RS485 Outdoor Air Quality Sensor

User Manual

Chapter 1 Product Introduction

1.1 Product Overview

The PM2.5/10 sensor employs a laser probe — a professional testing device for PM2.5/10 concentration sensors — as its core detection component. It features a wide measurement range, high accuracy, excellent linearity, versatility, ease of use, convenient installation, long transmission distance, and reasonable pricing.
The system employs a pumped probe, where air is pumped into the sensor by a fan. Compared to conventional diffusion sensors, this design delivers faster response times and higher accuracy.

1.2 Features

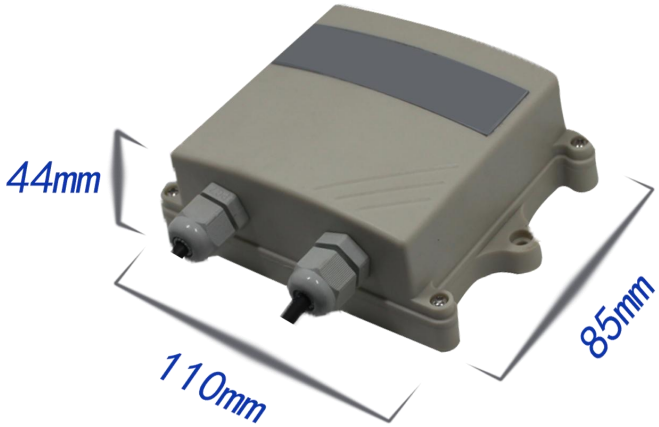
This product utilizes a highly sensitive gas detection probe, ensuring stable signals and high precision. It offers a wide measurement range, excellent linearity, ease of use, simple installation, long transmission distance, and reasonable pricing.

1.3 Key Parameters

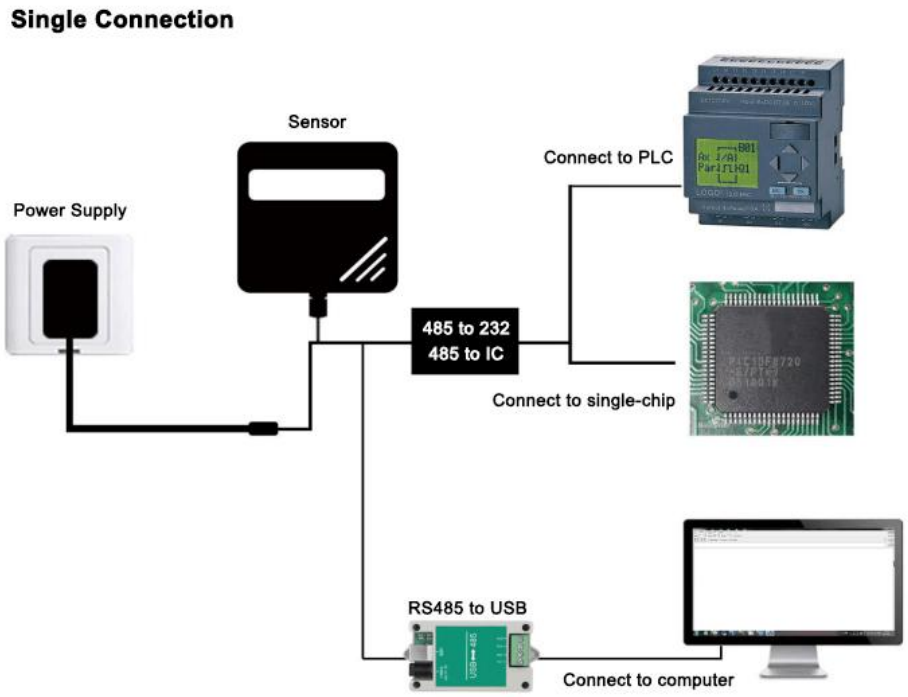
Parameter	Specification
Power Supply (DC, default)	10–30 V DC
Power Consumption	0.5 W
Operating Temperature & Humidity	−20 °C to +60 °C, 0%RH–95%RH (non-condensing)
Communication Interface	RS485 (Modbus)
Baud Rate	2400 / 4800 (default) / 9600
Data Bits	8
Parity	None
Stop Bits	1
Default Modbus Address	1
Parameter Configuration	Via supplied configuration software through RS485
PM Resolution (PM2.5 / PM10 / PM1.0)	1 μg/m³
Temperature Resolution	0.1 °C
Humidity Resolution	0.1%RH
Particle Counting Efficiency	50% @ 0.3 μm, 98% @ ≥0.5 μm
PM2.5 Accuracy	±3% FS (0–100 μg/m³, 25 °C, 50%RH)
Temperature & Humidity Accuracy (Grade A)	±2%RH / ±0.4 °C (25 °C)
Temperature & Humidity Accuracy (Grade B, default)	±3%RH / ±0.5 °C (25 °C)
PM Measurement Range	0–1000 μg/m³
Temperature Measurement Range	−40 °C to +80 °C
Humidity Measurement Range	0–100%RH
Response Time	≤ 90 s

