# VENTILATION & INDOOR AIR QUALITY MONITORING

## The Importance of Indoor Air Quality (IAQ) Monitoring and Ventilation

In major cities all around the world, people spend as much as 90% of their time indoors whether this be in the workplace with mechanical ventilation systems and artificial lighting or at home. But how often do we think about the quality of the air that we are breathing in day in, day out?

Indoor Air Quality (IAQ) refers to the air quality within buildings and confined areas such as classrooms, offices, and that of your home. Unlike outdoor air, indoor air is generally continuously recycled and therefore allowing pollutants to be built up and trapped in confined spaces.

Inadequate ventilation can increase indoor pollutant levels by:
1. Not bringing in enough outdoor air to dilute emissions from indoor sources
2. Not removing enough indoor air pollutants out of the confined space

The result of poor indoor air ventilation has been shown to affect human health, comfort, performance and focus. Additionally, well ventilated rooms can also help to reduce transmission risks of respiratory illnesses from aerosol transmission.

## Health Effects of Poor Ventilation

Health effects from poor ventilation may be experienced immediately after exposure or possibly years later. These adverse health effects can be acute or chronic and can differ from person to person.

Common symptoms associated with poor indoor air quality include:
- Irritation of the eyes, nose, and throat
- Headaches
- Dizziness and fatigue
- Nausea

Other health effects may present itself years after the exposure has occurred and only after long or repeated periods of exposure. These include acute and chronic respiratory illnesses, lung cancer, pneumonia, systemic hypertension, and can be severely debilitating or fatal.

## Why is $CO_2$ Concentration used as an Indicator of Poor Indoor Air Quality?

$CO_2$ is a natural component of air and $CO_2$ concentration is a key marker of IAQ and ventilation effectiveness in offices, schools, dwellings and any other enclosed structure. Commonly expressed as parts per million (ppm), elevated levels of $CO_2$ concentration indoors is usually attributed to the building's occupants.

$CO_2$ is released in every breath and the average human will release roughly 500L of $CO_2$ into the air daily just from breathing.

Without adequate ventilation to dilute and remove the $CO_2$ that is being continuously generated by the occupants, $CO_2$ can accumulate hence is used as an indicator of poor ventilation.

While $CO_2$ levels are not a direct measure of possible exposure to COVID-19, checking concentration levels using a $CO_2$ sensor/ monitor can assist in identifying poorly ventilated areas.

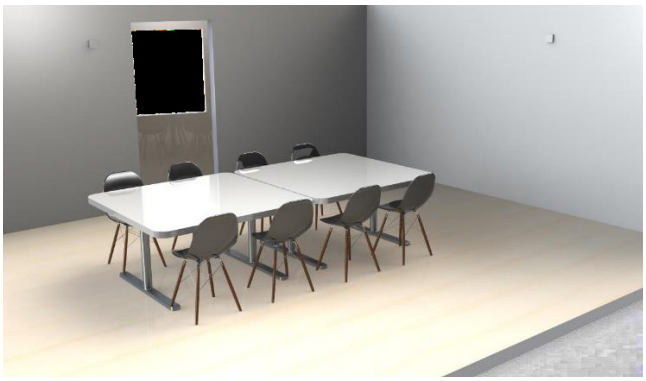
# VENTILATION & INDOOR AIR QUALITY MONITORING

## How can the Measurements from $CO_2$ Monitors assist in Improving Ventilation?

Carbon dioxide concentration is easily measured with carbon dioxide monitors/sensors.

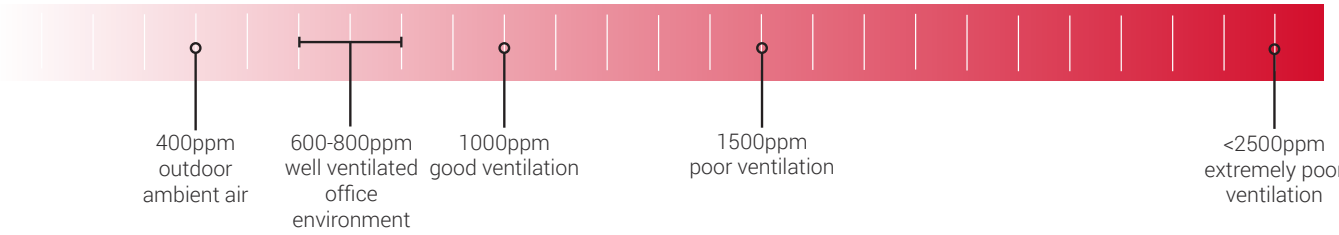
These easy-to-use monitoring devices are commonly used to evaluate indoor air quality, ventilation, and general comfort in a range of industries and are generally mounted in the room of concern.

