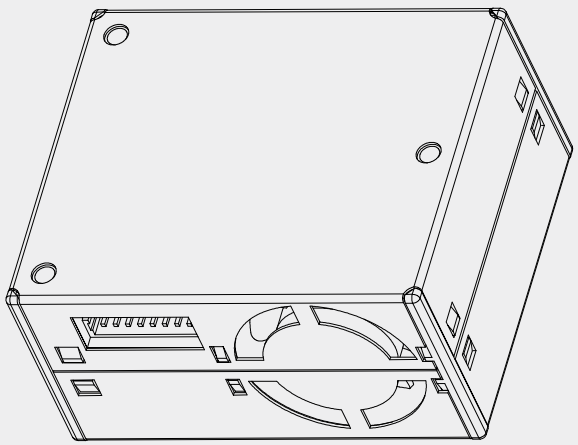
MPM14-CS

Air Laser Particulate Matter Sensor



SPECIFICATION

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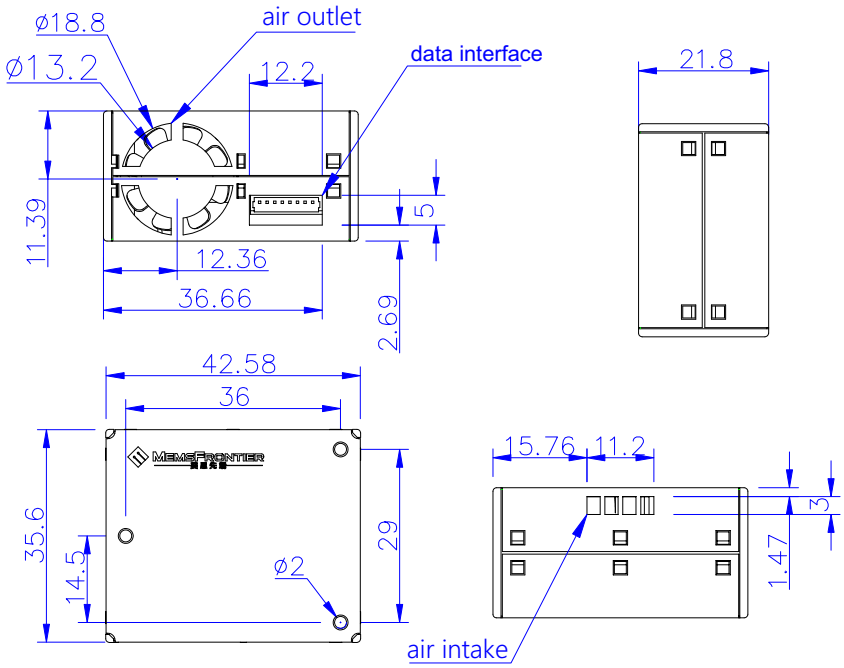
◆ Product appearance and size



◆ Product parameters

parameters	index	unit
Types of particle detection	PM1.0, PM2.5, PM10	
Particle detection diameter range	0.3-10	(μm)
Particulate matter concentration range (PM2.5 standard value)	0~1000	(μg/m3)
Particle Mass Concentration Resolution	1	(μg/m3)
Consistency of particulate matter concentration (PM2.5 standard value) *Note	±10%(@100~500μg/m3) ±10μg/m3 (@ 0~100μg/m3)	
single response time	≤1	(s)
Comprehensive response time	≤10	(s)
DC supply voltage	Typ:5.0 Min:4.5 Max: 5.5	(V)
Working current	≤80	(mA)
Stand-by current	≤20	(mA)
output method	UART / IIC / PWM	
Data interface level	L < 0.8 (@3.3); H > 2.7(@3.3)	(V)
Storage temperature	- 30 ~ +70	(℃)
Range of working temperature	-10~+60	(℃)
Working humidity range	0~99%RH (no condensation)	
Mean time between failures	≥5	(Year)
Dimensions	42.58x35.6x21.8mm(L×W×H)	(mm)

Note: The particle concentration consistency data is data 2 in the communication protocol (test conditions: 25±2℃, 50±10%RH).

