

# Indoor Temperature and Humidity Solution

## USER MANUAL

## Table of Contents

1 Overview .....	3
1.1 Description .....	3
1.2 Features.....	3
2 Specifications .....	4
2.1 Device List .....	4
2.2 Hardware Specifications .....	4
2.2.1 Mechanical Dimension .....	4
2.2.2 Measurement Parameters.....	5
2.2.3 Technical Specifications.....	5
3 Installation .....	5
3.1 Wall Mounting .....	6
3.2 Other Operations .....	6
3.2.1 Power Options .....	6
3.2.2 Charging.....	7
3.2.3 Check the Network Signal .....	7
3.2.4 Factory Reset .....	8
4 Device Configuration .....	8
4.1 Connect the Device.....	8
4.2 Basic Settings .....	10
4.3 LoRa Network Configuration .....	11
4.4 Data Description .....	12
4.4.1 Protocol Communication.....	12
4.4.2 Protocol Command Format.....	13

# 1 Overview

## 1.1 Description

In the fast-paced digital age, remote temperature monitoring is quickly becoming the norm in various fields, from homes and schools to heavy industries.

The RAK indoor temperature and humidity monitoring solution employs LoRaWAN<sup>®</sup> sensors to provide highly precise temperature and humidity monitoring data. It is specially designed to precisely monitor temperature and humidity in various environments, including extreme conditions. This solution is particularly suitable for greenhouse applications.

## 1.2 Features

- **Precision:** Provides high-precision temperature and humidity readings.
- **Wireless connectivity:** Enables seamless wireless data transmission.
- **Remote monitoring:** Supports remote monitoring, which improves convenience.
- **Configurable reporting:** Allows flexible reporting and notification strategies and can be configured remotely.
- **Supported frequency bands:** EU433, EU868, RU864, CN470, KR920, IN865, AU915, US915, AS923-1/2/3/4 frequencies, with EU868 as the default setting.
- **Network join mode:** OTAA/ABP
- **Device work mode:** Class A

## 2 Specifications

### 2.1 Device List



Figure 1: Device list

Device List	Description
1x Sensor	Temperature and RH Sensor
1x Power Cable	USC Cable

### 2.2 Hardware Specifications

The following sections cover the parameters and measurements of the sensor. It also includes the sensor overview and dimensions.

#### 2.2.1 Mechanical Dimension

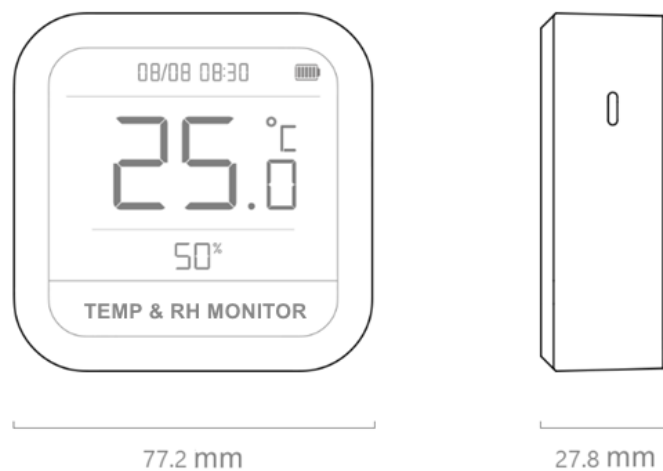


Figure 2: Qingping dimensions

## 2.2.2 Measurement Parameters

The following tables show the temperature and humidity measurements of the device.

### Temperature

Parameter	Description
Range	-20°C ~ 50°C
Precision	±0.2°C (in the range of 0°C ~ 50°C)
Resolution Ratio	0.1°C

### Humidity

Parameter	Description
Range	0 ~ 99.9% RH (no condensation)
Precision	±2% (in the range of 10 ~ 90%)
Resolution Ratio	0.1%

#### NOTE

Long-term use in environments with humidity exceeding 90% is not recommended.

## 2.2.3 Technical Specifications

Parameter	Description
Wireless Network	LoRa
Bluetooth	Bluetooth 5.0
Battery Type	Lithium-ion
Battery Capacity	2600 mAh
Charging Port	USB-C
Rated Input	5V = 1A

## 3 Installation

The temperature and humidity sensors are complete node devices, so users do not need to assemble them after unpacking. Refer to the following sections for mounting the sensor in the appropriate location and performing relevant sensor operations:

### 3.1 Wall Mounting

Included in the product package is a wall sticker with double-sided adhesive tape on the back. To install the sensor, peel off the protective film of the tape and stick the wall sticker to the desired location on the wall or any other object surface. Then, you can easily hang the sensor on the wall sticker.



