EM500-UDL
User Guide

www.ursalink.com

Safety Precautions

Ursalink will not shoulder responsibility for any loss or damage resulting from not following the instructions of this operating guide.

- The device must not be disassembled or remodeled in any way.
- Please clarify your application environment before deployment so that the device can function well.
- The device is not intended to be used as a reference sensor, and Ursalink will not should responsibility for any damage which may result from inaccurate readings.
- Do not place the device in places that are already out of measuring range or where the temperature is below/above the operating range .
- Make sure electronic components do not drop out of the enclosure while opening.
- When closing the lid, make sure the lid is fitted the right way, so that the enclosure is properly sealed.
- When installing the battery, please install it accurately, not reversely or with wrong model.
- The device must never be subjected to shocks or impacts.

Declaration of Conformity

Ursalink EM500-UDL is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.

For assistance, please contact
Ursalink technical support:
Email: helpdesk@ursalink.com
Tel: 86-592-5023060
Fax: 86-592-5023065

Revision History

Date	Doc Version	Description
April 7, 2020	V 1.0	Initial version
August 27, 2020	V 1.1	Document Structure Change

Contents

1. Overview

1.1 Description

EM500-UDL is an outdoor environment monitoring sensor mainly used to measure distance without object interface contact. EM500-UDL device is battery powered and designed for multiple mounting ways. It is equipped with NFC (Near Field Communication) and can easily be configured from a smartphone or a PC software.

Sensor data are transmitted in real-time using standard LoRaWAN protocol. LoRaWAN enables encrypted radio transmissions over long distance while consuming very little power. The user can obtain sensor data and view the trend of data change through Ursalink Cloud or thr ough the user's own Network Server.

1.2 Features

- Distance detection without immediate contact
- Up to 11km communication range
- Easy configuration via NFC
- Standard LoRaWAN support
- Ursalink Cloud compliant
- Low power consumption with 19000mAh replaceable battery

1.3 Specifications

LoRaWAN	
Frequency	EU433/CN470/IN865/RU864/EU868/US915/AU915/KR920/AS923
Tx Power	16dBm(868)/20dBm(915)/19dBm(470)
Sensitivity	-147dBm @300bps
Mode	OTAA/ABP Class A
Antenna	Embedded Ceramic Antenna
Distance Measurement	
Range[1]	EM500-UDL-W050：0.3-5m EM500-UDL-W100：0.5-10m (Customize for snow level detection)
Resolution	1 mm
Accuracy	± 1%
Physical Characteristics	
Power Supply	19000 mAh Li-$SoCl_2$ battery

Battery Life[2]	6 year (10 min interval, SF12) >10 year (10 min interval, SF7)
Operating Temperature	-30°C to +65°C
Relative Humidity	0% to 100% (non-condensing)
Dimension	156.1 × 71 × 69.5 mm
Mounting	Pole, wall, DIN rail

1. Max distance/level data for W050 model is 4.999m, max distance/level data for W100 model is 9.998m.
2. Tested under laboratory conditions and for guideline purposes only.

2. Hardware Introduction

2.1 Packing List

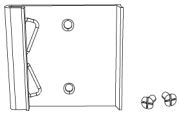
1 × EM500-UDL

2 × Mounting Screws

1 × Hose Clamp

1 × Warranty Card

1 × Quick Guide



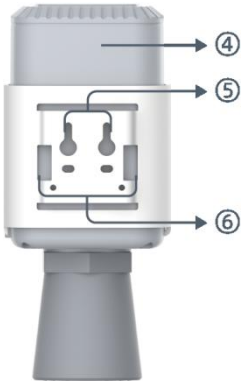
1 × DIN Rail (Optional)

If any of the above items is missing or damaged, please contact your Ursalink sales representative.

2.2 Product Overview

Front View:

①LoRa Antenna (Internal)
②NFC Area
③Ultrasonic Horn



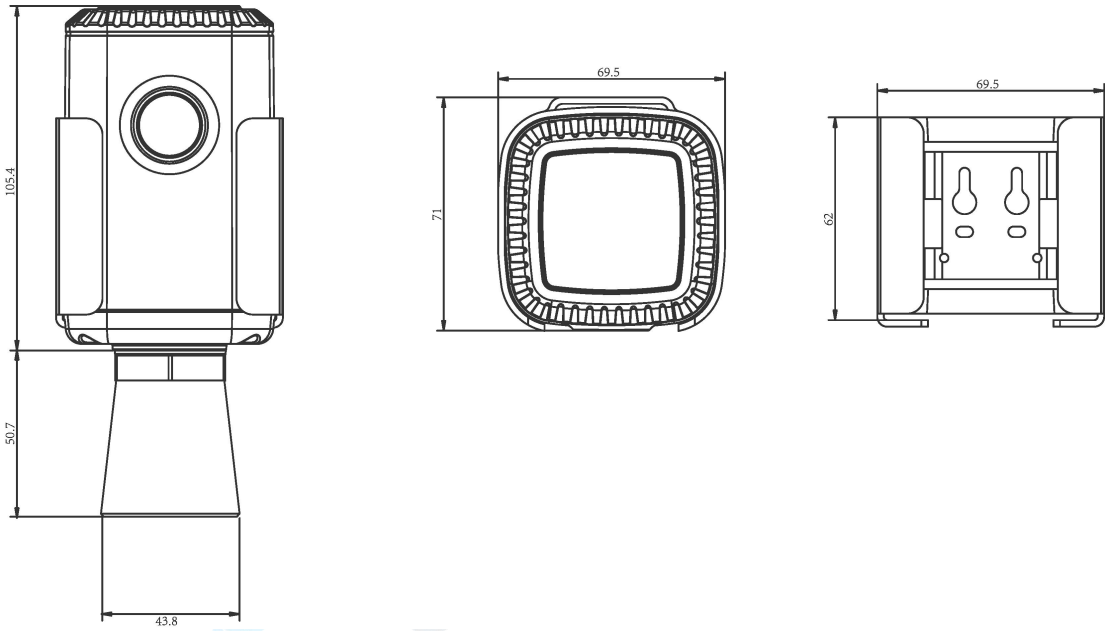
Back View:

④Battery (Internal)

⑤Wall Mounting Holes

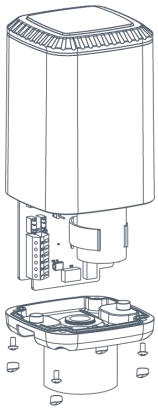
⑥Pole Mounting Holes

2.3 Dimensions(mm)



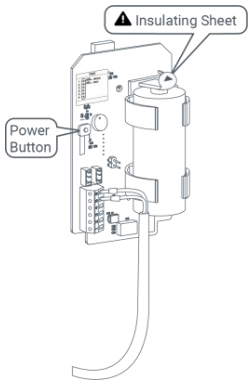
3. Insulating Sheet Disassembly

1. Take off the mounting bracket, remove the lid and screws on the bottom of the device, and then take off the enclosure cover.



