T68DL LoRaWAN Temperature Sensor Manual

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on 2024/12/05 14:40

Table of Contents:

1. Introduction

1.1 What is T68DL LoRaWAN Temperature Sensor

The Dragino **T68DL Temperature sensor** is a Long Range LoRaWAN Sensor.

The T68DL allows users to send data and reach extremely long ranges. It provides ultra-long range spread spectrum communication and high interference immunity whilst minimizing current consumption. It targets professional wireless sensor network applications such as irrigation systems, smart metering, smart cities, building automation, and so on.

T68DL has a **built-in 2400mAh non-chargeable battery** which can be used for up to 10 years*.

T68FL is full compatible with LoRaWAN v1.0.3 Class A protocol, it can work with a standard LoRaWAN gateway.

T68DL supports **Datalog Feature**. It will record the data when there is no network coverage and users can retrieve the sensor value later to ensure no miss for every sensor reading.

*The actual battery life depends on how often to send data, please see the battery analyzer chapter.

1.2 Features

- LoRaWAN v1.0.3 Class A protocol
- Frequency Bands: CN470/EU433/KR920/US915/EU868/AS923/AU915
- AT Commands to change parameters
- Remote configure parameters via LoRaWAN Downlink
- Firmware can be upgraded via OTA
- Built-in 2400mAh battery for up to 10 years of use.
- Built-in Temperature sensor
- Tri-color LED to indicate working status
- Datalog feature (Max 3328 records)

1.3 Specification

Built-in Temperature Sensor:

- Resolution: 0.01 °C
- Accuracy Tolerance : Typ ±0.3 °C
- Long Term Drift: < 0.02 °C/yr
- Operating Range: -40 ~ 85 °C

2. Connect T68DL to IoT Server

2.1 How does T68DL work?

T68DL is configured as LoRaWAN OTAA Class A mode by default. Each T68DL is shipped with a worldwide unique set of OTAA keys. To use T68DL in a LoRaWAN network, first, we need to put the OTAA keys in LoRaWAN Network Server and then activate T68DL.

If T68DL is under the coverage of this LoRaWAN network. T68DL can join the LoRaWAN network automatically. After successfully joining, T68DL will start to measure environment temperature, and start to transmit sensor data to the LoRaWAN server. The default period for each uplink is 20 minutes.

2.2 How to Activate T68DL?

The T68DL has two working modes:

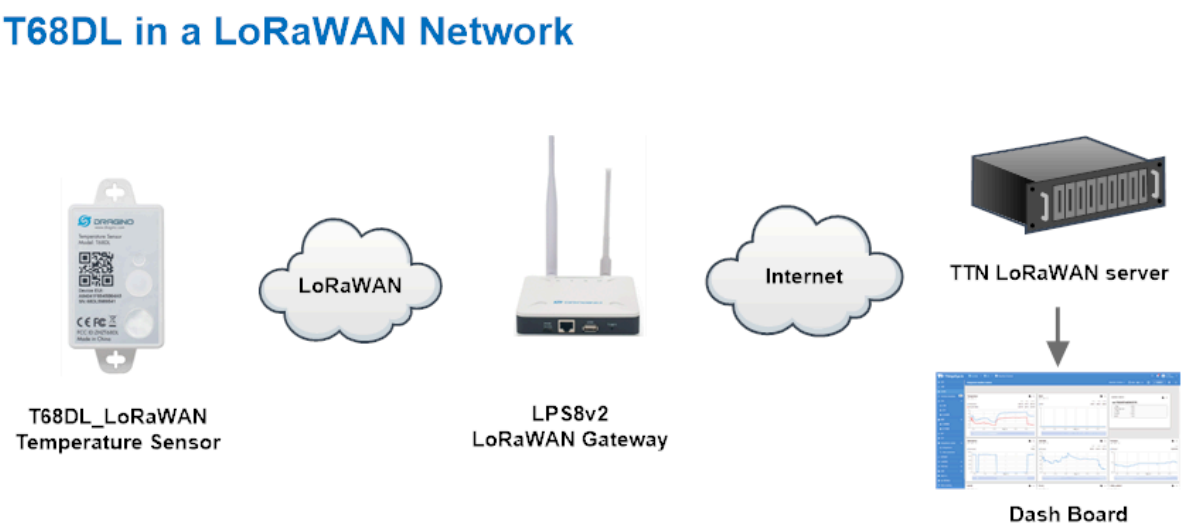
- **Deep Sleep Mode**: T68DL doesn't have any LoRaWAN activities. This mode is used for storage and shipping to save battery life.
- **Working Mode**: In this mode, T68DL works as LoRaWAN Sensor mode to Join LoRaWAN network and send out the sensor data to the server. Between each sampling/tx/rx periodically, T68DL will be in STOP mode (IDLE mode), in STOP mode, T68DLhas the same power consumption as Deep Sleep mode.

The T68DL is set in deep sleep mode by default; The ACT button on the front is to switch to different modes:

Behavior on ACT	Function	Action
Pressing ACT between 1s < time < 3s	Test uplink status	If T68DL is already Joined to rhe LoRaWAN network, T68DL will send an uplink packet, **Blue led** will blink once.
Pressing ACT for more than 3s	Active Device	**Green led** will fast blink 5 times, T68DL will enter working mode and start to JOIN LoRaWAN network. **Green led** will solidly turn on for 5 seconds after join in network.
Fast press ACT 5 times.	Deactivate Device	**Red led** will solid on for 5 seconds. Means T68DL is in Deep Sleep Mode.

2.3 Quick guide to connect to LoRaWAN server (OTAA)

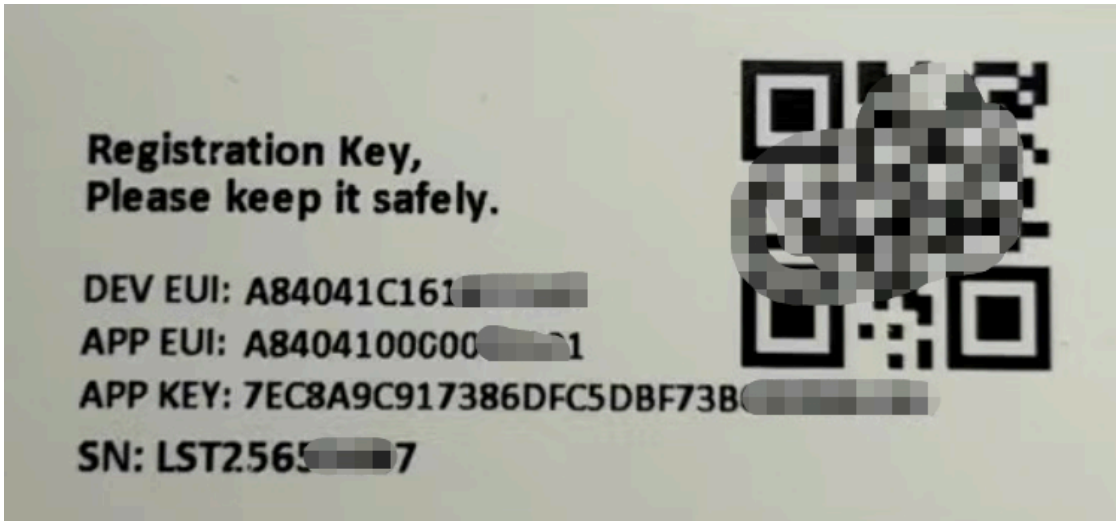
This section shows an example of how to join the TTN V3 LoRaWAN IoT server. Use with other LoRaWAN IoT servers is of a similar procedure.



Assume the LPS8v2 is already set to connect to TTN V3 network, So it provides network coverage for T68DL. Next we need to add the T68DL device in TTN V3:

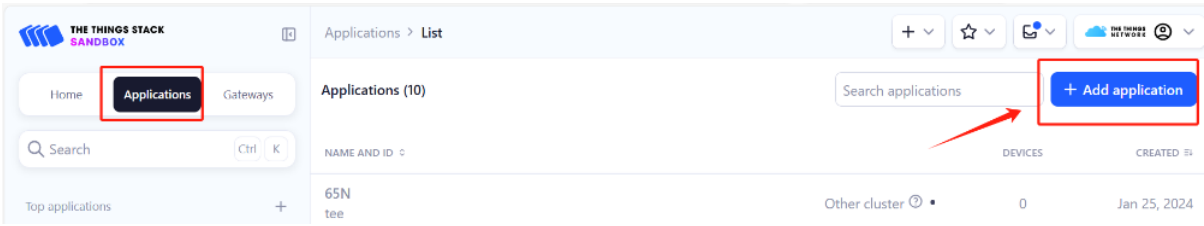
Step 1: Create a device in TTN V3 with the OTAA keys from T68DL.

