

## WS1300 Air Pollution Sensor



### OVERVIEW

WS1300 is designed and produced by Handan Yantai Import and Export Co., Ltd.. It innovatively realizes noise, PM2.5、PM10、CO、SO2、NO2、O3、T、RH、W、WDIR、P and rainfall through a highly integrated structure, which can realize the 24-hour continuous online monitoring of outdoor meteorological parameters, and output the parameters to the EPA.. In addition, it also can added to measure H<sub>2</sub>S, volatile organic pollutants, total suspended particulate matter and other meteorological sensors (wind speed, wind direction, atmospheric pressure, rainfall, sunshine radiation)Output is RS485(MODBUS protocol). WS1300 air pollution environment monitor can be used in urban grid environment monitoring and control, smart street lights, scenic spots, factories or mines, construction sites (site dust monitoring), urban roads, highways, public places and other places related to air quality monitoring.

### APPLICATION

WS1300 can be widely used in urban environmental monitoring, wind power generation, meteorological monitoring, Bridges, tunnels, ships, aviation airports, agricultural meteorology, water conservancy meteorology, power environment, highway meteorological monitoring and other fields.No maintenance and on-site calibration is required.

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## FEATURES

- 1、 Standard configuration monitoring PM2.5、 PM10、 CO、 SO2、 NO2、 O3、 T、 RH、 W、 WDIR、 P and Rainfall (MODBUS ) ;
- 2、 High precision, reliable performance, suitable for outdoor weather harsh environment;
- 3、 Parameter collection, optional wireless data collector, automatic data upload network platform, mobile phone client real-time data view;
- 4、 Real-time monitoring of meteorological environmental data, low cost, suitable for grid distribution;
- 5、 Small size, modular design, flexible layout;
- 6、 Optional GPS positioning, device tracking function;
- 7、 Data acquisition adopts 32-bit high-speed processing chip, stable and anti-interference.

## TECHNICAL SPECIFICATION

Item	Measuring Range	Resolution	Accuracy
PM2.5	0-1000ug/m <sup>3</sup>	1ug/m <sup>3</sup>	± 10%
PM10	0-1000ug/m <sup>3</sup>	1ug/m <sup>3</sup>	± 10%
CO	0-10ppm	≤10ppb	± 5% FS
SO2	0-5000ppb	≤10ppb	± 5% FS
NO2	0-5000ppb	≤10ppb	± 5% FS
O3	0-5000ppb	≤10ppb	± 5% FS
Temperature	-40-85°C	0.1°C	± 0.3°C
Humidity	0-100%RH	0.1%	± 3%RH
Wind Speed	0-60m/s	0.01m/s	± 0.3 m/s
Wind Direction	0-360°	0.1°	± 3°
Air Pressure	300-1100hpa	0.1hpa	± 0.3hPa

Rainfall	0-200mm/h	0.1mm	± 10%
Noise	30-130dB	0.1 dB	± 1.5dB
Power Supply	DC12-24V		
Power Waste	<1.2w@12V		
Output	Default 485 output, ModbusRTU protocol Extensible function: GPS positioning		
Working Condition	Temperature -40-70°C		Humidity 5-90%RH

**NOTE:**

The four pollution gases can be converted to ug/m<sup>3</sup>. The conversion coefficient is as follows:

coefficient N = (ug/m<sup>3</sup>)/ PPB

Item	NO <sub>2</sub>	SO <sub>2</sub>	CO	O <sub>3</sub>
(Factor)N	2.054	2.857	1.25	2.143

**MODBUS RTU COMMUNICATION PROTOCOL**

Baud rate: 9600

Data bits: 8

Stop bit: 1

Check bit: None

**1.1 CRC Instruction:**

Among all the following instructions, the two bytes of CRC16 in MODBUS RTU protocol are as follows: the low byte comes before the high byte comes after.

In the following instructions, the sensor address 0xFF is assumed (the sensor default address is FF)

**1.2 Return error code rule:**

When receive error instruction (including CRC16 validation error), the sensor will not return error code. After the instruction is issued 100ms, it fails to receive issuing instruction The upper computer may consider failure and may resend the instruction.

**2.1 Standard MODBUS register specification**

Note: The quantity or length of register in Modbus is two bytes and 16 bits(the high byte comes first and the low byte comes last), Non - byte 8 bits are a unit.

