PS-LB-NA LoRaWAN Analog Sensor User Manual

last modified by Xiaoling

on 2025/03/27 15:32

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1. Introduction

1.1 What is LoRaWAN Analog Sensor

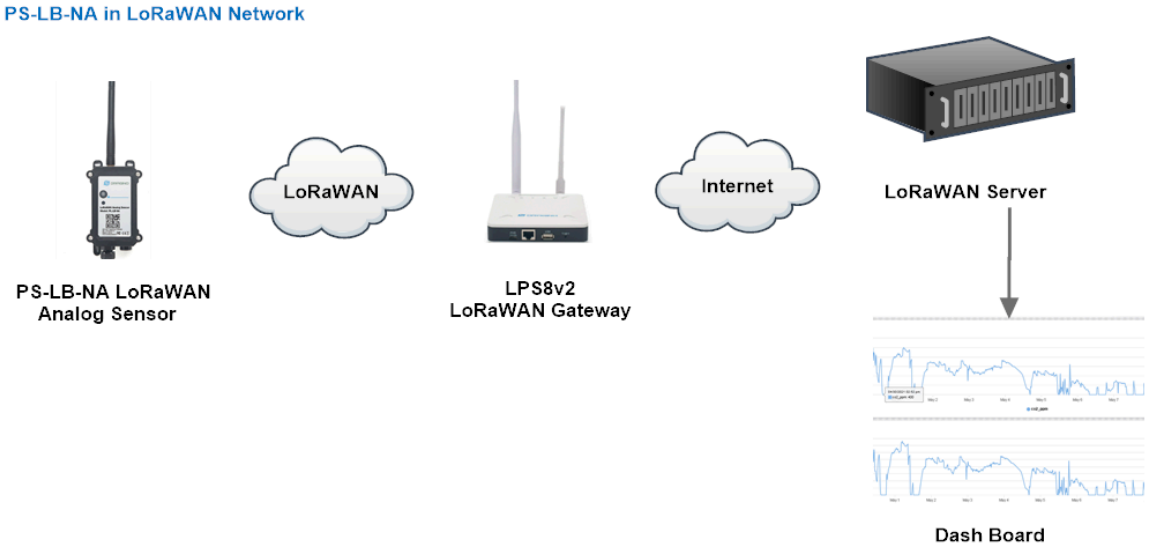
The Dragino PS-LB-NA is a **LoRaWAN Analog Sensor** for Internet of Things solution. PS-LB-NA has 5v and 12v output , 4~20mA, 0~30v input interface to power and get value from Analog Sensor. PS-LB-NA will convert the Analog Value to LoRaWAN wireless data and send to IoT platform via LoRaWAN gateway.

The LoRa wireless technology used in PS-LB-NA 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.

PS-LB-NA **supports BLE configure** and **wireless OTA update** which make user easy to use.

PS-LB-NA is powered by **8500mAh Li-SOCl2 battery**, it is designed for long term use up to 5 years.

Each PS-LB-NA 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.



1.2 Features

- LoRaWAN 1.0.3 Class A
- Ultra-low power consumption
- 1 x 0~20mA input , 1 x 0~30v input
- 5v and 12v output to power external sensor
- Monitor Battery Level
- Bands: CN470/EU433/KR920/US915/EU868/AS923/AU915/IN865
- Support Bluetooth v5.1 and LoRaWAN remote configure
- Support wireless OTA update firmware
- Uplink on periodically
- Downlink to change configure
- 8500mAh Battery for long term use

1.3 Specification

Micro Controller:

- MCU: 48Mhz ARM
- Flash: 256KB
- RAM: 64KB

Common DC Characteristics:

- Supply Voltage: 2.5v ~ 3.6v
- Operating Temperature: -40 ~ 85°C

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

Current Input (DC) Measuring :

- Range: 0 ~ 20mA
- Accuracy: 0.02mA
- Resolution: 0.001mA

Voltage Input Measuring:

- Range: 0 ~ 30v
- Accuracy: 0.02v
- Resolution: 0.001v

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 Supported Extenal Sensors

PS-LB-NA can be used to power and connect to traditional industrial sensors and convert the sensor output signal to LoRaWAN signal. Below are some examples field as reference:

- **Pressure Sensor**: level sensors, level probes and pressure transmitters.
- **Flow**: flow of gases, liquids, or sludges.
- **Level**:
- **Temperature/ Humidity**: temperature probes, such as RTD temperature probes, thermocouples.
- **Liquid analysis**: pH values, redox potential, electrolytic conductivity, ammonia, dissolved oxygen, turbidity, chlorine, and much more

Key point for external sensor:

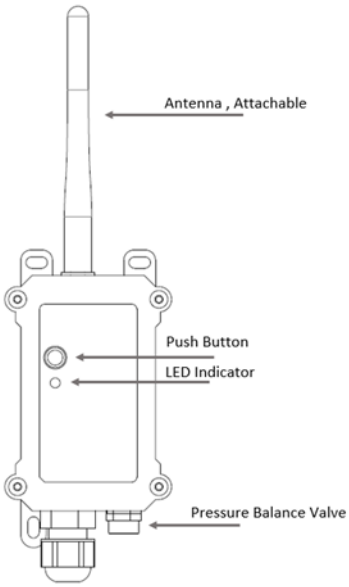
- Can be powered by 5v or 12v. Require Current < 1A.
- Sensor has output within range: 4~20mA or 0~30v.
- Sensor will be power off and power on after deployment. and After power on, it can provide valid output within several seconds.

1.5 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.

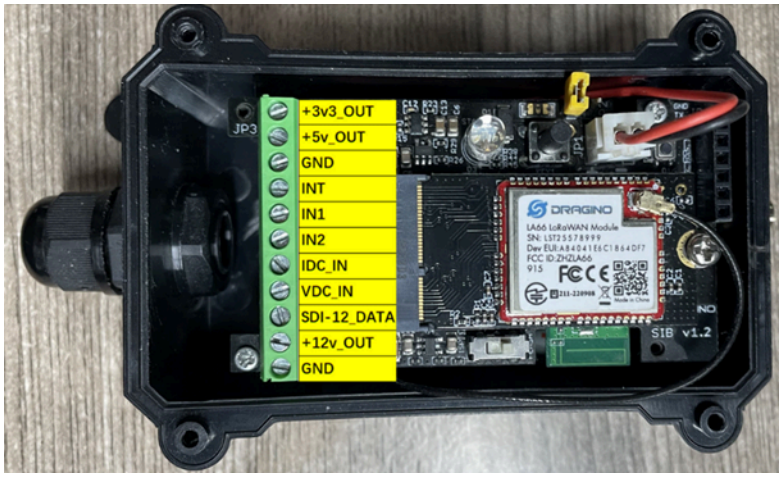
Working Mode: In this mode, Sensor will work as LoRaWAN Sensor to Join LoRaWAN network and send out sensor data to server. Between each sampling/tx/rx periodically, sensor will be in IDLE mode), in IDLE mode, sensor has the same power consumption as Deep Sleep mode.

1.6 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 PS-LB-NA is in Deep Sleep Mode.

1.7 Pin Mapping



- **+3v3_OUT**: Controllable 3.3v output, Actually voltage level same as Battery, 2.6v ~ 3.6v
- **+5v_OUT**: Controllable 5.0v output
- **GND**: GND
- **INT**: Interrupt Pin
- **IN1 & IN2**: Digital IN1 and Digital IN2
- **IDC_IN**: 4~20mA current input pin
- **VDC_IN**: 0~30v sensor voltage input pin
- **SDI-12_DATA**: No used
- **+12v_OUT**: Controllable 12v output
- **GND**: GND

1.8 BLE connection

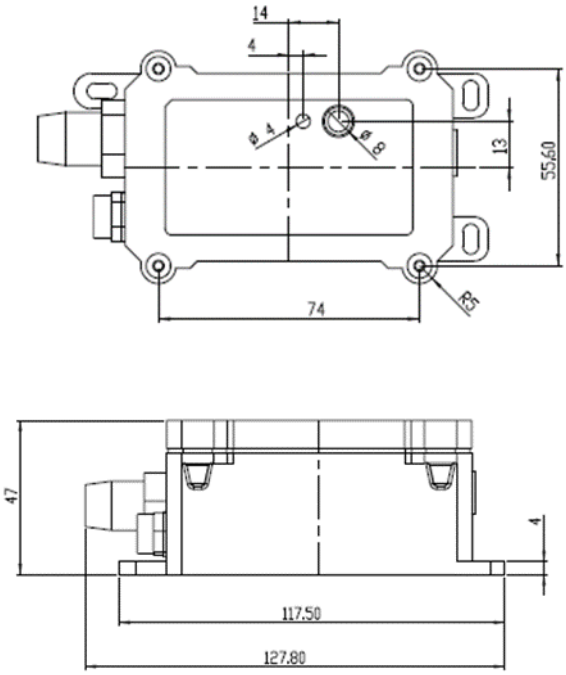
PS-LB-NA support BLE remote configure.

