



Wireless Photogate (P4520-PG) User manual



Rev. WL120PG-4-2024

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

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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 wireless photogate consists of the following.

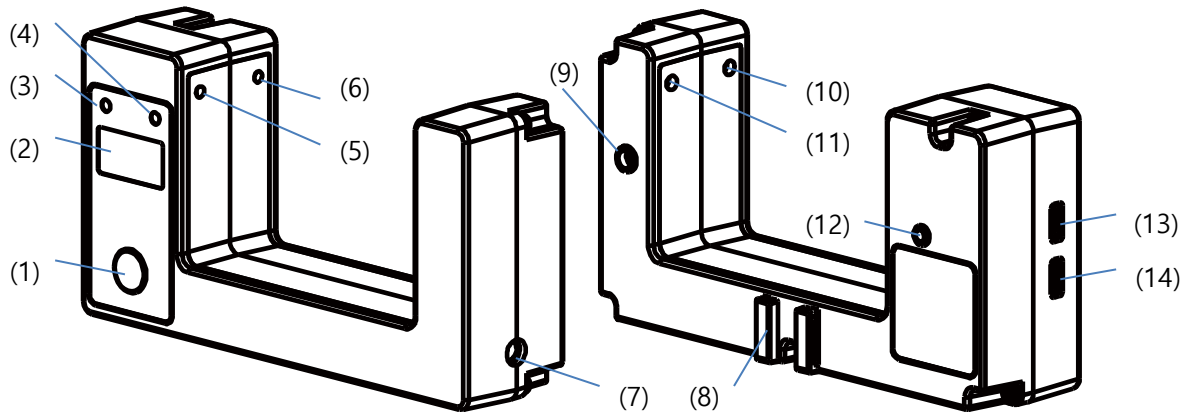
- Wireless photogate (P4520-PG)
- USB-A/C cable
- Booklet

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

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

Function of wireless sensor

Structure

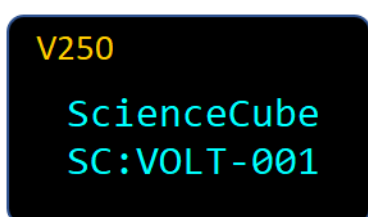


- ① Power and gate switching button : Press the button to turn on the power, and press and hold for about 5 seconds to turn it off. One short press allows you to switch between inner and outer gates.
- ② OLED Display : Displays measured sensor values and remaining battery capacity.
- ③ Gate #1 detection 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.

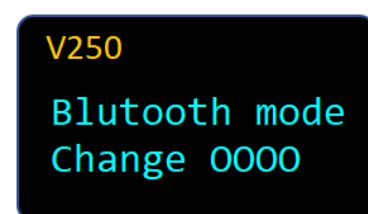
Start screen



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.

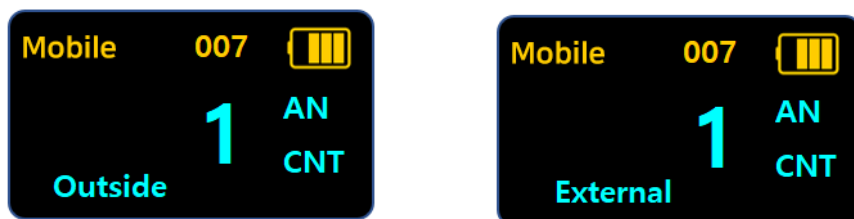
See last page for more information.

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) Values and units that change depending on analog mode or time mode are displayed. 3) Displays the gate currently being measured. (Inside/Outside/External)

