SENSECAP

THE NEW GENERATION LORAWAN SENSORS OF SENSECAP

# S210X Sensors User Guide

Version: v1.0.0

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# 1. Product Introduction

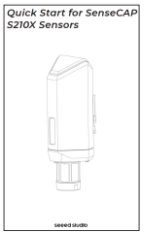
Among the first launch of Seeed Industrial IoT product series, SenseCAP is focusing on wireless environmental sensing applications: smart agriculture, precision farming, smart city and so on. It consists of hardware products (sensors, data-loggers & gateways, etc.), software services (SenseCAP portal, mobile App, open dashboard), and API for device & data management.

The next generation of SenseCAP LoRaWAN sensors, the S210X series offers users' industrial long-distance data acquisition via LoRa. The S210x series is suitable for a wide variety of different industries such as smart agriculture, smart buildings and industrial control.

With the IP66 rating, -40 ~ +85C ° operating temperature and built-in 19Ah high-capacity battery, combined with the devices' low power consumption, the S210X series can operate in harsh outdoor environments for up to 10 years with a range of up to 10km. The built-in Bluetooth facilitates setup and greatly reduces large-scale deployment costs. Users can focus on application development with the easy set-up and start retrieving data in a few steps. Just install the device, bind it using the QR code and configure the network, then data can be viewed from the SenseCAP portal, which supports popular IoT protocols such as HTTP and MQTT.

# 2. Part List

Before installing, please check the part list to ensure nothing is missing.

| Picture | Name | Quantity |
|---|---|---|
| | Sensor Node | 1 |
| | Bracket | 1 |
|   | Quick Start Guide | 1 |
| | KA4*20mm Self-drilling Screw | 4 |

# 3. Key Parameters of the Sensor

## 3.1 Introduction of Key Parameters

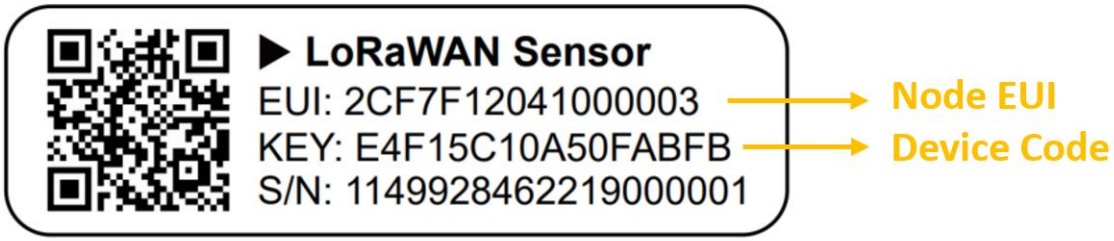
Using the LoRaWAN protocol generally involves the following parameters.

| Parameters | Description |
|---|---|
| LoRaWAN MAC Version | v1.0.3 |
| Join Type | OTAA (Default)<br><br>ABP (It can be modified through App) |
| Device EUI | Unique identification of device, one of the join network parameters (OTAA mode). |
| Device Code (KEY) | On the device label, for device binding and API call. |
| App EUI | Unique identification of application, one of the join network parameters (OTAA mode). |
| App Key | Application key, one of the join network parameters (OTAA mode). |
| DevAddr | This parameter is available only in ABP mode, one of the join network parameters. |
| NwkSkey | This parameter is available only in ABP mode, one of the join network parameters. |
| AppSkey | This parameter is available only in ABP mode, one of the join network parameters. |

## 3.2 Get Device EUI, App EUI and Key

### 3.2.1 Get the parameters via API

(1) Device EUI and Device Code is on the SenseCAP product label.




⚠ ***Note:***

*The "Key" on the label is Device Code, which is not the App Key!*

(2) SenseCAP Node's App EUI and App Key have been flashed into the device by Seeed. Use HTTP API to get App EUI and App Key. You can use a browser (Google Chrome) to launch an HTTP GET request.

**Curl:**

```
https://sensecap.seeed.cc/makerapi/device/view_device_info?nodeEui=2CF7F12014700297&deviceCode=34BF25920A4EFBF4
```

In the API, replace the Device EUI and device Code with your own Device EUI and Device Code respectively. And you will get the following response:

| | | |
|---|---|---|
| dev_eui | Device EUI | 2CF7F12014700297 |
| app_eui | App EUI | 8000000000000006 |
| app_key | App Key | 6FD0EF47CBC6E00F1921A08C2E94E8E5 |


```
{
  "code": "0",
  "data": {
    "nodeEui": "2CF7F12014700297",
    "deviceCode": "34BF25920A4EFBF4",
    "lorawanInformation": {
      "dev_eui": "2CF7F12014700297",
      "app_eui": "8000000000000006",
      "app_key": "6FD0EF47CBC6E00F1921A08C2E94E8E5"
    }
  },
  "time": 0.019
}
```

***Note:***

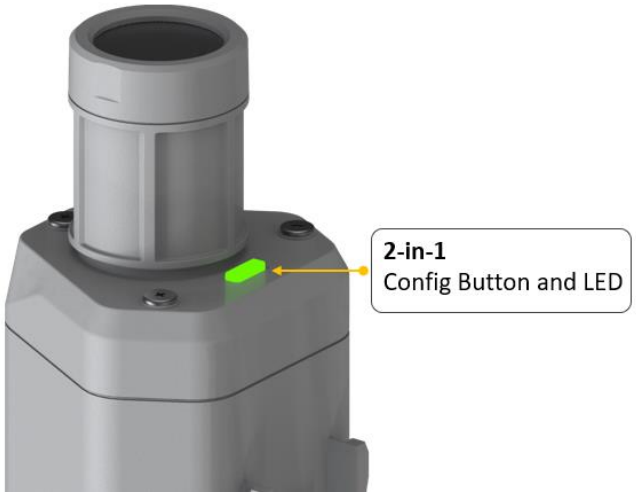
*The SenseCAP LoRaWAN Sensor can modify to EUI, Key, and Frequency.*

*Please refer to the following sections.*

### 3.2.1 Get the parameters via SenseCAP Mate App

Please refer to the section 5.

# 4. LED of Sensor Working Status




You can refer to the LED indicator for the Sensor Node for its working status. Please see the status explanations in the chart below:

| Actions | Description | Green LED Status |
|---|---|---|
| First power up, press and hold for 9s | Power on and activate the Bluetooth | LED flashes at 1s frequency |
| Press once | Reboot device and join LoRa network | 1. The LED will be on for 5 seconds for initialization<br>2. Waiting for join network: breathing light flashing<br>3. Join network success: LED flashes fast for 2s |
| Press and hold for 3s | Activate Bluetooth again | 1. Waiting for Bluetooth connection: LED flashes at 1s frequency<br>2. Enter configuration mode after Bluetooth |

| | | |
|---|---|---|
| | | connection is successful: LED flashes at 3s frequency |
| Press and hold for 9s | Power off | In the 3rd seconds will start flashing at 1s frequency, until the light is steady on, release the button, the light will go out |

⚠***Note:***

*After power off, you need to reconfigure the frequency band. Power off is recommended when not deployed.*

# 5. SenseCAP Mate App

## 5.1 Download App

As a tool, SenseCAP Mate App is used to config LoRa parameters, set interval, bind devices to your account and check device basic information.

⚠***Note:***

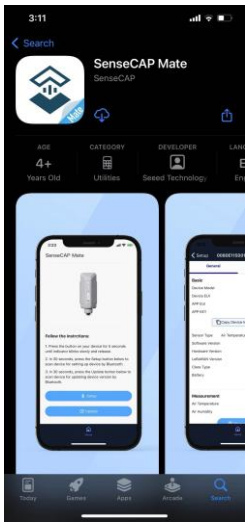
*SenseCAP Mate App functions are being iterated in stages:*

*Stage1: Equipment configuration, firmware update. (Done)*

*Stage2: Bind the device to SenseCAP Portal and manage the device. (Developing)*

*Stage3: Data visualization and scene monitoring. (Developing)*

(1) For iOS, please search for “SenseCAP Mate” in the App Store and download it.

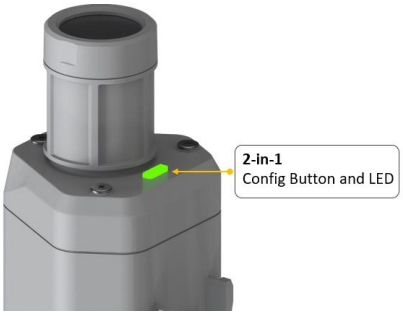



(2) For Android, please search for “SenseCAP Mate” in the Google Store and download it.

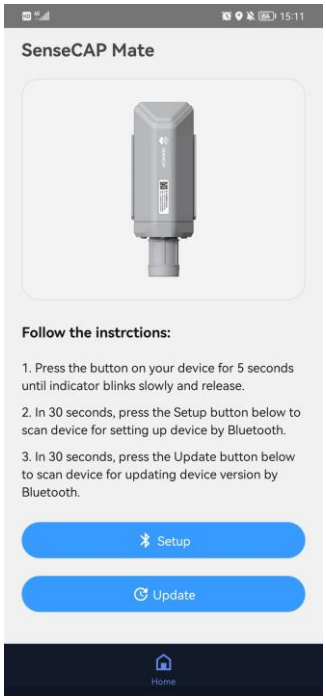
You can also download App from https://www.pgyer.com/sensecapmate

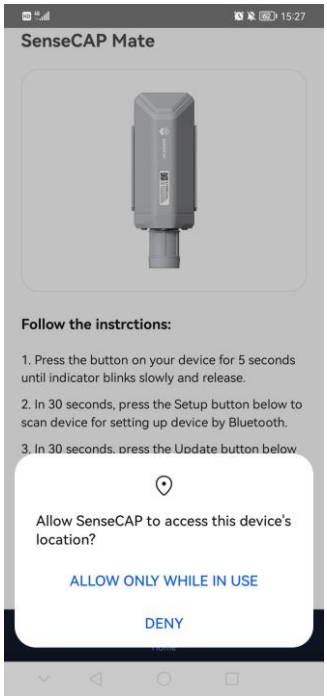
## 5.2 How to connect sensor to App

1) Press button and hold for **3 seconds**, the LED will flash at 1s frequency.

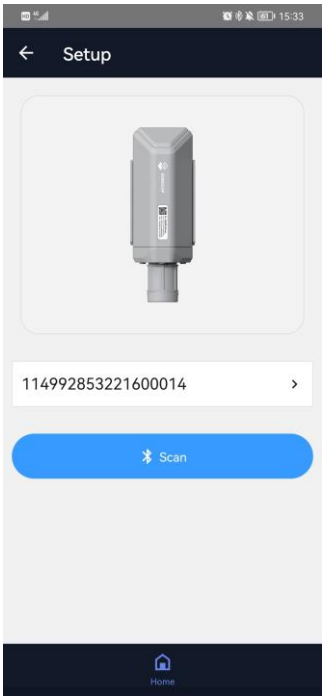



2) Please click the “Setup” button to turn on Bluetooth and click “Scan” to start scanning the sensor's Bluetooth.




3) Select the Sensor by S/N. Then, the basic information of the sensor will be displayed after entering.

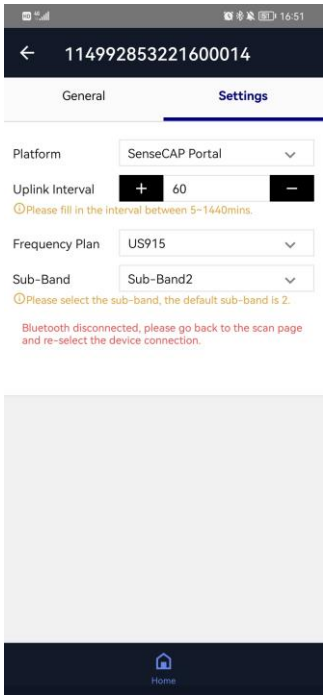


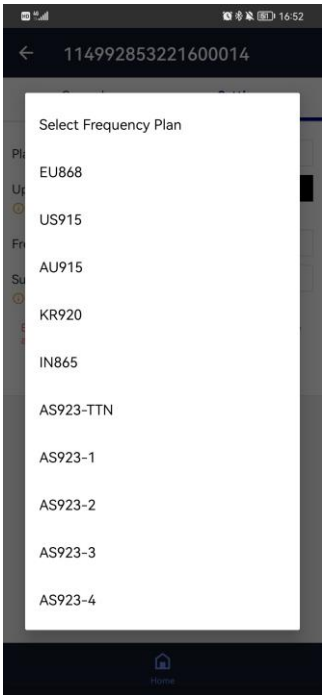
4) Enter configuration mode after Bluetooth connection is successful: LED flashes at 3s frequency.

## 5.3 Configure parameters through App

### 5.3.1 Select the Platform and Frequency

S210x Sensors are manufactured to support universal frequency plan from 863MHz ~928MHz in one SKU. That is to say, every single device can support 7 frequency plans.




**1) SenseCAP Portal:**

We provide the SenseCAP Portal to manage devices and data: sensecap.seeed.cc

When SenseCAP Portal is selected, the device runs in a fixed main frequency and sub-band. You only need to select the main frequency, such as EU868 and US915.

***Note:***

*Now, the device needs to be used with the SenseCAP outdoor gateway (https://www.seeedstudio.com/LoRaWAN-Gateway-EU868-p-4305.html) to transmit data to the SenseCAP Portal.*

SenseCAP Portal supports the following frequency plan:

| Frequency | Description |
|---|---|
| EU868 | It must be used with SenseCAP EU868 Gateway (https://www.seeedstudio.com/LoRaWAN-Gateway-EU868-p-4305.html ) |
| US915 | It must be used with SenseCAP US915 Gateway (https://www.seeedstudio.com/LoRaWAN-Gateway-US915-p-4306.html ) |
| AU915 | Need to contact sales. |
| KR920 | Need to contact sales. |
| IN865 | The sensor is supported, but there is no SenseCAP gateway for the frequency band. |
| AS923-1 | Need to contact sales. |
| AS923-2 | Need to contact sales. |
| AS923-3 | The sensor is supported, but there is no SenseCAP gateway for the frequency band. |
| AS923-4 | The sensor is supported, but there is no SenseCAP gateway for the frequency band. |

### 2) Other Platform:

When you use Helium, TTN and other LoRaWAN network server, please select Other Platform. At this point, you need to determine the sensor frequency band according to the gateway frequency and sub-band.

S210x Sensors support the following frequency plan:

| Frequency | Common Name | Sub-band |
|---|---|---|
| EU863-870 | EU868 | -------- |
| US902-928 | US915 | Sub band from 1 to 8 (default sub-band 2) |
| AU915-928 | AU915 | Sub band from 1 to 8 (default sub-band 2) |
| KR920-923 | KR920 | -------- |
| IN865-867 | IN865 | -------- |

| | | |
|---|---|---|
| AS923 | AS923-1 | -------- |
| | AS923-2 | -------- |
| | AS923-3 | -------- |
| | AS923-4 | -------- |
| RU864-867 | RU864 | -------- |

⚠ ***Note:***

*Different countries and LoRaWAN network servers use different frequency plans.*

*For Helium network, please refer to:*

*https://docs.helium.com/lorawan-on-helium/frequency-plans*

*For The Things Network, please refer to:*

*https://www.thethingsnetwork.org/docs/lorawan/frequency-plans/*

### 5.3.2 Set the Interval

The working mode of device: wake up the device every interval and collect measurement values and upload them through LoRa. For example, the device collects and uploads data every 60 minutes by default.

