CO2 Sensor
Product Number: ENCO2B040A

Carbon Dioxide (CO_2) is one of the most important gases on earth. It is critical for photosynthesis –during which trees breathe the gas in and exhale oxygen. It also plays an important part in the Greenhouse Effect, trapping warmth inside the atmosphere.

The CO_2 sensor has a broad dynamic range of 350-10k ppm. Plus, it's easy to use – the sensor automatically calibrates itself before every experiment.

The CO_2 sensor can be connected to all einstein™ data loggers.
It can be used for various experiments in Biology, Chemistry and Environmental Science.

Typical Experiments

Environmental Science

- Increases in carbon dioxide levels from small animals and insects
- Changes in carbon dioxide concentration inside a plant terrarium during photorespiration and photosynthesis cycles

Biology

- Carbon dioxide levels during cellular respiration of peas and beans
- Changing carbon dioxide levels in aclassroom

Chemistry

- The rate at which carbon dioxide is removed from a closed atmosphere using sodium hydroxide or potassium hydroxide
- The rate of production of carbon dioxide in a chemical reaction between hydrochloric acid and sodium bicarbonate
- The rate at which carbon dioxide gas diffuses through a gas diffusion tube
- The production of carbon dioxide during fermentation ofsugars

How it works

The CO_2 sensor uses non-dispersive infrared (NDIR) principle to detect the existence of CO_2 in the air. An infrared (IR) lamp directs waves of light through a tube filled with air towards an IR light detector, which measures the amount of IR light that hits it. As the light passes through the tube, any gas molecules that are the same size as the wavelength of the IR absorb the IR light only, while letting other wavelength of light pass through.

Next, the remaining light hits an optical filter that absorbs every wavelength of light except the exact wavelength absorbed by CO_2.

Finally, an IR detector reads the amount of light that was not absorbed by the CO_2 molecules or optical filter.

The difference between the amount of light radiated by the IR lamp and the amount of IR light received by the detector is measured. The difference is proportional to the number of CO_2 molecules in the air inside the tube.

Sensor specification

Range:	350 to 10000 ppm
Accuracy:	±50 ppm, ±5% full scale
Resolution(12-bit):	8 ppm at 350 ppm; 100ppm at 5000 ppm
Recommended SamplingRate:	10 samples per second
ResponseTime:	90 seconds (to 90% of full value)
CurrentConsumption:	Approx. <85 mA
Normal Operating Temp. Range:	-10 °C to 50 °C
Normal Operating Humidity Range:	5% to95%
Storage Temperature Range:	-20 °C to 60 °C
Storage Humidity Range:	5% to 90%

Note: Sensor cables sold separately

Calibration

The CO$_2$ Sensor is shipped fully calibrated and also performs a simple, automatic, calibration procedure every time you plug the sensor into an einstein™device.

For greater accuracy the sensor can be manually calibrated.

MiLAB™ Desktop

1. Go to the Full Setup window and in the Calibrate column click Set
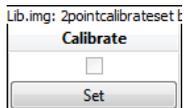
2. The Calibration window will appear
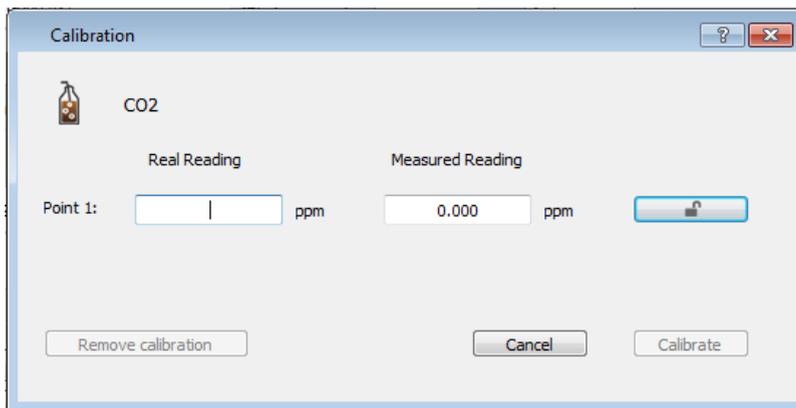
3. Enter 415 ppm as the Real Reading
4. Measure air in a well-ventilated room and wait for the readings to stabilize. Click the lock button
5. Click Calibrate

Calibration – MiLAB™

1. Tap the Settings button next to the sensor's name

2. Tap Manual Calibration

3. Enter 415ppm as the Real Reading
4. Measure the air in a well-ventilated room and wait for the readings to stabilize.
5. Tap the lock button 🔒
6. Tap Calibrate.

Data logging and analysis

MiLAB™

1. Take your einstein™ Tablet OR pair your einstein™LabMate with your Android or iOS tablet via Bluetooth
2. Insert the sensor cable into one of the sensor ports
3. Launch MiLAB
4. MiLAB will automatically detect the sensor and show it in the Launcher View

