Wireless PM2.5 / Noise / Temperature / Humidity Sensor

RA0723_R72623_RA0723Y
User Manual

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1. Introduction

RA0723_R72623_RA0723Y is a ClassA type device based on the LoRaWAN open protocol of Netvox and is compatible with the LoRaWAN protocol.

RA0723_R72623_RA0723Y can be connected to the detector of PM2.5, temperature and humidity, and noise. The values collected by the sensor are reported to the corresponding gateway.

LoRa Wireless Technology:

LoRa is a wireless communication technology famous for its long-distance transmission and low power consumption. Compared with other communication methods, LoRa spread spectrum modulation technique greatly extend the communication distance. It can be widely used in any use case that requires long-distance and low-data wireless communications. For example, automatic meter reading, building automation equipment, wireless security systems, industrial monitoring. It has features like small size, low power consumption, long transmission distance, strong anti-interference ability and so on.

LoRaWAN:

LoRaWAN uses LoRa technology to define end-to-end standard specifications to ensure interoperability between devices and gateways from different manufacturers.

2. Appearance

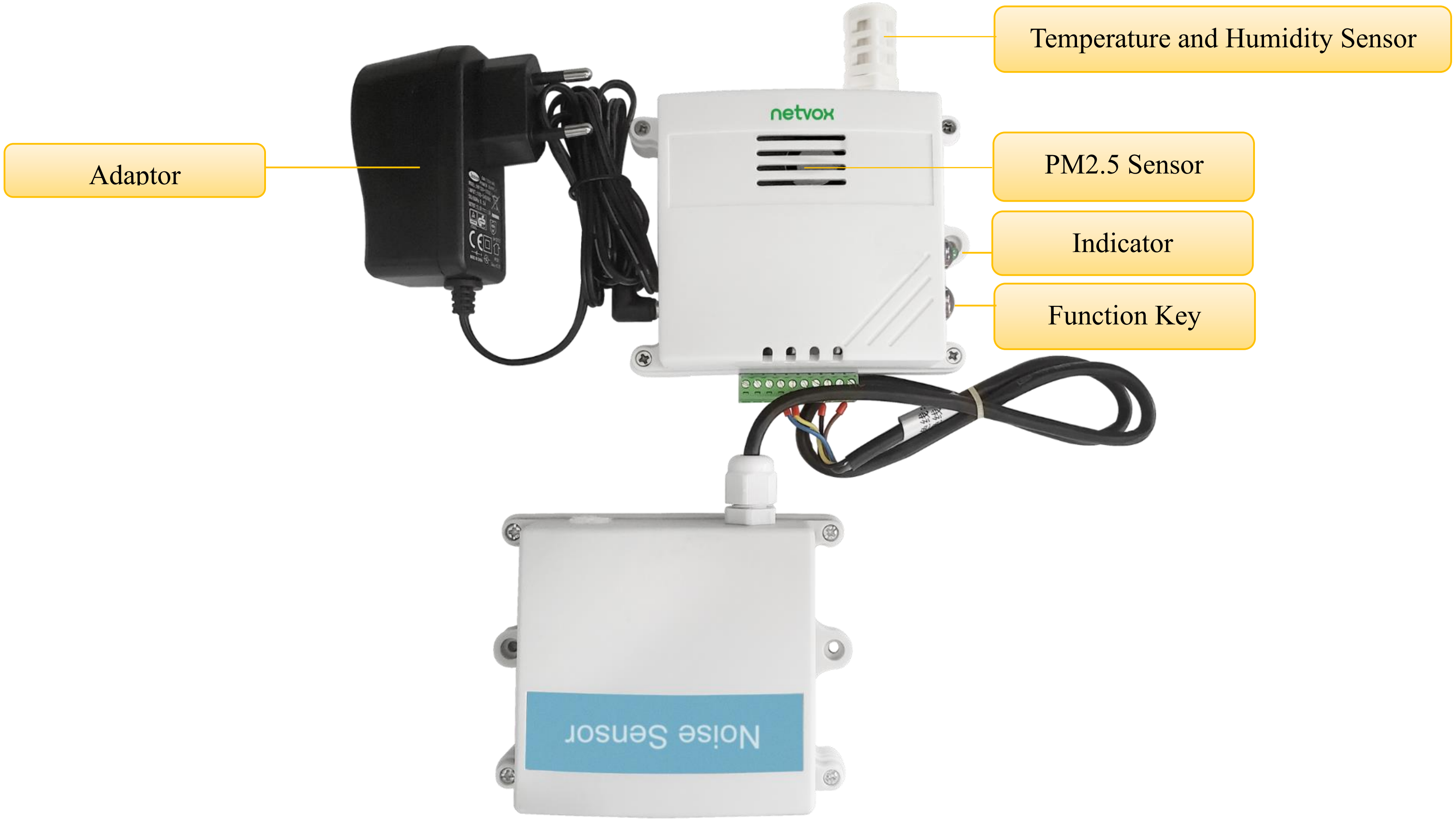

Temperature and Humidity Sensor
Adaptor
PM2.5 Sensor
Indicator
Function Key
netvox
Noise Sensor

Fig. 1. RA0723 internal PM2.5 and temperature and humidity sensor, external noise Sensor

(subject to the actual object)

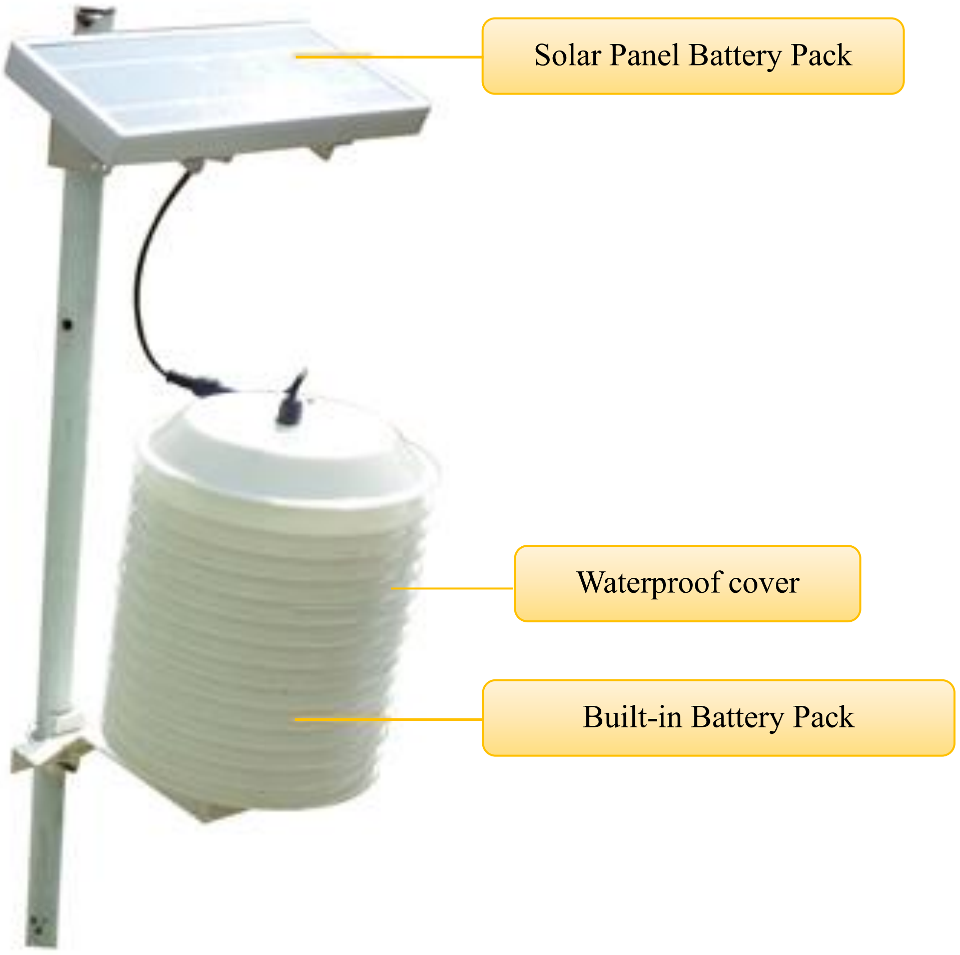

Solar Panel Battery Pack
Waterproof cover
Built-in Battery Pack

Fig. 2. R72623 shield is equipped with PM2.5, temperature and humidity sensor and noise sensor

(subject to the actual object), external solar power supply.