2. Pull out the insulating sheet on the side of the battery and check if electrode of the battery is reversed.

Note: Refer to Chapter 4 to check if EM500 can be turned on via power button.



4. Turn ON/OFF and Reset (Power Button)

The LED indicator is inside the device. EM500-UDL can also be turned on/off and reset via Mobile APP or Toolbox.

Function	Action	LED Indication
Turn On	Press and hold the button for more than 3 seconds.	Off → Static Green
Turn Off	Press and hold the button for more than 3 seconds.	Static Green -> Off
Reset	Press and hold the button for more than 10 seconds. **Note:** EM500 will automatically power on after reset.	Blink 3 times.
Check On/Off Status	Quickly press the power button.	Light On: Device is on. Light Off: Device is off.

5. Sensor Configuration

Ursalink EM500-UDL sensor can be monitored and configured via one of the following methods:

- Mobile APP (NFC);
- Windows software (NFC or Type-C port).

In order to protect the security of sensor, password validation is required when turning on/off the sensor or changing configuration. Default password is **123456**.

5.1 Configuration via Smartphone APP

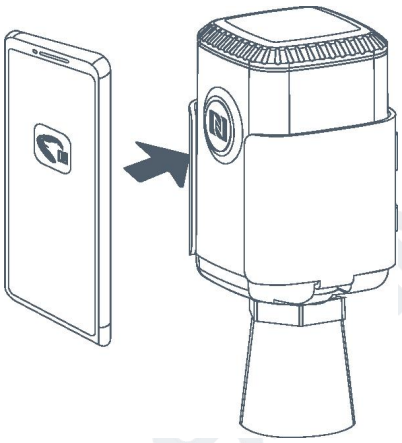
Preparation:

- Smartphone (NFC supported)
- Toolbox APP: download and install from Google Play or Apple Store.

5.1.1 Read/Write Configuration via NFC

1. Enable NFC on the smartphone and open “Toolbox” APP.
2. Attach the smartphone with NFC area to the device to read basic information.

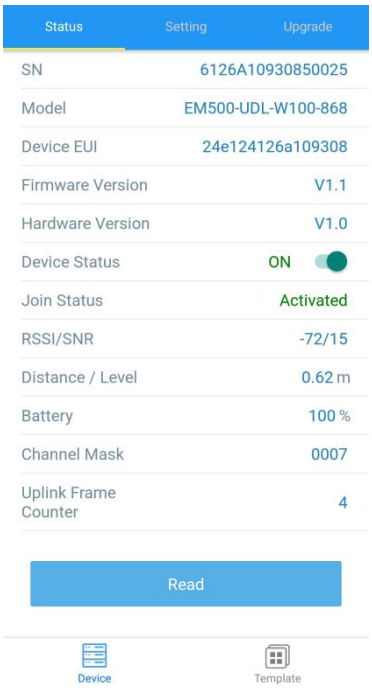
Note: Ensure your smartphone NFC area and it is recommended to take off phone case before using NFC.



3. When you perform one of the following operations, enter the password and attach the smartphone with NFC area to the device until the APP shows a successful prompt.

- Turn on/off the sensor
- Reset the sensor
- Tap “Write” to change settings in “Device > Settings”.

4. Go to “Device > Status” to tap “Read” and attach the smartphone with NFC area to the device to read real-time data of sensor.

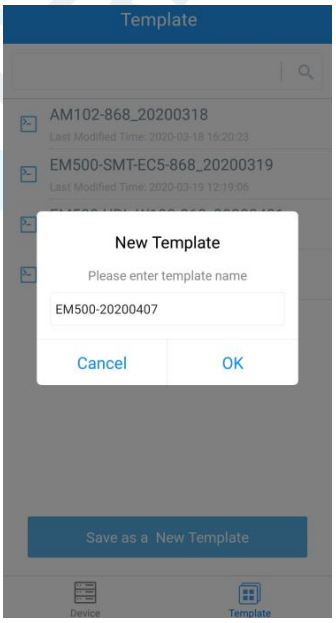


5.1.2 Template Configuration

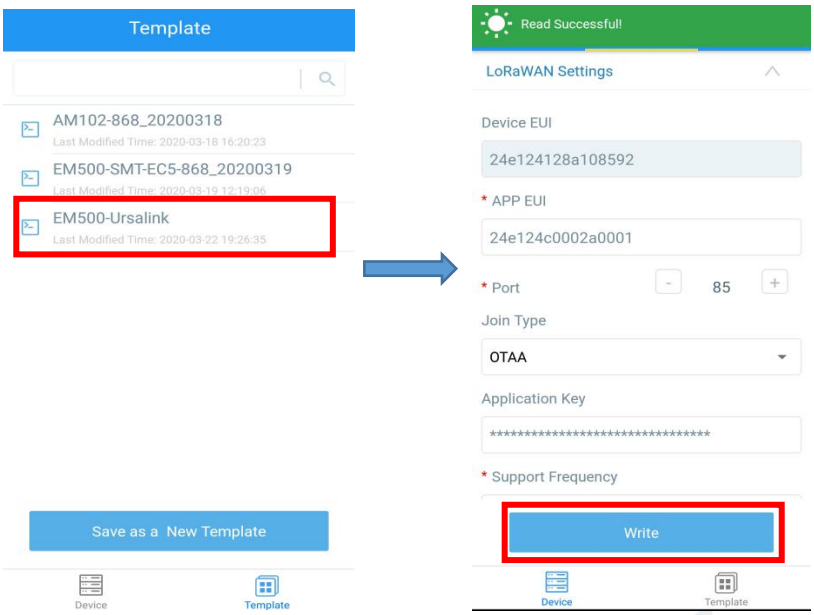
Template settings are used for easy and quick device configuration in bulk.

Note: Template function works only for sensors with the same model and LoRa frequency band.

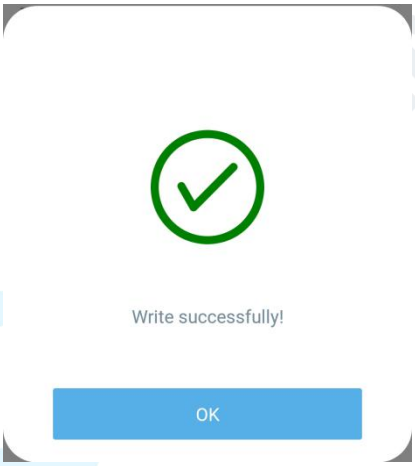
1. Go to "Template" page on the APP and save current settings as a template.



