MDS200-LB/LS -- LoRaWAN Microwave Radar Distance Sensor User Manual

last modified by Bei Jinggeng

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1. Introduction

1.1 What is LoRaWAN Microwave Radar Distance Sensor

The Dragino MDS200-LB/LS is a **LoRaWAN Microwave Radar distance sensor**. It uses **24Ghz Microwave** to detect the **distance between sensor and different objects**. Compare vs ultrasonic or Lidar measurement method, Microwave Radar is **more reliable for condensation / dusty environment**. It can sense correct distance even there is water or thick dust on top of the sensor.

The MDS200-LB/LS can be applied to scenarios such as horizontal distance measurement, parking management system, object proximity and presence detection, intelligent trash can management system, robot obstacle avoidance, automatic control, sewer, etc.

MDS200-LB/LS can measure two distances: the closest object and next object behind the closest one.

MDS200-LB/LS supports **Alarm Feature**, user can set the MDS200-LB/LS to uplink data in a short interval when the distance is out of configured range.

The LoRa wireless technology used in MDS200-LB/LS allows device to send data and reach extremely long ranges at low data-rates. It provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption.

MDS200-LB/LS **supports BLE configure** and **wireless OTA update** which make user easy to use.

MDS200-LB/LS is powered by **8500mAh Li-SOCI2 battery** or **solar powered + Li-ion battery** , it is designed for long term use up to 5 years.

Each MDS200-LB/LS is pre-load with a set of unique keys for LoRaWAN registrations, register these keys to local LoRaWAN server and it will auto connect after power on.

*Battery life depends on how often to send data, please see battery analyzer.

1.2 Features

- LoRaWAN 1.0.3 Class A
- Bands: CN470/EU433/KR920/US915/EU868/AS923/AU915/IN865
- Ultra-low power consumption
- Microwave Radar for distance detection
- Short uplink interval for Distance Alarm

- Monitor Battery Level
- Support Bluetooth v5.1 and LoRaWAN remote configure
- Support wireless OTA update firmware
- AT Commands to change parameters
- Downlink to change configure
- 8500mAh Li/SOCl2 Battery (MDS200-LB)
- Solar panel + 3000mAh Li-ion battery (MDS200-LS)

1.3 Specification

Common DC Characteristics:

- Supply Voltage: Built-in Battery , 2.5v ~ 3.6v
- Operating Temperature: -40 ~ 85°C

Radar probe specification:

- Measuring Method: FMCW
- Frequency: 24.000~24.500 GHz
- Measurement output power: 6dBm
- Measure Range : 0.5 ~ 20m
- Accuracy: ±0.1m
- Resolution: 0.01m
- Measurement Angle : 78 degrees horizontal and 23 degrees vertical

LoRa Spec:

- Frequency Range, Band 1 (HF): 862 ~ 1020 Mhz
- Max +22 dBm constant RF output vs.
- RX sensitivity: down to -139 dBm.
- Excellent blocking immunity

Battery:

- Li/SOCI2 un-chargeable battery
- Capacity: 8500mAh
- Self-Discharge: <1% / Year @ 25°C
- Max continuously current: 130mA
- Max boost current: 2A, 1 second

Power Consumption

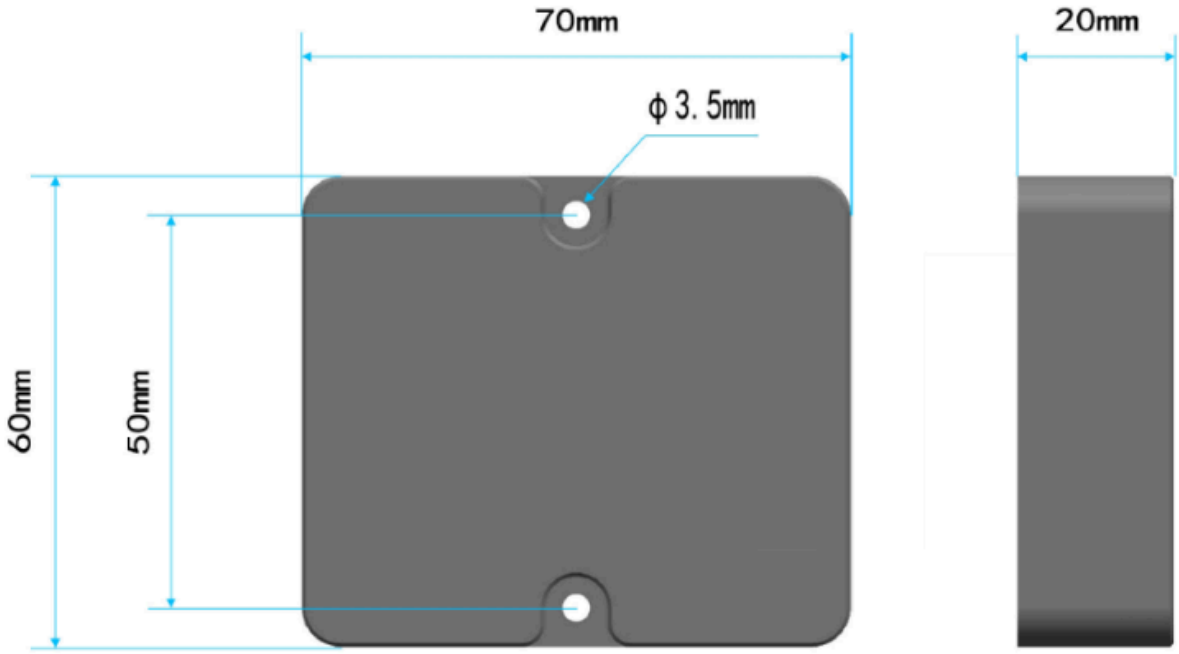
- Sleep Mode: 5uA @ 3.3v
- LoRa Transmit Mode: 125mA @ 20dBm, 82mA @ 14dBm

1.4 Applications

- Horizontal distance measurement
- Liquid level measurement
- Parking management system
- Object proximity and presence detection
- Intelligent trash can management system
- Robot obstacle avoidance
- Automatic control
- Sewer
- Bottom water level monitoring

1.5 Installation

Sensor measure direction and angle is as below. When install the sensor, please make sure the sensor direct to object.

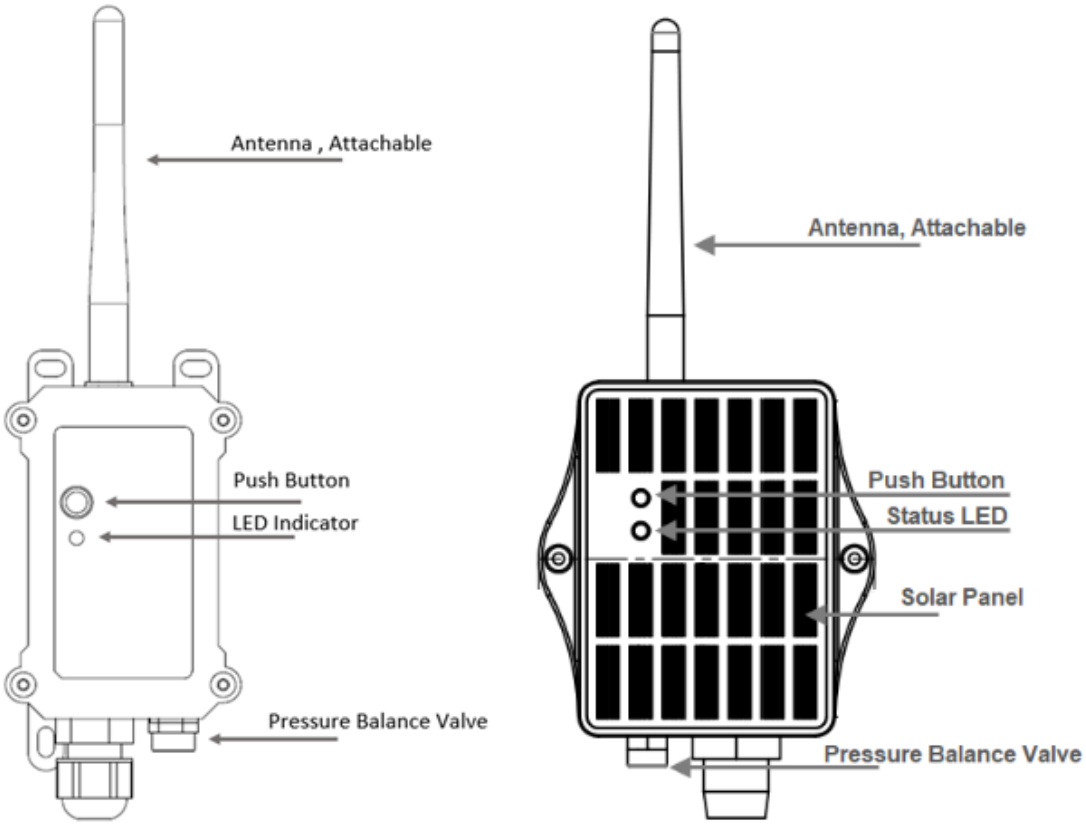


1.6 Sleep mode and working mode

Deep Sleep Mode: Sensor doesn't have any LoRaWAN activate. This mode is used for storage and shipping to save battery life.

Working Mode: In this mode, Sensor will work as LoRaWAN Sensor to Join LoRaWAN network and send out sensor data to server. Between each sampling/tx/rx periodically, sensor will be in IDLE mode), in IDLE mode, sensor has the same power consumption as Deep Sleep mode.