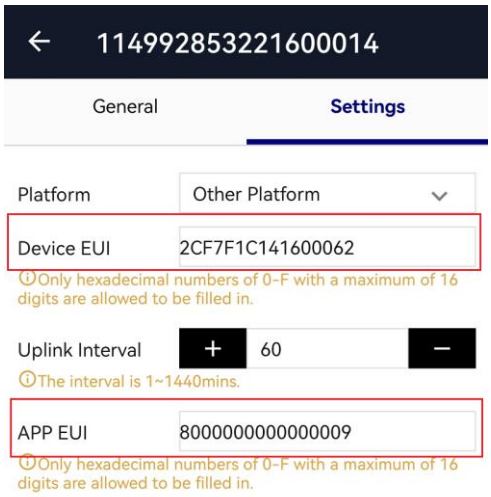
| Parameter | Type |
|---|---|
| Uplink Interval | Unit: minutes, number from 1 to 1440. |

### 5.3.3 Set the EUI and Key

The device uses OTAA to join the LoRaWAN network by default. So, it can set the device EUI and App EUI.

| Parameter | Type |
|---|---|
| Device EUI | 16 bits, hexadecimal from 0 ~ F |

| | |
|---|---|
| App EUI | 16 bits, hexadecimal from 0 ~ F |
| App Key | 32 bits, hexadecimal from 0 ~ F |




### 5.3.4 Set the Packet Policy

The sensor uplink packet strategy has three modes.

| Parameter | Description |
|---|---|
| 2C+1N (default) | 2C+1N (2 confirm packets and 1 none-confirm) is the best strategy, the mode can minimize the packet loss rate, however the device will consume the most data packet in TTN, or date credits in Helium network. |
| 1C | 1C (1 confirm) the device will sleep after get 1 received confirm packet from server. |
| 1N | 1N (1 none-confirm) the device only send packet and then start to sleep, no matter the server received the data or not. |

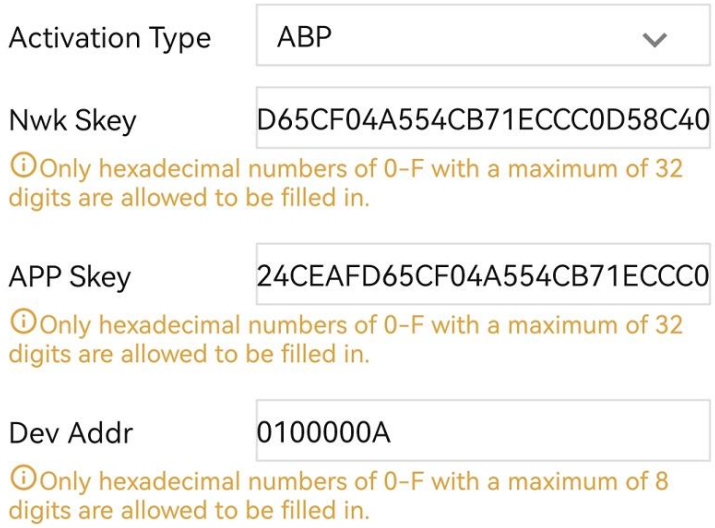
### 5.3.5 Set the Activation Type

The sensor supports two network access modes, OTAA by default.

| Parameter | Description |
|---|---|
| OTAA (default) | Over The Air Activation, it joins the network through Device EUI, App EUI, and App Key. |
| ABP | Activation By Personalization, it joins the network through DevAddr, NwkSkey, and AppSkey. |

When using ABP mode, you need to configure the following information:

| Parameter | Description |
|---|---|
| DevAddr | 32 bits, hexadecimal from 0 ~ F |
| NwkSkey | 32 bits, hexadecimal from 0 ~ F |
| AppSkey | 8 bits, hexadecimal from 0 ~ F |




***Note:***

*The factory defaults to a fixed value.*

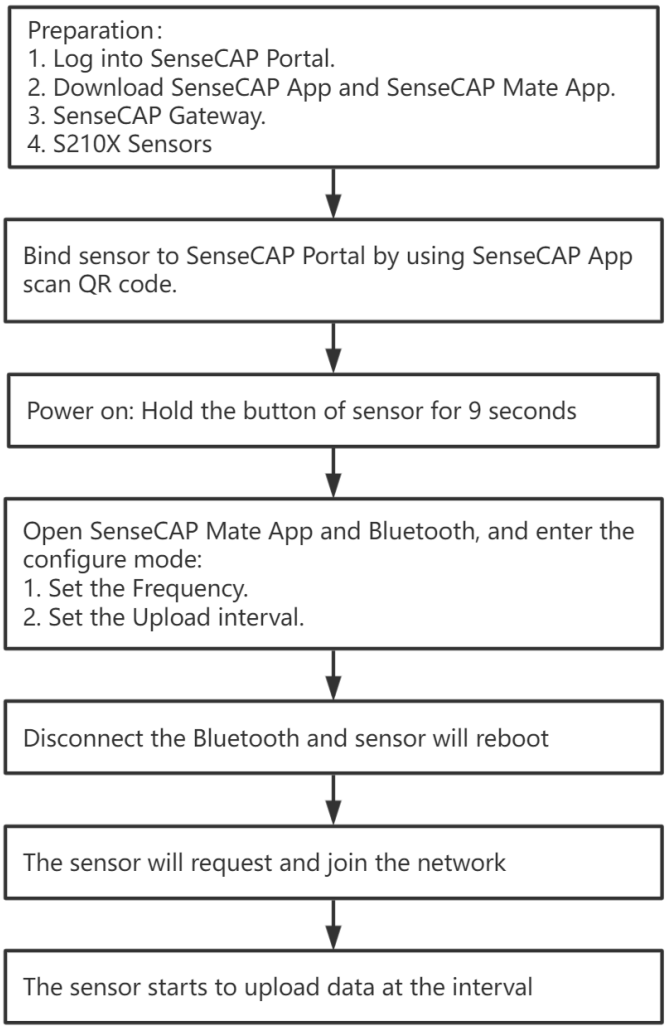
### 5.3.6 Restore Factory Setting

When we make a mistake or want to reset everything, we can click the button. The device will be restored to the factory's default configuration.

# 6. Connect to the SenseCAP Portal

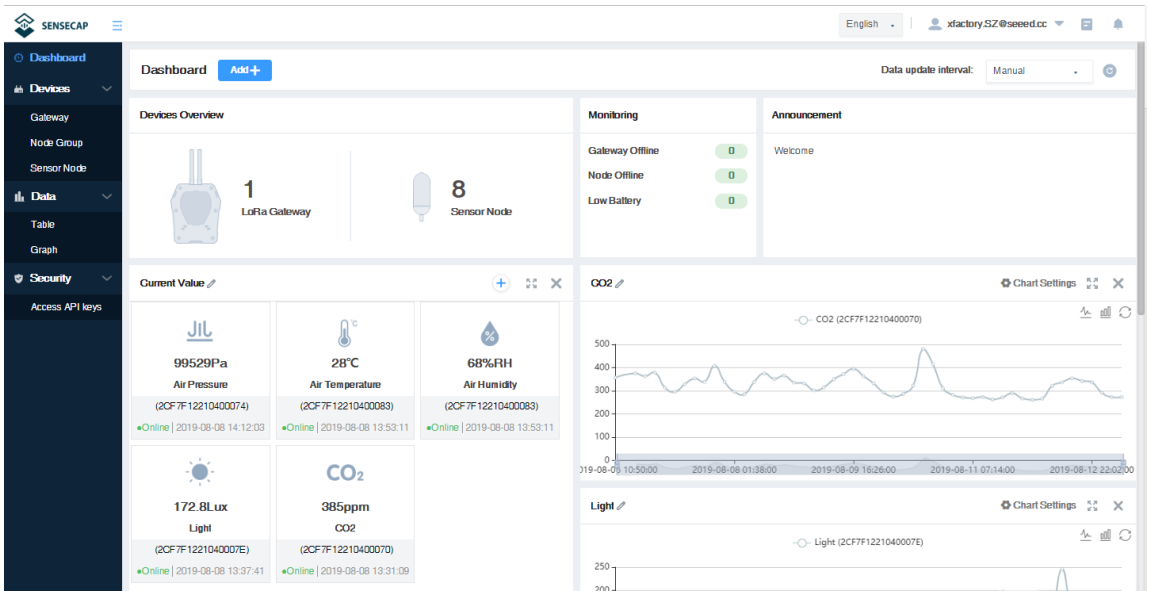
## 6.1 Quick Start

Follow this process to quickly use the sensor, see the following section for details.



## 6.2 SenseCAP Portal

The main function of the SenseCAP Portal is to manage SenseCAP devices and to store data. It is built on Azure, a secure and reliable cloud service from Microsoft. You can apply for an account and bind all devices to this account. SenseCAP provides the web portal and API. The web portal includes Dashboard, Device Management, Data Management, and Access Key Management, while API is open to users for further development.




### 6.2.1 Create a New Account

Portal Website: [http://sensecap.seeed.cc](http://sensecap.seeed.cc)

1) Select register account, enter email information and click "register", the registered email will be sent to the user's mailbox.

2) Open the "SenseCAP···"Email, click the jump link, fill in the relevant information, and complete the registration.

3) Return to the login interface and complete the login.

---

⚠ ***Note:***

*If you can't find the email, it may be automatically identified as "spam" and put in the "trash can".*

---

### 6.2.2 Other Functions

- **Dashboard:** Including Device Overview, Announcement, Scene Data, and Data Chart, etc.
- **Device Management:** Manage SenseCAP devices.
- **Data Management:** Manage data, including Data Table and Graph section, providing methods to search for data.
- **Subaccount System:** Register subaccounts with different permissions.
- **Access Key Management:** Manage Access Key (to access API service), including Key Create, Key Update, and Key Check.

⚠ ***Note:***

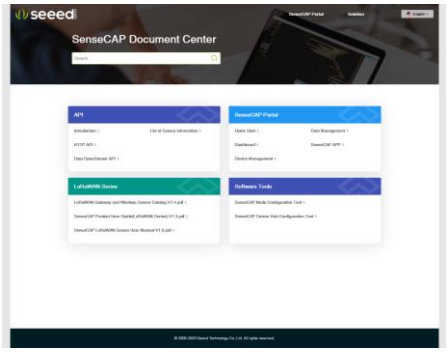
***SenseCAP Portal User Guide:*** *https://sensecap-docs.seeed.cc/quickstart.html*

### 6.2.3 API Instruction

SenseCAP API is for users to manage IoT devices and data. It combines 3 types of API methods: HTTP protocol, MQTT protocol, and Websocket protocol.

- With HTTP API, users can manage LoRa devices, to get raw data or historical data.
- With MQTT API, users can subscribe to the sensor's real-time measurement data through the MQTT protocol.
- With Websocket API, users can get real-time measurement data of sensors through Websocket protocol.

Please refer to this link for API User Guide: https://sensecap-docs.seeed.cc/



## 6.3 Preparation

### 6.3.1 App

We need to use two apps:

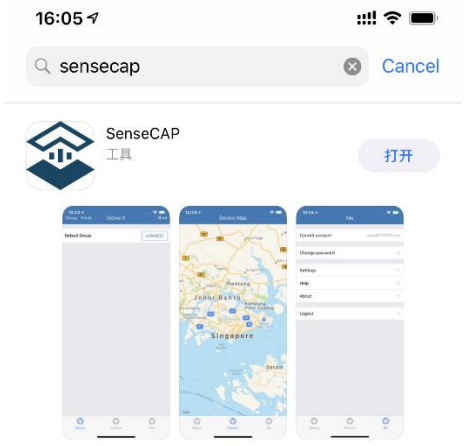
- SenseCAP Mate App: Configuration tool for sensor.
- SenseCAP App: Management device tool for use with SenseCAP Portal.

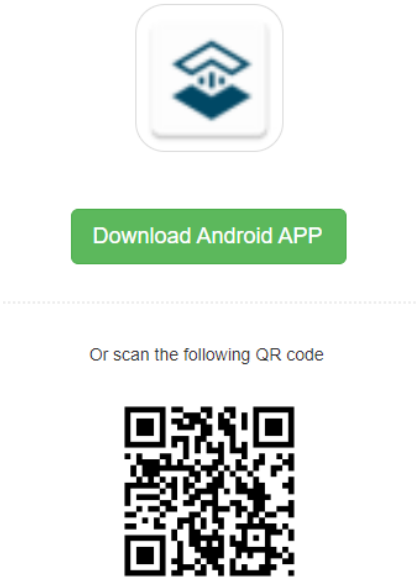
**SenseCAP Mate App**

Please refer to section 5 for using.

SenseCAP App is used to bind devices to your account and check device information.

- For iOS, please search for “SenseCAP” in the App Store and download it.
- For Android, you can download the App from http://sensecap-app-download.seeed.cn



### 6.3.2 SenseCAP Gateway

Now, the device needs to be used with the SenseCAP Outdoor Gateway (https://www.seeedstudio.com/LoRaWAN-Gateway-EU868-p-4305.html) to transmit data to the SenseCAP Portal.

1) Setup the Gateway, connect to power cable and Internet.

2) Bind the gateway to SenseCAP Portal.

3) Ensure the gateway indicator is steady on.

4) Ensure the gateway is displayed online on the portal.

## 6.4 Bind Sensor to SenseCAP Portal

Please open SenseCAP App.

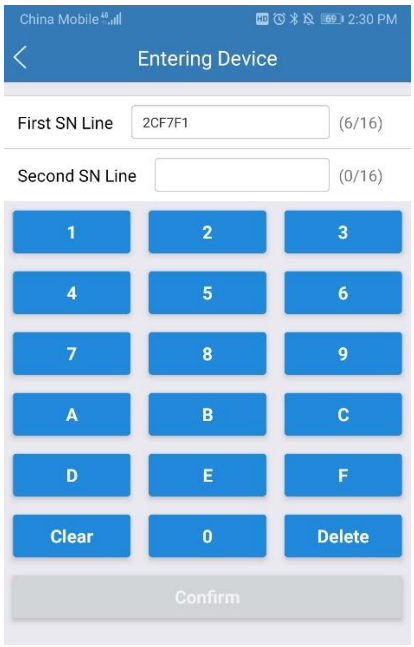
### 6.4.1 Scan QR Code

1) Click “Bind” on the upper-right corner to enter the device binding page.

2) Scan the QR code on the device to bind the device to your account. If you do not set it to a designated group, the device will be put into the “default” group.

### 6.4.2 Manually fill in the EUI

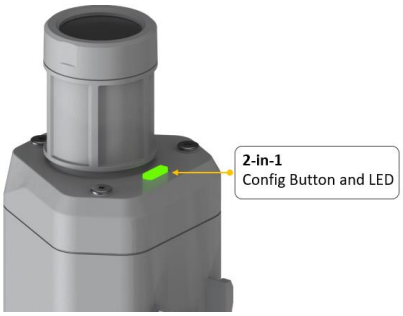
If the QR code sticker is damaged, you can manually fill in the EUI of the device to bind the device to your account. Please make sure you put in the EUI in the format suggested by the system and then click “confirm”.


