

# Outdoor Environment Monitoring Sensor

## Featuring LoRaWAN®

### EM500 Series

User Guide



### Applicability

This guide is applicable to EM500 series sensors shown as follows, except where otherwise indicated.

Model	Description
EM500-CO <sub>2</sub>	Carbon Dioxide Sensor
EM500-LGT	Light Sensor
EM500-PP	Pipe Pressure Sensor
EM500-PT100	PT100 Temperature Sensor
EM500-SMT	Soil Moisture Sensor
EM500-SMTC	Soil Moisture Moisture, Temperature and Conductivity Sensor
EM500-SWL	Submersible Level Sensor
EM500-UDL	Ultrasonic Distance/Level Sensor

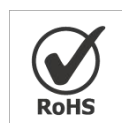
### Safety Precautions

Milesight 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.
- ❖ In order to protect the security of the device, please change device password when first configuration. The default password is 123456.
- ❖ The device is not intended to be used as a reference sensor, and Milesight will not should responsibility for any damage which may result from inaccurate readings.
- ❖ Do not place the device close to objects with naked flames.
- ❖ Do not place the device where the temperature is below/above the operating range.
- ❖ Make sure electronic components do not drop out of the enclosure while opening.
- ❖ 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.

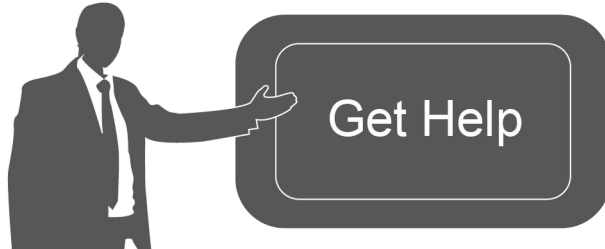
### Declaration of Conformity

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



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### Revision History

Date	Doc Version	Description
Nov. 23, 2020	V 1.0	Initial version
Dec. 7, 2021	V 1.1	Content update
Apr. 11, 2022	V 1.2	<ol style="list-style-type: none"> <li>EM500-SMT/SMTC supports soil type selection</li> <li>Add wirings of EM500-PP-G1/2M-4842 and EM500-SWL-4846W</li> <li>Support RX2 datarate and frequency settings</li> </ol>
May 31, 2023	V 2.0	Update based on hardware v2.x: <ol style="list-style-type: none"> <li>Add data storage and data transmission feature;</li> <li>Add temperature mutation alarm feature;</li> <li>Add CO2 barometric pressure compensation;</li> <li>Add single-channel mode;</li> <li>Add sensor installation guide.</li> </ol>

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# 1. Product Introduction

## 1.1 Overview

EM500 series is a sensor mainly used for outdoor environment through wireless LoRaWAN® network. EM500 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.


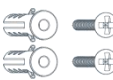



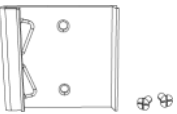


Sensor data are transmitted in real-time using standard LoRaWAN® protocol. LoRaWAN® enables encrypted radio transmissions over long distance while consuming very little power. The user can obtain sensor data and view the trend of data change through Milesight IoT Cloud or through the user's own Network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

## 1.2 Features

- Up to 15 km communication range
- Easy configuration via NFC
- Standard LoRaWAN® support
- Milesight IoT Cloud compliant
- Low power consumption with 19000mAh replaceable battery

# 2. Hardware Introduction

## 2.1 Packing List

			
1 × EM500 Device (Include Mounting Bracket)	2 × Wall Mounting Kits	2 × Fixing Screws	4 × Rubber Screw Caps
			
1 × Hose Clamp	1 × DIN Rail Kit (Optional)	1 × Warranty Card	1 × Quick Guide

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

## 2.2 Hardware Overview

EM500 series sensors is made up of a LoRaWAN® transceiver and a sensor. Among them, ultrasonic sensors and gas sensors are combined with LoRaWAN® transceiver.



### Front View of EM500:

- ① LoRaWAN® Antenna (Internal)
- ② NFC Area
- ③ Water-proof Connector



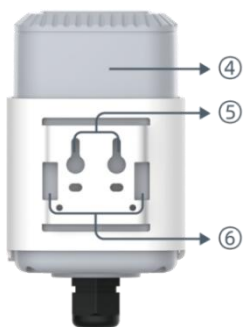
### Front View of EM500-CO<sub>2</sub>:

- ① LoRaWAN® Antenna (Internal)
- ② NFC Area
- ③ Vent Tube



### Front View of EM500-UDL:

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

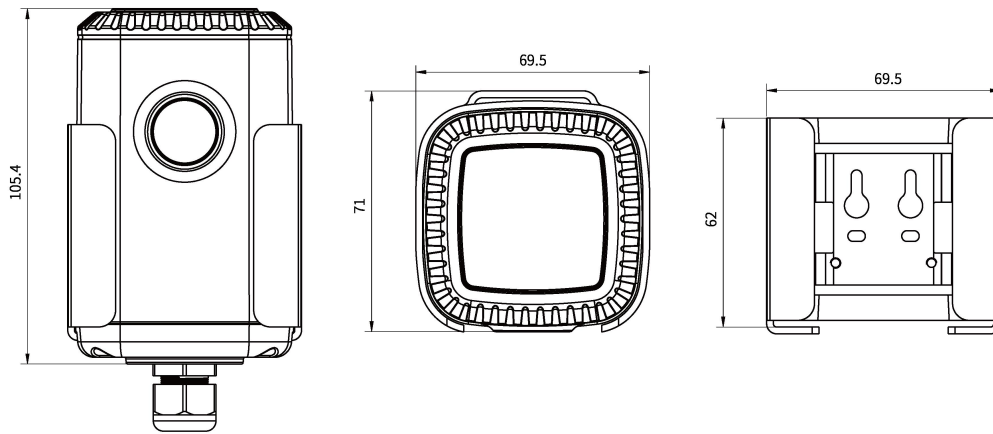


### Back View:

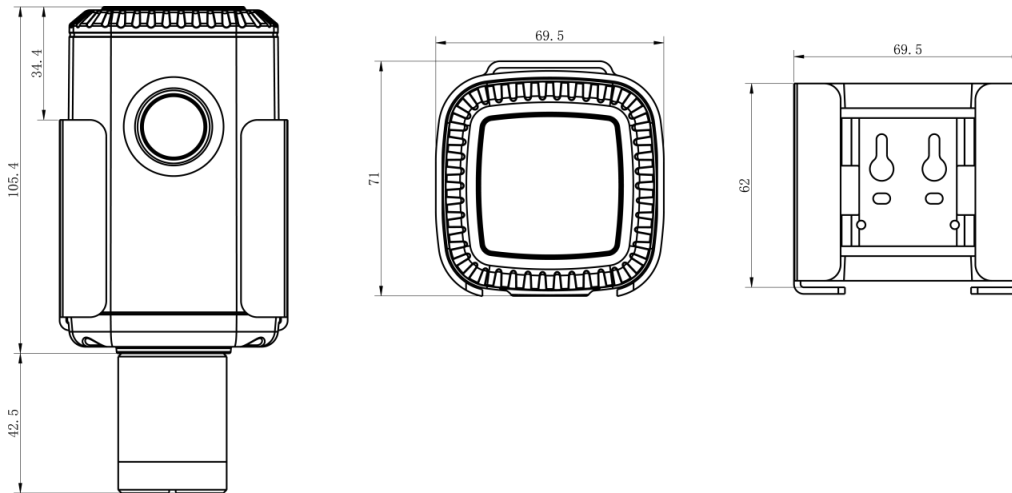
- ④ Battery (Internal)
- ⑤ Wall Mounting Holes
- ⑥ Pole Mounting Holes

