

Installation Guidance IAQ

RF-LW-TIAQ

RF-LW-TIAQ-CO2

RF-LW-TIAQ-VAPE



LoRaWAN Wireless Indoor Air Quality Sensor

IAQ accurately measures up to nine key indoor air quality parameters with class leading accuracy.

- LoRa long range wireless
- Satisfies the accuracy and range requirements for IWBI WELL v2 standard. • Battery or externally powered
- Built in sensor options for:
 - Temperature (°C) • Relative Humidity (%RH)
 - Carbon Dioxide (CO₂)* • Sound (dB)*
 - Barometric Pressure (Pa)* • Volatile Organic Compounds (VOC's)
 - Particles PM 1, 2.5, 4, 10* • Ozone*
 - One additional gas from CH₂O (Formaldehyde), CO, NO₂, H₂S, SO₂, O₂. *

*Sensor Options

These units meet all of the requirements for WELL[®] v2 and RESET[®] air quality monitoring. Air quality data is transferred using LoRaWAN long range wireless so the data can be used for control and analysis.

Long life battery power allows the freedom to position the unit where it will measure the air experienced by the building occupants.

Introduction

We spend around 90% of our time indoors – at home, at work, at school, or when we go to shops or restaurants.

Many studies have indicated that poor indoor air quality (IAQ) has a negative effect on health and productivity. Every year, millions of work hours are lost due to minor symptoms, such as headaches, dry throat, nausea, fatigue, and eye irritation, often caused or exasperated by poor indoor air quality.

More severe outcomes can include asthma attacks, infection, poisoning and cancer. Exposure to air pollutants has also been shown to increase the risk of respiratory and cardiovascular diseases, angina, high blood pressure and heart disease.

CO₂ Monitoring

Measuring CO₂ levels can serve as a good indicator of the indoor air quality. CO₂ concentrations within a building often are used to indicate whether adequate fresh air is being supplied to the space. Indoor CO₂ concentration is directly proportional to the number of people in a building and the ability of the ventilation system to dilute the CO₂ generated by occupants.

Moderate to high levels of carbon dioxide can cause headaches and fatigue, and higher concentrations can produce nausea, dizziness, and vomiting. Elevated levels of CO₂ can also affect performance and productivity. In one study³ of 24 employees, cognitive scores were 50% lower when the participants were exposed to 1,400ppm of CO₂ compared with 550ppm during a working day.

CO ₂ concentration	Remarks / Effect
400ppm	Normal CO ₂ concentration in outdoor ambient air
400-1,000ppm	Concentrations typical of occupied indoor spaces with good ventilation
1,000-2,000ppm	Complaints of drowsiness and poor air.
2,000-5,000 ppm	Headaches, sleepiness and stagnant, stale, stuffy air. Lack of concentration, loss of attention, increased heart rate and slight nausea may also be present.
5,000ppm +	Workplace exposure limit (as 8-hour TWA)

CO₂ and Covid-19

Studies have shown that where there is a high level of exhaled CO₂ in the air, there is also a high level of aerosols. A high concentration of aerosols increases the risk of spreading infection. When an infected person coughs, speaks, or sneezes, a spray consisting of droplets and aerosols is generated, which penetrates air in the room and then spreads¹.

CO₂ sensors can therefore act as the equivalent of the “Canary in a coal mine” and provide valuable information regarding the air quality and the degree of ventilation. Higher levels of CO₂ levels in an indoor space mean there is a higher chance of transmission if an infected person is present.

Prof John Wenger ², director of the Centre for Research into Atmospheric Chemistry in UCC suggests a target of 1,000 ppm if CO₂ is being used as a proxy for Covid in classrooms, and argues that room level transmission is “the key. It’s in the air, and it can fill a room. The amount of the virus in the air can accumulate, and we get an increased exposure. If you’re indoors, in a poorly ventilated room for a long time, then you’re at quite a high risk even if you’re distanced, because the air moves around.”

Installation Guidance

IAQ units are lightweight (approx. 330g inc. batteries) and can be fixed to indoor walls or partitions using a variety of methods including double sided adhesive tape, Velcro, Nano tape, screws and ties.

The quantity of monitoring units to be deployed will depend on which standards are being targeted. For example, WELL™ requires a monitor density of at least one sensor per 325 m² [3500 ft²] of occupiable space. RESET™ uses the space type and number of occupants in each area to determine the quantity of monitors.

Sensor Positioning

Care should be taken to position the IAQ units so that they are:

- at locations where occupants would typically be seated or standing
- at a height of about 1.1-1.7 m [3.6-5.6 ft] above the finished floor and on the inner walls
- at least 0.5 - 1 m [3.3 ft] away from walls, doors, windows, air supply/exhaust outlets
- at least 1 m [3.3 ft] from the corner of a room
- in places where the temperature is in the range of 10-30 ° C
- at a point where air exhausts from the room (where possible)



Sensor Orientation

Fix the IAQ unit to the wall or partition and ensure that the grey ventilation grills are at the bottom of the enclosure facing towards the floor.