China Mobile
2:30 PM
Entering Device
First SN Line
2CF7F1
(6/16)
Second SN Line
(0/16)
1
2
3
4
5
6
7
8
9
A
B
C
D
E
F
Clear
0
Delete
Confirm

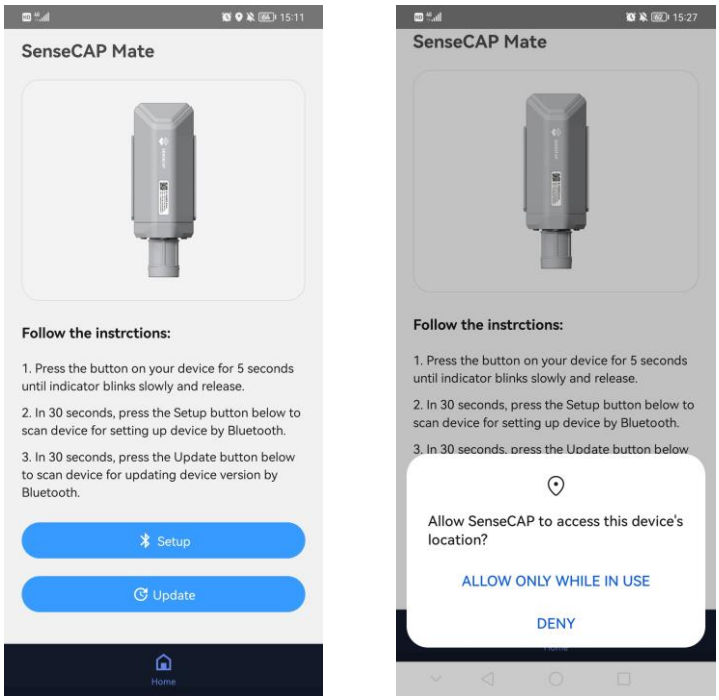
## 6.5 Setup the Sensor

1) Open the SenseCAP Mate App

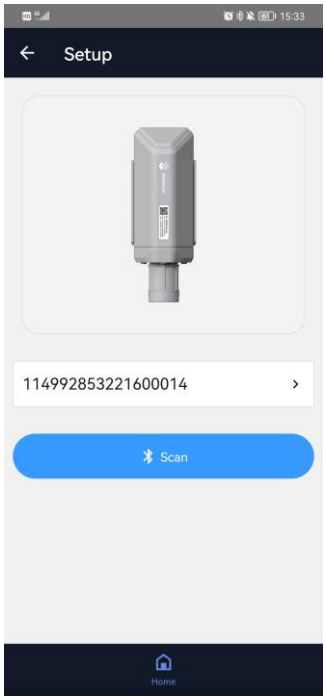
2) Press button and hold for 9 seconds, the LED will flash at 1s frequency.




3) Please click the “Setup” button to turn on Bluetooth and click “Scan” to start scanning the sensor's Bluetooth.




4) Select the Sensor by S/N (label). Then, the basic information of the sensor will be displayed after entering.


15:33
Setup
114992853221600014
Scan
Home

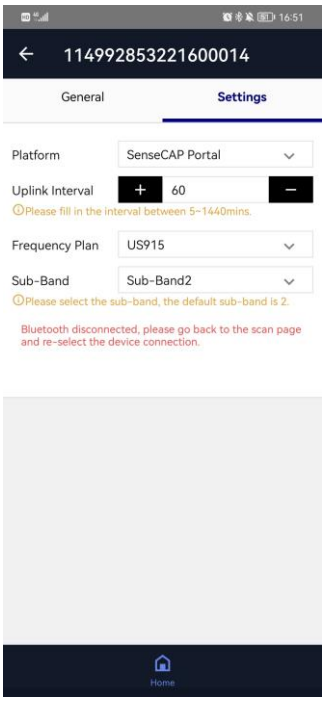
15:50
114992853221600014
General
Settings
Basic
Device Model SenseCAPS2104
Device EUI 2CF7F1C141600062
APP EUI 8000000000000009
APP KEY 24CEAF...D58C40
Copy Device Information
Sensor Type Soil Moisture and Temperature Sensor
Backup Firmware Version 1.1.3
Software Version 1.1.3
Hardware Version V1.0
LoRaWAN Version V1.0.3
Class Type ClassA
Battery 86
Measurement
Measure
Home

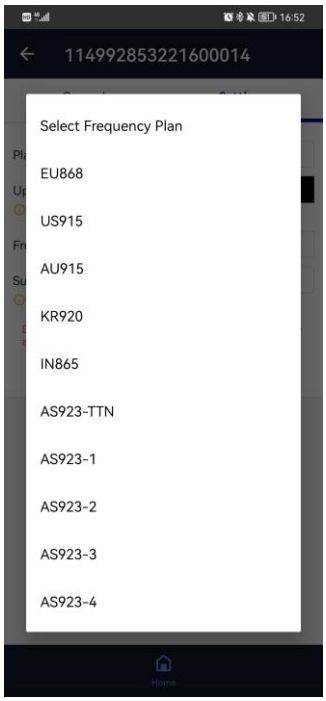
## 6.6 Set Frequency of Sensor via SenseCAP Mate App

Set the corresponding frequency band based on the frequency band of the gateway.

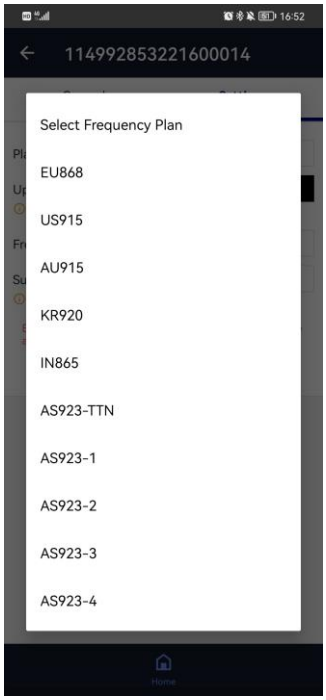
Please refer to section 5 for detail.

1) Click the “Setting” and select the platform is “SenseCAP Portal”.




2) Select the Frequency Plan, if the gateway is US915, set the sensor to US915.




3) Click the “Send” button, send the setting to the sensor for it to take effect.

4) Click the “Home” button, the App will disconnect the Bluetooth connection.

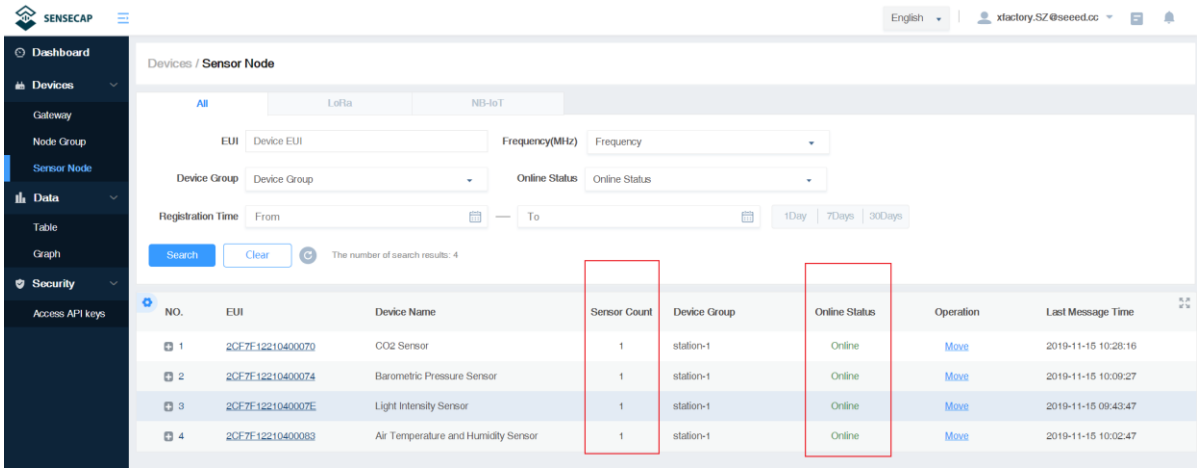
   Then, the sensor will reboot.

5) When the device is disconnected from Bluetooth, the LED lights up for 5 seconds and then flashes as a breathing light.

6) After joining the network successfully, LED flashes fast for 2s.

## 6.7 Check Data on SenseCAP Portal

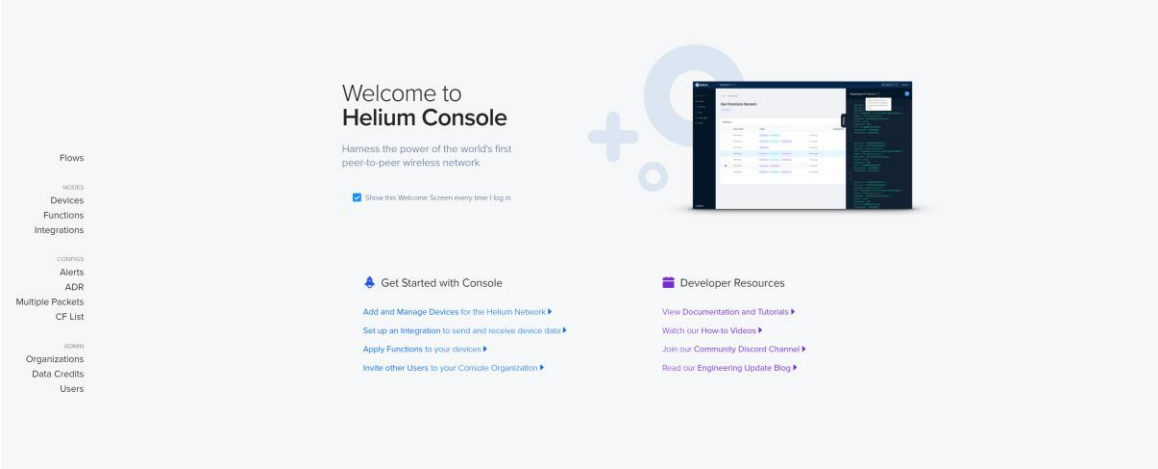
On the SenseCAP App or the website http://sensecap.seeed.cc/ , you can check the device online status and the latest data. In the list for each Sensor, you can check its online status and the time of its last data upload.



# 7. Connect to Helium Network

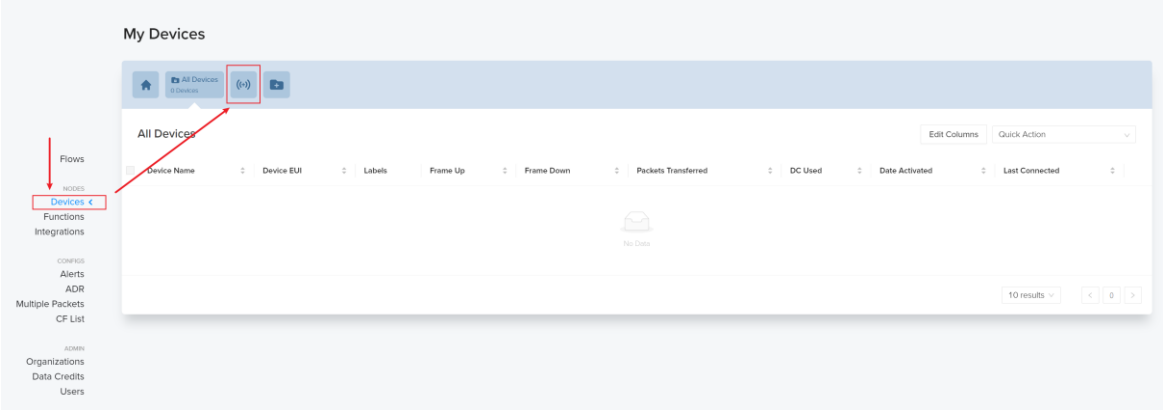
## 7.1 Register

Please go to [https://console.helium.com/](https://console.helium.com/) , and register your account.

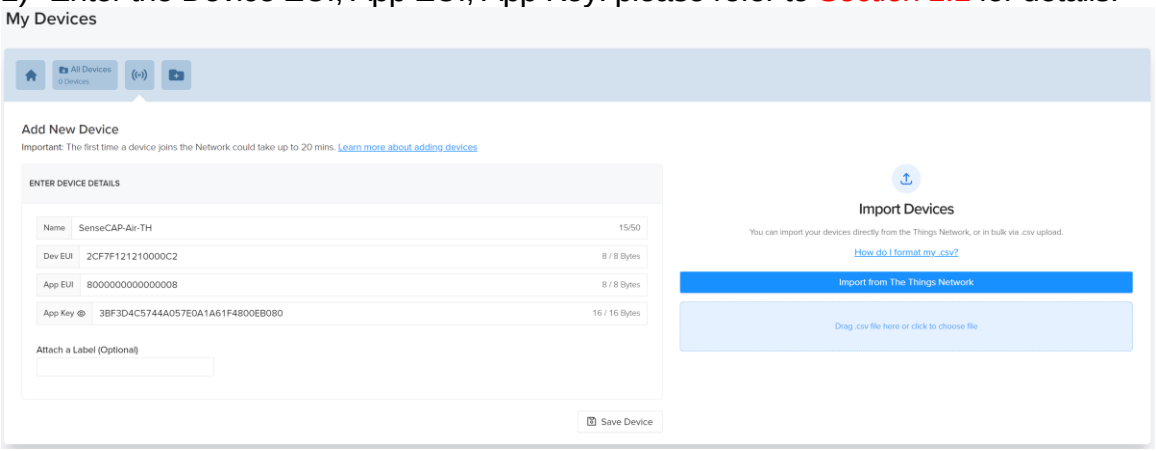


## 7.2 Add New Device

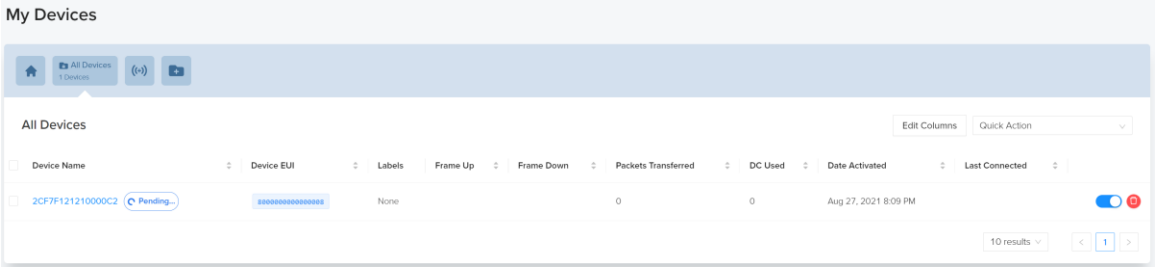
1) Click “Devices” –> “Add New Device”



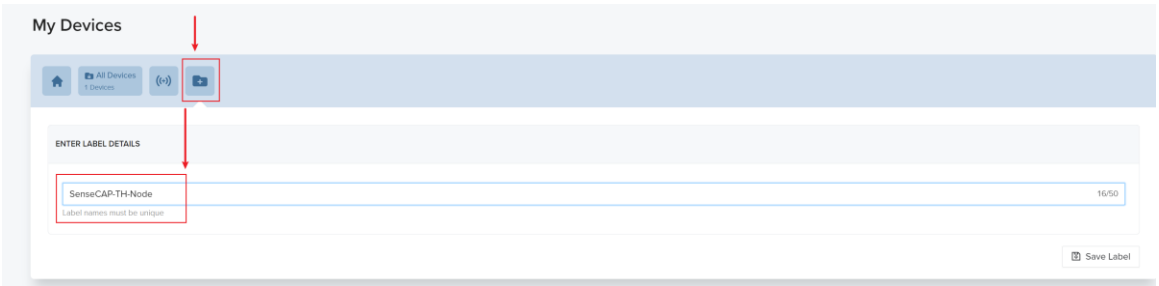

2) Enter the Device EUI, App EUI, App Key: please refer to Section 1.1 for details.

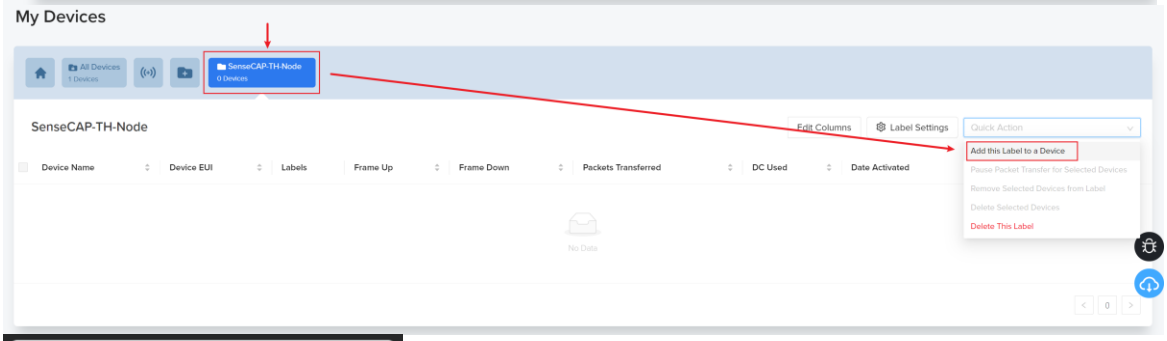


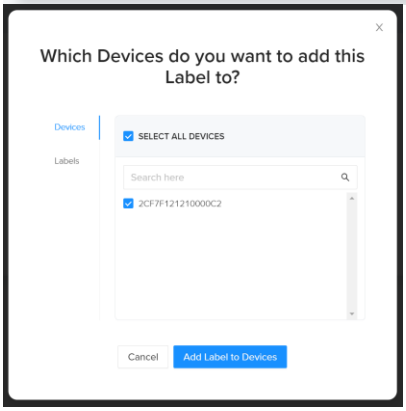

3) Save device.

