RS485-BL – Waterproof RS485 to LoRaWAN Converter User Manual

Document Version: 1.1

Image Version: v1.3.0

Version	Description	Date
1.0	Release	2020-Dec-7
1.1	Change to use TTNv3, Add TTL Interface info.	2021-Jun-25

1. Introduction

1.1 What is RS485-BL RS485 to LoRaWAN Converter

The Dragino RS485-BL is a **RS485 / UART to LoRaWAN Converter** for Internet of Things solutions. User can connect RS485 or UART sensor to RS485-BL converter, and configure RS485-BL to periodically read sensor data and upload via LoRaWAN network to IoT server.

RS485-BL can interface to RS485 sensor, 3.3v/5v UART sensor or interrupt sensor. RS485-BL provides **a 3.3v output** and **a 5v output** to power external sensors. Both output voltages are controllable to minimize the total system power consumption.

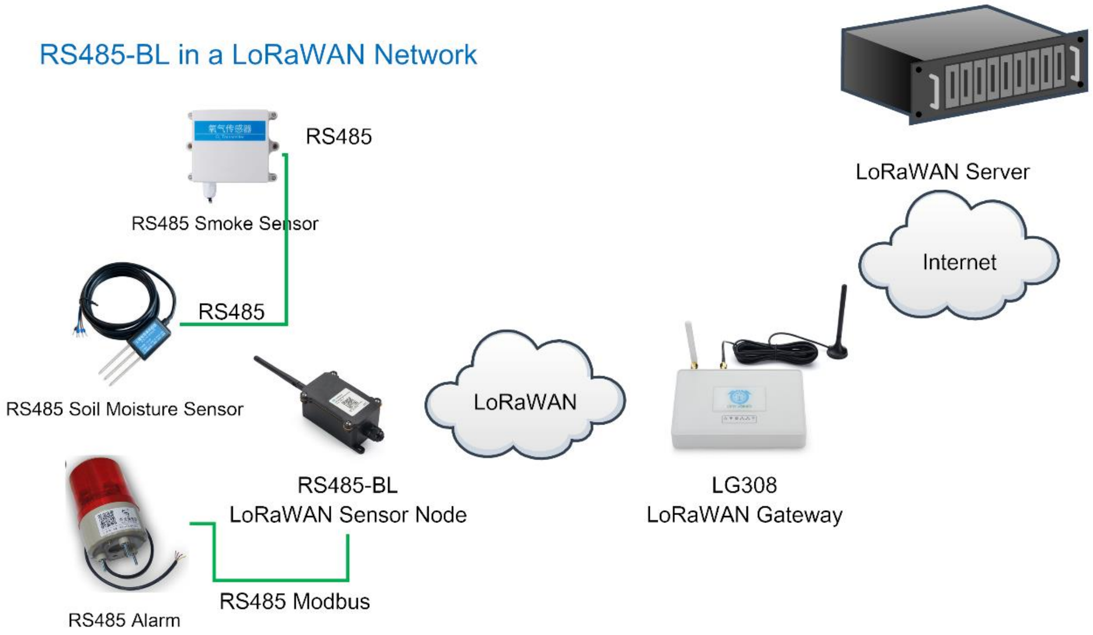
RS485-BL is IP67 **waterproof** and powered by **8500mAh Li-SOCI2 battery**, it is designed for long term use for several years.

RS485-BL runs standard **LoRaWAN 1.0.3 in Class A**. It can reach long transfer range and easy to integrate with LoRaWAN compatible gateway and IoT server.

For data uplink, RS485-BL sends user-defined commands to RS485 devices and gets the return from the RS485 devices. RS485-BL will process these returns data according to user-define rules to get the final payload and upload to LoRaWAN server.

For data downlink, RS485-BL runs in LoRaWAN Class A. When there is downlink commands from LoRaWAN server, RS485-BL will forward the commands from LoRaWAN server to RS485 devices.

Each RS485-BL pre-load with a set of unique keys for LoRaWAN registration, register these keys to LoRaWAN server and it will auto connect after power on.



1.2 Specifications

Hardware System:

- STM32L072CZT6 MCU
- SX1276/78 Wireless Chip
- Power Consumption (exclude RS485 device):
  - Idle: 6uA@3.3v
  - 20dB Transmit: 130mA@3.3v

Interface for Model:

- 1 x RS485 Interface
- 1 x TTL Serial , 3.3v or 5v.
- 1 x I2C Interface, 3.3v or 5v.
- 1 x one wire interface
- 1 x Interrupt Interface
- 1 x Controllable 5V output, max

LoRa Spec:

- Frequency Range:
  - ✓ Band 1 (HF): 862 ~ 1020 Mhz
  - ✓ Band 2 (LF): 410 ~ 528 Mhz
- 168 dB maximum link budget.
- +20 dBm - 100 mW constant RF output vs.
- Programmable bit rate up to 300 kbps.
- High sensitivity: down to -148 dBm.
- Bullet-proof front end: IIP3 = -12.5 dBm.
- Excellent blocking immunity.
- Fully integrated synthesizer with a resolution of 61 Hz.
- LoRa modulation.
- Built-in bit synchronizer for clock recovery.
- Preamble detection.
- 127 dB Dynamic Range RSSI.
- Automatic RF Sense and CAD with ultra-fast AFC.

