

**Milesight**

# Ultrasonic Distance Sensor

Featuring LoRaWAN<sup>®</sup>

**EM310-UDL**

User Guide



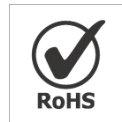
## Safety Precautions

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.

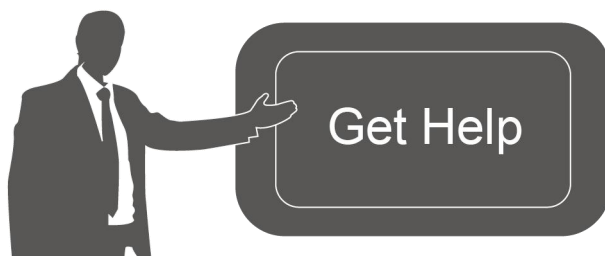
## Declaration of Conformity

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



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## Revision History

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

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# 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

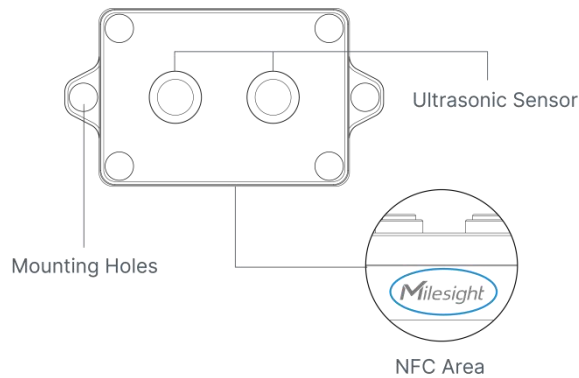
# 2. Hardware Introduction

## 2.1 Packing List

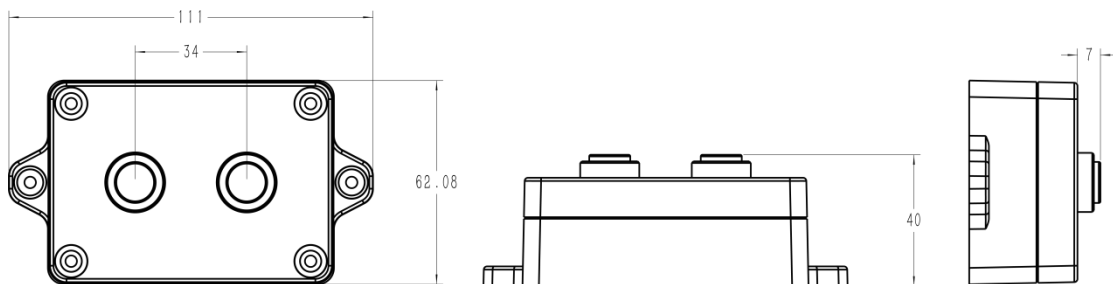
				
1 × EM310-UDL Device	2 × Mounting Kits	2 × Screw Caps	1 × Warranty Card	1 × Quick Guide

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

## 2.2 Hardware Overview



## 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

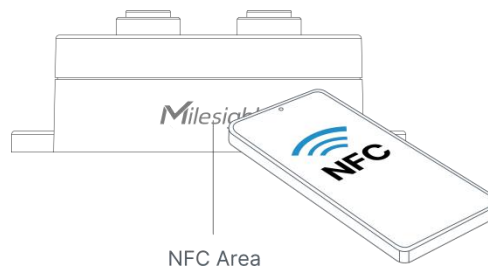
## 3. Operation Guide

### 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

App EUI

Application Port

Join Type

Application Key

Spread Factor

Confirmed Mode

Rejoin Mode

Set the number of packets sent  packets

ADR Mode

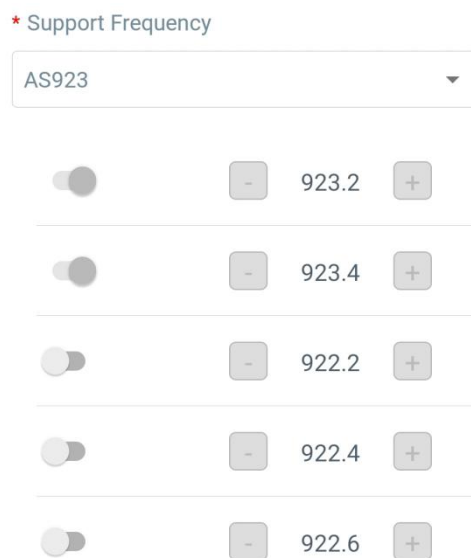
Parameters	Description
Device EUI	Unique ID of the device which can also be found on the label.
App EUI	Default App EUI is 24E124C0002A0001.
Application Port	The port used for sending and receiving data, default port is 85.
Join Type	OTAA and ABP mode are available.
Application Key	Appkey for OTAA mode, 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 ≤ 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. 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.



