



Wireless Fine Particles (Dust) (P4515-PM) User manual



Rev. WL115PM-12-2023

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

The wireless fine particles sensor can measure the concentration of particles in the air.

The wireless fine particles (dust) sensor measures the concentration of fine dust in the air. Measures fine dust (PM10) and ultrafine dust (PM2.5) simultaneously.

Fine dust concentration can be measured more accurately by using a light scattering method that uses a signal that scatters the physical properties of light through a laser light source. The fine dust concentration measured in this way is expressed as $\mu\text{g}/\text{m}^3$, which means the weight of fine dust (μg , meaning 1/1 millionth of a gram) contained in 1 m^3 of air.

Additionally, the sensor has a display window so you can immediately check the measured values. You can measure by remotely connecting to a smart device or PC wirelessly or wired.

Suggested experiments

- Measurement of indoor fine dust concentration
- Observe changes in fine dust throughout the year in the measurement area
- Fine dust reduction experiment using an air purifier

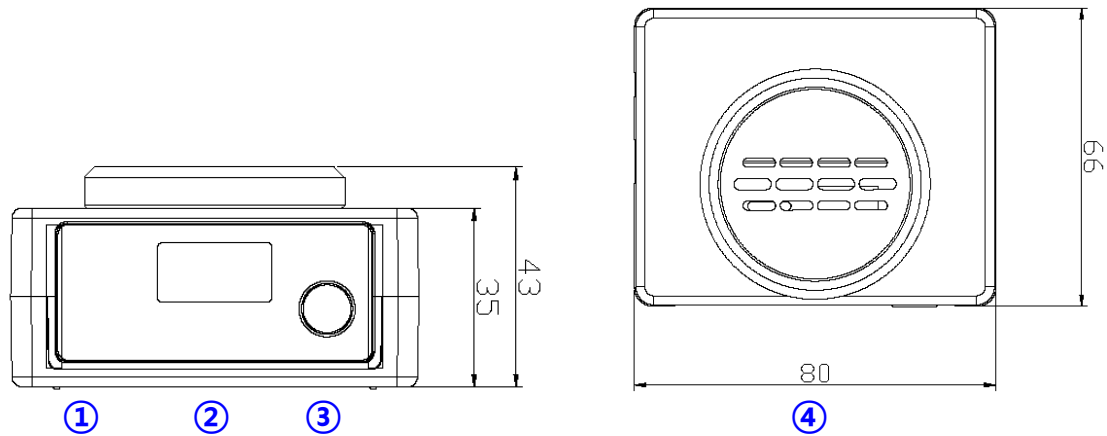
Composition

The wireless fine particles sensor consists of the following.

- Wireless fine particles sensor (P4515-PM)
- USB-A/C cable
- Booklet

Function of wireless sensor

Structure



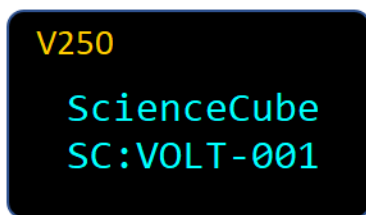
- ① USB port : Connect the sensor to a PC and use it for experiments or charging.
- ② OLED Display : Displays measured sensor values, sensor type, sensor ID, and remaining battery level.
- ③ Power/Function Button : It has functions such as power ON/OFF, measurement sensor change and calibration, etc.
- ④ Sensing part : detects dust concentration by sucking in air.

Caution : The installation must ensure that the inlet or outlet is not covered during the experiment. If the air flow is affected, accurate values cannot be obtained and the durability of the product may be affected.

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)
	Long click	■■■■■	Turns off.

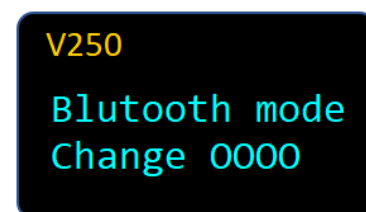
Start screen



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)

