ScienceCube

# Wireless Photogate (WL120P/PG)*

## User Guide


Rev. WL120PG-12-2023

*** WL120P and WL120PG are the same product and there is no difference in performance or functionality.**

**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 photogates can measure Wireless photogates measure the event times of objects passing between the gates.***

**The wireless photogates** measure the event times of objects passing between the gates. There are two internal gates for measuring time or instantaneous speed, and sequential measurements are possible by connecting other photogates in succession in a daisy chain.

There is a separate external gate, so it is possible to detect large objects by connecting an external light source or another photogate. The inner gate detects objects passing between the photogate arms, and the outer gate detects objects passing outside the photogate arms. Photogates can be daisy-chained, with up to five per channel.

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

## Suggested experiments

- Measurement of speed and acceleration of objects
- Simple pendulum movement cycle measurement
- Measurement of time intervals of moving objects
- Measurement of gravitational acceleration of free fall motion

## Composition

***The ScienceCube wireless photogate*** *consists of the following.*

- Wireless photogate(WL120P/PG)
- USB-A/C cable
- Booklet

*The following accessories are additionally available (**Not included**):*

- Pulley
- Connection cable for daisy chain (USB-C to USB-C)

## 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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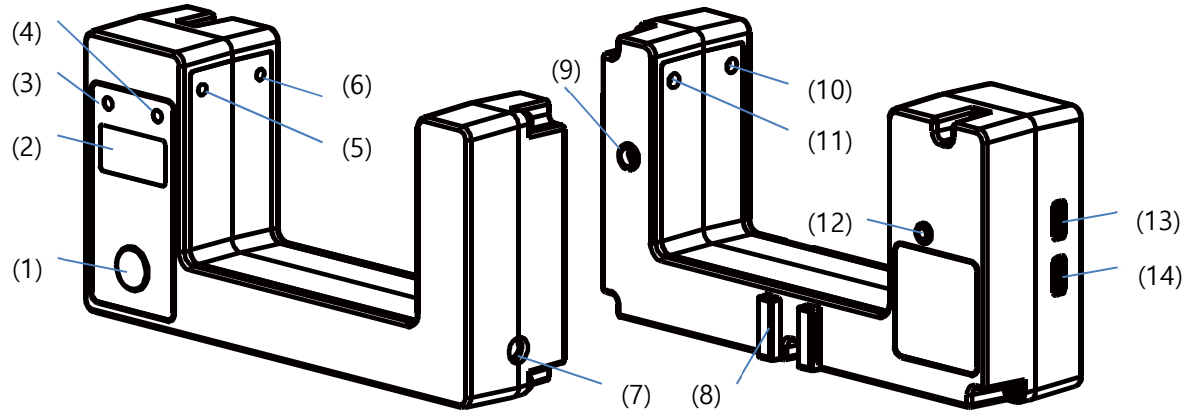
## Function of wireless sensor

### Structure



① Power and gate switching button : Press the button to turn on the power, and press and hold for about 5 seconds to turn it off. One short press allows you to switch between inner and outer gates.

② OLED Display : Displays measured sensor values and remaining battery capacity.

③ Gate #1 detection LED : When gate #1 (No. ⑤) is detected, the LED turns on.

④ Gate #2 detection LED : When gate #2 (No. ⑥) is detected, the LED turns on.

⑤ Gate #1 light receiving unit : Receives the optical signal from gate #1.

⑥ Gate #2 light receiving unit : Receives the optical signal from gate #2.

⑦ Fixing nut hole: The sensor rod can be connected to the nut and fixed to the stand.

⑧ Pulley fixing guide: You can attach the pulley.

⑨ External gate light emitting unit : When using an external gate, an optical signal is emitted.

⑩ Gate #1 light emitting unit : Transmits the infrared signal of gate #1.

⑪ Gate #2 light emitting unit : Transmits the infrared signal of gate #2.

⑫ External gate light receiving unit : Receives optical signals when using an external gate.

