URSALINK

EM500-SWL
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 remodeled in any way.
- Please clarify your application environment before deployment, in case 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 cable close to objects with naked flames.
- Do not place the device, cable and sensor 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, and do not install the reverse or wrong model.
- The device must never be subjected to shocks or impacts.

Declaration of Conformity

Ursalink EM500-SWL 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
Apr. 7, 2020	V 1.0	Initial version
Sept. 16, 2020	V 1.1	Document structure change

Contents

1. Overview

1.1 Description

EM500-SWL is an outdoor environment monitoring sensor mainly used to measure liquid level data through wireless LoRa network. EM500-SWL device is battery powered and designed for multiple mounting ways. It is equipped with NFC (Near Field Communication) and can easily be configured by 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

- Large measurement range for liquid level measurement
- 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	20dBm
Sensitivity	-147dBm @300bps
Mode	OTAA/ABP Class A
Antenna	Embedded Ceramic Antenna
Temperature Measurement	
Pressure Type	Gauge Pressure
Range	EM500-SWL-W003: 3m H_2O EM500-SWL-W005: 5m H_2O EM500-SWL-W010: 10m H_2O (Customizable up to 200m and for other liquid)
Accuracy	± 0.5% FS
Physical Characteristics	
Cable Length	At least should be 1-1.5m longer than measuring range

Power Supply	19000 mAh Li-SoCl2 battery
Battery Life	4.5 year (10 min interval, SF12) >10 year (10 min interval, SF7)
Operating Temperature	Transceiver: -30°C to +70°C Pressure Sensor: -10°C to +60°C
Relative Humidity	0% to 100% (non-condensing)
Dimension	Transceiver: 105.4 × 71 × 69.5 mm (Waterproof connector is not included) Level Sensor: 122 × ϕ26 mm
Mounting	Pole, wall, DIN rail

2. Hardware Introduction

2.1 Packing List

1 × EM500-SWL

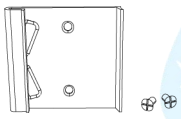
(Include sensor)

2 × Mounting Screws

1 × Hose Clamp

1 × Warranty Card

1 × Quick Guide

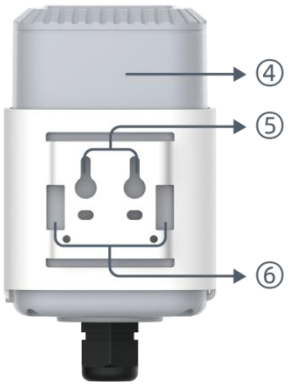


1 × DIN Rail (Optional)

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

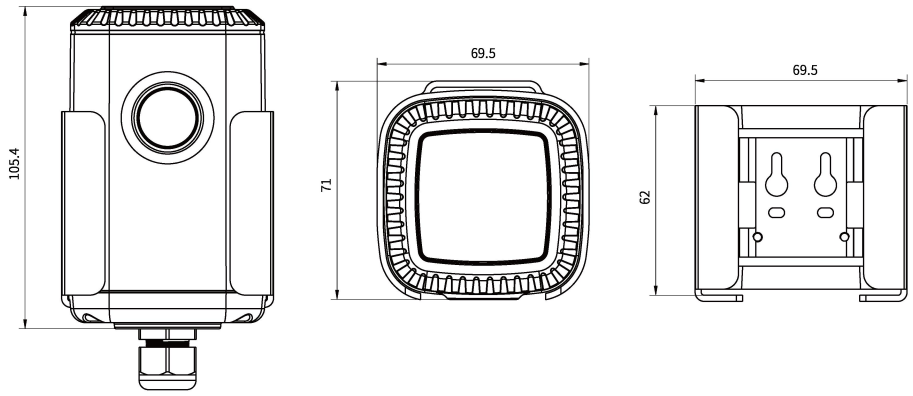
2.2 Transceiver Overview

Front View:
①LoRa Antenna (Internal)
②NFC Area
③Water-proof Connector with Vent



Back View:
④Battery (Internal)
⑤Wall Mounting Holes
⑥Pole Mounting Holes

2.3 Dimensions(mm)

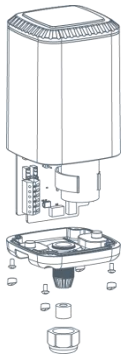


3. Assembly and Preparation

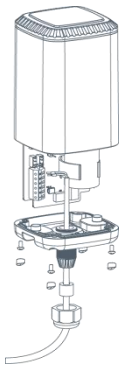
3.1 Sensor Assembly

Follow the steps below to connect light sensor cable to EM500 transceiver if they are separated.

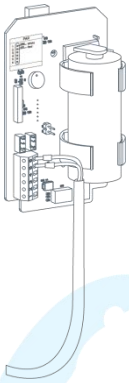
1. Take off the mounting bracket, remove the cap, rubber seal and the screws on the bottom of the device, and then take off the enclosure cover.



