

Wireless CO₂ / Temperature / Humidity Sensor

User Manual

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Table of Contents

1. Introduction.....	2
2. Appearance	3
3. Features.....	4
4. Set up Instructions	4
5. Data Report.....	6
5.1 Example of ReportDataCmd.....	7
5.2 Example of ConfigureCmd.....	9
5.3 Example of GlobalCalibrateCmd.....	10
5.4 Set/GetSensorAlarmThresholdCmd	12
5.5 Example of NetvoxLoRaWANRejoin.....	14
6. Installation	15
7. Important Maintenance Instructions	17

1. Introduction

RA0715_R72615_RA0715Y is a Class A device based on the LoRaWAN™ protocol of Netvox and is compatible with the LoRaWAN protocol.

RA0715_R72615_RA0715Y can be connected with the sensor of the temperature and humidity, and CO₂. The values collected by the sensor are reported to the corresponding gateway.

LoRa Wireless Technology:

LoRa is a wireless communication technology dedicated to long distance and low power consumption. Compared with other communication methods, LoRa spread spectrum modulation method greatly increases to expand the communication distance. Widely used in long-distance, low-data wireless communications. For example, automatic meter reading, building automation equipment, wireless security systems, industrial monitoring. Main features include small size, low power consumption, transmission distance, anti-interference ability and so on.

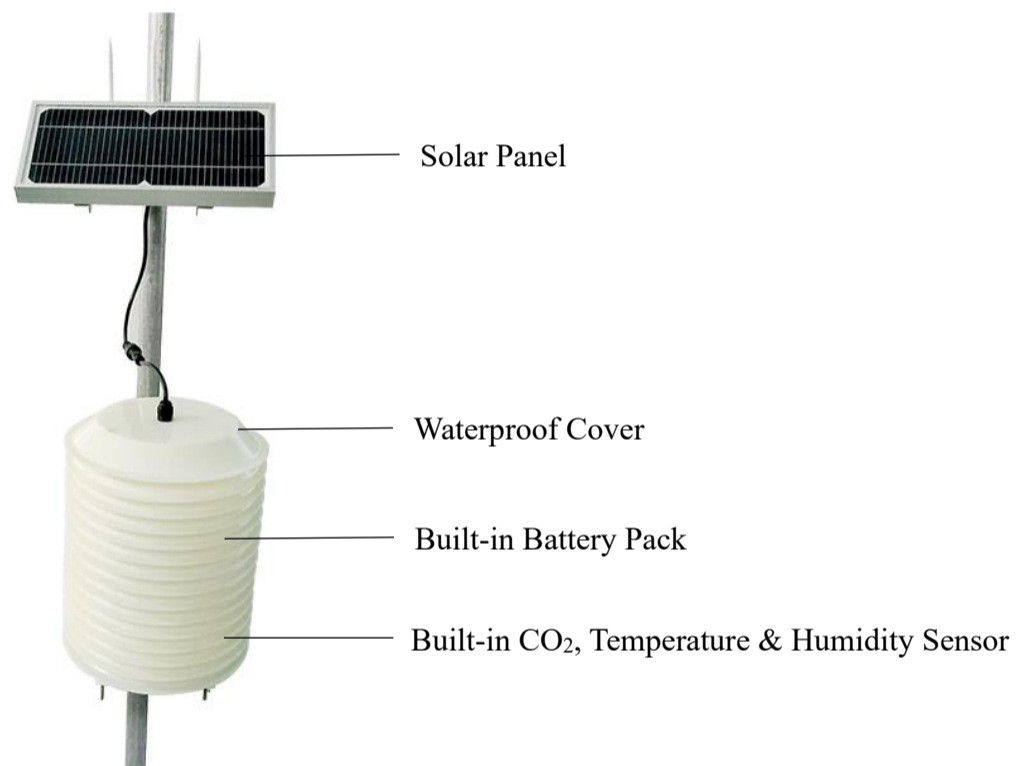
LoRaWAN:

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

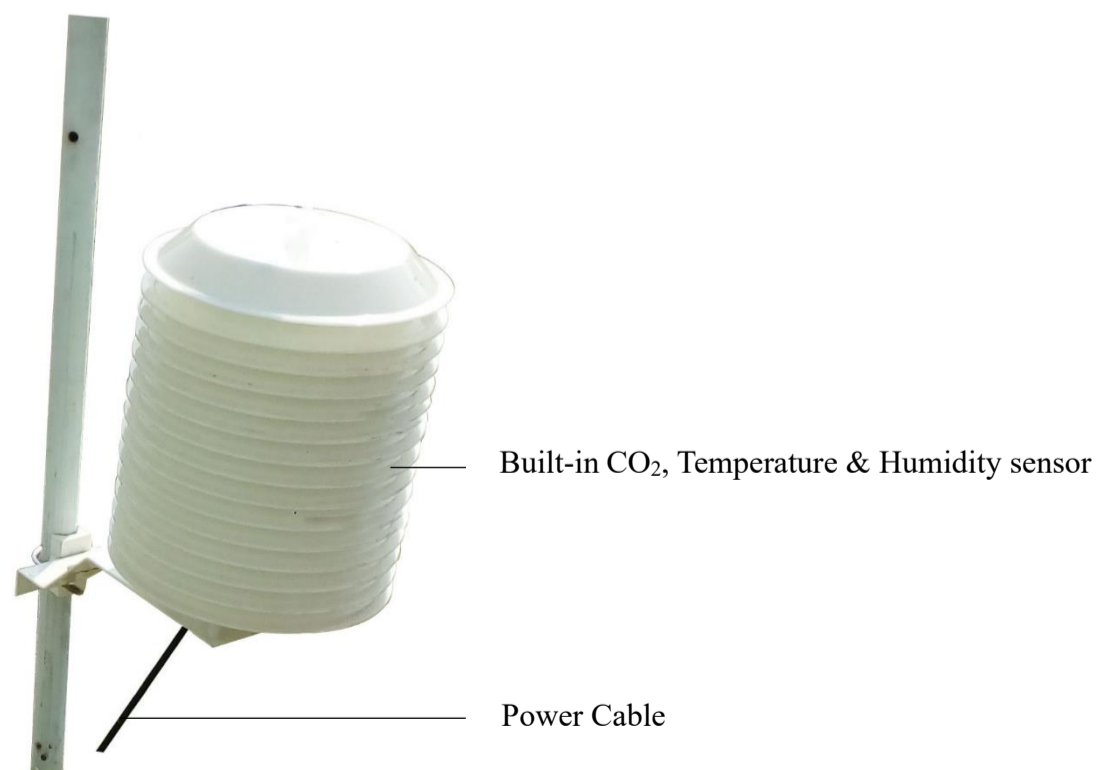
2. Appearance



▲ RA0715



▲ R72615



▲ RA0715Y

3. Features

- Compatible with LoRaWAN
- RA0715 and RA0715Y applies DC 12V adapters
- R72615 applies solar and rechargeable lithium batteries
- Simple operation and setting
- CO₂, temperature, and humidity detection
- SX1276 wireless communication module

4. Set up Instructions

On/Off

Power On	RA0715 and RA0715Y are connected to DC 12V adapter for power on. R72615 applies solar power 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, and the green indicator flashes 20 times.
Power Off	Disconnect from the power supply.
Note	<ol style="list-style-type: none">1. The engineering test requires to write the engineering testing software separately.2. 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 original 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 original 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.

Low Voltage Threshold

Low Voltage Threshold	10.5 V
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5. Data Report

After power on, the device will immediately send a version packet report and two data reports including CO₂, temperature, humidity and voltage.

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

ReportMaxTime:

RA0715 and RA0715Y is 900s,

R72615 is 1800s (subject to original setting)

* MaxTime **cannot** be set less than 15 min

* The value of the ReportMaxTime should be **greater than ReportType count *ReportMinTime+10**

ReportMinTime:

30s (US915, AU915, KR920, AS923, IN865)

120s (EU868)

*Data packets should be sent at MinTime intervals.

Report Type count: 2

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 RA0715_R72615_RA0715Y (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 packet: CO₂, temperature, and humidity.

(5) The CO₂ sensor operates stably. It takes about 180 seconds after power-on to send the data report.

(6) 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.

(7) It would take 180 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.

Tips

1. Battery Voltage:

(a) The voltage value is bit 0 ~ bit 6, bit 7=0 is normal voltage, and bit 7=1 is low voltage.

Battery=0xE9, binary=1110 1001, if bit 7= 1, it means low voltage.

