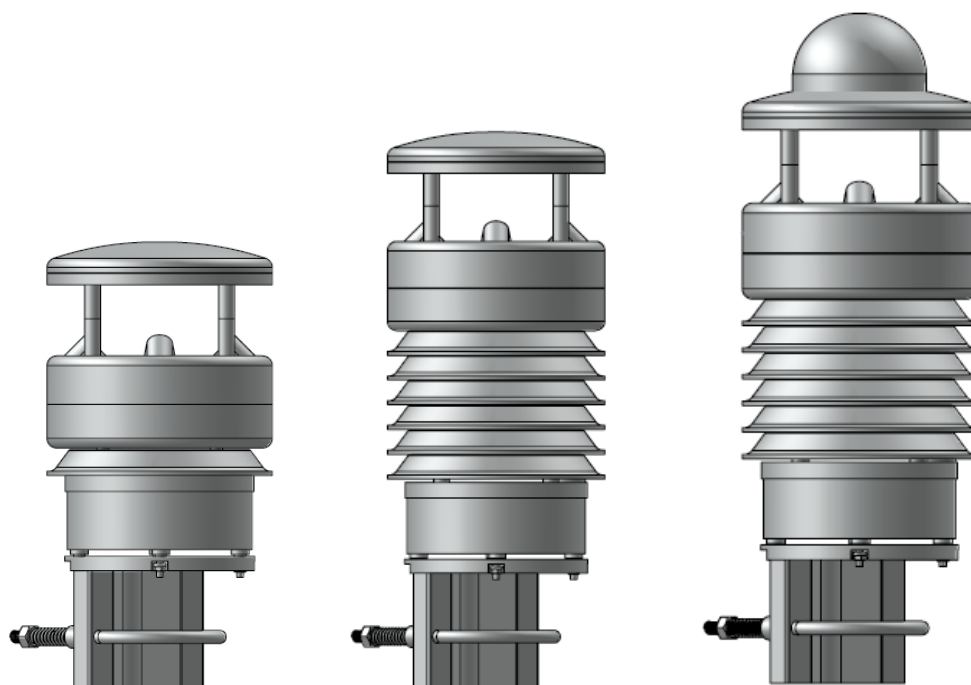


## FRT RDM



Fronttech (Beijing) Limited

## **Introduction:**

1. This manual introduces how to use FRT RDM.
2. This manual introduces the connection mode and protocol interface.

**Title:** Manual for FRT RDM series compact weather station

**Date:** 2017(Version:1.3)

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## 1 Please Read Before Use

### 1.1 Symbols Used



Important information concerning potential hazards to the user



Important information concerning the correct operation of the equipment

### 1.2 Safety Instructions



- Installation and commissioning must be carried out by suitably qualified specialist personnel only.
- Never take measurements on or touch live electrical parts.
- Pay attention to the technical data and storage and operating conditions.

### 1.3 Designated Use



- The equipment must only be operated within the range of the specified technical data.
- The equipment must only be used under the conditions and for the purposes for which it was designed.
- The safety and operation of the equipment can no longer be guaranteed if it is modified or adapted.

### 1.4 Incorrect Use



- If the equipment is installed incorrectly,
  - It may not function.
  - It may be permanently damaged.
  - Danger of injury may exist if the equipment is allowed to fall.
- If the equipment is not connected correctly,
  - It may not function.
  - It may be permanently damaged.
  - The possibility of an electrical shock may exist.

### 1.5 Guarantee

The guarantee period is 12 months from the date of delivery. The guarantee is forfeited if the designated use is violated.

## 1.6 Brand Names

All brand names referred to are subject without limitation to the valid trademark and ownership rights of the respective owner.

## 2 Scope of Delivery

- Equipment
- Connection cable
- Operating manual

## 3 Order Numbers

No.	Model	Descriptions	Remark (RS485)
1	RDM202	Wind direction, Wind speed, PM2.5, PM10	
2	RDM302	Wind direction, Wind speed, PM2.5, PM10, Noise	
3	RDM305	Temperature, Humidity, Air pressure, Wind direction, Wind speed, PM2.5, PM10, Noise	
4	RDM306	Temperature, Humidity, Air pressure, Wind direction, Wind speed, Rainfall, PM2.5, PM10, Noise	
5	RDM307	Temperature, Humidity, Air pressure, Wind direction, Wind speed, Rainfall, Radiation, PM2.5, PM10, Noise	
6	RDM308	Temperature, Humidity, Air pressure, Wind direction, Wind speed, Rainfall, Radiation, UVI, PM2.5, PM10, Noise	

## 4 Equipment Description

On the basis of advanced sensor technology, the FRT RDM series integrates the main ambient gases and meteorological parameter. It can be widely used in the areas of Meteorology, Transportation, Electric power industry, Agricultural industry, Intelligent street lamp, etc.

