WIRELESS PHOTOGATE W44

USER GUIDE



cma-science.nl

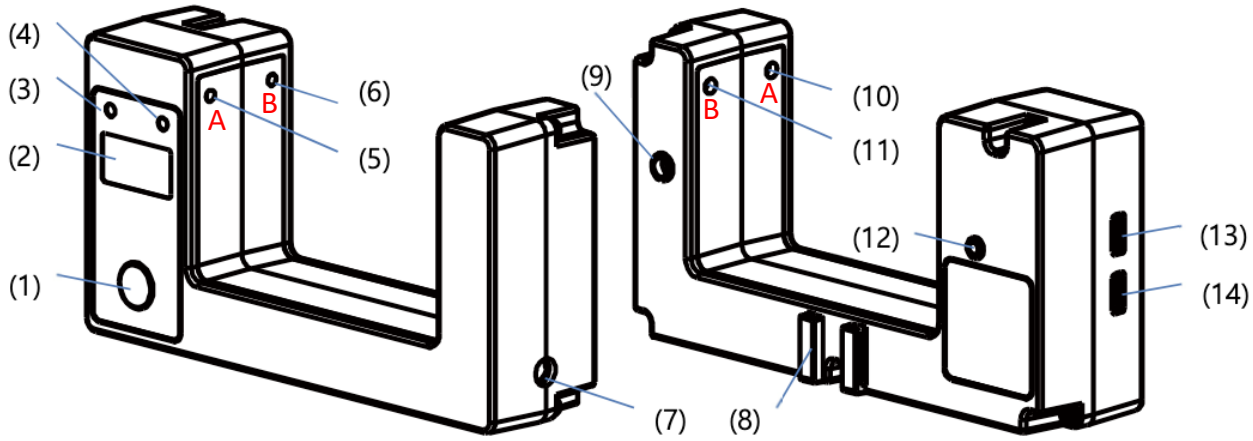
Short description

The CMA Wireless Photogate W44 features a pair of light gates placed side by side that detect objects passing between its arms. It can be used for timing measurements with a single gate and for velocity measurements using both gates. It also supports position measurements when used with a Smart Pulley.
A separate external gate allows detection of larger objects using an external light source or another photogate.
In addition, multiple photogates can be connected in a daisy chain, allowing sequential measurements across up to five photogates.

The photogate is switched on and off using the power button. It has a color OLED color display that shows sensor information, measured values, and the selected mode, allowing it to be used as a standalone measuring instrument. Press the button to turn it on, and hold it for about 5 seconds to turn it off.

The sensor can be used wirelessly via Bluetooth or wired via USB with the Coach 7 or Coach 7 Lite programs/apps on computers (Windows and Mac), Chromebooks and mobile devices (Android and iOS).

Device overview



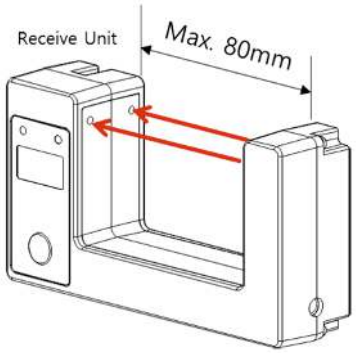
1) Power button
2) OLED Sensor Display
3) LED A indicator
4) LED B indicator
5) Gate A detector
6) Gate B detector
7) Nut hole for the stand rod
8) Smart Pulley slider
9) External light emitter
10) Gate A emitter
11) Gate B emitter
12) External light detector
13) USB-C port for connecting photogates in daisy-mode
14) USB-C port for data and charging

Modes of operation

By briefly pressing the Power button on the photogate, you can switch between different operation modes: Inside, Outside and Daisy Chain. The selected mode is

shown at the bottom of the display.

Inside mode



This mode uses only Gate B for digital, time-interval and position measurements, and both Gates A and B for speed measurements.