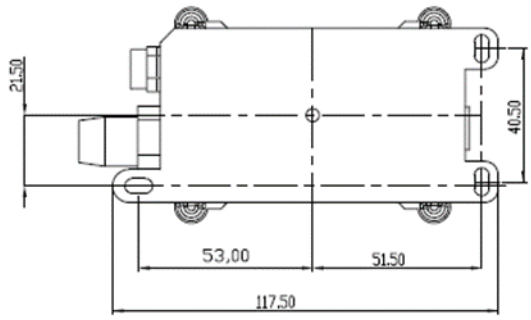
BLE can be used to configure the parameter of sensor or see the console output from sensor. BLE will be only activate on below case:

- 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 Mechanical





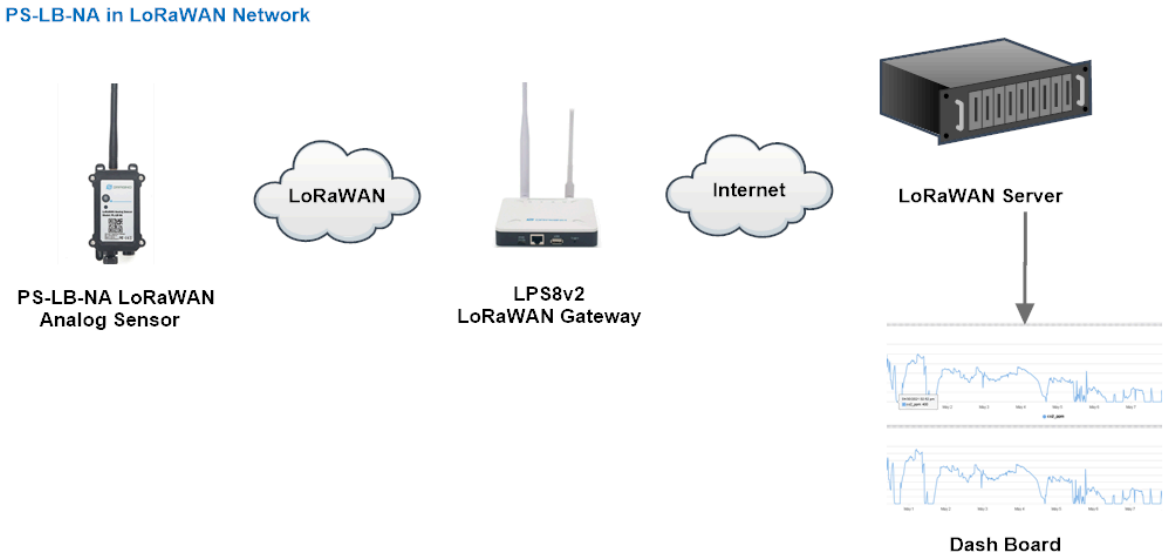
2. Configure PS-LB-NA to connect to LoRaWAN network

2.1 How it works

The PS-LB-NA 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 activate the PS-LB-NA. 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)

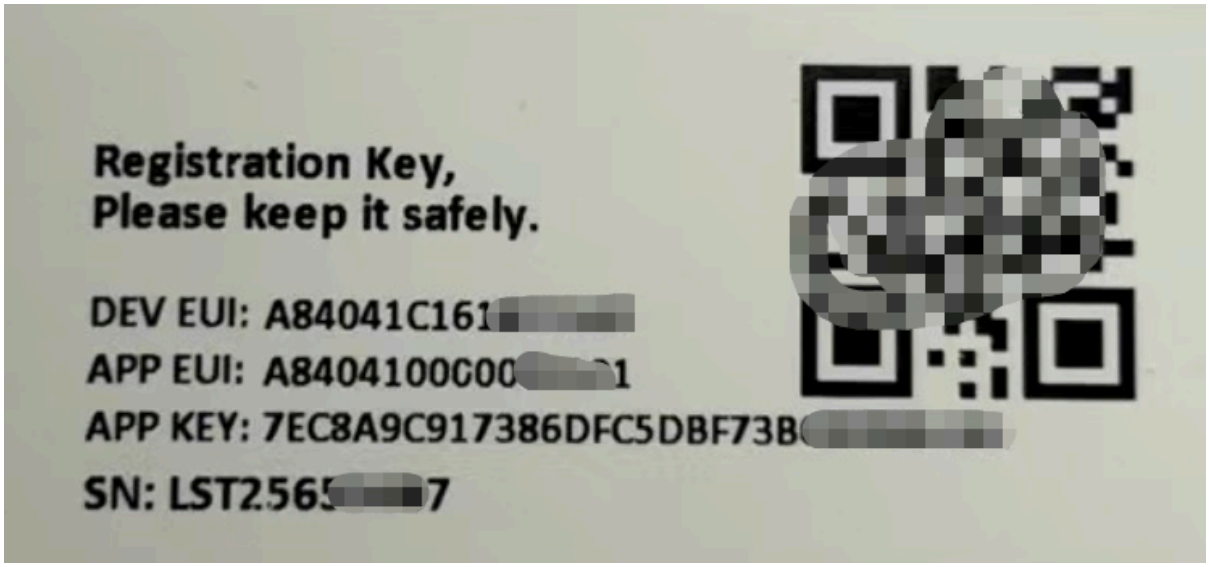
Following is an example for how to join the TTN v3 LoRaWAN Network. Below is the network structure; we use the LPS8v2 as a LoRaWAN gateway in this example.



The LPS8V2 is already set to connected to TTN network , so what we need to now is configure the TTN server.

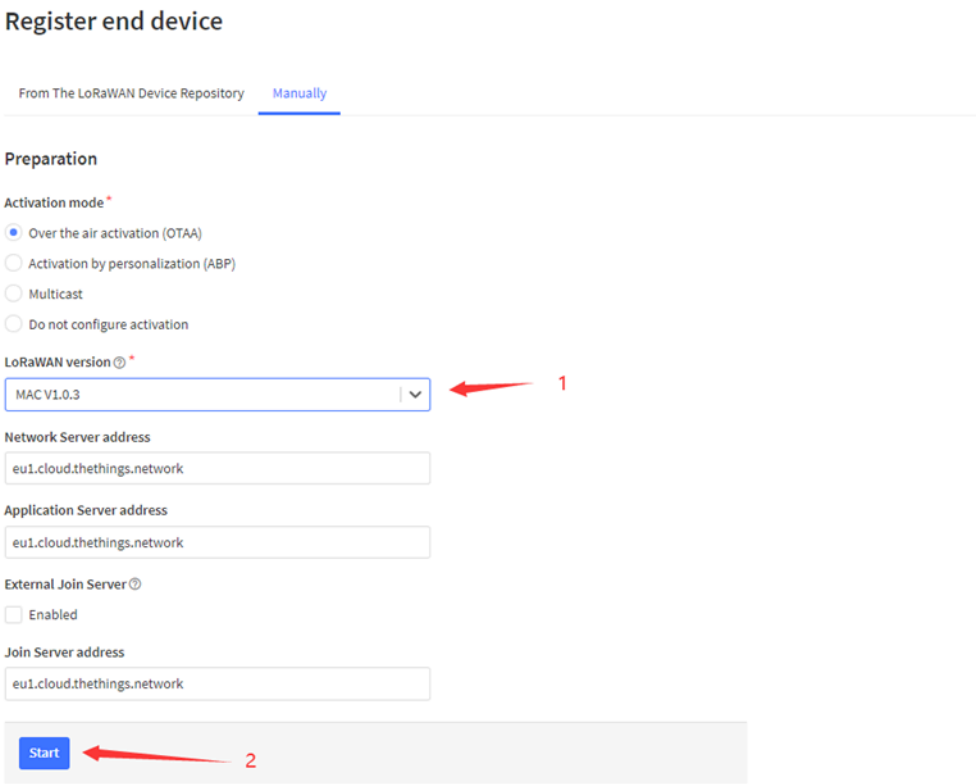
Step 1: Create a device in TTN with the OTAA keys from PS-LB-NA.

Each PS-LB-NA is shipped with a sticker with the default device EUI as below:

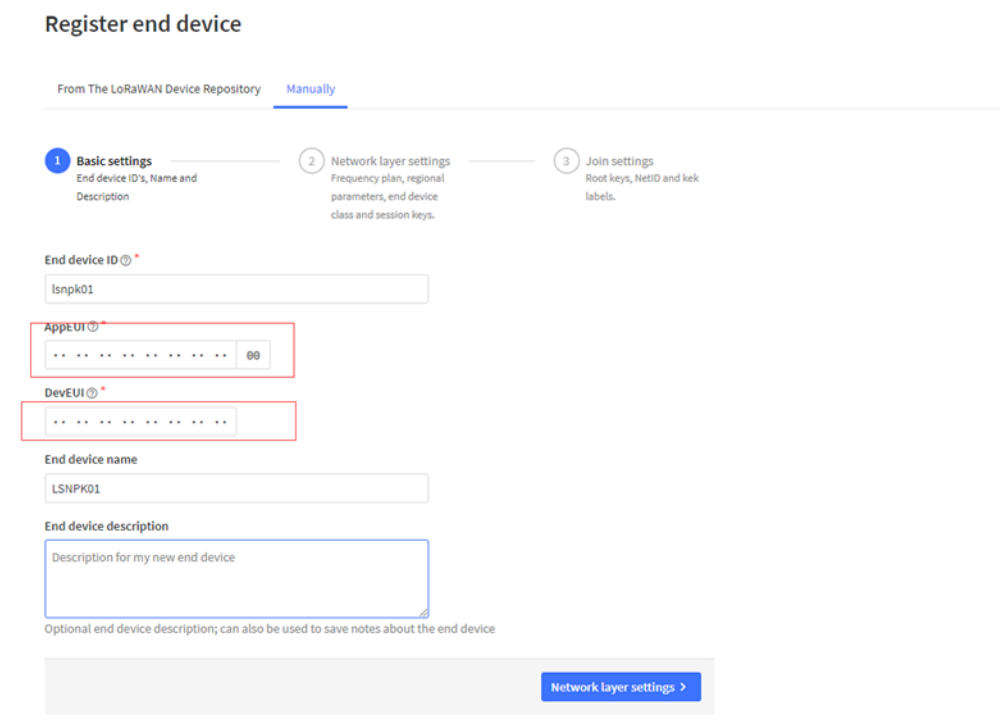


You can enter this key in the LoRaWAN Server portal. Below is TTN screen shot:

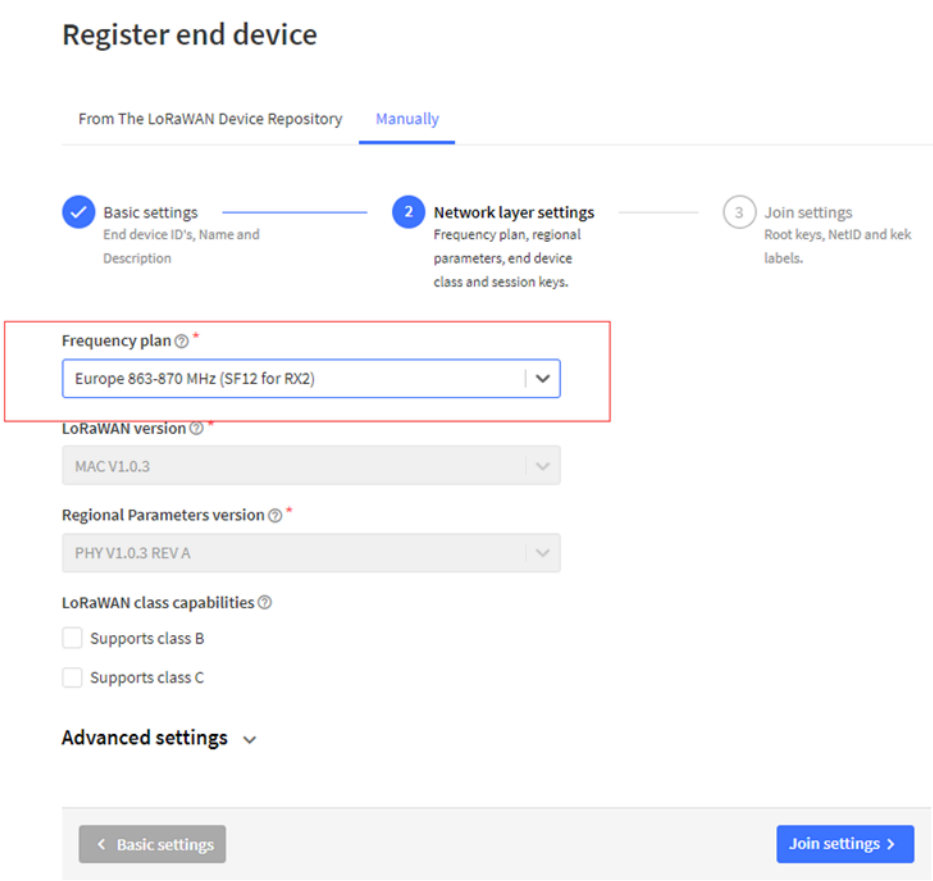
Register the device



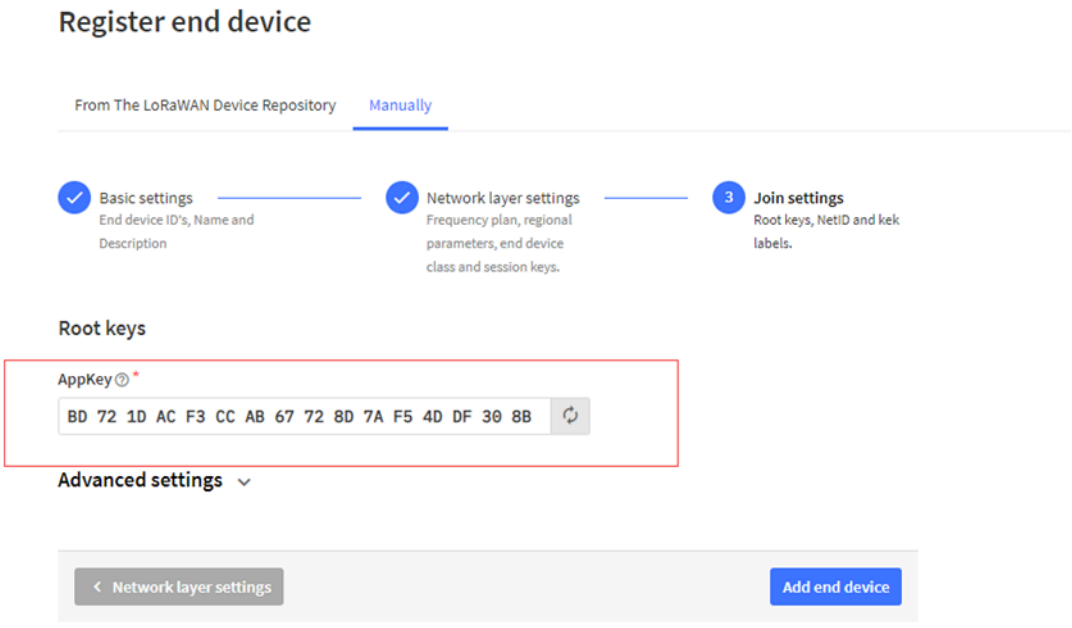
Add APP EUI and DEV EUI



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


Register end device
From The LoRaWAN Device Repository
Manually
Basic settings
End device ID's, Name and Description
Network layer settings
Frequency plan, regional parameters, end device class and session keys.
3
Join settings
Root keys, NetID and kek labels.
Root keys
AppKey *
BD 72 1D AC F3 CC AB 67 72 8D 7A F5 4D DF 30 8B
Advanced settings
Network layer settings
Add end device

Step 2: Activate on PS-LB-NA

Press the button for 5 seconds to activate the PS-LB-NA.

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

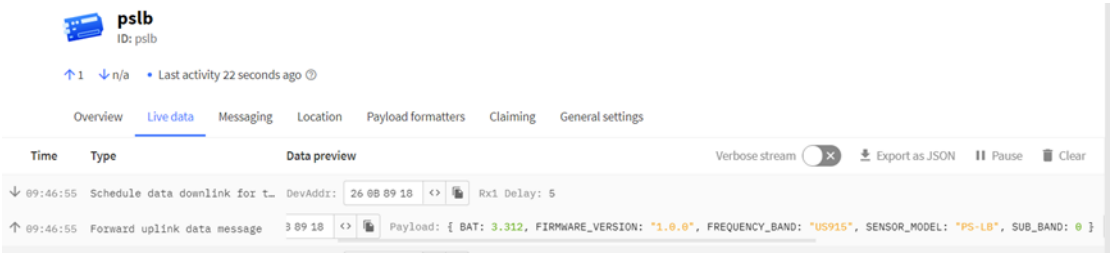
2.3.1 Device Status, FPORT=5

Include device configure status. Once PS-LB-NA Joined the network, it will uplink this message to the server.

Users can also use the downlink command(0x26 01) to ask PS-LB-NA to resend this uplink.

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

Example parse in TTNv3



Sensor Model: For PS-LB-NA, this value is 0x16

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 value, FPORT=2

Uplink payload includes in total 9 bytes.

Size(bytes)	2	2	2	2	1
Value	BAT	Probe Model	0 ~ 20mA value	0 ~ 30v value	IN1 &IN2 Interrupt_flag

2.3.3 Battery Info

Check the battery voltage for PS-LB-NA.

Ex1: 0x0B45 = 2885mV

Ex2: 0x0B49 = 2889mV

2.3.4 Probe Model

PS-LB-NA might connect to different kind of probes, 4~20mA represent the full scale of the measuring range. So a 12mA output means different meaning for different probe.

For example.

Probe Type	4~20mA scale for this probe	Example: 12mA actually meaning for this probe
PH Combination Electrodes	0 ~ 14 pH	PH Value: 7
Water Pressure Sensor	0~5 meters	2.5 meters pure water
Pressure transmitter probe	0~1MPa	0.5MPa air / gas or water pressure

User can set different probe model for above probes. So IoT server is able to se identical how it should parse the 4~20mA or 0~30v sensor value and get the correct value.

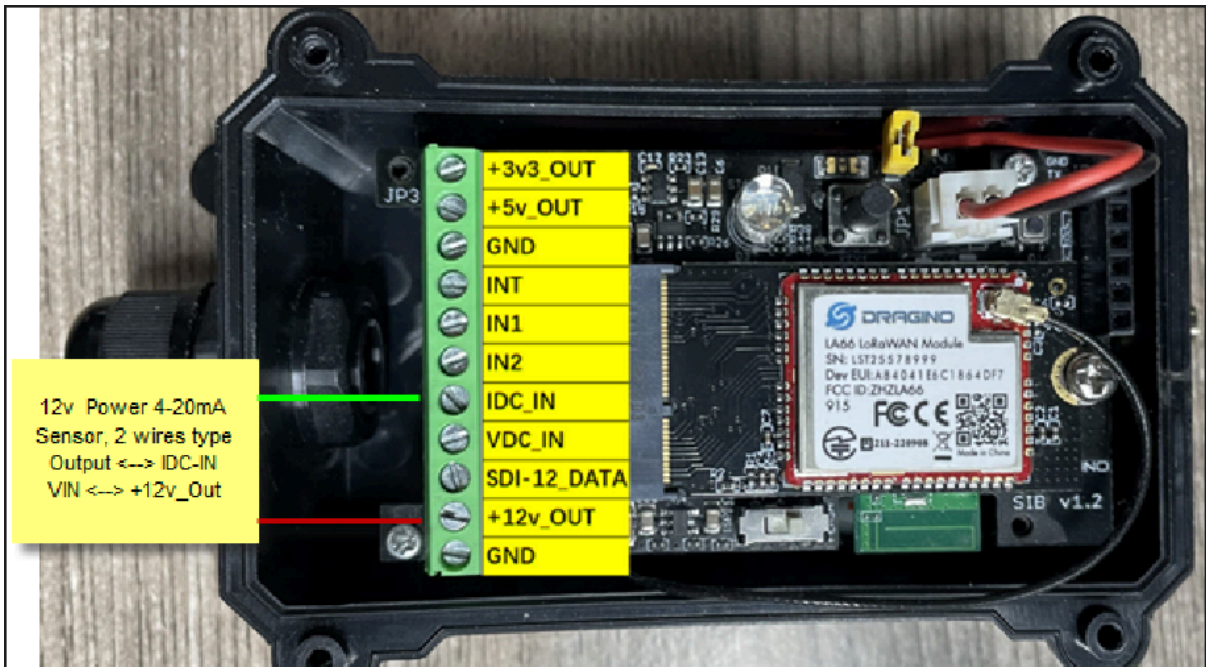
2.3.5 0~20mA value (IDC_IN)

Payload Example:

27AE(H) = 10158 (D)/1000 = 10.158mA.

4~20mA Sensor Type	Connectin to PS-LB-NA
2-wire Type	VCC (12v) <--> +12v_OUT OUT <--> IDC-IN
3-wrie Type	VCC (12v) <--> +12v_OUT OUT <--> IDC-IN GND <--> GND

Connect to a 2 wire 4~20mA sensor.



2.3.6 0~30V value (pin VDC_IN)

Measure the voltage value. The range is 0 to 30V.

Example:

138E(H) = 5006(D)/1000= 5.006V

2.3.7 IN1&IN2&INT pin(GPIO_EXTI)

IN1 and IN2 are digital level inputs, INT(GPIO_EXTI) is interrupt pin, and their maximum input voltage is 3.6V.

IN1 and IN2 are used as digital input pins.

Example:

09 (H): (0x09&0x08)>>3=1 IN1 pin is high level.

09 (H): (0x09&0x04)>>2=0 IN2 pin is low level.

For motherboards older than SIB V1.2, the interrupt pin name is "INT", and for motherboards older than SIB V1.3, the interrupt pin name is "GPIO_EXTI."