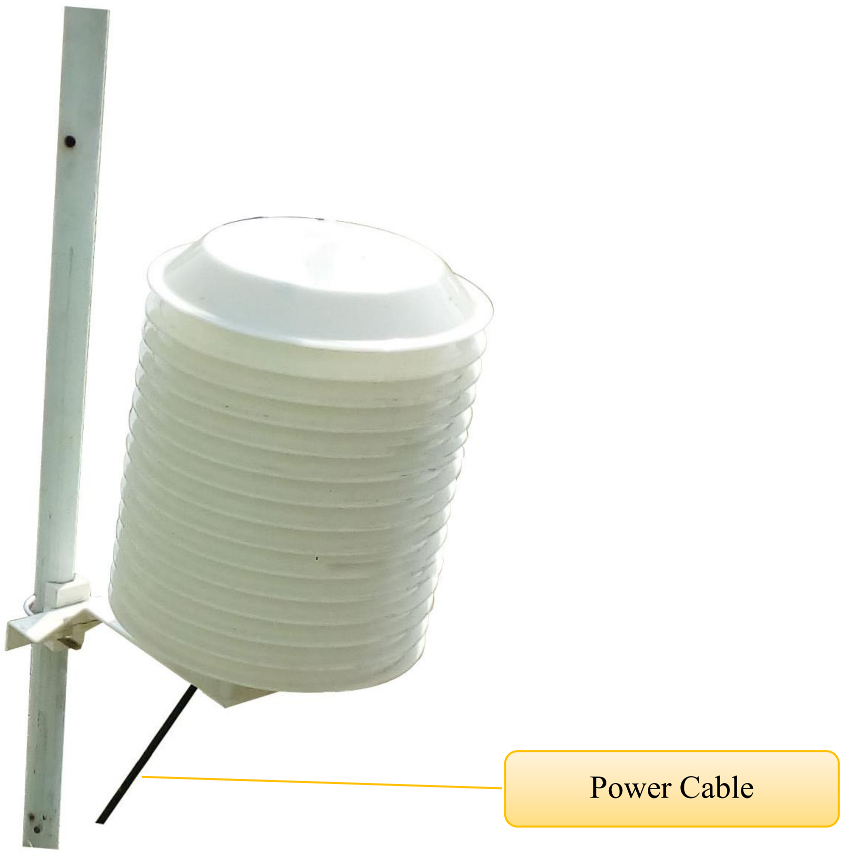


Fig. 3. RA0723Y shield is equipped with PM2.5, temperature and humidity sensor and noise sensor (subject to the actual object).

3. Main Feature

- Compatible with LoRaWAN
- RA0723 and RA0723Y applies DC 12V adapters
- R72623 applies solar and rechargeable lithium batteries
- Simple operation and setting
- PM2.5, noise, temperature and humidity detection
- Adopt SX1276 wireless communication module
- Frequency hopping spread spectrum
- Configuring parameters and reading data via the third-party software platforms, and set alarms via SMS text and email (optional)
- Applicable to the third-party platforms: Actility/ThingPark, TTN, MyDevices/Cayenne

4. Set Up Instruction

On/Off

Power ON	RA0723 and RA0723Y are connected to DC 12V adapter for power on. R72623 applies solar and rechargeable lithium batteries.
Turn On	Connect with power on to turn on.
Restore to Factory Setting	Press and hold the function key for 5 seconds till green indicator flashes for 20 times.
Power Off	Disconnect from the power supply.
*The engineering test requires to write the engineering testing software separately.	

Note	The interval between on and off is suggested to be about 10 seconds to avoid the interference of capacitor inductance and other energy storage components.

Network Joining

Never Join the Network	Turn on the device to search the network. The green indicator keeps on for 5 seconds: success. The green indicator remains off: fail
Had Joined the Network (Not in the factory setting)	Turn on the device to search the previous network. The green indicator keeps on for 5 seconds: success. The green indicator remains off: fail.
Fail to Join the Network	Suggest checking the device registration information on the gateway or consulting your platform server provider if the device fails to join the network.

Function Key

Press and Hold for 5 Seconds	Restore to the factory setting / Turn off The green indicator flashes 20 times: success The green indicator remains off: fail
Press once	The device is in the network: the green indicator flashes once and the device sends a data report. The device is not in the network: the green indicator remains off.

Restore to Factory Setting

Description	RA0723_R72623_RA0723Y has the function of the power-down saving the memory of network-joining information. This function acquiesces in turn off, that is, it will rejoin every time when it is power on. If the device is turned on by the ResumeNetOnOff command, the last network-joining information will be recorded when every time it is power on. (including saving the

	network address information that it is assigned, etc.) If users want to join a new network, the device needs to perform the factory setting, and it will not rejoin the last network.
Operation Method	1. Press and hold the binding button for 5 seconds and then release (release the binding button when the LED flashes), and the LED flashes 20 times. 2. The device automatically restarts to rejoin the network.

