CO2METER.COM
CO2 MEASUREMENT SPECIALISTS

Why Customers Choose the Low-Power Senseair K30 CO2 Sensor

Why Measure Carbon Dioxide (CO2)?

Carbon Dioxide plays an important role in the world today. It provides the signature “fizz” in soft drinks,maintains perishable foods, ensures proper pH in cell cultures, is vital for plant growth, and can be the cause of poor indoor air quality as well. The history of measuring carbon dioxide dates back to prestigious Scottish chemist and physician, Joseph Black. He first identified carbon dioxide (CO2) in the 1750’s. In 1856, Eunice Newton Foote, an American scientist and women’s rights campaigner, published a paper titled, “Circumstances Effecting the Heat of the Sun’s Rays” in the The American Journal of Science and Arts. Foote’s work documented the existence and effects of carbon dioxide on climate. While she failed to be recognized for her work for several years, Foote’s research continues to be one of the basis for the observation and qualitative interpretation of gases, specifically carbon dioxide (CO2). It is now known that hydrogen and oxygen gases lack a greenhouse effect because of their inability to generate a vibration which gives rise to the molecular greenhouse effect in carbon dioxide. Since these discoveries, scientists around the world have been exploring ways to measure this incredible, mysterious, and common inert gas.

Prior to the 1950’s, CO2 levels were measured using mercury manometers. Manometers involve a U-shaped glass tube that is filled with mercury in order to measure the pressure of gases. The Ideal gas law (PV=nRT) was used to calculate the moles of CO2 if temperature, pressure and volume of a dry gas sample was known and if it contained CO2 molecules.

Although mercury manometers are very accurate, this method for measuring CO2 levels in the air was very time consuming. Due to this, Charles Keeling was approached by the US Weather Bureau and asked to record hourly atmospheric CO2 measurements at the Mauna Loa Observatory in Hawaii.

He used an early infrared (IR) gas analyzer that he calibrated against his manometer. From 1958 until 2006, the original Applied Physics Corp. Infrared Gas Analyzer operated on Mauna Loa. Similar to every IR gas sensor, the analyzer used at Mauna Loa used the same basic principle for measuring CO2. It involves an infrared light source at one end of a sample tube and an IR detector and filter at the other end.

The IR absorption peak of CO2 gas is 4.26, microns. The 4.26 micron light is absorbed by the CO2 molecules, and is proportional to the quantity of carbon dioxide in the gas sample.

Consequently, because low levels of CO2 absorb small qualities of light,a long tube is needed to measure low concentrations. Beer-Lambert equations demonstrate the required measurement path length is inversely proportionate to the concentration.

Though the original IR gas analyzer was accurate, there was still an issue, it was complex, large and bulky. To put into perspective, the sample tube alone was 40 cm (16 inches) long. The challenge was making a longer optical path in a shorter smaller package.

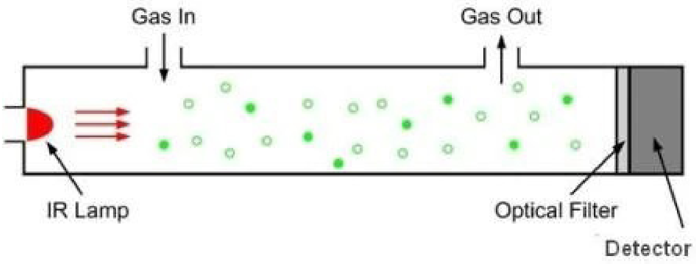
In 1993, an engineering breakthrough occurred, SenseAir patented a design for CO2 sensors with a small-footprint. This breakthrough resulted from using a folded optical path and metalized molded plastic mirrors, which reflected the light several times and increased the useful path length IR source to the detector.

This technological breakthrough has now led to sensors the size of microchips.

Today, we stand by Senseair's technology and ability to provide the newest generation of CO2 sensors which hold even more enhanced capabilities, and are easily integrated into almost any device, application, or environment.

How Does an NDIR Sensor Work?

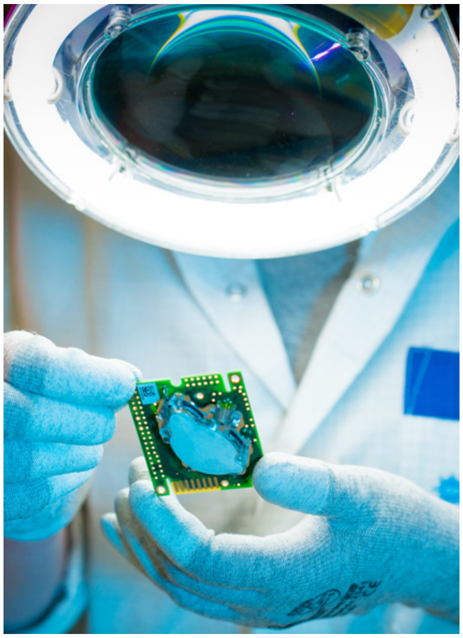
NDIR is an industry standard term for "nondispersive infrared", and is the most common type of sensor used to measure carbon dioxide, or CO2.



This drawing shows how an NDIR sensor works.

The basis of the NDIR technology is an infrared (IR) lamp that directs waves of light through a tube filled with a sample of air, toward an optical filter in front of an IR light detector. The IR light detector measures the amount of IR light that passes through the optical filter for the CO2 gas wavelength. The IR radiation produced by the lamp, includes the absorption band of CO2 allowing the measurement of the concentration of CO2.

Because the IR spectrum of CO2 is unique, matching the light shape or wavelength; it serves as a signature or "fingerprint" to identify the CO2 molecule.



