

Laser Particle Sensor Module

PM3015



Description

PM3015 laser particle sensor module use light scattering principle, to measure and calculate the suspending particle number which is within unit volume on the air exactly. Then output particle mass concentration by mathematical algorithm and scientific calibration.

Working principle

To draw air into closed interior space and then take air sampling in certain proportion. When sampling particles pass through light beam (laser), there will be light scattering phenomenon. Scattered light will be converted into electrical signal (pulse) via photoelectric transformer. The bigger the particles are, the stronger the pulse signal will be (peak value). Based on peak value and number of pulses, particle quantity concentration can be calculated. After calibrated with standard instrument, particle mass concentration is obtained.

Main features

- ✧ Equipped with special high-efficiency production line, the production capacity is 5 times higher
- ✧ EMC meets industrial grade IEC61000 standards
- ✧ High reliability, with ROHS certification
- ✧ The smallest size of available measurement: 0.3 μ m
- ✧ Four types of measuring mode for option: single / continuous / timing / dynamic mode
- ✧ High sensitive and quick response
- ✧ Compacted structure, light weight, easy to install

Application

- ✧ Air purifier, air quality monitor
- ✧ Ventilation system, air conditioner with purifying function
- ✧ Auxiliary product of consumer electronic products

Table1 Cubic particle sensor module specification

Detection principle	Principle of light scattering
Measurement range	PM1.0: 0 ~ 500 μ g/m ³ PM2.5: 0 ~ 500 μ g/m ³ PM10: 0 ~ 500 μ g/m ³
Resolution	1 μ g/m ³
Working temperature	-25°C ~ +60°C
Storage temperature	-30°C~+70°C, 0~95%RH(non-condensing)
Working humidity	0~ 95%RH(non-condensing)
Maximum Consistency Error for PM1.0&PM2.5(0~150 μ g/m ³)	$\leq 100\mu\text{g/m}^3, \pm 10\mu\text{g/m}^3$ $> 100\mu\text{g/m}^3, \pm 10\%$ reading (Reference instrument: GRIMM Conditions: 25 \pm 2°C, 50 \pm 10%RH)
Respond time	1sec
Time to first reading	≤ 8 seconds
Power supply	DC 5V \pm 0.1V, ripple wave<50mV
Working current	<100mA
Standby current	<20mA
Dimensions	42mm \times 35mm \times 23.7mm
Digital output 1 (default)	UART_TTL_3.3V(default) I ² C_3.3V/5V(default)
MTTF	37,297hr (continuous turn on)