Low Voltage Threshold

Low Voltage Threshold	10.5 V

5. Data Report

After power on, the device will immediately send a version packet report and a data report including the noise value, PM2.5, temperature and humidity, and voltage.

The device sends data according to the default configuration before any other configuring.

Default setting:

Report MaxTime & MinTime

Model		US915, AU915, KR920, AS923, IN865	EU868
RA0723	MaxTime	180s	370s
	MinTime	30s	120s
R72623	MaxTime	1800s	1800s
	MinTime	30s	120s
RA0723Y	MaxTime	180s	370s
	MinTime	30s	120s

Report Type count = 3

Report Change: 0

* Report Max Time should be greater than ReportType count *ReportMinTime+10 and should not be less than 300 seconds.

Note:

(1) The cycle of the device sending the data report is according to the default.

(2) The interval between two reports must be the MaxTime.

(3) ReportChange is not supported by RA0723_R72623_RA0723Y (Invalid configuration).

The data report is sent according to ReportMaxTime as a cycle (the first data report is the start to the end of a cycle).

(4) Data pocket: PM2.5, noise, temperature, and humidity

(5) The device also supports the TxPeriod cycle configuration instructions of Cayenne. Therefore, the device can perform the report according to the TxPeriod cycle. The particular report cycle is ReportMaxTime or TxPeriod depending on which report cycle was configured last time.

(6) It would take **35 seconds** for the sensor to sample and process the collected value after pressing the button, please be patient.

Please refer Netvox LoRaWAN Application Command document and Netvox Lora Command Resolver http://cmddoc.netvoxcloud.com/cmddoc to resolve uplink data.

5.1 Example of ReportDataCmd

FPort：0x06

Bytes	1	1	1	Var (Fix=8 Bytes)
	Version	DeviceType	Report Type	NetvoxPayLoadData

Version– 1 byte –0x01——the Version of Netvox LoRaWAN Application Command Version

DeviceType– 1 byte – Device Type of Device

The device type is listed in Netvox LoRaWAN Application Device type.doc

Report Type – 1 byte –the presentation of the NetvoxPayLoadData， according the device type

NetvoxPayLoadData– Fixed bytes (Fixed =8bytes)

Device	**Device Type**	**Report Type**	**NetvoxPayLoadData**				
RA0723 R72623 RA0723Y	0x05 0x09 0x0D	0x02	Battery (1Byte, unit:0.1V)	PM1.0 (2Byte 1ug/m^3)	PM2.5 (2Byte 1ug/m^3)	PM10 (2Byte 1ug/m^3)	Reserved (1Byte,fixed 0x00)
		0x07	Battery (1Byte, unit:0.1V)	CO2 (2Byte ,0.1ppm)	NH3 (2Byte ,0.1ppm)	Noise (2Byte ,0.1db)	Reserved (1Byte,fixed 0x00)
		0x0C	Battery (1Byte, unit:0.1V)	Temperature (Signed2Bytes,unit:0.01°C)	Humidity (2Bytes,unit:0.01%)	WindSpeed (2Bytes,unit:0.01m/s)	Reserved (1Byte,fixed 0x00)

Example of R72623 Uplink:

Packet #1: 01090278FFFF000EFFFF00

1st byte (01): Version

2nd byte(09): DeviceType 0x09 — R726 Series

3rd byte (02): ReportType

4th byte (78): Battery—12v , 78 H_{ex}=120 D_{ec} 120*0.1v=12v

5th6th byte (FFFF): PM1.0

7th 8th byte (000E): PM2.5 —14 ug/m^3

9th10th byte (FFFF): PM10

11th byte (00): Reserved

Packet #2: 01090778FFFFFFFF025800

1st byte (01): Version

2nd byte (09): DeviceType 0x09 — R726 Series

3rd byte (07): ReportType

4th byte (78): Battery—12v , 78 H_{ex}=120 D_{ec} 120*0.1v=12v

5th6th byte (FFFF): CO2

7th 8th byte (FFFF): NH3

9th10th byte (0258): Noise—60dB , 258 H_{ex}=600 D_{ec} 600*0.1v=60 dB

11th byte (00): Reserved

Packet #3: 01090C7809C41B58FFFF00

1st byte (01): Version

2nd byte (09): DeviceType 0x09 － R726 Series

3rd byte (0C): ReportType

4th byte (78): Battery－12v , 78 H_{ex}=120 D_{ec} 120*0.1v=12v

5th6th byte (09C4): Temperature－25° , 09C4 H_{ex}=2500 D_{ec} 2500*0.01°=25°

7th 8th byte(1B58): Humidity－70% , 1B58 H_{ex}=7000 D_{ec} 7000*0.01%=70%

9th10th byte (FFFF): Wind Speed

11th byte (00): Reserved

5.2 Example of ConfigureCmd

FPort：0x07

Bytes	1	1	Var (Fix =9 Bytes)
	CmdID	DeviceType	NetvoxPayLoadData

CmdID– 1 byte

DeviceType– 1 byte – Device Type of Device

NetvoxPayLoadData– var bytes (Max=9bytes)

Description	Device	CmdID	DeviceType	NetvoxPayLoadData		
Config ReportReq	RA0723 R72623 RA0723Y	0x01	0x05 0x09 0x0D	MinTime (2bytes Unit: s)	MaxTime (2bytes Unit: s)	Reserved (5Bytes, Fixed 0x00)
Config ReportRsp		0x81		Status (0x00_success)	Reserved (8Bytes, Fixed 0x00)	
ReadConfig ReportReq		0x02		Reserved (9Bytes, Fixed 0x00)		
ReadConfig ReportRsp		0x82		MinTime (2bytes Unit: s)	MaxTime (2bytes Unit: s)	Reserved (5Bytes, Fixed 0x00)

(1) Configure R72623 device parameter MinTime = 30s, MaxTime = 3600s

Downlink： 0109001E0E100000000000

Device returns：

8109000000000000000000 (Configuration success)

8109010000000000000000 (Configuration failure)

(2) Read R72623 device parameter

Downlink: 0209000000000000000000

Device return: 8209001E0E100000000000 (device current parameter)

5.3 Example of GlobalCalibrateCmd

FPort: 0x0E

<table>
<tr><th>Description</th><th>Cmd ID</th><th>Sensor Type</th><th colspan="30">PayLoad(Fix =9 Bytes)</th></tr>
<tr><td>SetGlobal CalibrateReq</td><td>0x01</td><td rowspan="4">See below</td><td colspan="6">Channel (1Byte, 0_Channel1, 1_Channel2,etc)</td><td colspan="6">Multiplier (2bytes, Unsigned)</td><td colspan="6">Divisor (2bytes, Unsigned)</td><td colspan="6">DeltValue (2bytes, Signed)</td><td colspan="6">Reserved (2Bytes, Fixed 0x00)</td></tr>
<tr><td>SetGlobal CalibrateRsp</td><td>0x81</td><td colspan="10">Channel (1Byte) 0_Channel1, 1_Channel2,etc</td><td colspan="10">Status (1Byte, 0x00_success)</td><td colspan="10">Reserved (7Bytes, Fixed 0x00)</td></tr>
<tr><td>GetGlobal CalibrateReq</td><td>0x02</td><td colspan="15">Channel (1Byte) 0_Channel1, 1_Channel2,etc</td><td colspan="15">Reserved (8Bytes, Fixed 0x00)</td></tr>
<tr><td>GetGlobal CalibrateRsp</td><td>0x82</td><td colspan="6">Channel (1Byte, 0_Channel1, 1_Channel2,etc)</td><td colspan="6">Multiplier (2bytes, Unsigned)</td><td colspan="6">Divisor (2bytes, Unsigned)</td><td colspan="6">DeltValue (2bytes, Signed)</td><td colspan="6">Reserved (2Bytes, Fixed 0x00)</td></tr>
</table>

Sensor Type:

0x01 Temperature Sensor

0x02 Humidity Sensor

0x04 PM2.5 Sensor

0x18 Noise Sensor

(1) Sensor detects temperature = 27.15°C , Actual = 26.87 // -0.28°C

Downlink: 01010000010001FFE40000

1st byte (01): CMD ID

2nd byte (01): Sensor Type 0x01- Temperature sensor

3rd byte (00): Channel 1

4th5th byte (0001): Multiplier

6th7th byte (0001): Divisor-

8th 9th byte (FFE4): DeltValue, FFE4 (Hex)= -28 (Dec) , -28*0.01°C= -0.28 °C

10th11th byte (0000): Reserved

(2) Sensor detects humidity = 51% , Actual = 55% // +4%

Downlink: 0102010001000101900000

1st byte (01): CMD ID

2nd byte (02): Sensor Type 0x02- Humidity sensor

3rd byte (01): Channel 2

4th5th byte (0001): Multiplier

6th7th byte (0001): Divisor-

8th 9th byte (0190): DeltValue, 190(Hex)= 400 (Dec) , 400*0.01%= 4%

10th11th byte (0000): Reserved

(3) Sensor detects PM2.5 = 155 ug/m^3, Actual = 150 ug/m^3 // -5 ug/m^3

Downlink: 01040200010001FFFB0000

1st byte (01): CMD ID

2nd byte (04): Sensor Type 0x04- PM2.5 sensor

3rd byte (02): Channel 3

4th5th byte (0001): Multiplier

6th7th byte (0001): Divisor-

8th 9th byte (FFFB): DeltValue, FFFB(Hex)= -5(Dec) , -5*1 ug/m^3= -5 ug/m^3

10th11th byte (0000): Reserved

(4) Sensor detects noise = 88 dB, Actual = 90dB // +2 dB

Downlink: 0118030001000100140000

1st byte (01): CMD ID

2nd byte (18): Sensor Type 0x18- Noise sensor

3rd byte (03): Channel 4

4th5th byte (0001): Multiplier

6th7th byte (0001): Divisor-

8th 9th byte (0014): DeltValue, 14(Hex)= 20(Dec) , 20*0.1 dB= 2dB

10th11th byte (0000): Reserved

Note:

1. When Multiplier is not 1, Calibration value = DeltValue*Multiplier.
2. When Divisor is not 1, Calibration value = DeltValue/Divisor.
3. The choices of the Channel would be 00-03 Channel
4. With different sensor type, it is forbidden to use that same Channel number.
5. This universal calibration supports calibration of positive and negative numbers.

6. PM2.5 Sensor Dust Removal

PM2.5 sensor dust removal needs to disassemble.

There are currently two ways to clean the dust of PM2.5 sensor:

1: If it is ordinary dry dust, it can use a hair dryer to clean it up. Be careful not to get too hot and too strong wind. Please use a hair dryer to clean the air inlet and outlet when the PM2.5 sensor stops operating. (Among them, the fan of PM2.5 sensor is the air outlet; therefore, please fix the fan blade when cleaning the air outlet, and fixing fan blade can be clamped with tweezers or caught by something.)

2: When the PM2.5 sensor stops operating, the sticky dust inside the sensor cannot be cleaned. The user can use a brush to clean the dust that can be seen inside the air inlet and outlet.

3: The average time that PM2.5 Dust Sensor is without any failures is 3 years.
If the concentration is more than 300ug/m3 for more than 50% of a year,
or the concentration exceeds 500ug/m3 for more than 20% of a year, the consistency of the sensor will decrease.
The data may be high because of the internal dust accumulation.

7. Installation

Precautions for installing the noise sensor:

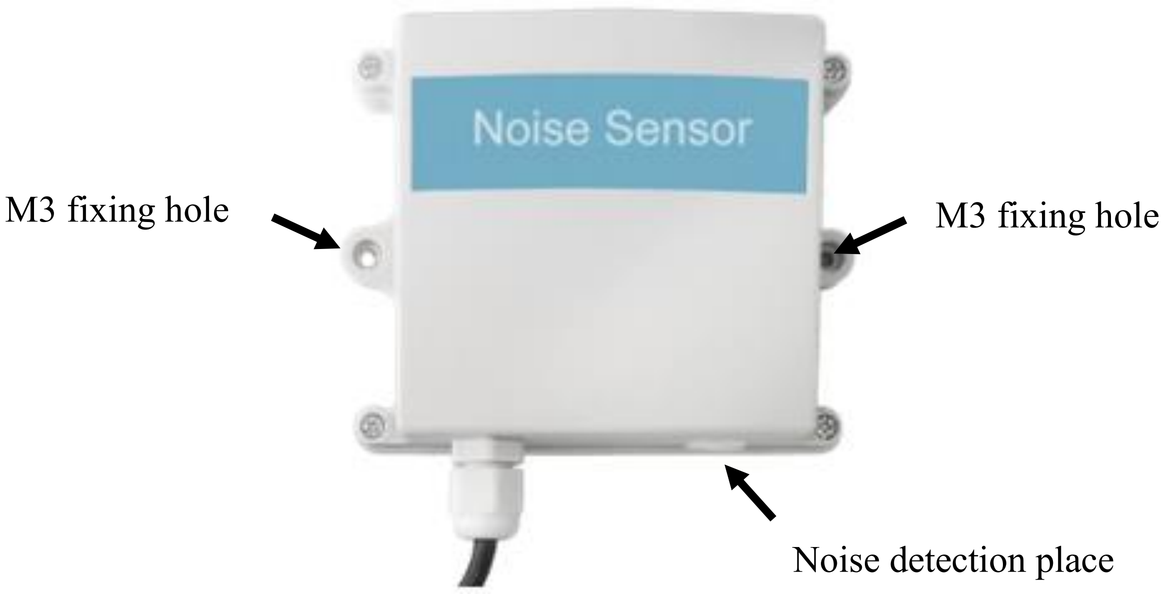
1.The noise sensor shall be placed vertically as far as possible to ensure that the noise detection hole is below the noise sensor when installing on the wall

