

# Environment Monitoring Sensor Featuring LoRaWAN® EM300 Series

User Guide



## Applicability

This guide is applicable to EM300 series sensors shown as follows, except where otherwise indicated.

| Model     | Description                     |
|-----------|---------------------------------|
| EM300-TH  | Temperature and Humidity Sensor |
| EM300-MCS | Magnet Switch Sensor            |
| EM300-SLD | Spot Leak Detection Sensor      |
| EM300-ZLD | Zone Leak Detection Sensor      |
| EM300-DI  | Pulse Counter Sensor            |

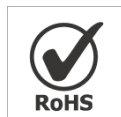
## Safety Precautions

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.
- ❖ Make sure both batteries are newest when install, or battery life will be reduced.
- ❖ The device must never be subjected to shocks or impacts.

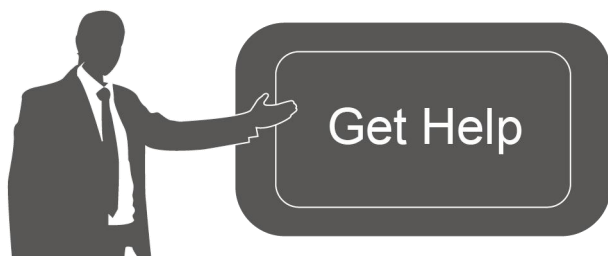
## Declaration of Conformity

EM300 series is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.



**Copyright © 2011-2022 Milesight. All rights reserved.**

All information in this guide is protected by copyright law. Whereby, no organization or individual shall copy or reproduce the whole or part of this user guide by any means without written authorization from Xiamen Milesight IoT Co., Ltd.



For assistance, please contact

Milesight technical support:

Email: [iot.support@milesight.com](mailto:iot.support@milesight.com)

Support Portal: [support.milesight-iot.com](https://support.milesight-iot.com)

Tel: 86-592-5085280

Fax: 86-592-5023065

Address: Building C09, Software Park III,  
Xiamen 361024, China

## Revision History

| Date          | Doc Version | Description                                                                                                                                         |
|---------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Oct. 14, 2020 | V 1.0       | Initial version                                                                                                                                     |
| Oct. 21, 2020 | V 1.1       | Model name change and pictures replace                                                                                                              |
| Nov. 19, 2020 | V 2.0       | Layout replace                                                                                                                                      |
| Mar. 4, 2021  | V 2.1       | Layout update                                                                                                                                       |
| July 5, 2021  | V 2.2       | Delete USB Type-C description                                                                                                                       |
| Dec. 7, 2021  | V 2.3       | Add alarm setting, change SN to 16 digits                                                                                                           |
| Nov. 24, 2022 | V 2.4       | 1. Add EM300-DI model<br>2. Add Milesight D2D feature<br>3. Add data storage feature<br>4. Add time synchronization and data retransmission feature |

# Contents

|                                               |    |
|-----------------------------------------------|----|
| 1. Product Introduction .....                 | 5  |
| 1.1 Overview .....                            | 5  |
| 1.2 Features .....                            | 5  |
| 2. Hardware Introduction .....                | 5  |
| 2.1 Packing List .....                        | 5  |
| 2.2 Hardware Overview .....                   | 6  |
| 2.3 GPIO Wiring (EM300-DI) .....              | 6  |
| 2.3 Dimensions .....                          | 6  |
| 2.4 Power Button .....                        | 7  |
| 3. Operation Guide .....                      | 7  |
| 3.1 NFC Configuration .....                   | 7  |
| 3.2 LoRaWAN Settings .....                    | 8  |
| 3.3 Time synchronization .....                | 11 |
| 3.4 Basic Settings & Interface Settings ..... | 12 |
| 3.5 Advanced Settings .....                   | 13 |
| 3.5.1 Calibration Settings .....              | 13 |
| 3.5.2 Threshold Settings .....                | 13 |
| 3.5.3 Alarm Settings .....                    | 13 |
| 3.5.4 Data Retransmission .....               | 16 |
| 3.5.5 Milesight D2D Settings .....            | 17 |
| 3.6 Maintenance .....                         | 18 |
| 3.6.1 Upgrade .....                           | 18 |
| 3.6.2 Backup .....                            | 19 |
| 3.6.3 Reset to Factory Default .....          | 20 |
| 4. Installation .....                         | 20 |
| 5. Device Payload .....                       | 21 |
| 5.1 Basic Information .....                   | 22 |
| 5.2 Sensor Data .....                         | 22 |
| 5.3 Downlink Commands .....                   | 23 |
| 5.4 Historical Data Enquiry .....             | 25 |

## 1. Product Introduction

### 1.1 Overview

EM300 series is a sensor mainly used for outdoor environment through wireless LoRaWAN® network. EM300 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.

