

**Small Ultrasound
All-in-one weather
station
(Type 485)**

SN-*-FSXCS-N01

Ver 2.0



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No. Chapter 1 Product Introduction

1.1 Product Overview

This small integrated weather station can be widely used in environmental detection, integrating wind speed, wind direction, temperature and humidity, noise collection, PM2.5 and PM10, atmospheric pressure, light, and accumulated rainfall. The equipment adopts standard ModBus-RTU communication protocol and RS485 signal output. The communication distance can reach up to 2000 meters, and the data can be transmitted through RS485 communication to the customer's monitoring software or PLC configuration screen, etc., and also supports secondary development.

The device with built-in electronic compass has no orientation requirement during installation, and only needs to be installed horizontally. It is suitable for use in mobile occasions such as marine ships and automobile transportation, and has no orientation requirement during installation.

This product is widely used in various occasions that need to measure environmental temperature and humidity, noise, air quality, atmospheric pressure, light, etc. It is safe and reliable, beautiful in appearance, easy to install and durable.

1.2 Features

This product is small in size, light in weight, made of high-quality UV-resistant materials, has a long service life, uses a highly sensitive probe, has a stable signal, and is highly accurate. The key components are imported, stable and reliable, with wide measuring range, good linearity, good waterproof performance, easy to use, easy to install, and long transmission distance.

- Adopting multi-collection device integrated design, easy to install;
- Wind speed and direction are measured using ultrasonic principles, with no angle restrictions and 360° omnidirectional, and data on wind speed and direction can be obtained simultaneously;
- Noise collection, accurate measurement, range up to 30dB~120dB;
- PM2.5 and PM10 are collected simultaneously, with a range of 0-1000 μ g/m³ and a resolution of 1 μ g/m³. It has unique dual-frequency data collection and automatic calibration technology, and the consistency can reach $\pm 10\%$;
- Measure ambient temperature and humidity. The measuring unit is imported from Switzerland and the measurement is accurate.
- Wide range 0-120kPa air pressure range, can be applied to various altitudes;

- The rainfall is measured by optical principle. Easy to maintain, not easily obscured by fallen leaves;
- Adopting dedicated 485 circuit, the communication is stable;
- For devices with built-in electronic compass, there is no direction requirement when installing them, and they can be installed horizontally.

1.3 Main parameters

DC power supply (default)	10-30VDC	
Maximum power consumption	RS485 output	0.7W
Accuracy	Wind speed	$\pm 0.5 + 2\%FS$ (60%RH, 25°C)
	wind direction	$\pm 3^\circ$ (60%RH, 25°C)
	humidity	$\pm 3\%RH$ (60%RH,25°C)
	temperature	$\pm 0.5^\circ C$ (25°C)
	Atmospheric pressure	$\pm 0.15kPa@25^\circ C$ 101kPa
	noise	$\pm 0.5dB$ (at reference pitch, 94dB@1kHz)
	PM2.5	Particle counting efficiency: 50%@0.3 μm , 98%@ $\geq 0.5\mu m$. PM2.5 accuracy: $\pm 3\%FS$ (@100 $\mu g/m^3$, 25°C, 50%RH)
	CO2	$\pm(50ppm + 3\%F \cdot S)$ (25°C)
	Light intensity	$\pm 7\%$ (25°C)
	Total solar radiation	$\leq \pm 3\%@150W/m^2$
Range	Wind speed	0~40m/s, start wind speed is 0.5m/s
	wind direction	0~359°
	humidity	0%RH~99%RH
	temperature	-40°C~+80°C

