RS-FSXCS-N01-*-EX
Small Ultrasonic Integrated Weather Station
User Manual

Document version:V1.7

Catalog

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 rainfall. The equipment adopts standard MODBUS-RTU communication protocol and RS485 signal output. The communication distance can be up to 2000 meters, and data can be uploaded to the customer's monitoring software or PLC configuration screen through 485 communication mode, and secondary development is also supported.

With the built-in electronic compass selection device, there is no longer a position requirement during installation, just ensure that it is installed horizontally. It is suitable for use in mobile occasions such as marine ships and automobile transportation, and there is no direction 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 and rainfall etc. It is safe and reliable, beautiful in appearance, easy to install, and durable.

1.2 Features

This product is with small size and light weight, made of high-quality anti-ultraviolet materials, long service life, adopt high-sensitivity probe, have stable signal and high precision. The key components adopt imported components, which are stable and reliable, and have the characteristics of wide measurement range, good linearity, good waterproof performance, convenient use, easy installation, and long transmission distance etc..

- The integrated design of multiple collection devices is adopted, which is easy to install.
- Wind speed and direction are measured by ultrasonic principle, no angle limit, 360° omni-directional, wind speed and wind direction data can be obtained at the same time.
- Noise collection, accurate measurement, the range is as high as 30dB~130dB.
- PM2.5 and PM10 are collected at the same time, range: 0~1000μg/m³, resolution 1μg/m3, unique dual-frequency data collection and automatic calibration technology, the consistency can reach ±10%.
- Measure the environmental temperature and humidity, the measuring unit is imported from Switzerland, and the measurement is accurate.
- Wide range 0~120Kpa air pressure range, applicable to various altitudes.
- Using dedicated 485 circuit, the communication is stable.
- Equipment with built-in electronic compass, no direction requirements during installation, just install it horizontally。

1.3 Main technical parameters

DC power supply (default)	10~30VDC	
Maximum power consumption	RS485 output	0.7W
Precision	Wind speed	±0.5+2%FS(60%RH,25℃)
	Wind direction	±3°(60%RH,25℃)
	Humidity	±3%RH(60%RH,25℃)
	Temperature	±0.5℃(25℃)
	Atmospheric pressure	±0.15Kpa@25℃ 101Kpa
	Noise	±0.5dB (at reference pitch, 94dB@1kHz
	PM2.5	Particle counting efficiency: 50%@0.3μm, 98%@>=0.5μm。 PM2.5 precision: ±3%FS(@100μg/m³, 25℃, 50%RH)
	CO2	±(50ppm+ 3%F·S) (25℃)
	Light intensity	±7%(25℃)
	Total solar radiation	≤±3%@150W/m²
Range	Wind speed	0~40m/s, start-up wind speed is 0.5m/s
	Wind direction	0~359°
	Humidity	0%RH~99%RH
	Temperature	-40℃~+80℃
	Atmospheric pressure	0~120Kpa
	Noise	30dB~120dB
	PM10 PM2.5	0~1000μg/m3
	CO2	0-5000ppm
	Light intensity	0~200,000 Lux
	Total solar radiation	0-1,800W/m²
Long term stability	Temperature	≤0.1℃/y
	Humidity	≤1%/y
	Atmospheric pressure	-0.1Kpa/y
	Noise	≤3dB/y
	PM10 PM2.5	≤1%/y
	CO2	≤1%/y

	Light intensity	≤5%/y
	Total solar radiation	≤±3%
Response time[1]	Wind speed	1s
	Wind direction	1s
	Temperature	≤25s(1m/s wind speed[2])
	Humidity	≤8s(1m/s wind speed[2])
	Atmospheric pressure	≤2s
	noise	≤3s
	PM10 PM2.5	≤90s
	CO2	≤180s
	Light intensity	≤2s
	Total solar radiation	≤10s
Optical rainfall parameter	Typical precision	±5%(from Renke Labs data)
	Resolution	Standard 0.1mm
	Maximum instantaneous rainfall	24mm/min
	Rain sensitive diameter	6cm
Optical tipping bucket rain gauge	Typical precision	±4%(from Renke Labs data)
	Resolution	Standard 0.1mm
	Maximum instantaneous rainfall	4mm/min
Protective grade		IP54
Output signal		RS485 (standard ModBus communication protocol)

The performance data stated above were obtained under test conditions using our test system and software. In order to continuously improve the product, We reserve the right to change the design features and specifications without prior notice.

[1] Response time is τ63 time.