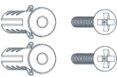
Sensor data are transmitted in real-time using standard LoRaWAN® protocol. LoRaWAN® enables encrypted radio transmissions over long distance while consuming very little power. The user can obtain sensor data and view the trend of data change through Milesight IoT Cloud or through the user's own Network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

### 1.2 Features

- Up to 11 km communication range
- Easy configuration via NFC
- Standard LoRaWAN® support
- Milesight IoT Cloud compliant
- Low power consumption with 4000mAh replaceable battery

## 2. Hardware Introduction

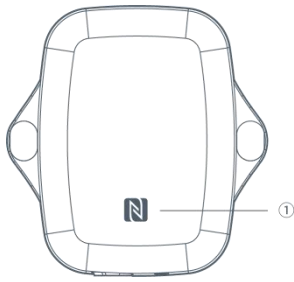
### 2.1 Packing List

|                                                                                     |                                                                                     |                                                                                      |                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |  |
| 1 × EM300 Sensor                                                                    | 2 × Wall Mounting Kits                                                              | 2 × Screw Caps                                                                       | 1 × Quick Guide                                                                       |
|  |  |   |                                                                                       |
| 1 × Warranty Card                                                                   | 3M Double Sided Tape (SLD or MCS Sensor Only)                                       | Mounting Screws (SLD or MCS Sensor Only)                                             |                                                                                       |



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

## 2.2 Hardware Overview



**Front View:**

- ① NFC Area



**Bottom View:**

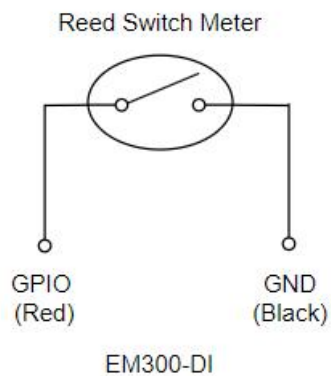
- ② Vent

- ③ Waterproof Connectors

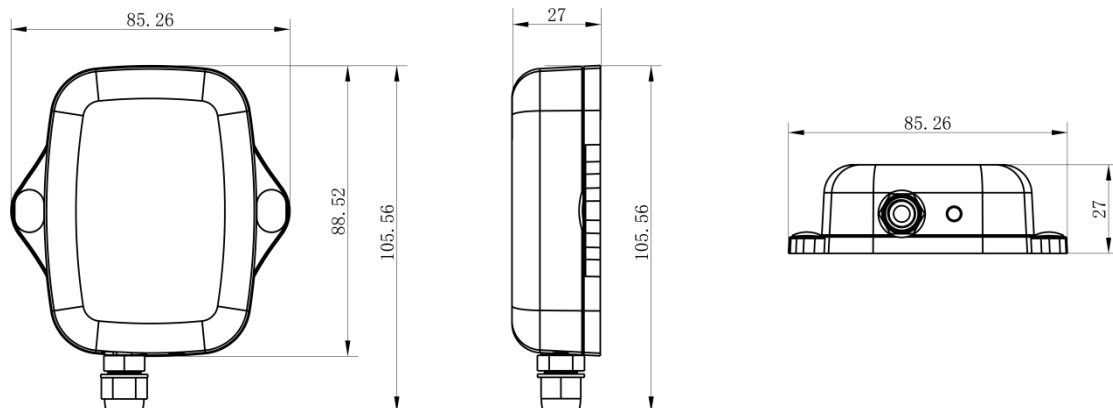
(For EM300-DI/MCS/SLD/ZLD)



## 2.3 GPIO Wiring (EM300-DI)



## 2.3 Dimensions(mm)



## 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.

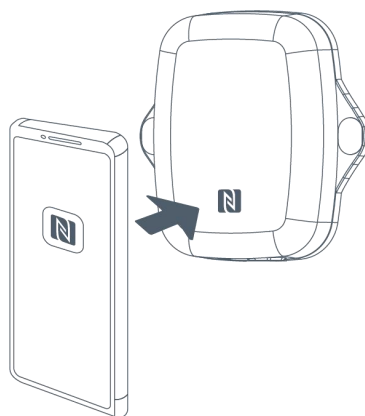
| Function               | Action                                              | LED Indication                                                     |
|------------------------|-----------------------------------------------------|--------------------------------------------------------------------|
|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

## 3. Operation Guide

### 3.1 NFC Configuration

EM300 series can be monitored and configured via NFC. Please refer the following steps to complete configuration.

