OXYGEN GAS SENSOR W38

USER GUIDE

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Short description

CMA Wireless Oxygen Gas sensor W38 measures the gaseous oxygen concentration in the range of 0 to 25 %. It uses luminescence–based optical technology.

The power button located on the top of the sensor allows you to turn it on and off. The sensor is equipped with an OLED color display which shows sensor information and the measured values. This makes the sensor suitable to use as a standalone independent measuring instrument.

The sensor can be used wirelessly via Bluetooth or wired via USB with the Coach 7 or Coach 7 lite programs/apps on computers (Windows and Mac), Chromebooks and mobile devices (Android and iOS).

The Oxygen Gas Sensor has a **limited lifespan** due to the gradual degradation of the luminescent material used for oxygen detection. Several factors influence the longevity of the sensing element, including storage temperature, pressure, and oxygen exposure. Proper storage is crucial to maintaining accuracy and extending its lifespan. Under optimal conditions, the sensor can last up to approximately five years.

The oxygen measurement may take some time to stabilize because the gas needs to diffuse through a membrane filter in the sensor probe.

How the sensor works

The sensor uses the principle of luminescence quenching by oxygen. This oxygen (O_2) measurement method involves coating the sensor with a material that emits luminescence when exposed to light. When illuminated, the material luminesces, but the presence of oxygen reduces this luminescence through a process called quenching. The sensor measures the reduction in luminescence, with more oxygen causing more quenching, allowing the oxygen level to be determined. It is calibrated with known oxygen levels for accurate real-time readings.

Calibration

The Oxygen Gas sensor W38 is supplied calibrated with a factory calibration in %. The factory calibration may be sufficient in most cases.
You may choose to calibrate your sensor by setting it to 20.9 % while measuring in fresh air.

- Place a sampling bottle in the air outside long enough to ensure that its content is replaced with fresh air. The calibration will be based on this sample having a O_2 concentration of about 20,9 %.
- While still outdoors insert the sensor tube with the rubber stopper into the sampling bottle and close tightly. You can now take the bottle and the sensor to the location where the measurements will be done.
- Turn on the sensor.
- When the readings have stabilized, double press the power button. The sensor

will display a value of about 20,9 %, and the symbol ‘UC’ will appear to indicate that user calibration has been applied.

- You are ready to use the sensor.

Software

You can use the Conductivity sensor W04 with Coach 7 or Coach 7 Lite (free) program on computers (Windows and Mac) or Coach 7 and Coach 7 Lite (free) app on mobile devices (Android and iOS). For Chromebooks, we offer a special Android app. The support for the wireless CO_2 sensor W02 is added starting from Coach version 7.12.

Check the CMA website for the latest installations. https://cma-science.nl/downloads_en

Collecting data without software connection

1. Turn the Oxygen Gas sensor on by pressing its power button.
2. The sensor briefly displays its Bluetooth identification code. This ID code is also printed on the sticker located on the bottom side of the sensor box.
3. Then the display shows:
   - the Bluetooth mode, ‘Mobile’ or ‘PC’.
     Mobile indicates Bluetooth Low Energy mode which should be used when working with mobile devices (Android, iOS), Chromebook and Apple computers.
     PC indicates Bluetooth Classic which should be used for Windows computers.
   - the battery level, and
   - the current measured value.
4. If needed perform the calibration, see the calibration procedure above.
5. Now you can use the sensor as an independent measuring instrument.
6. While the sensor responds relatively quickly to changes in CO_2 concentration, the gas must first diffuse through the holes in the sensor tube before a change can be detected. Because gas diffusion is a slow process, this results in a delay in the readings.

Collecting data via the Bluetooth connection

Mobile devices, Chromebooks, and Apple computers

For mobile devices (Android, iOS), Chromebooks and Apple computers Bluetooth Low Energy technology is used for wireless communication. For these devices **do not pair** the sensor just use it directly in the Coach software.

- Turn the sensor on by pressing its power button.
- Ensure your sensor is set to Mobile mode.
  If the display shows in the top-left corner ‘PC’ first you must set the sensor to the Mobile mode. Turn off the sensor. Then press and hold the power button until the text ‘Bluetooth mode Change Mobile’ is shown, then release the button. The mode

is set to ‘Mobile’ which means that Bluetooth Low Energy is used.

- Start the Coach 7 or Coach 7 Lite program/app.
- Select the Dashboard Activity ‘Measurement with Wireless sensors’.
- On opening of the Activity Coach starts searching for sensors which are turned on and in the Mobile mode. The found sensors appear in the list.
- Select the Oxygen Gas sensor you want to connect to. If needed check the sensor’s Bluetooth ID which is located on the sensor’s bottom label.
- When the connection is established, the Bluetooth symbol will appear in the top-left corner of the sensor’s display, and the sensor’s icon will be displayed in Coach, showing the values measured by the sensor.
- Now you are ready to use the Oxygen Gas sensor for your measurement.

Windows computers

For Windows computers, Bluetooth Classic technology is used for wireless communication. Before you start to use the sensor for measurement in Coach **you have to pair it**.

