



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 ₂	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

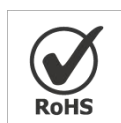
Safety Precautions

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.

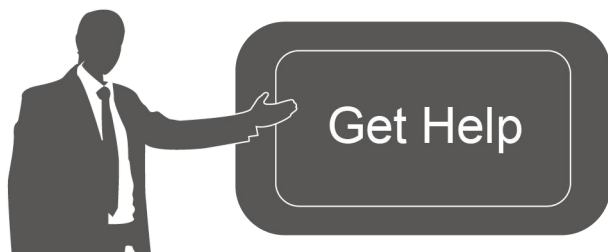
Declaration of Conformity

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	1. EM500-SMT/SMTC supports soil type selection 2. Add wirings of EM500-PP-G1/2M-4842 and EM500-SWL-4846W 3. Support RX2 datarate and frequency settings
May 31, 2023	V 2.0	Update based on hardware v2.x: 1. Add data storage and data transmission feature; 2. Add temperature mutation alarm feature; 3. Add CO2 barometric pressure compensation; 4. Add single-channel mode; 5. Add sensor installation guide.
March 29, 2024	V 2.1	1. Add distance shift threshold feature; 2. Add Milesight D2D controller feature; 3. Add alarm reporting times and alarm dismiss report feature.

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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.

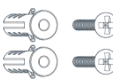
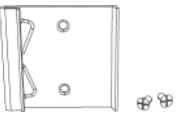
Sensor data are transmitted in real-time using standard LoRaWAN® protocol. LoRaWAN® enables encrypted radio transmissions over long distance while consuming very little power. The user can obtain sensor data and view the trend of data change through Milesight IoT Cloud or through the user's own Network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



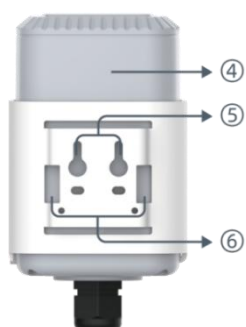
Front View of EM500-CO₂:

- 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

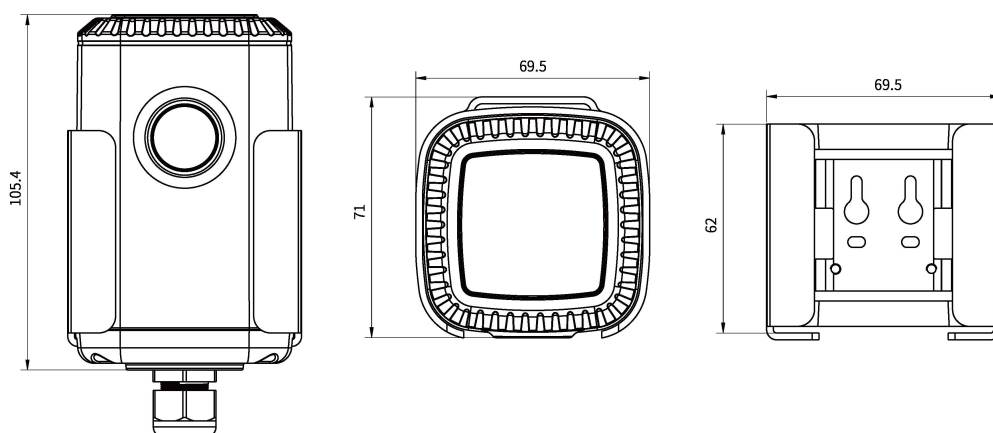


Back View:

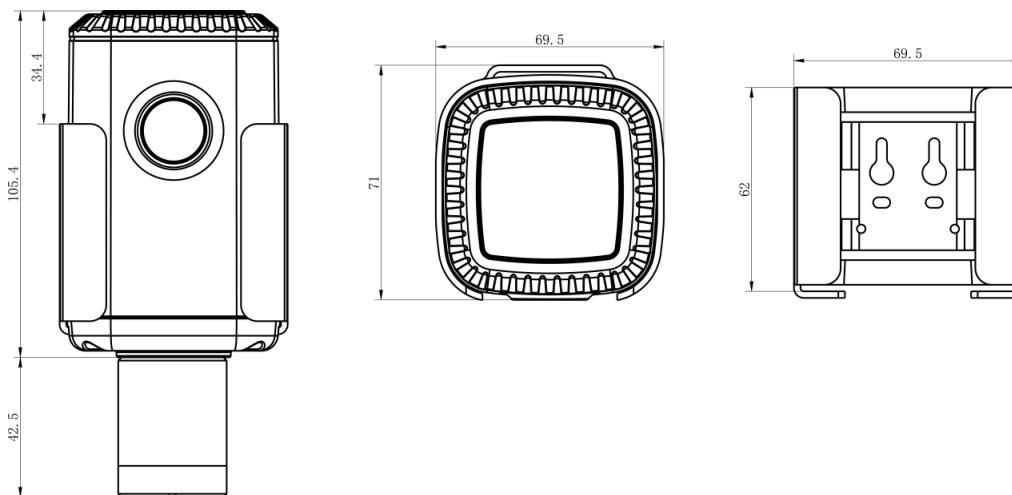
- ④ Battery (Internal)
- ⑤ Wall Mounting Holes
- ⑥ Pole Mounting Holes

