

Wireless CO Sensor

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RA0701_R72601_RA0701Y

User Manual

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1. Introduction

RA0701_R72601_RA0701Y is a ClassA type device based on the LoRaWAN protocol.

The RA0701_R72601_RA0701Y data can be sent to the corresponding gateway via externally connecting the CO detector.

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.

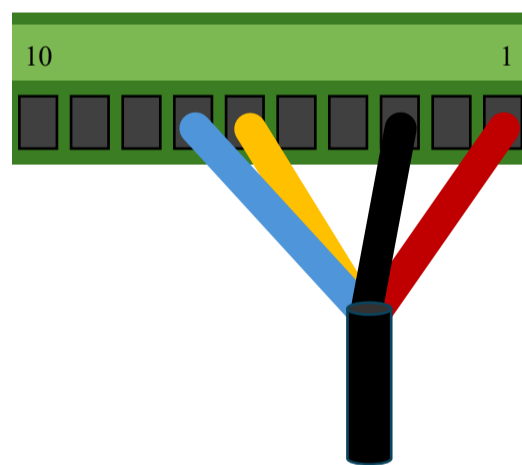
LoRaWAN:

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

2. Appearance

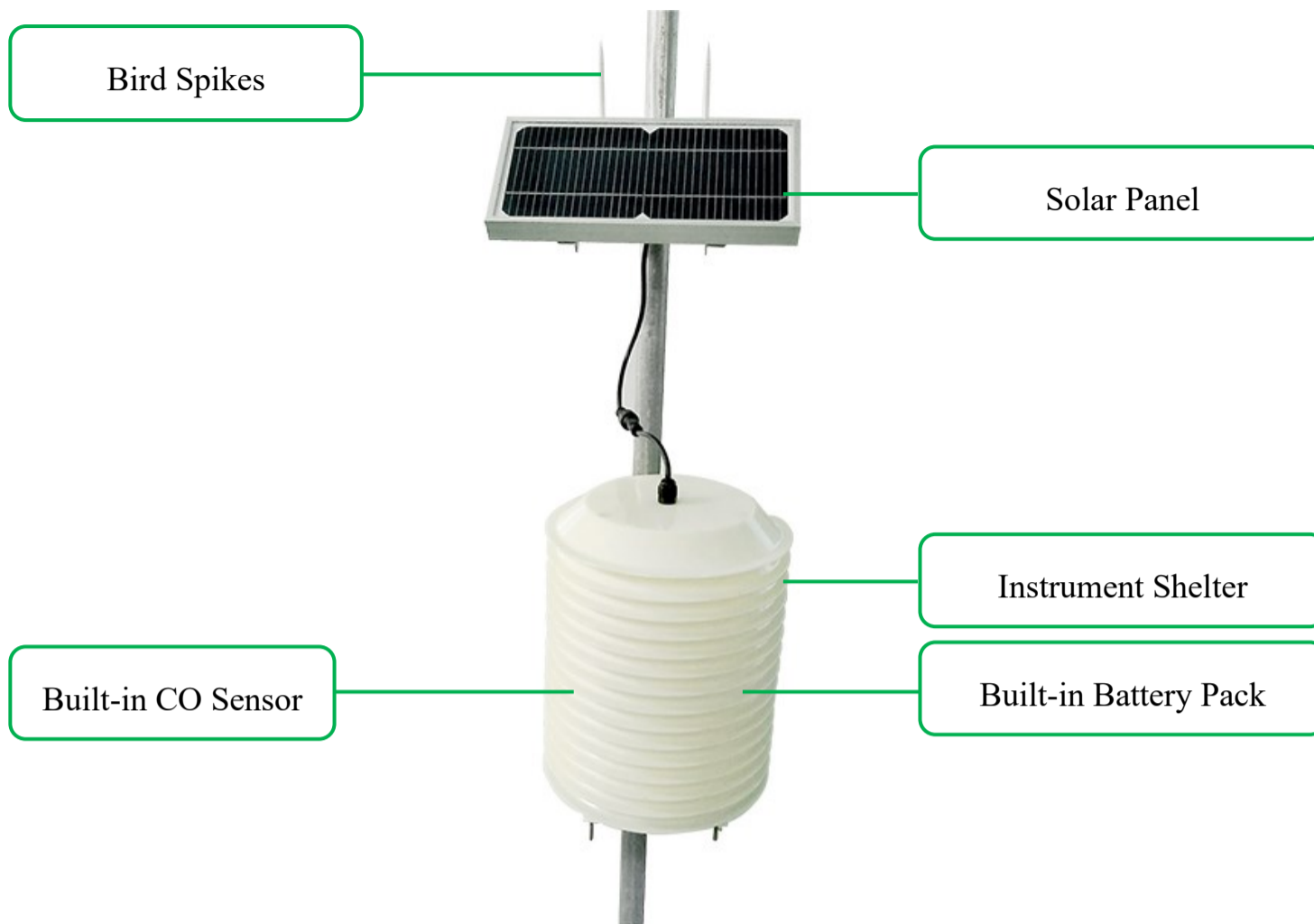


RA0701

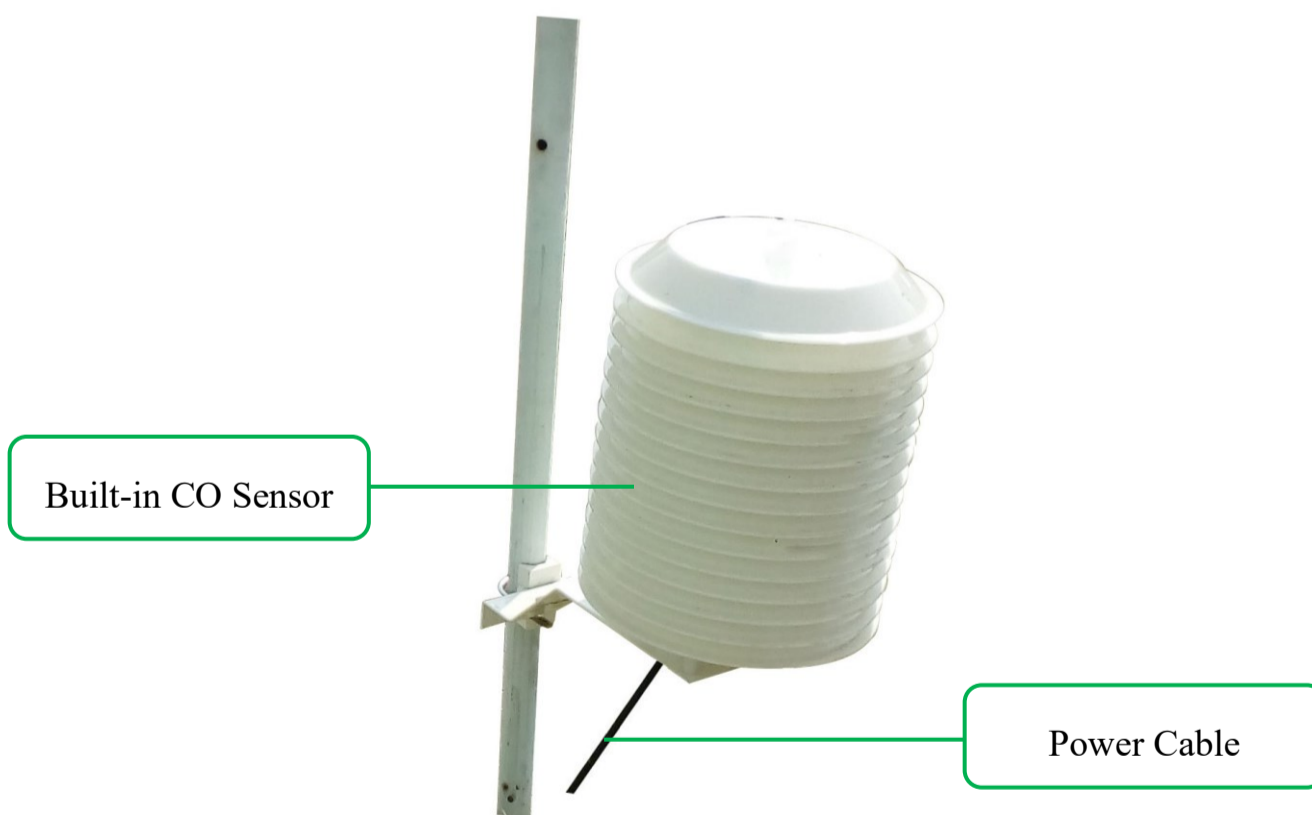


PIN	Color	Description
PIN 1	Red	VCC
PIN 3	Black	GND
PIN 6	Yellow	RS485-A
PIN 7	Blue	RS485-B

CO Sensor Wiring



R72601



RA0701Y

3. Main Features

- Compatible with LoRaWAN
- RA0701 and RA0701Y applies DC 12V adapters
- R72601 applies solar and rechargeable lithium batteries
- CO detection
- Adopt SX1276 wireless communication module
- Frequency Hopping Spread Spectrum (FHSS)
