



# RS-FSXCS-N01-\*

Small ultrasonic integrated weather station

## User Manual

Document version: V1.8





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## 1. Product Introduction

### 1.1 Product Overview

This small integrated weather station can be widely used in environmental detection, and can collect wind speed, wind direction, temperature and humidity, noise, PM2.5 and PM10, atmospheric pressure, light, and rainfall are integrated into one device. The device adopts the standard ModBus-RTU communication protocol. RS485 signal output, the communication distance can reach up to 2000 meters, the data can be uploaded to the customer through 485 communication Monitoring software or PLC configuration screen, etc., also support secondary development.

For devices with built-in electronic compass, there is no need for orientation during installation, just ensure horizontal installation.

It is used in mobile occasions such as marine vessels and automobile transportation, and there is no direction requirement during installation.

This product is widely used in measuring environmental temperature and humidity, wind speed and direction, noise, air quality, atmospheric pressure, light. It is suitable for various occasions with different rainfalls, 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 material, has a long service life, and uses a highly sensitive probe.
- The signal is stable and the accuracy is high. The key components are imported, stable and reliable, with wide measurement range, good linearity and waterproof.
- It has the characteristics of good performance, easy use, easy installation 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 can obtain wind speed and direction at the same time.
- data;
- Noise collection and measurement accuracy, with a range of up to 30dB~120dB;
- PM2.5 and PM10 are collected simultaneously, with a range of 0-1000 $\mu$ g/m<sup>3</sup> and a resolution of 1 $\mu$ g/m<sup>3</sup>. Unique dual-frequency data collection and Automatic calibration technology, 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;
- Adopting dedicated 485 circuit, the communication is stable;
- For devices with built-in electronic compass, there is no direction requirement during installation and they can be installed horizontally.

### 1.3 Main technical indicators

DC power supply (default)	10-30VDC	
Maximum power consumption	RS485 output	0.7W
Accuracy	Wind speed 2	$\pm 0.5 + 2\%FS \pm 60\%RH, 25\%$
	wind direction	$\pm 3^\circ \pm 60\%RH, 25\%$
	humidity	$\pm 3\%RH(60\%RH, 25\%)$
	temperature	$\pm 0.5\% \pm 25\%$
	Atmospheric pressure	$\pm 0.15kPa @ 25\% 101kPa$
	noise	$\pm 0.5dB$ (at reference pitch, 94dB @ 1kHz)



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	PM2.5	Particle counting efficiency:  50% @ 0.3µm ~ 98% @ ≥ 0.5µm  PM2.5 accuracy: ±3%FS (@ 100µg/m³, 25µ, 50%RH)
	CO2	±(50ppm+ 3%F-S) (25µ)
	Light intensity	±7% (25µ)
	Total solar radiation	±3% @ 150W/m²
Range	Wind speed	0~40m/s, start wind speed is 0.5m/s
	wind direction	0~359°
	humidity	0%RH~99%RH
	temperature	-40µ~+80µ
	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	0~1800W/m²
Long-term stability	temperature	±0.1µ/y
	humidity	±1%/y
	Atmospheric pressure	-0.1 kPa/y
	noise	±3dB/y
	PM10 PM2.5	±1%/y
	CO2	±1%/y
	Light intensity	±5%/y
Response time 1	Total solar radiation	±3%
	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	±90s
	Light intensity	±2s



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	Typical accuracy of	±10s
Optical rainfall parameters	global solar radiation	±5% (from PeopleSoft Laboratory data)
	Resolution	Standard 0.1mm
	Maximum instantaneous rainfall	24mm/min
	Rain Sensing Diameter	6cm
Optical and pulse rainfall parameters <sup>3</sup>	Typical Accuracy	±4% (from PeopleSoft Labs data)
	Resolution	Standard 0.1mm
	Measuring range	±4mm/min
Protection level	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 our products, we reserve the right to change design functions and specifications. rights without prior notice.

<sup>1</sup> The response time is 1/63 time.