The user shall ensure that the range of the address and the range of quantity of registers are within the system range. If it exceeded, the output of the sensor will be unpredictable. The user shall ensure that the MODBUS meets the requirements of this manual in the software design of the upper computer

**Input register: read with function code 03**

Address	Operation	Contents	Note
0x0001	Read-only	Noise, a hexadecimal number amplified by 10 times, such as 0x01193, means $403/10=40.3\text{dB}$	
0x0002	Read-only	Hydrogen sulfide/TVOC, hexadecimal number	
0x0003	Read-only	SO <sub>2</sub> concentration, hexadecimal, such as 0x0172, indicates that SO <sub>2</sub> concentration is 370ppb.	
0x0004	Read-only	NO <sub>2</sub> concentration, hexadecimal, such as 0x0036, indicates that NO <sub>2</sub> concentration is 54ppb	
0x0005	Read-only	CO concentration, hexadecimal, such as 0x0A00, indicates that CO concentration is 2560ppb	
0x0006	Read-only	O <sub>3</sub> concentration, hexadecimal, such as 0x0123, indicates that O <sub>3</sub> concentration is 291ppb	
0x0007	Read-only	PM <sub>2.5</sub> concentration, hexadecimal, such as 0x0172, indicates that PM <sub>2.5</sub> concentration is 370 $\mu\text{g}/\text{m}^3$	
0x0008	Read-only	PM <sub>10</sub> concentration, hexadecimal, such as 0x0193, indicates that PM <sub>10</sub> concentration is 403 $\mu\text{g}/\text{m}^3$	
0x0009	Read-only	Atmospheric temperature, Hexadecimal number plus 40 then it is magnified as 100 times, such as 0x1B00 indicates $6912/100-40=29.12^\circ\text{C}$	
0x000A	Read-only	Air humidity, hexadecimal number magnified by 100 times, such as 0x1603 means $5635/100=56.35\%$	
0x000B	Read-only	Atmospheric pressure, magnified 10 times hexadecimal number, such as 0x2784 means $10116/10=1016\text{hPa}$	
0x000C	Read-only	Wind speed, Hexadecimal number is magnified as 100 times, such as 0x0125 indicates $293/100=2.93\text{m/s}$	
0x000D	Read-only	Wind direction, Hexadecimal number is magnified as 10 times, such as 0x0C14 indicates $3092/10=309.2^\circ$	North is 0°
0x000E	Read-only	Rainfall in 10 minutes, magnified 10 times of hexadecimal number, such as 0x0016 means 2.2mm	
0x000F	Read-only	solar radiation, Hexadecimal number, such as 0x0172 indicates 370 $\text{W}/\text{m}^2$	
0x0010	Read-only	Illumination, Hexadecimal number is magnified as 100 times, such as 0x0123 indicates 2.91.Klux	
0x0011	Read-only	UV index	
0x0012	Read-only	CO <sub>2</sub> , Hexadecimal number, such as 0x01F4 indicates 500ppm	
0x0013	Read-only	Keep	
0x0014-	Read-only	Keep	

0x001f			
0x0020	Read-only	Electronic compass, hexadecimal number, such as 0x0036 means it is currently pointing to 54°	North is 0
0x0021	Read-only	Pitch angle 1	
0x0022	Read-only	Pitch angle 2	
0x0023	Read-only	Pitch angle 3	
0x0024	Read-only	longitude-1	
0x0025	Read-only	longitude-2	
0x0026	Read-only	latitude-1	
0x0027	Read-only	latitude-2	
0x0028	Read-only	Altitude	

#### 1.4 communication examples

Here is an example of using Modbus RTU command to access system registers

1. Read multiple input registers (5 live data) commands

Send: FF 03 00 09 00 05 40 15

FF	03	00 09	00 05	40 15
System address	function code	Register address	Register number	CRC16 check bit generated automatically by software

Answer: FF 03 0A 1A 57 0C 5F 27 83 00 11 0C 14 30 1C

FF	03	0A	1A 57 0C 5F 27 83 00 11 00 14	30 1C
System address	function code	Number of bytes of data segment	Data segment data	CRC16 check bit

parse data:

$$0x1A57 = 0x1A * 256 + 0x57 = 6743$$

$$\text{Temperature} = 6743/100 - 40 = 27.43^{\circ}\text{C}$$

$$0x0C5F = 0x0C * 256 + 0x5F = 3167$$

$$\text{Humidity} = 3167/100 = 31.67\% \text{RH}$$

$$0x2783 = 0x27 * 256 + 0x83 = 10115$$

$$\text{atmospheric pressure} = 10115/10 = 1011.5 \text{hPa}$$

$$0x0011 = 17$$

$$\text{Wind speed} = 17/100 = 0.17 \text{m/s}$$

$$0x0C14 = 0x0C * 256 + 0x14 = 3092$$

$$\text{Wind direction} = 3092/10 = 309.2^{\circ}$$

2. Read the single input register command

Send: FF 03 00 01 00 01 C0 14

FF	03	00 01	00 01	C0 14
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System address	function code	Register address	Register address	CRC16 check bit generated automatically by software
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Answer: FF 03 02 02 1C 91 39

