



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

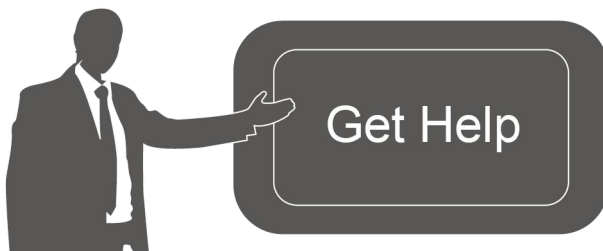
Ursalink EM500-UDL is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.



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Revision History

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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 Uursalink Cloud or through 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
- Uursalink 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



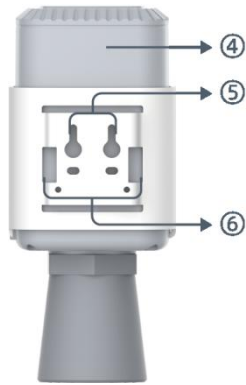
If any of the above items is missing or damaged, please contact your Ursalink sales representative.

2.2 Product Overview



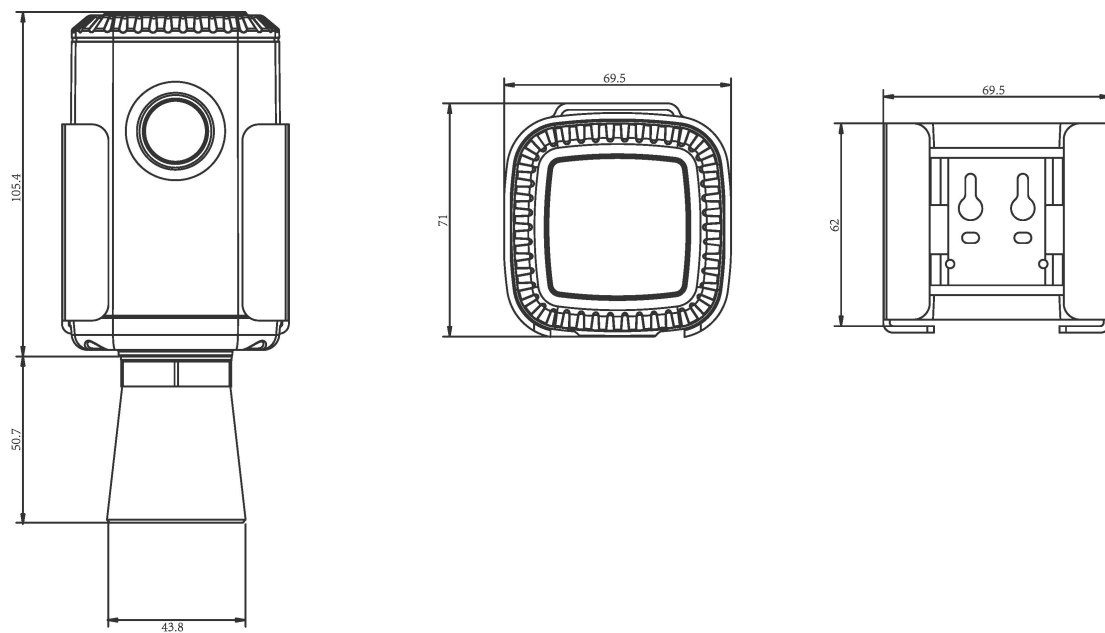
Front View:

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

**Back View:**

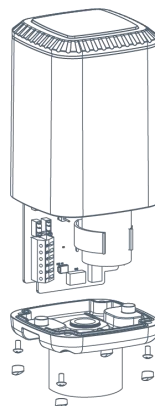
- ④ Battery (Internal)
- ⑤ Wall Mounting Holes
- ⑥ Pole Mounting Holes

2.3 Dimensions(mm)



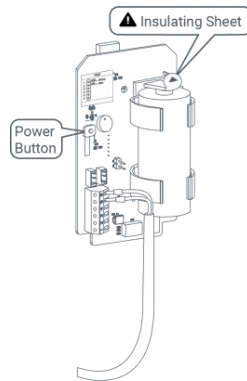
3. Insulating Sheet Disassembly

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

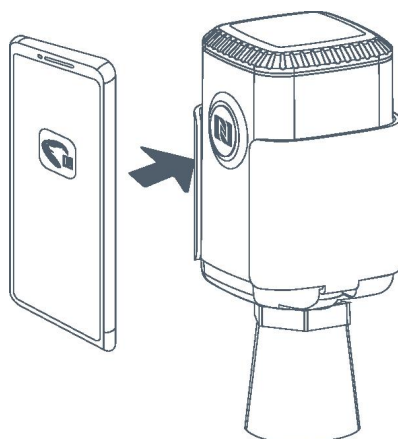
Preparation:

- 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.