Position the photogate so that the object passes through the light beam and blocks it. When the beam is blocked, the gate output goes low (0) and the corresponding LED indicator turns green. When the beam is not blocked, the output is high (1) and the LED is off.

Because the sensor uses infrared light, it is relatively insensitive to ambient room lighting. The spacing between the photogate arms is 80 mm, and the distance between the Gate A and Gate B is 20 mm.

The Pulley attachment



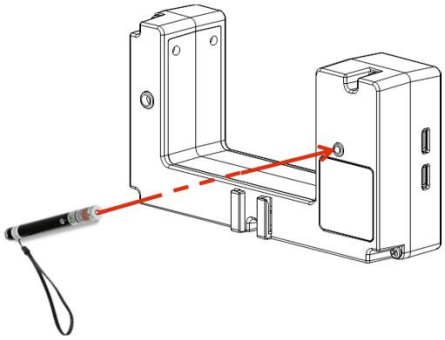
For position measurements, the Smart Pulley supplied with the photogate can be used. It is a low-friction, 10-spoke pulley that attaches to the photogate via the slider. When correctly positioned, each spoke interrupts the infrared beam as it passes.

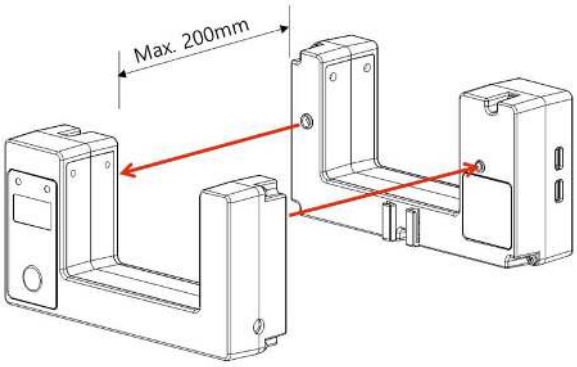
The pulley cannot detect direction or changes in direction, so it is suitable only for motion in one direction.

It has a V-shaped groove, with a circumference of approximately 0.20 m (measured along the groove).

Outside mode

This mode operates using the external light detector and light emitter located at the back of the photogate. The detector can detect light from an external laser source or from the external emitter of another photogate. When paired with another photogate, the maximum detection distance is less than 200 mm.



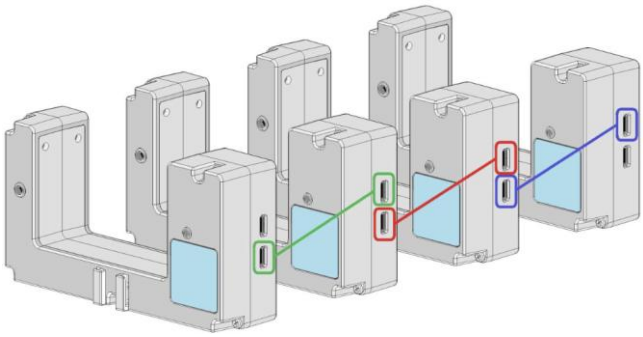


When the light beam reaches the external detector, both LEDs are off. When the beam is blocked, the LEDs turn on. It is recommended to first align roughly align the beam approximately, and then fine-tune the photogate position until the LEDs switch off.

Warning: Do not look directly into the laser beam during alignment. Always follow the safety instructions provided by the laser manufacturer.

Daisy-Chain mode

In this mode, multiple photogates can be connected in series and used as a single system. Up to five photogates can be linked using optional extension cables. Only Gate A of each photogate is used in this mode. When the light beam is blocked, both LEDs turn green.



The software does not indicate which specific photogate in the chain has been used. Therefore, it is recommended to arrange the photogates in a clear physical sequence so their order in the setup is easy to identify.

Software

You can use the Photogate System W44 with Coach 7 or Coach 7 Lite (free) program on computers (Windows and Mac) or Coach 7 and Coach 7 Lite (free) app on mobile devices (Android and iOS). For Chromebooks, we offer a special Android app. The support for this wireless sensor is added starting from Coach version 7.13.