## 2.3 Dimensions(mm)

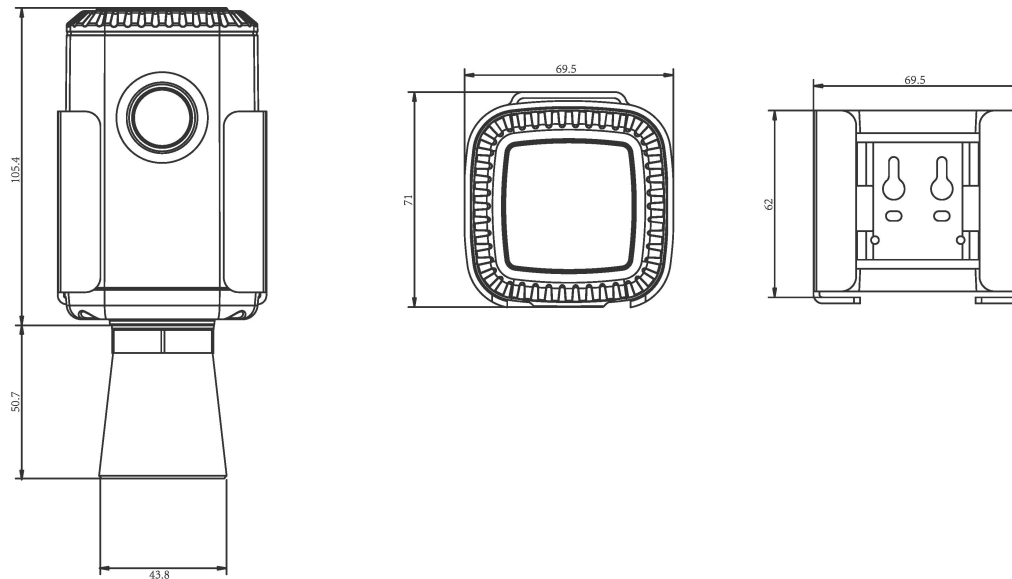
### EM500



### EM500-CO<sub>2</sub>



### EM500-UDL



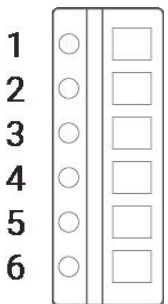
## 2.4 Power Button

**Note:** The LED indicator and power button are inside the device. Switch on/off and reset can also be configured via NFC.

Function	Action	LED Indication
Turn On	Press and hold the button for more than 3 seconds.	Off → On
Turn Off	Press and hold the button for more than 3 seconds.	On → Off
Reset	Press and hold the button for more than 10 seconds.	Blink 3 times.
Check On/Off Status	Quickly press the power button.	Light On: Device is on. Light Off: Device is off.

## 2.5 Pinouts

For parts of EM500 sensors, you need to connect the sensor part to EM500 transceiver according to the pinouts. **You can also find pinouts label on the motherboard.**



PIN	LGT	PP-4780/S WL	PP-4842/SW L-4846W	PT100	SMT	SMTC
1	Black/GND	Red/GND	White/GND	White/GND	Black/GND	Black/GND
2	---	---	Red/AIN	---	Yellow/AIN	---
3	---	---	---	---	---	---
4	Blue/B	White/B	---	Red/PT1	---	White/B
5	Green/A	Yellow/A	---	Red/PT2	---	Yellow/A
6	Red/VOU T	Black/VOU T	Black/VOUT	---	Brown/VOUT	Red/VOU T

**Note:**

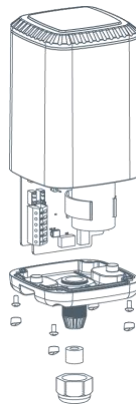
- 1) For EM500-SMT sensor, VOUT=2.5 V; for other sensors, VOUT=12V;
- 2) For EM500-SMTC sensor, it has a green cable which does not need to connect to EM500 transceiver, please cut off it or insulated wrap it.
- 3) For EM500-PP-4842 sensor, connect any one of two red cables to motherboard and the other leaves blank.

## 3. Device Assembly

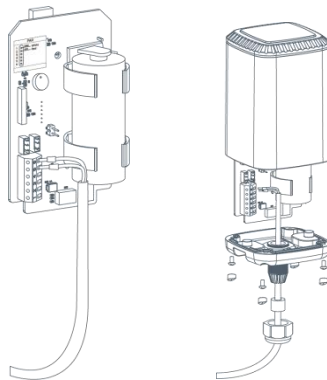
For parts of models, you need to connect sensor to the EM500 transceiver to make the whole device work.

1. Take off the mounting bracket on the transceiver, remove the screws, rubber seal and cover on the bottom of the device.

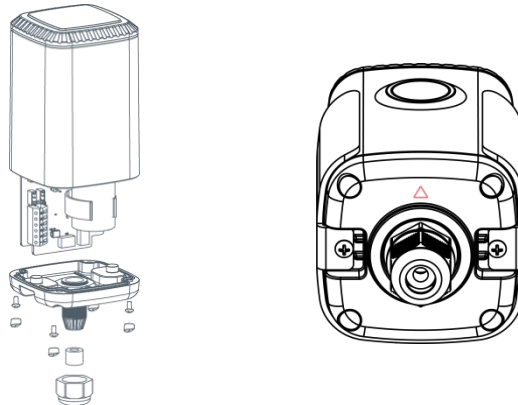




2. Lock the sensor wires to the block according to the label on the motherboard or [chapter 2.5](#), then pass the sensor cable through the cap, rubber seal and cover.



3. Put the motherboard back and restore everything to its due position. When restoring the cover, ensure the **arrow** faces the front of the transceiver.