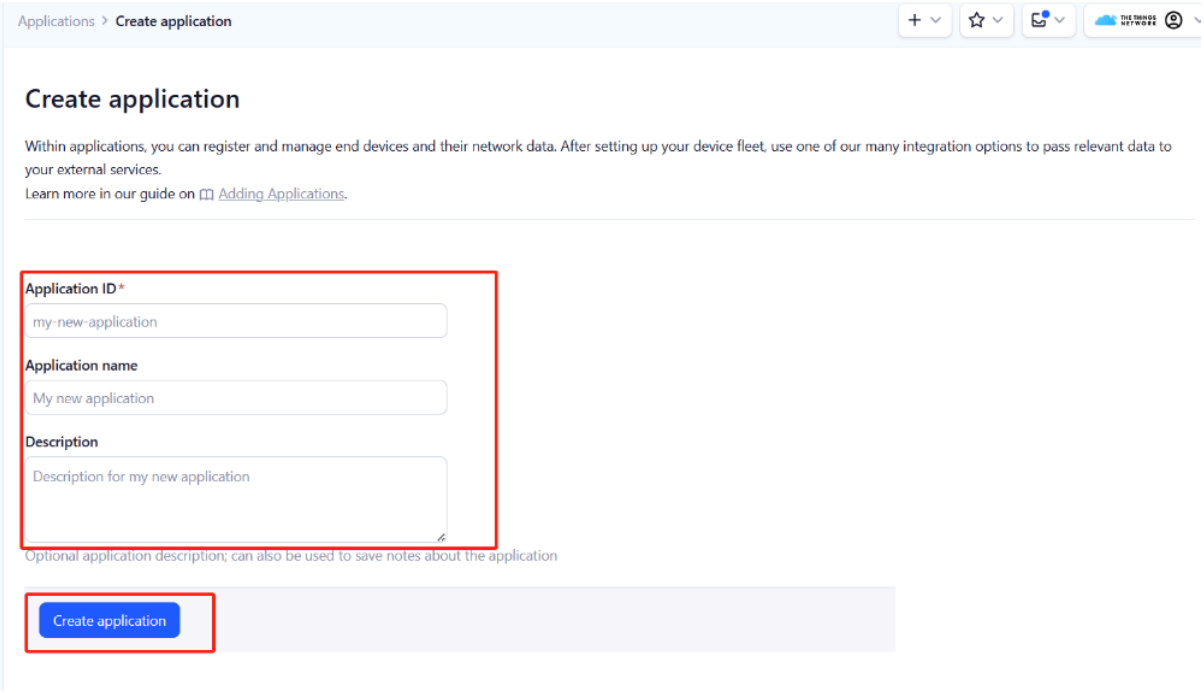
Each T68DL is shipped with a sticker with its device EUI, APP Key and APP EUI as below:



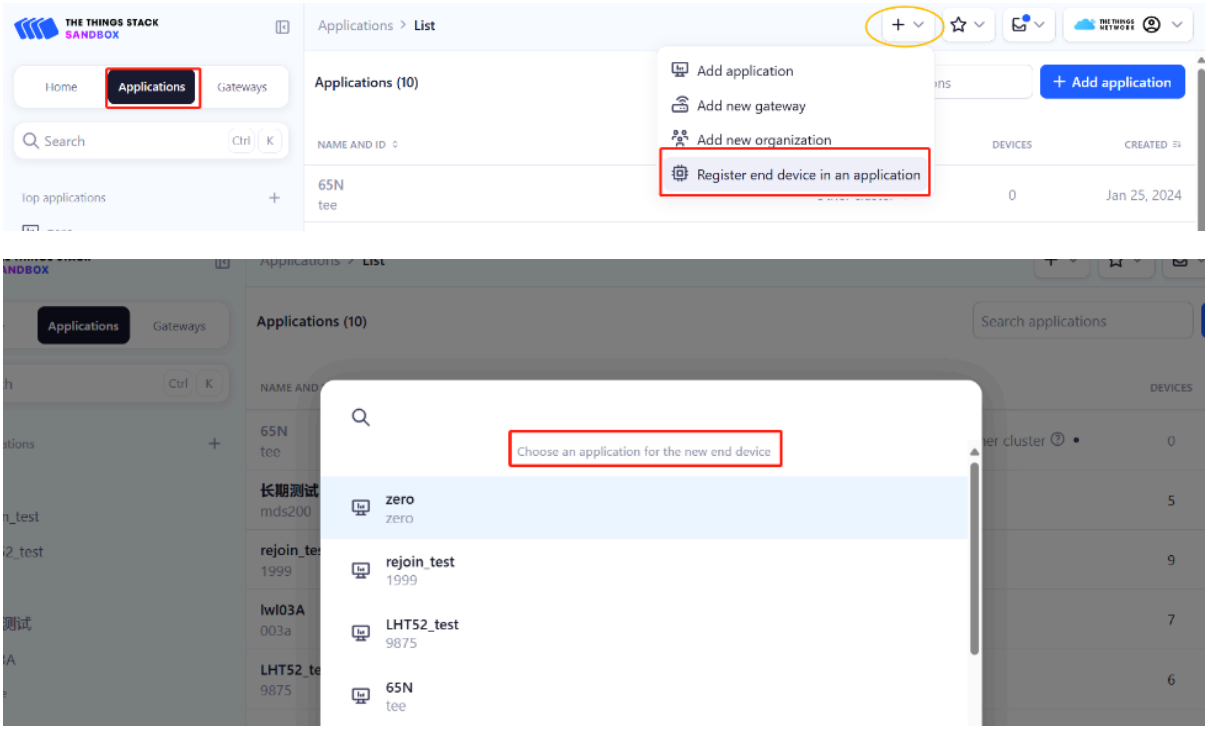
User can enter these keys in the LoRaWAN Server portal. Below is TTN V3 screenshot:

Create the application.