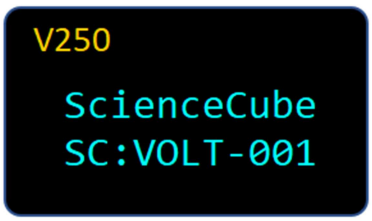
⑬ Sensor expansion port : Used when connecting multiple sensors.

⑭ USB port: Used to conduct experiments or charge the sensor by connecting to the USB port of a PC.

## 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 | ■ | Switches the gate of the sensor. (Inside/Outside/External) |
| | Long click | ■■■■■ | Turns off. |

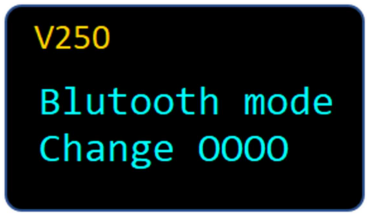
### Start screen




V250 : Displays the sensor's firmware version.

SC:OOOO-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 Android or iOS.<br>**PC** : Connecting to Windows PC<br>⇢ : Connected with a USB cable. |
| 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.<br>2) Values and units that change depending on **analog mode** or **time mode** are displayed.<br>3) Displays the gate currently being measured.(**Inside/Outside/External**) |

### Multiple sensor screen



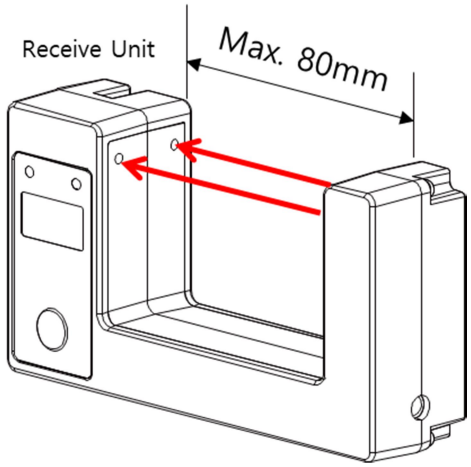
The sense gate switches each time the power button is pressed.

## How it Works

Each time you press the button on the front of the sensor, the detected gate switches.


### Inside Gate

For inside gates, Gate 1 and Gate 2 can be used simultaneously. The maximum passage width is 80 mm, the gap between gates is 20 mm, and the infrared (invisible) light entering the receiver is detected when it is blocked by an object.

