



# Wireless EKG/ECG (Electrocardiogram) (P4521-EK) User manual

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Rev. WL121E-12-2023

**This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.**

*The wireless EKG/ECG sensor can measure the rhythm signals produced by the heart.*

**The wireless EKG sensor** measures the rhythm signals produced by the heart. When depolarization and repolarization of the heart muscle occur, the electrocardiogram sensor measures the heart rate and displays it on a graph. The sensor also comes with a conductive adhesive patch that can be easily removed. Measurements can be made by remotely connecting to a smart device or PC wirelessly or wired without a separate interface.

## **Suggested experiments**

- Monitor resting EKG
- Study the P, Q, R, S and T wave forms
- Monitor EKG after mild exercise
- Investigating EKG with different body position.
- Investigating EKG changes after mild stimulants.

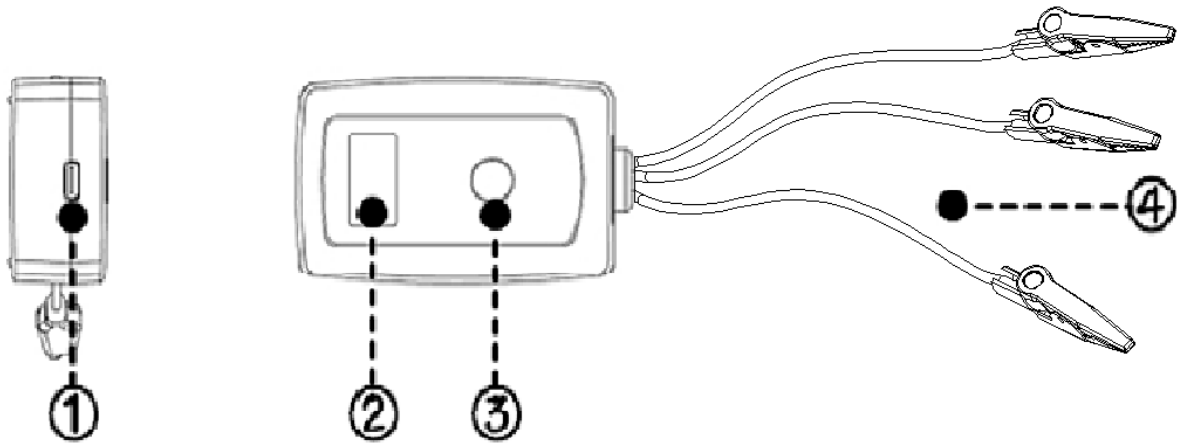
## **Composition**

*The wireless EKG sensor consists of the following.*

- Wireless EKG sensor (P4521-EK)
- Conductive adhesive patch
- USB-A/C cable
- Booklet

# Function of wireless sensor

## Structure

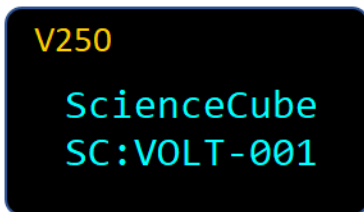


- ① USB port : Connect the sensor to a PC and use it for experiments or charging.
- ② OLED Display : Displays measured sensor values, sensor type, sensor ID, and remaining battery level.
- ③ Power/Function Button : It has functions such as power ON/OFF, measurement sensor change and calibration, etc.
- ④ Sensing part : Three signal wires connected by clips that secure the conductive patch.

## Power/Function Button

Status	Turn	Action	Description
When the power is off	Click once	■	A short press turns the sensor on.
	Long click	■	A long press changes the mode and turns on the sensor.
When it's on	Long click	■	Turns off.

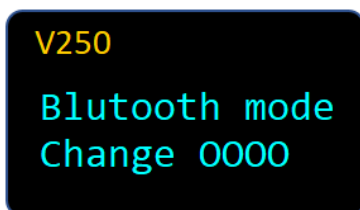
## Start screen



V250 : Displays the sensor's firmware version.

SC:0000-001 : When you search for a Bluetooth device, the device name will be displayed. (Sensor name and 3-digit serial number)

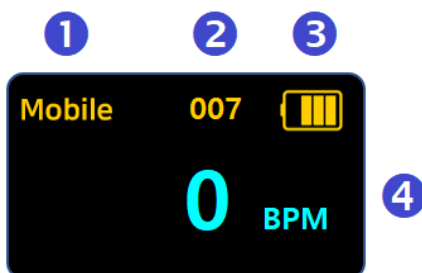
## Mode change




When you press and hold the power button and turn it on, the Bluetooth connection mode changes to **Mobile** or **PC** with the following message.

See last page for more information.