2. The installation height is the human body sitting height or the environmental area that is mainly required to be measured.

3. It shall be installed in an area with stable environment, avoiding direct sunlight, keeping away from windows, air conditioning, heating and other devices, and avoiding direct exposure to windows and doors.

4.Keep away from high-power interference device as far as possible to avoid inaccurate measurement, such as frequency converter, motor, etc.

1. **RA0723** does not have the waterproof function. After the device completes joining the network, please place it indoor.
   Please pay attention to the direction when installing the noise sensor and keep the pickup facing down



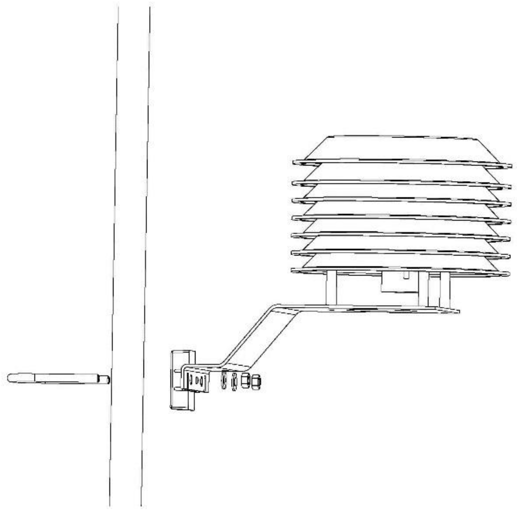
2. **R72623** has a waterproof function. After the device completes joining the network, please place it outdoors.

(1) In the installed position, loosen the U-shaped screw, the mating washer, and the nut at the bottom of R72623, and then make the U-shaped screw pass through the appropriate size cylinder and fix it on the fixing strut flap of R72623. Install the washer and the nut in order and lock the nut till R72623 body is stable and does not shake.

(2) At the upper side of the fixed position of R72623, loosen the two U-shaped screws, the mating washer and nut on the side of the solar panel. Make the U-shaped screw pass through the appropriate size cylinder and fix them on the main bracket of the solar panel and install the washer and the nut in sequence. Lock nut till the solar panel is stable and does not shake.

(3) After adjusting the angle of the solar panel completely, lock the nut.

(4) Connect the top waterproof cable of R72623 with the wiring of the solar panel and lock it tight.