Internal architecture description

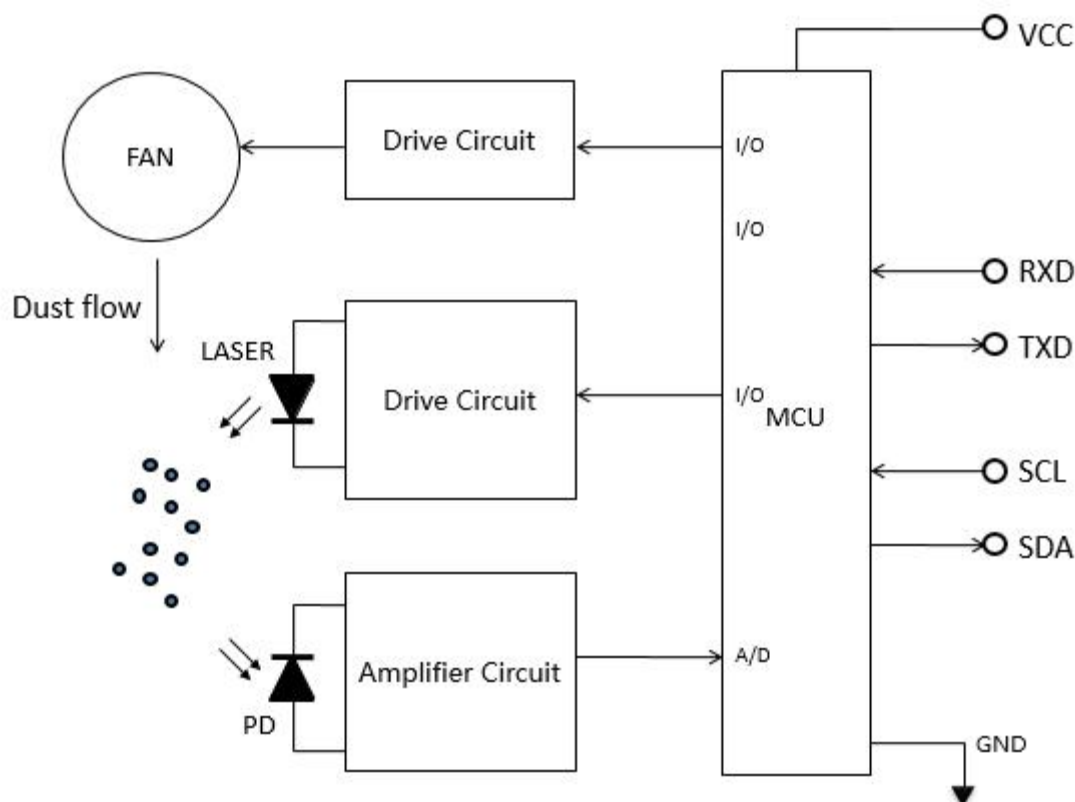
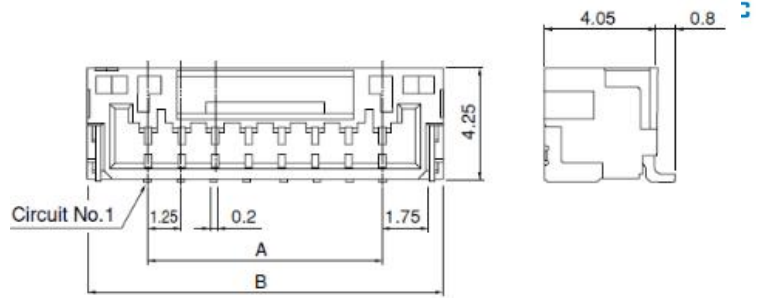
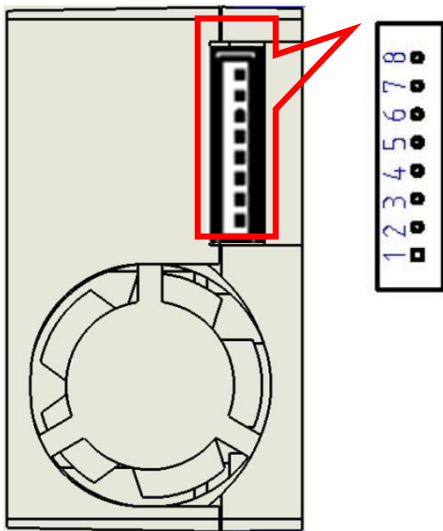


Figure 1. Internal configuration

The light source of the PM3015 consists of a laser tube that emits light to detect particles and a drive circuit. The detector consists of a photosensor that receives reflected light and an amplifier circuit. The data processing and communication outputs are performed by a microprocessor.

The principle of particle detection is that while in-flowed particle is passing by the measuring scope through fan flow, the lights from laser diode is scattered by particle and is recognized as a signal at photo diode. The signal from photo diode is transformed into a UART/PWM/IIC signals by MCU.

I/O definitions and Connector



Circuits	Model No.		Dimensions (mm)		Q'ty/ reel
	Top entry type	Side entry type	A	B	
2	BM02B-GHS-TBT	SM02B-GHS-TB	1.25	5.75	2,500
3	BM03B-GHS-TBT	SM03B-GHS-TB	2.50	7.00	2,500
4	BM04B-GHS-TBT	SM04B-GHS-TB	3.75	8.25	2,500
5	BM05B-GHS-TBT	SM05B-GHS-TB	5.00	9.50	2,500
6	BM06B-GHS-TBT	SM06B-GHS-TB	6.25	10.75	2,500
7	BM07B-GHS-TBT	SM07B-GHS-TB	7.50	12.00	2,500
8	BM08B-GHS-TBT	SM08B-GHS-TB	8.75	13.25	2,500
9	BM09B-GHS-TBT	SM09B-GHS-TB	10.00	14.50	2,500
10	BM10B-GHS-TBT	SM10B-GHS-TB	11.25	15.75	2,500

Figure 2. Connector Structure

I/O Connector Specification

No.	Pin	Description
1	NC	Vacant (Do not connect)
2	5V	Power input (+5V)
3	SCL	I ² C clock (3.3V/5V)
4	SDA	I ² C data (3.3V/5V)
5	NC	Vacant (Do not connect)
6	TXD	UART-TX output (0-3.3V)
7	RXD	UART-RX input (0-3.3V)
8	GND	Power input (ground terminal)