- Ultra low power consumption (0.2W\*), especially suitable for battery power supply system with high power requirement.
- 9 ~ 35V power input range.
- With the measurement data storage function (1~12 months), can ensure the integrity of the measurement data.
- It has a high precision clock calendar function.
- Industrial protective shell, can ensure the long-term field life of more than 10

years.

- Industrial electrical interface protection.
- Standard data output protocol.

Essential factor	RDM202	RDM 302	RDM 305	RDM 306	RDM 307	RDM308
PM2.5	•	•	•	•	•	•
PM10	•	•	•	•	•	•
Noise		•	•	•	•	•
Temperature			•	•	•	•
Humidity			•	•	•	•
Wind direction	•	•	•	•	•	•
Wind speed	•	•	•	•	•	•
Air pressure			•	•	•	•
Rainfall				•	•	•
Radiation					•	•
UVI						•

## 4.1 Air Temperature and Relative Humidity

Temperature is measured by way of a highly accurate Air Chip 3000 while humidity is measured using a capacitive humidity sensor (accuracy < 0.8 % / 0.1 K). In order to keep the effects of external influences (e.g. solar radiation) as low as possible, these sensors are located in a ventilated housing with radiation protection. In contrast to conventional non-ventilated sensors, this allows significantly more accurate measurement during high radiation conditions.

Additional variables such as dew point, absolute humidity and mixing ratio are calculated from air temperature and relative humidity, taking account of air pressure.

## 4.2 Air Pressure

Absolute air pressure is measured by way of a built-in sensor (MEMS). The relative air pressure referenced to sea level is calculated using the barometric formula with the aid of the local altitude, which is user-configurable on the equipment.

## 4.3 Wind

The wind meter uses 4 ultrasound sensors which take cyclical measurements in all directions. The resulting wind speed and direction are calculated from the

measured run-time sound differential.

#### **4.4 Heating\***

The precipitation sensor and wind meter are heated for operation in winter.

It has low temperature automatic heating function, can ensure the normal operation of the sensor under the condition of frost or ice.

#### **4.5 Precipitation**

The optical gauge is built on the basis of principle optics. When there are raindrops hitting the outer surface, the photosensitive member inside obtain the changes of the beam intensity. At the same time, it exports certain pulse value by the changes of beam intensity, and reflects the size of raindrops.

It can detect tiny raindrops depends on complicated circuit and digital signal processing, by filtering out the interference of ambient light. Date compensation was made if the outer surface was defaced.

Besides detecting the outer diameter size of raindrops, the monitoring sensor can also simulate tipping bucket rain gauge (accuracy range is adjustable: 0.2mm / 0.01mm / 0.001mm), but it's more sensitive than tipping bucket rain gauge, which can be monitored to 0.01mm even 0.001mm rainfall.

No moving parts, convex design can complete self-cleaning.

By emitting LED to detect whether the internal sensor is operating properly.

#### **4.6 Global Radiation**

Used for measuring the short-wave radiation (main wavelength: 400 ~ 1100nm), which uses a silicon light detector generates a voltage output signal proportional to the incident light. In order to reduce the cosine error, we placed a cosine corrector in the instrument, the radiometer can be connected directly to a digital voltmeter or data acquisition, measure the radiation intensity.

#### **4.7 The UV Index**

Sense the ultraviolet A and B bands by a built-in light sensor, it can be used in ultraviolet radiation intensity gauge.

#### **4.8 PM2.5&PM10**

Importance of Particulate Matter Monitoring : Ultra-fine Particulate Matter (PM1), Suspended Particulate Matter (PM2.5), Particulate Matter 10 (PM10).Particulate Matter (PM) is microscopic solid or liquid matter suspended in the Earth's atmosphere which may include dust particles, biological contaminants like bacteria, mold, pollen; particulate contaminants like oil-smoke, fly-ash, cem



ent dust etc. The size of the Particulate Matter (PM) varies from 0.1micron to 100 microns.

