



Wireless Electrostatic Charge (P4527-EC) User manual



Rev. WL127Q-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 electrostatic charge sensor can measure the electrostatic charges.

The wireless electrostatic charge sensor measures electrostatic charges and can be used as an electronic electroscope. The sensor can also be used to measure charge polarity. The sensor has three operating ranges and a zeroing switch to discharge the input capacitor.

You can measure by remotely connecting to a smart device or PC wirelessly or wired.

Suggested experiments

The wireless electrostatic charge sensor is designed for experiments in electrostatics such as:

- Measurement of charge by induction.
- Measurement of charge production and distribution.
- Measurement of charge on a capacitor.

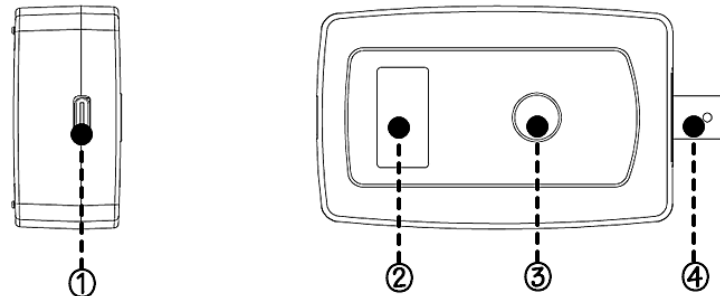
Composition

The wireless electrostatic charge sensor consists of the following.

- Wireless electrostatic charge sensor (P4527-EC)
- BNC cable with clip leads(red/black)
- USB-A/C cable
- Booklet

Function of wireless electrostatic charge sensor

Structure

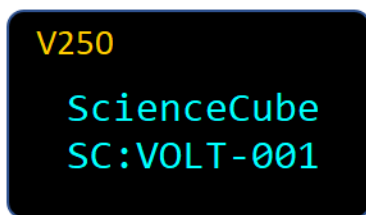


- ① USB port : Connect the sensor to a PC and use it for experiments or charging.
- ② OLED Display : Displays measured sensor values, sensor type, sensor ID, and remaining battery level.
- ③ Power/Function Button : It has functions such as power ON/OFF, measurement sensor change and calibration, etc.
- ④ Sensing part : measure static electricity by connecting an clip-leads to the BNC connector.

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	Click once	■	Change sensor type or range. (Multi-sensor or range sensor only)
	Double click	■■■	Zero Reset button (Zero point setting)
	Long click	■■■■■	Turns off.

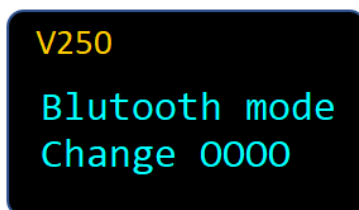
Start screen



V250 : Displays the sensor's firmware version.

SC:VOLT-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.

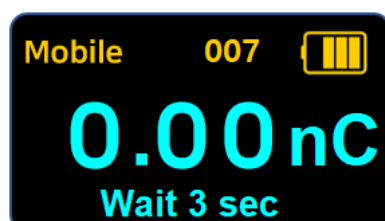
See last page for more information.

Measurement screen



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

Zero Reset screen



How it Works

The wireless electrostatic 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 $\text{M}\Omega$ 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.