1.3 Features

- ✓ LoRaWAN Class A & Class C protocol (default Class A)
- ✓ Frequency Bands: CN470/EU433/KR920/US915/EU868/AS923/AU915/IN865/RU864
- ✓ AT Commands to change parameters
- ✓ Remote configure parameters via LoRaWAN Downlink
- ✓ Firmware upgradable via program port
- ✓ Support multiply RS485 devices by flexible rules
- ✓ Support Modbus protocol

- ✓ Support Interrupt uplink

1.4 Applications

- ✓ Smart Buildings & Home Automation
- ✓ Logistics and Supply Chain Management
- ✓ Smart Metering
- ✓ Smart Agriculture
- ✓ Smart Cities
- ✓ Smart Factory

1.5 Firmware Change log

RS485-BL Image files – Download link and Change log

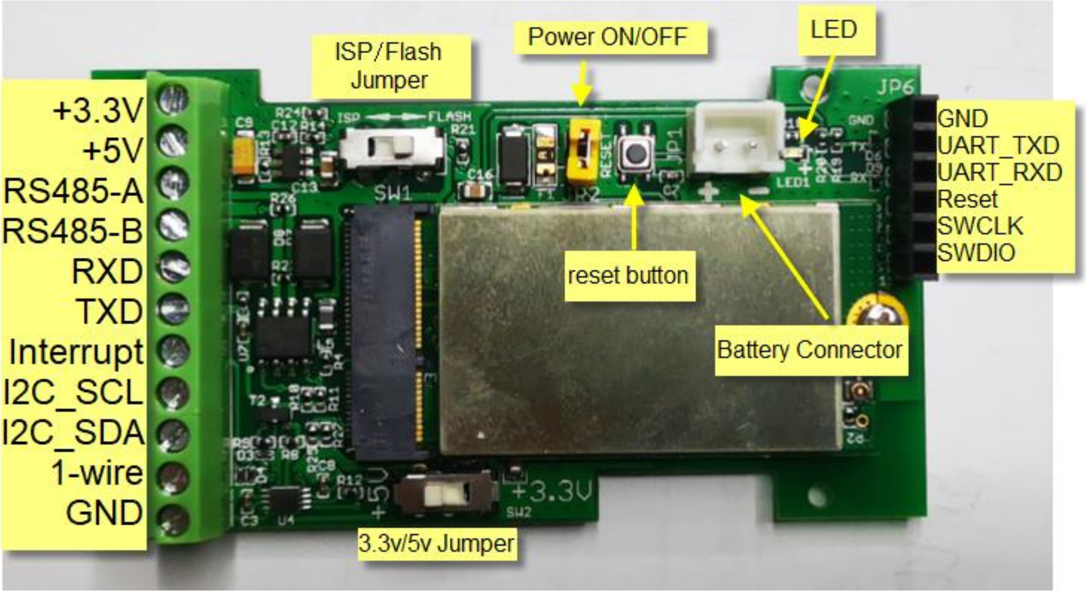
1.6 Hardware Change log

v1.3

Release version

2. Pin mapping and Power ON Device

The RS485-BL is powered on by 8500mAh battery. To save battery life, RS485-BL is shipped with power off. User can put the jumper to power on RS485-BL.



The Left TXD and RXD are TTL interface for external sensor. TTL level is controlled by 3.3/5v Jumper.

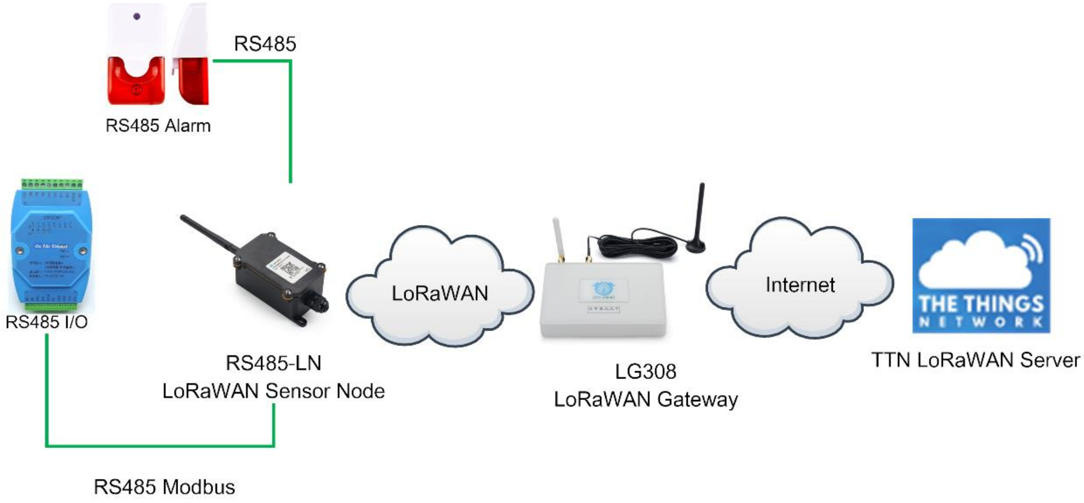
3. Operation Mode

3.1 How it works?

The RS485-BL is configured as LoRaWAN OTAA Class A mode by default. It has OTAA keys to join network. To connect a local LoRaWAN network, user just need to input the OTAA keys in the network server and power on the RS485-BL. It will auto join the network via OTAA.

3.2 Example to join LoRaWAN network

Here shows an example for how to join the TTN V3 Network. Below is the network structure, we use LG308 as LoRaWAN gateway here.

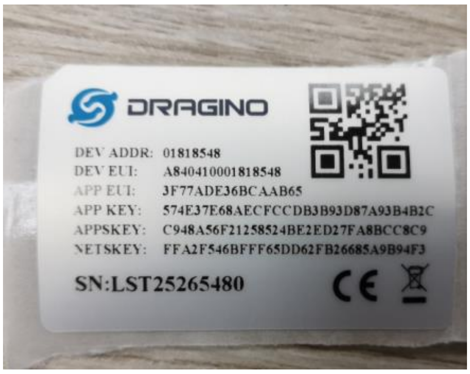


The RS485-BL in this example connected to two RS485 devices for demonstration, user can connect to other RS485 devices via the same method.

The LG308 is already set to connect to TTN V3 network . So what we need to now is only configure the TTN V3:

Step 1: Create a device in TTN V3 with the OTAA keys from RS485-BL.

