LoRaWAN Distance Detection Sensor User Manual

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1.1	Add mechanical drawing, Add UART Connection for different hardware	2020-Nov-5

1. Introduction 3
   - 1.1 What is LoRaWAN Distance Detection Sensor 3
   - 1.2 Features 4
   - 1.3 Specification 4
     - 1.3.1 Rated environmental conditions 4
     - 1.3.2 Effective measurement range Reference beam pattern 4
   - 1.4 Applications 5
2. Configure LDDS75 to connect to LoRaWAN network 6
   - 2.1 How it works 6
   - 2.2 Quick guide to connect to LoRaWAN server (OTAA) 7
   - 2.3 Uplink Payload 10
     - 2.3.1 Battery Info 10
     - 2.3.2 Distance 10
     - 2.3.3 Decode payload in The Things Network 10
   - 2.4 Downlink Payload 11
   - 2.5 Show Data in Mydevices IoT Server 12
   - 2.6 LED Indicator 13
   - 2.7 Firmware Change Log 13
   - 2.8 Mechanical 14
   - 2.9 Battery Analysis 14
     - 2.9.1 Battery Type 14
     - 2.9.2 Replace the battery 15
3. Using the AT Commands 16
   - 3.1 Access AT Commands 16
4. FAQ 19
   - 4.1 What is the frequency plan for LDDS01? 19
   - 4.2 How to change the LoRa Frequency Bands/Region? 19
5. Trouble Shooting 19
   - 5.1 Why I can’t join TTN in US915 / AU915 bands? 19
   - 5.2 AT Command input doesn’t work 19
6. Order Info 20
7. Packing Info 20
8. Support 20

1. Introduction

1.1 What is LoRaWAN Distance Detection Sensor

The Dragino LDDS75 is a **LoRaWAN Distance Detection Sensor** for Internet of Things solution. It is used to measure the distance between the sensor and a flat object. The distance detection sensor is a module that uses **ultrasonic sensing** technology for distance measurement, and **temperature compensation** is performed internally to improve the reliability of data. The LDDS75 can be applied to scenarios such as 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, etc.

It detects the distance **between the measured object and the sensor**, and uploads the value via wireless to LoRaWAN IoT Server.

The LoRa wireless technology used in LDDS75 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.

LDDS75 is powered by **4000mA Li-SOCI2 battery**; It is designed for long term use up to 10 years*.

Each LDDS75 pre-loads with a set of unique keys for LoRaWAN registrations, register these keys to local LoRaWAN server and it will auto connect if there is network coverage, after power on.

*Actually lifetime depends on network coverage and uplink interval and other factors

LDDS75 in a LoRaWAN Network

1.2 Features

- ✧ LoRaWAN 1.0.3 Class A
- ✧ Ultra low power consumption
- ✧ Distance Detection by Ultrasonic technology
- ✧ Flat object range 280mm - 7500mm
- ✧ Accuracy: ±(1cm+S*0.3%) (S: Distance)
- ✧ Cable Length : 25cm
- ✧ Bands: CN470/EU433/KR920/US915/EU868/AS923/AU915/IN865
- ✧ AT Commands to change parameters
- ✧ Uplink on periodically
- ✧ Downlink to change configure
- ✧ IP66 Waterproof Enclosure
- ✧ 4000mAh Battery for long term use

1.3 Specification

1.3.1 Rated environmental conditions

Item	Minimum value	Typical value	Maximum value	Unit	Remarks
Storage temperature	-25	25	80	℃	
Storage humidity		65%	90%	RH	(1)
Operating temperature	-15	25	60	℃	
Working humidity		65%	80%	RH	(1)

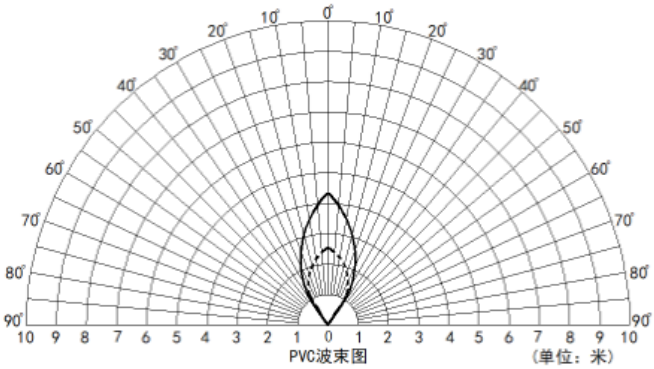
Remarks: (1) a. When the ambient temperature is 0-39 ℃, the maximum humidity is 90% (non-condensing)

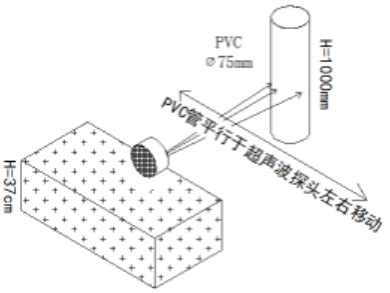
b. When the ambient temperature is 40-50 ℃, the highest humidity is the highest humidity in the natural world at the current temperature (no condensation)

1.3.2 Effective measurement range Reference beam pattern

(1) The tested object is a white cylindrical tube made of PVC, with a height of 100cm and a diameter of 7.5cm.