The actual voltage is 0110 1001 = 0x69 = 105, 105*0.1v =10.5v.

(b) If the battery is equal to 0x00, it means that the device is powered by a DC power supply.

2. Version Packet:

When Report Type=0x00 is the version packet, such as 010D000D04202101060000, the firmware version is 2021.01.06.

3. Data Packet:

(a) When Report Type=0x01 is data packet; If the device data exceeds 11 bytes or there are shared data packets, the Report Type will have different values.

(b) When Report Type=0xFFFF, it means that RA0715/ R72615/RA0715Y does not support the connected device or sensor malfunction.

4. Signed Value:

5.1 Example of ReportDataCmd

FPort: 0x06

Bytes	1	1	1	Var(Fix=8 Bytes)
	Version	DeviceType	ReportType	NetvoxPayLoadData

Version— 1 byte –0x01—the Version of NetvoxLoRaWAN Application Command Version

DeviceType— 1 byte – Device Type of Device

The devicetype is listed in Netvox LoRaWAN Application Devicetype doc

ReportType – 1 byte –the presentation of the NetvoxPayLoadData, according to the devicetype

NetvoxPayLoadData— Fixed bytes (Fixed = 8 Bytes)

Device	Device Type	Report Type	NetvoxPayLoadData				
RA07	0x05	0x00	SoftwareVersion (1Byte) Eg.0x0A—V1.0	HardwareVersion (1 Byte)	DateCode (4 Bytes, eg 0x20170503)		Reserved (2 Bytes, fixed 0x00)
R726	0x09	0x07	Battery (1Byte, unit: 0.1V)	CO ₂ (2 Byte ,0.1ppm)	NH ₃ (2 Byte ,0.1ppm)	Noise (2 Byte ,0.1db)	Reserved (1 Byte, fixed 0x00)
RA07xxY	0x0D	0x0C	Battery (1Byte, unit: 0.1V)	Temperature (Signed 2 Bytes, unit: 0.01°C)	Humidity (2 Bytes, unit: 0.01%)	WindSpeed (2 Bytes, unit: 0.01m/s)	Reserved (1 Byte, fixed 0x00)

Example of RA0715Y Uplink:

Packet #1: 010D07001CF2FFFFFFFF00

1st byte (01): Version

2nd byte(0D): DeviceType 0x0D — RA0715Y

3rd byte (07): ReportType

4th byte (00): DC power supply

5th 6th byte (1CF2): CO₂ — 741ppm , 1CF4 Hex = 7410 Dec $7410 * 0.1 \text{ppm} = 741 \text{ ppm}$

7th 8th byte (FFFF): NH₃ — N/A

9th 10th byte(FFFF): Noise — N/A

11th byte (00): Reserved

Packet #2: 010D0C0009E9175AFFFF00

1st byte (01): Version

2nd byte (0D): DeviceType 0x0D — RA0715Y

3rd byte (0C): ReportType

4th byte (00): DC power supply

5th 6th byte (09E9): Temperature — 25.37°, 09E9 Hex = 2537 Dec $2537 * 0.01^\circ\text{C} = 25.37^\circ\text{C}$

7th 8th byte (175A): Humidity — 59.78%, 175A Hex = 5978 Dec $5978 * 0.01\% = 59.78\%$

9th 10th byte (FFFF): Wind Speed — N/A

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	RA0715 R72615 RA0715Y	0x01	0x05	MinTime (2 Bytes, Unit: s)	MaxTime (2 Bytes, Unit: s)	Reserved (5 Bytes, Fixed 0x00)
Config ReportRsp		0x81		Status (0x00_success)	Reserved (8 Bytes, Fixed 0x00)	
ReadConfig ReportReq		0x02	0x09	Reserved (9 Bytes, Fixed 0x00)		
ReadConfig ReportRsp		0x82	0x0D	MinTime (2 Bytes, Unit: s)	MaxTime (2 Bytes, Unit: s)	Reserved (5 Bytes, Fixed 0x00)

(1) Configure RA0715 device parameter MinTime = 30s, MaxTime = 3600s

Downlink: 010500780E100000000000

Response: 8105000000000000000000 (configuration success)

810501000000000000000000 (configuration failure)

(2) Read RA0715 device parameter

Downlink: 0205000000000000000000

Response: 820500780E100000000000 (device current parameter)

