RADIATION SENSOR W46

USER GUIDE

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Short description

CMA Wireless Radiation sensor W46 senses alpha, beta and gamma radiation. The Radiation sensor uses a Geiger-Müller tube to detect this radiation.

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 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

A Geiger–Müller tube detects radiation by using a gas-filled chamber, typically containing a mixture of neon (Ne) or argon (Ar) with a small amount of halogen gas added as a quenching agent. The tube has two electrodes: a central wire anode (positive) positioned in the center of a tubular cathode (negative). A high voltage is applied to the electrodes to create an electrical field within the chamber. When radiation passes through the chamber and ionizes the gas, it generates a pulse of current. The sensor electronically processes these pulses to display the radiation level in counts per minute. A clicking sound is emitted for each detected radiation event (for each count).

The end of the GM tube has a thin mica window. It allows alpha particles to reach the GM tube and be detected. The mica window will also sense low energy beta particles and gamma radiation that cannot penetrate the plastic case or the side of the tube.

For the short amount of time the GM tube is detecting one particle, it is not able to detect another radioactive particle if it enters the tube. This is called the sensor's dead time. The maximum dead time for the GM tube is 90 microseconds.

To detect radiation, point the sensor toward the source of radiation. To detect alpha radiation put the sensor close to the source, this is because alpha particles do not travel far through air.

Calibration

The Radiation sensor is supplied with a factory calibration in counts per minute (cpm).

Software

You can use the Radiation sensor W46 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 this wireless sensor 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 the Radiation 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 the sensor off 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 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 discovery mode. The found Bluetooth sensors appear in the list.
- Select the Radiation 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 Radiation 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 Radiation 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 Radiation 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 Radiation sensor for your measurement.

Collecting data via the USB connection

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

- Turn the Radiation 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 icon shows measured data.
- Now you are ready to use the Radiation 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

1. Monitoring background radiation: measure natural background radiation from cosmic rays, earth minerals, and materials. This low-level radiation varies by location and should be recorded to subtract from other readings for accuracy.
2. Monitoring radiation of common radioactive materials: use everyday radioactive materials like potassium salts or lantern mantles to demonstrate the random nature of radiation.
3. Radioactive Decay and half-Life determination: measure decay rates and half-lives using isotope generators such as Protactinium (72 s) or Ba-137m (153 s).
4. Radiation level versus shielding: record radiation levels with different thicknesses and types of absorbers—aluminum for beta, lead for gamma—and compare their shielding effects on alpha, beta, and gamma radiation.
5. Radiation intensity vs. distance: measure how radiation levels change as the sensor is moved farther from the source.

Technical Specifications

Sensor kind	Digital
Sensitive to	Alpha, beta, gamma radiation
Measuring range	0 .. 20 000 counts per minute (cpm)
Resolution	1 count per minute (cpm)
GM tube	Ne / Ar + Halogen quenched GM-tube
Cathode material	446 Stainless Steel
Cathode wall thickness	0.25 mm
Mica window	Effective diameter 9 mm Areal density 1.5 – 2.0 mg/cm^2
Gamma sensitivity (Cs137)	18 cps, 1000 CPM, 1 mR/hr
Operating voltage	500 V
Minimum Dead Time	90 µs
Max. Background Shielded	50 mmpB = 3 mmAI (cpm) 10
Audio output	Clicking sound for each count
Maximal sampling rate	1 Hz
Battery life *after full charge*	Approximately 6 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	W46RADI-xxx

Warranty

The Radiation sensor W46 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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