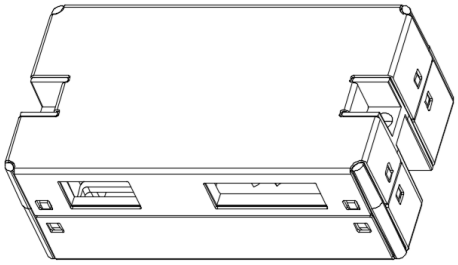
Laser Particle Sensor module

PM-S1

Features



- ✧ Principle of laser scattering
- ✧ 100% calibration in factory
- ✧ Constant fan speed control
- ✧ Long life laser
- ✧ Unique algorithm and compensation to get high accuracy
- ✧ Optimized structure and aerodynamic design
- ✧ EMI/EMC
- ✧ Good reliability

Product Series

Series / Model	Standard	Common	Slim	Infrared Upgrade	Mini Type	Outdoor	Infrared Type
PM-D4	★						
PM-G3		★					
PM-E5	★	☆					
PM-G7		★	★				
PM-G7M		★	★				
PM-T7	★	☆	★				
PM-T7M	★	☆	★				
PM-R3				★			
PM-H3		★					
PM-S1	☆	★			★		
PM-SP1						★	
PM-A3							★

★：Available in all cases ☆：Available in some cases

Standard Series ： Patented product

Common Series ： Compatible with other models in the market

Slim Series ： Slim design, only 12mm thick

Mini Type Series ： Designed for space saving, mini size

Infrared Upgrade ： Laser scattering principle, used to upgrade mainstream infrared sensors on the market

Outdoor Series ： Specially designed for the harsh outdoor environment

Infrared Type Series ： Infrared principle, low cost

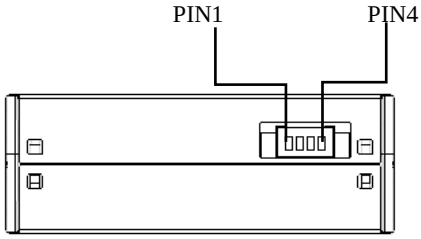
Specification

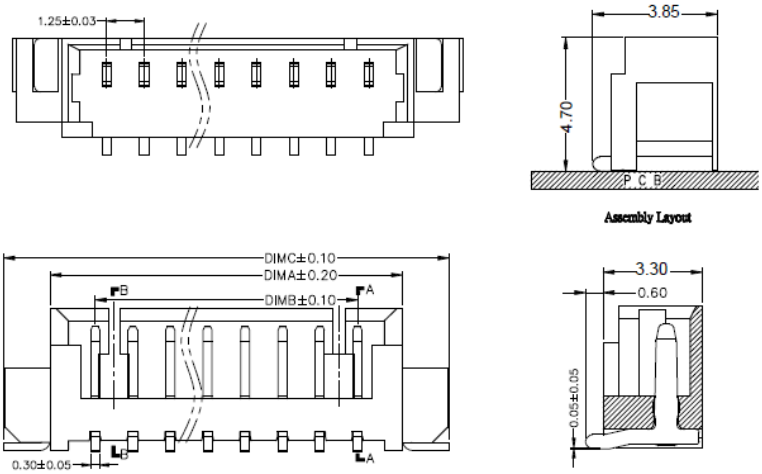
Item	Type
Range with good Accuracy (PM2.5 concentration)	0～500μg/m^3
Maximum measurement range (PM2.5 concentration)	1000μg/m^3
Resolution(Particle mass concentration)	1μg/ m^3
Minimum particle size	0.3μm
Maximum consistency error (PM2.5 concentration)（25±5）℃，(50 ±10)%RH，	±10%， @（100～500 ）μg/ m^3 ±10μg/ m^3， @ （0～100 ）μg/ m^3
Response Time	≤3s
Data Output	UART@3.3V
	PWM
I/o electric	（VIH）：1.8V ~5V
	（VIL）<0.8V
	（VOH）>2.9V
	（VOL）<0.4V
Power supply	5V（4.8V~5.5V）
Working Current	<100mA
Operation temperature/humidity	(–10～60) ℃ / (0～99)% RH（non-condensation）
Storage temperature	–30℃ ～70℃
Size	45*24.5*16.5 mm
MTTF	>30000hrs

Note:

Range with good consistency:The measuring range to ensure the nominate consistency .