<sup>2</sup> Wind speed refers to the wind speed at the sensitive material inside the sensor. When the wind speed in the test environment is 10 ~2m/s, the wind direction is perpendicular to the sensor acquisition port.

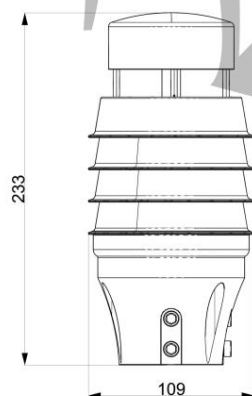
The wind speed is about 1m/s.

<sup>3</sup>From laboratory indoor simulated rainfall test. Optical rainfall measurement components are optional

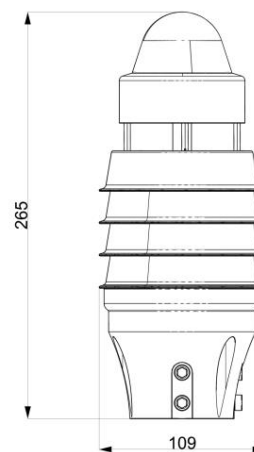
## 1.4 Product Selection

RS-				Company Code
	FSXCS-	N01-		Ultrasonic integrated weather station
				485 communication (standard ModBus-RTU protocol)
			3-	Small ultrasonic integrated housing
			3H-	Premium appearance
			3HP-	Optical tipping bucket rainfall appearance
			null	No built-in electronic compass
			CP	Built-in electronic compass function

