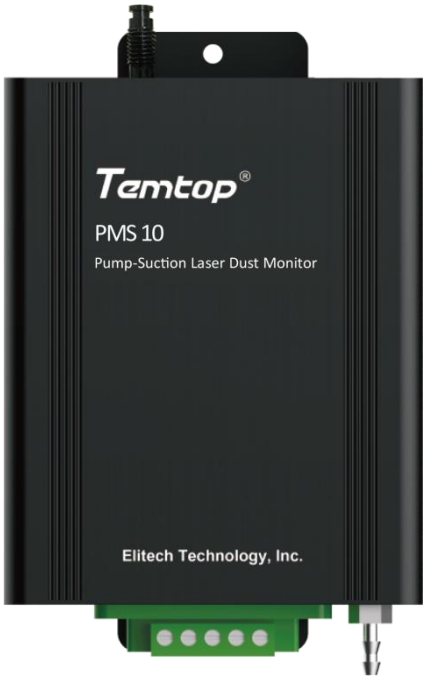
PMS 10
Specifications of Pump-Suction Laser Dust Monitor



Contents

1. Product Overview

PMS10 series is a pump-suction laser particle (dust) monitor specially designed to provide solutions for the online monitoring industry of atmospheric environment.

It is widely used in micro air monitoring station, dust monitoring, oil-smoke monitoring and other air monitoring systems.

2. Produce Features

- Benchmarking β-ray method adopted, enjoying higher accuracy and correlation
- Equipped with four-wire brushless vacuum pump, enjoying higher sampling efficiency
- All-metal precise optical-mechanical structure, stable operation in multiple scenes
- Small size, convenient for integrated use of multiple devices
- Continuous operation for 10,000 hours normally

3. Working Principle

This monitor relies on MIE scattering principle to monitor the concentration of particles. When the outside air passes through the light collection chamber uniformly, the particles in the sampled gas will scatter through the light beam. The photoelectric collection unit converts the scattered light signal into a voltage pulse signal, which is converted into a digital signal after pre-amplification and AD conversion. The number of voltage pulses measured is the number of particles, and the amplitude of voltage pulses reflects the size of optical equivalent size of particle. The standard substance is used to calibrate the monitor after the particle conversion, so as to determine the concentration of particles in the testing environment.

3.1 MIE scattering principle

A scattering occurred when the diameter of particles in the atmosphere is equal to the wavelength of radiation is called the MIE scattering. The scattering intensity of MIE scattering is inversely proportional to the second power of the wavelength. Unlike Rayleigh scattering enjoying a symmetrical distribution, MIE scattering has stronger scattering in the forward direction than in the backward direction, with a more obvious directivity.

3.2 Optical-mechanical structure and principle

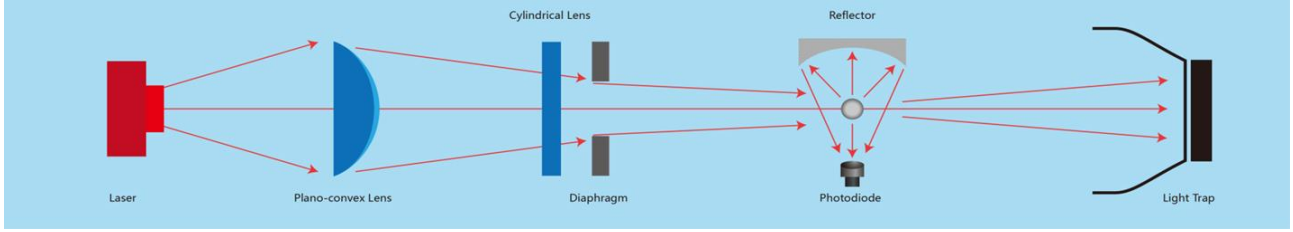


Fig. 1 Analysis Chart of Light Refraction

4. Specifications of Particle Monitor

Parameters	Values		Unit	Remarks
PM2.5 accuracy	0-100μg/m³	±10	μg/m³	-----
	>100μg/m³	±10	%	-----
PM1.0 measurement range	0-2000		μg/m³	-----
PM2.5 measurement range	0-5000		μg/m³	-----
PM10 measurement range	0-5000		μg/m³	-----
TSP measurement range	0-10000		μg/m³	-----
Resolving power	1		μg/m³	-----
Sampling interval	60		s	Set by users
Sampling time	60		s	Set by users
Sample time	10		s	-----
Service life	10000		h	-----
Counting efficiency	50％ for 0.3μm		-----	As per JIS
	100% for more than 0.5μm			
Flow	1.1		L/min	Error±5%
Weight	350		g	-----
Maximum size	113*88*38		mm	Excluding the size of air inlet and outlet, terminal

Table 1 Specifications of Particle Monitor

5. Electrical Specifications

5.1 Electrical properties

Standard output (Temperature 25℃, humidity 0-50% RH and 12V power supply voltage).

