

*PARTICULATE
MATTER SENSOR*
Introduction of PPD71

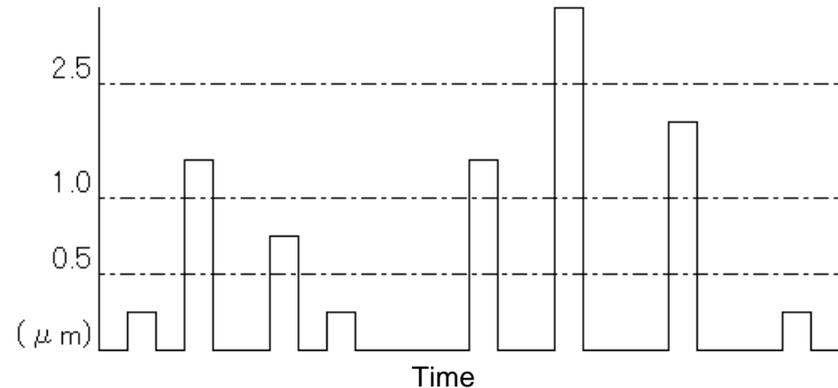
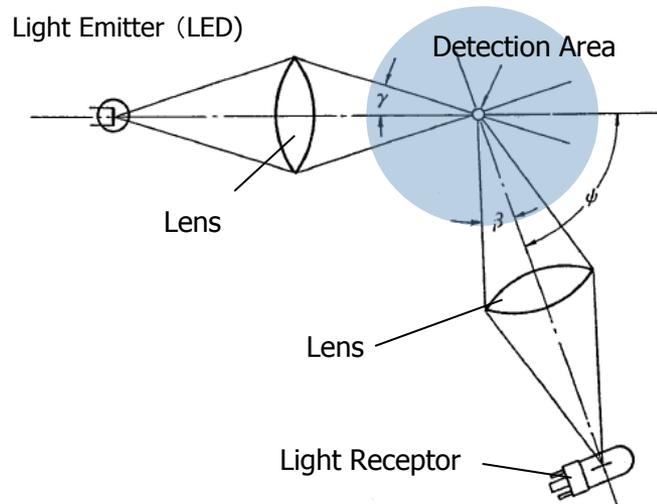


What is PPD?

- PPD=Photo Particle Detector
- Detects airborne particles continuously, then outputs the detection result in UART digital output based on mass concentration ($\mu\text{g}/\text{m}^3$).
- Sensitive to dust, particles and cigarette smoke which can trigger many allergic symptoms.
- Major Application : Household air purifier, Air quality monitor etc.

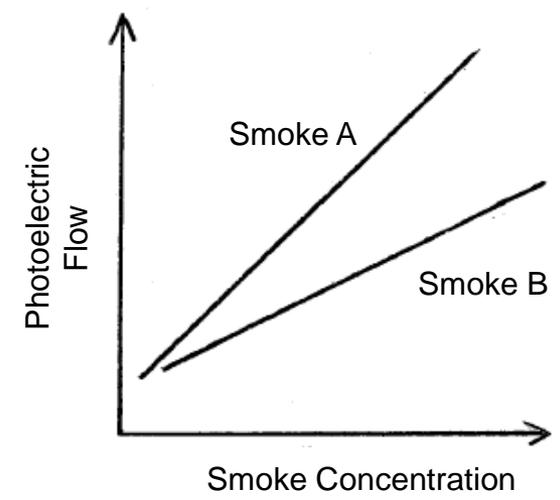
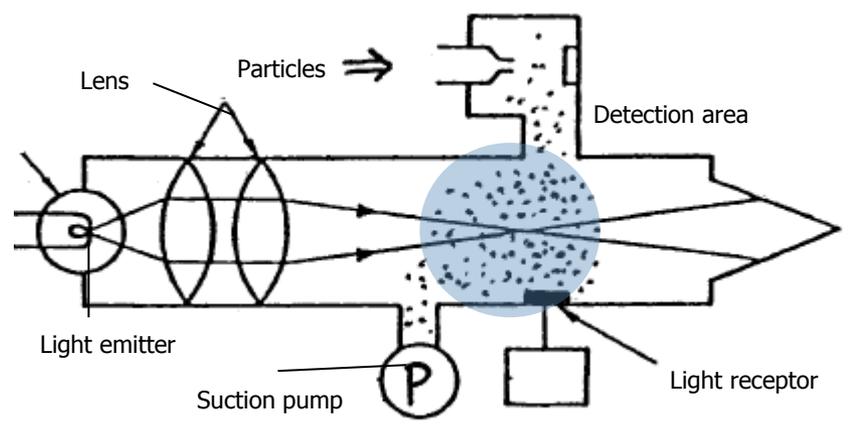


Detection Principle (Particle Counter)



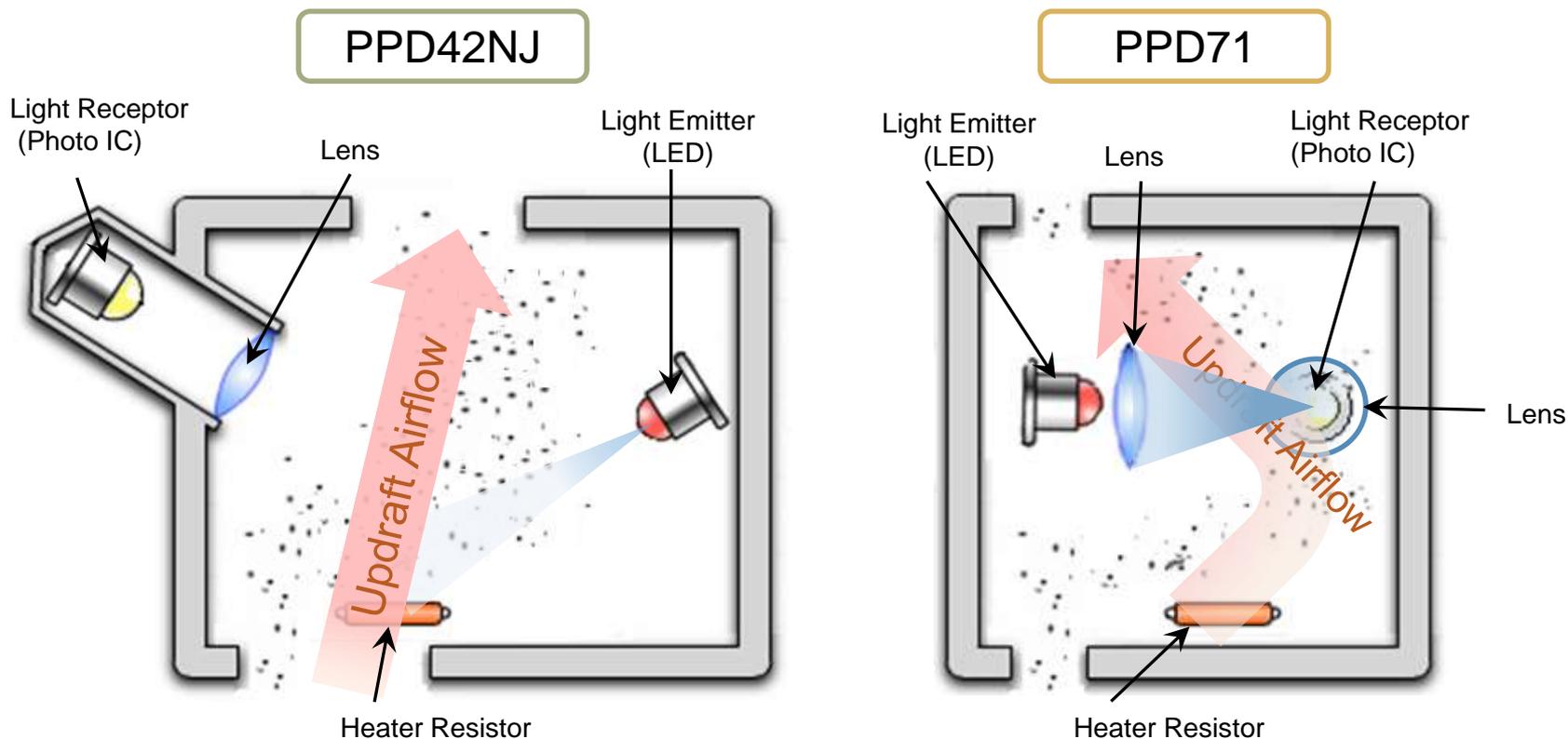
- Light source emitted from light emitter narrows down the focus to detection area.
- When particles inflows into detection area, they generate scattering light which intensity is depended on particle size.
- The number of pulse count at certain period equivalents to number concentration.