I/O Interface Definition



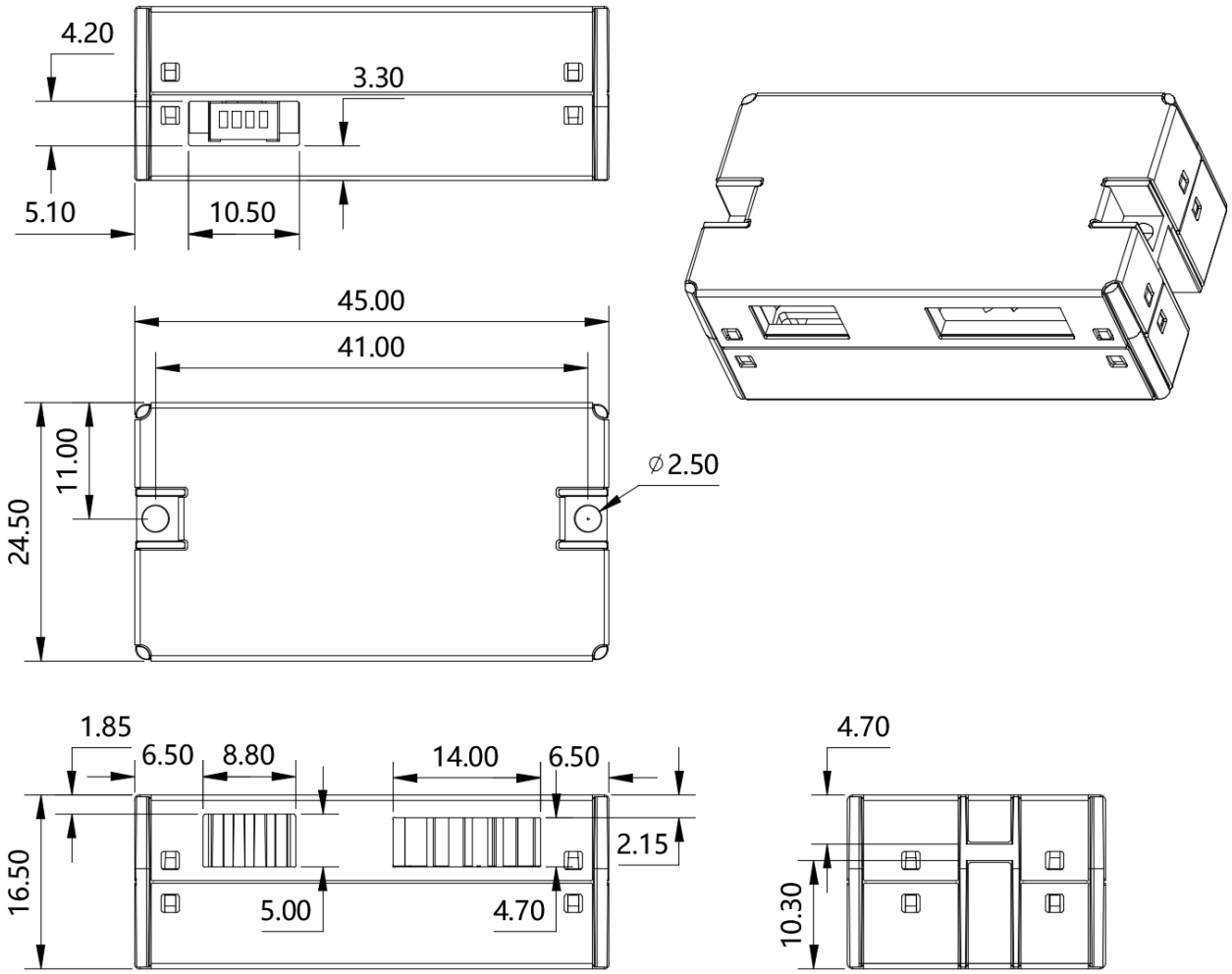


4 PIN Connector

Pin Description

PIN NO.	Name	PIN Description
PIN1	TXD	UART Digital Output
PIN2	RXD	UART Digital Input
PIN3	GND	Ground
PIN4	VCC	Power Supply

