ScienceCube

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Wireless Energy (WL131J)

User Guide

Rev. WL131J-09-2025

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 Energy Sensor is an educational tool that makes renewable energy experiments simple and engaging, helping students understand the concepts of electricity and energy through direct experimentation.

The wireless energy sensor is designed to easily measure the electricity produced by renewable energy sources such as solar panels and small wind turbines.
With this sensor, you can directly measure voltage and current, and the system automatically calculates power, and energy values.

- Observe real-time output from solar panels, wind turbines, and small generators.
- Connects to tablets, smartphones, or PCs via Bluetooth. Use the Graphical Analysis app to view data and graphs instantly.
- Records voltage (V), current (A), power (W), and energy (J).
- Built for low-voltage classroom experiments rather than household power, ensuring safe use by students.

Without the need for complex laboratory equipment, the sensor connects quickly to smartphones, tablets, or computers via Bluetooth® or USB. This makes it ideal for classroom or laboratory experiments focused on understanding the principles of renewable energy.
Up to 4 sensors can be connected simultaneously, so you can use it easily in complex experiment environments.
Even complex experiments can be designed more easily with simple movement and fixation without the need to connect signal cables during scientific experiments.
Additionally, the sensor has a display window so you can immediately check the measured values, and measurements can be made by remotely connecting to a smart device or PC wirelessly or wired without a separate interface.

Suggested experiments

- Compare the energy output of wind turbines with different blade shapes or angles.

- Investigate how solar panel orientation and light intensity affect energy generation.
- Study the effect of various loads (light bulbs, motors, pumps, LEDs) on power output.
- Explore the process of converting renewable energy into electrical energy in hands-on experiments.

Composition

The ScienceCube wireless energy sensor consists of the following.

- Wireless Energy Sensor(WL131J)
- Banana Jack to Alligator Clip Cables (Red and Black, two each)
- 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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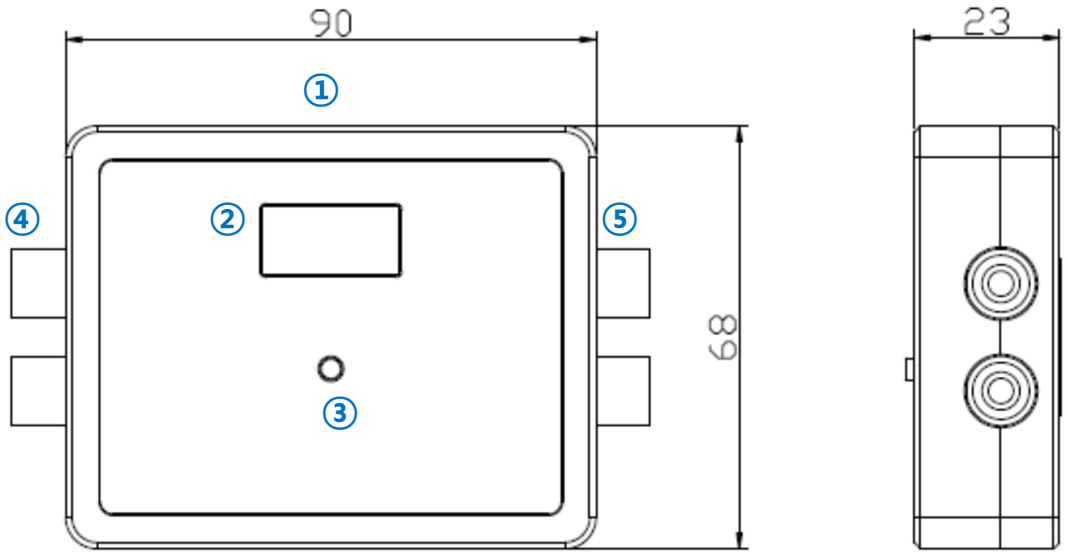
Function of wireless sensor

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 **SOURCE Input** : Detects input voltage and current, connected via red/black banana jacks and alligator clips.