Detection Principle (Dust Monitor)



- Total amount of scattering light from particles are detected by light receptor.
- Light intensity of between particles and light emitter is compared as illuminance level.

Detection Principle (PPD)



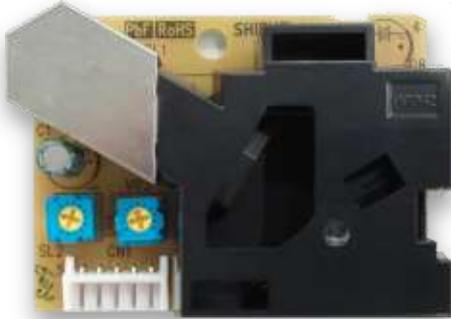
1. Updraft airflow is generated by a heater resistor. Infrared light beam is emitted from LED.
2. Air-borne particles inflow into the sensor box by the updraft airflow generated by the heater resistor.
3. Particles pass through sensing point.
4. Light receptor (Photo IC) receives scattered light through the lens and transforms it into pulse signal.

PPD71

- The smallest sensor ever.
- ✓ Redesigning sensor structure achieves the smallest Shinyei particle sensor.
- Easy to design your software.
- ✓ PM2.5 digital output by UART communication offers you designing software easily.
- Better accuracy.
- ✓ New optical design and a built-in MCU provide better accuracy and fine particle sensing.
- Long life, high reliability.
- ✓ Using custom-made key optical parts achieves long operating life time with high reliability.



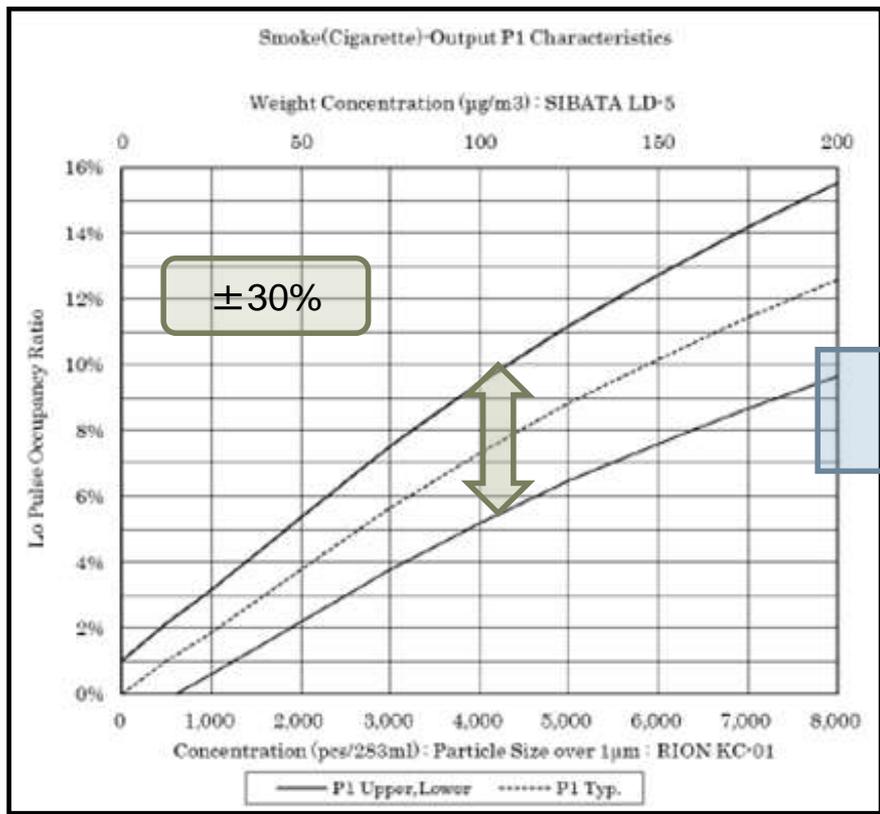
Comparison of PPD42NJ and PPD71 (Specifications)

	PPD42NJ	PPD71
Model #		
Dimension	59(W) × 45(H) × 22(D) [mm]	30(W) × 30(H) × 28(D) [mm]
Detectable Size	Over1.0μm (approx.)	Over 0.5μm (approx.)
Detection Range	0 to 8,000pcs/283ml	0 to 500μg/m ³
Light Source	LED	LED
Output Method	Pulse	UART
Ripple	Below 30mV	No limitation
Detection Method	Auto-suction by a built-in heater resistor	Auto-suction by a built-in heater resistor
Maintenance	Possible	Possible

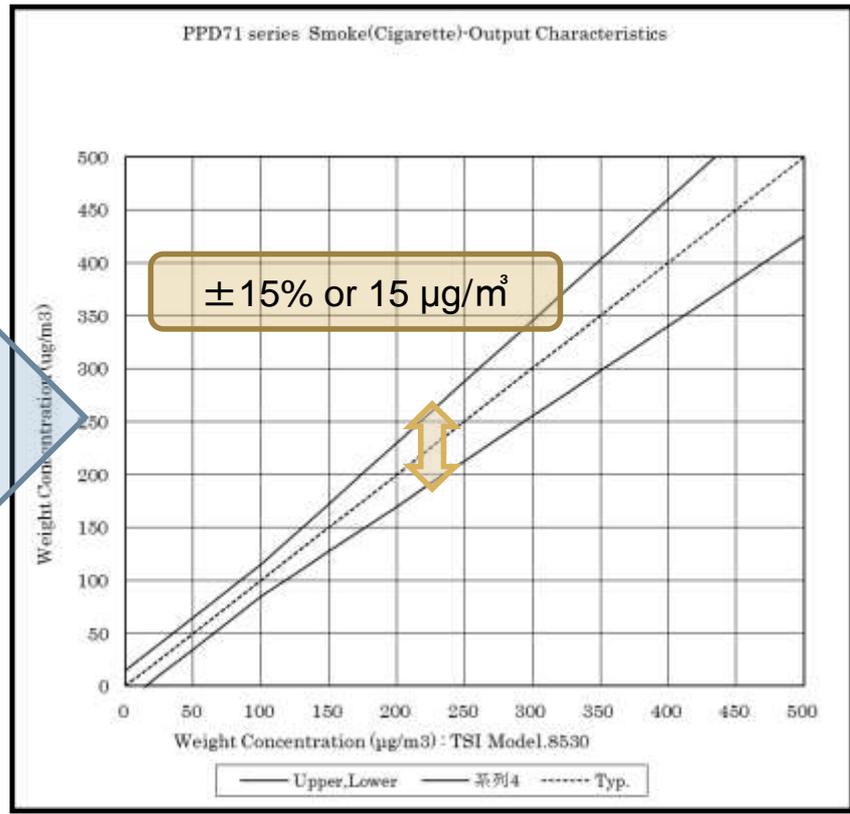
Drastic changes from PPD42NJ are shown in Red.

