

ELECTRICAL ENERGY SENSOR W17

USER GUIDE



cma-science.nl

Short description

The CMA Wireless Electrical energy Sensor W17 is a device for measuring electrical power and energy in DC circuits. It features separate Source and Load terminals to monitor both the voltage supplied by a power source and the current delivered to a load. Using these values, the sensor calculates instantaneous power (W) and accumulated energy (J) over time. The Source and Load terminals accept standard banana plugs. The sensor comes with four cables that have banana plugs on one end and alligator clips on the other.

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.

To reset the energy meter (J) double-press the power button.

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 Electrical energy sensor is connected in series between a power source and a load using its two terminals: the Source and the Load. from a connected power source and the current flowing through an external load. Using these measurements, the sensor calculates the instantaneous electrical power (in W) by multiplying voltage and current. By integrating this power over time, the sensor determines the total electrical energy (in J) transferred in the circuit.

Measurements with the sensor

1. To set up the Electrical energy Sensor, first connect the device that generates power, such as a model wind turbine, solar panel, battery, power supply, or function generator, to the terminals labeled Source on the sensor. These terminals receive the electrical energy from the power source.
2. Next, connect the terminals labeled Load on the sensor to the electrical device you want to power, called the load. This can be any DC electrical device - such as a resistor, small motor, or light bulb - that operates at a voltage compatible with your power source.
3. When the circuit is complete and the power source is turned on, the Energy Sensor will measure the voltage and current flowing through the load. It calculates and displays the power and total energy delivered.
4. Remember to reset the energy meter (J) by double-pressing the power button:
 - Before starting a new experiment to make sure you only measure the energy for that test.
 - After changing the circuit setup (for example, switching the load or power source) so your readings stay accurate.

- If the readings seem wrong or inconsistent, resetting can clear errors or old data.

5. At the end of the experiment, turn off the power source and carefully disconnect all components.

Safety Tips:

- Always turn off the power source before you start setting up the circuit.
- Don't touch any bare wires or metal parts when the power is on.
- Be careful with batteries and other power sources to avoid breaking them or hurting yourself.

Software

You can use the Electrical energy sensor W17 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 Electrical energy 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 Conductivity 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 conductivity values.
- Now you are ready to use the Electrical energy 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 Electrical energy 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 Conductivity 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 conductivity values.
- Now you are ready to use the Electrical energy sensor for your measurement.

Collecting data via the USB connection

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

- Turn the Conductivity 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 Electrical energy 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

You can use this sensor for:

- Investigate how different loads (e.g., resistors of various values, motors, or bulbs) affect power consumption
- Compare the energy output of a solar panel under different lighting conditions.
- Use the sensor to monitor how the voltage, current, and energy output of a battery change as it powers a device over time.
- If you have a small model wind turbine, measure how much electrical energy it generates at different wind speeds

- Use the sensor to measure the efficiency of simple circuits by calculating input vs. output energy.

Technical Specifications

<i>Sensor kind</i>	Digital (on-sensor digital conversion)
<i>Measuring ranges</i>	0 .. 30 V 0 .. 1 A 0 .. 60 W 0 .. 6000 J
<i>Maximal sampling rate</i>	5 Hz
<i>Battery life after full charge</i>	Approximately 4 hours Battery life varies by use, configuration, temperature, and many other factors; actual results will vary.
<i>Connection</i>	Bluetooth 5, Low Energy (Mac, Android, iOS) Bluetooth 2.1, Classic (Windows) USB 2.0 (type C)
<i>Bluetooth ID</i>	W17ENER-xxx

Warranty

The Electrical energy sensor W17 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.

Rev. 01.09.2025