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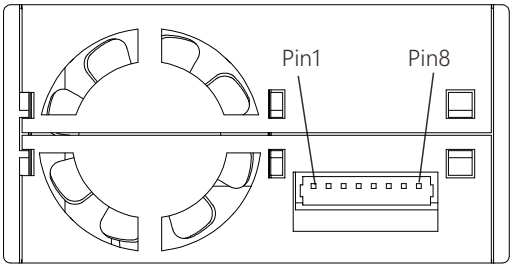
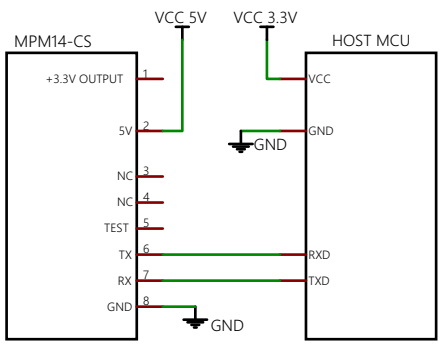
◆ Pin Diagram



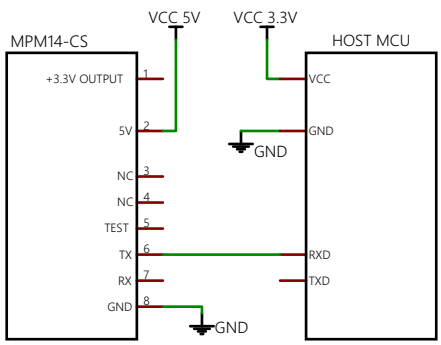
Single row 8 PIN connector

Pin number	Pin name definition	Pin function description	Pin Electrical Characteristics
Pin 1	+3.3V	3.3V/100mA output	
Pin 2	5V	+5V power input	No reverse polarity protection
Pin 3	NC	Vacant	
Pin 4	NC	Vacant	
Pin 5	TEST	For testing (floating)	
Pin6	TX	UART TX output (0-3.3V)	
Pin7	RX	UART RX input (0-3.3V)	
Pin 8	GND	5V power ground	

◆ circuit connection



Typical circuit connection diagram



Simplest circuit connection diagram

Circuit design should pay attention to:

1. The power supply voltage of the MPM14-CS module is 5V. The data communication and control pins are both 3.3V as high level, so the mainboard MCU connected to communicate should be powered by 3.3V. If the main board MCU is powered by 5V, a level conversion chip or circuit should be added to the communication line (RX, TX).

2. Attention should be paid when applying the hibernation function: the fan stops working during hibernation, and it takes at least 30 seconds to stabilize the fan to restart. Therefore, in order to obtain accurate data, the working time of the module after hibernation and waking up should not be less than 30 seconds.

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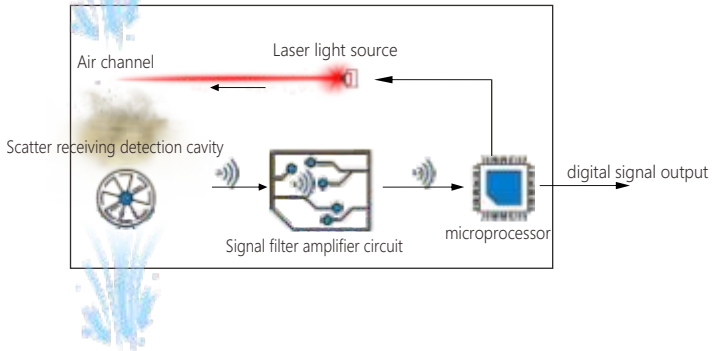
working principle

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



Serial communication protocol

Serial output is divided into two states: automatic output and passive output. After the module is powered on, the default state is automatic output, that is, the module actively sends serial data to the host, and the time interval is 1sec. The host MCU can send an instruction to turn the module into passive output mode, and the host MCU initiates a query command for passive output, and the module responds to output data once.

Default baud rate: 9600bps Check bit: none Stop bit: 1 bit, total data length: 32 bytes

Serial port automatic output data format:

Number	byte	Numerical value	Descriptions
0	start character 0	0x42	(fixed)
1	start character 1	0x4d	(fixed)
2	Frame length high byte	**	Frame length=2x13+2(data+check digit)
3	frame length low byte	**	
4	data 0 high byte	**	reserve
5	data 0 low byte	**	
6	Data 1 high byte	**	PM2.5 concentration value (standard particulate matter), unit μg/m3*
7	Data 1 low byte	**	
8	Data 2 high byte	**	Pm10 concentration value (standard particulate matter), unit μg/m3*
9	Data 2 low byte	**	
10	Data 3 high byte	**	reserve
11	Data 3 low byte	**	
12	Data 4 high byte	**	reserve
13	Data 4 low byte	**	
14	Data 5 high byte	**	reserve
15	Data 5 low byte	**	
16	Data 6 high byte	**	reserve
17	Data 6 low byte	**	

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Number	byte	Numerical value	Descriptions
18	Data 7 high byte	**	reserve
19	Data 7 low byte	**	
20	Data 8 high byte	**	reserve
21	Data 8 low byte	**	
22	Data 9 high byte	**	reserve
23	Data 9 low byte	**	
24	Data 10 high byte	**	reserve
25	Data 10 low byte	**	
26	Data 11 high byte	**	reserve
27	Data 11 low byte	**	
28	Data 12 high byte	**	reserve
29	Data 12 low byte	**	
30	Data and parity high byte	**	Check code = start symbol 1 + start symbol 2 + ... + data 12 low byte
31	Data and parity low byte	**	

Note: The standard particle mass concentration value refers to the mass concentration value obtained by using industrial metal particles as equivalent particles for density conversion, which is suitable for industrial production workshops and other environments. The mass concentration value of particulate matter in the atmospheric environment is converted into the density of the main pollutants in the air as equivalent particles, which is suitable for ordinary indoor and outdoor atmospheric environments.

