ScienceCube

Wireless Conductivity (WL107EC)

User Guide

Rev. WL107EC-12-2023

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

KOREADIGITAL

The Science Cube wireless conductivity sensor can measure the conductivity of solution.

The wireless conductivity sensors can be used to measure either conductivity of solution or total ion concentration of aqueous samples being investigated in the field or the laboratory. Conductivity measurement is the easiest method for environmental testing of aqueous samples. Even though it does not tell you specific ions that are present, it does quickly determine the total concentration of ions in a sample. It can be used to perform a wide variety of tests or planned experiments to determine the changes in or levels of total dissolved ions or salinity.
You can measure by remotely connecting to a smart device or PC wirelessly or wired.

Suggested experiments

- Use the probe to confirm the direct relationship between conductivity and ion concentration in an aqueous solution. Concentrations of unknown samples can then be determined.
- Measure changes in conductivity resulting from photosynthesis in aquatic plants, with the resulting decrease in bicarbonate-ion concentration from carbon dioxide.
- Use this sensor for an accurate on-site measurement of total dissolved solids (TDS) in a tream or lake survey.
- Monitor the rate of reaction in a chemical reaction.
- Perform a conductivity titration to determine when stoichiometric quantities of two substances have been combined.
- Monitor changes in conductivity or total dissolved solids in an aquarium containing aquatic plants and animals. These changes could be due to photosynthesis or respiration.

Composition

The ScienceCube wireless conductivity sensor consists of the following.

- Wireless conductivity sensor(WL107EC)
- USB-A/C cable
- Booklet

Feature

- Up to four Science Cube 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.

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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.

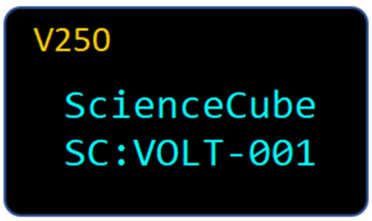
③ Power/Function Button : It has functions such as power ON/OFF, measurement sensor change and calibration, etc.

④ Sensing part : A part immersed in the solution to be measured, where opposing electrodes and a temperature probe are located.

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	Double click	■■	Zero point setting (For sensors with zero point function) is performed and **U0** is displayed above the device.
	Long click	■■■■■	Turns off.

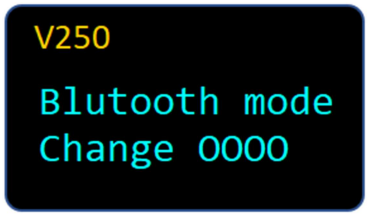
Start screen



V250 : Displays the sensor's firmware version.

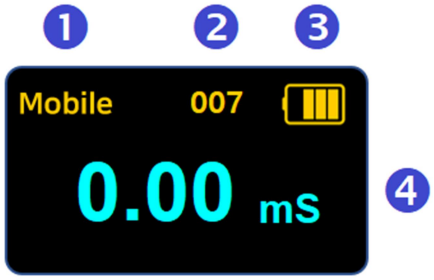
SC:VOLT-001 : When you search for a Bluetooth device, the device name will be displayed. (Sensor name and 3-digit serial number)

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.

Measurement screen



①**Connection mode**	**Mobile** : Connecting Androidor iOS. **PC** : Connecting to Windows PC ※ 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 **user calibration** is used, **U0** or **UC** will be displayed above the units. 3) For sensors with **multiple ranges**, the current range is displayed. 4) For **multiple sensors**, the values for each sensor type are displayed.

How it Works

ScienceCube conductivity probe measures the ability of a solution to conduct an electric current between two electrodes. In solution, the current flows by ion transport. Therefore, an increasing concentration of ions in the solution will result in higher conductivity values.

The conductivity probe is actually measuring conductance, defined as the reciprocal of resistance. When resistance is measured in ohms, conductance is measured using the SI unit, *siemens* (formerly known as a $ohm[\Omega]$). Since the *siemens* is a very large unit, aqueous samples are commonly measured in *micro-siemens*, or μS.

Even though the Conductivity Sensor is measuring conductance, we are often interested in finding conductivity of a solution. Conductivity, C, is found using the following formula:

$$C = G \cdot kc$$

where G is the conductance, and kc is the cell constant. The cell constant is determined for a probe using the following formula:

$$kc = d / A$$

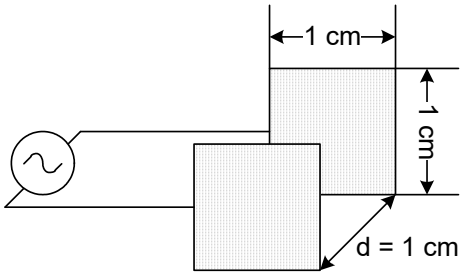


Figure 2.

where d is the distance between the two electrodes, and A is the area of the electrode surface.