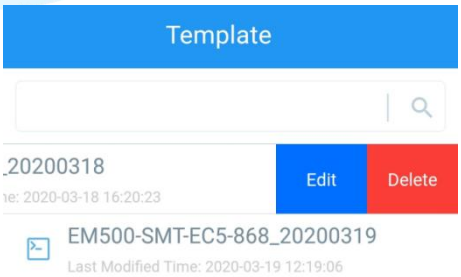
2. Attach the smartphone with NFC area to another device.
3. Select the template file from Toolbox APP and tap "Write".



4. Enter password of this device and keep the two devices close until the APP shows a successful prompt.



5. Slide the template item to the left to edit or delete the template.



5.2 Configuration via PC

Preparation:

- Dedicated NFC Reader or Type-C USB cable
- PC (Windows 10 is recommended)
- Toolbox: https://www.ursalink.com/en/software-download/

5.2.1 Log in the Toolbox

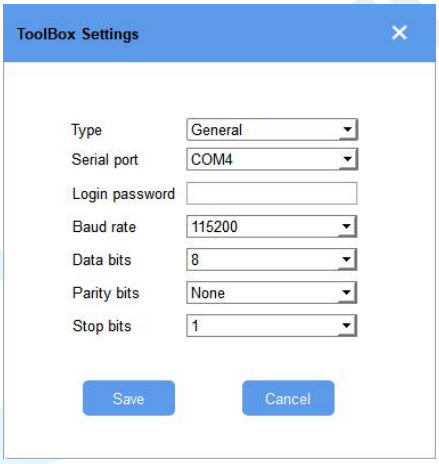
Make sure "Toolbox" is downloaded on your computer. Select one of the following methods to log in Toolbox.

Type-C Connection

1. Connect the EM500-UDL to computer via type-C port.

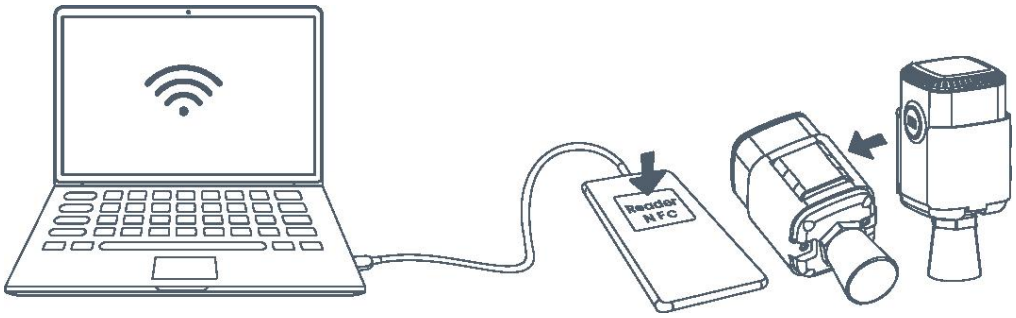
Type-C port is inside the transceiver of the EM500-UDL.

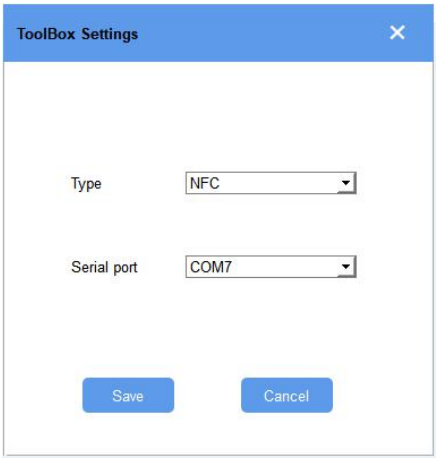
2. Select type as "General" and click password to log in Toolbox. (Default password: 123456)



NFC Connection

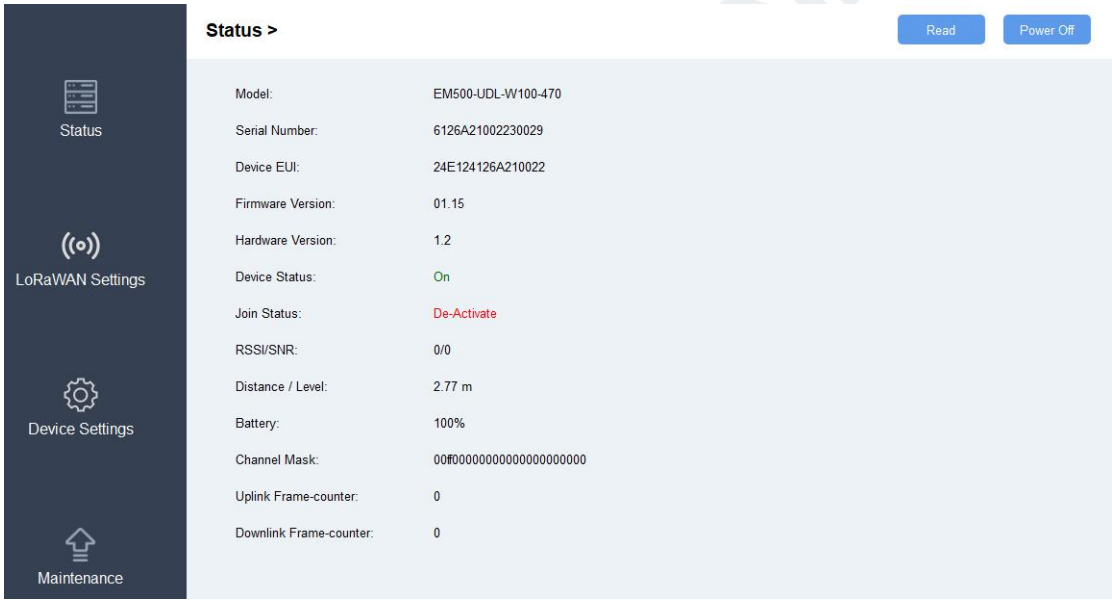
1. Connect the NFC reader to computer, then attach the EM500-UDL to NFC area of the reader.
2. Select type as "NFC" and serial port as NFC reader port on Toolbox.