Note:

The value of MinTime should be $\geq 30s$ (US915, AU915, KR920, AS923, IN865)

The value of MinTime should be $\geq 120s$ (EU868)

The value of MaxTime should be $\geq 900s$

5.3 Example of GlobalCalibrateCmd

FPort: 0x0E

Description	Cmd ID	Sensor Type	PayLoad(Fix =9 Bytes)				
SetGlobalCalibrateReq	0x01	0x01_Temperature 0x02_Humidity 0x06_CO ₂	Channel (1 Byte) 0_Channel1 1_Channel2, etc.	Multiplier (2 Bytes, Unsigned)	Divisor (2 Bytes, Unsigned)	DeltValue (2 Bytes, Signed)	Reserved (2 Bytes, Fixed 0x00)
SetGlobalCalibrateRsp	0x81		Channel (1 Byte) 0_Channel1 1_Channel2, etc.	Status (1 Byte, 0x00_success)	Reserved (7 Bytes, Fixed 0x00)		
GetGlobalCalibrateReq	0x02		Channel (1 Byte) 0_Channel1 1_Channel2, etc.	Reserved (8 Bytes, Fixed 0x00)			
GetGlobalCalibrateRsp	0x82		Channel (1 Byte) 0_Channel1 1_Channel2, etc.	Multiplier (2 Bytes, Unsigned)	Divisor (2 Bytes, Unsigned)	DeltValue (2 Bytes, Signed)	Reserved (2 Bytes, Fixed 0x00)
ClearGlobalCalibrateReq	0x03	Reserved (10 Bytes, Fixed 0x00)					
ClearGlobalCalibrateRsp	0x83	Status (1 Byte, 0x00_success)	Reserved (9 Bytes, Fixed 0x00)				

0x01_Temperature Sensor, channel = 0x00; 0x02_Humidity Sensor, channel = 0x01; 0x06_CO₂ Sensor, channel = 0x02

(1) SetGlobalCalibrateReq

Temperature increased by 10°C (25.1°C → 35.1°C)

Multiplier = 0x0001, Divisor = 0x0001, and DeltValue = 0x03E8

Downlink: 0101000001000103E80000

Response: 8101000000000000000000

(2) GetGlobalCalibrateReq

Downlink: 0201000000000000000000

Response: 8201000001000103E80000

(3) SetGlobalCalibrateReq

Temperature decreased by 10°C (25.1°C → 15.1°C)

Multiplier = 0x0001, Divisor = 0x0001, and DeltValue = 0xFC18

Downlink: 01010000010001FC180000

Response: 81010000000000000000

(4) GetGlobalCalibrateReq

Downlink: 02010000000000000000

Response: 82010000010001FC180000

(5) ClearGlobalCalibrateReq

Downlink: 03000000000000000000

Response: 83000000000000000000

5.4 Set/GetSensorAlarmThresholdCmd

Fport: 0x10

CmdDescriptor	CmdID (1 byte)	Payload (10 bytes)			
SetSensorAlarm ThresholdReq	0x01	Channel (1 byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.)	SensorType (1 byte, 0x00_Disable ALL SensorthresholdSet, 0x01_Temperature, 0x02_Humidity, 0x03_CO ₂)	SensorHighThreshold (4 bytes, unit: 0.1°C; 0.01%; 0.1ppm)	SensorLowThreshold (4 bytes, unit: 0.1°C; 0.01%; 0.1ppm)
SetSensorAlarm ThresholdRsp	0x81	Status (0x00_success)	Reserved (9 bytes, Fixed 0x00)		
GetSensorAlarm ThresholdReq	0x02	Channel (1 byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.)	SensorType (1 byte, 0x00_Disable ALL SensorthresholdSet, 0x01_Temperature, 0x02_Humidity, 0x03_CO ₂)	Reserved (8 bytes, Fixed 0x00)	
GetSensorAlarm ThresholdRsp	0x82	Channel (1 byte, 0x00_Channel1, 0x01_Chanel2, 0x02_Channel3, etc.)	SensorType (1 byte, 0x00_Disable ALL SensorthresholdSet, 0x01_Temperature, 0x02_Humidity, 0x03_CO ₂)	SensorHighThreshold (4 bytes, unit: 0.1°C; 0.01%; 0.1ppm)	SensorLowThreshold (4 bytes, unit: 0.1°C; 0.01%; 0.1ppm)

0x01_Temperature Sensor, channel = 0x00; 0x02_Humidity Sensor, channel = 0x01; 0x03_CO₂ Sensor, channel = 0x02

Configure temperature HighThreshold = 30°C, LowThreshold = 10°C

(1) SetSensorAlarmThresholdReq

When the HighThreshold or LowThresholdAlarm is triggered, the device reports the data packet of reporttype = 0x12.