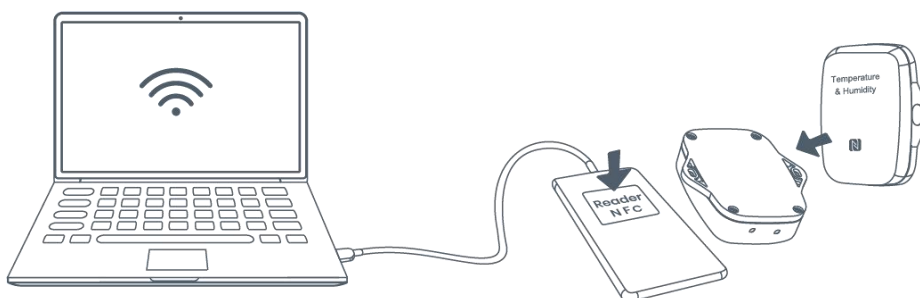
1. Download and install “Milesight ToolBox” App from Google Play or Apple Store.
2. Enable NFC on the smartphone and launch Milesight ToolBox.
3. Attach the smartphone with NFC area to the device to read device information. Basic information and settings of the device will be shown on ToolBox App if it's recognized successfully. 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:**

- 1) Ensure the location of smartphone NFC area and it's recommended to take off phone case.
- 2) If the smartphone fails to read/write configurations via NFC, keep the phone away and back to try again.

3) EM300 series can also be configured by dedicated NFC reader provided by Milesight IoT or you can configure it via TTL interface inside the device.



## 3.2 LoRaWAN Settings

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

### Basic LoRaWAN Settings:

Go to **Device > Setting > LoRaWAN Settings** to configure join type, App EUI, App Key and other information. You can also keep all settings by default.

Device EUI

24E124136C379287

\* APP EUI

24e124c0002a0001

\* Application Port



85



Join Type

OTAA

\* Application Key

\*\*\*\*\*

LoRaWAN Version

V1.1.0

Work Mode

Class A

RX2 Data Rate

DR0 (SF12, 125 kHz)

RX2 Frequency

921900000

Confirmed Mode ⓘ



Rejoin Mode



Set the number of detection signals sent ⓘ

4

ADR Mode ⓘ



Spreading Factor ⓘ

SF10-DR2

TXPower

TXPower0~14 dBm

| 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.                                                       |
| 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.                     |
| LoRaWAN Version         | V1.0.2, V1.0.3, V1.1 are available.                                                    |
| Work Mode               | It's fixed as Class A.                                                                 |
| RX2 Data Rate           | RX2 data rate to receive downlinks or send D2D commands.                               |
| RX2 Frequency           | RX2 frequency to receive downlinks or send D2D commands. Unit: Hz                      |

|                                |                                                                                                                                                                                                |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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                    | The device will send a specific number of LinkCheckReq MAC packets to the network server every 30 mins 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.                                                                                                                      |
| 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.

**LoRaWAN Frequency Settings:**

Go to **Setting > LoRaWAN Settings** to select supported frequency and select channels to send uplinks. Make sure the channels match the LoRaWAN® gateway.

\* Support Frequency

EU868

|                                     |                                  |       |                                  |
|-------------------------------------|----------------------------------|-------|----------------------------------|
| <input checked="" type="checkbox"/> | <input type="button" value="-"/> | 868.1 | <input type="button" value="+"/> |
| <hr/>                               |                                  |       |                                  |
| <input checked="" type="checkbox"/> | <input type="button" value="-"/> | 868.3 | <input type="button" value="+"/> |
| <hr/>                               |                                  |       |                                  |
| <input checked="" type="checkbox"/> | <input type="button" value="-"/> | 868.5 | <input type="button" value="+"/> |
| <hr/>                               |                                  |       |                                  |
| <input type="checkbox"/>            | <input type="button" value="-"/> | 863   | <input type="button" value="+"/> |

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

\* Support Frequency

AU915

Enable Channel Index ⓘ

0-71

| 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   |

### 3.3 Time synchronization

#### ToolBox App Sync:

Go to **Device** -> **Status** of ToolBox App to click **Sync** to sync the time.

|                  |                                                                                                       |
|------------------|-------------------------------------------------------------------------------------------------------|
| Hardware Version | V3.0                                                                                                  |
| Device Status    | ON                |
| Join Status      | De-activated                                                                                          |
| RSSI/SNR         | -32/11                                                                                                |
| Device Time      | 2022-10-31 17:10  |

#### Network Server Sync:

Go to **Device** > **Settings** > **LoRaWAN Settings** of ToolBox App to change device LoRaWAN® version as 1.0.3 or above, the network server will use MAC command to assign the time to device every time it joins the network.

#### Note:

- 1) This function is only applicable to network server using LoRaWAN® 1.0.3 or 1.1 version.
- 2) Network server will sync the time which time zone is UTC+0 by default. It's suggested to sync the time via ToolBox App to change the time zone.

### 3.4 Basic Settings & Interface Settings

Go to **Device > Setting > General Settings** to change the reporting interval, etc.

Temperature Unit ⓘ

°C

Reporting Interval - 10 + min

Change Password ☐

| Parameters         | Description                                                                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reporting Interval | Reporting interval of transmitting current sensor values to network server. Default: 10 min                                                                                                                  |
| Temperature Unit   | Change the temperature unit displayed on the ToolBox.<br><b>Note:</b><br>1) The temperature unit in the reporting package is fixed as °C.<br>2) Please modify the threshold settings if the unit is changed. |
| Change Password    | Change the password for ToolBox App or software to read/write this device.                                                                                                                                   |

For EM300-DI, go to **Device > Settings > Interface Settings** to modify configurations.

