.

Holding the sensor in the palm of a hand can warm up the sensor also causing innacuracy.

2.8 Discrepancy in readings against expected values

The VN202 is intended to be used only as a secondary means to verify the accuracy and check the concentration of oxygen in a pre-mixed source.

When ever a discrepancy of +/- 1% or greater is observed between the calculated mix and the VN202 the source of the discrepancy must be resolved immediately.
Check gas calculations
Check method of preparation
Check VN202 calibration both in air and 100% 02
Use another calibrated measuring device.

3.0 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
* Leave for 1 hour after replacing the batteries
* Calibrate after replacing the batteries
* Calibrate after replacing the sensor + each reading
* Use properly installed alkaline battery
* Make sure the R-17 is properly attached
* Visually inspect the sensor for leakage or water on the sensing surface before use
* Use the plastic flow adaptor when using the Tee Piece
* Remove the flow adaptor when measuring in a bag
* Clean the case with a damp cloth and mild detergent
* Remove the batteries prior to extended storage

3.1 DON'T

* Use the VN202 if you suspect any malfunction
* Use any but alkaline batteries
* 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 VN202 unit in a water vapour saturated environment
* Expose the VN202 or sensor to excessive sunlight
* Expose the VN202 or sensor to temperatures greater than 40 C (106 F) or 0 C (-32 F)
* use for -- minutes after sealed storage.
* use without locking in the jack plug.

Sent to
K. Gunn.

VN202

Portable Oxygen Analyser

Operators manual

DRAFT

CONFIDENTIAL

23/11/94

8.0 Trouble Shooting

Symptom	Possible cause	What to do
No Reading	Battery	Check connections Replace Battery
Battery Symbol Visible	Battery	Check Connections Replace Battery
Reads Zero or Very Low	Sensor Connections	Clean Sensor Cable Plug & rotate gently in sensor to remove any deposits in sensor socket
	Sensor Exhaustion	Replace Sensor
Will Not Calibrate	Sensor exhausted	Replace Sensor
Erratic Reading	Sensor Connections	Clean Sensor Cable Plug rotate sensor cable plug in socket
	Sensor Nearly Exhausted	Check For Large swings in Readings when Sensor Is Turned Upside Down
	Windy conditions	Wind effects pressure on sensor surface and causes calibration problems. Remove from wind
Digits incomplete	Instrument Dropped	Return to Vandagraph
Random digits Digits incomplete No digits LCD Cloudy LCD has extra segments lit or segments missing. Battery contacts discoloured	VN202 Wet	Dry out Return to Vandagraph

8.1 Helpline Contact on Compuserve:
or CIX :
Fax :

V2.3
November 1994