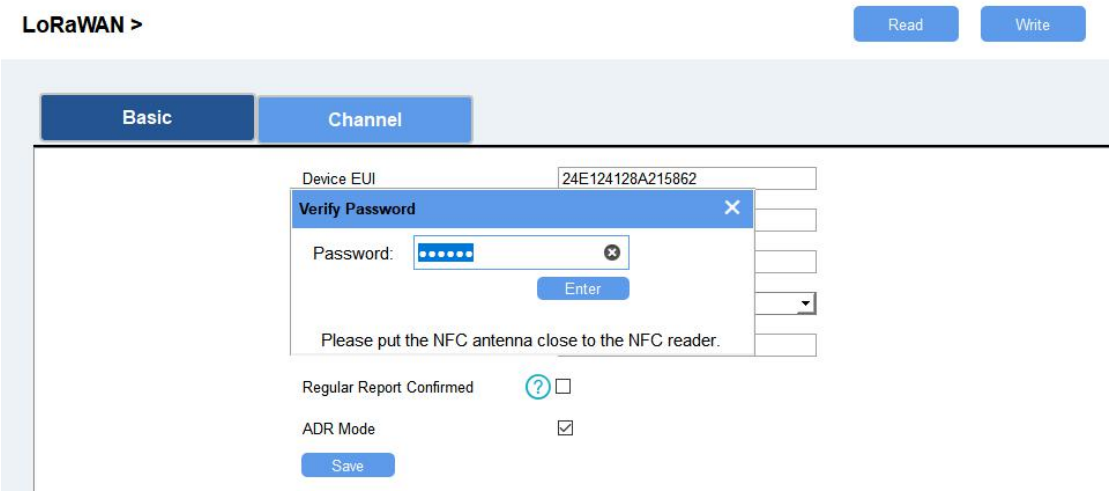
5.2.2 Basic Configuration

1. Click “Read” to read current data of the sensor.



2. When you perform one of the following operations, enter the password and wait a few seconds until toolbox shows a successful prompt. (Password is not needed if you connect it via type-C port)

- Turn on/off the sensor
- Reset the sensor
- Upgrade the sensor
- Click “Write” to change settings

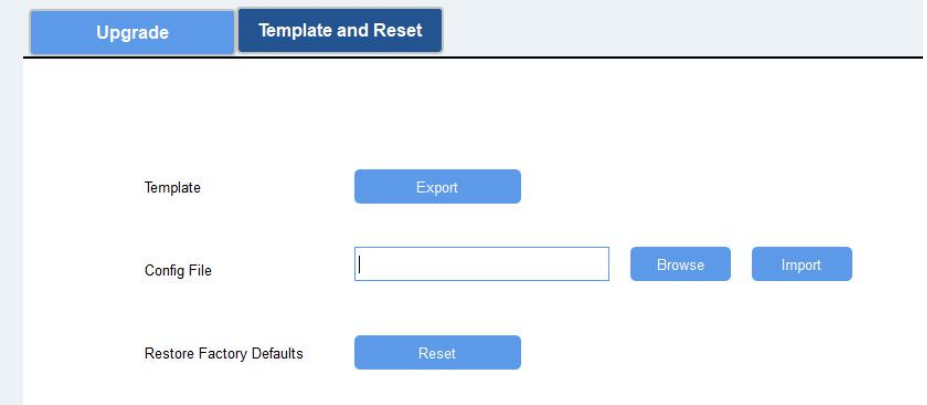


5.2.3 Template and Reset

5.2.3.1 Template Configuration

Note: Template function works only for sensors with the same model and LoRa frequency band.

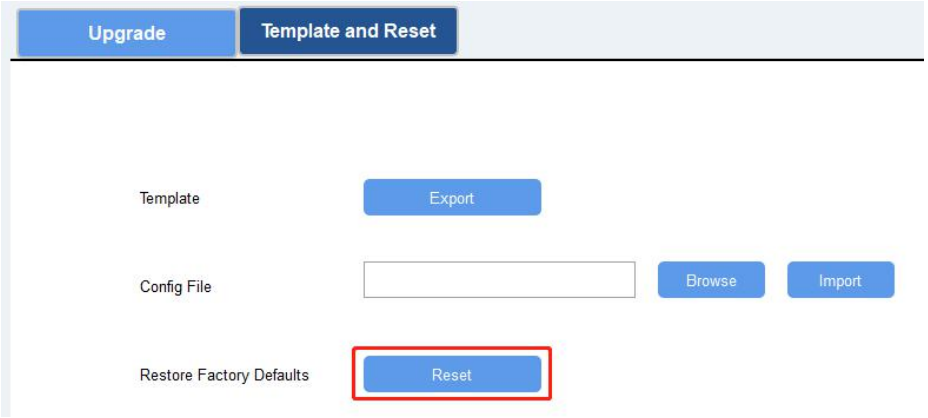
1. Go to “Maintenance -> Template and Reset” page in Toolbox.
2. Click “Export” to save the current settings as a template.



3. Click “Browse” to select the correct template from computer.
4. Click “Import” to import the template to the device.

5.2.4.2 Reset

Go to “Maintenance -> Template and Reset” page in Toolbox, then click the “Reset” to reset the device to the factory settings.

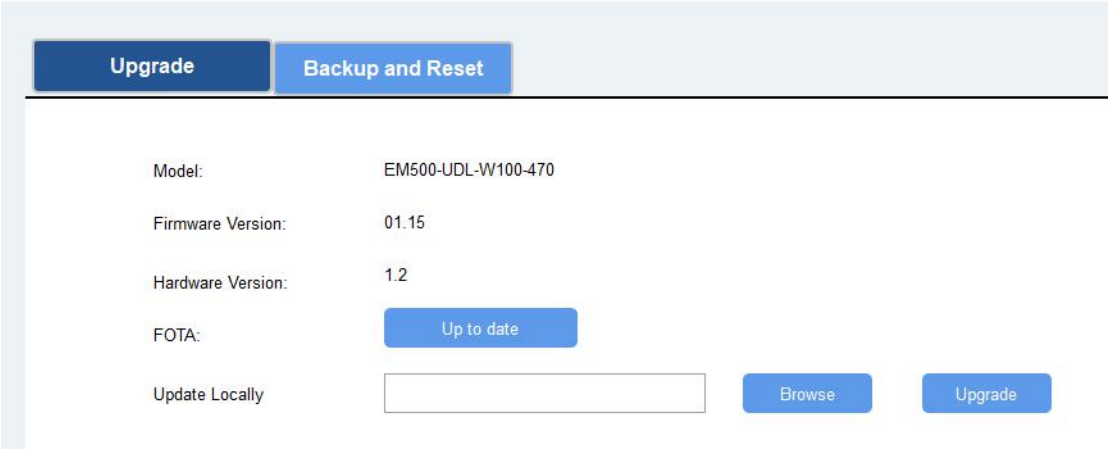


5.2.4 Upgrade

1. Download firmware on your computer.
2. Go to “Maintenance -> Upgrade” page in Toolbox.
3. Click “Browse” and select the firmware from computer.
4. Click “Upgrade” to upgrade the device.