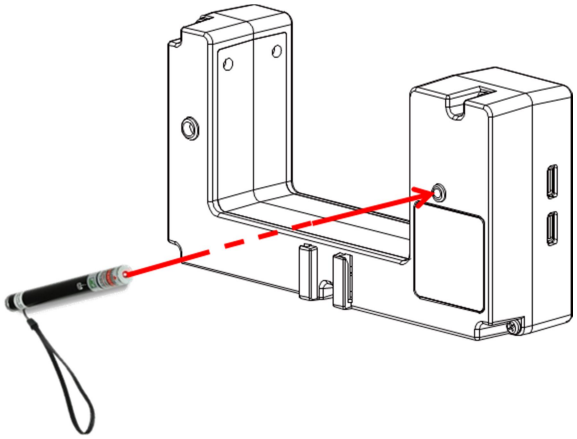



### Outside Gate

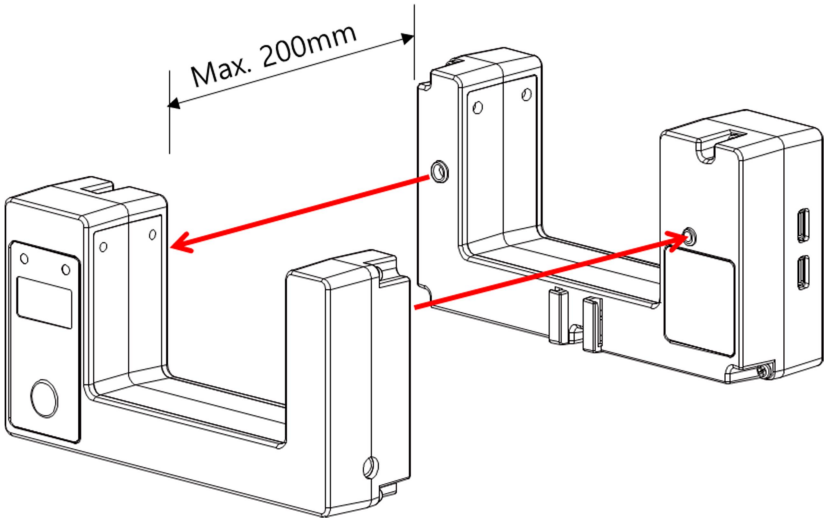
The outside gate has a light receiving part and a light emitting part on the back of the sensor, and can be measured by irradiating a separate laser light source to the light

receiving part or by placing two photogates with their backs facing each other. In this case, the maximum detection distance is less than 200 mm.

It is also detected when an object blocks the laser beam or infrared rays of an opposing photogate.



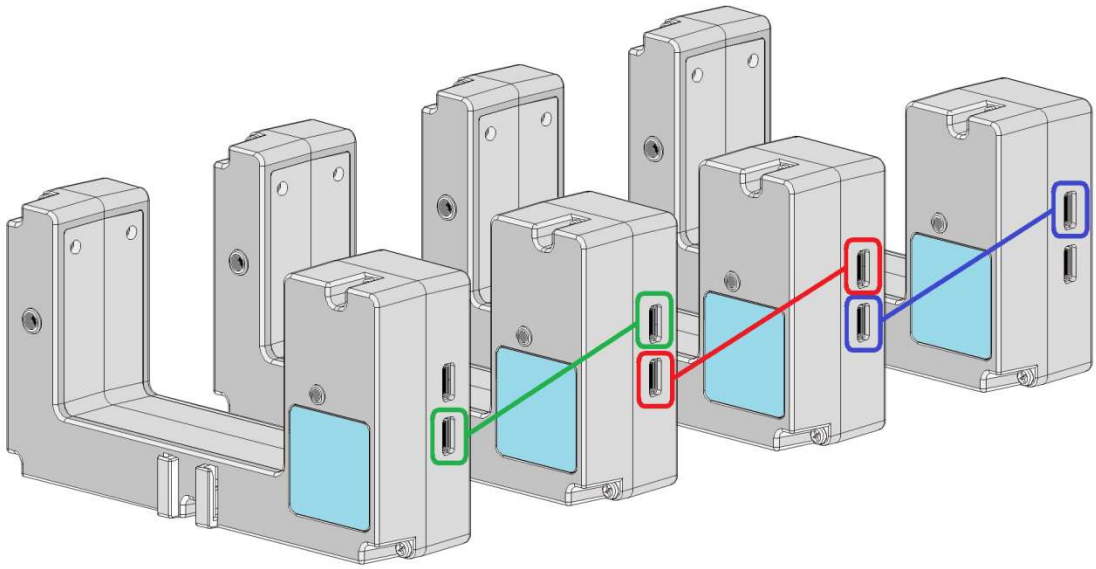
Using an external laser pointer




Using two photogates

## Daisy chaining of external gates

External functionality allows multiple photogates (daisy chained) to be used as a single photogate using optional extension cables. Up to 5 photogates can be connected and used. In this case, only gate 1 of the two internal gates of the photogate is used.



**NOTE : Daisy chain refers to a configuration of hardware devices connected in series. For example, this refers to a bus wiring method in which device A is connected to device B, and device B is sequentially connected to device C.**

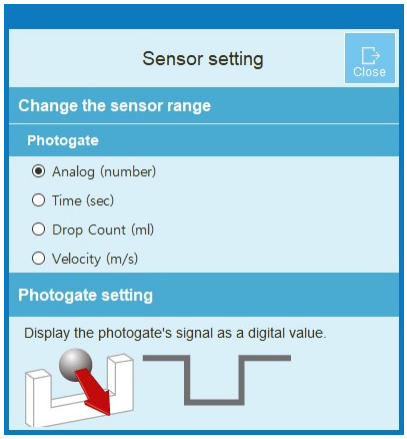
It is unknown which photogates were detected in daisy chain mode. The easiest way is to lay them out in order so you can easily see them.

