

XF700L  
Compact Weather Station

Manual

## Catalogue

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## XF700L Compact Weather Station

### ◆ Product Brief

XF700L compact weather station integrates seven meteorological parameters, Ambient Temperature, Relative Humidity, Atmospheric Pressure, Wind Speed (Third Generation), Wind Direction (Third Generation), Optical Rainfall and Illuminance, in one structure. It realizes 24 hours continuous online monitoring of outdoor meteorological parameters, and output these data to users through digital communication interface all at once.

### ◆ Application

- Meteorological Monitoring
- Micro Environmental Monitoring
- Grid Environment Monitoring
- Agricultural Meteorological Monitoring
- Meteorological Traffic Monitoring
- Photovoltaic Environment Monitoring
- Meteorological Monitoring of Power Tower

### ◆ Features

- Small in size
- Integrated design
- High integration
- Compact structure with no moving parts
- Easy to install
- One year warranty
- Protective cover with special process heat insulation treatment
- Support extended parameter measurement
- Free testing software XF\_PcSoftV1.0 (ask your salesperson for it )

# Technical Data

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## ◆ Technical Parameter

| Parameters                              | Measuring Range                                                                                                                                                                                                                 | Accuracy                                                                                                        | Resolution | Sampling Frequency |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------|--------------------|
| Ambient Temperature                     | -40-85℃                                                                                                                                                                                                                         | ±0.3℃@25℃                                                                                                       | 0.01℃      | 1HZ                |
| Relative Humidity                       | 0-100%RH                                                                                                                                                                                                                        | ±3%RH<br>(10%-90%RH, No Condensation)                                                                           | 0.01%RH    | 1HZ                |
| Wind Speed<br>(Third Generation)        | 0-40m/s                                                                                                                                                                                                                         | ± (0.3+0.03V) m/s; V≤30m/s<br>± (0.3+0.05V) m/s; V>30m/s<br>(V stands for standard wind speed in a wind tunnel) | 0.01m/s    | 10HZ               |
| Wind Direction<br>(Third Generation)    | 0-360°                                                                                                                                                                                                                          | ±5° (Wind Speed <10M/S)                                                                                         | 0.1°       | 10HZ               |
| Atmospheric Pressure                    | 500-1100hPa                                                                                                                                                                                                                     | ±0.5hPa (25℃, 950-1100hPa)                                                                                      | 0.1hPa     | 1HZ                |
| Rainfall                                | Measurement form: optical; Measuring range: 0-200mm/h;<br>Resolution: 0.2mm; Sampling frequency: 1HZ                                                                                                                            |                                                                                                                 |            |                    |
| Illuminance                             | 0-100KLux                                                                                                                                                                                                                       | ±3% Or 1%F.S                                                                                                    | 10Lux      | 1HZ                |
| Operating Temperature                   | -30℃—70℃                                                                                                                                                                                                                        |                                                                                                                 |            |                    |
| Output                                  | Standard product with RS485 interface, ModbusRTU;<br>Customized option SDI-12(Extra costs apply)                                                                                                                                |                                                                                                                 |            |                    |
| Maximum Output Frequency                | Passive Mode: 1/S Active Mode: 1/min                                                                                                                                                                                            |                                                                                                                 |            |                    |
| Power Supply                            | DC9-30V                                                                                                                                                                                                                         |                                                                                                                 |            |                    |
| Level of Protection                     | IP65                                                                                                                                                                                                                            |                                                                                                                 |            |                    |
| Fixed Method                            | Standard Product is sleeve fixed ,see product size drawing<br>(Optional flange fixing or bending plate fixing method)                                                                                                           |                                                                                                                 |            |                    |
| Fixed Bracket<br>(additional purchased) | Optional: 1.5 meter or 1.8 meter bracket                                                                                                                                                                                        |                                                                                                                 |            |                    |
| Cable                                   | 3 meter cable line (Optional: 10 meter cable additional purchased)                                                                                                                                                              |                                                                                                                 |            |                    |
| Remarks                                 | 1. This Sensor with Ambient Temperature, Relative Humidity and Atmospheric Pressure integrated, is installed in a three-layer outdoor radiation shield. The radiation shield adopts PC+ fiber special proportion configuration, |                                                                                                                 |            |                    |

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and the interior is sprayed with thermal insulation layer, to minimize the solar radiation influence.

