AN013: Calculating Relative Humidity

ABSTRACT

Several of GSS CO_2 sensors come with the option to include Relative Humidity measurements. But what exactly is Relative Humidity and why is there a requirement to measure it?

This application note looks at the different types of humidity and the relationship between them, before going on to place specific focus on Relative Humidity, including the calculation required to find this value. Finally, the application note will draw attention to GSS CO_2 Sensors which include a RH option.

Selection of GSS CO_2 Sensors with Relative Humidity option.

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WHAT IS HUMIDTY?

Air in the atmosphere usually contains a certain amount of moisture. Humidity is the term used to describe the concentration of moisture, also known as water vapor, found in the air.

When discussing humidity, typically there are three measurements: Absolute, Relative and Specific. While all three are related to moisture in the atmosphere, they are different from one another.

TYPES OF HUMIDITY

There are three terms used to describe humidity. They are as follows.

Absolute humidity measures the amount of water vapor in the air. This measurement does not include any reference to the temperature. Absolute humidity is usually expressed as mass per volume - g / m^3.

Specific Humidity, also known as the moisture content in air, is the ratio of water vapor mass to total moist air parcel mass. This is expressed as a ratio.

Relative Humidity is a ratio of how much of water vapor is currently in the air, against the maximum amount of water vapor the air can hold at a specific temperature. If the temperature is lowered or increased, the Relative Humidity will also change. This measurement is expressed as a percentage.

This application note will focus on Relative Humidity (RH).

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WHY MEASURE RELATIVE HUMIDITY?

In certain applications, there may be a requirement to measure Relative Humidity in addition to carbon dioxide concentrations and temperature. For example, when controlling indoor air quality, the three measurements of normally of interest are temperature, Relative Humidity, and carbon dioxide concentration. Many air conditioning systems will only record Temperature, which often means there is a requirement to monitor RH and CO_2 independently. RH levels can affect people's perceived sense of comfort in a room.

Another application where RH measurement is crucial is in the storage of certain foods. Too much moisture in the air can result in the growth and spread of microorganisms. The result of this is shortened shelf lives, spoiled product and decreased quality.

HOW TO MEASURE RELATIVE HUMIDITY

The formula for Relative Humidity is as follows:

$$\textbf{Relative Humidity}\ (\%) = \frac{\boldsymbol{Actual\ Vapor\ Density}}{\boldsymbol{Saturation\ Vapor\ Density}}\ \boldsymbol{X}\ \mathbf{100\%}$$

For example, 25% Relative Humidity means the air is holding a quarter of the water vapour it is theoretically capable of holding.

GSS CO_2 SENSORS WITH RH SENSORS

The GSS CozIR-A, SprintIR-W and ExplorIR-W CO_2 sensors all come with the option to include a combined Temperature and Relative Humidity sensor. This option must be selected when ordering the sensor as both temperature and Relative Humidity outputs are a factory fit option only.

The Relative Humidity measurement range in all cases (no-condensing) is 0-95%.

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