Check the CMA website for the latest installations. https://cma-science.com/downloads_en

Measurement Ranges in Coach 7

Depending on the mode selected on the photogate, Coach 7 provides several measurement ranges to support different types of experiments.

To select the range in Coach 7

Turn on the photogate and connect it in Coach 7, then right-click its icon in the Wireless Sensors panel. Select **Input Range** and choose the desired range from the list.

Digital

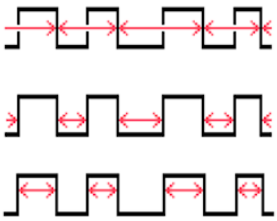
Digital range allows you to detect two states of the photogate:

- **Blocked**: the LED turns on and the sensor outputs 0,

- **Unblocked**: the LED turns off and the sensor outputs 1,

Time Interval

Time Interval range allows you to measure the time between successive signal changes, indicating when the beam is blocked and unblocked. The available options are:



- **Down-Down**: measures the time between successive signal falling edges (signal changes from high to low),
- **Down-Up**: measures the time between a falling edge (from high to low) and the following rising edge (from low to high),
- **Up-Down**: measures the time between a rising edge (from low to high) and the following falling edge (from high to low).

Speed

Speed range allows you to measure speed of an object moving between the two gates:

- **Speed A to B:** measures the speed (m/s) of an object moving from Gate A to B,
- **Speed B to A**: measures the speed (m/s) of an object moving from Gate B to A.

Position

Position range is used when working with the Smart Pulley attachment to measure displacement (m). It applies a calibration in which each passing spoke corresponds to a displacement of 2 cm.

Collecting data without software connection

- Turn the Photogate on by pressing its power button.
- The sensor briefly displays its Bluetooth identification code. This ID code is also printed on the sticker located on the bottom side of the sensor box.
- Then the display shows:
  - the Bluetooth mode, 'Mobile' or 'PC'.
    Mobile indicates Bluetooth Low Energy mode which should be used when working with mobile devices (Android, iOS), Chromebook and Apple computers.
    PC indicates Bluetooth Classic which should be used for Windows computers.
  - the battery level, and
  - the current measured value.
- Now you can use the sensor as an independent measuring instrument.
- To turn the sensor off press and hold its power button for 3 sec. To save its battery the sensor automatically turns off after a few minutes of inactivity (no connection to power, no communication).

Collecting data via the Bluetooth connection

Mobile devices, Chromebooks, and Apple computers

For mobile devices (Android, iOS), Chromebooks and Apple computers Bluetooth Low

Energy technology is used for wireless communication. For these devices **do not pair** the sensor just use it directly in the Coach software.

- Turn the photogate on by pressing its power button.
- Ensure your sensor is set to Mobile mode.
  If the display shows in the top-left corner 'PC' first you must set the sensor to the Mobile mode. 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' which means that Bluetooth Low Energy is used.
- Start the Coach 7 or Coach 7 Lite program/app.
- Select the Dashboard Activity 'Measurement with Wireless sensors'.
- On opening of the Activity Coach starts searching for sensors which are turned on and in the Mobile discovery mode. The found Bluetooth sensors appear in the list.
- Select the Radiation sensor you want to connect to. If needed check the sensor's Bluetooth ID which is located on the sensor's bottom label.
- When the connection is established the Bluetooth symbol appears in the top-left corner of the sensor's display and the icon of the sensor appears showing the measured values.
- Now you are ready to use the Photogate for your measurement.

Windows computers

For Windows computers, Bluetooth Classic technology is used for wireless communication. Before you start to use the sensor for measurement in Coach **you have to pair it**.