Status	Setting	Upgrade
SN	6126A10930850025	
Model	EM500-UDL-W100-868	
Device EUI	24e124126a109308	
Firmware Version	V1.1	
Hardware Version	V1.0	
Device Status	ON 	
Join Status	Activated	
RSSI/SNR	-72/15	
Distance / Level	0.62 m	
Battery	100 %	
Channel Mask	0007	
Uplink Frame Counter	4	

Read

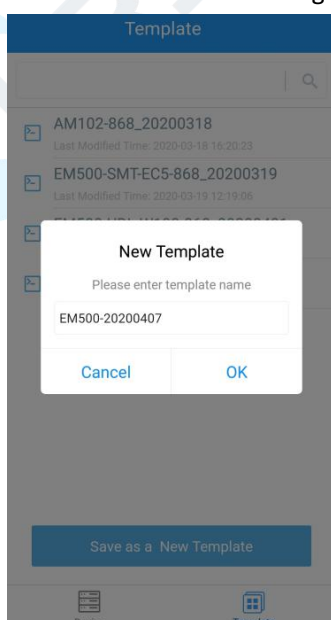
Device Template

5.1.2 Template Configuration

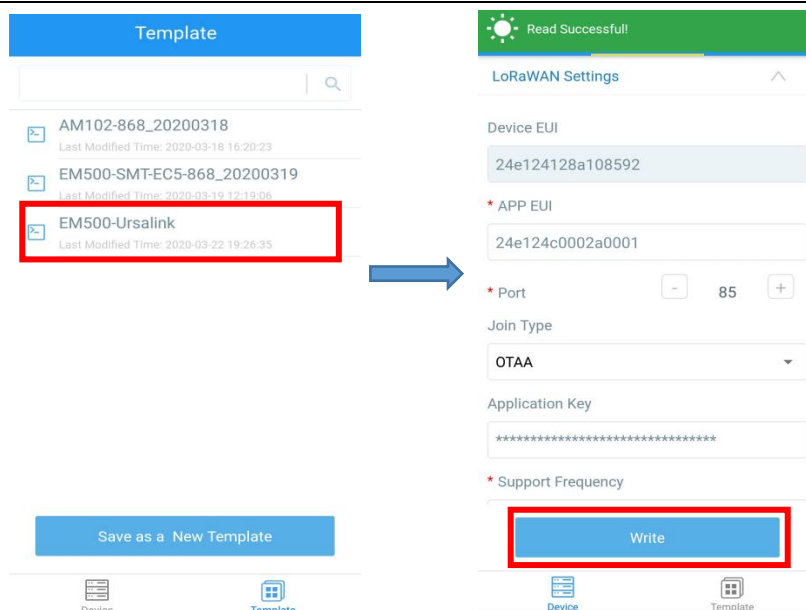
Template settings are used for easy and quick device configuration in bulk.

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

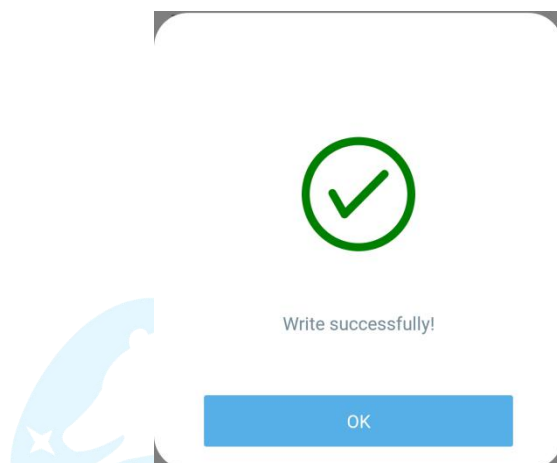
1. Go to “Template” page on the APP and save current settings as a template.



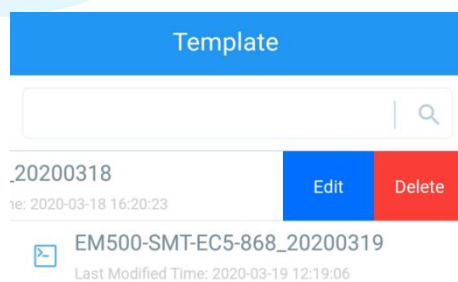
2. Attach the smartphone with NFC area to another device.
3. Select the template file from Toolbox APP and tap “Write”.



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

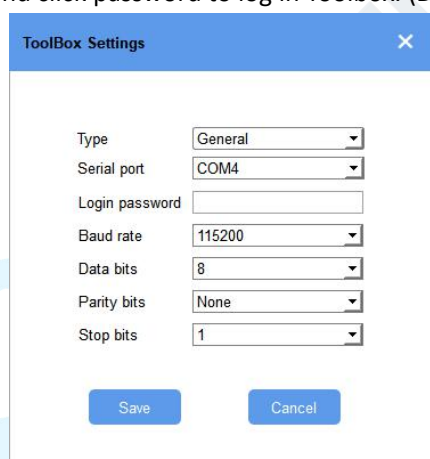
Make sure “Toolbox” is downloaded on your computer. Select one of the following methods to log in Toolbox.