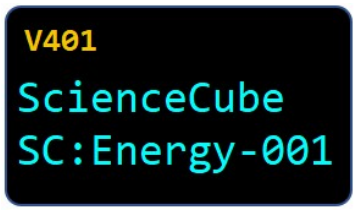
⑤ **LOAD Connection** : Connect loads (resistors, motors, lamps, etc.) via red/black banana jacks and alligator clips.

Caution : Do not measure beyond the sensor's measurement range. Doing so can reduce the accuracy of the sensor, cause sensor malfunctions, or result in permanent damage. Please use within the safe measurement range.

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	■■	Resets the energy(Joule) value.
	Long click	▬▬	Turns off.

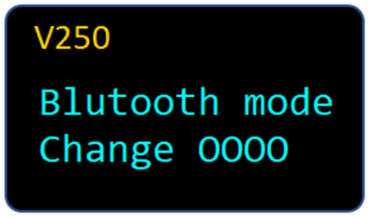
Start screen



V401 : Displays the sensor's firmware version.

SC:Energy-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

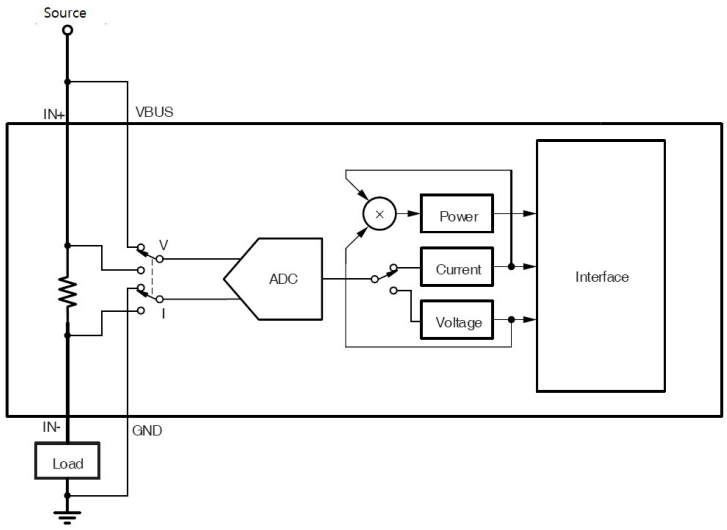
①Connection mode	**Mobile** : Connecting an Android or iOS. **PC** : Connecting a Windows-based PC. : Connected via **USB** cable.
②Sensor-ID	When connecting wirelessly using the sensor's serial number, this is the

	sensor name displayed in 'Device Name'.
③Battery	You can check the battery status, and when you connect the USB charging cable, the display changes to charging.
④Value	Displays sensor measurement values and units in real time.

How it Works

Science Cube Wireless Energy Sensor uses the INA260 chip from Texas Instruments (TI) to measure voltage (V), current (A), and power (W). The INA260 includes a high-precision 2 mΩ shunt resistor, eliminating the need for an external shunt, and provides direct digital readings of current and voltage.

Current is determined by measuring the voltage drop across the internal shunt resistor connected in series with the load. According to Ohm's law, Current = Voltage Drop ÷ Resistance, and the INA260's built-in ADC converts this into a high-resolution digital value. Voltage is measured directly across the load terminals, with a supported input range of 0 – 36 V.



Power is calculated internally by multiplying the measured voltage and current in real time. The results for voltage, current, and power are stored in registers, and users can

access them directly via I²C communication. In addition, applications can integrate the power data over time to calculate the total energy (J).

Because the built-in shunt resistor has excellent temperature stability, the device maintains high accuracy and requires no external calibration.

This allows users to observe electrical characteristics of renewable energy sources, such as solar panels or small wind turbines, easily and accurately without complex circuit design or manual calibration.