Each RS485-BL is shipped with a sticker with unique device EUI:



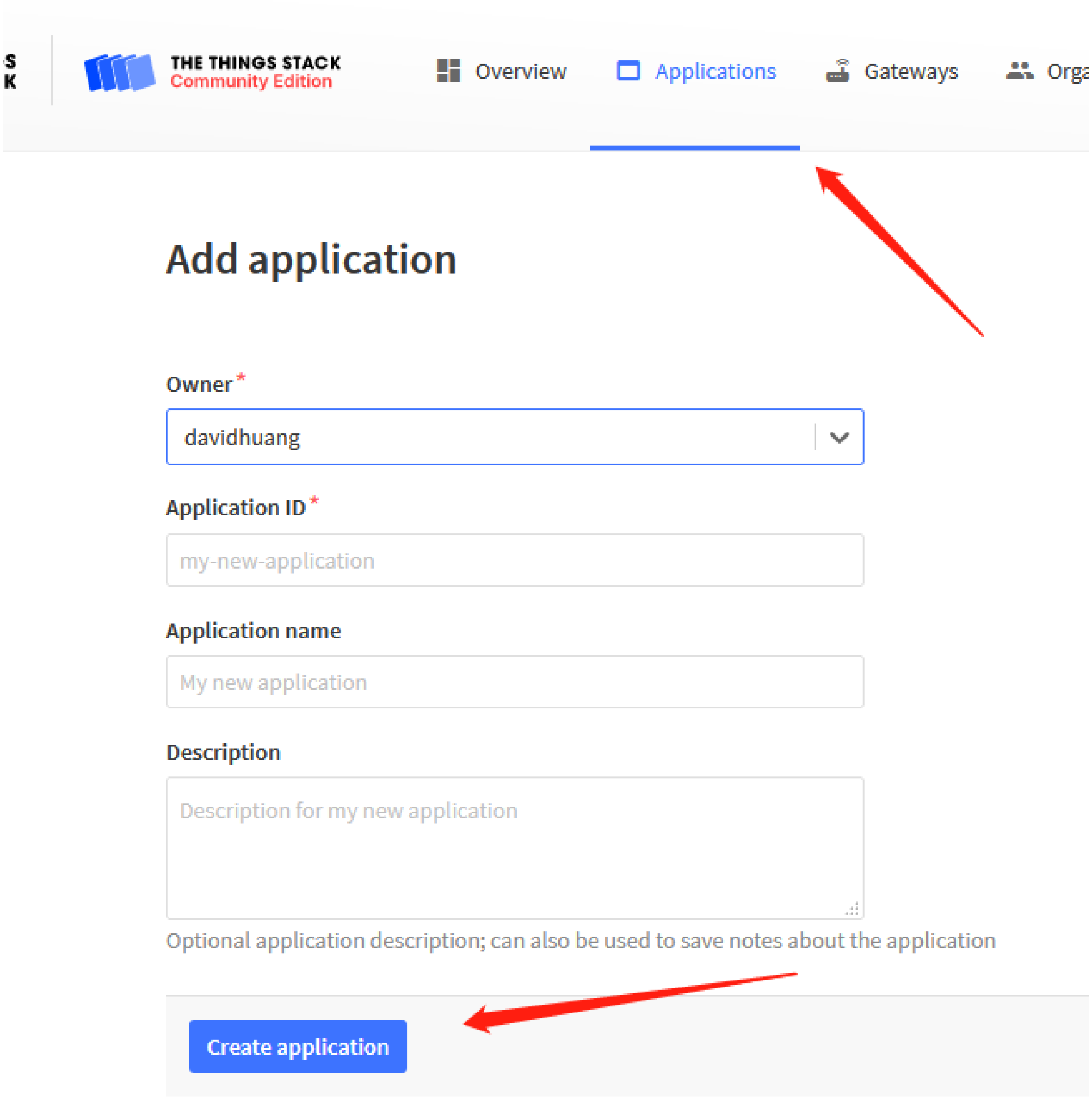
DRAGINO

DEV ADDR:	01818548
DEV EUI:	A840410001818548
APP EUI:	3F77ADE36BCAAB65
APP KEY:	574E37E68AECFCCDB3B93D87A93B4B2C
APPSKEY:	C948A56F21258524BE2ED27FA8BCC8C9
NETSKEY:	FFA2F546BFFF65DD62FB26685A9B94F3

SN:LST25265480

User can enter this key in their LoRaWAN Server portal. Below is TTN V3 screen shot:

Add APP EUI in the application.



Add application

Owner*

davidhuang

Application ID*

my-new-application

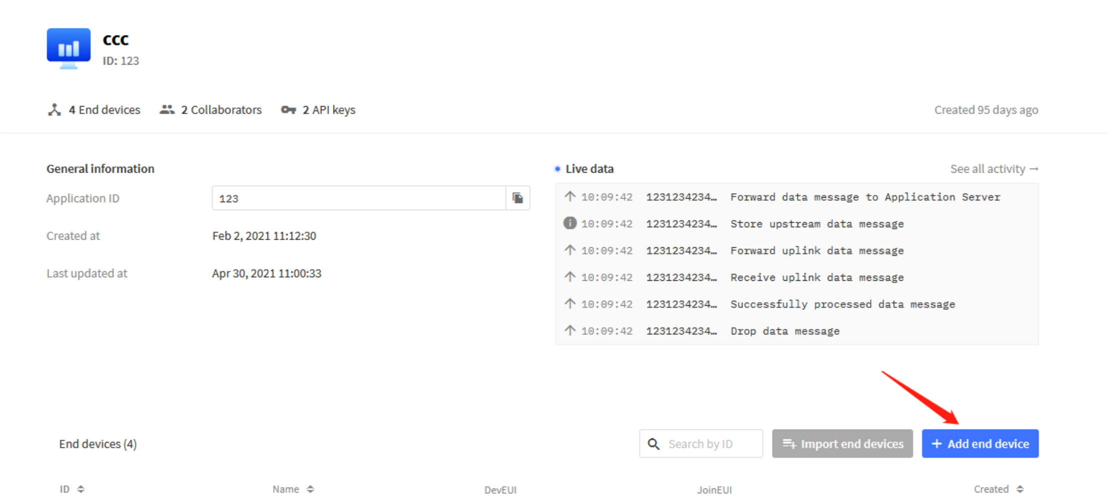
Application name

My new application

Description

Description for my new application

Optional application description; can also be used to save notes about the application