Connector Description (Connector can be customized)

Item	Pin spacing	Brand
JST SM08B-GHS-TB	1.25 mm pitch	JST

Typical application circuit

Case 1. UART application

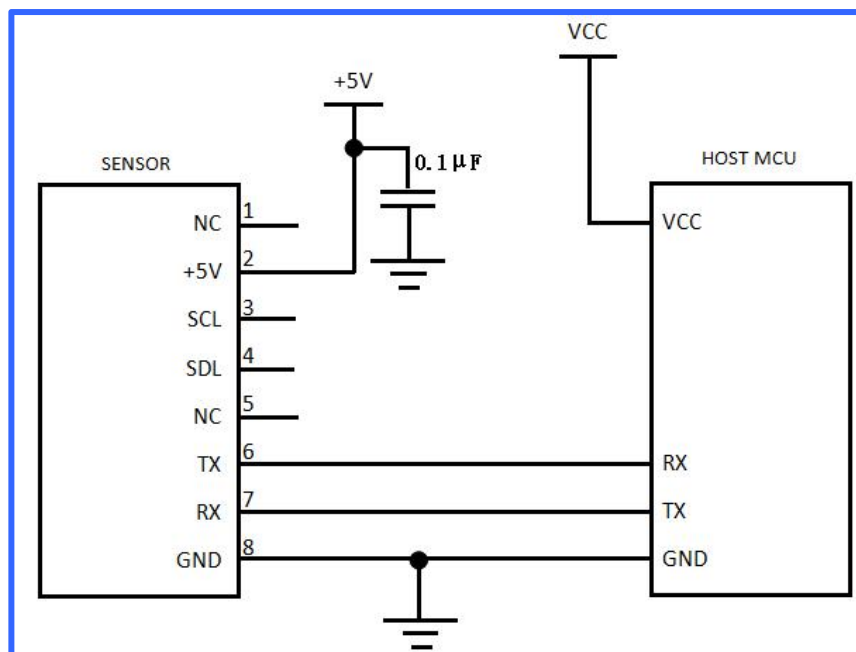


Figure 3. UART application circuit

Case 2. I²C application

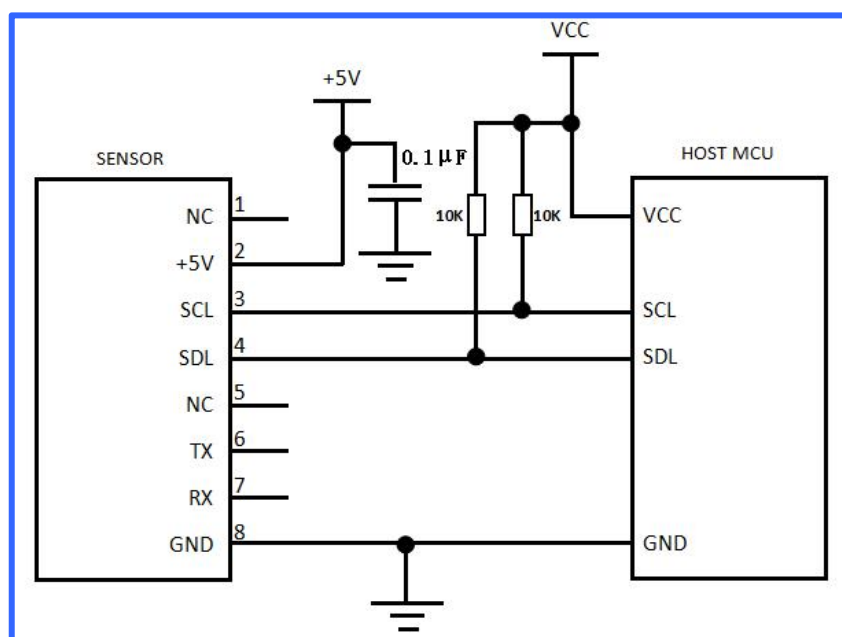


Figure 4. I²C application circuit

Case 3: 3.3V -5V Level Shift

RX, TX Level Shift

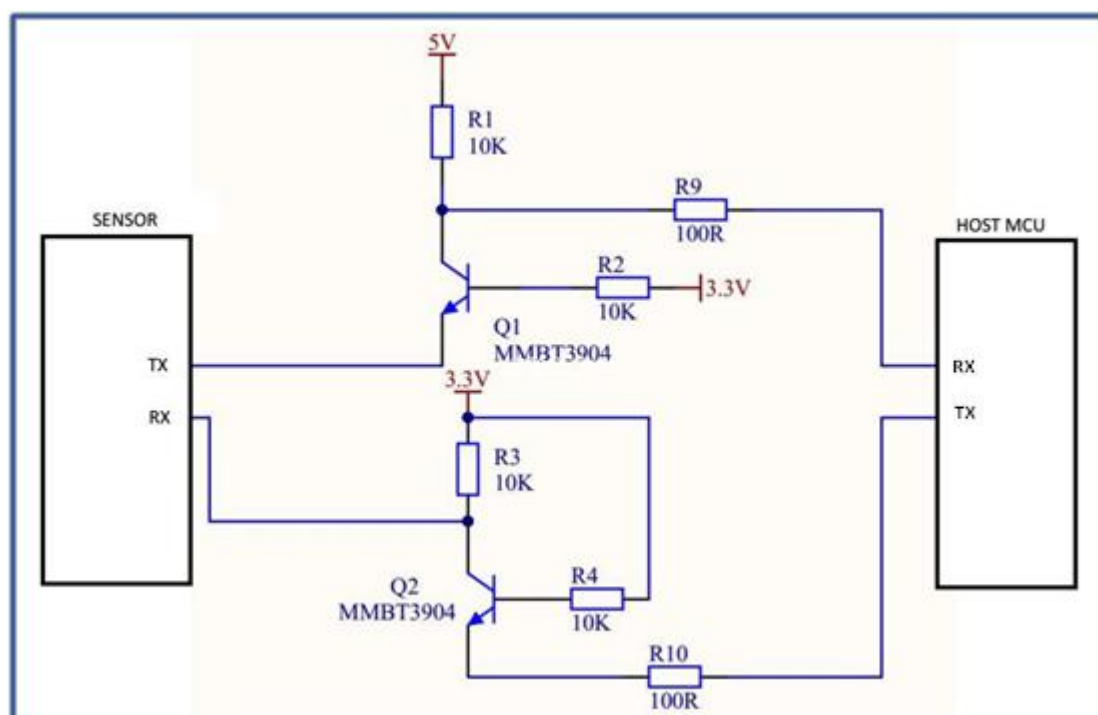


Figure 5. RX, TX Level Shift (3.3V-5V) Diagram

Dimension

Unit: mm, tolerances: $\pm 0.2\text{mm}$

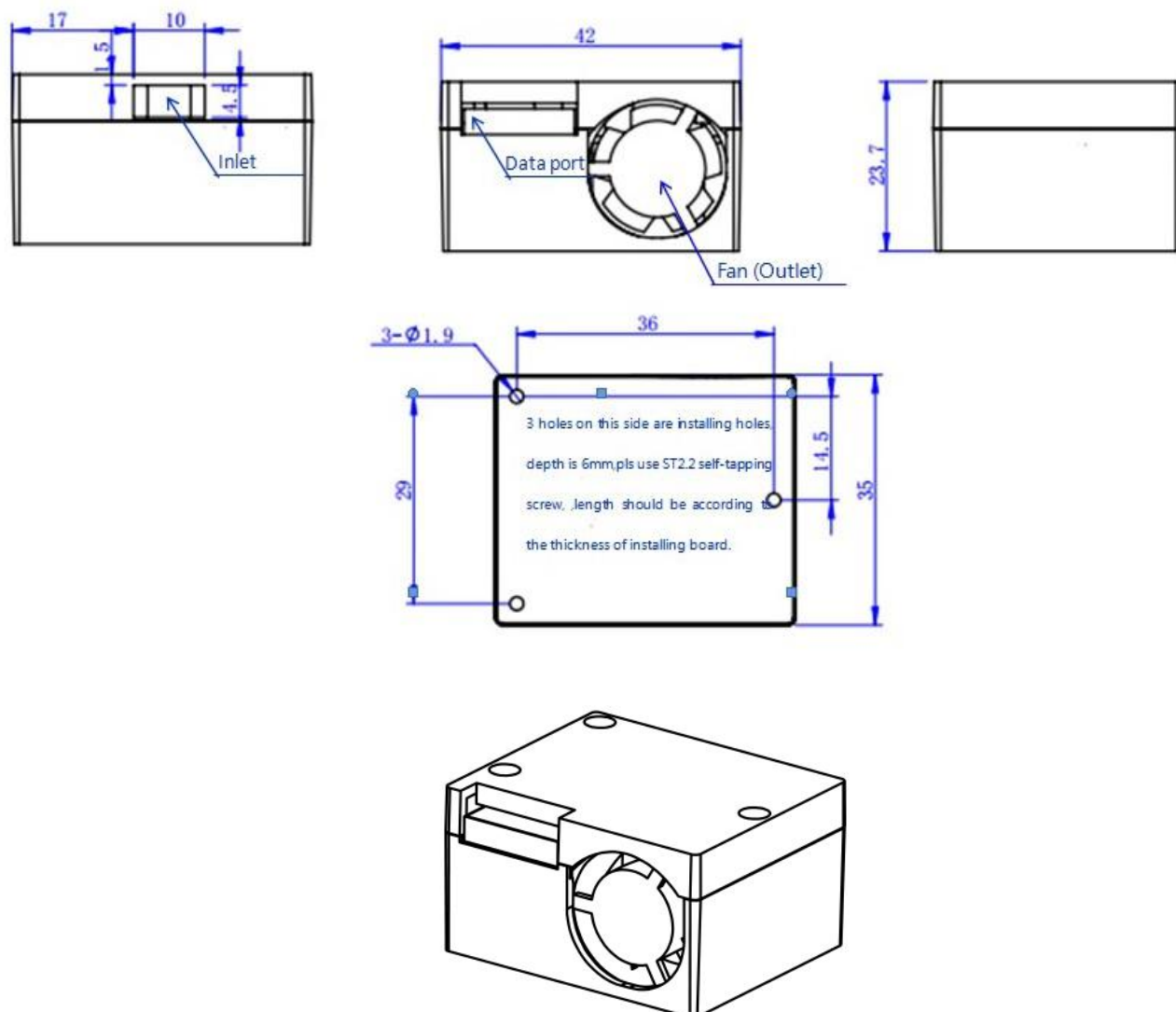


Figure 6. Dimension

No.	Test List	Test Condition	Standard	Sample qty: N Defective qty: C
1	High temperature and high humidity operation	Operating the sensor in the ambient of $40\pm 2^{\circ}\text{C}$, 95%RH, max voltage (within range of acceptable working voltage), for 500 hours.	The sensor works normally after 2 hours in the ambient.	N=10, C=0