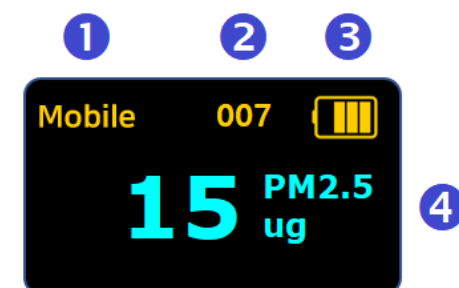
Mode change



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



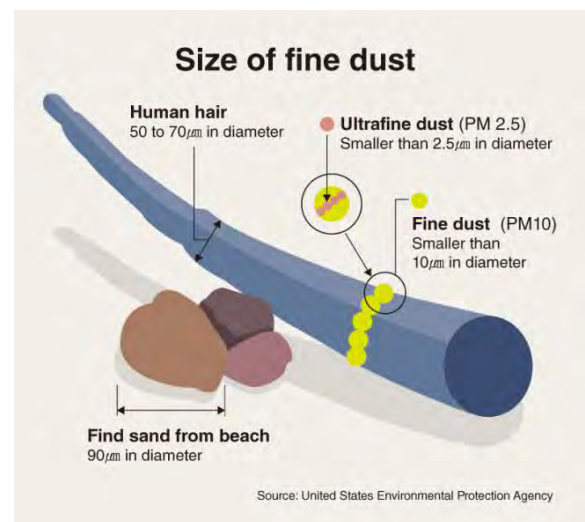
① Connection mode	Mobile : Connecting Android or iOS PC : Connecting to Windows PC 🔌 : Connected via USB cable ※ A long press changes the mode and turns on the sensor.
② Sensor-ID	This is the sensor's unique number and is displayed along with the sensor name in the device name when connected via Bluetooth.
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. 3) For sensors with multiple ranges , the current range is displayed.

How it Works

What is dust?

It refers to particulate matter that floats or scatters in the air. Depending on the size of the particles, they are classified into total dust (TSP, Total Suspended Particles) of 50µm or less and very small fine dust (PM, Particulate Matter).

Fine dust is further divided into fine dust with a diameter of 10 μm or less (PM₁₀) and fine dust with a diameter of 2.5 μm or less (PM_{2.5}). PM₁₀ is about 1/5 to 1/7 smaller than the thickness of a human hair (50 to 70 μm), while PM_{2.5} is very small, about 1/20 to 1/30 of the thickness of a human hair.



Each country's environmental standards are determined by considering the pollution status, impact on the human body, target substances and concentration, etc.

Each country sets its own fine dust standards by referring to the standards recommended by the World Health Organization (WHO).

Table 0.1. Recommended AQG levels and interim targets

Pollutant	Averaging time	Interim target				AQG level
		1	2	3	4	
PM ₁₀ , $\mu\text{g}/\text{m}^3$	Annual	35	25	15	10	5
	24-hour ^a	75	50	37.5	25	15
PM _{2.5} , $\mu\text{g}/\text{m}^3$	Annual	70	50	30	20	15
	24-hour ^a	150	100	75	50	45
O ₃ , $\mu\text{g}/\text{m}^3$	Peak season ^b	100	70	-	-	60
	8-hour ^c	160	120	-	-	100
NO ₂ , $\mu\text{g}/\text{m}^3$	Annual	40	30	20	-	10
	24-hour ^a	120	50	-	-	25
SO ₂ , $\mu\text{g}/\text{m}^3$	24-hour ^a	125	50	-	-	40
CO, mg/m^3	24-hour ^a	7	-	-	-	4

^a 99th percentile (i.e. 3-4 exceedance days per year).

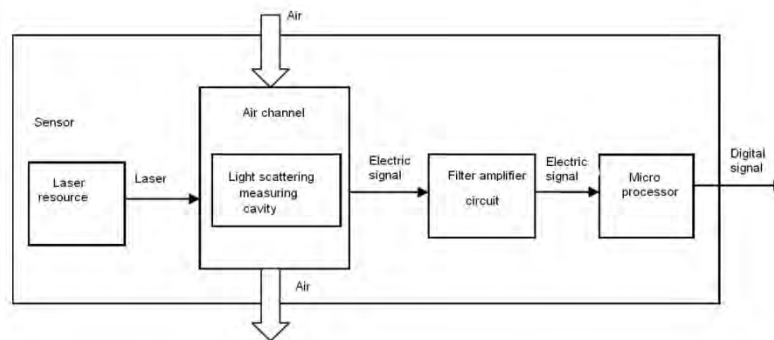
^b Average of daily maximum 8-hour mean O₃ concentration in the six consecutive months with the highest six-month running-average O₃ concentration.

Measurement principle

Fine dust concentration can be measured more accurately by using a light scattering method that uses a signal that scatters the physical properties of light through a laser light source.

The fine dust concentration measured in this way is expressed as $\mu\text{g}/\text{m}^3$, which means the weight of fine dust (μg , meaning 1/1 millionth of a gram) contained in 1 m^3 of air.

The fine dust sensor sucks in air and dust through the intake port and discharges it through the exhaust port. In this process, a laser light source is used to irradiate the air, the light is scattered by dust particles, and this signal is detected optically.



The detected signal is converted to concentration through electronic circuitry and a digital signal source.

Specifications

Item	Description
Range	PM2.5 : 0 ~ 500 $\mu\text{g}/\text{m}^3$ PM10 : 0 ~ 500 $\mu\text{g}/\text{m}^3$
Resolution	1 $\mu\text{g}/\text{m}^3$
Sampling Time	Max. 100Hz (0.01 sec.), (Typical 1Hz)
Condition	10 ~ 40°C, ~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



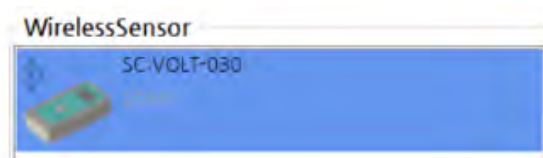
Features

- 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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