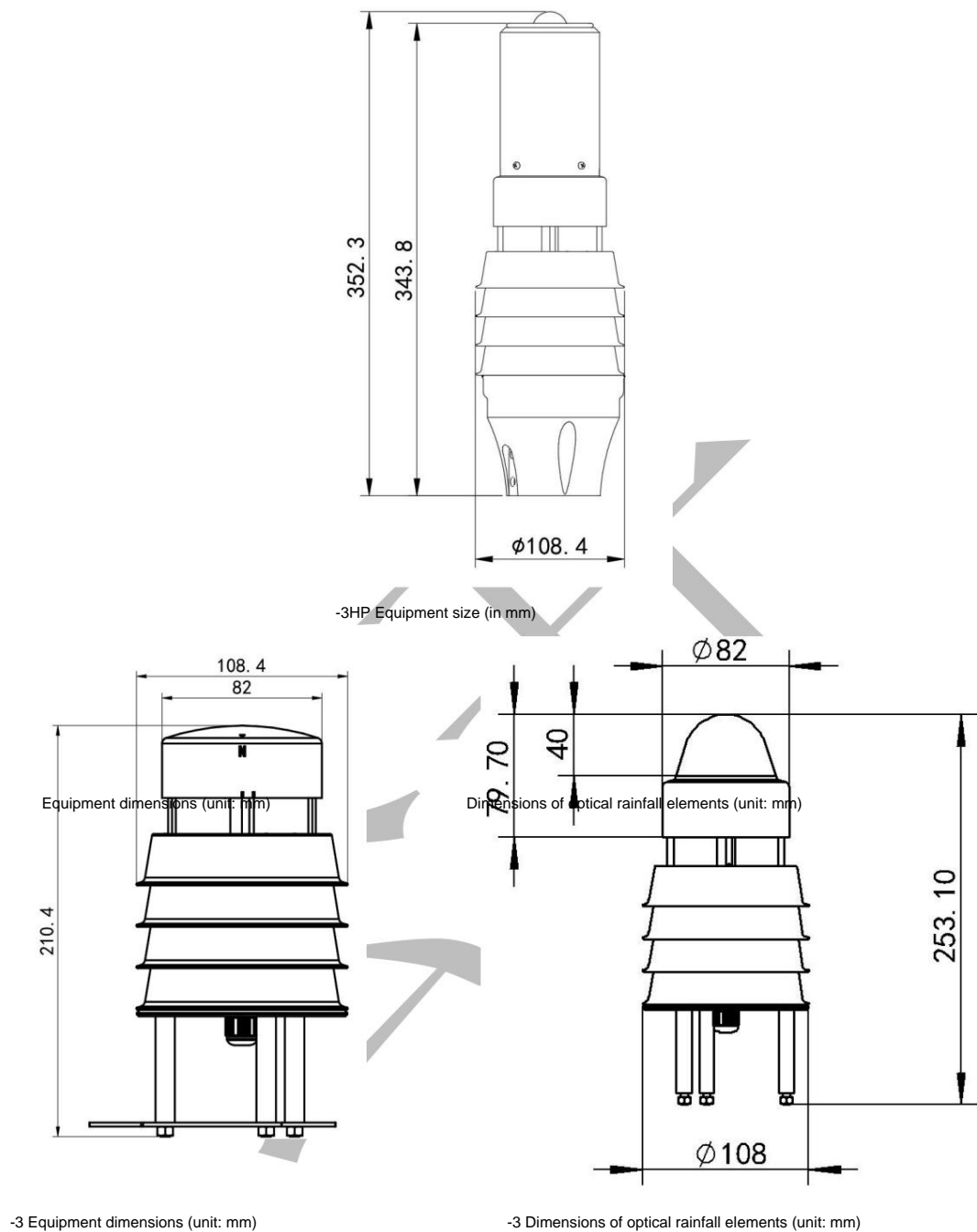
## 2. Equipment size



-3H Equipment dimensions (unit: mm)



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



### 3. Equipment installation instructions

#### 3.1 Equipment inspection before installation

Equipment List:

- Transmitter equipment 1 set
- Certificate of conformity, warranty card
- 70cm waterproof male plug 1 piece
- 2 white brackets, 2 M4\*10 screw nuts, 3 M5\*14 hexagonal screws (-3 optional accessories)

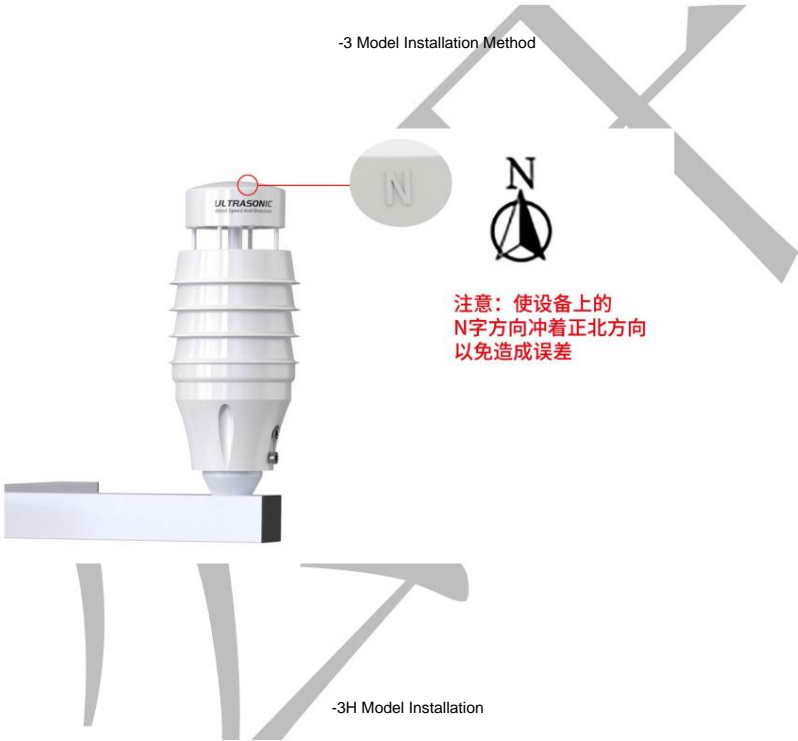


γ Hexagonal wrench 1 piece (-3H and -3HP optional accessories)

3.2 Installation method



-3 Model Installation Method



-3H Model Installation



-3HP Model Installation



### 3.3 Interface Description

DC power supply 10-30V. When wiring the 485 signal line, pay attention to the A/B lines. Do not connect them in reverse.