Position unit so the grey vent is facing the floor.

For ceiling mounting, position the unit so the unit is horizontal and perpendicular to the floor.

Sensor Calibration

The IAQ unit features high accuracy, long life sensors. The temperature, relative humidity, VOC, CO₂ and particle sensors all have an operational life in excess of 5 years. With the exception of the CO₂ sensor, the sensors are maintenance free and do not require any additional calibration.

The CO₂ sensor uses NDIR optical sensing to provide high accuracy readings (± 30 ppm $\pm 3\%$ of reading). The CO₂ sensor automatically self calibrates using a built-in self-correcting ABC-algorithm. ABC stands for Automatic Baseline Correction.

The ABC-algorithm keeps track of the sensor's lowest reading over a preconfigured time interval and slowly corrects for any long-term drift detected when compared to the expected fresh air value of 400 ppm (or 0.04%vol) CO₂.

In normal indoor applications, the CO₂ level drops to approximately outside air at some point during a week. By sampling the values for an 8-day period and then comparing the lowest value with the sensors 400 point, the sensor can automatically adjust the zero point if required.

What if a room is occupied 24 hours per day?

If a space is constantly occupied and there are no periods when outside levels drop to background levels, the ABC-algorithm will not work. This is the case for greenhouses or in closed confined spaces where CO₂ levels may always be elevated. For these applications, the ABC-function should be turned off. Without the ABC operating, the sensor should be externally calibrated every year.

What if outside/background levels are higher or lower than 400 ppm?

Sometimes, the lowest level may be higher or lower than the 400 ppm assumed by the selfcalibration algorithm. If the background level is known to be another level, for example 450 ppm, then this can be set within the unit.

For many applications like CO₂ based ventilation control, the strategy is based on measuring the difference between inside and outside concentrations. It really does not matter if the lowest level of the concentration is 450 ppm; just knowing the difference between the baseline period and the occupied period is enough to provide adequate ventilation control.

How long will the sensor maintain calibration?

The sensor will maintain calibration as long as it periodically senses a background level of CO₂. The electronics and components in the sensor are rated for a 15-year life. The sensor should maintain calibration over its working life.

Battery Installation / Replacement

These devices use SAFT LS14500 AA size 3.6 Volt Lithium Thionyl Chloride (Li-SOCl₂) batteries (nonrechargeable) or direct equivalent.

No other batteries are approved for use in the device.

Lithium Thionyl Chloride batteries have very high energy capacity and must be used and handled with care observing the guidance below.



WARNING

Risk of death or serious injury from explosion or fire.

- Keep out of sight and reach of children.
- Fire, explosion and burn hazard - do not recharge, short circuit, crush, disassemble, incinerate
- Due to the high terminal voltage (3.6V), they are not suitable as direct replacements for other battery technologies in the same can sizes.
- When not in use the Batteries must be stored in a non-Hazardous Area.
- Do not change batteries in an explosive gas atmosphere.
- When installing batteries, do not snag the battery terminal on the clip or the battery may be damaged. Do not apply excessive force.
- Do not drop. Dropping the battery may cause damage. If a battery is dropped, do not install the dropped battery into the unit. Dispose of dropped battery promptly per local regulations or per the battery manufacturer's recommendations.

Guidance

- Always install the batteries correctly as per instructions taking great care to observe the battery polarity.
- Ensure that the contact points are clean and conductive.
- All batteries must be the same model from the same manufacturer.
- Do not mix old and new batteries or batteries from different manufacturers.
- Do not heat or attempt to recharge the battery.
- Do not dispose of in a fire.
- Only install approved batteries: SAFT LS14500 Lithium Thionyl Chloride AA Battery 3.6 Volt, or direct equivalent.

Safe disposal



- Please recycle responsibly, a wide range of schemes are available.
- Do not dispose of in normal waste or in a fire.

References

¹ Yuguo Li, et al. Evidence for probable aerosol transmission of SARS-CoV-2 in a poorly ventilated restaurant. <https://doi.org/10.1101/2020.04.16.20067728>

² <http://publish.ucc.ie/researchprofiles/D004/jwenger>

³ Allen, Joseph G. et al. Associations of Cognitive Function Scores with Carbon Dioxide, Ventilation, and Volatile Organic Compound Exposures in Office Workers: A Controlled Exposure Study of Green and Conventional Office Environments. <http://nrs.harvard.edu/urn-3:HUL.InstRepos:27662232>

WEEE Directive:



At the end of the products useful life please
dispose as per the local regulations.
Do not dispose of with normal household waste.
Do not burn.

