CHARGE SENSOR W18

USER GUIDE

cma-science.nl

Short description

CMA Wireless Charge sensor W18 is designed to measures electrostatic charges in three ranges -5 .. +5 nC, -20 .. +20 nC and -100 .. +100 nC. It can replace a traditional electroscope by showing not only the polarity of the charge but also performing quantitative measurements. The sensor is supplied with a shielded BNC/crocodile lead. The lead ends with a red and black 4-mm crocodile clip.

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.

By default, the sensor uses the ± 100 nC range. Press the power button briefly to select another range. For accurate sensor detection in the Coach software, first select the desired range before connecting it.
After the initial power-up, or whenever changing the range setting, press the power button twice with the leads shorted together to ensure all charge is discharged from the internal capacitor. After this initial reset, shorting the leads together will usually zero the unit adequately.

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 Charge sensor is an extremely high impedance voltage sensor with a 0.01 µF input capacitor. The capacitor will accumulate charge until the source's voltage is reached, i.e. equilibrium is achieved. Small amounts of charge can be measured even though their initial potential is higher than the input range of the sensor. The input circuit also includes a 1 MΩ resistor in series with the capacitor to protect the unit from large current surges. When used with computer, the negative polarity (black) input lead is grounded to the computer.

Calibration

The Charge sensor is supplied calibrated with a factory calibration in nC. To discharge the sensor, press the power button twice with the leads shorted together.

Software

You can use the Charge sensor W18 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

Working with Sensor

- Turn the Charge sensor on 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 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 Charge 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 Charge 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 values.
- Now you are ready to use the Charge 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 Charge 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 Charge 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 values.
- Now you are ready to use the Charge sensor for your measurement.

Collecting data via the USB connection

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

- Turn the Charge 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 Charge sensor for your measurement.

Practical information

- The sensor should be stored with the input leads shorted together to protect it from high static potentials that could damage the unit.
- After the initial power-up, or whenever changing the range setting, press the power button twice with the leads shorted together to ensure all charge is discharged from the internal capacitor. After this initial reset, shorting the leads together will usually zero the unit adequately.
- Do not use the Reset – double press the power button- while the leads are connected to a voltage source such as a power supply or battery, as this will cause incorrect readings. However, it is acceptable to use it this functionality when the leads are connected to a collector screen or a floating capacitor plate. As long as the sensor reads zero after resetting, the measurements will be accurate.
- Because the sensor can detect extremely small amounts of charge, handle the leads carefully to avoid introducing stray charges that could affect the readings. The insulation on the clip leads can become oily from handling, and fingers often carry small amounts of charge at high potential. This charge can easily leak through the insulation and influence the measurement. To minimize this, ground your fingers to remove any charge before disconnecting the positive lead from its ground connection.
- Begin recording data before removing the lead from ground so you can detect any stray charge accumulation before making the measurement connection.
- When connecting to static sources (rather than fixed voltages like a battery), you may use the Reset functionality while connected to a passive charge receptor. Always ensure the output reads zero after resetting.
- The sensor is not differential; the negative (black) lead is always at ground potential. The supplied cable is shielded and uses a low-leakage dielectric. When using other cables, test them to ensure they do not allow excessive leakage currents.

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 Charge sensor can be used in a variety of experiments, such as:

- Measure the electrostatic charge generated by rubbing a balloon on different fabrics.
- Compare the charge on a plastic rod after rubbing it with wool versus silk.
- Observe how distance affects the charge measured between two objects.
- Investigate the charge buildup on a glass rod after repeated rubbing.
- Test how grounding an object affects the measured electrostatic charge.
- Measure the charge on different materials like PVC, rubber, and acrylic after friction.
- Explore charge induction by bringing a charged object near a neutral conductor.
- Observe how humidity affects electrostatic charge buildup on a material.

Technical Specifications

Sensor kind	Digital, on-sensor digital conversion
Measuring range	± 5 nC ± 25 nC ± 100 nC
Resolution	0.003 nC 0.01 nC 0.05 nC
Maximum input	± 150 V
Typical bias input current	0.005 pA
Input capacitor	0.01 μF
Input resistance	1 MΩ
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 4 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	W60CHAR-xxx

Warranty

The Charge sensor W18 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. 09.09.2025