1.7 Button & LEDs



Behavior on ACT	Function	Action
Pressing ACT between 1s < time < 3s	Send an uplink	If sensor is already Joined to LoRaWAN network, sensor will send an uplink packet, **blue led** will blink once. Meanwhile, BLE module will be active and user can connect via BLE to configure device.
Pressing ACT for more than 3s	Active Device	**Green led** will fast blink 5 times, device will enter **OTA mode** for 3 seconds. And then start to JOIN LoRaWAN network. **Green led** will solidly turn on for 5 seconds after joined in network. Once sensor is active, BLE module will be active and user can connect via BLE to configure device, no matter if device join or not join LoRaWAN network.
Fast press ACT 5 times.	Deactivate Device	**Red led** will solid on for 5 seconds. Means device is in Deep Sleep Mode.

1.8 BLE connection

MDS200-LB/LS support BLE remote configure.

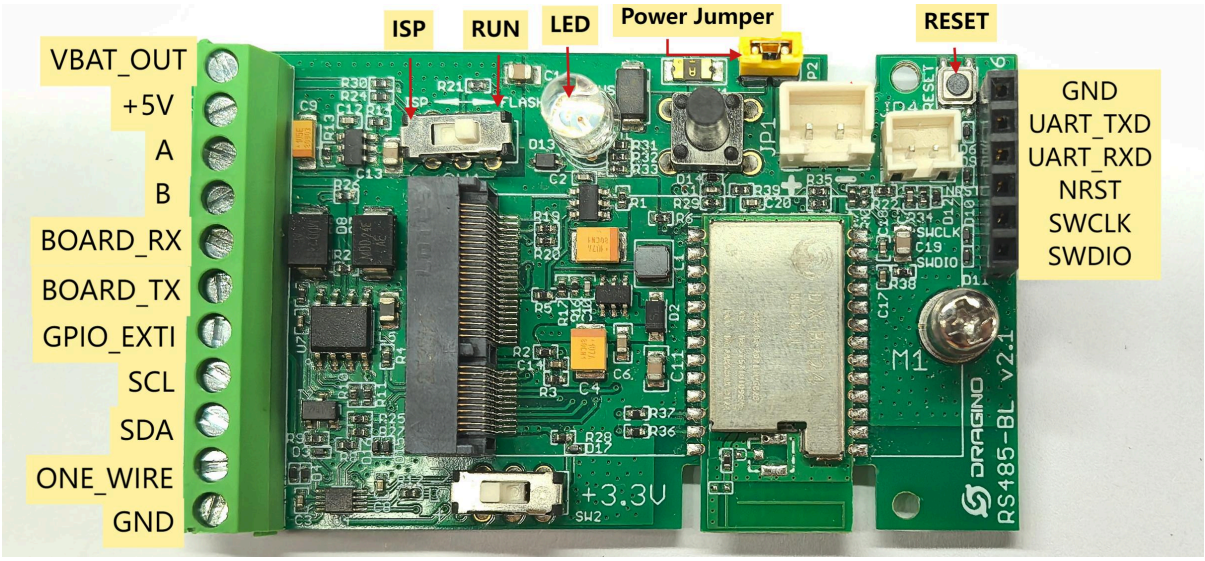
BLE can be used to configure the parameter of sensor or see the console output from sensor. BLE will be only activate on below case:

- Press button to send an uplink
- Press button to active device.

- Device Power on or reset.

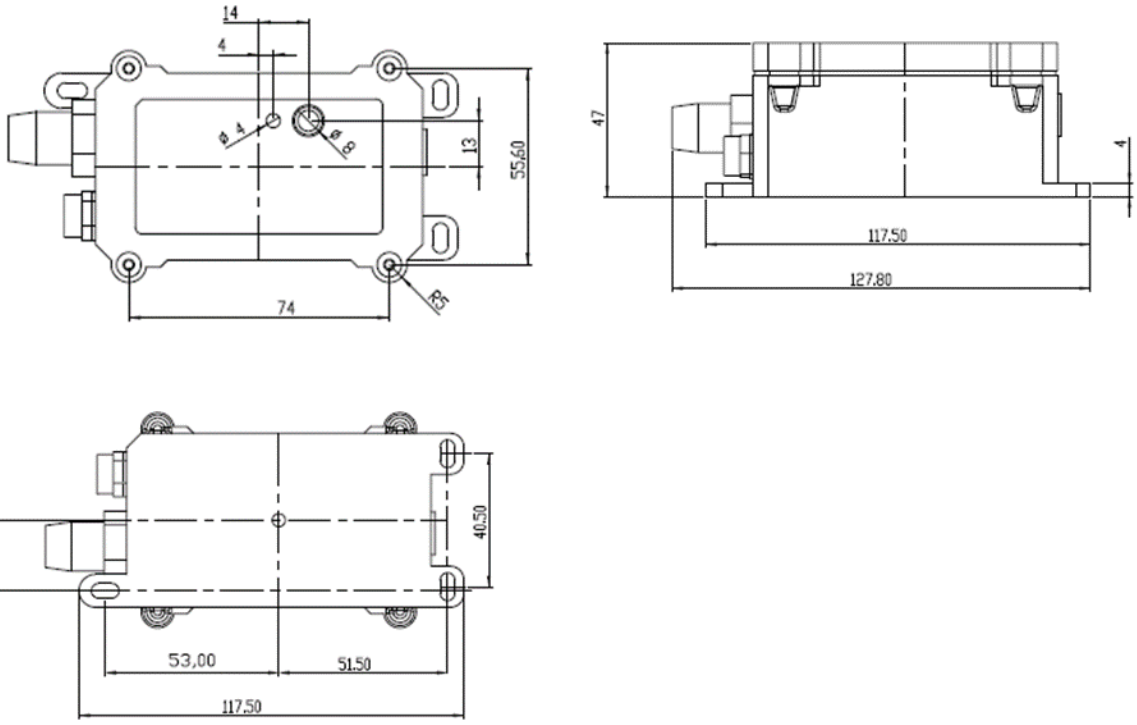
If there is no activity connection on BLE in 60 seconds, sensor will shut down BLE module to enter low power mode.