Note: If NFC connection is selected, please keep the two devices close and don’t move them in order to get the best connectivity as possible when upgrading.

Upgrade >



5.3 Configuration Examples

5.3.1 LoRaWAN Channel Settings

The configuration of LoRaWAN channel of EM500-UDL must match the LoRaWAN gateway’s. Refer to Appendix to check default channel settings of EM500-UDL.

Mobile APP Configuration:

Open Toolbox APP and go to “Device ->Setting -> LoRaWAN Settings”to change the frequency and channels.

Software Configuration:

Log in Toolbox and go to “LoRaWAN Settings -> Channel” to change frequency and channels.

Note: If frequency is one of CN470/AU915/US915, you can enter the index of the channel that you want to enable in the input box, making them separated by commas.

Examples:

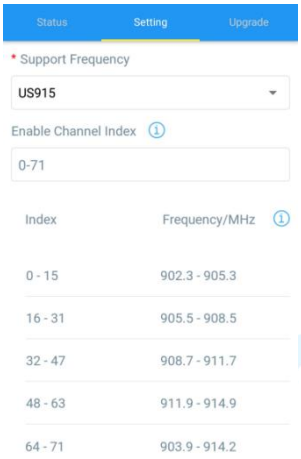
1, 40: Enabling Channel 1 and Channel 40

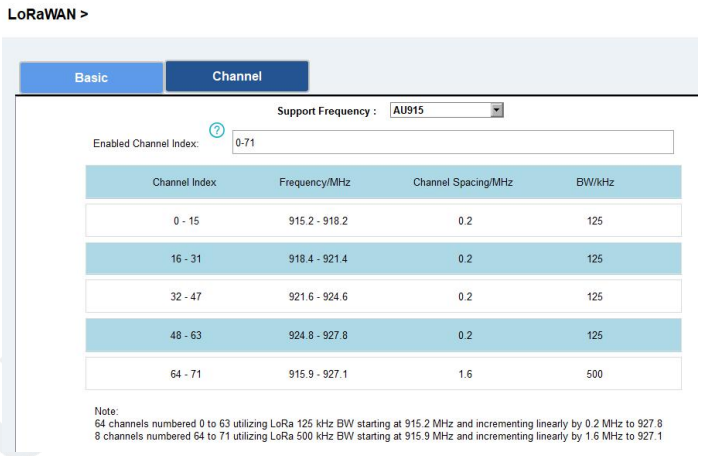
1-40: Enabling Channel 1 to Channel 40

1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60

All: Enabling all channels

Null: Indicates that all channels are disabled

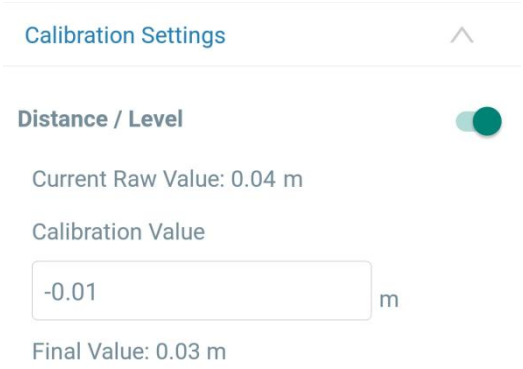




5.3.2 Data Calibration Settings

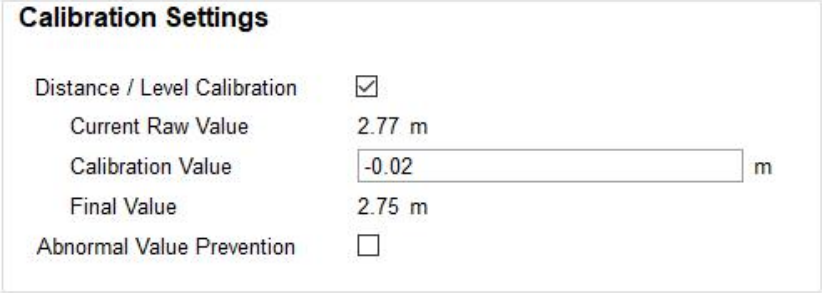
Mobile APP Configuration:

Open Toolbox APP and go to “Device -> Setting -> Calibration Settings”to enable the calibration and input the calibration value.



Software Configuration:

Log in Toolbox and go to “Device Settings -> Basic -> Calibration Settings” to enable the calibration and type the calibration value.

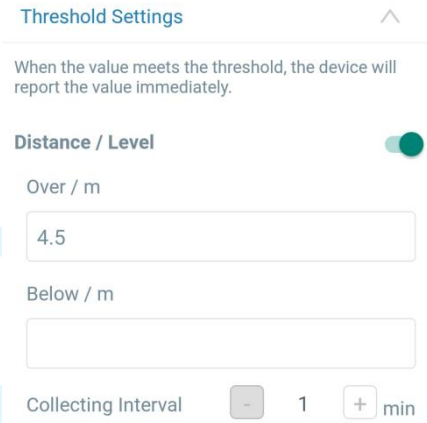


5.3.3 Alarm Settings

EM500-UDL will upload the current data instantly after the threshold is triggered.

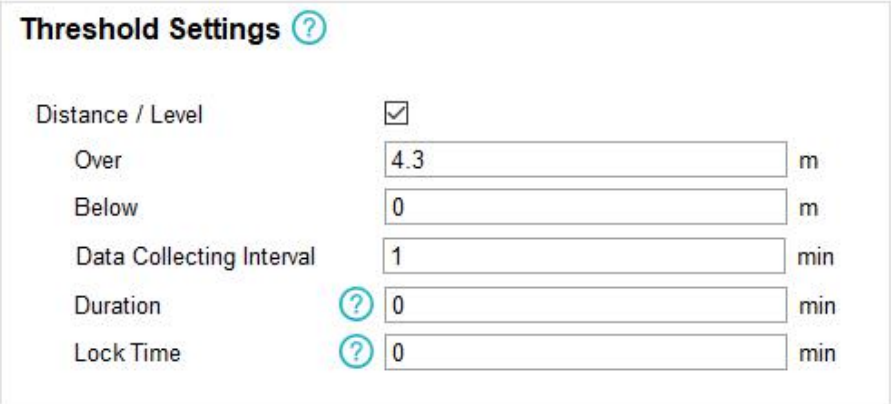
Mobile APP Configuration:

Open Toolbox APP and go to “Device -> Setting -> Threshold Settings”to enable the threshold settings and input the threshold.