[2] Wind speed refers to the wind speed at the sensitive material inside the sensor. When the test environment wind speed is 10-2m/ms, the wind direction is perpendicular to the sensor acquisition port, and the wind speed at the sensitive material inside the sensor is about 1m/s.

1.4 Product model

RS-					Company code
	FSXCS-				Ultrasonic integrated weather station
		N01-			485 communication (standard Modbus-RTU protocol)
			3-		Small ultrasonic integrated shell
			3H-		Premium appearance
			3HP-		Optical tipping rainfall appearance
				None	No built-in electronic compass
				CP-	Built-in electronic compass function
					EX Fixed code

2. Equipment size
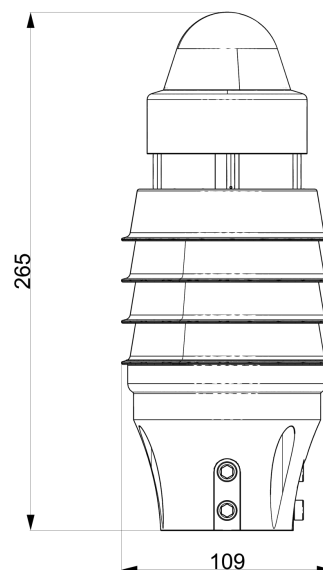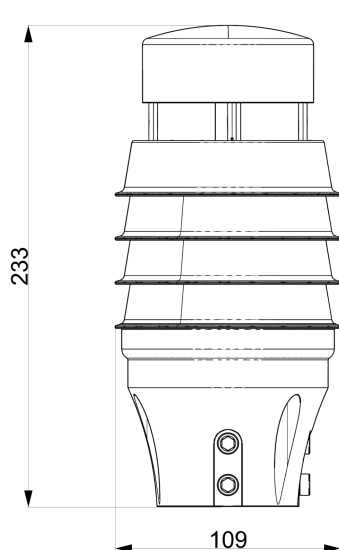
-3H device dimension diagram(unit:mm)   -3H device with optical rainfall dimension diagram(unit:mm)
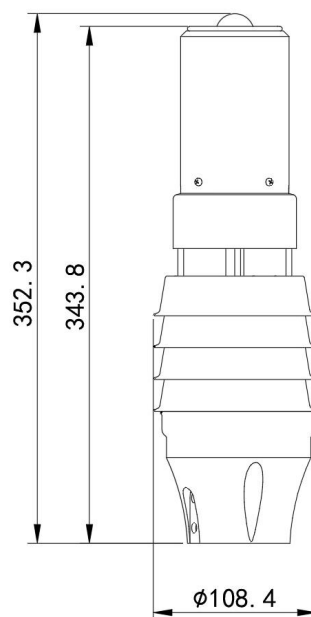
-3HP device dimension(unit: mm)
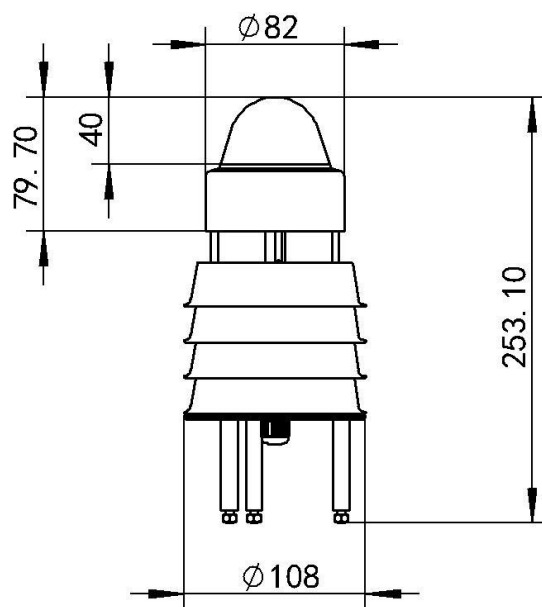
-3 device dimension diagram(unit:mm)   -3H device with optical rainfall dimension diagram(unit:mm)

3. Equipment installation instructions

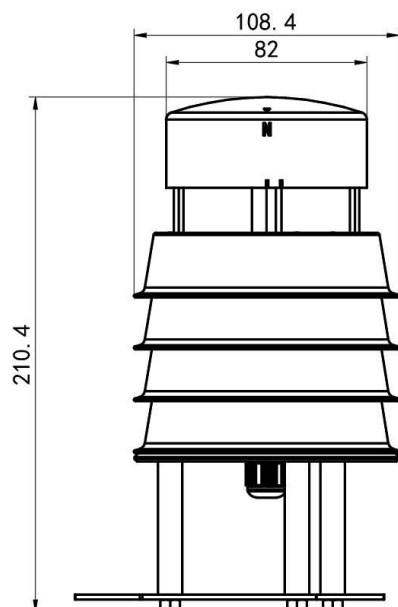## 3.1 Inspection before equipment installation