Figure 3: Wall Mount Installation

### 3.2 Other Operations

Other operations introduce relevant operations on how to use the sensor. Users may refer to the corresponding sections according to their needs.

#### 3.2.1 Power Options

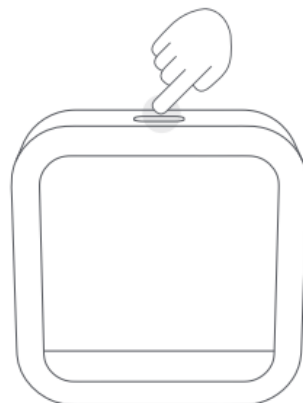


Figure 4: Sensor Power Options

### A. Power ON

Long-press the button on the top of the device, as shown in Figure 4. If it doesn't turn on, charge the device first, then try again.

### B. Power OFF

Press and hold the button on the top of the device for 6 seconds.

 **NOTE**

Press and hold the top button for 2 seconds, then release. The sensor will enter Bluetooth pairing mode to connect to the mobile app.

## 3.2.2 Charging

Use a USB-C charging cable and a power adapter with a 5V output voltage and a current output of at least 1A. While charging, the battery icon in the upper right corner of the screen will flash to indicate the charging progress. When fully charged, the battery icon will stop flashing.

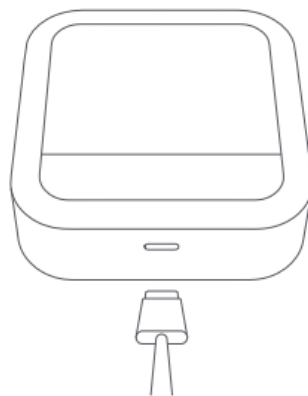


Figure 5: USB-C Charging Cable

## 3.2.3 Check the Network Signal

To check the signal status of the LoRa network, short-press the button on the top of the device.

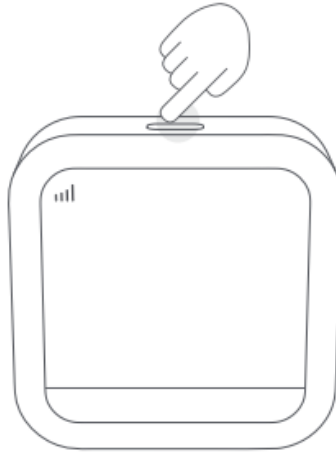


Figure 6: Check the LoRa Network Signal

To extend the battery life, the sensor will not remain continuously connected to the network. Instead, it will connect to the network at set intervals. If you are not connected to the internet, the network signal status will not be displayed on the screen.

You can adjust the timing of the sensor connecting to the network by using the Qingping IoT App. For more information, refer to the **Connect the Device** section in the user manual.

### 3.2.4 Factory Reset

1. Turn off the sensor to restore factory settings. Press and hold the button on the top of the device for 6 seconds to turn it off.
2. Press and hold the top button while the device is off. Continue holding it even after the device turns on until it turns off again to complete a factory reset.

## 4 Device Configuration

### 4.1 Connect the Device

The mobile application allows you to configure the temperature and humidity sensors. Before proceeding, download the Qingping IoT application, available on Android and iOS.



- After downloading, sign up for and log in to the mobile application.
- Open the app and click **More** in the lower-right corner of your screen.
- Select **Advanced Options**, then **Configure LoRa Product**.
- Choose **Temp & RH Barometer Pro**. Press and hold the device's button for 2 seconds, or until the Bluetooth icon begins to flash.