Downlink: 01000100000BB8000003E8

Response: 810000000000000000000000

(2) GetSensorAlarmThresholdReq

Downlink: 020001000000000000000000

Response: 82000100000BB8000003E8

(3) Clear all thresholds (Set SensorType = 0)

Downlink: 010000000000000000000000

Response: 810000000000000000000000

Note:

- a. The last configuration would be kept as the device is factory reset.
- b. Set SensorHigh/LowThreshold as 0xFFFFFFFF to disable threshold.

5.5 Example of NetvoxLoRaWANRejoin

Fport: 0x20

CmdDescriptor	CmdID (1 Byte)	Payload (5 Bytes)	
SetNetvoxLoRaWANRejoinReq	0x01	RejoinCheckPeriod (4 Bytes, unit: 1s 0xFFFFFFFF Disable NetvoxLoRaWANRejoinFunction)	RejoinThreshold (1 Byte)
SetNetvoxLoRaWANRejoinRsp	0x81	Status (1 Byte, 0x00_success)	Reserved (4 Bytes, Fixed 0x00)
GetNetvoxLoRaWANRejoinReq	0x02	Reserved (5 bytes, Fixed 0x00)	
GetNetvoxLoRaWANRejoinRsp	0x82	RejoinCheckPeriod (4 Bytes, unit: 1s)	RejoinThreshold (1 Byte)

(1) Configure parameters

RejoinCheckPeriod = 60min (0x00000E10); RejoinThreshold = 3 times (0x03)

Downlink: 0100000E1003

Response: 810000000000 (configuration succeed)

810100000000 (configuration fail)

(2) Read configuration

Downlink: 020000000000

Response: 8200000E1003

Note: a. Set RejoinCheckThreshold as 0xFFFFFFFF to stop the device from rejoining the network.

b. The last configuration would be kept as user reset the device back to the factory setting.

c. Default setting: RejoinCheckPeriod = 2 (hr) and RejoinThreshold = 3 (times)

6. Installation

(1) RA0715 does not have waterproof function. After the device completes joining the network, please place it indoors.

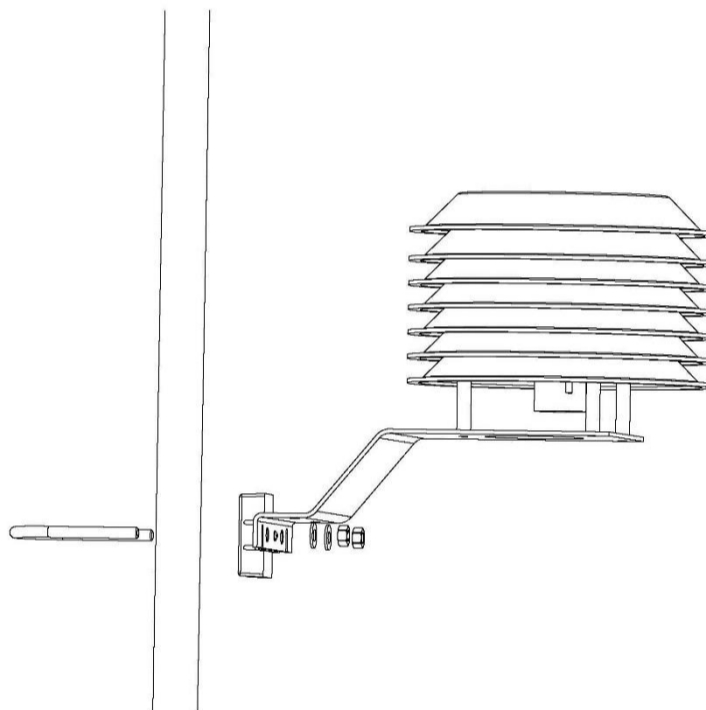
(2) R72615 has a waterproof function. After the device completes joining the network, please place it outdoors.