FF	03	02	02 1C	91 39
System address	function code	Number of bytes of data segment	Data segment data	CRC16 check bit

parse data:

$$0x021C = 0x02 * 256 + 0x1C = 540$$

$$\text{Noise} = 540/10 = 54.0\text{dB}$$

3. Read the address register command

Send: 00 03 00 00 00 01 85 DB

00	03	00 00	00 01	85 DB
	function code	Register address	Register address	CRC16 check bit generated automatically by software

Answer: 00 03 02 00 01 44 44

00	03	02	00 01	44 44
	function code	Number of bytes of data segment	Data segment data	CRC16 check bit

Data segment data 0x0001 = 01 system address 01

4. Modify internal register (System address) Command (Modify address to 0x33)

Send: 00 06 00 00 00 33 C8 0E

00	06	00 00	00 33	C8 0E
	function code	Register address	New address	CRC16 check bit

Answer: 00 06 00 00 00 33 C8 0E (Indicates successful modification)

00	06	00 00	00 33	C8 0E
	function code	Start address	New address	CRC16 check bit

5. Read the electronic compass (output value is the Angle between compass north and sensor north arrow)

Send: FF 03 01 05 00 01 80 29

FF	03	01 05	00 01	80 29
Station number	function code	Register address	Register number	CRC16 check bit

Answer: FF 03 02 00 36 11 86

FF	03	02	00 36	11 86
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Station number	function code	Number of bytes of data segment	Data segment data	CRC16 check bit
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The latitude data segment data is 0x0036 =54, which means the arrow points to 54° at this time

6、Set time of rainfall accumulation

Send: 00 06 01 07 00 0A B8 21

00	06	01 07	00 0A	B8 21
	function code	Start address	Time accumulation(min)	CRC16 check bit

Answer: 00 06 01 07 00 0A D8 21 (Indicates successful modification)

00	06	01 07	00 0A	D8 21
	function code	Start address	accumulation(min)	CRC16 check bit

**Note: The default immediate time is 10 mins from factory**

**When the cumulative time of rainfall is set to 0, the equipment does not automatically reset , but accumulates all the time. The rainfall can be reset by resetting the cumulative time of rainfall after power failure**

**After done sets restart the products**

7、Set magnetic declination correction (only for optional electronic compass)

Send: 00 06 01 06 00 05 A9 E5

00	06	01 06	00 05	A9 E5
Station No	Function code	Register Address	Correction angle	CRC16 check bit

回答: 00 06 01 06 00 05 A9 E5 (It indicates that the modification was successful)

00	06	01 06	00 05	A9 E5
Station No	Function code	Register Address	Correction angle	CRC16 check bit

Correction angle meaning

The upper eight bits indicate the direction of correction, 0x00 represents positive correction, 0x01 represents negative correction, The lower eight bits are the angles that need to be corrected

For example,

0x00 05 means that the output value needs to be increased by 5 degrees

0x01 03 means that the output value needs to be reduced by 3 degrees

8、Read longitude and latitude information

Send AT+GPS#

Reply

GPS:36.12345,N;114.12345,E;2019-01-01,D;10:20:00,T;0040.2,H#

Supplementary agreement: (The default device address is FF)

Active reporting cycle (Register Address 0x01 0A) Unit: min, 0 means not to report

00 06 01 0A 00 0A 29 E2 (Set the active reporting period to 10 minutes)

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Active report length ( Register Address 0x01 0B )  
00 06 01 0B 0C 02 7C E4(Automatic report register address 0C-0D)

Baud rate (register address 0X0102)  
00-06 represents 2400, 4800, 9600, 19200, 38400, 57600, 115200 respectively  
00 06 01 02 00 02 A9 E6 (Set the baud rate to 9600, non-professionals should not change it by themselves)