AN013: Calculating Relative Humidity

ABSTRACT

Several of Gas Sensing 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 Gas Sensing CO_2 Sensors which include a RH option.

Selection of GSS CO_2 Sensors with Relative Humidity option.

AN013: Calculating Relative Humidity

TABLE OF CONTENTS

AN013: Calculating Relative Humidity

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).

AN013: Calculating Relative Humidity

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.

Gas Sensing CO_2 SENSORS WITH RH SENSORS

The Gas Sensing 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%.

AN013: Calculating Relative Humidity

IMPORTANT NOTICE

Gas Sensing Solutions Ltd. (Gas Sensing) products and services are sold subject to Gas Sensing's terms and conditions of sale, delivery and payment supplied at the time of order acknowledgement. Gas Sensing warrants performance of its products to the specifications in effect at the date of shipment. Gas Sensing reserves the right to make changes to its products and specifications or to discontinue any product or service without notice.

Customers should therefore obtain the latest version of relevant information from Gas Sensing to verify that the information is current. Testing and other quality control techniques are utilised to the extent Gas Sensing deems necessary to support its warranty. Specific testing of all parameters of each device is not necessarily performed unless required by law or regulation. In order to minimise risks associated with customer applications, the customer must use adequate design and operating safeguards to minimise inherent or procedural hazards. Gas Sensing is not liable for applications assistance or customer product design. The customer is solely responsible for its selection and use of Gas Sensing products. Gas Sensing is not liable for such selection or use nor for use of any circuitry other than circuitry entirely embodied in a Gas Sensing product.

Gas Sensing products are not intended for use in life support systems, appliances, nuclear systems or systems where malfunction can reasonably be expected to result in personal injury, death or severe property or environmental damage. Any use of products by the customer for such purposes is at the customer's own risk.

Gas Sensing does not grant any licence (express or implied) under any patent right, copyright, mask work right or other intellectual property right of Gas Sensing covering or relating to any combination, machine, or process in which its products or services might be or are used. Any provision or publication of any third party's products or services does not constitute Gas Sensing's approval, licence, warranty or endorsement thereof. Any third party trade-marks contained in this document belong to the respective third-party owner.

Reproduction of information from Gas Sensing datasheets is permissible only if reproduction is without alteration and is accompanied by all associated copyright, proprietary and other notices (including this notice) and conditions. Gas Sensing is not liable for any unauthorised alteration of such information or for any reliance placed thereon.

Any representations made, warranties given, and/or liabilities accepted by any person which differ from those contained in this datasheet or in Gas Sensing's standard terms and conditions of sale, delivery and payment are made, given and/or accepted at that person's own risk. Gas Sensing is not liable for any such representations, warranties or liabilities or for any reliance placed thereon by any person.

ADDRESS

Gas Sensing Solutions Ltd.
60-62 Grayshill Road
Cumbernauld
G68 9HQ
United Kingdom

AN013: Calculating Relative Humidity

AN013: Calculating Relative Humidity

REVISION HISTORY

DATE	RELEASE	DESCRIPTION OF CHANGES	PAGES
10/09/2021	1.0	First revision	All