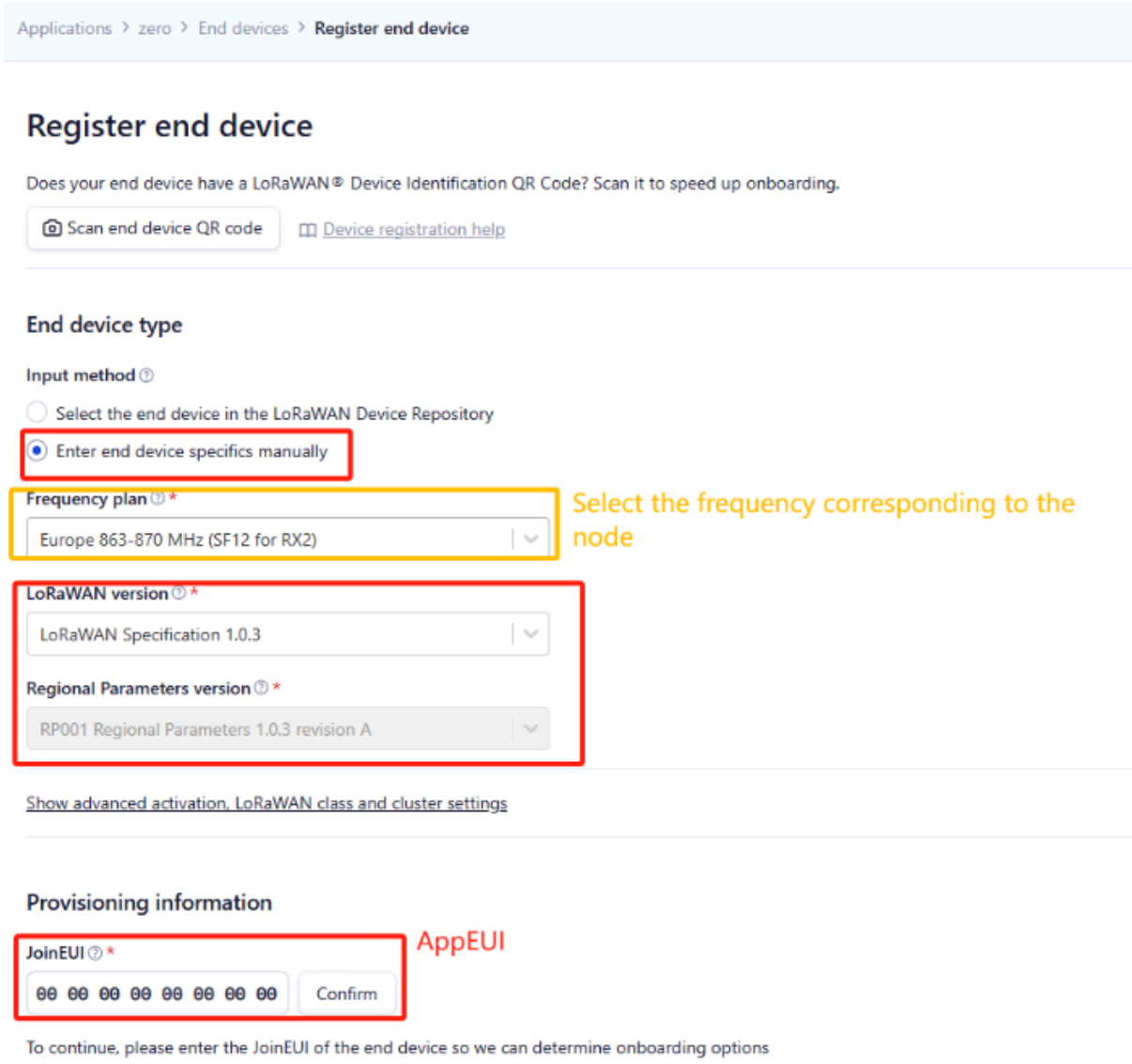


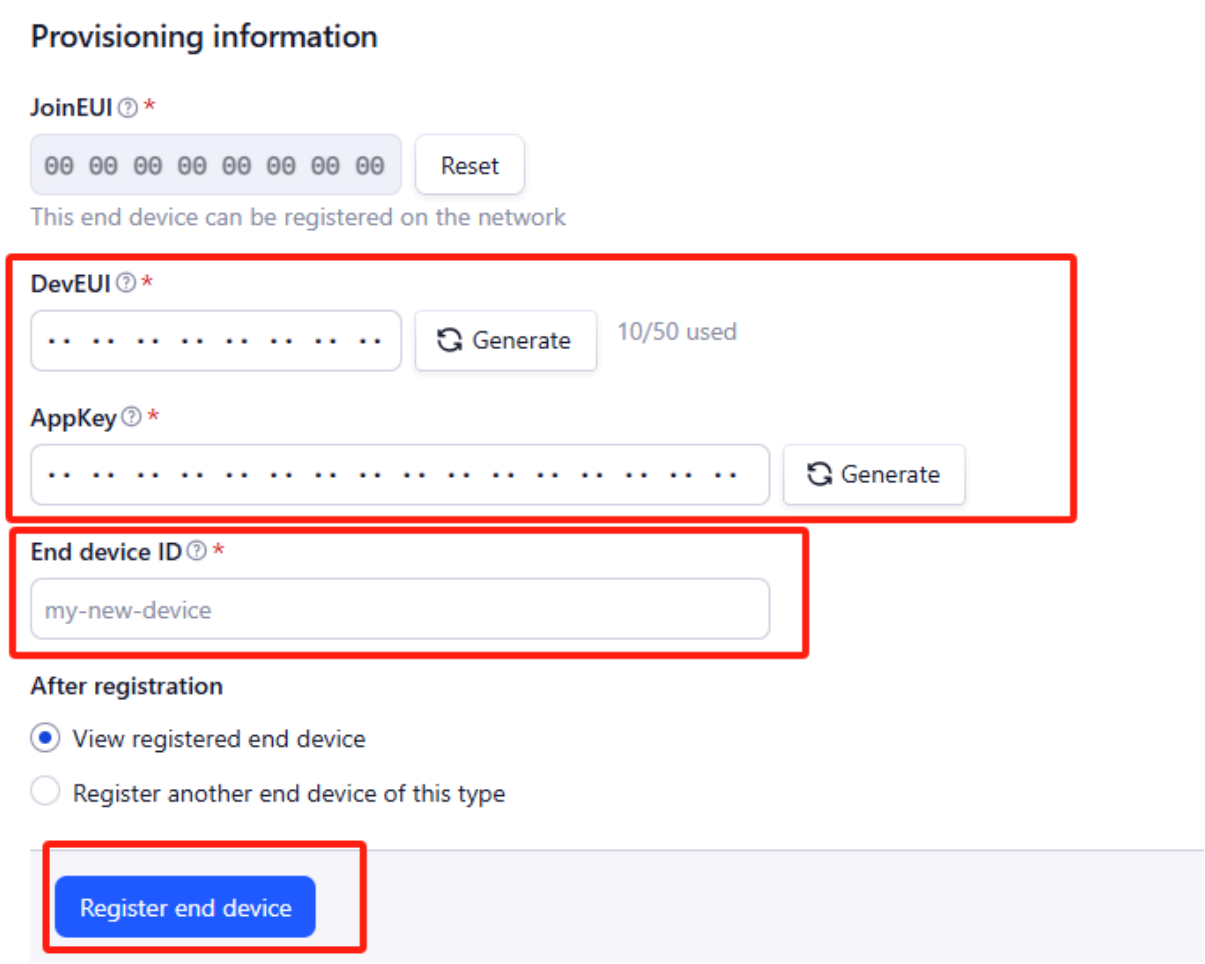


Add devices to the created Application.



Enter end device specifics manually.


Applications > zero > End devices > Register end device
Register end device
Does your end device have a LoRaWAN® Device Identification QR Code? Scan it to speed up onboarding.
Scan end device QR code
Device registration help
End device type
Input method
Select the end device in the LoRaWAN Device Repository
Enter end device specifics manually
Frequency plan *
Europe 863-870 MHz (SF12 for RX2)
Select the frequency corresponding to the node
LoRaWAN version *
LoRaWAN Specification 1.0.3
Regional Parameters version *
RP001 Regional Parameters 1.0.3 revision A
Show advanced activation, LoRaWAN class and cluster settings
Provisioning information
JoinEUI *
00 00 00 00 00 00 00 00
Confirm
AppEUI
To continue, please enter the JoinEUI of the end device so we can determine onboarding options

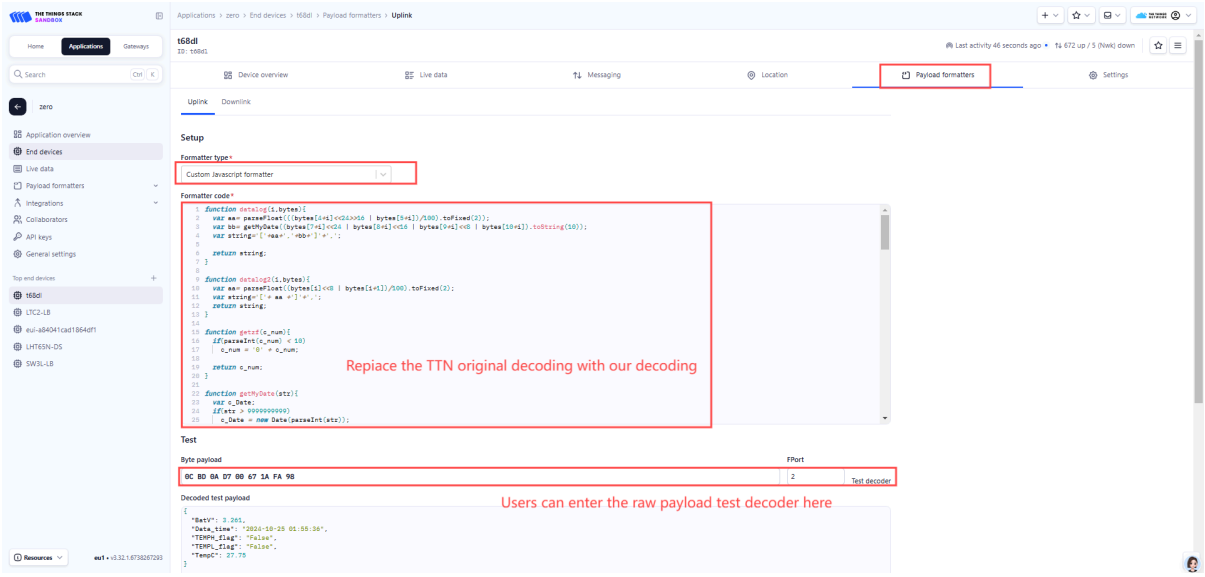


Step 2: Add decoder

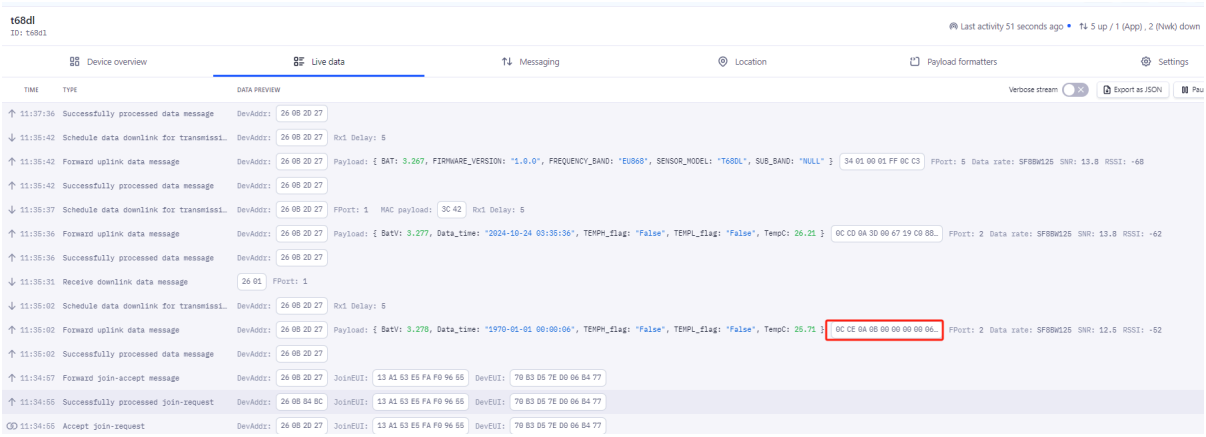
In TTN, user can add a custom payload so it shows friendly reading.

Click this link to get the decoder: T68DL decoder.

Below is TTN screen shot:



Step 3: Power on T68DL and it will auto join to the TTN V3 network. After join success, it will start to upload message to TTN V3 and user can see in the panel.



2.4 Uplink Payload

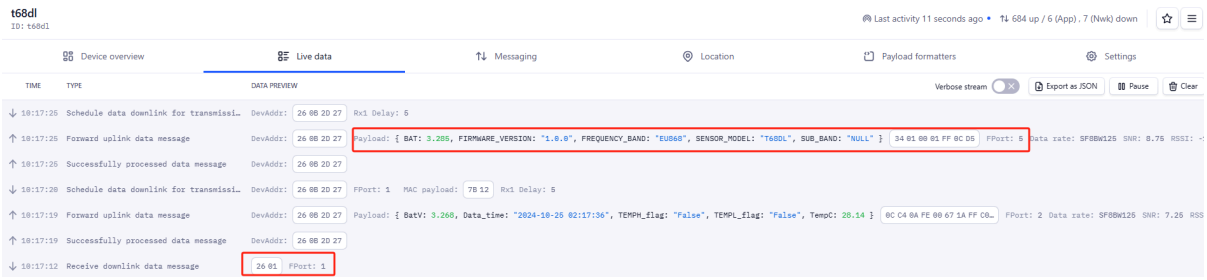
2.4.1 Device Status, FPORT=5

Users can use the downlink command(**0x26 01**) to ask T68DL to send device configure detail, include device configure status. T68DL will uplink a payload via FPort=5 to server.