$CO_2$ measurements should be used as a broad guide to determine if an area has effective ventilation.



As a guide, the general outside air concentration levels of $CO_2$ is approximately 400ppm and typical office environments have levels between 600-800ppm. An average of 1500ppm $CO_2$ concentration over the occupied period in a space is an indicator of poor ventilation and air quality and occupants will begin to experience symptoms of drowsiness.

Where $CO_2$ readings are consistently higher than 1500ppm, ventilation, whether mechanical, natural or a combination should be taken to reduce $CO_2$ build-up.




Ideally, providing ventilation sufficient to ensure $CO_2$ readings are consistently kept below 1000ppm is highly recommended.

# VENTILATION & INDOOR AIR QUALITY MONITORING

## Wireless $CO_2$ Monitoring for Measuring & Improving Ventilation in Buildings

The Elsys ERS $CO_2$ is designed for measuring indoor air quality parameters including carbon dioxide ($CO_2$), indoor temperature, light, motion and humidity. It is designed to be wall-mounted and comes enclosed in a minimalistic and discreet room sensor box.

LoraWAN Certified™, the wireless ERS $CO_2$ sensor is battery operated and can be used anywhere where the monitoring of the indoor environment and air quality are essential, including workplaces, schools, hospitals, aged care facilities, libraries and more.

The sensor is maintenance free, as it uses an ABC algorithm (Automatic Baseline Correction) and will self-calibrate on a regular basis.

This sensor is also has a traffic light feature to let you know when a certain threshold of $CO_2$ levels, or any other value, has been reached. The threshold value is configurable and you can choose the color of the light, the frequency, and the light intensity.

## Elsys ERS $CO_2$ Sensor

LEARN MORE

**Wireless functionality** – ERS $CO_2$ is completely wireless and powered by two 3.6VAA lithium batteries.

**NFC enabled for easy configuration** – The sensors in ERS $CO_2$ come equipped with NFC for easy configuration with an Android device allowing users to change the sample rate, data rate, encryption keys, triggers, activation and much more.

**Long Lasting Battery** – The device has a battery life of up to 10 years based on 30min logging frequency. Increasing the logging frequency will reduce the life expectancy.

**Automatic Calibration Routine** – The $CO_2$ sensor has an internal automatic calibration routine. This routine calibrates the sensor to set 400ppm to the lowest value that has been read in the last period of approximately 8 days.

**LoRaWAN™ Certified** – Being a LoRaWAN $CO_2$ sensor it is self-contained and transmits at low data rates of large distances to a local gateway enabling installation anywhere in the building.

## About Air-Met Scientific

Still proudly Australian owned and operated, Air-Met Scientific has been delivering reliable measurement and monitoring solutions to OHS and environmental professionals since 1984. Operating from 6 locations nationwide, Air-Met has grown into Australia's market leader in the supply, service, rental and engineering of such solutions.

Underpinning our success is our core commitment to providing the highest level of customer service and support. This is reflected in all facets of our business from technical support to instrumentation service and maintenance.

Our dedicated local support teams ensure our customers can work with confidence knowing they are equipped with the right instrumentation for their job. With offices located in most major cities, our highly qualified and experienced team members are uniquely equipped to get to your needs on a local level whilst also having access to the premier facilities and support systems of a national organisation.

**Contact your local office today to discuss your monitoring requirements.**

DOWNLOAD CAPABILITY BROCHURE

# VENTILATION & INDOOR AIR QUALITY MONITORING

## Creating a Wireless Network of Sensors to Improve IAQ

Elsys ERS $CO_2$ Sensors will be placed in each room that requires indoor air quality monitoring. In most applications such as in schools and office buildings, a $CO_2$ sensor is placed in each room at the height of approximately 1.5m from the floor and in a typical zone not beside a door or window which will affect the accuracy of the $CO_2$ readings.

