

ScienceCube



sciencecube.com

Wireless Force/Acceleration (WL105F) User Guide



Rev. WL105F-02-2024

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

 **KOREADIGITAL**

The ScienceCube wireless force/acceleration sensors can measure weight or force, as well as the magnitude of gravitational acceleration.

Wireless Force Sensor measures the weight and force. Unlike conventional force sensors, it measures the force and the magnitude of the gravitational acceleration on each of the X, Y, and Z axes. It can be widely used for acceleration, shock, vibration and inclination measurement as well.

To measure force the Force sensor uses strain gauge technology. Strain gauges attached to both sides of the beam change resistance as the beam bends. The strain gauges are used in a bridge circuit such that a small change in resistance will result in a change in voltage. This voltage change is proportional to the change in force. A maximal force of 80 N can be applied to the sensor, for forces above 80 N the sensor can be damaged permanently.

This product is wireless, so you can use it easily in complex experiment environment because you don't need a connecting cable separately, you can just connect up to 4 sensors at same time, so you can use it with other kinds of sensors together.

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

Suggested experiments

- Principle of Pulley
- Composition of Force
- Hook's Law
- Frictional force
- The law of inertia
- Action and reaction
- Impact and momentum

Composition

The ScienceCube wireless Force/Acceleration sensor consists of the following.

- Wireless Force/Acceleration sensor(WL105F)
- Hook (Attached to sensor)
- Thumb screw (Attached to sensor)
- Rubber bumper
- USB-A/C cable
- Booklet

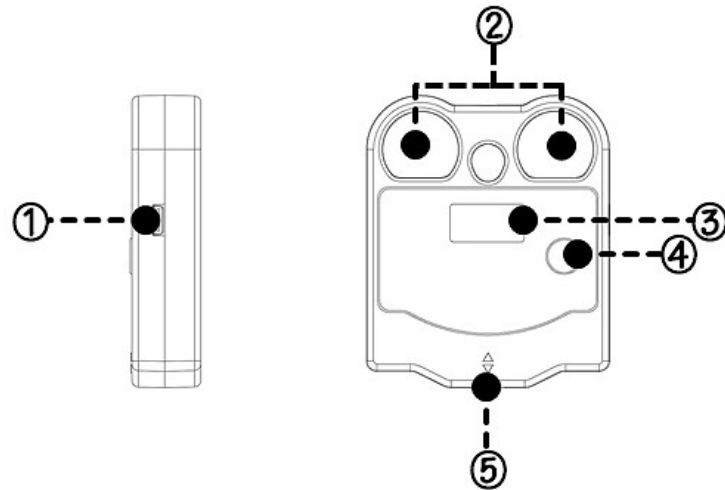
Feature

- 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.



Function of wireless sensor

Structure



- ① USB port : Connect the sensor to a PC and use it for experiments or charging.
- ② Handle : Hold it with your hand and keep your fingers fixed during the experiment.
- ③ OLED Display : Displays measured sensor values, sensor type, sensor ID, and remaining battery level.
- ④ Power/Function Button : It has functions such as power ON/OFF, measurement sensor change and calibration, etc.
- ⑤ Sensor detection unit : Force can be measured by connecting a hook or rubber bumper.

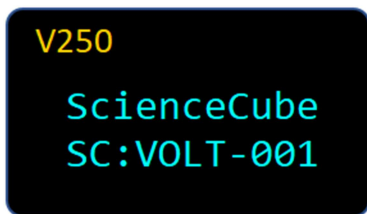
Caution : Do not measure beyond the sensor's measurement range. Doing so can reduce the accuracy of the sensor, cause sensor malfunctions, or result in permanent damage. Please use within the safe measurement range.

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. |

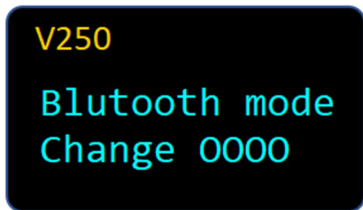
| | | | |
|--------------|--------------|------------|---|
| When it's on | Click once | ■ | Change sensor type or range. (Multi-sensor or range sensor only) |
| | Double click | ■ ■ | 1) Zero point setting (For sensors with zero point function) 2) A zero setting is performed and U0 is displayed above the device. |
| | Long click | ■■■■■■■■■■ | Turns off. |

Start screen



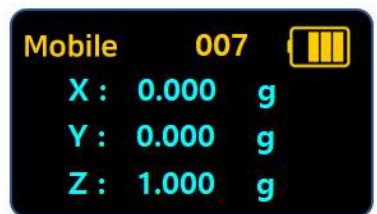
V250 : Displays the sensor's firmware version.
 SC:NAME-001 : When you search for a Bluetooth device, the device name will be displayed. (Sensor name and 3-digit serial number)

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

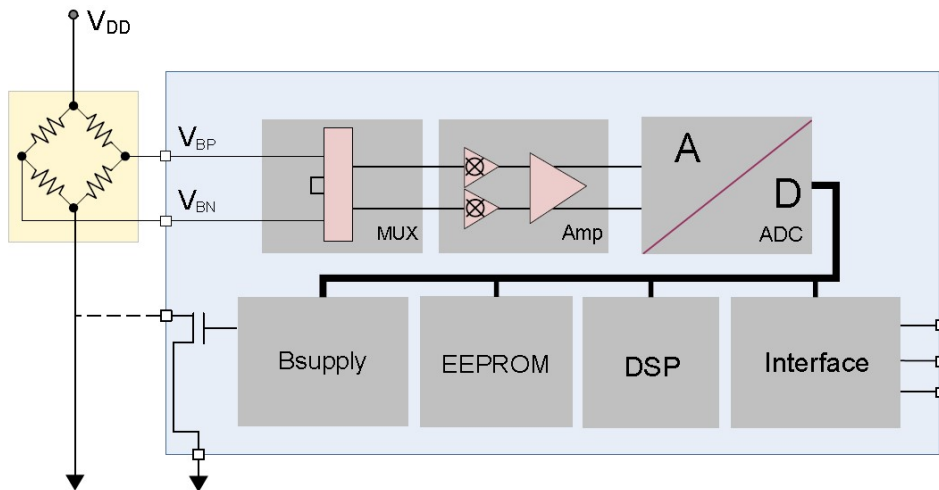


| | |
|-------------------|---|
| ① Connection mode | Mobile : Connecting an Android or iOS. PC : Connecting a Windows-based PC. |
|-------------------|---|