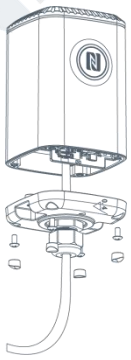
2. Pass the cable through the cap, rubber seal and enclosure cover.



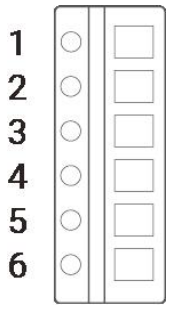
3. Pull out the motherboard, insert and lock the wires accordingly (see the label on the motherboard or following picture).



4. Put the motherboard back and restore everything in its due position.



Pinouts:

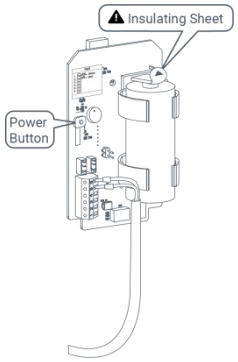


PIN	Color	Description
1	Red	GND
2	--	--
3	---	--
4	White	B
5	Yellow	A
6	Black	VOUT=12V

3.2 Insulating Sheet Disassembly

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-SWL 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-SWL 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 first configuration. Default password is **123456**.

5.1 Configuration via Smartphone APP

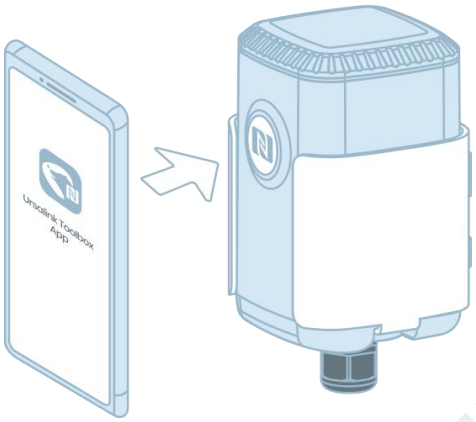
Preparation:

- Smartphone (NFC supported)
- Toolbox APP: APP can be downloaded on Google Play or Apple Store.

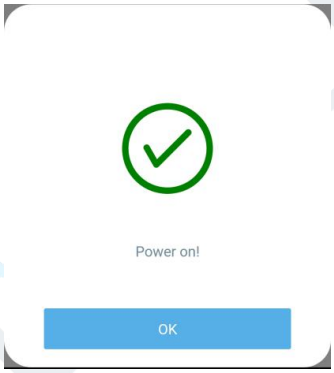
5.1.1 Read/Write Configuration via NFC

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. Click “Write” to change the configuration of EM500 and attach the smartphone with NFC area to the device until the APP shows a successful prompt.



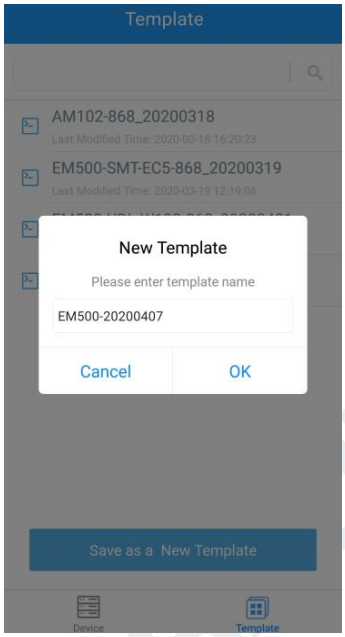
4. Go to “Device” > “Status” and click “Read” and attach the smartphone with NFC area to the device to read real-time data of sensor.

5.1.2 Template Configuration

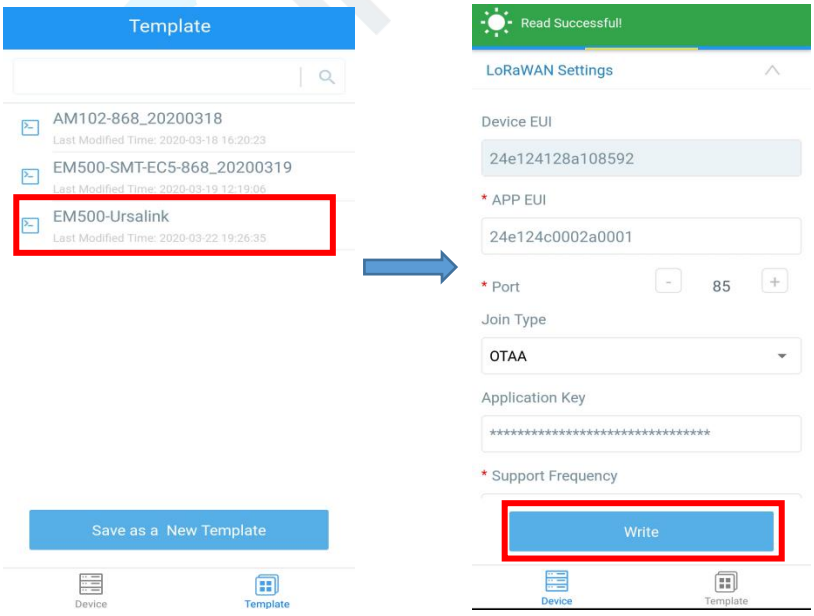
Template settings are used for easy and quick device configuration in bulk.