Type-C Connection

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

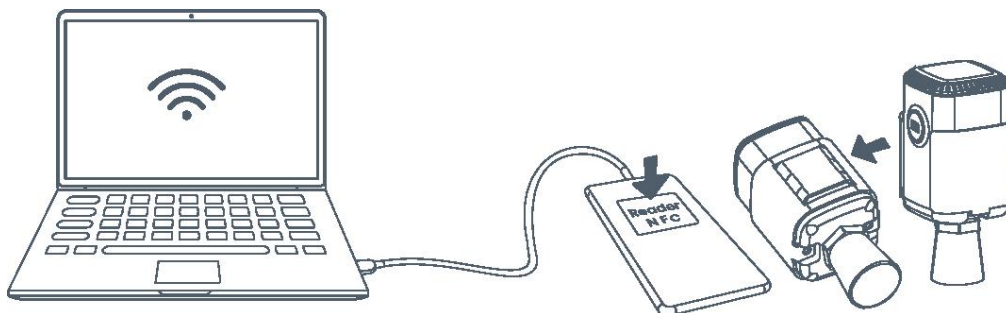
 Type-C port is inside the transceiver of the EM500-UDL.

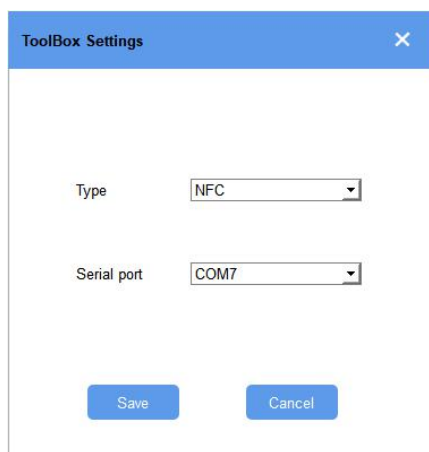
2. Select type as “General” and click password to log in Toolbox. (Default password: 123456)



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.

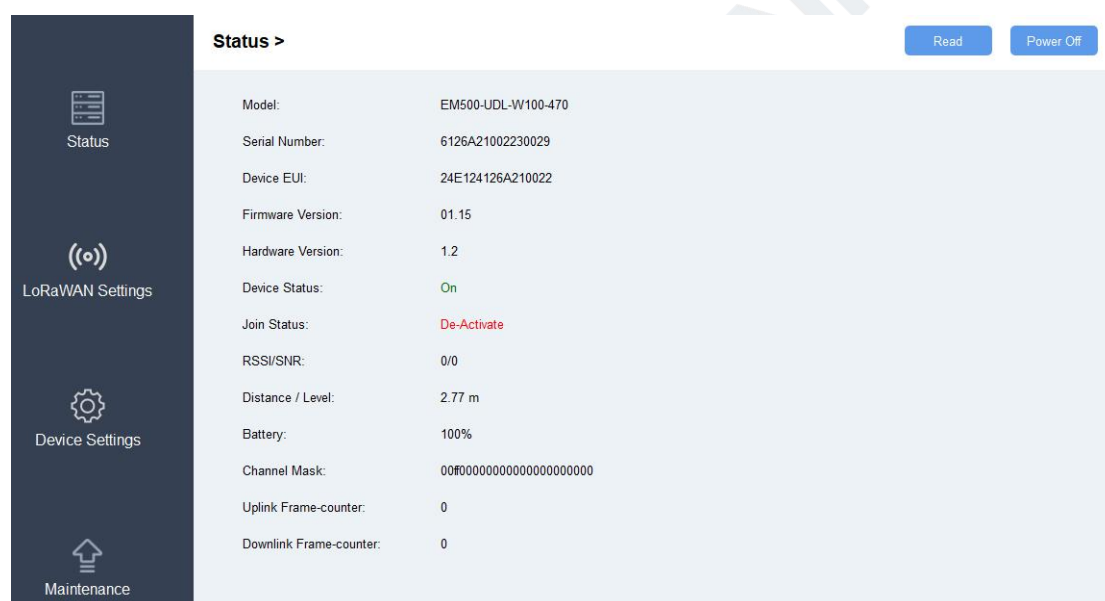




The image shows a 'ToolBox Settings' dialog box with a blue header and a close button (X) in the top right corner. Inside the dialog, there are two dropdown menus: 'Type' set to 'NFC' and 'Serial port' set to 'COM7'. At the bottom, there are two buttons: 'Save' and 'Cancel'.

5.2.2 Basic Configuration

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



The image shows a 'Status >' page with a dark sidebar on the left containing icons for Status, LoRaWAN Settings, Device Settings, and Maintenance. The main area displays sensor data with 'Read' and 'Power Off' buttons at the top right.

Parameter	Value
Model:	EM500-UDL-W100-470
Serial Number:	6126A21002230029
Device EUI:	24E124126A210022
Firmware Version:	01.15
Hardware Version:	1.2
Device Status:	On
Join Status:	De-Activate
RSSI/SNR:	0/0
Distance / Level:	2.77 m
Battery:	100%
Channel Mask:	00#0000000000000000000000
Uplink Frame-counter:	0
Downlink Frame-counter:	0

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

LoRaWAN > Read Write

Basic **Channel**

Device EUI: 24E124128A215862

Verify Password ✕

Password: ✕

Enter

Please put the NFC antenna close to the NFC reader.