No moving parts, ensuring the accuracy of long-time measurement data.

2. Wind Speed, Wind Direction: The wind speed and wind direction is measured through ultrasonic principle, and the data of instantaneous wind speed, instantaneous wind direction, average wind speed and average wind direction can also output.

3. Optical Rainfall: automatically senses rain falling on its outer surface and calculates the amount of rainfall according to the size and number of raindrops. Compare with the traditional physical bucket rain gauge, the accuracy of the optical rain gauge is its weakness. Most of the time, the reading of the optical rain gauge will be close to the bucket rain gauge, but abnormal events will be significantly different (heavy rain). But it is an integrated design, more suitable for application in site where tipping bucket rainfall is hard to apply, not restricted by the installation situation. And when the rainfall is small and light, it is more sensitive.

4. Illuminance: Select high specification 400-1100nm wavelength range optical elements with filter to achieve measurement.

5. XF\_PcSoftV1.0: the upper computer reading software, Nong-IoT developed for XF series compact weather station.

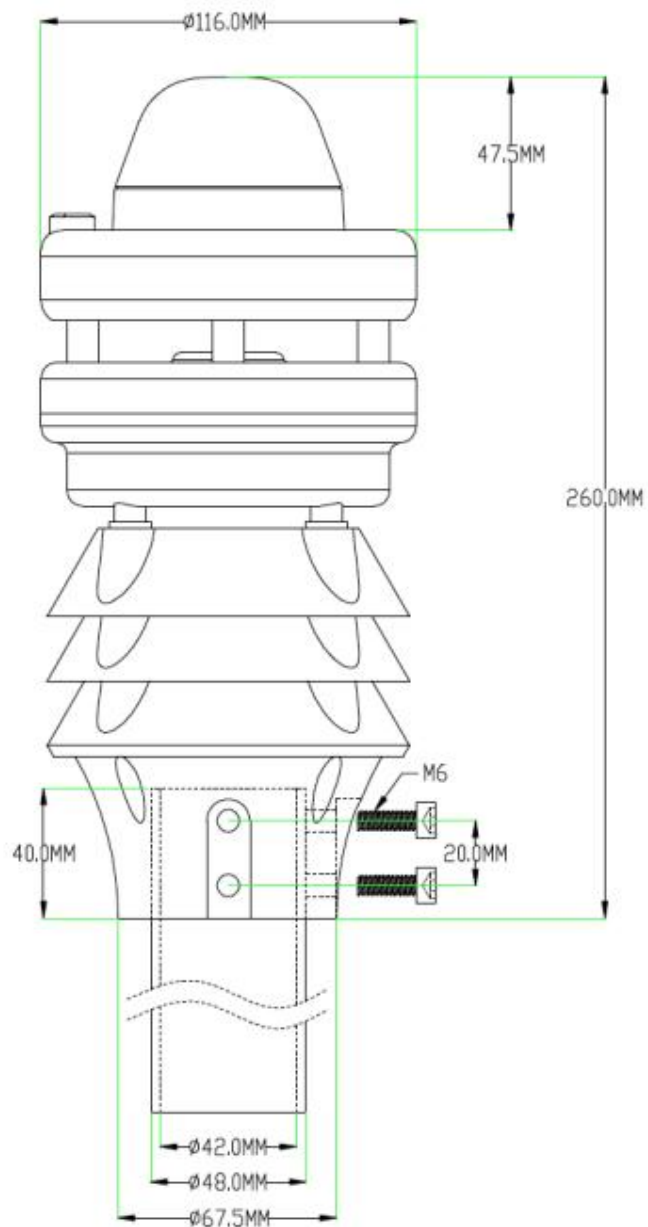
★ Specifications may be updated without prior notice.

