EKG SENSOR W14

USER GUIDE

cma-science.nl

Short description

CMA Wireless EKG sensor W14 measures electrical potentials produced by the heart (electrocardiogram) within a range of 0 to 5 mV. These small voltages are detected through electrodes placed on the skin.
In addition to cardiac activity, the sensor can also measure electrical potentials generated by muscle cells during contraction and relaxation (electromyogram).

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 a standalone 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).

The EKG sensor is delivered together with a package of 100 electrode patches.

Calibration

The EKG sensor W14 is supplied calibrated with a factory calibration in mV. Additional calibration is not needed.

Safety instructions

For safety reasons, the sensor uses an optical coupler to ensure there is no direct electrical contact between the person being measured and the sensor's internal electronics or any connected devices. However, for safe operation, always follow these instructions when using the EKG sensor:

1. The sensor, electrode patches, and alligator clips must **never** come into contact with water or any other liquid.
2. **Do not use** the sensor if the insulation of any wires is damaged.
3. **Only connect** the alligator clips to the electrodes—never to any other object.
4. Ensure that the alligator clips are kept **away** from wall outlets or any other power source.

The **EKG sensor is intended for educational use only**. It is **not** suitable for medical applications or patient diagnosis.

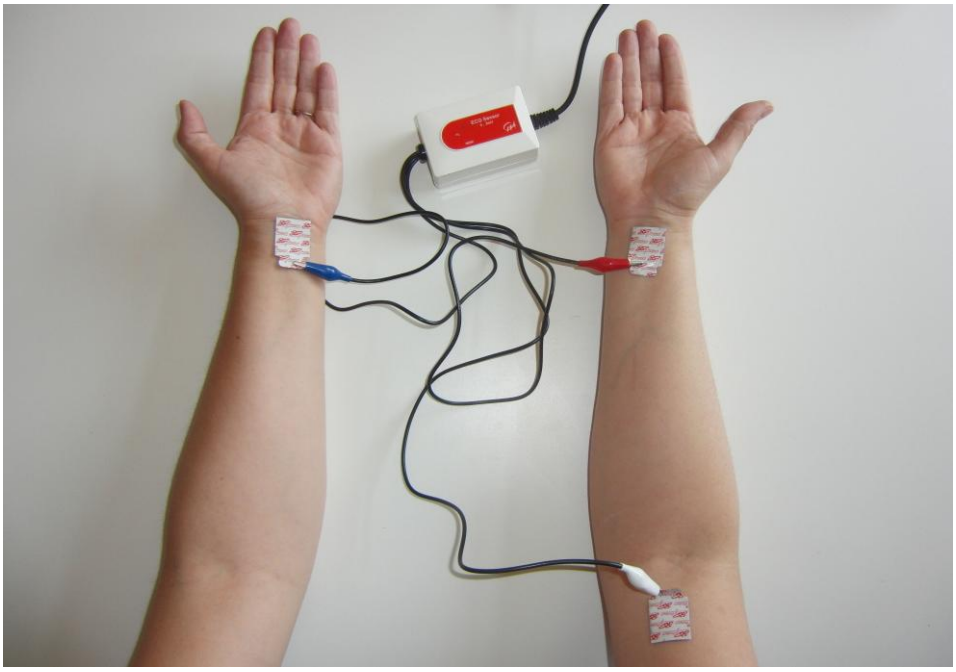
Connection of the sensor to the body

Because the electrical signal produced by the heart and measured at the skin is very weak, ensuring good contact between the skin and the electrodes is essential for the EKG sensor to function properly.

1. Read the safety instructions.
2. Clean the areas of the skin where the electrode patches will be applied (inside of the left and right wrist, and right elbow).
3. Peel off an electrode patch and firmly place it on the inside of the right elbow (this

serves as the reference electrode).