2	High temperature storage.	Leave the sensor in the ambient of $70\pm 2^{\circ}\text{C}$, $(50\pm 10)\%$ RH for 96 hours without power on.	The sensor works normally after 2 hours in the ambient.	N=10, C=0
3	Low temperature storage.	Leave the sensor in the ambient of $-30\pm 2^{\circ}\text{C}$, $(50\pm 10)\%$ RH for 96 hours without power on.	The sensor works normally after 2 hours in the ambient.	N=10, C=0
4	High temperature working	Leave the sensor in the ambient of $60\pm 2^{\circ}\text{C}$, powered with nominal voltage for 96 hours.	The sensor works normally after 2 hours in the ambient.	N=10, C=0
5	Low temperature working	Leave the sensor in the ambient of $-25\pm 2^{\circ}\text{C}$, powered with max voltage (within range of acceptable working voltage) for 96 hours.	The sensor works normally after 2 hours in the ambient.	N=10, C=0
6	Thermal cycle	Leave the sensor in ambient of -30°C for 60mins then move it to ambient of $+70^{\circ}\text{C}$ for 60mins. Keep this cycle for 10 times. No control in temperature, and the sensor is power off.	The sensor works normally after 2 hours in the ambient.	N=10, C=0
7	Vibration test	10-55-10Hz/min, with amplitude of 1.5mm, vibrate in X, Y, Z direction, each direction for 2 hours.	The sensor works normally after 1 hour in the ambient.	N=4, C=0
8	Packaging drop test	Height of fall: Set according to the corresponding height of the weight specified in GB/T 4857.18 Test according to GB/T4857.5 packaging transport package drop test method. The drop test sequence is one corner, three edges and six sides	No damage, no breaking in appearance, No components drop off, no failure in working performance	n=1 c=0
9	Salt spray test	According to GB/T2423.17-2008, leave the sensor in the 35°C salt-fog cabinet, spray it with 5% sodium chloride saltwater for 24 hours. Clean the sensor after test.	Recovery under standard conditions is not less than 1h and not more than 2h. The appearance should be no bad and no corrosion.	N=2, C=0