The Payload format is as below.

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 T68DL, this value is 0x34

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: 0x0CD5 = 3285mV

Ex2: 0x0B49 = 2889mV

2.4.2 Real-Time Temperature data, Uplink FPORT=2

T68DL will send this uplink **after** Device Status once join the LoRaWAN network successfully. And T68DL will: periodically send this uplink every 20 minutes, this interval can be changed.

Uplink Payload totals 9 bytes.

Size(bytes)	2	2	1	4
Value	BAT	Built-In Temperature(TMP116)	TEMPH_flag & TEMPL_flag	Data_time

- **Battery**

Check the battery voltage.

Example: 0x0CBF(H)= 3263(D) mV

- **Built-In Temperature (TMP116)**

Example:

If payload is: 0x0AFE: (0AFE & 8000 == 0), temp = 0AFEH/10 = 28.14 degree

If payload is: 0xFF3F : (FF3F & 8000 == 1) , temp = (FF3FH - 65536)/10 = -19.3 degrees.

(FF3F & 8000:Judge whether the highest bit is 1, when the highest bit is 1, it is negative)

- **TEMPH_flag & TEMPL_flag**

Example:

TEMPH_flag:

If payload is: 0x02: (0x02 & 0x01 == 0), TEMPH_flag = False

If payload is: 0x01: (0x01 & 0x01 == 1). TEMPH_flag = True

TEMPL_flag:

If payload is: 0x01: (0x01 & 0x02 == 0), TEMPL_flag = False

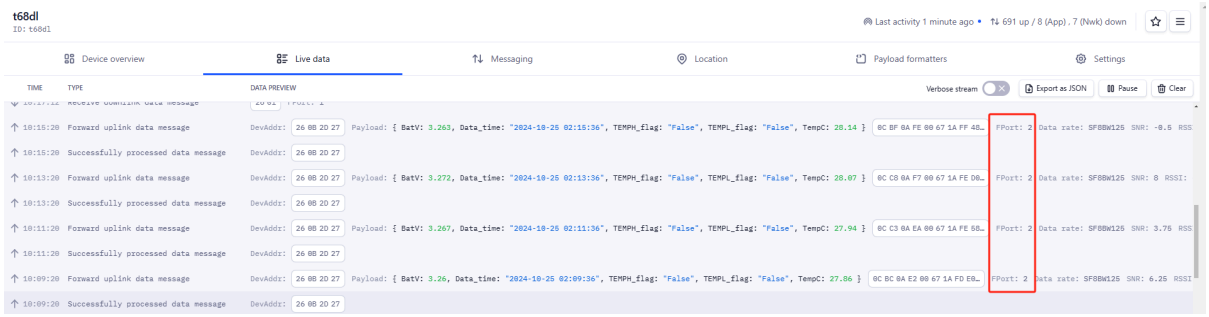
If payload is: 0x02: (0x02 & 0x02 == 1). TEMPL_flag = True

- **Data_time**

Unit TimeStamp Example: 671F024A(H) = 1730085450(D)

Put the decimal value into this link(https://www.epochconverter.com))to get the time.

Example parse in TTNv3:

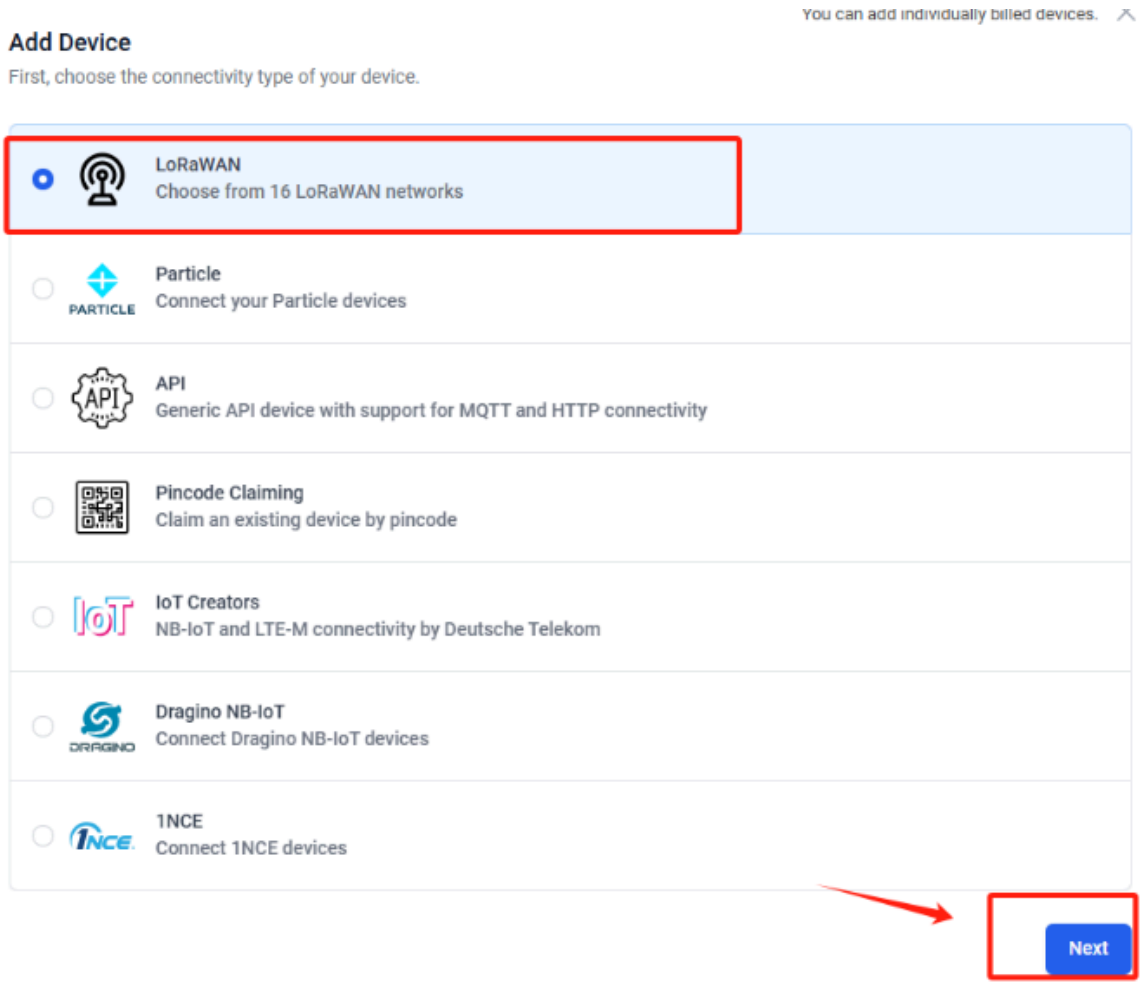


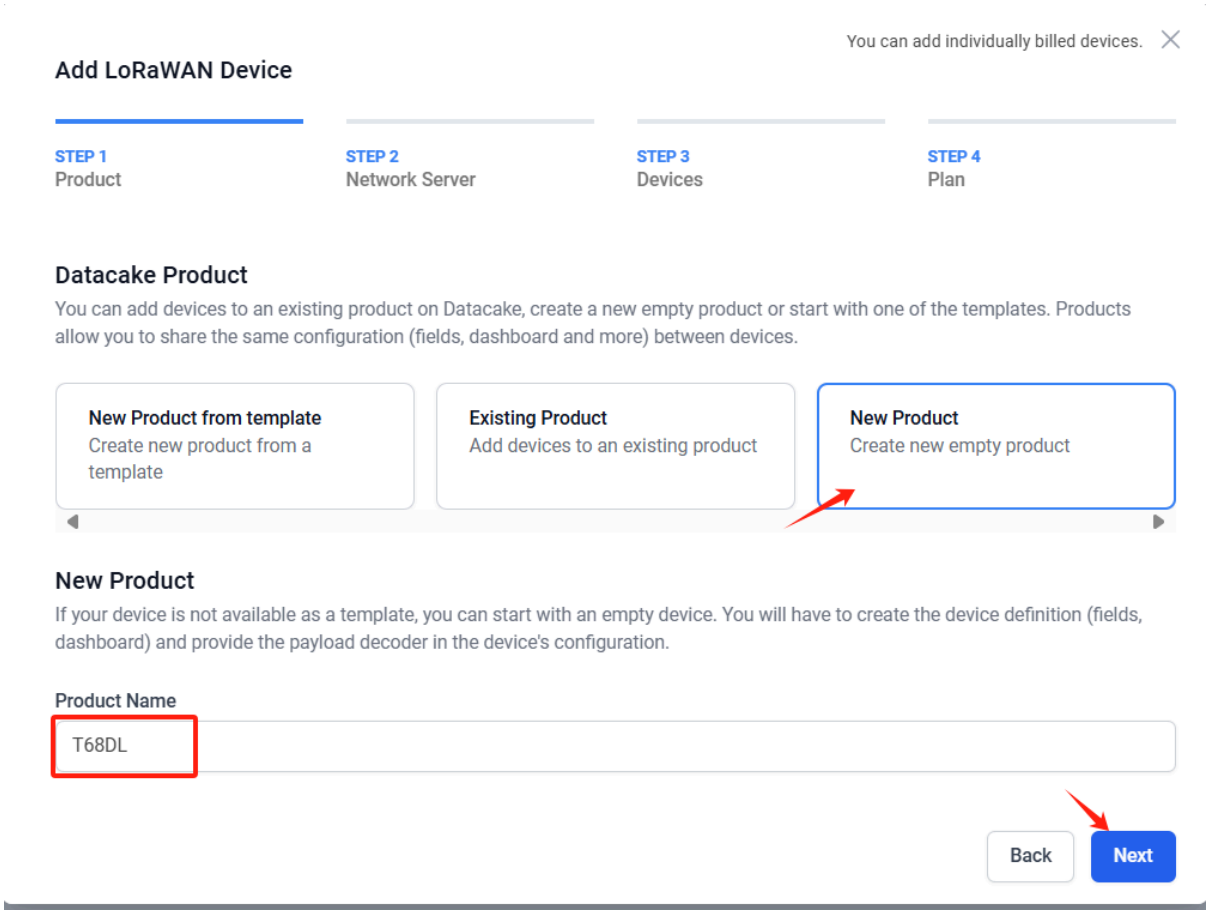
2.5 Show data on Datacake

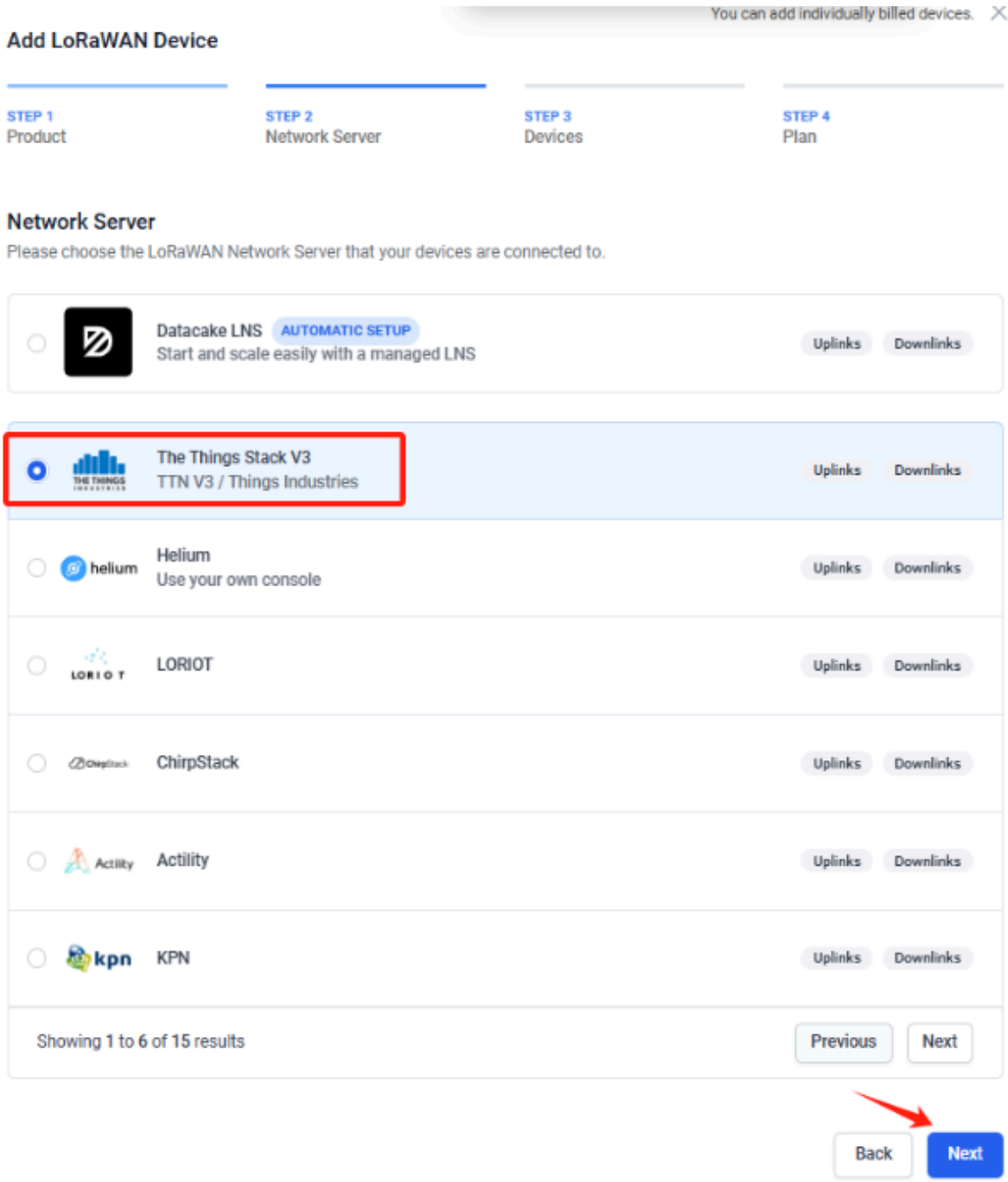
Datacake IoT platform provides a human-friendly interface to show the sensor data, once we have sensor data in TTN V3, we can use Datacake to connect to TTN V3 and see the data in Datacake. Below are the steps:

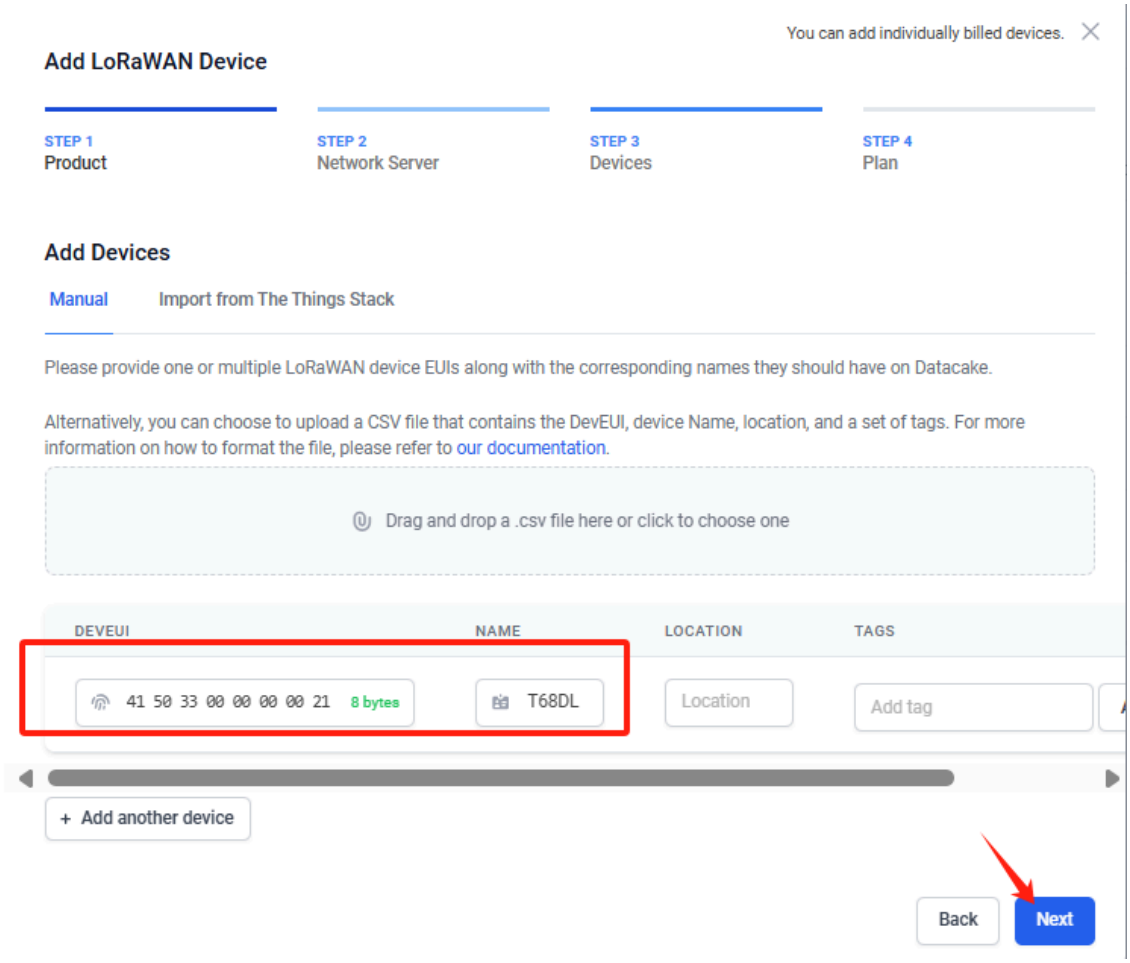
Step 1: Link TTNv3 to Datacake. https://docs.datacake.de/lorawan/lns/thethingsindustries#create-integration-on-tti

Step 2: Add T68DL to Datacake. Go to TTN V3 Console --> Applications --> Integrations --> Add Integrations.