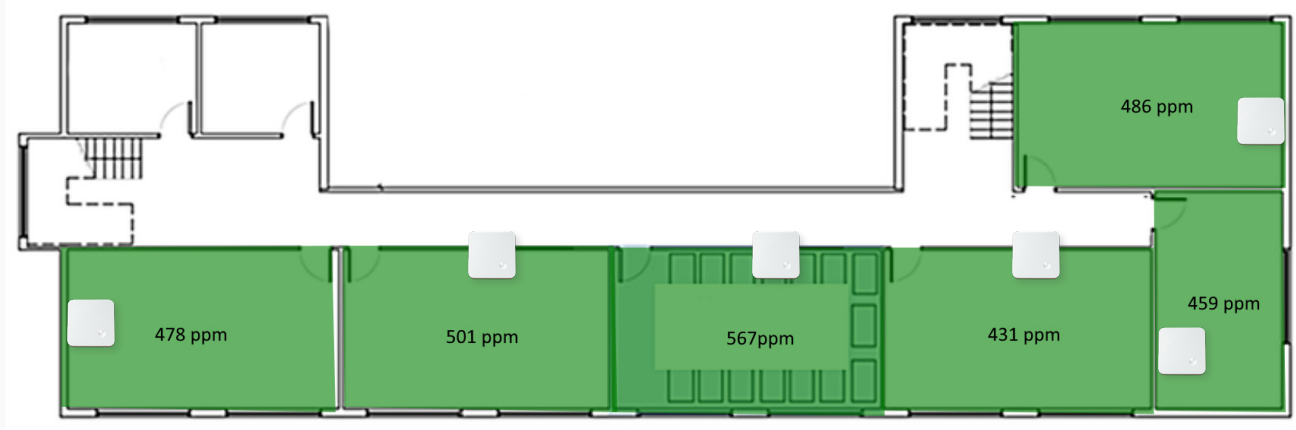



Figure 1. Typical placement of $CO_2$ Sensors in rooms which require IAQ monitoring

$CO_2$ sensors transmits data in real-time utilising the LoRaWAN networking protocol via a secure gateway to a cloud-based platform where the data will be accessible on an easy-to-use interface via the LiveSense Platform. All data is secured and hosted in Australia on Amazon Web Services.

## Make Informed Decisions with Real-Time Data & Visibility

LiveSense allows authorised users to access real-time data and visibility into each room's IAQ readings and allowing users to make informed decisions to improve ventilation within those rooms. Additionally, LiveSense allows authorised users to set up unlimited email notifications should $CO_2$ levels exceed pre-set limits.

In addition to allowing an authorised user to integrate the data on the cloud system, trigger point alerts may be set up with unlimited email notification.

The number of gateways required for any site is dependant on the location of sensors and the distance between buildings. Typically, a gateway will receive data up to approximately 200m.

There is an ongoing annual subscription for each sensor (data) and each gateway (Simcard) and the first years' subscription is included in the initial investment.

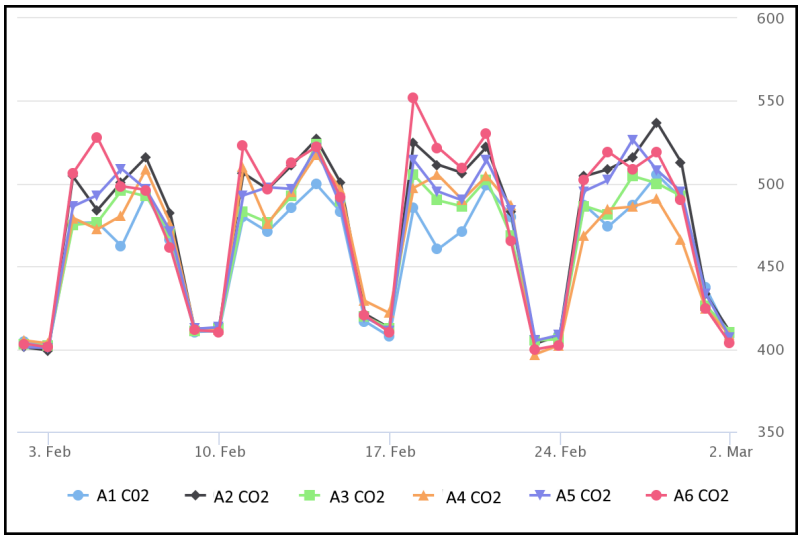



Figure 2. Example of $CO_2$ Readings on LiveSense

# VENTILATION & INDOOR AIR QUALITY MONITORING

## Understanding LoRaWAN® & Gateways

The LoRaWAN® specification is a Low Power, Wide Area (LPWA) networking protocol designed by Semtech to wirelessly connect battery operated 'things' to the internet in regional, national or global networks.