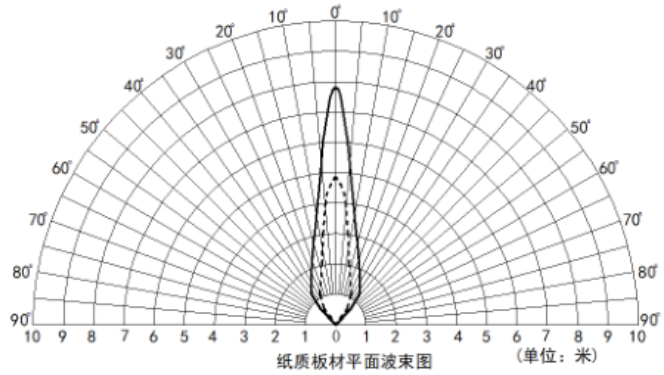
In the figure below, the solid line is the test data with bell mouth; the dotted line is the test data without bell mouth.

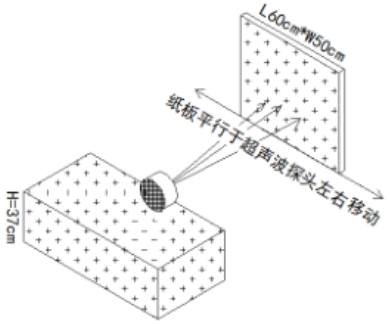




(2) The object to be tested is a "corrugated cardboard box" perpendicular to the central axis of 0 °, and the length * width is 60cm * 50cm.

In the figure below, the solid line is the test data with a bell mouth; the dotted line is the test data without a bell mouth.





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

2. Configure LDDS75 to connect to LoRaWAN network

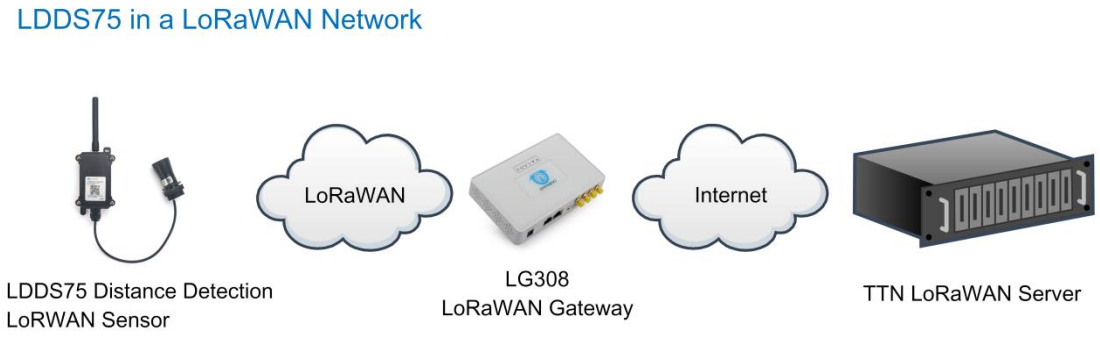
2.1 How it works

The LDDS75 is configured as LoRaWAN OTAA Class A mode by default. It has OTAA keys to join LoRaWAN network. To connect a LoRaWAN network, you need to input the OTAA keys in the LoRaWAN IoT server and power on the LDDS75. If there is coverage of the LoRaWAN network, it will automatically join the network via OTAA and start to send the sensor value

In case you can't set the OTAA keys in the LoRaWAN OTAA server, and you have to use the keys from the server, you can use AT Commands to set the keys in the LDDS75.

2.2 Quick guide to connect to LoRaWAN server (OTAA)

Following is an example for how to join the TTN LoRaWAN Network. Below is the network structure; we use the LG308 as a LoRaWAN gateway in this example.



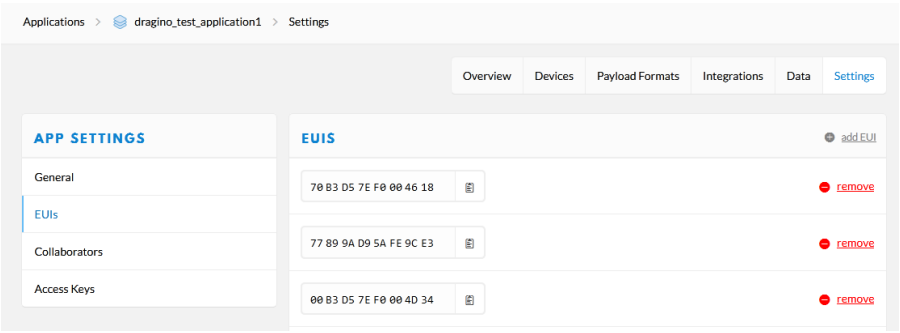
The LG308 is already set to connected to TTN network , so what we need to now is configure the TTN server.