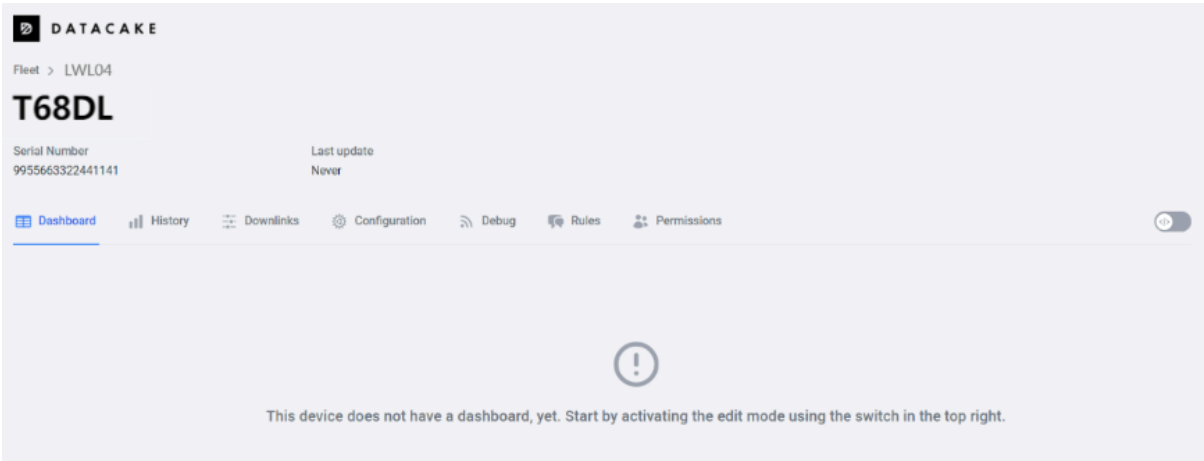

You can add individually billed devices.
Add Device
First, choose the connectivity type of your device.
LoRaWAN
Choose from 16 LoRaWAN networks
Particle
Connect your Particle devices
API
Generic API device with support for MQTT and HTTP connectivity
Pincode Claiming
Claim an existing device by pincode
IoT Creators
NB-IoT and LTE-M connectivity by Deutsche Telekom
Dragino NB-IoT
Connect Dragino NB-IoT devices
1NCE
Connect 1NCE devices
Next

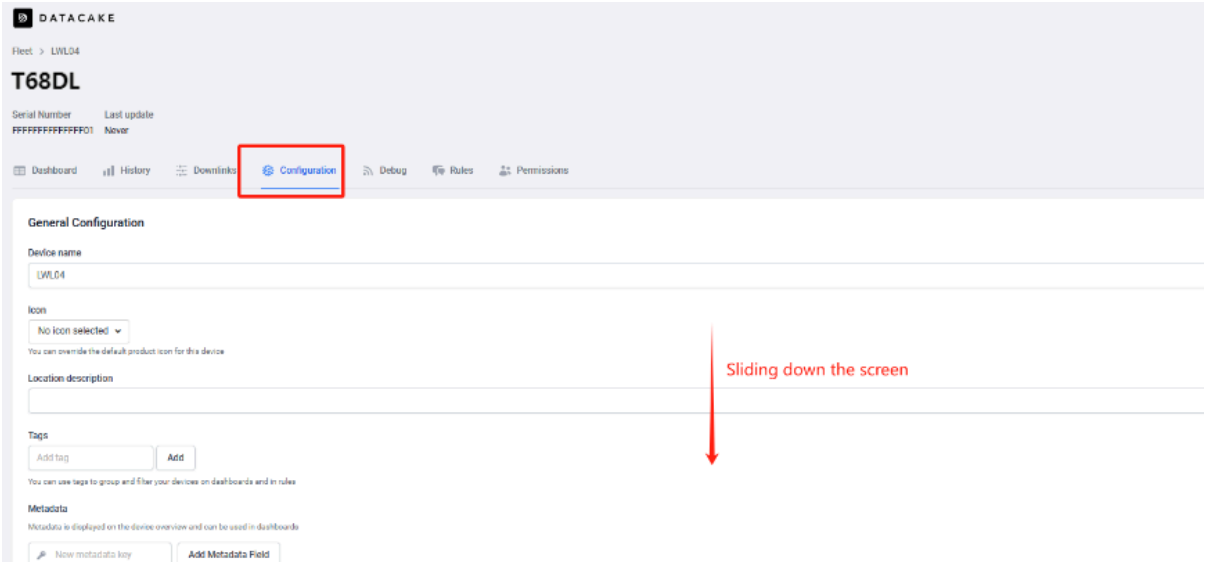

You can add individually billed devices.
Add LoRaWAN Device
STEP 1
Product
STEP 2
Network Server
STEP 3
Devices
STEP 4
Plan
Datacake Product
You can add devices to an existing product on Datacake, create a new empty product or start with one of the templates. Products allow you to share the same configuration (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
T68DL
Back
Next


You can add individually billed devices.
Add LoRaWAN Device
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.
Datacake LNS
AUTOMATIC SETUP
Start and scale easily with a managed LNS
Uplinks
Downlinks
The Things Stack V3
TTN V3 / Things Industries
Uplinks
Downlinks
Helium
Use your own console
Uplinks
Downlinks
LORIOT
Uplinks
Downlinks
ChirpStack
Uplinks
Downlinks
Actility
Actility
Uplinks
Downlinks
kpn
KPN
Uplinks
Downlinks
Showing 1 to 6 of 15 results
Previous
Next
Back
Next



Step 3: Configure T68DL 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, T68DL will store the reading for future retrieving purposes. There are two ways for IoT servers to get datalog from T68DL.

2.6.1 Ways to get datalog via LoRaWAN

There are two methods:

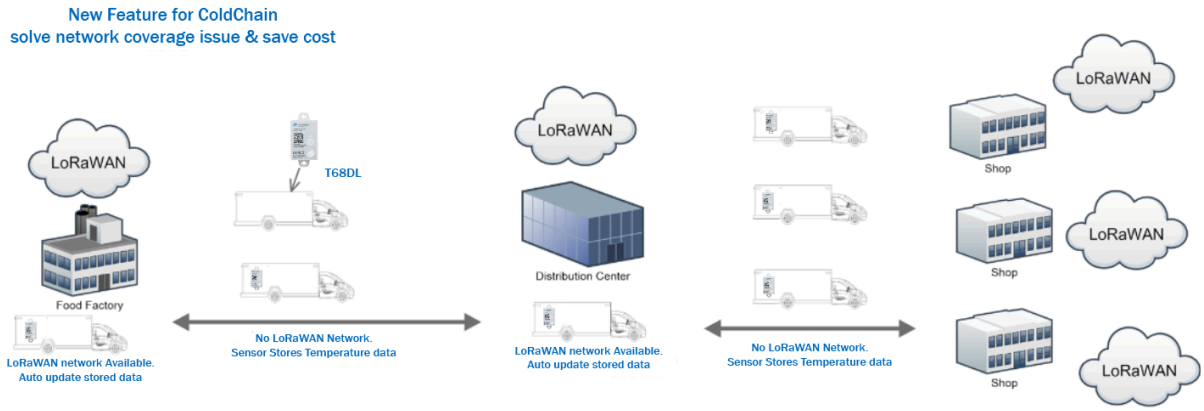
Method 1: IoT Server sends a downlink LoRaWAN command to poll the value for specified time range.

Method 2: Set PNACKMD=1, T68DL will wait for ACK for every uplink, when there is no LoRaWAN network, T68DL 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.

Note for method 2:

- a) T68DL will do an ACK check for data records sending to make sure every data arrive server.
- b) T68DL will send data in **CONFIRMED Mode** when PNACKMD=1, but T68DL 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 T68DL gets a ACK, T68DL will consider there is a network connection and resend all NONE-ACK Message.

Below is the typical case for the auto-update datalog feature (Set PNACKMD=1)



2.6.2 Unix TimeStamp

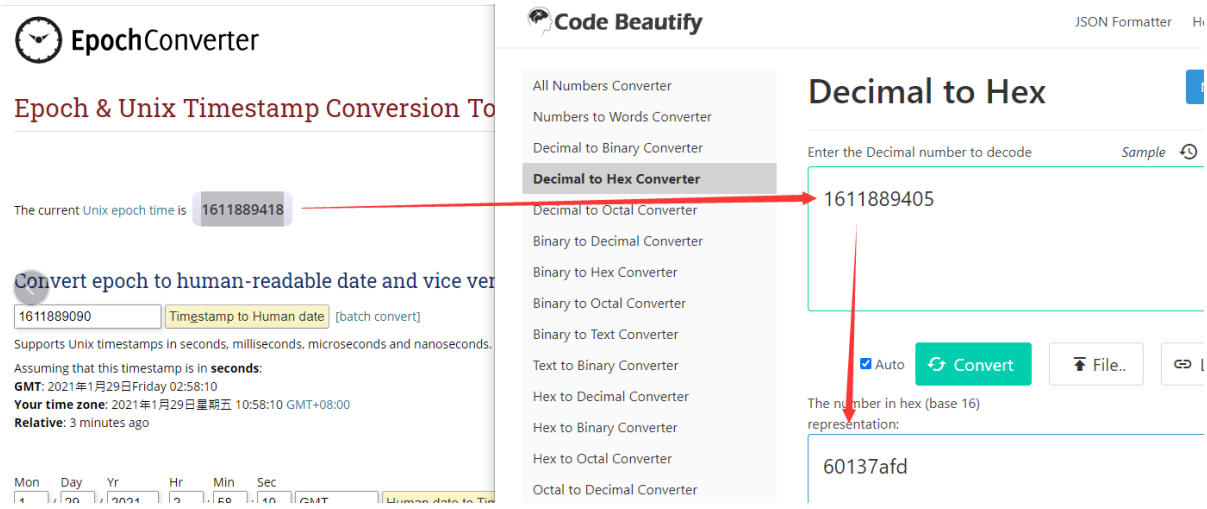
T68DL uses Unix TimeStamp format based on

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=1730085450 or downlink 30671F024A to set the current time 2024 – October -- 28 Monday 3:17:30

2.6.3 Set Device Time

There are two ways to set device's time:

1. **Through LoRaWAN MAC Command (Default settings)**

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

Once T68DL Joined LoRaWAN network, it will send the MAC command (DeviceTimeReq) and the server will reply with (DeviceTimeAns) to send the current time to T68DL. If T68DL fails to get the time from the server, T68DL 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. Manually Set Time

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

2.6.4 Poll sensor value

User can poll sensor value based on timestamps from the server. Below is the downlink command.