Software Configuration:

Log in Toolbox and go to “Device Settings -> Basic -> Threshold Settings” to enable the calibration and input the calibration value.

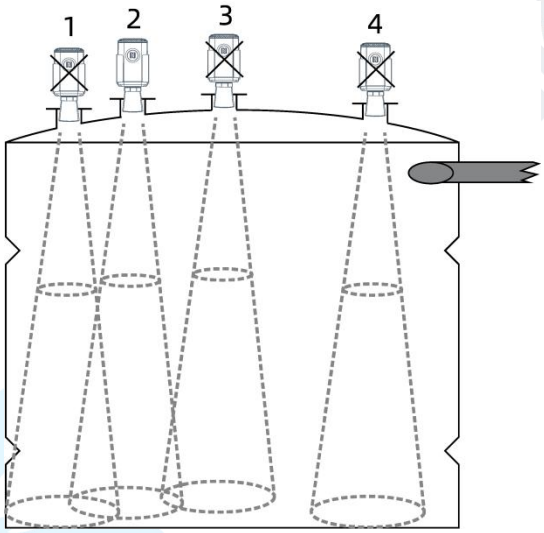


6. Sensor Installation

6.1 Installation Location

When installing EM500-UDL, please take in mind:

- Ensure the location of EM500-UDL is within the communication range of LoRaWAN gateway.
- Device must sit in a vertical position on top of the object and be fitted such that it has a clear path to the object.
- Place device where it is far away the side-wall more than **30cm** and without internal obstructions that block the ultrasonic signal. (Position 1)
- Position 2 is the ideal location to install EM500-UDL.
- Do not place device in the center of arched or circular container tops since it will cause multiple echos. (Position 3)
- Do not place the device above the container inlet orifice.(Position 4)

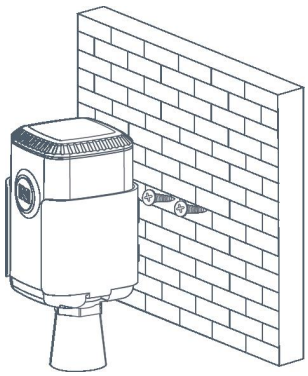


6.2 Wall Mounting

1. Attach the mounting bracket to the wall and drill. (Around 16mm)

Note: The connecting line of two holes must be a horizon line.

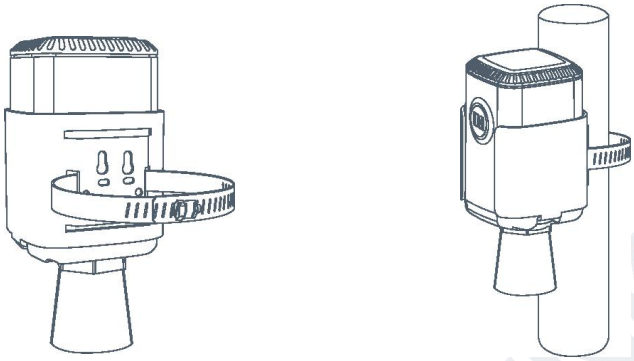
2. Drive two screws into wall at the marks using screw driver.
3. Mount the device on the wall.



6.3 Pole Mounting

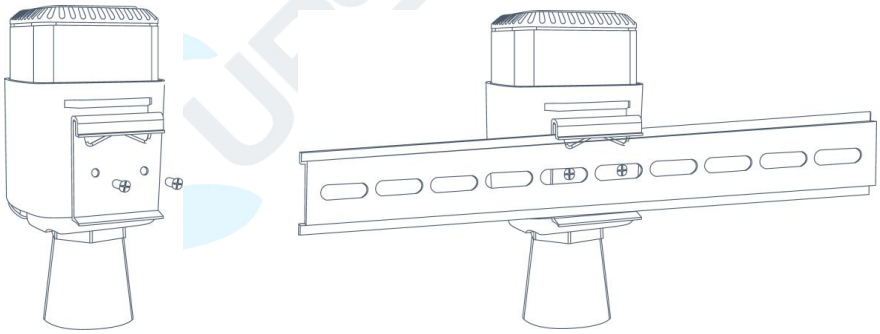
1. Loosen the hose clamp by turning the locking mechanism counter-clockwise.

2. Straighten out the hose clamp and slide it through the rectangular holes in the mounting bracket, wrap the hose clamp around the pole.
3. Use a screwdriver to tighten the locking mechanism by turning it clockwise.



6.4 DIN Rail Mounting

Use 2 pieces of M3 × 6 flat head Phillips screws to fix the DIN rail to the device, and then hang the DIN rail on the mounting bracket. It is necessary to choose a standard bracket.



7. Payload Format

All data are based on following format:

Channel1	Type1	Data1	Channel2	Type2	Data2	Channel 3	...
1 Byte	1 Byte	N Bytes	1 Byte	1 Byte	M Bytes	1 Byte	...

Please refer to decoder example: https://github.com/Ursalink-CN/ursalink-decoder

Uplink Packet(HEX)

Channel	Type	Data Example	Unit
01	75(Battery Level)	64 => 100	%

03	82 (Distance)	1e 00 => 00 1e= 30	mm
FF	01(Ursalink Protocol Version)	01=> V1.0	/
	09 (Hardware Version)	01 40=> V1.4	
	0a(Software Version)	01 14=> V1.14	
	0b(Power on Notification)	ff	
	0c(Power off Notification)	ff	
	0f(Device Type)	00 => Class A	
	16 (Device SN)	64 10 90 82 43 75 00 01 =>Device SN is 6410908243750001	

Downlink Packet(HEX)

Channel	Type	Data Example	Unit
FF	03(Set Reporting Interval)	b0 04 => 04 b0 = 1200	s

