Temtop

PMS 31
Remote Particle Counter
User Manual

Notices about this User Manual

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⚠ CAUTION!

Please read this manual carefully! Use of controls or adjustments or operation other than those specified in this manual, may cause danger or damage to the monitor.

⚠ WARNING!

- The monitor features an internal laser transmitter. Do not open the monitor housing.
- The monitor shall be maintained by the professional from the manufacturer.
- Unauthorized maintenance may cause hazardous radiation exposure of the operator to laser radiation.
- Elitech Technology, Inc. accepts no responsibility for any malfunction that are caused by improper handling of this product, and such malfunction will deem as falling outside the conditions of Warranty and Services outlined in this User Manual.

⚠ IMPORTANT!

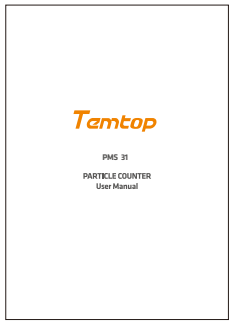
- Do not use this monitor to detect heavy smoke, high-concentration oil mist, or high-pressure gas to avoid laser tip damage or air pump block.

After opening the monitor case, make sure that the parts in the case are complete according to the following table. If anything is missing, please contact our company.

Standard Accessories



PMS 31



User Manual



Fixed Pegboard

Optional Accessories



USB Flash Drive

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1. Introduction

The PMS 31 is a professional, DC 24V powered, remote particle counter with seven channels of simultaneous detection, outputting the number of particles at 0.3 μm, 0.5 μm, 0.7 μm, 1.0 μm, 2.5 μm, 5.0 μm and 10.0 μm.

Large screen display, touch screen operation, simple and efficient, suitable for multi-scene rapid detection. At the same time, PMS 31 supports 485 communication and interaction.

2. Product Overview

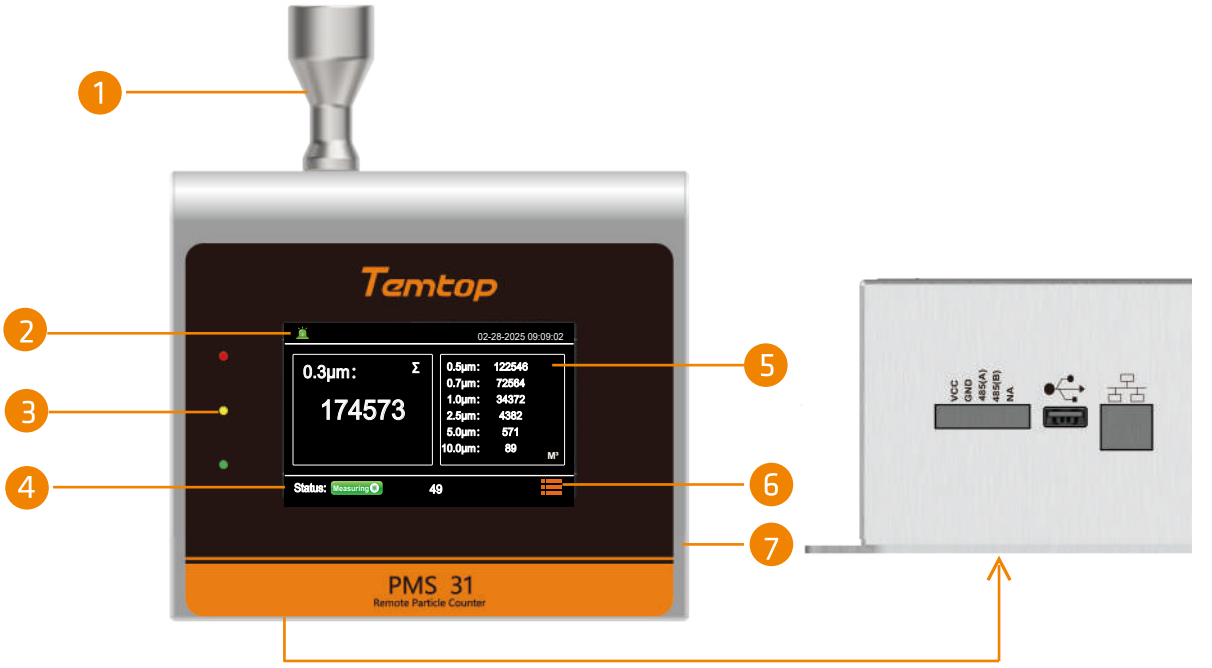


Fig. 1

① Intake Duct	② Alarm Button	③ Status Light*	④ Status
⑤ Touch Screen	⑥ Menu	⑦ Air Outlet	

* *Red Light: Detection value exceeds the alarm threshold.*
Yellow Light: Flow rate attenuation warning.
Green Light: Device in operation.

3. Onerations

3.1 Power ON

After power is applied, the instrument turns on and displays the initialisation screen (Fig.2).

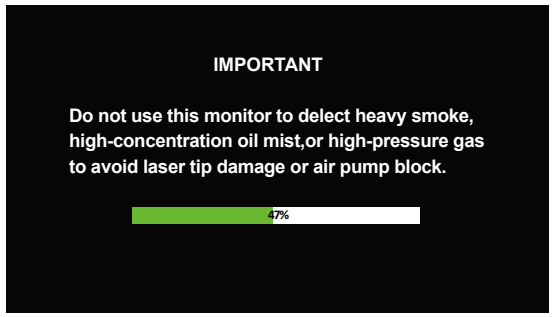


Fig.2

After initialisation, enter the main interface of the system.
Press Waiting to start the test, the interface displays the real-time data of all parameters, the default sampling unit of the instrument is CF, the default sampling time is 60s (the sampling unit and time can be set according to your needs, please refer to 3.2.1 Sampling Settings for details), and the status bar at the bottom displays the sampling countdown.
The instrument defaults to continuous sampling, which can be paused during sampling by pressing Measuring (Fig.3).