	Atmospheric pressure	0-120kPa
	noise	30dB~120dB
	PM10 PM2.5	0-1000 μ g/m ³
	CO2	0-5000ppm
	Light intensity	0~200,000 Lux
	Total solar radiation	0~1800W/m ²
Long-term stability	temperature	$\leq 0.1^{\circ}\text{C}/\text{y}$
	humidity	$\leq 1\%/\text{y}$
	Atmospheric pressure	-0.1kPa/y
	noise	$\leq 3\text{dB}/\text{y}$
	PM10 PM2.5	$\leq 1\%/\text{y}$
	CO2	$\leq 1\%/\text{y}$
	Light intensity	$\leq 5\%/\text{y}$
	Total solar radiation	$\leq \pm 3\%$
Response time 1	Wind speed	1s
	wind direction	1s
	temperature	$\leq 25\text{s}$ (1m/s wind speed 2)
	humidity	$\leq 8\text{s}$ (1m/s wind speed 2)
	Atmospheric pressure	$\leq 2\text{s}$
	noise	$\leq 3\text{s}$
	PM10 PM2.5	$\leq 90\text{s}$
	CO2	$\leq 90\text{s}$
	Light intensity	$\leq 2\text{s}$
	Total solar	$\leq 10\text{s}$

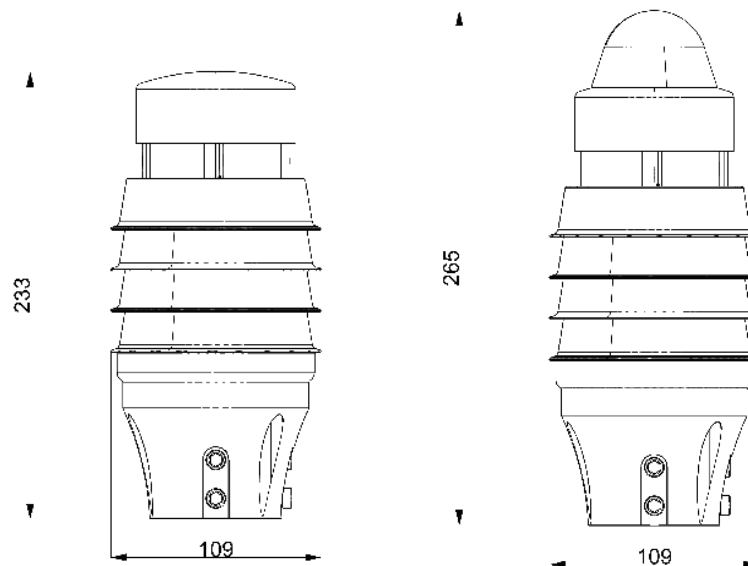
	radiation	
Optical rainfall parameters	Typical accuracy	±5%
	Resolution	Standard 0.1mm
	Maximum instantaneous rainfall	24mm/min
	Rain Sensing Diameter	6cm
Protection level	IP54	
Output signal	RS485 (standard ModBus communication protocol)	

¹The response time is τ 63 time.

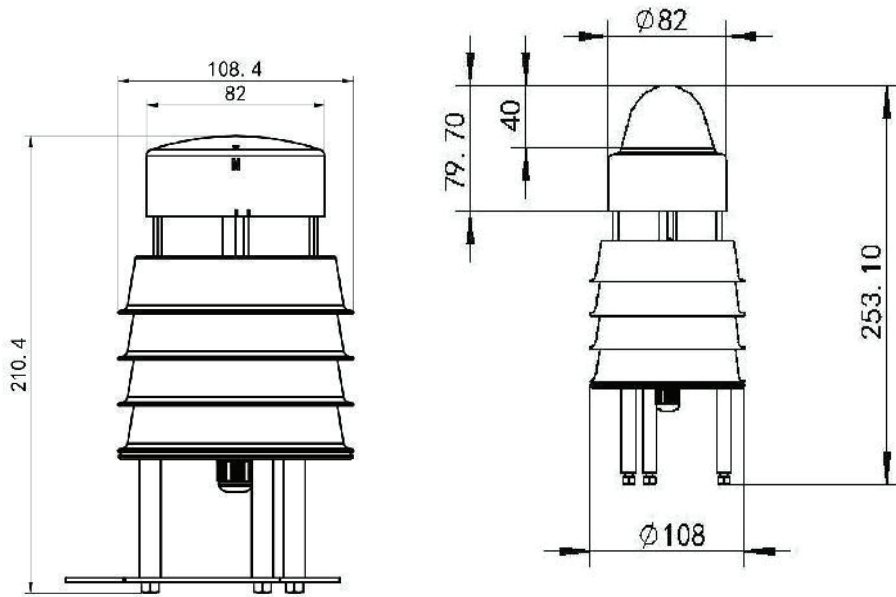
²Wind speed refers to the wind speed at the sensitive material inside the sensor. The wind speed in the test environment is 10^{-2} When the wind speed is 0.1m/s, the wind direction is perpendicular to the sensor collection port, and the wind speed at the sensitive material inside the sensor is about 1m/s.