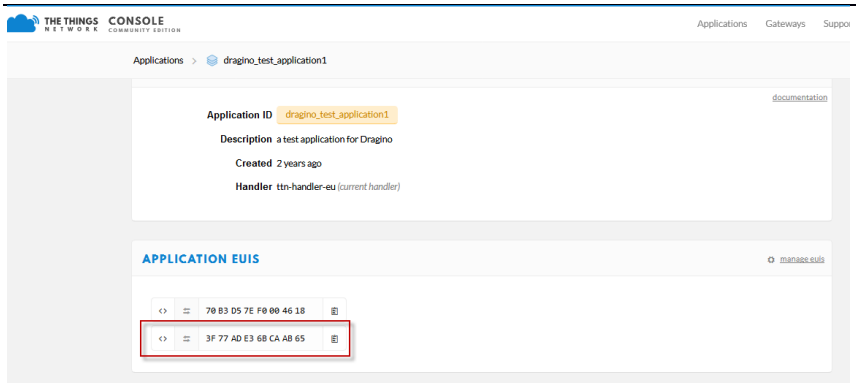
Step 1: Create a device in TTN with the OTAA keys from LDDS75.
Each LDDS75 is shipped with a sticker with the default device keys, user can find this sticker in the box. it looks like below.

For OTAA registration, we need to set **APP EUI/ APP KEY/ DEV EUI**. Some server might no need to set APP EUI.

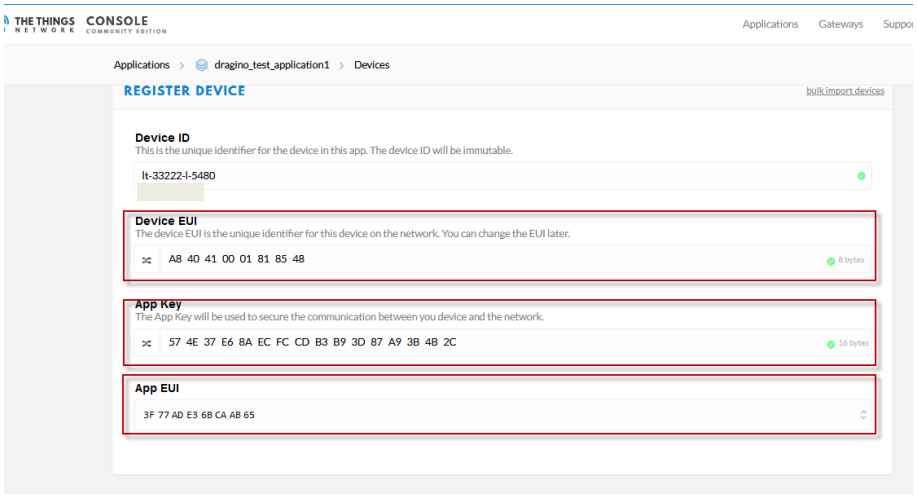
Enter these keys in the LoRaWAN Server portal. Below is TTN screen shot:

Add APP EUI in the application





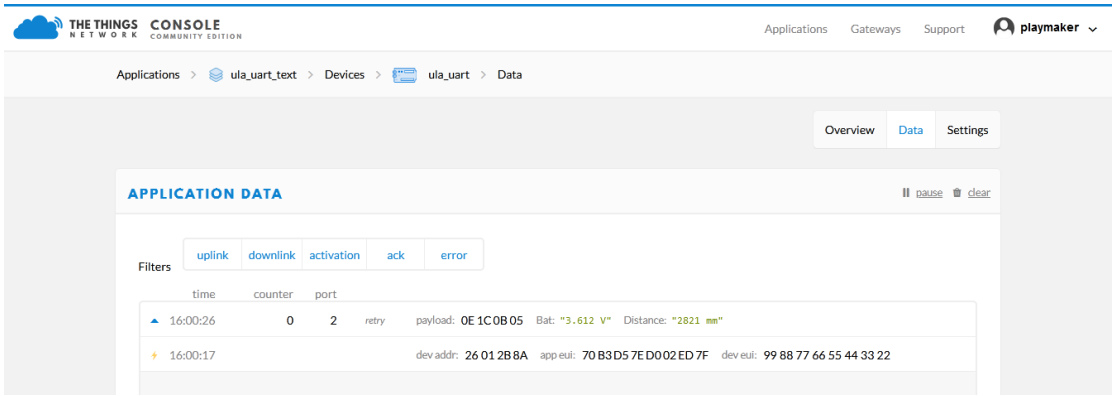
Add APP KEY and DEV EUI



Step 2: Power on LDDS75

Put a Jumper on JP2 to power on the device. (The switch must be set in FLASH position).

Step 3: The LDDS75 will auto join to the TTN network. After join success, it will start to upload messages to TTN and you can see the messages in the panel.