ccc
ID: 123

Created 95 days ago

General information

Application ID: 123

Created at: Feb 2, 2021 11:12:30

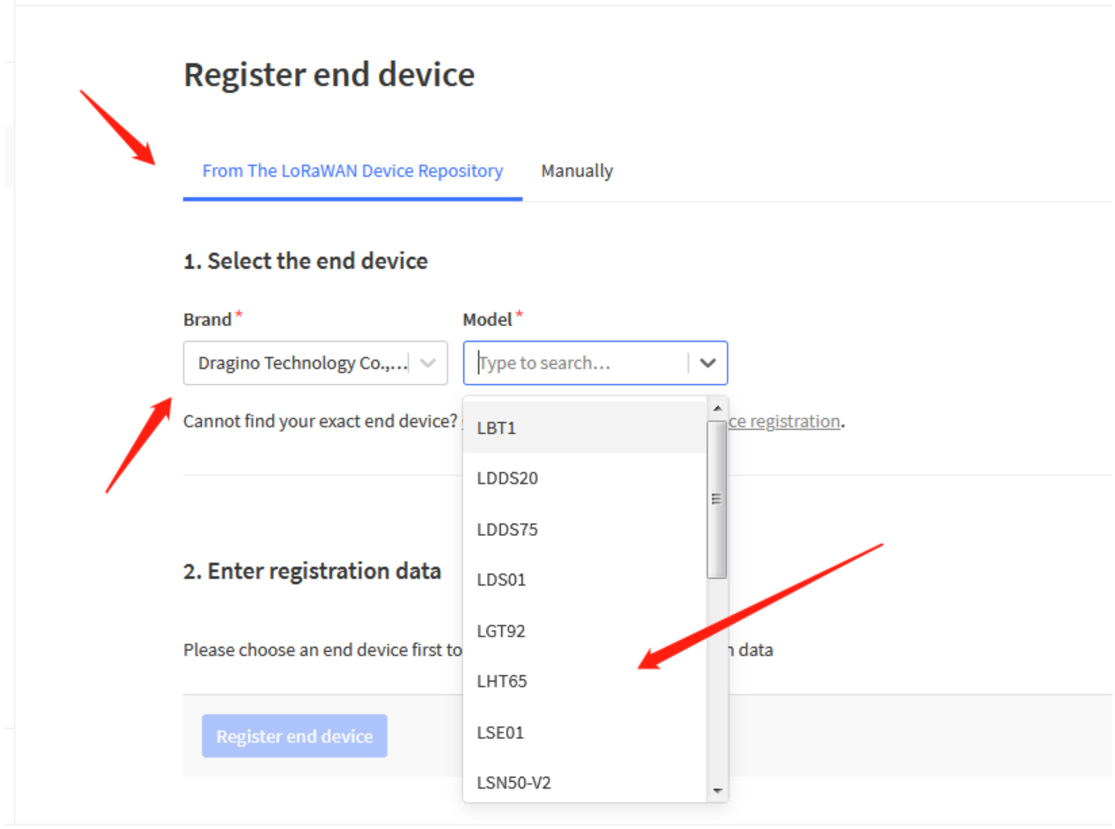
Last updated at: Apr 30, 2021 11:00:33

Live data

```
↑ 10:09:42  1231234234…  Forward data message to Application Server
  10:09:42  1231234234…  Store upstream data message
↑ 10:09:42  1231234234…  Forward uplink data message
↑ 10:09:42  1231234234…  Receive uplink data message
↑ 10:09:42  1231234234…  Successfully processed data message
↑ 10:09:42  1231234234…  Drop data message
```

End devices (4)

ID	Name	DevEUI	JoinEUI	Created



Register end device

1. Select the end device

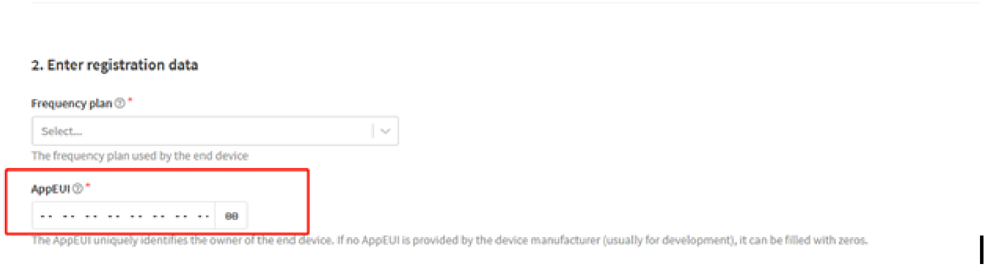
Brand * Dragino Technology Co.,...

Model * Type to search...

Cannot find your exact end device? ... ce registration.