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## ◆ Product Dimension



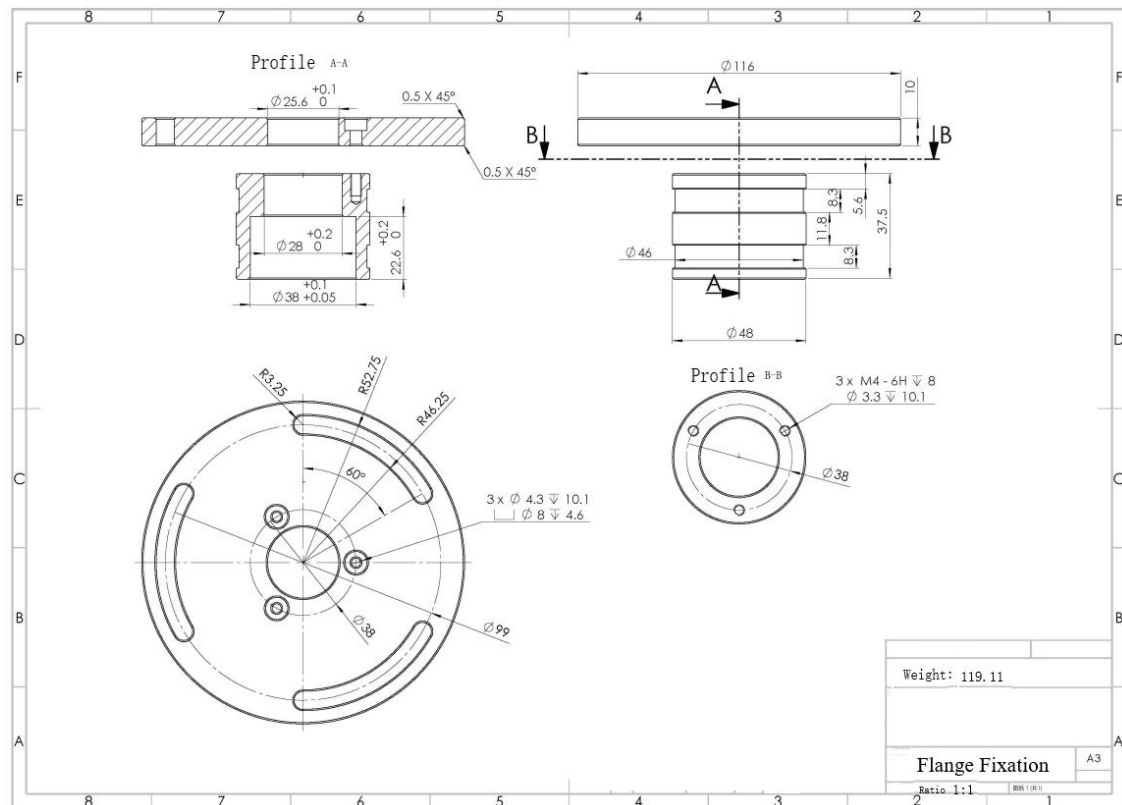
# Technical Data

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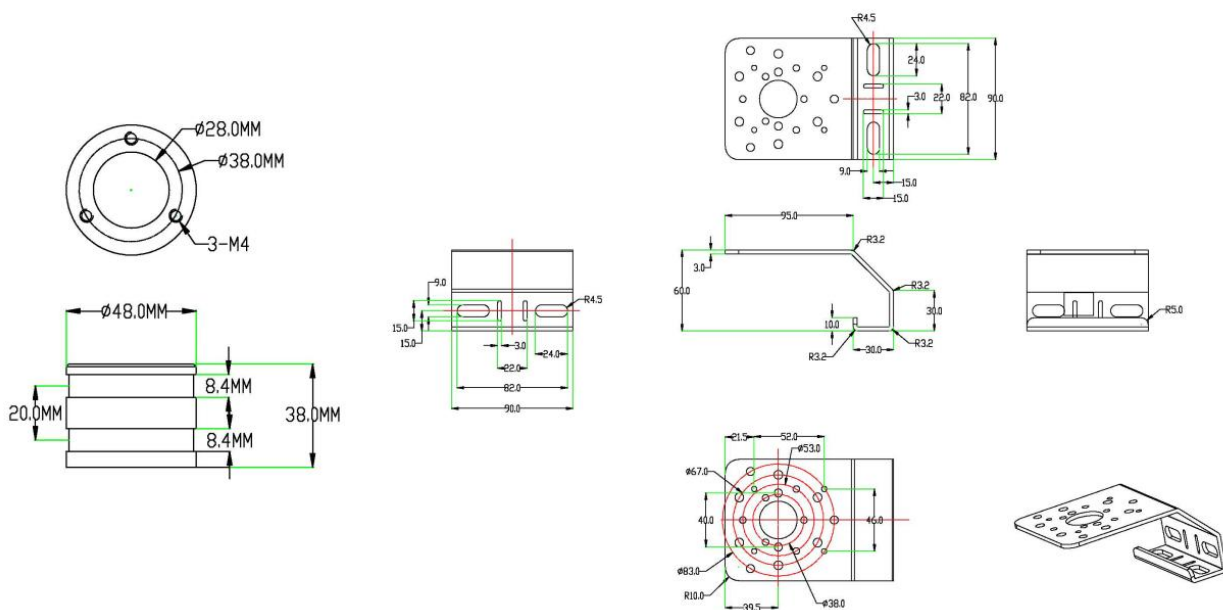
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## ◆ Accessories