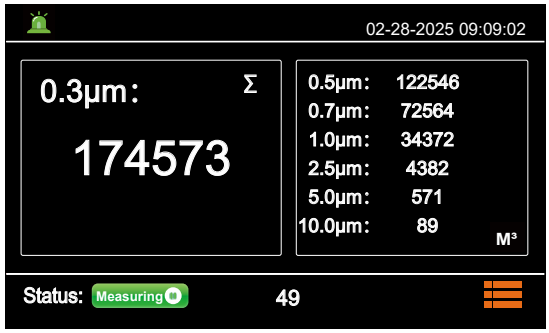


Fig.3

By default, 0.3μm data is displayed in the main viewframe, and the items displayed in the main viewframe can be switched by sliding up and down (Fig.4).

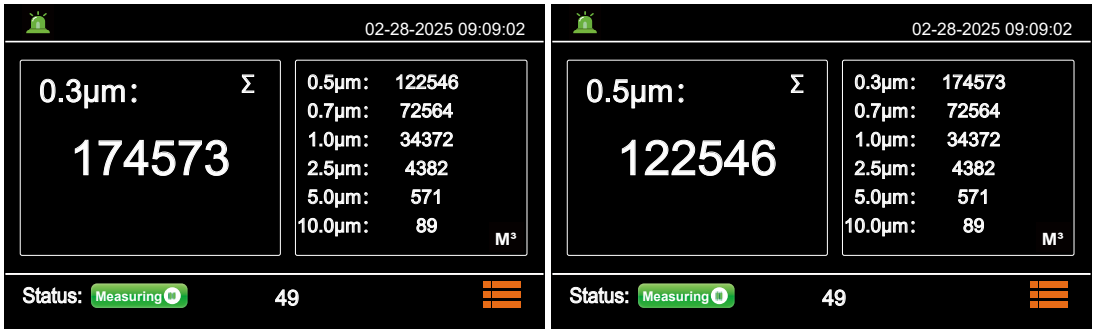


Fig.4

3.2 Settings Menu

In Wait Mode, tap , then enter the password (initial password: "543210") to access the Settings interface. Touch-click to select the function (Fig.5).

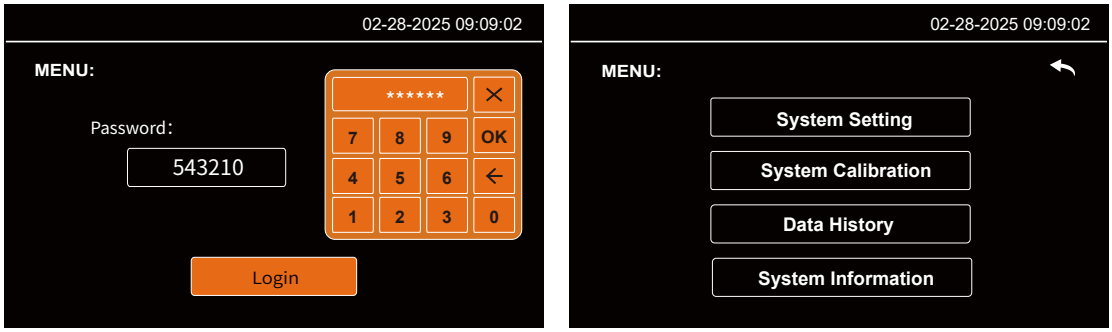


Fig.5

MENU options are as follows:

Menu	Display as...	Description
System Setting	Setting	Set system time, sample, COM, language, backlight and alarm
System Calibration	Calibration	Calibrate zero
Data History	History	Query, download and delete the data
System Information	Information	Display system information

3.2.1 System Setting

In the system setting interface MENU -> Setting, you can set the time, sampling, COM, language, backlight adjustment and alarm setting. Click the item to be set to make the relevant settings (Fig.6).

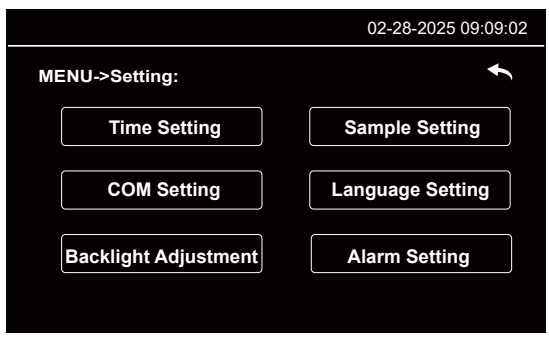


Fig.6

• Time Setting

In the time setting interface, you can click on the value you want to set. The page will display an orange data keyboard pop-up window. Click on the number you want to put on the keyboard and then click on 'OK' to make sure. After finishing the settings, click on 'Save' to save the settings (Fig.7).