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

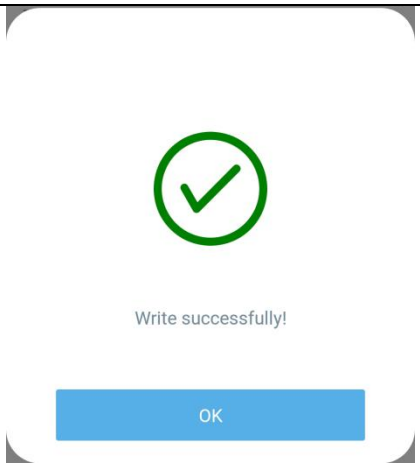
1. Go to “Template” page on the APP and save current settings as a template.



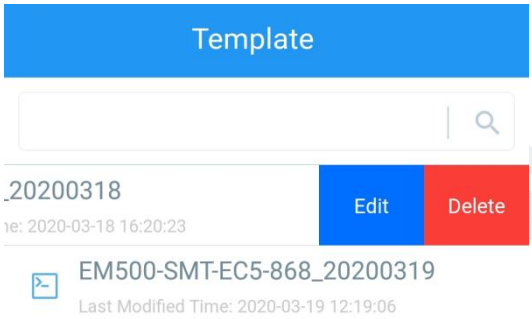
2. Attach the smartphone with NFC area to another device.
3. Select the template file from Toolbox APP and tap “Write”.



4. 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

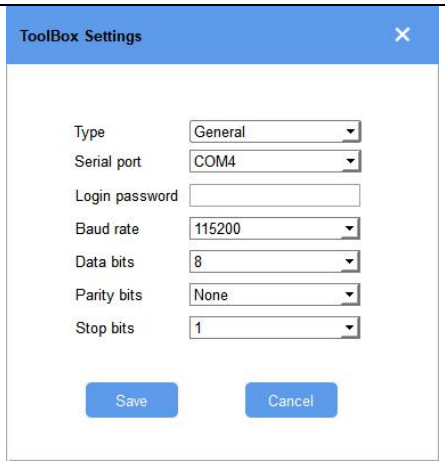
Make sure "Toolbox" is downloaded on your computer. Select one of the following methods to log in Toolbox.

Type-C Connection

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

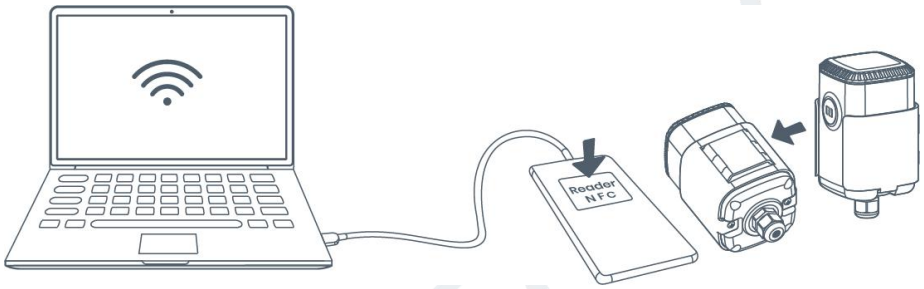
Type-C port is inside the transceiver of the EM500-SWL.

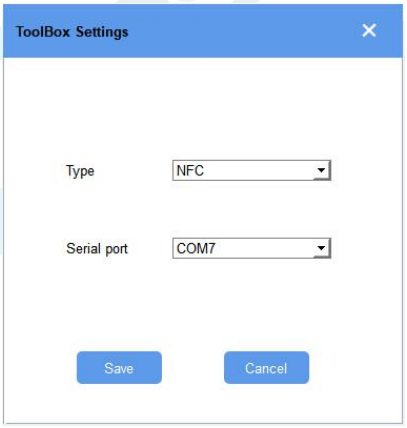
2. Select type as "General" and click password to log in Toolbox. (Default password: 123456)