Regular Report Confirmed ? ☐

ADR Mode ☒

Save

Downlink Frame-counter: 1

Success Firmware Version: 01.01

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.

Upgrade **Template and Reset**

Template Export

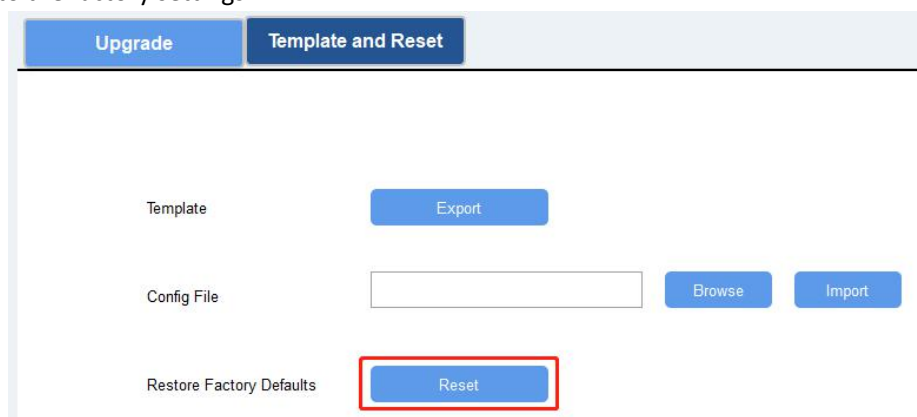
Config File Browse Import

Restore Factory Defaults Reset

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.

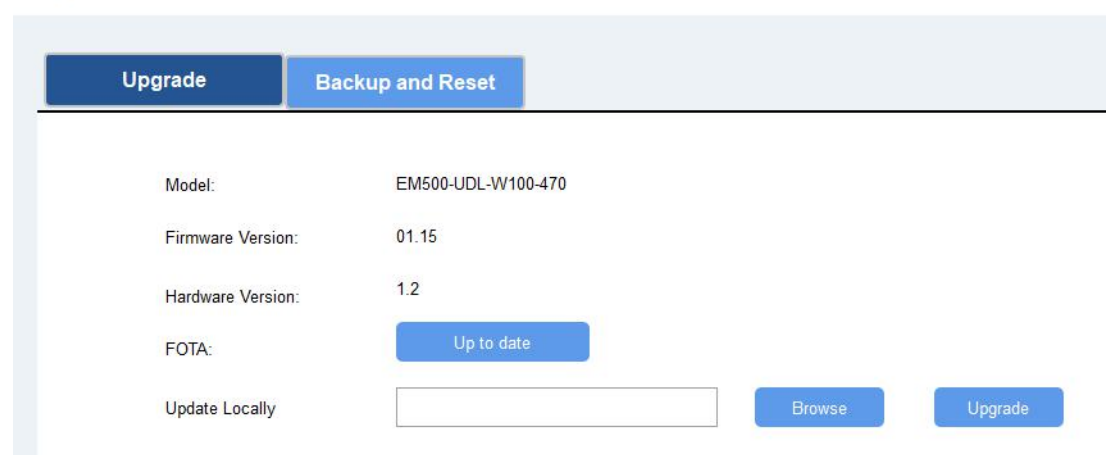


5.2.4 Upgrade

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:

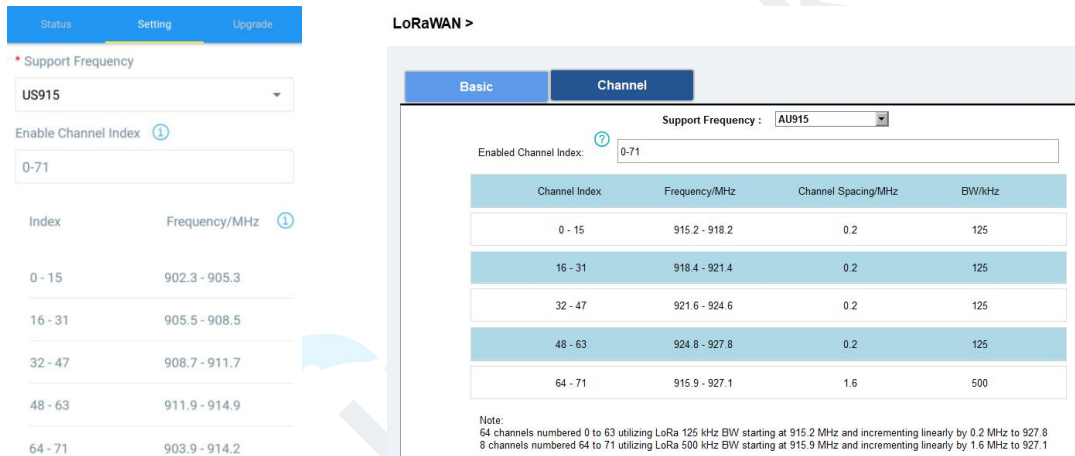
1, 40: Enabling Channel 1 and Channel 40