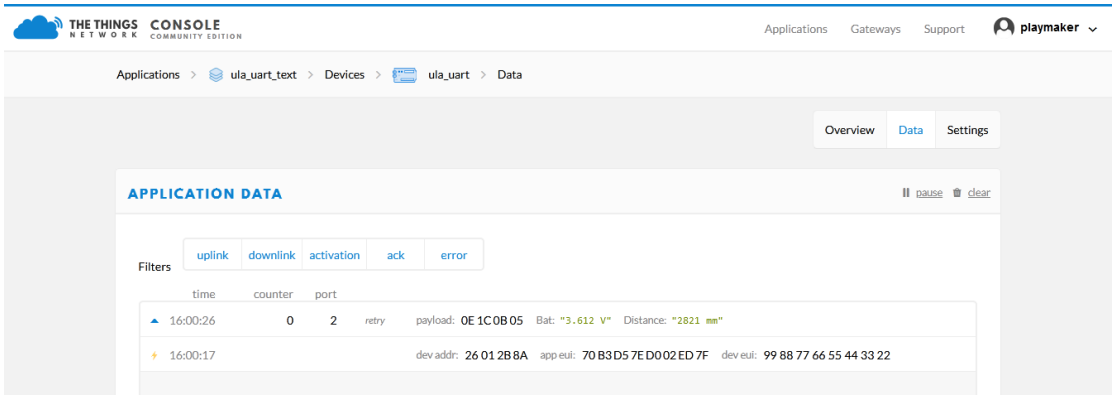


2.3 Uplink Payload

LDDS75 will uplink payload via LoRaWAN with below payload format:

Uplink payload includes in total 4 bytes.

Size (bytes)	2	2
Value	BAT	Distance (unit: mm)



2.3.1 Battery Info

Check the battery voltage for LDDS75.
Ex1: 0x0B45 = 2885mV
Ex2: 0x0B49 = 2889mV

2.3.2 Distance

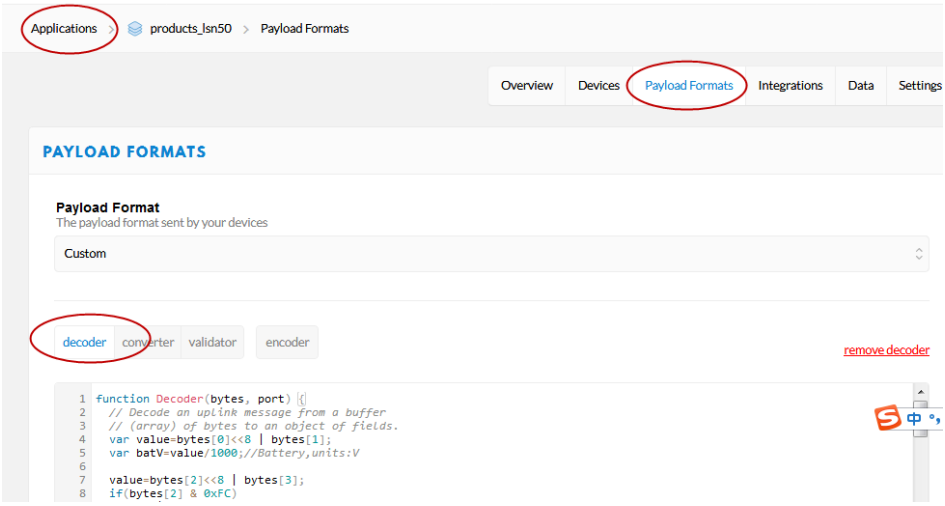
Get the distance. Flat object range 280mm - 7500mm.
For example, if the data you get from the register is 0x0B 0x05, the distance between the sensor and the measured object is

0B05(H) = 2821 (D) = 2821 mm.

If the sensor value is 0x0000, it means system doesn't detect ultrasonic sensor.
If the sensor value lower than 0x0118 (280mm), the sensor value will be invalid.

2.3.3 Decode payload in The Things Network

While using TTN network, you can add the payload format to decode the payload.



The payload decoder function for TTN is here:
LDDS75 TTN Payload Decoder:

http://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/LDDS75/Payload_Decoder/

2.4 Downlink Payload

By default, LDDS75 prints the downlink payload to console port.

Downlink Control Type	FPort	Type Code	Downlink payload size(bytes)
TDC (Transmit Time Interval)	Any	01	4
RESET	Any	04	2
AT+CFM	Any	05	4
INTMOD	Any	06	4

Examples

Set TDC
If the payload=0100003C, it means set the END Node's TDC to 0x00003C=60(S), while type code is 01.
Payload: 01 00 00 1E TDC=30S
Payload: 01 00 00 3C TDC=60S