NFC Connection

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



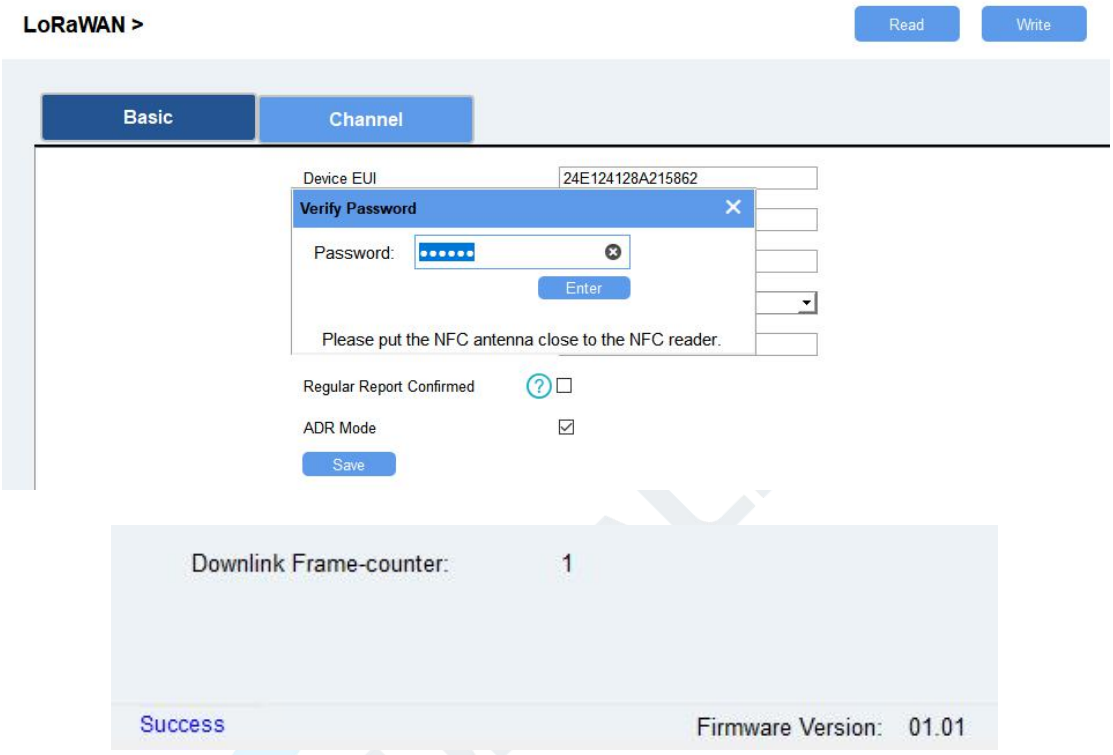


5.2.2 Basic Configuration

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

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

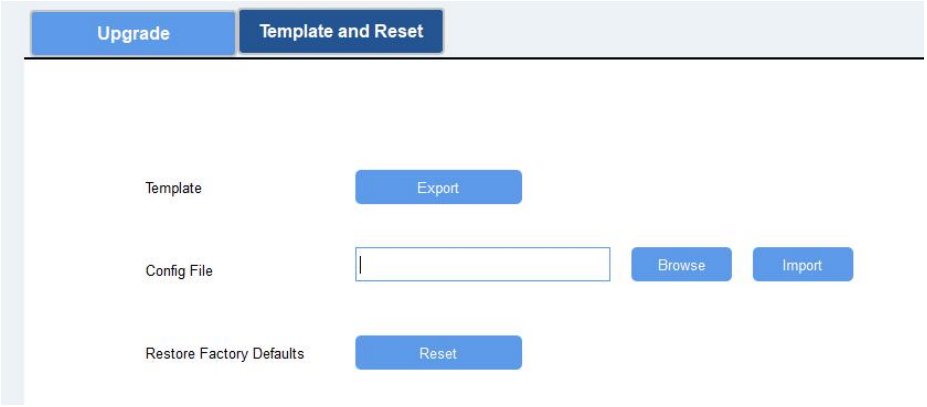
- Turn on/off the sensor
- Reset the sensor
- Click “Write” to change settings
- Upgrade



5.2.3 Template Settings

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

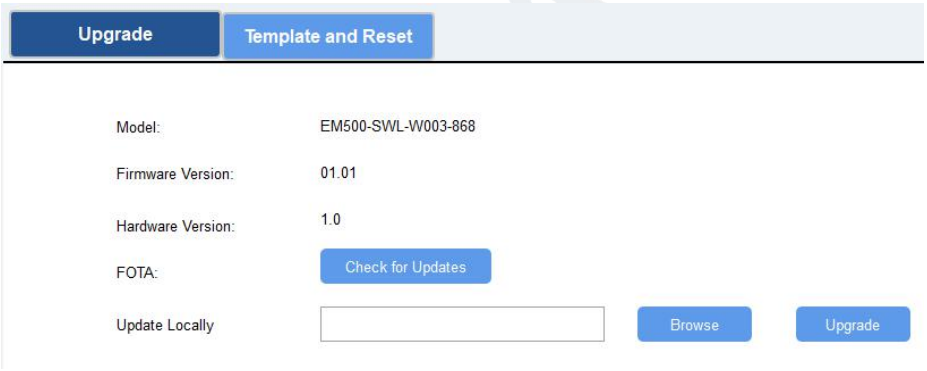
1. Go to “Maintenance -> Template and Reset” page in Toolbox.
2. Click “Export” to save the current settings as a template.
3. Click “Browse” to select the correct template from computer.
4. Click “Import” to import the template to the device.



