
CO₂ GAS SENSOR ML60M

USER'S GUIDE



CENTRE FOR MICROCOMPUTER APPLICATIONS

<http://www.cma-science.nl>

Short description

The CO₂ Gas sensor ML60m is used to monitor gaseous carbon dioxide levels in the range of 0 to 5000 ppm¹. The sensor uses the Non-Dispersive Infrared Detection (NDIR) method and detects the net increase or decrease of light that occurs at the wavelength where absorption of carbon dioxide takes place. The light intensity is then correlated to CO₂ concentrations. CO₂ gas moves in and out of the sensor tube by diffusion through the six vent holes in it. The tube contains an infrared source at one end and an infrared detector at the other end. The detector measures infrared radiation absorbed in a narrow band centered at a wavelength of 4.26 μm. The greater the concentration of the absorbing gas in the sampling tube, the less radiation is detected by the IR detector. When the sensor is collecting data, the IR source blinking on and off – it takes a reading about every 3 seconds.

The sensor is delivered with a 250 ml sampling bottle and rubber stopper to attach the sensor tube to the bottle.

Do not place the sensor tube directly into any liquid. The sensor is intended only for measuring gaseous, **not aqueous**, CO₂ concentrations.

The CO₂ Gas sensor is an I2C digital sensor, which gives calibrated values of the measured quantity. This sensor can only be connected to special interfaces that support I2C digital sensors like the CMA MoLab interface. The sensor cable needed to connect the sensor to MoLab is not supplied with the sensor, it is supplied with MoLab.

Sensor specifications

The CO₂ Gas sensor ML60m is a digital sensor that converts the measured CO₂ in ppm to a digital value via 12-bit analog-to-digital conversion. The maximal sampling rate of the sensor is 1 Hz. Due to the measurement process of the sensor the optimal sampling rate is 20 per minute.

Collecting data

This CO₂ Gas sensor works only with specific interfaces. The sensor will be automatically detected when connected to such an interface. For detailed information about measurements with sensors consult the User Manuals of the interface and the Coach 6 software.

¹ The CO₂ sensor measures in parts per million (ppm).

In gaseous mixtures, 1 part per million refers to 1 part by volume in 1 million volume units of the whole. This unit can be recalculated to *percent* by dividing a value in ppm by 10000. 5000 ppm is equal to 0.5 %. The level of CO₂ in the Earth's troposphere has gradually increased from 317 ppm in 1960 to current levels of nearly 370 ppm. Exhaled human breath has a CO₂ concentration of about 50 000 ppm.

Calibration

The CO₂ Gas sensor is supplied with a factory calibration for CO₂ level in ppm. The Coach 6 program allows shifting the pre-defined calibration if needed. The user calibration is stored in non-volatile user sensor memory.

The sensor can be calibrated at one known CO₂ level using the calibration button on the sensor box.

- Place the 250-ml sampling bottle long enough in the air outside to ensure that its content is replaced with fresh air. The calibration will be based on the CO₂ concentration level of fresh air of about 390 ppm. While still outdoors insert the sensor with the rubber stopper into the bottle. You can now take the bottle and the sensor to the location where the measurements are to be done.
- Connect the CO₂ sensor to an interface.
- Let the sensor warm up by collection data for at least 90 seconds.
- When the readings are stabilized use a paper clip or a ballpoint to press down the calibration button. After about 30 seconds, the reading should stabilize at a value of approximately 390 ppm (plus or minus 40 ppm).
- If the reading is significantly lower or higher than 390 ppm (while still in fresh air), simply press the button again to repeat the process.

Additional information

- The CO₂ sensor needs to warm up for 90 seconds anytime when power is interrupted.
- The sensor requires a large current (120 mA). We recommend that you use the AC connector for the interface when using the CO₂ sensor. Only one CO₂ sensor can be used at a time.
- The sensor cannot take readings at a CO₂ concentration higher than 5000 ppm. Once the CO₂ concentration reaches this level the computer will continue to display a reading of 5000 ppm, until the actual level drops below 5000 ppm again.
- Even though the sensor responds rather quickly to changes in CO₂ concentration, remember that gas has to diffuse through the holes in the sensor tube before any changes in concentration will be detected. Since diffusion of gases is a fairly slow process, there is a resulting delay in the readings.
- The sensor is designed to operate between 20°C and 30°C. The sensor can be used outside of this temperature range; however there will be a loss in accuracy of readings, even if the 1-point calibration at the lower level or higher temperature is done. Allow enough time for the sensor to stabilize at the desired operating temperatures.

Suggested experiments

- Measuring CO₂ levels (respiration) from small animals and insects.
- Monitoring CO₂ changes in a plant terrarium during photorespiration and photosynthesis in light/dark (combination with the light sensor).
- Measuring CO₂ levels during cellular respiration of peas or beans.
- Monitoring production of CO₂ during chemical reactions.
- Measuring CO₂ levels in classrooms.

Technical Specifications

<i>Sensor kind</i>	Digital 12-bits resolution (on-sensor digital conversion) communication via I2C
<i>Measuring range</i>	0 .. 5000 ppm
<i>Resolution</i>	2.44 ppm
<i>Accuracy</i>	100 ppm in the range of 0-1000 ppm 10% of reading in the range of 1000 – 5000 ppm
<i>Maximal sampling rate</i>	1 Hz
<i>Warm-up time</i>	90 seconds (maximum) faster when air circulates
<i>Respond time</i>	90% of full scale reading in 60 s
<i>Normal operation temperature</i>	25°C
<i>Operating humidity range</i>	5 – 95% (non-condensing)
<i>Connection</i>	5-pins mini jack plug

Warranty:

The CO₂ Gas sensor ML60m is warranted to be free from defects in materials and workmanship for a period of 12 months from the date of purchase provided that it has been used under normal laboratory conditions. This warranty does not apply if the sensor has been damaged by accident or misuse.

Note: *This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.*

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