

# Ultrasonic Distance Sensor

## EM310-UDL

### User Guide

## 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.
- ❖ The device is not intended to be used as a reference sensor, and Milesight won't 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 in where the temperature is below/above the operating range.
- ❖ The device must never be subjected to shocks or impacts.

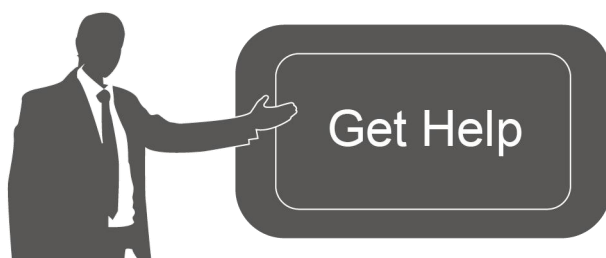
## Declaration of Conformity

EM310-UDL is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.



Copyright © 2011-2021 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)  
Tel: 86-592-5085280  
Fax: 86-592-5023065  
Address: 4/F, No.63-2 Wanghai Road,  
2<sup>nd</sup> Software Park, Xiamen, China

## Revision History

| Date            | Doc Version | Description     |
|-----------------|-------------|-----------------|
| August 25, 2021 | V 1.0       | Initial version |

# Contents

|                                        |    |
|----------------------------------------|----|
| 1. Product Introduction.....           | 4  |
| 1.1 Overview.....                      | 4  |
| 1.2 Features.....                      | 4  |
| 2. Hardware Introduction.....          | 4  |
| 2.1 Packing List.....                  | 4  |
| 2.2 Hardware Overview.....             | 5  |
| 2.3 Dimensions.....                    | 5  |
| 2.4 Power Button.....                  | 5  |
| 3. Operation Guide.....                | 5  |
| 3.1 NFC Configuration.....             | 5  |
| 3.2 LoRaWAN Settings.....              | 6  |
| 3.3 Basic Settings.....                | 9  |
| 3.4 Advanced Settings.....             | 10 |
| 3.4.1 Calibration Settings.....        | 10 |
| 3.4.2 Threshold Settings.....          | 10 |
| 3.5 Maintenance.....                   | 11 |
| 3.5.1 Upgrade.....                     | 11 |
| 3.5.2 Backup.....                      | 11 |
| 3.5.3 Reset to Factory Default.....    | 12 |
| 4. Installation.....                   | 13 |
| 5. Milesight IoT Cloud Management..... | 13 |
| 6. Device Payload.....                 | 14 |
| 6.1 Basic Information.....             | 15 |
| 6.2 Sensor Data.....                   | 15 |
| 6.3 Downlink Commands.....             | 16 |

## 1. Product Introduction

### 1.1 Overview

EM310-UDL is a LoRaWAN® ultrasonic distance/level sensor mainly used for detection of waste bin and other container's level. With a compact size and wide measure range, EM310-UDL can be installed to any types of waste bins or containers to monitor solid or liquid level. Besides, EM310-UDL equips with 3-axis accelerometer to detect the status of container cover. It is equipped with NFC (Near Field Communication) and can easily be configured by a smartphone.

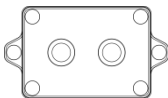
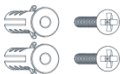
Sensor data are transmitted in real-time using standard LoRaWAN® protocol. LoRaWAN® enables encrypted radio transmissions over long distance while consuming very little power. The user can obtain sensor data and view the trend of data change through Milesight IoT Cloud or through the user's own Network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

### 1.2 Features

- 3 to 450 cm wide measuring range with short blind zone
- Support temperature compensation for high accuracy
- Up to 15 km communication range
- Easy configuration via NFC
- Standard LoRaWAN® support
- Milesight IoT Cloud compliant
- Low power consumption with 7000mAh replaceable battery