- Available third-party platform: Actility/ThingPark, TTN, MyDevices/Cayenne

4. Set up Instruction

On/Off

Power On	RA0701 and RA0701Y are connected to DC 12V adapter for power on. R72601 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 (It would take 35 seconds for the sensor to sample and process the collected value after pressing the button) The device is not in the network: the green indicator remains off

Low Voltage Threshold (R72601)

Low Voltage Threshold	10.5 V
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5. Data Report

After powering on, the device will immediately send a version packet and then send a data packet after 45 seconds.

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

Default

MaxTime:

RA0701 and RA0701Y: 0x00B4 (180s)

R72601: 0x0708 (1800s)

MinTime: 30s

ReportType count: 1

ReportChange: 0

* ReportChange is not supported by RA0701_R72601_RA0701Y (Invalid configuration).

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

Note:

- (1) 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.
- (2) It would **take 35 seconds** for the sensor to sample and process the collected value after pressing the button, please be patient.
- (3) Data pocket: CO concentration (unit: 0.1ppm)

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	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 the devicetype

NetvoxPayLoadData– Fixed bytes (Fixed =8bytes)

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 0105000D04202101060000, the firmware version is 2021.01.06

3. Data Packet:

(a) When Report Type=0x05 is data packet.

(b) RA0701/R72601/RA0701Y only detect CO, it does not detect NO and O3, therefore the returned value of NO and O3 would be “FFFF”.

Device	Device Type	Report Type	NetvoxPayLoadData				
RA07 Series	0x05	0x00	SoftwareVersion	HardwareVersion	DateCode	Reserved	
R726 Series	0x09		(1Byte) Eg.0x0A—V1.0	(1Byte)	(4Bytes, eg0x20170503)	(2Bytes, fixed 0x00)	
RA07xxY Series	0x0D	0x05	Battery	O3	CO	NO	Reserved
			(1Byte, unit:0.1V)	(2Bytes,0.1ppm)	(2Bytes,0.1ppm)	(2Bytes ,0.1ppm)	(1Byte, fixed 0x00)