5.2.4 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.



5.3 Configuration Examples

5.3.1 LoRaWAN Channel Settings

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

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:

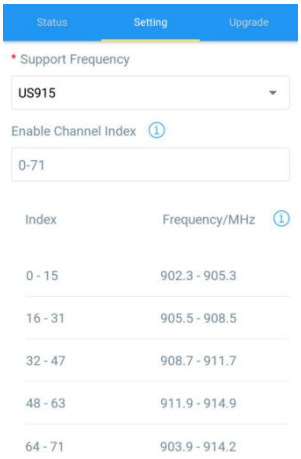
1, 40: Enabling Channel 1 and Channel 40

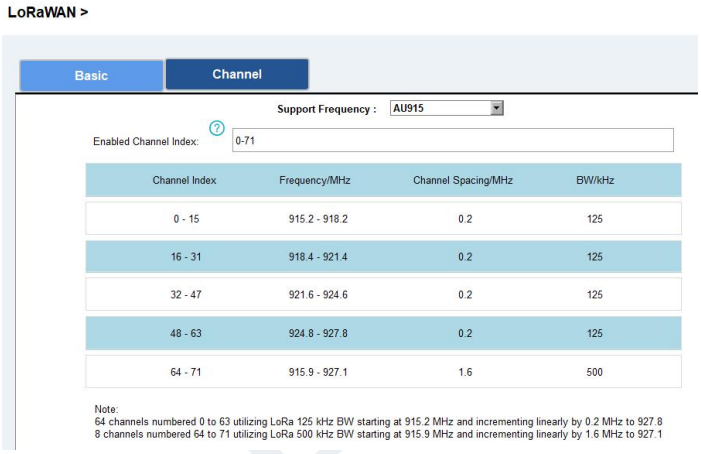
1-40: Enabling Channel 1 to Channel 40

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

All: Enabling all channels

Null: Indicates that all channels are disabled

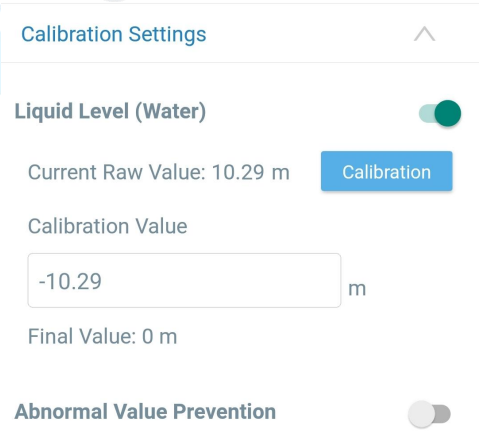




5.3.2 Data Calibration Settings

Mobile APP Configuration:

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



Software Configuration:

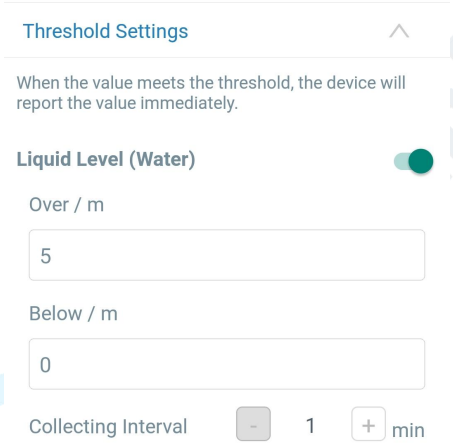
Log in Toolbox and go to “Device Settings -> Basic -> Calibration Settings” to enable the calibration and type the calibration value.

5.3.3 Alarm Settings

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

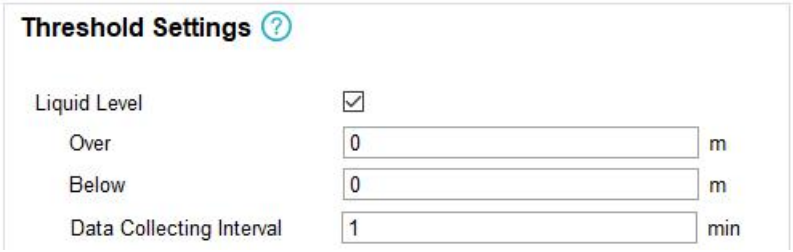
Mobile APP Configuration:

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. Installation

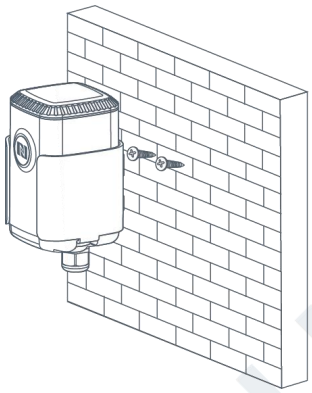
6.1 Transceiver Installation

6.1.1 Wall Mounting

1. Attach the mounting bracket to the wall and mark the two holes(around 16mm) on the wall.

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

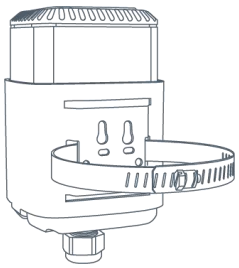
2. Drill the holes according to the marks and screw the mounting screws into the wall.
3. Mount the device on the wall.

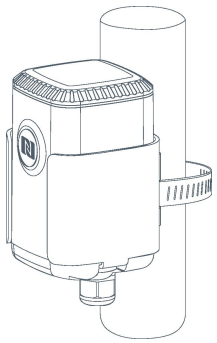


6.1.2 Pole Mounting

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

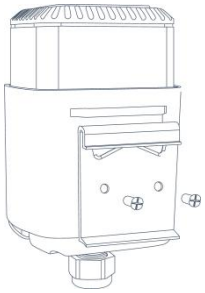
1. Straighten out the hose clamp and slide it through the rectangular holes in the mounting bracket, wrap the hose clamp around the pole.
2. Use a screwdriver to tighten the locking mechanism by turning it clockwise.

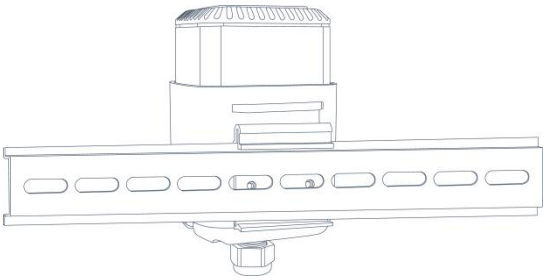




6.1.3 DIN Rail Mounting

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.



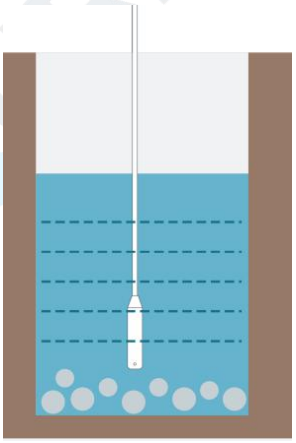


6.2 Sensor Installation

Lower the sensor via cable into the media until it is close to the bottom of tanks or ponds. Be careful not to hit the bottom hard or touch hard objects like sand or sludge since it will damage the sensor.

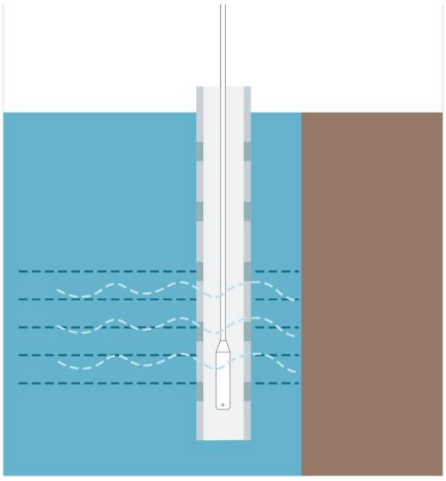
Note:

- Ensure the gas holes of transmitter do not be blocked while mounting or using it.
- To prevent the separation of level sensor and transceiver due to water shock and gravity, please fix the sensor cable with a fixed bracket or wrap it around the pole.



If the sensor is to be used in a well or other locations with turbulence or other disturbances, it is advisable to install a pipe to protect the sensor. Several holes should be drilled at different heights of the pipe in order to let water flow into and remove dydrodynamic pressure.

Note: The pipe can't be placed bend.



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	77 (Water Level)	02 00 => 00 02 = 2	cm
FF	01(Ursalink Protocol Version)	01=> V1.0	/
	09 (Hardware Version)	01 40=> V1.4	
	0a(Software Version)	01 14=> V1.14	
	0b(Device Restart Notification)	ff (reserved)	
	0f(Device Type)	00 => Class A	
	16 (Device SN)	64 10 90 82 43 75 00 01 =>Device SN is 6410908243750001	

Downlink Packet(HEX)