## Measurement screen



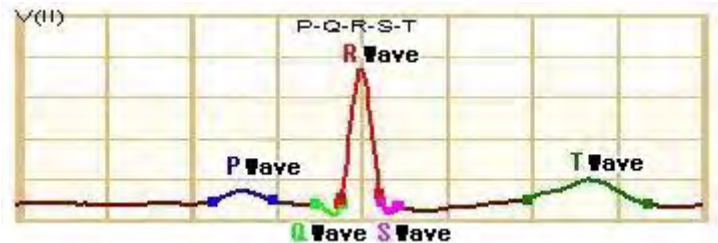
<p>① <b>Connection mode</b></p>	<p><b>Mobile</b> : Connecting Android or iOS  <b>PC</b> : Connecting to Windows PC   : Connected via <b>USB</b> cable            ※ A long press changes the mode and turns on the sensor.</p>
<p>② <b>Sensor-ID</b></p>	<p>This is the sensor's unique number and is displayed along with the sensor name in the device name when connected via Bluetooth.</p>
<p>③ <b>Battery</b></p>	<p>Check the battery status, and when charging via USB, the display will change to charging.</p>
<p>④ <b>Value</b></p>	<p>1) Displays sensor measurement values and units in real time.            2) If <b>user calibration</b> is used, <b>U0</b> or <b>UC</b> will be displayed above the units.            3) For sensors with <b>multiple ranges</b>, the current range is displayed.            4) For <b>multiple sensors</b>, the values for each sensor type are displayed.</p>

**NOTE** : EKG/ECG waveforms can be viewed through the Science# application after connecting to a smart device.

## How it Works

### Electrocardiogram waveform

Electrocardiogram wave form is influenced by electrical activation step which is consist of P, Q, R, S, T.



#### P-WAVE

The P wave is the electrical signature or the current that causes atrial contraction. Both the left and right contract simultaneous may indicate arrhythmia. Its relationship to QRS complexes determines the presence of a heart block.

#### QRS-COMPLEX

The QRS complex corresponds to the current that causes contraction of the left and right ventricles, which is much more forceful than that of the atria and involves more muscle mass, thus resulting in a greater EKG deflection.

The Q wave, when present, represents the small horizontal (left to right) current as the action potential travels through the interventricular septum. Very wide and deep Q waves do not have a septal origin, but indicate myocardial infarction.

The R and S waves indicate contraction of the myocardium. Abnormalities in the QRS complex may indicate bundle branch block (when wide), ventricular origin of tachycardia, ventricular hypertrophy or other ventricular abnormalities. The complexes are often small in pericarditis.

#### T-WAVE

The T wave represents the repolarization of the ventricles. The QRS complex usually obscures the atrial repolarization wave so that it is not usually seen. Electrically, the

cardiac muscle cells are like loaded springs. A small impulse sets them off, they depolarize and contract. Setting the spring up again is repolarization.