- Turn the Photogate on.
- Ensure your sensor is set to PC mode.
  If the display shows in the top-left corner 'Mobile' first you must set the sensor to the PC mode. 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' which means that Bluetooth Classic is used.
- Pair your sensor.
  - Go to the Windows Settings **Bluetooth and other devices** and select **Add Bluetooth or other devices**. Select **Bluetooth device**.
  - Windows looks for Bluetooth devices and after a while lists discovered devices. The wireless sensors are listed with their Bluetooth IDs.
  - Select the sensor you want to connect to. If needed check the sensor's Bluetooth ID which is located on the bottom label of your sensors.
  - When the connection is successfully established Windows indicates that the sensor is paired and ready to go.
  - Click **Done** to accept it. The sensor appears in the list of paired Bluetooth devices.
- Start the Coach 7 or Coach 7 Lite program.

- Select the Dashboard Activity ‘Measurement with Wireless sensors’.
- Coach starts searching and displays the list with detected sensors, even if they are not paired.
- Select the Photogate you want to connect to. If needed check the sensor’s Bluetooth ID which is located on the sensor’s bottom label. If the sensor was not paired yet Coach will force you to pair the sensor first via Windows Settings.
- When the connection is established the Bluetooth symbol appears in the top-left corner of the sensor’s display and the icon of the sensor appears showing the measured values.
- Now you are ready to use the Photogate for your measurement.

Collecting data via the USB connection

For computers (Windows and Mac) the Radiation sensor can also be used as USB sensor.

- Turn the Photogate on.
- Use the provided USB cable to connect the sensor to a USB port.
- Start the Coach 7 or Coach 7 Lite program.
- Select the Dashboard Activity ‘Measurement with Wireless sensors’.
- The connected USB sensor should be detected automatically, and its icon appears on the first empty sensor position in the Wireless sensors panel.
- When the connection is established the USB symbol appears in the top-left corner of the sensor’s display and the icon shows measured data.
- Now you are ready to use the Photogate for your measurement.

Charging a battery

An internal rechargeable battery (Li-Poly 3.7 V, 700 mAh) powers the sensor. The battery symbol located in the top-right corner of the sensor’s display shows the battery level. When the battery level becomes critical, the battery gauge shows an empty battery. Use the provided cable to connect the sensor to a USB port for charging. A fully discharged battery requires up to 2 hours of charge time to become fully charged again. To prolong battery life, automatic power down turns the sensor off after 5 minutes of inactivity.

To replace the battery, use **only** the approved rechargeable batteries provided by CMA.

Suggested experiments

The CMA Wireless Photogate System W44 can be used for a wide variety of experiments:

- Motion measurements using a Smart Pulley
- Measuring the speed and acceleration of moving objects
- Measuring time intervals of moving objects
- Measuring the period of a simple pendulum

- Studying rotational motion and its period.

Technical Specifications

Range	Digital: 0 (blocked gate) and 1 (unblocked gate)
Detector rise/fall time	2.5 μs / 3.8 μs
Smart Pulley diameter *Circumference of pulley* *Number of spokes* *Step size*	In groove = 0.064m, On edge = 0.067m In groove = 0.20 m, On edge = 0.21m 10 angle = 0.6283, rad = 36°, distance = 0.02 m
Steel rod	Length = 0.13 m
Battery life *after full charge*	Approximately 6 hours Battery life varies by use, configuration, temperature, and many other factors; actual results will vary.
Connection	Bluetooth 5, Low Energy (Mac, Android, iOS) Bluetooth 2.1, Classic (Windows) USB 2.0 (type C)
Bluetooth ID	W44PHGA-xxx

Warranty

The Photogate system W44 is warranted to be free from defects in materials and workmanship for a period of 3 years from the date of purchase provided that it has been used under normal laboratory conditions. This warranty does not apply if the sensor has been damaged by accident or misuse.

The sensor battery is consumable and is warranted to be free from defects in materials and workmanship for a period of 12 months from the date of purchase.

Discard batteries according to local regulations.

Note: *This product is designed for educational purposes only.*
It is not intended for industrial, medical, research, or commercial applications.

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