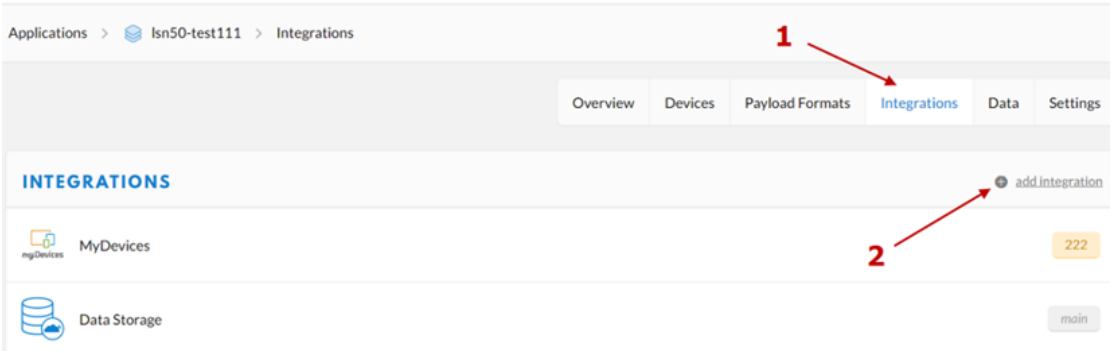
Reset
If payload = 0x04FF, it will reset the LDDS75

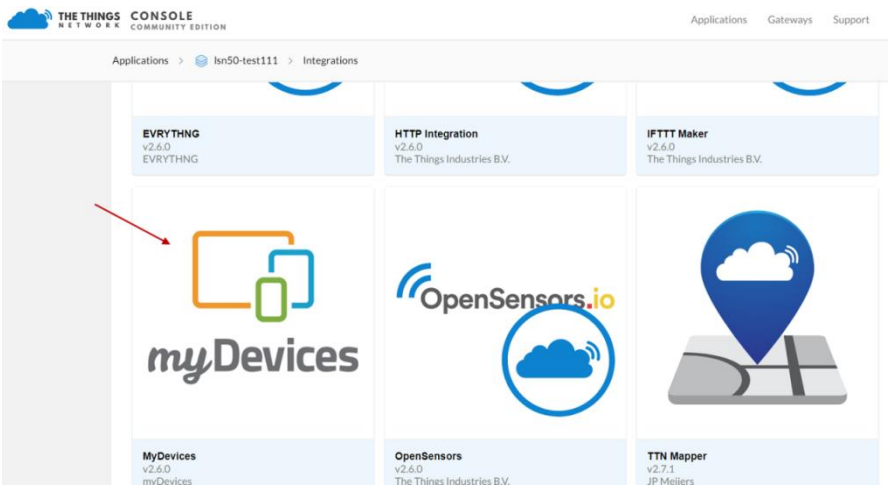
CFM
Downlink Payload: 05000001, Set AT+CFM=1 or 05000000 , set AT+CFM=0