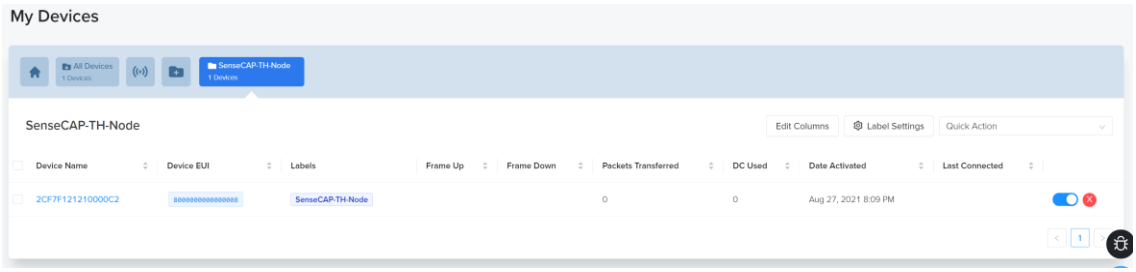



4）Add a new label, then add the label to a device.


My Devices
All Devices
1 Devices
ENTER LABEL DETAILS
SenseCAP-TH-Node
16/50
Label names must be unique
Save Label

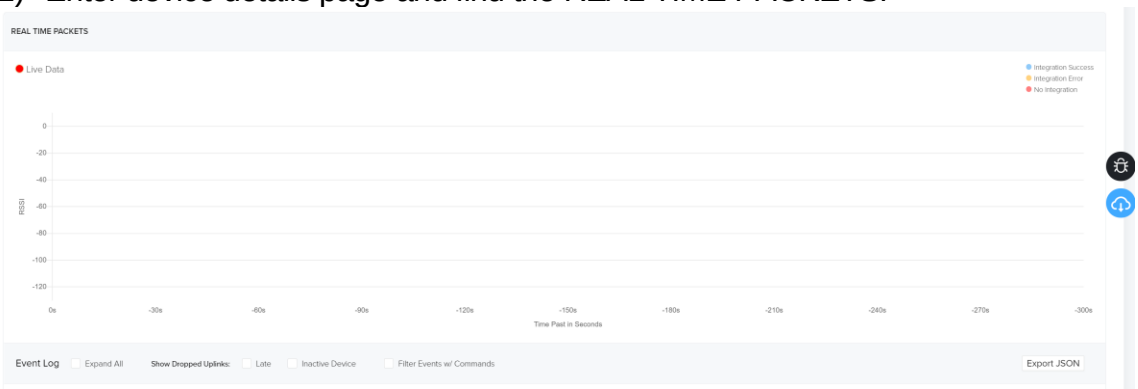

My Devices
All Devices
1 Devices
SenseCAP-TH-Node
0 Devices
SenseCAP-TH-Node
Edit Columns
Label Settings
Quick Action
Device Name
Device EUI
Labels
Frame Up
Frame Down
Packets Transferred
DC Used
Date Activated
Add this Label to a Device
Pause Packet Transfer for Selected Devices
Remove Selected Devices from Label
Delete Selected Devices
Delete This Label
No Data


Which Devices do you want to add this Label to?
Devices
Labels
SELECT ALL DEVICES
Search here
2CF7F121210000C2
Cancel
Add Label to Devices

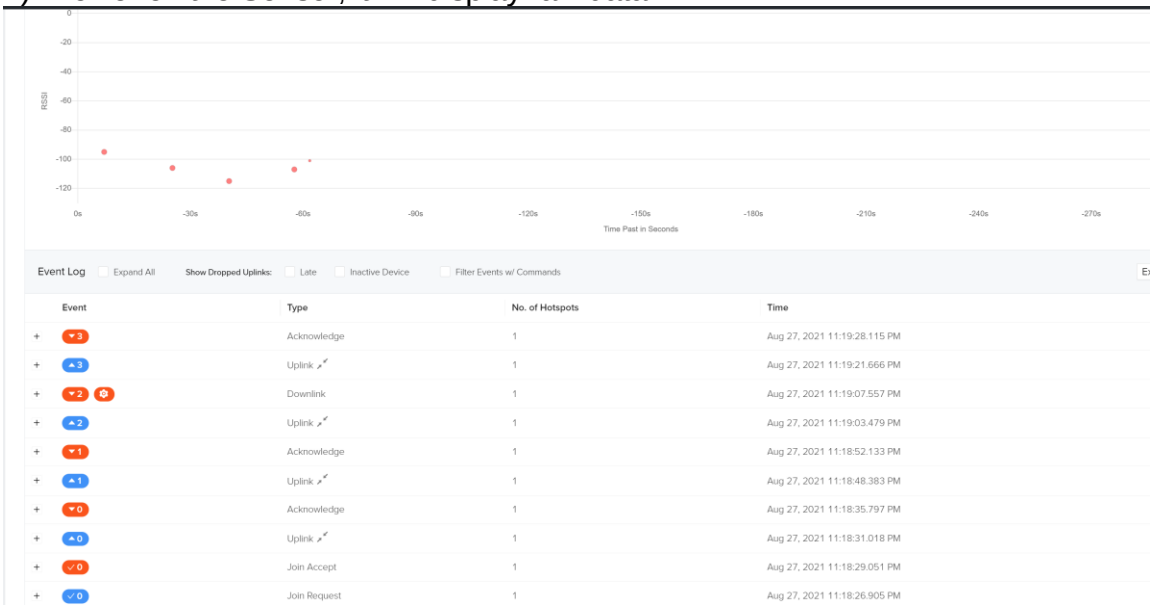

My Devices
All Devices
1 Devices
SenseCAP-TH-Node
1 Devices
SenseCAP-TH-Node
Edit Columns
Label Settings
Quick Action
Device Name
Device EUI
Labels
Frame Up
Frame Down
Packets Transferred
DC Used
Date Activated
Last Connected
2CF7F121210000C2
SenseCAP-TH-Node
0
0
Aug 27, 2021 8:09 PM

## 7.3 Check the data on Helium

1) Enter device details page and find the REAL TIME PACKETS.



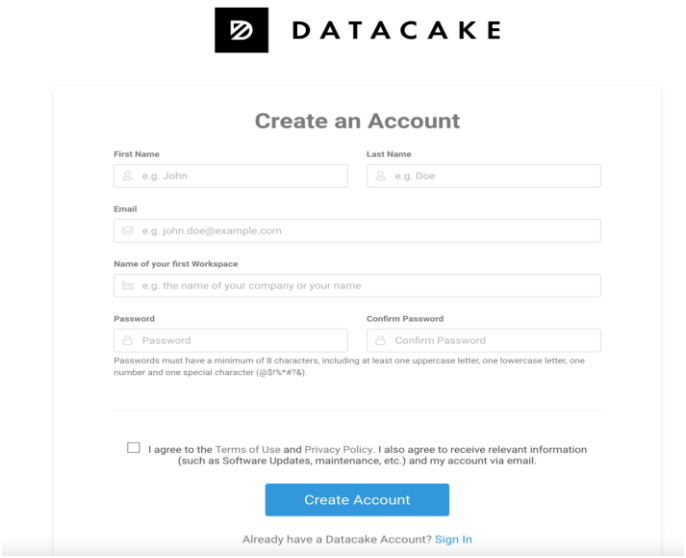

2) Power on the Sensor, it will display raw data.



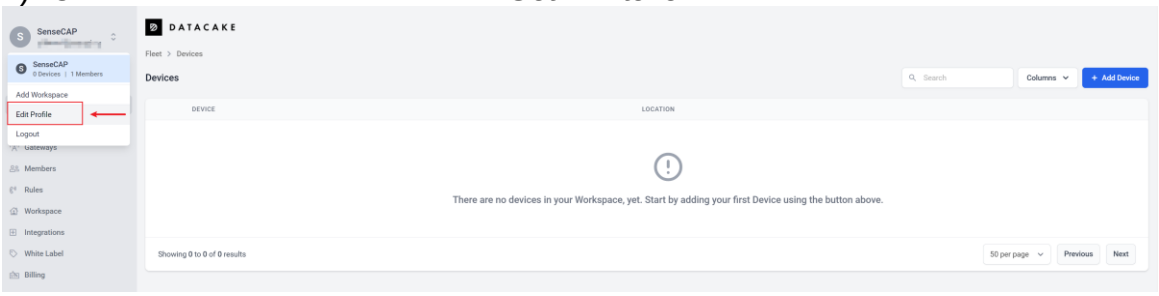
## 7.4 Upload Data from Helium to Datacake

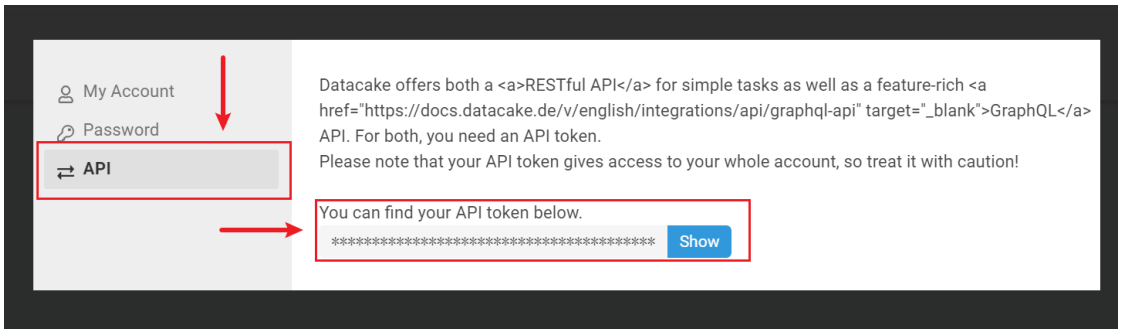
### 7.4.1 Create a Datacake Account

1) Create a new account, website: https://datacake.co/



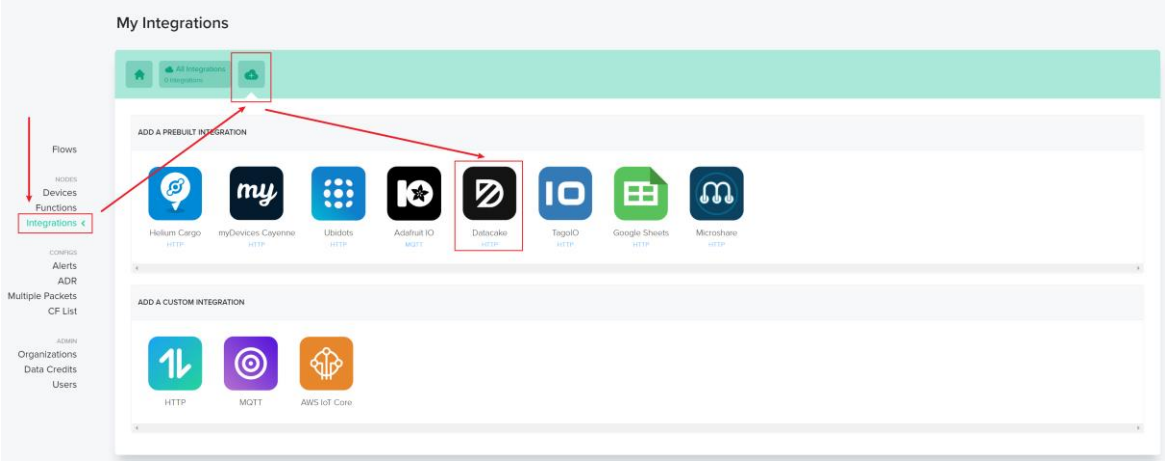

2) Click the “Edit Profile” → “API” → Get API token.



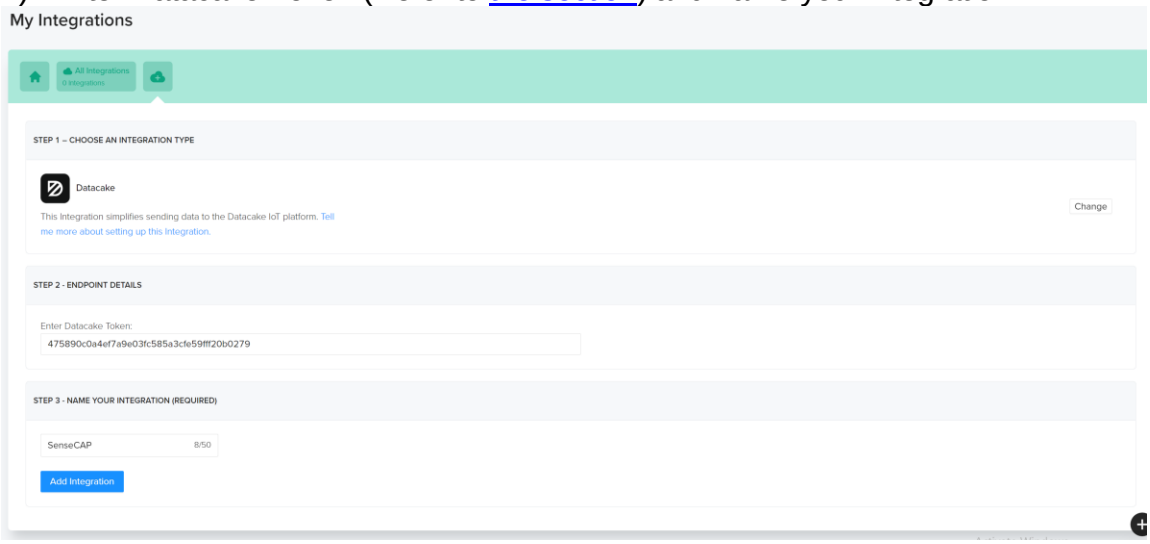




### 7.4.2 Add New Integration on Helium Console

1) Click “Integrations” →”Add New Integration” →”Datacake”.

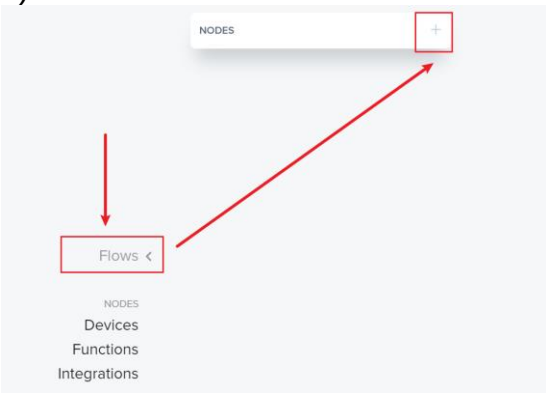



2) Enter Datacake Token (Refer to the section) and name your integration.