Low range and low power, the LoRaWAN protocol provides seamless interoperability among smart things without the need of complex local installations and networks.

Elsys ERS $CO_2$ Sensors will send data to a gateway so that authorised users will be able to access the readings on the LiveSense Platform.

A gateway typically refers to the physical box or encasement housing the hardware and application software that performs essential tasks to connect the Elsys ERS $CO_2$ Sensor to the cloud. Much like a Wi-Fi router, the gateway acts as a central hub to drop measurements from the $CO_2$ Sensors and connects that data to external networks (LiveSense).

**Benefits of LoRaWAN**

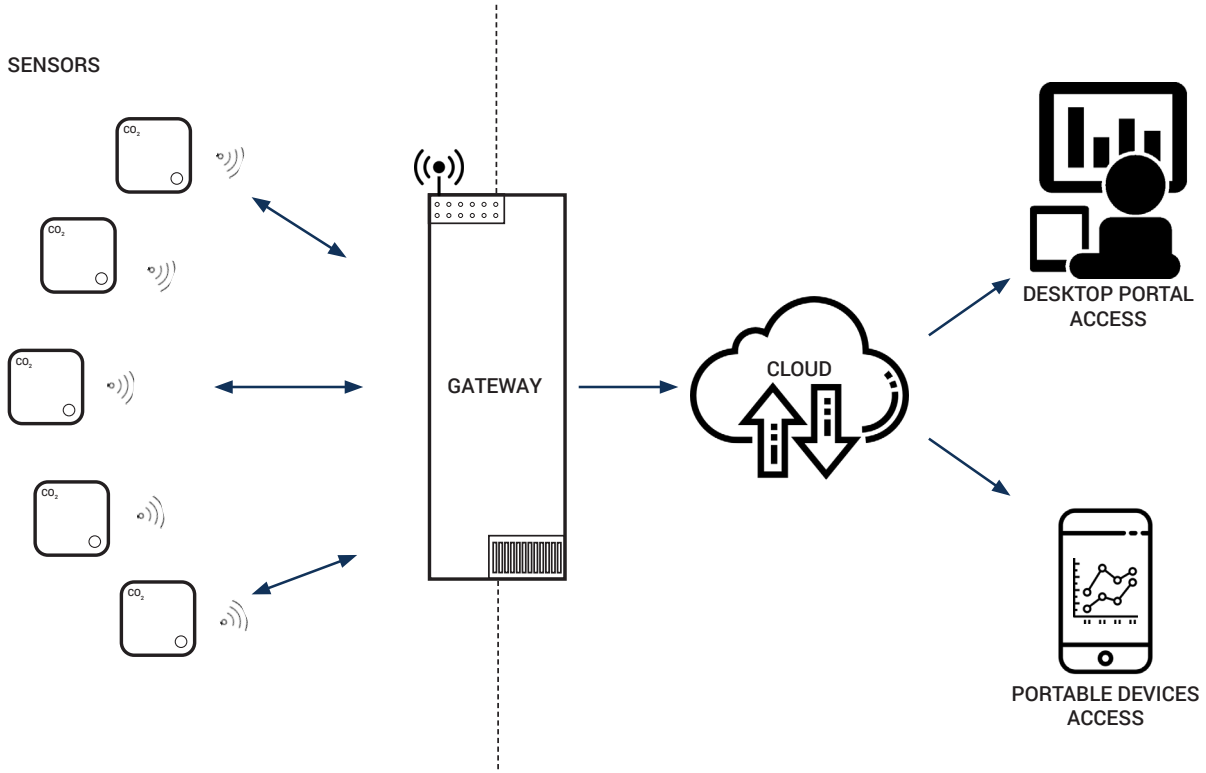
> Reliability: LoRaWAN offers greater reliability than other wireless networking technology such as Wi-Fi as it is not dependent on internet connectivity. It will also not rely on existing customer's congested networks which may result in dropouts and loss of data.