Communication protocol command function description and format description:

Instruction function description	frame header HEAD	length LEN	command CMD	DATA	check byte CS	Example
stop automatic sending	0x68	0x01	0x20	NA	CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256)	68 01 20 77
normal response	0xA5A5					
Response exception	0x9696					
Enable automatic sending	0x68	0x01	0x40	NA	CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256)	68 01 40 57
normal response	0xA5A5					
Response exception	0x9696					
Start measuring particle concentration	0x68	0x01	0x01	NA	CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256)	68 01 01 96
normal response	0xA5A5					
Response exception	0x9696					

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Finish measuring particle concentration	0x68	0x01	0x02	NA	CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256)	68 01 02 95
normal response	0xA5A5					
Response exception	0x9696					
Read measurement results	0x68	0x01	0x04	NA	CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256)	68 01 04 93
normal response	0x40	0x05	0x04	"Df1, DF2, DF3, DF4 PM2.5 = DF1 * 256 + DF2 PM10 = DF3 * 256 + DF4"	CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256)	40 05 04 00 30 00 31 56
Response exception	0x9696					
Read user adjustment factor	0x68	0x01	0x10	NA	CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256)	68 01 02 95
normal response	0x40	0x02	0x10	Df1: 30 ~ 200 (Defalut:100)	CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256)	40 02 10 64 4A
Response exception	0x9696					
Set User Adjustment Factor	0x68	0x02	0x08	Df1: 30 ~ 200 (Default, 100)	CS = MOD ((65536-(HEAD+LEN+CMD+DATA)), 256)	68 02 08 64 2A
normal response	0xA5A5					
Response exception	0x9696					

◆ Installation Precautions

1. The metal shell of the module is connected to the internal power supply ground. Be careful not to short-circuit with other circuits or the chassis shell.

2. It is the best installation method that the plane where the air inlet and air outlet are located is close to the air hole on the inner wall of the user machine that communicates with the outside world. There should be a structure between the air inlet and the air outlet to isolate the airflow to prevent the airflow from directly flowing back from the air outlet to the air inlet inside the user machine.

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

4. When applied to purifier products, try to avoid placing the module directly in the air duct of the purifier itself. If it is unavoidable, an independent structure space should be set up separately, and the module should be placed in it so that it is connected to the purifier itself. Air duct isolation.

5. When applied to purifiers or fixed testing equipment, the module position should be more than 20cm above the ground. Otherwise, it may be polluted by large dust particles or even flocs near the ground, causing the fan to wind up and stop rotating.

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

7. The module is an integral component, users should not disassemble it, including the metal shielding case, to prevent irreversible damage.

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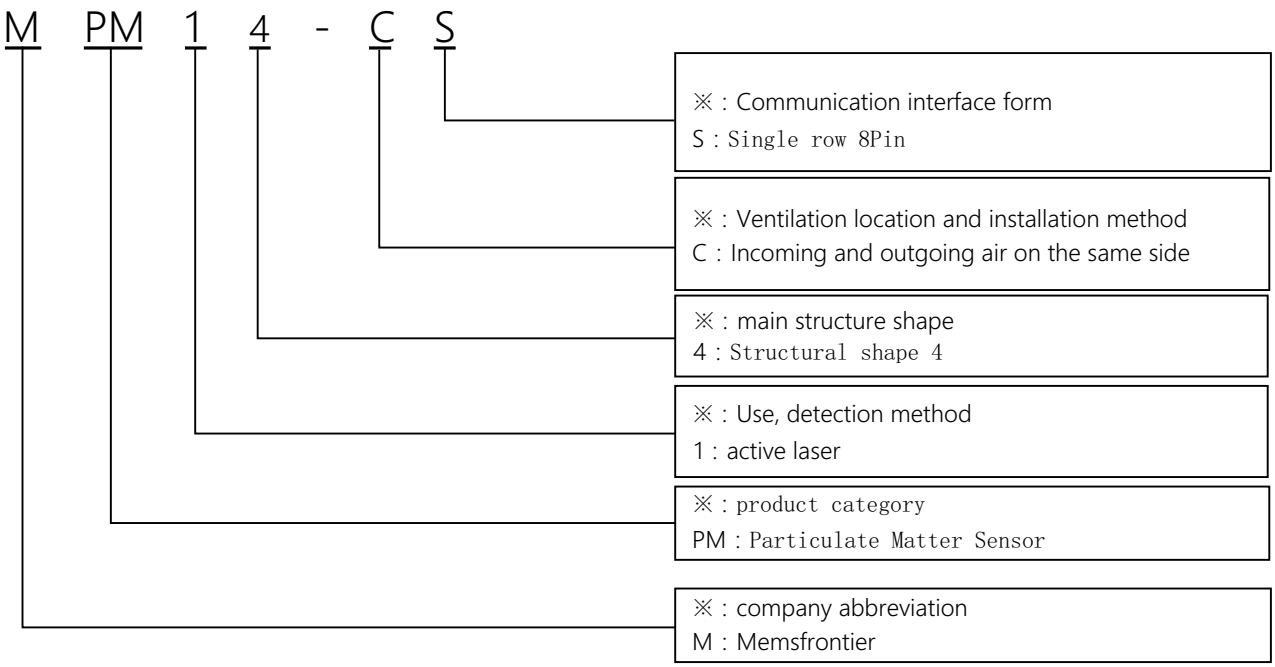
◆ Number Description



