Temtop PM900M Laser Particle Sensor User Manual

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PM900M Laser Particle Sensor
User Manual

Model: PM900M
Version: V1.2
Laser Particle Sensor

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Overview

PM-900M is a laser-based particle sensor which uses light scattering method to detect and count particles and calculate PM1.0, PM2.5 and PM10 concentration in a given environment. The sensor features an imported processing chip and photosensitive element. Signals are collected and processed by the microprocessor chip and then output in digital format. The sensor is ideal to detect the concentration of different particles precisely in real time.

Applications

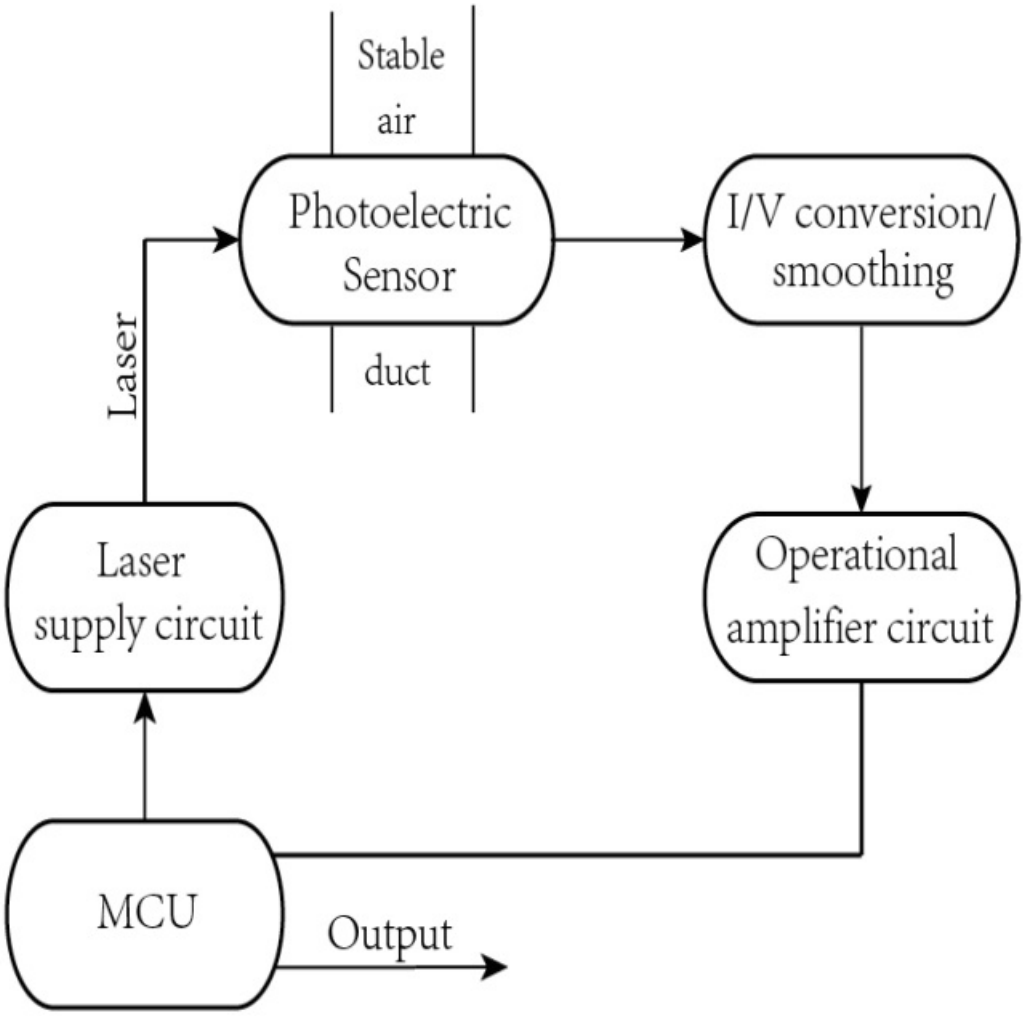
Air purifiers, air quality detectors, fresh air systems, air conditioners and automobiles with air purifying function, consumer electronics.

Value to Customers

Consistent, stable, reliable.
Small zero drift, good repeatability.
Compact size, easy to mount.
Low power consumption, long service life.
High sensitivity, fast response.
Proven EMC and EMI performance, strong anti-interference.