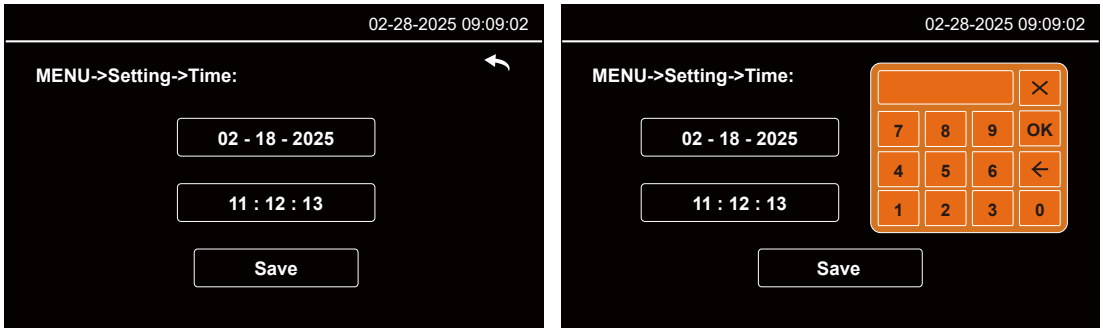


Fig.7

• Sample Setting

In the Sample Setting interface, you can set the sample unit, counting mode, sample time and hold time (Fig.8).

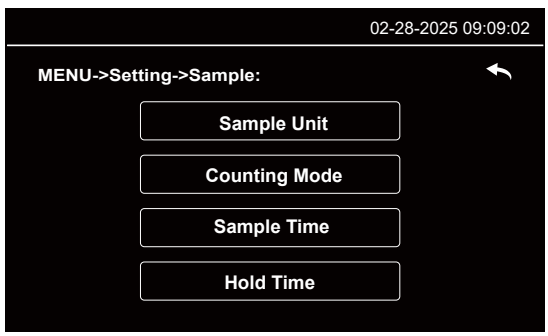


Fig. 8

• Sample Unit

Click 'Sample Unit' to enter the Sample Unit setting interface. The device supports four counting units: CF, L, M³, and TC. CF: number of particles per cubic foot. L: number of particles per litre. M³: number of particles per cubic metre. TC: number of particles measured during the sampling time. Click the location of the sampling unit to enter the drop-down box, select the sampling unit you want to set, and then press 'Save' to save the settings (Fig.9).

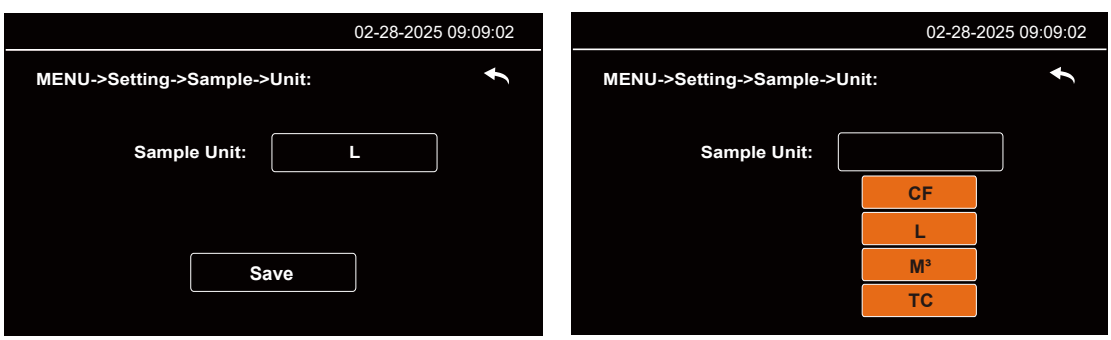


Fig.9

• Counting Mode

Click 'Counting Mode' to enter the Counting Mode setting interface.
Click on the '∑' or 'Δ' location to access the drop-down box, select the Counting Mode you want to set, and then press 'Save' to save the settings (Fig.10).



Fig.10

• Sample Time

Click 'Sample Time' to enter the Sample Time setting interface.The device supports setting the sampling time freely in the range of 10-3600 seconds. Click on the location of the sampling time and the page will pop up with a Pop-up Orange Data Keyboard window. Click on the number to be entered on the keyboard and click 'OK' to confirm. After completing the settings, click 'Save' to save the settings (Fig.11).

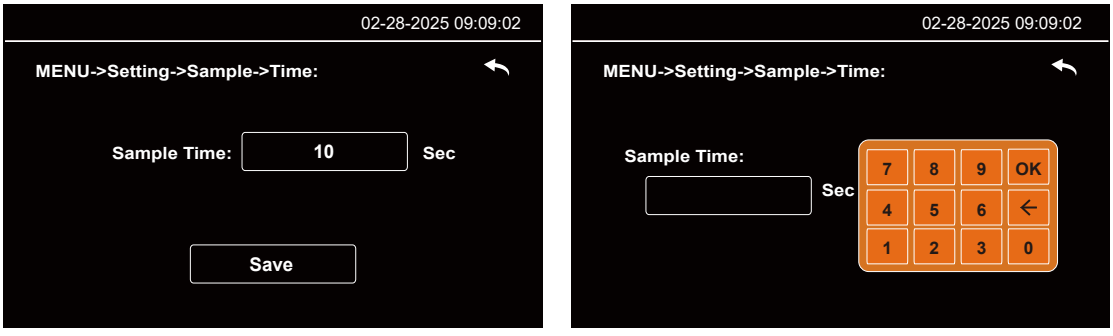


Fig.11

• Hold Time

Click 'Hold Time' to enter the Hold Time setting interface. The device supports setting the hold time freely in the range of 0, 6-9999s. Click on the location of the hold time, and the page will pop up with the orange data keypad window. Click on the number to be entered on the keyboard and click OK to confirm. After completing the settings, click 'Save' to save the settings (Fig.12).