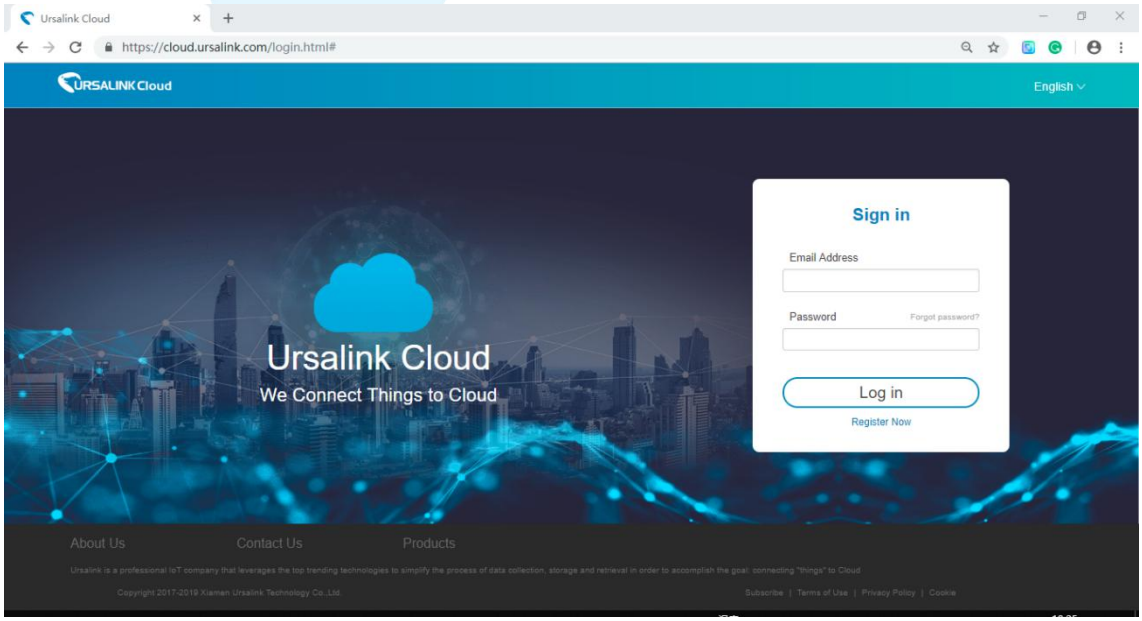
7.Sensor Management via Ursalink Cloud

Ursalink cloud is a comprehensive platform that provides multiple services including device remote management and data visualization with the easiest operation procedures.

7.1 Ursalink Cloud Registration

Register and log in Ursalink Cloud.

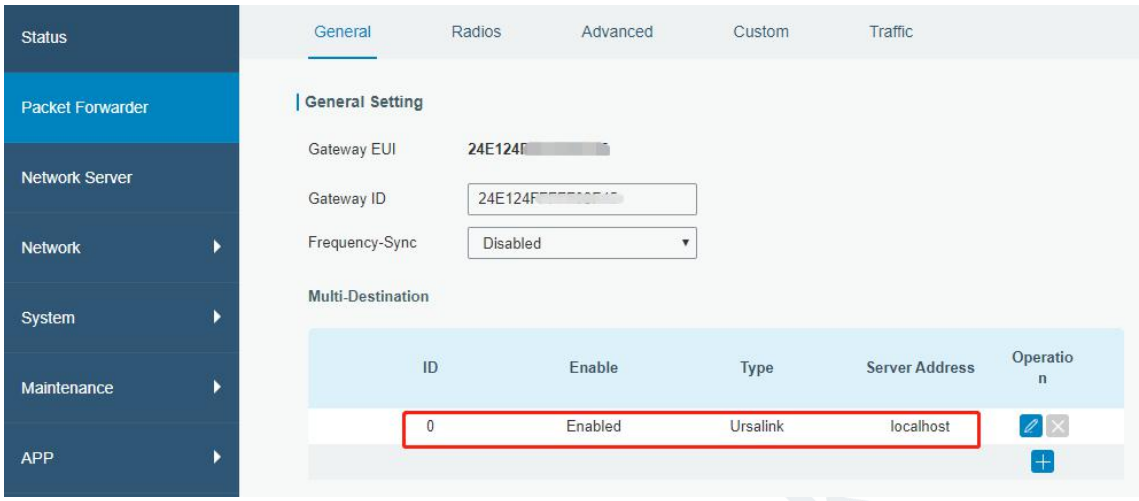
Ursalink Cloud URL: https://cloud.ursalink.com/login.html

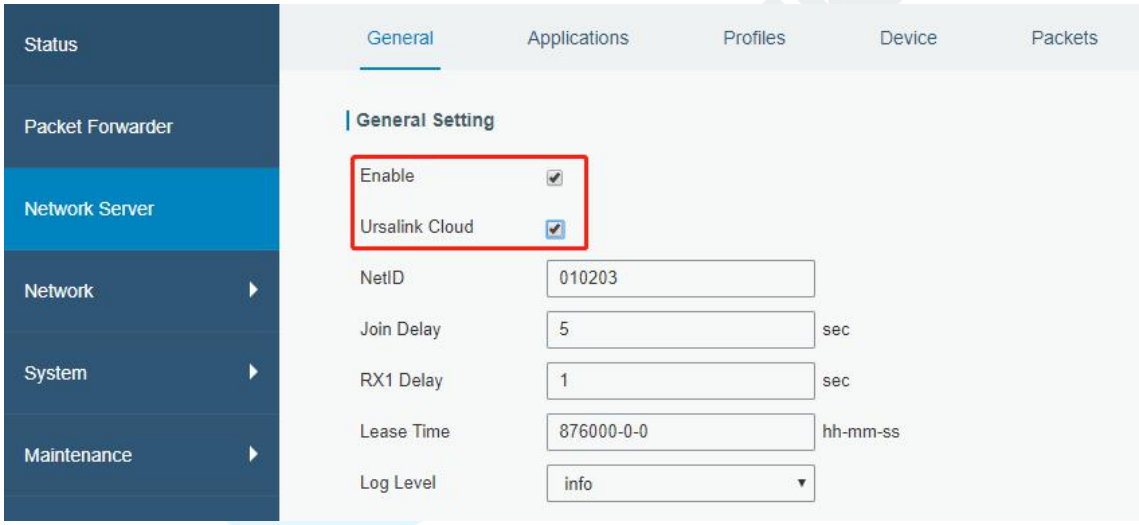


7.2 Add a Ursalink LoRaWAN Gateway

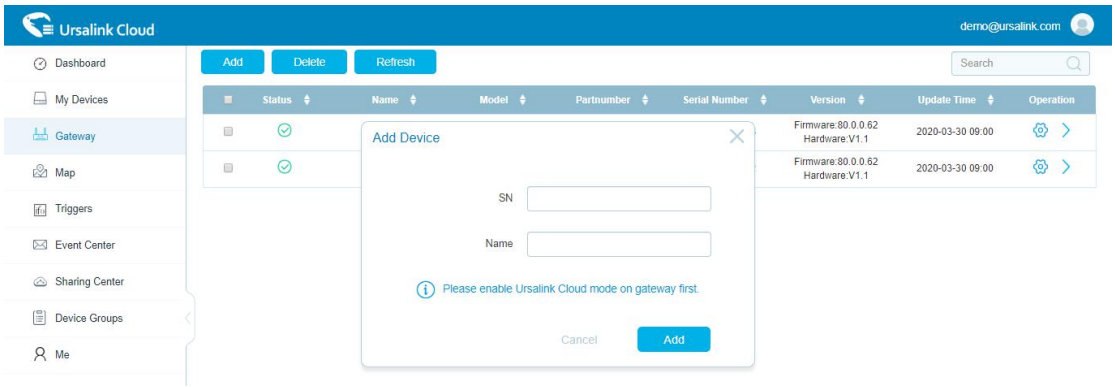
1. Enable “Ursalink” type network server and “Ursalink Cloud” mode in gateway web GUI.

