ATO

Temp and Humidity Sensor for Duct

User Manual

Chapter 1 Product Introduction

1.1 Product Overview

This sensor is designed for pipeline temperature and humidity measurement. It incorporates an imported temperature and humidity measurement unit featuring low drift, high precision, and strong anti-interference capabilities, ensuring outstanding measurement performance. The product utilizes a sintered particle probe housing with an IP65 protection rating, making it suitable for various industrial environments.
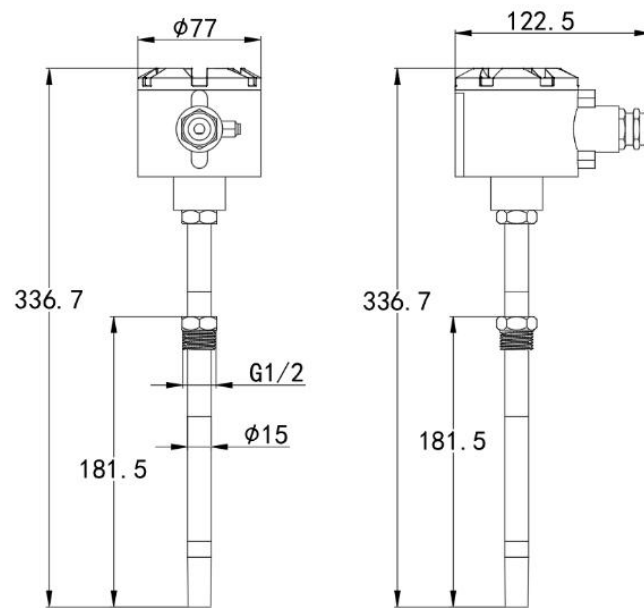
The device operates on a wide voltage range of 7-30V DC, features a 485 signal output, and supports the standard ModBus-RTU communication protocol. The ModBus address is configurable, the baud rate is adjustable, and the communication distance extends up to 2000 meters.

1.2 Product Features

■ Incorporates an imported temperature measurement unit for high measurement accuracy and strong anti-interference capability.

■ Standard ModBus-RTU communication protocol via 485 interface, with configurable address and baud rate, supporting communication distances up to 2000 meters.

■ Wide-range DC power supply (7-30V) adapts to diverse on-site DC power sources.

■ G1/2 threaded installation ensures easy mounting, while IP65 protection rating enables operation in harsh outdoor environments.
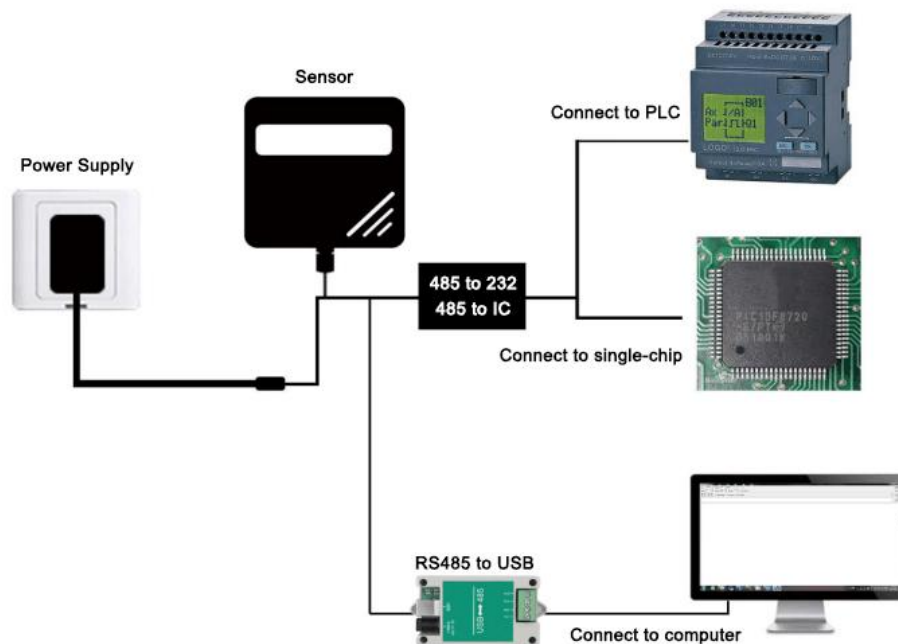
1.3 Key Specifications