2. Enter registration data

Please choose an end device first to ... n data



2. Enter registration data

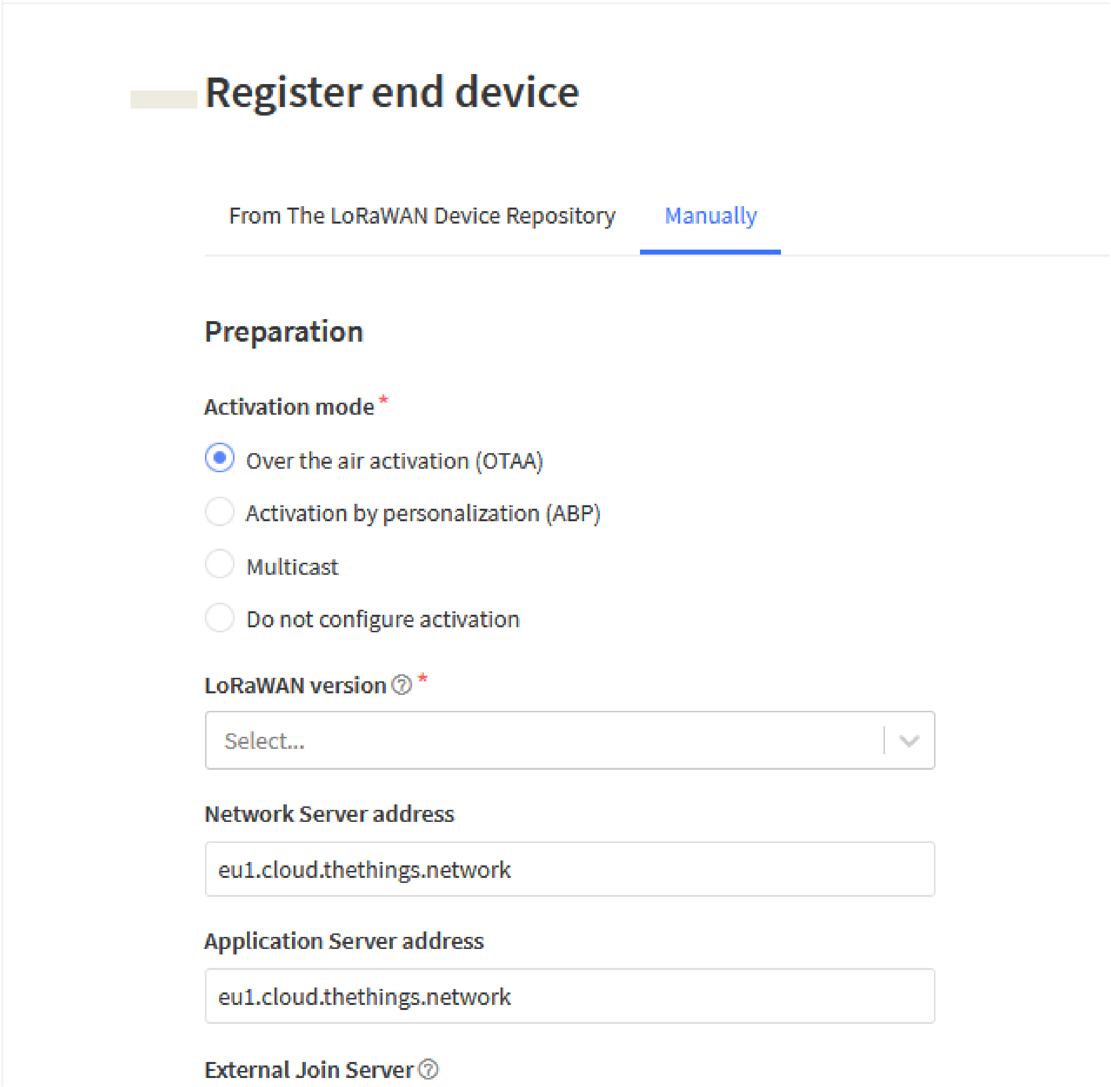
Frequency plan * Select...

The frequency plan used by the end device

AppEUI * -- -- -- -- -- -- -- --

The AppEUI uniquely identifies the owner of the end device. If no AppEUI is provided by the device manufacturer (usually for development), it can be filled with zeros.

You can also choose to create the device manually.



Register end device

From The LoRaWAN Device Repository | Manually

Preparation

Activation mode *

● Over the air activation (OTAA)

○ Activation by personalization (ABP)

○ Multicast

○ Do not configure activation

LoRaWAN version ⓘ *

Select...

Network Server address

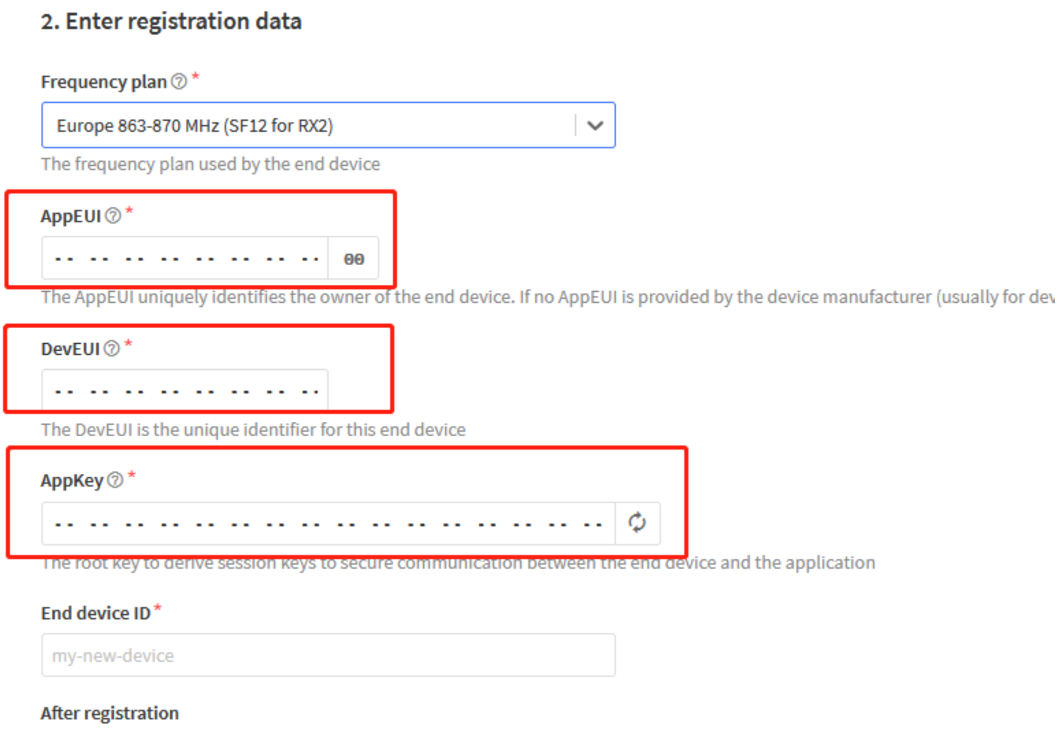
eu1.cloud.thethings.network

Application Server address

eu1.cloud.thethings.network

External Join Server ⓘ

Add APP KEY and DEV EUI



2. Enter registration data

Frequency plan ⓘ *

Europe 863-870 MHz (SF12 for RX2)

The frequency plan used by the end device

AppEUI ⓘ *

-- -- -- -- -- -- -- -- 00

The AppEUI uniquely identifies the owner of the end device. If no AppEUI is provided by the device manufacturer (usually for dev