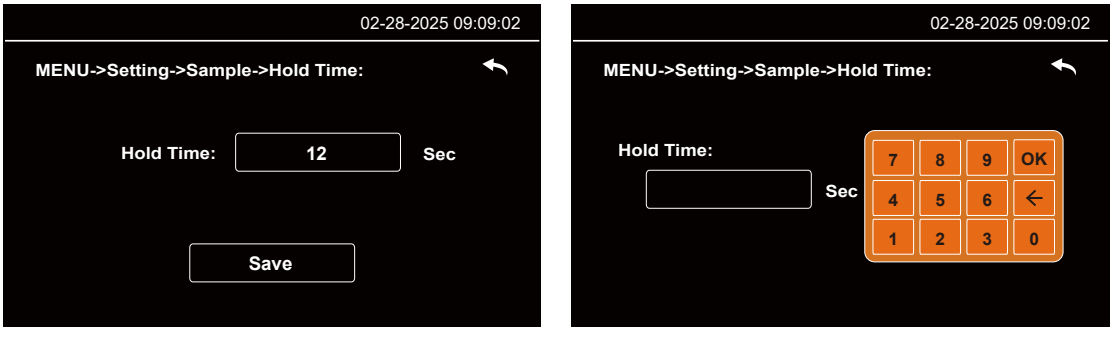


Fig.12

• COM Setting

Click 'COM Setting' to enter the COM setting interface.
Click the location of baud data to enter the drop-down box, select the baud rate you want to set from the three baud rates of 9600, 19200, and 115200, and then press 'Save' to save the setting (Fig.13).

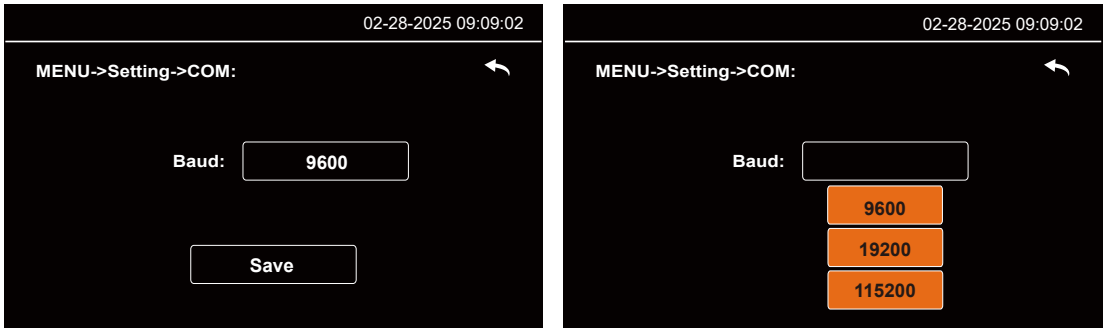


Fig.13

• Language Setting

Click 'Language Setting' to enter the language setting interface.
Click the location of the language setting to enter the drop-down box, select the language to be set from 'English' and '中文', and then press 'Save' to save the setting (Fig. 14).



Fig. 14

• Backlight Adjustment

Click Backlight Adjustment Settings to enter the Backlight Adjustment Settings interface.
Click Backlight Level Position to enter the drop-down box, select the backlight level you want to set from '1', '2', and '3' backlight levels, and then press 'Save' to save the setting (Fig. 15).

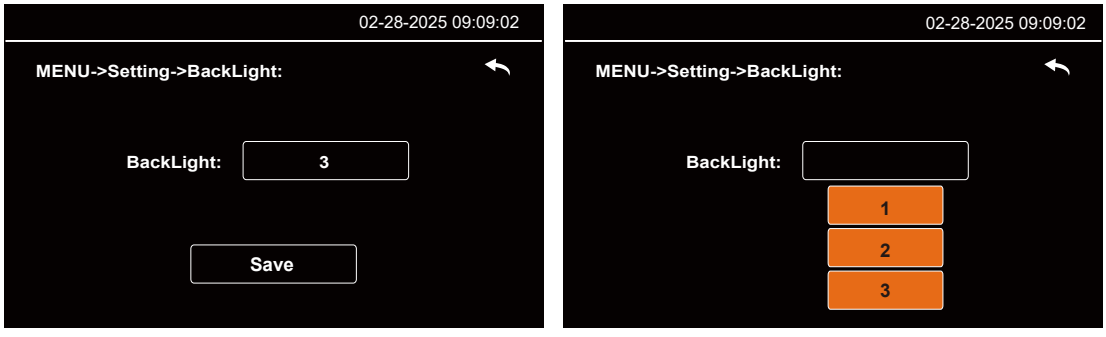


Fig. 15

• Alarm Setting

Click 'Alarm Setting' to enter the alarm setting screen.
The device supports seven-channel alarm setting with threshold interval 0-999999999 (Alarm Value Unit: m^3), click the corresponding channel for alarm value editing, the page will pop up the orange data keyboard window. Click the number to be entered on the keyboard and then click 'OK' to confirm. After completing the settings, click 'Save' to save the settings (Fig. 16).

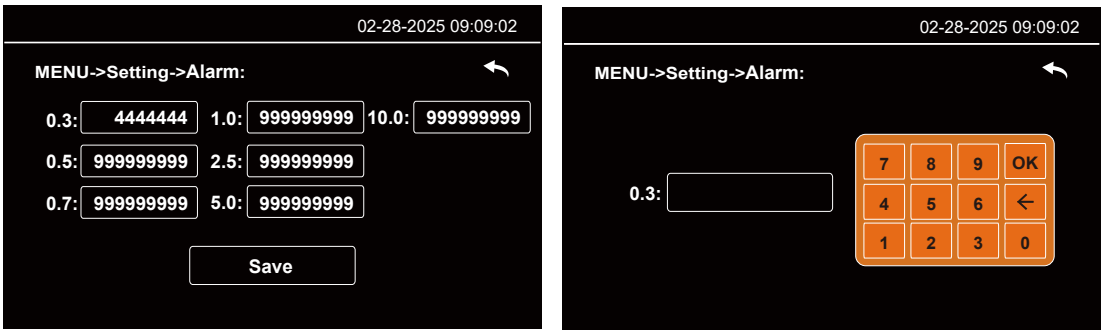


Fig. 16

3.2.2 System Calibration

In the System Calibration screen, you can perform zero calibration (Fig. 17).