## 2. Hardware Introduction

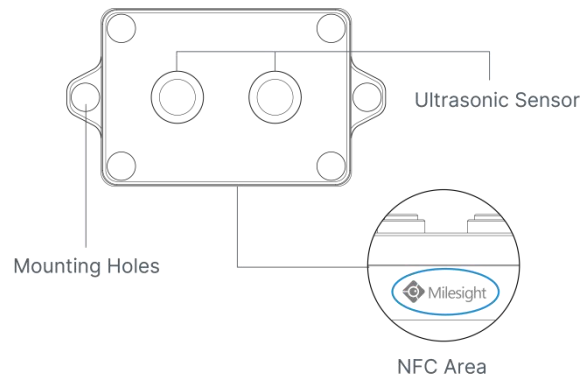
### 2.1 Packing List

|                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |  |  |
| 1 × EM310-UDL<br>Device                                                             | 2 × Mounting<br>Kits                                                                | 2 × Screw<br>Caps                                                                   | 1 ×<br>Warranty Card                                                                 | 1 ×<br>Quick Guide                                                                    |

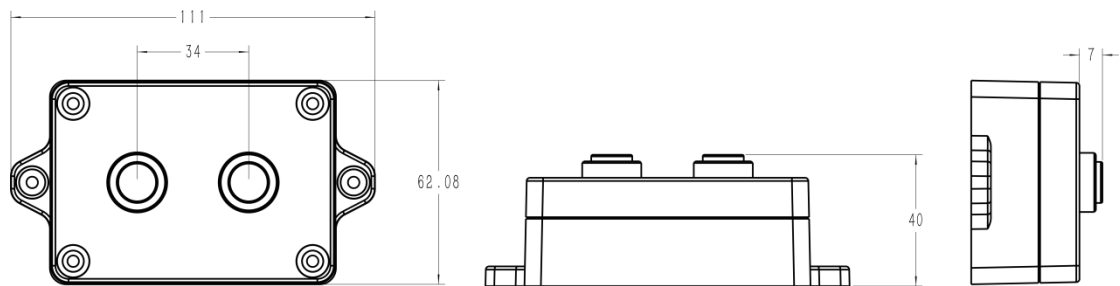


If any of the above items is missing or damaged, please contact your sales representative.

## 2.2 Hardware Overview



## 2.3 Dimensions (mm)



## 2.4 Power Button

EM310-UDL can be switched on/off via NFC. Besides, users can use power button to switch on/off and reset the device manually.

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

## 3. Operation Guide

### 3.1 NFC Configuration

EM310-UDL can be configured via NFC.

1. Download and install "Milesight ToolBox" App from Google Play or App Store.
2. Enable NFC on the smartphone and open "Milesight ToolBox" App.

3. Attach the smartphone with NFC area to the device to read the basic information.



4. Basic information and settings of devices will be shown on ToolBox if it's recognized successfully. You can switch on/off the device by tapping the button on the Device Status. In order to protect the security of devices, password validation is required when configuring via unused phone. Default password is **123456**.

| Status           | Setting          | Maintenance              |
|------------------|------------------|--------------------------|
| SN               | 6713B31056670013 |                          |
| Model            | EM310-UDL-868M   |                          |
| Device EUI       | 24E124713B310566 |                          |
| Firmware Version | V1.0-a4          |                          |
| Hardware Version | V1.0             |                          |
| Device Status    | Off              | <input type="checkbox"/> |

5. Tap "Read" button to check current status and sensor data of device.

6. Tap "Write" button to write all your settings to the device.

**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) EM310-UDL 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** of ToolBox App to configure join type, App EUI, App Key and other information. You can also keep all settings by default.