Flange Mounting Manner:



Bending Plate Mounting Manner:



## MODBUS RTU Communication Protocol

### (Apply to XF700L product)

Baud Rate: 9600

Data Bits: 8

Stop Bit: 1

Check Bit: None

#### 1.1 CRC Description:

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

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

#### 1.2 Return Error Code Rule:

When receive error instruction (including CRC16 validation error), no error codes will be returned. It is considered to be a failure, when there is no return data in 200ms after the instruction is issued. Upper computer may resend instruction.

#### 1.3 Standard MODBUS register description

Special Notice:

The quantity or length of the register in Modbus is two bytes with 16 bits as a unit (the high byte comes first, and the low bytes follows), instead of one byte with 8 bits as a unit.

User shall ensure that the address and quantity of register in command are confined within the range specified by the system. Otherwise, the output of the sensor will be unpredictable. Users shall ensure that the MODBUS command complies with the requirements of this manual in the software design of the upper computer and the minimum query period supported is 1s/ time.

## 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, a hexadecimal number.                                                                                                                   |                            |
| 0x0003  | Read-only | SO <sub>2</sub> concentration, a hexadecimal.<br>For example, 0x0172 indicates that SO <sub>2</sub> concentration is 370ppb.                                   |                            |
| 0x0004  | Read-only | NO <sub>2</sub> concentration, a hexadecimal number.<br>For example, 0x0036 indicates that NO <sub>2</sub> concentration is 54ppb.                             |                            |
| 0x0005  | Read-only | CO concentration, a hexadecimal number.<br>For example, 0x0A00 indicates that CO concentration is 2560ppb.                                                     |                            |
| 0x0006  | Read-only | O <sub>3</sub> concentration, a hexadecimal number.<br>For example, 0x0123 indicates that O <sub>3</sub> concentration is 291ppb.                              |                            |
| 0x0007  | Read-only | PM <sub>2.5</sub> concentration, a hexadecimal number.<br>For example, 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, a hexadecimal number.<br>For example, 0x0193 indicates that PM <sub>10</sub> concentration is 403 $\mu\text{g}/\text{m}^3$ .   |                            |
| 0x0009  | Read-only | Ambient Temperature, a hexadecimal number add 40 then magnified 100 times.<br>For example, 0x1B00 indicates $6912/100-40=29.12^{\circ}\text{C}$                |                            |
| 0x000A  | Read-only | Relative Humidity, a hexadecimal number magnified by 100 times.<br>For example, 0x1603 indicates $5635/100=56.35\%\text{RH}$ .                                 |                            |
| 0x000B  | Read-only | Atmospheric Pressure, a hexadecimal number magnified by 10 times.<br>For example, 0x2784 indicates $10116/10=1011.6\text{hPa}$ .                               |                            |
| 0x000C  | Read-only | Wind Speed, a hexadecimal number magnified by 100 times.<br>For example, 0x0125 indicates $293/100=2.93\text{m/s}$                                             |                            |
| 0x000D  | Read-only | Wind Direction, a hexadecimal number magnified by 10 times.                                                                                                    | The North points to the 0° |

