COZIR™ Application Note: Condensation

Contents

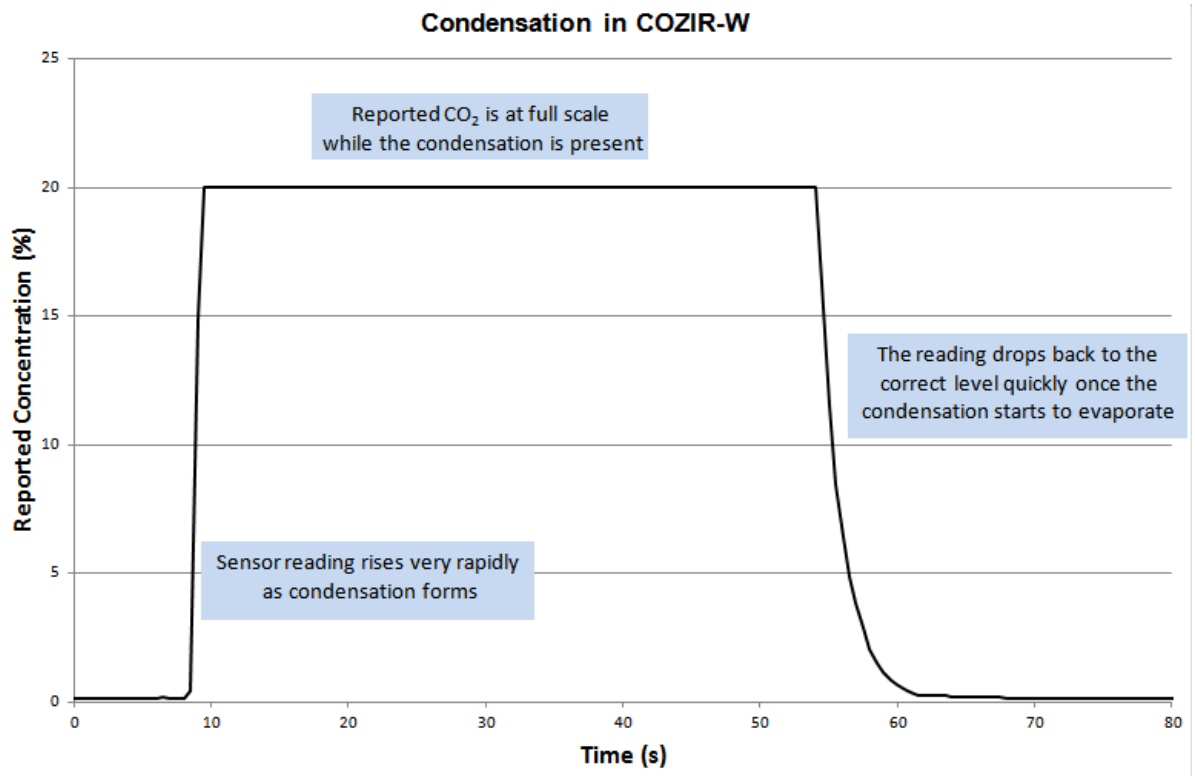
1 Introduction

COZIR sensors are calibrated prior to shipping. They will require periodic zero calibration during use.

2 Effect of Condensation

In all testing at GSS in condensing conditions, condensation has affected the optical surfaces in the sensor long before there is any measurable effect on the electronics. The effect can be ready seen by breathing (rather than blowing) into the sensor.

Condensation on the optical surfaces reduces the measured optical signal in the sensor, which is interpreted by the sensor as a sharp rise in CO2 levels. The effect is large, so sensors will typically report full scale concentrations when condensation is present.



3 Countermeasures

There is unfortunately no fast, cheap, universal solution to avoid condensation when a humid air stream hits a cold(er) sensor. The range of techniques below have been used by GSS customers to eliminate condensation problems in a range of challenging applications. The choice of the best tec

3.1 Heating

Simple heating of the sensor can be enough to raise it above the dew point of the air stream. A typical figure quoted is that the surfaces must be 3C above the temperature of the air stream to avoid condensation.

Heating is effective, but has two drawbacks:

- It uses more power. This is not so much an issue in mains powered applications, but is a clear (and significant) disadvantage in battery powered applications.

- The sensor noise increases with temperature. The effect is not noticeable around normal ambient temperatures, but becomes more of an issue as the temperature increases above 40C.

3.2 Nafion® Tubing

Nafion tubing can remove water vapor from an air stream, and is widely used in applications such as breathylisers and medical devices. It only works when the gas analyte is in a flow which can be passed through the tubing, but is very effective in these conditions. For more details, see

http://www.permapure.com/products/nafion-tubing/

3.3 Dessicant

For some applications, it may be possible to use a dessicant close to the sensor to reduce the humidity levels and prevent condensation. This is of limited application as the desiccant will need to be changed once it becomes saturated.

3.4 Physical Filters

Increasing the physical filters between the sensor and the humid air can also reduce the effect of condensation. Physical filters do not selectively filter humidity, but large surface areas can provide nucleation sites onto which humidity can preferentially condense.

3.5 Orientation

If condensation does form on the optical surfaces (or elsewhere in the sensor) the long term effect can be mitigated by orienting the sensor so that the condensation does not collect in the optics, but runs out of the optics.

Note that this does not prevent condensation, but it does speed up the recovery from condensation, for example after a step change in temperature. It also reduces the long term degradation due to repeated condensation/evaporation cycles.

For COZIR-W, SprintIR-W and MinIR sensors, position the sensor so that the white filter is pointing DOWN. That avoids condensation gathering in the 'bowl' of the optics. For example, when using the sensor in an incubator, position the sensor at the top of the incubator, with the filter facing down.

For COZIR-A and MISIR sensors, the orientation is less importanta, but for optimal results, orientate the sensors as shown below.