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

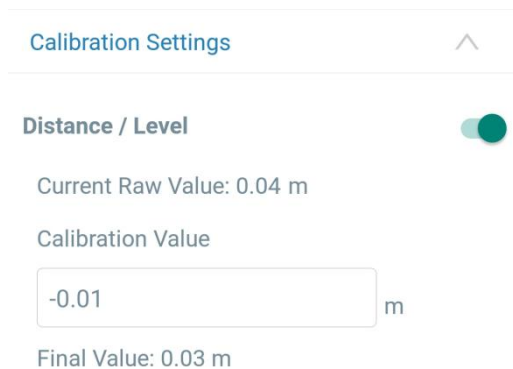


Channel Index	Frequency/MHz	Channel Spacing/MHz	BW/kHz
0 - 15	902.3 - 905.3	0.2	125
16 - 31	905.5 - 908.5	0.2	125
32 - 47	908.7 - 911.7	0.2	125
48 - 63	911.9 - 914.9	0.2	125
64 - 71	903.9 - 914.2	1.6	500

Note:
64 channels numbered 0 to 63 utilizing LoRa 125 kHz BW starting at 915.2 MHz and incrementing linearly by 0.2 MHz to 927.8 MHz
8 channels numbered 64 to 71 utilizing LoRa 500 kHz BW starting at 915.9 MHz and incrementing linearly by 1.6 MHz to 927.1 MHz

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.



Calibration Settings

Distance / Level ☒

Current Raw Value: 0.04 m


Calibration Value

m

Final Value: 0.03 m

Software Configuration:

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



Calibration Settings

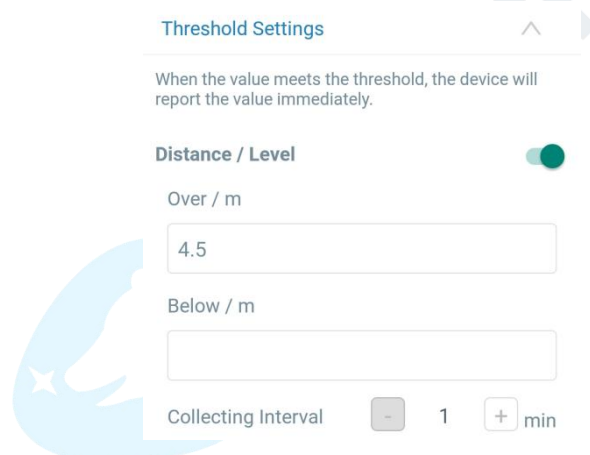
Distance / Level Calibration	<input checked="" type="checkbox"/>
Current Raw Value	2.77 m
Calibration Value	<input type="text" value="-0.02"/> m
Final Value	2.75 m
Abnormal Value Prevention	<input type="checkbox"/>

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.



Threshold Settings

When the value meets the threshold, the device will report the value immediately.

Distance / Level ☒

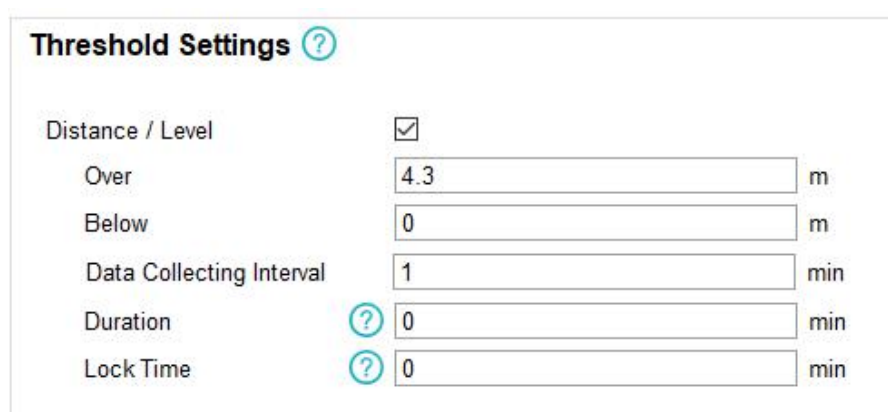
Over / m

Below / m

Collecting Interval 1 min

Software Configuration:

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



Threshold Settings ?