Sources of Particulate Matter : Thermal Power Plants, Vehicle Fuel Emission, Open Fire, Atmospheric Dust, Smog, Cement Industry, Natural Sources etc.

Health Hazard of Particulate Matter : Larger particles are generally filtered in the nose and throat via cilia and mucus, but particulate matter smaller than about 10 micrometers, can settle in the bronchi and lungs and cause health problems. The effects of inhaling particulate matter that have been widely studied in humans and animals include asthma, lung cancer, cardiovascular disease, respiratory diseases, premature delivery, birth defects, and premature death.

This product adopts the laser scattering method to collect the PM2.5&PM10 concentration in the environment.

## 4.9 Noise

Importance of Noise Monitoring : Environmental noise is the accumulation of all noise present in a specified environment. These noise sources expose millions of people to noise pollution that creates not only annoyance, but also significant health consequences such as elevated incidence of hearing loss and cardiovascular disease.

Sources of Noise :Motor Vehicles, Aircraft, Trains, Industries, Honking, Loud Music etc.

Health Hazard of Noise :Depending on duration and level of exposure, noise may promote hearing loss, high blood pressure, ischemic heart disease, sleep disturbances, birth defects, and even decreased school performance.

## 5 Measurement Parameters

Measurement parameters are transported by RS485 protocol (factory setting).

### 5.1 Air Temperature

- Actual temperature values: temperature value at current time.
- Average temperature: the arithmetic mean temperature value within a set period.
- Maximum temperature values: the maximum temperature within a set period.
- Minimum temperature: the minimum temperature within a set period.

<b>Air Temperature</b>	Measurement methods: NTC
	Measurement range: -50°C ... +80°C
	Resolution: 0.1°C

	Sensor accuracy: $\pm 0.1^{\circ}\text{C}$
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## 5.2 Relative humidity

- Actual humidity: humidity value at current time.
- Average humidity: the arithmetic mean humidity value within a set period.
- Maximum humidity values: the maximum humidity within a set period.
- Minimum humidity: the minimum humidity within a set period.

<b>Air Humidity</b>	Measurement methods: Capacitive
	Measurement range: 0 ... 100% RH
	Resolution: 0.1% RH
	Sensor accuracy: 0.8% RH

## 5.3 Pressure

- Actual pressure: pressure value at current time.
- Average pressure: the arithmetic mean pressure value within a set period.
- Maximum pressure values: the maximum pressure within a set period.
- Minimum pressure: the minimum pressure within a set period.

<b>Pressure</b>	Measurement methods: MEMS sensor——Capacitive
	Measurement range: 10 ... 1100hPa
	Resolution: 0.1hPa
	Accuracy: $\pm 1.0\text{hPa}$
	Unit: hPa

## 5.4 Wind Speed

- Actual wind speed: wind speed value at current time.
- Average wind speed: the arithmetic mean wind speed value within a set period.
- Maximum wind speed values: the maximum wind speed within a set period.
- Minimum wind speed: the minimum wind speed within a set period.

<b>Wind Speed</b>	Measurement methods: ultrasonic wave
-------------------	--------------------------------------

	Measurement range: 0 – 60m/s
	Resolution: 0.1m/s
	Accuracy: $\pm 0.3$ m/s or 3%
	Response threshold: 0.3 m/s
	Unit: m/s; km/h

## 5.5 Wind Direction

- Actual wind direction: wind direction value at current time.
- Average wind direction: the arithmetic mean wind direction value within a set period.
- Maximum wind direction values: the maximum wind direction within a set period.
- Minimum wind direction: the minimum wind direction within a set period.

<b>Wind Direction</b>	Measurement methods: ultrasonic wave
	Measurement range: 0 – 360°
	Resolution: 0.1°
	Accuracy: $< 3^\circ$ , RMSE from 1.0 m / s
	Response threshold: 0.3 m/s

## 5.6 Precipitation Quantity

- Period Precipitation Quantity: calculate the precipitation quantity within the current transmission period.
- Day Cumulative Precipitation Quantity: Calculate the daily accumulated precipitation quantity.