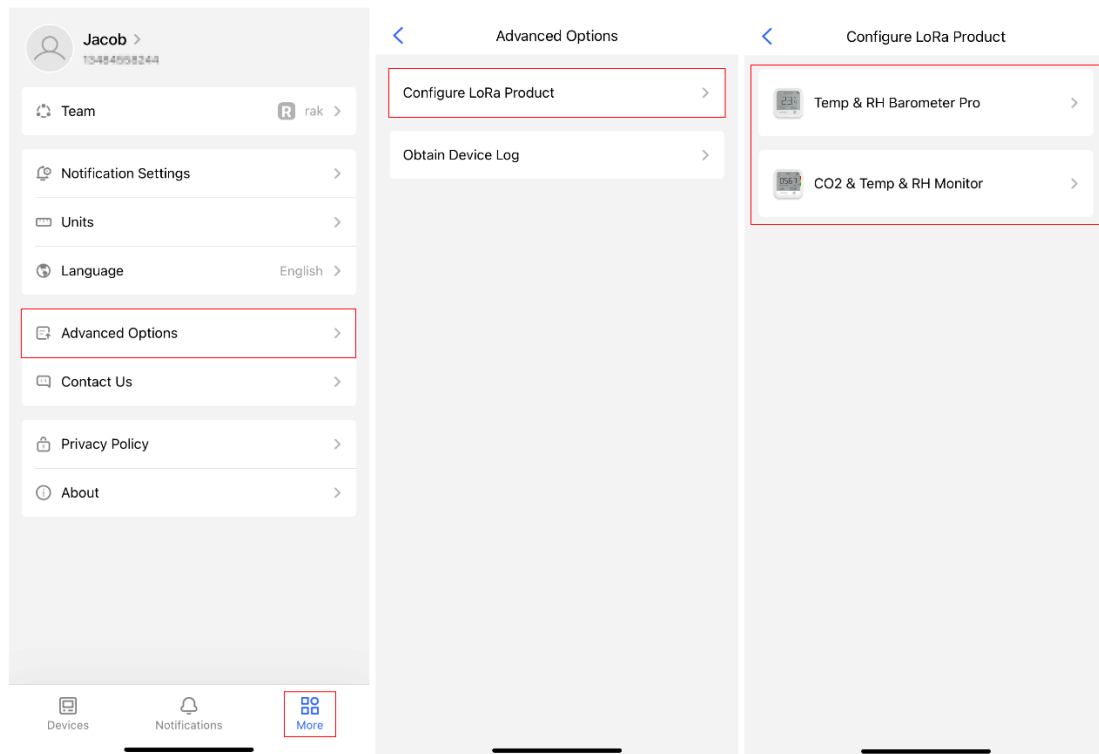


Figure 7: Device Configuration

- Place the mobile device near the sensor.
- Enter the device settings page once the Bluetooth connection is successful.

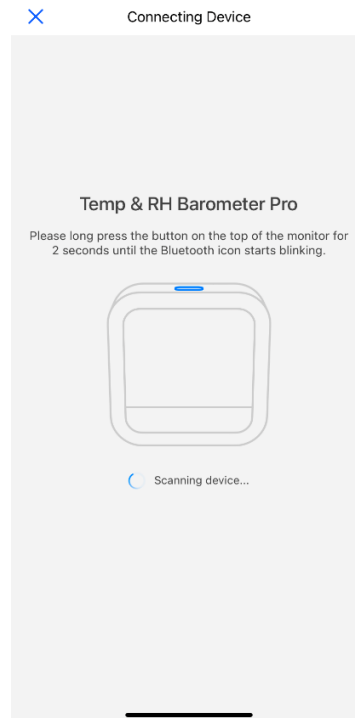


Figure 8: Connect to Temp & RH Barometer Pro

- Place the mobile device near the sensor.
- Enter the device settings page once the Bluetooth connection is successful.

## 4.2 Basic Settings

Basic settings include the recording and uploading interval, temperature unit, and temperature and humidity compensation. You can configure the settings according to your preference. Other device information is available, but not configurable.

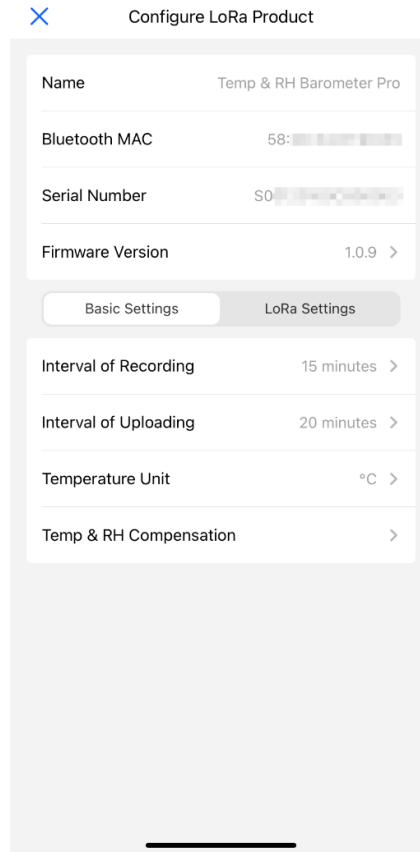


Figure 9: Basic Settings Configuration

## 4.3 LoRa Network Configuration

In the LoRa Network Configuration menu, you can choose the network join mode you prefer—either OTAA or ABP. Additionally, you can adjust other settings, such as the ternary group and frequency band, to suit your needs.