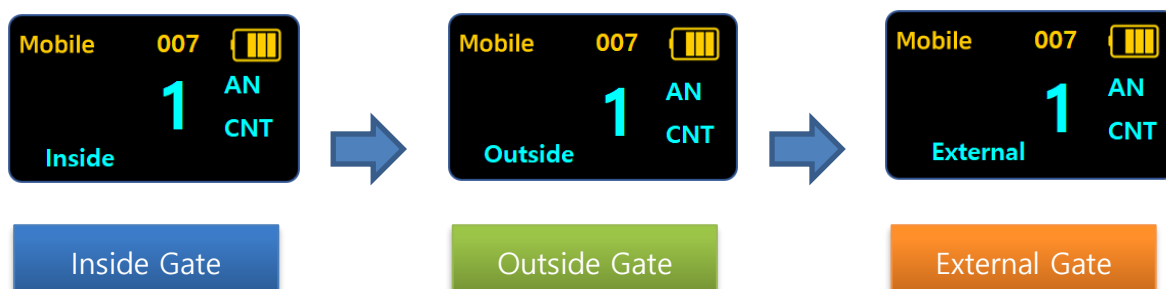
Multiple sensor screen



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

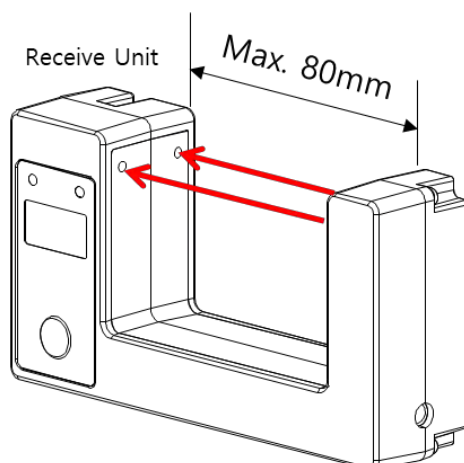
How it Works

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



Inside Gate

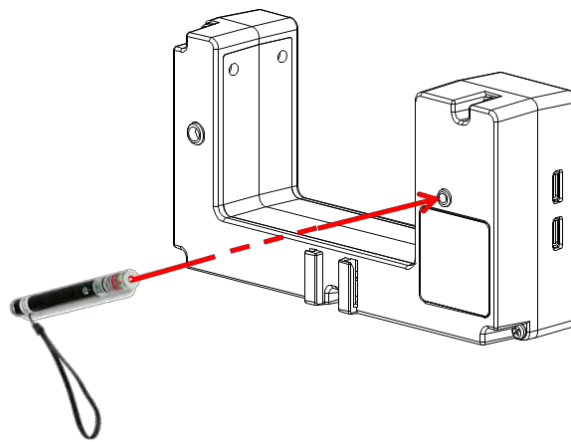
For inside gates, Gate 1 and Gate 2 can be used simultaneously. The maximum passage width is 80 mm, the gap between gates is 20 mm, and the infrared (invisible) light entering the receiver is detected when it is blocked by an object.



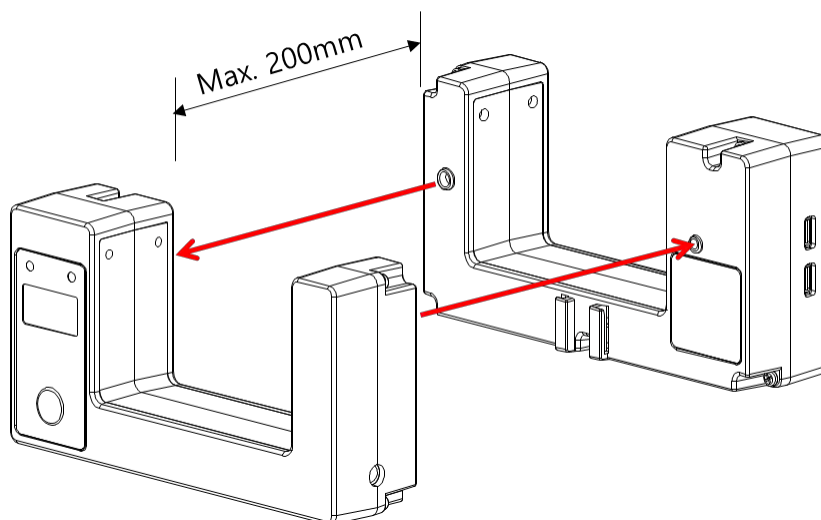
Outside Gate

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.