|                                |                                               |
|--------------------------------|-----------------------------------------------|
| Device EUI                     | <input type="text" value="24E124127A270222"/> |
| App EUI                        | <input type="text" value="24E124C0002A0001"/> |
| Application Port               | <input type="text" value="85"/>               |
| Join Type                      | <input type="text" value="OTAA"/>             |
| Application Key                | <input type="text" value="*****"/>            |
| Spread Factor                  | <input type="text" value="SF10-DR2"/>         |
| Confirmed Mode                 | <input type="checkbox"/>                      |
| Rejoin Mode                    | <input checked="" type="checkbox"/>           |
| Set the number of packets sent | <input type="text" value="32"/> packets       |
| ADR Mode                       | <input checked="" type="checkbox"/>           |

| 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.                                                                                                                                                                                                                                                                                                                                           |
| 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 3 times at most.                                                                                                                                                                                                                                                                                                          |
| Rejoin Mode             | Reporting interval $\leq$ 30 mins: device will send specific mounts of LoRaMAC packets to check connection status every 30 mins; If no reply after specific packets, the device will re-join.<br>Reporting interval $>$ 30 mins: device will send specific mounts of LoRaMAC packets every to check connection status every reporting interval; If no reply after specific packets, the device will re-join. |
| 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** of ToolBox App to select supported frequency and select channels to send uplinks. Make sure the channels match the LoRaWAN® gateway.

\* Support Frequency

AS923 ▼

|                                     |   |       |   |
|-------------------------------------|---|-------|---|
| <input checked="" type="checkbox"/> | - | 923.2 | + |
| <input checked="" type="checkbox"/> | - | 923.4 | + |
| <input type="checkbox"/>            | - | 922.2 | + |
| <input type="checkbox"/>            | - | 922.4 | + |
| <input type="checkbox"/>            | - | 922.6 | + |

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

**Note:**

For -868M model, default frequency is EU868;

For -915M model, default frequency is AU915.

### 3.3 Basic Settings

Go to **"Device -> Setting -> General Settings"** of ToolBox App to change the reporting interval, etc.

Reporting Interval

-

10

+

min

Tilt &amp; Distance Switch ⓘ



Change Password



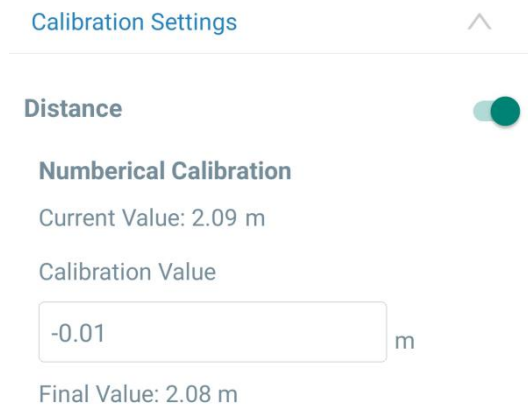
| Parameters             | Description                                                                                                 |
|------------------------|-------------------------------------------------------------------------------------------------------------|
| Reporting Interval     | Reporting interval of transmitting data to network server. Default: 10 mins<br>Range: 1-1080 mins           |
| Tilt & Distance Switch | When detected the horizontal offset angle of the device is greater than 20°, stop the distance measurement. |
| Change Password        | Change the password for ToolBox App or software to access this device.                                      |

## 3.4 Advanced Settings

### 3.4.1 Calibration Settings

Go to **Device -> Setting -> Calibration Settings** of ToolBox App to enable calibration. EM310-UDL supports two calibration types:

- **Numerical Calibration:** users can define calibration value to correct every distance.



Calibration Settings

Distance ☒

**Numerical Calibration**

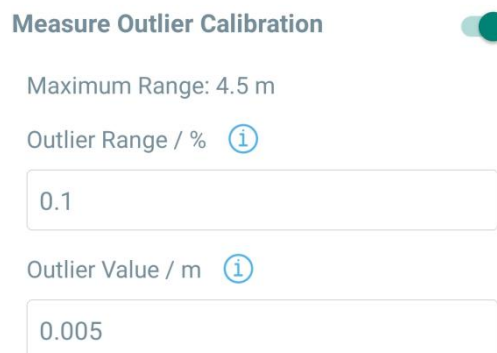
Current Value: 2.09 m

Calibration Value

m

Final Value: 2.08 m

- **Measure Outlier Calibration:** users can define either outlier range or value. When the device distance value exceeds the outlier range (or value) comparing to last value, the device will measure the distance again.