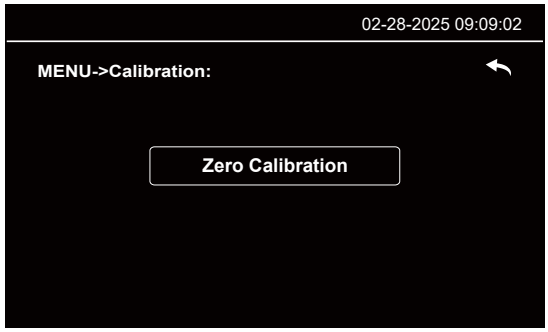


Fig. 17

• Zero Calibration

Click 'Zero Calibration' to enter the zero calibration interface.
Connect the filter and air inlet according to the prompts on the screen, click Start Calibration, the calibration time is 180s, and the interface shows a countdown. After the countdown is over, the system prompts successful calibration and automatically returns to the menu interface (Fig. 18).

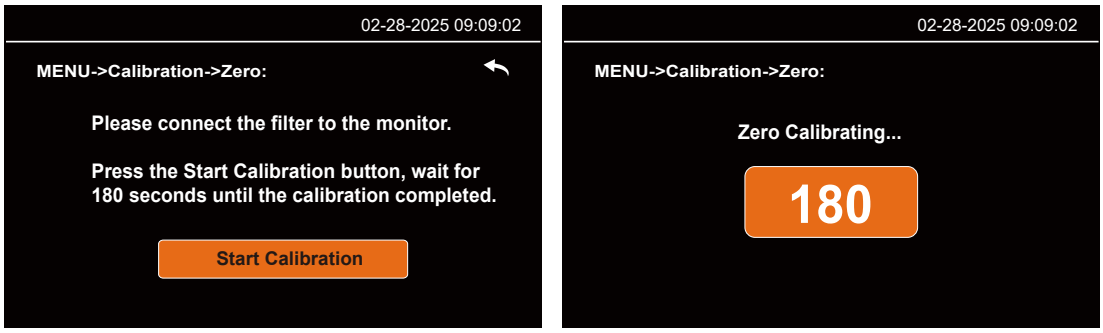


Fig. 18

3.2.3 Data History

In the Data History screen, you can perform data query, history download and history delete operations (Fig. 19).

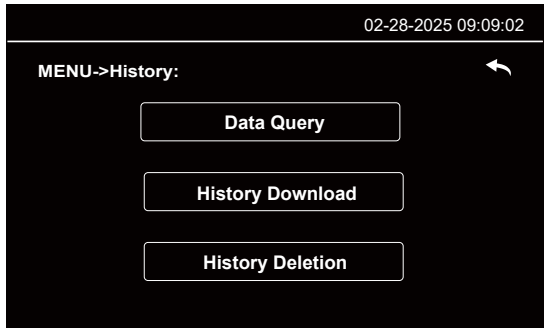


Fig. 19

• Data Query

Click on 'Data Query' to enter the data query screen.
In the data query screen, the data stored in the device will be displayed by month. The system automatically recommends the current month. If you need to look up the data for other months, click the position where the month or year is located and the page will pop up the orange data keyboard window.
Click the number to be entered on the keyboard and then click 'OK' to confirm.
After completing the settings, click 'Query' to query the data (Fig. 20).

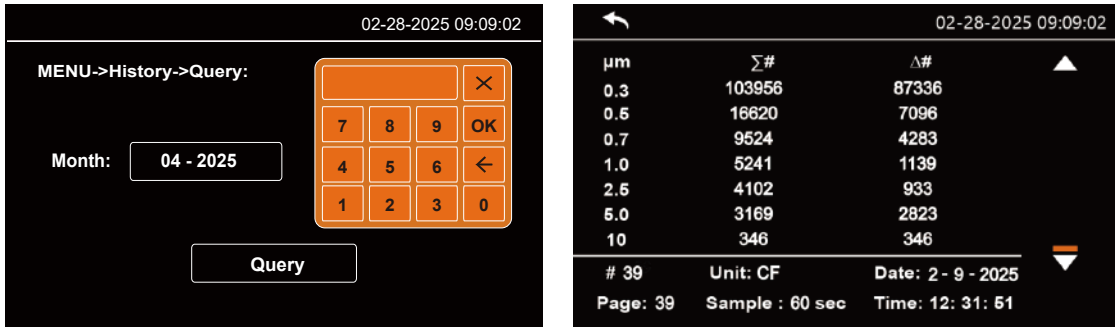


Fig. 20

• History Download

In the data history interface, insert a USB device such as a USB stick or card reader into the USB port of the instrument and click 'History Download'. The system will check the connection status of the USB device (Fig. 21).



Fig. 21

If no device is connected, it prompts no device, if the device is detected normally, it prompts download success after the data download is completed.
After the data download is complete, unplug the USB device and plug the USB into the computer. You will find a folder named 'TEMTOP', where users can view and analyse the data by themselves (Fig. 22).