This data field shows if this packet is generated by **Interrupt Pin** or not. Click here for the hardware and software set up.

Example:

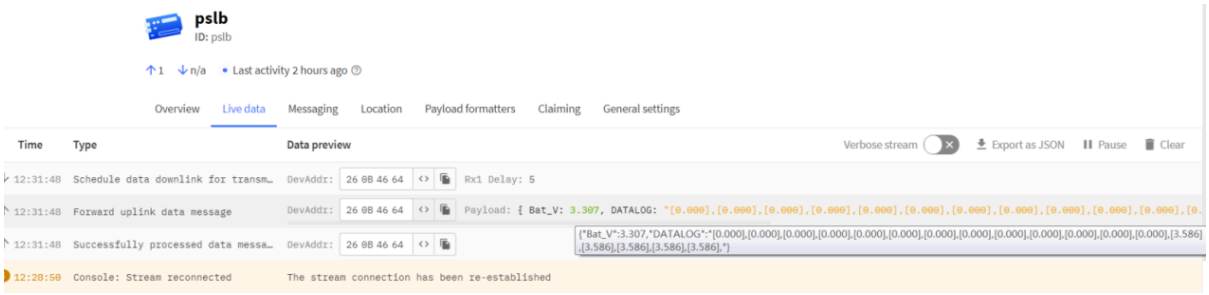
09 (H): (0x09&0x02)>>1=1 The level of the interrupt pin.

09 (H): 0x09&0x01=1 0x00: Normal uplink packet.

0x01: Interrupt Uplink Packet.

2.3.8 Sensor value, FPORT=7

Size(bytes)	2	n
Value	BAT	Voltage value, each 2 bytes is a set of voltage values.

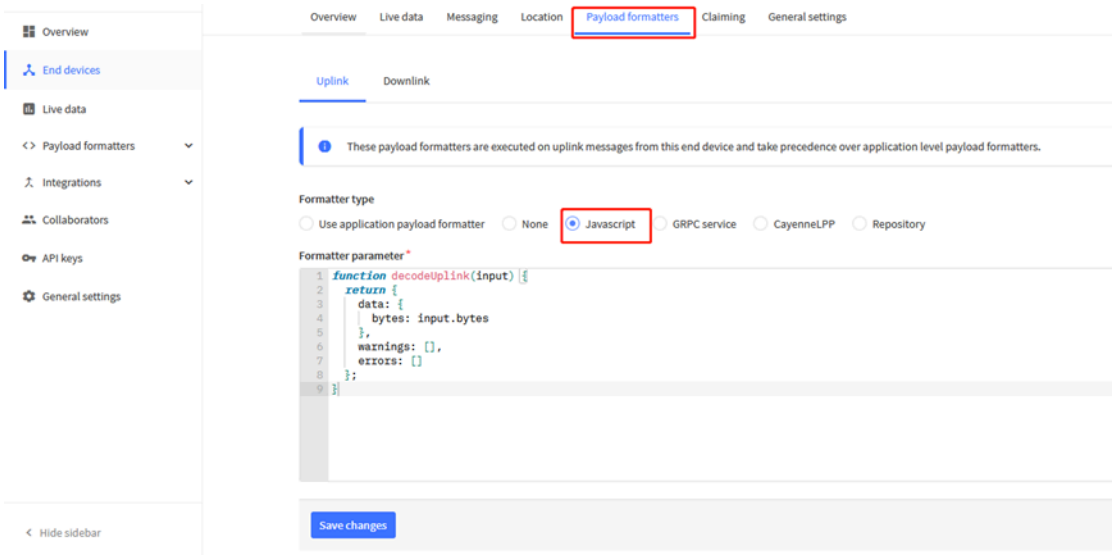


Multiple sets of data collected are displayed in this `form`:

[voltage value1], [voltage value2], [voltage value3],...[voltage value n/2]

2.3.9 Decode payload in The Things Network

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



PS-LB-NA TTN Payload Decoder: https://github.com/dragino/dragino-end-node-decoder

2.4 Uplink Interval

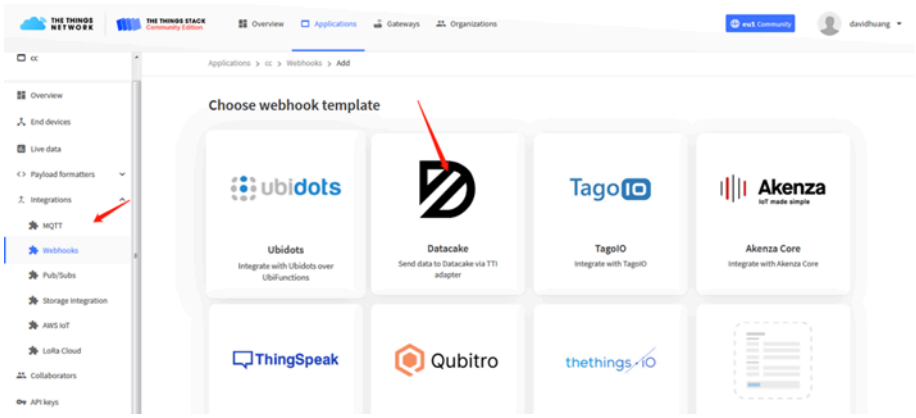
The PS-LB-NA by default uplink the sensor data every 20 minutes. User can change this interval by AT Command or LoRaWAN Downlink Command. See this link: http://wiki.dragino.com/xwiki/bin/view/Main/End%20Device%20AT%20Commands%20and%20Downlink%20Command/#H4.1ChangeUplinkInterval

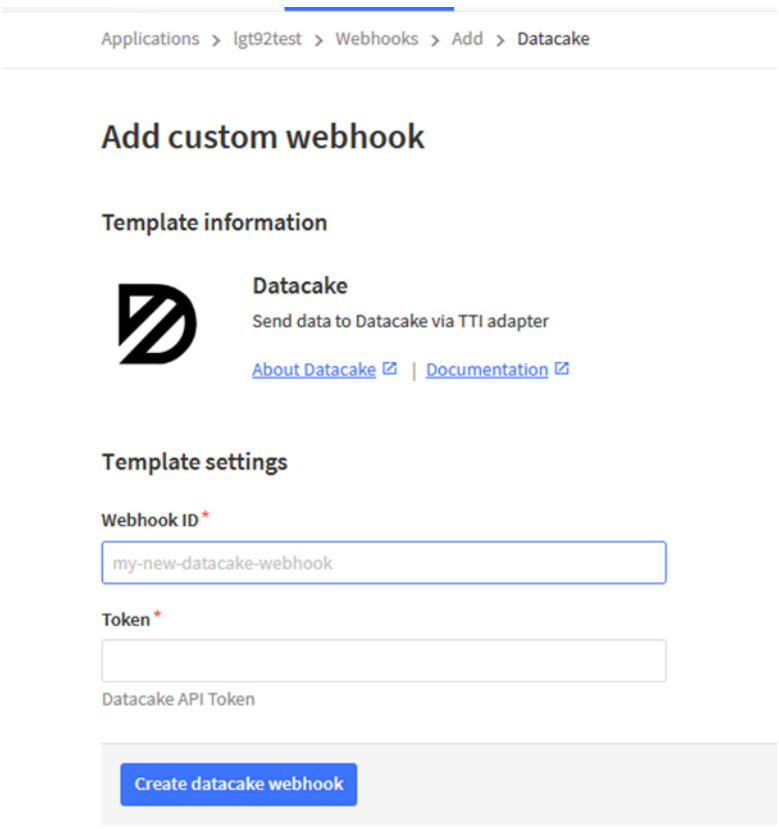
2.5 Show Data in DataCake IoT Server

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.

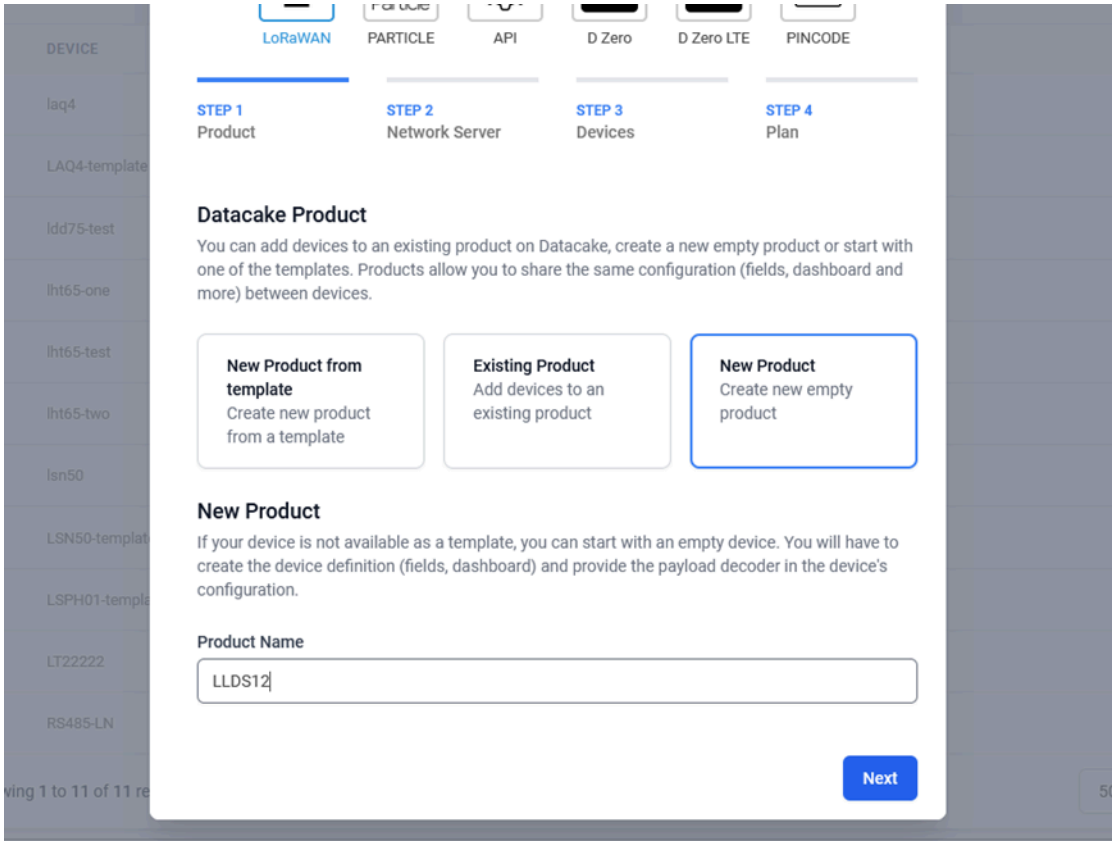
Step 2: To configure the Application to forward data to DATACAKE you will need to add integration. To add the DATACAKE integration, perform the following steps:

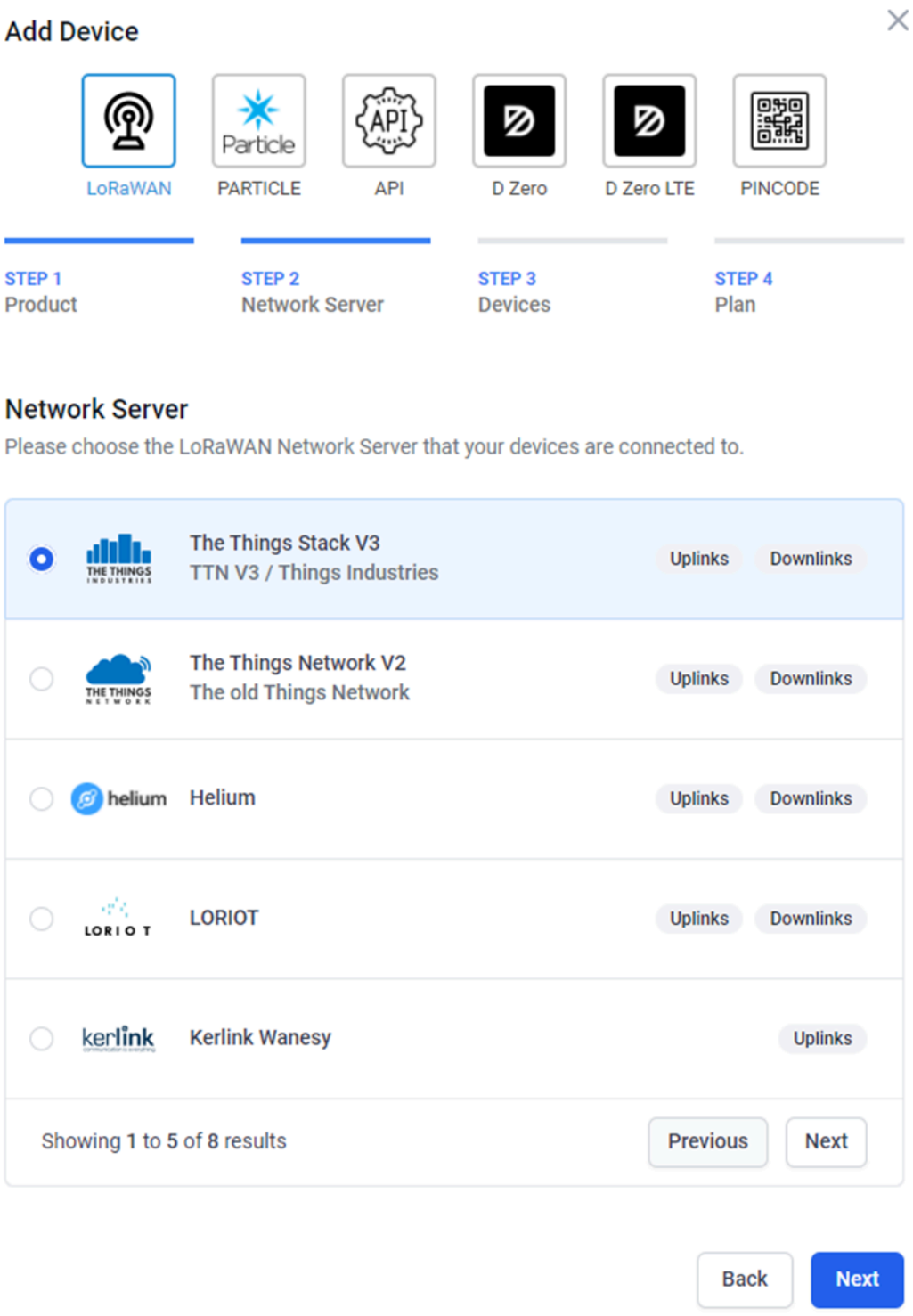


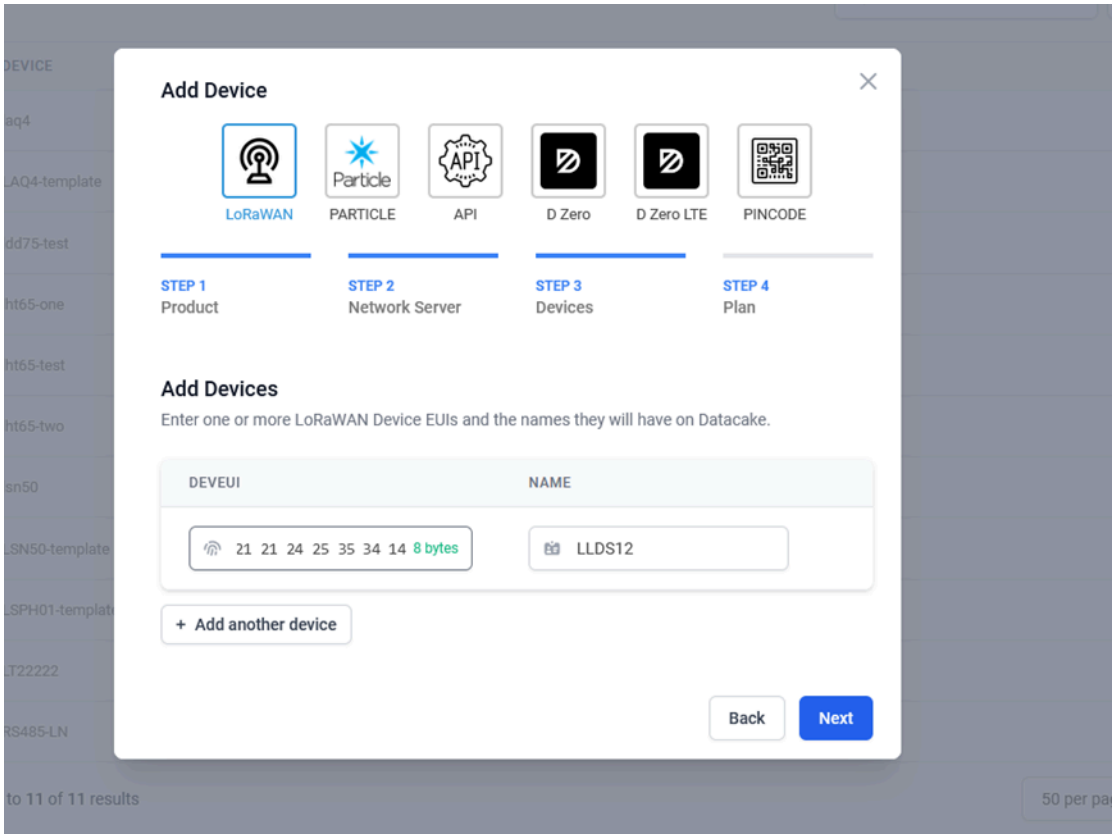


Step 3: Create an account or log in Datacake.

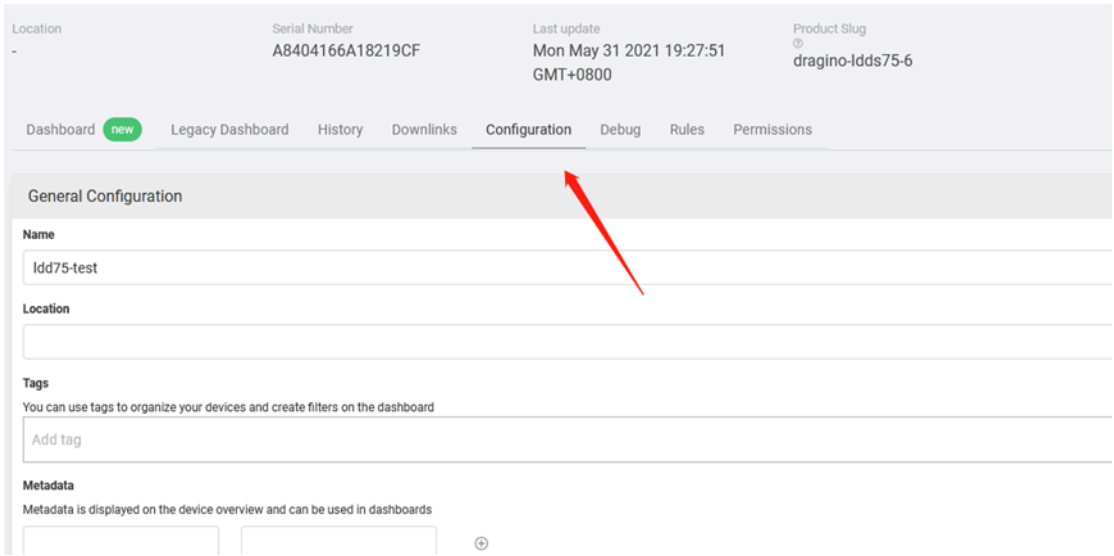
Step 4: Create PS-LB-NA product.