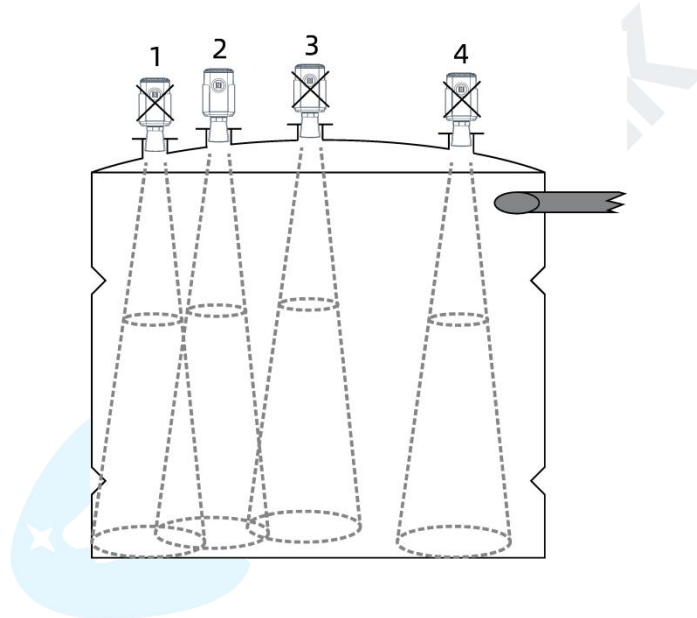
Distance / Level	<input checked="" type="checkbox"/>
Over	<input type="text" value="4.3"/> m
Below	<input type="text" value="0"/> m
Data Collecting Interval	<input type="text" value="1"/> min
Duration	? <input type="text" value="0"/> min
Lock Time	? <input type="text" value="0"/> min

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)

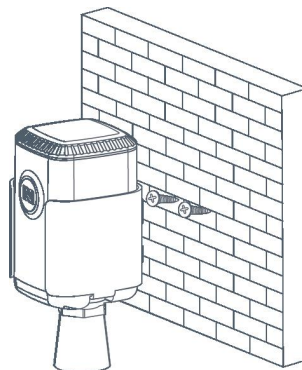


6.2 Wall Mounting

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

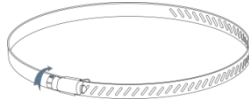
Note: The connecting line of two holes must be a horizon line.

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

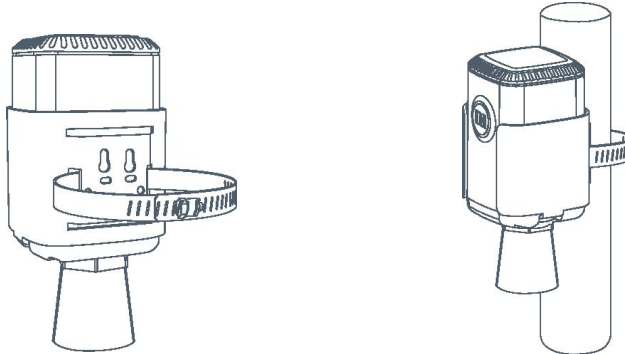


6.3 Pole Mounting

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

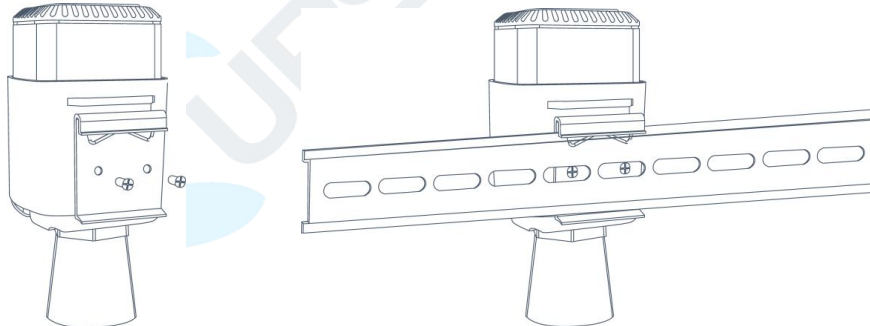


2. Straighten out the hose clamp and slide it through the rectangular holes in the mounting bracket, wrap the hose clamp around the pole.
3. Use a screwdriver to tighten the locking mechanism by turning it clockwise.