2.3 Dimensions(mm)

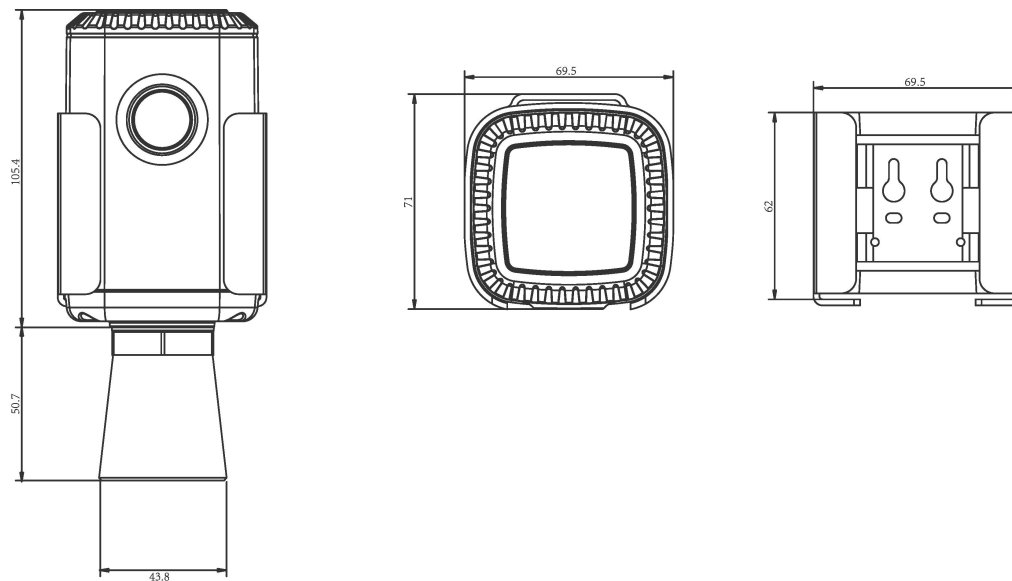
EM500



EM500-CO₂



EM500-UDL



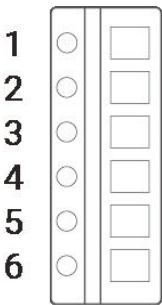
2.4 Power Button

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-4842/SWL-4 846W	PT100	SMT	SMTC
1	1	Black/GND	White/GND	White/GND	Black/GND	Black/GND
2	2	---	Red/AIN	---	Yellow/AIN	---
3	3	---	---	---	---	---
4	4	Blue/B	---	Red/PT1	---	White/B
5	5	Green/A	---	Red/PT2	---	Yellow/A
6	6	Red/VOUT	Black/VOUT	---	Brown/VOUT	Red/VOUT

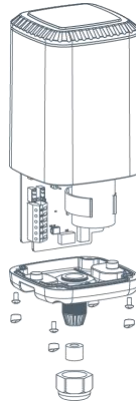
Note:

- 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.

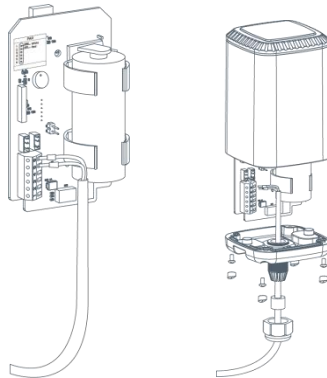
3. Device Assembly

For parts of models, it is necessary to connect sensor to the EM500 transceiver to make the whole device work.

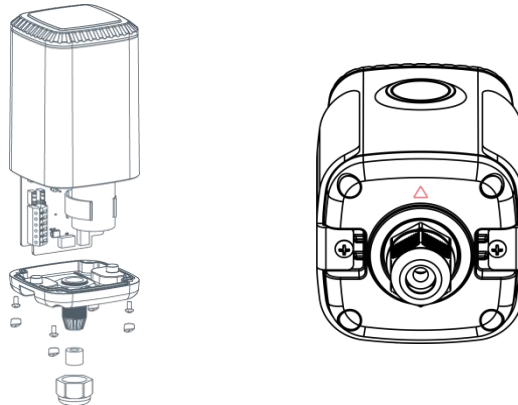
1. Take off the mounting bracket on the transceiver, remove the screws, rubber seal and cover on the bottom of the device.



2. Lock the sensor wires to the block according to the label on the motherboard or Pinouts, 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.