Working Principle

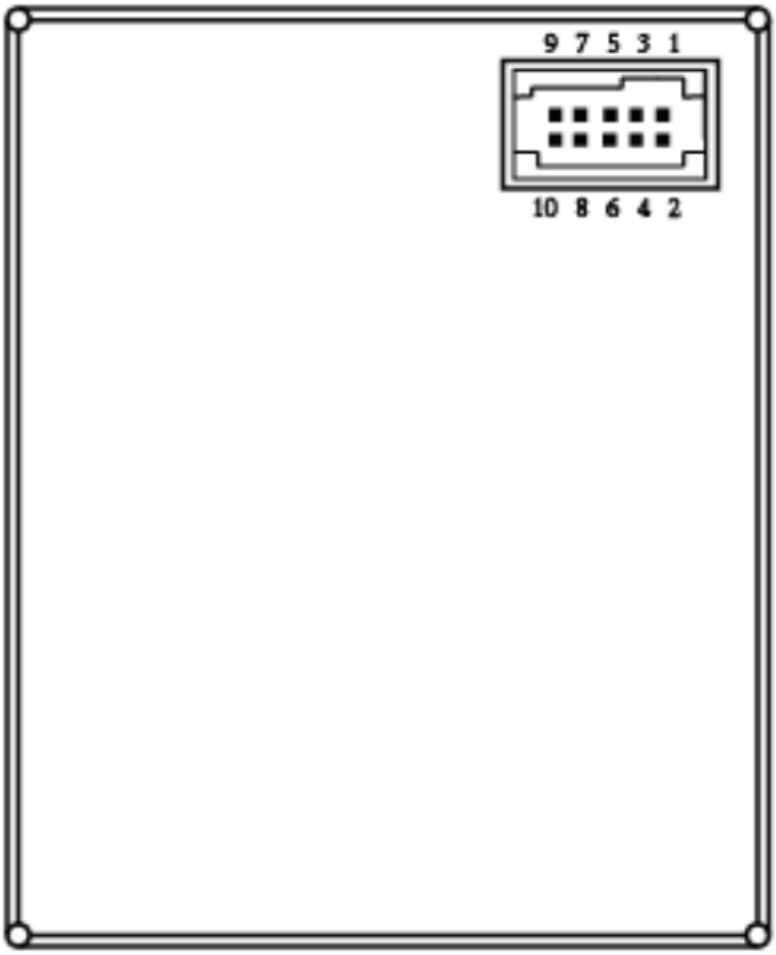
The sensor is based on the particle concentration analysis technology of Mie scattering theory. A laser light source illuminates a particle as it is pulled through the detection chamber. The particles are scattering when passing through the laser beam. The information processing circuit converts the light intensity signal of the scattered light via the
photoelectric sensor into a voltage pulse signal, which is preamplified, converted by AD into digital signal. After noise processing and optimal algorithm analysis, particle count with the equivalent particle size per unit volume can be obtained, and then the particle concentration is calculated. Refer to the following figure for how the principle works:



Technical Data

Output data	PM 1.0, PM2.5, PM 10 concentration and particle count
Concentration range (PM2.5)	0-999pg/m3
Effective range (PM2.5)	0-500pg/m3
Accuracy	0-100pg/m3: ±10pg/m3 100-500pg/m3: ±10%
Minimum distinguishable particle diameter	0.3pm
Power supply	5VI-0.1V (Ripple < 100mV)
Max working current	100mA
Working temperature	-10°C-60°C
Working humidity	0-95%RH(non-condensing) -30°C-70°C
Storage temperature	
Response time	<I.5s
Resolution	1139/n3
Maximum dimensions	47.9×36.8×11.8mm

Connector Pinout



Connector Definition

Pin	Name	Description
I	VCC	5V
2	VCC	5V
3	GND	
4	GND	
5	NC	N/A
6	NC	N/A
7	RX	UART RX output ,TTL@3.3V
8	NC	N/A
9	TX	UART TX output ,TTL@3.3V
10	CTRL	Control pin, active at high level, level voltage: 3.3V; inactive at low level

Communications Protocol

Serial communication protocol: 9600 N1 (Baud rate: 9600, length: 32 bytes, parity: none, stop bit: 1).
Serial communication reporting period: 1.5s

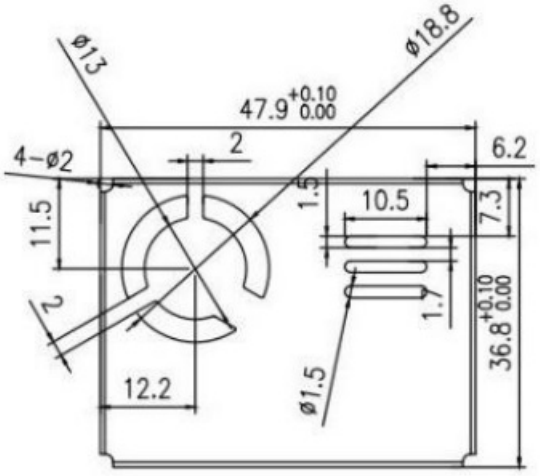
Name	Description	Note
Start bit 1	0x42	Frame header
Start bit 2	0x4D	
The upper 8bits of frame length	0x00	Frame length
The lower 8 bits of frame length	0x1C	
The upper 8 bits of data 1	0XXX	PM1.0 concentration, unit μg/m³
The lower 8 bits of data 1	0XXX	
The upper 8 bits of data 2	0XXX	PM2.5 concentration, unit μg/m³
The lower 8 bits of data 2	0XXX	
The upper 8 bits of data 3	0XXX	PM10 concentration, unit μg/m³
The lower 8 bits of data 3	0XXX	
The upper 8	0XXX	PM1.0