<b>Precipitation Quantity</b>	Measurement methods: Optical Scattering Method
	Measurement range: Unlimited
	Resolution: 0.001mm /0.01mm/0.2mm
	Accuracy: $< 4\%$

## 5.7 Global Radiation

<b>Global</b>	Measurement methods: Silicon photo detector
	Wavelength range: 400nm~1100nm
	Measurement range: 0~2000w/m <sup>2</sup>

<b>Radiation</b>	Resolution: 1w/m2
	Accuracy: < 5%

## 5.8 The UV Index

<b>The UV Index</b>	Measurement methods: Photosensitive element
	Wavelength range: 290nm~400nm
	Measurement range: 0~15 UVI

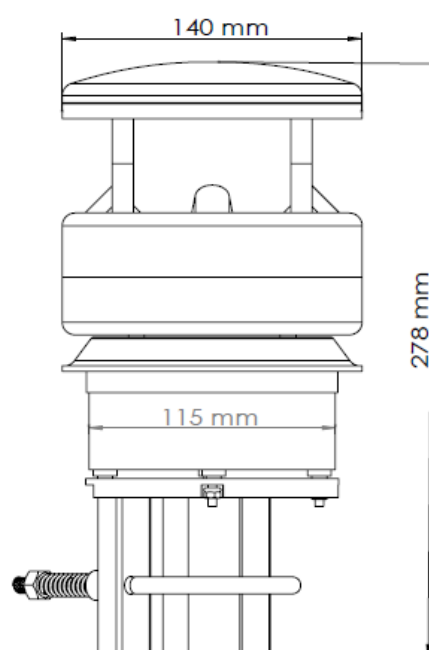
## 5.9 PM2.5&10

<b>PM2.5</b>	Measurement methods: Laser scattering / fan
	Measurement range: 0~1000ug/m2
	Sensitivity:0.3ug/m3
	Accuracy: 15% or $\pm 10\text{ug/m}^3$
<b>PM10</b>	Measurement methods: Laser scattering / fan
	Measurement range: 0~1000ug/m2
	Sensitivity:0.3ug/m3
	Accuracy: 15% or $\pm 10\text{ug/m}^3$

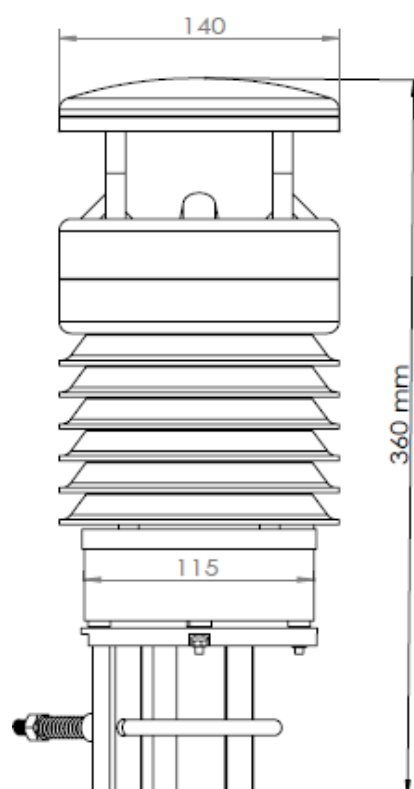
## 5.10 Noise

<b>Noise</b>	Measurement methods: Semiconductor method
	Measurement range: 30~130dB(A)
	A-weighting (simulated human ear)
	Accuracy: 1.5dB

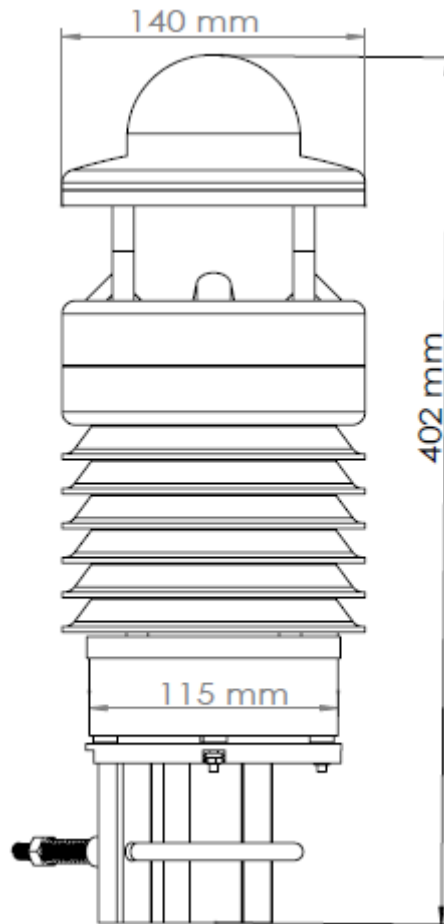
## 6 Installation



(RDM202/RDM302 size&structure)