Dimensions （Unit : mm）



Communication Protocol

- **TTL（3.3V）**
- **Baud Rate：9600Kbps ,Check Bit：none ,Stop Bit：1**

Master send command format

Start bite	Length	Command bite	Data bite 1	……	Data bite 1	Checksum
HEAD	LEN	CMD	DATA1	……	DATAn	CS
11H	XXH	XXH	XXH	……	XXH	XXH

Specification of the communication format

Starter	Master sent [11H], Slaver module responsive【16H】
Length	Frame Length=Length of data+1 （CMD+DATA）
Command bite	Command bite
Data bite	Data that read or write in，Length adjustable
Checksum	Checksum=256-（HEAD+LEN+CMD+DATA）

Definition of the CMD

No.	**Description**	**CMD code**
1	Measurement function is switched from ON/OFF	0x0C
2	Read the data from the Slaver sensor	0x0B

Example：

1) Switched ON/OFF of the measurement function of the slaver sensor

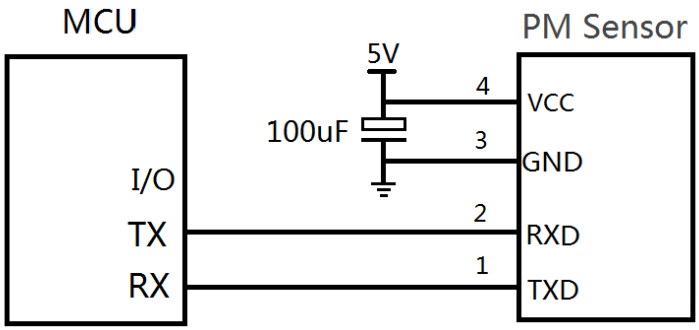
Send ： 11 03 0C DF1 1E C2
Response： 16 02 0C DF1 CS
Function：Switched ON/OFF of the measurement function of the slaver sensor
Description： 1、 In the send CMD，DF1=2 switch on the measurement ，DF1=1 stop the measurement 2、 In the response CMD，DF1=2 switch on the measurement ，DF1=1 stop the measurement 3、 When the sensor receives the measurement CMD, it start the continuous measurement by default. .
E.g. 1 ： Send： 11 03 0C 02 1E C0// Switch on of the measurement Response： 16 02 0C 02 DA// The slaver sensor is on the measurement mode
E.g. 2 ： Send： 11 03 0C 01 1E C1// Switch off of the measurement

Response： 16 02 0C 01 DB// The slaver sensor is stop of the measurement mode

2) Read the measurement value of the particle concentration

Send： 11 02 0B 01 E1
Response： 16 11 0B DF1 DF2 DF3 DF4 DF5 DF6 DF7 DF8 DF9 DF10 DF11 DF12 DF13 DF14 DF15 DF16 [CS]
Function：Read the particle concentration value from the slaver sensor（μg/ m^3）
Description： 1、 PM2.5 concentration =DF1*256^3+DF2*256^2+DF3*256+DF4 2、 PM10 concentration=DF5*256^3+DF6*256^2+DF7*256+DF8 3、 Definition the data bite： 16 11 0B 00 02 83 C9 00 00 00 EC 00 00 00 67 00 00 00 00 2D PM2.5 PM10 Reserved Reserved