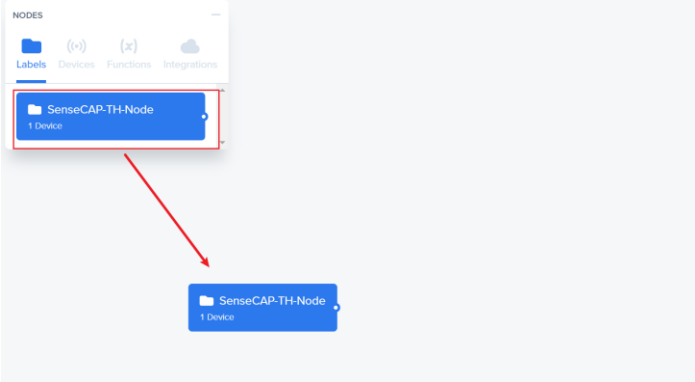



### 7.4.3 Configure the Flows on Helium

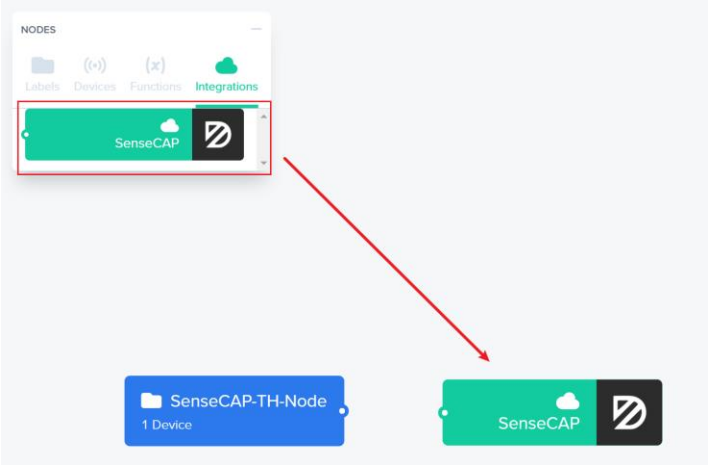
1) Click “Flows”.



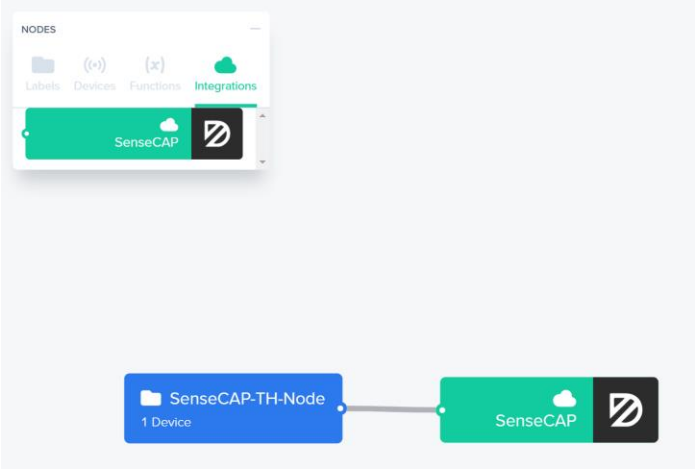

2) Drag the Label into a blank place.



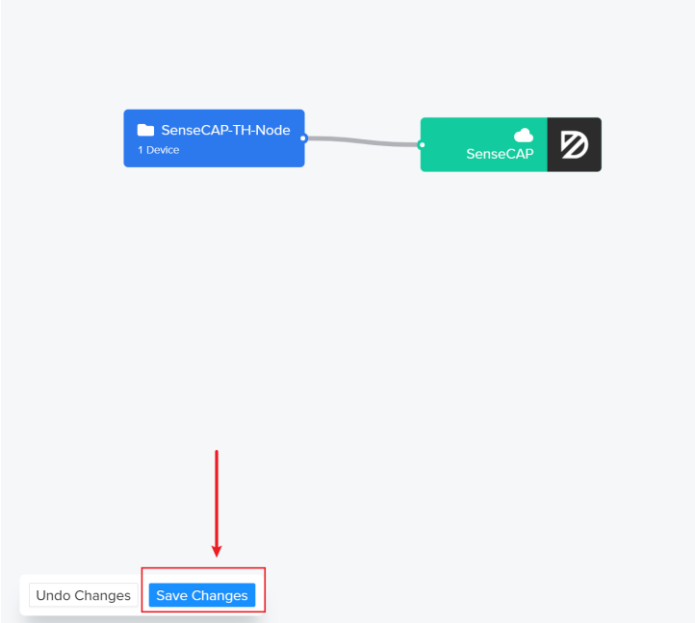

3) Drag the Integration in to a blank place.




4) Connect the two blocks.

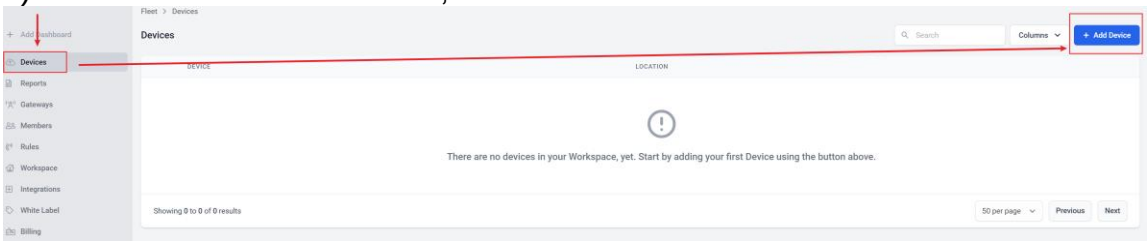



5) Save Changes.

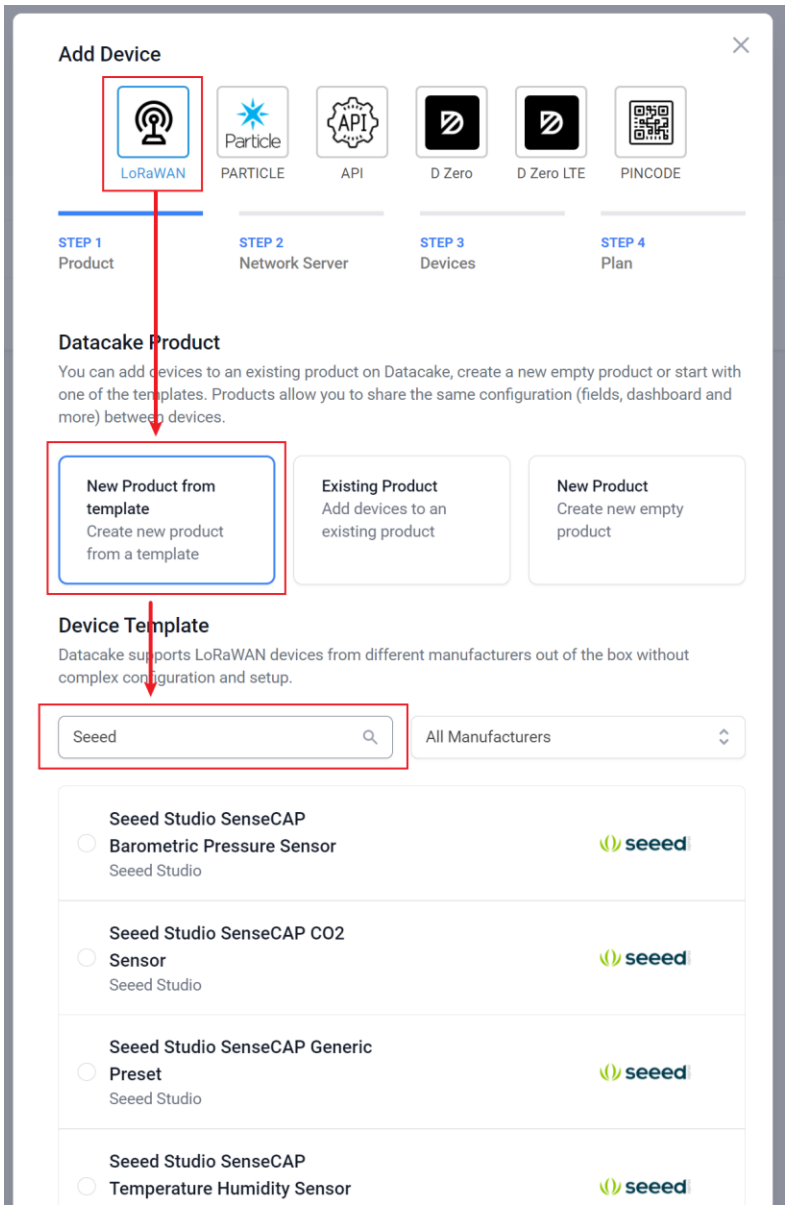



### 7.4.4 Add the Sensor on Datacake

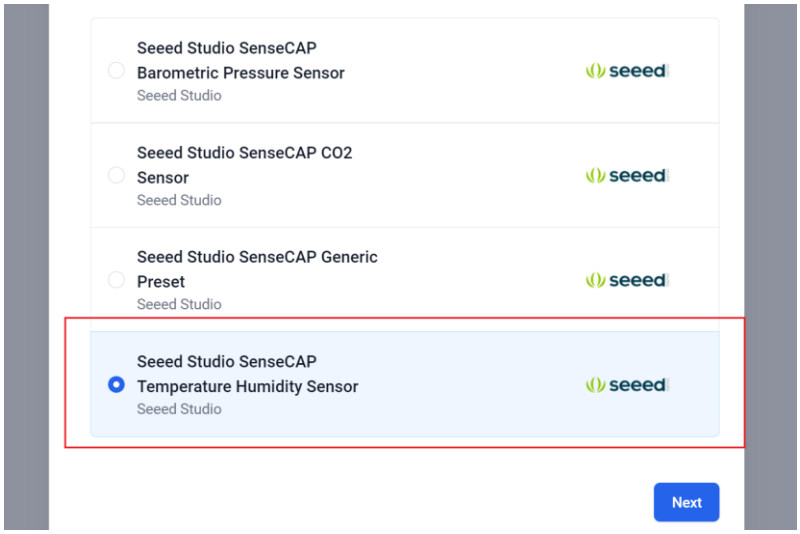
1) Return Datacake Dashboard, and click “Device”→”Add Device”



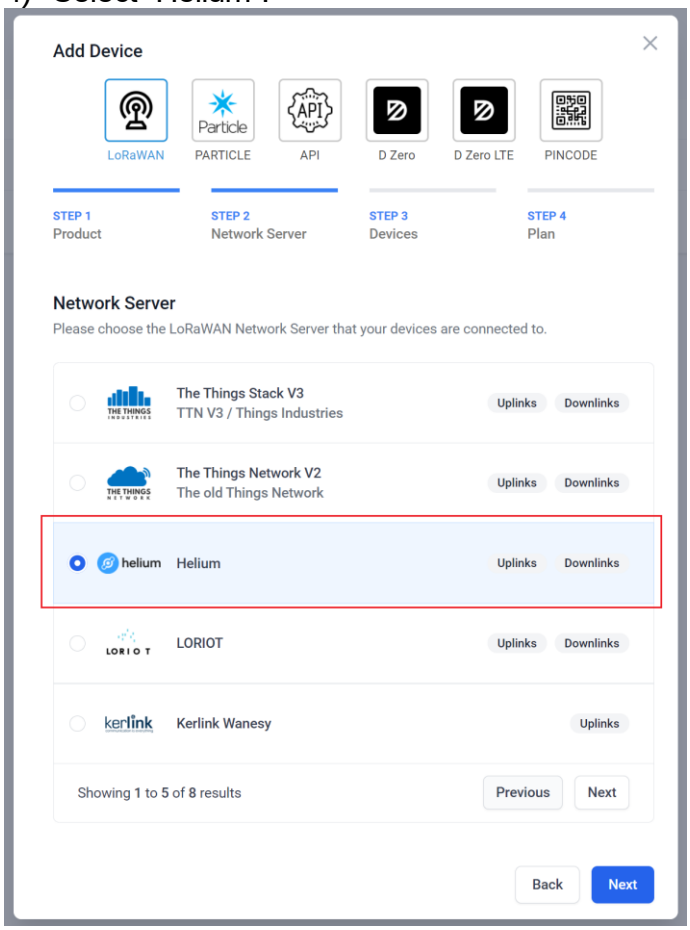

2) Search “Seeed”, You can select some sensors directly.



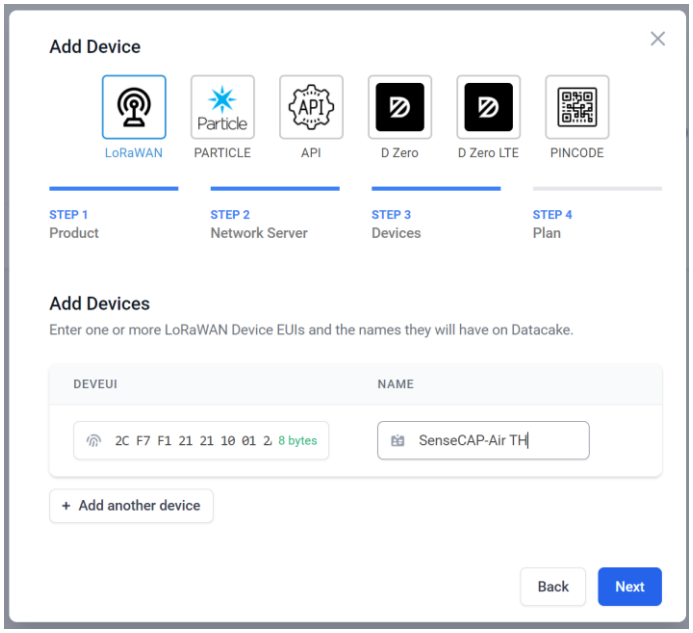

3) Select the Sensor Template.



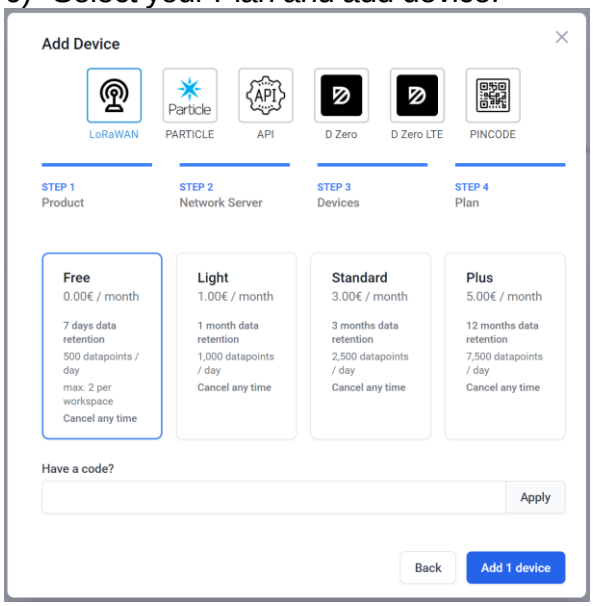

4) Select “Helium”.




5) Enter your Device EUI and Name.