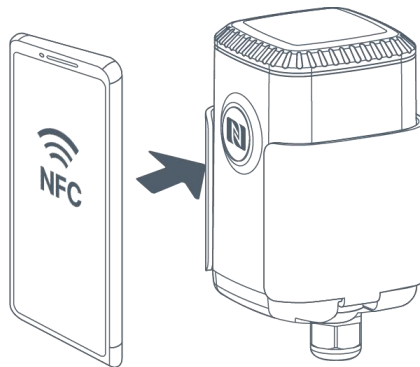
4. Operation Guide

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 be pulled out and battery is not placed reversed.**

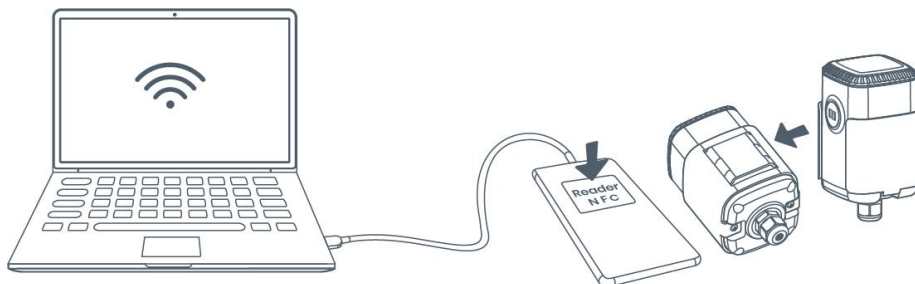
4.1.1 NFC Configuration

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**)

A screenshot of the 'ToolBox Settings' dialog box. It contains several configuration options: 'Type' set to 'General', 'Serial port' set to 'COM4', 'Login password' (empty), 'Baud rate' set to '115200', 'Data bits' set to '8', 'Parity bits' set to 'None', and 'Stop bits' set to '1'. At the bottom are 'Save' and 'Cancel' buttons.

ToolBox Settings	
Type	General
Serial port	COM4
Login password	
Baud rate	115200
Data bits	8
Parity bits	None
Stop bits	1
Save Cancel	

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

A screenshot of the 'Status' page in the ToolBox software. It displays various device information and status indicators. A 'Power Off' button is located in the top right corner. The status is shown as 'On' in green, while 'Join Status' is 'De-Activate' in red.

Status >	
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

24E124732D074534

* APP EUI

24e124c0002a0001

* Application Port

- 85 +

Join Type

OTAA

* Application Key

LoRaWAN Version

V1.0.3

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 th to 12 th 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.

Channel	Enable or disable the frequency to send uplinks. * Support Frequency EU868 ☐ - 868.1 + ☐ - 868.3 + ☐ - 868.5 + ☐ - 863 + 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. 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 * Support Frequency AU915 Enable Channel Index i 8-15 <table> <thead> <tr> <th>Index</th><th>Frequency/MHz i</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 i	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 i												
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												
Spread Factor	If ADR is disabled, the device will send data via this spread factor.												
Confirmed Mode	If the device does not receive ACK packet from network server, it will resend data once.												
Rejoin Mode	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.												

	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. Note: the actual sending number is Set the number of packets sent + 1 .
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 or Milesight Development Platform 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.

Temperature Unit ⓘ

°C

Reporting Interval - 10 + min

Data Storage ⓘ ☒

Data Retransmission ⓘ ☐

Change Password ☐

Parameters	Description
Reporting Interval	Reporting interval of transmitting data to network server. Default: 10 mins, Range: 1-1080 mins.
Temperature Unit (EM500-CO ₂ /SMTC/ PT100)	Change the temperature unit displayed on the ToolBox. Note: 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 (EM500-PP)	Change the pressure unit displayed on the ToolBox. Note: 1) The pressure unit in the reporting package is fixed as kPa. 2) Please modify the threshold settings if the unit is changed.
Data Storage	Disable or enable data storage locally.
Data Retransmission	Disable or enable data retransmission.
Change Password	Change the password for ToolBox App to write this device or ToolBox software to log in this device.

4.4 Advanced Settings

4.4.1 Data Collection Settings

Applicable model: EM500-CO₂, EM500-SMTC.

Enable or disable to collect and upload corresponding data.

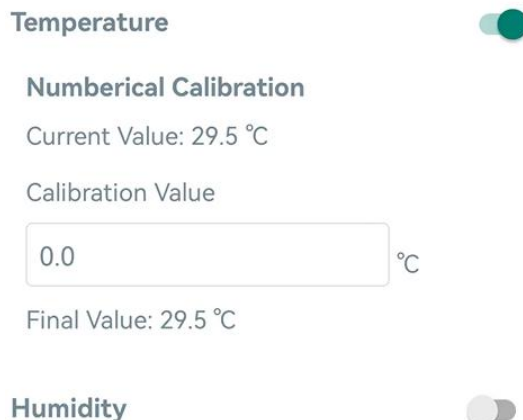


4.4.2 Calibration Settings

Numerical Calibration:

Applicable model: All EM500 series

Type the calibration value and save, the device will add the calibration value to raw value.