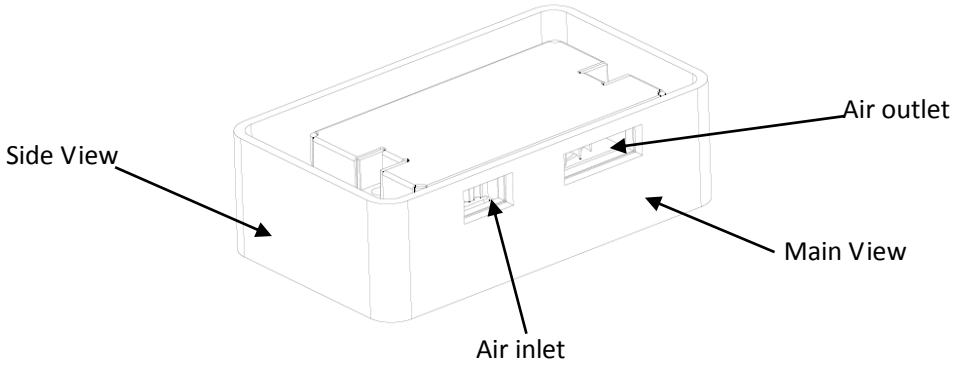
Circuit Design

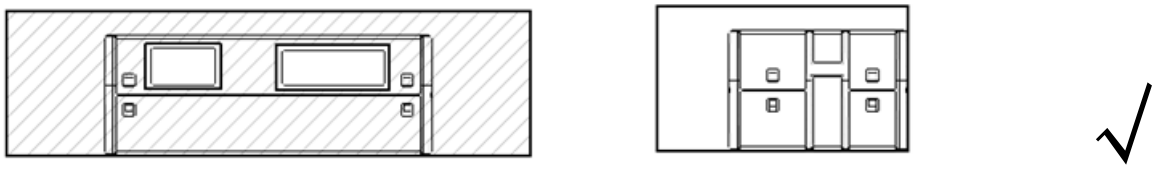


Note of the circuit design:

1. The sensor is 5V power supply. The sensor has no reverse protection. It cannot be reversed connected. It is recommended to add a 100 μ F capacitor to the power supply for filtering.
2. UART communication pins are 3.3V level interfaces.
3. PIN2 is the RXD port. If not use it recommended to be not connected.

Structural Design





Main View　　Side View

Main View　　Side View

Note

1. Mounting and fixed：The sensor recommended Secured by clamping, embedding, and bonding；
2. Inlet and outlet cannot be intercepted between the measurement environment;
3. Inlet and outlet where the plane must be close to the out wall of the device, and the use of air duct design with the outside, as cannot be achieved, the inlet and outlet should be structured to ensure the airflow in and out isolation;
4. The inlet and outlet of the equipment should be greater than or equal to the size of the sensor inlet and outlet, and ensure that all the inlet are exposed.
5. Equipment designed air duct do not have corners, to ensure the airflow can be measured and go into the sensor ;
6. When the sensor is applied to purifier products, it is necessary to avoid placing the sensor directly in the purifier's own air duct; if it is unavoidable, it is necessary to design a separate structural space to install the sensor to isolate the air inlet and outlet of the sensor from the air duct of the purifier.
7. When applied to purifiers or fixed testing equipment, the working position of the sensor should be higher than 20cm above the ground to prevent the large particles of dust and floccules in

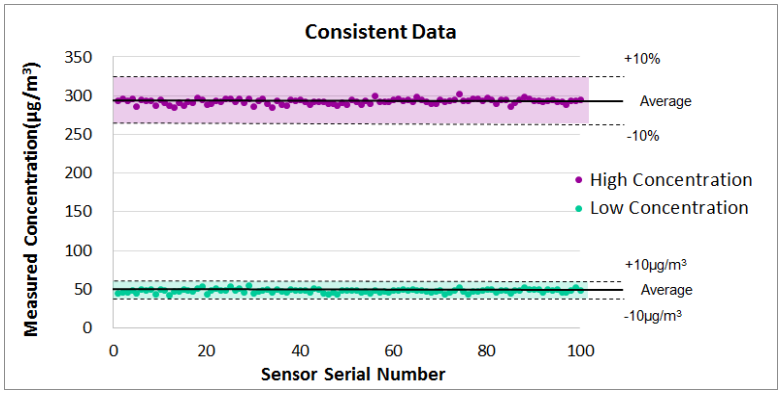
that causing the measurement error;

8. Sensor should be away from the higher fever and radiation components;
9. When the sensor is used in outdoor equipment, the protection of large particulate dust, rain and snow, catkins and so on should be completed by the structure of the equipment.