User attention

- PM3015 laser particle sensor module is for household electronics products. For application of medical, mining, disaster preparedness, which need high security and high dependence, this sensor is not suitable.
- Please do not use it in bad dusty environment.
- Avoid using the sensor under situation with strong magnetic, such as situation close to stereo speaker, microwave oven, induction cooking.
- When install PM3015 sensor module in your system or equipment, please make sure of unobstructed air-inlet and air-outlet. And there is no huge airflow faced to air-inlet and air-outlet. **Correct installation position as below for reference:**

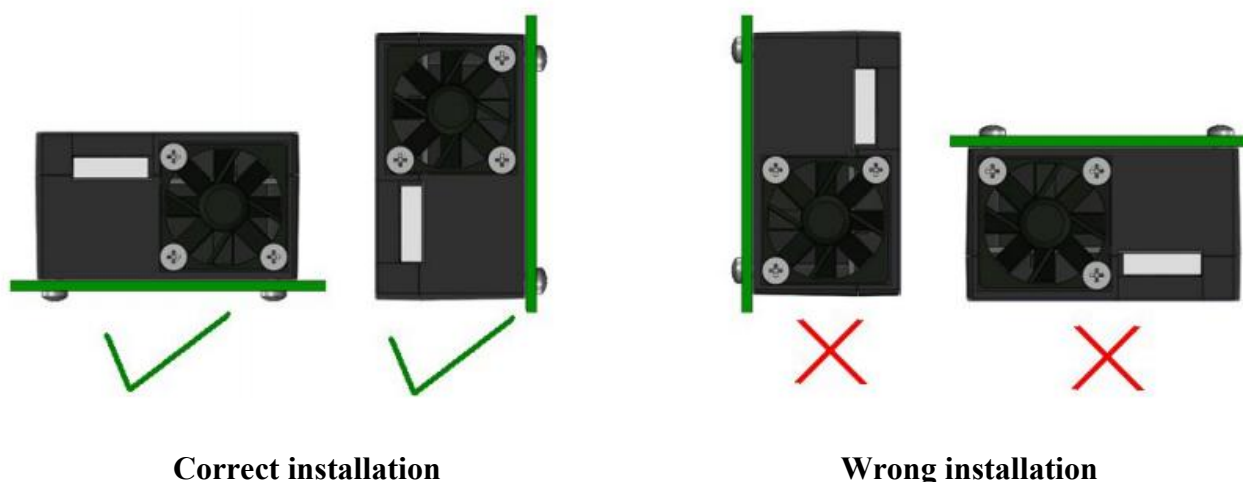
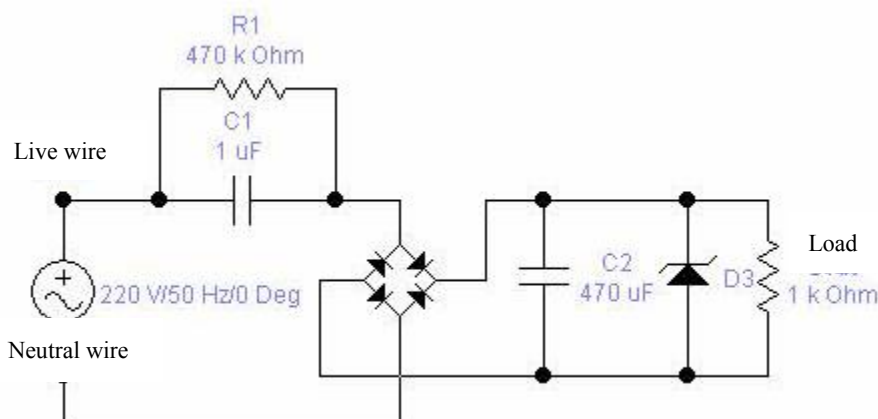