Preheating Time	≤ 2 min
Mounting Method	Wall-mounted

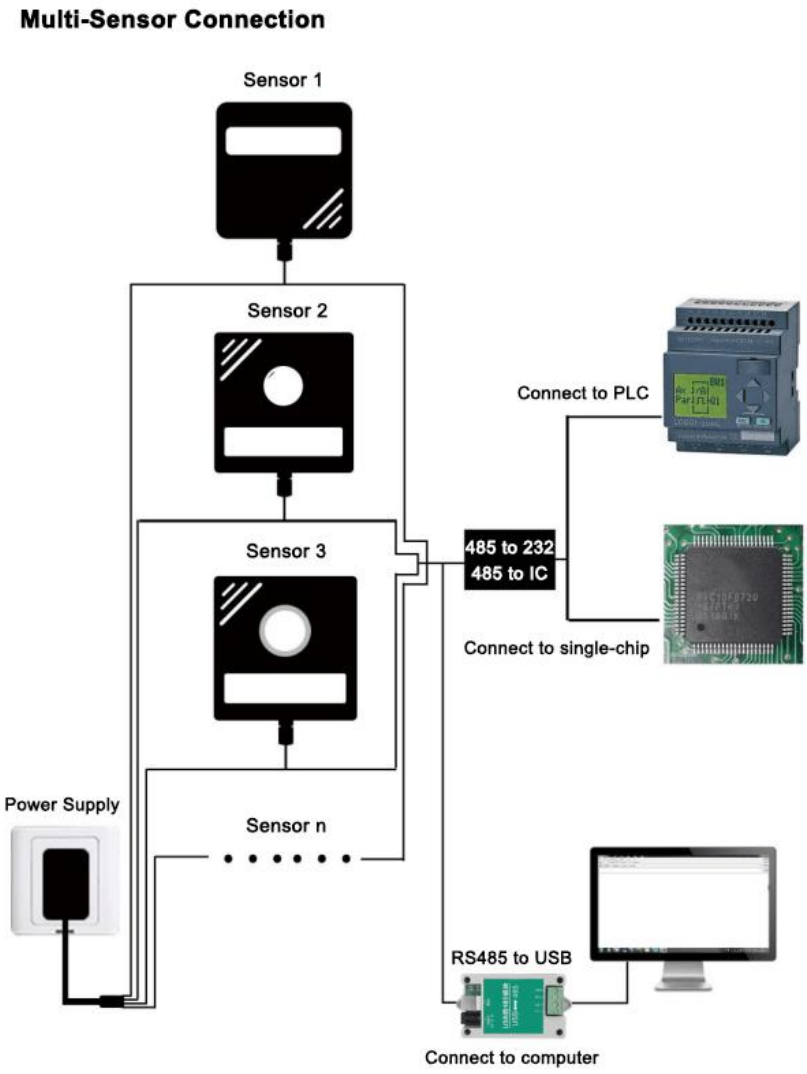
Dimensions: 110*85*44 mm



1.4 System Architecture Diagram



This product can also be used with multiple sensors connected to a single 485 bus. Theoretically, one bus can support up to 254 485 sensors. The other end can be connected to a PLC with a 485 interface, linked to a microcontroller via a 485 interface chip, or connected to a computer using a USB-to-485 adapter. Configuration and testing are performed using the sensor configuration tool provided by our company (only one device can be connected at a time when using this configuration software).