Measure Outlier Calibration ☒

Maximum Range: 4.5 m

Outlier Range / % ⓘ

Outlier Value / m ⓘ

### 3.4.2 Threshold Settings

Go to **Device -> Setting -> Threshold Settings** of ToolBox App to enable the threshold settings and input the distance threshold. EM310-UDL will detect whether the distance reaches the threshold according to collecting interval. If threshold is triggered, it uploads the current data once instantly.

Distance 

Over / m

Below / m

Collecting Interval  10  min

## 3.5 Maintenance

### 3.5.1 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:**

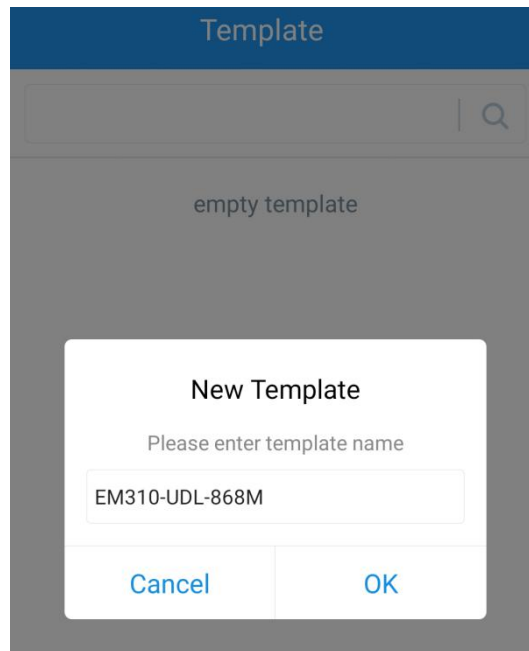
- 1) Operation on ToolBox is not supported during a firmware upgrade.
- 2) Only Android version ToolBox supports the upgrade feature.

| Status                                                               | Setting          | Maintenance |
|----------------------------------------------------------------------|------------------|-------------|
| SN                                                                   | 6713B31056670013 |             |
| Model                                                                | EM310-UDL-868M   |             |
| Firmware Version                                                     | V1.0-a4          |             |
| Hardware Version                                                     | V1.0             |             |
| Manual Upgrade                                                       |                  |             |
| <input data-bbox="566 1514 1023 1581" type="button" value="Browse"/> |                  |             |

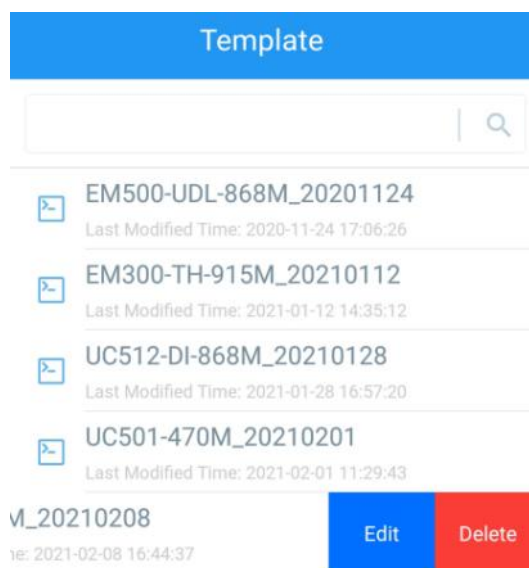
### 3.5.2 Backup

EM310-UDL support configuration backup for easy and quick device configuration in bulk. Backup is allowed only for devices with the same model and LoRa 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.