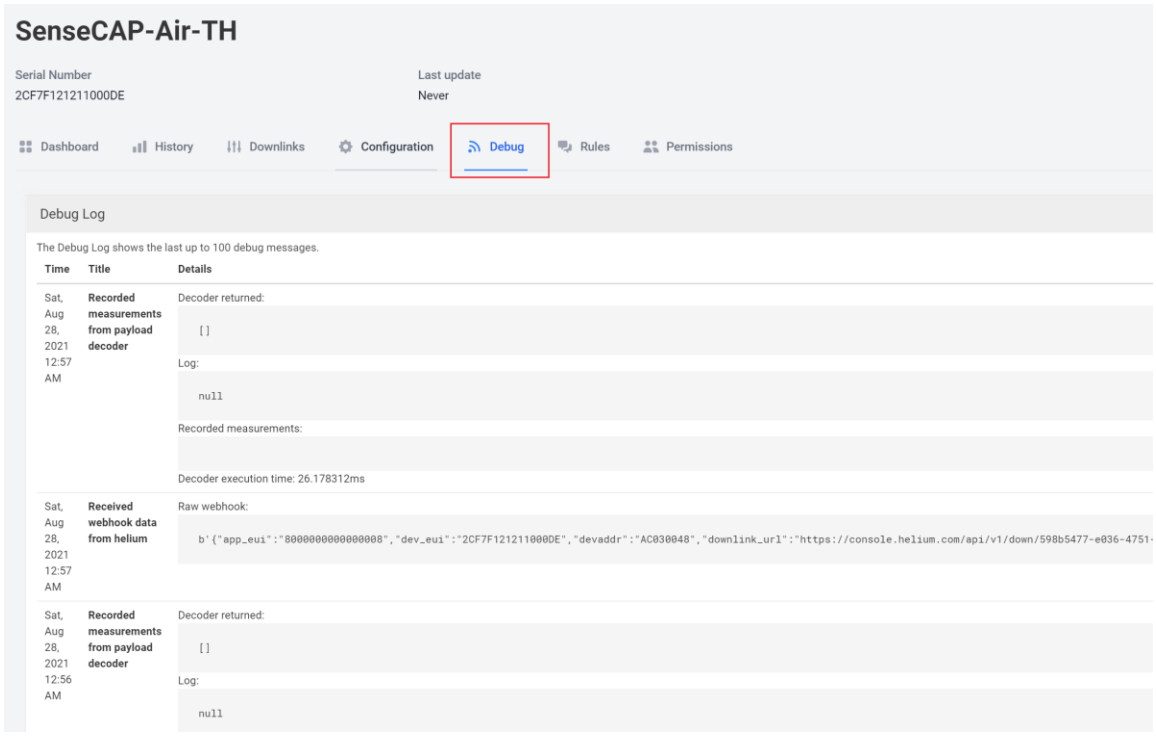


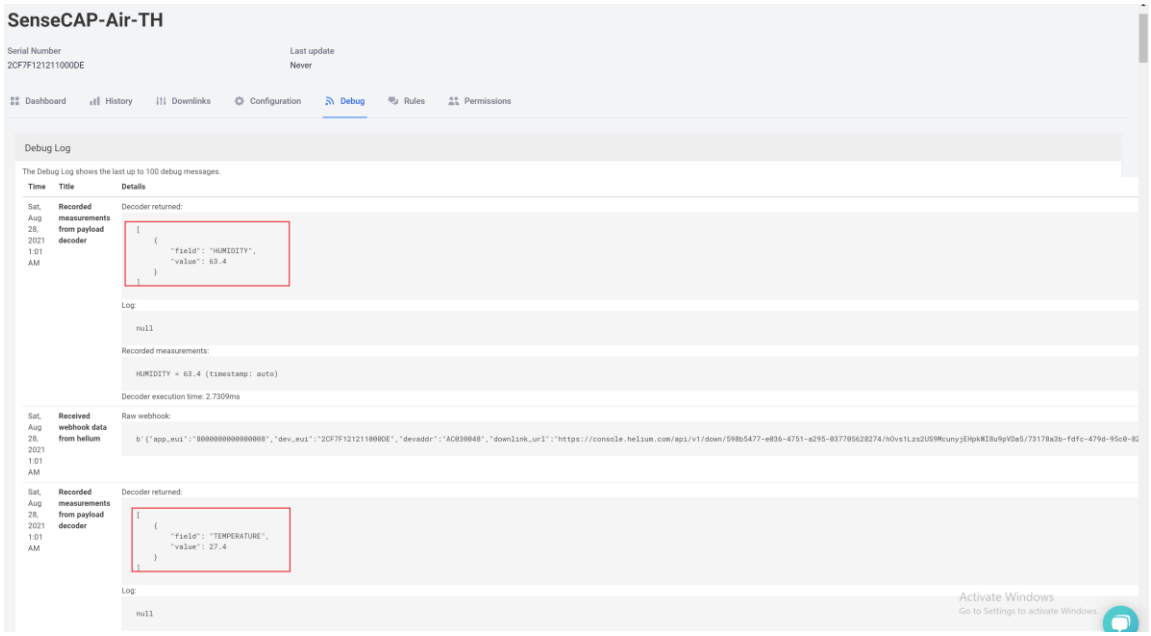

6) Select your Plan and add device.

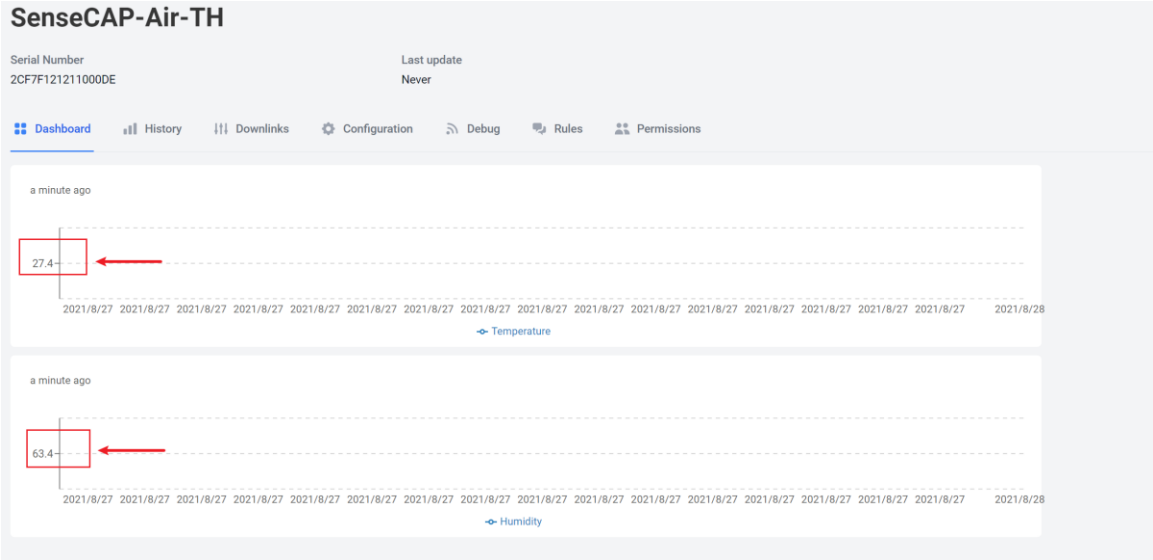



## 7.4.5 Check Data from Datacake

1) Click Debug button, it will display debug log.


SenseCAP-Air-TH
Serial Number
2CF7F121211000DE
Last update
Never
Dashboard
History
Downlinks
Configuration
Debug
Rules
Permissions
Debug Log
The Debug Log shows the last up to 100 debug messages.
Time
Title
Details
Sat, Aug 28, 2021 12:57 AM
Recorded measurements from payload decoder
Decoder returned:
[]
Log:
null
Recorded measurements:
Decoder execution time: 26.178312ms
Sat, Aug 28, 2021 12:57 AM
Received webhook data from helium
Raw webhook:
b'{"app_eui":"8000000000000008","dev_eui":"2CF7F121211000DE","devaddr":"AC030048","downlink_url":"https://console.helium.com/api/v1/down/598b5477-e036-4751-
Sat, Aug 28, 2021 12:56 AM
Recorded measurements from payload decoder
Decoder returned:
[]
Log:
null


SenseCAP-Air-TH
Serial Number
2CF7F121211000DE
Last update
Never
Dashboard
History
Downlinks
Configuration
Debug
Rules
Permissions
Debug Log
The Debug Log shows the last up to 100 debug messages.
Time
Title
Details
Sat, Aug 28, 2021 1:01 AM
Recorded measurements from payload decoder
Decoder returned:
[
{
"field": "HUMIDITY",
"value": 63.4
}
]
Log:
null
Recorded measurements:
HUMIDITY = 63.4 (timestamp: auto)
Decoder execution time: 2.7309ms
Sat, Aug 28, 2021 1:01 AM
Received webhook data from helium
Raw webhook:
Sat, Aug 28, 2021 1:01 AM
Recorded measurements from payload decoder
Decoder returned:
[
{
"field": "TEMPERATURE",
"value": 27.4
}
]
Log:
null
Activate Windows
Go to Settings to activate Windows.


SenseCAP-Air-TH
Serial Number
2CF7F121211000DE
Last update
Never
Dashboard
History
Downlinks
Configuration
Debug
Rules
Permissions
a minute ago
27.4
2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/28
Temperature
a minute ago
63.4
2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/27 2021/8/28
Humidity

# 8. Connect to The Things Network

The Things Network website: https://www.thethingsnetwork.org

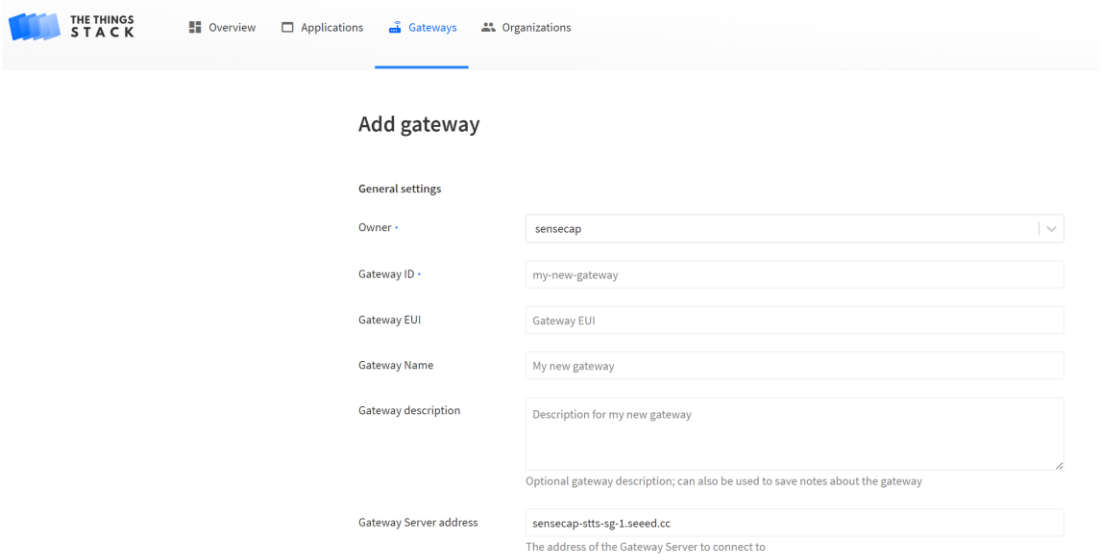
The Things Industries login: https://accounts.thethingsindustries.com/login

TTN Quick Start: https://www.thethingsnetwork.org/docs/quick-start/

## 8.1 Preparation

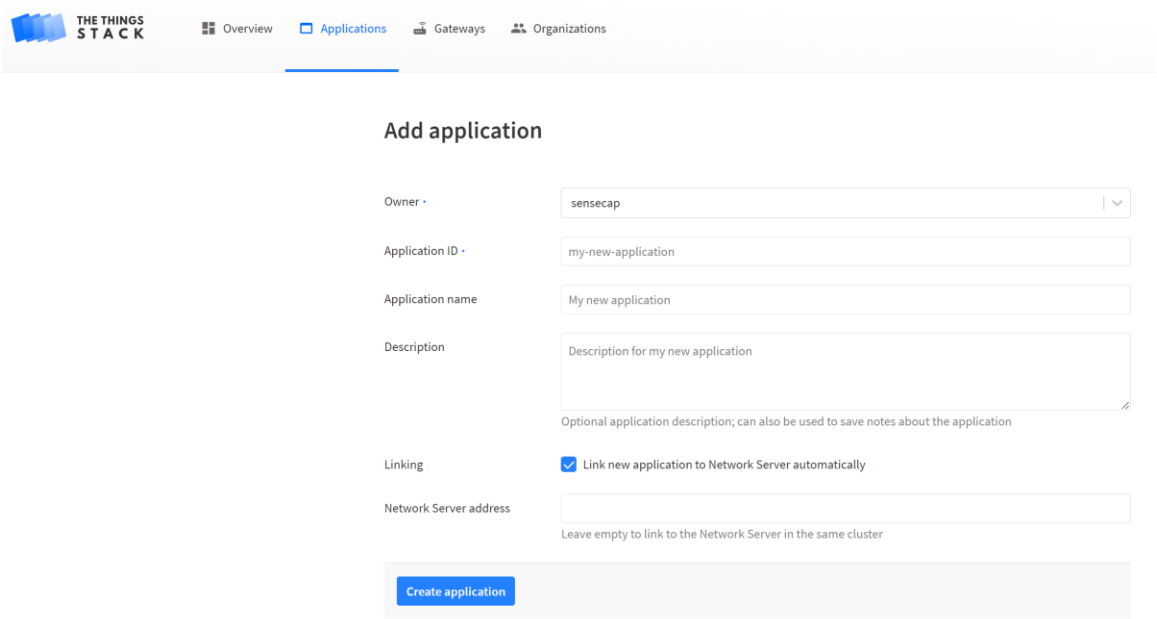
### 8.1.1 Gateway Registration on TTN

Create a Gateway on the TTN console.



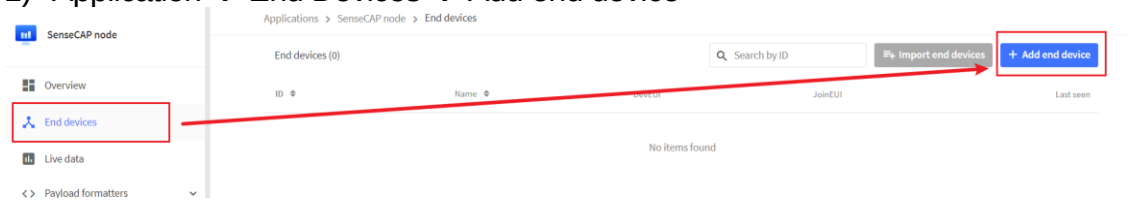

### 8.1.2 Create the Application

Create an application on your TTN console.