Chapter 2 Hardware Connection

2.1 Pre-Installation Equipment Inspection

Equipment List:

- Transmitter unit ×1
- Certificate of Conformity, Warranty Card, After-Sales Wiring Instructions, etc.
- Self-tapping screws ×2, Expansion plugs ×2
- USB to 485 Adapter (Optional)

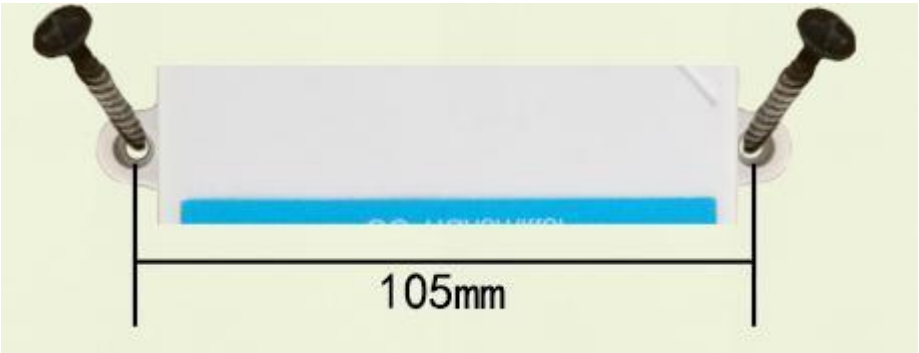
2.2 Interface Specifications

Wide voltage power input: 10~30V compatible. When connecting the 485 signal lines, ensure the A and B wires are not reversed. Addresses must not conflict between multiple devices on the bus.

2.2.1 Sensor Wiring

Function	Wire Color	Description
Power Supply	Brown	Power + (10–30 V DC)
Power Supply	Black	Power −
Communication	Yellow (Green)	RS485 A
Communication	Blue	RS485 B

2.3 Installation Methods



Wall-mounted installation. Mounting holes are located at the center of both sides of the device. The hole diameter is less than 4mm, with a hole spacing of 105mm. Installation can be performed using 3mm self-tapping screws.

3. Communication Protocol

3.1 Communication Basic Parameters

Code	8-bit binary
Data bits	8-bit
Parity bit	None
Stop bit	1-bit
Error check	CRC (Redundant Cyclic Code)
Baud rate	2400bit/s, 4800bit/s, 9600 bit/s settable, factory default 4800bit/s

3.2 Data Frame Format Definition

The ModBus-RTU communication protocol is used with the following format:
Initial structure ≥ 4 bytes of time
Address code = 1 byte
Function code = 1 byte
Data area = N bytes
Error check = 16-bit CRC code
End structure ≥ 4 bytes of time
Address code: Address of the transmitter, unique in the communication network

(factory default 0x01).
Function code: the function of the command issued by the host, this transmitter only uses function code 0x03 (read register data).
Data area: Data area is the specific communication data, note that 16bits data high byte in front!
CRC code: two-byte check code.
The host asks for the frame structure:

Address code	Function code	Register start address	Register length	Checksum low	Checksum high
1 byte	1 byte	2 byte	2 byte	1 byte	1 byte

Slave answer frame structure:

Address code	Function code	Number of valid bytes	Data one area	Second data area	Nth data area	Checksum code
1 byte	1 byte	1 byte	2 byte	2 byte	2 byte	2 byte

3.3 Register Address

When the device is configured for PM2.5/PM10 parameters:

Register Address	PLC / Modbus Address	Description	Access	Supported Function Codes
0000H	40001	PM2.5 (uploaded value is the actual measured value)	Read Only	0x03, 0x04
0001H	40002	PM10 (uploaded value is the actual measured value)	Read Only	0x03, 0x04
0002H	40003	PM1.0 (uploaded value is the actual measured value)	Read Only	0x03, 0x04
0052H	40083	PM10 Calibration Register (actual value ×10)	Read / Write	0x03, 0x04, 0x06, 0x10
0053H	40084	PM2.5 Calibration Register (actual value ×10)	Read / Write	0x03, 0x04, 0x06, 0x10
0054H	40085	PM1.0 Calibration Register (actual value ×10)	Read / Write	0x03, 0x04, 0x06, 0x10