**Note:** Rubber seal and rubber screw caps should be installed accordingly, or the water will come into the device.

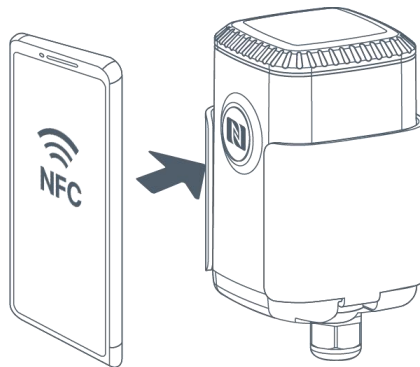
## 4. Operation Guide

### 4.1 Log in the ToolBox

EM500 series can be monitored and configured via ToolBox App or ToolBox software. **Before configuration, ensure the insulating sheet inside the device has been pulled out and battery is not placed reversed.**

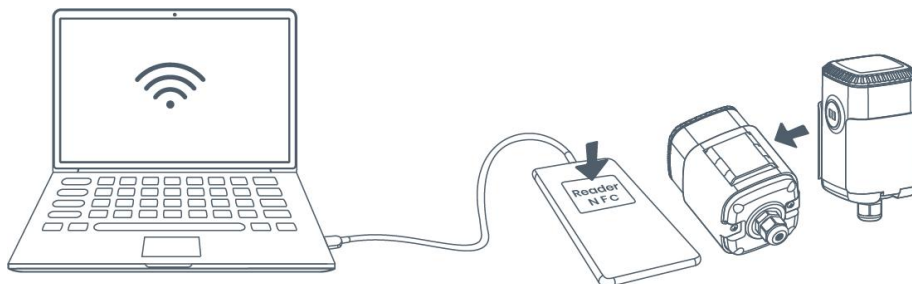
#### 4.1.1 NFC Configuration

1. Download and install **Milesight ToolBox** App from Google Play or Apple App Store.
2. Enable NFC on the smartphone and launch Milesight ToolBox.
3. Attach the smartphone with NFC area, click **NFC Read** button to read device information. You can read and configure the device by tapping the Read/Write device on the App. In order to protect the security of the device, please change password when first configuration. The default password is **123456**.



**Note:**

- 4) Ensure the location of smartphone NFC area and it's recommended to take off phone case.
- 5) If the smartphone fails to read/write configurations via NFC, keep the phone away and back to try again.
- 6) EM500 series can also be configured by dedicated NFC reader, which can be purchased from Milesight IoT.



### 4.1.2 USB Configuration

1. Download ToolBox software from Milesight official website.
2. Release the enclosure of the EM500 transceiver, then connect the device to a computer via Type-C port.



3. Open the ToolBox and select type as **General**, then click password to log in ToolBox. (Default password: **123456**)

ToolBox Settings
✕

Type:

Serial port:

Login password:

Baud rate:

Data bits:

Parity bits:

Stop bits:

4. After logging in the ToolBox, you can turn on/off devices and change other settings.

**Status >**
Power Off

Model:	EM500-SMTC-868M
Serial Number:	6126A39347142028
PN:	MEC20
Device EUI:	24e124126a393471
Firmware Version:	02.25
Hardware Version:	1.3
Device Status:	On
Join Status:	De-Activate
RSSI/SNR:	0/0
Temperature:	0°C
Humidity:	0%
Conductivity:	Disabled
Battery:	100%

## 4.2 LoRaWAN Settings

LoRaWAN settings is used for configuring the transmission parameters in LoRaWAN® network.

Device EUI

\* APP EUI

\* Application Port  85

Join Type

\* Application Key

LoRaWAN Version

Parameters	Description
Device EUI	Unique ID of the device which can also be found on the label.
App EUI	Default App EUI is 24E124C0002A0001.
Application Port	The port used for sending and receiving data, default port is 85.
Join Type	OTAA and ABP mode are available.
LoRaWAN Version	V1.0.2, V1.0.3 are available.
Work Mode	It's fixed as Class A.
Application Key	Appkey for OTAA mode, default is 5572404C696E6B4C6F52613230313823.
Device Address	DevAddr for ABP mode, default is the 5 <sup>th</sup> to 12 <sup>th</sup> digits of SN.
Network Session Key	Nwkskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
Application Session Key	Appskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
RX2 Data Rate	RX2 data rate to receive downlinks.
RX2 Frequency	RX2 frequency to receive downlinks. Unit: Hz
Channel Mode	Select Standard-Channel mode or Single-Channel mode. When Single-Channel mode is enabled, only one channel can be selected to send uplinks. Please enable Single-Channel mode if you connect device to DS7610.

	<p>Enable or disable the frequency to send uplinks.</p> <p>* Support Frequency</p> <p>EU868</p> <p><input type="checkbox"/> <input type="button" value="-"/> 868.1 <input type="button" value="+"/></p> <p><input type="checkbox"/> <input type="button" value="-"/> 868.3 <input type="button" value="+"/></p> <p><input type="checkbox"/> <input type="button" value="-"/> 868.5 <input type="button" value="+"/></p> <p><input type="checkbox"/> <input type="button" value="-"/> 863 <input type="button" value="+"/></p> <p>If frequency is one of CN470/AU915/US915, enter the index of the channel that you want to enable and make them separated by commas.</p> <p><b>Examples:</b>          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</p> <p>* Support Frequency</p> <p>AU915</p> <p>Enable Channel Index ⓘ</p> <p>8-15</p> <table border="1"> <thead> <tr> <th>Index</th> <th>Frequency/MHz ⓘ</th> </tr> </thead> <tbody> <tr> <td>0 - 15</td> <td>915.2 - 918.2</td> </tr> <tr> <td>16 - 31</td> <td>918.4 - 921.4</td> </tr> <tr> <td>32 - 47</td> <td>921.6 - 924.6</td> </tr> <tr> <td>48 - 63</td> <td>924.8 - 927.8</td> </tr> <tr> <td>64 - 71</td> <td>915.9 - 927.1</td> </tr> </tbody> </table>	Index	Frequency/MHz ⓘ	0 - 15	915.2 - 918.2	16 - 31	918.4 - 921.4	32 - 47	921.6 - 924.6	48 - 63	924.8 - 927.8	64 - 71	915.9 - 927.1
Index	Frequency/MHz ⓘ												
0 - 15	915.2 - 918.2												
16 - 31	918.4 - 921.4												
32 - 47	921.6 - 924.6												
48 - 63	924.8 - 927.8												
64 - 71	915.9 - 927.1												
<p>Spread Factor</p>	<p>If ADR is disabled, the device will send data via this spread factor.</p>												
<p>Confirmed Mode</p>	<p>If the device does not receive ACK packet from network server, it will resend data once.</p>												
<p>Rejoin Mode</p>	<p>Reporting interval ≤ 35 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval or 2*reporting interval to validate connectivity; If there is no response, the device will re-join the network.</p>												

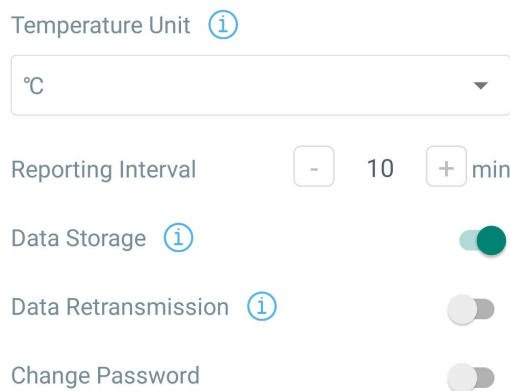
	Reporting interval > 35 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval to validate connectivity; If there is no response, the device will re-join the network.
Set the number of packets sent	When rejoin mode is enabled, set the number of LinkCheckReq packets sent. <b>Note:</b> the actual sending number is <b>Set the number of packets sent + 1</b> .
ADR Mode	Allow network server to adjust datarate of the device.
Tx Power	Transmit power of device.