> Low power consumption: compared to other data transmission protocols, LoRaWAN requires very little power therefore prolonging the battery life of the sensor.

> Open-source protocol: LoRa covers all the community best practices.

> Bi-directional communication. LoRa-enabled IoT network units such as the Elsys $CO_2$ Sensor can both transmit and receive data. Sending data to networks and receiving information in return, LoRa sensors can deliver status messages even to remote locations.

> Good building penetration and low path loss: LoRa radio waves can pass through obstacles and reach sensors indoors, such as those placed in elevators, basements, or underground parking garages.

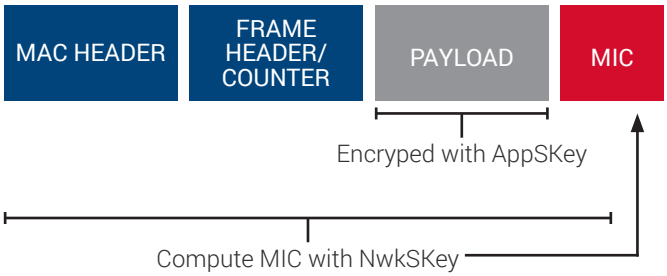


# VENTILATION & INDOOR AIR QUALITY MONITORING

## NETWORK FAQS

**1. Does the system/device use SSL to communicate to the "controller" / "Gateway" device?**
Between sensors and gateway, under the LoRaWANan Protocol, it uses an encrypted message by 128 bit AES encryption. Thus, all data between the Sensor and the Gateway is encrypted and secure.

The data format is generally based on the below design. The payload (data) is encrypted by the APPSKEY.




**2. Does the "Controller" or "Gateway" device communicate via SSL TLS2.0 to the server in the cloud hosting the management portal?**
The data is encrypted between the gateway and the server (internet/cloud), where the data will be decoded in the server based on the agreed APPSKEY and NWKSkey.

**3. Is the portal secured with SSL to accept logins?**
To prevent data from being used by unauthorised personnel, LiveSense's development team members that are permitted to access AWS platform use personal-protected password accounts. These accounts are managed through AWS Identity and Access Management (IAM) service.

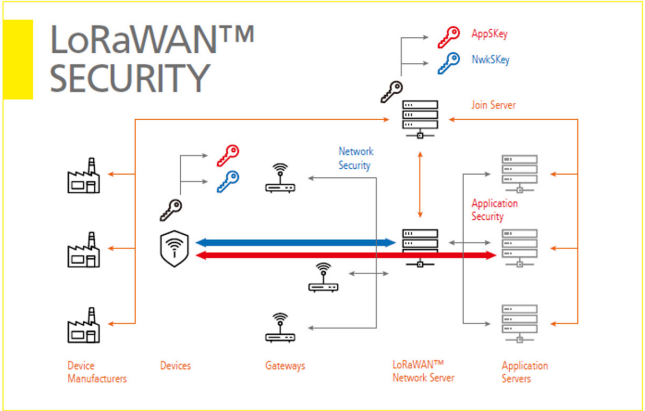
This service enables the creation of granular permissions. Team members permissions only have access to the resources that are relevant for their role in the company. The access Tokens to AWS are associated with the IAM account and can be revoked at any time by the System Administrator.

In addition to IAM, LiveSense also makes use of the AWS Cloud Trail. This service keeps track of all user's activity in LiveSense's AWS account.

To ensure data cannot be read, copied, altered or removed during transmission, LiveSense uses adequate firewalls and encryption (SSL and SSH) technologies to protect the gateways and pipelines through which the data travels.

**4. Is the data being collected encrypted on the servers in the "cloud"?**
Data is initially encrypted by Livesense, then decrypted and displayed in the Graphical User Interface. No one can access data in the cloud other than via Livesense through the AWS service.

**5. What kind of security protocols are being followed and security measures being taken by the hosted server/platform?**
There will be SSL/SSH encryption for all data loaded.




**NEED MORE INFORMATION? CONTACT US!**

For more information about IAQ Monitoring or to discuss the ideal set up at your premises, contact your local Air-Met Scientific representative today on 1800 000 744.

Alternatively, scan the QR code to find your nearest Air-Met Scientific office.