Fig. 22

• History Deletion

In the History Delete screen, you can perform Delete by Month and All Data operations (Fig. 23).

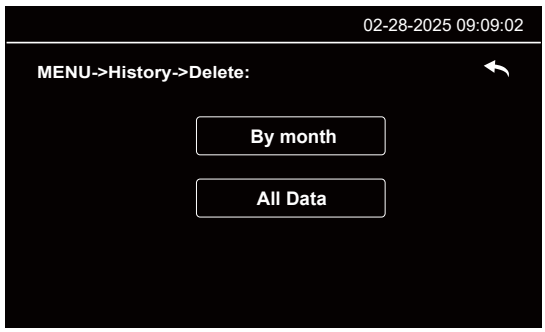


Fig. 23

• By month

Click 'By Month' to enter the Delete by Month interface.
In the Delete by Month screen, by default, the system automatically recommends the current month. If you need to delete other months data, click the position where the month or year is located, and the page will pop up the orange data Keyboard window.
Click the number to be entered on the keyboard, and then click 'OK' to confirm.
After completing the settings, click 'Delete' to delete the data (Fig. 24).



Fig. 24

- **All Data**

Click ‘All Data’ to enter the interface to delete all data.
The interface will prompt to confirm the deletion of all information, click ‘Confire Delete’. And wait patiently. After the deletion is completed, the screen will prompt to automatically return to the menu interface (Fig. 25).

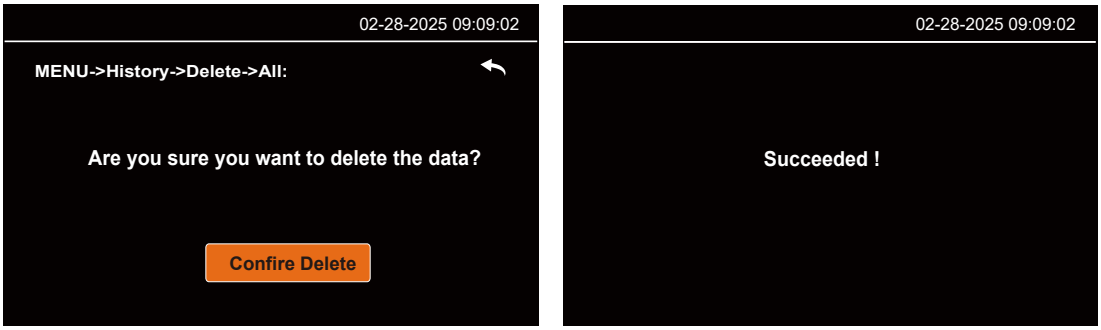


Fig. 25

3.2.4 System Information

Click ‘System Information’ to enter the system information interface, where you can view the model, serial number, firmware version, brand, tel, and other information (Fig. 26).

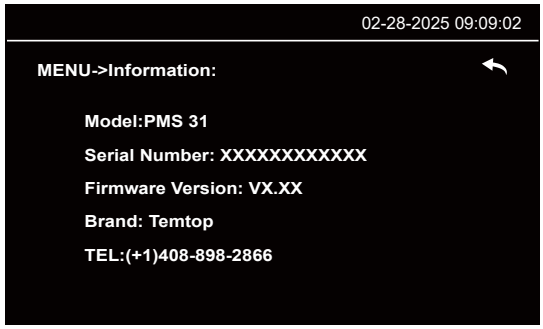


Fig. 26

3.3 Power OFF

After disconnecting the power supply, the instrument switches off.

4. Protocols

PMS 31 supports two communication modes: RS-485 and USB.
RS-485 serial communication is used for real-time interaction.
USB communication is used to export data history.

4.1 RS-485 Serial Communication

The PMS 31 is based on the Modbus RTU protocol.

Description

1) Master-Slave:

Only the master can initiate communication, as the PMS 31 is a slave and will not initiate communication.

2) Packet icentificatior:

Any message(packet) starts with a silent interval of 3.5 characters. Another silent interval of 3.5 characters marks message end.Silence interval between characters in the message needs to be kept less than 1.5 characters.
Both intervals are from the end of Stop-bit of previous byte to the beginning of the Start-bit of the next byte.

3) Packet length:

The maximum packet supported by the PMS 31 (serial line PDU, including address byte and 2-byte CRC) is 21 bytes.

4) Modbus Data Model:

PMS 31 has 4 main data tables (addressable registers) that can be overwritten:
•Discrete inputs (read-only bits)
•Coils (read/write bits)
•Input register (read-only16-bit word, interpretation depends on application)
•Holding register (read / write 16-bit word)
Note: The sensor does not support bit-wise access to registers.

4.1.1 Register List

Restrictions:

1. Input registers and holding registers are not allowed to overlap;
2. Bit-addressable items (i.e., coils and discrete inputs) are not supported;
3. The total number of registers is limited: The input register range is 0x03~0x10, and the holding register range is 0x04~0x06, 0x61~0x69.
4. Alarm Value Unit: m^3.

The register map (all registers are 16-bit words) is summarized in the table below.