Comparison of PPD42NJ and PPD71 (Output Characteristics)

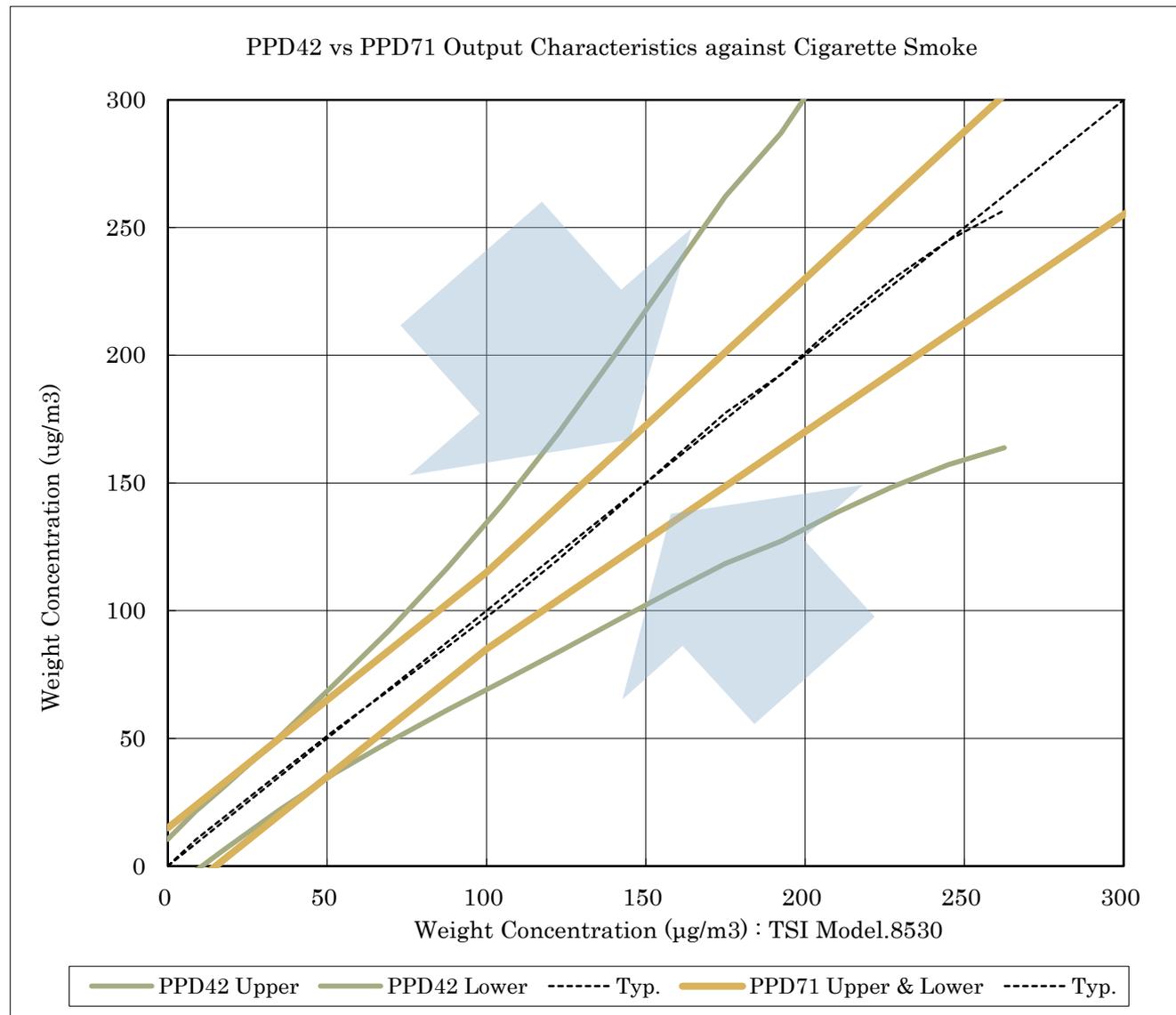
PPD42



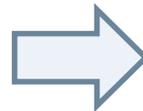
PPD71



- ✓ New optical design
- ✓ Detecting smaller particles



- ✓ New optical design.
- ✓ A built-in microcontroller.
- ✓ Digital calibration using original algorithm.



Better accuracy and high linearity from low to high concentration.

PPD71 Specifications

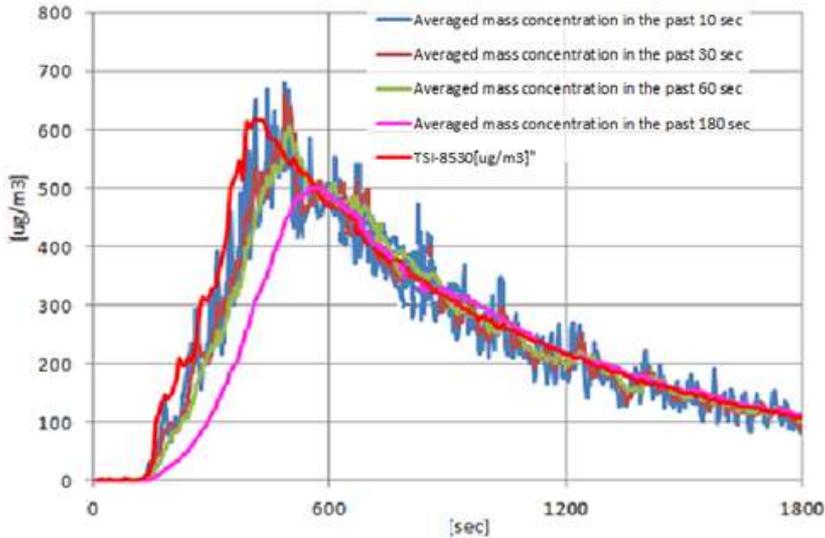


Dimension	30(W) × 30(H) × 28(D) [mm]
Supply voltage	DC5V±10%
Detectable size	Over 0.5μm(approx.)
Detection range	0 to 500μg/m ³
Light source	LED
Output method	UART
Ripple	No limitation
Operating temp. & humidity	-10 to 60°C, below 95%rh
Storage temp & humidity	-25 to 70°C, below 95%rh
Initial stabilization time	60 seconds after power is supplied.
Light Souse Life time	7 years
Power consumption	Below 100mA
Detection method	Auto-suction by a built-in heater resistor
Maintenance	Possible
Reference	TSI DUSTTRACK II 8530

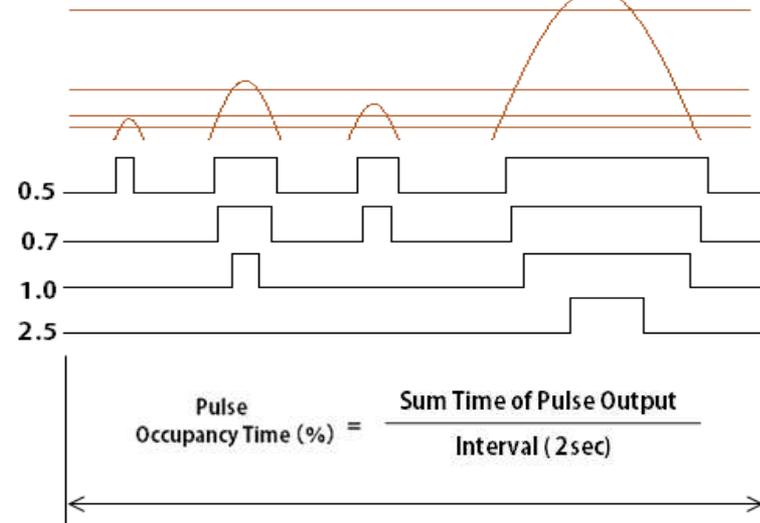
Drastic changes from PPD42NJ are shown in Red.