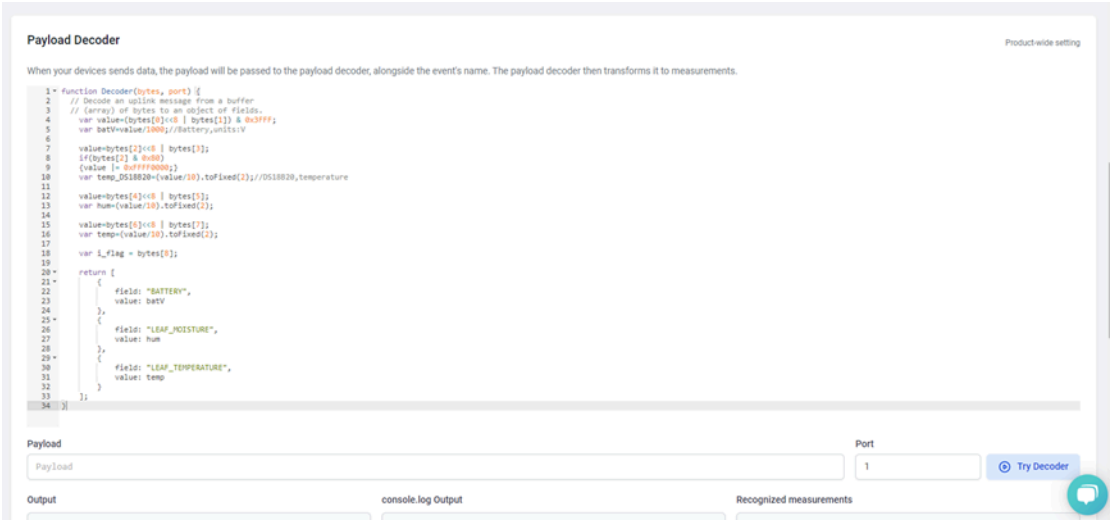

LoRaWAN
PARTICLE
API
D Zero
D Zero LTE
PINCODE
STEP 1
Product
STEP 2
Network Server
STEP 3
Devices
STEP 4
Plan
Datacake Product
You can add devices to an existing product on Datacake, create a new empty product or start with one of the templates. Products allow you to share the same configuration (fields, dashboard and more) between devices.
New Product from template
Create new product from a template
Existing Product
Add devices to an existing product
New Product
Create new empty product
New Product
If your device is not available as a template, you can start with an empty device. You will have to create the device definition (fields, dashboard) and provide the payload decoder in the device's configuration.
Product Name
LLDS12
Next


Add Device
LoRaWAN
PARTICLE
API
D Zero
D Zero LTE
PINCODE
STEP 1
Product
STEP 2
Network Server
STEP 3
Devices
STEP 4
Plan
Network Server
Please choose the LoRaWAN Network Server that your devices are connected to.
The Things Stack V3
TTN V3 / Things Industries
Uplinks
Downlinks
The Things Network V2
The old Things Network
Uplinks
Downlinks
Helium
Uplinks
Downlinks
LORIOT
Uplinks
Downlinks
Kerlink Wanesy
Uplinks
Showing 1 to 5 of 8 results
Previous
Next
Back
Next

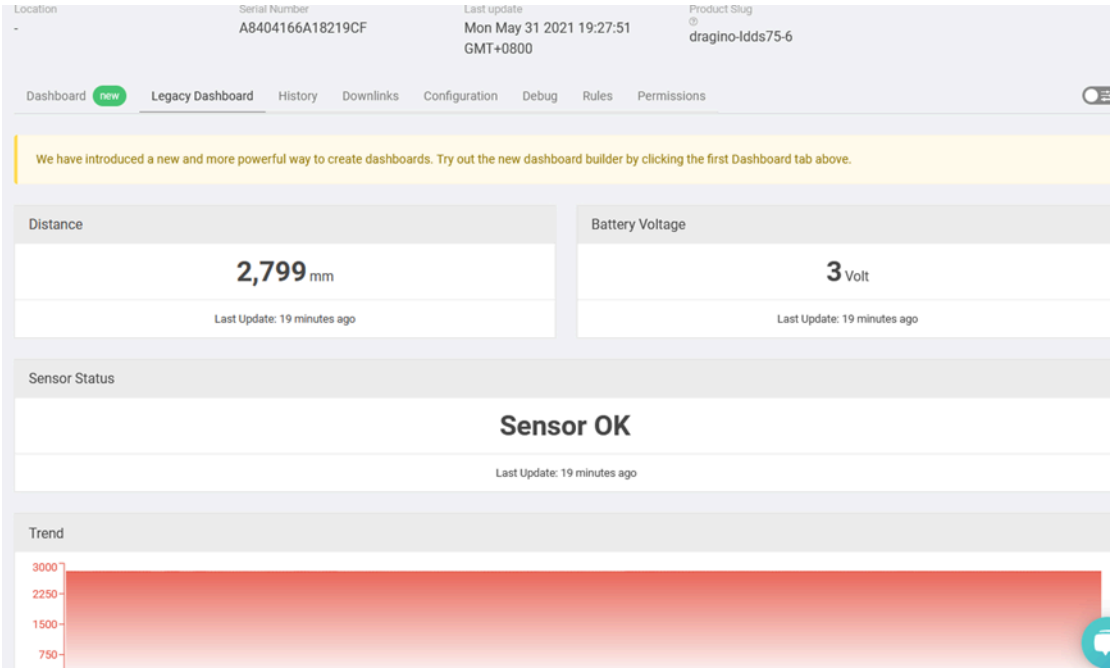


Step 5: add payload decode





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



2.6 Frequency Plans

The PS-LB-NA 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/

2.7 Datalog Feature (Since V1.1)

When a user wants to retrieve sensor value, he can send a poll command from the IoT platform to ask the sensor to send value in the required time slot.

2.7.1 Unix TimeStamp

PS-LB-NA 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

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

Below is the converter example:

2.7.2 Set Device Time

There are two ways to set the device's time:

1. Through LoRaWAN MAC Command (Default settings)

Users need to set SYNCMOD=1 to enable sync time via the MAC command.

Once PS-LB Joined the LoRaWAN network, it will send the MAC command (DeviceTimeReq) and the server will reply with (DeviceTimeAns) to send the current time to CPL01. If CPL01 fails to get the time from the server, PS-LB will use the internal time and wait for the next time request [via Device Status (FPORT=5)].

Note: LoRaWAN Server needs to support LoRaWAN v1.0.3(MAC v1.0.3) or higher to support this MAC command feature.

2. Manually Set Time

Users need to set SYNCMOD=0 to manual time, otherwise, the user set time will be overwritten by the time set by the server.

2.7.3 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 31 67653A43 67658093 05

Is to check 2024/12/20 09:34:59 to 2024/12/20 14:34:59's data

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

2.7.4 Datalog Uplink payload (FPORT=3)

The Datalog uplinks will use below payload format.

Retrieval data payload:

Size(bytes)	2	2	2	1	4
Value	Probe_mod	VDC_intput_V	IDC_intput_mA	IN1_pin_level& IN2_pin_level& Exti_pin_level&Exti_status	Unix Time Stamp

IN1_pin_level & IN2_pin_level & Exti_pin_level & Exti_status:

Bits	[4:7]	3	2	1	0
mean	Reserved	IN1_pin _level	IN2_pin _level	Exti_pin _level	Exti_status

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 PS-LB-NA has below data inside Flash:

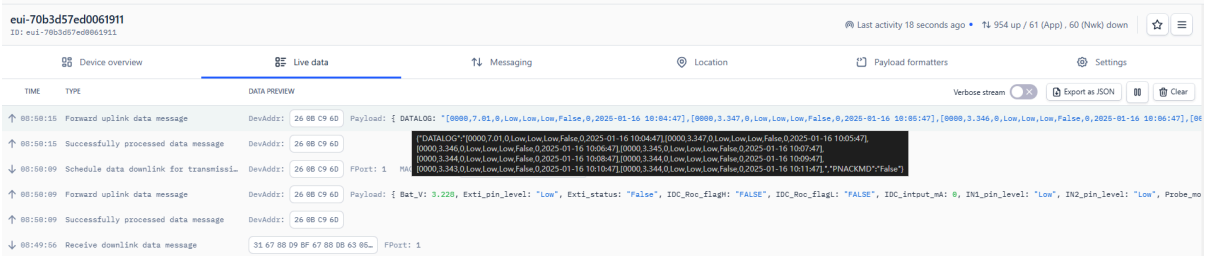
```
Stop Tx events when read sensor data
8031000 2025/1/16 10:04:47 3240 in1:low in2:low exti:low status:false vdc:7.010 idc:0.000 proble:0000
water_deep:0.000

8031010 2025/1/16 10:05:47 3246 in1:low in2:low exti:low status:false vdc:3.347 idc:0.000 proble:0000
water_deep:0.000
8031020 2025/1/16 10:06:47 3240 in1:low in2:low exti:low status:false vdc:3.346 idc:0.000 proble:0000
water_deep:0.000
8031030 2025/1/16 10:07:47 3240 in1:low in2:low exti:low status:false vdc:3.345 idc:0.000 proble:0000
water_deep:0.000
8031040 2025/1/16 10:08:47 3240 in1:low in2:low exti:low status:false vdc:3.344 idc:0.000 proble:0000
water_deep:0.000
8031050 2025/1/16 10:09:47 3240 in1:low in2:low exti:low status:false vdc:3.344 idc:0.000 proble:0000
water_deep:0.000

8031060 2025/1/16 10:10:47 3240 in1:low in2:low exti:low status:false vdc:3.343 idc:0.000 proble:0000
water_deep:0.000

8031070 2025/1/16 10:11:47 3240 in1:low in2:low exti:low status:false vdc:3344.000 idc:0.000 proble:
0000 water_deep:0.000
Start Tx events

OK
```

If user sends below downlink command: 316788D9BF6788DB6305

Where : Start time: 6788D9BF = time 25/1/16 10:04:47

Stop time: 6788DB63 = time 25/1/16 10:11:47

PA-LB-NA will uplink this payload.



