

Effects of Humidity on Oxygen measurement

The Oxygen sensor will display correct readings at relative humidity's from 0% to 100%.

However when water vapour is present it exerts its own pressure which will display as a slightly lower reading than a dry gas.

In 100% relative humidity the following table is a guide to pressure due to the water vapour at various temperatures

°C	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Cm H ₂ O	43	46	49	51	54	57	61	64	68	71	75	79	84	88	93	98

There are Standard tables published for a range of humidity levels

The following formulae can be used to calculate the actual oxygen % compensating for 100% RH

$$\text{Actual \% O}_2 = \text{Display reading} \left(\frac{\text{Ambient Pressure} - \text{Water Vapour Pressure}}{\text{System Pressure}} \right)$$

NB It is important that for normal use Ambient Pressure = System Pressure i.e No internal pressure builds up. Therefore use low flow rate < 2 ltr /min and leave the exit for the gas open to atmosphere.

In practice the relative humidity can also change

However the changes are very small in most cases can be ignored.

The table below gives approximate readings for air at different temperatures and humidity assuming the ambient pressure remains constant

Expected variations in Oxygen readings in air at Sea level						
Relative Humidity	0 °C	10 °C	20 °C	30 °C	40 °C	50 °C
10%	20.9	20.9	20.9	20.8	20.7	20.7
30%	20.9	20.8	20.7	20.6	20.4	20.2
50%	20.8	20.8	20.6	20.4	20.1	19.7
70%	20.8	20.7	20.5	20.3	19.7	19
100%	20.8	20.6	20.4	20	19.2	18.5

This table is approximate readings and the calculations have been rounded off to the nearest digit. The analyser resolution is 0.1% and the accuracy claimed is +/-1%

Any of the above readings can be out by the last digit +/-0.1.

For most diving applications the most important factor is Altitude as this has the greatest effect on readings

The most accurate way to solve the problem if great accuracy required is to use Compressed gas to calibrate as it is completely devoid of water.