(RDM305 size&structure)



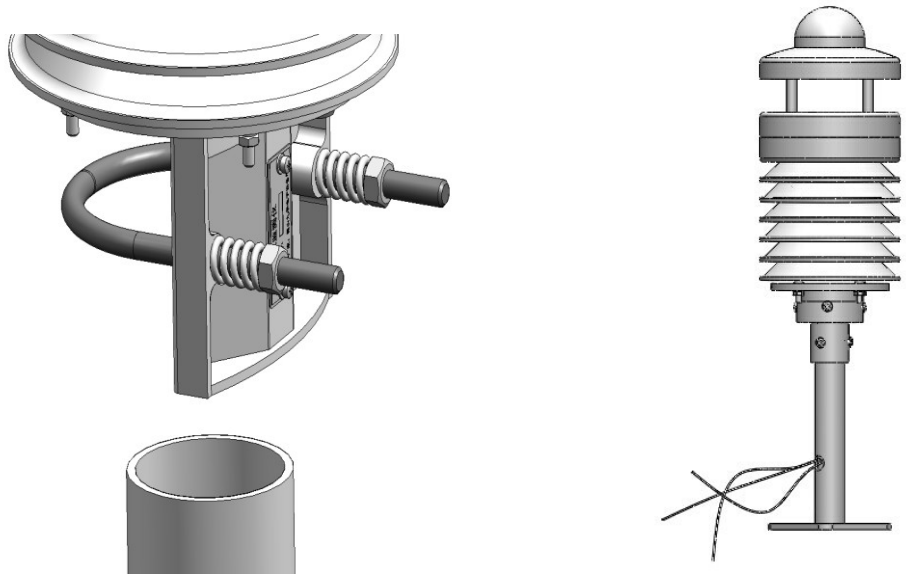
(RDM305/306/307 size&structure)

The sensor bracket is designed to be installed on the top of a mast with a diameter of 60 –76mm.

The following tools are required for the installation:

- Open-end or ring spanner (SW13).
- Compass for aligning the wind meter to the north.

## 6.1 Fastening



1: Hoop-style

2: Pinning-style

Figure 2: Fastening to the Mast

- Loosen nuts
- Push the sensor onto the top of the mast from above
- Tighten the nuts evenly until contact is made with the springs but the sensor can still be
- Align the sensor to the North (for wind meters)
- Tighten both nuts with 3 revolutions

## 6.2 \*North Alignment

In order for the wind direction to display correctly, the sensor must be aligned to the North. The sensor has a number of directional arrows for this purpose.

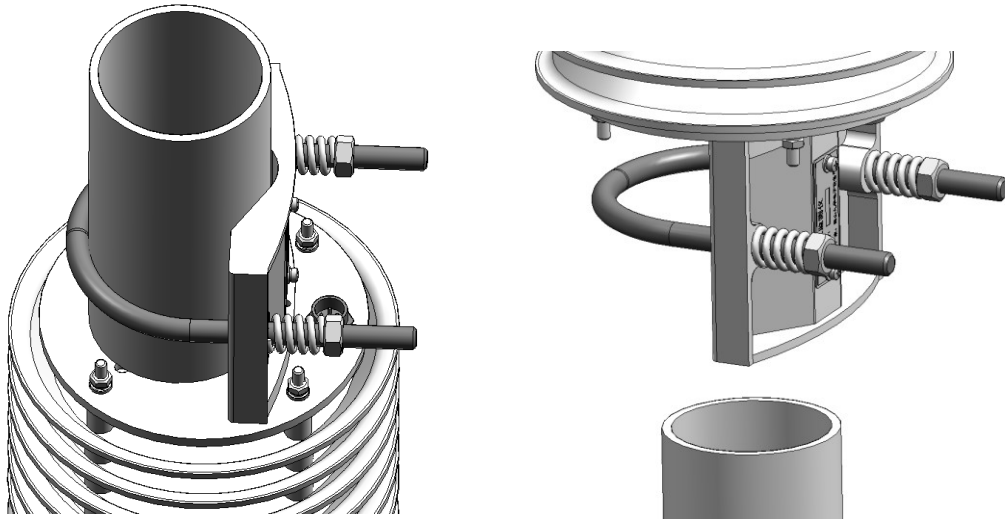


Figure 3: North Markings

Procedure:

- If the sensor is already installed, first loosen both nuts evenly until you can turn the sensor easily
- Using the compass, identify the North and fix a point of reference on the horizon
- Position the sensor in such a way that the South and North sensors are in alignment with the fixed point of reference in the North
- Tighten both nuts with 3 revolutions

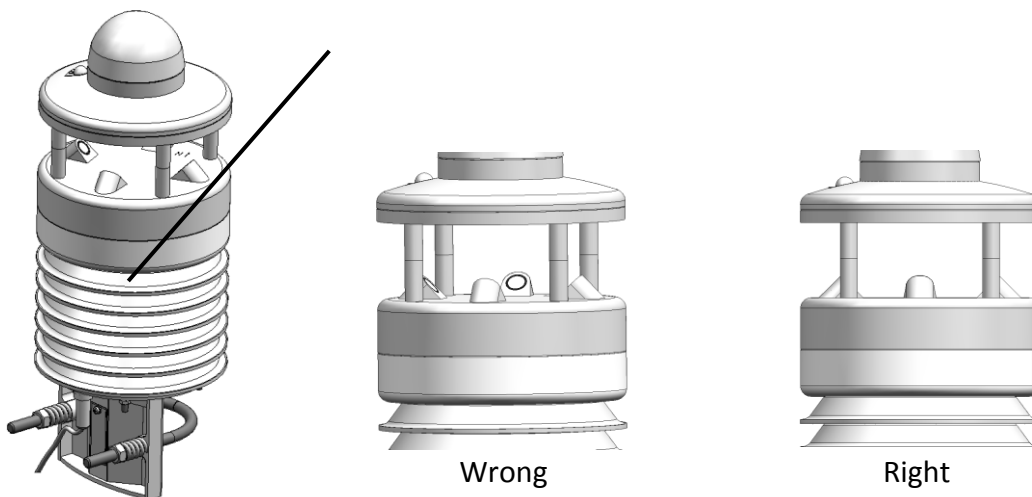


Figure 4: Alignment to North Pole

**Note:** As the magnetic North Pole indicated by the compass differs from the Geographic North Pole, account must be taken of the declination (variation) at the location when aligning the sensor.



Depending on the location, the variation can be more than 15° (in North America for example). In Central Europe the variation can be largely ignored at present (< 3°). You can find further helpful information on this subject on the Internet.

## **6.3 Selecting the Installation Location**

In order to guarantee long service life and correct equipment operation, please pay attention to the following points when selecting the installation location.

### **6.3.1 Introduction**

- Stable subsurface for installing the mast
- Free access to the equipment for maintenance works
- Reliable power supply for permanent operation
- Good network coverage when transmitting over a mobile communications network

**Note:** The computed measurements specifically apply to the equipment location only. No conclusions can be drawn with regard to the wider environment or a complete road section.

#### **ATTENTION:**

- Only approved and tested appliances (conductors, risers etc.) should be used to install the device on the mast.
- All relevant regulations for working at this height must be observed.
- The mast must be sized and anchored appropriately.
- The mast must be earthed in accordance with regulations.
- The corresponding safety regulations for working at road side and in the vicinity of the road carriageway must be observed.

If the equipment is installed incorrectly

- It may not function.
- It may be permanently damaged.

Danger of injury may exist if the equipment is allowed to fall.

### **6.3.2 Sensors with Wind Measurement**

- Installation at the top of the mast

- Installation height at least 1.5m above the ground
- Free field around the sensor

**Note:** Buildings, bridges, embankments and trees may influence the wind measurement. Equally, passing traffic may cause gusts which may influence the wind measurement.

## 7 Connections

There is an 8 pole screw connector on the underside of the equipment. This serves to connect the supply voltage and interfaces by way of the supplied connection cable.