(1) Example of RA0701 Uplink: 01050500FFFF0064FFFF00

1st byte (01): Version

2nd byte (05): DeviceType 0x05 — RA07 Series

3rd byte (05): ReportType

4th byte (00): DC power supply

5th6th byte (FFFF): O3 — N/A

7th 8th byte (0064): CO — 10ppm , 64 H_{ex}=100 D_{ec} 100*0.01=10 ppm

9th10th byte (FFFF): NO — N/A

11th byte (00): Reserved

(2) Example of R72601 Uplink:01090578FFFF0064FFFF00

1st byte (01): Version

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

3rd byte (05): ReportType

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

5th 6th byte (FFFF): O3 — N/A

7th 8th byte(0064): CO — 10ppm , 64 H_{ex}=100 D_{ec} 100*0.01=10 ppm

9th 10th byte (FFFF): NO — N/A

11th byte (00): Reserved

(3) Example of RA0701Y Uplink: 010D0500FFFF0064FFFF00

1st byte (01): Version

2nd byte (0D): DeviceType 0x0D — RA07xxY Series

3rd byte (05): ReportType

4th byte (00): DC power supply

5th 6th byte (FFFF): O3 — N/A

7th 8th byte (0064): CO — 10ppm , 64 H_{ex}=100 D_{ec} 100*0.01=10 ppm

9th 10th byte (FFFF): NO — 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	Device Type	NetvoxPayLoadData		
Config ReportReq	RA07 Series R726 Series RA07xxY Series	0x01	0x05	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	0x09	Reserved (9Bytes, Fixed 0x00)		
ReadConfig ReportRsp		0x82	0x0D	MinTime (2bytes Unit: s)	MaxTime (2bytes Unit: s)	Reserved (5Bytes, Fixed 0x00)

(1)Configure RA0701 device parameter MinTime = 30s, MaxTime = 3600s (3600>30*1+10)

Downlink: 0105001E0E100000000000

Device Return:

81050000000000000000000 (configuration success)

81050100000000000000000 (configuration failure)

(2)Read RA0701 device parameter

Downlink: 0205000000000000000000

Device Return:

8205001E03840000000000 (device current parameter)

5.3 Example of GlobalCalibrateCmd

Port:0x0E

Remain the last configuration when the device is reset back to factory setting.

Description	Cmd ID	Sensor Type	PayLoad(Fix =9 Bytes)				
SetGlobal CalibrateReq	0x01	CO Sensor 0x05	Channel(1Byte) 0_Channel1, 1_Channel2,etc	Multiplier (2bytes,Unsigned)	Divisor (2bytes,Unsigned)	DeltValue (2bytes,Signed)	Reserved (2Bytes,Fixed 0x00)
SetGlobal CalibrateRsp	0x81		Channel (1Byte) 0_Channel 1, 1_Channel 2,etc	Status (1Byte,0x00_success)		Reserved (7Bytes,Fixed 0x00)	
GetGlobal CalibrateReq	0x02		Channel (1Byte,0_Channel1,1_Channel2,etc)	Reserved (8Bytes,Fixed 0x00)			
GetGlobal CalibrateRsp	0x82		Channel (1Byte) 0_Channel 1, 1_Channel 2,etc	Multiplier (2bytes,Unsigned)	Divisor (2bytes,Unsigned)	DeltValue (2bytes,Signed)	Reserved (2Bytes,Fixed 0x00)
ClearGlobal CalibrateReq	0x03	Reserved (10Bytes,Fixed 0x00)					
ClearGlobal CalibrateRsp	0x83	Status (1Byte,0x00_success)			Reserved (9Bytes,Fixed 0x00)		
1. GlobalCalibrateCmd supports calibration of positive and negative numbers. Negative values use the 2's complement. 2. The sensor channel is fixed at channel 0x00.							

(1) Set the CO sensor calibration to increase by 10 ppm.

SensorType =0x05, Channel 1= 00, Multiplier = 0001, Divisor = 0001, DeltValue=0064

Downlink: 0105000001000100640000 // The CO concentration unit is 0.1 ppm. 100*0.1ppm=10ppm

Response: 810500000000000000000000 (Configuration success)

(2) Set the CO sensor calibration to decrease by 10 ppm.

SensorType =0x05, Channel 1= 00, Multiplier = 0001, Divisor = 0001, DeltValue=FF9C

Downlink: 01050000010001FF9C0000

Response: 810500000000000000000000 (Configuration success)

(3) Get the CO sensor calibration.

Downlink:020500000000000000000000

Response: 8205000001000100640000 (Current configuration)

(4) Clear the CO sensor calibration.