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 log during this time period, use the uplink interval.

For example, downlink command **31 67180C82 671836B2 05**

Is to check 2024/10/22 20:35:14 to 2024/10/22 23:35:14's data

Uplink Internal =5s, means T68DL will send one packet every 5s. range 5~255s.

2.6.5 Datalog Uplink payload

The Datalog poll reply uplink will use below payload format.

Retrieval data payload:

Size(bytes)	4	2	1	4
Value	Reserved	TMP116_Temp	ACK message flag	Unix Time Stamp

ACK message flag:

Bits	7	6	[5:0]
Status	No ACK Message	Poll Message Flag	Reserved

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 T68DL has below data inside Flash:

Flash Add	Unix Time	BAT voltage	Value
8031460	2024/10/22 20:35:14	2913	tmp116_temp:28.80
8031470	2024/10/22 20:55:14	2912	tmp116_temp:28.82
8031480	2024/10/22 21:15:14	2911	tmp116_temp:28.85

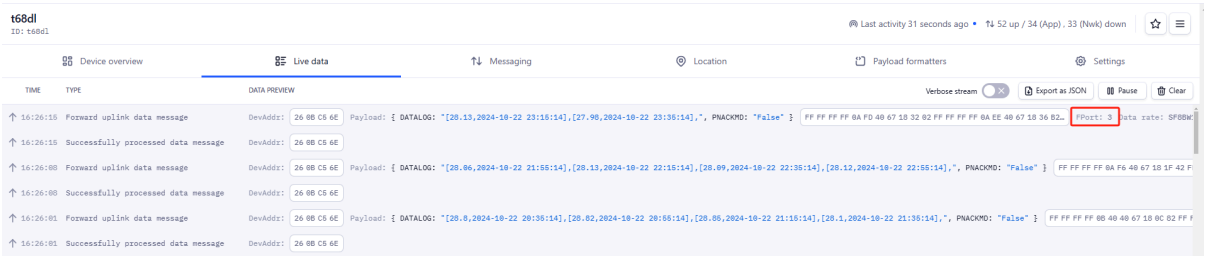
8031490	2024/10/22 21:35:14	2921	tmp116_temp:28.10
80314A0	2024/10/22 21:55:14	2923	tmp116_temp:28.06
80314B0	2024/10/22 22:15:14	2924	tmp116_temp:28.13
80314C0	2024/10/22 22:35:14	2925	tmp116_temp:28.09
80314D0	2024/10/22 22:55:14	2924	tmp116_temp:28.12
80314E0	2024/10/22 23:15:14	2924	tmp116_temp:28.13
80314F0	2024/10/22 23:35:14	2924	tmp116_temp:27.98

If user sends below downlink command: 31 67180C82 671836B2 05

Where : Start time: 67180C82 = time 24/10/24 20:35:14

Stop time: 671836B2 = time 24/10/24 23:35:14

T68DL will uplink this payload.



FFFFFFFF 0B4040 67180C82

FFFFFFFF0B424067181132FFFFFFFF0B4540671815E2FFFFFFFF0AFA4067181A92FFFFFFFF0AF64067181F42FFFFFFF

Where the first 11 bytes is for the first entry:

FFFFFFFF 0B40 40 67180C82

Bytes not used, so reserved: FFFFFFFF

Temp=0x0B40/100=28.8℃

PNACK status flag: ((bytes[6]>>7)&0x01) ? "True":"False" =(0x40>>7)&0x01=0

Unix time is 0x67180C82=1729629314s=24/10/22 20:35:14

2.7 Alarm Mode & Feature "Multi sampling, one uplink"

when the device is in alarm mode, it checks the built-in sensor temperature for a short time. if the temperature exceeds the preconfigured range, it sends an uplink immediately.

Note: alarm mode adds a little power consumption, and we recommend extending the normal read time when this feature is enabled.

2.7.1 Threshold alarm with built-in temperature sensor (TMP116)

AT+WMOD=1,60,-10,20

Explain:

- **parameter1:** Set Working Mode to **Mode 1,Threshold Alarm(Out of range alarm)**
- **parameter2:** Sampling Interval is **60**s.

- **parameter3 & parameter4:** Temperature alarm range is **-10** to 20°C(Set the temperature range value with a coefficient of 100)

Downlink Command:

Example: A5013CFC1807D0

MOD=01

CITEMP=3C(S) =60(S)

TEMPlow=FC18 = -1000/100=-10(°C)

TEMPhigh=07D0=2000/100=20(°C)

2.7.2 Fluctuation alarm for TMP116

Acquisition time: minimum 1s.

AT+WMOD=2,60,5

Explain:

- **parameter1:** Set Working Mode to **Mode 2,Fluctuation alarm**
- **parameter2:** Sampling Interval is **60**s.
- **parameter3:** The temperature fluctuation is +-5 °C

Downlink Command

Example: A5023C05

MOD=02

CITEMP=3C(S)=60(S)

temperature fluctuation=05(°C)

2.7.3 Sampling multiple times and uplink together

Internal TMP116 temperature alarm(Acquisition time: fixed at one minute)

AT+WMOD=3,60,20,-16,32,1

Explain:

- **parameter1:** Set Working Mode to **Mode 3,Sampling multiple times and uplink together**
- **parameter2:** Sampling Interval is **60**s.(This parameter has no effect on internal sensors)
- **parameter3:** When there is **20** sampling dats, Device will send these data via one uplink. (max value is 60, means max 60 sampling in one uplink)
- **parameter4 & parameter5:** Temperature alarm range is **-16** to **32**°C,
- **parameter6:** 1 to enable temperature alarm, **0** to disable the temperature alarm. If alarm is enabled, a data will be sent immediately if temperate exceeds the Alarm range.

Downlink Command:

Example: A50301003C14FFF0002001

MOD=03

CITEMP=003C(S)=60(S)

Total number of acquisitions=14

TEMPlow=FFF0=-16(°C)

TEMPhigh=0020=20(°C)

ARTEMP=01

Uplink payload(Fport=3)

Example: 0BEA01**0992***0A41***09C4**

BatV=0BEA

TEMP=DS18B20

Temp1=0992 // 24.50°C

Temp2=0A41 // 26.25°C

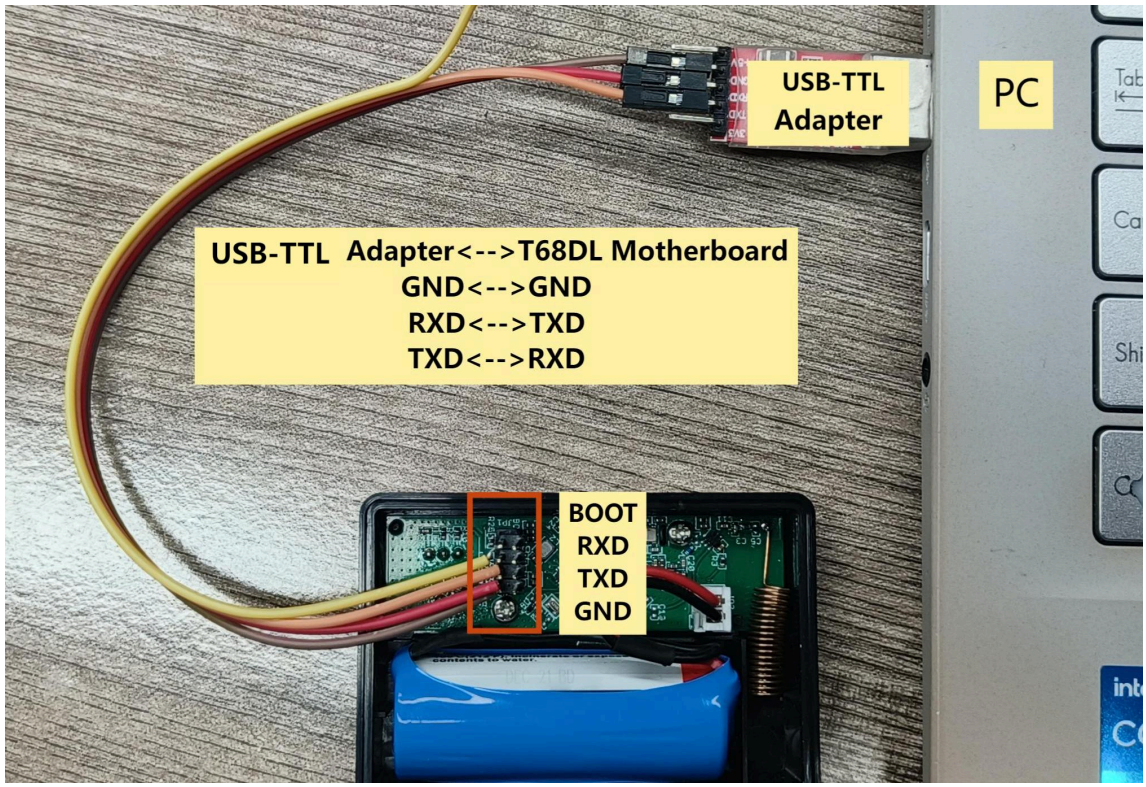
Temp3=09C4 // 25.00°C

Note: This uplink will automatically select the appropriate DR according to the data length.

3. Configure T68DL via AT command or LoRaWAN downlink

Use can configure T68DL via AT Command or LoRaWAN Downlink.