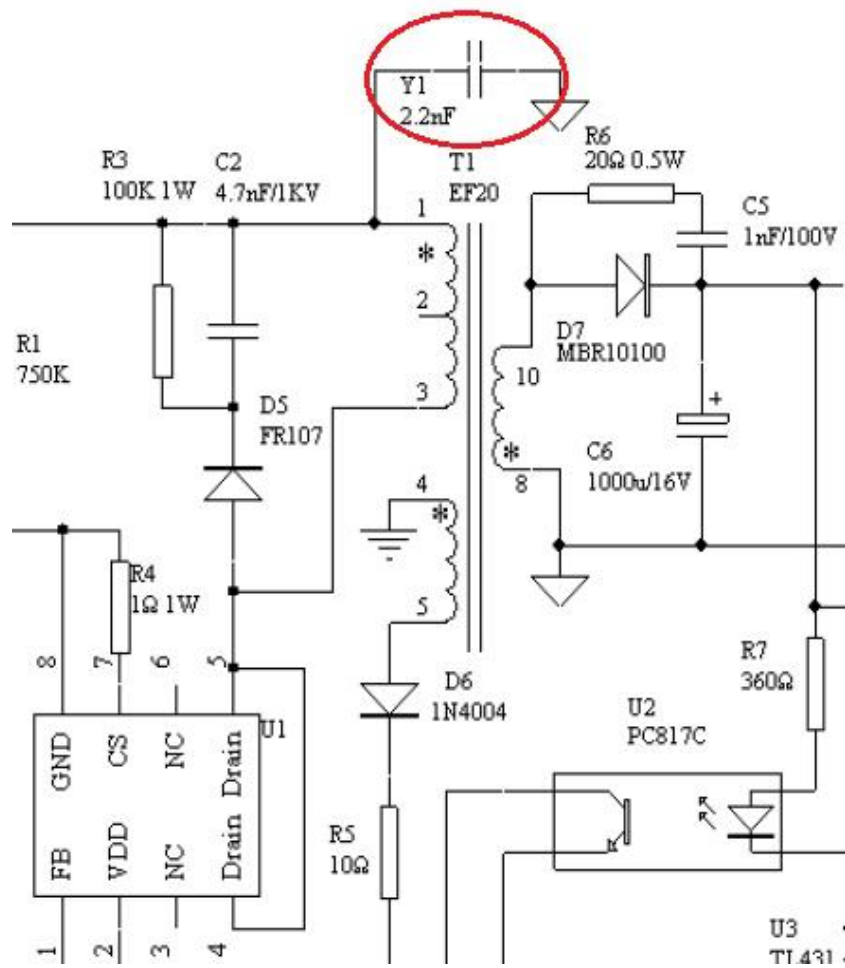
Figure 8. Installation Display

- Because the metal shell of the sensor relates to the DC ground of interior circuit board, it's dangerous to touch the sensor's DC ground. So please install the sensor somewhere human body cannot touch directly. Cut off the power before touching the sensor.
- The sensor has no high voltage instantaneous protection and other circuits. The power supply of the sensor should be stable 5V and low noise. Please refer to the working voltage of Table 1.
- The sensor needs 5V power supply because the fan needs a 5V power to drive. But all other data communication and control pins require 3.3V as a high level. Therefore, the main board MCU communication with the sensor should be the 3.3V communication level. If the main board MCU is 5V communication level, then it need to connect 5V to 3.3V level conversion chips or circuits outside the communication port (RX, TX) and control port (RET, RESET). Pls refer to figure 5.
- When RC is used to reduce voltage, be cautious that the metal shell will relate to either 220VAC live wire or the neutral wire.