1.9 Pin Definition

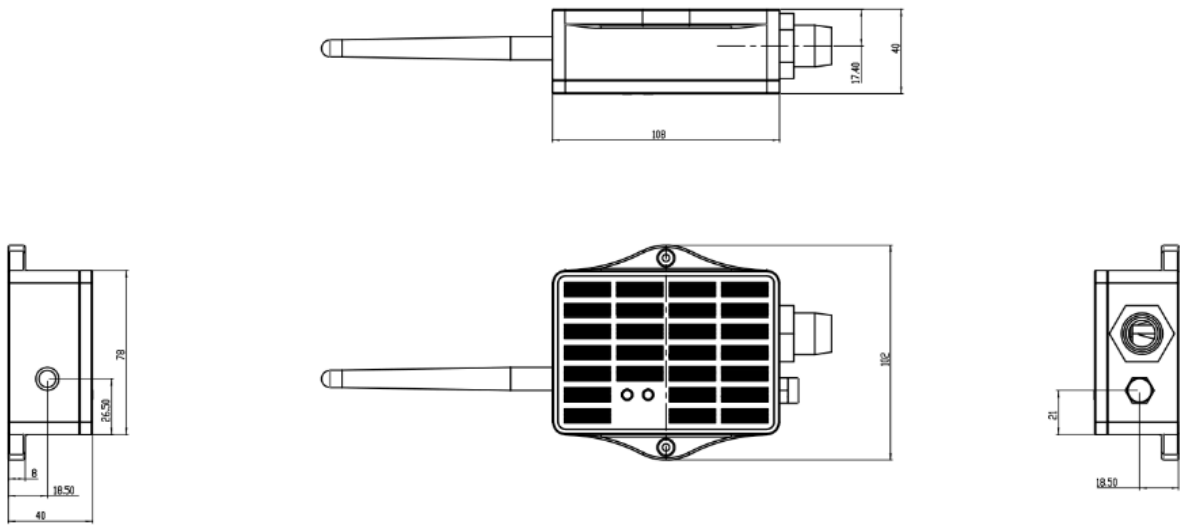


1.10 Mechanical

1.10.1 for LB version



1.10.2 for LS version



2. Configure MDS200-LB/LS to connect to LoRaWAN network

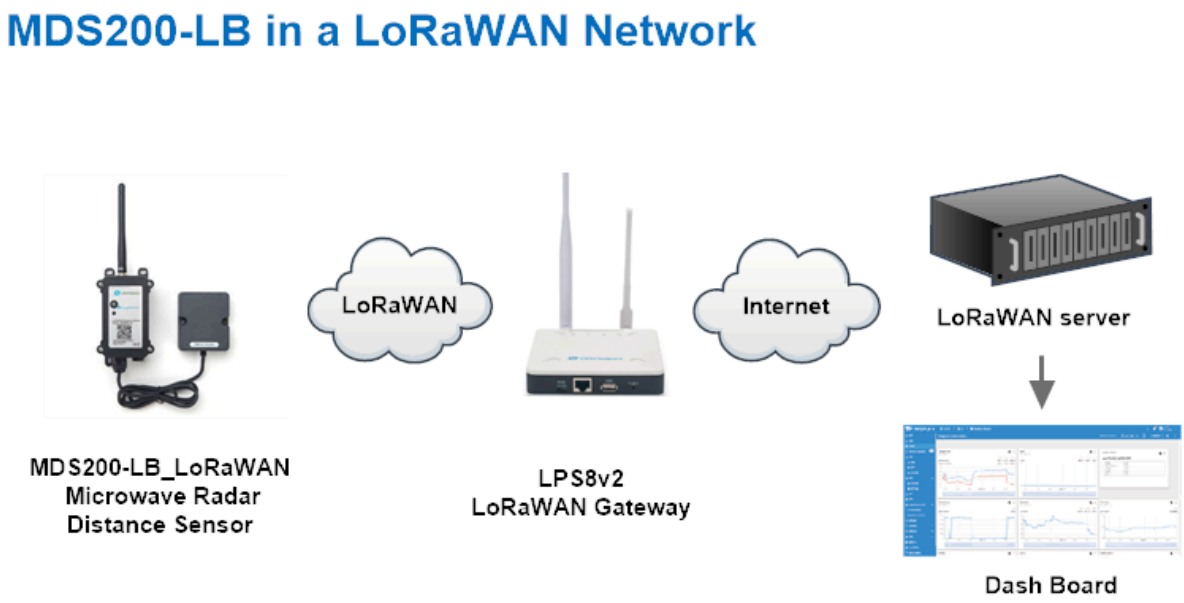
2.1 How it works

The MDS200-LB/LS is configured as **LoRaWAN OTAA Class A** mode by default. It has OTAA keys to join LoRaWAN network. To connect a local LoRaWAN network, you need to input the OTAA keys in the LoRaWAN IoT server and press the button to activate the MDS200-LB/LS. It will automatically join the network via OTAA and start to send the sensor value. The default uplink interval is 20 minutes.

2.2 Quick guide to connect to LoRaWAN server (OTAA)

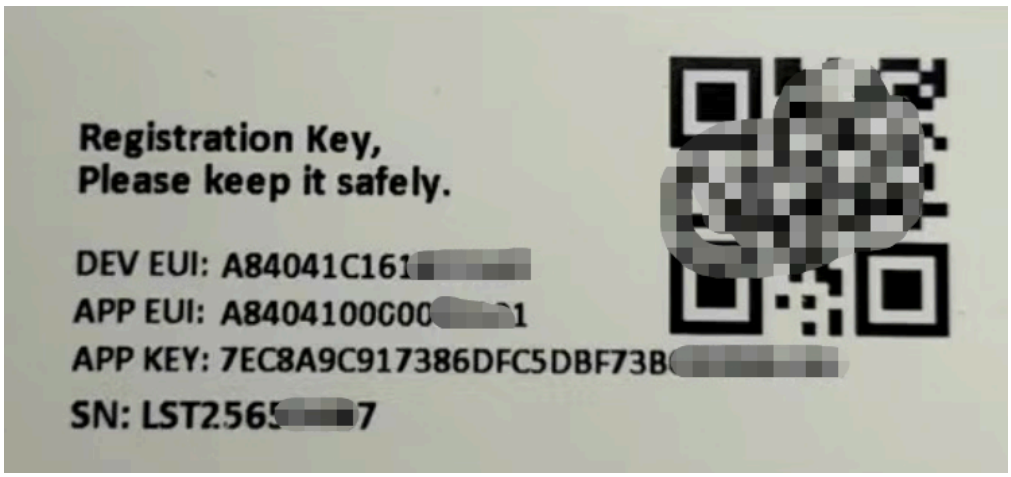
Following is an example for how to join the TTN v3 LoRaWAN Network. Below is the network structure; we use the LPS8v2 as a LoRaWAN gateway in this example.

The LPS8v2 is already set to connected to TTN network , so what we need to now is configure the TTN server.



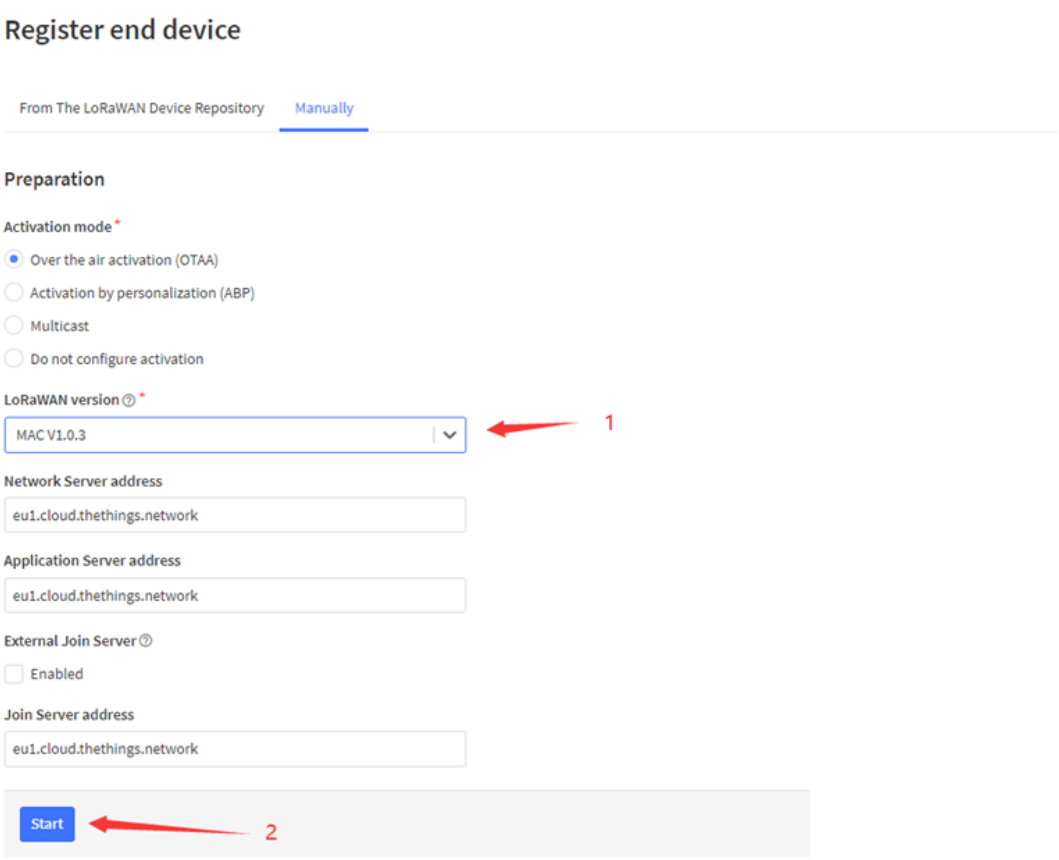
Step 1: Create a device in TTN with the OTAA keys from MDS200-LB/LS.

Each MDS200-LB/LS is shipped with a sticker with the default device EUI as below:

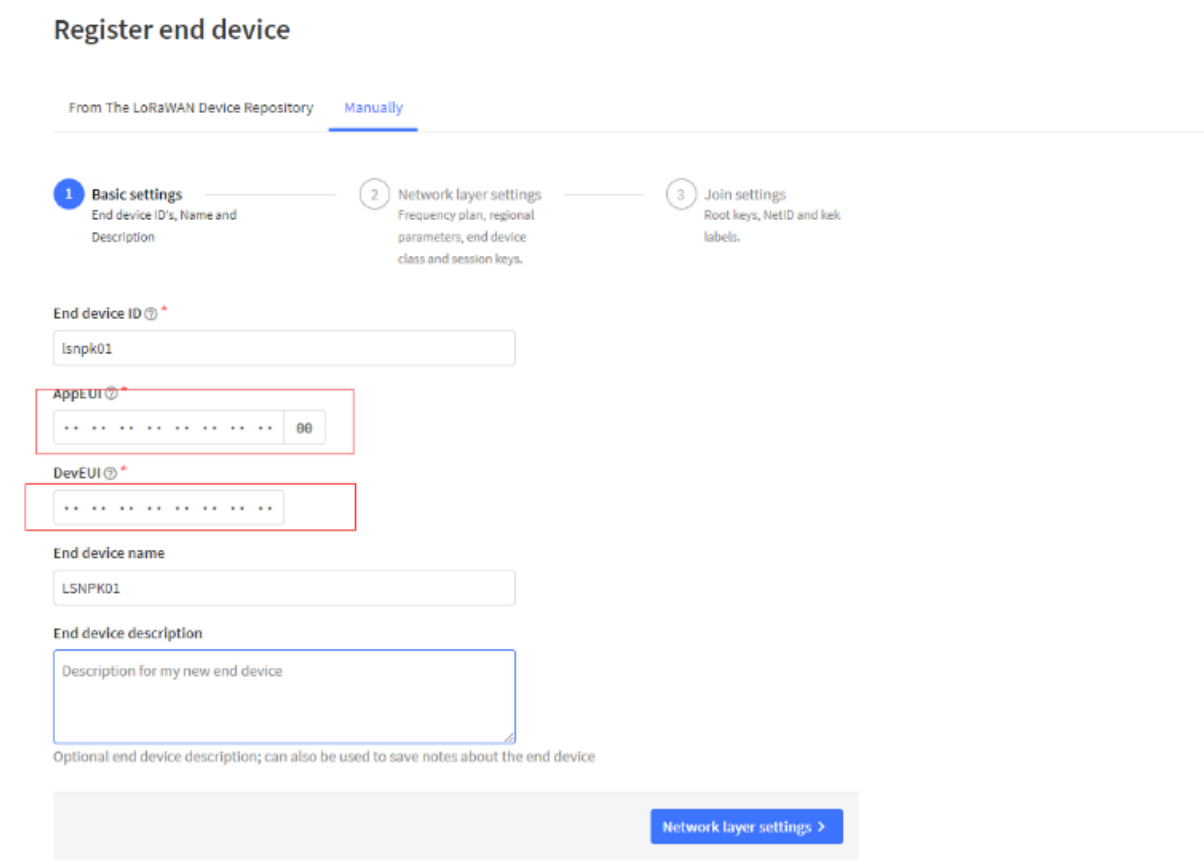


You can enter this key in the LoRaWAN Server portal. Below is TTN screen shot:

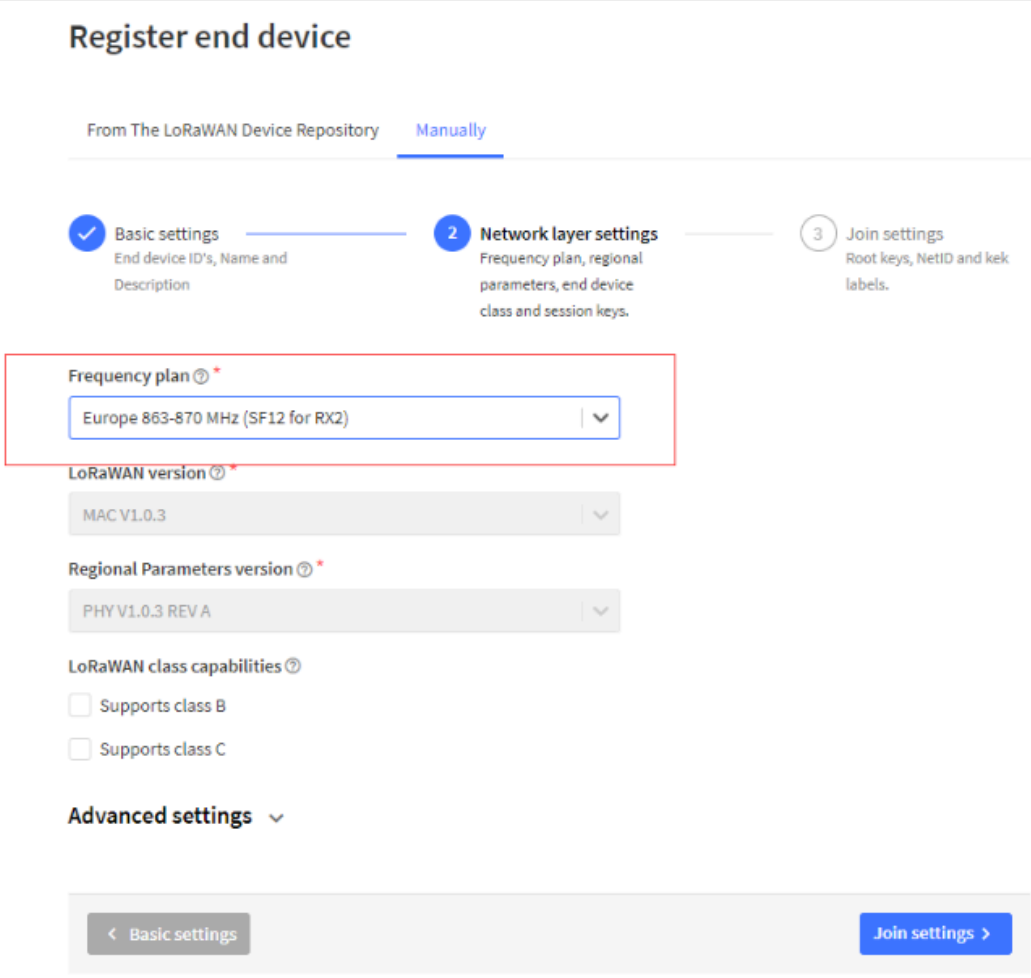
Register the device



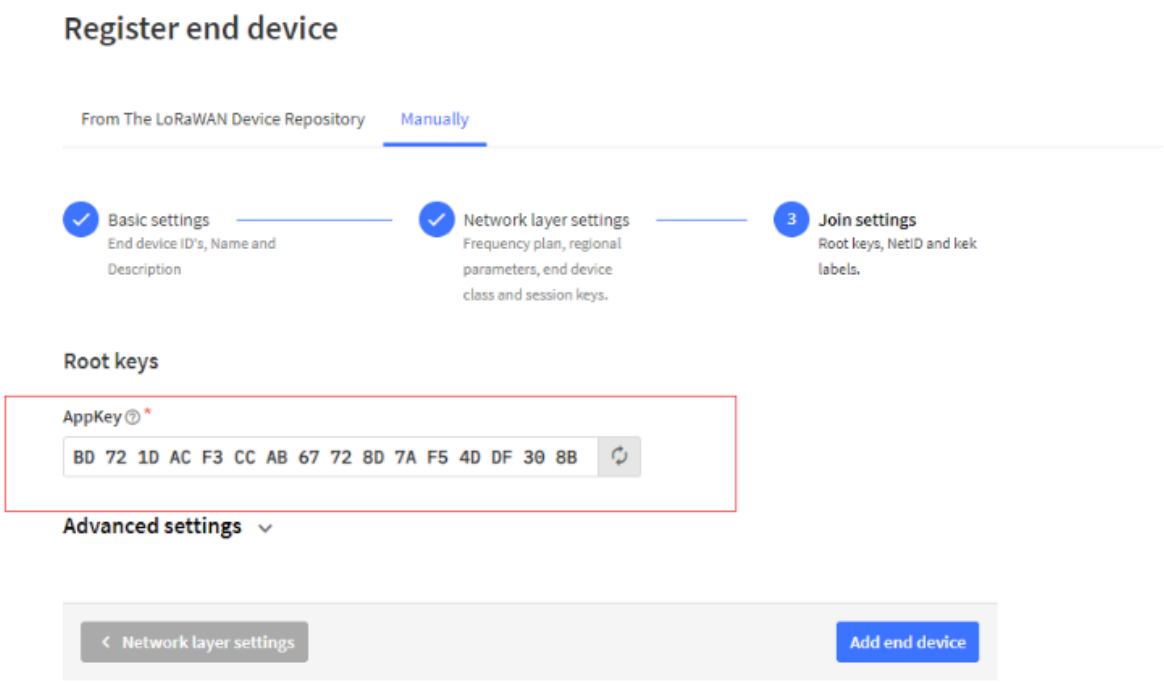
Add APP EUI and DEV EUI



Add APP EUI in the application


Register end device
From The LoRaWAN Device Repository
Manually
Basic settings
End device ID's, Name and Description
2
Network layer settings
Frequency plan, regional parameters, end device class and session keys.
3
Join settings
Root keys, NetID and kek labels.
Frequency plan *
Europe 863-870 MHz (SF12 for RX2)
LoRaWAN version *
MAC V1.0.3
Regional Parameters version *
PHY V1.0.3 REV A
LoRaWAN class capabilities
Supports class B
Supports class C
Advanced settings
Basic settings
Join settings

Add APP KEY



Step 2: Activate on MDS200-LB/LS

Press the button for 5 seconds to activate the MDS200-LB/LS.

Green led will fast blink 5 times, device will enter **OTA mode** for 3 seconds. And then start to JOIN LoRaWAN network. **Green led** will solidly turn on for 5 seconds after joined in network.

After join success, it will start to upload messages to TTN and you can see the messages in the panel.

2.3 Uplink Payload

Uplink payloads have two types:

- Distance Value: Use FPORT=2
- Other control commands: Use other FPORT fields.

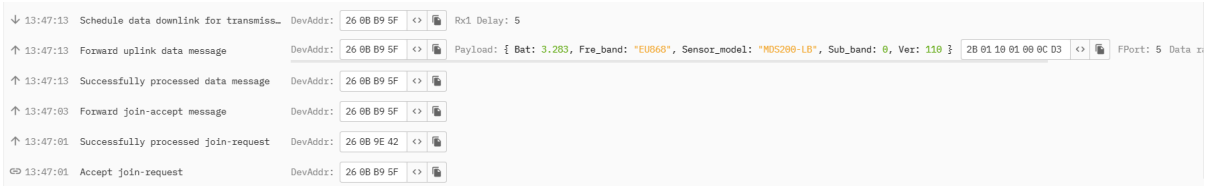
The application server should parse the correct value based on FPORT settings.

2.3.1 Device Status, FPORT=5

Include device configure status. Once MDS200-LB/LS Joined the network, it will uplink this message to the server.

Users can also use the downlink command (0x26 01) to ask MDS200-LB/LS to resend Device Status.

Device Status (FPORT=5)					
Size(bytes)	**1**	**2**	**1**	**1**	**2**
Value	Sensor Model	Firmware Version	Frequency Band	Sub-band	BAT



- **Sensor Model**: For MDS200-LB/LS, this value is 0x2B
- **Firmware Version**: 0x0100, Means: v1.0.0 version
- **Frequency Band**:

0x01: EU868

0x02: US915

0x03: IN865

0x04: AU915

0x05: KZ865

0x06: RU864

0x07: AS923

0x08: AS923-1

0x09: AS923-2

0x0a: AS923-3

0x0b: CN470

0x0c: EU433

0x0d: KR920

0x0e: MA869

- **Sub-Band**:
  - AU915 and US915: value 0x00 ~ 0x08
  - CN470: value 0x0B ~ 0x0C
  - Other Bands: Always 0x00
- **Battery Info:**

Check the battery voltage.