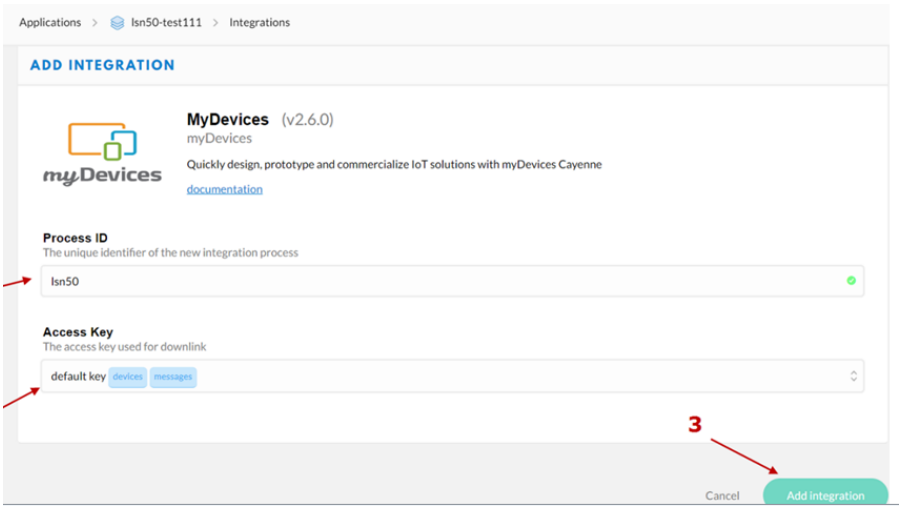
2.5 Show Data in Mydevices IoT Server

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

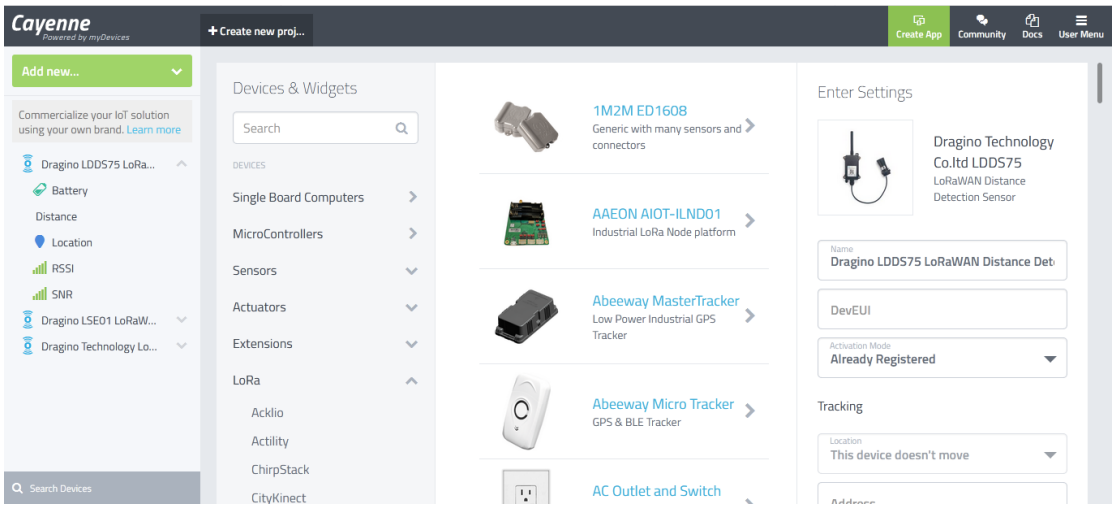
Step 1: Be sure that your device is programmed and properly connected to the network at this time.
Step 2: To configure the Application to forward data to Mydevices you will need to add integration. To add the Mydevices integration, perform the following steps:



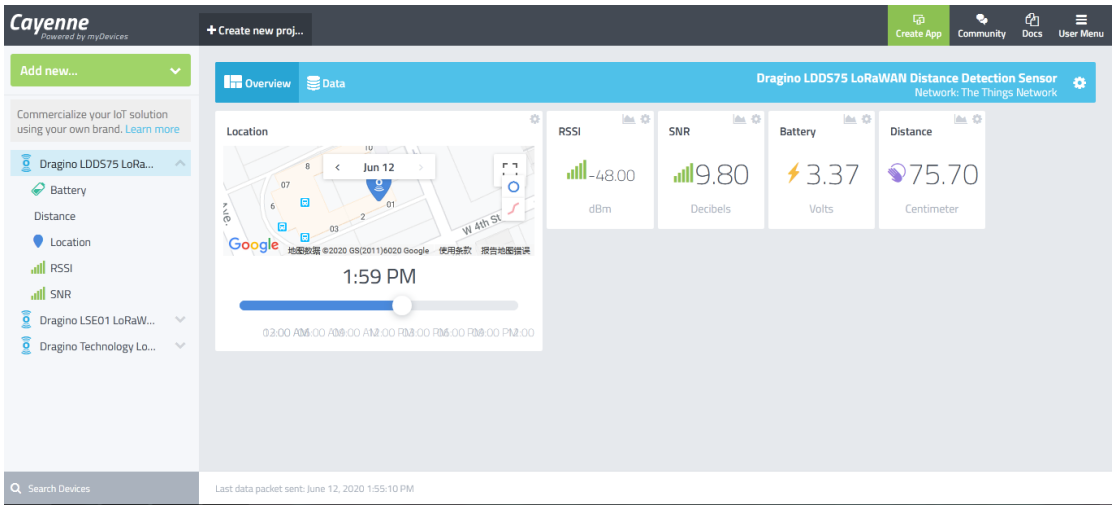




Step 3: Create an account or log in Mydevices.
Step 4: Search the LDDS75 and add DevEUI.



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



2.6 LED Indicator

The LDDS75 has an internal LED which is to show the status of different state.

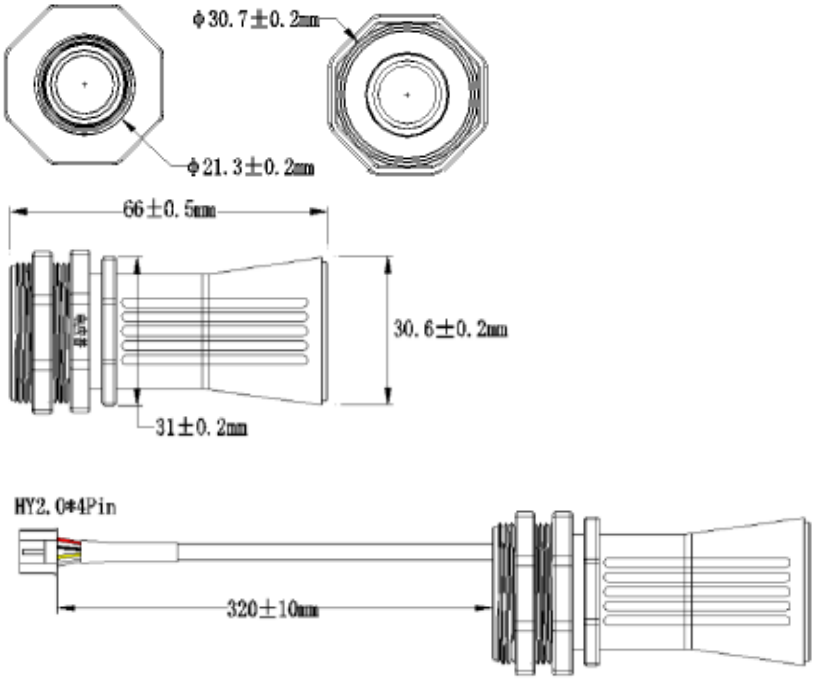
- Blink once when device power on.
- The device detects the sensor and flashes 5 times.
- Solid ON for 5 seconds once device successful Join the network.
- Blink once when device transmit a packet.