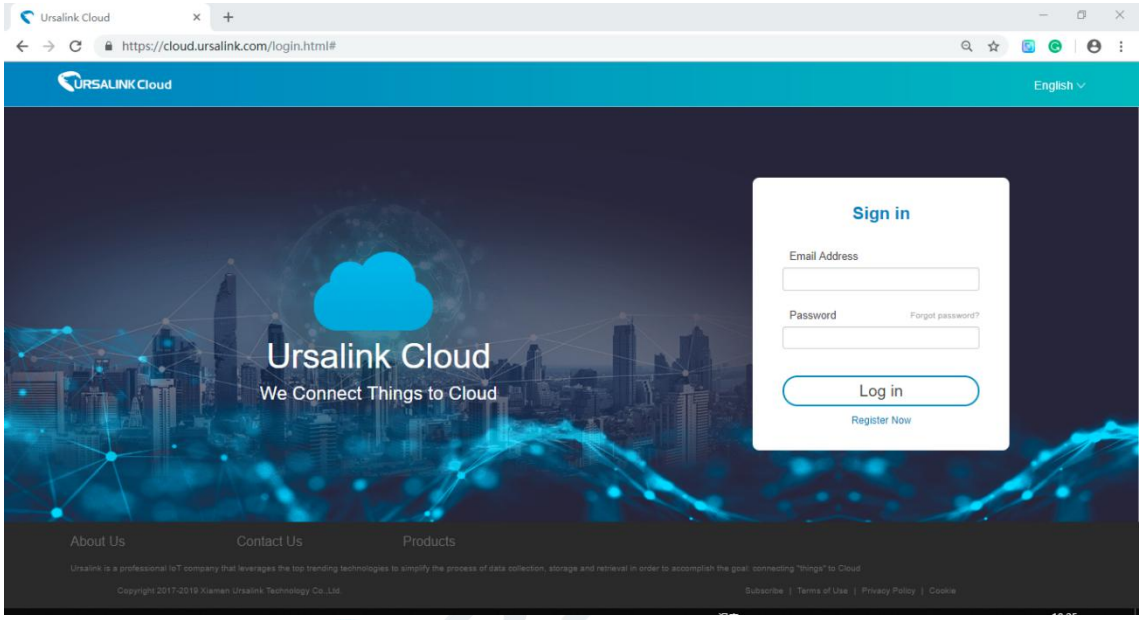
Channel	Type	Data Example	Unit
FF	03(Set Reporting Interval)	b0 04 => 04 b0 = 1200	s

8.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.