The performance data stated above was obtained under test conditions using our test system and software. In order to continuously improve our products, our company reserves the right to change design features and specifications without prior notice.

Shell size



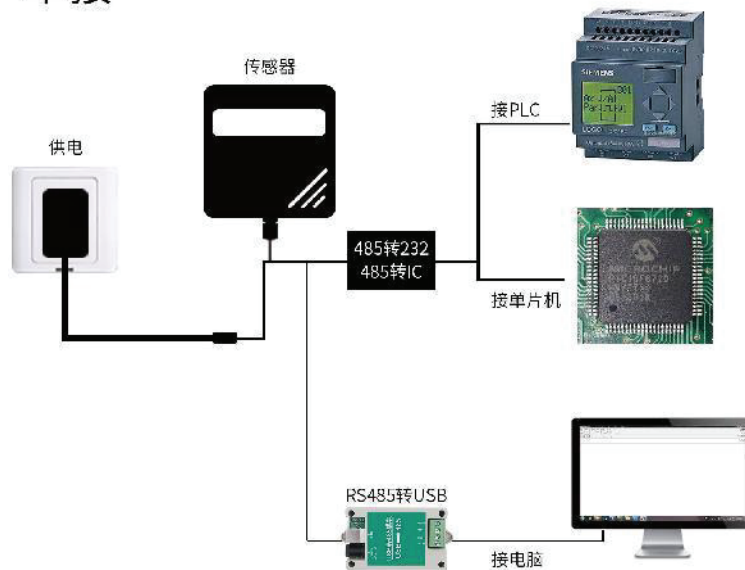
-3H equipment dimensions (unit: mm) -3H with optical rainfall element dimensions (unit: mm)



Equipment dimensions (unit: mm) Dimensions with optical rainfall element (unit: mm)