- Turn the Oxygen Gas sensor on.
- Ensure your sensor is set to PC mode.
  If the display shows in the top-left corner ‘Mobile’ first you must set the sensor to the PC mode. Turn off the sensor. Then press and hold the power button until the text ‘Bluetooth mode Change PC’ is shown, then release the button. The mode is set to ‘PC’ which means that Bluetooth Classic is used.
- Pair your sensor.
  - Go to the Windows Settings **Bluetooth and other devices** and select **Add Bluetooth or other devices**. Select **Bluetooth device**.
  - Windows looks for Bluetooth devices and after a while lists discovered devices. The wireless sensors are listed with their Bluetooth IDs.
  - Select the sensor you want to connect to. If needed check the sensor’s Bluetooth ID which is located on the bottom label of your sensors.
  - When the connection is successfully established Windows indicates that the sensor is paired and ready to go.
  - Click **Done** to accept it. The sensor appears in the list of paired Bluetooth devices.
- Start the Coach 7 or Coach 7 Lite program.
- Select the Dashboard Activity ‘Measurement with Wireless sensors’.
- Coach starts searching and displays the list with detected sensors, even if they are not paired.
- Select the Oxygen Gas sensor you want to connect to. If needed check the sensor’s Bluetooth ID which is located on the sensor’s bottom label. If the sensor was not paired yet Coach will force you to pair the sensor first via Windows Settings.
- When the connection is established, the Bluetooth symbol will appear in the top-

left corner of the sensor's display, and the sensor's icon will be displayed in Coach, showing the values measured by the sensor.
- Now you are ready to use the Oxygen Gas sensor for your measurement.

Collecting data via the USB connection

For computers (Windows and Mac) the Conductivity sensor can also be used as USB sensor.

- Turn the Oxygen Gas sensor on.
- Use the provided USB cable to connect the sensor to a USB port.
- Start the Coach 7 or Coach 7 Lite program.
- Select a Measurement Activity. If it is made for another interface choose **Use with Wireless sensors** during opening of the activity or right click the interface panel and choose **Change interface** in the activity.
- The connected USB sensor should be detected automatically, and its icon appears on the first empty sensor position in the Wireless sensors panel, or if the sensor was already predefined it changes its status from grey to green.
- When the connection is established the USB symbol appears in the top-left corner of the sensor's display and the icon shows measured data.
- Now you are ready to use the Oxygen Gas for your measurement.

Atmospheric Considerations

Because the % of oxygen varies with the amount of water vapor in the atmosphere, you may want to adjust your atmospheric oxygen calibration value to improve accuracy when using the Oxygen Gas Sensor. The accepted value of 20.9 % for atmospheric oxygen levels is calculated in dry air (0 % humidity). If you know the relative humidity of the location at which you are calibrating, you can substitute one of the values below in place of 20.9 %.

Relative Humidity	0 %	25 %	50 %	75 %	100 %
Oxygen in % by volume	20.9	20.7	20.5	20.3	20.1

How to store the sensor

Proper storage helps the sensor stay accurate and can significantly extend its lifetime. Here are some key storage recommendations:

- Keep the sensor in a dry and dark place. Exposure to excessive moisture or direct light (especially UV light) can degrade the sensor's luminescent material over time.
- Keep at a stable temperature. Avoid extreme heat or cold, as temperature fluctuations can affect sensor performance and accelerate degradation.
- Keep it in an airtight container with little or no oxygen inside e.g. a vacuum sealed bag. This can slow down the sensor degradation.

- Keep it away from strong chemicals, which can damage the sensor.

Important

- Do ***not*** place the sensor into any liquid. The sensor is intended only for measuring *gaseous*, **not** aqueous, O_2 concentration.
- Even though the sensor responds rather quickly to changes in O_2 concentration, remember that gas must diffuse into the cell located at the top of the sensor shaft before any changes in concentration can be detected. Since diffusion of gases is a slow process, there can be some delay in readings.

Charging a battery

An internal rechargeable battery (Li-Poly 3.7 V, 700 mAh) powers the sensor. The battery symbol located in the top-right corner of the sensor's display shows the battery level. When the battery level becomes critical, the battery gauge shows an empty battery. Use the provided cable to connect the sensor to a USB port for charging. A fully discharged battery requires up to 2 hours of charge time to become fully charged again. To prolong battery life, automatic power down turns the sensor off after 5 minutes of inactivity.
To replace the battery, use **only** the approved rechargeable batteries provided by CMA.

Suggested experiments

The Oxygen Gas sensor can be used to monitor gaseous oxygen in a variety of experiments such as:

- Monitoring oxygen levels in different environments outdoor and indoor (classroom)
- Monitoring changes in oxygen concentration during photosynthesis and respiration of plants
- Monitoring changes in oxygen concentration respiration of animals, insects, or germinating seeds
- Monitoring consumption of oxygen by yeast during respiration of sugars.
- Measuring oxygen level during combustion e.g. burning a candle in a closed jar.
- Measuring oxygen level in exhaled air.

Technical Specifications

Measuring range	0 .. 25% O_2
Resolution	0.01 %
Maximal sampling rate	1 Hz
Operating lifetime	Depends on the way it is stored and exposed to air, max. 5 years
Response time	Less than 30 seconds to detect and respond to 90% of the actual change in oxygen levels under typical conditions
Conditions	-30 – 60 ℃, 0 – 99 % Rh (non-condensing), 500–1200 mbar
Battery life after full charge	Approximately 12 hours, battery life varies by use, configuration, temperature, and many other factors
Connection	Bluetooth 5, Low Energy (Mac, Android, iOS) Bluetooth 2.1, Classic (Windows) USB 2.0 (type C)
Bluetooth ID	W38OXYG-xxx

Warranty

The Oxygen Gas sensor W38 is warranted to be free from defects in materials and workmanship for a period of 3 years 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.

The sensor battery is consumable and is warranted to be free from defects in materials and workmanship for a period of 12 months from the date of purchase.

Discard batteries according to local regulations.

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

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