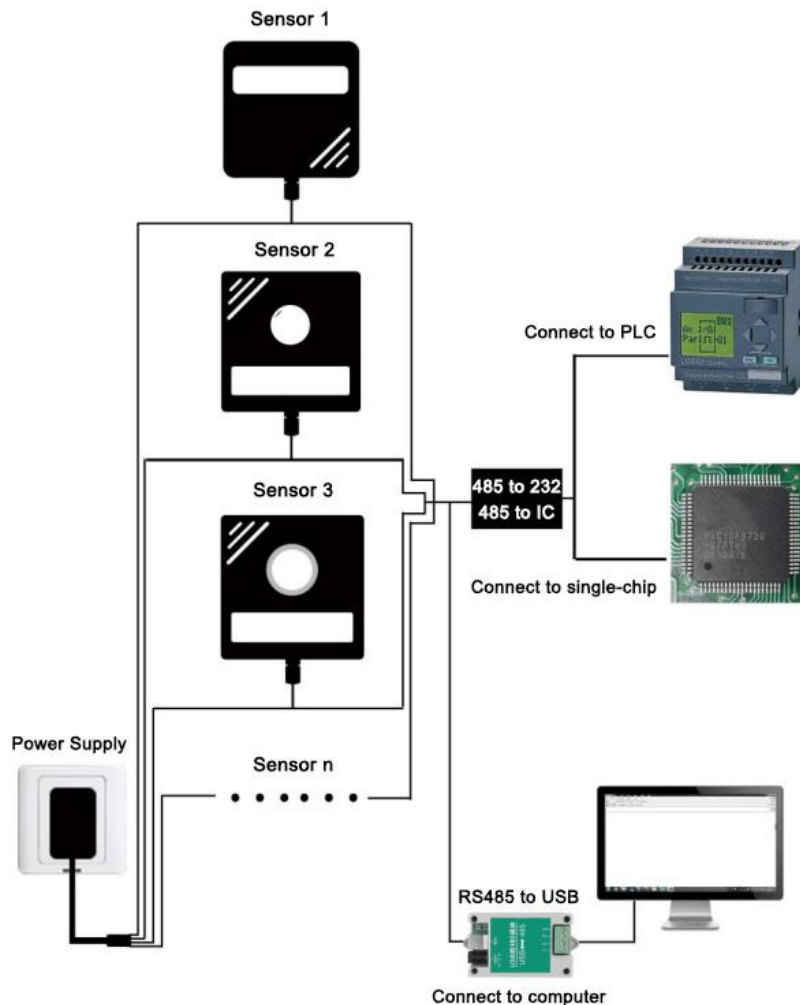|	
Power Supply (DC, default)	DC 7–30 V
Average Power Consumption	0.35 W
Operating Environment	-40°C to +60°C, 0%RH to 95%RH (non-condensing)
Temperature & Humidity Measuring Range	Temperature: -40°C to +120°C (default: -40°C to +80°C)
	Humidity: 0%RH to 100%RH
Temperature Display Resolution	0.1°C
Humidity Display Resolution	0.1%RH
Measurement Accuracy	Humidity: ±3%RH (60%RH, 25°C)
	Temperature: ±0.5°C (25°C)
Output Signal	RS485 (Modbus protocol)
Long-Term Stability	Humidity: ≤1%RH/year
	Temperature: ≤0.1°C/year
Installation Method	G1/2 Thread Mounting
Protection Rating	IP65

Unit: mm

1.4 System Architecture Diagram

Single Connection

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).

Multi-Sensor Connection

Chapter 2 Hardware Connection

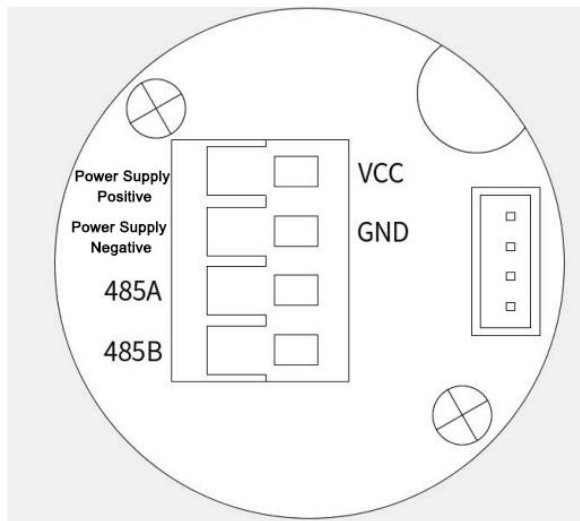## 2.1 Pre-Installation Equipment Inspection