Equipment List:

- 1pc transmitter device
- Certificate of conformity, warranty card
- 70cm waterproof plug wire male plug 1pc
- 2pcs white pallets, 2sets M4*10 screws and nuts, 3pcs M5*14 outer hexagon screw(-3 select model components)
- 1pc hex wrench(-3H and -3HP select model components)

3.2 Installation method

Beam installation (optional):

The installation of devices without electronic compass is shown in the figure below, and devices with built-in electronic compass only need to be installed horizontally.

Note: Make the N-word direction on the device face due north to avoid error

-3 model installation mode

Note: Make the N word on the device face to due north to avoid error.

-3H model installation mode

Note: Keep the letter "N" align to due north direction, to avoid deviasion.
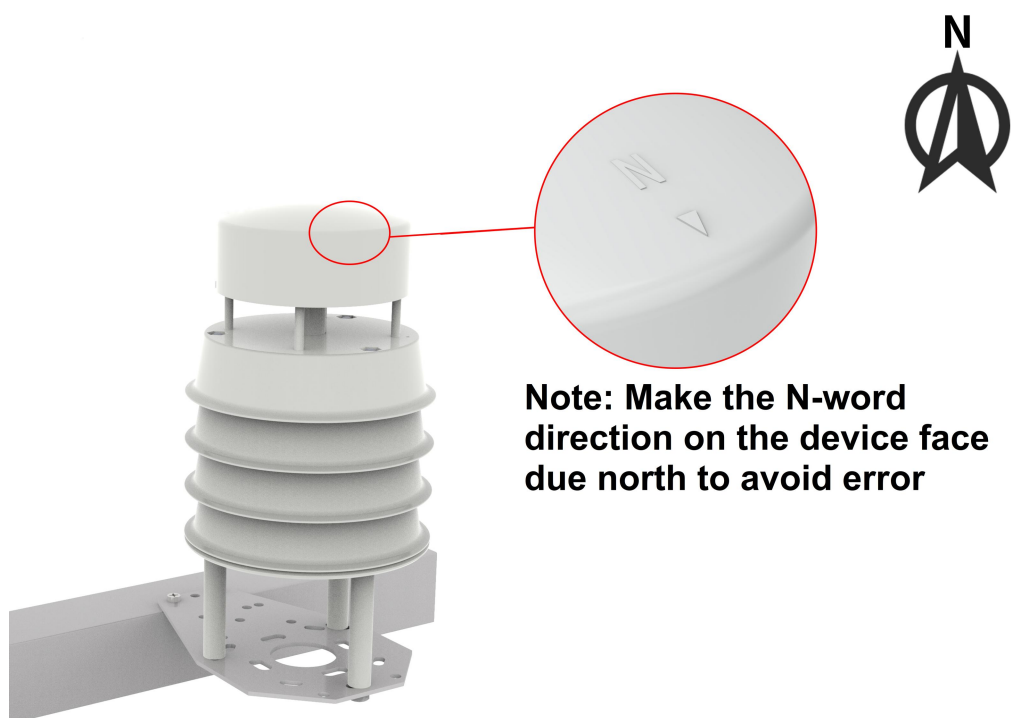
-3HP model installation mode

3.3 Interface Description

DC 10~30V power supply. When wiring the 485 signal line, pay attention to the two lines A/B not to be reversed, and the addresses of multiple devices on the bus must not conflict.。

	Thread color	Description
Power supply	brown	V+(10-30V DC)
	black	V-
Communication	green(yellow)	485-A
	blue	485-B

3.4 485 Field wiring instructions

When multiple 485 devices are connected to the same bus, there are certain requirements for field wiring. For details, please refer to the "485 Device Field Wiring Manual" in the document package.

4. Configuration software installation and use

4.1 Software selection

Open the document package, select "Debug software" --- "485 parameter configuration software",

find "485 parameter configuration tool" and just open it..

4.2 Parameter settings

①. Select the correct COM port (check the COM port in "My Computer—Properties—Device Manager—Port"). The following figure lists the driver names of several different 485 converters.

② Connect only one device alone and power it on, click the test baud rate of the software, 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.

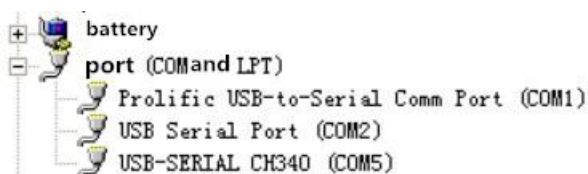③. Modify the address and baud rate according to the needs of use, and at the same time, you can query the current function status of the device.