Summary

‘ $\mu\text{g}/\text{m}^3$ ’ output in 4 different averaged time
(Longer averaged time gives better stability.)



‘pulse occupancy ratio %’ output based on the different particle sizes



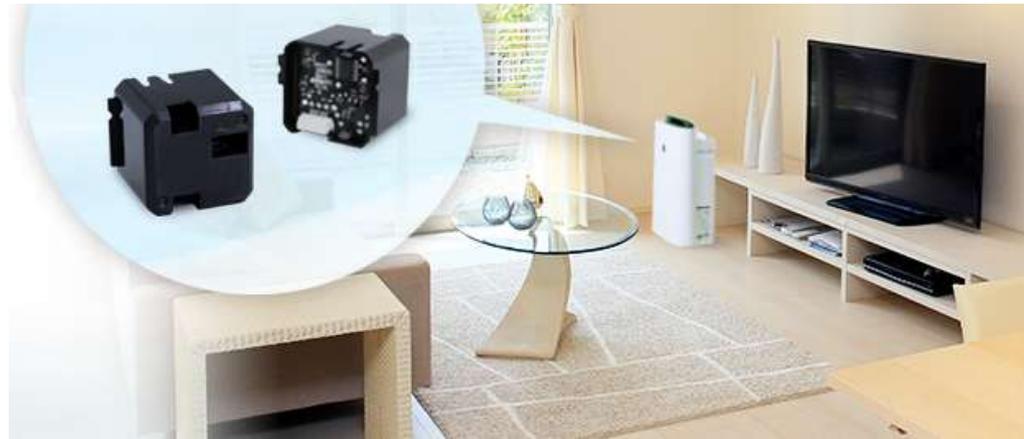
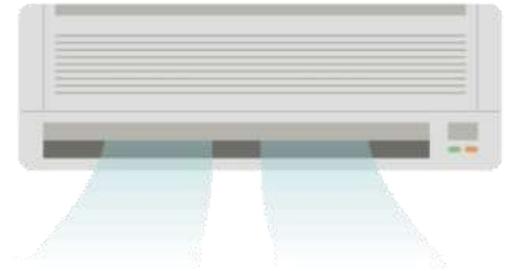
- ✓ **Better accuracy and high linearity from low to high concentration** by applying new optical design, a microcontroller, and digital calibration.
- ✓ **Long operating life time** by using custom-made components and manual maintenance.
- ✓ **No external fan needed** because of auto suction by a built-in heater resistor.
- ✓ **No ripple limitation** because of a voltage regulator.
(Comparison to the current PPD series)
- ✓ **Multiple outputs from UART: $\mu\text{g}/\text{m}^3$ and pulse information (Pulse occupancy ratio)** offer individual control algorithm design on customer's side.

Applications

- Numerical display on air purifier, air-conditioning system.
- Numerical display and better LED segmentation on IAQ monitor.
- Featuring new application!



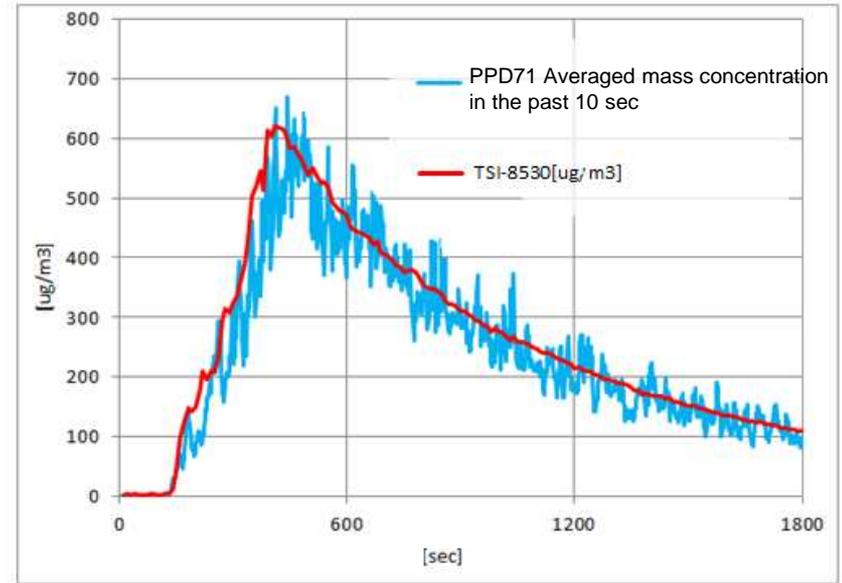
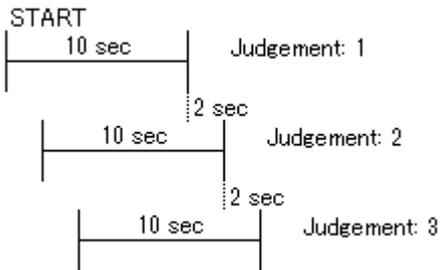
Visualize
air quality.



Examples of Air Condition Judgement

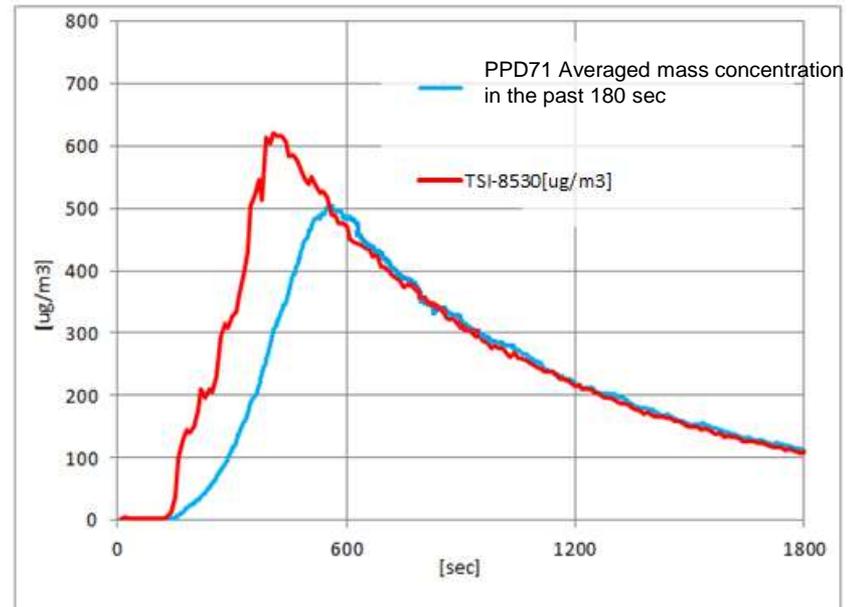
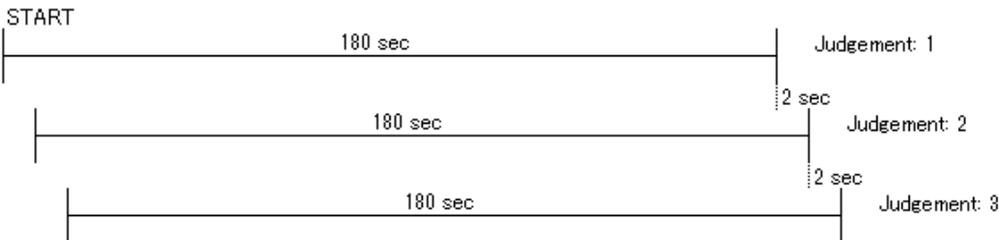
Averaged mass concentration in the past 10 seconds (For Quick Response)