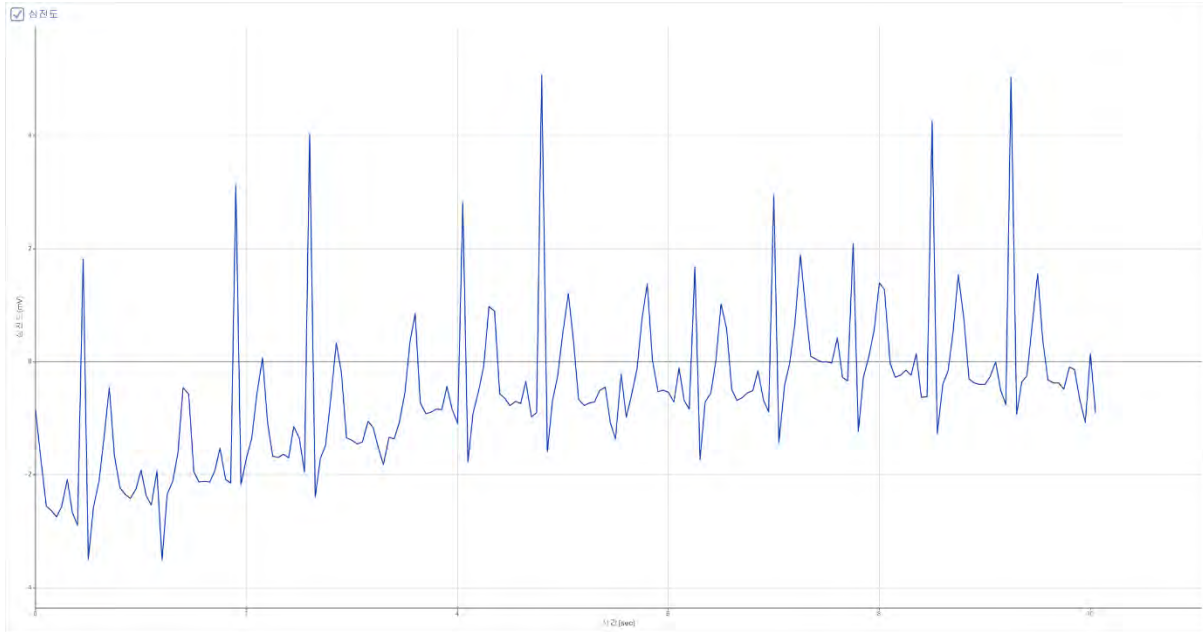
## Using the Sensor

### Connecting the wireless EKG sensor to a person

Use three electrode patches per subject. The electrodes can be reused, but they tend to absorb moisture so, reuse is not recommended. Once opened, the electrodes should be kept in refrigerator with air-tight container. But, you can't preserve more than 1 year if you keep the electrodes as above.



- ① Because the electrical signal produced by the heart and detected at the body's surface is so small, it is very important that the electrode patch makes good contact with the skin.
- ② Peel first electrode from the backing paper. Place it on the inside of the right elbow.
- ③ Place a second electrode on the right wrist.
- ④ Place a third electrode on the left wrist.
- ⑤ Connect the clips from sensor to the tabs on the edges of the electrode patches.
- ⑥ Connect white clip to the right elbow electrode patch.
- ⑦ Connect red clip to the right wrist electrode patch.
- ⑧ Connect blue clip to the left wrist electrode patch.



## Specifications

Item	Description
Range	0 ~ 5 mV
Resolution	5 $\mu$ V
Sampling Time	Max. 100Hz (0.01 sec.), (Typical 1Hz)
Condition	0 ~ 40°C, ~85%RH
Wireless Connection	Bluetooth 5.0 or Classic 2.1
Wired Connection	USB-C
Battery	700mAh Li-Polymer rechargeable
Charging Time	within 2 hours
Operating Time	Approximately 8 hours after full charge (depending on usage conditions)
EMC	CE : EN 61326-1, EN 55011, EN 55032, EN 301

**CAUTION: Do not use the instrument beyond the measurement range or in conditions that exceed the short-term exposure limits. Prolonged exposure beyond the maximum permissible range can cause serious damage to the sensor.**

## How to install Science#

### ● Install Windows PC version

Online installation file (approximately 39MB)

<http://www.koreadigital.com/url/updates/sciencesharppc/setup.exe>

\* Internet connection is required during installation

Offline installation file (approximately 340MB)

[http://www.koreadigital.com/url/updates/sciencesharppc/setup\\_full.exe](http://www.koreadigital.com/url/updates/sciencesharppc/setup_full.exe)

\* Installation does not require an Internet connection, but contains large content

### ● Install from a mobile smart device (Smartphone or Tablet PC)

1. Download Science# to your smart device (Refer to QR codes below)
2. Connect using Bluetooth (See Science# documentation or refer to next page)
3. Run Science#
4. When you connect the sensor, the measurement is displayed on the Science# screen




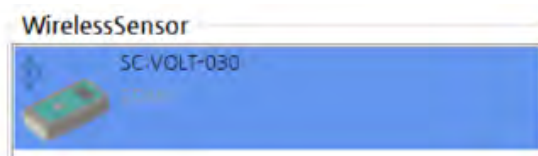
## Features

- Up to four wireless sensors can be connected to a PC or smart device at the same time.
- It supports dual-mode Bluetooth, allowing you to connect not only smart devices but also desktop and laptop PCs to conduct experiments using the Science# application.
- It can be connected to a PC through a USB port and experiments can be performed using the Science# program.


## How to connect Wireless Sensor to Science# program

### ● Windows PC

1. Install and run Science# (Refer to previous page for installation method)
2. Power on the sensor
3. Click the  [Connect] icon and select [Bluetooth Interface] from [Select Interface]
4. [Add Bluetooth or other device] → [Bluetooth] → Add sensor number after checking the number on the backside of sensor
5. When you see like the picture, click on Wireless Sensor and connect



### ● Android or iOS (Smartphone or Tablet PC)

1. Install and run Science# (Refer to previous page for installation method)
2. Power on the sensor
3. Click the  [Connect] icon and select [Bluetooth Interface]
4. After selecting the device search, check the sensor number on the backside and connect



If you experience any connection issues, check Bluetooth mode on the sensor. Please refer to the next page for instructions on how to change it.

## How to switch to Bluetooth mode for Android and iOS

For mobile devices (Android, iOS) Bluetooth Low Energy technology is used for wireless communication. For these devices do not pair the sensor just use it directly in the software.

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 that Bluetooth Low Energy is used.

## How to switch to Bluetooth mode for Windows

For Windows computers, Bluetooth Classic technology is used for wireless communication. Before you start to use the sensor for measurement you have to pair it. If you are asked for a PIN, enter either "1234" or "0000".

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.

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