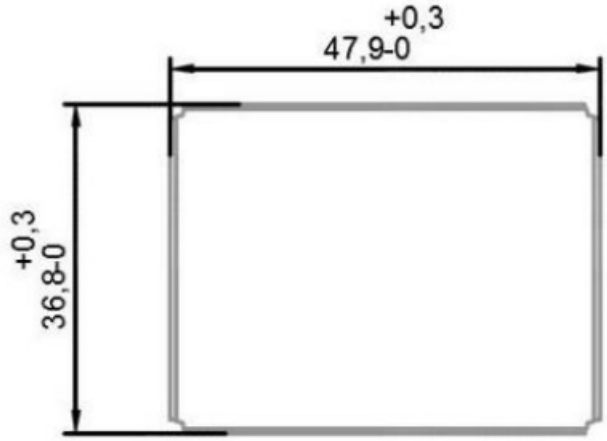
bits of data 4		concentration, unit pg/m3 (atmospheric environment)
The lower 8 bits of data 4	OXXX	
The upper 8 bits of data 5	OXXX	PM2.5 concentration, unit μg/m3 (atmospheric environment)
The lower 8 bits of data 5	OXXX	
The upper 8 bits of data 6	OXXX	PM 10 concentration, unit μg/m3 (atmospheric environment)
The lower 8 bits of data 6	OXXX	
The upper 8 bits of data 7	OXXX	Particle (diameter> 0.3pm) count/O.IL
The lower 8 bits of data 7	OXXX	
The upper 8 bits of data 8	OXXX	Particle (diameter> 0.5pm) count/O.IL
The lower 8 bits of data 8	OXXX	
The upper 8 bits of data 9	OXXX	Particle (diameter> 1.0pm) count/O.IL
The lower 8 bits of data 9	OXXX	
The upper 8 bits of data 10	OXXX	Particle (diameter> 2.5pm) count/O.IL
The lower 8 bits of data 10	OXXX	
The upper 8 bits of data 1 I	OXXX	Particle (diameter> 5pm) count/O.IL
The lower 8 bits of data 1 I	OXXX	
The upper 8 bits of data 12	OXXX	Particle (diameter > 10pm)

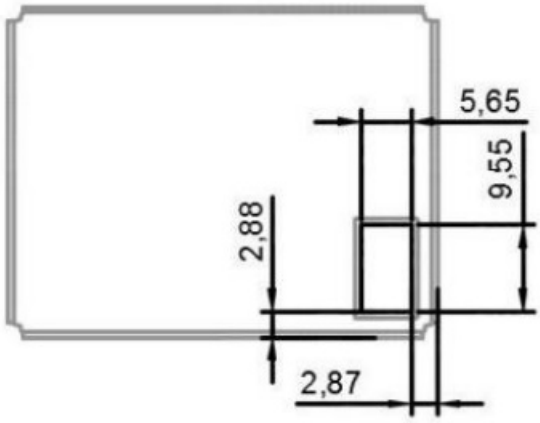
Typical Output Features

The lower 8 bits of data 12	OXXX	count/O.IL
The upper 8 bits of data 13	Ox80	Reserve
The lower 8 bits of data 13	Ox00	
The upper 8 bits of checksum	OXXX	CRC check from start bit to the lower 8 bits of data 13
The lower 8 bits of checksum	OXXX	

