Pressure Compensation

For the utilization of the device under various pressure conditions, we recommend adjusting the measurement signal through the use of pressure compensation.

Calibrated Instrument		TCD3000 SiA G1/2"; FW 0.532 SN.: 391 **Manual Version: V08** Hardware Version: 1000-0000-0011-0001
The following Gases were used for Pressure Compensation:		
H_2	Purity 6.0	ALPHAGAZ 2 WASSERSTOFF Fla-S reg 10/200 Delivery Nr.: D630M5N
O_2	Purity 4.8	ALPHAGAZ 1 SAUERSTOFF Fla-S reg 50/200 Delivery Nr.: D4NF90N
Pressure Regulator		Alicat MCS-2SLPM-D-DB9M-485-PCV10/10M
Accuracy set point		±0.06 bar
Ambient Temperature		25,3 °C
Adjustment Range		1–10 bar abs

To use pressure compensation, the concentration change of hydrogen and oxygen must be calculated using the following two formulas. Please insert the pressure *p* in [bar abs].

$$H_2(p) = -1{,}3276 \cdot p^6 + 49{,}204 \cdot p^5 - 734{,}3 \cdot p^4 + 5656{,}4 \cdot p^3 - 23970 \cdot p^2 + 55202 \cdot p + 963280$$

$$O_2(p) = -0{,}2168 \cdot p^6 + 8{,}0609 \cdot p^5 - 120{,}64 \cdot p^4 + 931{,}29 \cdot p^3 - 3954{,}4 \cdot p^2 + 9376{,}8 \cdot p - 6308{,}4$$

Then the measurement must be compensated using the following formula. Please insert the measured gas concentration *x* in [ppm] as well as the concentration change *H2(p)* and *O2(p)* in [ppm]. The compensated concentration C is calculated in [ppm] with the following formula.

$$C = \frac{(x - O_2(p)) \cdot 10^6}{H_2(p) - O_2(p)}$$

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Cross sensitivity compensation for SN391

In binary measurement methods such as thermal conductivity measurement, two gases are typically considered: the sample gas and the background gas. If an additional gas with a different conductivity than the sample and background gases is present, this is referred to as cross-sensitivity due to an interfering gas. This "interfering gas" can distort the measurement signal, either increasing or decreasing the value.

If the interfering gas is detected using an additional measurement method, its effect can be compensated.

- **Sample Gas:** H_2
- **Background Gas:** O_2
- **Interfering Gas:** H_2O (g)

The following graphs illustrate the impact of the interfering gas (H_2O) on the measurement of H_2 in O_2. If the sample gas is completely saturated, then the function of the graph in figure 1 must be used.

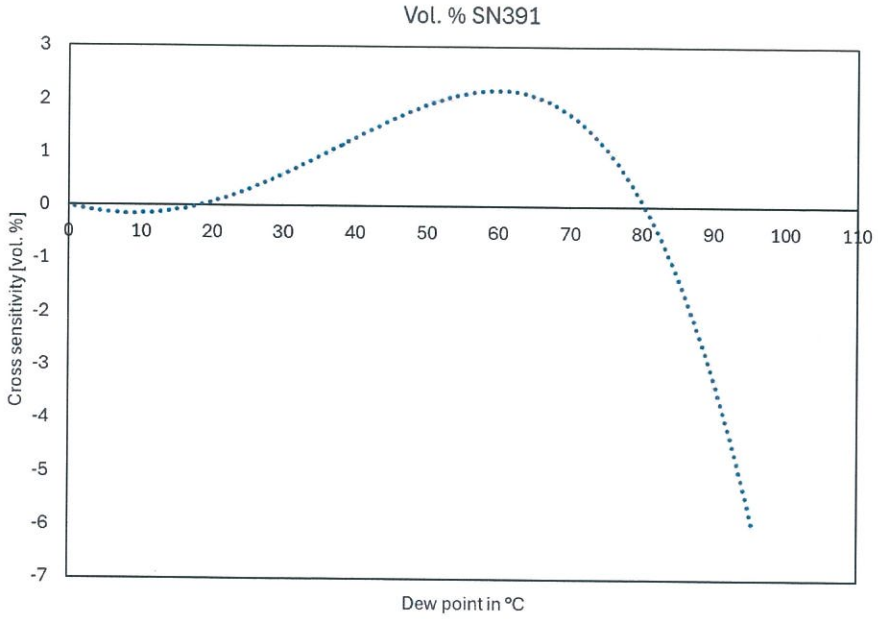

Figure 1: Measured value of the sensor as a function of the dew point of the sample gas.