Interface Type

Counter

Pulse Filter ⓘ ☒

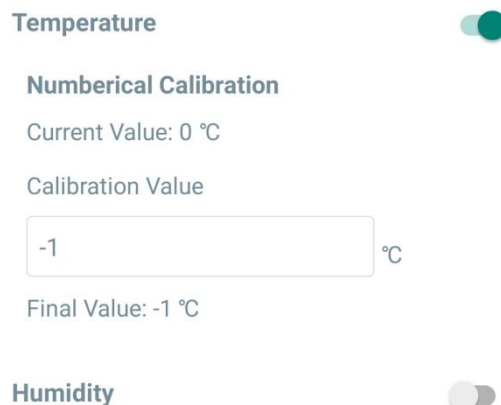
Modify count value

| Parameters         | Description                                                                                        |
|--------------------|----------------------------------------------------------------------------------------------------|
| Interface Type     | Change the interface type of GPIO interface. Counter and Digital is available, counter as default. |
| Pulse Filter       | When the function is enabled, pulse with a rate of more than 250us can be counted.                 |
| Modify Count Value | Set the initial counting value.                                                                    |

## 3.5 Advanced Settings

### 3.5.1 Calibration Settings

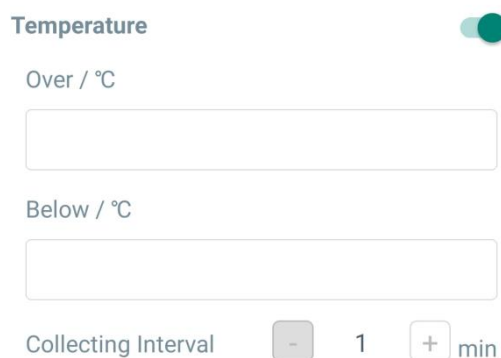
ToolBox supports temperature and humidity calibration. Go to **Device > Setting > Calibration Settings** to type the calibration value and save, the device will add the calibration value to raw value.



The screenshot shows the 'Calibration Settings' interface. At the top, there is a 'Temperature' toggle switch which is turned on (green). Below it, the 'Numerical Calibration' section is visible. It shows 'Current Value: 0 °C' and a 'Calibration Value' input field containing '-1'. Below the input field, it shows 'Final Value: -1 °C'. At the bottom, there is a 'Humidity' toggle switch which is turned off (grey).

### 3.5.2 Threshold Settings

Go to **Device > Setting > Threshold Settings** to enable the threshold settings and input the threshold. EM300 series will upload the current data once instantly when the temperature threshold is triggered. Note that when you change the temperature unit, please re-configured the threshold.



The screenshot shows the 'Threshold Settings' interface. At the top, there is a 'Temperature' toggle switch which is turned on (green). Below it, there are two input fields: 'Over / °C' and 'Below / °C'. At the bottom, there is a 'Collecting Interval' section with a minus button, the number '1', a plus button, and the unit 'min'.

### 3.5.3 Alarm Settings

Go to **Device > Setting > Alarm Settings** to enable the alarm settings. When EM300 detects door status change or water leakage, it will report the alarm according to reporting interval and reporting times setting.

**Alarm Reporting**

If someone invades, the alarm reporting interval and the alarm reporting times can be set as follows

Alarm Reporting Interval  1  min

Alarm Reporting Times  2

### 3.5.4 Data Storage

EM300 series sensor supports storing more than 2000 data records locally and exports data via ToolBox App. The device will record the data according to reporting interval and even joining network.

1. Go to **Device > Setting > General Settings** to enable data storage feature.

The screenshot shows the Milesight ToolBox App interface. At the top, there are three tabs: 'Status', 'Setting' (which is highlighted with a yellow underline), and 'Maintenance'. Below the tabs, there are two expandable sections: 'LoRaWAN Settings' (collapsed with a downward arrow) and 'General Settings' (expanded with an upward arrow). Under 'General Settings', there is a 'Temperature Unit' section with an information icon (i) and a dropdown menu currently showing '°C'. Below that is a 'Reporting Interval' section with minus and plus buttons, the number '10', and the unit 'min'. At the bottom is a 'Data Storage' section with an information icon (i) and a toggle switch that is currently turned on (green).

2. Go to **Device > Maintenance**, click **Export**, then select the data time range and click **Confirm** to export data. ToolBox App can only export last 14 days' data.

