THE NEW GENERATION LORAWAN SENSORS OF SENSECAP

SenseCAP A1101

LoRaWAN Vision AI Sensor

User Guide

Version: v1.0.6

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1. Product Introduction

1.1 Overview

SenseCAP A1101 LoRaWAN Vision AI Sensor combines TinyML AI technology and LoRaWAN long-range transmission to enable a low-power, high-performance AI device solution for both indoor and outdoor use.

This sensor features Himax's high-performance, low-power AI vision solution which supports the Google TensorFlow Lite framework and multiple TinyML AI platforms.

Different models can implement different AI functions, for example, people counting, object recognition, meter recognition, etc. Users can adopt models provided by native firmware, or train and generate their own models through AI training tools, or procure deployable, commercial models from third-party model providers.

With the IP66 rating, -40 ~ +85C ° operating temperature, built-in 19Ah high-capacity battery and devices' low power consumption, the A1101 sensor 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.

1.2 Features

• **Ultra-Low Power and Powerful Himax Camara**: 400Mhz DSP, Maximum camera frame rate 640*480*VGA 60 FPS, Local inferencing

• **Low Power and Long Range Transmission:** Down to 2.3uWh sleep mode power consumption, powered by Wio-E5 LoRaWAN Modules, transfers data up to miles

• **High Data Security by Edge Computing:** Local image inferencing and transfers the final result data to the Cloud, suitable for applications that require limited data transmission and high data privacy.

• **Easy to Visualize Data:** Few clicks to display and manage data via SenseCAP Mate App and SenseCAP Dashboard, wide compatibility with other third-party tools

• **High Industrial Protection Grade**: -40 ~ 85℃ operating temperature and IP66 rating, suitable for indoor and outdoor deployment

• **Easy for Scalable Deployment:** 1min to add and configure the device by scanning the device QR code, low LoRaWAN network cost and maintenance cost ensure business scalability.

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

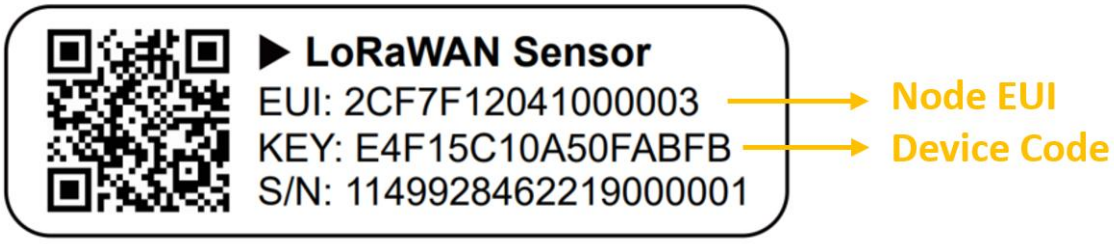
Using the LoRaWAN protocol generally involves the following parameters.