2.7 Firmware Change Log

Firmware download link:
http://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/LSE01/Firmware/

Firmware Upgrade Method:
http://wiki.dragino.com/index.php?title=Firmware_Upgrade_Instruction_for_STM32_base_products#Introduction

2.8 Mechanical



2.9 Battery Analysis

2.9.1 Battery Type

The LDDS75 battery is a combination of a 4000mAh Li/SOCI2 Battery and a Super Capacitor. The battery is non-rechargeable battery type with a low discharge rate (<2% per year). This type of battery is commonly used in IoT devices such as water meter.

The battery related documents as below:

- Battery Dimension,
- Lithium-Thionyl Chloride Battery datasheet, Tech Spec
- Lithium-ion Battery-Capacitor datasheet, Tech Spec

2.9.2 Replace the battery

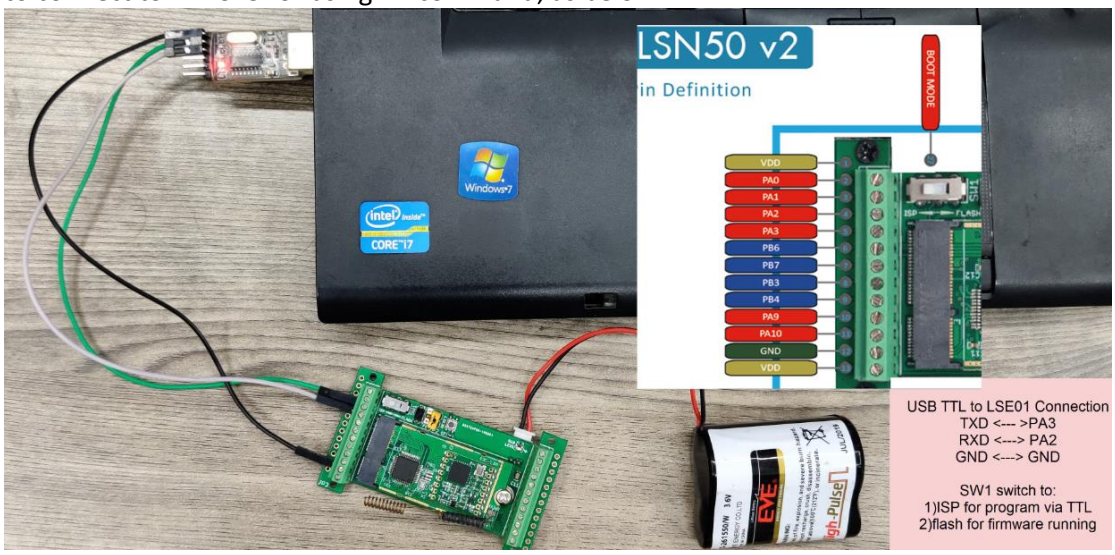
You can change the battery in the LDDS75.The type of battery is not limited as long as the output is between 3v to 3.6v. On the main board, there is a diode (D1) between the battery and the main circuit. If you need to use a battery with less than 3.3v, please remove the D1 and shortcut the two pads of it so there won't be voltage drop between battery and main board.

The default battery pack of LDDS75 includes a ER18505 plus super capacitor. If user can't find this pack locally, they can find ER18505 or equivalence, which will also work in most case. The SPC can enlarge the battery life for high frequency use (update period below 5 minutes)