Dimensions

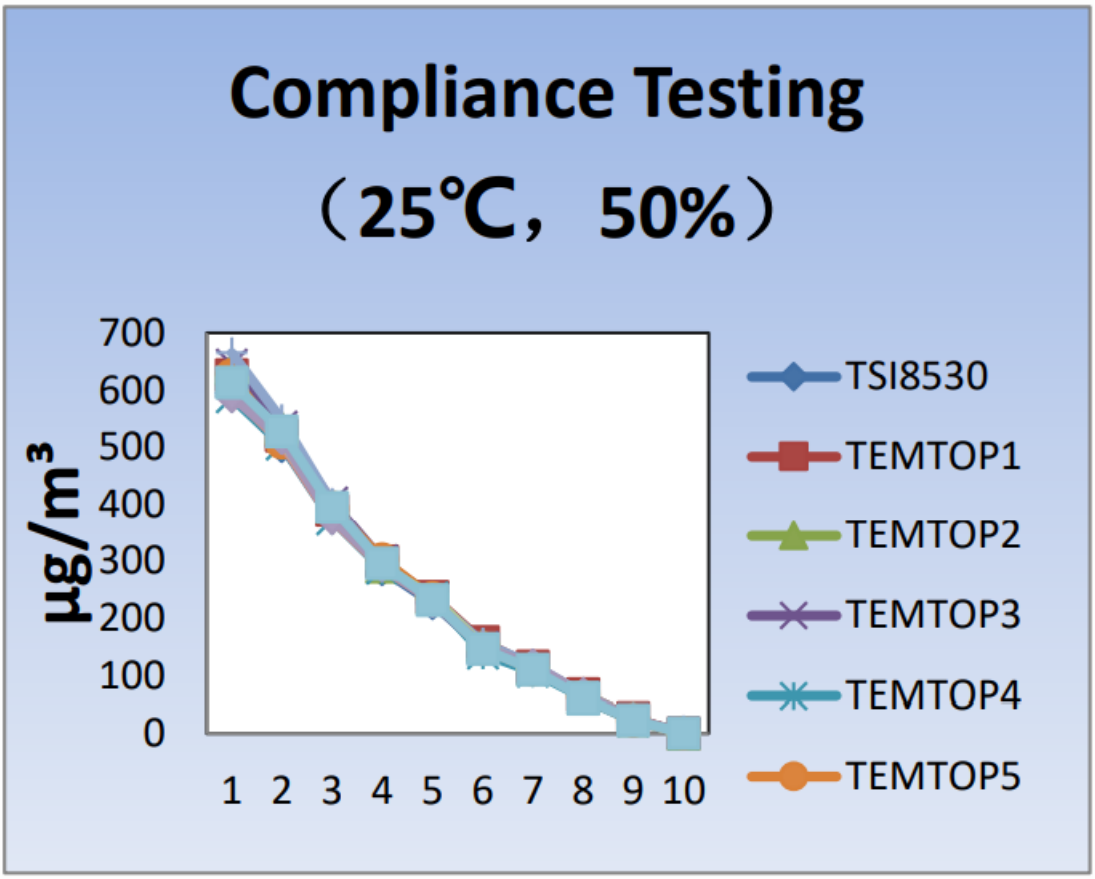




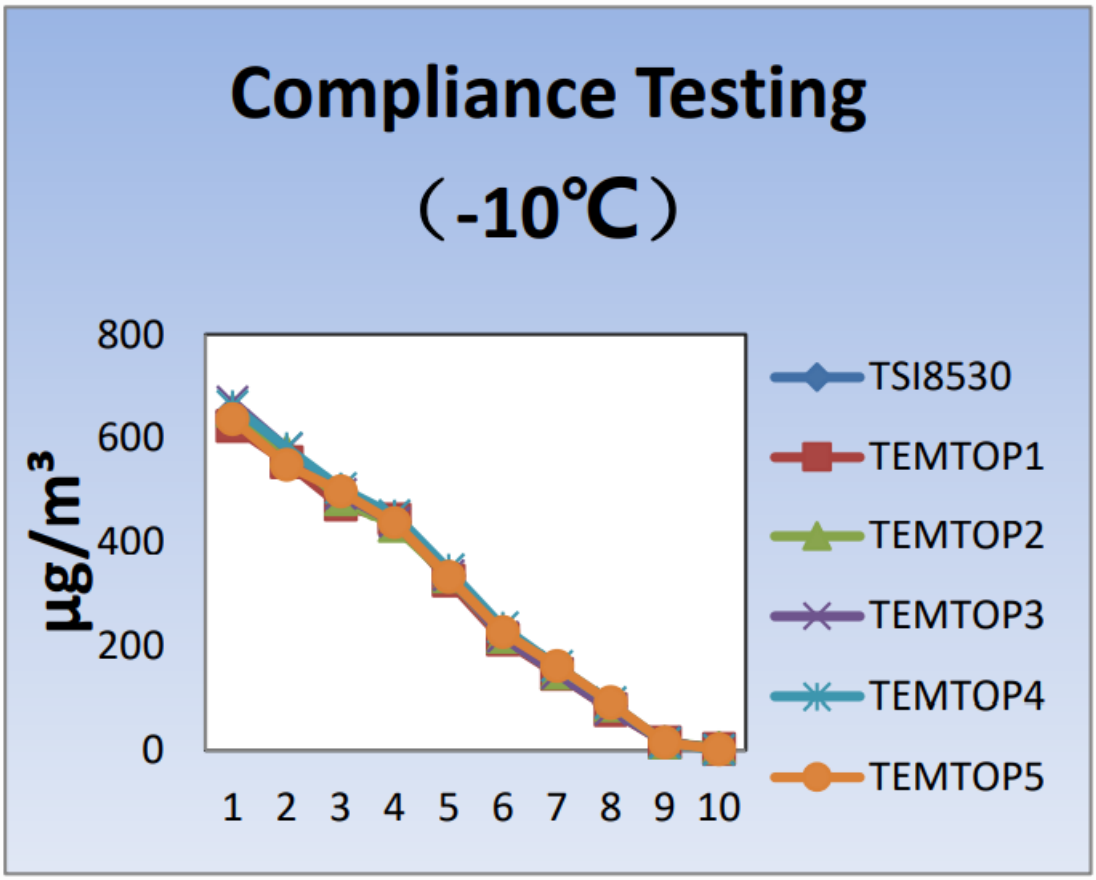


Unit: mm

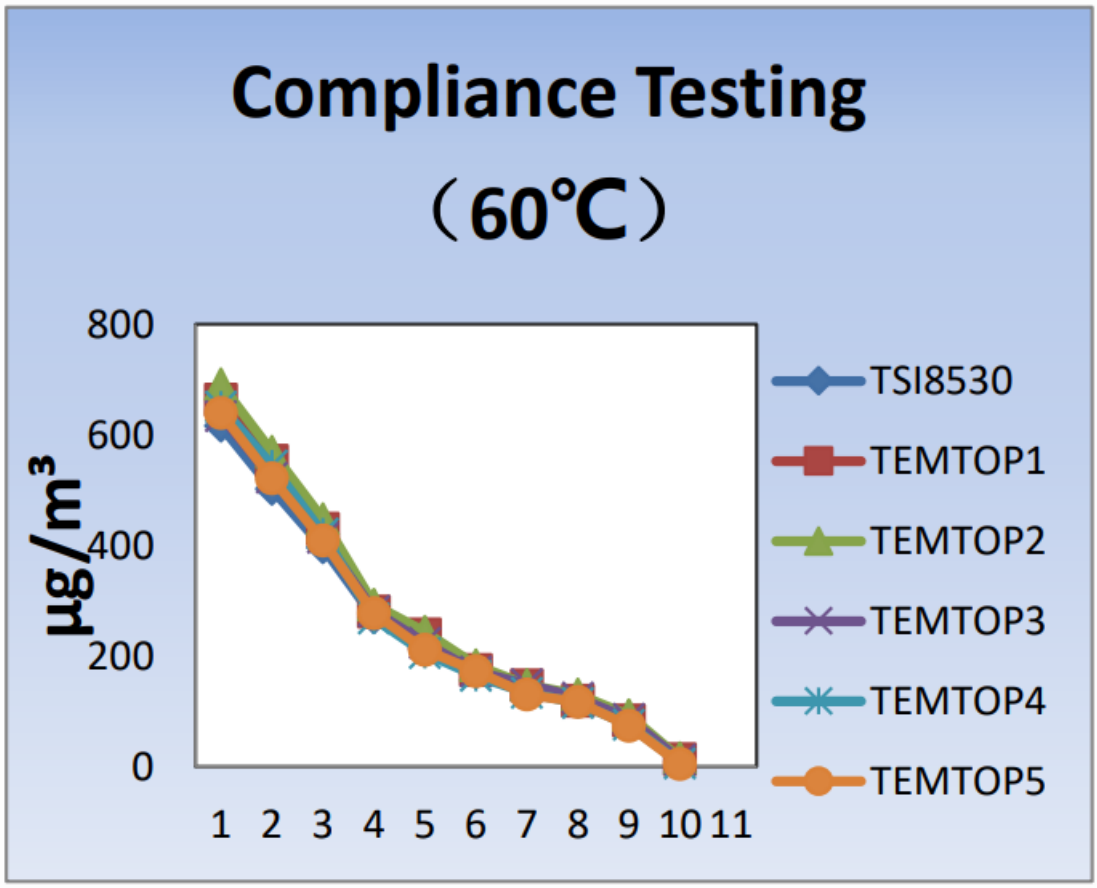
9.1 Compliance at room temperature



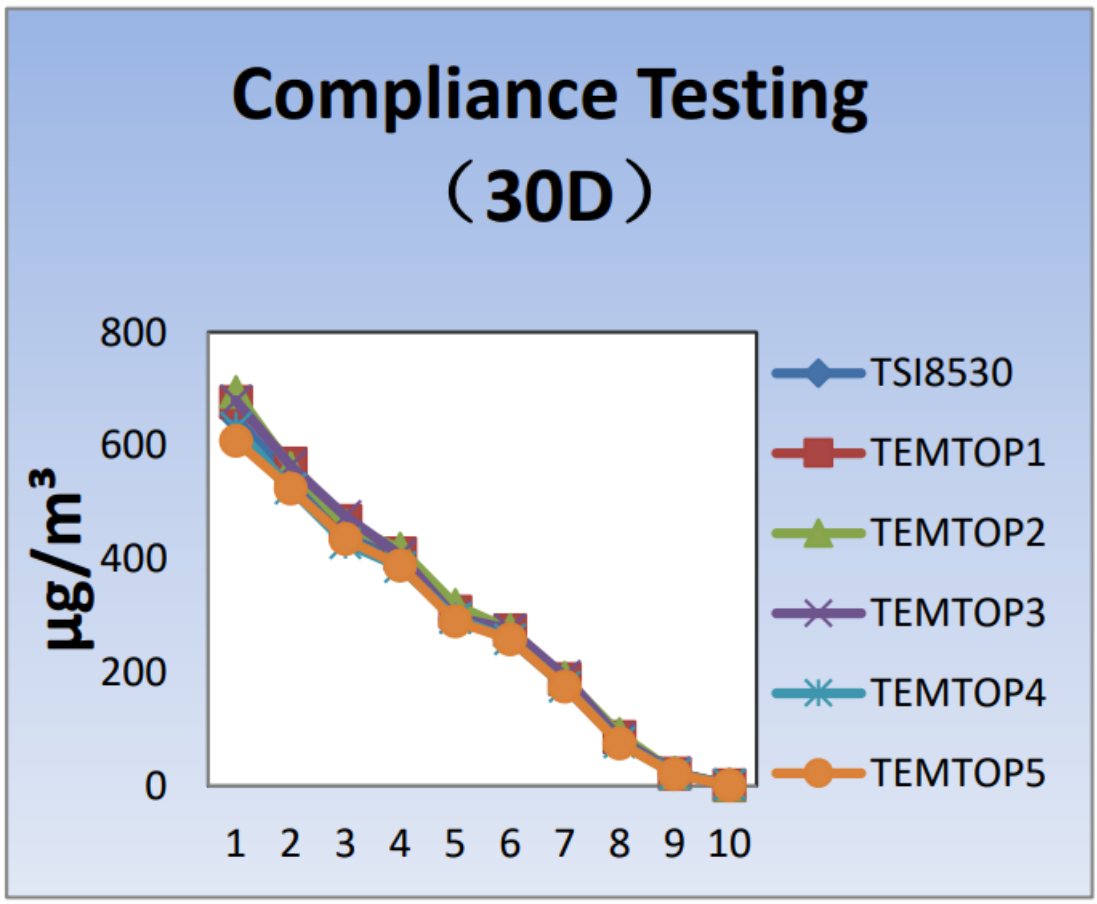
9.2 Compliance at low temperature



9.3 Compliance at high temperature



9.4 Compliance after long term running



Reliability Testing

No.	Test item	Unit	Technical requirements	Quantity	Test result	Result
1	Stores at low temperature	–	Store the sensors for 500 hours at -30 ℃±2℃, then place them at room temperature for 2 hours, and check the compliance.	