StatusSettingMaintenance

SN

ModelEM300-DI-915M

Firmware VersionV1.1-a3

Hardware VersionV3.0

Manual Upgrade

CancelExport Data PeriodConfirm

2022-10-06 10:36 To 2022-10-20 10:36

|      |    |   |    |    |
|------|----|---|----|----|
| 2020 | 8  | 4 | 8  | 34 |
| 2021 | 9  | 5 | 9  | 35 |
| 2022 | 10 | 6 | 10 | 36 |

3. Click **Data Cleaning** to clear all stored data inside the device.

StatusSettingMaintenance

Firmware VersionV1.1-a3

Hardware VersionV3.0

Manual Upgrade

Browse

Restore Factory Default

Reset

Export Historical Data

Export

Export Record

Data Cleaning

### 3.5.4 Data Retransmission

EM300 series sensor 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 to enquire the historical data for specifying time range, see section [5.4](#);
- 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. Ensure the device time is correct (see section [3.4](#));
2. Enable data storage feature and data retransmission feature;

The screenshot shows the 'Setting' tab of the Milesight device interface. Under 'General Settings', the 'Temperature Unit' is set to '°C' and the 'Reporting Interval' is 10 minutes. A red box highlights the 'Data Storage' and 'Data Retransmission' settings, both of which are toggled on (indicated by green switches).

3. Go to **Device > Setting > General Settings** to 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 at least every 30 minutes to check if the network is disconnected; if there is no response for 8 times ( $8 * 30 \text{ mins} = 240 \text{ mins} = 4 \text{ hours}$ ), the device will record a data lost time point (disconnected time minus 4 hours).

The screenshot shows the 'Setting' tab of the Milesight device interface. Under 'General Settings', the 'Confirmed Mode' is toggled off. A red box highlights the 'Rejoin Mode' setting, which is toggled on (green switch), and the 'Set the number of detection signals sent' input field, which is set to 8. Below this, the 'ADR Mode' is also toggled on (green switch).

4. 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.

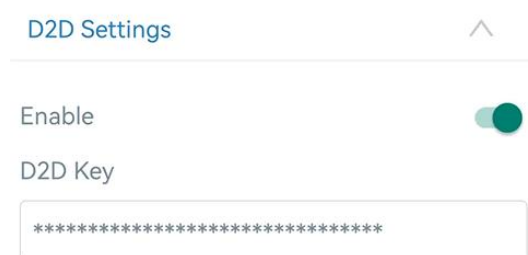
**Note:**

- 1) If the device is rebooted or re-power 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 disconnected data;
- 3) The retransmission data format is started with "20ce", please refer to see section [5.4](#).
- 4) Data retransmission will increase the uplinks and shorten the battery life.

### 3.5.5 Milesight D2D Settings

Milesight D2D protocol is developed by Milesight and used for setting up transmission among Milesight devices without gateway. When the Milesight D2D settings is enabled, EM300-TH/EM300-ZLD/ EM300-SLD/EM300-MCS can work as D2D controller to send 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. Go to **Device > Setting > D2D Settings** to enable Milesight D2D feature.
3. Define an unique D2D key which is the same as Milesight D2D agent devices. (Default D2D key: 5572404C696E6B4C6F52613230313823)



D2D Settings

Enable ☒

D2D Key

\*\*\*\*\*

4. Enable one of status mode and configure 2-byte hexadecimal Milesight D2D command. When the status is triggered, EM300 series sensor will send this control command to corresponding Milesight D2D agent devices. Take EM300-ZLD as example below:

Sensor Status: Leak ☒

Control command

0001

LoRa Uplink ⓘ ☐

Sensor Status: No Leak ☐

Temperature Threshold Trigger Status: Trigger ☐

Temperature Threshold Trigger Status: not triggered ☐

**Note:**

- 1) If you enable **LoRa Uplink**, a LoRaWAN® uplink packet that contains the sensor status or temperature threshold alarm will be sent to gateway after the Milesight D2D control command packet. Otherwise, sensor status or threshold alarm will not send to LoRaWAN® gateway.
- 2) If you want to enable **Temperature Threshold Trigger Status: Trigger** or **Temperature Threshold Trigger Status: not triggered**, please enable and configure temperature threshold feature under **Threshold Settings**.

## 3.6 Maintenance

### 3.6.1 Upgrade

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

**Note:**

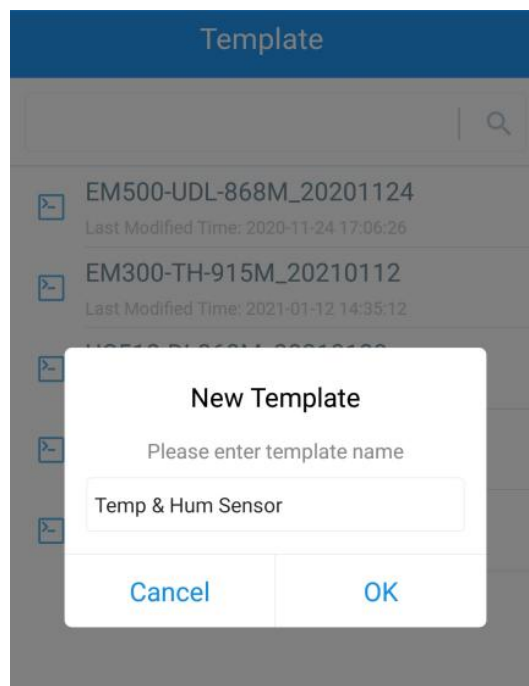
- 1) Operation on ToolBox is not supported during an upgrade.
- 2) Only Android version ToolBox supports the upgrade feature.

