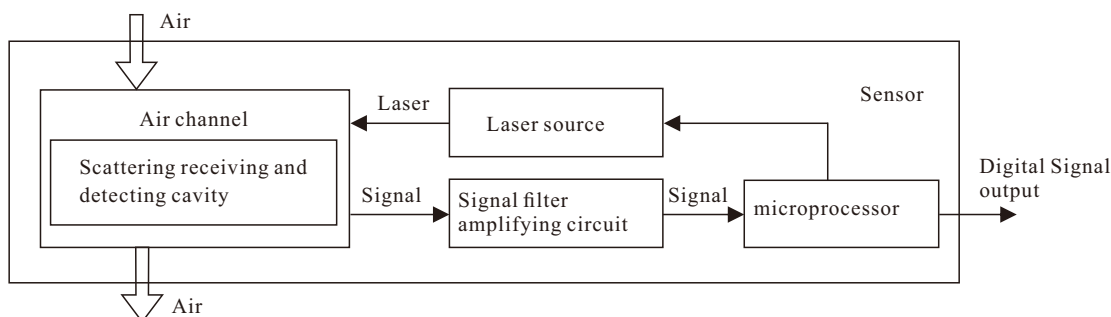# MPM-10B

LASER PARTICLE SENSOR

◆ Product Introduction

The MPM-10B sensor module uses the principle of optical scattering to detect the concentration of dust in the air. It can collect and calculate the number of suspended particles of different sizes in the air per unit volume, that is, the particle concentration distribution, and then convert it to mass concentration. The particle concentration value is output in the form of a universal UART digital serial port, or it can be output through the IIC serial port and PWM level signal number. The unit of counting data is pcs/0.1L, and the unit of concentration data is ug/m3. The sensor is applied in air purifiers, air conditioners with purification functions, fresh air systems and air quality testing instruments.

◆ Working Principle

According to the principle of laser scattering, the laser beam emitted by the laser irradiates the suspended particles in the air to produce scattering, and the laser photoelectric receiver is placed in a specific position to collect the scattered light, and the curve of the scattered light intensity with time is obtained. The micro-processing collects the electrical signal of the receiver in real time, and uses an algorithm based on MIE theory to obtain the equivalent particle size of the particles and the number of particles of different sizes per unit volume. The functional block diagram of the sensor is shown in the figure.

◆ Size and Structure

Single row seat:
Unit: mm

MPM-10B (a)
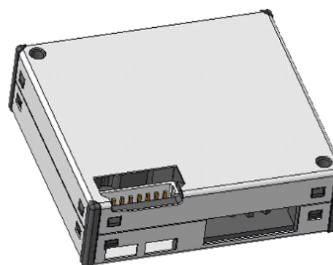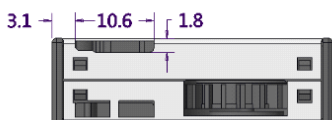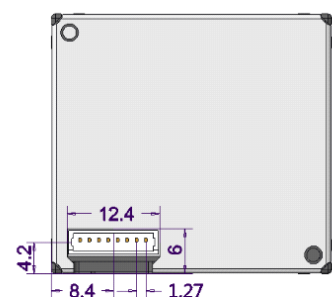
Only the size and position of the single-row data interface socket are marked. For other dimensions, please refer to the double-row socket size drawing in the previous figure.