DevEUI ⓘ *

-- -- -- -- -- -- -- --

The DevEUI is the unique identifier for this end device

AppKey ⓘ *

-- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --

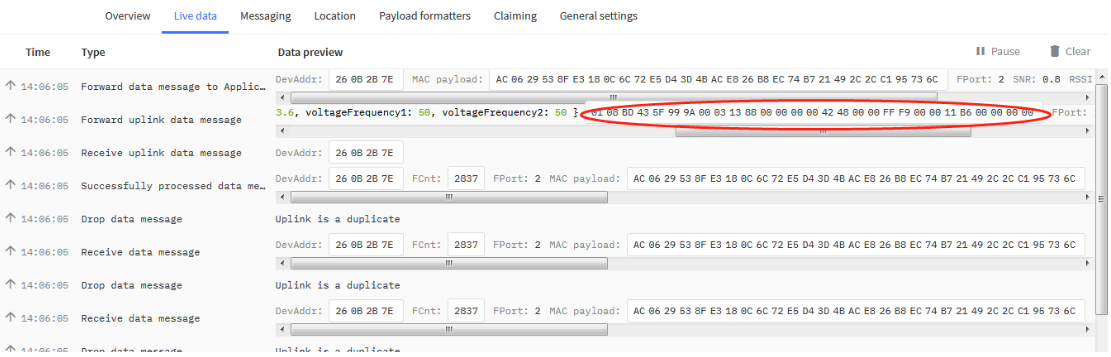
The root key to derive session keys to secure communication between the end device and the application

End device ID *

my-new-device

After registration

Step 2: Power on RS485-BL 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.



```
Time      Type                                 Data preview
↑ 14:06:05 Forward data message to Applic…     DevAddr: 26 0B 2B 7E  MAC payload: AC 06 29 53 8F E3 18 0C 6C 72 E5 D4 3D 4B AC E8 26 B8 EC 74 B7 21 49 2C 2C C1 95 73 6C  FPort: 2  SNR: 0.8  RSSI
↑ 14:06:05 Forward uplink data message         3.6, voltageFrequency1: 50, voltageFrequency2: 50 } 01 08 BD 43 5F 99 9A 00 03 13 88 00 00 00 00 42 48 00 00 FF F9 00 00 11 B6 00 00 00 00  FPort:
↑ 14:06:05 Receive uplink data message         DevAddr: 26 0B 2B 7E
↑ 14:06:05 Successfully processed data me…     DevAddr: 26 0B 2B 7E  FCnt: 2837  FPort: 2  MAC payload: AC 06 29 53 8F E3 18 0C 6C 72 E5 D4 3D 4B AC E8 26 B8 EC 74 B7 21 49 2C 2C C1 95 73 6C
↑ 14:06:05 Drop data message                   Uplink is a duplicate
↑ 14:06:05 Receive data message                DevAddr: 26 0B 2B 7E  FCnt: 2837  FPort: 2  MAC payload: AC 06 29 53 8F E3 18 0C 6C 72 E5 D4 3D 4B AC E8 26 B8 EC 74 B7 21 49 2C 2C C1 95 73 6C
↑ 14:06:05 Drop data message                   Uplink is a duplicate
↑ 14:06:05 Receive data message                DevAddr: 26 0B 2B 7E  FCnt: 2837  FPort: 2  MAC payload: AC 06 29 53 8F E3 18 0C 6C 72 E5 D4 3D 4B AC E8 26 B8 EC 74 B7 21 49 2C 2C C1 95 73 6C
↑ 14:06:05 Drop data message                   Uplink is a duplicate
```

3.3 Configure Commands to read data

There are plenty of RS485 and TTL level devices in the market and each device has different command to read the valid data. To support these devices in flexible, RS485-BL supports flexible command set. User can use AT Commands or LoRaWAN Downlink Command to configure how RS485-BL should read the sensor and how to handle the return from RS485 or TTL sensors.

3.3.1 Configure UART settings for RS485 or TTL communication

RS485-BL can connect to either RS485 sensors or TTL sensor. User need to specify what type of sensor need to connect.

1) RS485-MODBUS mode:
   AT+MOD=1 // Support RS485-MODBUS type sensors. User can connect multiply RS485 , Modbus sensors to the A / B pins.

2) TTL mode:
   AT+MOD=2 // Support TTL Level sensors, User can connect one TTL Sensor to the TXD/RXD/GND pins.

RS485-BL default UART settings is **9600, no parity, stop bit 1**. If the sensor has a different settings, user can change the RS485-BL setting to match.

AT Commands	Description	Example
AT+BAUDR	Set the baud rate (for RS485 connection). Default Value is: 9600.	AT+BAUDR=9600 Options: (1200,2400,4800,14400,19200,115200)
AT+PARITY	Set UART parity (for RS485 connection) Default Value is: no parity.	AT+PARITY=0 Option: 0: no parity, 1: odd parity, 2: even parity
AT+STOPBIT	Set serial stopbit (for RS485 connection) Default Value is: 1bit.	AT+STOPBIT=0 for 1bit AT+STOPBIT=1 for 1.5 bit AT+STOPBIT=2 for 2 bits

3.3.2 Configure sensors

Some sensors might need to configure before normal operation. User can configure such sensor via PC or through RS485-BL AT Commands AT+CFGDEV.

When user issue an AT+CFGDEV command, Each AT+CFGDEV equals to send a command to the RS485 or TTL sensors. This command will only run when user input it and won't run during each sampling.

AT Commands	Description	Example
AT+CFGDEV	This command is used to configure the RS485/TTL devices; they won't be used during sampling. AT+CFGDEV=xx xx xx xx xx xx xx xx xx xx xx xx,m m: 0: no CRC, 1: add CRC-16/MODBUS in the end of this command	AT+CFGDEV=xx xx xx xx xx xx xx xx xx xx xx xx,m

Detail of AT+CFGDEV command see AT+CFGDEV detail.

3.3.3 Configure read commands for each sampling

RS485-BL is a battery powered device; it will sleep most of time. And wake up on each period and read RS485 / TTL sensor data and uplink.