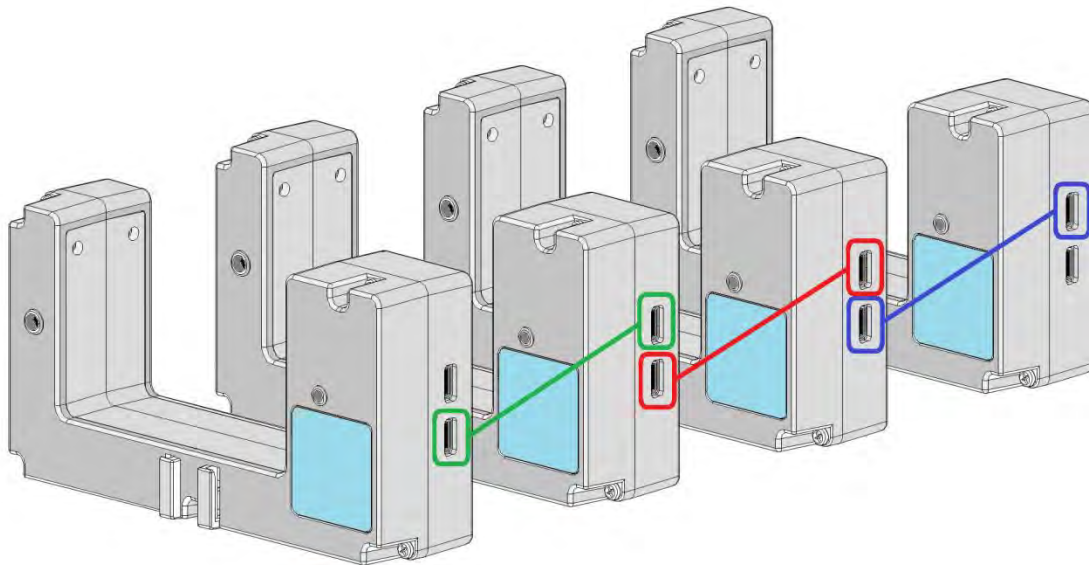
Using an external laser pointer



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.



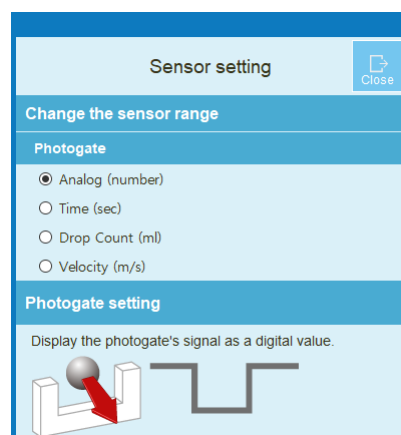
NOTE : Daisy chain refers to a configuration of hardware devices connected in series. For example, this refers to a bus wiring method in which device A is connected to device B, and device B is sequentially connected to device C.

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

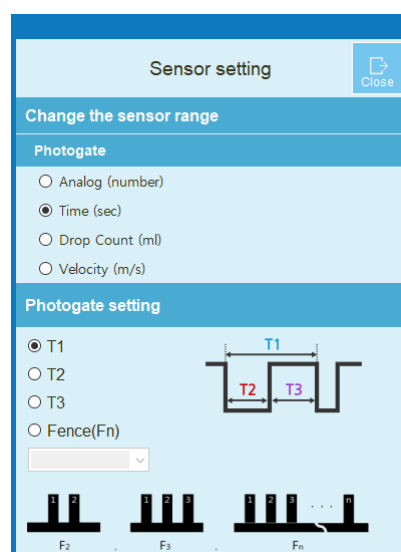
Photogates can be measured in analog or digital timing modes. You can change the mode selection through the sensor settings in the Science# logging program and it will operate in analog mode by default. You can change it in sensor settings in the following ways:

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.

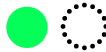
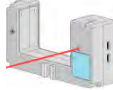
Time (Based) Mode



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 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) Time mode : event based
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 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.

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



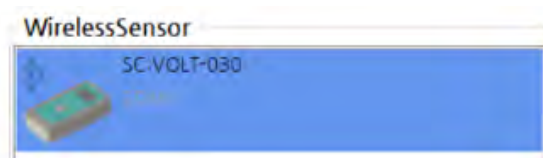
Features

- 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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