| | |
|---------------|---|
| |  : 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. |
| ④Sensor Value | 1) Displays sensor measurement values and units in real time. 2) When using 'Zero Point Setting', U0 is displayed above the unit. 4) In the case of a complex sensor with several types of sensors built-in, the measured values and units of each sensor are displayed. |

How it Works

Wireless force sensors measure weight, force, and three-axis acceleration. To measure force the Force sensor uses strain gauge technology. Strain gauges attached to both sides of the beam change resistance as the beam bends. The strain gauges are used in a bridge circuit such that a small change in resistance will result in a change in voltage.



The force value can be obtained by amplifying and quantifying minute changes in voltage and calculating them through a digital signal processor.

Using the Sensor

The ScienceCube wireless force/acceleration sensor can be measured in the following ways

1. Run 'Science#' and connect the sensor wirelessly or wired.
2. Select the force units to use in [Sensor Settings].
3. To start measurement from '0', select [Zero Point].
3. Set the [Data Collection Interval] and [Experiment Time] in [Experiment Settings].
4. Click [Start] to start the experiment.

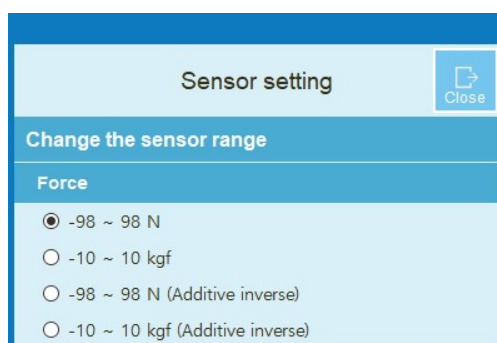
For more information on how to use the Science# application, see the help.

Change units in *Science#*


1. Click the Change Units icon in the area where force sensor values are displayed.



2. Select the desired unit in [Sensor Settings]. Force sensors can be selected in N (newton) or Kgf (kilograms).



3. The sign may be reversed depending on the experimental environment, and the default setting is to display the pulling force as a positive(+) value and the pressing force as negative number(-).

☞ For detailed usage, please refer to the help in *Science#* .

Calibration

All sensors are precisely calibrated using standard solutions during the manufacturing process before being shipped and are ready for immediate use.


However, if you want to display "0" in the force value for a smooth experiment, proceed with **[Zero Point Setting]**. Zero point setting can be done separately in the wireless sensor or program.

Sensor zero point setting

1. Press the sensor's Power/Calibrate button twice in succession.
2. **[Zero point setting]** is completed, and the word '**U0**' is displayed above the unit on the sensor screen.
3. To cancel, press twice again and '**U0**' will disappear and return to the default value.

Note : Science#'s **[Zero setting]** does not affect the sensor's zero setting and is only reflected in the values displayed in the program.



Zero setting in *Science#*

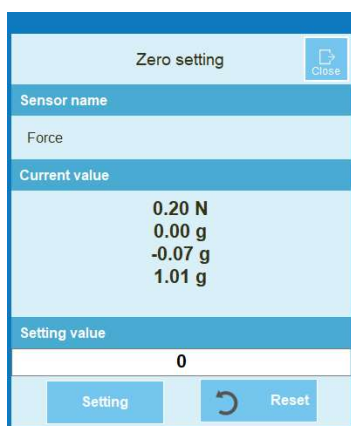
1. If you press the  icon in the space where the sensor value is displayed in Science #, the **[Zero point setting]** menu will appear.
2. Here, if you press **[Setting]**, it will change to 0.00 N(F), and if you press **[Reset]**, it will return to the initial value.


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

Experiment example

Action and reaction

1. Connect the rubber hammer accessories to the two force sensors.
2. Run **Science#**  and connect the two wireless force sensors.
3. Set the **[Experiment Setting]** to **[Auto collection]** - **[Line chart]** - **[5Hz]**
4. Press one of the force sensors to set the sign **[Additive inverse]** and set the **[Zero point setting]** by pressing  for both force sensors.
5. Press **[Start]**, insert your fingers into the two force sensor handles, and gently push or pull them toward each other. In this case, it is important that the portion of the force sensor which is subjected to the force is not deflected in the vertical direction.
6. Press **[Exit]** to end data collection, or it will be automatically terminated after the set experiment time.
7. Graph the magnitude of the force when pushing or pulling the two force sensors and compare them.



*For detailed experiments, please refer to contents in **Science#** .

Specifications

| Item | Description |
|----------------------------|---|
| Range | Force -80 ~ +80 N |
| | Acceleration - 16 ~ +16 <i>g</i> (XYZ) |
| Resolution | @Science# 0.01 N, 0.01 <i>g</i> |
| | @Display 0.1N, 0.001 <i>g</i> |
| Sampling Time | Wirelessly 100Hz (0.01 sec.) Wired 1,000Hz (0.001 sec.) |
| Condition | -20 ~ 60°C, 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 13 hours after full charge (depending on usage conditions) |
| EMC | CE : EN 61326-1, EN 55011, EN 55032, EN 301 ☞ R202-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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