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|               |           |                                                                                                                                     |                            |
|---------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
|               |           | For example, 0x0C14 indicates 3092/10=309.2°                                                                                        |                            |
| 0x000E        | Read-only | Continuous Rainfall, a hexadecimal number magnified by 10 times ,<br>For example, 0x0016 indicates 2.2mm.                           |                            |
| 0x000F        | Read-only | Solar Radiation, a hexadecimal number.<br>For example, 0x0172 indicates 370W/m².                                                    |                            |
| 0x0010        | Read-only | Illumination, a hexadecimal number magnified by 100 times.<br>For example, 0x0123 indicates 2.91Klux or 2910lux                     |                            |
| 0x0011        | Read-only | UV index                                                                                                                            |                            |
| 0x0012        | Read-only | CO2, a hexadecimal number.<br>For example, 0x01F4 indicates 500ppm.                                                                 |                            |
| 0x0013        | Read-only | Negative Oxygen Ion, a hexadecimal number reduced by 10 times.<br>For example, 0x01F4 indicates Negative Oxygen Ion number is 5000. |                            |
| 0x0014-0x001f | Read-only | Keep                                                                                                                                |                            |
| 0x0020        | Read-only | Electronic compass, a hexadecimal number.<br>For example, 0x0036 indicates currently pointing to 54°                                | The North points to the 0° |
| 0x0021        | Read-only | Pitch angle 1                                                                                                                       | Customized                 |
| 0x0022        | Read-only | Pitch angle 2                                                                                                                       | Customized                 |
| 0x0023        | Read-only | Pitch angle 3                                                                                                                       | Customized                 |
| 0x0024        | Read-only | longitude-1                                                                                                                         | Customized                 |
| 0x0025        | Read-only | longitude-2                                                                                                                         | Customized                 |
| 0x0026        | Read-only | latitude-1                                                                                                                          | Customized                 |
| 0x0027        | Read-only | latitude-2                                                                                                                          | Customized                 |
| 0x0028        | Read-only | Altitude                                                                                                                            | Customized                 |

## 1.4 Communication Example

The following is an example of how to use Modbus RTU commands to access system registers:

### 1. Read multiple input registers (7 real time data) command

Send: FF 03 00 09 00 08 81 D0

|                |               |                  |                     |                                                       |
|----------------|---------------|------------------|---------------------|-------------------------------------------------------|
| FF             | 03            | 00 09            | 00 08               | 81 D0                                                 |
| System Address | Function Code | Register Address | Number of Registers | CRC16 check digit automatically generated by software |

Answer: FF 03 10 1A 57 0C 5F 27 83 00 11 0C 14 00 02 00 00 01 09 47 03

|                |               |                                       |                                                 |                 |
|----------------|---------------|---------------------------------------|-------------------------------------------------|-----------------|
| FF             | 03            | 10                                    | 1A 57 0C 5F 27 83 00 11 0C 14 00 02 00 00 01 09 | 47 03           |
| System Address | Function Code | The number of bytes in a data segment | Segment Data                                    | CRC16 check bit |

Analytical Data:

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

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

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

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

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

$$\text{Atmospheric Pressure} = 10115/10 = 1011.5\text{hPa}$$

$$0x0011 = 17$$

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

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

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

$$0x0002 = 2$$

$$\text{Rainfall} = 2/10 = 0.2\text{mm}$$

$$0x0109 = 0x01 * 256 + 0x09 = 265$$

$$\text{Illuminance} = 265/100 = 2.65\text{klux} = 2650\text{lux}$$

### 2. Read a single input register command

Send: FF 03 00 09 00 01 41 D6

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|                |               |                  |                     |                                                       |
|----------------|---------------|------------------|---------------------|-------------------------------------------------------|
| FF             | 03            | 00 09            | 00 01               | 41 D6                                                 |
| System Address | Function Code | Register Address | Number of Registers | CRC16 check digit automatically generated by software |

Answer: FF 03 02 1A 57 DB 0E

|                |               |                                       |              |                 |
|----------------|---------------|---------------------------------------|--------------|-----------------|
| FF             | 03            | 02                                    | 1A 57        | DB 0E           |
| System Address | Function Code | The number of bytes in a data segment | Segment Data | CRC16 check bit |

