

CO2x Gaseous CO2 Sensor

Additional Application Notes

Rev A - December 2009

Introduction

The prime use of the CO2x readings are three fold;

1. To ensure active absorbent has been fitted
2. To ensure the absorbent sealing systems are operative
3. To warn of reducing absorbent efficiency in order to give the diver time to respond by reducing depth, temperature or work rate in order to avoid an incident occurring.

The CO2x should NOT be used to determine absorbent duration.

As more actual dive data becomes available it may be possible to model the CO2 curves and generate some level of prediction of remaining absorbent life. This is currently a work in progress.

Construction

The CO2x comprises a Sensor, a Sensor carrier (with cable attached) and a removable/changeable filter.

The basic principle of the system is to use Infra Red technology to detect carbon dioxide (CO2) in the rebreathers' breathing loop. However certain contaminants and in particular moisture will affect the sensors ability to read accurately. To help with this issue, the assembly comes complete with a user-changeable filter system which can be simply unscrewed from the Sensor Carrier and serviced by the diver.



Filter

Sensor Carrier

It is vital that to maintain accurate CO2 readings the performance of the filtration system is maintained and the calibration of the sensor is confirmed regularly.

Filter Management

Different environments will produce different amounts of moisture and hence the filter change-out routine may vary.



The filter (the black section attached to the end of the blue section) unscrews. The basic construction of the filter starts with a specialist filter membrane (the white material) backed up by a water absorbing material (the yellow material).

Inside the Sensor carrier (blue section) is another membrane **which should never be removed. The Sensor itself is not a user serviceable part and damage may result if it is tampered with.**

The yellow material can be removed using a small blunt pick tool. With the purchase of the system comes spare absorbent material. Simply remove one and refit a new one.

The used material can be dried out, preferably in an air conditioned environment. **Each absorbent material piece should only be used a maximum of 10 times or if damage is noted, replaced immediately.**

If debris is noted on the front face of the membrane (white material) or if it is suspected that contamination is restricting the flow through the membrane, this can be flushed in fresh water and again dried.

As a general guide, the filter material should be changed when it is time to renew the CO2 absorbent or sooner if the readings from the CO2 are not within the expected range.

Calibration

Please see the screen views in the following pages for instructions. The best source of calibration gas is fresh air. **With the filter removed and the sensor in fresh air** the CO2 reading should 0.4mb +/- 0.1mb. Leave the sensor exposed for at least 5 minutes.

Post dive, if you want to do another calibration, it is always best to **unscrew the filter and then calibrate.**

The same system should be used to just check the calibration. There is **no need to constantly calibrate** but it is good practice to check the calibration using the above method.

Once it is calibrated, to confirm the operation, gently breathe across the sensor face until the reading changes. **Now re-install the filter** prior to diving.

After calibration and with the sensor inserted into the loop; if a full pre-breathe with fresh absorbent is undertaken the CO2 reading should fall. This is normal.

Post dive and with no gas flow (breathing) you may see a small rise in CO2 levels due to gas density and pocketing. This should stabilise again after a pre-breathe. Blowing into the sensor face may also create the same affect until it is used again normally in the breathing loop.

If at anytime you see a reading that is abnormal you should check the calibration. These could include;

1. Fixed at zero
2. An abnormally high reading, give that under CE conditions after 3 hours at 40m at 1.6l of CO₂ in 4 degrees centigrade it should read 5mb.
3. Fixed at a reading given that for almost 2 hours (given the conditions in 2) it will read almost zero.
4. Readings that change up **and** down (not in one direction). This could be a faulty sensor or a faulty connection into the electronics cap.

The CO₂x will benefit from calibrations every week or so. Certainly a calibration should be done every month or when having not been used for over a month or if you suspect a bad reading (see additional notes on filter care). **It is good practice for the user to check the approximate validity of the CO₂ readings regularly, ideally prior to any dive.** Simple testing by breathing directly onto the sensor should see the reading rise within approximately 1 minute. **Also exposure to clean fresh outside air should give a reading in the order of 0.4mB.** The unit will respond faster with the filter removed. So the user must familiarise themselves with the operation and ballistics of the system to be confident the device is working correctly. **Consult the factory if in doubt.**

If you wish to calibrate the unit you must ensure you are in fresh ventilated (outside) air. Do not calibrate in a closed room. How to calibrate is discussed above and in the screen views below.

Electrical Connection

The connector and cable supplied with the unit plugs into the connector on the electronics cap. This is also the same connector for charging the unit.

If moisture is present when this connection is mated, then contact corrosion may occur. This may give false readings on the CO₂ sensor.

It is vital this connection is kept clean. Contact cleaner or white vinegar and a soft brush can be used to achieve this. Once clean, put a **small amount** of silicone grease around the cable end connectors' front face, which when inserted will grease the bulkhead O ring. **Inspect this connection regularly.**

Mechanical fitting

The sensor should be fitted into the Sentinel breathing loop head assembly or the relevant adapter for other units (available Winter 09).

Check the O ring around the sensor carrier is not damaged. Ensure the O ring is lightly greased. Perform a loop pressure test as per the rebreathers' operations manual.

Ensure the special filter is correctly attached into the front of the CO₂x sensor prior to fitting into the rebreather. The filter should be periodically checked for water or mechanical damage. It is advised to keep spare replacement filters. The filter is the main protection for the sensor from the breathing loops general environment. If damage occurs to the filter or it becomes exhausted, then damage will result to the CO₂ sensor itself! So always keep in it good condition.

Post a dive-day, remove the module from the rebreather and unscrew the filter. Keep the filter in a dry environment (air conditioning if possible) until the next dive.