## Select measurement mode

Photogates can be measured in analog or digital timing modes. You can change the mode selection through the sensor settings in the Science# logging program and it will

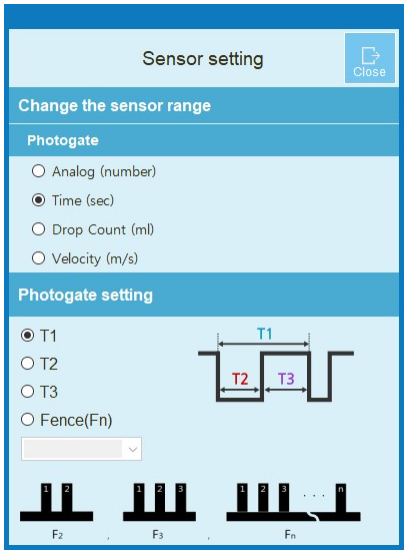
operate in analog mode by default. You can change it in sensor settings in the following ways:

**Analog Mode**




Analog mode indicates whether gate is detected or not. When a gate is detected, the LED turns on and the measurement changes to "0". When using internal gates, the measurement changes when one of the two gates is detected.

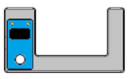
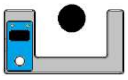
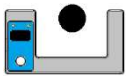
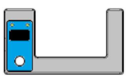
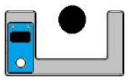
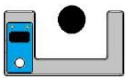
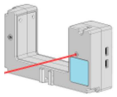
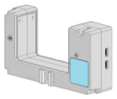
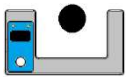
**Time (Based) Mode**



Time mode is a mode that measures the time between detection intervals. Measurement times are displayed whenever an event occurs, regardless of sampling time. You can time it the way you want by setting the number of T1/T2/T3 or fence intervals.

- T1: Time from detection to next detection
- T2: Detected time
- T3: Time not detected
- Fence: Events occur depending on the number of spokes of the fence or pulley.

**Next,** the detection unit, LED indication, and measured value are displayed according to each gate selection.

| | Gate 1 | Gate 2 | External Gate | LED #1 #2 | Analog mode | Time mode |
|---|---|---|---|---|---|---|
| **Inside** |  |  | - | ○ ○ | 1 | T1/T2/T3 or fence detection time. |
| |  |  | - | ○ ● | 0 | |
| |  |  | - | ● ○ | 0 | |
| |  |  | - | ● ● | 0 | |
| **Outside** | - | - |  | ○ ○ | 1 | |
| | - | - |  | ● ● | 0 | |
| **External** |  | - | - | ○ ○ | 1 | |
| |  | - | - | ● ● | 0 | |

# Using the Sensor

Science Cube wireless photogate can be used in the following ways.

1. Run Science# and connect the photogate wired or wirelessly.
2. Use the buttons on the photogate to select the gate (internal, external or extended).
3. Set up an analog or time event experiment in Sensor Settings in Science#.
4. Start measuring.


# Specifications

| Item | Description |
|---|---|
| **Range** | 0 ~ 100 sec |
| **Resolution** | Analog mode : 0/1<br>Time mode : 10 us (Display digit : 1ms) |
| **Internal gate** | width : 80 mm,  gate 1~2 interval : 20 mm |
| **Rising/falling Time** | 2.5 us / 3.8 us |
| **Sampling Time** | Analog mode : Max. 100Hz (0.01 sec.),  (Typical 1Hz)<br>Time mode : event 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 |

**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.**

Rev. WL120PG-12-2023

- 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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