BAROMETER/TEMPERATURE SENSOR W01

USER GUIDE

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Short description

CMA Wireless Barometer/Temperature sensor W01 measure absolute atmospheric pressure and temperature, with ranges -30 to 110 kPa and -40 to 125 °C, respectively.

The power button located on the top of the sensor allows you to turn the sensor on and off. The sensor is equipped with an OLED color display which shows some sensor information and the measured by the sensor values. This makes the sensor suitable to use as an 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).

How the sensor works

The Barometer sensor a digital micro-electro-mechanical (MEMS) sensor that measures atmospheric pressure. It measures air pressure with a tiny silicon diaphragm that bends under changing pressure. Built-in electronics convert this into digital data and correct for temperature, giving accurate pressure readings that can also be used to calculate altitude.

Calibration

The Barometer/Temperature sensor W01 converts measured pressure and temperature values to digital values. The sensor is supplied with a factory calibration in kPa and in °C.
When working with the Coach program the pre-defined calibration can be shifted by using the **Set to Value** option.

Software

You can use the Barometer/Temperature sensor W01 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 wireless sensors 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

- Turn on the Barometer/Temperature sensor by pressing its power button.
- The sensor briefly displays its Bluetooth identification code. This code is also printed on the sticker located on the bottom side of the sensor box.
- 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.
- Now you can use the sensor as an independent measuring instrument.
- To turn off the sensor press and hold its power button for 3 sec. To save its battery the sensor automatically turns off after 5 minutes of inactivity (no connection to power, no communication).

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 Barometer/Temperature sensor on.
- 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 discovery mode. The found Bluetooth sensors appear in the list.
- Select the Gas Pressure 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 appears in the top-left corner of the sensor's display and the icon of the sensor appears showing the measured values.
- Now you are ready to use the Barometer/Temperature 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 Barometer/Temperature 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’, meaning 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 Gas Pressure 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 appears in the top-left corner of the sensor’s display and the icon of the sensor appears showing the measured values.
- Now you are ready to use the Barometer/Temperature sensor for your measurement.

Collecting data via the USB connection

For computers (Windows and Mac) the Gas Pressure sensor can also be used as USB sensor. When using this connection, the sensor can measure with a higher sampling frequency of up to 1000 Hz.

- Turn the Barometer/Temperature on.
- Use the provided USB cable to connect the sensor to a USB port.
- Start the Coach 7 or Coach 7 Lite program.
- Select the Dashboard Activity ‘Measurement with Wireless sensors’.
- The connected USB sensor should be detected automatically, and its icon appears on the first empty sensor position in the Wireless sensors panel.
- When the connection is established the USB symbol appears in the top-left corner of the sensor’s display and the sensor icon shows measured data.
- Now you are ready to use the Barometer/Temperature sensor for your measurement.

Calculation absolute altitude

You can calculate the altitude sing the following formula:

$$\text{Altitude} = 44{,}300*(1-(p/p_0)^{(1/5.255)})$$

Where p is the measured barometric pressure, and p_0 is the standard sea-level atmospheric pressure, which is 1,013.25 hPa (101.325 kPa).

A pressure change of Δp = 1 hPa = 0.1 kPa corresponds to 8.43 m of altitude at sea level. Be aware that using a fixed value gives provides only an approximate altitude. For accurate altitude measurements, you should use the current local sea-level pressure obtained from weather data.

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 Barometer/Temperature sensor can be used in various experiments such as:

- Measure atmospheric pressure over time to observe daily fluctuations.
- Calculate altitude changes by moving the sensor to different floors or heights.
- Track pressure trends to predict weather changes.
- Measure pressure changes in a sealed container when air is added or removed.
- Attach the sensor to a small balloon or drone to study pressure vs. altitude.
- Map a hiking route's elevation profile using pressure readings.

Technical Specifications

Sensor kind	Digital, on-sensor digital conversion, 16-bit resolution
Measuring range *Pressure* *Temperature*	 30 .. 110 kPa -40 .. 125 °C
Accuracy	0.4 kPa 0.2 °C
Maximal sampling rate	10 Hz
Display	OLED 0.96" (128*64 px)
Battery	Li-Poly Rechargeable Battery (3,7 V 700 mAh)
Battery life after full charge	Approximately 13 hours Battery life varies by use, configuration, temperature, and many other factors; actual results will vary.
Connection	Bluetooth 5, Low Energy (Mac, Android, iOS) Bluetooth 2.1, Classic (Windows) USB 2.0 (type C)
Bluetooth ID	W01BARO-xxx

Warranty

The Barometer/Temperature sensor W01 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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