Parameters	Description
LoRaWAN MAC Version	v1.0.4
Join Type	OTAA (Default) 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
}
```


⚠***Note1:***

The SenseCAP LoRaWAN Sensor can modify to EUI, Key, and Frequency. Please refer to the following sections.

⚠***Note2:***

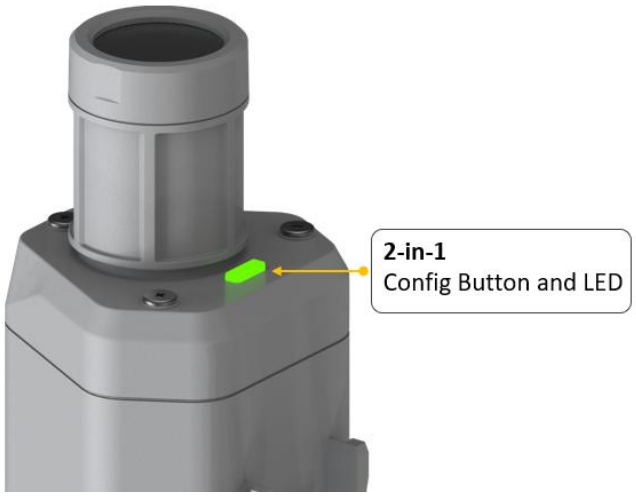
When connecting to SenseCAP, use the default EUI, App EUI and App Key. When using another LoRa network server, the EUI will not change, and

the App EUI and App Key will be randomly generated according to the rules.

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, waiting for Bluetooth connection. If Bluetooth not connected within 1 minute, the machine will shut down again.
Press once	Reboot device and join LoRa network	1. The LED will be on for 15 seconds for initialization 2. Waiting for join LoRa network: breathing light flashing 3. Join LoRa network success: LED flashes fast for 2s 4. LoRa network join

		failure: LED suddenly stop.
Press and hold for 3s	Activate Bluetooth again	1. Waiting for Bluetooth connection: LED flashes at 1s frequency 2. Enter configuration mode after Bluetooth connection is successful: LED flashes at 2s frequency If Bluetooth is not connected within 1 minute, the device will reboot and join LoRa network.
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 configurate 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. (Done)

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.

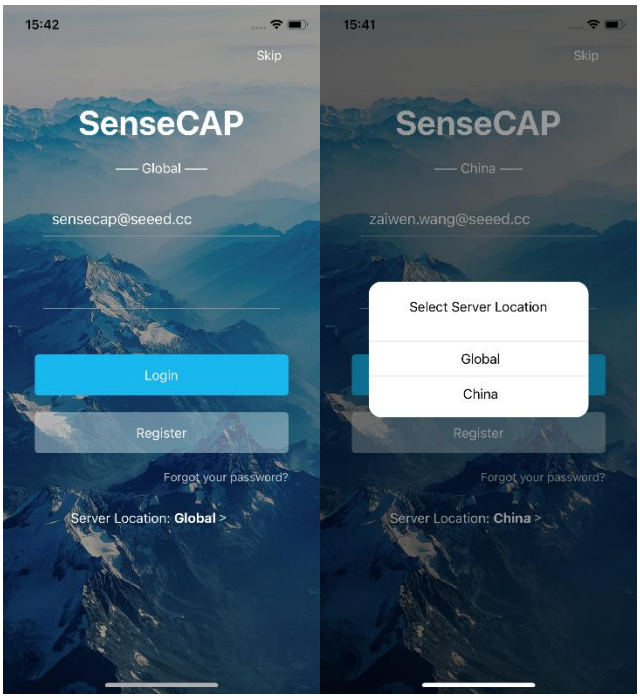
You can also download App from https://www.pgyer.com/sensecapmate or https://install.appcenter.ms/orgs/seeed/apps/sensecap-mate/distribution_groups/public

5.2 How to connect sensor to App

5.2.1 Create a New Account

SenseCAP Mate supports device configuration and remote management. To use the SenseCAP Portal platform and other functions, please register an account. If only the device configuration function is used, click "Skip".

Please select **Global** of Server Location.



You can also set up an account through the website.

Portal Website: 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.

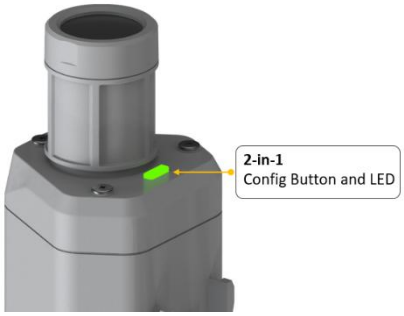
3) Return to the login interface and complete the login.

⚠***Note:***

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

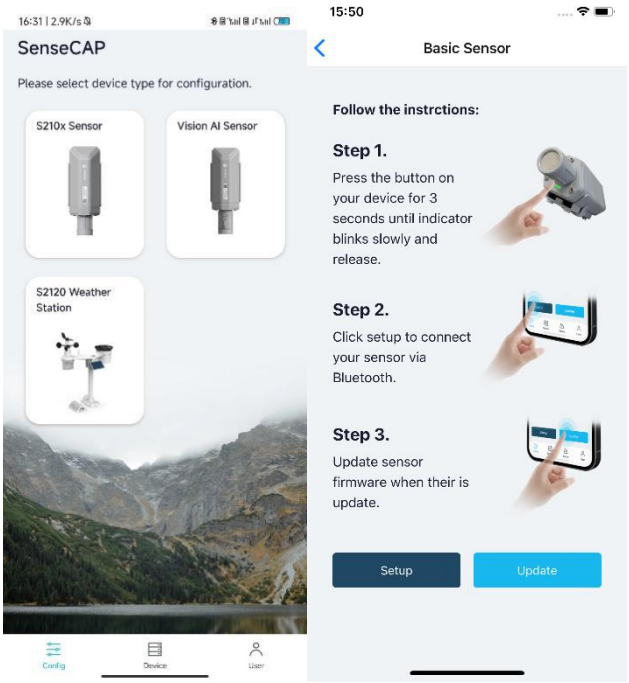
5.2.2 Connect to Sensor to App

1) Press button and hold for **3 seconds**, the LED will flash at 1s frequency. Please use the App to connect the sensor within 1 minute; otherwise, the device will power off or re.

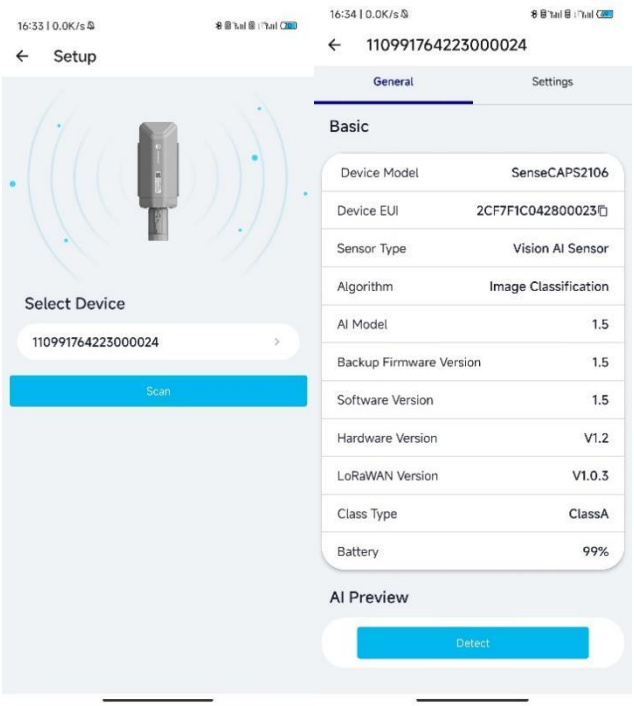


2) Please select “Vision AI Sensor”.

   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 (S/N is on the front label of the sensor). Then, the basic information of the sensor will be displayed after entering.

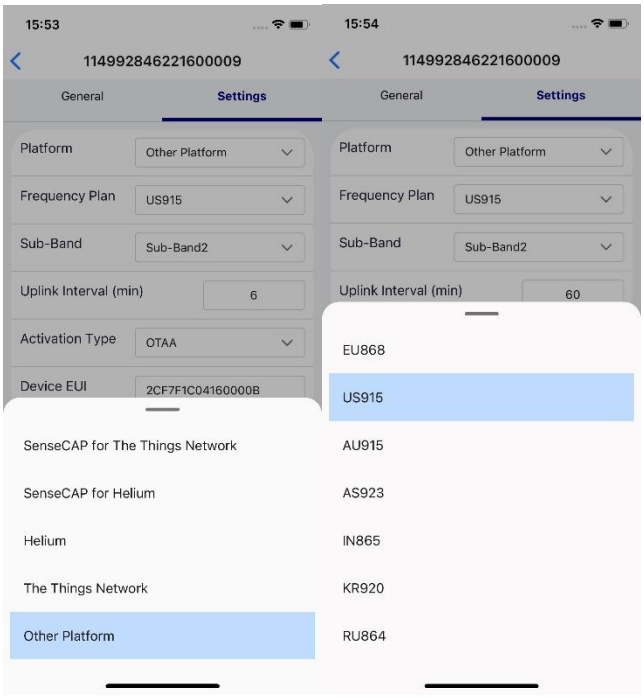


4) Enter configuration mode after Bluetooth connection is successful: LED flashes at 2s frequency.

5.3 Configure parameters through App

5.3.1 Select the Platform and Frequency

A1101 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.



Platform	Description
SenseCAP for The Things Network	It must be used with SenseCAP Outdoor Gateway (https://www.seeedstudio.com/LoRaWAN-Gateway-EU868-p-4305.html). SenseCAP builds a proprietary TTN server that enables sensors to be used out of the box when paired with an SenseCAP outdoor gateway.
SenseCAP for Helium	**Default platform.** When there is the Helium network around the user, data can be uploaded using sensors. Devices run on a private Helium console of SenseCAP. Users do not need to create devices on Helium console, right out of the box.