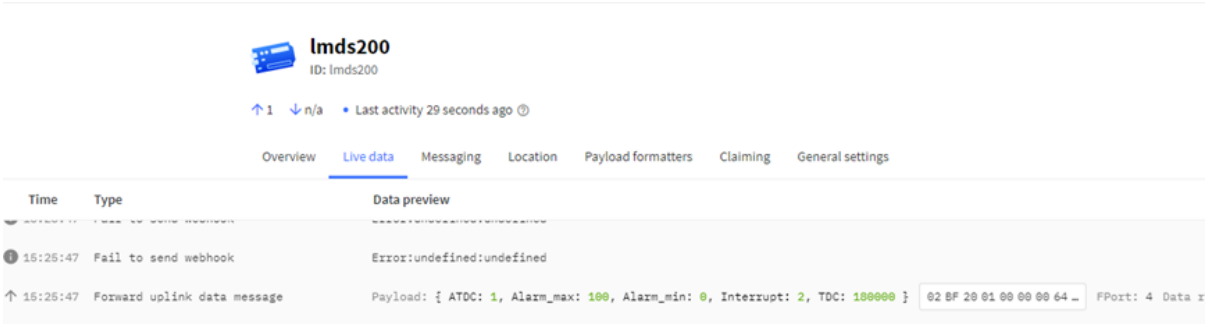
Ex1: 0x0B45 = 2885mV

Ex2: 0x0B49 = 2889mV

2.3.2 Sensor Configuration, FPORT=4

MDS200-LB/LS will only send this command after getting the downlink command (0x26 02) from the server.

Sensor Configuration FPORT=4				
Size(bytes)	**3**	**1**	**4**	**1**
Value	TDC (unit:sec)	ATDC (unit:min)	Alarm Settings	Interrupt Settings



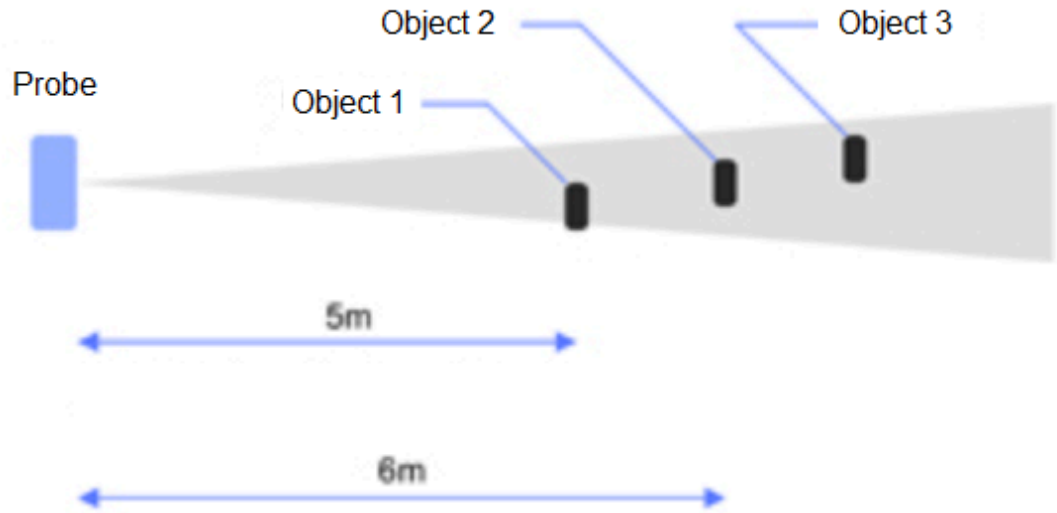
2.3.3 Distance, Uplink FPORT=2

MDS200-LB/LS will send this uplink **after** Device Status once join the LoRaWAN network successfully. And MDS200-LB/LS will:

1. periodically send this uplink every 1 hour (TDC time), this interval can be changed.
2. periodically send this uplink every 1 minute in Alarm Mode.
3. send this uplink while there is interrupt event.

Distance Value, FPORT=2				
Size(bytes)	**2**	**2**	**2**	**1**
Value	BAT	Object1 Distance	Object2 Distance	Status & Alarm

Status & Alarm field			
Size(bit)	**6**	**1**	**1**
Value	DALARM Counter	Distance Alarm 0: Normal Value 1: Distance Alarm	Interrupt Alarm 0: No Alarm 1: external Interrupt Alarm



Object1 Distance:

Distance between sensor probe to the first object. (unit: cm)

For example, if the data you get from the register is **0x00 0x73**, the distance between the sensor and the measured object is **0073(H) = 115 (D) = 115 cm.**

Notice: There are two special values for object 1 distance:

- **0x0001**: Probe not detected
- **0x0002**: Reading Invalid (exceed the valid range of the probe)

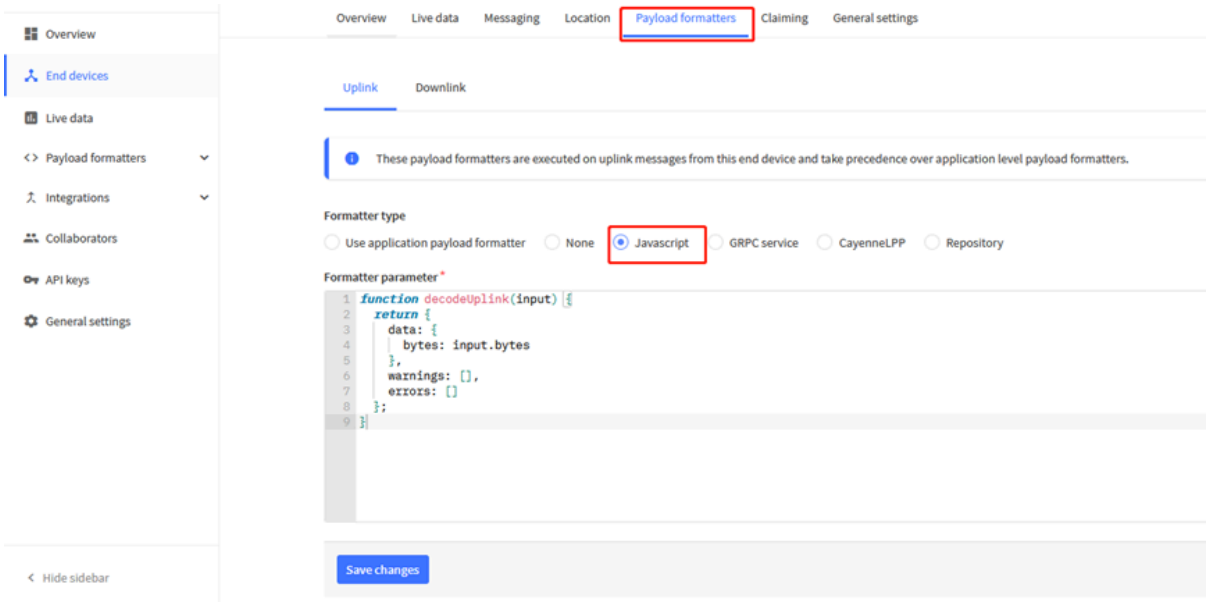
Object2 Distance:

Distance between sensor probe to the second object. (unit: cm)

DALARM Counter : Alarm Counter.

14:30:18	Forward uplink data message	Payload: { Bat: 3.328, DALARM_count: 19, Distance_alarm: 1, Interrupt_alarm: 0, dis1: 115, dis2: 164 }	0D 00 00 73 00 A4 4E FP
14:29:18	Fail to send webhook	Error:undefined:undefined	
14:29:18	Fail to send webhook	Error:undefined:undefined	
14:29:18	Fail to send webhook	Error:undefined:undefined	
14:29:18	Fail to send webhook	Error:undefined:undefined	
14:29:18	Forward uplink data message	Payload: { Bat: 3.328, DALARM_count: 18, Distance_alarm: 1, Interrupt_alarm: 0, dis1: 115, dis2: 164 }	0D 00 00 73 00 A4 4A FP
14:28:18	Fail to send webhook	Error:undefined:undefined	
14:28:18	Fail to send webhook	Error:undefined:undefined	
14:28:18	Fail to send webhook	Error:undefined:undefined	
14:28:18	Fail to send webhook	Error:undefined:undefined	
14:28:18	Forward uplink data message	Payload: { Bat: 3.33, DALARM_count: 17, Distance_alarm: 1, Interrupt_alarm: 0, dis1: 115, dis2: 164 }	0D 02 00 73 00 A4 46 FPo

2.3.4 Decoder in TTN V3



Please check the decoder from this link: https://github.com/dragino/dragino-end-node-decoder