Parameters	Values	Unit
Rated voltage	DC 12	V
Standby current	30	mA
Average current	350	mA
Maximum current	400	mA
Starting current	700	mA
High-level input voltage	6	V
Low-level input voltage	-6	V
High-level output voltage	6	V
Low-level output voltage	-6	V

Table 2 Electrical Properties

5.2 Absolute limit values

The reliability of the device may be affected under the limit conditions for a long time.

Exceeding the following parameters range (Table **3**) may cause permanent damage to the device.

Parameters	Range
Power supply voltage	11.5-12.5V
Voltage at I/O pin	-6-6 V
Working temperature range	-10-60 °C
Storage temperature range	-20-70 °C
Working humidity range	0-95%RH (non-condensation)
Lightning surge	2KV
Static electricity	1KV for terminal test 8KV for test voltage of other surfaces

Table 3 Absolute Limit Values

6. Definition of Hardware Interface

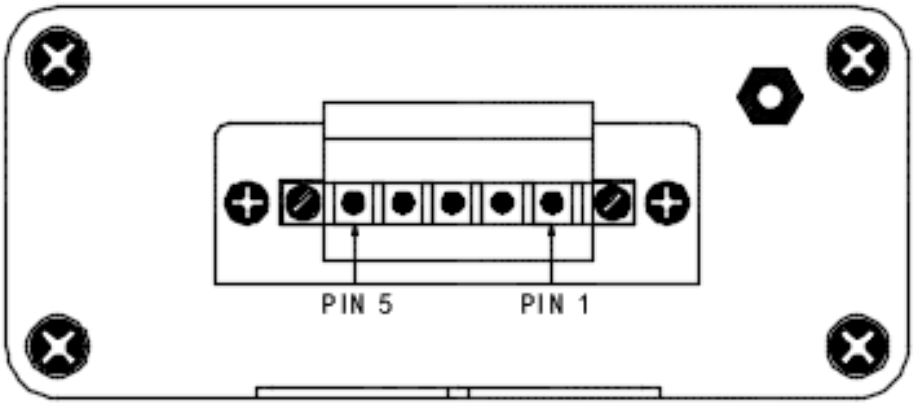


Fig.2 Hardware Interface

Pin	Name	Description	Note
1	VCC	Device power supply (positive)	12V
2	GND	Device grounding	——
3	TX（A）	Communication sending pin	(RS485+) serial sending
4	RX（B）	Communication receiving pin	(RS485-) serial receiving
5	NC	——	——

Table 4 Definition of Hardware Interface

7. Communication Protocol

UART parameters:

- Baud rate: 9600

- Data bit: 8
- Check bit: None
- Stop bit: 1

Communication mode:

- RS485 (Slave in receiving state, one for questioning and one for answering)

Address:

- The default out-of-factory address of the monitor is 01.

Command mode:

- The slave (monitor) is in the receiving state, only responding to the command of the host, not actively sending the command.

Checksum:

- It is the sum of all bits except the check bits, with high bytes before low bytes.

Working mode:

- Continuous measurement: The monitor works continuously;
- Intermittent mode: The sampling time/sampling interval can be set (The intermittent time can be set by the users, and the monitor normally responds to the command of the host during the intermittent mode)
- The default out-of-factory setting of the monitor is intermittent mode, measuring for 60s and stopping for 60s

7.1 Format of host communication protocol

The length of the command sent by the host is fixed to 8 bytes, as shown in Table 5.

Start symbol 1	Start symbol 2	Slave address	Command	High data	Low data	High check	Low check
0x4A	0x43	ADDR	CMD	DATAH	DATAL	0xXX	0xXX

Table 5 Host Command Format

See Table 6 for the description of host command.