### 3.5.3 Reset to Factory Default

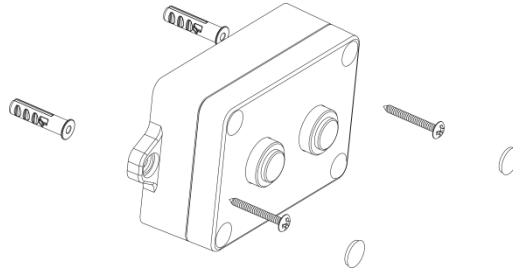
Please select one of following methods to reset device:

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

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

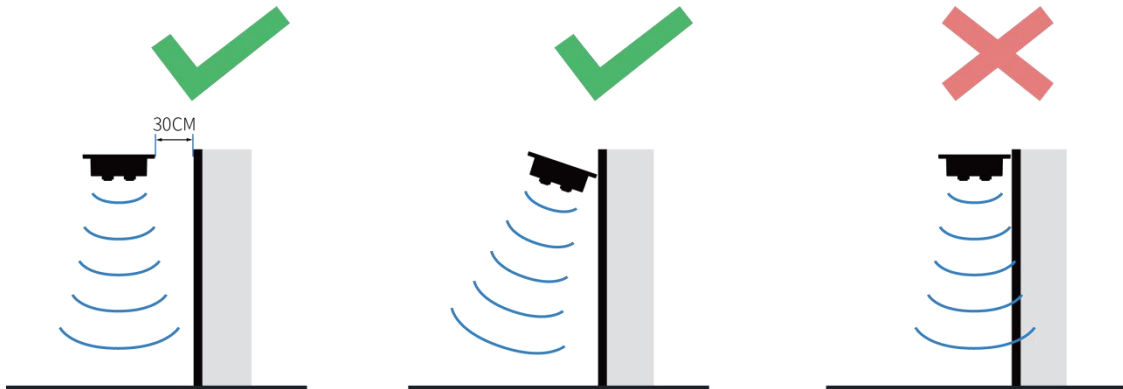
## 4. Installation

1. Fix the wall plugs into the wall, then fix the device to the wall plugs with screws.
2. Cover the screws with screw caps.



### Installation location:

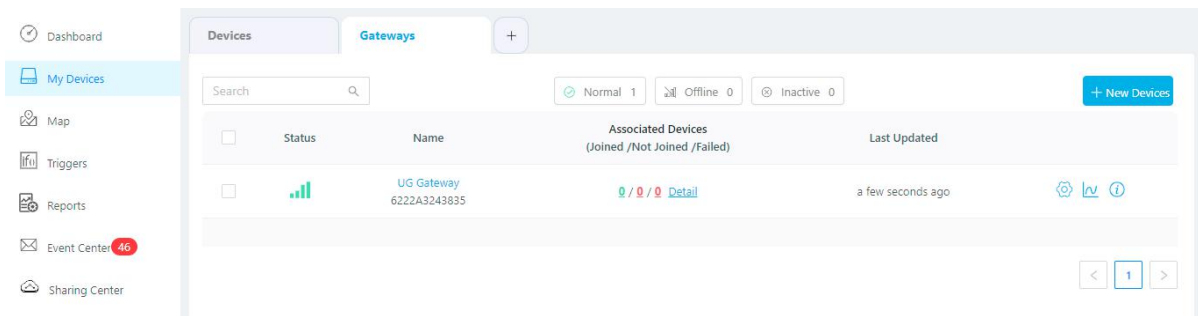
- Ensure the location of device is within the communication range of LoRaWAN® gateway and keep it away from metal objects.
- Device must sit in a horizontal position on top of the object so that it has a clear path to the object.
- Place device in where it is far away from the side-wall more than **30 cm** and without internal obstructions that block the ultrasonic signal. If the device has to install on the side wall, please ensure the ultrasonic sensor direction point away from the wall.



## 5. Milesight IoT Cloud Management

EM310-UDL 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 the device and select an associated gateway.

