Application Solution

Dual Channel CO_2 Sensors

KEY POINTS

- All sensors experience drift
- Typical spaces have cyclical periods of occupation and inoccupation
- ABC (Automatic Baseline Correction) eliminates the effects of drift and is highly accurate in periodically occupied spaces
- ABC may cause drastic inaccuracies in continuously occupied spaces
- Dual channel NDIR sensors are able to automatically calibrate without needing exposure to unoccupied CO_2 levels
- Dual channel CO_2 sensors are the perfect solution for monitoring air quality in greenhouses and continually occupied spaces.

SINGLE-CHANNEL NDIR CO_2 SENSORS

Non-Dispersive Infrared, or NDIR, sensors have become the air-quality industry-standard for CO_2 sensing as they are affordable, robust, and accurate. An NDIR sensor relies on the principle of light absorption: different materials or gases absorb different wavelengths of light.

An NDIR sensor consists of an infrared light source, a filtering lens, and an infrared absorber, illustrated in Figure 1. The infrared emitter radiates light into a chamber which is then partially absorbed by the CO_2 present. The filtering lens allows only a certain wavelength of light to reach the absorber; in this case, that filter is tuned to a 4.2µm wavelength which is specific to only CO_2 gas.

As the CO_2 concentration rises in the chamber, proportionally less of the infrared light will pass through the filter and into the absorber, allowing the concentration of CO_2 to be accurately measured.

SENSOR CALIBRATION

All sensors drift as they age. Each of the elements of an NDIR sensor can dim, break down, or become contaminated over time. Therefore, all sensors require either manual or automatic calibration.

Automatic Baseline Correction, or ABC, is an industry-standard calibration algorithm. It measures CO_2 for some calibration period, tracks the minimum value during that time, and then calibrates assuming the lowest point should be equal to a known minimum CO_2 level which is typically 400 ppm. Typical spaces have cyclical periods of inoccupation allowing sensors to return to the minimum value and calibrate effectively, as shown in Figure 2. ABC eliminates the effects of drift and is highly accurate in most applications.

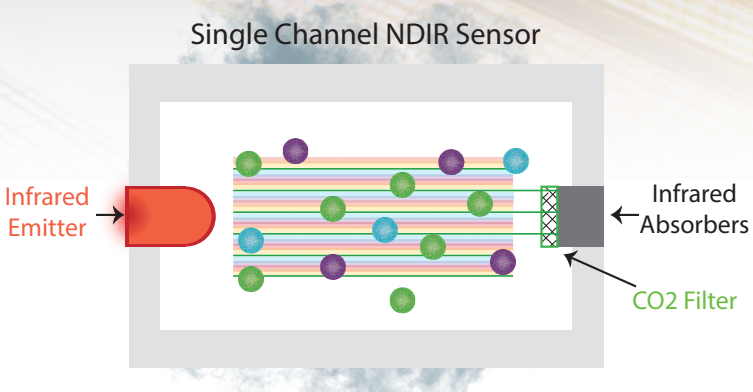

Figure 1: Single-Channel NDIR CO_2 Element

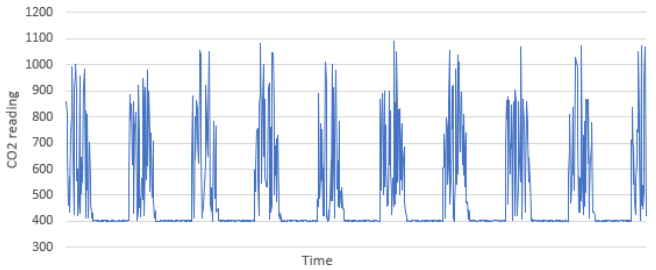

Figure 2: Typical Periodic Occupancy with ABC Calibration

CONTINUOUSLY OCCUPIED SPACES

Unfortunately, applying ABC on sensors in areas that are continuously occupied can cause drastic inaccuracies.

Many spaces that are irregularly or consistently occupied such as hostpitals, hotel lobbies, airports, transit stations, 24-hour convenience stores, and particularly greenhouses, may not reach the needed 400 ppm value in the calibration period to accurately calibrate. If enabled, ABC may cause sensor readings in these locations to be erroneously low, as shown in Figure 3.