CO₂ Calibration:

Applicable model: EM500-CO₂

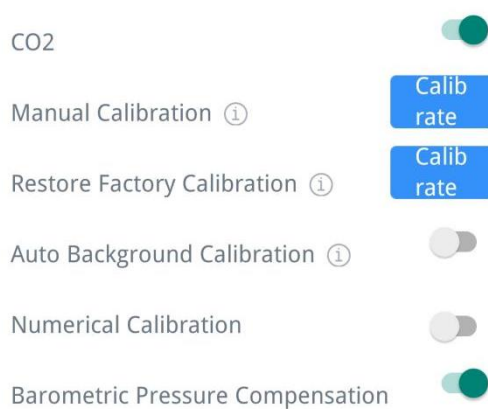
ToolBox provides more methods for CO₂ calibration:

Manual Calibration: Put the device in an open outdoor environment for more than 10 minutes and click this button to calibrate the CO₂ value.

Auto Background Calibration: When enabled, keep the device work in a well-ventilated environment for 180 hours (around 7 days), then disable the calibration.

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

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



Abnormal Value Prevention:

Applicable model: EM500-PT100, EM500-SWL, EM500-UDL

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 once 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

Normal Threshold:

Applicable model: All EM500 series

When the sensor value falls over or below the threshold value, the device will report a packet including current sensor value immediately..

CO2

Over / ppm

Below / ppm

Collecting Interval(min)

Alarm Reporting Times

Alarm Dismiss Report ⓘ

Note: The settings below will work for all normal threshold settings if there are multiple sensors.

Parameters	Description
Collect Interval	The interval to collect sensor data after threshold alarm triggers. This interval should be less than reporting interval.
Alarm Reporting Times	Set the times of alarm report.
Alarm Dismiss Report	After it is enabled, when the collected value changes to not exceeding the threshold range, a packet including current sensor value will be reported.

Temperature Mutation Threshold:

Applicable model: EM500-CO₂, EM500-SMTC, EM500-PT100

When this function is enabled, the device will report an alarm packet when the absolute value of the difference between the two collected values exceeds the set threshold.

Temperature Mutation Threshold ⓘ ☒

Temperature mutation value over(°C)

Distance Shifts Threshold:

Applicable model: EM500-UDL

When this function is enabled, the device will report an alarm packet when the absolute value of the difference between the two collected values exceeds the set threshold.

Distance Shifts Threshold ⓘ ☒

Distance Shifts Over(m)

4.4.4 Data Storage

Applicable model: All EM500 series

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 ☒
Join Status	Activated
Reading Mode	NFC
RSSI/SNR	-82/8
Device Time	2023-06-10 14:44 Sync

Besides, when device LoRaWAN® version is set as 1.0.3, the device will send MAC commands to ask the network server for the time every time it joins the network.

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.

Manual Upgrade

Browse

Restore Factory Default

Cancel Export Data Period Confirm

2023-06-07 16:44 To 2023-06-14 16:44

2021 4 5 14 12

2022 5 6 15 43

2023 6 7 16 44

8 17 45

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

Export Historical Data

Export

Export Record

Data Cleaning

4.4.5 Data Retransmission

Applicable model: All EM500 series

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;

The screenshot shows the 'Setting' tab of the Milesight device configuration interface. Under the 'General Settings' section, the 'Temperature Unit' is set to '°C' and the 'Reporting Interval' is set to '10 min'. Below these, the 'Data Storage' and 'Data Retransmission' features are both enabled, indicated by green toggle switches. These two settings are highlighted with a red rectangular box.

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).

The screenshot shows the 'Setting' tab of the Milesight device configuration interface. Under the 'General Settings' section, the 'Confirmed Mode' is disabled. Below it, the 'Rejoin Mode' is enabled, indicated by a green toggle switch. The 'Set the number of detection signals sent' is set to '8'. These two settings are highlighted with a red rectangular box. Below this, the 'ADR Mode' is enabled and the 'Spreading Factor' is set to 'SF10-DR2'.

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.

4.4.6 Milesight D2D Settings

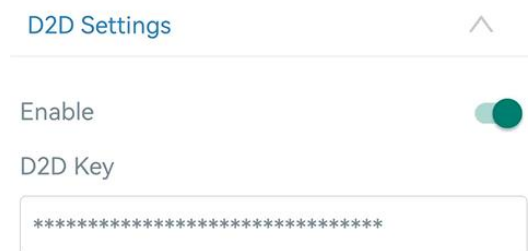
Applicable model: EM500-PP, EM500-PT100, EM500-SMTC, EM500-UDL

Milesight D2D protocol is developed by Milesight and is used for setting up transmission among Milesight devices without a gateway. When the Milesight D2D settings is enabled, EM500 series can work as a D2D controller in sending control commands to trigger Milesight D2D agent devices.

1. Configure RX2 datarate and RX2 frequency in LoRaWAN® settings, it is suggested to change the default value if there are many LoRaWAN® devices around.