Determining Cross-Sensitivity (CS):

To calculate the cross-sensitivity affecting the H_2 measurement in O_2, for a completely saturated gas, use the following formula. Here, T_{H2O} represents the dew temperature of the interfering gas in Celsius.

$$CS(T_{H2O}) = -3{,}205 \cdot 10^{-7} \cdot {T_{H2O}}^4 + 8{,}566 \cdot 10^{-6} \cdot {T_{H2O}}^3 + 1{,}796 \cdot 10^{-3} \cdot {T_{H2O}}^2 - 3{,}288 \cdot 10^{-2} \cdot T_{H2O}$$

Compensating for Interfering Gas Effects:

To compensate for the effect of the interfering gas, subtract the calculated cross-sensitivity CS (T_{H2O}) from the original H_2 measurement value:

$C_{comp} = C_{H_2} - CS\ (T_{H2O})$

The corrected concentration (C_{comp}) represents the H_2 in O_2 value with the influence of the interfering gas accounted for and compensated.

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If the sample gas is **not** completely saturated (relative humidity <100 %), then the function of the graph in figure 2 must be used. Note that the x-axis is normalized from 0 to 1, which corresponds to a concentration range from 0 to 100%.

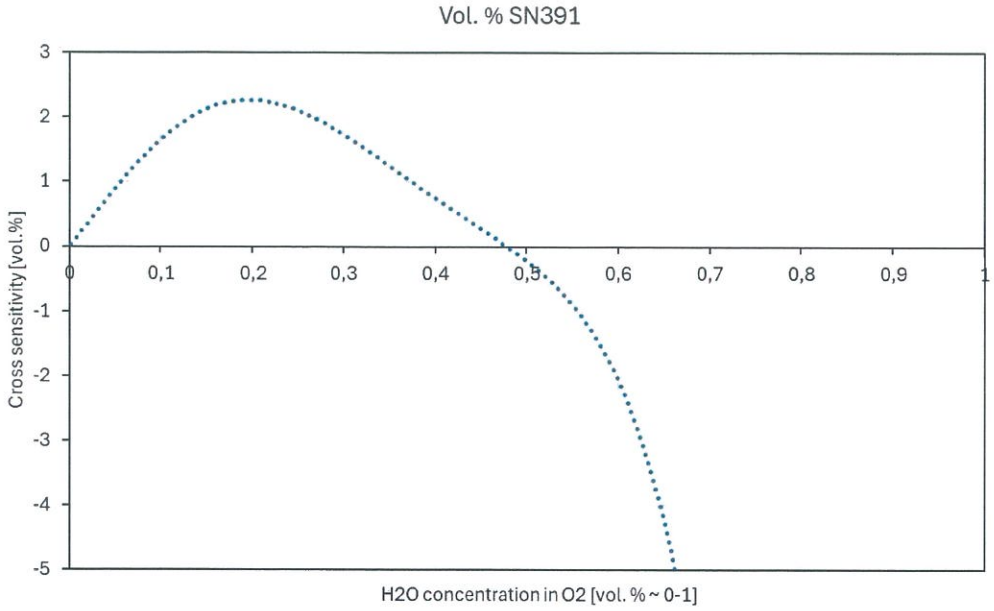

Figure 2: Measured value of the sensor as a function of the H_2O concentration in O_2.

Determining Cross-Sensitivity (CS):

To calculate the cross-sensitivity affecting the H_2 measurement in O_2, use the following formula. Here, C_{H2O} represents the volume concentration of the interfering gas in percentage. The volume fraction of H_2O in O_2 must be entered as a decimal number, not as a percentage!

$$CS(C_{H2O}) = -908{,}8895 \cdot {C_{H2O}}^5 + 1258{,}1286 \cdot {C_{H2O}}^4 - 548{,}8421 \cdot {C_{H2O}}^3 + 38{,}7685 \cdot {C_{H2O}}^2 + 16{,}9306 \cdot C_{H2O}$$

Compensating for Interfering Gas Effects:

To compensate for the effect of the interfering gas, subtract the calculated cross-sensitivity CS (C_{H2O}) from the original H_2 measurement value:

$C_{comp} = C_{H_2} - CS\ (C_{H2O})$

The corrected concentration (C_{comp}) represents the H_2 in O_2 value with the influence of the interfering gas accounted for and compensated.

Note:

Measurement values from volume percent (vol.%) to ppm are converted as follows:

PPM = vol. % · 10.000

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For any inquiries or questions regarding this product, please contact us at **support@archigas.com** or call **Ms. Hedwig** at **+49 69247544980**.