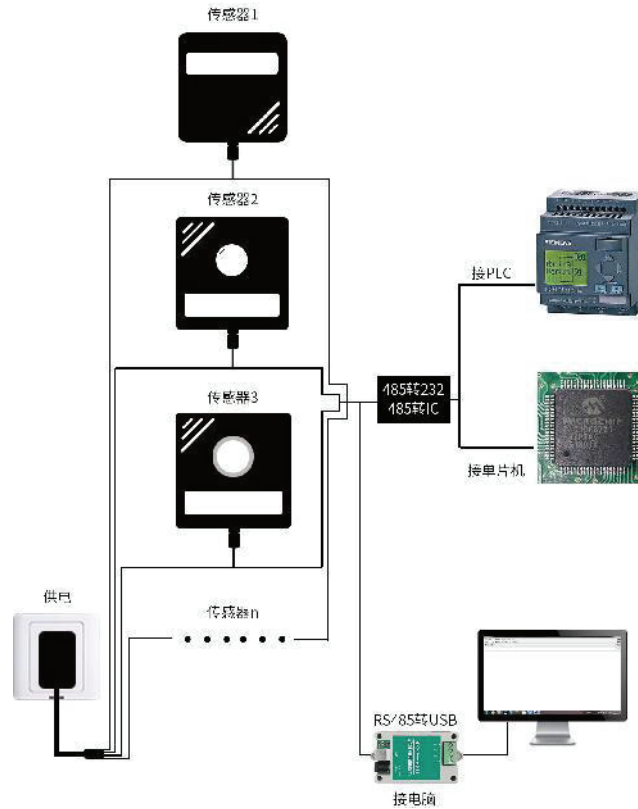
1.4 System Framework Diagram

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This product can also be used by combining multiple sensors on a 485 bus. Theoretically, one bus can connect 254 485 sensors, and the other end can be connected to a PLC with a 485 interface, connected to a single-chip microcomputer through a 485 interface chip, or connected to a computer using a USB to 485 converter. Use the sensor configuration tool provided by our company for configuration and testing (only one device can be connected when using this configuration software).

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1.5 Product Selection

SN-			Company Code
	3003-		Small ultrasonic integrated weather station housing
	3003H		Premium appearance
	-		
	FSXCS		Ultrasonic integrated weather station
	-	N01	485 communication (standard ModBus-RTU protocol)
		-	
		nu	No built-in electronic compass
		ll	
		C	Built-in electronic compass function
		P	

Chapter 2 Hardware Connection

2.1 Equipment inspection before installation

Equipment List:

- 1 weather station equipment
- Certificate of Compliance
- 1 70cm waterproof male plug
- 2 white brackets, 2 M4*10 screw nuts, 3 M5*14 hexagon screws (-3 optional accessories)
- Hexagonal wrench 1 (-3H optional accessory)

2.2 Interface Description

The DC power supply is 10-30V. When wiring the 485 signal line, please note that the A/B lines cannot be connected in reverse, and the addresses of multiple devices on the bus cannot conflict.

2.2.1 Sensor Wiring

	Line Color	illustrate
power supply	brown	Power positive (10-30V DC)
	black	Negative power supply
Communications	Yellow (green)	485-A
	blue	485-B

2.3 Installation



-3 Model Installation Method



-3H model installation method

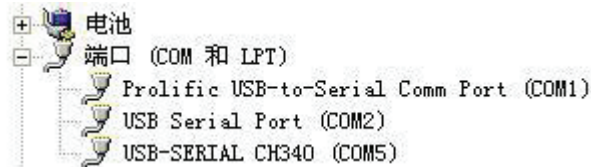
Chapter 3 Configuration Software Installation and Usage

Our company provides the matching "485 parameter configuration software", which can conveniently use the computer to read the parameters of the sensor and flexibly modify the device ID and address of the sensor.

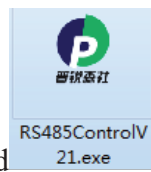
Note that when using software to automatically acquire, it is necessary to ensure that there is only one sensor on the 485 bus.

3.1 Sensor connected to computer

After the sensor is correctly connected to the computer via USB to 485 and powered, the correct COM port can be seen on the computer (check the COM port in "My Computer - Properties - Device Manager - Port").