Double row seat:
Unit: mm

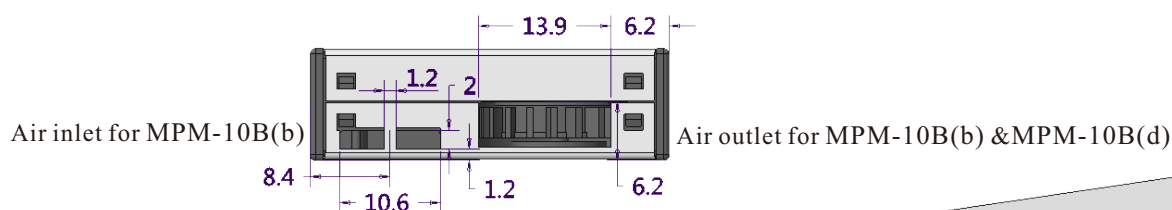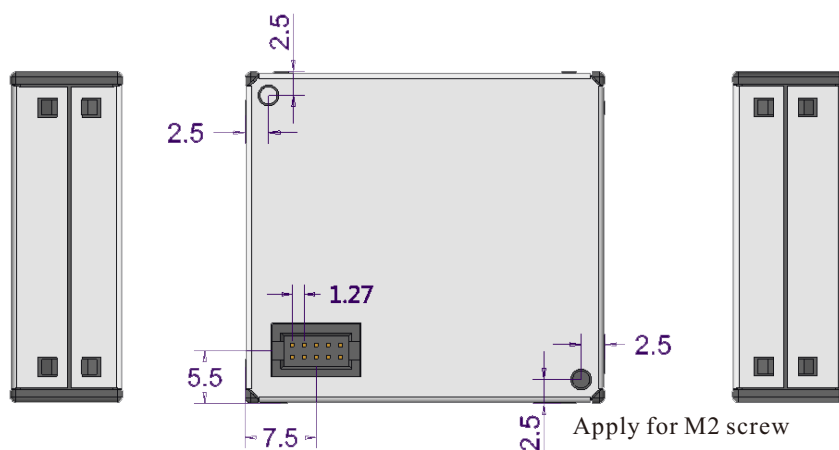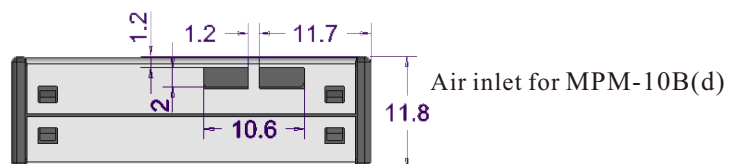Depending on different air inlet and outlet positions,
we differentiate by MPM-10B(b) ,MPM-10B(c) and MPM-10B(d) .

Air inlet for MPM-10B(d)

Apply for M2 screw

Air inlet for MPM-10B(b)

Air outlet for MPM-10B(b) &MPM-10B(d)

Air inlet/outlet for
MPM-10B(c)
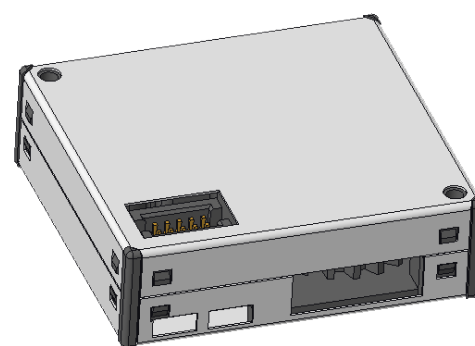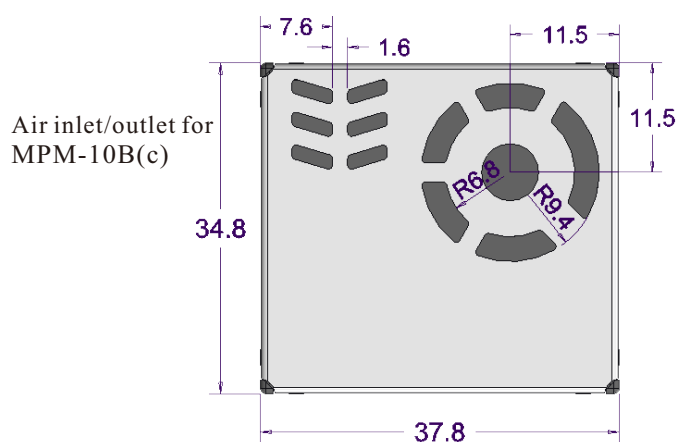
◆ Technical data