Input Register List		
No.	**Meaning**	**Description**
0x00	N/A	Reserved
0x01	N/A	Reserved
0x02	N/A	Reserved
0x03	0.3μm Hi 16	Particles
0x04	0.3μm Lo 16	Particles
0x05	0.5μm Hi 16	Particles
0x06	0.5μm Lo 16	Particles
0x07	0.7μm Hi 16	Particles
0x08	0.7μm Lo 16	Particles
0x09	1.0μm Hi 16	Particles
0x0A	1.0μm Lo 16	Particles
0x0B	2.5μm Hi 16	Particles
0x0C	2.5μm Lo 16	Particles
0x0D	5.0μm Hi 16	Particles
0x0E	5.0μm Lo 16	Particles
0x0F	10μm Hi 16	Particles
0x10	10μm Lo 16	Particles

Holding Register List		
No.	**Meaning**	**Description**
0x00	Modbus Address	1~247
0x01	Stop Detection	0x00: Stop Detection
0x06	Menu password Hi 16	6-digit password
0x07	Menu password Lo 16	
0x08	Year	Year
0x09	Month	Month
0x0A	Day	Day
0x0B	Hour	Hour
0x0C	Minute	Minute
0x0D	Second	Second
0x0E	Counting mode	0x00:∑ 0x01:△
0x0F	Sample Unit Setting	0x00:TC 0x01:CF 0x02:L 0x03:M^3
0x10	Sample Time Setting	Sample Time
0x11	HOLD Time Setting	HOLD Time
0x12	Alarm 0.3μm Hi 16	Alarm Value
0x13	Alarm 0.3μm Lo 16	Alarm Value

0x14	Alarm 0.5μm Hi 16	Alarm Value
0x15	Alarm 0.5μm Lo 16	Alarm Value
0x16	Alarm 0.7μm Hi 16	Alarm Value
0x17	Alarm 0.7μm Lo 16	Alarm Value
0x18	Alarm 1.0μm Hi 16	Alarm Value
0x19	Alarm 1.0μm Lo 16	Alarm Value
0x1A	Alarm 2.5μm Hi 16	Alarm Value
0x1B	Alarm 2.5μm Lo 16	Alarm Value
0x1C	Alarm 5.0μm Hi 16	Alarm Value
0x1D	Alarm 5.0μm Lo 16	Alarm Value
0x1E	Alarm 10.0μm Hi 16	Alarm Value
0x1F	Alarm 10.0μm Lo 16	Alarm Value
0x20	Serial Number	Serial Number 0
0x21	Serial Number	Serial Number 1
0x22	Serial Number	Serial Number 2
0x23	Serial Number	Serial Number 3
0x24	Serial Number	Serial Number 4
0x25	Serial Number	Serial Number 5

4.1.2 Function Gode Description

PMS 31 supports the following function codes:

0x03: Read holding register 0x06: Write a single holding register

0x04: Read input register 0x10: Write multiple holding register

The remaining Modbus function codes are not supported for the time being.

4.1.3 Serial Setting

Baud rate: 9600,19200,115200(see **3.2.1 System Setting-COM Setting**)

Data bits:8 Stop bit:1 Check bit: N/A

4.1.4 Application Example

- **Read Detected Data**

The sensor address is 0xFE.

The following uses ‘0xFE’ as an example.

Use 0x04 (read input register) in Modbus to obtain detected data.

The detected data is put in a register with a starting address of 0x03, the number of registers is 0x0E, and the CRC check is 0x95C1.

The master sends:

Slave Address	Function Code	Starting Address Hi	Starting Address Lo	Quantity Hi	Quantity Lo	CRC16 Hi	CRC16 Lo
0xFE	0x04	0x00	0x03	0x00	0x0E	0x95	0xC1

The slave responds:

Slave Address	Function Code	Quantity	0.3μm Hi 16 Hi	0.3μm Hi 16 Lo	0.3μm Lo 16 Hi	0.3μm Lo 16 Lo	0.5μm Hi 16 Hi	0.5μm Hi 16 Lo
0xFE	0x04	0x1C	0x00	0x02	0x34	0x24	0x00	0x02

0.5μm Lo 16 Hi	0.5μm Lo 16 Lo	0.7μm Hi 16 Hi	0.7μm Hi 16 Lo	0.7μm Lo 16 Hi	0.7μm Lo 16Lo	1.0μm Hi 16 Hi	1.0μm Hi 16 Lo	1.0μm Lo 16 Hi
0x34	0x24	0x00	0x02	0x34	0x24	0x00	0x02	0x34

1.0μm Lo 16 Lo	2.5μm Hi 16 Hi	2.5μm Hi 16 Lo	2.5μm Lo 16 Hi	2.5μm Lo 16 Lo	5.0μmHi 16 Hi	5.0μm Hi 16 Lo	5.0μm Lo 16 Hi	5.0μm Lo 16 Lo
0x24	0x00	0x02	0x34	0x24	0x00	0x00	0x08	0xE8

10.0μm Hi 16 Hi	10.0μm Hi 16 Lo	10.0μm Lo 16 Hi	10.0μm Lo 16 Lo	CRC16 Hi	CRC16 Lo
0x00	0x00	0x08	0xE8	0xD3	0xF5

- **Set Address**

The sensor address is 0xFE

Use 0x06 (write a single holding register) in Modbus to set the address. Write 0x01 to register 0x00 to set address. The starting address is 0x00, and the registered value is 0x01. CRC calculated as 0x5C05, first sent in the low byte.

The master sends:

Slave Address	Function Code	Starting Address Hi	Starting Address Lo	Value Hi	Value Lo	CRC16 Hi	CRC16 Lo
0xFE	0x06	0x00	0x00	0x00	0x01	0x5C	0x05

The slave responds:

Slave Address	Function Code	Starting Address Hi	Starting Address Lo	Value Hi	Value Lo	CRC16 Hi	CRC16 Lo
0xFE	0x06	0x00	0x00	0x00	0x01	0x5C	0x05

- **Start / Stop Detection**

The sensor address is 0xFE

Use 0x06 (write a single holding register) in Modbus to start the detection.