5pcs	Compliance: 0-100μg/m³: ±10; 100-500μg/m³; ±10%; 500-700 μg/m³; ±15%; The fan has no obvious abnormal sound; the appearance is not deformed; the output value is stable.	Pass
2	Stores at high temperature	–	Store the sensors for 500 hours at 70 ℃±2℃, then place them at room temperature for 2 hours, and check the compliance.	5pcs		Pass
3	Stores at high temperature and humidity	–	Place the sensors powered off at 70 ℃±2℃and 90-95%RH for 500 hours, then put them at room temperature for 2 hours and test the compliance.	5pcs		Pass
4	Power on and off	–	Power on the sensors for 5 minutes and then power off for 5 minutes. Repeat such operations for 1000 times. Sample 10 points from 0 to 700μg/m³ in the testing device. All data complies with the requirements.	5pcs		Pass
5	Operates at low temperature	–	The sensors run for 48 hours continuously at -10℃±2℃. Sample 10 points from 0-00μg/m³ to in the testing device. All data complies with the requirements. Keep placing the sensors to 120 hours and sample 10 points from 0 to 700μg/m³. All data complies with the requirements.	5pcs		Pass
6	Operates at high temperature	–	The sensors run for 48 hours continuously at 60℃±2℃. Sample 10 points from 0 to 700μg/m³ in the testing device. All data complies with the requirements. Keep placing the sensors to 120 hours and sample 10 points from 0 to 700μg/m³. All data complies with the requirements.	5pcs		Pass