00001B620000406788D9BF 00000D130000406788D9FB 00000D120000406788DA37
00000D110000406788DA73 00000D100000406788DAAF 00000D100000406788DAEB
00000D0F0000406788DB27 00000D100000406788DB63

Where the first 11 bytes is for the first entry :

0000 0D10 0000 40 6788DB63

Probe_mod = 0x0000 = 0000

VDC_intput_V = 0x0D10/1000=3.344V

IDC_intput_mA = 0x0000/1000=0mA

IN1_pin_level = (0x40& 0x08)? "High":"Low" = 0(Low)

IN2_pin_level = (0x40& 0x04)? "High":"Low" = 0(Low)

Exti_pin_level = (0x40& 0x02)? "High":"Low" = 0(Low)

Exti_status = (0x40& 0x01)? "True":"False" = 0(False)

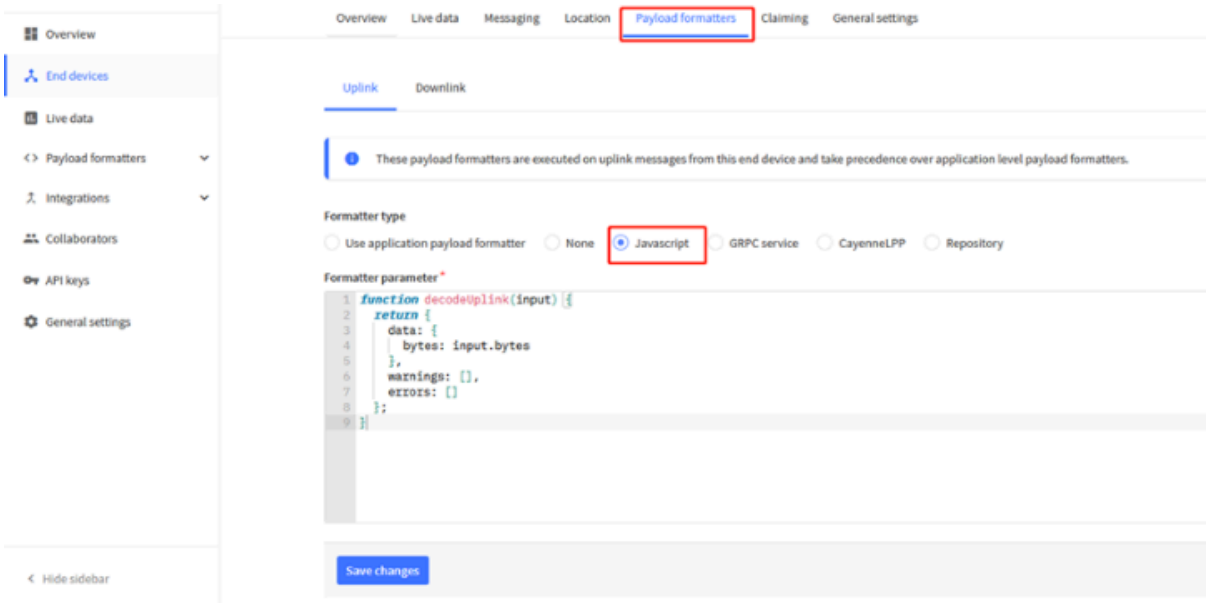
Unix time is 0x6788DB63 = 1737022307s = 2025/1/16 10:11:47

Its data format is:

[Probe_mod, VDC_intput_V, IDC_intput_mA, IN1_pin_level, IN2_pin_level, Exti_pin_level, water_deep, Data_time],[Probe_mod, VDC_intput_V, IDC_intput_mA, IN1_pin_level, IN2_pin_level, Exti_pin_level, water_deep, Data_time],...

Note: water_deep in the data needs to be converted using decoding to get it.

2.7.5 Decoder in TTN V3



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

2.8 Report on Change Feature (Since firmware V1.2)

2.8.1 Uplink payload(Enable ROC)

Used to Monitor the IDC and VDC increments, and send ROC uplink when the IDC or VDC changes exceed.

With ROC enabled, the payload is as follows:

Size(bytes)	2	1	2	2	1
Value	BAT	Probe Model	0 ~ 20mA value	0 ~ 30v value	IN1 & IN2 Interrupt flag & ROC_flag

IN1 &IN2 , Interrupt flag , ROC_flag:

Size(bit)	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Value	IDC_Roc_flagL	IDC_Roc_flagH	VDC_Roc_flagL	VDC_Roc_flagH	IN1_pin_level	IN2_pin_level	Exti_pin_level	Exti_status

- **IDC_Roc_flagL**

80 (H): (0x80&0x80)=80(H)=**1**000 0000(B) bit7=1, "TRUE", This uplink is triggered when the decrease in the IDC compared to the last ROC refresh exceeds the set threshold.

60 (H): (0x60&0x80)=0 bit7=0, "FALSE", This uplink is not triggered when the decrease in the IDC compared to the last ROC refresh does not exceeds the set threshold.

- **IDC_Roc_flagH**

60 (H): (0x60&0x40)=40(H)=0**1**000 0000(B) bit6=1, "TRUE", This uplink is triggered when the increase in the value of the IDC compared to the last ROC refresh exceeds the set threshold.

80 (H): (0x80&0x40)=0 bit6=0, "FALSE", This uplink is not triggered when the increase in the value of the IDC compared to the last ROC refresh does not exceeds the set threshold.

- **VDC_Roc_flagL**

20 (H): (0x20&0x20)=20(H)=00**1**0 0000(B) bit5=1, "TRUE", This uplink is triggered when the decrease in the VDC compared to the last ROC refresh exceeds the set threshold.

90 (H): (0x90&0x20)=0 bit5=0, "FALSE", This uplink is not triggered when the decrease in the VDC compared to the last ROC refresh does not exceeds the set threshold.

- **VDC_Roc_flagH**

90 (H): (0x90&0x10)=10(H)=000**1** 0000(B) bit4=1, "TRUE", This uplink is triggered when the increase in the value of the VDC compared to the last ROC refresh exceeds the set threshold.

20 (H): (0x20&0x10)=0 bit4=0, "FALSE", This uplink is not triggered when the increase in the value of the VDC compared to the last ROC refresh does not exceeds the set threshold.

- **IN1_pin_level & IN2_pin_level**

IN1 and IN2 are used as digital input pins.

80 (H): (0x80&0x08)=0 IN1 pin is low level.

80 (H): (0x80&0x04)=0 IN2 pin is low level.

- **Exti_pin_level &Exti_status**

This data field shows whether the packet is generated by an interrupt pin.

Note: The Internet pin of the old motherboard is a separate pin in the screw terminal, and the interrupt pin of the new motherboard(SIB V1.3) is the **GPIO_EXTI** pin.

Exti_pin_level: 80 (H): (0x80&0x02)=0 "low", The level of the interrupt pin.

Exti_status: 80 (H): (0x80&0x01)=0 "False", Normal uplink packet.

2.8.2 Set the Report on Change

Feature: Get or Set the Report on Change.

2.8.2.1 Wave alarm mode

Feature: By setting the detection period and a change value, the IDC/VDC variable is monitored whether it exceeds the set change value. If this change value is exceeded, the ROC uplink is sent and the comparison value is flushed.

- **Change value:** The amount by which the next detection value increases/decreases relative to the previous detection value.
- **Comparison value:** A parameter to compare with the latest ROC test.

AT Command: AT+ROC

Command Example	Parameters	Response/Explanation
AT+ROC=?	Show current ROC setting	0,0,0,0(default) OK
AT+ROC=a,b,c,d	**a**: Enable or disable the ROC	**0:** off **1:** Turn on the wave alarm mode, send the ROC uplink when the increment exceeds the set parameter and refresh the comparison value. **2:** Turn on the wave alarm mode, send the ROC uplink when the increment exceeds the set parameter and refresh the comparison value. In addition, the comparison value is refreshed when the device sends packets (TDC or ACT).
	b: Set the detection interval	Range: 0~65535s
	c: Setting the IDC change value	Unit: uA
	d: Setting the VDC change value	Unit: mV

Example:

- AT+ROC=0,0,0,0 // The ROC function is not used.
- AT+ROC=1,60,3000, 500 // Check value every 60 seconds. If there is change in IDC (>3mA) or VDC (>500mV), sends an ROC uplink, and the comparison value is refreshed.
- AT+ROC=1,60,3000,0 // Check value every 60 seconds. If there is change in IDC (>3mA), send an ROC uplink and the comparison value of IDC is refreshed. dd=0 Means doesn't monitor Voltage.
- AT+ROC=2,60,3000,0 // Check value every 60 seconds. If there is change in IDC (>3mA), send an ROC uplink and the comparison value of IDC is refreshed. dd=0 Means doesn't monitor Voltage. In addition, if the change in the IDC does not exceed 3mA, then the ROC uplink is not sent, and the comparison value is not refreshed by the ROC uplink packet. However, if the device TDC time arrives, or if the user manually sends packets, then the IDC comparison value is also refreshed.

Downlink Command: 0x09 aa bb cc dd

Format: Function code (0x09) followed by 4 bytes.

aa: 1 byte; Set the wave alarm mode.

bb: 2 bytes; Set the detection interval. (second)

cc: 2 bytes; Setting the IDC change threshold. (uA)

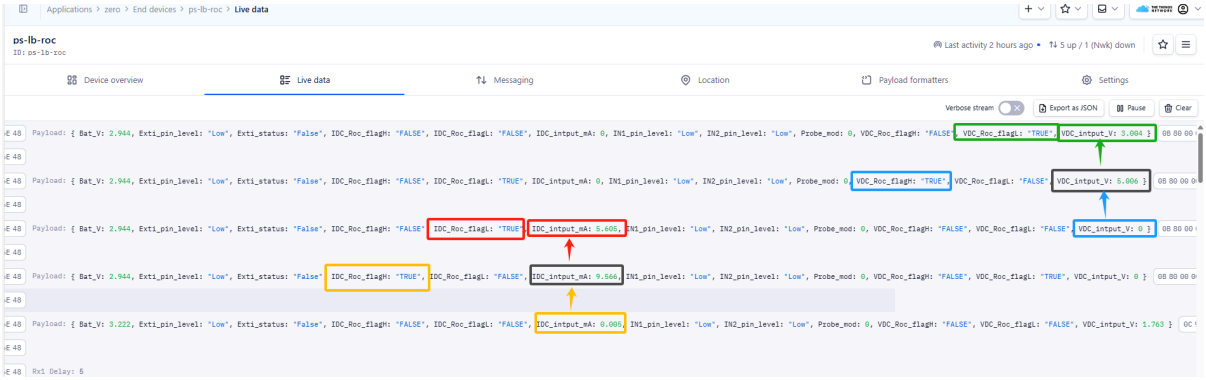
dd: 2 bytes; Setting the VDC change threshold. (mV)

Example:

- Downlink Payload: **09 01 00 3C 0B B8 01 F4** // Equal to AT+ROC=1,60,3000, 500
- Downlink Payload: **09 01 00 3C 0B B8 00 00** // Equal to AT+ROC=1,60,3000,0
- Downlink Payload: **09 02 00 3C 0B B8 00 00** // Equal to AT+ROC=2,60,3000,0

Screenshot of parsing example in TTN:

- AT+ROC=1,60,3000, 500.



2.8.2.2 Over-threshold alarm mode

Feature: Monitors whether the IDC/VDC exceeds the threshold by setting the detection period and threshold. Alarm if the threshold is exceeded.