※Judge 10 seconds after START, then judge in every 2 seconds by moving average time of the past 10 seconds.



Averaged mass concentration in the past 180 seconds (For Stability)

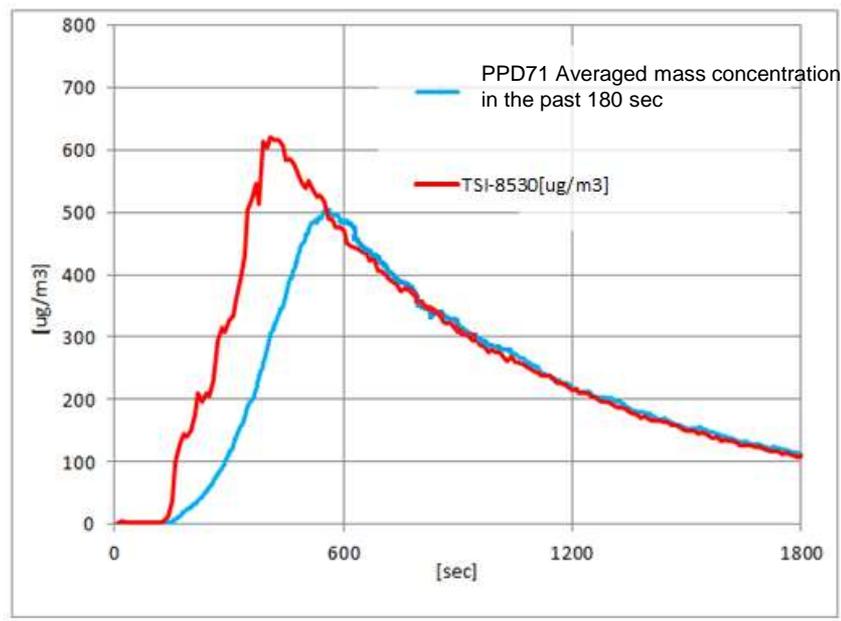
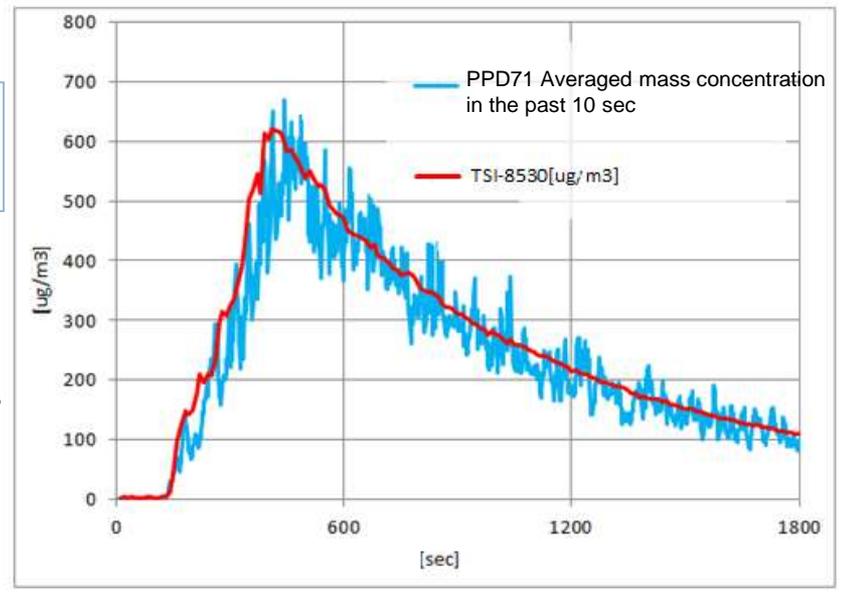
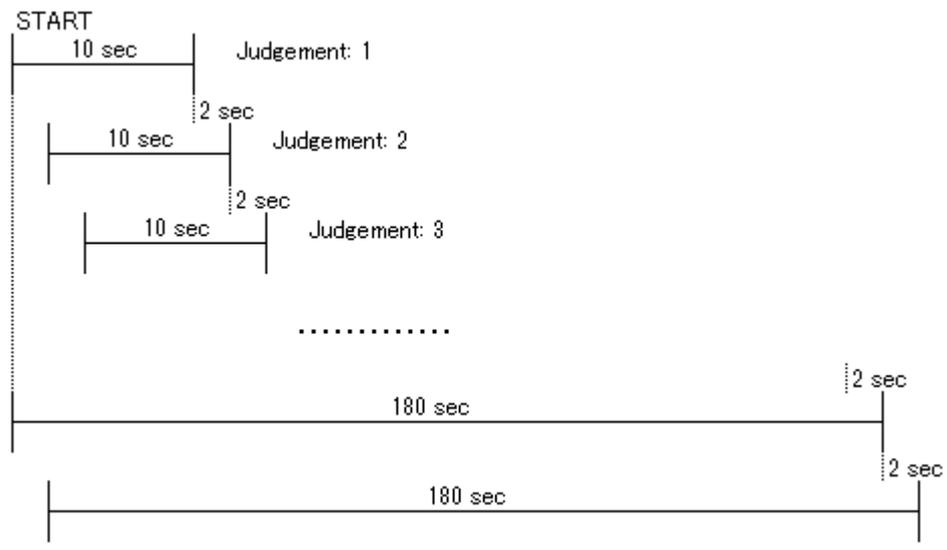
※Judge 180 seconds after START, then judge in every 2 seconds by moving average time of the past 180 seconds.