- AT Command Connection:



- LoRaWAN Downlink instruction for different platforms: IoT LoRaWAN Server

There are two kinds of commands to configure T68DL, they are:

- **General Commands**.

These commands are to configure:

1. General system settings like: uplink interval.
2. LoRaWAN protocol & radio-related commands.

They are the same for all Dragino Devices which supports DLWS-005 LoRaWAN Stack(Note**). These commands can be found on the wiki: End Device Downlink Command

- **Commands special design for T68DL**

These commands are only valid for T68DL, as below:

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

3.2 Set Password

Feature: Set device password, max 9 digits

AT Command: AT+PWORD

Command Example	Function	Response
AT+PWORD=?	Show password	123456 OK
AT+PWORD=999999	Set password	OK

Downlink Command:

No downlink command for this feature.

3.3 Quit AT Command

Feature: Quit AT Command mode, so user needs to input password again before use AT Commands.

AT Command: AT+DISAT

Command Example	Function	Response
AT+DISAT	Quit AT Commands mode	OK

Downlink Command:

No downlink command for this feature.

3.4 Set to sleep mode

Feature: Set device to sleep mode

- **AT+Sleep=0** : Normal working mode, device will sleep and use lower power when there is no LoRa message
- **AT+Sleep=1** : Device is in deep sleep mode, no LoRa activation happen, used for storage or shipping.

AT Command: AT+SLEEP

Command Example	Function	Response
AT+SLEEP	Set to sleep mode	Clear all stored sensor data... OK

Downlink Command:

- There is no downlink command to set to Sleep mode.

3.5 Set system time

Feature: Set system time, unix format. See here for format detail.

AT Command:

Command Example	Function
AT+TIMESTAMP=1611104352	OK Set System time to 2021-01-20 00:59:12

Downlink Command:

0x306007806000 // Set timestamp to 0x(6007806000),Same as AT+TIMESTAMP=1611104352

3.6 Set Time Sync Mode

Feature: Enable/Disable Sync system time via LoRaWAN MAC Command (DeviceTimeReq), LoRaWAN server must support v1.0.3 protocol to reply this command.

SYNCMOD is set to 1 by default. If user want to set a different time from LoRaWAN server, user need to set this to 0.

AT Command:

Command Example	Function
AT+SYNCMOD=1	Enable Sync system time via LoRaWAN MAC Command (DeviceTimeReq)

Downlink Command:

0x28 01 // Same As AT+SYNCMOD=1
0x28 00 // Same As AT+SYNCMOD=0

3.7 Set Time Sync Interval

Feature: Define System time sync interval. SYNCTDC default value: 10 days.

AT Command:

Command Example	Function

AT+SYNCTDC=0x0A	Set SYNCTDC to 10 (0x0A), so the sync time is 10 days.

Downlink Command:

0x29 0A // Same as AT+SYNCTDC=0x0A

3.8 Get data

Feature: Get the current sensor data.

AT Command:

- **AT+GETSENSORVALUE=0** // The serial port gets the reading of the current sensor
- **AT+GETSENSORVALUE=1** // The serial port gets the current sensor reading and uploads it.

3.11 Print data entries base on page

Feature: Print the sector data from start page to stop page (max is 416 pages).

AT Command: AT+PDTA

Command Example	Function
AT+PDTA=1,1 Print page 1 to 1	Stop Tx events when read sensor data 8031000 1970/1/1 00:04:53 2 tmp116_temp:31.18 8031010 2024/10/21 02:23:09 2 tmp116_temp:31.24 8031020 2024/10/21 02:25:04 1 tmp116_temp:31.23 8031030 2024/10/21 02:25:28 2 tmp116_temp:31.24 8031040 2024/10/21 02:40:35 2 tmp116_temp:31.28 8031050 2024/10/21 03:00:29 2 tmp116_temp:31.65 8031060 2024/10/21 03:15:40 2 tmp116_temp:0.00 8031070 2024/10/21 03:17:22 2 tmp116_temp:0.00 Start Tx events OK

Downlink Command:

No downlink commands for feature

3.12 Print last few data entries

Feature: Print the last few data entries

AT Command: AT+PLDTA

Command Example	Function
AT+PLDTA=5 Print last 5 entries	Stop Tx events when read sensor data 0001 2024/10/25 02:29:19 3273 tmp116_temp:28.16 0002 2024/10/25 02:31:19 3258 tmp116_temp:28.21 0003 2024/10/25 02:33:19 3255 tmp116_temp:28.26 0004 2024/10/25 02:35:19 3266 tmp116_temp:28.40

```
0005 1970/1/1 00:00:13 3255 tmp116_temp:25.74
Start Tx events
OK
```

Downlink Command:

No downlink commands for feature

3.13 Clear Flash Record

Feature: Clear flash storage for data log feature.

AT Command: AT+CLRDTA

Command Example	Function	Response
AT+CLRDTA	Clear date record	Clear all stored sensor data... OK

Downlink Command: 0xA3

- Example: 0xA301 // Same as AT+CLRDTA

3.14 Auto Send None-ACK messages

Feature: T68DL will wait for ACK for each uplink, If T68DL doesn't get ACK from the IoT server, it will consider the message doesn't arrive server and store it. T68DL keeps sending messages in normal periodically. Once T68DL gets ACK from a server, it will consider the network is ok and start to send the not-arrive message.

AT Command: AT+PNACKMD

The default factory setting is 0

Command Example	Function	Response
AT+PNACKMD=1	Poll None-ACK message	OK

Downlink Command: 0x34

- Example: 0x3401 // Same as AT+PNACKMD=1

3.15 high datarate function

Feature: Enable or disable high datarate

AT Command: AT+HDR

The default factory setting is 0

Command Example	Function	Response
AT+HDR=1	Enable high datarate	OK

Downlink Command: 0xA1

- Example: 0xA101 // Same as AT+HDR=1
- Example: 0xA100 // Same as AT+HDR=0

3.16 Revised WMOD Command for Internal Sensor TMP116 Temperature Alarms

Feature: Set internal and external temperature sensor alarms.

Command Example	Function	Response
AT+WMOD=parameter1,parameter2,parameter3,parameter4	Set internal and external temperature sensor alarms	OK

AT+WMOD=parameter1,parameter2,parameter3,parameter4

Parameter 1: Alarm mode:

0): Cancel

1): Threshold alarm

2): Fluctuation alarm

3): Sampling multiple times and uplink together

Parameter 2: Sampling time. Unit: seconds, up to 255 seconds.

Note: When the collection time is less than 60 seconds and always exceeds the set alarm threshold, the sending interval will not be the collection time, but will be sent every 60 seconds.

Parameter 3 and parameter 4:

1): If Alarm Mode is set to 1: Parameter 3 and parameter 4 are valid, as before, they represent low temperature and high temperature.

Such as AT+WMOD=1,60,45,105, it means high and low temperature alarm.

2): If Alarm Mode is set to 2: Parameter 3 is valid, which represents the difference between the currently collected temperature and the last uploaded temperature.

Such as AT+WMOD=2,10,2,it means that it is a fluctuation alarm.

If the difference between the current collected temperature and the last Uplin is ±2 degrees, the alarm will be issued.

3): If Alarm Mode is set to 3:

- **parameter1:** Set Working Mode to **Mode 3**
- **parameter2:** Sampling Interval is **60**s.
- **parameter3:** When there is **20** sampling dats, Device will send these data via one uplink. (max value is 60, means max 60 sampling in one uplink)
- **parameter4 & parameter5:** Temperature alarm range is **-16** to **32**°C,
- **parameter6:** 1 to enable temperature alarm, **0** to disable the temperature alarm. If alarm is enabled, a data will be sent immediately if temperate exceeds the Alarm range.

Downlink Command: 0xA5

0xA5 00 -- AT+WMOD=0.

0xA5 01 0A 11 94 29 04 -- AT+WMOD=1,10,45,105 (AT+WMOD = second byte, third byte, fourth and fifth bytes divided by 100, sixth and seventh bytes divided by 100)

0XA5 01 0A F9 C0 29 04 --AT+WMOD=1,10,-16,105(Need to convert -16 to -1600 for calculation, -1600(DEC)=FFFFFFFFFFFFF9C0(HEX) FFFFFFFFFFFFF9C0(HEX) +10000(HEX)=F9C0(HEX))

0xA5 02 0A 02 -- AT+WMOD=2,10,2 (AT+WMOD = second byte, third byte, fourth byte)

0xA5 03 00 3C 14 FF F0 00 20 01--AT+WMOD=3,60,20,-16,32,1

0xA5 FF -- After the device receives it, upload the current alarm configuration (FPORT=8). Such as 01 0A 11 94 29 04 or 02 0A 02.

4. Battery

4.1 Battery Type

T68DL is equipped with a 2400mAH Li-MnO2 (CR17450) battery . The battery is an un-rechargeable battery with low discharge rate targeting for up to 8~10 years use.

The minimum Working Voltage for the T68DL is about 2.5v. When battery is lower than 2.6v, it is time to change the battery.

4.2 Power Consumption Analyze

Dragino battery powered products are all run in Low Power mode. User can check the guideline from this link to calculate the estimate battery life:

Battery Info & Power Consumption Analyze .

5. OTA Firmware update

User can change firmware T68DL 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 Why can't I see the datalog information

1. The time is not aligned, and the correct query command is not used.
2. Decoder error, did not parse the datalog data, the data was filtered.

7. Order Info

Part Number: **T68DL-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

8. Packing Info

Package Includes:

- T68DL Temperature Sensor x 1

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.cc.

Warning statement

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.