2. Enable Milesight D2D feature.

3. Define a unique D2D key which is the same as Milesight D2D agent devices. (Default D2D key: 5572404C696E6B4C6F52613230313823)



4. Enable one of status mode and configure 2-byte hexadecimal Milesight D2D command. When the threshold is triggered or released, EM500 series sensor will send this control command to corresponding Milesight D2D agent devices. Take EM500-UDL as example below:

Distance Threshold Triggered	☒
Control command	120c
LoRa Uplink ⓘ	☐
Distance Threshold Not Triggered	☐
Distance Shift Threshold Triggered	☐

Note:

- 1) If you enabled **LoRa Uplink**, a LoRaWAN® uplink packet that contains corresponding alarm status will be sent to gateway after the Milesight D2D control command packet. Otherwise, the alarm packet will not send to LoRaWAN® gateway.
- 2) Enable and configure corresponding threshold settings before enabling Milesight D2D feature.

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:	Beijing Server	
FOTA:	Up to date	
Update Locally		Browse Upgrade

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:

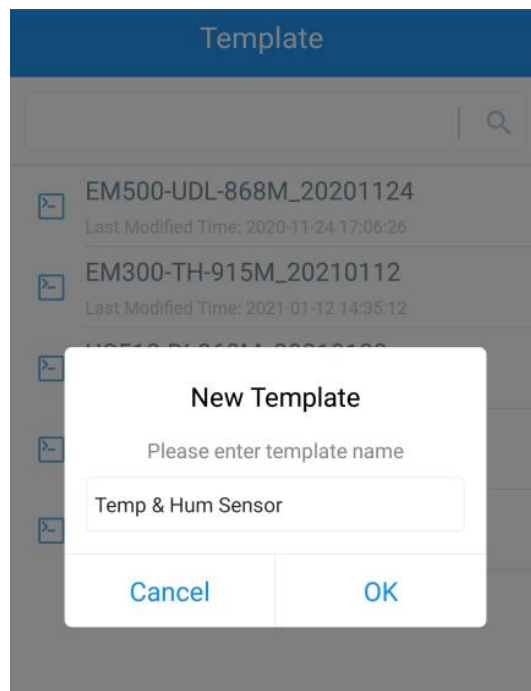
- 1) Operation on ToolBox is not supported during the upgrade.
- 2) Only Android version ToolBox supports the upgrade feature.

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

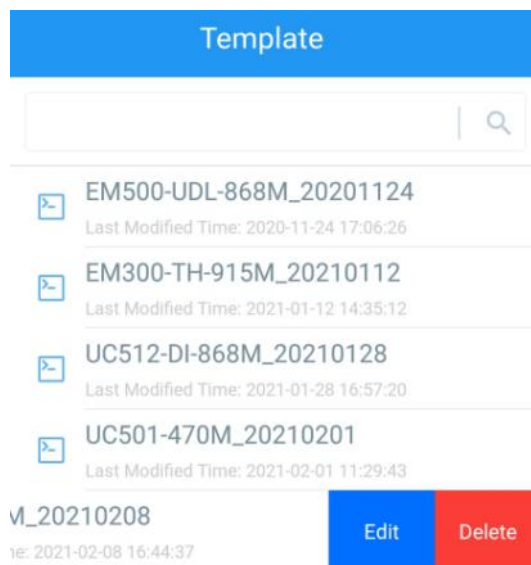
4.5.2 Backup

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.