4. Peel off a second electrode patch and firmly place it on the inside of the right wrist.
5. Peel off a third electrode patch and firmly place it on the inside of the left wrist.
6. Connect the white alligator clip from the sensor to the tab of the right elbow electrode.
7. Connect the red clip to the tab of the right wrist electrode.
8. Connect the blue clip to the tab of the left wrist electrode.



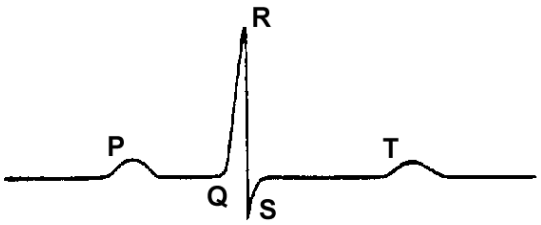
Connection of the EKG sensor to the body.

Tips for use

- Contracted muscles generate electrical signals that are much stronger than the signal produced by the heart. To obtain a clear EKG signal, it is essential to keep the muscles of the arms (and other muscles) as relaxed as possible. The easiest way to do this is to rest your arms on the arms of a chair or on a table. Also, breathe slowly to help relax.
- If the signal is not satisfactory, the issue may be that the contact between the skin and the electrode patches is insufficient. Clean the skin with soap and water or alcohol, dry with a paper towel, and then reapply new patches.
- Electrode patches have a limited lifespan, especially after the package has been opened. Check whether the patches are still in good condition. Opened packages should be stored in an airtight box in the refrigerator for best preservation.
- Additional packages of electrode patches (100 per package) can be ordered from CMA.

The electrocardiogram

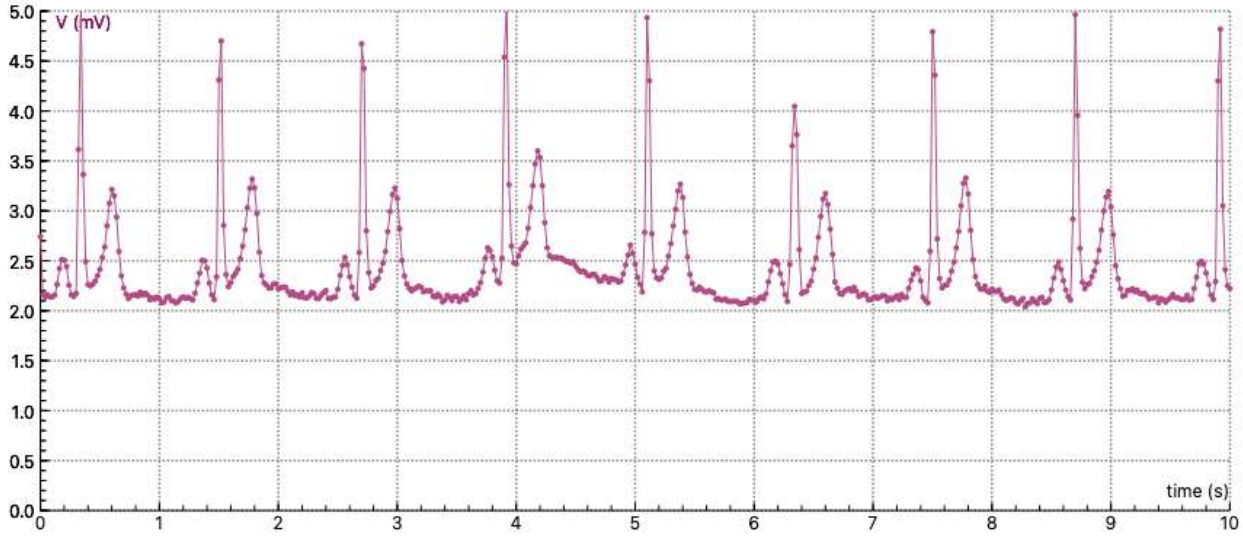
A schematic EKG of one heartbeat is shown in the figure on the right. Every normal heartbeat consists of three main components: the P wave, the QRS complex, and the T wave.