Parameter	Indicator	Unit
Detection particle size	0.3~1.0; 1.0~2.5; 2.5~10	μm
Particle counting efficiency	50% (@ 0.3μm), 98% (@ ≥0.5μm)	
Particulate matter concentration range (PM2.5 standard value)	0~1000	$μg/m^3$
Mass concentration resolution	Sensor type identifier, reading as fixed character "1"	$μg/m^3$
Mass concentration Consistency (PM2.5 standard value)	±10%(@100~500μg/m3) ±10μg/m3 (@ 0~100μg/m3)	
Standard volume	0.1	L
Single response time	≤1	s
Integrated Response time	≤10	s
DC supply voltage	Typ:5.0Min: 4.5Max: 5.5	V
Working Current	≤85	mA
Standby Current	≤45	μA
Data interface level	L < 0.8 (@3.3); H > 2.7(@3.3)	V
Operating Temperature Range	-10~+60	℃
Operating Humidity Range	0~99%	
MTBF	≥3	Y
Dimensions	37.8×34.8×11.8	mm

Remark:The consistency data of the particle concentration is the data in the communication protocol(See Appendix A), measuring environment temperature is 20℃, humidity 50%

Interface definition (double row seat / single row seat, 2 kinds of output interface)
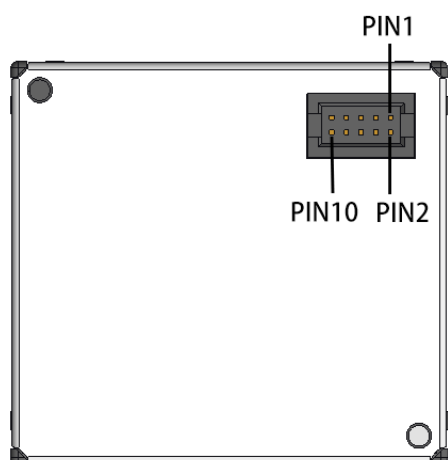
Double row 10 PIN connector
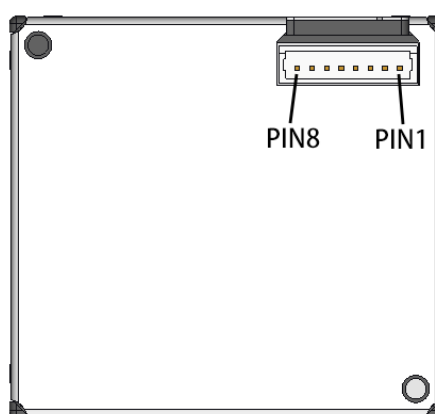
Single row 8 PIN connector

Interface socket pin spacing: 1.27mm

Pin number (double row seat)	Pin number (single row seat)	Functional Label	Explanation
Pin 1	Pin 1	VCC	Power supply positive +5V
Pin 2	--	VCC	Power supply positive +5V
Pin 3	Pin 2	GND	Power supply negative
Pin 4	--	GND	Power supply negative
Pin 5	Pin 6	Reset	Module reset signal, TTL level @3.3V, low level reset
Pin6	Pin 8	N/C	
Pin7	Pin 4	RX/SDA	Serial port receiving/IIC data pin, TTL level @3.3V
Pin 8	Pin 7	PWM	Connected to high or floating when powering on: the pin outputs PWM signal, and the data interface is UART; when powering on and connected to GND: no PWM signal is output, and the data interface is IIC. TTL level@3.3V
Pin 9	Pin 5	TX/SCL	Serial port send/IIC clock pin, TTL level @3.3V
Pin 10	Pin 3	En	Set the pin, high level or floating is the normal working state, low level is the dormant state, TTL level @3.3V

◆ Output result

1. Output the mass and number of particles of each concentration in a unit volume. The unit volume of the number of particles is 0.1 L, and the unit of mass concentration is $\mu g/m^3$.

2. The output mode is including two states: automatic output and passive output. After the sensor is powered on, the default state is automatic output, that is, the sensor will send the serial data to the host actively, time interval is 1 second.

Passive output is initiated by the motherboard MCU to query the command, every time it makes query instruction and the sensor responds to output the data accordingly.