Helium	Connect Sensor to public Helium console.
The Things Network	Connect Sensor to your TTN(TTS) server.
Other Platform	Other LoRaWAN Network Server.

1) SenseCAP for Helium:

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

We built a private Helium Console with an embedded SenseCAP Portal. When users get the SenseCAP sensors, you can use it by scanning the code and binding it to the Portal.

"SenseCAP for Helium" is selected by default. The device runs in a fixed main frequency and sub-band, refer to Helium Frequency Plan (https://docs.helium.com/lorawan-on-helium/frequency-plans/). You only need to select the main frequency, such as EU868 and US915.

SenseCAP for Helium supports the following frequency plan:

EU868 / US915 / AU915 / KR920 / IN865 / AS923-1 / AS923-2 / AS923-3 / AS923-4

2) SenseCAP for The Things Network

SenseCAP Portal also builds the TTN private server, and the sensor must be used together with the SenseCAP Outdoor Gateway (*https://www.seeedstudio.com/LoRaWAN-Gateway-EU868-p-4305.html*) *or* SenseCAP Multi-Platform LoRaWAN Indoor Gateway (*https://www.seeedstudio.com/SenseCAP-Multi-Platform-LoRaWAN-Indoor-Gateway-SX1302-EU868-p-5471.html*).

SenseCAP Multi-Platform LoRaWAN Indoor Gateway supports the following frequency plans:

IN865 / EU868 / RU864 / US915 / AU915 / KR920 / AS923.

3) Helium

Users can choose sensors to use on the public helium console:

https://console.helium.com/

4) The Things Network

Users can choose sensors to use on the public The Things Network server:

https://console.cloud.thethings.network/

5) Other Platform:

When you use 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.

A1101 Sensors support the following frequency plan:

Sensor 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-TTN	Frequency plan for TTN
	AS923-1	Frequency plan for Helium
	AS923-2	
	AS923-3	
	AS923-4	
RU864-867	RU864	--------

⚠ ***Note1:***

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/

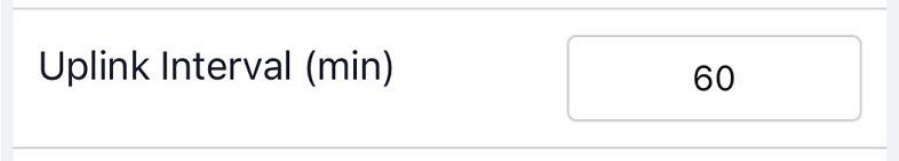
⚠ ***Note2:***

1) *When using the SenseCAP platform, the EUI, APP EUI and APP Key are fixed and are the same as the sensor label.*
2) *When the sensor is selected to be used with a public platform such as Helium or TTN, the EUI will not change, and the sensor will generate a new fixed App EUI and App Key for network access.*

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**.

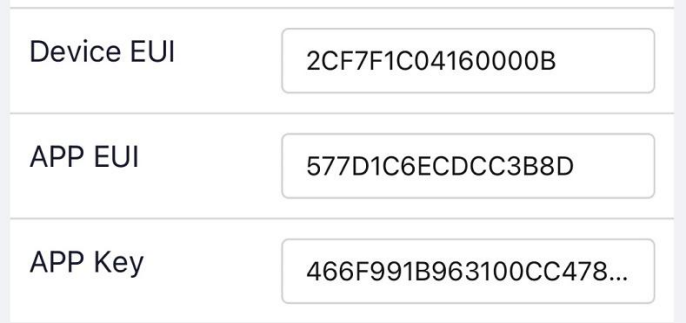
Parameter	Type
Uplink Interval	Unit: minutes, number from 1 to 1440.



5.3.3 Set the EUI and Key

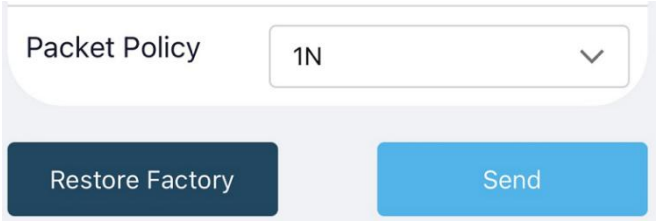
The device uses OTAA to join the LoRaWAN network by default. So, it can set the device EUI and App EUI.

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

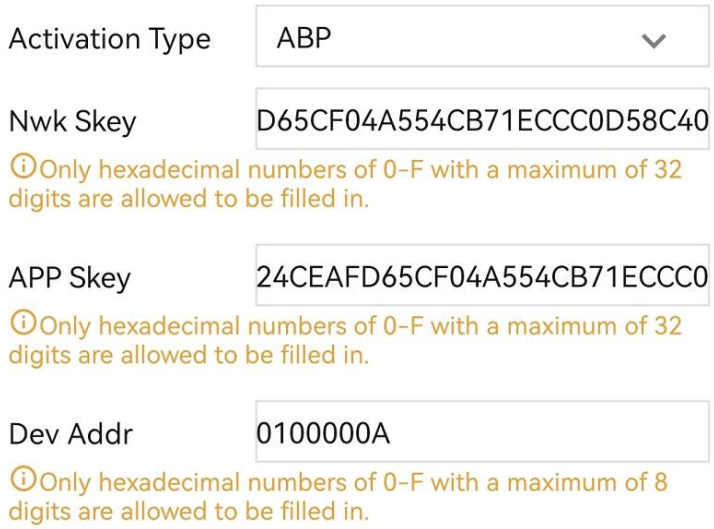
The sensor supports two network access modes, OTAA by default.

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

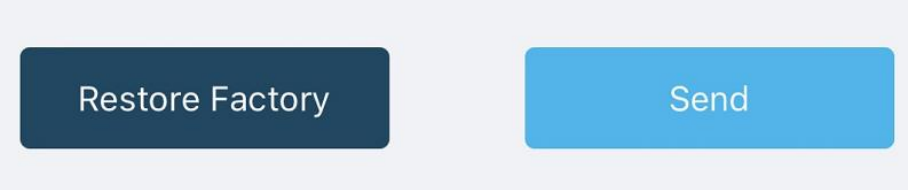


Note:

The factory defaults to a fixed value.

5.3.6 Restore Factory Setting

When selecting the SenseCAP platform, you must use the fixed EUI/App EUI/App Key. Therefore, you need to restore the factory Settings before switching back to the SenseCAP platform from other platforms.



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.

5.4 Preview AI Recognition Results

5.4.1 Select AI Algorithms and Models

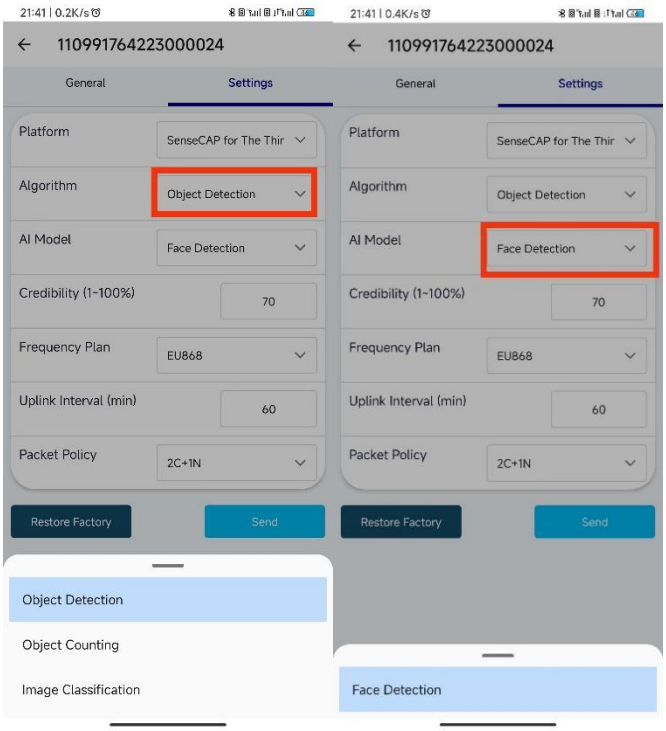
There are several built-in AI models for A1101, and users can select models according to their needs. Currently, the following algorithms and models are available:

Algorithm	AI Model