- The P wave is caused by the depolarization of the atrial tissue just before contraction.
- The QRS complex represents the electrical currents generated when the ventricular tissue depolarizes, just before contraction.
- The T wave is generated by the electrical currents as the ventricle recovers from depolarization.

The P-R interval typically ranges from 0.12 to 0.20 seconds for most people. The length of this interval is independent of the heart rate.

In general, EKGs produced with the CMA EKG sensor will follow this pattern. However, no EKG produced with this equipment will be exactly the same. Specifically, the height of the P wave and the length of the S wave may differ from the pattern shown in medical textbooks. Additionally, it is important to note that the CMA EKG sensor is not a medical-grade instrument and does not meet medical standards.



An example of an electrocardiogram recorded with the EKG sensor.

Software

You can use the EKG sensor W14 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 the wireless EKG W14 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

1. Turn the EKG sensor on by pressing its power button.
2. 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.
3. 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.
4. Now you can use the sensor as an independent measuring instrument.
5. 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.

1. Turn the EKG sensor on by pressing its power button.
2. 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.
3. Start the Coach 7 or Coach 7 Lite program/app.
4. Select the Dashboard Activity 'Measurement with Wireless sensors'.
5. On opening of the Activity Coach starts searching for sensors which are turned on and in the Mobile mode. The found sensors appear in the list.
6. Select the EKG sensor you want to connect to. If needed check the sensor's Bluetooth ID which is located on the sensor's bottom label.

7. When the connection is established, the Bluetooth symbol will appear in the top-left corner of the sensor's display, and the sensor's icon will be displayed in Coach, showing the values measured by the sensor.
8. Now you are ready to use the EKG 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**.

1. Turn the EKG sensor on.
2. 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.
3. 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.
4. Start the Coach 7 or Coach 7 Lite program.
5. Select the Dashboard Activity 'Measurement with Wireless sensors'.
6. Coach starts searching and displays the list with detected sensors, even if they are not paired.
7. Select the EKG 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.
8. When the connection is established, the Bluetooth symbol will appear in the top-left corner of the sensor's display, and the sensor's icon will be displayed in Coach, showing the values measured by the sensor.
9. Now you are ready to use the EKG sensor for your measurement.

Collecting data via the USB connection

The EKG sensor can also be used as a USB sensor for both Windows and Mac computers.

1. Turn the EKG sensor on.
2. Use the provided USB cable to connect the sensor to a USB port.
3. Start the Coach 7 or Coach 7 Lite program.
4. Select the Dashboard Activity 'Measurement with Wireless sensors'.
5. The connected EKG sensor should be detected automatically. When the connection is established, the USB symbol will appear in the top-left corner of the sensor's display, and the sensor's icon will be displayed in Coach, showing the values measured by the sensor.
6. Now you are ready to use the EKG 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 a few minutes of inactivity.

To replace the battery, use **only** the approved rechargeable batteries provided by CMA.

Suggested experiments

The EKG sensor can be used for a variety of experiments, including:

- Monitoring EKG at rest and after mild exercise
- Examining EKG changes in response to mild stimulants
- Analyzing the P, Q, R, S, and T waveforms
- Exploring the effect of different body positions on the EKG
- Recording muscle electrical activity (EMG)
- Investigating the relationship between electrical activity and muscle contraction strength
- Studying the connection between EMG signals and the force exerted by the arm.

Technical Specifications

Measurement range	0 to 5 mV
Resolution	5 µV
Maximal sampling rate	100 Hz
Condition	0 ~ 40 °C, ~ 85 %RH
Display	OLED 0.96" (128*64 px)
Battery	Li-Poly Rechargeable Battery (3,7 V 700 mAh)
Battery life after full charge	Approximately 8 hours after full charge, battery life varies by use, configuration, temperature, and many other factors.
Connection	Bluetooth 5, Low Energy (Mac, Android, iOS) Bluetooth 2.1, Classic (Windows) USB 2.0 (type C)
Bluetooth ID	W14EKG-xxx

Warranty

The EKG sensor W14 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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