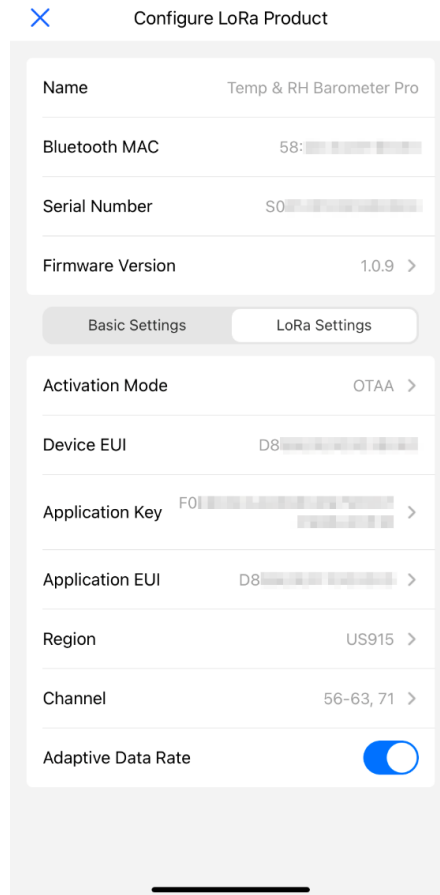


Figure 10: Settings Configuration

After you have completed configuring the settings, click on the **Finish** button located at the upper right corner of the screen. It will prompt the device to automatically join the network.

## 4.4 Data Description

### 4.4.1 Protocol Communication

The protocol used follows a data format like Modbus-RTU. It enables devices to actively report or request data.

All communication must be converted to base64 format before transmission.

 **NOTE**

The sample protocol provided only uses the original HEX format data. However, it is important to always remember to convert the content to base64 format before communication by default.

## 4.4.2 Protocol Command Format

All contents are arranged with high bytes first, followed by low bytes. Listed in the table is the protocol format.

Protocol Format	ADDR	CMD	LEN	DATA	CRC
Number of Bytes	1	1	1	N	2

Where:

- **ADDR** – Address
- **CMD** – Function code
- **LEN** – Data length
- **DATA** – Data content
- **CRC** – Cyclic redundancy check

### 4.4.2.1 Command Details

The tables display command definitions and sensor data reports, including both real-time and historical data formats.

 **NOTE**

The address code is fixed at 0x01.

## A. CMD Definitions

CMD	Description
0xFF	Reply to command
0x41	Device reports data
0x42	Device reports event configuration
0x43	Device retrieves event/server sends event

0x44	Device reports event
0x45	Device retrieves network time (LoRa)
0x47	Device reports configuration/server sends configuration

## B. Sensor Data Report

Type	ADDR	CMD	LEN	DATA	CRC
Send	0x01	0x41	0x06 - 0x24	0x00 0x02 0x01	-

Under **Data**, there are two data types:

- Historical data
- Real-time data

Data Type	Description
0x00	Historical data; 6-byte sensor data
0x01	Timestamp; 4-byte
	Real-time data; 6-byte
	Version number; 10-byte

## Historical Data Format Description

The following is an example of a complete historical data reporting format for sensor data:

**01 41 25 00 5C 77 88 B6 00 05 2F C2 9A 00 00 4E 2F C2 9A 00 00 4E 2F C2 9A 00 00 4E 2F C2 9A 00 00 4E 2F C2 9A 00 00 4E 48 8C**

The table below shows the historical data analysis:

Byte Number	Description	Value
1	Device address	0x01
2	Data reporting function code	0x41
3	Data length	0x25

4	Data type (historical data)	0x00
5 – 8	Timestamp	0x5C7788B6
9 – 10	Data storage interval (in seconds)	0x0005
11 – 16	First set of sensor data	Bytes 1–3: 0x2FC29A <ul style="list-style-type: none"> <li>• Represent temperature and humidity</li> <li>• Temperature: 0x02FC (high 12 bits)<sup>1</sup></li> <li>• Humidity: 0x29A (low 12 bits)<sup>2</sup></li> </ul> Bytes 4–5: 0x0000 <ul style="list-style-type: none"> <li>• Reserved bytes</li> <li>• Don't carry any data.</li> <li>• Optional, none in this example.</li> </ul> Byte 6: 0x4E <ul style="list-style-type: none"> <li>• Represents the battery level</li> </ul>
17 – 22	Second set of sensor data	The same format as the first set.
Every 6 bytes is a set of sensor data.	LoRa: One frame of historical data has up to 5 sets of sensor data.	The same format as the first set.
41 – 42	Check code	0x488C

<sup>1</sup> The temperature value is forward offset by 500. To get the actual temperature value, subtract 500 from the byte value of 0x02FC, equating to 264. However, the reading is expanded ten times, implying that the actual temperature of 264 is divided by ten.