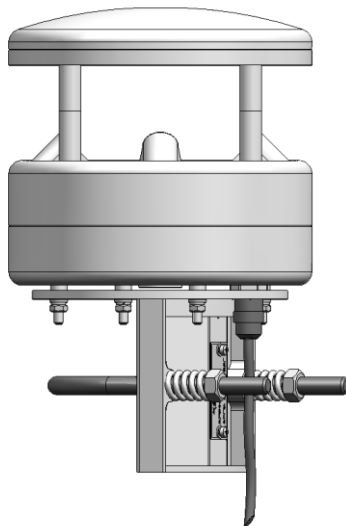
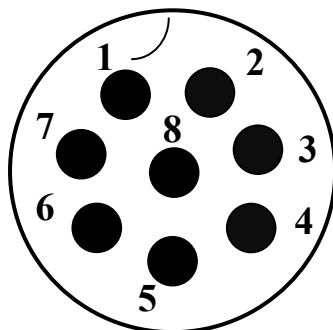


Figure 5: Connection

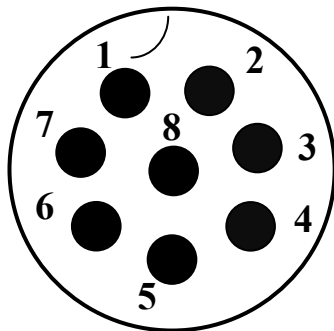


Mode 1 View on sensor connection

Pin assignment:

- 1 Red Positive heating voltage
- 2 Black Negative heating voltage
- 3 Yellow RS485\_A
- 4 Blue RS485\_B
- 5 Unassigned
- 6 Unassigned

The cable marking is in accordance with DIN 47100.



Pin assignment:

2 Red Positive heating voltage

8 Black Negative heating voltage

5 Yellow RS485\_A

7 Blue RS485\_B

Mode 2 View on sensor connection

**Note:** The protective cap must be removed before plugging in the equipment. (When applicable)

If the equipment is not connected correctly

- It may not function
- It may be permanently damaged
- The possibility of an electrical shock may exist

## 7.1 Supply Voltage

The supply voltage for the compact weather station is 12 - 24V DC. The power supply unit used must be approved for operation with equipment of protection class III (SELV).

**Note:** A heating voltage of 24V DC is recommended to guarantee full heating duty. If the heating is operated on 12V DC, account must be taken of the functional restrictions in winter operation.

## 7.2 RS485 Interface

The equipment has an electrically isolated, half-duplex, 2 wire RS485 interface for configuration, measurement polling and the firmware update.

## 8 Maintenance

In general, the equipment is maintenance-free.

However, it is recommended to carry out a functional test on an annual basis.

When doing so, pay attention to the following points:

- Visual inspection of the equipment for soiling
- Check the sensors by carrying out a measurement request

## 9 Technical Data

**Power supply:** 12 - 24VDC +/- 10%

**Current consumption and power input - sensor:**

FRT RDM202 when 12VDCca. 25mA

FRT RDM302 when 12VDCca. 25mA

FRT RDM305 when 12VDCca. 25mA

FRT RDM306 when 12VDCca. 30mA

FRT RDM307 when 12VDCca. 30mA

FRT RDM308 when 12VDCca. 30mA

**Dimensions including mounting bracket:**

FRT RDM202 Ø 140mm, height278mm

FRT RDM302 Ø 140mm, height278mm

FRT RDM305 Ø 140mm, height360mm

FRT RDM306 Ø 140mm, height402mm

FRT RDM307 Ø 140mm, height402mm

FRT RDM308 Ø 140mm, height402mm

**Weight including mounting bracket, excluding connection cable:**

FRT RDM202 ca. 1.2 kg

FRT RDM302 ca. 1.2 kg

FRT RDM305 ca. 1.6 kg

FRT RDM306 ca. 1.8 kg

FRT RDM307 ca. 1.8 kg

FRT RDM308 ca. 1.8 kg

Fastening: Stainless steel mast bracket for Ø 60 - 76mm

Protection class: III (SELV)

Protection type: IP64

**Storage Conditions**

Permissible storage temperature: -50°C ... +70°C

Permissible relative humidity: 0~100% RH

**Operating Conditions**

Permissible operating temperature: -40°C ... +60°C

Permissible relative humidity: 0 ... 100% RH

Permissible altitude above sea level: N/A

**RS485 interface, 2 wire, half-duplex**

Data bits: 8

Stop bit: 1

Parity: No

Tri-state: 2 bits after stop bit edge

Adjustable baud rates: 1200, 2400, 4800, 9600, 14400, 19200etc

Housing: Plastic (PC)

## 10 Fault Description

Error description	Cause - Remedy
Device does not allow polling / does not respond	<ul style="list-style-type: none"><li>- Check power supply</li><li>- Check interface connection</li><li>- Incorrect device ID ? ? check ID;</li></ul>



## 11 Repair / Corrective Maintenance

Please arrange for any faulty equipment to be checked and, if necessary, repaired by the manufacturer exclusively. Do not open the equipment and do not under any circumstances attempt to carry out your own repairs.