The addresses cannot conflict.

	Line Color	illustrate
power supply	brown	Power positive (10-30V DC)
	black	Negative power supply
communication	Yellow (green)	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. Please refer to the information package for details.

485 Equipment Field Wiring Manual.

## 4. Configure software installation and use

### 4.1 Software Selection

Open the data package, select "Debug Software" --- "485 Parameter Configuration Software", find Configuration Tool" to open it.

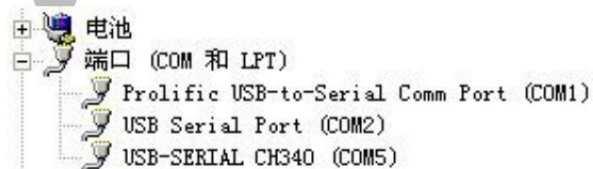


"485 Parameters

### 4.2 Parameter settings

ÿ. Select the correct COM port (check the COM port in "My Computer - Properties - Device Manager - Ports"),

The figure below lists the driver names of several different 485 converters.



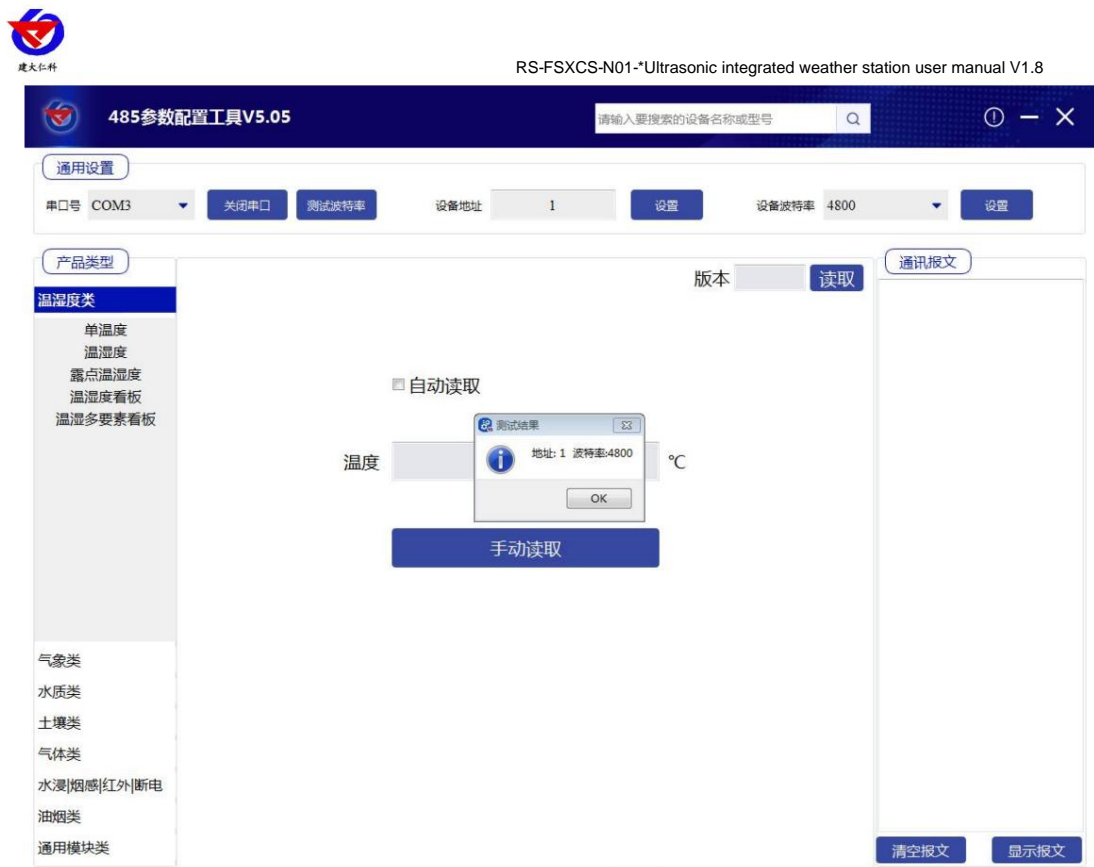
ÿ. Connect only one device and power it on. Click the test baud rate button in the software. The software will test the baud rate of the current device.

and address, the default baud rate is 4800bit/s, and the default address is 0x01.