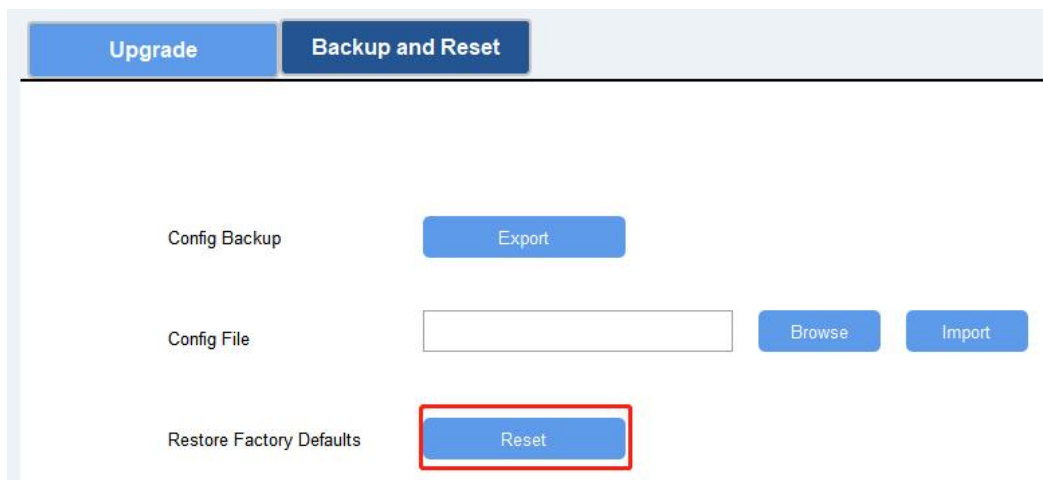


4.5.3 Reset to Factory Default

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

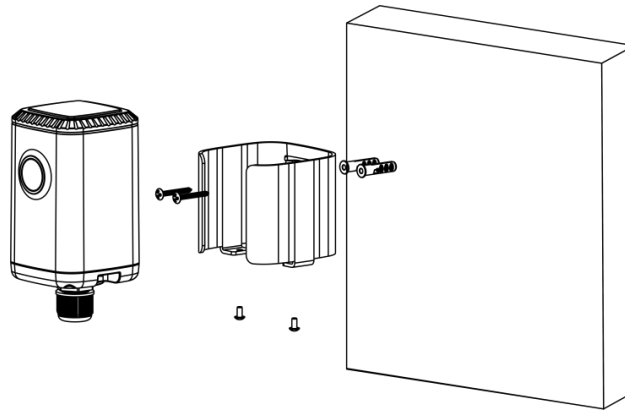
5.1 EM500 Transceiver Installation

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

Wall Mounting:

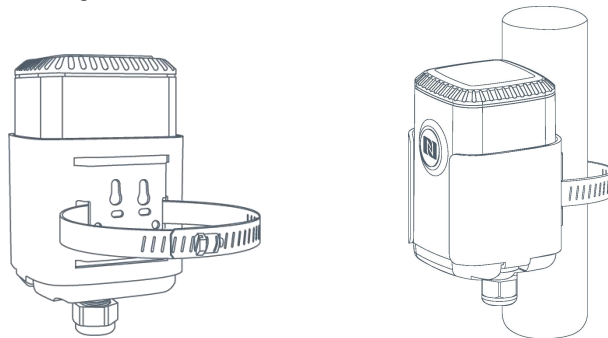
1. Drill 2 holes on the wall according to the mounting bracket, then fix the wall plugs into the wall.
2. Fix the mounting bracket to the wall via screws.

3. Put the device onto the mounting bracket, then fix the device to the bracket with 2 fixing screws.



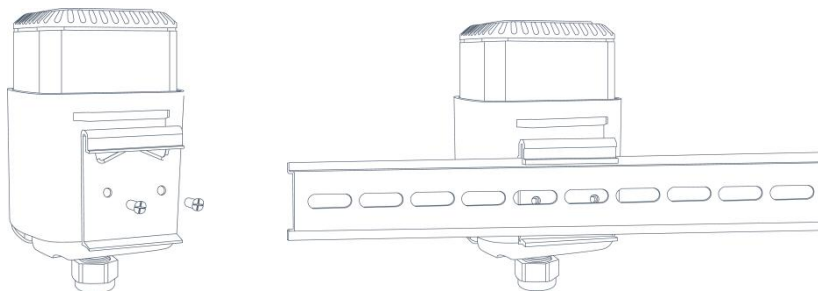
Pole Mounting:

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.



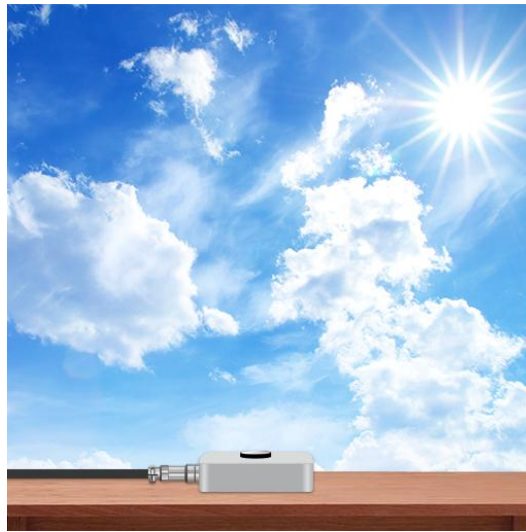
5.2 EM500-CO₂ Sensor Installation

EM500-CO₂ should be considered following notes to insure proper installation:

- CO₂ sensor should be mounted no higher than 12-18 inches above the floor since CO₂ 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 suggested to put the prongs totally to the soil to ensure accurate measurement.