Examples of Air Condition Judgement

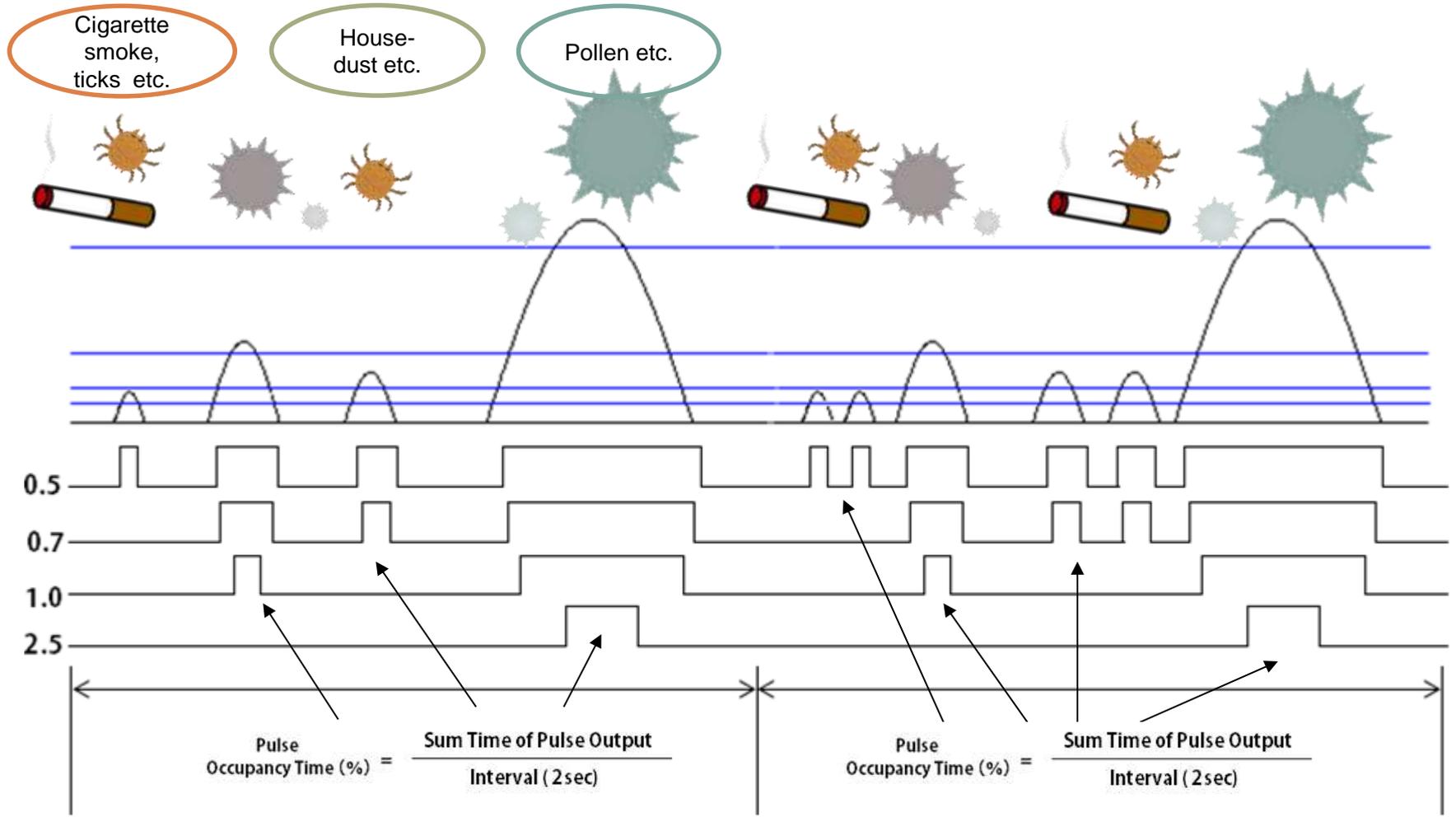
Averaged mass concentration in the past 10 seconds & 180 seconds
(For Quick Response & Stability)

※Judge 10 seconds after START, then judge in every 2 seconds by moving average time of the past 10 seconds for several times to get quick response.
After that, change the moving average time to 180 sec for stable output.



Examples of Air Condition Judgement

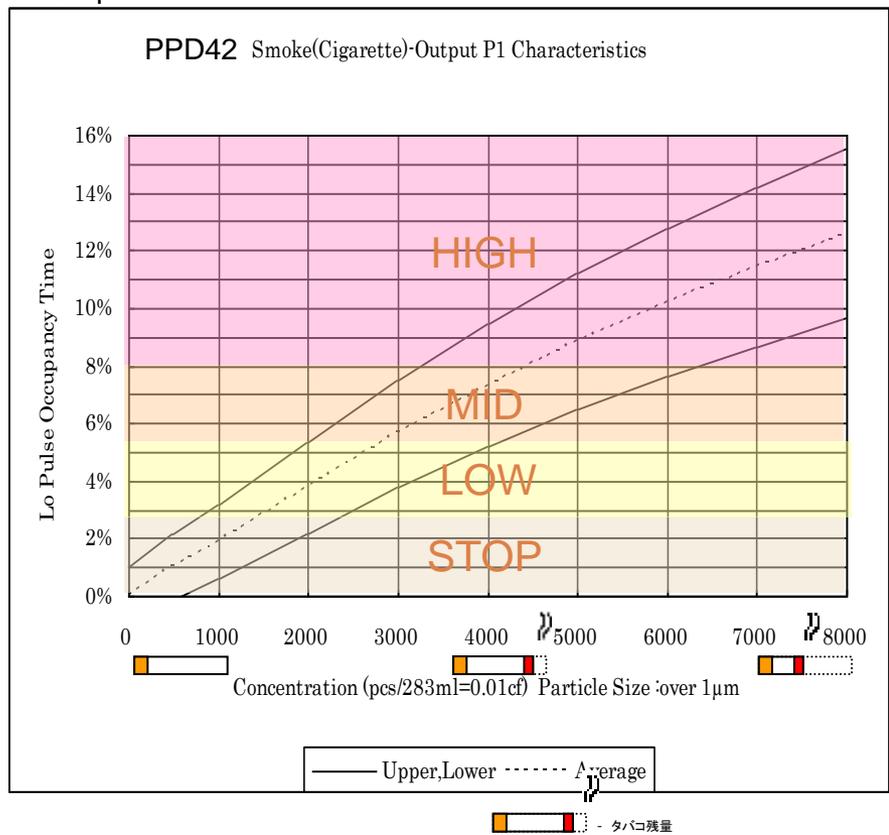
Pulse Occupancy Ratio (%)



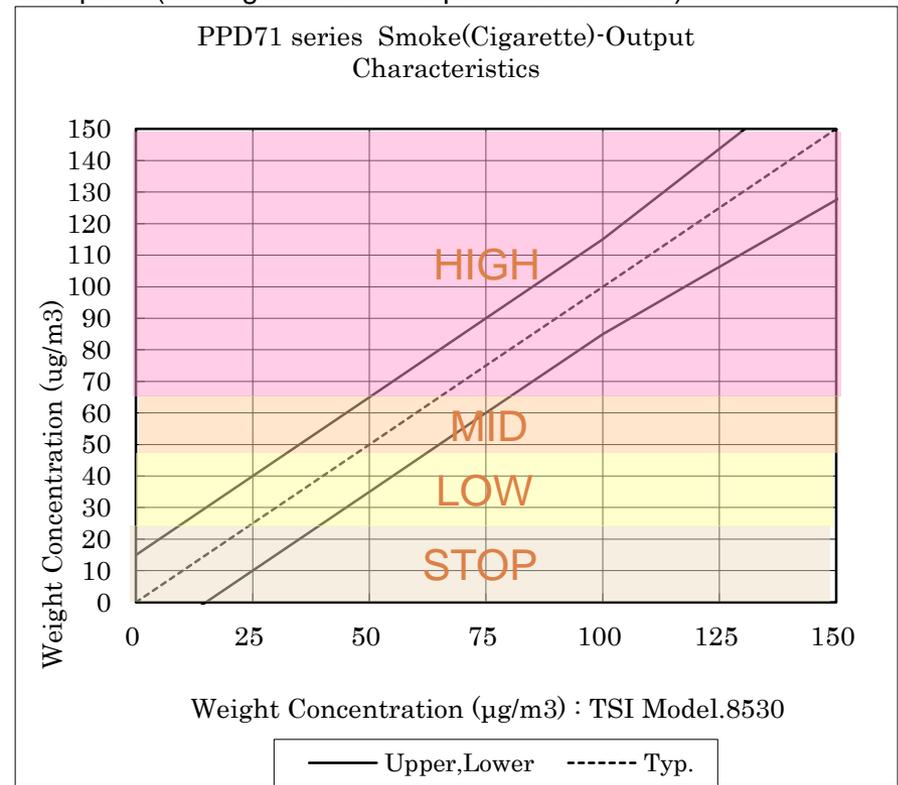
Pulse information (pulse occupancy ratio %) is output based on the different particle sizes. When the ratio from 2.5µm pulse gets high for certain period of time, change the fan speed mode from low to high to purify the air. The number of pulse may be able to read from the output for the mass production sensor.

