Proper Compensation for DO Measurement in Gas with Hamilton's Optical Sensors

Technical Note

Dissolved oxygen measurement effects due to changing environmental conditions from humidity and pressure

Applications: Exhaust gas in laboratories, nitrogen blanketing

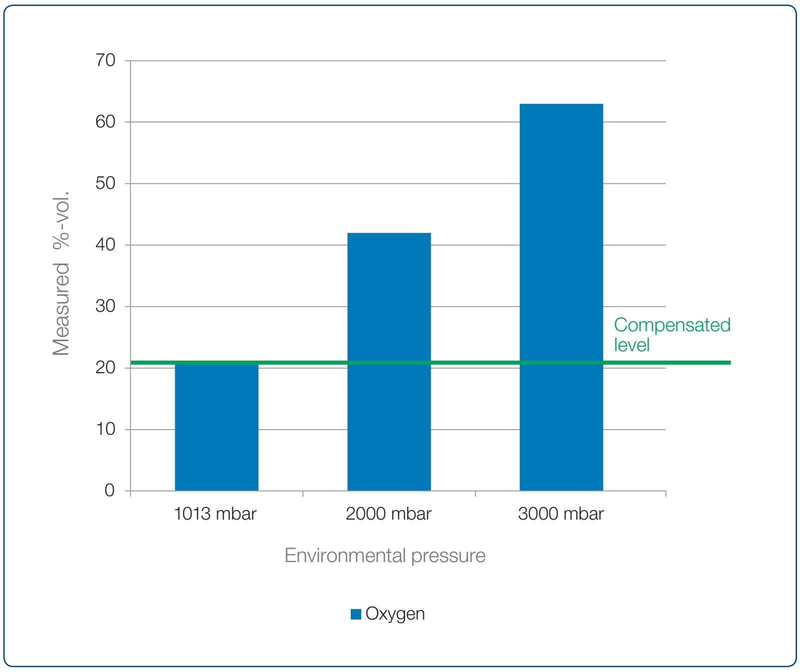

Figure 1: The measurement of oxygen concentration with optical DO sensor is influenced by the environmental pressure.

The measurement of oxygen concentration (in % volume or % air saturation) with optical dissolved oxygen (DO) sensors is affected by environmental pressure and humidity. Hamilton optical DO sensors refer to a concentration in water saturated air. The factory settings of atmospheric pressure are set to 1013 mbar at 25°C and 100% air humidity. For an accurate measurement Hamilton recommends to correct the atmospheric pressure and compensate the air humidity.

Effect of environmental pressure

The figure 1 shows the influence of the environmental pressure on the oxygen concentration measured by an optical DO sensor. The measured oxygen concentration (in % volume) is directly proportional to the environmental pressure, i.e. the atmospheric pressure or the pressure applied in the process vessel.

Therefore, before installing an optical DO sensor, verify that the air pressure of the process environment and the pressure setting in the sensor are equal. Compensate the atmospheric pressure in the sensor with the following parameter settings:

Set the pressure in ArcAir:
Configuration / Advanced / Measurement / Air pressure

Set the pressure in HDM:
Measurement / Parameter / Air pressure

HAMILTON

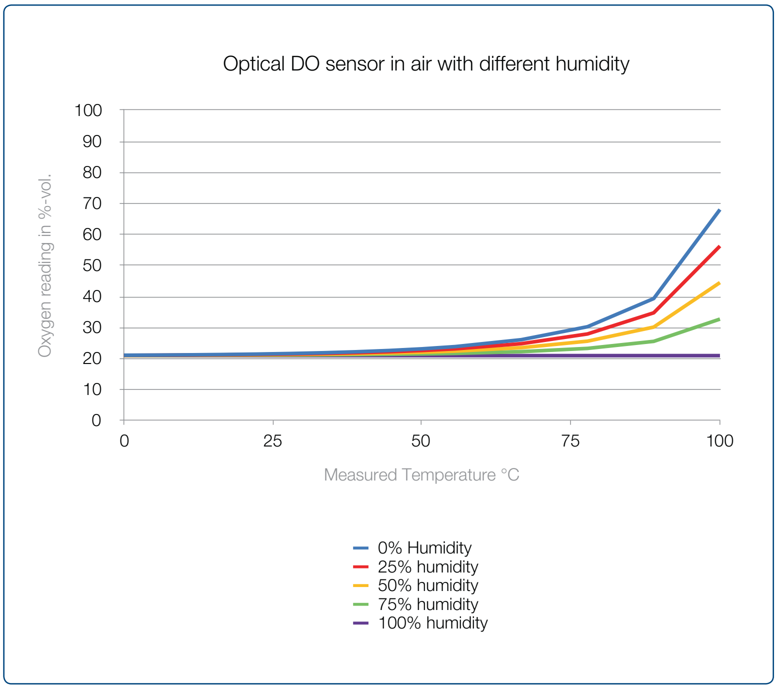

Figure 2: Humidity influence on the oxygen reading at different temperature.

Effect of humidity

Humidity may only impact oxygen concentration measurement in gas but not in liquids. All Hamilton optical DO sensors refer to a concentration in water saturated air (100% humidity). Figure 2 shows the effect of humidity on the measured oxygen concentration at different temperature. This effect is greater at higher temperatures.

As example

If the optical DO sensor is exposed to air at 40°C in 50% humidity the correct oxygen concentration is 21.8% and not 20.95%, resulting in an error of almost 4%.

To correct the oxygen concentration measured in gas you need to measure humidity and compensate the measured oxygen concentration using the following formula:

$$Adjusted\ Value\ [\% - vol.] = Sensor\ Measurement\ Value\ [\% - vol.]\ \frac{(P_{atm} - P_{H_2}O, T_{meas})}{(P_{atm} - rH * P_{H_2}O, T_{meas})}$$

Explanation

rH : relative humidity in air (e.g. 0.5 for 50%)
P_{atm} : Atmospheric air pressure
$P_{H_2}O, T_{meas}$: Theoretical water vapor partial pressure at the measurement temperature

REF 691163/00 — 10/2015

HAMILTON®

Web: www.hamiltoncompany.com
USA: 800-648-5950
Europe: +41-58-610-10-10

Hamilton Americas & Pacific Rim
4970 Energy Way
Reno, Nevada 89502 USA
Tel: +1-775-858-3000
Fax: +1-775-856-7259
sales@hamiltoncompany.com

Hamilton Europe, Asia & Africa
Via Crusch 8
CH-7402 Bonaduz, Switzerland
Tel: +41-58-610-10-10
Fax: +41-58-610-00-10
contact.pa.ch@hamilton.ch