④. If the test is unsuccessful, please recheck the equipment wiring and 485 driver installation.
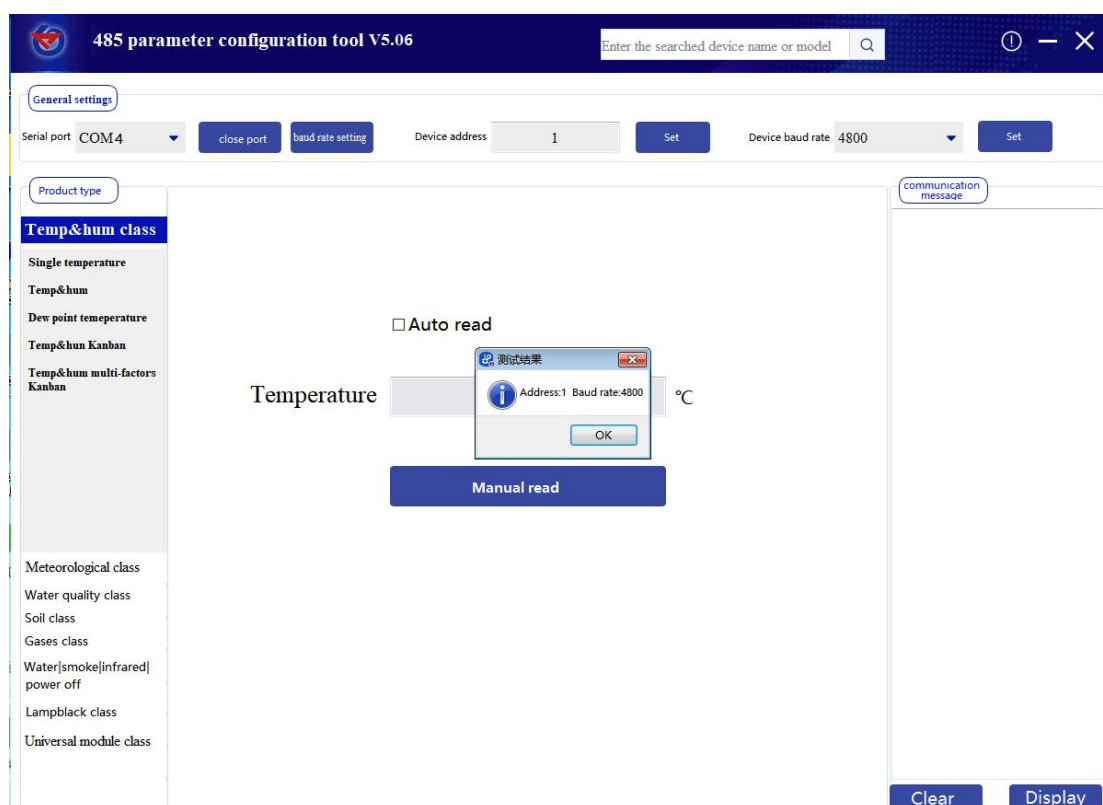
5. Communication protocol

5.1 Basic communication parameters

Code	8-bit binary
Data bit	8-bit
Parity bit	Not have
Stop bit	1-bit
Error checking	CRC (Cyclic Redundant Code)
Baud rate	1200bit/s, 2400bit/s, 4800bit/s, 9600bit/s, 19200bit/s, 38400bit/s, 57600bit/s, 115200bit/s can be set, the factory default is 4800bit/s

5.2 Data frame format definition

Using 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

Time to end structure ≥ 4 bytes

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

Function code: The command function instruction issued by the host.

Data area: The specific communication data, pay attention that 16bits data high byte are at the front!

CRC code: two-byte check code.

Host inquiry frame structure：

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

Slave machine response frame structure:

address code	function code	Number of valid bytes	Data area	Data area two	Data N area	Check code low byte	Check code high byte
1byte	1byte	1byte	2bytes	2bytes	2bytes	1byte	1byte

5.3 Communication register address description

The contents of the register are shown in the table below (support 03/04 function code)：

Register address	PLC or configuration address	Content	Support function code	Definition description
500	40501	Wind speed value	0x03/0x04	100 times of the actual value
501	40502	Wind force	0x03/0x04	Actual value (The wind level value corresponding to the current wind speed)
502	40503	Wind direction (0-7 grade)	0x03/0x04	Actual value (the direction of true north is 0, the value is increased clockwise, and the value of true east is 2)
503	40504	Wind direction (0-360°)	0x03/0x04	Actual value (the direction of true north is 0° and the degree increases clockwise, and the direction of true east is 90°)
504	40505	Humidity value	0x03/0x04	10 times of the actual value