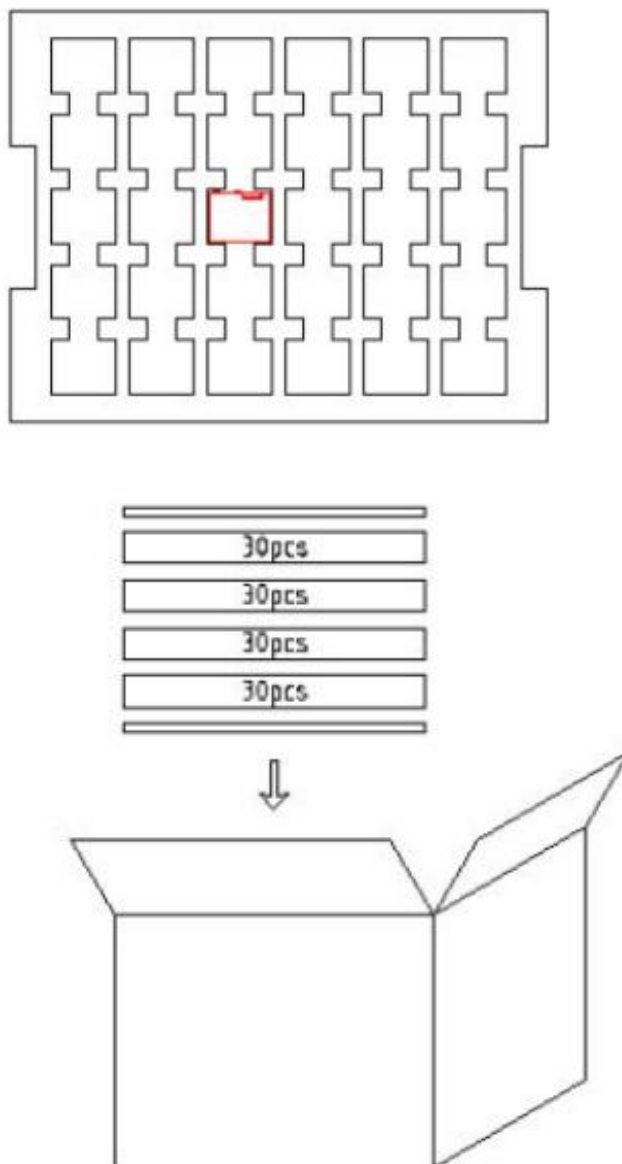
- If isolated switch power supply is adopted to obtain DC power, please control the capacitance between the DC ground and the AC ground below 2.2nF and withstand voltage reaches to 3KV.



- The sensor itself is safe to use, what you should be cautious is the safety of power supply and structure design on the sensor.
- This product is defined as a 3R class laser product according to "GB7247.1-2012 Safety of Laser Products". There is laser radiation inside and need to prevent direct exposure of the eyes. Warning logo shown as below.



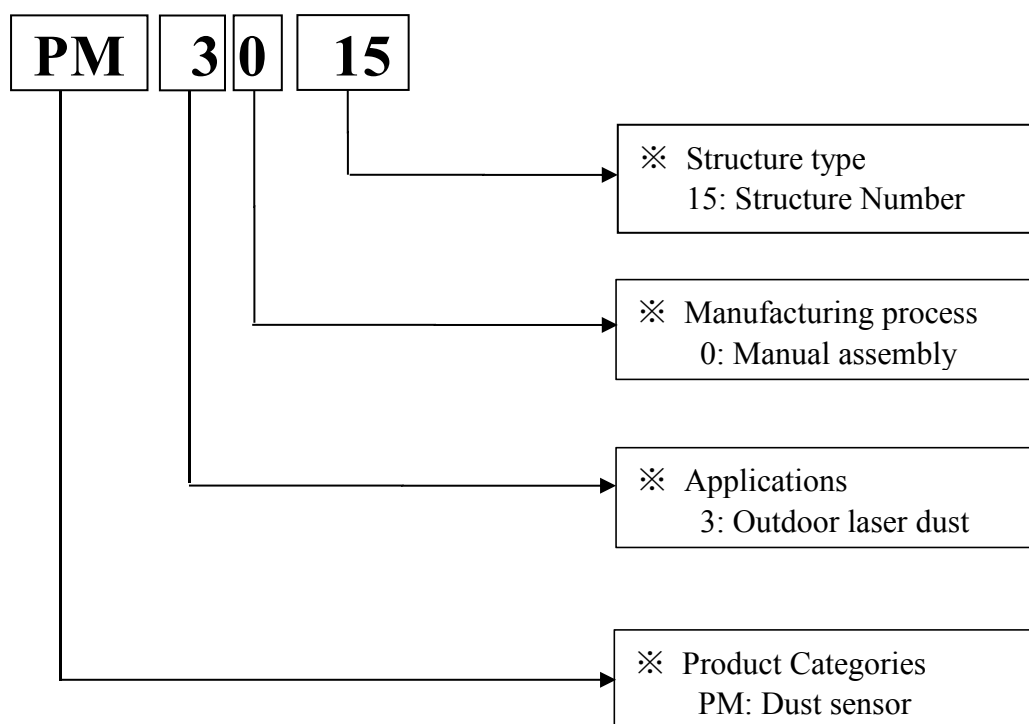
Packaging information



Packing description

Qty per layer	Layer	Carton	Carton dimensions	Packing material
30pcs	13 layers	390pcs	W480 * L400 * H320 mm	Red pearl cotton (ESD)

Ordering Information



After-sales services and consultancy

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