2.4 Uplink Interval

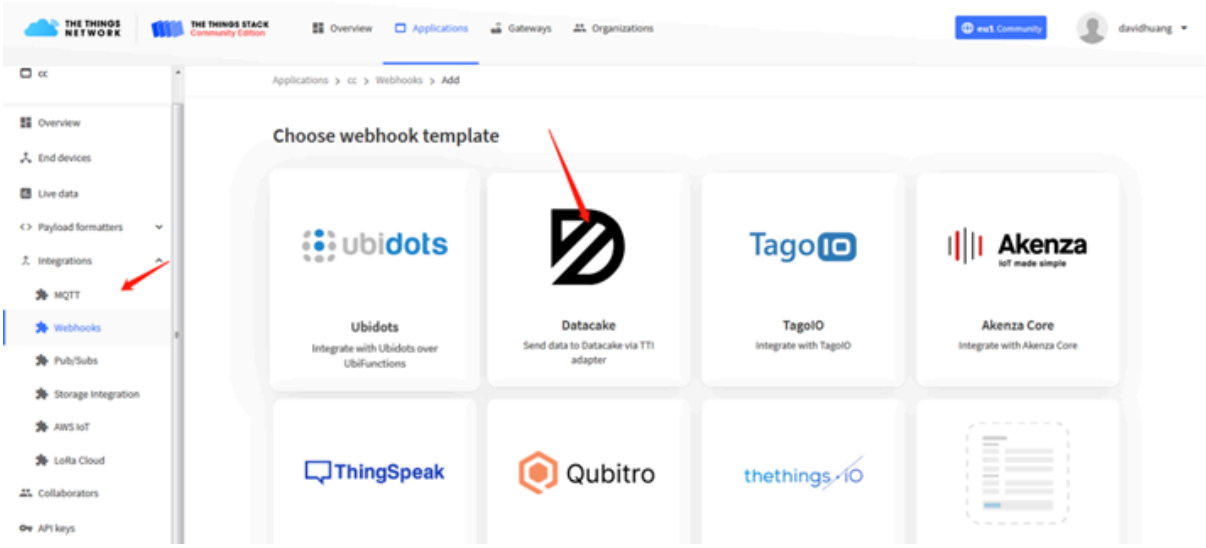
The MDS200-LB/LS by default uplink the sensor data every 20 minutes. User can change this interval by AT Command or LoRaWAN Downlink Command. See this link: Change Uplink Interval

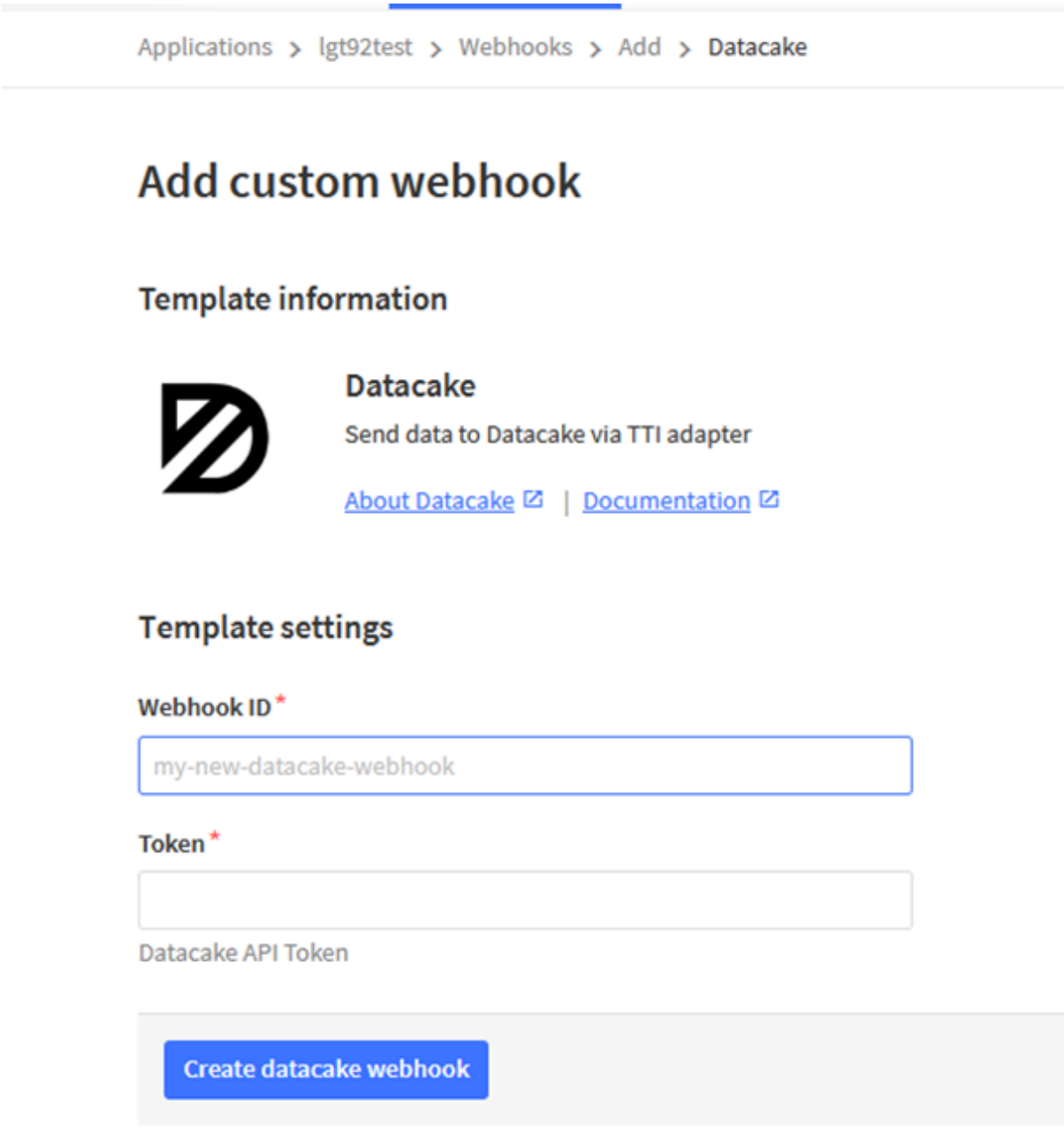
2.5 Show Data in DataCake IoT Server

DATACAKE provides a human friendly interface to show the sensor data, once we have data in TTN, we can use DATACAKE to connect to TTN and see the data in DATACAKE. Below are the steps:

Step 1: Be sure that your device is programmed and properly connected to the network at this time.

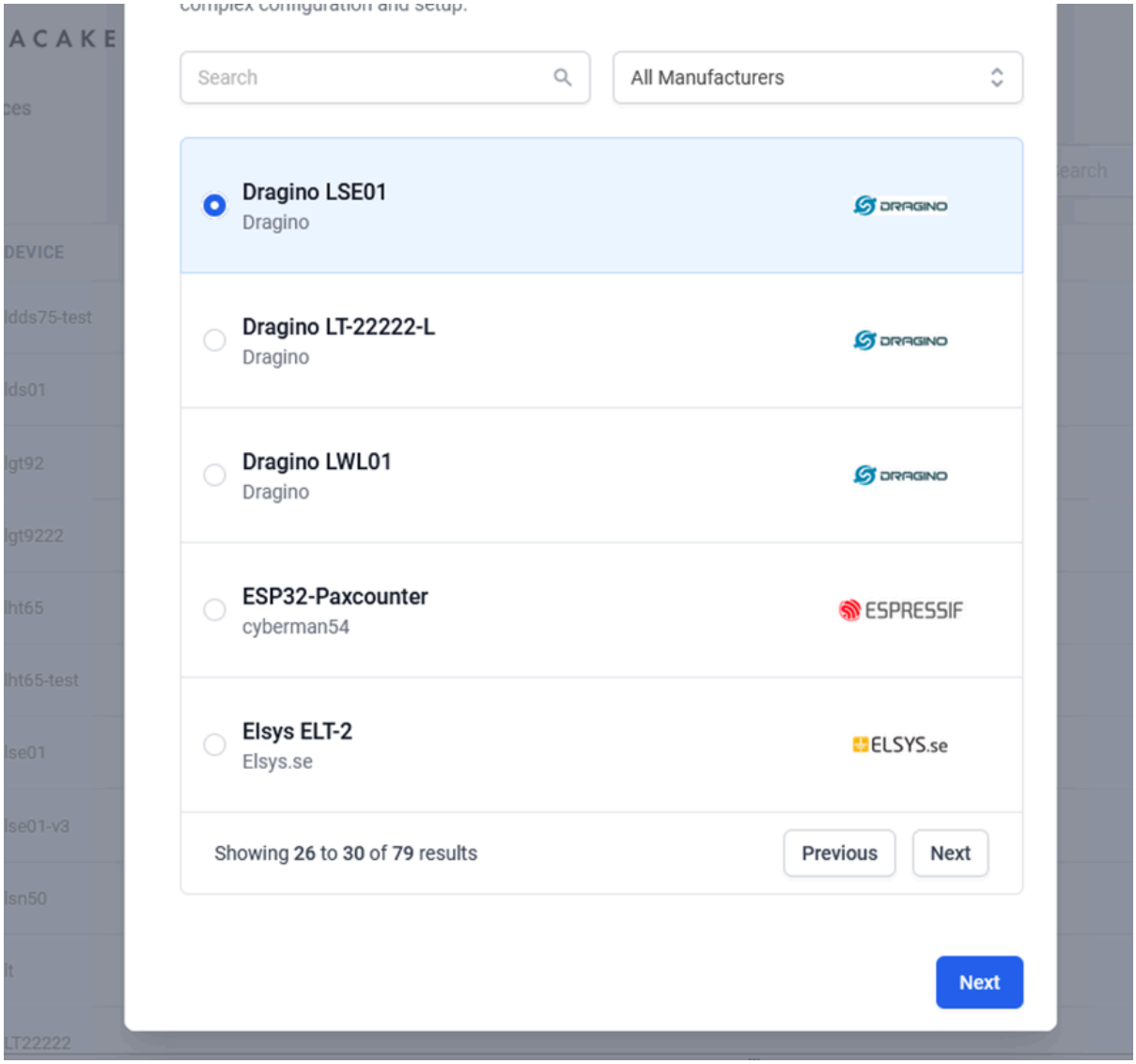
Step 2: To configure the Application to forward data to DATACAKE you will need to add integration. To add the DATACAKE integration, perform the following steps:


THE THINGS NETWORK
THE THINGS STACK
Community Edition
Overview
Applications
Gateways
Organizations
davidhuang
cc
Applications > cc > Webhooks > Add
Overview
End devices
Live data
Payload formatters
Integrations
MQTT
Webhooks
Pub/Subs
Storage Integration
AWS IoT
LoRa Cloud
Collaborators
API keys
Choose webhook template
ubidots
Ubidots
Integrate with Ubidots over UbiFunctions
Datacake
Send data to Datacake via TTI adapter
TagoIO
Integrate with TagoIO
Akenza
IoT made simple
Akenza Core
Integrate with Akenza Core
ThingSpeak
Qubitro
thethings.iO

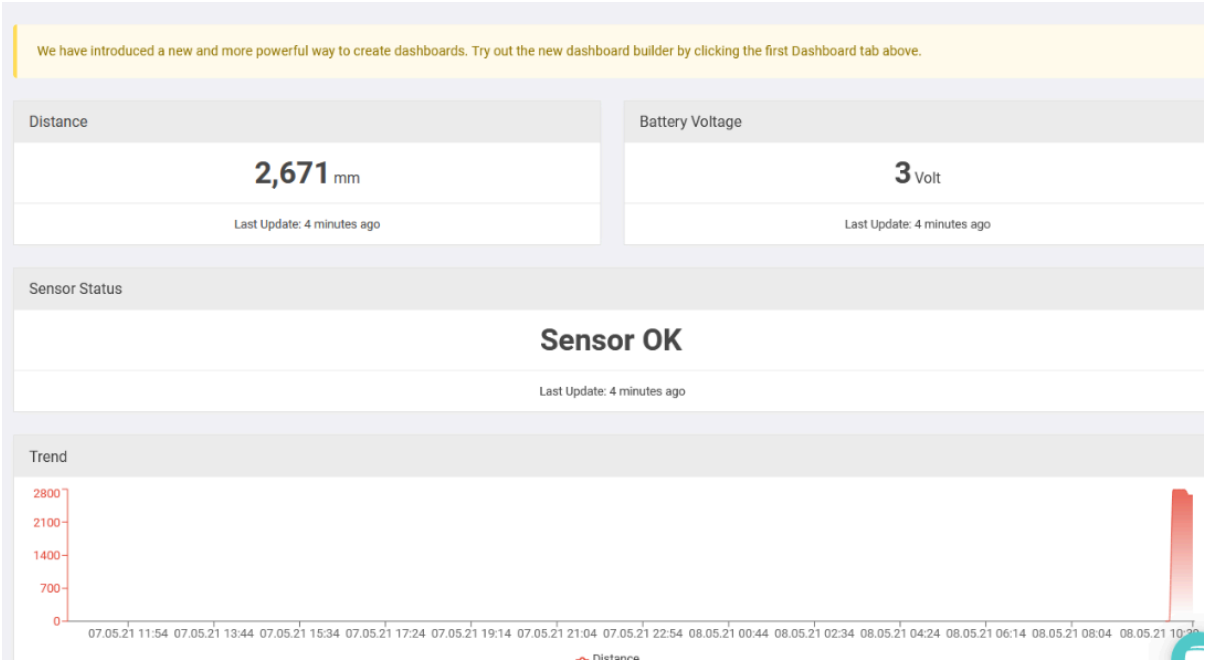


Step 3: Create an account or log in Datacake.

Step 4: Search the MDS200-LB/LS and add DevEUI.



After added, the sensor data arrive TTN V3, it will also arrive and show in Datacake.



2.6 Datalog Feature

Datalog Feature is to ensure IoT Server can get all sampling data from Sensor even if the LoRaWAN network is down. For each sampling, MDS200-LB/LS will store the reading for future retrieving purposes.

2.6.1 Ways to get datalog via LoRaWAN

Set **PNACKMD=1**, MDS200-LB/LS will wait for ACK for every uplink, when there is no LoRaWAN network, MDS200-LB/LS will mark these records with non-ack messages and store the sensor data, and it will send all messages (10s interval) after the network recovery.

- a) MDS200-LB/LS will do an ACK check for data records sending to make sure every data arrive server.
- b) MDS200-LB/LS will send data in **CONFIRMED Mode** when PNACKMD=1, but MDS200-LB/LS won't re-transmit the packet if it doesn't get ACK, it will just mark it as a NONE-ACK message. In a future uplink if MDS200-LB/LS gets a ACK, MDS200-LB/LS will consider there is a network connection and resend all NONE-ACK messages.

2.6.2 Unix TimeStamp

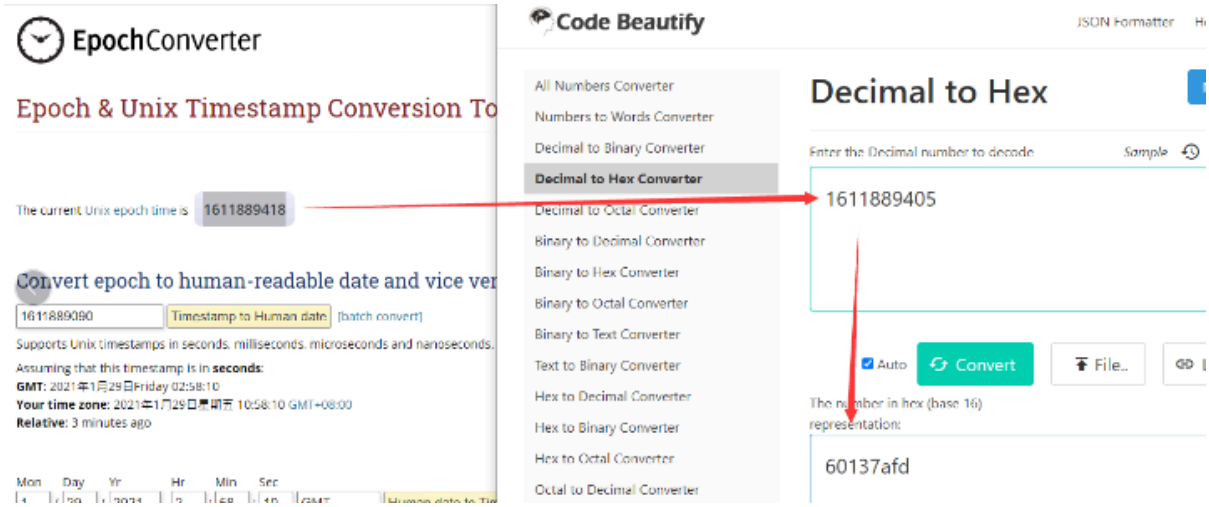
MDS200-LB/LS uses Unix TimeStamp format based on

Size (bytes)	4	1
DeviceTimeAns Payload	32-bit unsigned integer : Seconds since epoch*	8bits unsigned integer: fractional-second in ½^8 second steps

Figure 10 : DeviceTimeAns payload format

User can get this time from link: https://www.epochconverter.com/ :

Below is the converter example



So, we can use AT+TIMESTAMP=1611889405 or downlink 3060137afd00 to set the current time 2021 – Jan -- 29 Friday 03:03:25

2.6.3 Set Device Time

User need to set **SYNCMOD=1** to enable sync time via MAC command.

Once MDS200-LB/LS Joined LoRaWAN network, it will send the MAC command (DeviceTimeReq) and the server will reply with (DeviceTimeAns) to send the current time to MDS200-LB/LS. If MDS200-LB/LS fails to get the time from the server, MDS200-LB/LS will use the internal time and wait for next time request (AT+SYNCTDC to set the time request period, default is 10 days).

Note: LoRaWAN Server need to support LoRaWAN v1.0.3(MAC v1.0.3) or higher to support this MAC command feature, Chirpstack,TTN V3 v3 and loriot support but TTN V3 v2 doesn't support. If server doesn't support this command, it will through away uplink packet with this command, so user will lose the packet with time request for TTN V3 v2 if SYNCMOD=1.

2.6.4 Poll sensor value

Users can poll sensor values based on timestamps. Below is the downlink command.

Downlink Command to poll Open/Close status (0x31)			
1byte	**4bytes**	**4bytes**	**1byte**
31	Timestamp start	Timestamp end	Uplink Interval

Timestamp start and Timestamp end-use Unix TimeStamp format as mentioned above. Devices will reply with all data logs during this period, using the uplink interval.

For example, downlink command

Is to check 2021/11/12 12:00:00 to 2021/11/12 15:00:00's data

Uplink Internal =5s, means MDS200-LB/LS will send one packet every 5s. range 5~255s.

2.6.5 Datalog Uplink payload (FPORT=3)

The Datalog uplinks will use below payload format.

Retrieval data payload:

Size(bytes)	2	2	2	1	4
Value	BAT	distance1	distance2	Poll message flag & Alarm Flag& Interrupt Flag	Unix Time Stamp

No ACK Message: 1: This message means this payload is fromn Uplink Message which doesn't get ACK from the server before (for **PNACKMD=1** feature)

Poll Message Flag: 1: This message is a poll message reply.

- Poll Message Flag is set to 1.
- Each data entry is 11 bytes, to save airtime and battery, devices will send max bytes according to the current DR and Frequency bands.

For example, in US915 band, the max payload for different DR is:

a) DR0: max is 11 bytes so one entry of data

b) DR1: max is 53 bytes so devices will upload 4 entries of data (total 44 bytes)

c) DR2: total payload includes 11 entries of data

d) DR3: total payload includes 22 entries of data.