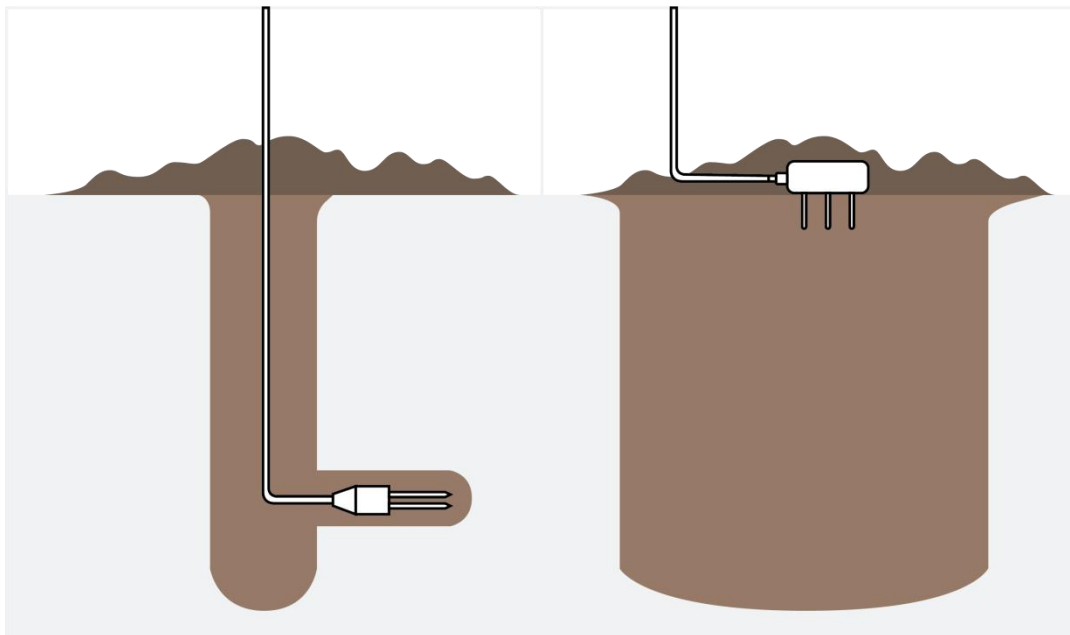
- It is possible to get sticks, bark, roots or other material stuck between the sensor prongs, which will severely affect the sensor data readings. Any air gaps or excessive soil compaction around the sensor can also influence the readings.
- Do not install the sensor adjacent to large metal objects.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

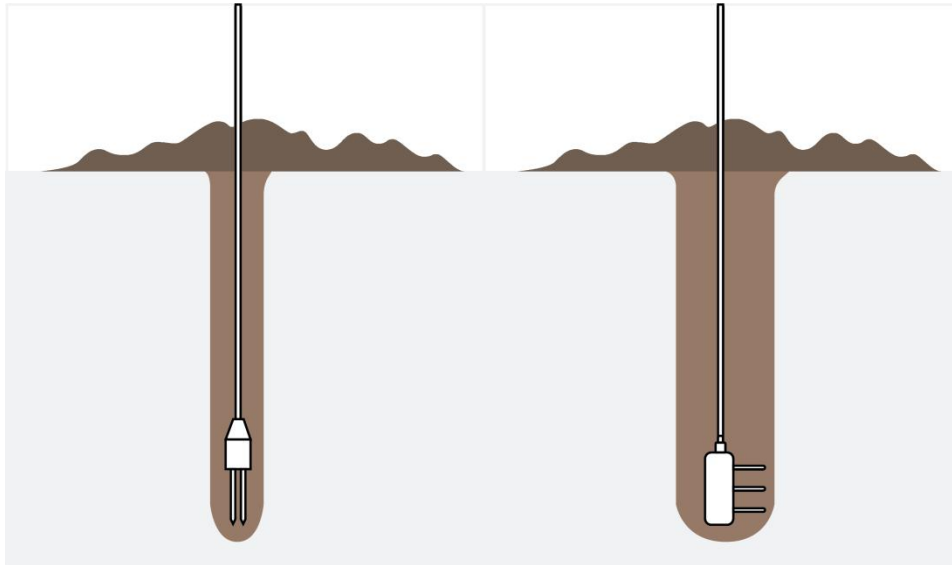
4. Backfill the trench taking care to pack the soil back to natural bulk density around the sensor body.



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.

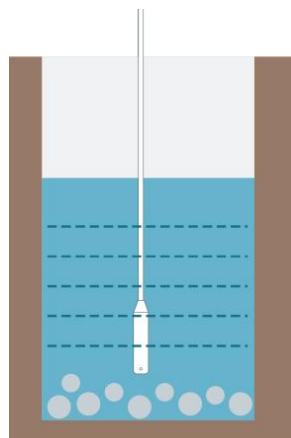


5.5 EM500-SWL Sensor Installation

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:

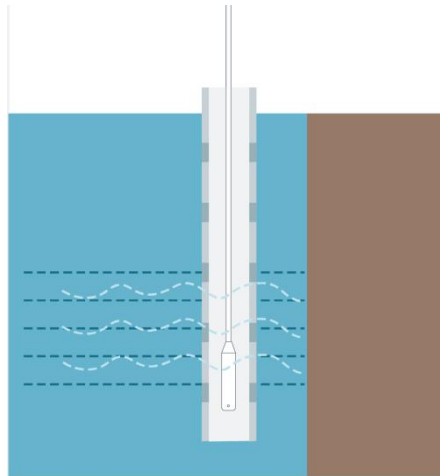
- Ensure the gas holes of SWL sensor do not be blocked while mounting or using it.
- Please do not put the EM500-SWL transceiver to closed environment, which will affect the accurate measurement of SWL sensor.
- To prevent the separation of SWL sensor and transceiver due to water shock and gravity, please fix the sensor cable with a fixed bracket or wrap it around the pole.
- Please add lightning protection devices or put the sensor under lightning rod when the sensor is placed outdoors.