| Status           | Setting          | Maintenance |
|------------------|------------------|-------------|
| SN               | 6136B26167392109 |             |
| Model            | EM300-ZLD-915M   |             |
| Firmware Version | V1.1-a1          |             |
| Hardware Version | V3.0             |             |
| Manual Upgrade   |                  |             |
| Browse           |                  |             |

### 3.6.2 Backup

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

### 3.6.3 Reset to Factory Default

Please select one of following methods to reset device:

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

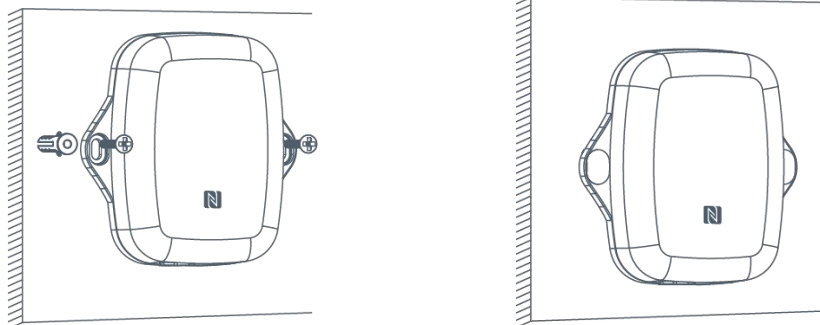
**Via ToolBox App:** Go to **Device > Maintenance** to click **Reset**, then attach smart phone with NFC area to device to complete reset.

| Status                  | Setting          | Maintenance |
|-------------------------|------------------|-------------|
| SN                      | 6136B26167392109 |             |
| Model                   | EM300-ZLD-915M   |             |
| Firmware Version        | V1.1-a1          |             |
| Hardware Version        | V3.0             |             |
| Manual Upgrade          |                  |             |
| <div>Browse</div>       |                  |             |
| Restore Factory Default |                  |             |
| <div>Reset</div>        |                  |             |

## 4. Installation

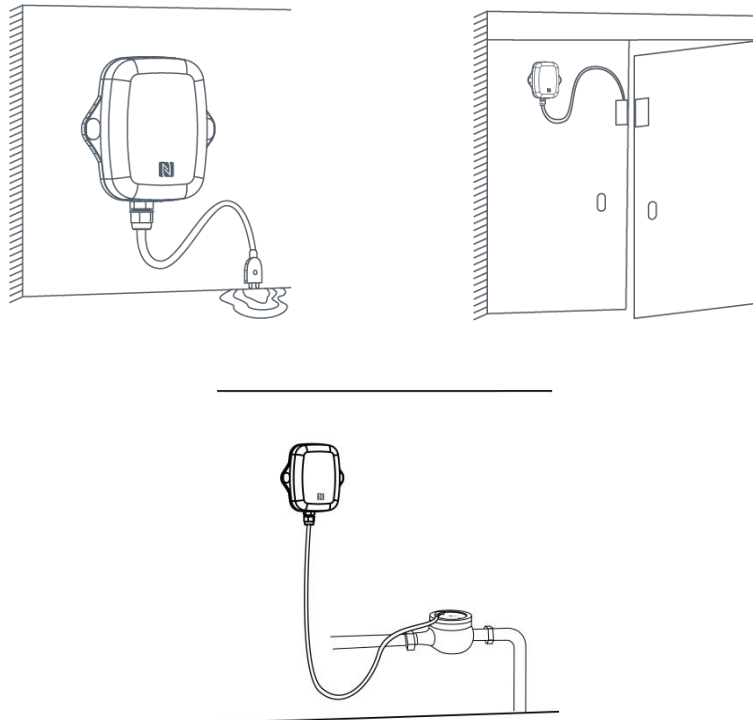
1. Attach EM300 to the wall and mark the two holes on the wall. The connecting line of two holes must be a horizontal line.

2. Drill the holes according to the marks and screw the wall plugs into the wall.
3. Mount the EM300 to the wall via mounting screws.
4. Cover the mounting screws with screw caps.



5. For leak detection sensor, install the probe/cable to the place where liquid may leak; for magnet switch sensor, install the magnet beside the door/window; for pulse counter, connect the wires to a pulse meter.

**Note:** For SLD sensor, please ensure the metal pins of the probe are flat on the floor; for ZLD sensor, the cable can't be twined or accumulated together. The probe or cable of water leakage sensor should be placed in an area of concern where water from a leak would likely accumulate.



## 5. Device Payload

All data are based on following format(HEX), the Data field should follow little-endian:

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

For decoder examples please find files on <https://github.com/Milesight-IoT/SensorDecoders>.