Using the Sensor

The ScienceCube wireless voltage sensor can be measured in the following ways

1. Run '**Science#**  ' and connect the sensor wirelessly or wired.
2. Connect the banana jack to the [**SOURCE]** side of the circuit containing the energy source to be measured, and connect the red clip to the **"+"** terminal.
3. Connect the black clip to the **"-"** terminal in the same way.
4. Use the banana jack and clip to connect a resistor or load (e.g., a light bulb, motor, or pump) to the **[LOAD]** side.
5. If measurement is required starting from '0', execute [**RESET**] setting.
6. Set the **[Data Collection Interval]** and **[Experiment Time]** in **[Experiment Settings]**.
7. Click **[Start]** to start the experiment.

For more information on how to use the **Science#**  application, see the help.

Calibration

All sensors are shipped after being precisely calibrated using standard equipment during the manufacturing process, so they can be used right away and do not require a separate calibration process.
However, to ensure a smooth experiment, perform **[RESET]** to reset the currently displayed energy value to "0". Reset settings are only available for sensors.

[Sensor RESET setting]

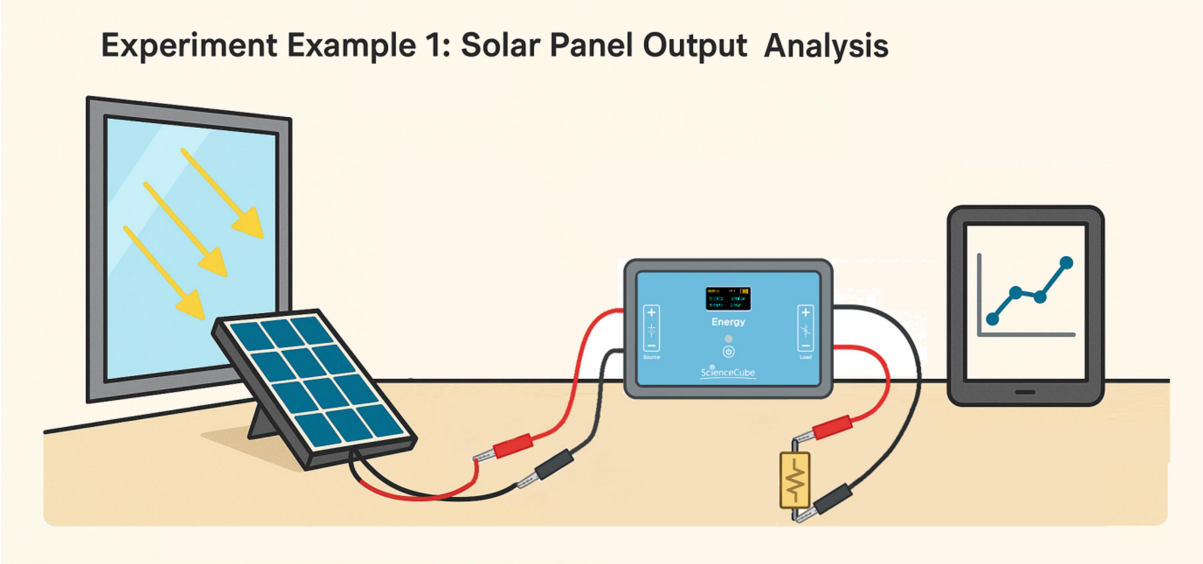
1. Press the sensor's Power/Calibrate button twice in succession.
2. **[RESET]** is completed, and the Joule displayed on the sensor will be displayed as "**0.000J**".

> **Note : [RESET]** is reflected temporarily and returns to the default value when the sensor is turned on again.