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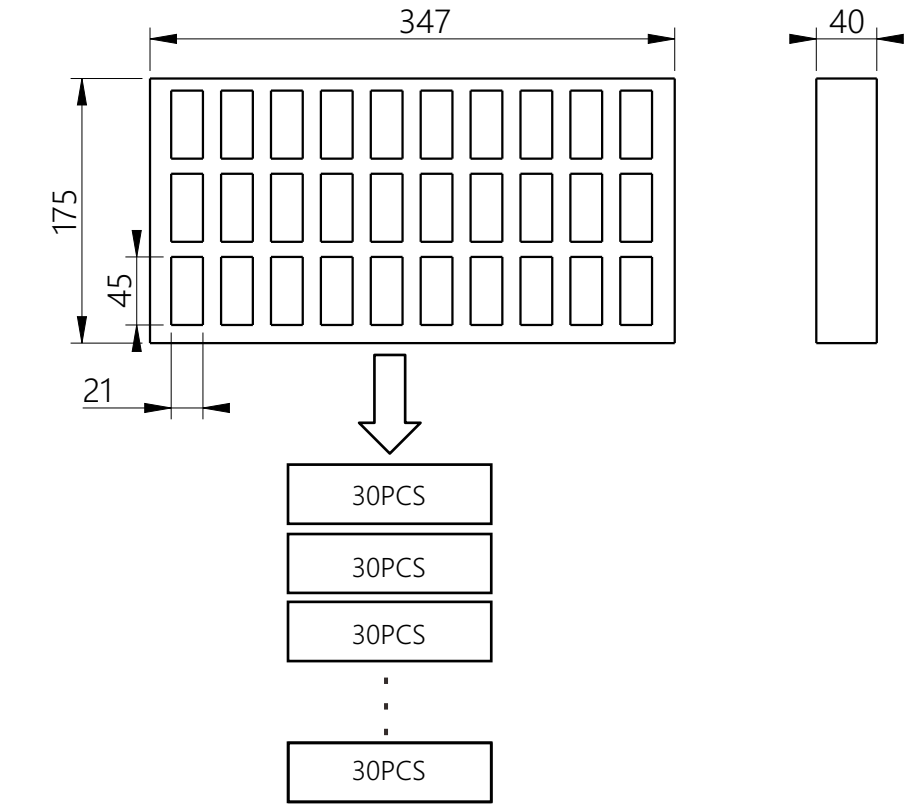
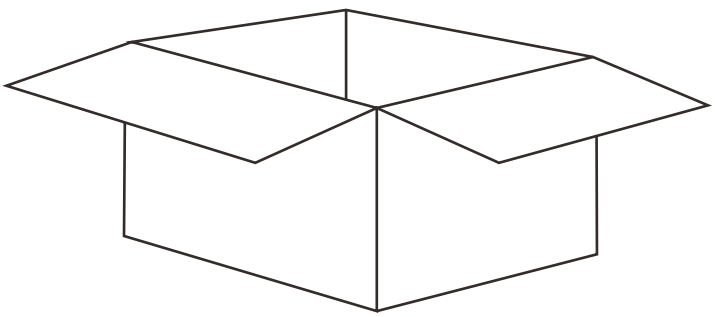
Packing

Quantity per plate	Packaging layers	Packaging Quantity	carton size	Packaging material
30	15	450	L530*W320*H250	red pearl cotton





Version history

date	version	change
2022.3.5	1.00	initial version
2022.7.20	1.10	Add the description of the number and the category of the packaging method

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