Object Detection	Human Body Detection
	User-defined
Object Counting	People Counting
	User-defined
Image Classification	Person&Panda Recognition
	User-defined

Model selection and configuration is also done in the Setting interface.

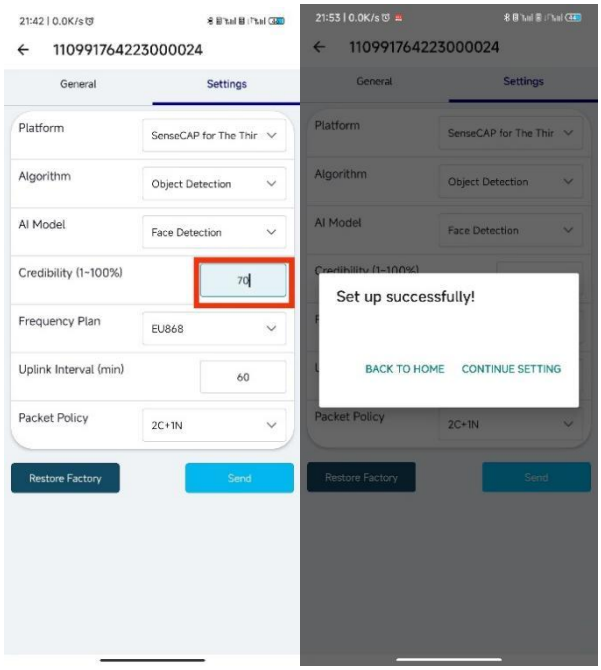
First select the Algorithm, different algorithms achieve different functions and show different results in the APP preview.Clicking on the drop-down triangle behind the algorithm will bring up the selection box.

Then select the AI model, click on the model, the selection box pops up, select the model.



5.4.2 Set Score Threshold

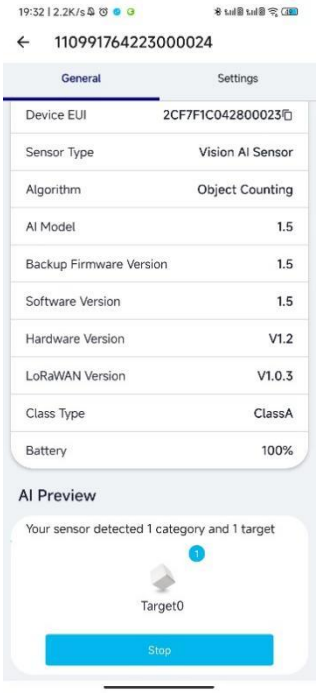
The **scores** represent the reliability of the AI model predictions. The higher the score, the more likely the identified object is the target object. Users can choose to upload more reliable results or more flexible results to the App and cloud by setting the **Score Threshold**. The Score Threshold ranges from 1 to 100, and only the results with a score greater than the Score Threshold will be uploaded to the APP and the cloud.



After completing the above configuration and selection, click "Send" to send the configuration information to the device. If the configuration is successful, it will prompt "Set up successfully".

5.4.3 Detect and Preview

Click the “General” button, then click “Detect”. Pointing the lens at the target object, adjust the angle and distance appropriately, and the recognition result will be displayed at the bottom of the screen.



5.4.4 Train Custom Models

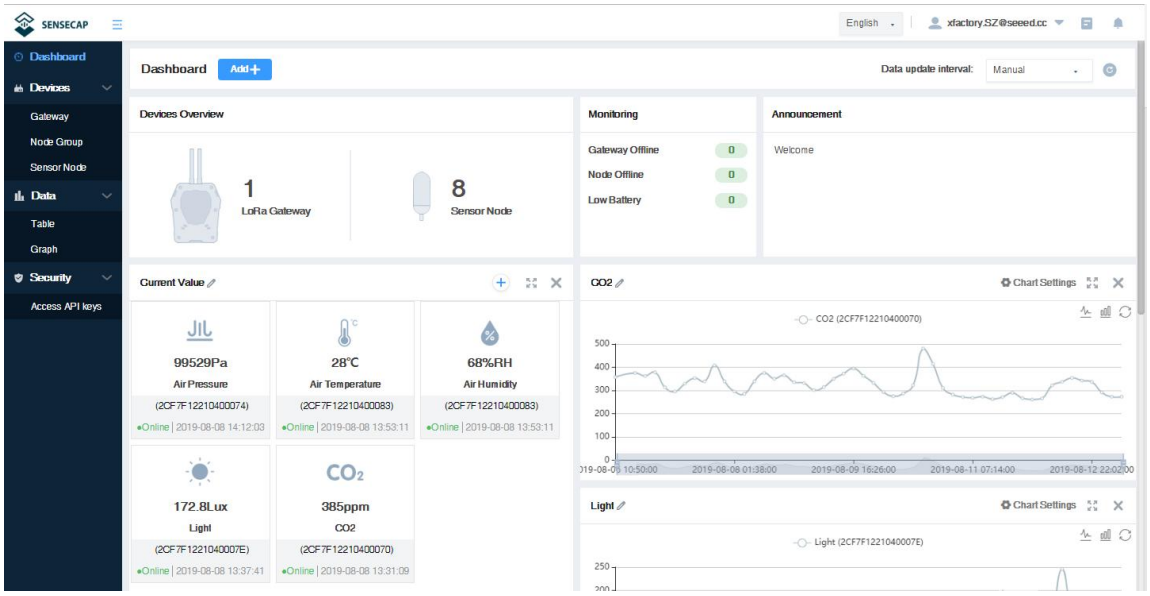
SenseCAP A1101 supports user-defined AI models, for more details please check the link below:

https://wiki.seeedstudio.com/Train-Deploy-AI-Model-SenseCAP-A1101

6. Connect to the SenseCAP Portal

6.1 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.



6.1.1 Create a New Account

Portal Website: http://sensecap.seeed.cc

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

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

6) 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".

6.1.2 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:***

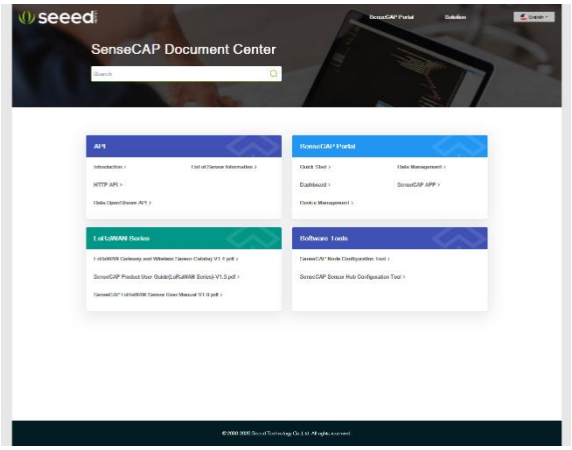
SenseCAP Portal User Guide: *https://sensecap-docs.seeed.cc/quickstart.html*

6.1.3 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.

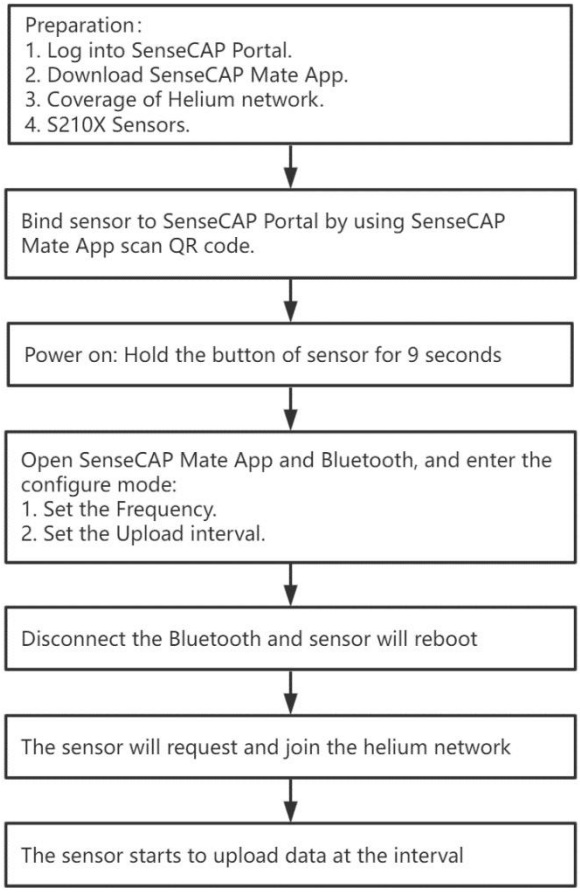
Please refer to this link for API User Guide: https://sensecap-docs.seeed.cc/



6.2 Connect to SenseCAP with Helium Network

6.2.1 Quick Start

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



6.2.2 Preparation

1) SenseCAP Mate App

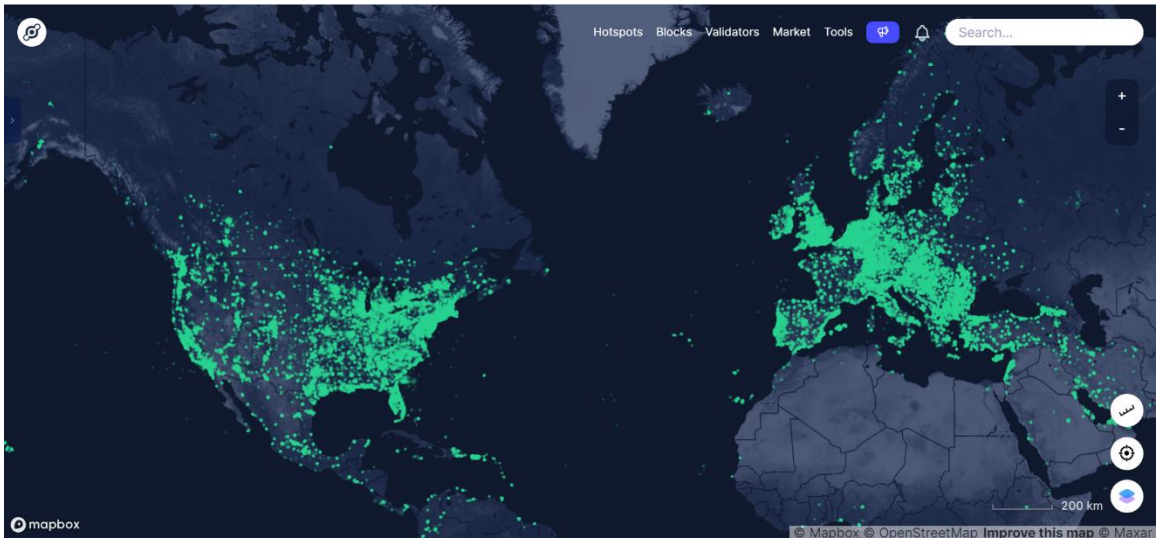
Download the App, please refer to section 5 for using.

2) Coverage of Helium network

Option 1: Use the Helium network that already exists nearby.

Please refer to the map, search your location to see if there's any helium network around: https://explorer.helium.com/

A green hexagon indicates the presence of the network.



Option 2: Deploy a new Helium gateway.

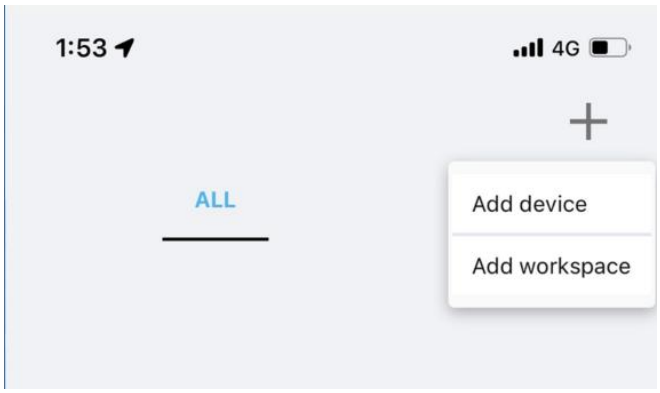
You can purchase M1, M2 gateways to cover your surroundings with the Helium network: https://www.sensecapmx.com/

6.2.3 Bind Sensor to SenseCAP Portal

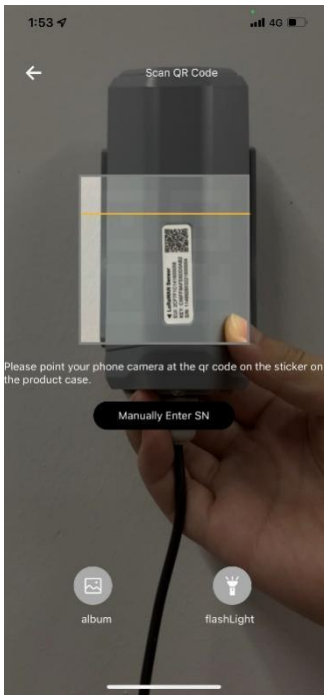
Please open SenseCAP Mate App.

(1) Scan QR Code

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

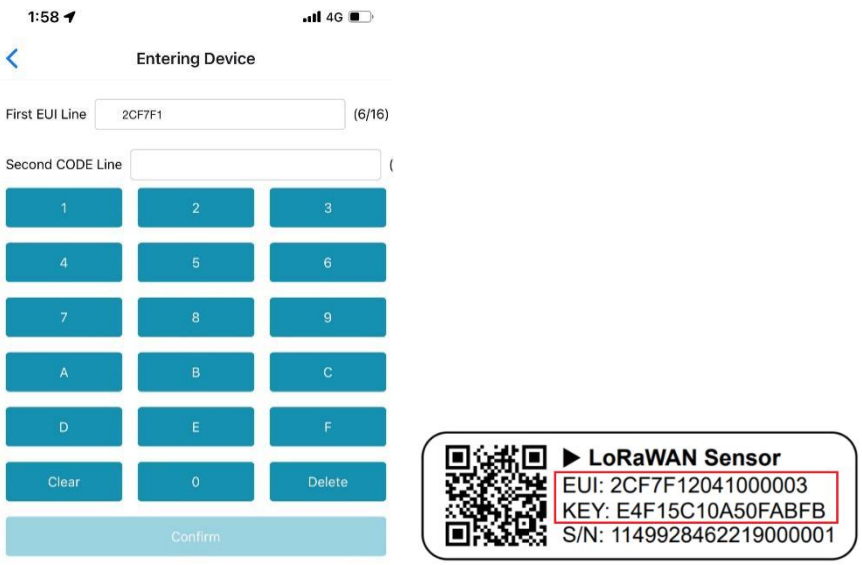


2) Scan the QR code on the device to bind the device to your account. If you do not set it to a designated group, the device will be put into the “default” group.



(2) Manually fill in the EUI