3. Using the AT Commands

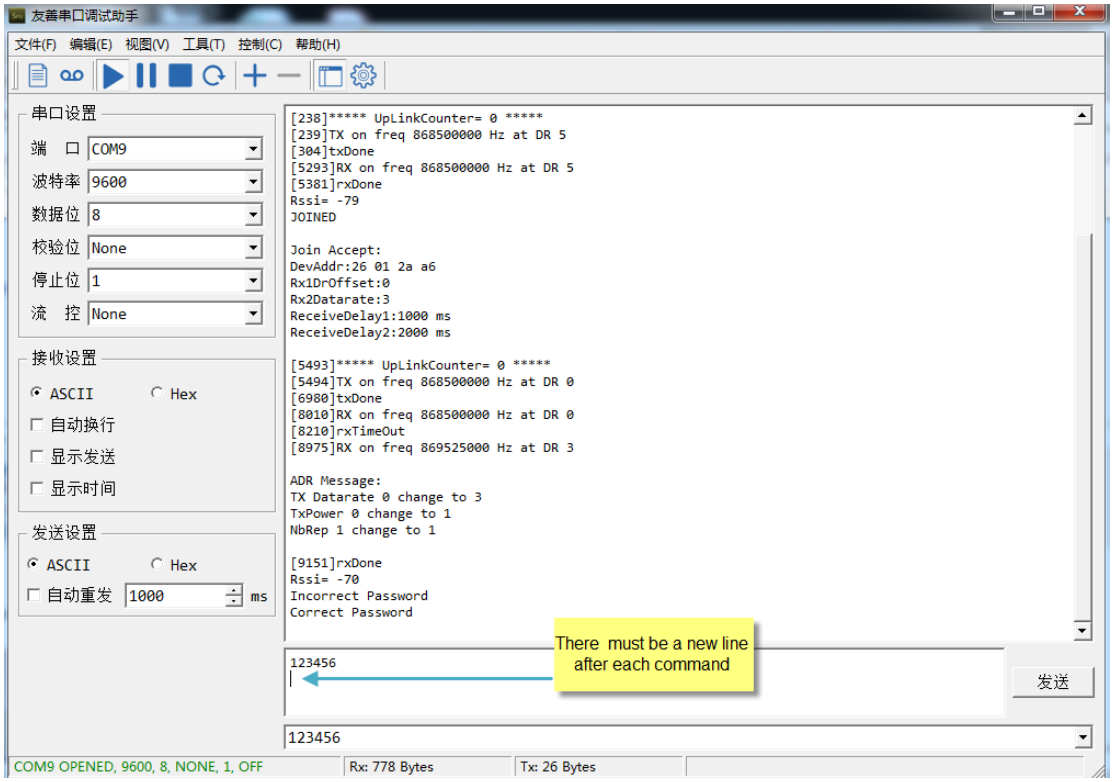
3.1 Access AT Commands

LDDS75 supports AT Command set in the stock firmware. You can use a USB to TTL adapter to connect to LDDS75 for using AT command, as below.



Or if you have below board, use below connection:

In the PC, you need to set the serial baud rate to **9600** to access the serial console for LDDS75. LDDS75 will output system info once power on as below:



Below are the available commands, a more detailed AT Command manual can be found at [AT Command Manual: http://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/LDDS75/](http://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/LDDS75/)

AT+<CMD>? : Help on <CMD>
AT+<CMD> : Run <CMD>
AT+<CMD>=<value> : Set the value
AT+<CMD>=? : Get the value

General Commands

AT : Attention
AT? : Short Help
ATZ : MCU Reset
AT+TDC : Application Data Transmission Interval

Keys, IDs and EUIs management

AT+APPEUI : Application EUI
AT+APPKEY : Application Key
AT+APPSKEY : Application Session Key
AT+DADDR : Device Address
AT+DEUI : Device EUI
AT+NWKID : Network ID (You can enter this command change only after successful network connection)
AT+NWKSKEY : Network Session Key Joining and sending date on LoRa network
AT+CFM : Confirm Mode
AT+CFS : Confirm Status
AT+JOIN : Join LoRa? Network
AT+NJM : LoRa? Network Join Mode
AT+NJS : LoRa? Network Join Status
AT+RECV : Print Last Received Data in Raw Format

AT+RECVB : Print Last Received Data in Binary Format
AT+SEND : Send Text Data
AT+SENB : Send Hexadecimal Data

LoRa Network Management

AT+ADR : Adaptive Rate
AT+CLASS : LoRa Class(Currently only support class A
AT+DCS : Duty Cycle Setting
AT+DR : Data Rate (Can Only be Modified after ADR=0)
AT+FCD : Frame Counter Downlink
AT+FCU : Frame Counter Uplink
AT+JN1DL : Join Accept Delay1
AT+JN2DL : Join Accept Delay2
AT+PNM : Public Network Mode
AT+RX1DL : Receive Delay1
AT+RX2DL : Receive Delay2
AT+RX2DR : Rx2 Window Data Rate
AT+RX2FQ : Rx2 Window Frequency
AT+TXP : Transmit Power

Information

AT+RSSI : RSSI of the Last Received Packet
AT+SNR : SNR of the Last Received Packet
AT+VER : Image Version and Frequency Band
AT+FDR : Factory Data Reset
AT+PORT : Application Port
AT+CHS : Get or Set Frequency (Unit: Hz) for Single Channel Mode
AT+CHE : Get or Set eight channels mode, Only for US915, AU915, CN470

4. FAQ

4.1 What is the frequency plan for LDDS01?

LDDS75 use the same frequency as other Dragino products. User can see the detail from this link:
http://wiki.dragino.com/index.php?title=End_Device_Frequency_Band#Introduction

4.2 How to change the LoRa Frequency Bands/Region?

You can follow the instructions for how to upgrade image.
When downloading the images, choose the required image file for download.

5. Trouble Shooting

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

It is due to channel mapping. Please see below link:
http://wiki.dragino.com/index.php?title=LoRaWAN_Communication_Debug#Notice_of_US915.2FCN470.2FAU915_Frequency_band

5.2 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.

6. Order Info

Part Number: **LDDS75-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

7. Packing Info

Package Includes:

- LDDS75 LoRaWAN Distance Detection x 1

Dimension and weight:

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

8. 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.com