Examples of Fan Speed Mode of Air Purifier (Comparison of PPD42 and PPD71)

Example A



Example A (Averaged time in the past 180 seconds)

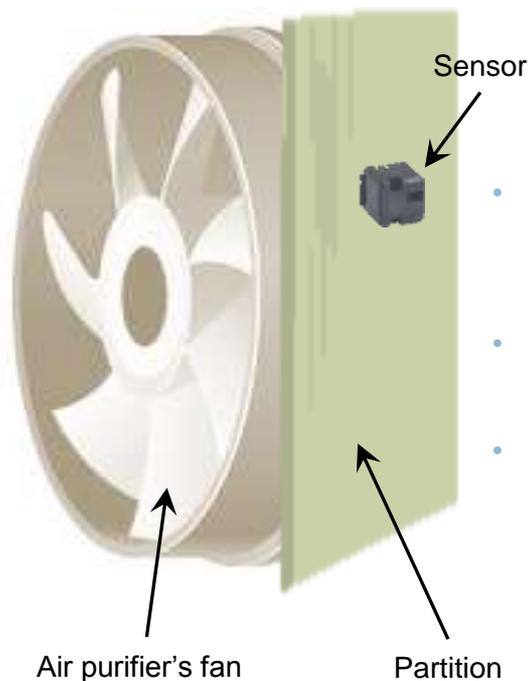


Fan Mode	Example A		Example B	
3step	6.9%		6.3%	
	4.8%	6.9%	4.4%	6.3%
	2.7%	4.8%	2.3%	4.4%
		2.7%		2.3%

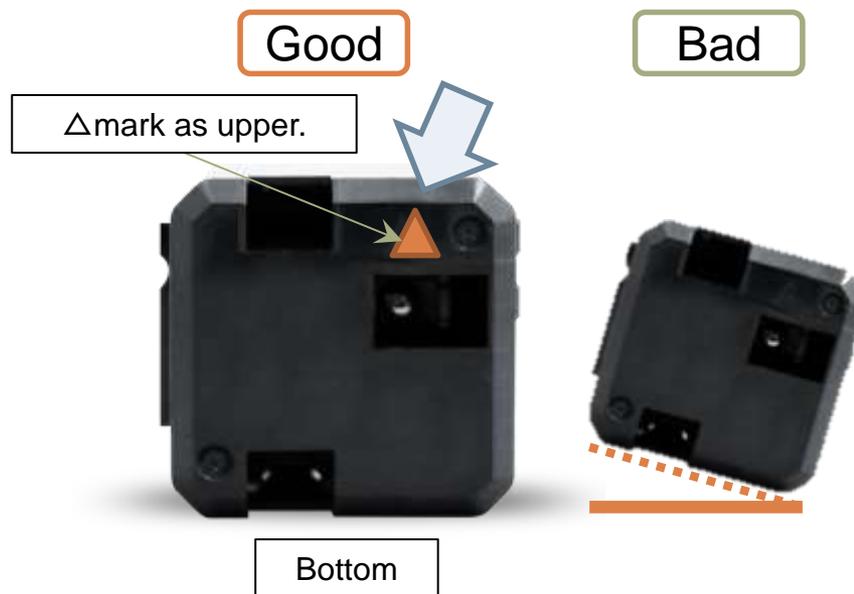
Fan Mode	Example A		Example B	
3step	65.4 µg/m ³		59.2 µg/m ³	
	44.6 µg/m ³	65.4 µg/m ³	40.8 µg/m ³	59.2 µg/m ³
	25.0 µg/m ³	44.6 µg/m ³	21.2 µg/m ³	40.8 µg/m ³
		25.0 µg/m ³		21.2 µg/m ³

Installation Notes

- Set the sensor at vertical angle ($\pm 3^\circ$).

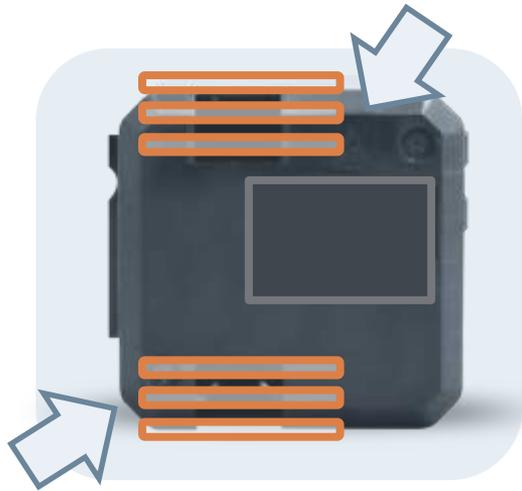


- Place the sensor at where strong air flow from fan does not disturb original airflow of PPD.
- Placing partition between fan and sensor would be recommended.
- Do not place the sensor at where air quality condition between inside and outside of air purifier is widely different.



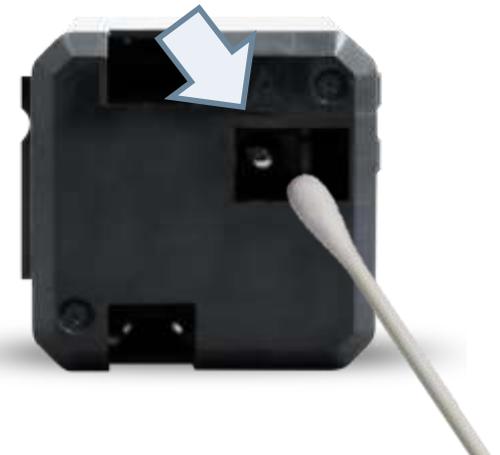
Installation Notes

- Set a cover on sensor's detection area to make the inside of sensor dark to prevent the light outside of air purifier. Unless, the sensor's light receptor does not detect particles properly.



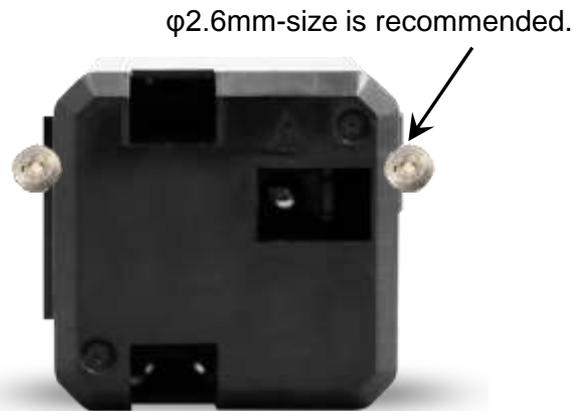
- Make some holes (slit) at where the sensor is mounted, so that ambient air goes into the sensor detection area properly.
- Be aware that the light outside of air purifier does not go trough the holes (slit).