**Note:**

- 1) Please contact sales for device EUI list if there are many units.
- 2) Please contact sales if you need random App keys before purchase.
- 3) Select OTAA mode if you use Milesight IoT cloud to manage devices.
- 4) Only OTAA mode supports rejoin mode.

### 4.3 Basic Settings

Go to **Device Settings > Basic** of ToolBox software or **Device > Settings > General Settings** of ToolBox App to change the reporting interval, etc.



Parameters	Description
Reporting Interval	Reporting interval of transmitting data to network server. Default: 10 mins, Range: 1-1080 mins.
Temperature Unit (EM500-CO <sub>2</sub> /SMTC/ PT100)	Change the temperature unit displayed on the ToolBox. <b>Note:</b> 1) The temperature unit in the reporting package is fixed as °C. 2) Please modify the threshold settings if the unit is changed.
Pressure Unit	Change the pressure unit displayed on the ToolBox.

(EM500-PP)	<p><b>Note:</b></p> <p>1) The pressure unit in the reporting package is fixed as kPa. 2) Please modify the threshold settings if the unit is changed.</p>
Soil Type (EM500-SMT/SMTC)	<p>Change the suitable soil type. It only works with hardware V2.0 and above.</p> <p><b>SMT:</b> Mineral soil, potting soil and rockwool are optional. <b>SMTC:</b> Mineral soil, sandy soil, clay and organic soil are optional.</p>
Data Storage	Disable or enable data storage locally. (see section <a href="#">4.4.4</a> to export data )
Data Retransmission	Disable or enable data retransmission. (see section <a href="#">4.4.5</a> )
Change Password	Change the password for ToolBox App or software to read/write this device.

## 4.4 Advanced Settings

### 4.4.1 Data Collection Settings

Enable or disable to collect and upload corresponding data. **This feature is only supported by EM500-CO<sub>2</sub> and EM500-SMTC sensors.**

CO2	<input checked="" type="checkbox"/>
Barometric Pressure	<input checked="" type="checkbox"/>
Temperature	<input checked="" type="checkbox"/>
Humidity	<input checked="" type="checkbox"/>

### 4.4.2 Calibration Settings

#### Numerical Calibration:

ToolBox supports numerical calibration for all items. Go to **Device Settings > Basic** of ToolBox software or **Device > Settings > Calibration Settings** of ToolBox App to type the calibration value and save, the device will add the calibration value to raw value.

Temperature Calibration	<input checked="" type="checkbox"/>
Current Raw Value	0 °C
Calibration Value	<input type="text" value="-1"/> °C
Final Value	-1 °C
Humidity Calibration	<input type="checkbox"/>

### CO<sub>2</sub> Calibration:

For EM500-CO<sub>2</sub>, ToolBox provides more calibration methods:

**Barometric Pressure Calibration:** this only works when barometric sensor is enabled.

**Manual Calibration:** Put the device in an open outdoor environment for more than 10 minutes and click this button to calibrate the CO<sub>2</sub> value.

**Factory Calibration Restored:** Clean the manual calibration and turn back to factory calibration.

CO<sub>2</sub> Calibration

?

?

Current Raw Value ppm

Calibration Value  ppm

Final Value ppm

Barometric Pressure Calibration

### Abnormal Value Prevention:

For EM500-PT100/SWL/JDL, ToolBox provides abnormal value prevention feature for accurate results. If the current value exceeds the range of previous value, the sensor will discard the current value and remeasure again. Take 20% as example, if last value is 5 and max range is 10, the next value should within the range 3-7, or the sensor will measure again.

Abnormal Value Prevention

Maximum Range: 50 m

Set Value ⓘ : 20 %

### 4.4.3 Threshold Settings

Enable the threshold settings and input the threshold. EM500 series will upload the current data once instantly when the collected value exceeds the preset threshold. Only when the value turns



back to normal and triggers the threshold again, it will send a new alarm.

CO2	<input checked="" type="checkbox"/>		
Over	<input type="text" value="0"/>	ppm	
Below	<input type="text" value="0"/>	ppm	
Data Collecting Interval	<input type="text" value="1"/>	min	

EM500-PT100/CO2/SMTC supports to send alarms when mutation of temperature value reaches the threshold value.

Temperature mutation value over / °C

#### 4.4.4 Data Storage

EM500 series supports storing 1000 data records locally and exports data via ToolBox App or software. The device will record the data according to reporting interval even not joining network.

1. Go to **Status** of ToolBox software or **Device > Status** of ToolBox App to sync the device time;

Device Status	ON	<input checked="" type="checkbox"/>
Join Status	Activated	
Reading Mode	NFC	
RSSI/SNR	-82/8	
Device Time	2023-06-10 14:44	<input type="button" value="Sync"/>

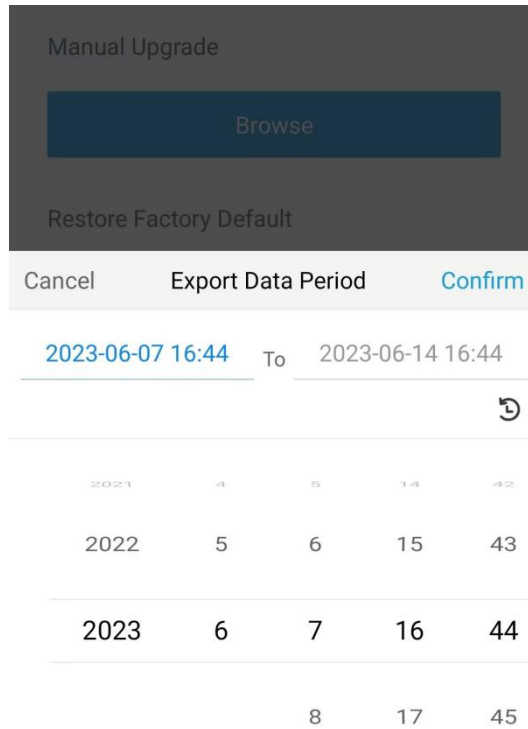
2. Enable data storage feature.

Data Storage

Data Retransmission

3. Go to **Maintenance > Backup and Reset** of ToolBox software or **Device > Maintenance** of ToolBox App, click **Export**, then select the data time range and click **Save** to export data.

**Note:** ToolBox App can only export 14 days' data at most. If you need to export more data, please use ToolBox software.