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 i

0-71

Index	Frequency/MHz <span style="color: blue;">i</span>
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 & Distance Switch i

Change Password

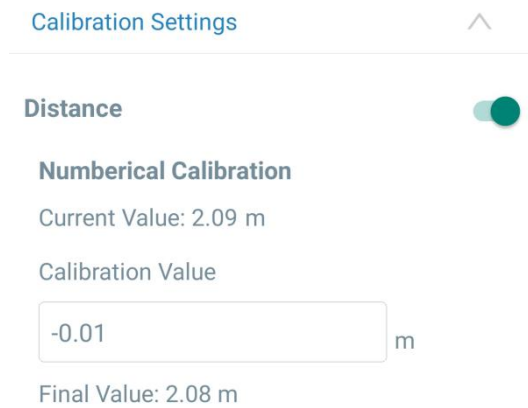
Parameters	Description
Reporting Interval	Reporting interval of transmitting data to network server. Default: 10 mins Range: 1-1080 mins
Tilt & Distance Switch	When detected the horizontal offset angle of the device is greater than 20°, stop the distance measurement.
Change Password	Change the password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

### 3.4 Advanced Settings

### 3.4.1 Calibration Settings

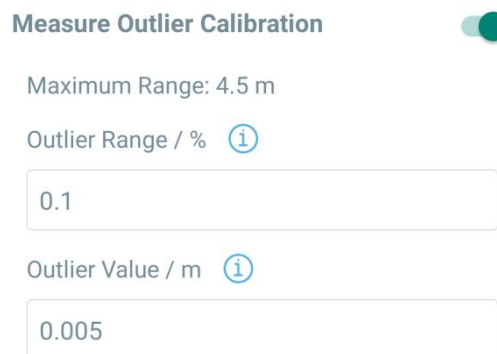
Go to “Device -> Setting -> Calibration Settings” of ToolBox App to enable calibration. EM310-UDL supports two calibration types:

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



The screenshot shows the 'Calibration Settings' screen. At the top, there is a title 'Calibration Settings' and an upward arrow. Below this, a 'Distance' toggle switch is turned on. Underneath, the 'Numerical Calibration' section is visible. It shows 'Current Value: 2.09 m' and a 'Calibration Value' input field containing '-0.01' with a unit 'm' to its right. Below the input field, it displays '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.



The screenshot shows the 'Measure Outlier Calibration' screen. At the top, there is a title 'Measure Outlier Calibration' and a toggle switch that is turned on. Below this, it shows 'Maximum Range: 4.5 m'. There are two input fields: 'Outlier Range / %' with an information icon and a value of '0.1', and 'Outlier Value / m' with an information icon and a value of '0.005'.

### 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:**

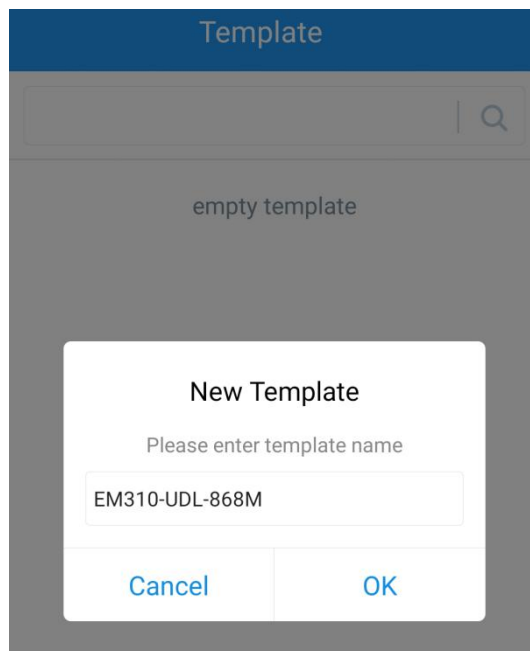
- 1) Operation on ToolBox is not supported during a firmware upgrade.
- 2) Only Android version ToolBox supports the upgrade feature.

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

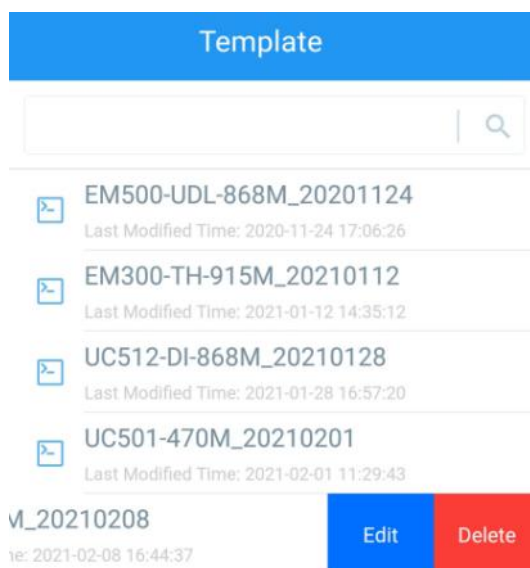
#### 3.5.2 Backup

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

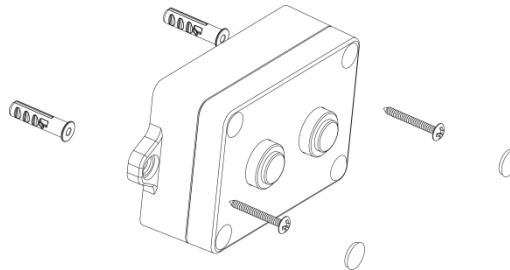
Please select one of following methods to reset device:

**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.

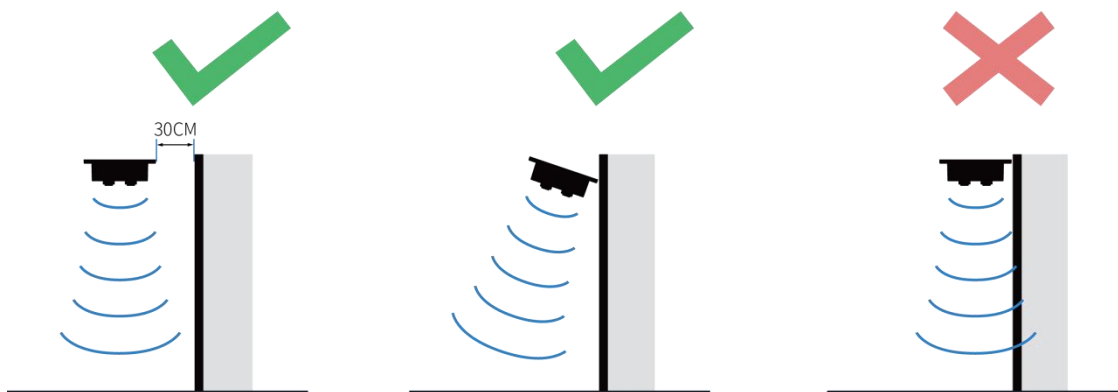
## 4. Installation

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:

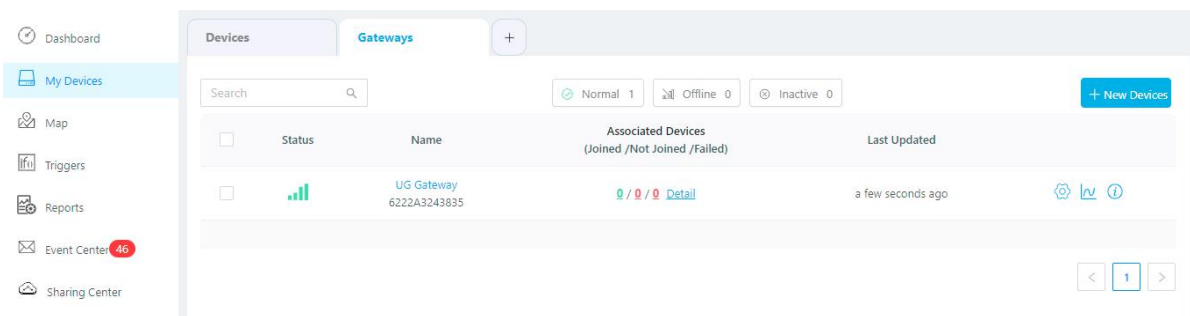
- Ensure the location of device is within the communication range of LoRaWAN® gateway and keep it away from metal objects.
- Device must sit in a horizontal position on top of the object so that it has a clear path to the object.
- Place device in where it is far away from the side-wall more than **30 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:

\* Name:

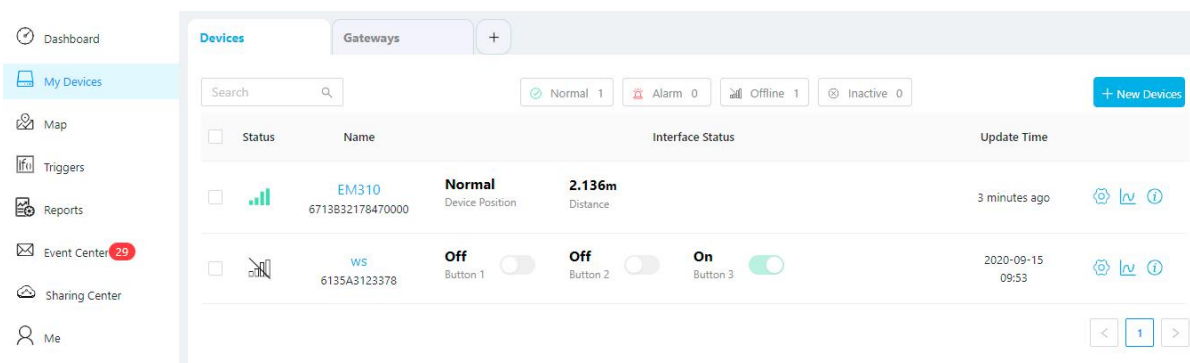
\* Associated Gateway:

\* Device EUI:

\* Application Key:

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 (Power On)	ff (Reserved)	ff	01 (Protocol Version)	01 (V1)
Channel	Type	Value	Channel	Type	Value
ff	16 (Device SN)	6713b31056 670013	ff	09 (Hardware version)	0100 (V1.0)
Channel	Type	Value	Channel	Type	Value
ff	0a (Software version)	0100 (V1.0)	ff	0f (Device Type)	00 (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°) 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 (Battery)	62 => 98%	03	82 (Distance)	44 08 => 08 44 = 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 = 20 minutes

**-END-**