A. In the installed position, loosen the U-shaped screw, the mating washer and the nut at the bottom of R72617, and then make the U-shaped screw pass through the appropriate size cylinder and fix it on the fixing strut flap of R72615. Install the washer and the nut in order and lock the nut till R72615 body is stable and does not shake.

B. At the upper side of the fixed position of R72615, 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 racket 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.

C. After adjusting the angle of the solar panel completely, lock the nut.

D. Connect the top waterproof cable of R72617 with the wiring of the solar panel and lock it tight.



E. Rechargeable lithium battery

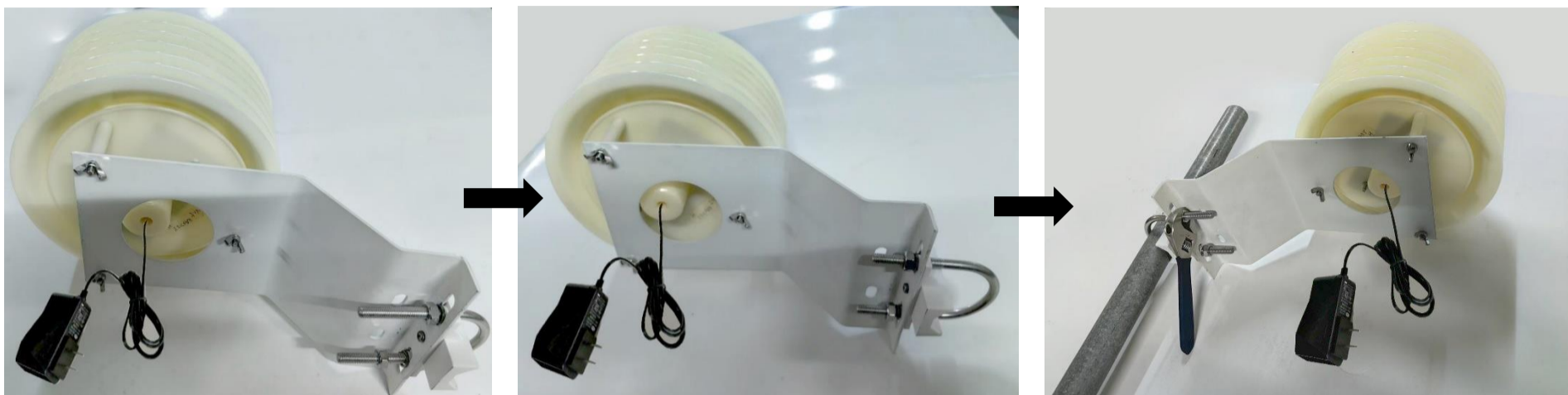
R72615 has a battery pack inside. Users can buy and install rechargeable 18650 lithium battery, a total of 3 sections, voltage 3.7V/ every single rechargeable lithium battery, recommended capacity 5000mah. The installation of rechargeable lithium battery steps are as follows:

- Remove the four screws around battery cover.
- Insert three 18650 lithium batteries. (Please make sure the positive and negative level of the battery)
- Press the activation button on the battery pack for the first time.
- After activation, close the battery cover and lock the screws around battery cover.



(3) RA0715Y is waterproof and can be placed outdoors after the device completes joining the network.

A. In the installed position, loosen the U-shaped screw, the mating washer and the nut at the bottom of RA0715Y, and then make the U-shaped screw pass through the appropriate size cylinder and fix it on the fixing strut flap of RA0715Y. Install the washer and the nut in order and lock the nut till RA0715Y body is stable and does not shake.



B. Loosen the M5 nut at the bottom of the RA0715Y matte and take the matte together with the screw.

C. Make the DC adaptor pass through the central hole of the bottom cover of RA0715Y and insert it into the RA0715Y DC socket and then put the mating screw to the original position and lock the M5 nut tight.

D. Fix the pole on the ground and connect DC power source.



7. Important Maintenance Instructions

Kindly pay attention to the following 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 a dusty or dirty environment. It might damage its detachable parts and electronic components.
- Do not store the device under extremely hot conditions. High temperatures 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, moisture that forms inside the device will damage 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 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 operating properly, please take it to the nearest authorized service facility for repair.