- Make a lid to clean the lens of PPD.
- Use a damp cotton swab to clean.
- After wiping the dirt off the lens, use a dried cotton swab to dry the lens.
- Do not use alcohol to clean the lens.

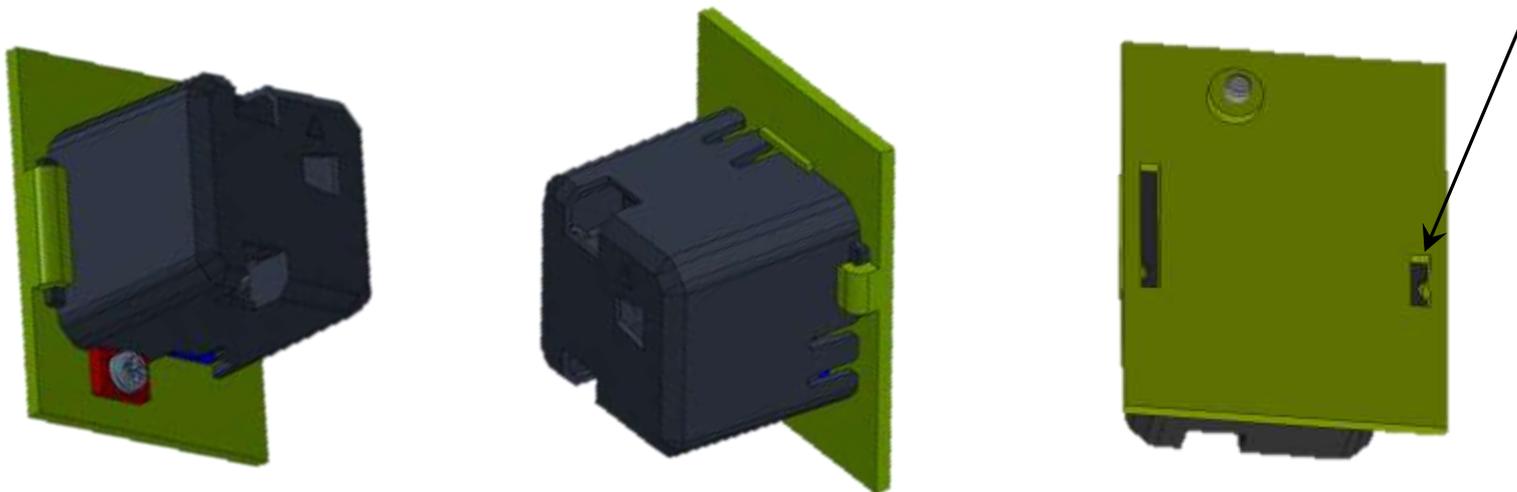


Installation Notes

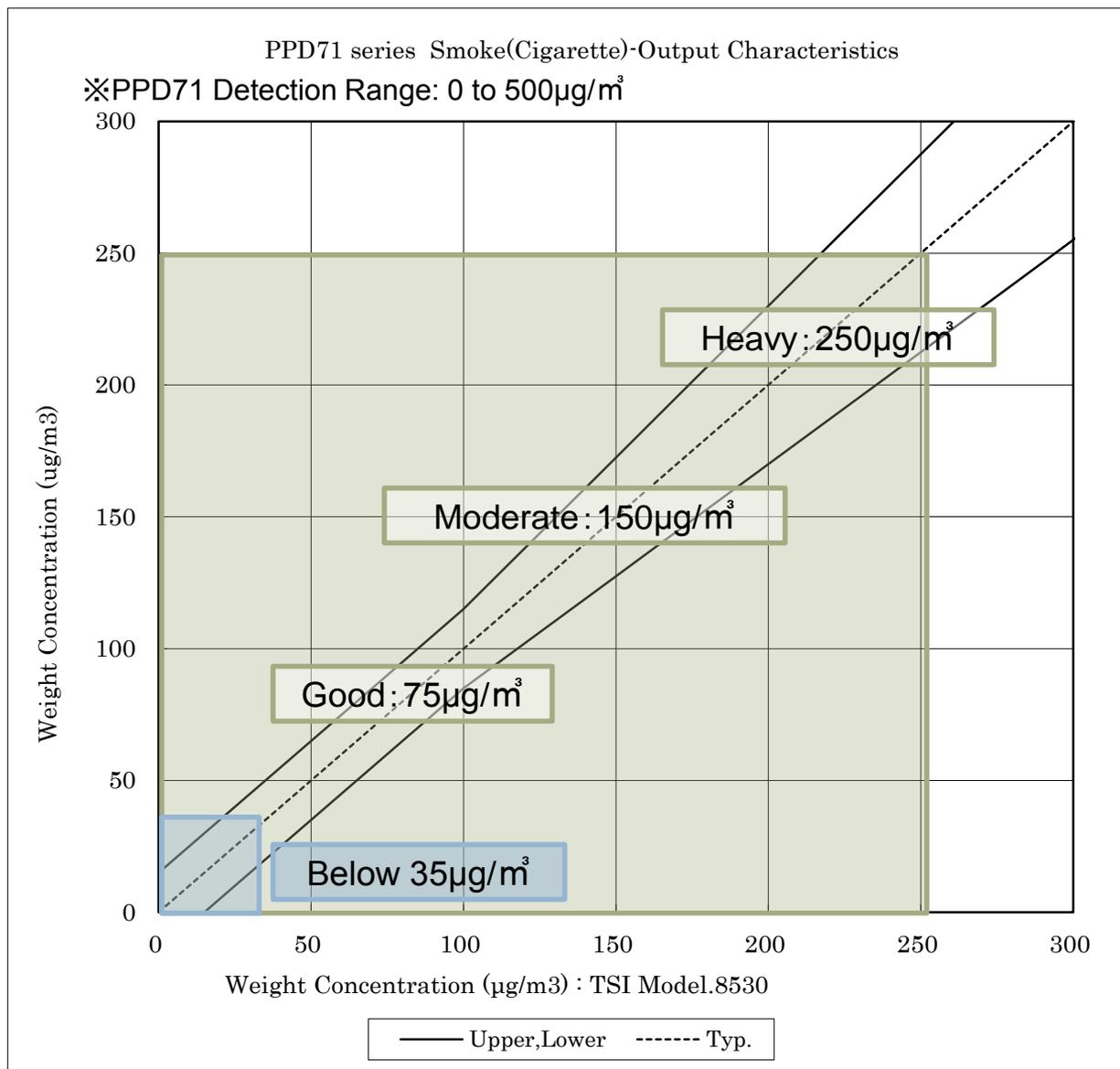
Install sensor with screws.



Install sensor with board.



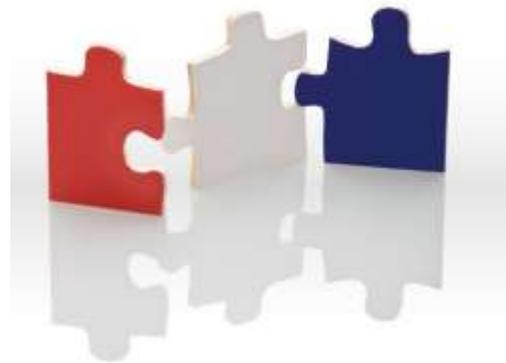
<Reference> PM2.5 regulations (Averaged time for the past 24hrs)



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