4. Click **Data Cleaning** to clear all stored data inside the device if necessary.



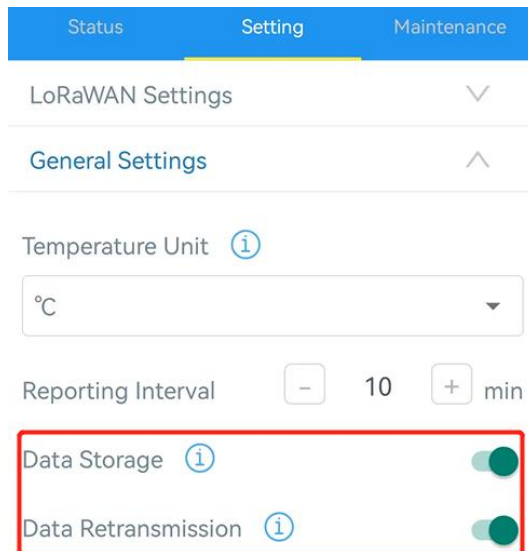
#### 4.4.5 Data Retransmission

EM500 series supports data retransmission to ensure network server can get all data even if network is down for some times. There are two ways to get the lost data:

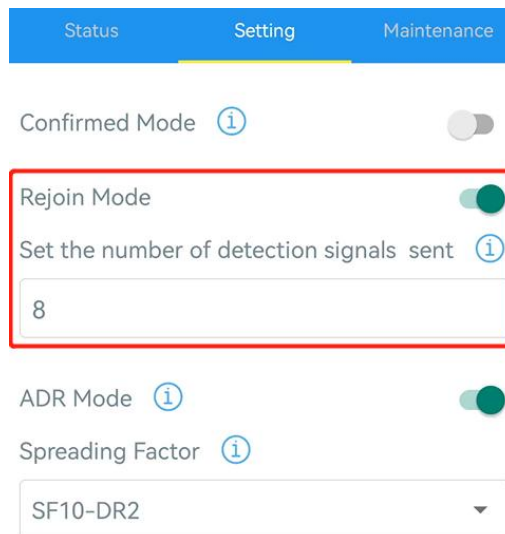
- Network server sends downlink commands to enquire the historical data for specifying time range, see section ***EM500 Series Communication Protocol;***
- When network is down if no response from LinkCheckReq MAC packets for a period of time, the device will record the network disconnected time and re-transmit the lost data after device re-connects the network.

Here are the steps for data retransmission:

1. Enable data storage feature and data retransmission feature;



2. Enable rejoin mode feature and set the number of packets sent. Take below as example, the device will send LinkCheckReq MAC packets to the network server regularly to check if the network is disconnected; if there is no response for 8+1 times, the join status will change to de-active and the device will record a data lost time point(the time to join the network).



3. After the network connected back, the device will send the lost data from the point in time when the data was lost according to the reporting interval.

**Note:**

- 1) If the device is rebooted or re-powered when data retransmission is not completed, the device will re-send all retransmission data again after device is reconnected to the network;
- 2) If the network is disconnected again during data retransmission, it will only send the latest disconnection data;
- 3) The retransmission data format is started with "20ce", please refer to **EM500 Series**

**Communication Protocol.**

- 4) Data retransmission will increase the uplinks and shorten the battery life.

## 4.5 Maintenance

### 4.5.1 Upgrade

**ToolBox Software:**

1. Download firmware from Milesight official website to your PC.
2. Go to **Maintenance > Upgrade**, click **Browse** to import firmware and upgrade the device.

**Maintenance >**

Upgrade
Backup and Reset

Model:	EM500-SMTC-868M		
Firmware Version:	02.25		
Hardware Version:	1.3		
Domain:	<div style="border: 1px solid #ccc; padding: 2px; display: inline-block;">Beijing Server</div>		
FOTA:	<div style="background-color: #007bff; color: white; padding: 5px 15px; border-radius: 3px; display: inline-block;">Up to date</div>		
Update Locally		<div style="background-color: #007bff; color: white; padding: 5px 10px; border-radius: 3px; display: inline-block;">Browse</div>	<div style="background-color: #007bff; color: white; padding: 5px 10px; border-radius: 3px; display: inline-block;">Upgrade</div>

**ToolBox App:**

1. Download firmware from Milesight official website to your smartphone.
2. Open ToolBox App and click **Browse** to import firmware and upgrade the device.

**Note:**

- 1) Operation on ToolBox is not supported during the upgrade.
- 2) Only Android version ToolBox supports the upgrade feature.

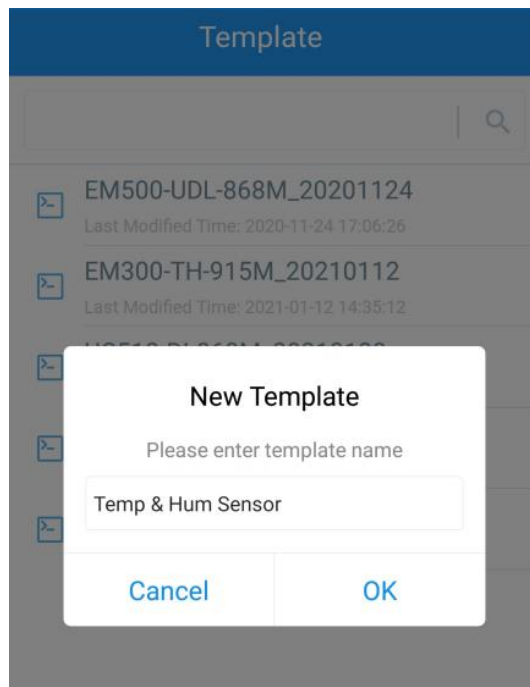
Status	Setting	Maintenance
SN	6126A39347142028	
Model	EM500-SMTC-868M	
Firmware Version	V2.25	
Hardware Version	V1.3	
Manual Upgrade		

Browse

### 4.5.2 Backup

EM500 devices support configuration backup for easy and quick device configuration in bulk. Backup is allowed only for devices with the same model and LoRaWAN® frequency band.

1. Go to **Template** page on the App and save current settings as a template. You can also edit the template file.
2. Select one template file which saved in the smartphone and click **Write**, then attach to another device to write configuration.