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

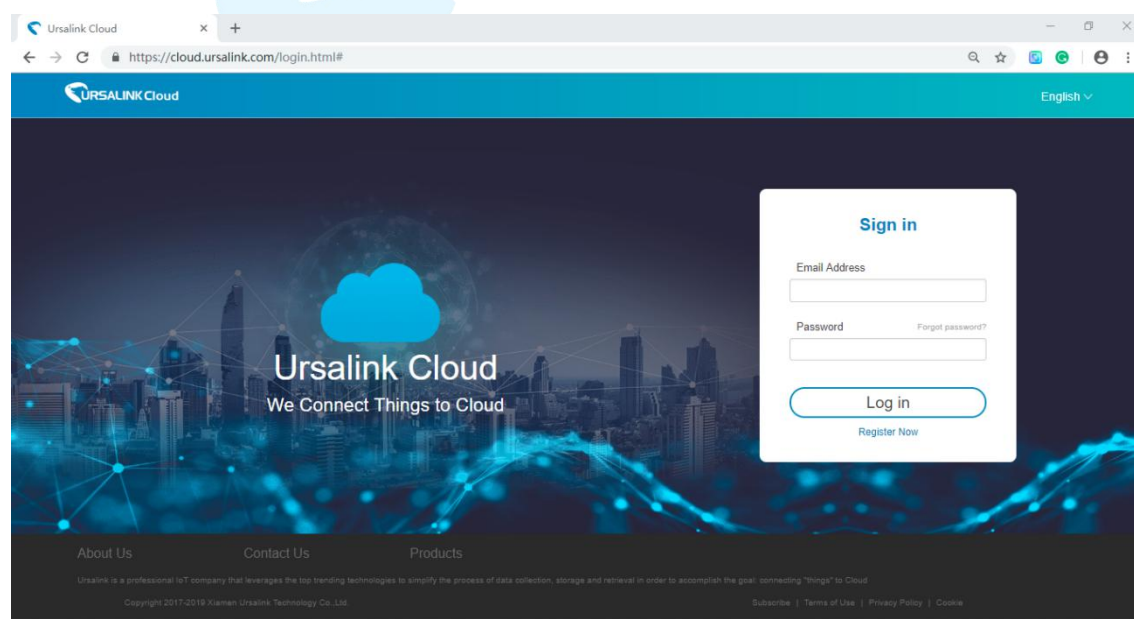
7.Sensor Management via Ursalink Cloud

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.

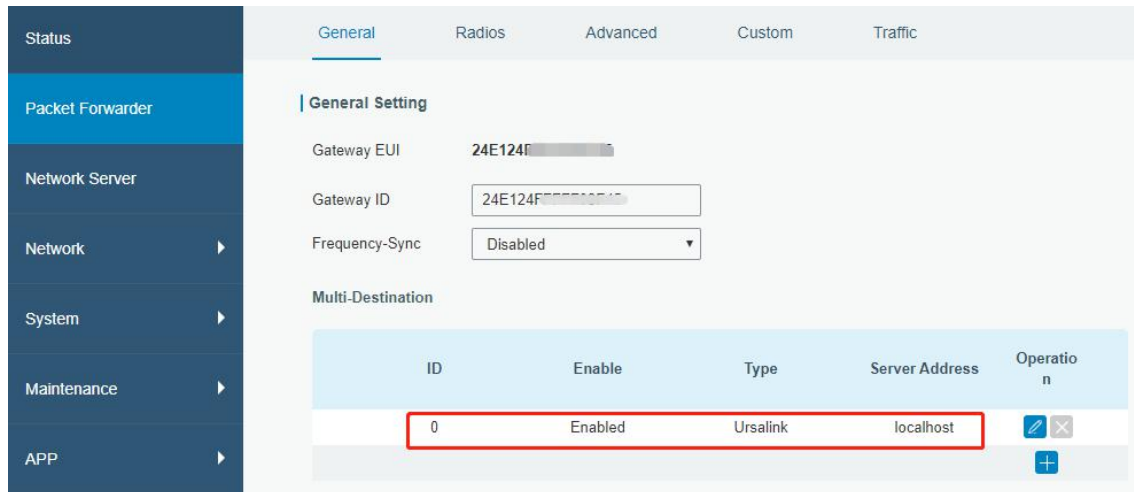
Ursalink Cloud URL: <https://cloud.ursalink.com/login.html>





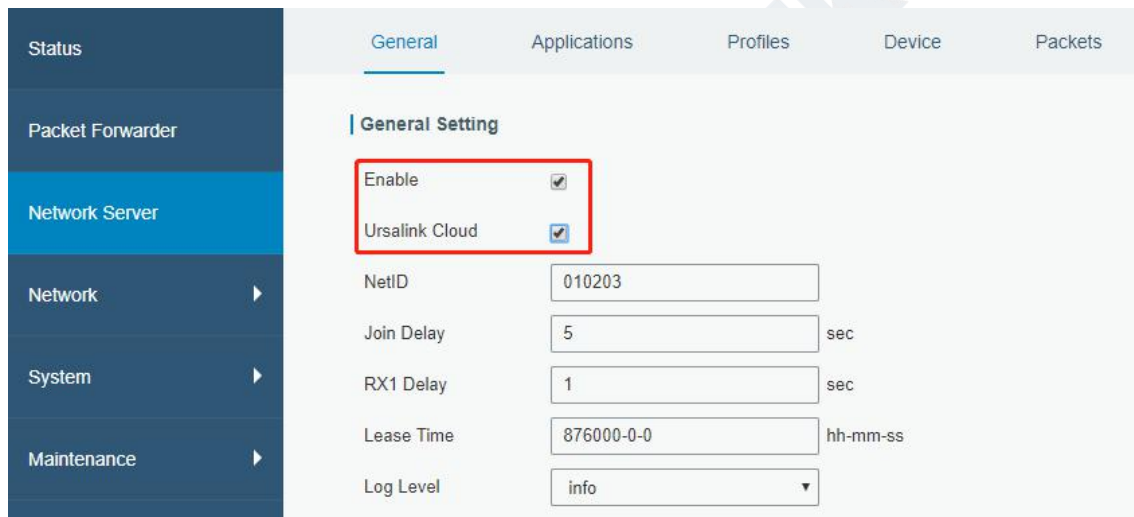
7.2 Add a Ursalink LoRaWAN Gateway

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

Note: Ensure gateway has accessed the Internet.