If devise doesn't have any data in the polling time. Device will uplink 11 bytes of 0

Example:

If MDS200-LB/LS has below data inside Flash:

```
8039B60 2023/7/31 13:33:40 3283 0 0 0 distance1=261 distance2=383
8039B70 2023/7/31 13:34:40 3283 0 0 0 distance1=261 distance2=383
8039B80 2023/7/31 13:35:40 3283 0 0 0 distance1=261 distance2=384
8039B90 2023/7/31 13:36:40 3283 0 0 0 distance1=261 distance2=384
8039BA0 2023/7/31 13:37:40 3283 0 0 0 distance1=261 distance2=383
8039BB0 2023/7/31 13:38:40 3283 0 0 0 distance1=261 distance2=383
8039BC0 2023/7/31 13:39:40 3283 0 0 0 distance1=261 distance2=383
8039BD0 2023/7/31 13:40:40 3283 0 0 0 distance1=261 distance2=383

8039BE0 2023/7/31 13:41:40 3283 0 0 0 distance1=261 distance2=383
8039BF0 2023/7/31 13:42:40 3283 0 0 0 distance1=261 distance2=383
8039C00 2023/7/31 13:43:40 3283 0 0 0 distance1=261 distance2=383
8039C10 2023/7/31 13:44:40 3283 0 0 0 distance1=261 distance2=384
8039C20 2023/7/31 13:45:40 3283 0 0 0 distance1=261 distance2=383
8039C30 2023/7/31 13:46:40 3283 0 0 0 distance1=261 distance2=383
8039C40 2023/7/31 13:47:40 3283 0 0 0 distance1=261 distance2=383
8039C50 2023/7/31 13:48:40 3283 0 0 0 distance1=261 distance2=383
```

If user sends below downlink command: 3164C7C55464C7C91405

Where : Start time: 64C7C554 = time 2023/7/31 22:29:40

Stop time: 64C7 C914 = time 2023/7/31 22:45:40

MDS200-LB/LS will uplink this payload.

0C D3 01 04 01 7F 40 64 C7 C5 54 0C D3 01 04 01 7F 40 64 C7 C5 90 0C D3 01 04 01 7F 40 64 C7 C5 CC 0C D3 01 04 01 7F 40 64 C7 C6 08 0C D3 01 04 01 7F 40 64 C7 C6 44

Where the first 11 bytes is for the first entry:

0C D3 01 04 01 7F 40 64 C7 C5 54

BAT=0x0C D3/1000=3.283

distance1=01 04=260

distance2=01 7F=383

Poll message flag & Alarm Flag& Interrupt Flag=0x40,means reply data,sampling uplink message,no Alarm,no interrupt

Unix time is 0x64 C7 C5 54 0C=1690813780s=2023-07-31 22:29:40

2.7 Frequency Plans

The MDS200-LB/LS uses OTAA mode and below frequency plans by default. Each frequency band use different firmware, user update the firmware to the corresponding band for their country.

http://wiki.dragino.com/xwiki/bin/view/Main/End%20Device%20Frequency%20Band/

3. Configure MDS200-LB/LS

3.1 Configure Methods

MDS200-LB/LS supports below configure method:

- AT Command via Bluetooth Connection (**Recommended**): BLE Configure Instruction.
- AT Command via UART Connection : See UART Connection.
- LoRaWAN Downlink. Instruction for different platforms: See IoT LoRaWAN Server section.

3.2 General Commands

These commands are to configure:

- General system settings like: uplink interval.
- LoRaWAN protocol & radio related command.

They are same for all Dragino Devices which support DLWS-005 LoRaWAN Stack. These commands can be found on the wiki:

http://wiki.dragino.com/xwiki/bin/view/Main/End%20Device%20AT%20Commands%20and%20Downlink%20Command/

3.3 Commands special design for MDS200-LB/LS

These commands only valid for MDS200-LB/LS, as below:

3.3.1 Set Transmit Interval Time(0x01)

Feature: Change LoRaWAN End Node Transmit Interval.

AT Command: AT+TDC

Command Example	Function	Response
AT+TDC=?	Show current transmit Interval	30000 OK the interval is 30000ms = 30s
AT+TDC=60000	Set Transmit Interval	OK Set transmit interval to 60000ms = 60 seconds

Downlink Command: 0x01

Format: Command Code (0x01) followed by 3 bytes time value.

If the downlink payload=0100003C, it means set the END Node's Transmit Interval to 0x00003C=60(S), while type code is 01.

- Example 1: Downlink Payload: 0100001E // Set Transmit Interval (TDC) = 30 seconds
- Example 2: Downlink Payload: 0100003C // Set Transmit Interval (TDC) = 60 seconds

3.3.2 Set Alarm Transmit Interval Time(0x0D)

Feature: Change LoRaWAN End Node Alarm Transmit Interval. Default Value: 1 minute

AT Command: AT+ATDC

Command Example	Function	Response
AT+ATDC=?	Show current alarm transmit Interval	1 OK the interval is 1 minute
AT+ATDC=1	Set Alarm Transmit Interval	OK Set alarm transmit interval to 1 minute

Downlink Command: 0x0D

Format: Command Code (0x0D) followed by 1 byte for time value.

If the downlink payload=0D02, it means set the END Node's Alarm Transmit Interval to 2 minutes, while type code is 0D.

3.3.3 Set Alarm Distance (0xA2)

MDS200-LB/LS supports Alarm Feature, when MDS200-LB/LS detect the distance exceed the alarm settings, MDS200-LB/LS will Enter Alarm Mode and use the ATDC interval (default is 1 minute) to uplink Distance value. Alarm mode will last for 60 uplinks (default 1 hour) and can be close by downlink command 0xA300.

Note: Alarm mode only valid for the Distance 1(the Closest Object)

User can set Alarm Distance to enable/disable Alarm Mode.

AT+ALARMC=AA,BB

Example:

AT+ALARMC=100,200 // Alarm when < 100 or higher than 200.(Min:50cm, Max:2000cm)

Downlink Payload:

0x(A2 00 64 00 C8) // Same as AT+ALARMC=100,200

3.3.4 Enter/Exit Alarm Mode (0xA3)

Feature: Enter/Exit Alarm mode:

AT Command: AT+ALARM=0(Exit Alarm Mode or AT+ALARM=1 (Enter Alarm Mode)

Downlink Command:

0xA3 00 // Exit Alarm Mode.

0xA3 01 // Enter Alarm Mode. Enter Alarm mode will use ATDC interval in the next 59 uplinks.

3.3.5 Set Interrupt Mode(0x06)

Feature, Set Interrupt mode for GPIO_EXIT.

AT Command: AT+INTMOD

Command Example	Function	Response
AT+INTMOD=?	Show current interrupt mode	0 OK the mode is 0 = No interruption
AT+INTMOD=2	Set Transmit Interval 0. (Disable Interrupt), 1. (Trigger by rising and falling edge) 2. (Trigger by falling edge) 3. (Trigger by rising edge)	OK

Downlink Command: 0x06

Format: Command Code (0x06) followed by 3 bytes.

This means that the interrupt mode of the end node is set to 0x000003=3 (rising edge trigger), and the type code is 06.

- Example 1: Downlink Payload: 06000000 // Turn off interrupt mode
- Example 2: Downlink Payload: 06000003 // Set the interrupt mode to rising edge trigger

4. Battery & Power Consumption

MDS200-LB use ER26500 + SPC1520 battery pack and MDS200-LS use 3000mAh Recharable Battery with Solar Panel. See below link for detail information about the battery info and how to replace.

Battery Info & Power Consumption Analyze .

5. OTA Firmware update

User can change firmware MDS200-LB/LS to:

- Change Frequency band/ region.
- Update with new features.
- Fix bugs.

Firmware and changelog can be downloaded from : **Firmware download link**

Methods to Update Firmware:

- (Recommanded way) OTA firmware update via wireless: **http://wiki.dragino.com/xwiki/bin/view/Main/Firmware%20OTA%20Update%20for%20Sensors/**
- Update through UART TTL interface: **Instruction**.

6. FAQ

6.1 What is the frequency plan for MDS200-LB/LS?

MDS200-LB/LS use the same frequency as other Dragino products. User can see the detail from this link: Introduction

7. Trouble Shooting

7.1 Why I can't join TTN V3 in US915 / AU915 bands?

It is due to channel mapping. Please see below link: Frequency band

7.2 AT Command input doesn't work

In the case if user can see the console output but can't type input to the device. Please check if you already include the **ENTER** while sending out the command. Some serial tool doesn't send **ENTER** while press the send key, user need to add ENTER in their string.

8. Order Info

Part Number: MDS200-LB-XX or MDS200-LS-XX

XX: The default frequency band

- **AS923**: LoRaWAN AS923 band
- **AU915**: LoRaWAN AU915 band
- **EU433**: LoRaWAN EU433 band
- **EU868**: LoRaWAN EU868 band
- **KR920**: LoRaWAN KR920 band
- **US915**: LoRaWAN US915 band
- **IN865**: LoRaWAN IN865 band
- **CN470**: LoRaWAN CN470 band

9. Packing Info

Package Includes:

- MDS200-LB or MDS200-LS LoRaWAN Microwave Radar Distance Sensor x 1

Dimension and weight:

- Device Size: cm
- Device Weight: g
- Package Size / pcs : cm
- Weight / pcs : g

10. Support

- Support is provided Monday to Friday, from 09:00 to 18:00 GMT+8. Due to different timezones we cannot offer live support. However, your questions will be answered as soon as possible in the before-mentioned schedule.
- Provide as much information as possible regarding your enquiry (product models, accurately describe your problem and steps to replicate it etc) and send a mail to Support@dragino.cc.