7	Cycle testing at high and low temperature	–	Place the sensors powered off at 60 ℃ for 4 hours, and then put them at -20℃ environment in 30 seconds for 4 hours. Repeat such operations for 5 times. Place them at room temperature for 2 hours and check the compliance.	5pcs	Compliance: 0-0μg/m³:±15;100-500μg/m³;±15%; 500-700μg/m³;±20%; The fan has no obvious abnormal sound; the appearance is not deformed; the output value is stable.	Pass
8	Operates at high temperature and humidity		The sensors continuously run for 2 days at 60℃and 85%RH. Sample 10 points from 0 to 700μg/m³ in the testing device. All data complies with the requirements. Keep placing the sensors to 5 days and sample 10 points from 0 to 700μg/m³. All data complies with the requirements.	5pcs		Pass
9	Operates at low temperature and humidity	–	The sensors continuously run for 48 hours at -10℃ and 20%RH. Sample 10 points from 0 to 700μg/m³ in the testing device. All data complies with the requirements. Keep placing the sensors to 120 hours and sample 10 points from 0 to 700μg/m³. All data complies with the requirements.	5pcs		Pass
10	Operates at room temperature and high humidity	–	The sensors continuously run for 48 hours at 25℃±2℃ and 85%RH. Sample 10 points from 0 to 700μg/m³ in the testing device. All data complies with the requirements. Keep placing the sensors to 120 hours and sample 10 points from 0 to 700μg/m³. All data complies with the requirements.	5pcs		Pass

11	Dusty test	–	Put 2g dry cement at 25℃ and 40%RH in a test chamber and use a fan to blow it. Add 2g dry cement every 24 hours. Keep the sensors running for 48 hours in the chamber. Then place the sensors in a normal test chamber. Sample 10 points from 0 to 700μg/m³. All data complies with the requirements. Repeat the testing once and sample 10 points from 0 to 700μg/m³. All data complies with the requirements.	5pcs		Pass

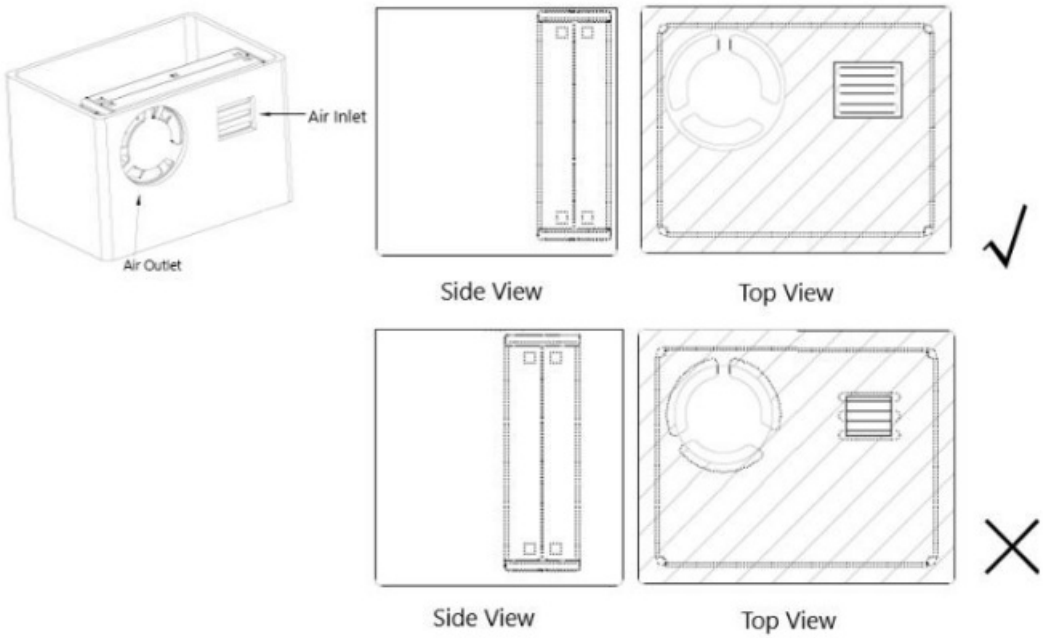
12	Automobile exhaust test	–	Keep the test chamber at 25℃ and 40%RH, add 20ml gasoline into the tin furnace and evaporate it at 200℃ for 30 minutes. Use a fan to blow in the chamber. Repeat such operations every 12 hours and continue for 2 days. Sample 10 points from 0 to 700μg/m³. All data complies with the requirements. Keep placing to 4 days; sample 10 points from 0 to 700μg/m³. All data complies with the requirements.	5pcs		Pass
13	Cooking fume test	–	Keep the test chamber at 25℃ and 40%RH, add 20ml cooking oil into the tin furnace and evaporate it at 200℃ for 30 minutes. Use a fan to blow in the chamber. Repeat such operations every 12 hours and continue for 2 days. Sample 10 points from 0 to 700μg/m³. All data complies with the requirements. Keep placing to 4 days; sample 10 points from 0 to 700μg/m³. All data complies with the requirements.	5pcs		Pass
					Compliance: 0-100μg/m³:±15; 100-500μg/m³;±15%;	