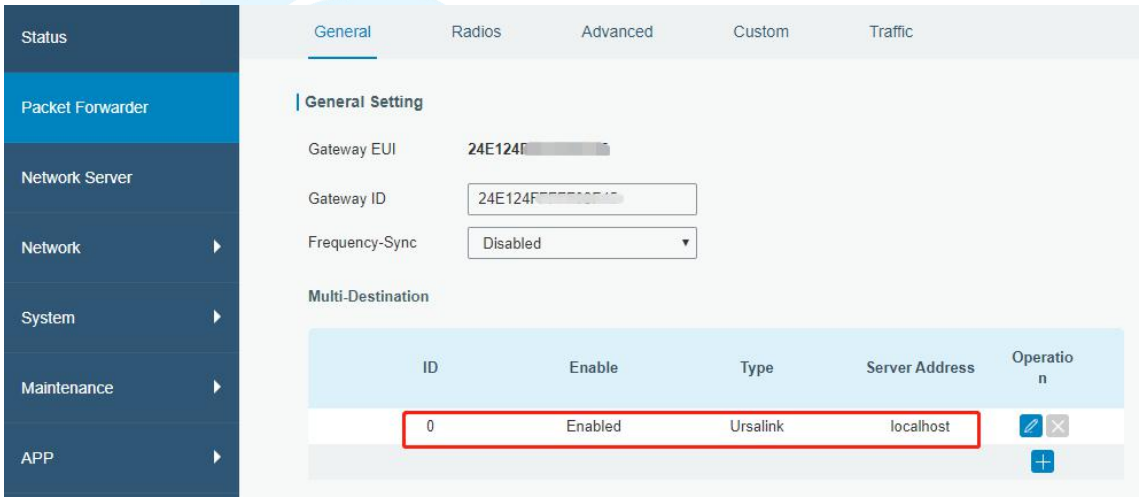
8.1 Ursalink Cloud Registration

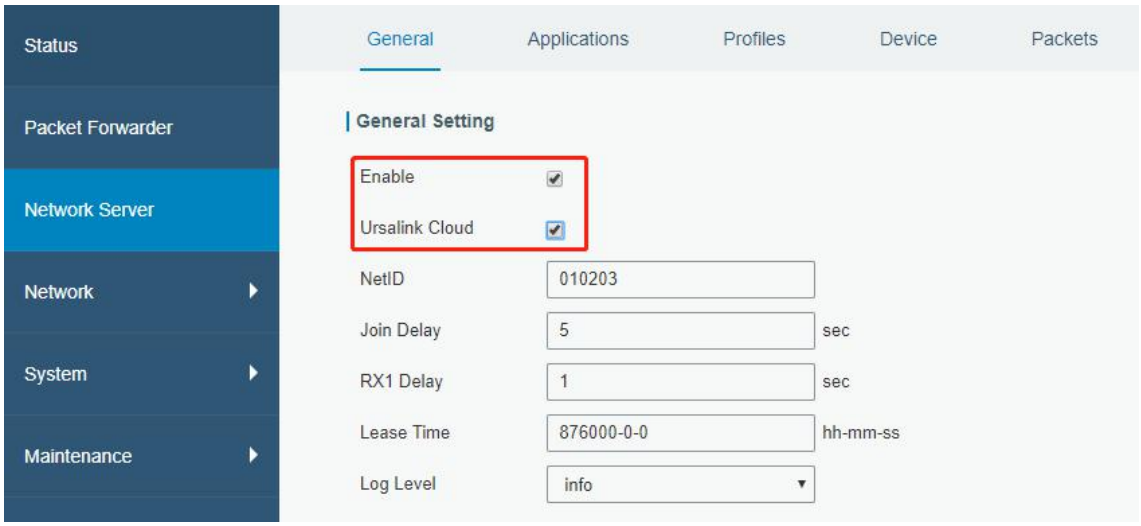
Register and log in Ursalink Cloud.
Ursalink Cloud URL: https://cloud.ursalink.com/login.html



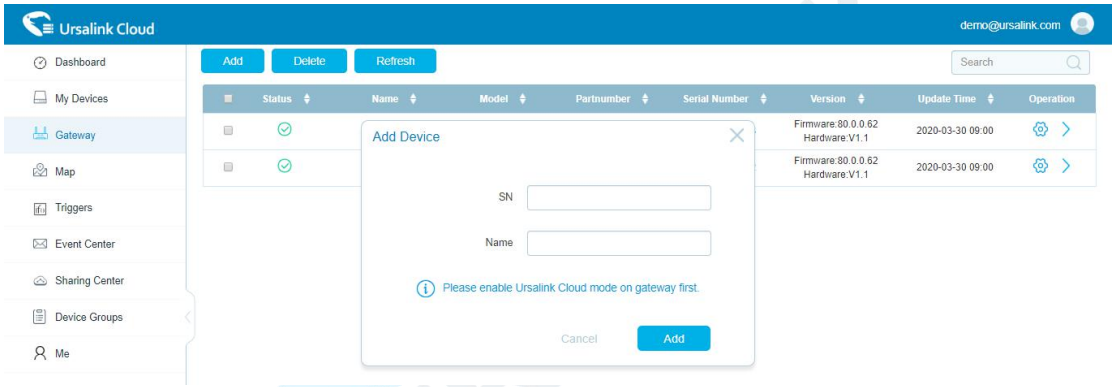
8.2 Add a Ursalink LoRaWAN Gateway

1. Enable “Ursalink” type network server and “Ursalink Cloud” mode in gateway web GUI.
Note: Ensure gateway has accessed the Internet.





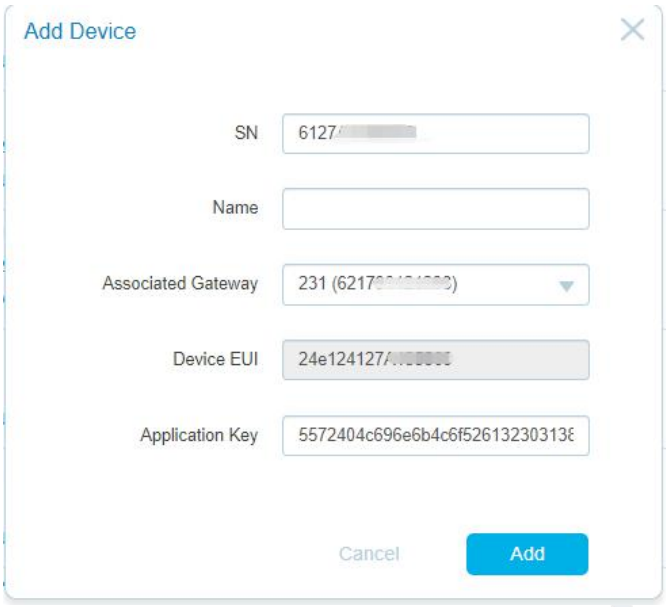
2.Go to “My Devices->Gateway” of Ursalink Cloud and click “Add” to add gateway to Ursalink Cloud via SN.



3.Check if gateway is online in Ursalink Cloud.

8.3 Add EM500-SWL to Cloud

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



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

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-SWL-433	EU433	433.175, 433.375, 433.575
EM500-SWL-470	CN470	470.3~489.3 (All 95 channels)
EM500-SWL-868	EU868	868.1, 868.3, 868.5
EM500-SWL-915	AU915	915.2~927.1 (All 72 channels)

-END-