Downlink: 030000000000000000000000

Response: 830000000000000000000000 (Current configuration)

5.4 AlarmThresholdCmd

FPort: 0x10 (port = 16, Dec)

CmdDescriptor	CmdID (1Byte)	Payload(10Bytes)			
SetSensorAlarm ThresholdReq	0x01	Channel (1Byte) 0x00_Channel 1	SensorType(1Byte) 0x00_Disable ALL SensorthresholdSet 0x0B_CO	SensorHighThreshold (4Bytes,Unit:0.1ppm)	SensorLowThreshold (4Bytes,Unit:0.1ppm)
SetSensorAlarm ThresholdRsp	0x81	Status (0x00_success)		Reserved (9Bytes,Fixed 0x00)	
GetSensorAlarm ThresholdReq	0x02	Channel(1Byte) 0x00_Channel1	SensorType(1Byte) 0x00_Disable ALL SensorthresholdSet 0x0B_CO	Reserved (8Bytes,Fixed 0x00)	
GetSensorAlarm ThresholdRsp	0x82	Channel (1Byte) 0x00_Channel 1	SensorType(1Byte) 0x00_Disable ALL SensorthresholdSet 0x0B_CO	SensorHighThreshold (4Bytes,Unit:0.1ppm)	SensorLowThreshold (4Bytes,Unit:0.1ppm)

Note:

- (1) CO sensor type = 0x0B, Channel = 0x00.
- (2) Set SensorHighThreshold or SensorLowThreshold as 0xFFFFFFFF to disable the threshold.
- (3) The last configuration will be kept after the device is factory reset.

(1) Configure Hight CO Alarm = 100ppm, Low CO Alarm =10ppm

Downlink: 01000B000003E800000064 // 3E8(Hex)=1000(DEC), 1000*0.1ppm=100ppm

// 64(Hex)=100(DEC), 100*0.1ppm=10ppm;

Response: 81000000000000000000 (Configuration success)

(1) GetSensorAlarmThresholdReq

Downlink: 02000B000000000000000000

Response: 82000B000003E800000064 (Configuration success)

(2) Clear all SensorThreshold (Sensor type=0x00)

Downlink: 010000000000000000000000

Response: 810000000000000000000000

5.5 LoRaWANRejoin

Check if the device is still in the network. If the device is disconnected, it will automatically rejoin back to the network.

FPort: 0x20 (port = 32, Dec)

CmdDescriptor	CmdID (1Byte)	Payload(5Bytes)						
SetNetvoxLoRaWAN RejoinReq	0x01	RejoinCheckPeriod (4Bytes,Unit:1s)				RejoinThreshold (1Byte)		
SetNetvoxLoRaWAN RejoinRsp	0x81	Status (1Byte,0x00_success)				Reserved (4Bytes,Fixed 0x00)		
GetNetvoxLoRaWAN RejoinReq	0x02	Reserved (5Bytes,Fixed 0x00)						
GetNetvoxLoRaWAN RejoinRsp	0x82	RejoinCheckPeriod (4Bytes,Unit:1s)				RejoinThreshold (1Byte)		
SetNetvoxLoRaWAN RejoinTimeReq	0x03	1st Rejoin Time (2Bytes Unit:1Min)	2nd Rejoin Time (2Bytes Unit:1Min)	3rdRejoin Time (2Bytes Unit:1Min)	4th Rejoin Time (2Bytes Unit:1Min)	5th Rejoin Time (2Bytes Unit:1Min)	6th Rejoin Time (2Bytes Unit:1Min)	7th Rejoin Time (2Bytes Unit:1Min)
SetNetvoxLoRaWAN RejoinTimeRsp	0x83	Status (1Byte,0x00_success)				Reserved (13Bytes,Fixed 0x00)		
GetNetvoxLoRaWAN RejoinTimeReq	0x04	Reserved (15Bytes,Fixed 0x00)						
GetNetvoxLoRaWAN RejoinTimeRsp	0x84	1st Rejoin Time (2Bytes Unit:1Min)	2nd Rejoin Time (2Bytes Unit:1Min)	3rdRejoin Time (2Bytes Unit:1Min)	4th Rejoin Time (2Bytes Unit:1Min)	5th Rejoin Time (2Bytes Unit:1Min)	6th Rejoin Time (2Bytes Unit:1Min)	7th Rejoin Time (2Bytes Unit:1Min)

Note:

(1) Set RejoinCheckThreshold as 0xFFFFFFFF to stop the device from rejoining the network.