**Note:** Slide the template item left to edit or delete the template. Click the template to edit the configurations.

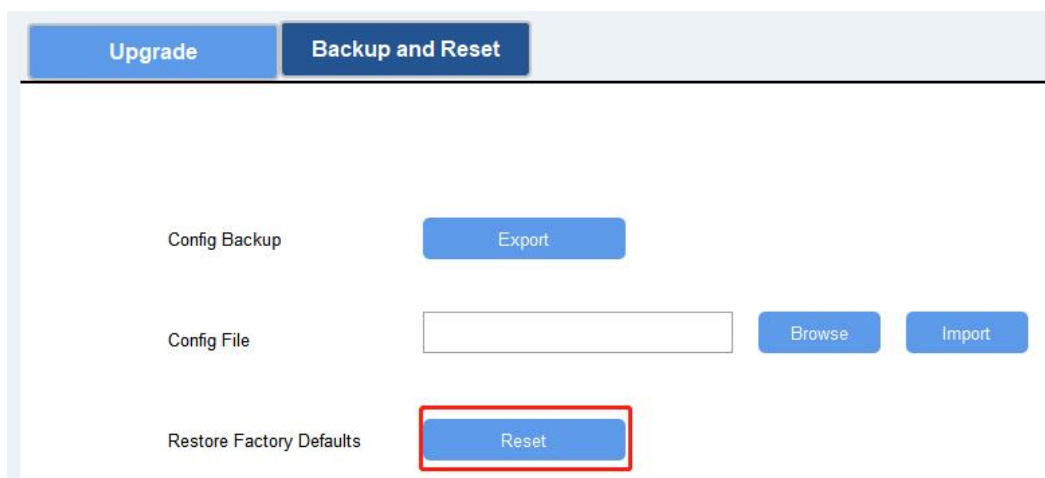
Template	
<input type="text"/>	<input type="button" value="Search"/>
<input type="checkbox"/> EM500-UDL-868M_20201124 Last Modified Time: 2020-11-24 17:06:26	
<input type="checkbox"/> EM300-TH-915M_20210112 Last Modified Time: 2021-01-12 14:35:12	
<input type="checkbox"/> UC512-DI-868M_20210128 Last Modified Time: 2021-01-28 16:57:20	
<input type="checkbox"/> UC501-470M_20210201 Last Modified Time: 2021-02-01 11:29:43	
<input type="checkbox"/> M_20210208 Last Modified Time: 2021-02-08 16:44:37	<input type="button" value="Edit"/> <input type="button" value="Delete"/>

### 4.5.3 Reset to Factory Default

Please select one of following methods to reset device:

**Via Hardware:** Hold on power button (internal) for more than 10s.

**Via ToolBox Software:** Go to **Maintenance > Backup and Reset** to click **Reset**.



**Via ToolBox App:** Go to **Device > Maintenance** to click **Reset**, then attach smart phone with NFC area to device to complete reset.

Status	Setting	Maintenance
SN	6126A39347142028	
Model	EM500-SMTC-868M	
Firmware Version	V2.25	
Hardware Version	V1.3	
Manual Upgrade		
Browse		
Restore Factory Default		
Reset		

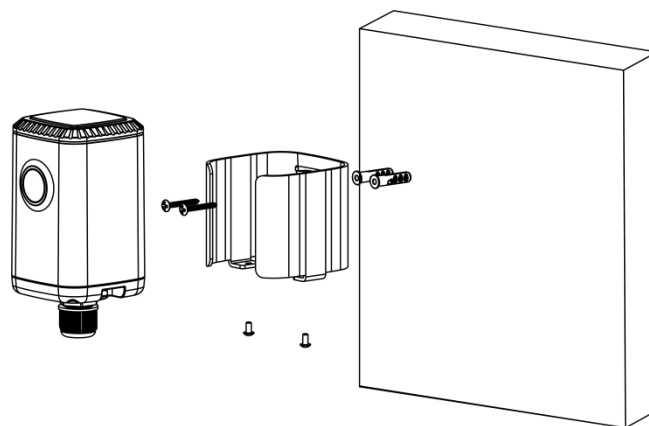
## 5. Installation

### 5.1 EM500 Transceiver Installation

EM500 transceiver support wall, pole and DIN rail mounting. Before installation, ensure the mounting bracket has fixed to the device via screws.

#### Wall Mounting:

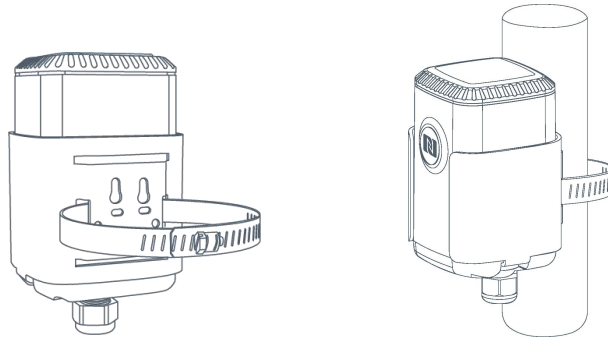
1. Drill 2 holes on the wall according to the mounting bracket, then fix the wall plugs into the wall.
2. Fix the mounting bracket to the wall via screws.
3. Put the device onto the mounting bracket, then fix the device to the bracket with 2 fixing screws.



#### Pole Mounting:

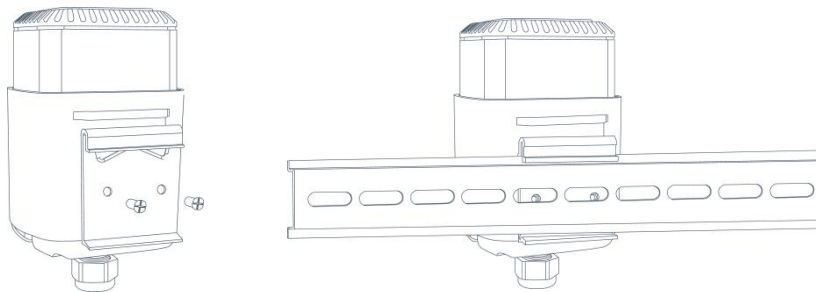
Straighten out the hose clamp and slide it through the rectangular holes in the mounting bracket,

wrap the hose clamp around the pole. After that use a screwdriver to tighten the locking mechanism by turning it clockwise.



### DIN Rail Mounting:

Use 2 pcs of M3 × 6 flat head Phillips screws to fix the mount clip to the bracket, and then hang the device to the DIN rail. The width of DIN rail is 3.5 cm.



## 5.2 EM500-CO<sub>2</sub> Sensor Installation

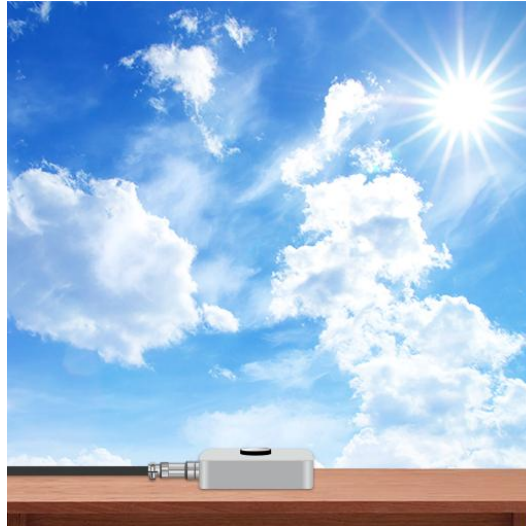
EM500-CO<sub>2</sub> should be considered following notes to insure proper installation:

- CO<sub>2</sub> sensor should be mounted no higher than 12-18 inches above the floor since CO<sub>2</sub> is heavier than normal air and will flow down.
- Installation should be considered the layout of a space. Enclosed spaces or varying spaces are recommended to install one more sensor.

