TEMPERATURE SENSOR W56

USER GUIDE

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Short description

CMA Wireless Temperature sensor W56 is a general-purpose temperature sensor that can be used to measure temperature in liquids (water, mild acidic solutions) and air. The sensor can measure temperature in the range of -40°C to 125°C. The sensing element of the sensor (thermistor) is housed at the end of a 195 mm stainless steel tube with Φ of 4 mm.

The power button on the top of the sensor allows you to turn the sensor on/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).

Practical information

The Temperature sensor can be used in a similar way as a thermometer. Here are some general guidelines for usage:

- Do not use the sensor to measure temperatures higher than 125°C, this may damage the sensor.
- Do not put any part of the sensor in a flame or on a hot plate.
- Avoid submerging the sensor probe beyond the stainless-steel part.
- Always clean the sensor thoroughly after use.
- The sensor tube is constructed from stainless steel, which has a high resistance to corrosion from weak acids and alkalis. Some environments e.g. salt water may cause some discoloration of the stainless steel tube but this will not affect the sensor's performance.
- Do not use this sensor in a strong acid or strong base. A chemical reaction may cause permanent damage.
- The sensor can be left in an alkaline solution, such as NaOH, for up to 48 hours, with only minor discolouration. We do not recommend using the sensor in basic solutions whose concentration is greater than 3 M.
- The maximum length of time recommended for exposure to acid is dependent on the acid's concentration. In general, we do not recommend sensors be left to soak in acids of between 1 - 3 M concentration for longer than 48 hours. The exceptions to this are Hydrochloric acid HCL and Sulphuric acid H_2SO_4.

The maximum exposure times for these acids are:

Acid	Maximum Exposure Time
1 M HCL	20 minutes
2 M HCL	10 minutes
3 M HCL	5 minutes
1 M H_2SO_4	48 hours
2 M H_2SO_4	20 minutes
3 M H_2SO_4	10 minutes

Calibration

The Temperature sensor W56 converts measured temperature values to digital values. It uses 12-bit analogue-to-digital conversion resulting in a temperature resolution of 0.06°C.
The sensor is supplied with a factory calibration in degrees Celsius °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 Temperature sensor W56 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 7.10.

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

Working with Sensor

- Turn the Temperature sensor on by pressing its power button.
- 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.
- 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 a few 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 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', meaning Bluetooth Low Energy is used.
- Start the Coach 7 or Coach 7 Lite program/app.
- Select the Dashboard Activity 'Measurement with Wireless sensors'.
- 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 Temperature 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 sensor icon appears showing the measured temperature values.
- Now you are ready to use the Temperature 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 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', 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 temperature 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 sensor icon appears showing the measured temperature values.
- Now you are ready to use the Temperature sensor for your measurement.

Collecting data via the USB connection

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

- Turn the Temperature 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 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 sensor for your measurement.

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

This Temperature sensor can be used in many experiments in Physics, Chemistry and Biology:

- monitoring indoor and outdoor temperatures,
- monitoring freezing and boiling water,
- monitoring endothermic and exothermic reactions,
- specific heat experiments,
- conduction, convection, radiation and evaporation experiments,
- solar energy studies, and many more.

Technical Specifications

Sensor kind	Digital, on-sensor digital conversion, 12-bit resolution
Measuring range	- 40°C to 125°C
Resolution	± 0.06˚C
Accuracy	Typical: ± 0.25˚C, Maximal: ± 1.0˚C
Maximal sampling rate	8 Hz
Response time	In water without stirring: 90 % of full reading: 9 s 99 % of full reading: 14.5 s In still air: 90 % of full reading: 295 s
Operating temperature	The sensor is designed to work in temperatures between 0°C and 45°C, and stored between 0°C and 35°C
Display	OLED 0.96" (128*64 px)
Battery	Li-Poly Rechargeable Battery (3,7 V 700 mAh)
Battery life after full charge	Approximately 14 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	W56TEMP-xxx
Sensor dimensions	Housing: 78 x 42 x 18 mm; Stainless steel tube: 4 mm (diameter) 195 mm (length)

Warranty

The Temperature sensor W56 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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