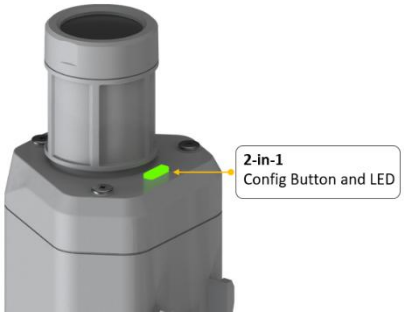
If the QR code sticker is damaged, you can manually fill in the EUI of the device to bind the device to your account. Please make sure you put in the EUI in the format suggested by the system and then click “confirm”.



6.2.4 Setup the Sensor

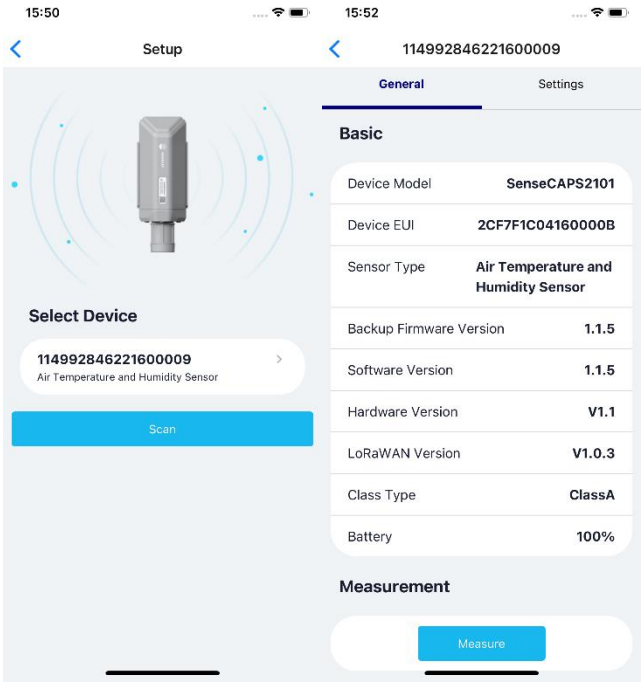
1) Open the SenseCAP Mate App

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.

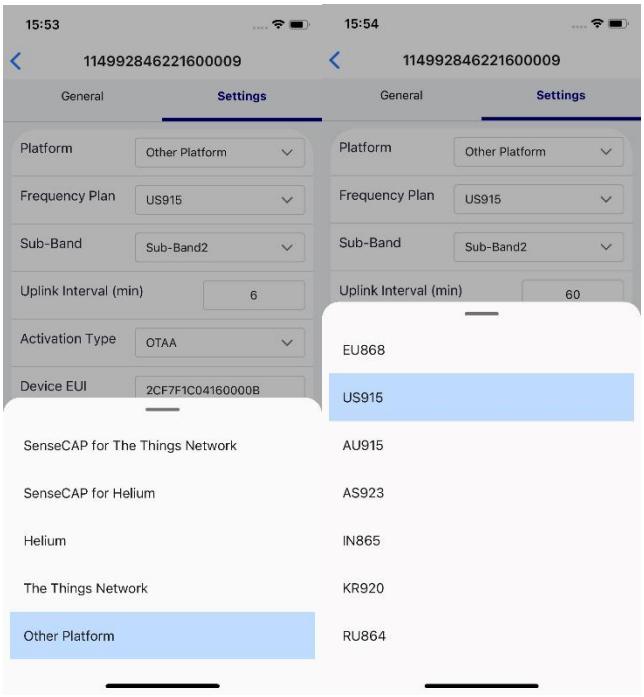


6.2.5 Set Frequency of Sensor via SenseCAP Mate App

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

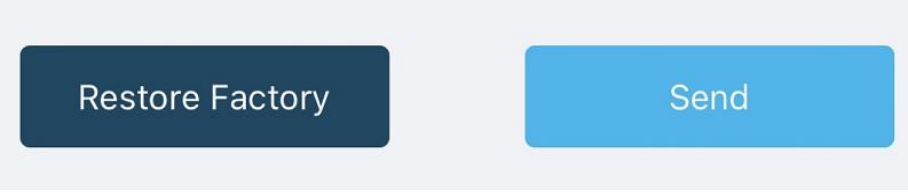
Please refer to section 5 for detail.

1) Click the “Setting” and select the platform is “**SenseCAP for Helium**”.



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.

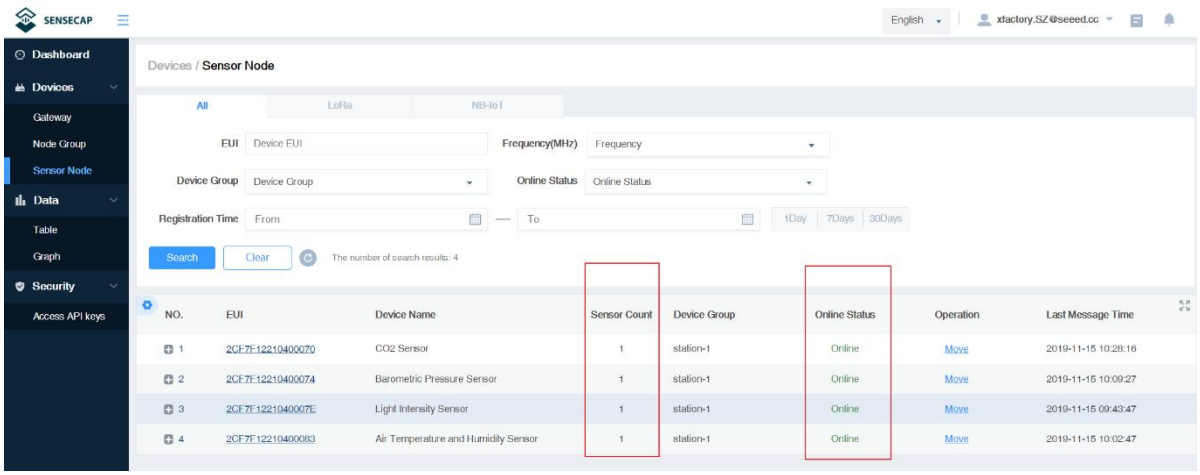
   Then, the sensor will reboot.

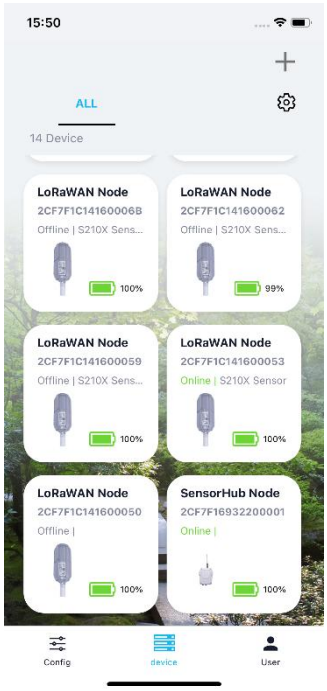
5) When the device is disconnected from Bluetooth, the LED lights up for **15 seconds** and then flashes as a **breathing light**.

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

6.2.6 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.

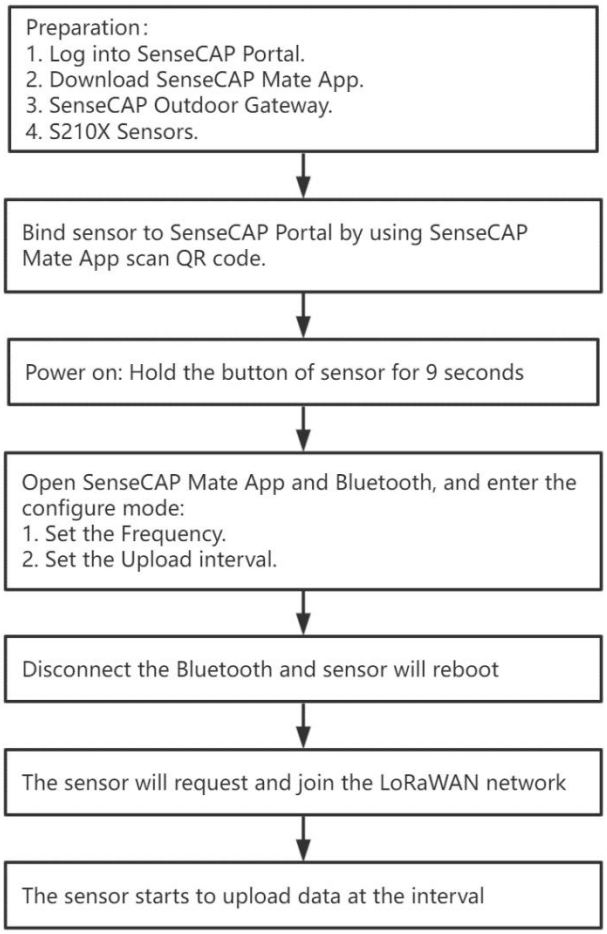




6.3 Connect to SenseCAP with private TTN

6.3.1 Quick Start

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



6.3.2 Preparation

1) SenseCAP Mate App

Download the App, please refer to section 5 for using.

2) SenseCAP Outdoor Gateway

Now, the sensor 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.

6.3.3 Bind Sensor to SenseCAP Portal

Please refer to the section 6.2.3

6.3.4 Setup the Sensor

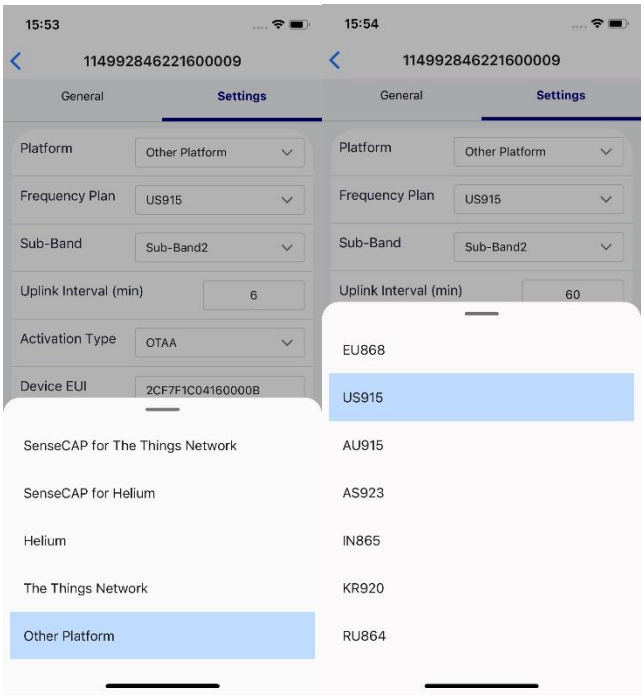
Please refer to the section 6.2.4

6.3.5 Set Frequency of Sensor via SenseCAP Mate App

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

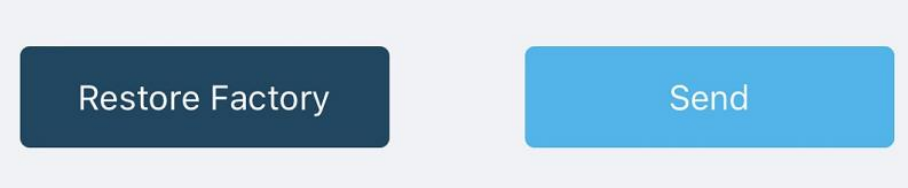
Please refer to section 5 for detail.

1) Click the “Setting” and select the platform is “**SenseCAP for The Things Network**”.



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 **15 seconds** and then flashes as a **breathing light**.

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

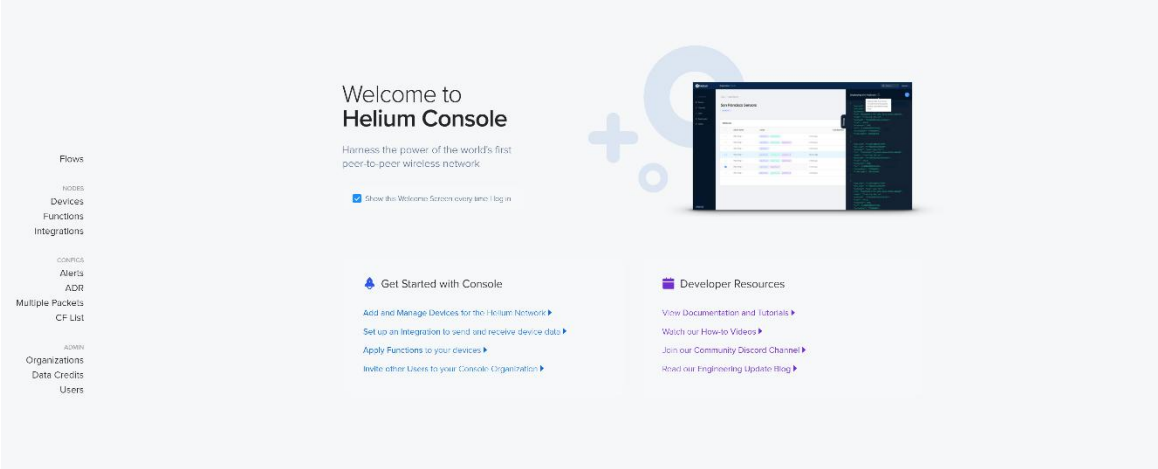
6.3.6 Check Data on SenseCAP Portal

Please refer to the section 6.2.6

7. Connect to Helium Network

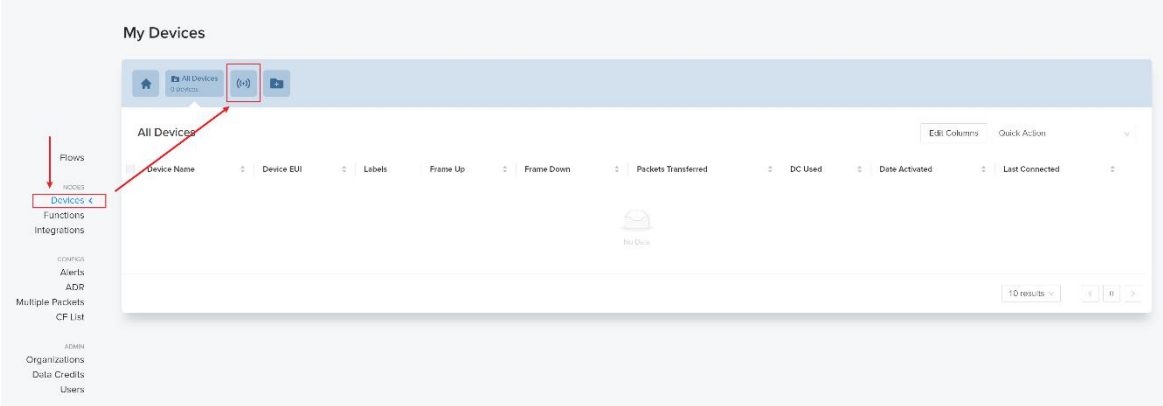
7.1 Register

Please go to https://console.helium.com/ , and register your account.

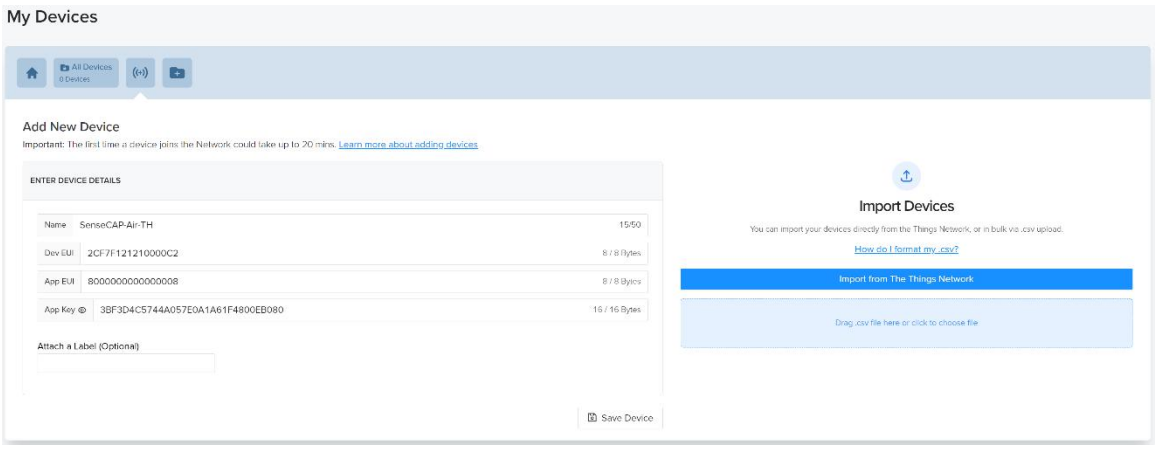


7.2 Add New Device

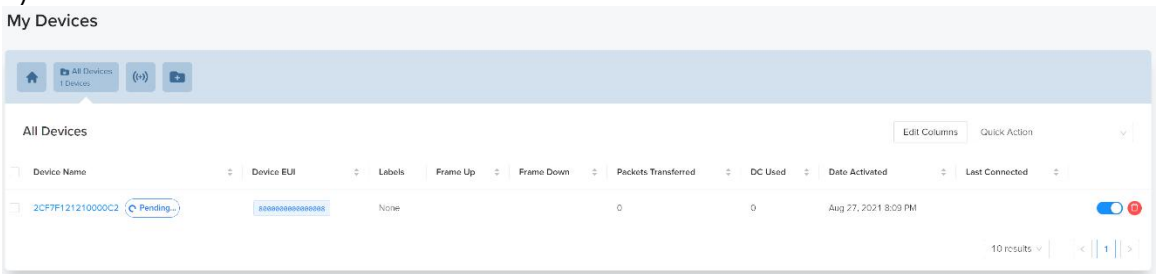
1) Click “Devices” –> “Add New Device”



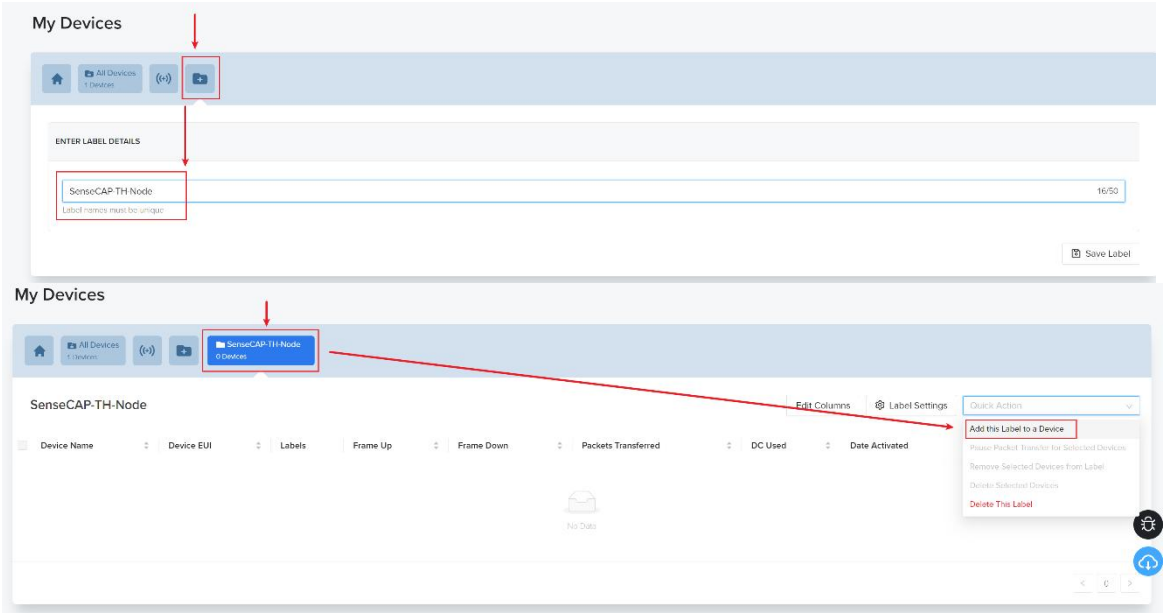
2) Enter the Device EUI, App EUI, App Key: please refer to Section 1.1 for details.

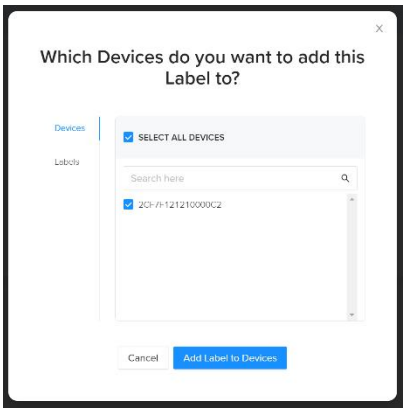


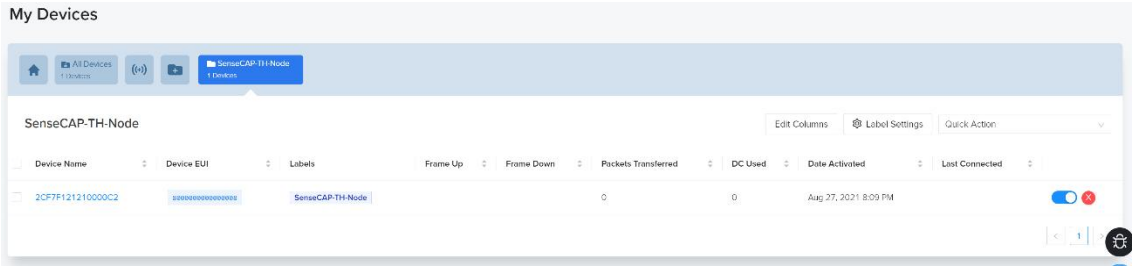
3) Save device.



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

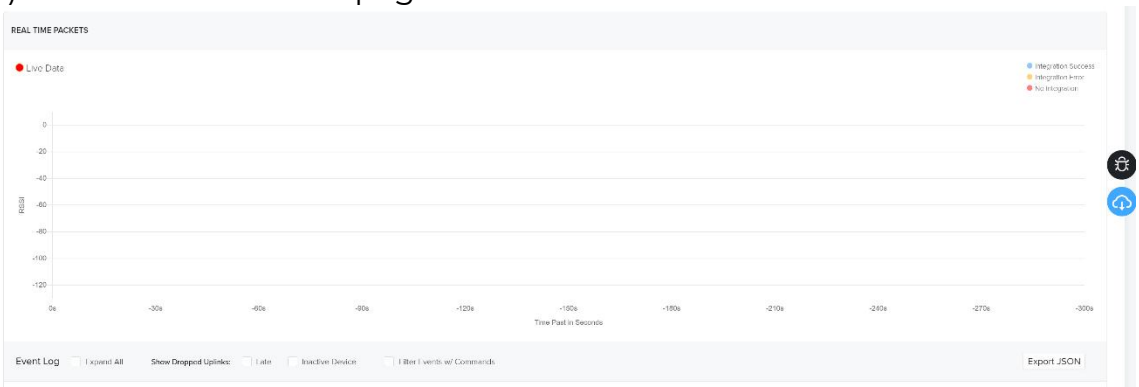




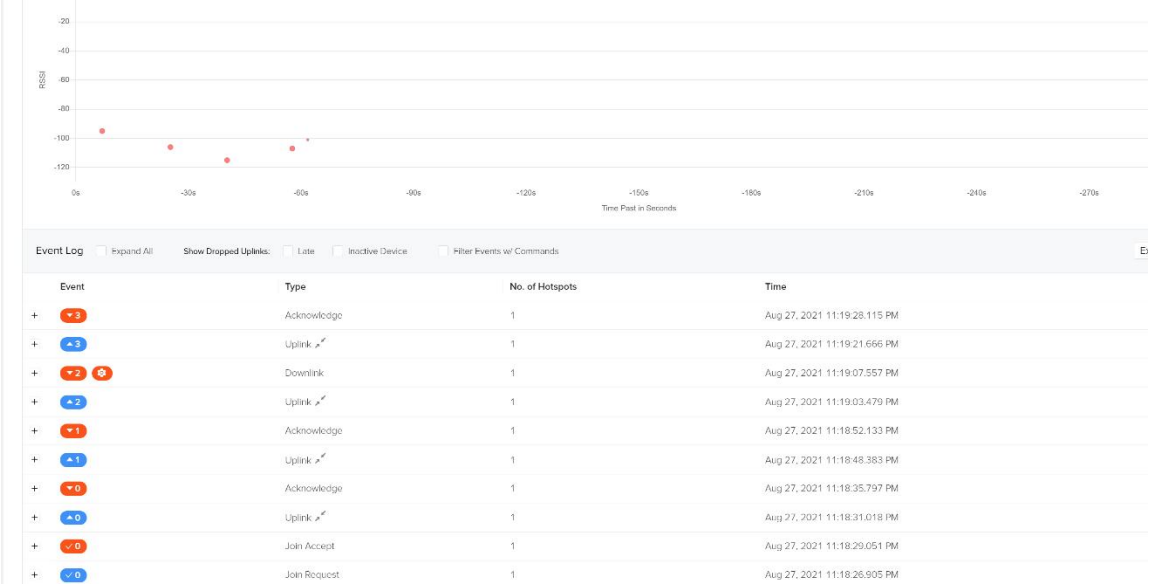


7.3 Check the data on Helium

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



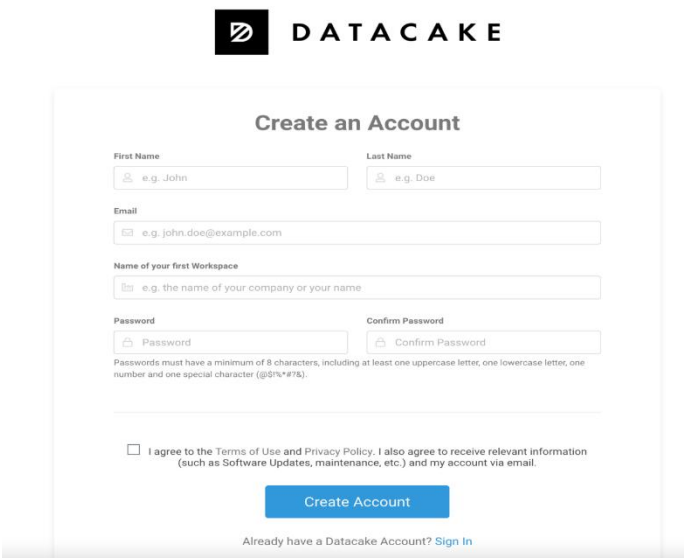
2) Power on the Sensor, it will display raw data.



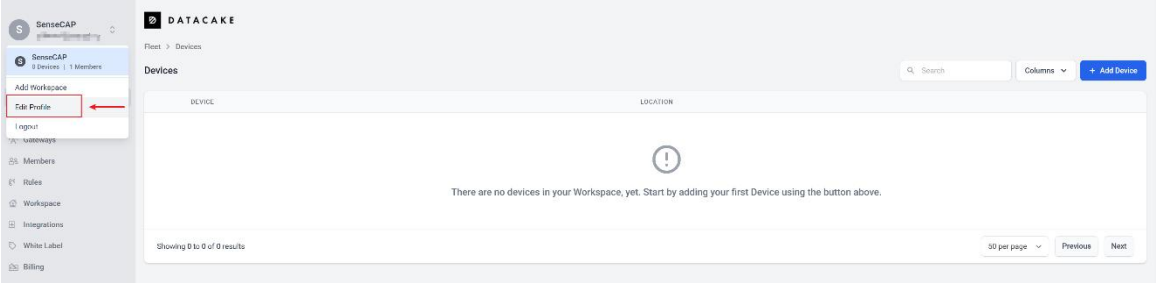
7.4 Upload Data from Helium to Datacake

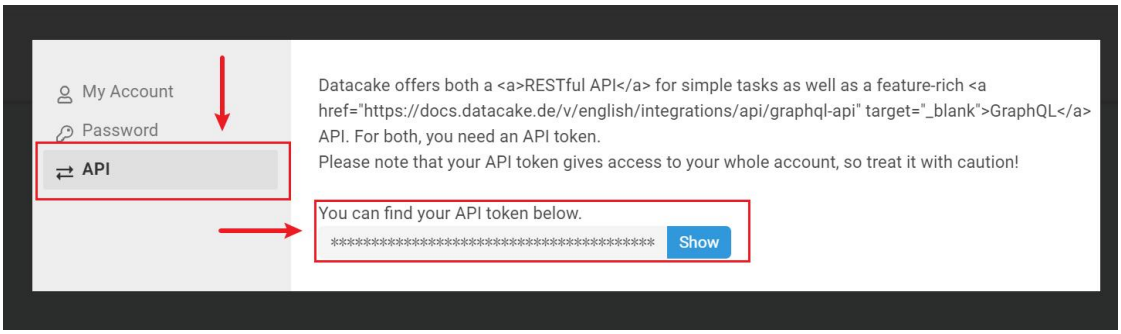
7.4.1 Create a Datacake Account

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



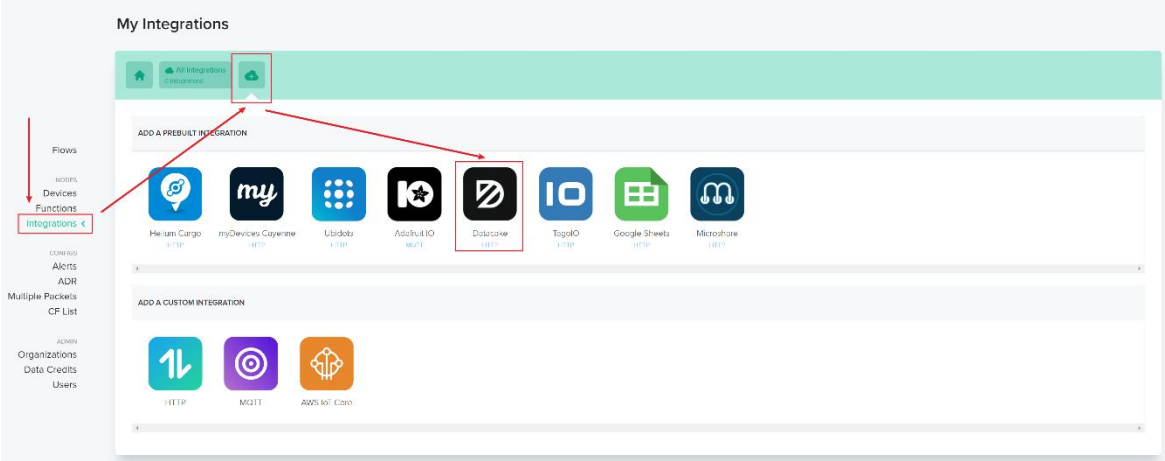
2) Click the “Edit Profile” → “API” → Get API token.



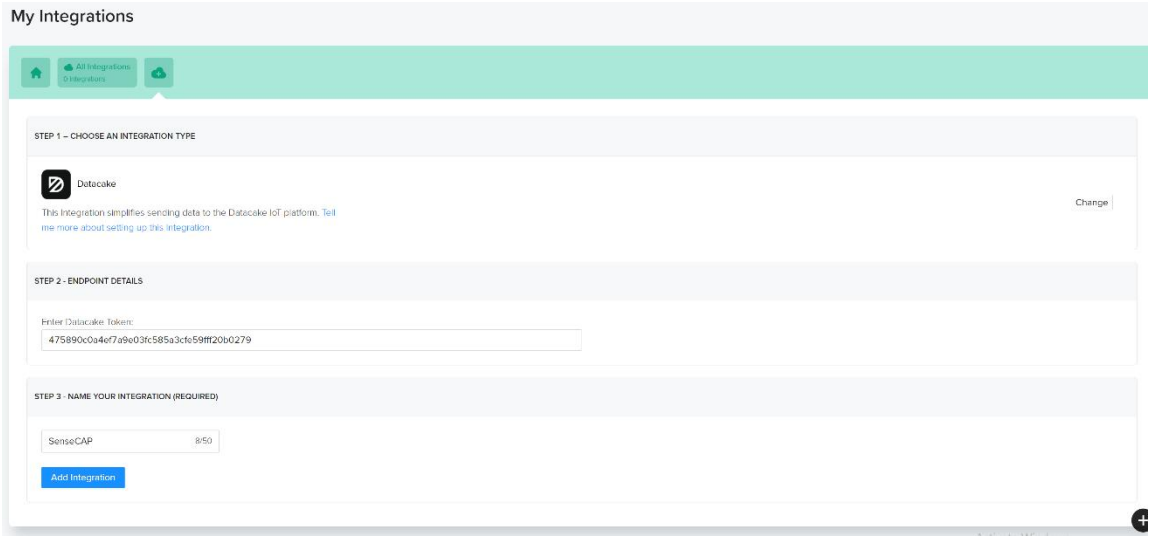


7.4.2 Add New Integration on Helium Console

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

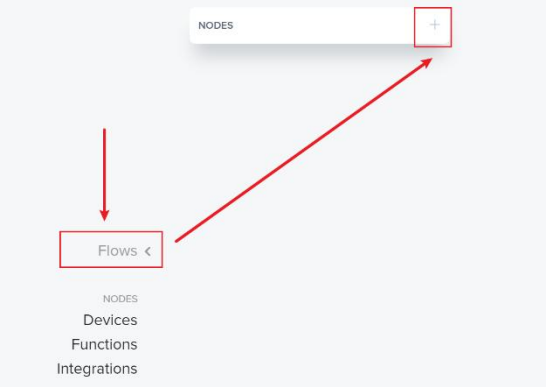