For example, the cell in Figure 2 has a cell constant:

$$kc = d / A = 1.0\ cm / 1.0\ cm^{2} = 1.0\ cm^{-1}$$

The conductivity value is found by multiplying conductance and the cell constant. Since the ScienceCube® Conductivity Probe also has a cell constant of $1.0\ cm^{-1}$, its conductivity and conductance have the same numerical value. For a solution with a conductance value of $1000\ \mu S$, the conductivity C, would be

$$C = G \cdot kc = (1000\ \mu S)\ X\ (1.0\ cm^{-1}) = 1000\ \mu S/cm$$

A potential difference is applied to the two probe electrodes in the Conductivity Probe. The resulting current is proportional to the conductivity of the solution. This current is converted to a digital value.

Using the Sensor

● Rinse the tip of the Conductivity Probe with distilled water. **Optional :** Blot the inside of the electrode cell dry only if you are concerned about water droplets diluting or contaminating the sample to be tested.

● Insert the tip of the probe into the sample to be tested. **Important :** Be sure the electrode surfaces in the elongated cell are completely submerged in the liquid.

● While gently swirling the probe, wait for the reading on your sensor to stabilize. This should no more than 5 to 10 seconds.

● Rinse the end of the probe with distilled water before taking another measurement.

● If you are taking readings at temperatures below 15°C or above 30°C, allow more time for the temperature compensation to adjust and provide a stable conductivity reading.

> **Important :** Do not place the electrode in viscous, organic liquids, such as heavy oils, glycerin(glycerol), or ethylens glycol. Do not place the probe in acetone or non-polar solvents, such as pentans or hexane.

Calibration

All sensors are precisely calibrated using standard solutions during the manufacturing process before being shipped and are ready for immediate use. However, you can perform **[User Calibration]** for more accurate measurements.

[User Calibration] is reflected temporarily and then returns to the default when the sensor is turned on again.

1. 1. Press the Power/Calibrate button twice in succession.
2. When the sensor shows 0.00 mS.
3. **[User Calibration]** is complete and the word “U0” is displayed above the unit on the sensor screen.

To cancel **[User Calibration]**, press the button twice in succession. U0 disappears and returns to default.

Automatic Temperature Compensation

ScienceCube wireless conductivity sensor is automatically temperature compensated between temperatures of 5 and 35°C. Note that the temperature of a solution is being read by a thermistor that extends into the space between the graphite electrodes. Readings are automatically referenced to a conductivity value at 25°C-therefore the Conductivity Probe will give the same conductivity reading in a solution that is at 15°C as it would if the same solution were warmed to 25°C. This means you can calibrate your probe in the lab, and then use these stored calibrations to take readings in colder (or warmer) water in a lake or stream. If the probe was not temperature compensated, you would notice a change in the conductivity reading as temperature changed, even though the actual ion concentration did not change.

Using the Conductivity sensor with Other ScienceCube Sensors

It is important to know what interaction occurs when you wire a wireless conductivity sensor to a PC or smart device via a USB cable and measure with another wired sensor in the same solution (in the same aquarium or beaker, for example).
This situation arises because the Conductivity Probe outputs a signal in the solution, and this signal can affect the reading of another probe.

> **Note :** This does not apply if each device is connected wirelessly.

The sensors below cannot be used wired to the same PC or smart device as conductivity probes from the same solution:

· Dissolved Oxygen Probe

· pH or ORP Probe and Ion Selective Electrodes

Storage and maintenance

- When you have finished using the Conductivity Probe, simply rinse it off with distilled water and blot it dry using a paper towel or lab wipe. The probe can then be stored dry.
- If the probe cell surface is contaminated, soak it in water with a mild detergent for 15 minutes. Then soak it in a dilute acid solution (0.1 M hydrochloric acid or 0.5 M acetic acid works well) for another 15 minutes. Then rinse it well with distilled water. Important: Avoid scratching the inside electrode surfaces of the elongated cell.

CAUTION: The electrode surface is treated with graphite. Do not touch or contaminate this area.

Specifications

Item	Description
Range	0 ~20,000 uS/cm (20mS/cm)
Resolution	0.01 mS/cm
Sampling Time	Max. 100Hz (0.01 sec.), (Typical 1Hz)
Condition	5 ~ 35℃ (Automatic Compensation)
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.

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