5. Make sure the icon next to the sensor is checked (✅) to enable it for logging

MiLAB™ Desktop

1. Pair your einstein™LabMate with your PC, MAC, or Linux machine via Bluetooth, or connect it via the USB cable (found in the einstein™LabMatebox).
2. Insert the sensor cable into one of the sensorports
3. Launch MiLAB Desktop
4. MiLAB Desktop will automatically detect the sensor and show it in the Current Setup Summary window
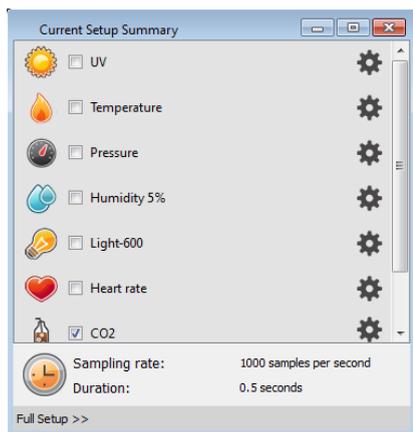
5. Click Full Setup, located at the bottom of the Current Setup Summary window to program the data logger's sample rate, number of samples, units of measurement, and other options
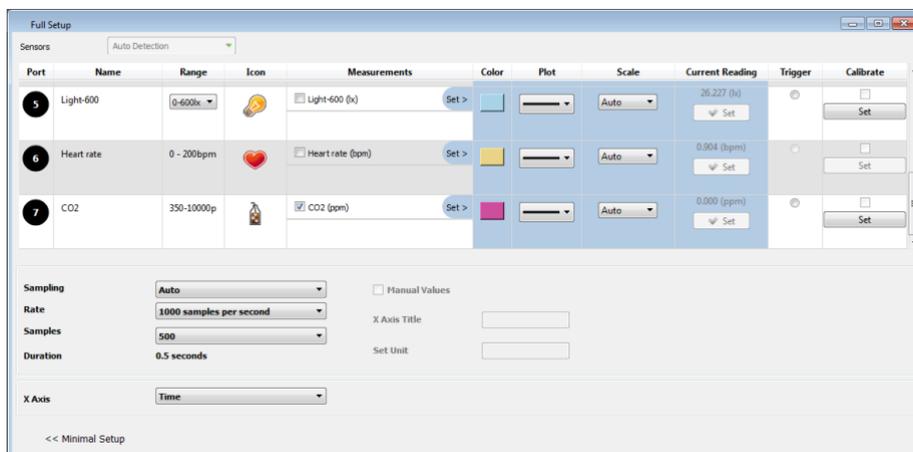
6. Click the Run button( )on the main toolbar of the Launcher View to start logging

Experimental Setup

The CO2 sensor comes with:

- One CO_2 sensor
- One Flask
- One Rubber Stopper
- Flat cover with a rubber stopper built in.

An example of using the CO₂ Sensor
Measuring the CO2 produced by a burning candle

For this experiment you will need:

- An einstein™ device
- A CO_2 sensor (with stopper)
- A container
- A cover for the container

1. Cut a hole in the cover to hold the rubber stopper
2. Put the CO_2 sensor in the stopper
3. Tap Run and wait for the sensor to measure around 390 ppm
4. Light a candle and put it in the container
5. Put the cover the container and follow the changes in CO_2 levels
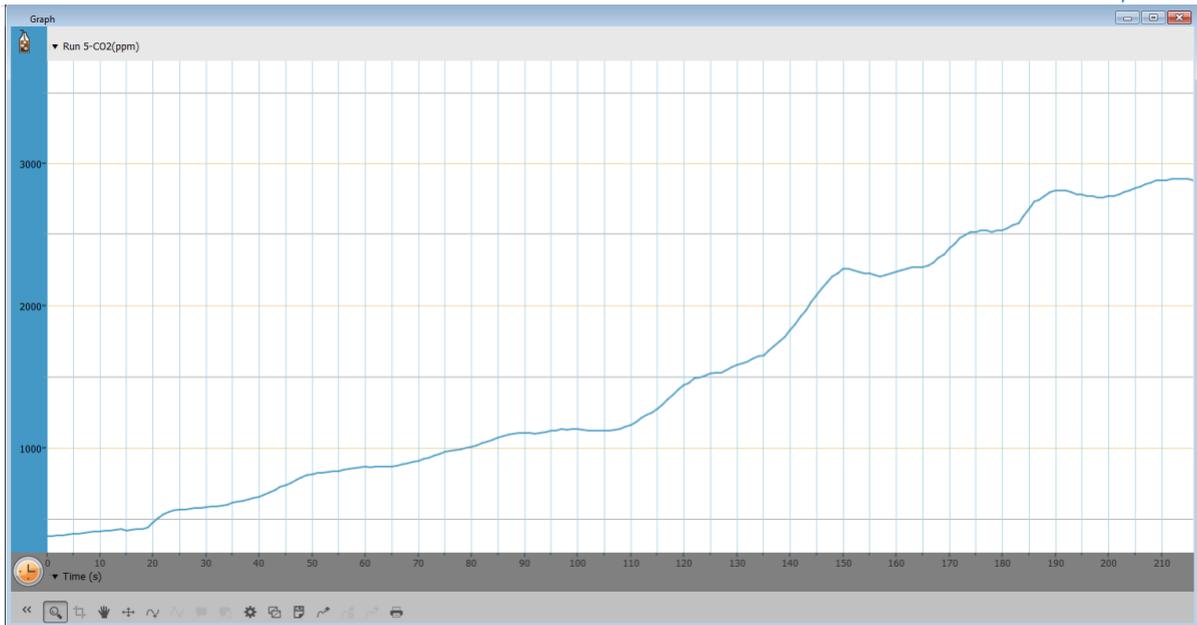
Typical graph produced by this experiment

Troubleshooting

If the CO_2 sensor isn't automatically recognized by MiLAB, please contact Fourier Education's technical support.

Technical support

For technical support, you can contact the Fourier Education's technical support team at:
Web: einsteinworld.com/support
Email: support@fourieredu.com

Copyright and Warranty

All standard Fourier Systems sensors carry a one (1) year warranty, which states that for a period of twelve months after the date of delivery to you, it will be substantially free from significant defects in materials and workmanship.
This warranty does not cover breakage of the product caused by misuse or abuse.
This warranty does not cover Fourier Systems consumables such as electrodes, batteries, EKG stickers, cuvettes and storage solutions or buffers.