Command	Data high	Data low	Definition
0x01	0x00	0x00	Obtaining the concentration value
0x02	0x00	0x00	Starting the measurement, the monitor works according to the mode (intermittent measurement/continuous measurement).
		0x01	Stopping the measuring, the monitor stops working.
0x03	0x00	0x00	Starting the continuous measurement mode, the monitor works continuously.
		0x01	Starting the intermittent measurement mode, the sampling time and sampling interval are set by the users.
0x04	0xXX	0xXX	Sampling time (20-3600, s)
0x05	0xXX	0xXX	Sampling interval (20-3600, s)
0x06	0xXX	0xXX	Modify the device address (1-255)

Table 6 Description of Host Command

7.2 Format of host communication protocol

The response length of slave is not fixed and changed according to the command of host, as shown in Table 7.

Start symbol 1	Start symbol 2	Slave address	Command	High data length	Low data length	High data 0	Low data 0
0x4A	0x43	ADDR	CMD	LENH	LENL	DATA0H	DATA0L
High data 1	Low data 1	……	……	High data N	Low data N	High check	Low check
DATA1H	DATA1L	……	……	DATANH	DATANL	0xXX	0xXX

Table 7 Response Format of Slave

Note: The address/function code is defined by the host (After modifying the device address, the address in the protocol is updated to the new address); see 7.3 command example for the specific response data of slave.

7.3 Command examples

7.3.1 Obtaining the concentration value (command: 0x01)

After the host sends the command to obtain the current concentration, the slave returns the current concentration data package. The specific contents are as shown in Table 8.

Slave:

Data No.	Data	Definition
Start symbol	0x4A	Frame header
Start symbol	0x43	Frame header
Address	0x01	Slave address
Command	0x01	Command
High data length	0x00	Data length, 24 bytes totally
Low data length	0x18	
High data 1	0xXX	PM1.0 mass concentration (atmospheric environment), unit: μg/m³
Low data 1	0xXX	
High data 2	0xXX	PM2.5 mass concentration (atmospheric environment), unit: μg/m³
Low data 2	0xXX	
High data 3	0xXX	PM10 mass concentration (atmospheric environment), unit: μg/m³
Low data 3	0xXX	
High data 4	0xXX	TSP (atmospheric environment), unit: μg/m³
Low data 4	0xXX	
High data 5	0x00	For later extended use
Low data 5	0x00	
High data 6	0x00	For later extended use
Low data 6	0x00	
High data 7	0x00	For later extended use

Low data 7	0x00	
High data 8	0x00	For later extended use
Low data 8	0x00	
High data 9	0x00	For later extended use
Low data 9	0x00	
High data 10	0x00	For later extended use
Low data 10	0x00	
High data 11	0x00	For later extended use
Low data 11	0x00	
High data 12	0x00	For later extended use
Low data 12	0x00	
High checksum	0xXX	Checksum
Low checksum	0xXX	

Table 8 Concentration Command Format of Slave Response

Example:

Host	0x4a	0x43	0x01	0x01	0x00	0x00	0x00	0x8F						
Slave	0x4a	0x43	0x01	0x01	0x00	0x18	0x00	0x16	0x00	0x23	0x00	0x2C	0x00	0x2F
	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
	0x00	0x00	0x01	0x3B										

In the above example, the specific values of PM1.0, PM2.5, PM10 and TSP are as follows:
PM1.0 = 0x0016 = 22μg/m³
PM2.5 = 0x0023 = 35μg/m³
PM10 = 0x002C = 44μg/m³
TSP = 0x002F = 47μg/m³

7.3.2 Start/stop (command: 0x02)

After the host sends the start/stop command, the slave performs the corresponding action and returns the response command;
When the slave performs the commands **0x03, 0x04, 0x05** and **0x06**, it returns the same format of response, as shown in Table 9.
Slave:

Data No.	Data	Definition
Start symbol	0x4A	Frame header
Start symbol	0x43	Frame header
Address	0x01	Slave address
Command	0x02	Command
High data length	0x00	Data length

Low data length	0x02	
High data 1	0x00	Replying data is the same as that of the host
Low data 1	0x00/0x01	
High checksum	0xXX	Checksum
Low checksum	0xXX	

Table 9 Performing Command Format of Slave Response

Example:

Host	Start the measurement: 0x4a 0x43 0x01 0x02 0x00 0x00 0x00 0x90 Stop the measurement: 0x4a 0x43 0x01 0x02 0x00 0x01 0x00 0x91
Slave	Start the measurement: 0x4a 0x43 0x01 0x02 0x00 0x02 0x00 0x00 0x00 0x92 Stop the measurement: 0x4a 0x43 0x01 0x02 0x00 0x02 0x00 0x01 0x00 0x93

7.3.3 Setting measurement mode (command: 0x03)

The host sends the command to set the measurement mode, the slave performs the corresponding mode selection, and then writes the measurement mode set by the users into the memory cell.