Write 0x01 (0x00: Stop; 0x01: Start) to register 0x01 to start detection. The starting address is 0x01, and the registered value is 0x01. CRC calculated as 0x0DC5, first sent in the low byte.

The master sends:

Slave Address	Function Code	Starting Address Hi	Starting Address Lo	Value Hi	Value Lo	CRC16 Hi	CRC16 Lo
0xFE	0x06	0x00	0x01	0x00	0x01	0x0D	0xC5

The slave responds:

Slave Address	Function Code	Starting Address Hi	Starting Address Lo	Value Hi	Value Lo	CRC16 Hi	CRC16 Lo
0xFE	0x06	0x00	0x01	0x00	0x01	0x0D	0xC5

- **Set Time**

The sensor address is 0xFE.

Use 0x10 (write multiple holding registers) in Modbus to set the time.

In the register with start address 0x08, the number of registers is 0x06, and the number of bytes is 0x0C, which respectively correspond to the year, month, day, hour, minute, and second.

Year is 0x07E4 (actual value is 2020)

Month is 0x0005 (actual value is May)

Day is 0x001D (actual value is 29th)

Houris 0x000D (actualvalue is 13),

Minute is 0x0018 (actual value is 24 minutes),

Second is 0x0000 (actual value is 0 seconds).

The CRC check is 0xC1BE.

The master sends:

Slave Address	Function Code	Starting Address Hi	Starting Address Lo	Value Hi	Value Lo	Byte Count	Year Hi
0xFE	0x10	0x00	0x08	0x00	0x06	0x0C	0x07

Year Lo	Month Hi	Month Lo	Day Hi	Day Lo	Hour Hi	Hour Lo	Minute Hi
0xE4	0x00	0x05	0x00	0x1D	0x00	0x0D	0x00

Minute Lo	Second Hi	Second Lo	CRC16 Hi	CRC16 Lo
0x18	0x00	0x00	0xC1	0xBE

The slave responds:

Slave Address	Function Code	Starting Address Hi	Starting Address Lo	Value Hi	Value Lo	CRC16 Hi	CRC16 Lo
0xFE	0x10	0x00	0x08	0x00	0x06	0xD5	0xC6

4.2 USB Communication

Please see **3.2.3 Data History - History Download** for detail USB operations.

5. Maintenance

5.1 Maintenance Schedule

To make better use of PMS 31, regular maintenance is required in addition to correct operation. Temtop recommends the following maintenance plan:

Service Items	Frequency	By
Zero calibration	Every week/User-defined	User/Manufacturer
Air pump, pipeline, optical detector inspection and cleaning	Every year	Manufacturer only

5.2 Zero Galibration

After the instrument has been used for a long time or the operating environment has been changed, the instrument should be zero-calibrated. Regular calibration is required, and the matching filter should be used for calibration by the following steps:
After the filter installed, open the Zero Calibration interface and refer to **3.2.2 System Calibration-Zero Calibration** for operation, After the calibration completed, remove the filter and screw the filter cover back. When calibration is complete, remove the filter and screw on the filter cover to complete the operation.

5.3 Annual Maintenance

It is recommended to return PMS 31 to the manufacturer for annual calibration by specialized maintenance personnel in addition to weekly or monthly calibration by users.
Annual return-to-factory maintenance also includes the following preventative items to reduce accidental failures:

- Check and clean the optical detector;
- Check air pumps and pipes;

6. Troubleshooting

Failure	Possible Causes	Solution
Noise	The flow is excessive	Flow calibration
	The pump is faulty	Send to the service center
Display is on, but pump does not run	The pump is faulty	Send to the service center
Detected value is not reliable	Flow deviation	Flow calibration
	Inlet screen clogged	Check the inlet screen
	Contamination inside the monitor	Replace the filter element
		Send to the service center

7. Specifications

Item	Parameter	Remark
Particle Diameter	0.3μm, 0.5μm, 0.7μm, 1.0μm, 2.5μm, 5.0μm, 10μm	Both detection and display
Operating Voltage	24V	
Operating Average Current	1500mA	
Measurement Range	3,000,000 CF	
Accuracy	±10%	Calibrate aerosol
Principle	Light scattering technique	
Light Source	50mW,780nm	
Sampling Time	10-3600s	
Hold Time	0, 6-9999s	
Flow	28.3 L/min	Error +5%
Display	5.0" Touch	
Communication	USB/RS-485	
Memory	8,000,000 readings	
Operating Temperature	0~50°C	
Storage Temperature	-20~60°C	
Monitor Dimensions	192*166*92.5mm	Excluding the air inlet (outlet) pipe
Weight	3.5kg	

8. Warranty & Services

Warranty: Any defective monitor may be replaced or repaired within the warranty period. However, this warranty does not cover monitors that have been altered or modified due to misuse, negligence, accidents, or acts of nature, nor does it cover monitors modified without Temtop's authorization.
Calibration: Temtop provides a 2-year free calibration service, with shipping costs borne by the customer. The monitor to be calibrated must not be contaminated by pollutants such as chemical substances, biological substances, or radioactive substances. If the monitor is contaminated by the aforementioned pollutants, the customer shall be responsible for paying the maintenance fee.

This product comes with a 5-year warranty and a 2-year calibration service, both starting from the date of your purchase.

Item	Warranty Period	Calibration Period*
Monitor	5 years	2 years
Accessories	N/A	N/A

** Only one free calibration service is provided annually for the same product.*

Note: A sincere effort was made to ensure that all information in this manual was current at the time of publication. However, final products may vary from the manual, and the specifications, features, and displays are subject to the finished products. Please check with your Temtop representative for the latest information.

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