◆ Application Circuit

Typical circuit connection diagram

Simplest circuit connection diagram
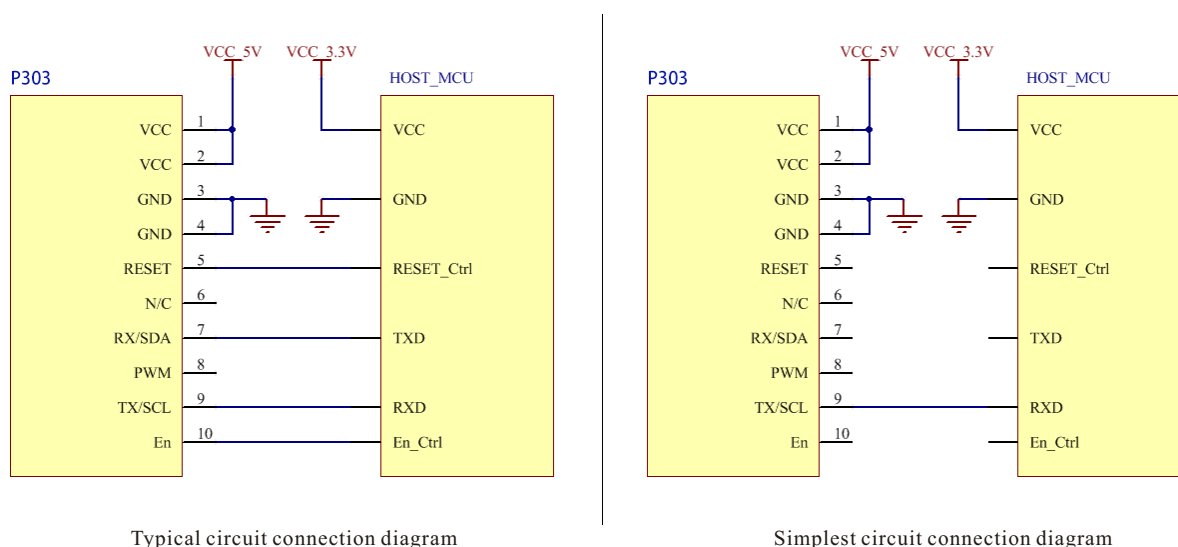
Pay attention to the Circuit design:

1. MPM-10B working voltage is 5V. The data communication and control pins are both 3.3V as the high level, so the motherboard MCU connected to the communication should be with 3.3V power supply. If the motherboard MCU is powered by 5V, need to add a level conversion chip or circuit on communication lines (RXD, TXD) and control lines (SET, RESET).

2. There is pull-up resistors in SET and RESET , if no need,please suspend it.

3. During the application of sleep function: the fan stops working in sleep status, and it takes at least 30s to stabilize after the fan restart. Therefore, in order to obtain accurate data, the sensor working time should not be less than 30 seconds after being awoken.

◆ Installation Precautions

1. The metal shell is electrically conductive to the internal power ground. Be careful not to short-circuit with other external board circuit or chassis shell.

2. The best installation way is the plane of air inlet and outlet is close to the air holes of the user's equipment, which connect the inner wall and external environment. If this is not possible, keep no occlusion within 2cm of the air outlet. There should be a structure between the air inlet and the air outlet to isolate the airflow, so that the airflow in user's equipment cannot directly backflow to the air inlet from the air outlet.

3. The vent on the inner wall of the user machine for the air inlet should not be smaller than the air inlet size.

4. When applied to purifier related products, do not directly put the sensor in the air duct of the purifier, and it should separately set up a separate structural space to place the sensor inside of it to isolate it from the air duct of the purifier.

5. When applied to purifiers or fixed detection equipment, the position of the sensor should be more than 20cm above the ground. Otherwise, it may be contaminated by large dust particles or even floccules near the ground, causing the fan to twine and cannot run.

6. When the sensor is applied to outdoor fixed equipment, the protection against sandstorms, rain and snow, and willow catkins should be completed by the equipment.