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.

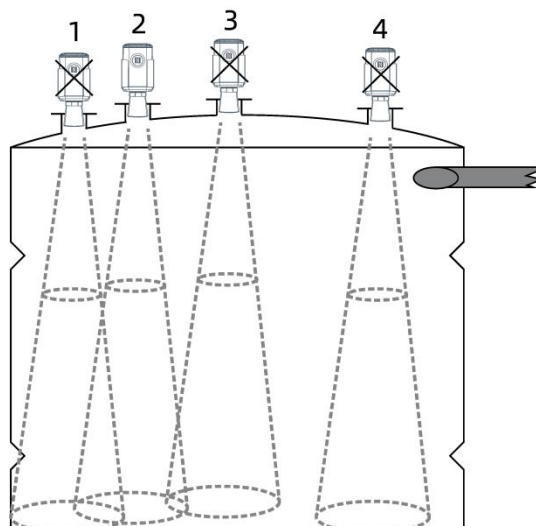
Note: The pipe can't be placed bend.



5.6 EM500-UDL Sensor Installation

When installing EM500-UDL, please take in mind:

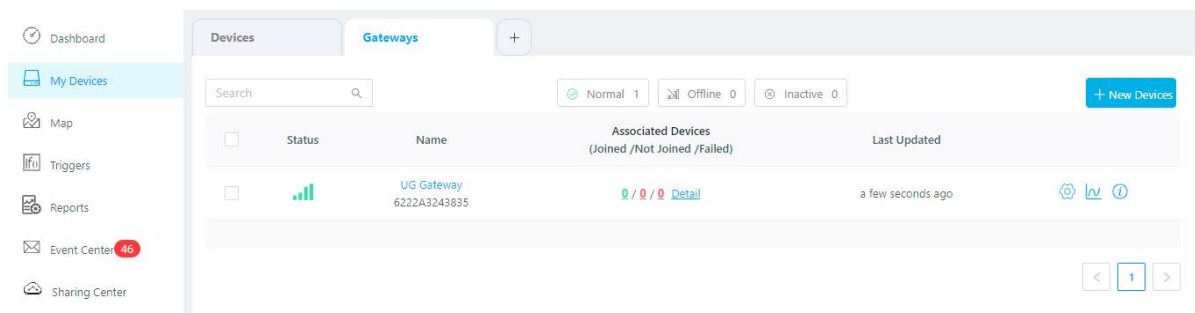
- Device must sit in a vertical position on top of the object and be fitted such that it has a clear path to the object.
- Place device where it is far away the side-wall more than **30cm** and without internal obstructions that block the ultrasonic signal. (Position 1)
- Position 2 is the ideal location 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

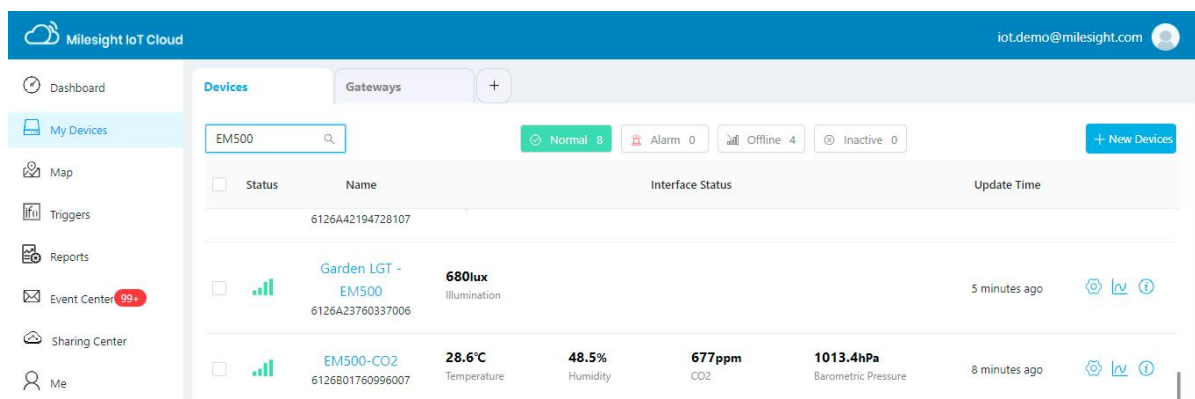
EM500 series can be managed by Milesight IoT Cloud platform. Milesight IoT cloud is a comprehensive platform that provides multiple services including device remote management and data visualization with the easiest operation procedures. Please register a Milesight IoT Cloud account before operating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

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-