Note: Ensure gateway has accessed the Internet.





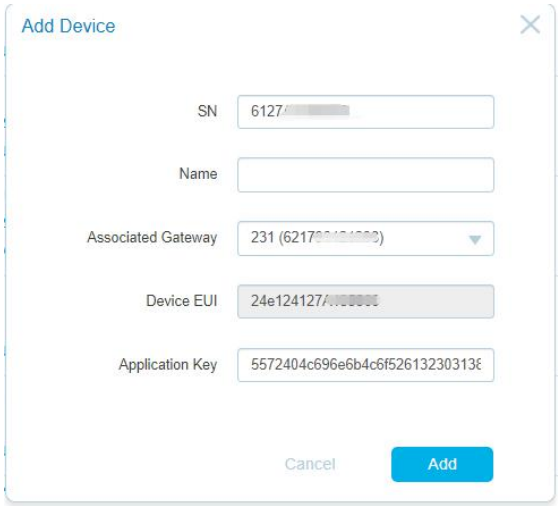
2.Go to “My Devices->Gateway” of Ursalink Cloud and click “Add” to add gateway to Ursalink Cloud via SN.



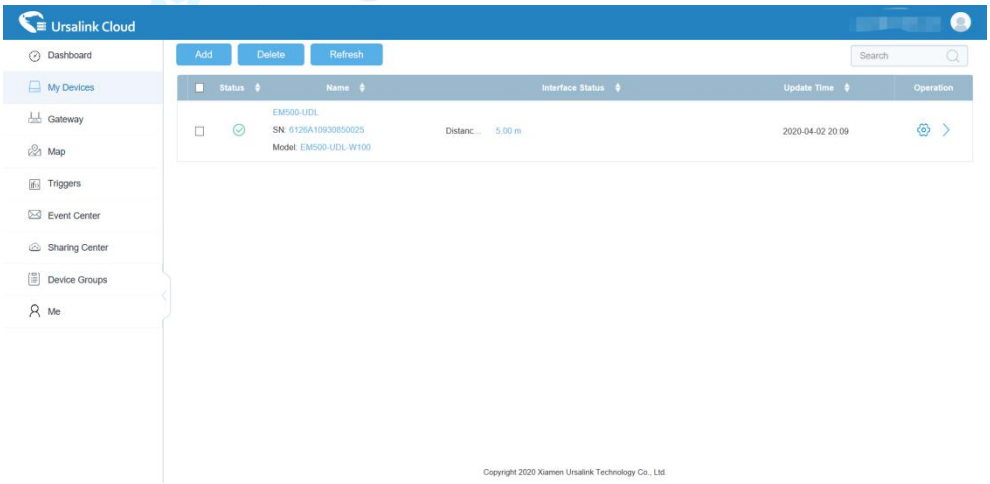
3.Check if gateway is online in Ursalink Cloud.

7.3 Add EM500-UDL to Cloud

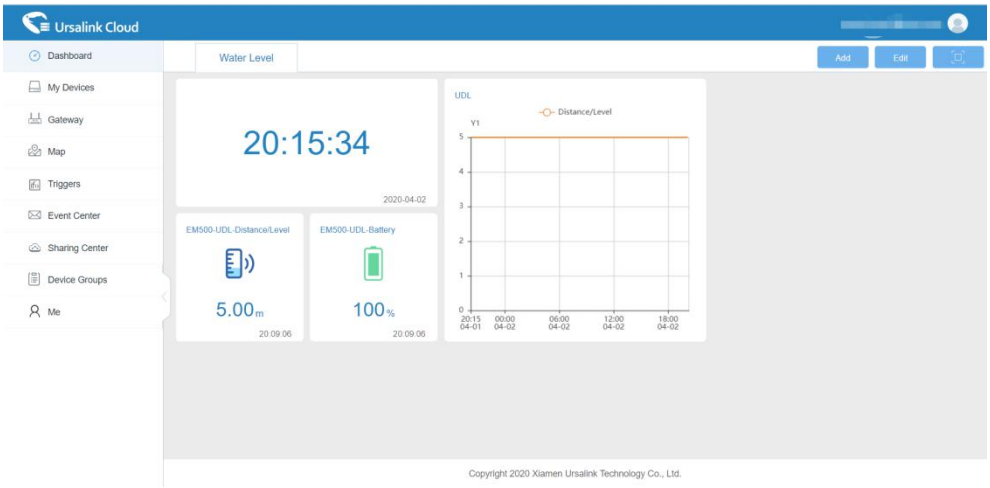
1. Go to “Device->My Devices” and click “Add Device”. Fill in the SN of EM500-UDL and select associated gateway.



1. After EM500-UDL is connected to Ursalink Cloud, Click > or “History Data” to check the data on Ursalink cloud.



3.Go to “Dashboard” page to add dashboard.



Appendix

Default LoRaWAN Parameters

DevEUI	24E124 + 2nd to 11th digits of SN e.g. SN = 61 26 A1 01 84 96 00 41 Then Device EUI = 24E124126A101849
AppEUI	24E124C0002A0001
Appport	0x55
NetID	0x010203
DevAddr	The 5th to 12th digits of SN e.g. SN = 61 26 A1 01 84 96 00 41 Then DevAddr = A1018496
AppKey	5572404C696E6B4C6F52613230313823
NwkSKey	5572404C696E6B4C6F52613230313823
AppSKey	5572404C696E6B4C6F52613230313823

Default Uplink Channels

Model	Channel Plan	Channel Settings/MHz
EM500-UDL-433	EU433	433.175, 433.375, 433.575
EM500-UDL-470	CN470	470.3~489.3 (All 95 channels)
EM500-UDL-868	EU868	868.1, 868.3, 868.5
EM500-UDL-915	AU915	915.2~927.1 (All 72 channels)

-END-