7. The sensor is an integral element, users should not disassemble it, including the metal shielding shell, in case bring irreversible damages.

8. The bottom of the sensor is fixed with 2mm self-tapping screws, and the length of the screw into the shell should not be longer than 3.0mm.

Appendix A

MPM-10B Automatic output data format

Default Baud Rate: 9600bps   Check Digit: None
No stop bit: 1 unit   Total length of data: 32 Byte

Serial No.	Numeric field	Value	Description
1	Start character1	0x42	(Constant)
2	Start character2	0x4d	(Constant)
3	Frame length high byte	**	Frame Length=2x13+2(data+check bit)
4	Frame length low byte	**	
5	Data 1 high byte	**	Data 1 means PM1.0 concentration (CF=1,standard particle matter) Unit $\mu g/m^3$ *
6	Data 1 low byte	**	
7	Data 2 high byte	**	Data 2 means PM2.5 concentration (CF=1,standard particle matter) Unit $\mu g/m^3$ *
8	Data 2 low byte	**	

9	Data 3 high byte	**	Data 3 means PM10 concentration (CF=1,standard particle matter) Unit $\mu g/m^3$ *
10	Data 3 low byte	**	
11	Data 4 high byte	**	Data 4 means PM1.0 concentration (CF=1, standard particle matter) Unit $\mu g/m^3$ *
12	Data 4 low byte	**	
13	Data 5 high byte	**	Data 5 means PM2.5 concentration (CF=1, standard particle matter) Unit $\mu g/m^3$ *
14	Data 5 low byte	**	
15	Data 6 high byte	**	Data 6 means PM10 concentration (CF=1, standard particle matter) Unit $\mu g/m^3$ *
16	Data 6 low byte	**	
17	Data 7 high byte	**	Data 7 means particles number of diameter above 0.3μm in 0.1L air
18	Data 7 low byte	**	
19	Data 8 high byte	**	Data 8 means particles number of diameter above 0.5μm in 0.1L air
20	Data 8 low byte	**	
21	Data 9 high byte	**	Data 9 means particles number of diameter above 1.0μm in 0.1L air
22	Data 9 low byte	**	
23	Data 10 high byte	**	Data 10 means particles number of diameter above 2.5μm in 0.1L air
24	Data 10 low byte	**	
25	Data 11 high byte	**	Data 11 means particles number of diameter above 5.0 μm in 0.1L air
26	Data 11 low byte	**	
27	Data 12 high byte	**	Data 12 means particles number of diameter above 10 μm in 0.1L air
28	Data 12 low byte	**	
29	Data 13 high byte	**	Reserved
30	Data 13 low byte	**	Reserved
31	Data and check high byte	**	Check code=start character 1+start character2+......+ data 13 low byte
32	Data and check low byte	**	

Remark:Standard particle mass concentration value means using industrial metal particles as equivalent particles for density conversion to get the mass concentration value,which is suitable for industrial production workshop and other environment.The density of atmospheric environmental particulate matter is converted by taking the main pollutants in the air as equivalent particles,which is suitable for indoor and outdoor environment.

Appendix B

MPM-10B Passive output data format

Communication protocol format

Attribute byte 1	Attribute byte 2	Instruction byte	Data byte 1	Data byte 2	Check byte 1	Check byte 2
0x42	0x4d	CMD	DATAL	DATAL	SUML	SUML

1.Command protocol table

CMD	DATAH	DATAL	Function description
0xE2	X	X	Passive reading instructions
0xE1	X	0x00-Passive mode 0x01-Automatic mode	Mode switch command
0xE4	X	00H-Standby mode 01H-Normal mode	Standardby control

X represents any value

2.Host command response:

0xE2: Sensor response output 32 bytes of sensor data, complying with Appendix A protocol
0xE1: Switch the output mode, if switch to automatic mode, it will automatically output data

3.The check word is generated from the characteristic word and all the bytes are accumulated and added.

◆ File Version

Date	Version	Initial or Update
2020.7.27	1.00	Initial