Open the data package, select "Debug Software" --- "485 Parameter Configuration

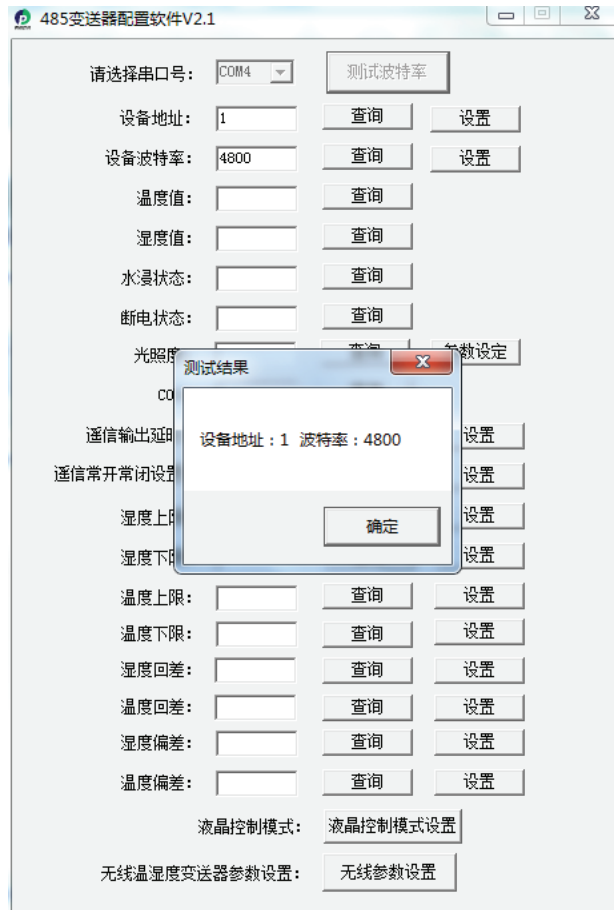


Software", find Just open it.

If the COM port is not found in the device manager, it means that you have not installed the USB to 485 driver (in the data package) or the driver is not installed correctly. Please contact the technician for help.

3.2 Use of sensor monitoring software

- ①、Configure the interface as shown in the figure. First, Use the method in Section 3.1 to obtain the serial port number and select the correct serial port.
- ②. Click the test baud rate of the software, and the software will test the baud rate and address of the current device. The default baud rate is 4800bit/s and the default address is 0x01.
- ③. Modify the address and baud rate according to the needs, and query the current functional status of the device.
- ④. If the test fails, please recheck the device wiring and 485 driver installation.



Chapter 4 Communication Protocol

4.1 Basic communication parameters

coding	8-bit binary
Data bits	8-bit
Parity bit	none
Stop bits	1st
Error checking	CRC (Redundant Cyclic Code)
Baud rate	2400 bit/s, 4800 bit/s, 9600 bit/s can be set, the factory default is 4800 bit/s

4.2 Data frame format definition

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

Time when initial structure ≥ 4 bytes

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error checking = 16-bit CRC code

End structure \geq 4 bytes time

Address code: The address of the transmitter, which is unique in the communication network (factory default 0x01).

Function code: The function indication of the command sent by the host. This transmitter only uses function code 0x03 (read register data).

Data area: The data area is the specific communication data. Note that the high byte of the 16-bit data comes first!

CRC code: a two-byte check code.

Host inquiry frame structure:

Address code	Function code	Register start address	Register length	Checksum lowbyte	Check code highbyte
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

Slave response frame structure:

Address code	Function code	Number of valid bytes	Data Zone 1	Data Zone 2	Data Area N	Check code low byte	Checksum high byte
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	1 byte	1 byte

4.3 Register Address

The contents of the register are shown in the following table (supporting 03/04 function codes):

Register Address	PLC or configuration address	content	Support function code	Definition
500	40501	Wind speed value	0x03/0x04	100 times the actual value
501	40502	Wind	0x03/0x04	Actual value (Wind level value corresponding to the current wind speed)
502	40503	Wind direction (0-7 levels)	0x03/0x04	Actual value (the north direction is 0, the value increases clockwise, and the east direction is 2)
503	40504	Wind direction (0-360°)	0x03/0x04	Actual value (0° in the north direction and increasing degrees clockwise, 90° in the east direction)
504	40505	Humidity value	0x03/0x04	10 times the actual value
505	40506	Temperature value	0x03/0x04	10 times the actual value
506	40507	Noise value	0x03/0x04	10 times the actual value
507	40508	PM2.5 value	0x03/0x04	Actual value
508	40509	PM10 value	0x03/0x04	Actual value
509	40510	Atmospheric pressure value (unit: kPa,)	0x03/0x04	10 times the actual value
510	40511	The Lux value of 20W is 16 bits higher	0x03/0x04	Actual value
511	40512	20W Lux value low 16 bits	0x03/0x04	Actual value
512	40513	20W light value (unit: 100 Lux)	0x03/0x04	Actual value