2) Enter Datacake Token (Refer to the section) and name your integration.

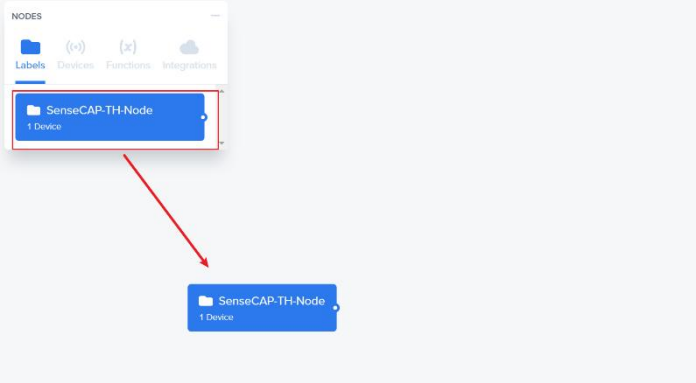


7.4.3 Configure the Flows on Helium

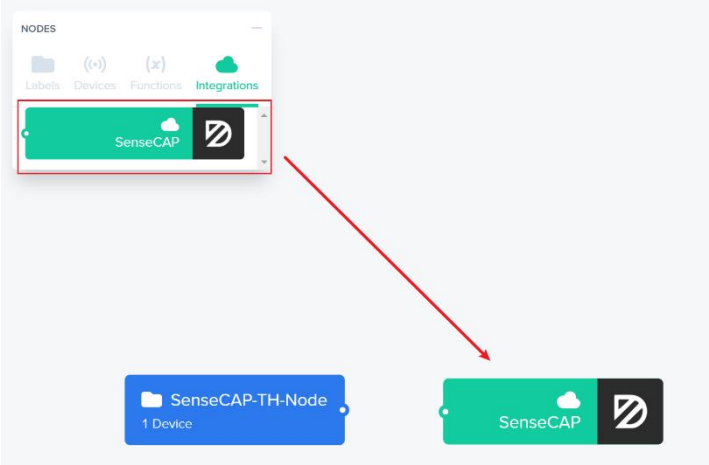
1) Click “Flows”.



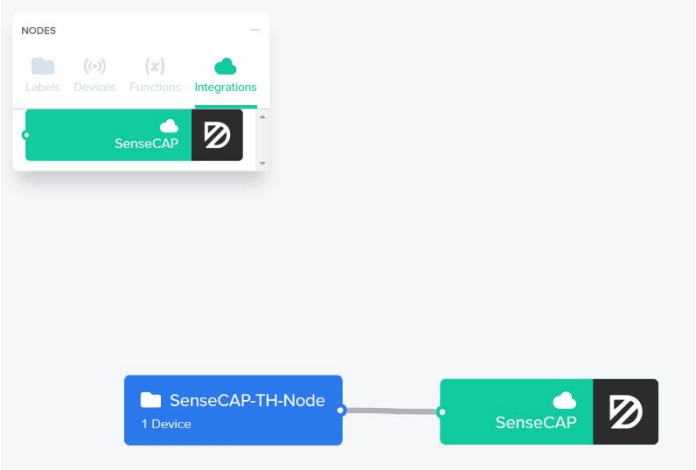
2) Drag the Label into a blank place.



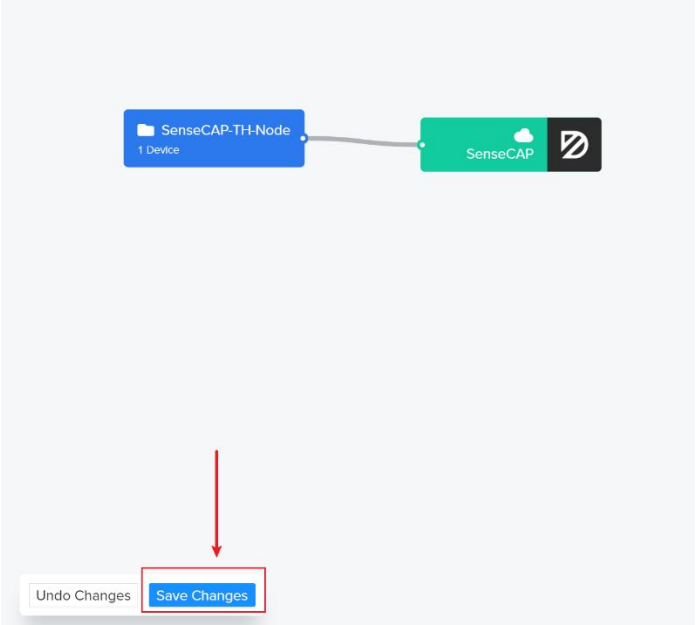
3) Drag the Integration in to a blank place.



4) Connect the two blocks.

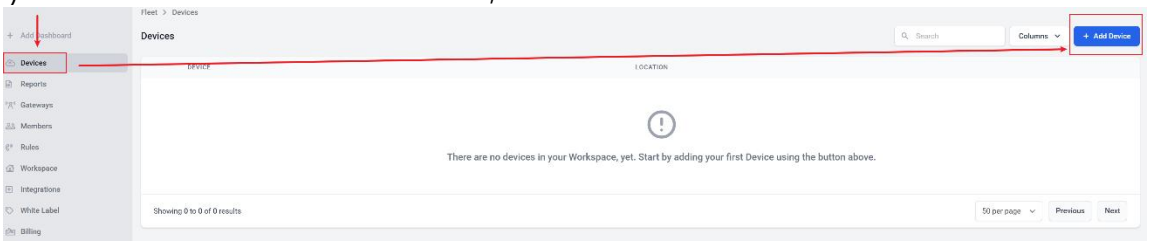


5) Save Changes.

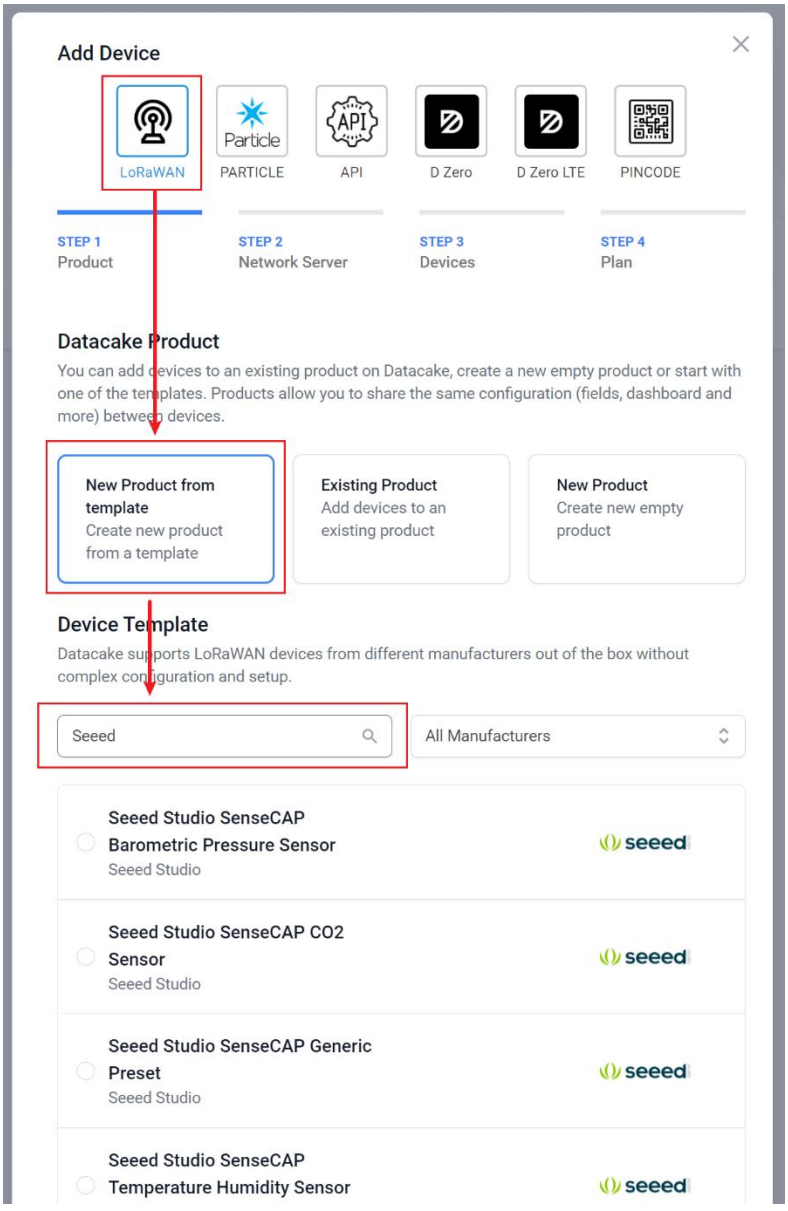


7.4.4 Add the Sensor on Datacake

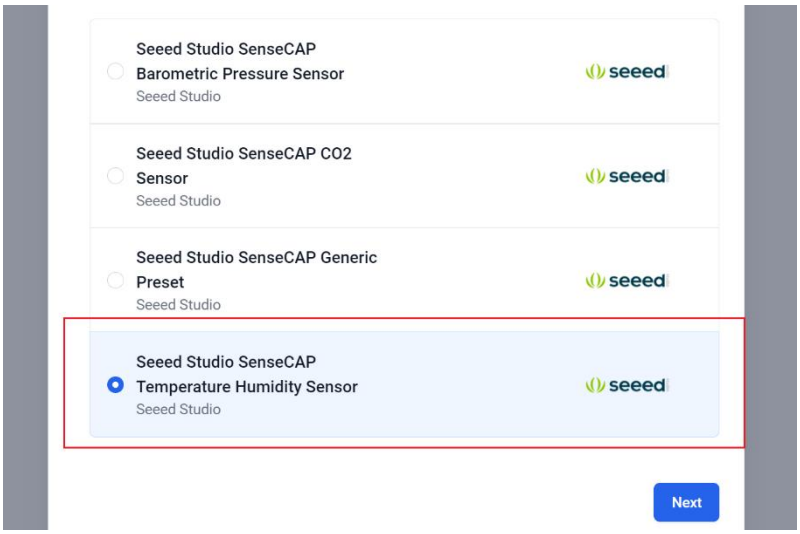
1) Return Datacake Dashboard, and click “Device”→”Add Device”



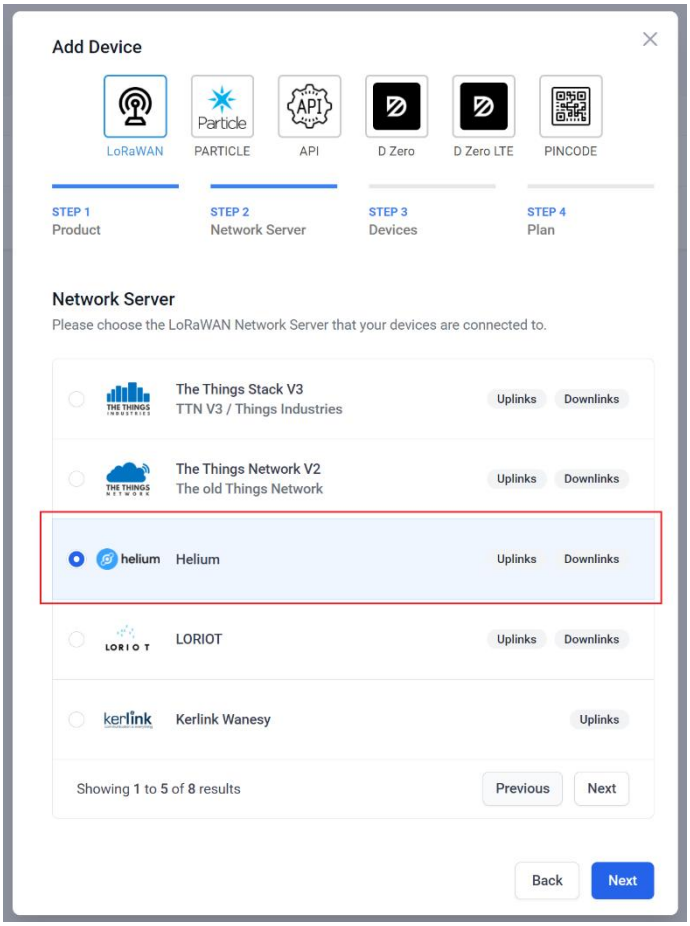
2) Search “Seeed”, You can select some sensors directly.



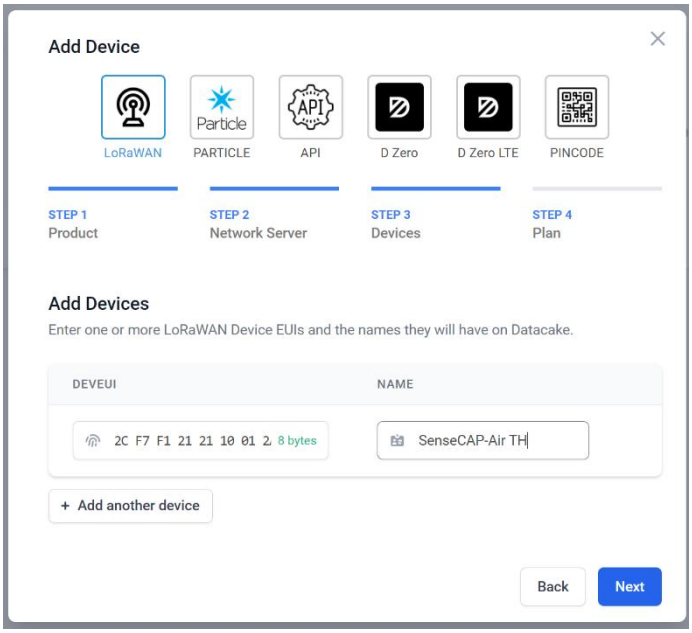
3) Select the Sensor Template.



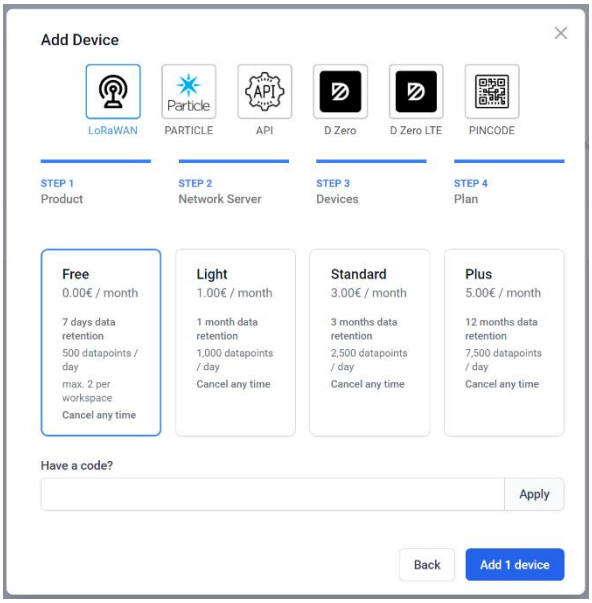
4) Select “Helium”.



5) Enter your Device EUI and Name.

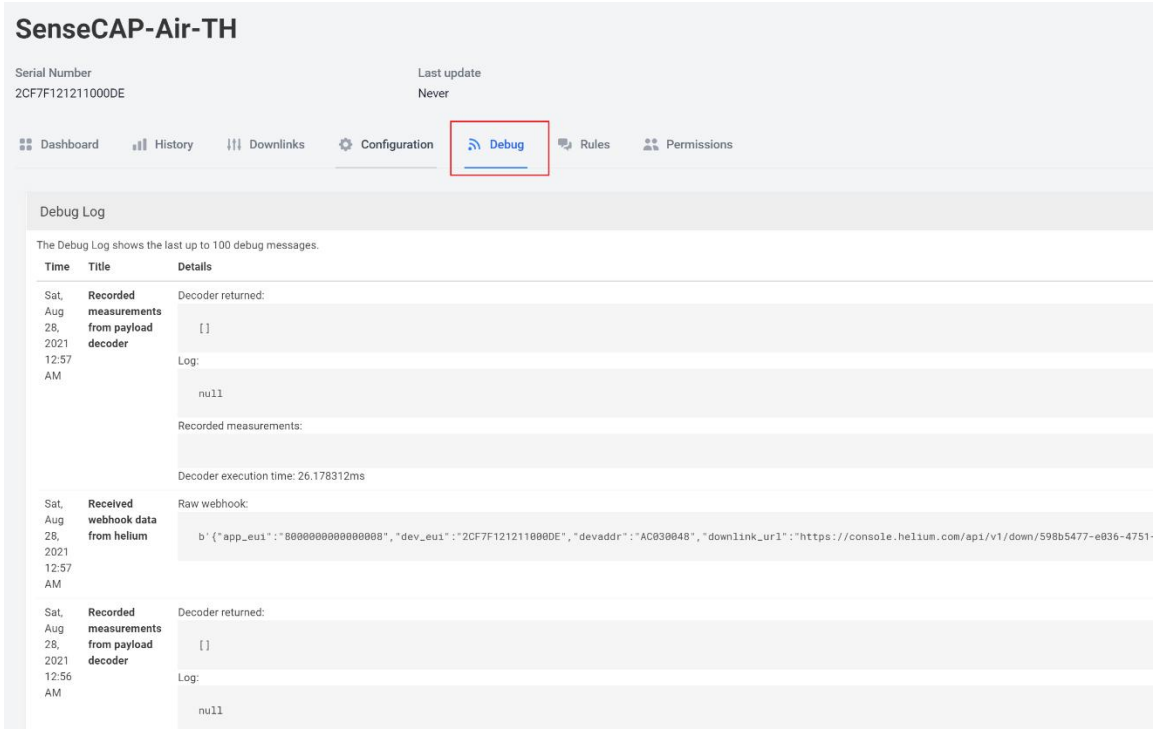


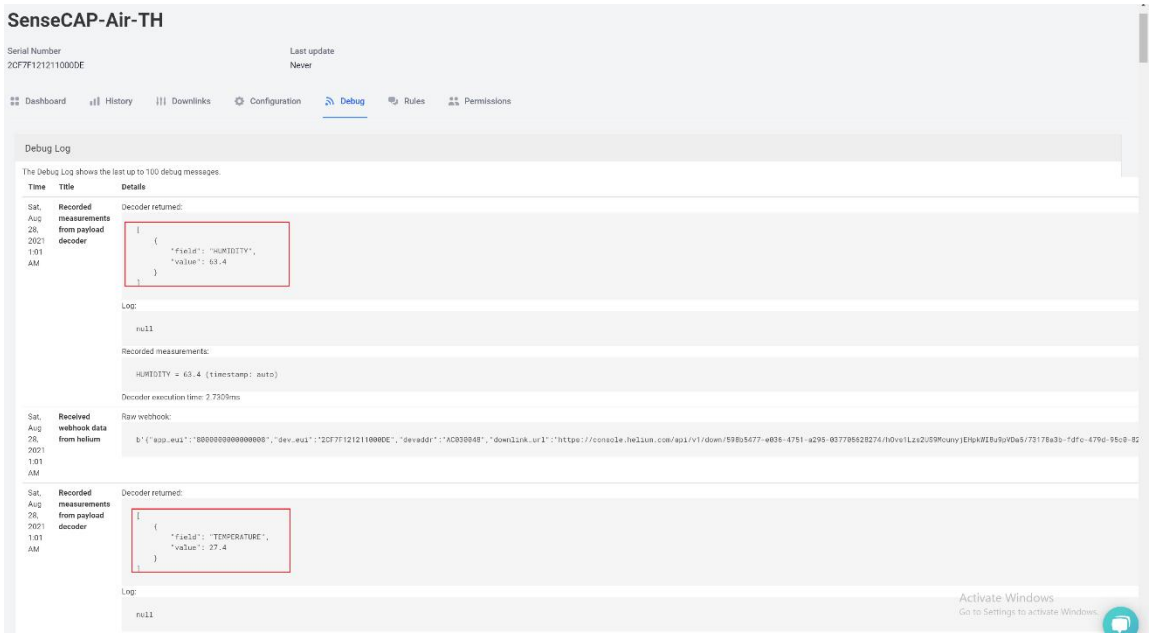
6) Select your Plan and add device.

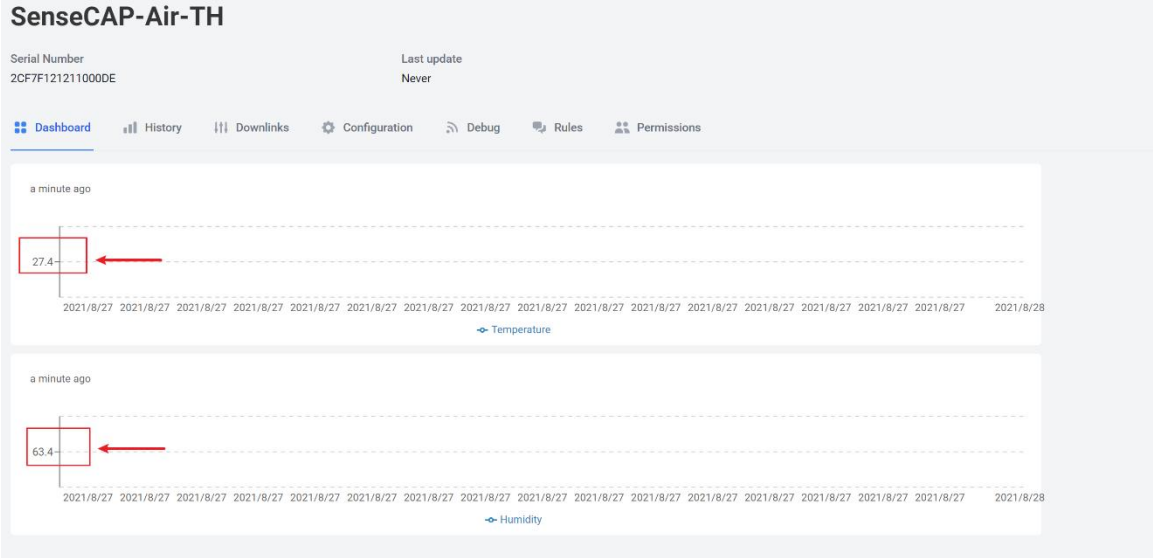


7.4.5 Check Data from Datacake

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

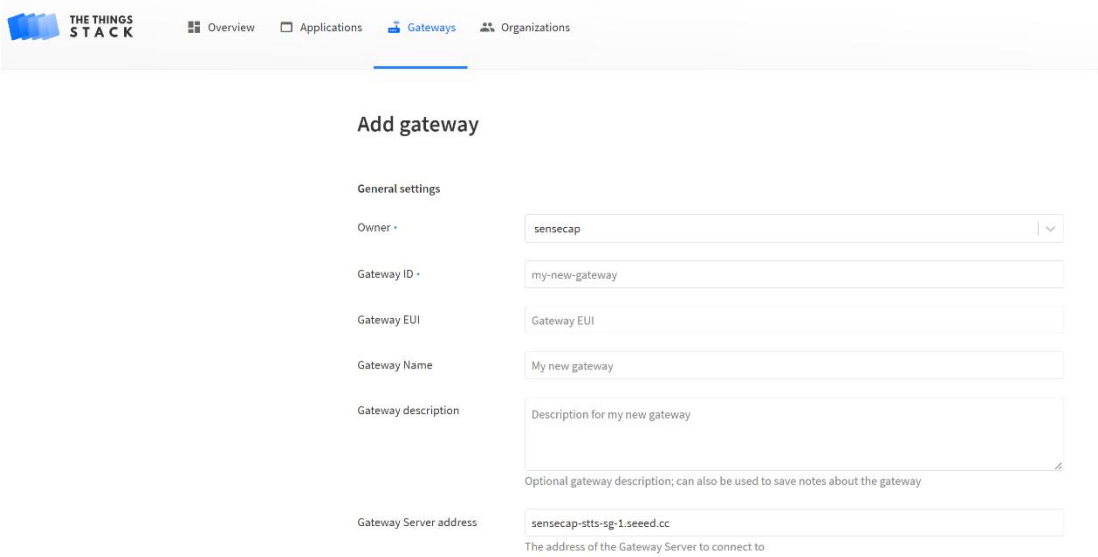
The Things Industries login: https://accounts.thethingsindustries.com/login

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

8.1 Preparation

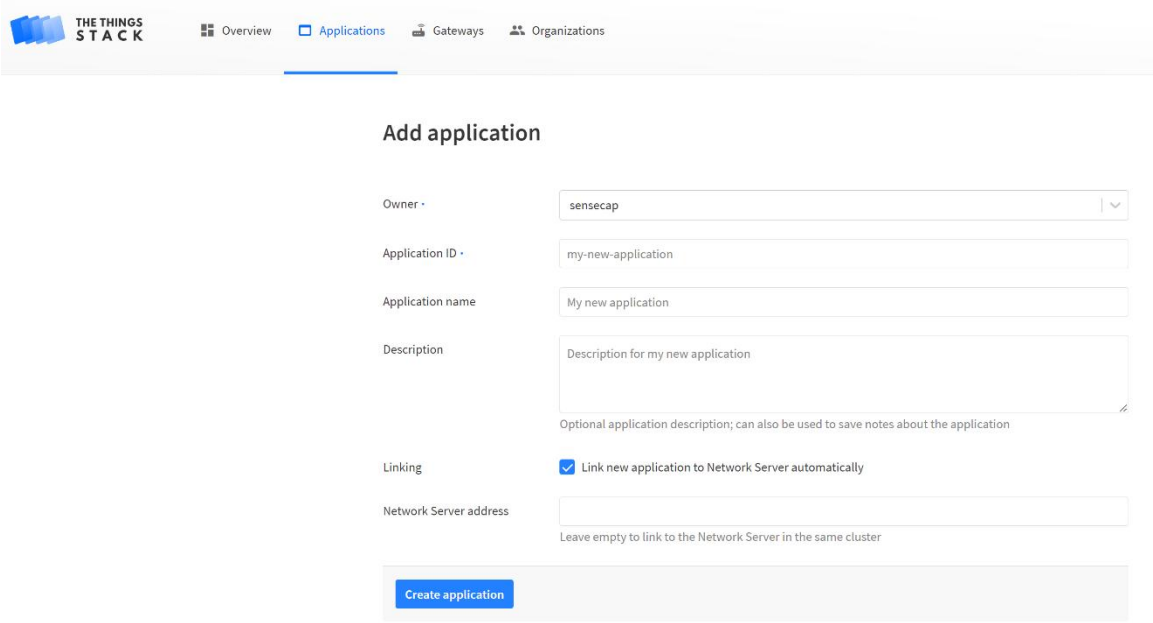
8.1.1 Gateway Registration on TTN

Create a Gateway on the TTN console.



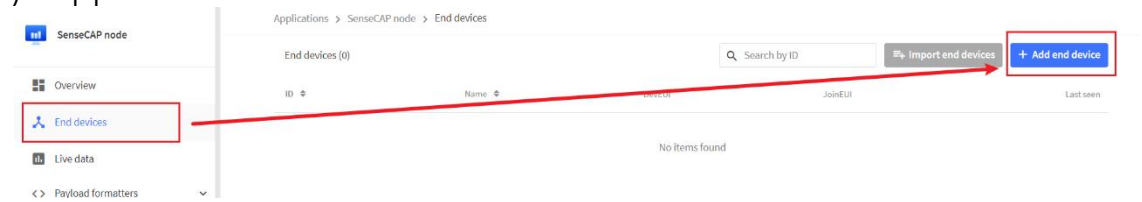
8.1.2 Create the Application

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.

Applications > SenseCAP node > End devices > Register from The LoRaWAN Device Repository

Register end device

From The LoRaWAN Device Repository | Manually

1. Select the end device

Brand * : SenseCAP ①

Model * : SenseCAP Wireless Air T… ②

Hardware Ver. * : 2.0 ③

Firmware Ver. * : 3.4 ③

Profile (Region) * : EU_863_870 ④

SenseCAP Wireless Air Temperature and Humidity Sensor - LoRaWAN

MAC V1.0.2, PHY V1.0.2 REV B, Over the air activation (OTAA), Class A

It measures temperature and humidity in the atmosphere. It's designed with a 2-in-1 sensor, a custom battery, and an industry-grade enclosure, optimized for outdoor use cases that need reliable data collection for years.

Product website

2. Enter registration data

Frequency plan * : Europe 863-870 MHz (SF9 for RX2 - recommended) ⑤

AppEUI * : 80 00 00 00 00 00 00 09 00

DevEUI * : 2C F7 F1 20 25 20 00 BB

AppKey * : 54 7E F3 ED 34 3B DB F3 2A 51 5A BF 4B A4 F8 3D ⑥

End device ID * : 2cf7f120252000bb

After registration

- (•) View registered end device
- ( ) Register another end device of this type

Register end device

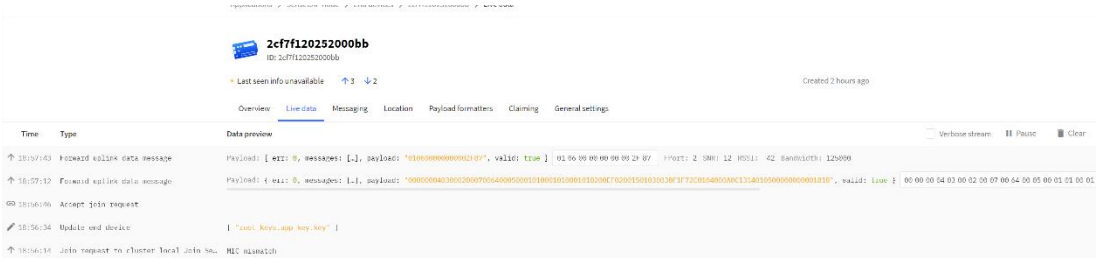
⑤ Frequency plan: Get it from SenseCAP Mate App.

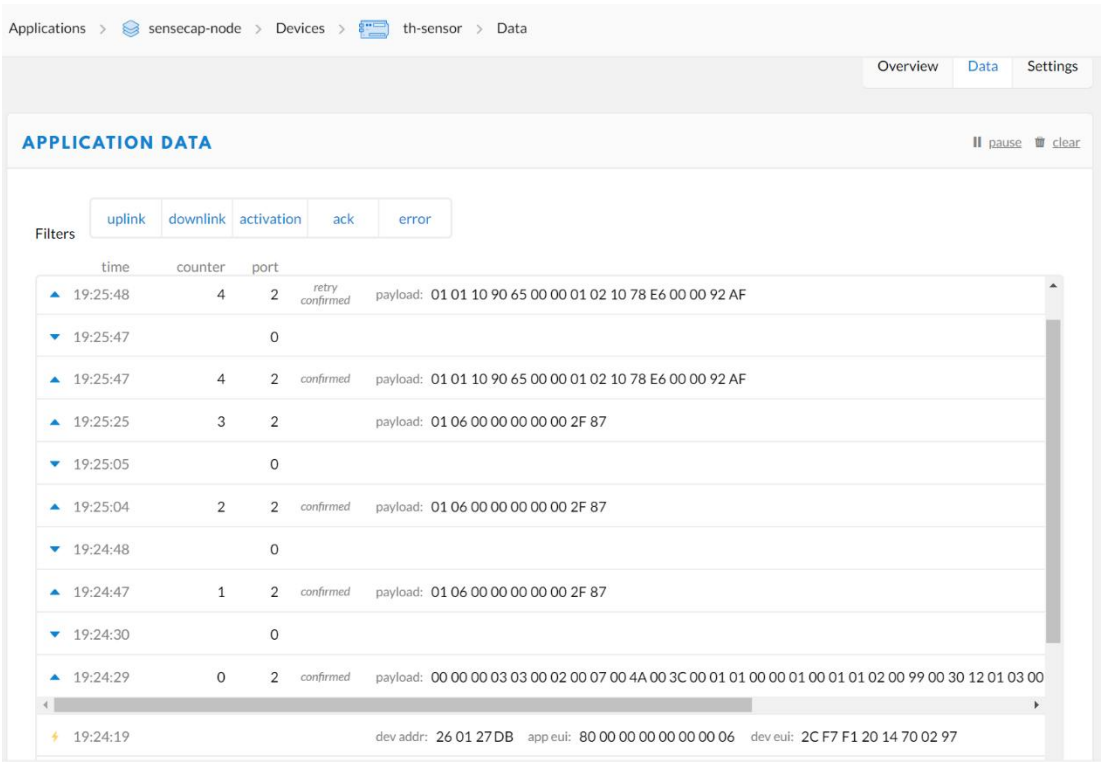
⑥ Device EUI、App EUI、 App Key: Get it from SenseCAP Mate App.

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 A1101:

https://github.com/Seeed-Solution/TTN-Payload-Decoder/blob/master/decoder_new-v3.js

TTN payload decoding script for SenseCAP S210X:

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

Helium payload decoding script for SenseCAP A1101:

https://github.com/Seeed-Solution/Helium-Console-Decoder/blob/main/decoder_datacake.js

9.2 Packet Parsing

9.2.1 Packet Initialization

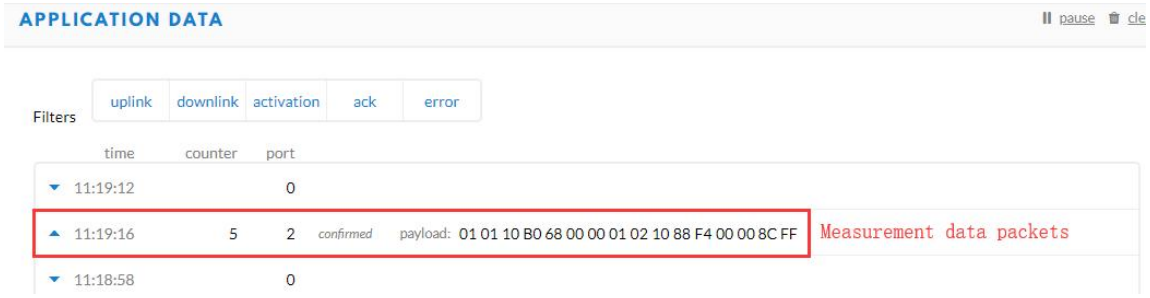
After being powered on or reboot, SenseCAP Sensors will be connected to the network using the OTAA activation method. Each Sensor Node will send data packets to the server, including the following data:

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 Example – A1101 Vision AI Sensor

