TELAIRE®

Application Spotlight

Carbon Dioxide (CO_2) Measurement and Control in Cell Incubators

Cell incubators, also called Carbon Dioxide (CO_2) incubators, are essential equipment in biological and medical laboratories. Utilized in the growth of cell cultures, these chambers provide the necessary environmental control to promote optimized cell growth and isolate cell cultures from external conditions and contamination.

Incubators incorporate environmental controls for Temperature (T), Relative Humidity (RH), and Carbon Dioxide (CO_2) typically in the range of 37°C, 95%RH, and 5,000 ppm CO_2. In some cases, Oxygen and Nitrogen gas concentrations are controlled in addition to CO_2.

Cell cultures grow best in environments maintained in a pH range of 7.0 – 7.7. Providing a controlled atmosphere of CO_2 sustains the desired concentration of dissolved CO_2 in the growth media and stabilizes the resultant pH. If too little CO_2 is in the atmosphere, the CO_2 will outgas from the growth medium, and the mixture will become too alkaline; too much CO_2 in the atmosphere will enable more CO_2 gas to be absorbed by the medium, leading to high levels of acidity.

Regardless of the optimal cell growth conditions, fast and accurate measurement and control of the atmospheric CO_2 concentration is vital to successful incubator operation.

Measurement Technologies

There are two primary sensing technologies available for the detection and control of Carbon Dioxide (CO_2) within cell incubators; Thermal Conductivity (TC) sensors and Nondispersive Infrared (NDIR) sensors.

TC sensors employ paired thermistors, one contained within a sealed enclosure providing a reference resistance value, and the other subjected to the incubator atmosphere providing a variable resistance value proportional to CO_2 concentration. Electronic circuitry measures the delta in resistance between the two thermistors and calculates the sample atmosphere CO_2 level.

While TC technology can provide good results under stable environmental conditions, thermistor resistance values vary with temperature and humidity, as well as gas composition. As a result, measurement accuracy is adversely impacted if the TC sensor is subjected to environments beyond the sensor's calibration limits, such as when the environment is disturbed due to opening the chamber door.

NDIR sensors are optical sensors utilizing the energy absorption characteristics of the gas at a defined wavelength (~4.2µm, in the case of CO_2). An NDIR emitter (light source) is directed through the chamber atmosphere and a narrow band spectral filter onto a detector that measures the amount of unabsorbed narrow band light passed through the atmosphere. The amount of narrow band light received by the detector is directly proportional to the level of CO_2 in the atmosphere, which is then calculated via supporting electronic circuitry..

Unlike TC sensors, NDIR sensors are stable across a broad range of operating conditions with low temperature dependence and no humidity and gas composition performance fluctuations. Further improvements in CO_2 measurement accuracy and stability can be achieved with NDIR sensors via the use of dual wavelength designs which provide an additional reference absorption level signal. This integrated reference level can be utilized to provide periodic automated calibrations via electronic circuitry and firmware.

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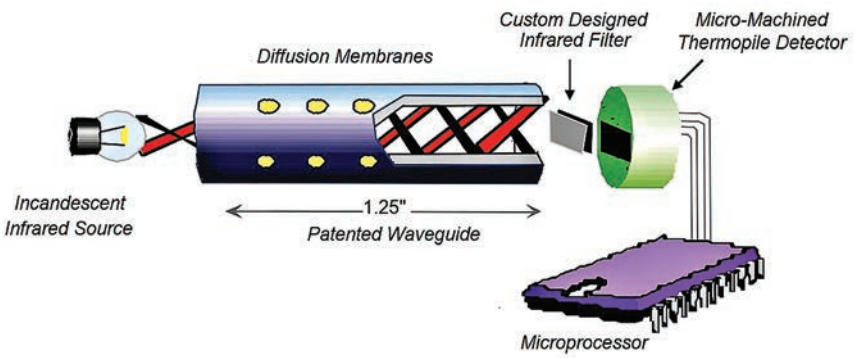

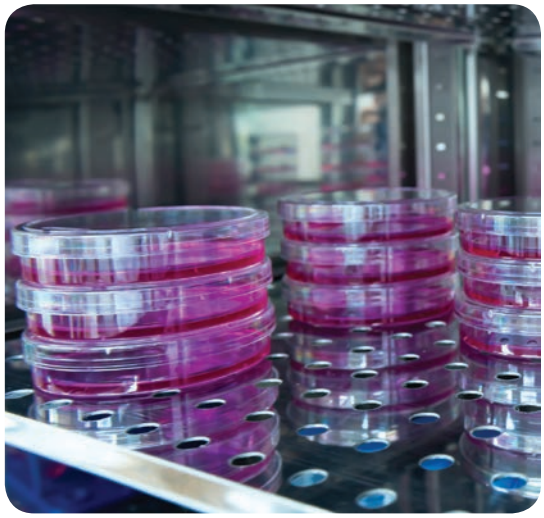

Telaire T3000 Series | CO_2 Sensors for Harsh Environments

The Telaire T3000 Series is a range of high accuracy Carbon Dioxide (CO_2) Sensors designed to meet the specific needs of customers who require measuring CO_2 in harsh or difficult environments. Based on a series of modules, the casing offers a number of combinations to meet the needs of range, supply voltage and output type in various applications.

- Nondispersive Infrared (NDIR) sensing technology.
- Dual wavelength design enables reliable high CO_2 concentration readings via periodic automated calibration algorithms
- Extended temperature operating range
- Factory calibrations available up to 20% CO_2 concentration
- Analog or digital output options
- IP67 ingress protection available
- Integrated diffusion filter and easy mounting with two external tabs
- Integrated connector enables re-calibration with available software
- Custom designs available

AAS Advantage

Telaire products have been at the forefront of Carbon Dioxide (CO_2) sensing technology for the last 28 years and are the originators of the maintenance free CO_2 infrared sensor.

Telaire has over 35 technology patents including ABC Logic™ and warrants single wavelength sensor calibration for the life of the sensor.

Amphenol Advanced Sensors is a trusted OEM partner providing temperature, humidity, pressure, CO_2 and dust sensors to solution providers in the HVAC, automotive, industrial and healthcare markets.

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