505	40506	Temperature value	0x03/0x04	10 times of the actual value
506	40507	Noise value	0x03/0x04	10 times of the actual value
507	40508	PM2.5 value /CO2	0x03/0x04	Actual value
508	40509	PM10 value/CO2	0x03/0x04	Actual value
509	40510	Atmospheric pressure value (unit Kpa,)	0x03/0x04	10 times of the actual value
510	40511	High 16-bit value of Lux value of 20W	0x03/0x04	Actual value
511	40512	Low 16-bit value of Lux value of 20W	0x03/0x04	Actual value
512	40513	20W light value (unit: hundred lux)	0x03/0x04	Actual value
513	40514	Optical rainfall rainfall value (unit: mm)	0x03/0x04	10 times of the actual value
514	40515	Electronic compass Angle	0x03/0x04	100 times of the actual value
515	40516	Solar radiation value high 16-bit value	0x03/0x04	Actual value

Contents of the calibration register

Register address	content	Support function code	Definition description
6000H	Small ultrasonic wind direction offset register	0x06	0 means normal direction 1 means the direction offset 180°
6001H	Small ultrasonic wind speed zero adjustment register	0x06	Write 0xAA, wait for 10s, and set the device to zero
6002H	Optical Rainfall Zeroing Register	0x06	Write 0x5A, set the rainfall value to zero
6003H	Optical rain sensitivity value	0x06	The default value is 11H, when reduced, the rainfall sensitivity can be increased

5.4 Communication protocol example and explanation

5.4.1Example: Read the real-time wind speed value of the transmitter device (address 0x01)

Inquiry frame

Address code	Function code	Starting address	Data length	Check code low byte	Check code high byte
0x01	0x03	0x01 0xF4	0x00 0x01	0x C4	0x04

Reply frame

Address code	Function code	Returns the number of valid bytes	Wind speed value	Check code low byte	Check code high byte
0x01	0x03	0x02	0x00 0x7D	0x78	0x65

Real-time wind speed calculation:

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

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

Inquiry frame

Address code	Function code	Starting address	Data length	Check code low byte	Check code high byte
0x01	0x03	0x01 0xF6	0x00 0x01	0x65	0xC4

Reply frame

Address code	Function code	Returns the number of valid bytes	Wind direction value	Check code low byte	Check code high byte
0x01	0x03	0x02	0x00 0x02	0x39	0x85

Wind direction calculation:

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

5.4.3 Example: Read the temperature and humidity value of the transmitter device (address 0x01)

Inquiry frame

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

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

address code	function code	Number of valid bytes	Humidity value	Temperature value	Check code low bit	Check code high byte
0x01	0x03	0x04	0x02 0x92	0xFF 0x9B	0x5A	0x3D

Temperature: upload in the form of complement code when the temperature is lower than 0℃

0xFF9B (hexadecimal) = -101 => temperature = -10.1℃

humidity:

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

6. Common problems and solutions

The device cannot be connected to the PLC or computer

possible reason:

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

2) The device address is wrong, or there are devices with duplicate addresses (the factory defaults are all 1).

3) The baud rate, check method, data bit, stop bit are wrong.

4) The host polling interval and waiting response time are too short, and both need to be set above 200ms.

5) The 485 bus is disconnected, or the A and B wires are connected reversely.

6) If the number of equipment is too much or the wiring is too long, power supply should be nearby, add 485 booster, and add 120Ω terminal resistance at the same time.

7) The USB to 485 driver is not installed or damaged.

8) The equipment is damaged.

7. Contact details

Shandong Renke Control Technology Co., Ltd.

Marketing Center:10th Floor, East Block, No.8 buildings, Shuntai Plaza, High-tech Zone, Jinan City, Shandong Province, China

Post code:250101

Phone:400-085-5807

Fax:(86)0531-67805165

Website:www.renkeer.com

Cloud platform address: en.0531yun.com

Shandong Renke Control Technology Co.,Ltd
Official website

Welcome to pay attetion to the WeChat public platform,enjoy convenient service

8. Document History

V1.0   Document establishment

V1.1   Add the optical rainfall factor

V1.2   Can be compatible with rainfall and light elements at the same time

V1.3   Parameters update

V1.4   Have added the electronic compass angle register

V1.5   Add total solar radiation parameters

V1.6   Add -3H model selection

V1.7   Add -3HP model selection