## 5.3 EM500-LGT Sensor Installation

Light sensor supports mount on the wall or plane surface. Be sure place the round area of the sensor always on top and always towards the sun while using it.





### 5.3 EM500-PP Sensor Installation

Pipe sensor should be considered following notes to insure proper installation:

- The selected installation position should reflect the actual situation of the measured pressure. Install the sensor in the pipe where the measuring medium flows straightly and avoid the location of bends, split, dead corners or other places where vortices are easy to form.
- Pay attention to whether the pressure sensor is too close to the valve or pump when installing. Because the opening and closing of the valve and the start and stop of the pump will impact the diaphragm of the pressure sensor, causing diaphragm damage.
- Install the sensor in a low vibration environment.
- Install a damper in order to prevent the pressure spikes or surges if you use EM500-PP with high pressure hydraulic or other liquid equipment.
- When freezing occurs in winter, the pressure sensor installed outside must adopt anti-freezing measures to prevent the liquid in the pressure inlet from expanding due to icing, which may cause damage to the pressure sensor.
- When measuring steam or other high-temperature gas, add a condenser such as a buffer tube (coil), and the operating temperature of the pressure sensor should not exceed the limit.
- Do not insert a foreign object into the pressure diaphragm in an effort to simulate pressure, which may cause permanent damage.
- Clean the sensor termly in cases of high corrosion or high dust.

### 5.4 EM500-SMT/SMTC Sensor Installation

EM500-SMT/SMTC should be considered following notes to insure proper installation:

- Abnormal data may show up if sensor prongs are exposed in the air.
- It is possible to get sticks, bark, roots or other material stuck between the sensor prongs, which will severely affect the sensor data readings. Any air gaps or excessive soil compaction around the sensor can also influence the readings.
- Do not install the sensor adjacent to large metal objects.

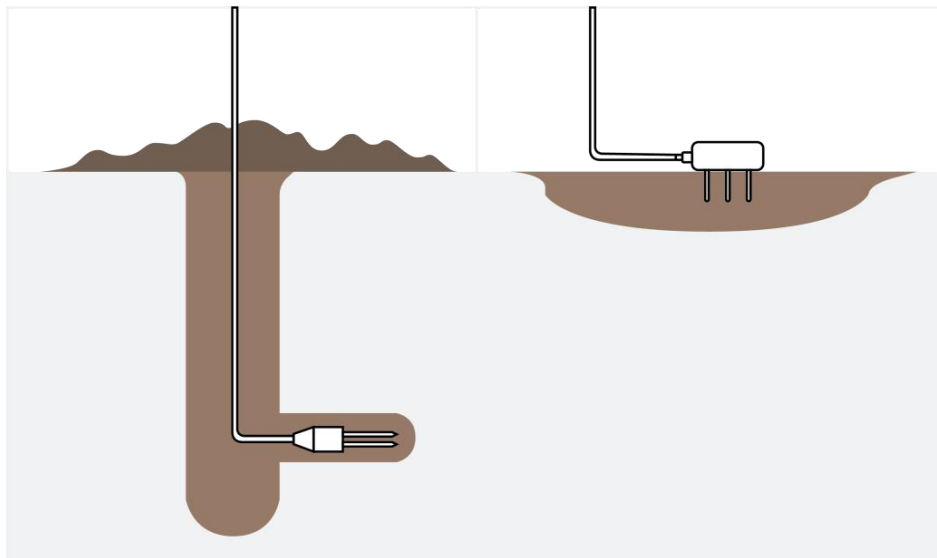
- Be careful when inserting the sensor into dense soil, as the prongs will break if excessive sideways force is used.
- When installing the sensor in a lightning prone area, please check your lightning protection.
- When removing the sensor from the soil, do not pull it out of the soil by the cable. Doing so may break internal connections and make the sensor unusable.

### 5.4.1 Horizontal Installation

1. Excavate a hole or trench a few centimeters deeper than the depth at which the sensor is to be installed.
2. At the installation depth, shave off some soil from the vertical soil surface exposing undisturbed soil.
3. Insert the sensor into the undisturbed soil surface until the entire sensor is inserted. The tip of each prong has been sharpened to make it easier to push the sensor into the soil. Be careful with the sharp tips!

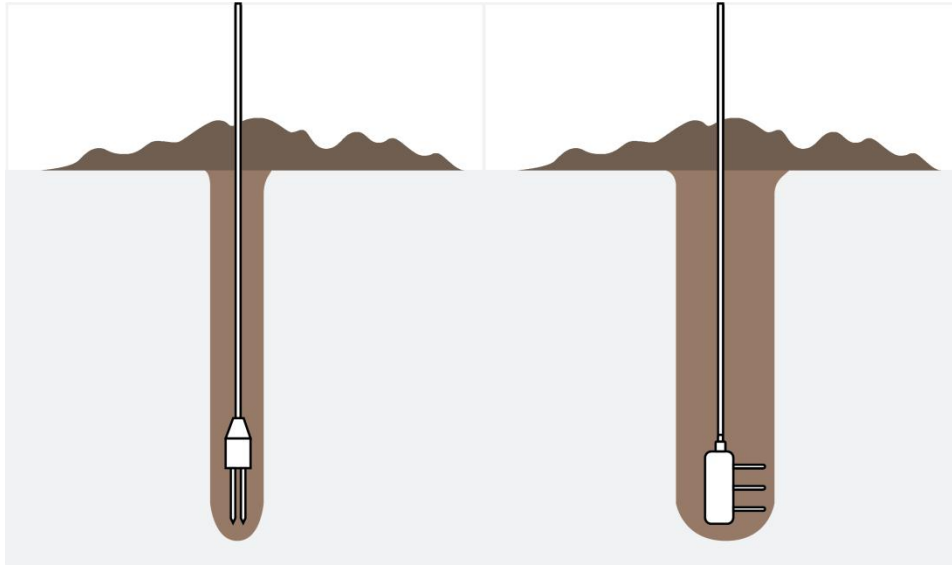
**Note:** If there is difficulty inserting the sensor, loosen or wet the soil.

4. Backfill the trench taking care to pack the soil back to natural bulk density around the sensor body.



### 5.4.2 Vertical Installation

1. Drill a hole to the depth at which the sensor is to be installed.
2. Insert the sensor into the undisturbed soil at the bottom of the drilled hole using a hand or any other implement that will guide the sensor into the soil at the bottom of the hole.
3. After inserting the sensor, backfill the hole, and take care to pack the soil back to natural bulk density while not damaging the over molding of the sensor and the sensor cable in the process.

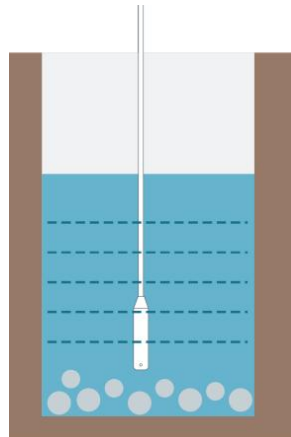


### 5.5 EM500-SWL Sensor Installation

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.