## 5.1 Basic Information

EM300 series sensors report basic information of sensor whenever joining the network.

| Channel | Type                  | Description                           |
|---------|-----------------------|---------------------------------------|
| ff      | 01(Protocol Version)  | 01=>V1                                |
|         | 09 (Hardware Version) | 01 40 => V1.4                         |
|         | 0a(Software Version)  | 01 14 => V1.14                        |
|         | 0f(Device Type)       | 00: Class A, 01: Class B, 02: Class C |
|         | 16(Device SN)         | 16 digits                             |

**Example:**

| ff 09 01 00 ff 0a 01 02 ff 0f 00 |                          |                 |         |                          |            |
|----------------------------------|--------------------------|-----------------|---------|--------------------------|------------|
| Channel                          | Type                     | Value           | Channel | Type                     | Value      |
| ff                               | 09<br>(Hardware version) | 0100 (V1.0)     | ff      | 0a<br>(Software version) | 0102(V1.2) |
| Channel                          | Type                     | Value           |         |                          |            |
| ff                               | 0f<br>(Device Type)      | 00<br>(Class A) |         |                          |            |

## 5.2 Sensor Data

EM300 series sensors report sensor data according to reporting interval (10min by default).

**Battery level is reported every 6 hours.**

| Channel | Type                     | Description                                       |
|---------|--------------------------|---------------------------------------------------|
| 01      | 75(Battery Level)        | UINT8, Unit: %                                    |
| 03      | 67 (Temperature)         | INT16, Unit: °C                                   |
| 04      | 68(Humidity)             | INT8, Unit: %                                     |
| 05      | 00(Water Leakage Status) | 00: Not water leaked<br>01: Water is leaked       |
| 06      | 00(Magnet Status)        | 00: Magnet switch close<br>01: Magnet switch open |
| 05      | c8(Counter)              | 4 bytes, unsigned                                 |
| 05      | 00(Digital)              | 00: low<br>01: high                               |

**Examples:****EM300-SLD/ZLD:**

| 01 75 64 03 67 10 01 04 68 71 05 00 01 |                  |                                  |         |                     |                                             |
|----------------------------------------|------------------|----------------------------------|---------|---------------------|---------------------------------------------|
| Channel                                | Type             | Value                            | Channel | Type                | Value                                       |
| 01                                     | 75<br>(Battery)  | 64 => 100%                       | 03      | 67<br>(Temperature) | 10 01 => 01 10 = 272<br>Temp=272*0.1=27.2°C |
| Channel                                | Type             | Value                            | Channel | Type                | Value                                       |
| 04                                     | 68<br>(Humidity) | 71=>113<br>Hum=113*<br>0.5=56.5% | 05      | 00                  | 01=>Water is leaked                         |

**EM300-DI (Counter):**

| 017564 03671e01 04685e 05c800000000 |                  |                              |         |                     |                                             |
|-------------------------------------|------------------|------------------------------|---------|---------------------|---------------------------------------------|
| Channel                             | Type             | Value                        | Channel | Type                | Value                                       |
| 01                                  | 75<br>(Battery)  | 64 => 100%                   | 03      | 67<br>(Temperature) | 1e 01 => 01 1e = 286<br>Temp=286*0.1=28.6°C |
| Channel                             | Type             | Value                        | Channel | Type                | Value                                       |
| 04                                  | 68<br>(Humidity) | 5e=>94<br>Hum=94*<br>0.5=47% | 05      | c8<br>(Counter)     | 06 00 00 00=><br>00 00 00 00=6              |

**5.3 Downlink Commands**

EM300 series sensors support downlink commands to configure the device. The application port is 85 by default.

| Channel | Type                        | Description                                                                                                                                                               |
|---------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ff      | 03 (Set Reporting Interval) | 2 Bytes, unit: s                                                                                                                                                          |
|         | 06 (Set Threshold Alarm)    | 9 Bytes, CTRL (1B) + Min (2B) + Max (2B) + 00000000(4B)<br><br>CTRL:<br>Bit0~Bit2:<br>000 - disable<br>001 - below (minimum threshold)<br>010 - above (maximum threshold) |

|  |                      |                                                                                                                                                                                                                                                                                                                  |
|--|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                      | 011 - within<br>100 - below or above<br>Bit3~Bit7: 11001                                                                                                                                                                                                                                                         |
|  | 10 (Reboot)          | ff(Reserved)                                                                                                                                                                                                                                                                                                     |
|  | 79(Set D2D settings) | 4 Bytes,<br>Number(1B)+Function(1B)+D2D<br>Command(2B)<br><b>Number:</b><br>01 -Temperature threshold trigger<br>02 -Temperature threshold doesn't<br>trigger<br>03 - Status trigger<br>04 -Status doesn't trigger<br><b>Function:</b><br>00 -Only use LoRaWAN<br>01 -Only use D2D<br>03 -Use D2D&LoRaWAN Uplink |
|  | 4e (Pulse counter)   | 0100-Clean the count<br>0101-Stop counting<br>0102-Start counting                                                                                                                                                                                                                                                |