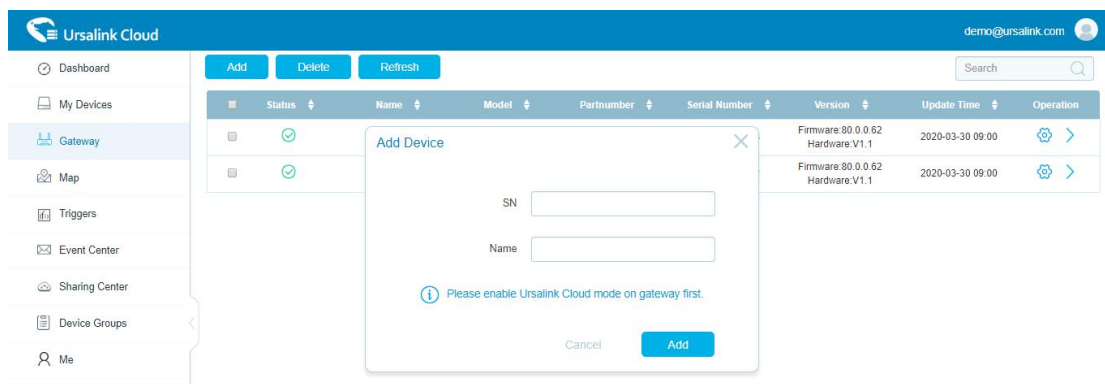
ID	Enable	Type	Server Address	Operation
0	Enabled	Ursalink	localhost	 



☒ Enable
☒ Ursalink Cloud

NetID: 010203
 Join Delay: 5 sec
 RX1 Delay: 1 sec
 Lease Time: 876000-0-0 hh-mm-ss
 Log Level: info







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



Ursalink Cloud

demo@ursalink.com

Search

Status	Name	Model	Partnumber	Serial Number	Version	Update Time	Operation
					Firmware 80.0.0.62 Hardware V1.1	2020-03-30 09:00	 
					Firmware 80.0.0.62 Hardware V1.1	2020-03-30 09:00	 

Add Device

SN

Name

Please enable Ursalink Cloud mode on gateway first.

Cancel Add

3. Check if gateway is online in Ursalink Cloud.

Dashboard	Add	Delete	Refresh	Search
My Devices				
Gateway				
Map				
Triggers				

Status	Name	Model	Partnumber	Serial Number	Version	Update Time	Operation
	231	UG85-L00E-EU868	L00E-EU868	62179000000000000000	Firmware 80.0.0.62 Hardware V1.1	2020-03-30 09:00	
	621793195782	UG85-L01CE-CN470	L01CE-CN470	62179000000000000000	Firmware 80.0.0.62 Hardware V1.1	2020-03-30 09:00	

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.

Add Device

SN
6127

Name

Associated Gateway
231 (62179000000000000000)

Device EUI
24e124127/000000

Application Key
5572404c696e6b4c6f52613230313e

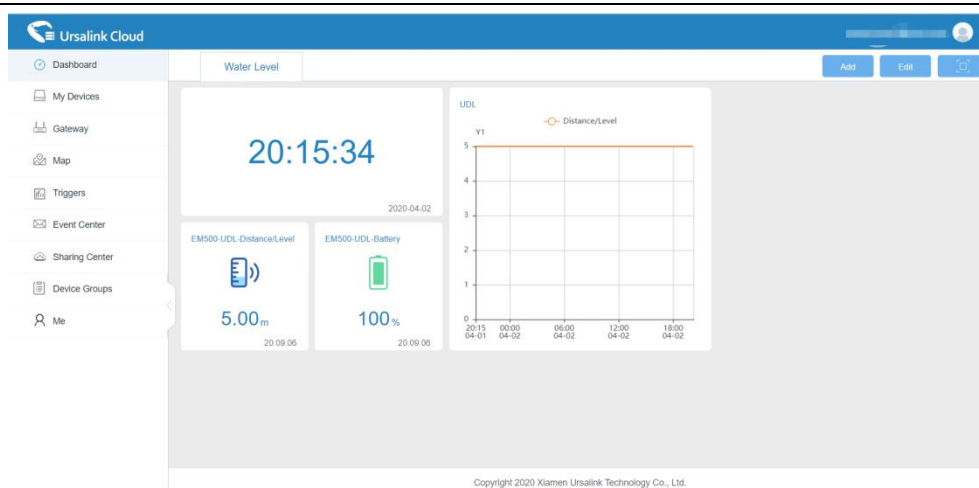
Cancel
Add

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

Ursalink Cloud	Add	Delete	Refresh	Search
Dashboard				
My Devices				
Gateway				
Map				
Triggers				
Event Center				
Sharing Center				
Device Groups				
Me				

Status	Name	Interface Status	Update Time	Operation
	EM500-UDL SN: 6126A10930050025 Model: EM500-UDL-W100	Distance: 5.00 m	2020-04-02 20:09	

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



Appendix

Default LoRaWAN Parameters

DevEUI	24E124 + 2 nd to 11 th 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 5 th to 12 th 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-