$$actual\ temperature\ value\ ^\circ C = \frac{temp\ value - 500}{10}$$

<sup>2</sup> The humidity value is expanded ten times to get the actual value.

$$actual\ humidity\ value\ \%RH = \frac{humidity\ value}{10}$$

The timestamp of each set of sensor data must be calculated based on the starting timestamp and data acquisition interval. In the previous reference data, the acquisition time for the set of sensor data is as follows:

- First set: **0x5C7788B6**
- Second set: **0x5C7788B6 + 0x0005** (data acquisition interval)
- Third set: **0x5C7788B6 + 0x0005 + 0x0005**

## Real-Time Data Format Description

The following is an example of a complete real-time data reporting format for sensor data:

**01 41 15 01 5C 77 88 B6 2F C2 9A 00 00 4E 31 2E 30 2E 30 5F 30 30 34 31 5D C6**

The table below shows the real-time data analysis:

Byte Number	Description	Value
1	Device address	0x01
2	Data reporting function code	0x41
3	Data length	0x15
4	Data type (real-time data)	0x01
5 – 8	Timestamp	0x5C7788B6
9 – 14	Sensor data	Bytes 1–3: 0x2FC29A <ul style="list-style-type: none"> <li>• Represent temperature and humidity</li> <li>• Temperature: 0x02FC (high 12 bits)<sup>1</sup></li> <li>• Humidity: 0x29A (low 12 bits)</li> </ul> Bytes 4–5: 0x0000 <ul style="list-style-type: none"> <li>• Reserved bytes</li> <li>• Don't carry any data.</li> <li>• Optional, none in this example.</li> </ul> Byte 6: 0x4E <ul style="list-style-type: none"> <li>• Represents the battery level</li> </ul>
15 – 19	Version number	Corresponding to ASCII: 1.0.0_0041
20-21	Check code	0x5DC6

<sup>1</sup> For actual temperature and humidity value calculation, refer to the **Historical Data Format Description** section.



## C. Event Reporting

The returned parameter format is shown in the following table:

Type	ADDR	CMD	LEN	DATA			
Receive	0x01	0x41	0x0B	Event	Timestamp	Sensor	Event setting
				type		data	value
				1 byte	4 bytes	6 bytes	2 bytes

## Sensor Data Format

Refer to the **Sensor Data Format** table in the **Real-Time Data Format Description** section for more information.

## Event Type

The event type in hex corresponds to temperature and humidity-specific conditions. It indicates when a report should be triggered based on the conditions.

Event Type	Description
0x07	Temperature is above a certain value.
0x08	Temperature is below a certain value.
0x0A	Humidity is above a certain value.
0x0B	Humidity is below a certain value.
0x0D	Reserved
0x0E	Reserved

## D. Event Sending

The description of setting the sensor reporting policy is as follows:

Type	ADDR	CMD	LEN	DATA					
Send	0x01	0x42	0x0C	Event	Repeat	Start	End	Settings	Ring
				type	times	time	time		duration
				1 byte	1 byte	4 bytes	4 bytes	2 bytes	2 bytes

## Event Type

Refer to the **Event Types** table in the **Event Reporting** section for more information.

## Repeat Times

Repeat Times	Value	Description
1 time in total	0x01	The default setting.
1 time a day	0xFE	

## Start and End Time

The start and end times are offset in minutes, with 0:00 as the base point. For example, a time of 7:00 to 10:00 corresponds to 420 to 600 minutes.

If the period is a full day, set the start and end times to the same value of 0. The predefined values indicate that the entire day has been covered.

## Value Setting

To convert the temperature value to its actual reading, offset the value forward (subtract) by 500, then expand (multiply) by 10. However, for humidity, multiply the given value by 10.

Unit description:

- Temperature: °C
- Humidity: %RH

For example, if the temperature remains above 26 degrees Celsius for the entire period, the hexadecimal value would be: **01 42 0C 07 01 00 00 00 00 00 00 02 F8 23 E4**.

## E. Configuration Settings

To configure the interval settings, set the values as follows:

- Data reporting interval: 1 hour
- Data acquisition interval: 15 minutes
- Fill in the unused items with 0 and send: **01 47 09 00 3C 03 84 00 00 00 00 00 28 5E**

Type	ADDR	CMD	LEN	DATA				
Send	0x01	0x47	0x06	Data Reporting Interval	Data Acquisition Interval	Bluetooth Broadcast interval	Notification Repeating Interval	Temperature unit
				2 bytes (minutes)	2 bytes (seconds)	2 bytes (seconds, reserved unused)	2 bytes (reserved unused)	1 byte (reserved unused)