**Example:**

1. Set reporting interval as 20 minutes.

| ff03b004 |                             |                                        |
|----------|-----------------------------|----------------------------------------|
| Channel  | Type                        | Value                                  |
| ff       | 03 (Set Reporting Interval) | b0 04 => 04 b0 = 1200s<br>= 20 minutes |

2. Reboot the device.

| ff10ff  |             |               |
|---------|-------------|---------------|
| Channel | Type        | Value         |
| ff      | 10 (Reboot) | ff (Reserved) |

3. Set a temperature threshold as below 15°C or above 30°C.

| ff 06 cc96002c0100000000 |      |       |
|--------------------------|------|-------|
| Channel                  | Type | Value |

|    |                          |                                                                                                    |
|----|--------------------------|----------------------------------------------------------------------------------------------------|
| ff | 06 (Set Threshold Alarm) | CTRL:cc =>11001100<br>100 = below or above<br>Min:96 00=> 00 96 = 15°C<br>Max: 2c 01=>01 2c = 30°C |
|----|--------------------------|----------------------------------------------------------------------------------------------------|

4. Set D2D settings of temperature threshold trigger.

| ff 79 01011001 |                        |                                                                                                    |
|----------------|------------------------|----------------------------------------------------------------------------------------------------|
| Channel        | Type                   | Value                                                                                              |
| ff             | 79 (Set D2D settings ) | Number: 01, temperature threshold trigger<br>Function: 01, only use D2D<br>D2D Command: 1001=>0110 |

## 5.4 Historical Data Enquiry

EM300 series sensor supports sending downlink commands to enquire historical data for specified time point or time range. Before that, ensure **the device time is correct and data storage feature was enabled to store the data.**

**Command format:**

| Channel | Type                            | Description                                                  |
|---------|---------------------------------|--------------------------------------------------------------|
| fd      | 6b (Enquire data in time point) | 4 Bytes, unix timestamp                                      |
| fd      | 6c (Enquire data in time range) | Start time (4 bytes) + End time (4 bytes),<br>Unix timestamp |
| fd      | 6d (Stop query data report)     | ff                                                           |
| ff      | 6a (Report Interval)            | 2 Byte, unit:s,<br>Range: 30~1200s (60s by default)          |

**Reply format:**

| Channel | Type                 | Description                                                                                                |
|---------|----------------------|------------------------------------------------------------------------------------------------------------|
| fc      | 6b/6c                | 00: data enquiry success<br>01: time point or time range invalid<br>02: no data in this time or time range |
| 20      | ce (Historical Data) | Data time stamp (4 Bytes) + Data Contents (Mutable)                                                        |

**Data format:**

| Sensor   | Description            |
|----------|------------------------|
| EM300-TH | Temperature + Humidity |

|                     |                                                             |
|---------------------|-------------------------------------------------------------|
| EM300-MCS           | Temperature + Humidity + Status                             |
| EM300-SLD/EM300-ZLD | Temperature + Humidity + Leakage status                     |
| EM300-DI            | Temperature + Humidity + Interface Type + Counter + Digital |

**Note:**

1. The device only uploads no more than 300 data records per range enquiry.
2. When enquiring the data in time point, it will upload the data which is closest to the search point within the reporting interval range. For example, if the device's reporting interval is 10 minutes and users send command to search for 17:00's data, if the device find there is data stored in 17:00, it will upload this data; if not, it will search for data between 16:50 to 17:00 and upload the data which is closest to 17:00.

**Example:**

1. Enquire historical data between 2022/10/28 14:15:00 to 2022/10/28 15:45:00.

| fd6c 64735b63 7c885b63 |                                 |                                                                                                                                        |
|------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Channel                | Type                            | Value                                                                                                                                  |
| fd                     | 6c (Enquire data in time range) | Start time: 64735b63 => 63466974 = 1666937700 =2022/10/28 14:15:00<br>End time: 7c885b63 => 635b887c = 1666943100 =2022/10/28 15:45:00 |

Reply:

| fc6c00  |                                 |                          |
|---------|---------------------------------|--------------------------|
| Channel | Type                            | Value                    |
| fc      | 6c (Enquire data in time range) | 00: data enquiry success |

| 20ce 0d755b63 0f01 6a 02 06000000 00 |                      |                                 |                                                                                                                                                                    |
|--------------------------------------|----------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Channel                              | Type                 | Time Stamp                      | Value                                                                                                                                                              |
| 20                                   | ce (Historical Data) | 0d755b63 => 2022/10/28 14:22:05 | Temperature: 0f01=>010f=27.1° C<br>Humidity: 6a=>106=53%<br>Interface Type: 02=Counter; (01=Digital)<br>Counter: 06 00 00 00=> 00 00 00 06 =6<br>Digital: 00=> low |

**-END-**