(2) The last configuration would be kept as user reset the device back to the factory setting

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

1st Rejoin Time = 0x0001 (1 min), 2nd Rejoin Time = 0x0002 (2 mins), 3rd Rejoin Time = 0x0003 (3 mins),

4th Rejoin Time = 0x0004 (4 mins), 5th Rejoin Time = 0x003C (60 mins), 6th Rejoin Time = 0x0168 (360 mins),

7th Rejoin Time = 0x05A0 (1440 mins)

(1) Command Configuration

Set RejoinCheckPeriod = 3600s (0x00000E10), RejoinThreshold = 3 times

Downlink: 0100000E1003

Response: 810000000000 (Configuration success)

810100000000 (Configuration failure)

(2) Read Current Configuration (RejoinCheckPeriod and RejoinThreshold)

Downlink: 020000000000

Response: 8200000E1003

(3) Configure Rejoin Time

1st Rejoin Time = 0x0001 (1 min), 2nd Rejoin Time = 0x0002 (2 mins), 3rd Rejoin Time = 0x0003 (3 mins),
4th Rejoin Time = 0x0004 (4 mins), 5th Rejoin Time = 0x0005 (5 mins), 6th Rejoin Time = 0x0006 (6 mins),
7th Rejoin Time = 0x0007 (7 mins)

Downlink: 030001000200030004000500060007

Response: 83000000000000000000000000000000 (Configuration success)

83010000000000000000000000000000 (Configuration failure)

(4) Read Rejoin Time parameter

Downlink: 04000000000000000000000000000000

Response: 840001000200030004000500060007

6. Installation

1. **The RA0701** product does not have a waterproof function.

After the network adding configuration is completed, please place it properly.

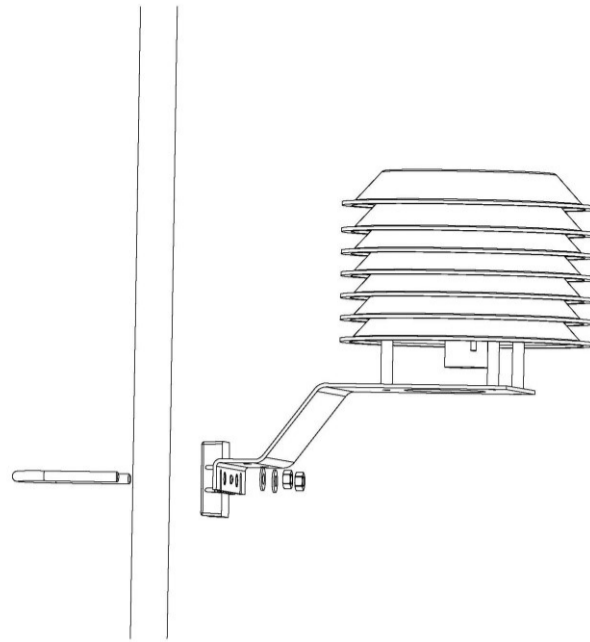
The sensor should be placed in a sheltered environment from the wind and rain, and the wall should be perpendicular to the ground at 90 degrees. Keep the sensor air vent hole directly below to prevent water to enter.

At the same time, in order to ensure the accuracy of the measurement, please install the carbon monoxide transmitter in a well ventilated position.



2. **The R72601** product is waterproof. After the network-joining is completed, please leave it outdoors.

- (1) In the position to be installed, loosen the U-shaped screw of the bottom of the R72601 and the mating washer nut, and fix the U-shaped screw through the appropriate size cylinder on the R72601 fixed strut piece. Install the washer nut in order, lock the nut till R72601 body is stable and does not shake.
- (2) At the upper side of the fixed position of R72601, loosen the two U-shaped screws on the side of the solar panel and the mating washer nut. Fix the U-shaped screw through the appropriate size cylinder on the main bracket of the solar panel, and install the gasket in sequence. Lock nut till the solar panel is stable and does not shake.
- (3) Adjust the angle of the solar panel. After the adjustment is completed, lock the nut.
- (4) Connect the R72601 top waterproof cable to the solar panel wiring and lock it tight.