14	Mixed gas test	–	Test the sensors in automobile exhaust, cooking fumes and dusty environment for 6 days in total (2 days for each test). After all tests finish, sample 10 points from 0 to 700μg/m³ in the chamber. All data complies with the requirements.	5pcs	500-700μg/m³;±20%; The fan has no obvious abnormal sound; the output value is stable.	Pass
15	Operate for a long period	–	Place the sensors powered on at room temperature for 30 days and sample 10 points from 0 to 700μg/m³. All data complies with the requirements.	5pcs		Pass
16	Vibration	–	Keep the 10 test chamber at 20°C and 50% humidity. Vibrate the sensors under the conditions: vibrational frequency 50Hz, accelerated velocity 9.8/S2, direction of vibration x, y, z, amplitude	5pcs		Pass
			of vibration (vertical direction) ±2mm, test duration 60 minutes in x, y, z direction respectively. The particulate generator puffs smoke and the air purifier regulates. Apply DC 5V on the sensors to test their compliance.			
17	Zero drift	–	The sensors run for 2 hours and full-span drift is no more than ±15% of standard reading.	5pcs		Pass
18	Full-span drift	–	The sensors run for 2 hours and full-span drift is no more than ±15% of standard reading.	5pcs		Pass

19	Operating current	mA	≤100	5pcs		Pass
20	Electrical fast transient burst	I/O Port	The sample sensors work normally after being tested at 4kV peak voltage (level 4) and 5/100kHz group pulse frequency.	5pcs		Pass
21	Electrostatic discharge (ESD)	–	No abnormal phenomena happen after contact discharge with senor port surface at 1KV test voltage and other surfaces at 8KV (level 4) test voltage.	5pcs		Pass
22	Surge (Shock)	–	Industrial level 4.	5pcs		Pass
23	Drop	–	The sample sensors drop freely at 1m height twice from different angles. Then power on the sensors and they function normally.	5pcs		Pass
24	Salt spray test	–	Place the sensors in a salt spray test chamber at 35℃, apply 5% sodium chloride solution to pray them for 48 hours. Then clean them up with water. No red rust is generated on their surface.	5pcs	No rust or color change on the metal pieces.	Pass

Installation and Operation Precautions

- The product is used on household appliances. Please do not use it in the fields that require high safety and dependency, such as medical treatment, mining industry, disaster prevention, etc.
- The product adopts non-electrostatic adsorption materials. Please avoid using it in harsh and dusty environment. It is suggested to close the air inlet after use.
- When installing the product, make sure the air inlet and outlet unblocked without large air stream in. Installation mode refers to the following figure.



- It is best to keep the air inlet and outlet close to the blowhole of the internal surface of user's appliance and communicating with the outside. If not, keep the space around the air outlet unobstructed in 2cm. A structure should be formed to separate the air inlet from the air outlet so that the airflow from the air outlet cannot flow back to the air inlet.
- The blowhole of user's appliance prepared for the air inlet should not be smaller than the air inlet itself. When applied to a purifier, the product should not be placed directly in the air channel of the purifier. If it has to do so, set an independent structure to put the product in to separate from the air channel of the purifier.
- When applied to a fixed detection device, the sensor should be placed 20cm above the ground. Otherwise, it may cause the fan to be blocked by surficial dust particles or even floccules.
- When applied to an outdoor fixed device, the product should be protected from sand storm, snow and rain or flocs. Do not damage, dissemble the product, including its metal shielding case.
- Install the product in the place that cannot be directly touched by human body, because the metal part of the case connects with the DC ground of its internal circuit board; if touched, it will cause safety problems of the whole product's DC ground. It can only be touched after power off.
- To keep the data of the sensors consistent after leaving factory, we don't take the third party detecting instrument or data correction standard. If user insists, please try to fit the data according to actual collected samples.
- The sensor is for indoor use. If users' device is used in the following environment, additional protection structure should be applied to the sensor. Otherwise, its data compliance may drops due to accumulation of dirt, oil, water, etc.

  1) Smoking room where the time with yearly dust load above 400μg/m3 is longer than 60% of a year, or the time with yearly dust load above 650μg/m3 is longer than 35% of a year.

  2) Lampblack environment, e.g. kitchen.

  3) High mist environment, e.g. SPA, shower room.

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Documents / Resources

	Temtop PM900M Laser Particle Sensor [pdf] User Manual PM900M Laser Particle Sensor, PM900M, Laser Particle Sensor, Particle Sensor, Sensor

References

- Digital Data Logger & HVAC Tools for Cold Chain – Elitech Technology, Inc.
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