During each sampling, we need to confirm what commands we need to send to the sensors to read data. After the RS485/TTL sensors send back the value, it normally includes some bytes and we only need a few from them for a shorten payload.

To save the LoRaWAN network bandwidth, we might need to read data from different sensors and combine their valid value into a short payload.

This section describes how to achieve above goals.

During each sampling, the RS485-BL can support 15 commands to read sensors. And combine the return to one or several uplink payloads.

Command from RS485-BL to Sensor:

RS485-BL can send out pre-set max 15 strings via **AT+COMMAD1**, **ATCOMMAND2**,…, to **AT+COMMANDF** . All commands are of same grammar.

Handle return from sensors to RS485-BL:

After RS485-BL send out a string to sensor, RS485-BL will wait for the return from RS485 or TTL sensor. And user can specify how to handle the return, by **AT+DATACUT or AT+SEARCH commands**

✓ **AT+DATACUT**

When the return value from sensor have fix length and we know which position the valid value we should get, we can use AT+DATACUT command.

✓ **AT+SEARCH**

When the return value from sensor is dynamic length and we are not sure which bytes the valid data is, instead, we know what value the valid value following. We can use AT+SEARCH to search the valid value in the return string.

Define wait timeout:

Some RS485 device might has longer delay on reply, so user can use AT+CMDDL to set the timeout for getting reply after the RS485 command is sent. For example, AT+CMDDL1=1000 to send the open time to 1000ms

After we got the valid value from each RS485 commands, we need to combine them together with the command **AT+DATAUP**.

Examples:

Below are examples for the how above AT Commands works.

AT+COMMANDx : This command will be sent to RS485/TTL devices during each sampling, Max command length is 14 bytes. The grammar is:

AT+COMMANDx=xx xx xx xx xx xx xx xx xx xx xx xx,m

xx xx xx xx xx xx xx xx xx xx xx xx: The RS485 command to be sent

m: 0: no CRC, 1: add CRC-16/MODBUS in the end of this command

For example, if we have a RS485 sensor. The command to get sensor value is: 01 03 0B B8 00 02 46 0A. Where 01 03 0B B8 00 02 is the Modbus command to read the register 0B B8 where stored the sensor value. The 46 0A is the CRC-16/MODBUS which calculate manually.
In the RS485-BL, we should use this command AT+COMMAND1=01 03 0B B8 00 02,1 for the same.

AT+SEARCHx: This command defines how to handle the return from AT+COMMANDx.

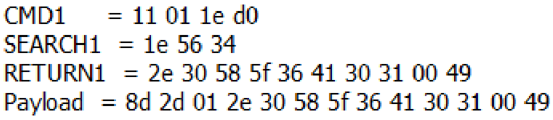
AT+SEARCHx=aa,xx xx xx xx xx

✧ **aa: 1: prefix match mode; 2: prefix and suffix match mode**

✧ **xx xx xx xx xx: match string. Max 5 bytes for prefix and 5 bytes for suffix**

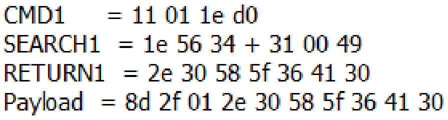
Examples:

1) For a return string from AT+COMMAND1: 16 0c 1e 56 34 2e 30 58 5f 36 41 30 31 00 49
 If we set AT+SEARCH1=1,1E 56 34. (max 5 bytes for prefix)
 The valid data will be all bytes after 1E 56 34 , so it is 2e 30 58 5f 36 41 30 31 00 49



```
CMD1     = 11 01 1e d0
SEARCH1  = 1e 56 34
RETURN1  = 2e 30 58 5f 36 41 30 31 00 49
Payload  = 8d 2d 01 2e 30 58 5f 36 41 30 31 00 49
```

2) For a return string from AT+COMMAND1: 16 0c 1e 56 34 2e 30 58 5f 36 41 30 31 00 49
If we set AT+SEARCH1=2, 1E 56 34+31 00 49
Device will search the bytes between 1E 56 34 and 31 00 49. So it is 2e 30 58 5f 36 41 30



```
CMD1     = 11 01 1e d0
SEARCH1  = 1e 56 34 + 31 00 49
RETURN1  = 2e 30 58 5f 36 41 30
Payload  = 8d 2f 01 2e 30 58 5f 36 41 30
```

AT+DATACUTx : This command defines how to handle the return from AT+COMMANDx, max return length is 45 bytes.

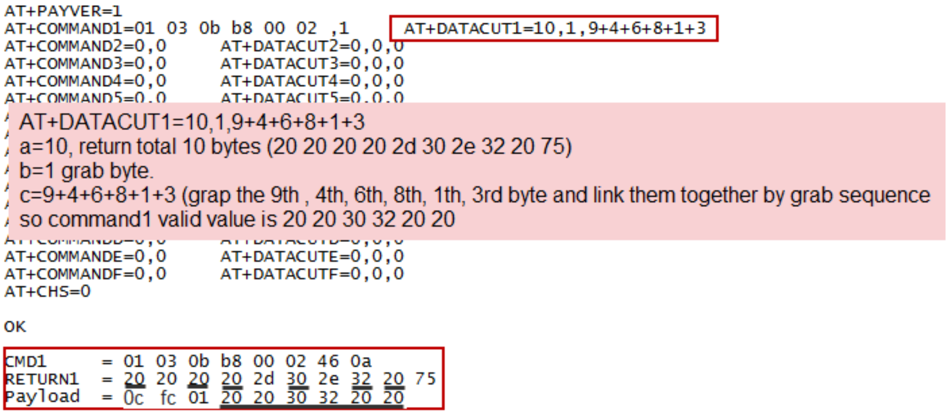
AT+DATACUTx=a,b,c

✧ **a: length for the return of AT+COMMAND**

- ✧ b:1: grab valid value by byte, max 6 bytes. 2: grab valid value by bytes section, max 3 sections.
- ✧ c: define the position for valid value.

