Sensor Accuracy in rebreathers

There are several concerns in the current use of sensors in rebreathers

1. Calibration
   It is important to take into account where and when in the re-breather cycle calibration takes place.
   If the calibration is before the dive it can be taken in air. or with 100% oxygen whilst the inside of the re-breather is at air temperature and can vary from sub zero to 30C.
   There is also a large volume in the re-breather so if 100% oxygen is used the re-breather must be flushed correctly.
   It is important the the sensor be allowed to stabilise. The recommended time is 30-60 mins.

2. Temperature
   Although the specification has always been stated as +/-5% over the range 0C- 40C It has always been specified by the manufacturer that a period of 30-60 mins should be allowed after a step change before stabilisation is achieved and the measurement is taken
   The temperature of the area in which the sensors are located is also important.
   It appears that the normal time for a rebreather to achieve final temperature stability will be after 20 mins to 30mins breathing.

This well with the 30-60 mins recommended by the manufacturers

3. Humidity
   Water vapour takes up a volume in the gas and is viewed by the sensor as a reduction in oxygen. If the calibration is originally taken in 100% Dry oxygen or ambient air it can be several % out if repeated during the dive when the gas is humidified
   It can be assumed that as the diver breathes out gas 100%RH and the sofnalime produces water as a by product The humidity in the system will, after 20mins always be 100%RH.
   The changes in water vapour pressure will be dependent on the temperature.
   The temperature of the system can be influenced by surrounding water temperature and insulating properties of the breathing hoses.

4. Dynamic gas calibration
   This is where known gas is squirted at the sensor throughout the dive to keep checking the calibration. There are two possible problems with this. If the pressure is to high moisture can be blasted through the membrane (This happens on the Mki5 where the jet is used to blow of water. The solution was to revert back to the medical versions with a grid.

   The second potential problem is that the sensor takes time to get to an equilibrium and have an equal temperature throughout the sensor. The gas squirted into the sensor face will be cold. If the period of the this gas on the membrane is to long the temperature can drop.
   If calibration is carried out underwater the temperature of the gas inserted into the system may be many degrees colder than the gas surrounding the sensor.