Host	Continuous measurement: 0x4a 0x43 0x01 0x03 0x00 0x00 0x00 0x91 Intermittent measurement: 0x4a 0x43 0x01 0x03 0x00 0x01 0x00 0x92
Slave	Continuous measurement: 0x4a 0x43 0x01 0x03 0x00 0x02 0x00 0x00 0x00 0x93 Intermittent measurement: 0x4a 0x43 0x01 0x03 0x00 0x02 0x00 0x01 0x00 0x94

7.3.4 Setting sampling time (command: 0x04)

The host sends the command to set the sampling time, and the slave writes the time to the memory cell and returns the response command. The minimum unit of time setting is seconds, and the minimum setting time is 20 seconds, with 3600 seconds as the maximum. The 600 seconds (0x0258) setting is taken as an example

Example:

Host	0x4a	0x43	0x01	0x04	**0x02**	**0x58**	0x00	0xEC		
Slave	0x4a	0x43	0x01	0x04	0x00	0x02	**0x02**	**0x58**	0x00	0xEE

7.3.5 Setting intermittent time (command: 0x05)

The host sends the command to set the sampling time, and the slave writes the time to the memory cell and returns the response command. The minimum unit of time setting is **seconds**, and the minimum setting time is **20** seconds, with **3600** seconds as the maximum. The 60 seconds (0x003C) setting is taken as an example.

Example:

Host	0x4a	0x43	0x01	0x05	**0x00**	**0x3C**	0x00	0xCF		
Slave	0x4a	0x43	0x01	0x05	0x00	0x02	**0x00**	**0x3C**	0x00	0xD1

7.3.6 Modifying slave address (command: 0x06)

The host sends the command to modify the slave address. The slave writes the modified address to the memory cell and returns the response command. The minimum address that the slave can set is **01** and the maximum address is **255**. If the set address exceeds the limit, the default is 01. The modification of the address from **01** to **02** is taken as an example.

Example:

Host	0x4a	0x43	0x01	0x06	**0x00**	**0x02**	0x00	0x96		
Slave	0x4a	0x43	0x02	0x06	0x00	0x02	**0x00**	**0x02**	0x00	0x99