Device Name	Measurements	Measurement ID (HEX)
SenseCAP A1101 - LoRaWAN Vision AI Sensor	AI Detection No.01	4175
	AI Detection No.02	4176
	AI Detection No.03	4177
	AI Detection No.04	4178
	AI Detection No.05	4179
	AI Detection No.06	4180
	AI Detection No.07	4181
	AI Detection No.08	4182
	AI Detection No.09	4183
	AI Detection No.10	4184

Vision AI Sensor measurement packet on the Human Body Detection Model:

01 4F10 7A030000 427D

Part	Value	Raw Data	Description
1	Vision AI Data info	01 4F10 7A030000	01 is the channel number. 4F10 is 0x104F (little-endian byte order) , which is the measurement ID 4175 for AI detection. 7A030000 is actually 0x0000037A, whose equivalent decimal value is 890. Divide it by1000, and you will get the actual measurement value 0.89. The integer digit is the target number (target Id range: 1~10), and the decimal digit is the confidence level or count value (range: 0~99). The confidence level 0~99 indicates the confidence level of 1~100.
2	CRC	427D	The CRC verification part.

Vision AI Sensor measurement packet on the People Counting Model:

01 4F10 0A000000 63C8

Part	Value	Raw Data	Description
1	Vision AI Data info	01 4F10 0A000000 63C8	01 is the channel number. 4F10 is 0x104F (little-endian byte order) , which is the measurement ID 4175 for AI detection. 0A000000 is actually 0x0000000A, whose equivalent decimal value is 1. Divide it by1000, and you will get the actual measurement value 0.01. That

			means only 1 people here. The integer digit is the target number (target Id range: 1~10), and the decimal digit is the number of person.
2	CRC	63C8	The CRC verification part.

Vision AI Sensor measurement packet on the Person&Recognition Model:

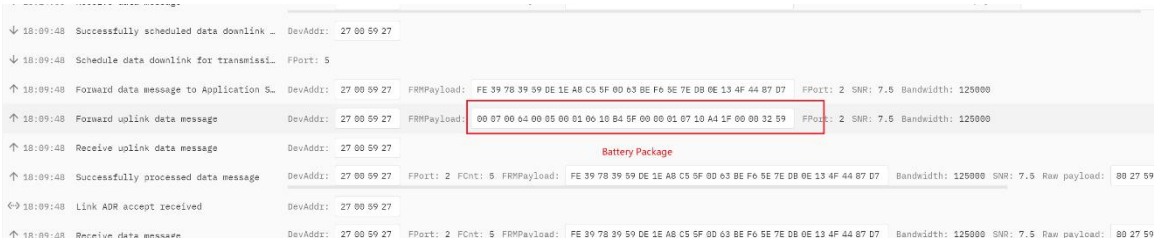
01 4F10 98030000 BEF0

Part	Value	Raw Data	Description
1	Vision AI Data info	01 4F10 98030000 BEF0	01 is the channel number. 4F10 is 0x104F (little-endian byte order) , which is the measurement ID 4175 for AI detection. 98030000 is actually 0x00000398, whose equivalent decimal value is 920. Divide it by1000, and you will get the actual measurement value 0.92. That means the probability of people. The integer digit is the target number (target Id range: 1~10), and the decimal digit is the probability of person or panda
2	CRC	BEF0	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:

000700640005000106 10B45F0000010710A41F00003259

Battery Package: 00070064000500

Example:

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

000700640005000106 10B45F0000010710A41F00003259

Part	Value	Raw Data	Description
1	Battery	00 0700 6400 0500	00 is the channel number. 0700 is 0x0007 (little-endian byte order), which is the measurement ID for battery. 6400 is 0x0064 (little-endian byte order), whose equivalent decimal value is 100. Battery level is 100%. 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. 0610 is 0x1006 (little-endian byte order), which is the measurement ID for soil temperature. 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. 0710 is 0x1007 (little-endian byte order), which is the measurement ID for soil moisture. 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. LoRaWAN Downlink Command

10.1 Set the Data Uplink Interval

(1) Using the Network Server's portal or API to send downlink command, then the Node will respond to the ack. The downlink command takes effect and responds the next time the node uploads data.
(2) Downlink as follow:

0x00	0x89	0x00	prepareId_L	prepareId_H	duty_L	duty_H	crc-L	crc-H

0x00	Fixed field
0x89	Fixed field
0x00	Fixed field