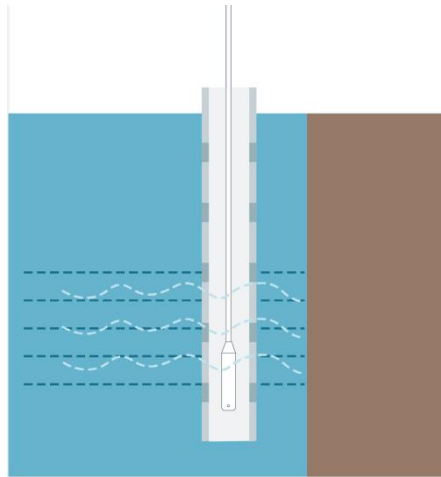
**Note:**

- Ensure the gas holes of SWL sensor do not be blocked while mounting or using it.
- To prevent the separation of SWL 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 in the pipe in order to let water flow in and remove hydrodynamic pressure.

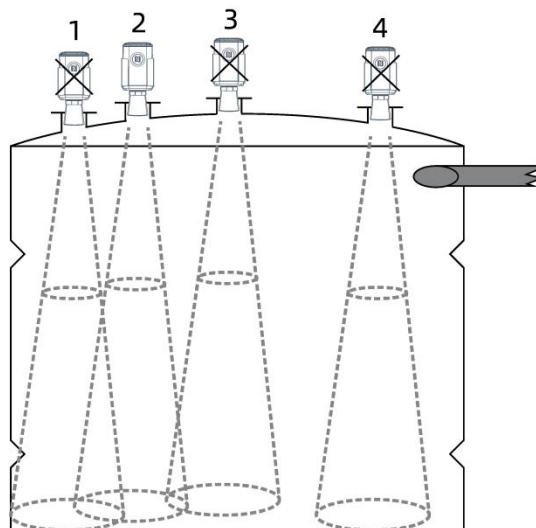
**Note:** The pipe can't be placed bend.



### 5.6 EM500-UDL Sensor Installation

When installing EM500-UDL, please take in mind:

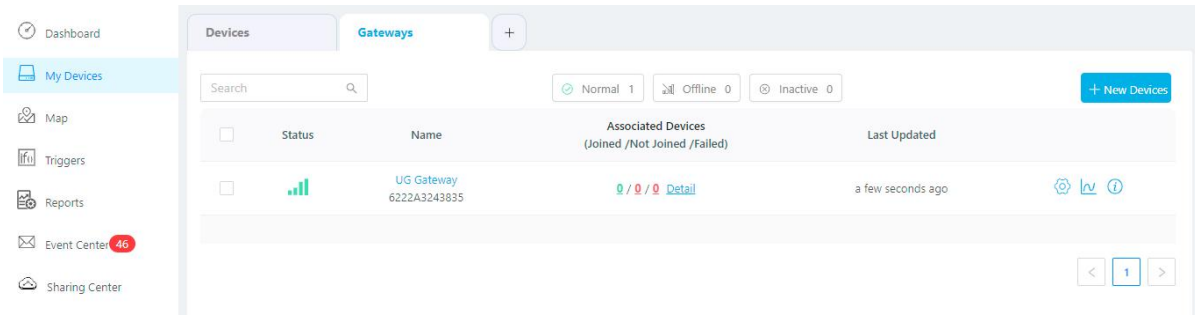
- Device must sit in a vertical position on top of the object and be fitted such that it has a clear path to the object.
- Place device where it is far away the side-wall more than **30cm** and without internal obstructions that block the ultrasonic signal. (Position 1)
- Position 2 is the ideal location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



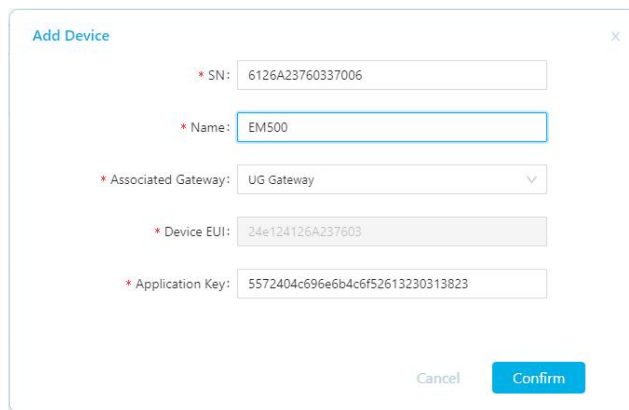
## 6. Milesight IoT Cloud Management

EM500 series can be managed by Milesight IoT Cloud platform. Milesight IoT cloud is a comprehensive platform that provides multiple services including device remote management and data visualization with the easiest operation procedures. Please register a Milesight IoT Cloud account before operating following steps.

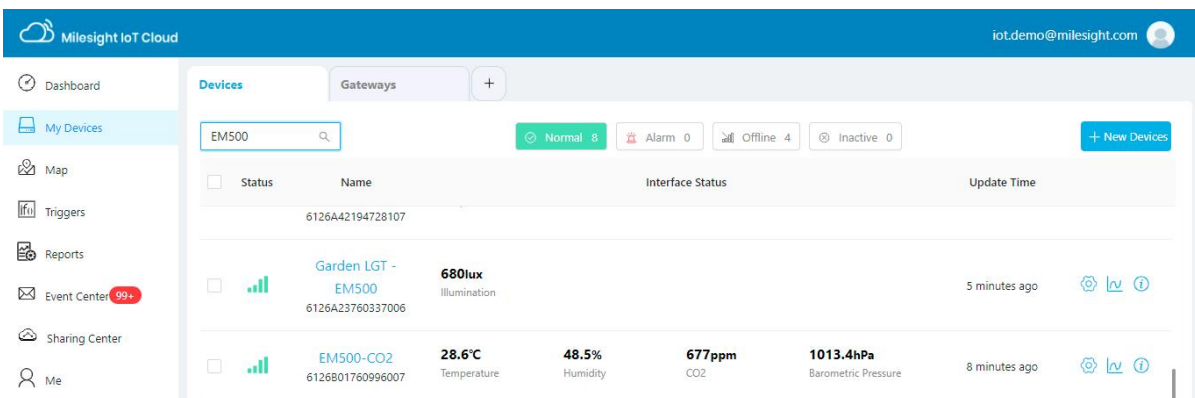
1. Ensure Milesight LoRaWAN® gateway is online in Milesight IoT Cloud. For more info about connecting gateway to cloud please refer to gateway’s user guide.



2. Go to “My Devices” page and click “+New Devices”. Fill in the SN of device and select an associated gateway.



3. After the device is online in Milesight IoT Cloud, you can check the data via webpage or mobile App and create dashboard for it.



## 7. Device Payload

EM500 Series use the standard Milesight IoT payload format based on IPSO. Please refer to the **EM500 Series Communication Protocol**, for decoders of Milesight IoT products please click [here](#).

-END-