513	40514	Optical rainfall value (unit: mm)	0x03/0x04	10 times the actual value
514	40515	Electronic compass angle	0x03/0x04	100 times the actual value
515	40516	Total solar radiation	0x03/0x04	Actual value

Contents of the calibration register

Register Address	content	Support function code	Definition
6000 H	Small Ultrasonic Wind Direction Deviation Register	0x06	0 represents normal direction 1 means the direction is offset by 180°
6001 H	Small ultrasonic wind speed zeroing register	0x06	Write 0xAA, wait 10 seconds, and then the device will be reset to zero.
6002 H	Optical Rain Zeroing Register	0x06	Write 0x5A, the rainfall value is set to zero
6003 H	Optical Rainfall Sensitivity	0x06	The default setting is 11 H. You can reduce it to increase the rainfall sensitivity.

4.4 Communication protocol examples and explanations

4.4.1 Example: Read the real-time wind speed value of the transmitter device (address 0x01)

Inquiry frame

Address code	Function code	Starting address	Data length	Checksum lowbyte	Check code highbyte
0x01	0x03	0x01 0xF4	0x00 0x01	0x C4	0x04

Response frame

Address code	Function code	Returns the number of valid bytes	Wind speed value	Checksum lowbyte	Check code highbyte
0x01	0x03	0x02	0x00 0x7D	0x78	0x65

Real-time wind speed calculation:

Wind speed : 007D (hexadecimal) = 125 => wind speed = 1.25 m/s

4.4.2 Example: Read the wind direction value of the transmitter device (address 0x01)

Inquiry frame

Address code	Function code	Starting address	Data length	Checksum lowbyte	Check code highbyte
0x01	0x03	0x01 0xF6	0x00 0x01	0x65	0xC4

Response frame

Address code	Function code	Returns the number of valid bytes	Wind direction value	Checksum lowbyte	Check code highbyte
0x01	0x03	0x02	0x00 0x02	0x39	0x85

Wind direction calculation:

wind direction : 0002 (hexadecimal) = 2 => Wind direction = east wind

4.4.3 Example: Read the temperature and humidity values of the transmitter device (address 0x01)

Inquiry frame

Address code	Function code	Starting address	Data length	Check code low	Check code high digit
0x01	0x03	0x01 0xF8	0x00 0x02	0x44	0x06

Response frame (for example, the temperature is -10.1°C and the humidity is 65.8%RH)

Address code	Function code	Number of valid bytes	Humidity value	Temperature value	Check code low	Check code high digit
0x01	0x03	0x04	0x02 0x92	0xFF 0x9B	0x5A	0x3D

Temperature: When the temperature is below 0°C Upload in the form of complement code

0xFF9B (hexadecimal) = -101 => Temperature = -10.1°C

humidity:

0x0292 (hexadecimal) = 658 => humidity = 65.8% RH

Chapter 5 Common Problems and Solutions

The device cannot connect to the PLC or computer

Possible causes:

- 1) The computer has multiple COM ports and the selected port is incorrect.
- 2) The device address is incorrect, or there are devices with duplicate addresses (factory default is all 1).
- 3) Baud rate, check mode, data bit, and stop bit errors.
- 4) The host polling interval and waiting response time are too short and need to be set to more than 200ms.
- 5) The 485 bus is disconnected, or the A and B lines are connected reversely.
- 6) If there are too many devices or the wiring is too long, power supply should be provided nearby, a 485 enhancer should be added, and a 120Ω terminal resistor should be added.
- 7) The USB to 485 driver is not installed or is damaged.
- 8) Equipment damage.

Note: To ensure the accuracy of the equipment, please clean the surface below the measuring area of the equipment regularly to keep it clean and free of dust or other foreign matter.