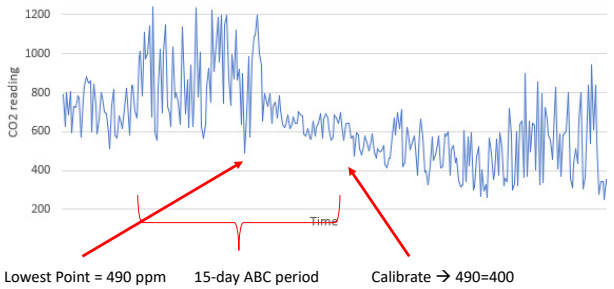

Figure 3: Irregular Occupancy with ABC Calibration

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CONTINUOUSLY OCCUPIED SPACES (CONTINUED)

Until recently, the most practical industry solution for this issue was to disable ABC. However, these sensors will still experience drift and without ABC's convenient automatic calibration, manual calibration becomes necessary. A typical NDIR sensor with ABC disabled can drift by up to 35 ppm/month. Because manual calibration is painstaking and expensive, many manufacturers recommend a generous 1 to 3-year calibration period for these applications. This extended calibration recommendation allows for the possibility of significant drift and long periods of inaccurate readings. Yet, a more frequent calibration would be unweildly to maintain.

Disabling ABC should not be considered an adequate solution to this problem.

DUAL CHANNEL NDIR TECHNOLOGY

Dual channel NDIR elements offer a realistic and cost effective solution for maintaining accuracy in continuously occupied spaces and greenhouses.

A dual channel NDIR element works similarly to a single-channel element, except that it utilizes a secondary reference filter and absorber, as shown in Figure 4. The second filter is tuned slightly differently to accept a 4µm wavelength, which is a wavelength at which no gases are detectable. Thus, the second absorber acts as a reference reading or a zero.

This second reading gives the sensor a known value to calibrate against, minimizing the effects of drift and eliminating the need for manual calibration.

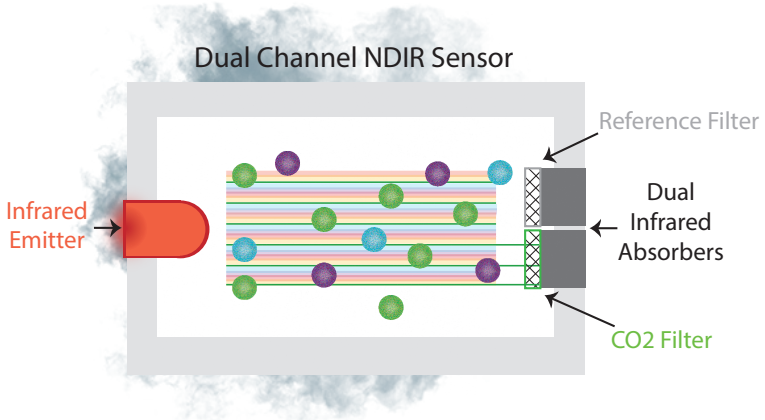

Figure 4: Dual-Channel NDIR CO_2 Element

SOLUTION

Senva's new dual-channel CO_2 element is now available on our AQO and CT1R product platforms. Check out Senvainc.com or call (866) 660-8864 to learn more.

AQO

The AQO is ideal for greenhouse applications. The series exceeds project requirements for monitoring air conditions for temperature, CO_2 and relative humidity. The AQO series is enclosed in an outdoor rated enclosure to protect electronics from rain, overhead watering systems and harmful UV rays.

AQO - [Output] [CO2] [RH] [RTD/TH]

Output Type
A = Analog (0-5/10V)
B = BACnet RS-485

CO2 Sensor
A = None
B = CO_2 Sensor
D = Dual Channel CO2

RH Sensor
A = None
B = 2% RH Sensor

RTD/Thermistor*
A = None
C = 100Pt (385) RTD
D = 1000Pt (385) RTD
E = 10k type 2
F = 10k type 3
G = 10k w/11k
H = 3k
I = 2k2

*Add-on RTD/Thermistor not readable via BACnet; Temperature output is standard on AQO devices, Add-on RTD/Thermistor is option for Analog.

Programmable up to 10,000 ppm range!

Senva's CT1R offers a variety of options for any indoor, continuously occupied space. Equipped for quick recessed mount or ask about our wall-mount version.

CT1R - [Temperature] [3] [Display (LCD)] - D

Temperature
A = None
B = Transmitter
C = 100Pt (385)
D = 1000Pt (385)
E = 10k type 2
F= 10k type 3
G = 10k type 3 w/11k shunt
H = 3k
I = 2k2
J = 1k8
K = 20k

Display (LCD)
D = Display + Stp Relay
X= None

Output Type
3 = 3-wire 4-20mA, 0-5V, 0-10V