Add Device

\* SN:

6713B32178470000

\* Name:

EM310

\* Associated Gateway:

UG Gateway

\* Device EUI:

24e124713B321784

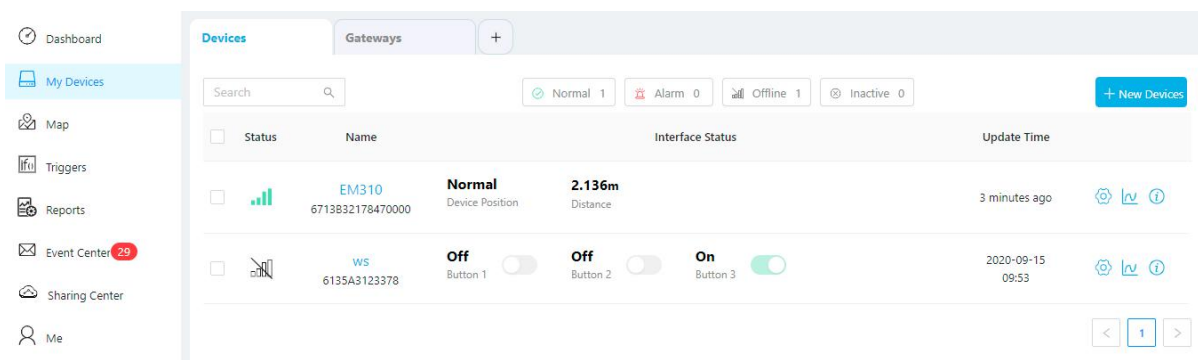
\* Application Key:

5572404c696e6b4c6f52613230313823

Cancel

Confirm

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.



## 6. Device Payload

All data are based on following format (HEX):

| 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>.

## 6.1 Basic Information

EM310-UDL reports basic information of sensor whenever it joins 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                        |
|         | 0b (Power On)         | Device is on                          |
|         | 0f (Device Type)      | 00: Class A, 01: Class B, 02: Class C |
|         | 16 (Device SN)        | 16 digits                             |

**Example:**

| ff0bff ff0101 ff166713b31056670013 ff090100 ff0a0100 ff0f00 |                          |                      |         |                          |                 |
|-------------------------------------------------------------|--------------------------|----------------------|---------|--------------------------|-----------------|
| Channel                                                     | Type                     | Value                | Channel | Type                     | Value           |
| ff                                                          | 0b<br>(Power On)         | ff<br>(Reserved)     | ff      | 01<br>(Protocol Version) | 01 (V1)         |
| Channel                                                     | Type                     | Value                | Channel | Type                     | Value           |
| ff                                                          | 16<br>(Device SN)        | 6713b31056<br>670013 | ff      | 09<br>(Hardware version) | 0100<br>(V1.0)  |
| Channel                                                     | Type                     | Value                | Channel | Type                     | Value           |
| ff                                                          | 0a<br>(Software version) | 0100<br>(V1.0)       | ff      | 0f<br>(Device Type)      | 00<br>(Class A) |

## 6.2 Sensor Data

EM310-UDL reports sensor data according to reporting interval (10 mins by default).

| Channel | Type                 | Description                                                                            |
|---------|----------------------|----------------------------------------------------------------------------------------|
| 01      | 75 (Battery Level)   | UINT8, Unit: %                                                                         |
| 03      | 82 (Distance)        | UINT16, Unit: mm                                                                       |
| 04      | 00 (Device Position) | 00: Normal (horizontal offset angle < 20°)<br>01: Tilt (horizontal offset angle ≥ 20°) |

**Example:**

| 01 75 62 03 82 44 08 04 00 00 |                 |           |         |                  |                                       |
|-------------------------------|-----------------|-----------|---------|------------------|---------------------------------------|
| Channel                       | Type            | Value     | Channel | Type             | Value                                 |
| 01                            | 75<br>(Battery) | 62 => 98% | 03      | 82<br>(Distance) | 44 08 => 08 44<br>= 2116 mm = 2.116 m |

| Channel | Type                 | Value     |  |  |  |
|---------|----------------------|-----------|--|--|--|
| 04      | 00 (Device Position) | 00=Normal |  |  |  |

## 6.3 Downlink Commands

EM310-UDL supports downlink commands to configure the device. Application port is 85 by default.

| Channel | Type                        | Description      |
|---------|-----------------------------|------------------|
| ff      | 03 (Set Reporting Interval) | 2 Bytes, unit: s |

**Example:** Set reporting interval as 20 minutes.

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

**-END-**