(5) Rechargeable lithium battery

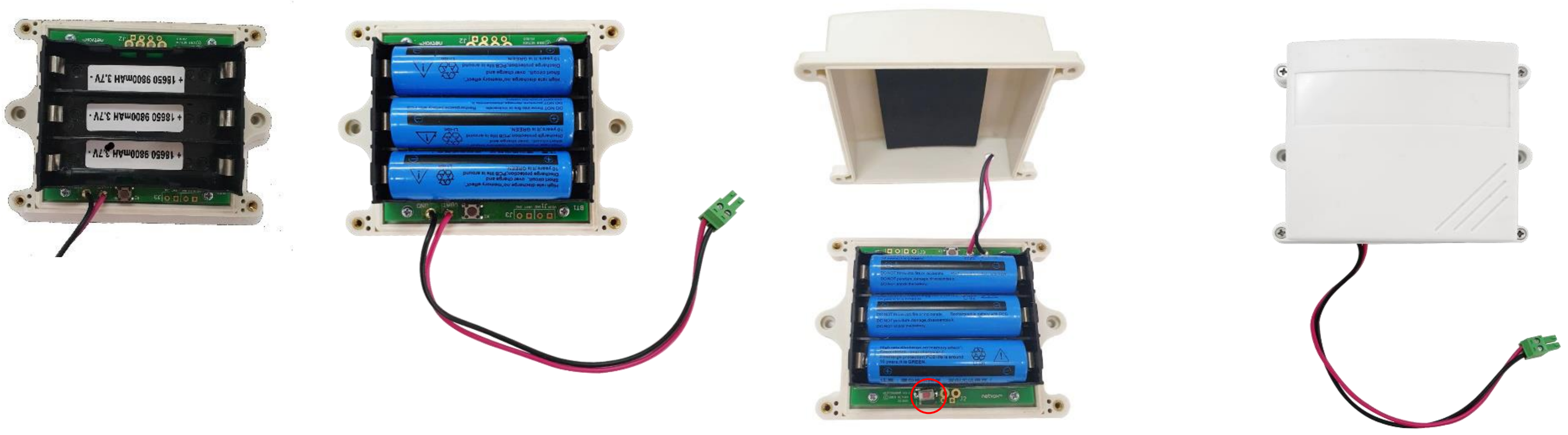
R72623 has a battery pack inside. Users can buy and install rechargeable 18650 lithium battery, a total of 3 sections, voltage 3.7V/ every single rechargeable lithium battery, recommended capacity 5000mah. The installation of rechargeable lithium battery steps are as follows:

1: Remove the four screws around battery cover.

2: Insert three 18650 lithium batteries. (Please make sure the positive and negative level of the battery)

3: Press the activation button on the battery pack for the first time.

4: After activation, close the battery cover and lock the screws around battery cover.



activation button

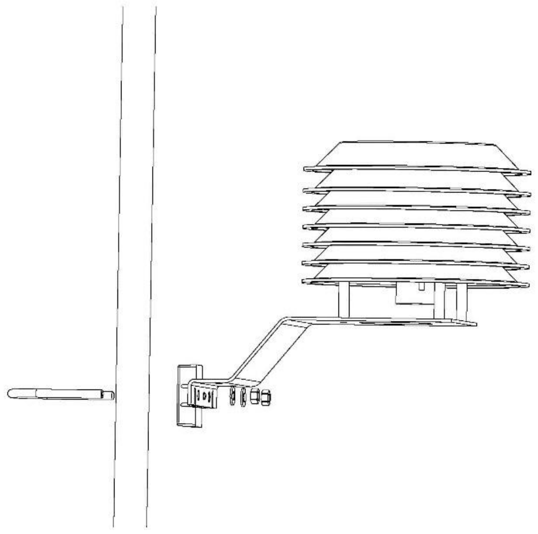
Fig. Rechargeable Lithium Battery

3. **RA0723Y** is waterproof and can be placed outdoors after the device completes joining the network..

(1) In the installed position, loosen the U-shaped screw, the mating washer, and the nut at the bottom of RA0723Y, and then make the U-shaped screw pass through the appropriate size cylinder and fix it on the fixing strut flap of RA0723Y. Install the washer and the nut in order and lock the nut till RA0723Y body is stable and does not shake.

(2) Loosen the M5 nut at the bottom of the RA0723Y matte and take the matte together with the screw.

(3) Make the DC adaptor pass through the central hole of the bottom cover of RA0723Y and insert it into the RA0723Y DC socket, and then put the mating screw to the original position and lock the M5 nut tight.



8.Important Maintenance Instruction

Kindly pay attention to the following in order to achieve the best maintenance of the product:

- Keep the device dry. Rain, moisture, or any liquid, might contain minerals and thus corrode electronic circuits. If the device gets wet, please dry it completely.
- Do not use or store the device in dusty or dirty environment. It might damage its detachable parts and electronic components.
- Do not store the device under excessive heat condition. High temperature can shorten the life of electronic devices, destroy batteries, and deform or melt some plastic parts.
- Do not store the device in places that are too cold. Otherwise, when the temperature rises to normal temperature, moisture will form inside, which will destroy the board.
- Do not throw, knock or shake the device. Rough handling of equipment can destroy internal circuit boards and delicate structures.
- Do not clean the device with strong chemicals, detergents or strong detergents.
- Do not apply the device with paint. Smudges might block in the device and affect the operation.
- Do not throw the battery into the fire, or the battery will explode. Damaged batteries may also explode.

All of the above applies to your device, battery and accessories. If any device is not working properly, please take it to the nearest authorized service facility for repair.