ThermoFisher SCIENTIFIC

CO_2 incubators

Question: Why does the location of sensors in my CO_2 incubator affect responses from my cultured cells?

Answer:

The sensors should be positioned in the incubation chamber to experience the same conditions as your sensitive cells. Some CO_2 incubators place the sensors outside the chamber in a "by-pass loop" requiring air to be pumped out of the chamber through tubing, past a pump, heater and then the sensor, and finally back into the chamber. This can create a delay in response, establishes conditions separate from the incubation chamber, and requires additional equipment.

Thermo Scientific™ CO_2 Incubators place all sensors (temperature, CO_2, O_2 and humidity) directly in the cell incubation chamber. This means the sensors react to the exact same conditions that your cells experience. In-chamber sensors give an accurate and quick response, and help minimize delay and extra parts that could require additional maintenance.

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Why does sensor location matter?

What is a by-pass loop?

A “by-pass” loop is a design that places gas, temperature and/or other sensors in an external electronics compartment rather than in the incubation chamber where cells are cultured. A sample of air is taken from the chamber, passed through tubing via a pump and filter and then past the sensors before returning the air sample to the chamber. A separate heater in the external compartment is required to maintain temperature similar to the incubation chamber and to limit condensation that would affect measurements. Clearly, conditions in a by-pass loop are not always the same as those in the incubation chamber. Also, a delay in response compared to what cultured cells experience is expected.

When they are outside the chamber, the sensors do not have to be robust enough to withstand hot, humid and slightly acidic conditions, which means by-pass sensors can be less robust and thus less expensive. They do not have to withstand high temperature sterilization or chemical disinfectants. At the same time, these by-pass loops cannot be cleaned or sterilized so they represent a likely reservoir of microbial contamination with access to the incubation chamber – and cultured cells.

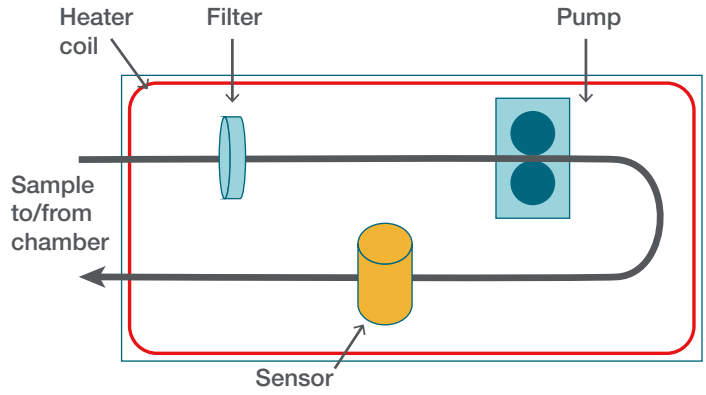

Figure 1: Representation of a typical by-pass loop.
Locating sensors outside the incubation chamber requires additional equipment including a filter, tubing, a pump, and a separate heater. The small sample of air, distance traveled and different environment mean the conditions may not match what cells in the chamber experience.

Why is sensor position important in a CO_2 incubator?

Sensor position is important to enable maximum growth potential for cells. The sensors must react immediately to correct for changes in the environment, perhaps even before that different temperature or atmosphere affects cells in culture vessels. A small air sample extracted and transported to an exterior box cannot accurately reflect the overall conditions in the incubator. That’s why, for decades, Thermo Scientific CO_2 Incubators have always located sensors in the culture chamber, combined with gentle air circulation to continually monitor the entire chamber air volume to provide consistent, ideal culture conditions.

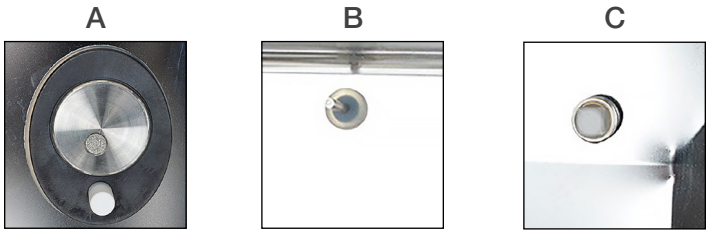

Figure 2: All Thermo Scientific CO_2 Incubators include high quality in-chamber sensors.
Positioning the sensors in the incubation chamber eliminates the need for extra tubing, filters, pump, and heater, and helps ensure that measurements accurately reflect exactly what cultured cells experience. Examples include: (A) Thermal Conductivity CO_2 sensor with Relative Humidity Compensation (B) Dual temperature probes (C) Zirconium oxide O_2 sensor.

Summary

For 21st century cell cultures such as stem cells and primary cells, maximum time at ideal conditions is critical for optimal cell growth. Ensure your CO_2 incubator has high quality in-chamber sensors that truly measure the conditions your cells experience, not an artificial exterior environment.

Find out more at **thermofisher.com/co2**