## 8.2 Add Sensor to TTN Console

1) Application → End Devices → Add end device



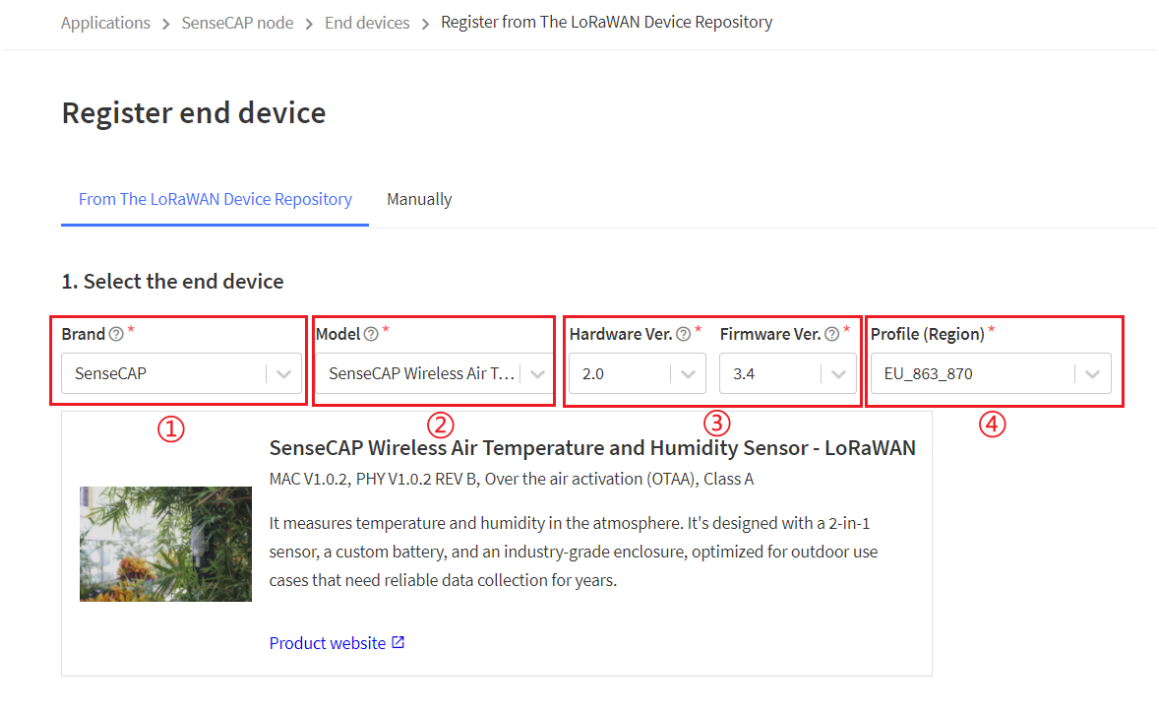

2) Select the end device

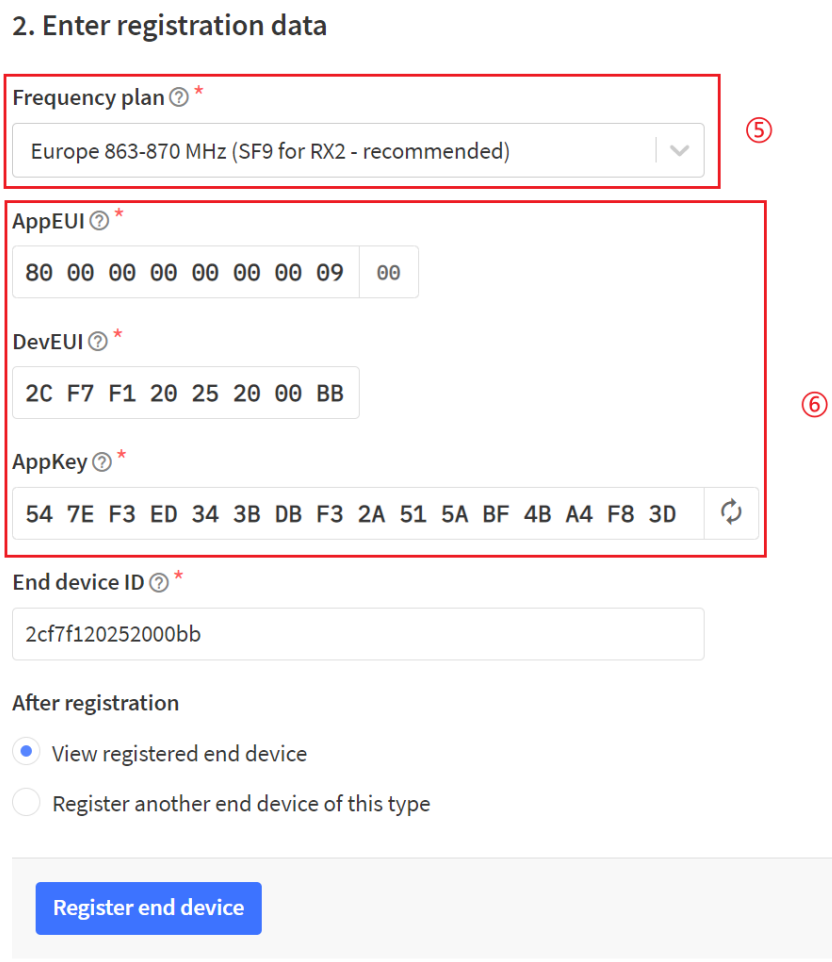
① Brand: SenseCAP

② Model: Select your sensor. (If not, use manual add)

③ Hardware / Firmware Version: Usually choose the latest

④ Device ID: Enter a unique name.





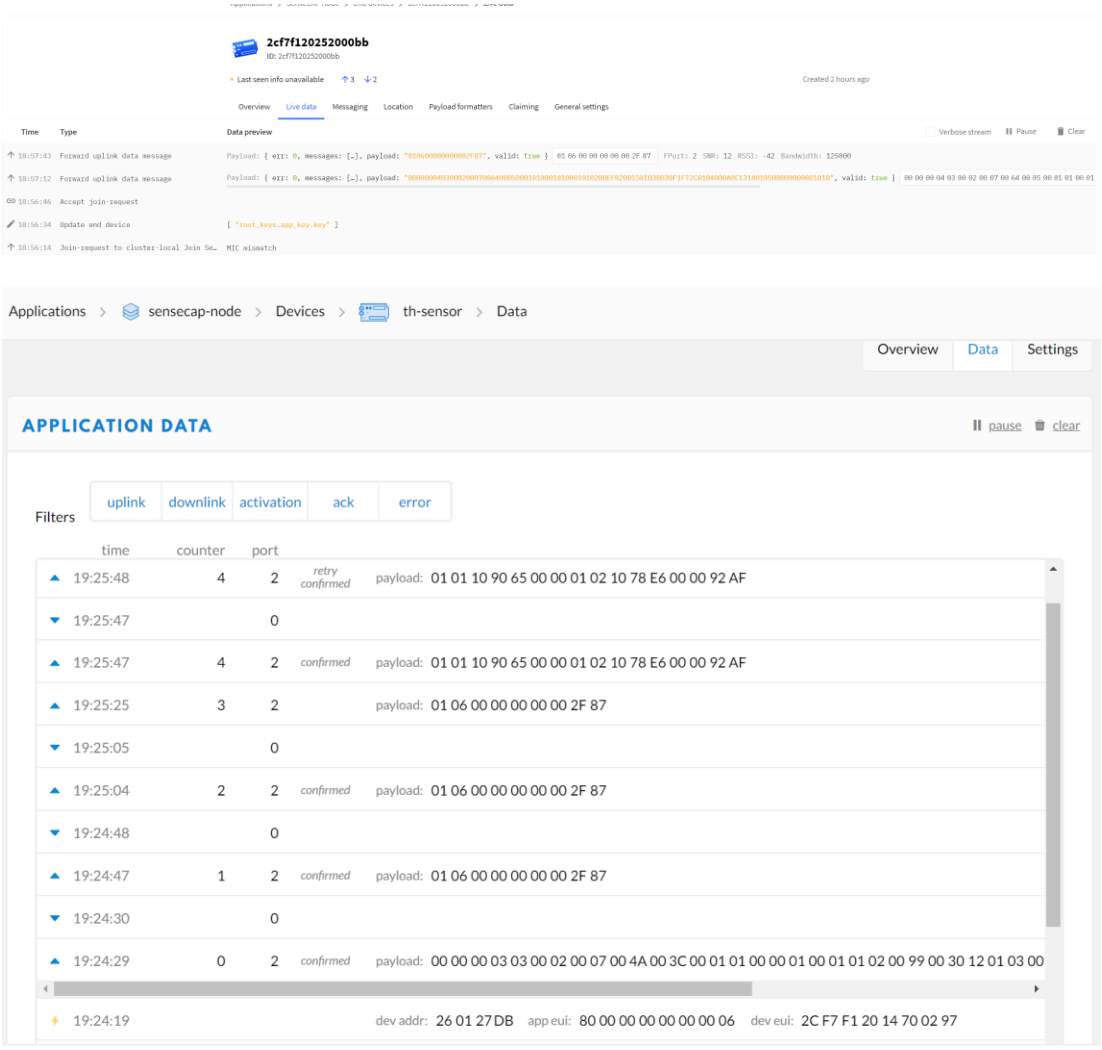

⑤ Frequency plan: Get it from SenseCAP Mate App.

⑥ Device EUI、App EUI、 App Key：Get it from SenseCAP Mate App.

⑦ Register end device.

## 8.3 Check Data on TTN Console

On the Data page, data package is uploaded. For the format of the payload, refer to the section of Payload Decoding.

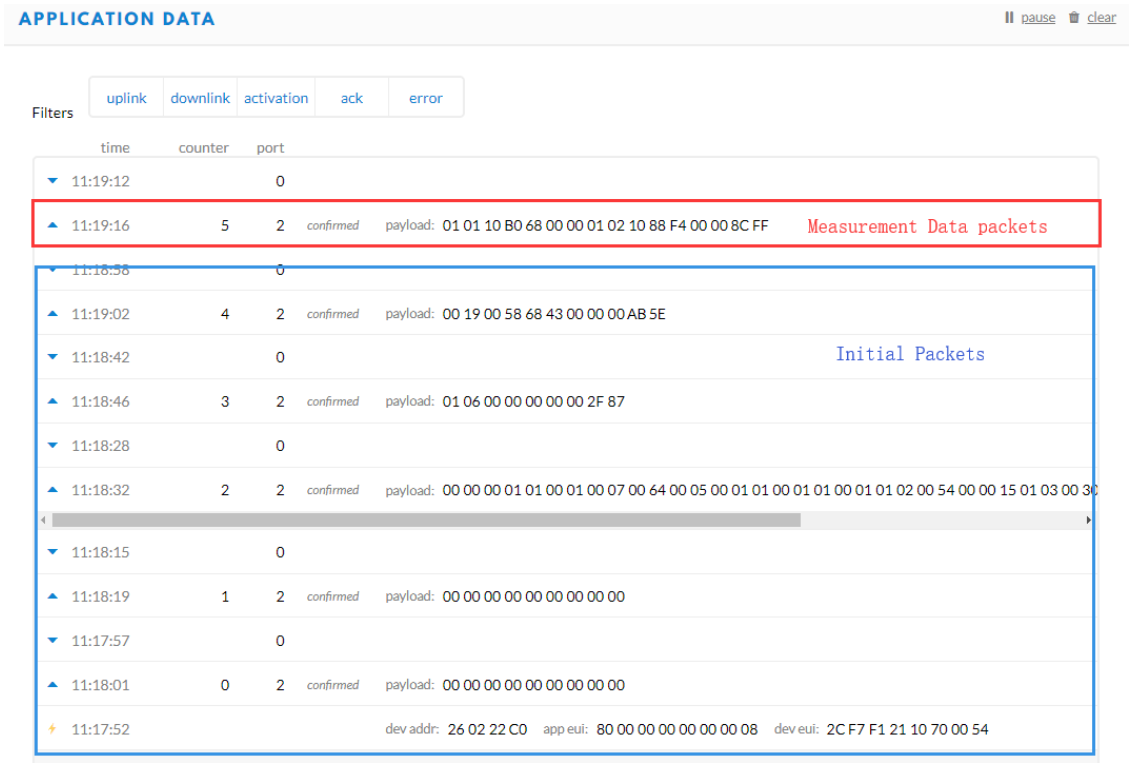


# 9. Payload Decoder

## 9.1 Decoder Code

TTN payload decoding script for SenseCAP LoRaWAN:

https://github.com/Seeed-Solution/TTN-Payload-Decoder/



## 9.2 Packet Parsing

### 9.2.1 Packet Initialization

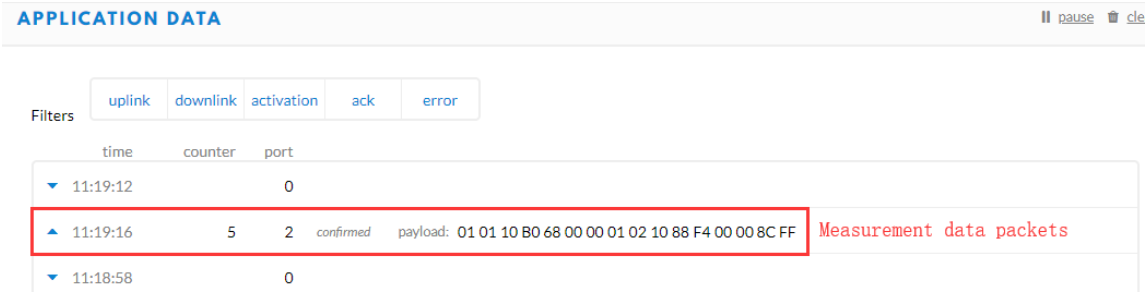
After being powered on or reboot, SenseCAP Sensors will be connected to the network using the OTAA activation method. Each Sensor Node will send data packets to the server, including the following data:

**Initial packets**（no need to learn about these initial packets）

One packet with device info including hardware version, software version, battery level, sensor hardware & software version, sensor EUI, power, and sensor power time counter at each channel.

**Measurement data packets**

The only thing we should pay attention to is the sensor measurement data packets.




**Packet Structure**

The structure of the frame is shown in the image below.

**1 byte for channel**， default as 1, means the sensor has been well connected.

**2 bytes for frame type**, in this case, it will be 0110 and 0210, means temperature value and humidity value

**4 bytes for content**, is the sensor value with CRC

The frame content is sent in **little-endian byte order**.

## 9.3 Data Parsing Example

### 9.3.1 Measurements List

| Measurements | Measurement ID (HEX) | Resolution | Unit |
|---|---|---|---|
| Air Temperature | 0x1001 | 0.01 | ℃ |
| Air Humidity | 0x1002 | 0.01 | %RH |
| Light Intensity | 0x1003 | 1 | Lux |
| CO2 | 0x1004 | 1 | ppm |
| Soil Temperature | 0x1006 | 0.1 | ℃ |
| Soil Moisture | 0x1007 | 0.1 | % |
| Soil EC (Electrical Conductivity) | 0x100C | 0.01 | dS/m |

### 9.3.2 Example – S2101 Air Temperature and Humidity Sensor

Air Temperature and Humidity Sensor measurement packet:

01 0110 B0680000 01 0210 88F40000 8CFF

| Part | Value | Raw Data | Description |
|---|---|---|---|
| 1 | Air Temperature | 01 0110 B0680000 | 01 is the channel number.<br><br>0110 is 0x1001 (little-endian byte order), which is the measurement ID for air temperature.<br><br>B0680000 is actually 0x000068B0, whose equivalent decimal value is 26800. Divide it by 1000, and you will get the actual measurement value for air temperature as 26.8℃. |
| 2 | Air Humidity | 01 0210 88F40000 | 01 is the channel number.<br><br>0210 is 0x1002 (little-endian byte order), which is the measurement ID for air humidity.<br><br>88F40000 is actually 0x0000F488, whose equivalent decimal value is 62600. Divide it by 1000, and you will get the actual value for air humidity as 62.6%RH. |
| 3 | CRC | 8CFF | The CRC verification part. |

### 9.3.1 Example – S2102 Light Intensity Sensor

Light Intensity Sensor measurement packet:

01 0310 A8550200 E3E9

| Part | Value | Raw Data | Description |
|---|---|---|---|
| 1 | Light Intensity | 01 0310 A8550200 | 01 is the channel number.<br><br>0310 is 0x1003（little-endian byte order）, which is the measurement ID for Light Intensity.<br><br>A8550200 is actually 0x000255A8, whose equivalent decimal value is 153000. Divide it by 1000, and you'll get the actual measurement value for Light Intensity as 153 Lux. |
| 3 | CRC | E3E9 | The CRC verification part. |

### 9.3.2 Example – S2103 CO2, Temperature and Humidity Sensor

CO2, Temperature and Humidity Sensor measurement packet:

01 0410 80140700 01 0110 F4650000 01 0210 7C7D0100 3C4D

| Part | Value | Raw Data | Description |
|---|---|---|---|
| 1 | CO2 | 01 0410 80140700 | 01 is the channel number.<br><br>0410 is 0x1004（little-endian byte order）, which is the measurement ID for CO2.<br><br>80140700 is actually 0x00071480, whose equivalent decimal value is 464000. Divide it by 1000, and you will get the actual measurement value for CO2 as 464 ppm. |
| 2 | Air Temperature | 01 0110 F4650000 | 01 is the channel number.<br><br>0110 is 0x1001（little-endian byte order）, which is the measurement ID for air temperature.<br><br>F4650000 is actually 0x000065F4, whose equivalent decimal value is 26100. Divide it by 1000, and you will get the actual measurement value for air temperature as 26.1 ℃. |
| 3 | Air Humidity | 01 0210 7C7D0100 | 01 is the channel number.<br><br>0210 is 0x1002 (little-endian byte order), which is the measurement ID for air humidity.<br><br>7C7D0100 is actually 0x00017D7C, whose equivalent decimal value is 97660. Divide it by 1000, and you will get the actual measurement value for air humidity as 97.66 %RH. |
| 4 | CRC | 3C4D | The CRC verification part. |

### 9.3.3 Example – S2104 Soil Moisture and Temperature Sensor

Soil Moisture and Temperature Sensor measurement packet:

01 0610 245E0000 01 0710 BCB10000 A3D9

| Part | Value | Raw Data | Description |
|---|---|---|---|
| 1 | Soil Temperature | 01 0610 245E0000 | 01 is the channel number.<br><br>0610 is 0x1006（little-endian byte order）, which is the measurement ID for soil temperature.<br><br>245E0000 is actually 0x00005E24, whose equivalent decimal value is 24100. Divide it by 1000, and you will get the actual measurement value for soil temperature as 24.1℃. |
| 2 | Soil Moisture | 01 0710 BCB10000 | 01 is the channel number.<br><br>0710 is 0x1007 (little-endian byte order), which is the measurement ID for soil moisture.<br><br>BCB10000 is actually 0x0000B1BC, whose equivalent decimal value is 45500. Divide it by 1000, and you will get the actual measurement value for soil moisture as 45.5％RH. |
| 3 | CRC | A3D9 | The CRC verification part. |

### 9.3.4 Example – S2105 Soil Moisture, Temperature and EC Sensor

Soil Moisture, Temperature and EC Sensor measurement packet:

01 0610 5C5D0000 01 0710 48A30000 01 0C10 B4000000 DD0A

| Part | Value | Raw Data | Description |
|---|---|---|---|
| 1 | Soil Temperature | 01 0610 5C5D0000 | 01 is the channel number.<br><br>0610 is 0x1006（little-endian byte order）, which is the measurement ID for soil temperature.<br><br>5C5D0000 is actually 0x00005D5C, whose equivalent decimal value is 23900. Divide it by 1000, and you will get the actual measurement value for soil temperature as 23.9℃. |
| 2 | Soil Moisture | 01 0710 48A30000 | 01 is the channel number.<br><br>0710 is 0x1007 (little-endian byte order), which is the measurement ID for soil moisture.<br><br>48A30000 is actually 0x0000B1BC, whose equivalent decimal value is 45500. Divide it by 1000, and you will get the actual measurement value for soil moisture as 45.5%RH. |
| 3 | Soil Electrical Conductivity | 01 0C10 B4000000 | 01 is the channel number.<br><br>0C10 is 0x100C (little-endian byte order), which is the measurement ID for soil EC.<br><br>B4000000 is actually 0x000000B4, whose equivalent decimal value is 180. Divide it by 1000, and you will get the actual measurement value for soil EC as 0.18 dS/m. |
| 4 | CRC | DD0A | The CRC verification part. |

## 9.4 Battery Information

Please note the counter number. After 20 packets, it will follow one special packet with battery info.