In matters of guarantee or repair please contact:

**Fronttech (Beijing) Limited**

Hot line: 4009205385

Phone: 010-62698418    010-62698458

Sales@fronttech.com.cn

or your local distributor.

## Appendix 1:RDM Protocol

**Command format:** aR0<cr><lf>

**Respond:**

0R0,Dn=000D,Dm=000D,Dx=000D,Sn=000.0M,Sm=000.0M,Sx=000.0M,Ta=023.1C,Ua=018.3P,Pa=001009.5H,Rc=0000.0M,Sr=0002.2W,Uv=02I,NX=058.0B,NI=051.2B,NS=056.1B,PM2.5=127.8U,PM10=0233.9U

Response message parameter description:

a	=	Device address;
R0	=	Wind data acquisition command;
Dn	=	Minimum wind direction;
Dm	=	Mean wind direction;
Dx	=	Maximum wind direction;
Sn	=	Minimum wind speed;
Sm	=	Mean wind speed;
Sx	=	Maximum wind speed;
Ta	=	Atmospheric temperature (C = °C);
Ua	=	Atmospheric relative humidity (P =%RH);
Pa	=	Atmospheric pressure (H = hPa);
Rc	=	Rainfall (mm);
Sr	=	Solar radiation (w/m2);
Uv	=	UV index;
NX	=	Maximum noise (dB);
NI	=	Minimum noise (dB);
NS	=	Average noise (dB);
PM2.5	=	PM2.5 particle concentration (ug/m3);
PM10	=	PM10 particle concentration (ug/m3);
<cr><lf>	=	Command terminator;

## Appendix 2: Modbus Protocol

Modbus Register version: V2.1

1 Address: 1~100(Algorism)

2 Register description:

Address	Name	Data length	Description
0	Wind direction minimum	2 bytes	Read only; Unsigned integer
1	Wind direction average	2 bytes	Read only; Unsigned integer
2	Wind direction maximum	2 bytes	Read only; Unsigned integer
3	Wind speed minimum	2 bytes	Read only; Unsigned integer; Expand ten times
4	Wind speed average	2 bytes	Read only; Unsigned integer; Expand ten times
5	Wind speed maximum	2 bytes	Read only; Unsigned integer; Expand ten times
6	Air temperature	2 bytes	Read only; Unsigned integer; Expand ten times
7	Air humidity	2 bytes	Read only; Unsigned integer; Expand ten times
8	Air pressure	2 bytes	Read only; Unsigned integer; Expand ten times
9	Rainfall	2 bytes	Read only; Unsigned integer; Expand ten times
10	Global radiation	2 bytes	Read only; Unsigned integer; Expand ten times
11	Ultraviolet grade	2 bytes	Read only; Unsigned integer

12	Reserved	2 bytes	
13	PM2.5	2 bytes	Read only; Unsigned integer; Expand ten times
14	PM10	2 bytes	Read only; Unsigned integer; Expand ten times
15	Reserved	2 bytes	
16	Reserved	2 bytes	
17			
18			
19			
20	Device address	2 bytes	Read-write; Default address:0x31
21	Baud rate	2 bytes	Read-write;4800、9600、19200、38400
22	Wind speed average time	2 bytes	Read-write; Unsigned integer; Unit: sec; Value:1-3600
23	Temperature and humidity update time	2 bytes	Read-write; Unsigned integer; Unit: sec; Value:1-3600;Advice:not less than 10
24	Rainfall supply control	2 bytes	Read-write; Unsigned integer;0=Close ;1=Open
25	Rainfall reset	2 bytes	Write only; 1=Reset
26	Software reset	2 bytes	Write only; 1=Reset
27	Resume to default setting	2 bytes	Write only; 1= Resume to default setting
28	Set protocol	2 bytes	Write only; 0=ASCII protocol;1= Modbus protocol
29			
30			
31			
32			
33			



3 Data register: Algorism is the current system data.

4 Supply voltage:

Algorism: Such as 168, which shows that voltage is 16.8 V.

5 Default communication interface:

Serial baud rate: 19200

Start bit: 1

Stop bit: 1

Data bit: 8

Parity bit: NO