Guide for scientific experiments

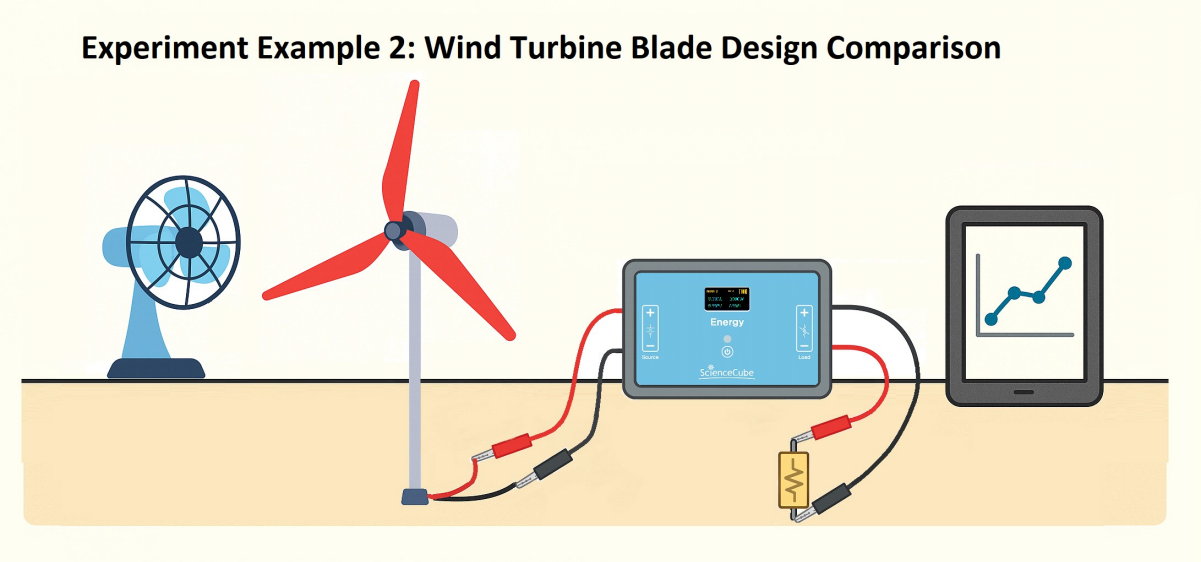
1: Solar Panel Output Analysis

1. Place a small solar panel near a window or under a lamp.
2. Connect the red clamp on the **SOURCE** side of the wireless energy sensor to the (+) terminal on the panel, and the black clamp to the (-) terminal.
3. Connect a 30Ω resistor to the red and black clamps on the **LOAD** side of the wireless energy sensor.
4. Select channels for **Voltage (V)**, **Current (A)**, and **Power(W)**.
5. Record data while adjusting the panel angle to 0°, 30°, and 60°.
6. Compare the power values for each angle.
7. Plot the results to analyze how tilt angle affects solar efficiency.



2: Wind Turbine Blade Design Comparison

1. Prepare a small wind turbine kit.
2. Position the turbine in front of a fan for steady airflow.
3. Connect the **SOURCE** terminal of the wireless energy sensor to the turbine output terminal.
4. Connect a 30Ω resistor to the **LOAD** terminal of the wireless energy sensor.
5. Run the experiment using Blade A (standard design) and record power output.
6. Replace with Blade B (longer blades) under the same conditions.
7. Record and compare power and energy results.
8. Summarize how blade design influences turbine efficiency.



*For detailed experimental information, please refer to the ***Science #*** content.

Specifications

Item	Description
Range	Current: 0 ~ 1.0A
	Voltage: 0 ~ 36V
	Power: 0 ~ 36W
	Energy: 0 ~ 3600J (Accumulation by calculation)

Resolution	Current: 1.25mA Voltage: 1.25mV Power: 10 mW Energy: 0.1J (calculates)
Sampling Time	5 Samples/second (Data Update Interval) 100 Samples/second (Logging program based)
Condition	-20 ~ 60℃, Max. 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 6 hours after full charge (depending on usage conditions)
EMC	CE : EN 61326-1, EN 55011, EN 55032, EN 301 ㉾ ㊋202-SMD070

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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- The contents of this manual are provided for informational purposes only, and product specifications and functions may be changed without prior notice to improve performance.
- This product is designed for science education. No warranty is provided and no liability is assumed for errors in industrial testing or manufacturing process controls, medical analysis or controls, or commercial design applications.

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