Analytical Data:

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

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

## 3. Read address register command

Send: 00 03 00 00 00 01 85 DB

|    |               |                  |                     |                                                       |
|----|---------------|------------------|---------------------|-------------------------------------------------------|
| 00 | 03            | 00 00            | 00 01               | 85 DB                                                 |
|    | Function Code | Register Address | Number of Registers | CRC16 check digit automatically generated by software |

Answer: 00 03 02 00 01 44 44

|    |               |                                       |              |                 |
|----|---------------|---------------------------------------|--------------|-----------------|
| 00 | 03            | 02                                    | 00 01        | 44 44           |
|    | Function Code | The number of bytes in a data segment | Segment Data | CRC16 check bit |

Segment data 0x0001 = 01 indicate system address is 01

## 4. Modify internal register (system address) command (change the 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 that the modification is successful)

|    |               |                  |             |                 |
|----|---------------|------------------|-------------|-----------------|
| 00 | 06            | 00 00            | 00 33       | C8 0E           |
|    | Function Code | Starting Address | New Address | CRC16 check bit |

## 5. Set the rainfall accumulation time

Send: 00 06 01 07 00 0A B8 21

|    |               |                  |                                |                 |
|----|---------------|------------------|--------------------------------|-----------------|
| 00 | 06            | 01 07            | 00 0A                          | B8 21           |
|    | Function Code | Register Address | Accumulative Time (10 Minutes) | CRC16 check bit |

Answer: 00 06 01 07 00 0A B8 21 (indicates that the modification is successful)

|    |               |                  |                                |                 |
|----|---------------|------------------|--------------------------------|-----------------|
| 00 | 06            | 01 07            | 00 0A                          | B8 21           |
|    | Function Code | Starting Address | Accumulative Time (10 Minutes) | CRC16 check bit |

**Note:** This device factory default setting is the continuous accumulation unclear 0 mode. When the rainfall accumulation time is set to 0, the device does not automatically clear the rainfall, and it has been accumulated continuously. The rainfall can be reset to zero by restarting the power or resetting the rainfall accumulation time ( sending command 00 06 01 07 00 00 38 26 cleared to 0 timing)

## 6. Set magnetic decrement correction (only for electronic compass function)

Send: 00 06 01 06 00 05 A9 E5

|                |               |                  |                  |                 |
|----------------|---------------|------------------|------------------|-----------------|
| 00             | 06            | 01 06            | 00 05            | A9 E5           |
| Station Number | Function Code | Register Address | Correction Angle | CRC16 check bit |

Answer: 00 06 01 06 00 05 A9 E5 (indicates that the modification is successful)

|                |               |                  |                  |                 |
|----------------|---------------|------------------|------------------|-----------------|
| 00             | 06            | 01 06            | 00 05            | A9 E5           |
| Station Number | Function Code | Register Address | Correction Angle | CRC16 check bit |

### Correction Angle Implication

The high eight digits indicate the direction of correction, 0x00 represent positive correction, 0x01 represent negative correction.

The low eight digits indicate the angle of the correction

Example: 0x00 05 represent that require to add 5 degree to the output

0x01 03 represent that require to reduce 3 degree to the output

## 7. Read the latitude and longitude information

Send AT+GPS#

Answer

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

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Supplementary agreement: (the default device address is FF)

Active reporting period (Register Address 0x01 0A) Unit is min, 0 indicates no reporting  
00 06 01 0A 00 0A 29 E2 (Set the active reporting period to 10 minutes)

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

Baud Rate (Register Address 0X0102)  
00-06 respectively represent 2400、4800、9600、19200、38400、57600、115200

**00 06 01 02 00 02 A9 E6 (Set the baud rate to 9600, non-professionals do not change it)**

## Warranty and After-sales Service:

Warranty: The product warranty period is 12 months from the delivery date (except for the product problems caused by not operating in accordance with corresponding technical requirements or other artificial behavior).

After-sales commitment: Users can consult technical issues by phone and get clear solutions. If it is a quality problem of the product itself, it can be returned to the factory for repair or replacement.

After-sales telephone: 0310-8033736