8. Dimension Drawing

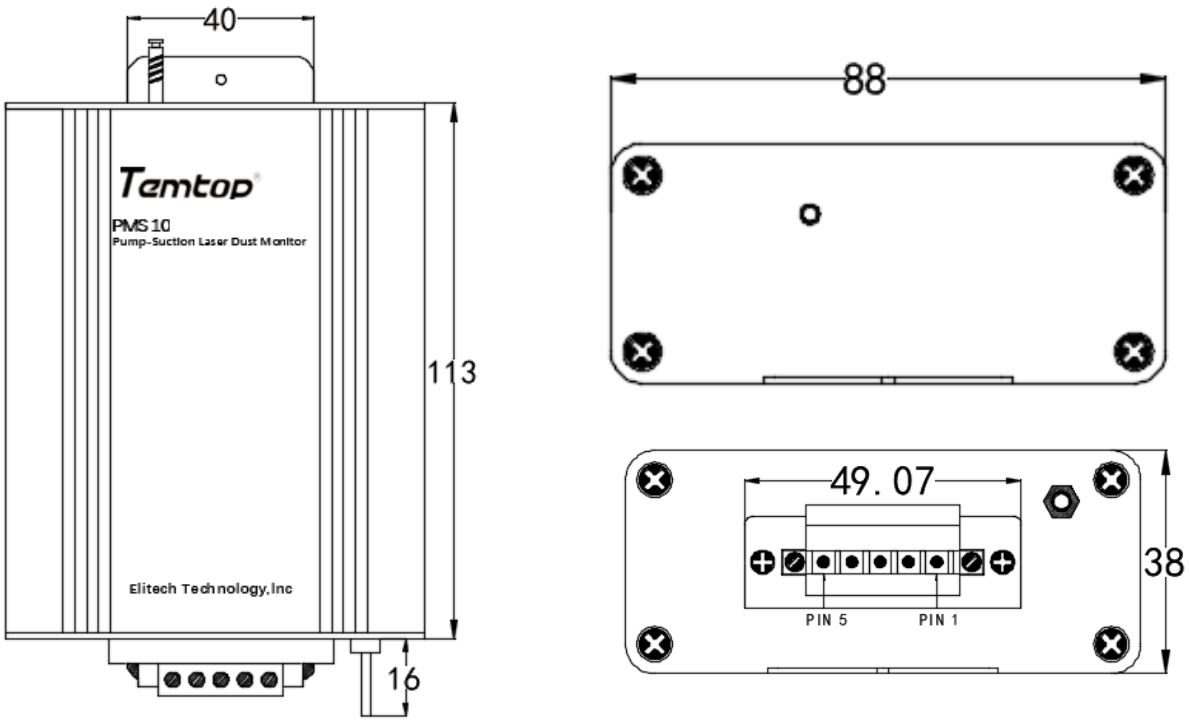


Fig.3 Dimension Drawing of PMS 10

9. Precautions for Installation and Operation

9.1 Precautions

- When the monitor is used for the outdoor fixed equipment, the protection of sandstorm, rain and snow

and fluffy catkins shall be completed by the outdoor equipment provider.

- The device is equipped with a laser transmitter internally, which may cause the operation personnel to be accidentally exposed to laser radiation due to private maintenance. The maintenance of the device shall be performed by the manufacturer's special personnel.
- It is forbidden to open the device shell for use.
- As the monitor is not directly in contact with the monitoring environment (for example, installed in the equipment enclosures), the air inlet of the monitor shall be connected to the external probe of the enclosure, with the length of the connecting hose between them controlled within 30cm, so as to obtain accurate measurement results of sampling;
- The external probe of the enclosure shall have the ability of wind proof, coarse filtration and water proof;
- In case of the increasing humidity, the data between the monitor and Beta attenuation mass monitor may have a positive deviation, so the users need to provide a dynamic heating system to ensure the data correlation with Beta attenuation mass monitor.

9.2 Recommended installation method

9.2.1 Correct installation method

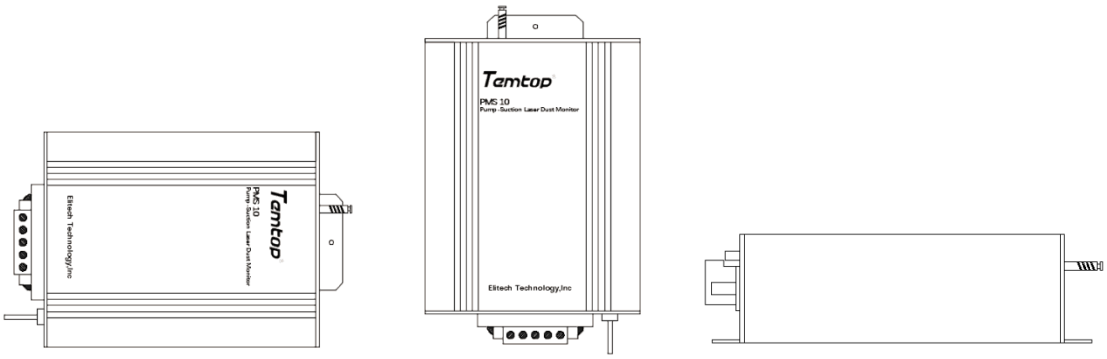


Fig. 4 Correct Installation Method

9.2.2 Wrong installation method

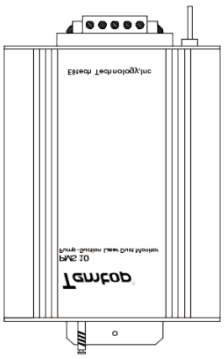


Fig. 5 Wrong Installation Method

Temtop U.S.:

Add: 2528 Qume Dr, Ste 2, San Jose, CA 95131

Web: www.temtopus.com

Tel:(+1)408-898-2866