(5) R72601 has a battery pack inside, users can buy and install rechargeable 18650 lithium battery, a total of 3 sections, a single rechargeable lithium battery voltage 3.7V, capacity recommended 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.

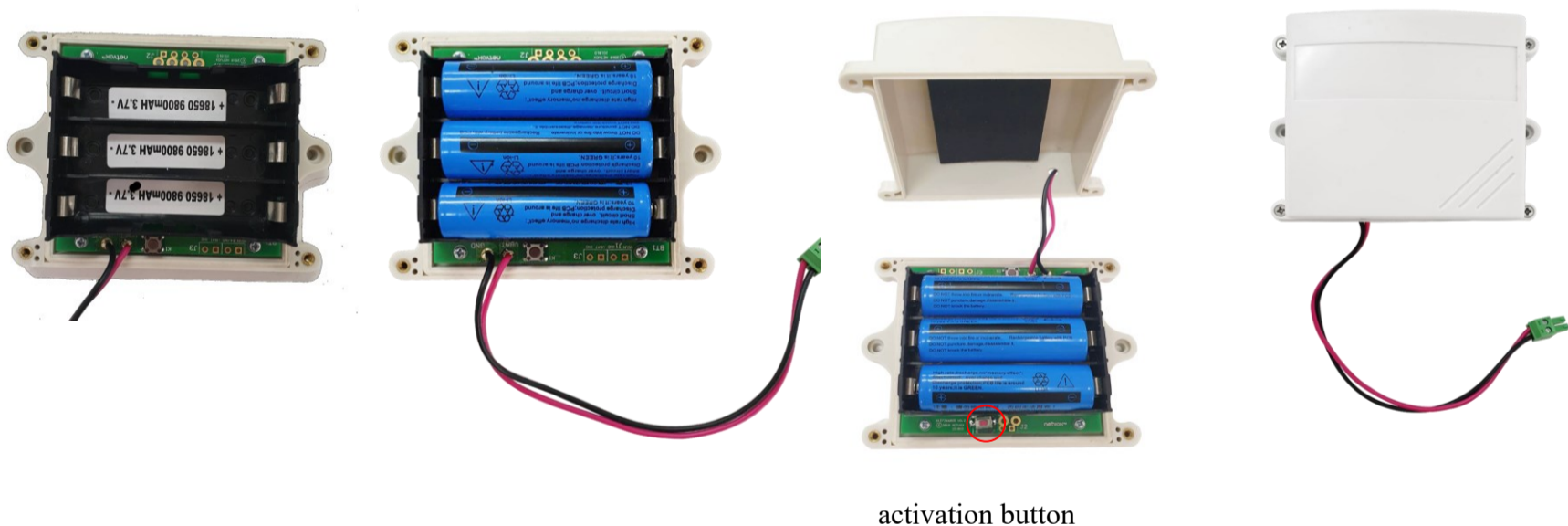


Fig. Rechargeable Lithium Battery

3. The RA0701Y product is waterproof and can be placed outdoors after the network-joining is completed.

- (1) In the position to be installed, loosen the bottom U-shaped screw of the RA0701Y and the mating washer nut, and fix the U-shaped screw through the appropriate size cylinder on the RA0701Y fixed strut piece. Install the washer nut in order, lock the nut till RA0701Y body is stable and does not shake.
- (2) Loosen the M5 nut at the bottom of the RA0710Y matte and take the matte together with the screw.
- (3) Insert the power DC plug from the center through hole of the RA0701Y bottom cover, insert it into the RA0701Y DC socket, and then return the mating screw to the original position and lock the M5 nut tight.

Note:

For accurate measurement results, please install the CO sensor in a well-ventilated environment.

The lifespan of an electrochemical sensor is 1 to 2 years. Users may need to change the probe if measurement errors have occurred and cannot be calibrated due to the aging of the sensor.

7. 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.