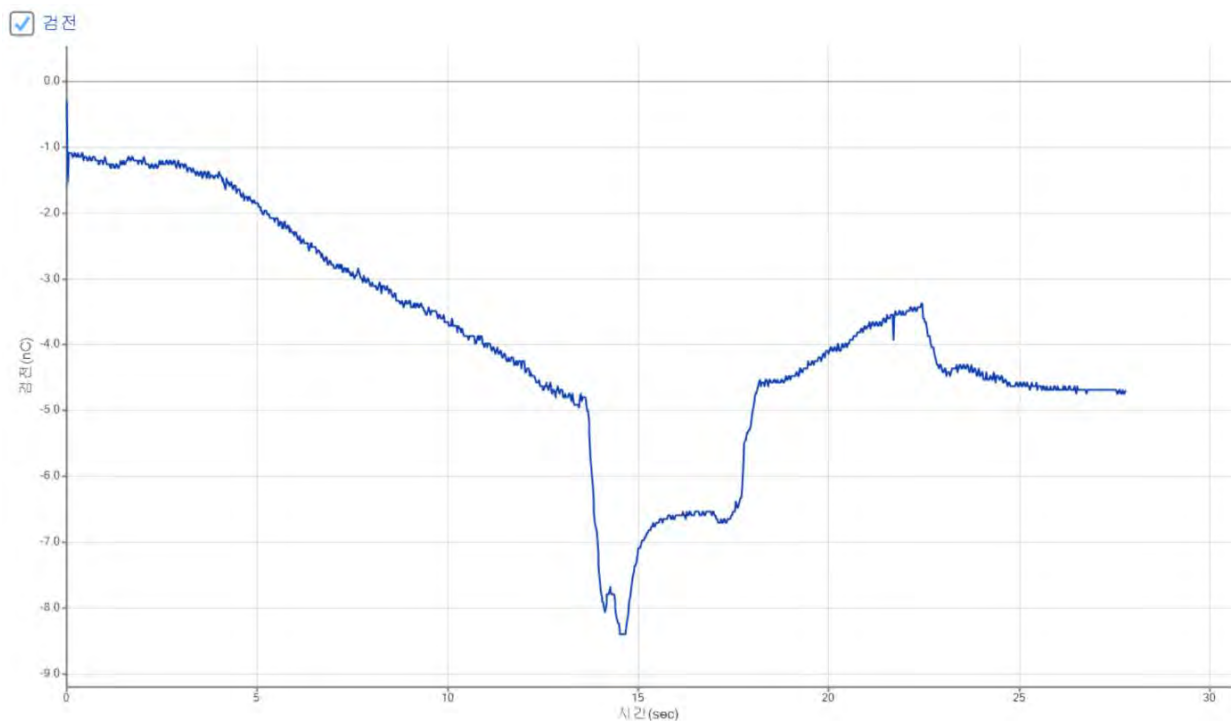
Using the Sensor

The sensor should be stored with the input leads shorted together to protect it from high static potential that could damage the unit. After initial power up or whenever changing range setting, press the Reset button (double click) with the leads shorted together just to make sure all charge is depleted from the internal capacitor. After the initial reset, shorting the leads together will probably zero the unit adequately. Pressing the Reset button (double click) with the leads connected to a voltage source such as a power supply or battery will cause an error in the reading. It is, however, acceptable to use the Reset button when connected to a collector screen or floating capacitor plate. As long as the sensor reads zero after resetting, you should get the correct readings.

Due to the sensor's ability to measure very small amounts of charge, you must be careful when handling the leads or you may alter the readings with stray charge. The insulator on the clip lead quickly becomes oily from handling, and fingers often carry small amounts of charge at high potential that can easily leak through the insulator and affect your reading. The best way to minimize this is by grounding your fingers to remove any charge before releasing the positive lead from its ground connection. Start recording data before removing the lead from ground so you will be aware if any stray charge accumulates before making your connection. When connecting to static sources (not a

fixed voltage like a battery), the Reset button can be used while connected to a passive charge receptor. Make sure the output reads zero after reset.

The sensor is not differential; therefore the negative (black) side is always at ground potential. The supplied cable is shielded and has a dielectric for low leakage. When using other cables, the unit should be tested to make sure the cable does not allow excessive leakage currents.



Specifications

Item	Description
Range	$\pm 0.5\text{V}$ ($\pm 5\text{ nC}$) $\pm 2\text{V}$ ($\pm 20\text{ nC}$) $\pm 10\text{V}$ ($\pm 100\text{ nC}$)
Resolution	0.01 nC When using <i>Science#</i> , 5 nC is 0.003 nC, 20 nC is 0.01 nC and, 100 nC is 0.05 nC.
Max. input voltage	$\pm 150\text{ V}$
Typ. bias input current	0.005 pA
Sampling Time	Max. 100Hz (0.01 sec.), (Typical 1Hz)
Condition	0 ~ 50°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 4 hours after full charge (depending on usage conditions)

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

* 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



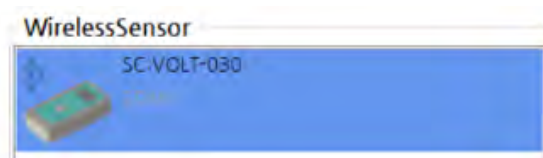
Features

- 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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