You can either ignore this packet or get rid of the battery info in your code.

Original Info:

00070064000500010610B45F0000010710A41F00003259

Battery Package: 00070064000500

**Example:**

Battery & Soil Moisture and Temperature Sensor(S2104) measurement packet:

00070064000500010610B45F0000010710A41F00003259

| Part | Value | Raw Data | Description |
|---|---|---|---|
| 1 | Battery | 00 0700 6400 0500 | 00 is the channel number.<br>0700 is 0x0007 (little-endian byte order), which is the measurement ID for battery.<br>6400 is 0x0064 (little-endian byte order), whose equivalent decimal value is 100. Battery level is 100%.<br>0500 is 0x0005 (little-endian byte order), whose equivalent decimal value is 5. Upload interval is 5 minutes. |
| 2 | Soil Temperature | 01 0610 B45F0000 | 01 is the channel number.<br>0610 is 0x1006 (little-endian byte order), which is the measurement ID for soil temperature.<br>B45F0000is actually 0x00005FB4, whose equivalent decimal value is 24500. Divide it by |

| | | | |
|---|---|---|---|
| | | | 1000, and you will get the actual measurement value for soil temperature as 24.5℃. |
| 3 | Soil Moisture | 01 0710 A41F0000 | 01 is the channel number.<br><br>0710 is 0x1007 (little-endian byte order), which is the measurement ID for soil moisture.<br><br>A41F0000 is actually 0x00001FA4, whose equivalent decimal value is 8100. Divide it by 1000, and you will get the actual measurement value for soil moisture as 8.1% RH. |
| 4 | CRC | 3259 | The CRC verification part. |

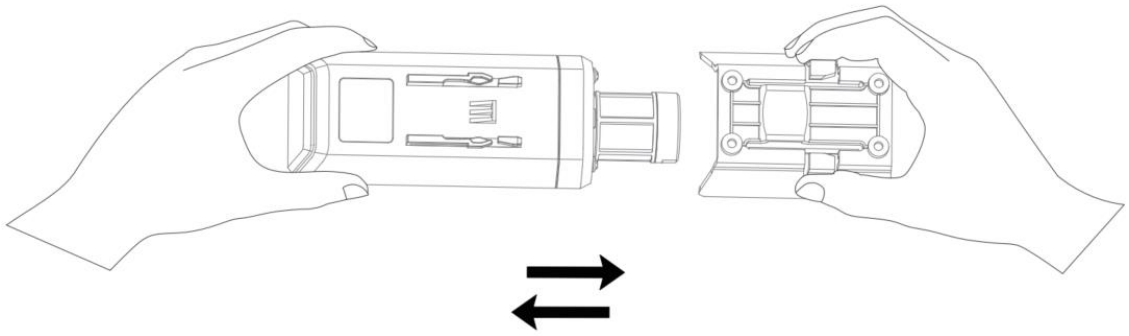
# 10. Device Installation

## 10.1 Installing Sensor

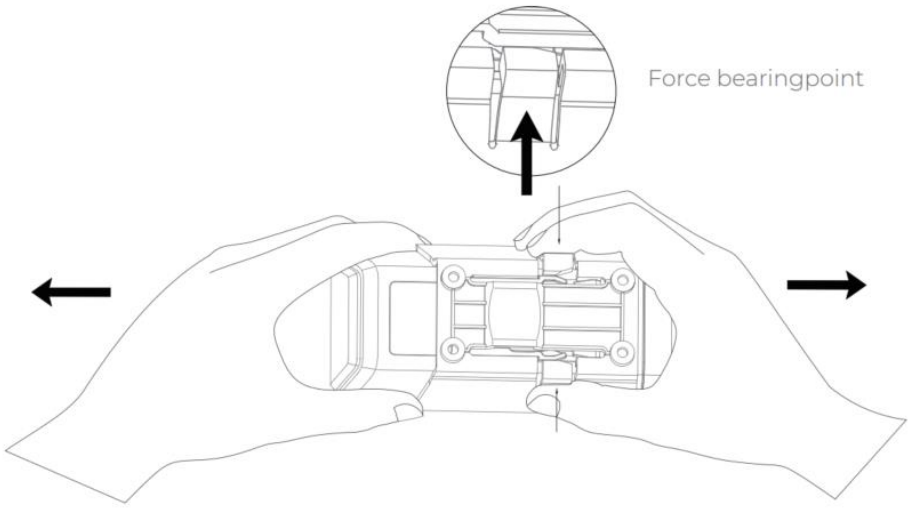
### 10.1.1 Installing the Sensor Bracket

Specially designed for installing SenseCAP Sensors, the bracket is a sliding cap. With designated screw-holes, the bracket helps fasten the Sensor Node firmly onto a pole or a wall.

1) With the sensor in one hand and a bracket in the other, find an unobstructed direction along the back of the sensor.

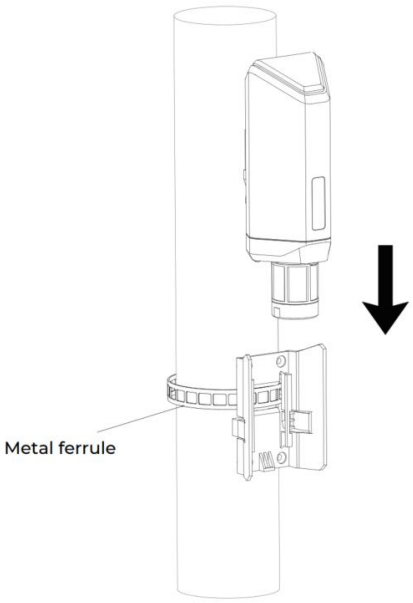


2) One hand holds the clasp while the other holds the device. Pull outward with opposite force. Press the upper part of the buckle with your finger.\

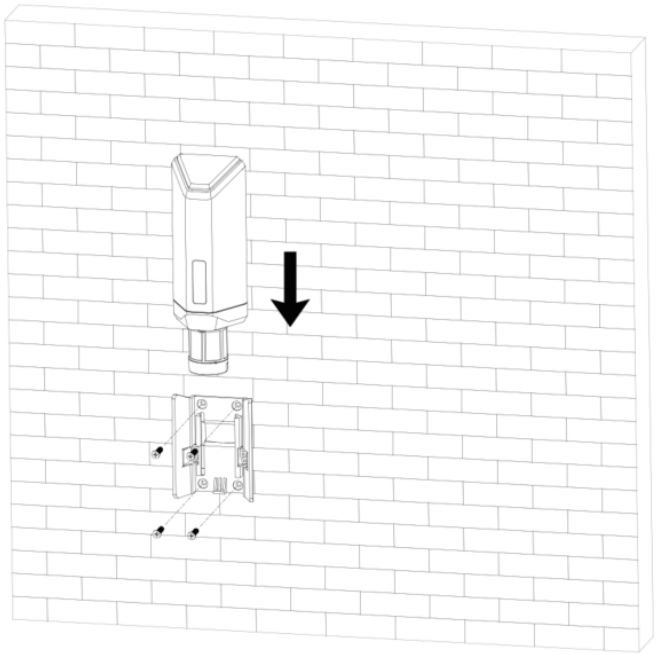



### 10.1.1 Mount on Pole and Wall

1) Mount on pole




2) Mount on wall



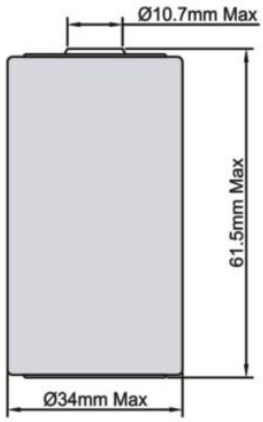
## 10.2 Replace the Battery

### 10.2.1 How to Buy the Battery

We suggest buying it from Amazon.

1) EEMB ER34615: Click here

2) Search the key word: LiSOCI2 ER34615 battery. Compare the batteries that meet the following parameters. The most important thing is to match the voltage.

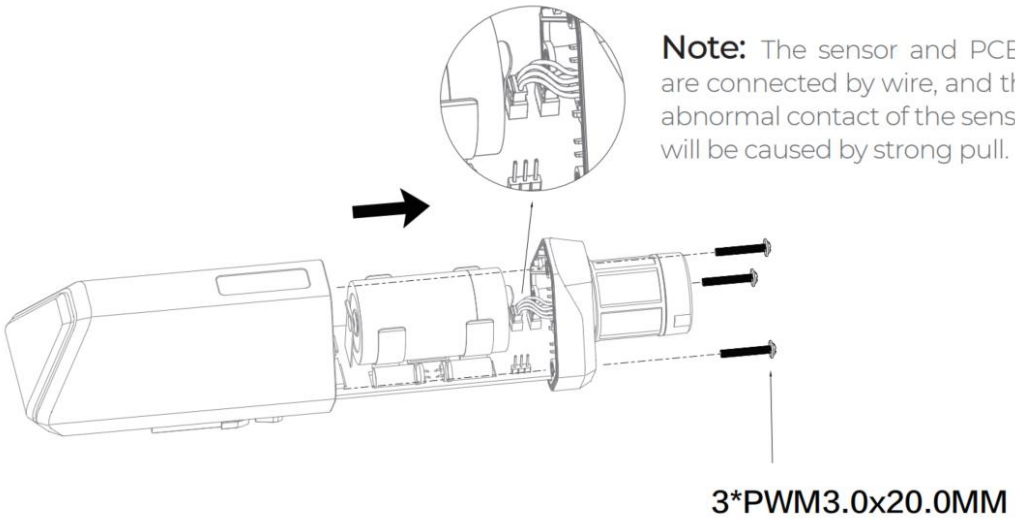
| Battery Specification | |
|---|---|
| Nominal capacity | 19000mAh |
| Model | Li-SOCl2, ER34615 |
| Nominal voltage | 3.6V |
| Max. continuous current | 230mA |
| Max. pulse current capability | 400mA |
| Dimension | ⌀ 34.0*61.5mm (D size)<br>  |
| Operating temperature range | -60℃ to 85℃ |

### 10.2.2 How to Replace a New Battery

1) Remove three screws.

⚠***Note:***

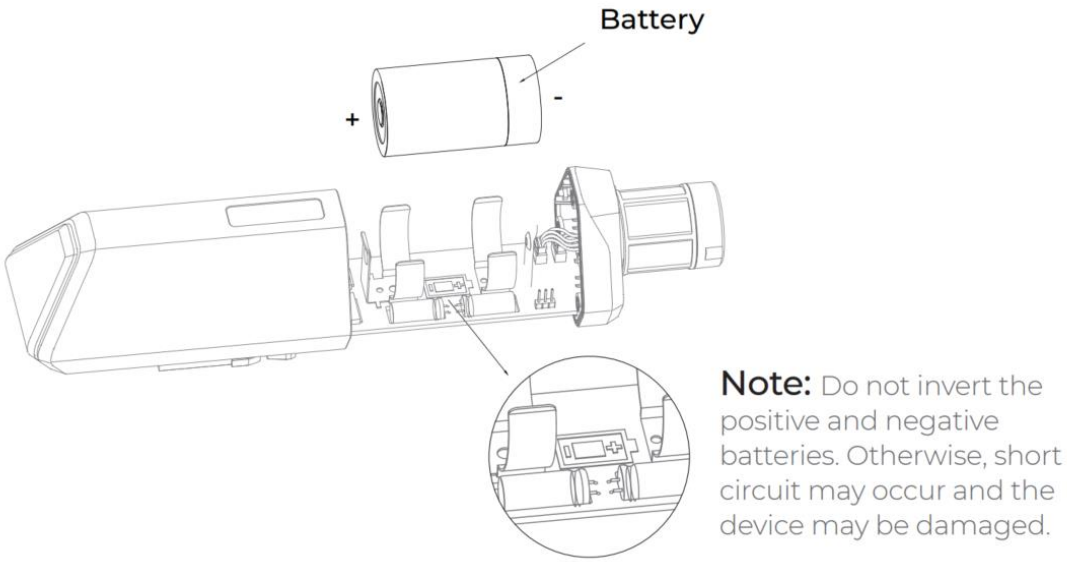
*The sensor and PCBA are connected by wire, please disassemble carefully.*



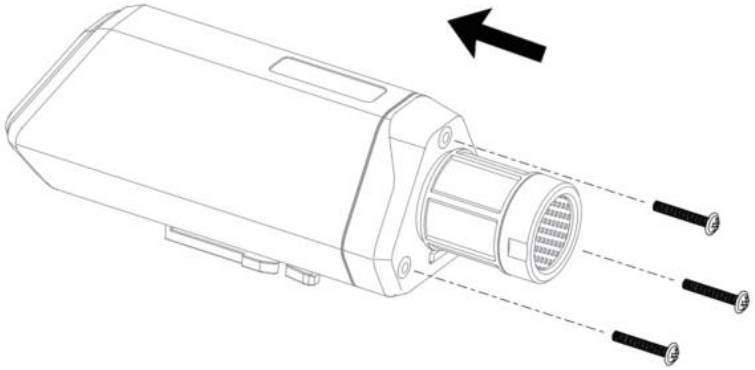

2) Install a new battery.

⚠***Note:***

*Pay attention to the positive and negative terminals of the battery.*




3) Install screws.



⚠***Note:***

*During the installation, ensure that the waterproof washer is properly installed and the screws are locked; otherwise, water will flow into the device.*

# 11. Trouble Shooting

## 11.1 Support

Support is provided Monday to Friday, from 09:00 to 18:00 GMT+8. Due to different time zones, we cannot offer live support. However, your questions will be answered as soon as possible in the before-mentioned schedule.

Provide as much information as possible regarding your enquiry (product models, accurately describe your problem and steps to replicate it etc.) and send a mail to: sensecap@seeed.cc

## 11.2 Document Version

| Version | Date | Description | Editor |
|---|---|---|---|
| V1.0.0 | 5/01/2022 | First edition | Jenkin Lu |