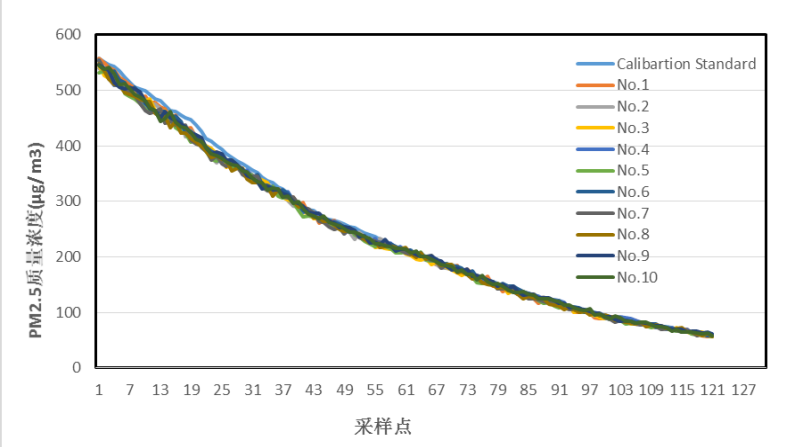
Others

1. Due to the electrostatic sensitive components on the module, installation and use of anti-static facility is necessary, such as wearing anti-static gloves;
2. In the process of installation, avoid non-standard operation such as hot swap;
3. Do not disassemble the sensor, or it will lead to irreversible damage;
4. The sensor is designed for indoor air quality measurement. If the equipment is working in the following actual environment, the necessary design should be added to make sure the sensor shows good consistency and long service life,
   a) the annual dust concentration greater than 300 micrograms per cubic meter for more than 50% of the time, or more than 500 micrograms per cubic meter for more than 20% of the time;
   b) a fume environment, such as a kitchen;
   c) high water fog environment, such as bathroom.

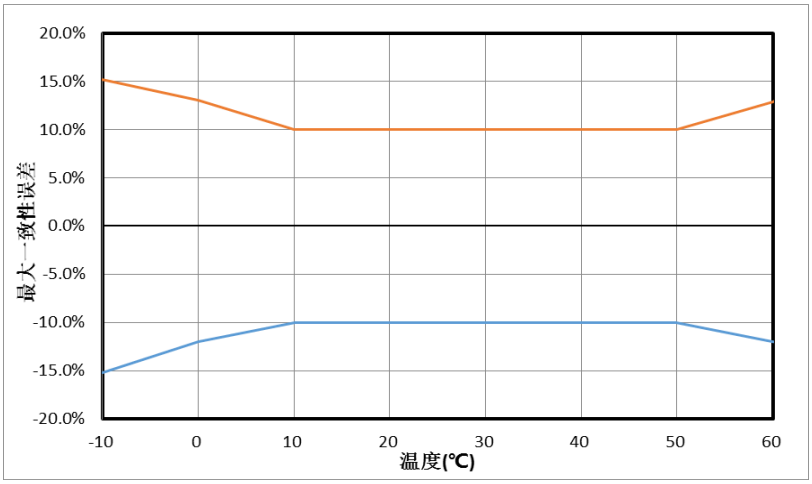
Enclosure 1. Characteristics: Accuracy & Uniformity



Randomly selected 100pcs sensors in the calibration room, In the high concentration the Uniformity tolerance is within 10%, In the Low concentration the Uniformity tolerance is within 10μg/m^3



Uniformity (25 degree Celsius & Range of 0 ~ 500μg/m3)



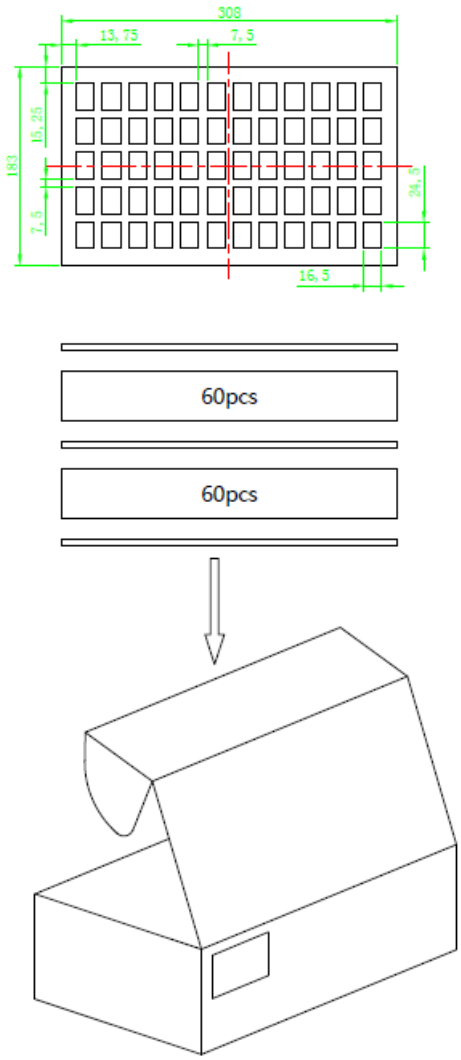
Temperature Characteristics(-10℃~60℃)(Temperature –Uniformity)