When the equipment has multiple elements

Register Address	PLC / Modbus Address	Description	Access	Supported Function Codes
0000H	40001	Humidity (actual value ×10)	Read Only	0x03, 0x04
0001H	40002	Temperature (actual value ×10)	Read Only	0x03, 0x04
0002H	40003	PM2.5 (actual value)	Read Only	0x03, 0x04
0003H	40004	PM10 (actual value)	Read Only	0x03, 0x04
0004H	40005	PM1.0 (actual value)	Read Only	0x03, 0x04
0050H	40081	Temperature Calibration Register (actual value ×10)	Read / Write	0x03, 0x04, 0x06, 0x10

0051H	40082	Humidity Calibration Register (actual value ×10)	Read / Write	0x03, 0x04, 0x06, 0x10
0052H	40083	PM10 Calibration Register (actual value ×10)	Read / Write	0x03, 0x04, 0x06, 0x10
0053H	40084	PM2.5 Calibration Register (actual value ×10)	Read / Write	0x03, 0x04, 0x06, 0x10
0054H	40085	PM1.0 Calibration Register (actual value ×10)	Read / Write	0x03, 0x04, 0x06, 0x10

3.4 Communication Protocol Examples and Explanations

(1) Example: Read the temperature and humidity value at device address 0x01
Interrogation frame (hexadecimal):

Address Code	Function Code	Start Address	Data Length	Check Digit Low Bit	Check Digit High
0x01	0x03	0x00 0x00	0x00 0x02	0xC4	0x0B

Answer frame (hexadecimal): (e.g. read temperature -10.1℃, humidity 65.8% RH)

Address Code	Function Code	Returns Valid Bytes	Humidity Value	Temp. Value	Check Digit Low Bit	Check Digit High
0x01	0x03	0x04	0x02 0x92	0xFF 0x9B	0x5A	0x3D

Temperature calculation:
Temperature data is uploaded as complementary code when the temperature is lower than 0℃. Temperature: FF9B H (hex) = -101 => Temperature = -10.1℃
Humidity calculation:
Humidity: 292 H (hex) = 658 => Humidity = 65.8%RH
(2) Example: Reading the PM value from device address 0x01
Interrogation frame (hexadecimal):

Address Code	Function Code	Start Address	Modify Value	Check Digit Low Bit	Check Digit High
0x01	0x03	0x00 0x02	0x00 0x03	0xA4	0x0B

Answer frame (hexadecimal):

Address	Function Code	Number of Valid Data Bytes	PM2.5 Value	PM10 Value	PM1.0 Value	CRC Low Byte	CRC High Byte
0x01	0x03	0x04	0x00 0x65	0x00 0x79	0x00 0x52	0x2B	0xCE

PM2.5 Calculation:
PM2.5: 0065H (hexadecimal) = 101 => PM2.5 = 101 μg/m³
PM10 Calculation:
PM10: 0079H (hexadecimal) = 121 => PM10 = 121 μg/m³
PM1.0 Calculation:
PM1.0: 0052H (hexadecimal) = 82 => PM1.0 = 80 μg/m³
When the device is a PM element:

Example: Reading the PM value from device address 0x01

Inquiry Frame:

Address	Function Code	Starting Address	Data Length	CRC Low Byte	CRC High Byte
0x01	0x03	0x00 0x00	0x00 0x03	0x05	0xCB

Response Frame: (For example, reading PM2.5 at 85 μg/m³, PM10 at 156 μg/m³)

Address	Function Code	Number of Valid Data Bytes	PM2.5 Value	PM10 Value	PM1.0 Value	CRC Low Byte	CRC High Byte
0x01	0x03	0x04	0x00 0x55	0x00 0x9C	0x00 0x4A	0xEA	0x4A

PM2.5 Calculation:

PM2.5: 0055 H (hexadecimal) = 85 => PM2.5 = 85 μg/m³

PM10 Calculation:

PM10: 009CH (hexadecimal) = 156 => PM10 = 156 μg/m³

PM1.0 Calculation:

PM1.0: 004AH (hexadecimal) = 74 => PM1.0 = 74 μg/m³

Chapter 5: Common Issues and Solutions

No Output or Output Error

Possible Causes:

① The computer has a COM port, but the selected port is incorrect.

② Incorrect baud rate.

③ Disconnection in the 485 bus or reversed A/B wiring.

④ Excessive device count or overly long cabling. Use local power supply, add a 485 repeater, and install a 120Ω terminating resistor.

⑤ Missing or corrupted USB-to-485 driver.

⑥ Device malfunction.