prepareId_L	Command ID low byte, you can customize the values, it allows each command ID to be the same
prepareId_H	Command ID high byte, you can customize the values, it allows each command ID to be the same
duty_L	Data interval low byte, you can set the data interval, unit: minute
duty_H	Data interval high byte, you can set the data interval, unit: minute
crc-L	CRC low byte, it's calculated by the CRC-16/CCITT
crc-H	CRC low byte, it's calculated by the CRC-16/CCITT

(3) When you send the downlink command, the Node responds to the ack command.

0x00	0x1F	0x00	prepareId_L	prepareId_H	result	0x00	crc-L	crc-H

0x00	Fixed field
0x1F	Fixed field
0x00	Fixed field
prepareId_L	Command ID low byte, it is the same as the downlink command
prepareId_H	Command ID high byte, it is the same as the downlink command
result	If the downlink command is in force, it responds 0x01, else it responds 0x00
0x00	Fixed field
crc-L	CRC low byte, it's calculated by the CRC-16/KERMIT
crc-H	CRC low byte, it's calculated by the CRC-16/ KERMIT

(3) Use the FPort = 2

CRC Tool: https://crccalc.com/ , select the algorithm of CRC-16/KERMIT.

Example: Set the Node's data interval is 10 minutes.

Send the downlink command (HEX) via FPort=2:

00 89 00 11 22 0A 00 38 B4

0x00	0x89	0x00	prepareId_L	prepareId_H	duty_L	duty_H	crc-L	crc-H
00	89	00	11	22	0A	00	38	B4

ACK Response:

00 1F 00 11 22 01 00 78 0F

0x00	0x1F	0x00	prepareId_L	prepareId_H	result	0x00	crc-L	crc-H
00	1F	00	11	22	01	00	78	0F

Command List:

Description	Command
Set Uplink interval = 1 minute	008900112201009050
Set Uplink interval = 5 minutes	00890011220500F037
Set Uplink interval = 10 minutes	00890011220A0038B4
Set Uplink interval = 15 minutes	00890011220F0080CA
Set Uplink interval = 20 minutes	0089001122150061A2
Set Uplink interval = 30 minutes	00890011221E00C946
Set Uplink interval = 60	00890011223C004A56

minutes	

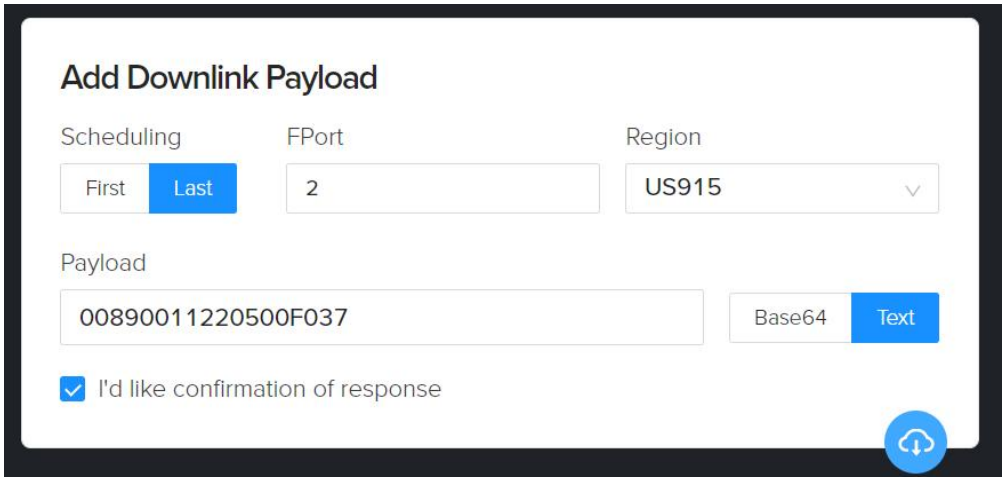
10.2 Reboot the device

FPort = 2

Command: 00C800000000002B26

10.3 How to send downlink

Example: use the Helium Console to send



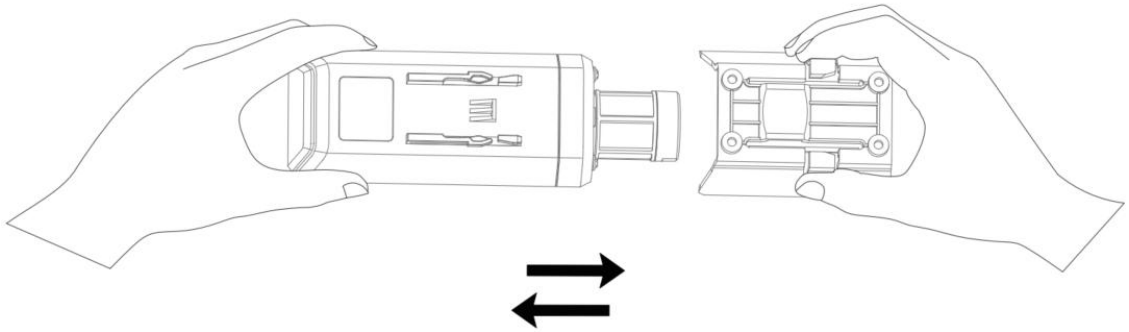
11. Device Installation

11.1 Installing Sensor

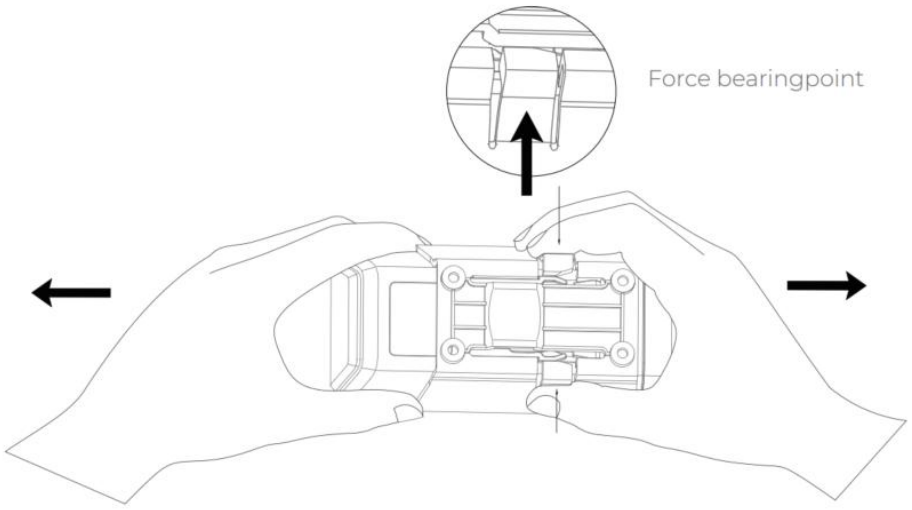
11.1.1 Installing the Sensor Bracket

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.

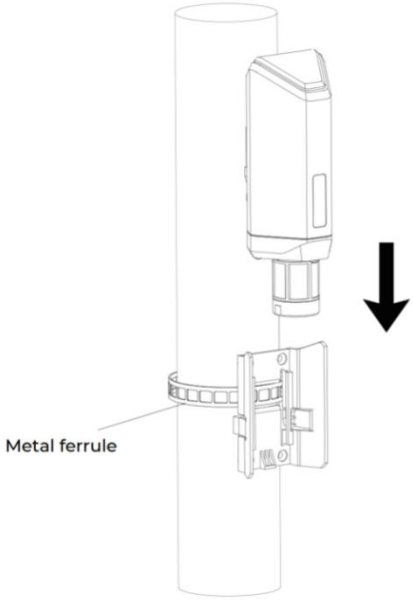


2) One hand holds the clasp while the other holds the device. Pull outward with opposite force. Press the upper part of the buckle with your finger.\

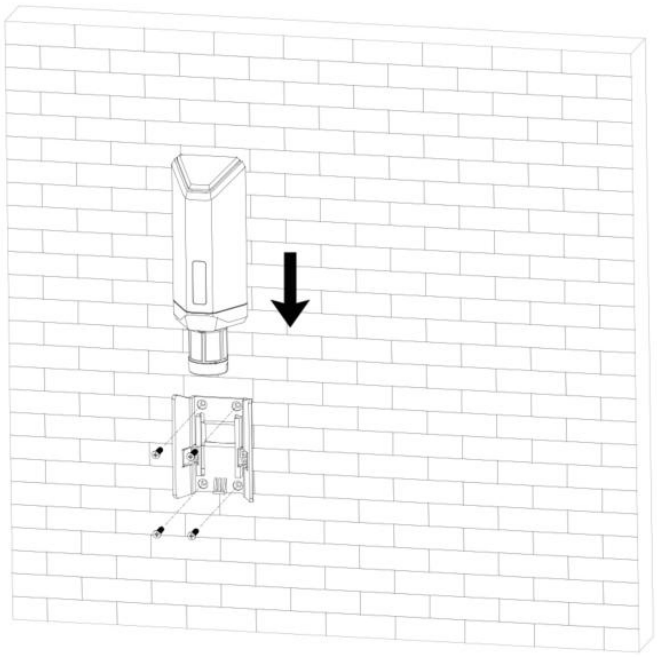


11.1.1 Mount on Pole and Wall

1) Mount on pole



2) Mount on wall



11.2 Replace the Battery

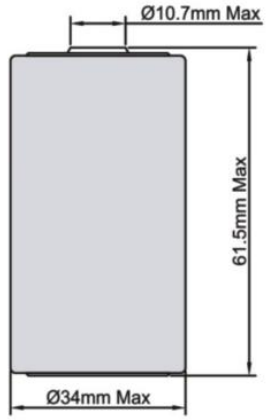
11.2.1 How to Buy the Battery

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)

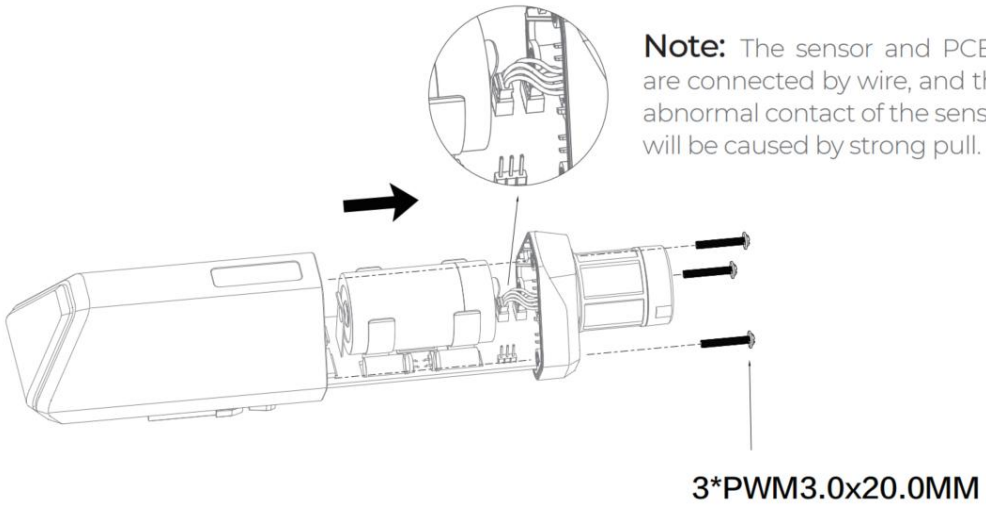
	
Operating temperature range	-60℃ to 85℃

11.2.2 How to Replace a New Battery

1) Remove three screws.

⚠Note:

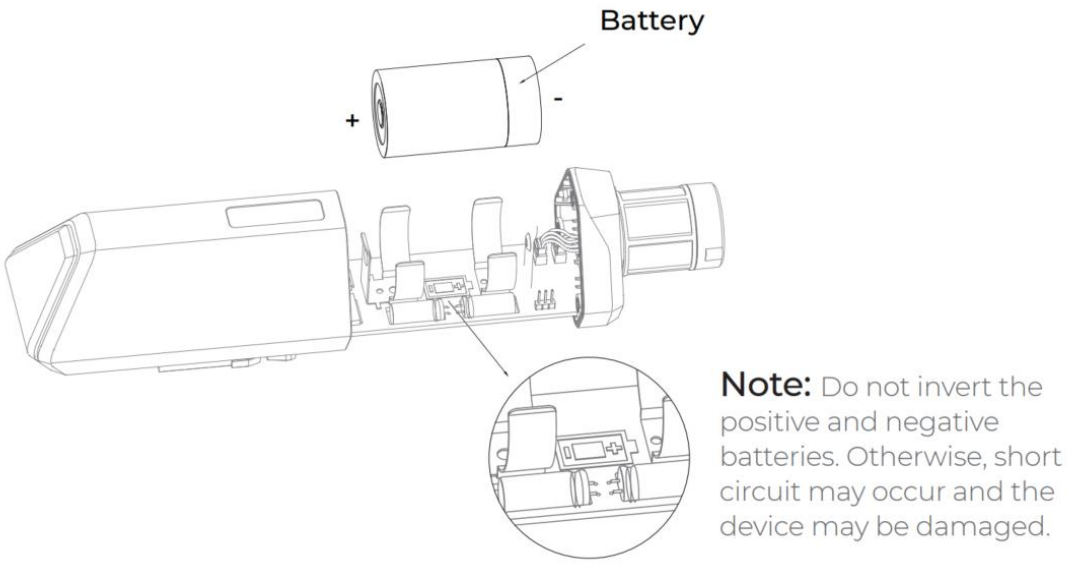
The sensor and PCBA are connected by wire, please disassemble carefully.



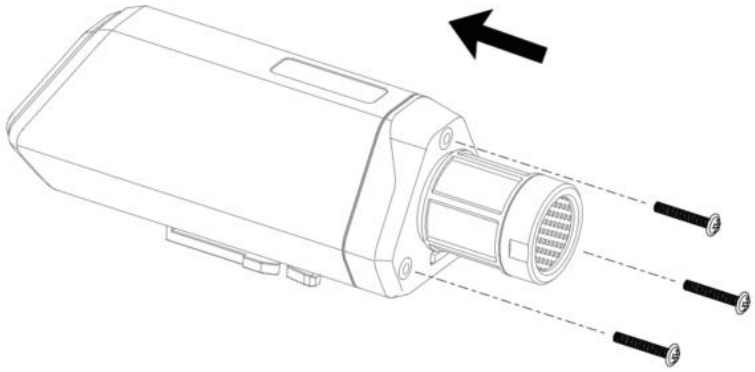
2) Install a new battery.

⚠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.

12. Trouble Shooting

12.1 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: support@sensecapmx.com

12.2 Document Version

Version	Date	Description	Editor
V1.0.0	5/01/2022	First edition	Jenkin Lu
V1.0.1	6/14/2022	Add App description	Jenkin Lu
V1.0.2	11/2/2022	A1101 Description	Ming Wen
V1.0.3	13/1/2022	A1101 Decoder Link Updated	Ming Wen
V1.0.4	3/2/2023	A1101 Decoder Demo Added	Ming Wen
V1.0.5	17/3/2023	Modified A1101 Decoder Description	Lee
V1.0.6	1/6/2023	A1101 Downlink Command	Andrea Ouyang