Note：The characteristic curve according to the test data of the PM-D4

Enclosure 2. Reliability

Item	Test Schedule	Acceptance standard
High temperature high humility storage	Constant temperature chamber, temperature 70 ℃, humidity (90 ~ 95)% RH; test duration: 96hours	After working for 2 hours at room temperature. 1. The test condition :temperature of (25 ± 5) ℃, humidity (50 ± 10)% RH, Cigarette smoke environment:(0 ~ 100) μg / m^3 range to meet the consistency error of less than ± 10μg / m3;(100 ~ 500) μg / m^3 range, to meet the consistency error of less than ± 10%; 2. Sensor has no abnormal sound and noise; 3. The output value is stable; 4. Normal appearance without distortion.
Low temperature storage	Constant temperature chamber, temperature -30 ℃; test duration: 96H	
Work Temperature characteristic	Standard temperature chamber, the temperature changes slowly, from -5 ℃ ~ 50 ℃, every 10 ℃ constant 20mins, measuring the sensor .(temperature includes and cover the highest and lowest value)	1. The test condition :temperature (25 ± 5) ℃, humidity (50 ± 10)% RH, Cigarette smoke environment: (0 ~ 100) μg / m^3 range, to meet the consistency error less than ± 15μg / m3; (100 ~ 500) μg / m^3 range to meet the consistency error of less than ± 15%; 2. Sensor has no abnormal sound and noise; 3. The output value is stable; 4. Normal appearance without distortion.
Long term performance	Temperature (25 ± 5) ℃, humidity (20 ~ 70)% RH, running time 1000hours	
Vibration test	1.30 m^3 temperature room, temperature (25 ± 5) ℃, humidity (50 ± 10)% RH; 2. Vibration frequency 50HZ, amplitude 2mm, X \ Y \ Z direction test 1H	
Power fluctuations	1.30 m^3 temperature room, temperature (25 ± 5) ℃, humidity (50 ± 10)% RH; 2. Adjust the power supply, 4.5V-5V-4.5V, voltage gradient of 0.1V / min, 500 rounds	
High temperature operation	Constant temperature chamber, temperature 60 ℃, test time: 360h	After working for 2 hours at room temperature. 1. The test condition :temperature (25 ± 5) ℃, humidity (50 ± 10)% RH, Cigarette smoke environment: (0 ~ 100) μg / m^3 range, to meet the consistency error less than ± 15μg / m3; (100 ~ 500) μg / m^3 range to meet the consistency error of less than ± 15%; 2. Sensor has no abnormal sound and noise; 3. The output value is stable; 4. Normal appearance without distortion.
Low temperature operation	Constant temperature chamber, temperature -10 ℃; Test time: 360h	
Power switch test	DC 5V power supply, switching frequency 0.5Hz, duration of 100 hours (6000 rounds)	
Sleep PIN switch test	DC 5V power supply, Sleep level switch frequency 0.5Hz, duration of 100 hours (6000 rounds)	
Salt flog test	Concentration of 5% industrial brine, hydrolytic spray 48h, remove with the pure water, place 48h	Wash and remove with the pure water, put 48h .metal parts without rust and discoloration

Packing



Qty. per layer	Layer	Carton	Carton dimensions	Packing material
60pcs	2 Layers	120pcs	310*184*105	Pearl cotton(ESD)

Technical consultancy and After-sales services

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