AT Command: AT+ROC=3,a,b,c,d,e

Command Example	Parameters	Response/Explanation
AT+ROC=?	Show current ROC setting	0,0,0,0(default) OK
AT+ROC=**3**,a,b,c,d,e	**a:** Set the detection interval	Range: 0~65535s
	b: Set the IDC alarm trigger condition	**0:** Less than the set IDC threshold, Alarm
		1: Greater than the set IDC threshold, Alarm
	c: IDC alarm threshold	Unit: uA
	d: Set the VDC alarm trigger condition	**0:** Less than the set VDC threshold, Alarm
		1: Greater than the set VDC threshold, Alarm
	e: VDC alarm threshold	Unit: mV

Example:

- AT+ROC=3,60,0,3000,0,5000 // The data is checked every 60 seconds. If the IDC is less than 3mA or the VDC is less than 5000mV, an alarm is generated.
- AT+ROC=3,180,1,3000,1,5000 // The data is checked every 180 seconds. If the IDC is greater than 3mA or the VDC is greater than 5000mV, an alarm is generated.

- AT+ROC=3,300,0,3000,1,5000 // The data is checked every 300 seconds. If the IDC is less than 3mA or the VDC is greater than 5000mV, an alarm is generated.

Downlink Command: 0x09 03 aa bb cc dd ee

Format: Function code (0x09) followed by 03 and the remaining 5 bytes.

aa: 2 bytes; Set the detection interval.(second)

bb: 1 byte; Set the IDC alarm trigger condition.

cc: 2 bytes; IDC alarm threshold.(uA)

dd: 1 byte; Set the VDC alarm trigger condition.

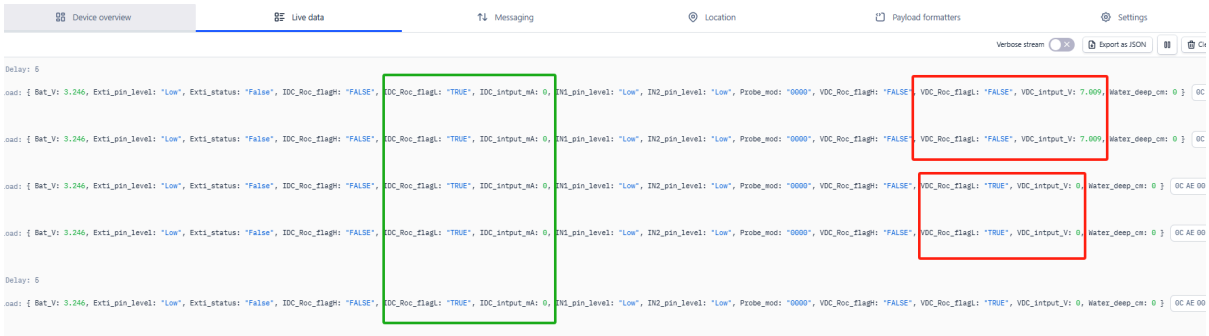
ee: 2 bytes; VDC alarm threshold.(mV)

Example:

- Downlink Payload: **09 03 00 3C 00 0B B8 00 13 38** // Equal to AT+ROC=3,60,0,3000,0,5000
- Downlink Payload: **09 03 00 b4 01 0B B8 01 13 38** // Equal to AT+ROC=3,180,1,3000,1,5000
- Downlink Payload: **09 03 01 2C 00 0B B8 01 13 38** // Equal to AT+ROC=3,300,0,3000,1,5000

Screenshot of parsing example in TTN:

- AT+ROC=3,60,0,3000,0,5000



3. Configure PS-LB-NA

3.1 Configure Methods:

PS-LB-NA supports below configure method:

- AT Command via Bluetooth Connection (**Recommand Way**): BLE Configure Instruction.
- AT Command via UART Connection : See FAQ.
- 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 PS-LB-NA

These commands only valid for PS-LB-NA, as below:

3.3.1 Set Transmit Interval Time

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 Interrupt Mode

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 =Disable Interrupt
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

3.3.3 Set Power Output Duration

Control the output duration 3V3 , 5V or 12V. Before each sampling, device will

1. first enable the power output to external sensor,

2. keep it on as per duration, read sensor value and construct uplink payload

3. final, close the power output.

AT Command: AT+3V3T

Command Example	Function	Response
AT+3V3T=?	Show 3V3 open time.	0 OK
AT+3V3T=0	Normally open 3V3 power supply.	OK default setting
AT+3V3T=1000	Close after a delay of 1000 milliseconds.	OK
AT+3V3T=65535	Normally closed 3V3 power supply.	OK

AT Command: AT+5VT

Command Example	Function	Response
AT+5VT=?	Show 5V open time.	0 OK
AT+5VT=0	Normally closed 5V power supply.	OK default setting
AT+5VT=1000	Close after a delay of 1000 milliseconds.	OK
AT+5VT=65535	Normally open 5V power supply.	OK

AT Command: AT+12VT

Command Example	Function	Response
AT+12VT=?	Show 12V open time.	0 OK
AT+12VT=0	Normally closed 12V power supply.	OK
AT+12VT=500	Close after a delay of 500 milliseconds.	OK

Downlink Command: 0x07

Format: Command Code (0x07) followed by 3 bytes.

The first byte is which power, the second and third bytes are the time to turn on.

- Example 1: Downlink Payload: 070101F4 **--->** AT+3V3T=500
- Example 2: Downlink Payload: 0701FFFF **--->** AT+3V3T=65535
- Example 3: Downlink Payload: 070203E8 **--->** AT+5VT=1000
- Example 4: Downlink Payload: 07020000 **--->** AT+5VT=0
- Example 5: Downlink Payload: 070301F4 **--->** AT+12VT=500
- Example 6: Downlink Payload: 07030000 **--->** AT+12VT=0

Note: Before v1.2, the maximum settable time of 3V3T, 5VT and 12VT is 65535 milliseconds. After v1.2, the maximum settable time of 3V3T, 5VT and 12VT is 180 seconds.

Therefore, the corresponding downlink command is increased by one byte to five bytes.

Example:

- 120s=120000ms(D) =0x01D4C0(H), Downlink Payload: 07 **01** 01 D4 C0 **--->** AT+3V3T=120000
- 100s=100000ms(D) =0x0186A0(H), Downlink Payload: 07 **02** 01 86 A0 **--->** AT+5VT=100000
- 80s=80000ms(D) =0x013880(H), Downlink Payload: 07 **03** 01 38 80 **--->** AT+12VT=80000

3.3.4 Set the Probe Model

Users need to configure this parameter according to the type of external probe. In this way, the server can decode according to this value, and convert the current value output by the sensor into water depth or pressure value.

AT Command: AT +PROBE

AT+PROBE=aabb

When aa=00, it is the water depth mode, and the current is converted into the water depth value; bb is the probe at a depth of several meters.

When aa=01, it is the pressure mode, which converts the current into a pressure value;

bb represents which type of pressure sensor it is.

(A->01,B->02,C->03,D->04,E->05,F->06,G->07,H->08,I->09,J->0A,K->0B,L->0C)

Command Example	Function	Response
AT +PROBE = ?	Get or Set the probe model.	0 OK
AT +PROBE =0003	Set water depth sensor mode, 3m type.	OK
AT +PROBE =000A	Set water depth sensor mode, 10m type.	OK
AT +PROBE =0101	Set pressure transmitters mode, first type(A).	OK
AT +PROBE =0000	Initial state, no settings.	OK

Downlink Command: 0x08

Format: Command Code (0x08) followed by 2 bytes.

- Example 1: Downlink Payload: 080003 **--->** AT+PROBE=0003
- Example 2: Downlink Payload: 080101 **--->** AT+PROBE=0101

3.3.5 Multiple VDC /IDC collections in one uplink(Since firmware V1.1)

Added AT+STDC command to collect the voltage of **VDC_INPUT/IDC_INPUT** multiple times and upload it at one time.

AT Command: AT +STDC

AT+STDC=aa,bb,bb

aa:
0: means disable this function and use TDC to send packets.
1: means that the function is enabled to send packets by collecting VDC data for multiple times
2: means that the function is enabled to send packets by collecting IDC data for multiple times
bb: Each collection interval (s), the value is 1~65535
cc: the number of collection times, the value is 1~120

Command Example	Function	Response
AT+STDC=?	Get the mode of multiple acquisitions and one uplink.	1,10,18 OK
AT+STDC=1,10,18	Set the mode of multiple acquisitions and one uplink, collect once every 10 seconds, and report after 18 times.	Attention:Take effect after ATZ OK
AT+STDC=0, 0,0	Use the TDC interval to send packets.(default)	Attention:Take effect after ATZ OK

Downlink Command: 0xAE

Format: Command Code (0xAE) followed by 4 bytes.

- Example 1: Downlink Payload: AE 01 02 58 12 **--->** AT+STDC=1,600,18

4. Battery & Power Consumption

PS-LB-NA uses ER26500 + SPC1520 battery pack. 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 PS-LB-NA 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 How to use PS-LB-Ix with liquid other than water?

Calculated according to the ratio of the density of the measured liquid to the density of water, and add their ratio in the decoding
Example: Use gasoline with a density of 0.70g/cm^3
Adding to this part of the decoding divides it by 0.7 and puts a parenthesis around the equation

```
if(decode.Probe_mod===0x00)
{
  if(decode.IDC_intput_mA<=4.0)
    decode.Water_deep_cm= 0;
  else
    decode.Water_deep_cm= parseFloat(((decode.IDC_intput_mA-4.0)*(bytes[3]*100/16)).toFixed(3));
}
```

Change:

```
 if(decode.Probe_mod===0x00)
{
  if(decode.IDC_intput_mA<=4.0)
    decode.Water_deep_cm= 0;
  else
    decode.Water_deep_cm= parseFloat((% style="color:red"
%)(((decode.IDC_intput_mA-4.0)*(bytes[3]*100/16)/0.7)).toFixed(3));
}
```

7. Order Info

Part Number: **PS-LB-NA-XX-YY**

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

YY: The grand connector hole size

- **M12**: M12 hole
- **M16**: M16 hole
- **M20**: M20 hole

8. Packing Info

Package Includes:

- PS-LB-NA LoRaWAN Analog Sensor

Dimension and weight:

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

9. 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