Equipment List:
- One metal pipe temperature and humidity sensor
- Product certificate of conformity, warranty card

2.2 Interface Specifications

Wide voltage power input: 10~30V DC. When connecting the 485 signal lines, ensure the A/B wires are not reversed. Avoid address conflicts between multiple devices on the bus.

2.2.1 Sensor Wiring

2.3 Installation Methods

G1/2 Threaded Mounting

Chapter 3 Communication Protocol

3.1 Basic Communication Parameters

Code	8-bit binary
Data Bit	8-bit
Parity Bit	None
Stop Bit	1 bit
Error Check	CRC (Cyclic Redundancy Code)

Baud Rate	1200bit/s, 2400bit/s, 4800bit/s, 9600bit/s, 19200bit/s, 38400bit/s, 5760 0bit/s, 115200bit/s can be set, and the factory default is 4800bit/s.

3.2 Data Frame Format Definition

Using the Modbus-RTU communication protocol, the format is as follows:

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: Represents the sensor's address, which is unique within the communication network (factory default 0x01).

Function code: Indicates the command function issued by the host. This sensor only uses function code 0x03 (read register data).

Data Area: Contains the actual communication data. Note: For 16-bit data, the high byte comes first!

CRC Code: A two-byte check code.

Host inquiry frame structure:

Address Code	Function Code	Register Starting Address	Register Length	Check Digit Low Bit	Check Digit High Bit
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

Slave answer frame structure:

Address Code	Function Code	Effective Bytes	Data Area 1	Data Area 2	Data Area N	Check Digit
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	2 bytes

3.3 Register Address

Register Address (Hex)	PLC / Holding Register	Description	Supported Function Codes	Notes
0000H	40001	Humidity Value	0x03 / 0x04	Transmitted value is multiplied by 10
0001H	40002	Temperature Value	0x03 / 0x04	Transmitted value is multiplied by 10
0050H	40081	Temperature Calibration Value	0x03 / 0x04 / 0x06	Calibration value setting, scaling factor ×10, factory default: 0
0051H	40082	Humidity Calibration Value	0x03 / 0x04 / 0x06	Calibration value setting, scaling factor ×10, factory default: 0
07D0H	42001	RS485 Address	0x03 / 0x04 / 0x06	Address range: 1–254 (factory default: 1)

07D1H	42002	RS485 Baud Rate	0x03/0x04/0x06	0 = 2400 bps
				1 = 4800 bps
				2 = 9600 bps
				3 = 19200 bps
				4 = 38400 bps
				5 = 57600 bps
				6 = 115200 bps
				7 = 1200 bps

3.4 Communication Protocol Examples and Explanations

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

Example: Device address 0x01 is changed to 0x02.

Inquiry frame (hexadecimal): (assuming that the modified address is 0x02 Note: After modifying t address, you need to power off and restart the device)

Address Code	Function Code	Start Address	Modify Value	Check Digit Low Bit	Check Digit High
0x01	0x06	0x07 0xD0	0x00 0x02	0x08	0x86

Answer frame (hexadecimal):

Address Code	Function Code	Start Address	Modify Value	Check Digit Low Bit	Check Digit High
0x01	0x06	0x07 0xD0	0x00 0x02	0x08	0x86

Chapter 4: Common Issues and Solutions

Device cannot connect to PLC or computer

Possible causes:

1) The computer has multiple COM ports; the selected port is incorrect.

2) Incorrect device address, or devices with duplicate addresses (factory default is 1 for all).

3) Incorrect baud rate, parity mode, data bits, or stop bits.

4) Host polling interval and response wait time are too short; both should be set to 200ms or higher.

5) Disconnection in the 485 bus, or reversed A/B wires.

6) Too many devices or excessive cable length. Power devices locally, add a 485 repeater, and install a 120Ω terminating resistor.

7) USB-to-485 driver is missing or corrupted.

8) Device failure.