ÿ. Modify the address and baud rate according to the needs, and query the current functional status of the device.

ÿ. If the test fails, please recheck the device wiring and 485 driver installation.





5. Communication Protocol

5.1 Basic communication parameters

coding	8-bit binary
Data bits	8-bit
Parity bit	none
Stop bits	1 bit
Error checking	CRC (Redundant Cyclic 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:

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 ~ 4 bytes time

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

Function code: Function indication of the command sent by the host.



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	Check code low byte	Check code high byte	
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 area 1	Data area 2	Data area N	Check code low byte	Check code high byte	
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	1 byte		1 byte

### 5.3 Communication register address description

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	10 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 clockwise direction is The needle increases the value, due east is 2)
503	40504 Wind direction (0-360°)	0x03/0x04	Actual value (0° clockwise for due north The needle increases in degrees, with due east being 90°)
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/CO2 value	0x03/0x04	Actual value
508	40509 PM10 value/CO2 value	0x03/0x04	Actual value
509	40510 Atmospheric pressure value (unit: kPa,)	0x03/0x04	10 times the actual value
510	40511 Lux value of 20W is 16 bits higher value	0x03/0x04	Actual value
511	40512 Lux value of 20W is 16 bits lower value	0x03/0x04	Actual value
512	40513 20W light value (unit: hundred Lux)	0x03/0x04	Actual value
513	40514 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 value	0x03/0x04	Actual value



## Contents of the calibration register

Register Address	content	Support function code	Definition
6000 H	Small Ultrasonic Wind Deflector register	0x06	0 represents normal direction 1 represents a 180° direction shift
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	Rainfall zero adjustment register	0x06	Write 0x5A, the rainfall value is set to zero
6003 H	Optical Rainfall Sensitivity	0x06	The default setting is 11 H. Reducing this setting can increase the rainfall sensitivity.

## 5.4 Communication protocol examples and explanations

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

## Inquiry frame

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

## Response frame

Address code	Function code	Return	Valid byte number	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 = 12.5 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

## Response frame

Address code	Function code	Return	Valid byte number	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 values of the transmitter device (address 0x01)

## Inquiry frame

Address code	Function code	Starting address	Data length	Check code Low bit	Check code High bit	
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 bit	Check code high bit	
0x01	0x03	0x04	0x02 0x92 0xFF 0x9B		0x5A		0x3D

Temperature: When the temperature is below 0°, it will be uploaded in the form of complement code

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



humidity:

0x0292 (hexadecimal) = 658 => humidity =

65.8%RH

**6. Common problems and solutions**

The device cannot connect to **the PLC** or computer

Possible reasons: 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 (factory default is all 1). 3) The baud rate, check mode, data bit, and stop bit are wrong. 4) The host polling interval and waiting

response time are too short, and they need to be set to more than 200ms. 5) The 485 bus is disconnected, or the A and B

lines are connected in reverse. 6) 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) The

device is damaged.

Note: To ensure the accuracy of the device, please clean the lower surface of the device's measurement area regularly to keep it clean and free of dust or other foreign matter.



## 7. Contact Information

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## 8. Document History

V1.0 Documentation creation

V1.1 Added optical rainfall element

V1.2 Compatible with both rainfall and light elements

V1.3 Parameter update V1.4

Added electronic compass angle value register V1.5

Added total solar radiation parameter Added

V1.6 -3H option Added

V1.7 -3HP option V1.8

Added CO2 parameter