As the IR light passes through the length of the tube, the CO2 gas molecules absorb the specific band of IR light while letting other wavelengths of light pass through. At the detector end, the remaining light hits an optical filter that absorbs every wavelength of light except the micron wave length absorbed by CO2 molecules in the air sample tube.

Finally, an IR detector reads the remaining amount of micron light that was not absorbed by the CO2 molecules or the optical filter.

The difference between the energy the IR lamp supplies and the amount of the particular IR light measured by the filter/detector combination, is equal to the absorption by the CO2 molecules in the air inside the tube.

At Senseair, they provide NDIR sensors which interpret the energy from the light source that reaches the detector resulting in the proper gas concentration measurement.

Consequently, there are certain certain drifts and deterioration due to age of a sensor, and every sensor needs a reference that it can trust and compare to in order to realign its energy to the associated concentration.

Let's examine Senseair 's K30 sensor modules, why they are some of the most common sensors in use, and the reason this sensing technology is so sought after in the world today.

Senseair K30 & K30 FS CO2 Sensors

CO2Meter has been fortunate to work in partnership with many sensor manufacturers in the industry and we cherish the long standing relationships with our partners. In providing Senseair sensing technologies to customers, we know that we are ensuring best-in-class, unique, low-power and precise solutions across a broad range of applications and industries.

The Senseair K30 Modules are a customer favorite, due to their enhanced NDIR sensing technologies across a broad measurement range for applications like indoor air quality, modified atmosphere packaging, occupancy detection, process monitoring, laboratory, safety, and many others.

Image of a Senseair research and development member, and a K30 10% CO2 Sensor.

CO2Meter provides the K30 CO2 sensor range which includes simple, pre-calibrated and ready to use solutions. These sensors are intended to monitor high levels of CO2 concentrations while providing low-cost highly accurate readings, across a diverse customer base.

When we look at the K30 10% CO2 Sensor, (one of our most popular sensors) this sensor specifically is sought after due to its customizable options, enhanced capabilities and maintenance-free communication abilities; which monitors CO2 concentrations all the way to 100,000 ppm. This sensing technology is ideal for incubation environments as its provides the researcher hyper accurate CO2 concentration readings inside the incubation chamber as it works to understand and control the pH level in the chamber. The sensor is also ideal because it allows the end user to customize and program the communication outputs across the entire 0 -100,000 ppm range, this sensor can truly be customized for a variety of sensing and control applications.

Customer Success Stories

SenseAir K30, Vaisala CMM222C, ELT S100, KCD AN100 and GE Sensing T6615 Sensor Comparison

In the case study above, the K30 10% CO2 Sensor was used alongside other comparative low-cost NDIR sensors to measure outdoor CO2 levels. Once the data was collected, the K30 was selected as the most accurate over the comparative sensors and published in an article titled, *Comparison of the Characteristics of Small Commercial NDIR CO2 Sensor Models and Development of a Portable CO2 Measurement Device.*

In discussing the K30 10,000ppm CO2 Sensor, one would add that this happens to be an incredibly popular sensor for customers looking at indoor air quality applications. The K30 10,000ppm CO2 Sensor is intended to be built into different host devices that require CO2 monitors in indoor air environments. With the ability to easily be placed in residential, commercial or industrial IAQ applications; those looking for a high quality, CO2 sensor for HVAC/IAQ industries would find the K30 an ideal solution. With a measurement range from 0-10,000ppm, ABC calibration, and compact size this sensor can be an add-on component to compliment other microprocessor-based controls and equipment — serving the total system for OEM and IAQ customers.

CO2Meter Sensors Used in Experiment to Test Growing Crops in Space

A similar success story features the K30 10,000ppm CO2 sensor which was used to design a plant growth system in space. Shyamal Patel won the best individual research presentation for his project on Undergraduate Research Discovery Day at Embry Riddle Aeronautical University. By incorporating

Image of the Senseair K30 fully customized for a variety of sensing and control applications the K30 in his research Shyamal was able to collect data on carbon dioxide reduction from the plant growing inside of his designed chamber.

Aside from just the K30 sensor modules, we have to mention the K30 FS Fast Response 10,000ppm CO2 Sensor. This sensor solution alone is intended to provide a higher sampler rate at 2X per second with minimal noise for those customers looking to integrate into a scientific, medical, or food processing environment. With the K30 FS Fast Response CO2 Sensor, customers can ensure fast response to sampled CO2 levels with high variability and fast diffusion times. With the ability to easily be placed in residential, commercial or industrial applications, those looking for a high-speed, accurate, CO2 sensor will find this technology optimal. With a measurement range from 0-10,000ppm, ABC calibration, and compact size this sensor can be an add-on component to compliment other microprocessor-based controls and equipment.

Image of a Modified Atmosphere Packaging Production Line.

CO2Meter Creates Modified Atmospheric Packaging Sensor Array

In the example above, the high-speed K30 FS Fast Response 10,000ppm CO2 Sensor was used to sample CO2 levels in a modified atmospheric packaging application for a pharmaceutical industry partner. By utilizing the K30 FS Fast Response 10,000ppm CO2 Sensor, the customer was able to test and achieve the required CO2 sampling rates/measurements to prevent spoilage during production.

For those looking to further data log or interface a K30 sensor with Arduino or Raspberry Pi development kits, please reference our app notes section or download our free GasLab® Data Logging Software to gain real-time analysis.

Conclusion

The Senseair K30 CO2 sensor line continues to lead the market in its design to provide accurate, precise, and reliable measurements to customers worldwide. With the opportunity to integrate the sensors into a vast array of industries and environments, paired with technological innovations, the Senseair K30 CO2 sensor line will be sought after for years to come.

Get More Information

For further information on selecting the proper sensing technology for your application please call 877-678-4259, or email us at sales@co2meter.com.