Examples:

➢ Grab bytes:



```
AT+PAYVER=1
AT+COMMAND1=01 03 0b b8 00 02 ,1      AT+DATACUT1=10,1,9+4+6+8+1+3
AT+COMMAND2=0,0       AT+DATACUT2=0,0,0
AT+COMMAND3=0,0       AT+DATACUT3=0,0,0
AT+COMMAND4=0,0       AT+DATACUT4=0,0,0
AT+COMMAND5=0,0       AT+DATACUT5=0,0,0
```

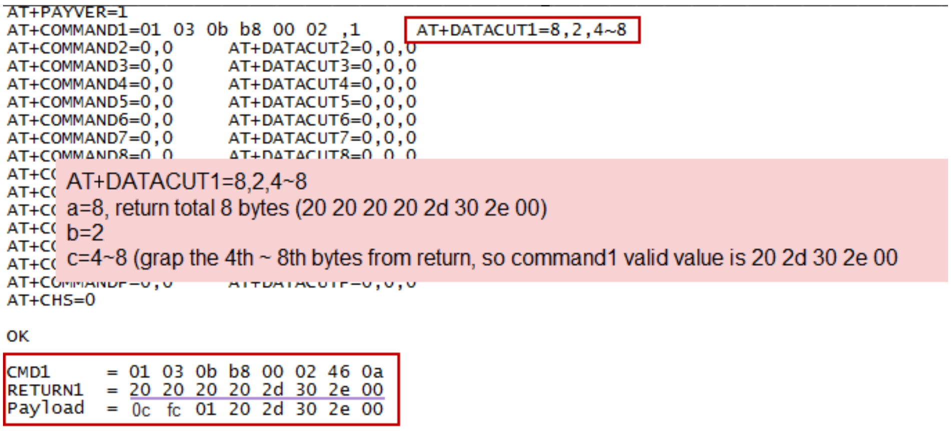
AT+DATACUT1=10,1,9+4+6+8+1+3
a=10, return total 10 bytes (20 20 20 20 2d 30 2e 32 20 75)
b=1 grab byte.
c=9+4+6+8+1+3 (grap the 9th , 4th, 6th, 8th, 1th, 3rd byte and link them together by grab sequence
so command1 valid value is 20 20 30 32 20 20

```
AT+COMMANDE=0,0       AT+DATACUTE=0,0,0
AT+COMMANDF=0,0       AT+DATACUTF=0,0,0
AT+CHS=0

OK

CMD1      = 01 03 0b b8 00 02 46 0a
RETURN1   = 20 20 20 20 2d 30 2e 32 20 75
Payload   = 0c fc 01 20 20 30 32 20 20
```

➢ Grab a section.



```
AT+PAYVER=1
AT+COMMAND1=01 03 0b b8 00 02 ,1      AT+DATACUT1=8,2,4~8
AT+COMMAND2=0,0       AT+DATACUT2=0,0,0
AT+COMMAND3=0,0       AT+DATACUT3=0,0,0
AT+COMMAND4=0,0       AT+DATACUT4=0,0,0
AT+COMMAND5=0,0       AT+DATACUT5=0,0,0
AT+COMMAND6=0,0       AT+DATACUT6=0,0,0
AT+COMMAND7=0,0       AT+DATACUT7=0,0,0
AT+COMMAND8=0,0       AT+DATACUT8=0,0,0
```

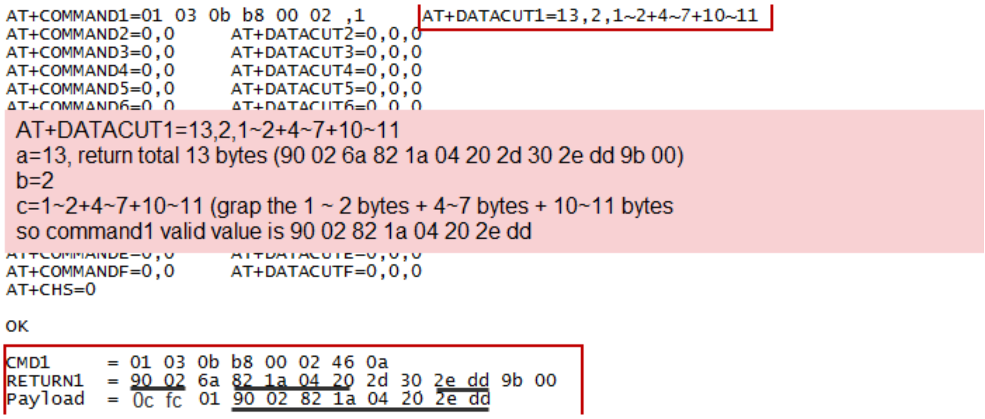
AT+DATACUT1=8,2,4~8
a=8, return total 8 bytes (20 20 20 20 2d 30 2e 00)
b=2
c=4~8 (grap the 4th ~ 8th bytes from return, so command1 valid value is 20 2d 30 2e 00

```
AT+COMMANDF=0,0       AT+DATACUTF=0,0,0
AT+CHS=0

OK

CMD1      = 01 03 0b b8 00 02 46 0a
RETURN1   = 20 20 20 20 2d 30 2e 00
Payload   = 0c fc 01 20 2d 30 2e 00
```

➢ Grab different sections.



```
AT+COMMAND1=01 03 0b b8 00 02 ,1      AT+DATACUT1=13,2,1~2+4~7+10~11
AT+COMMAND2=0,0       AT+DATACUT2=0,0,0
AT+COMMAND3=0,0       AT+DATACUT3=0,0,0
AT+COMMAND4=0,0       AT+DATACUT4=0,0,0
AT+COMMAND5=0,0       AT+DATACUT5=0,0,0
AT+COMMAND6=0,0       AT+DATACUT6=0,0,0
```

AT+DATACUT1=13,2,1~2+4~7+10~11
a=13, return total 13 bytes (90 02 6a 82 1a 04 20 2d 30 2e dd 9b 00)
b=2
c=1~2+4~7+10~11 (grap the 1 ~ 2 bytes + 4~7 bytes + 10~11 bytes
so command1 valid value is 90 02 82 1a 04 20 2e dd

```
AT+COMMANDF=0,0       AT+DATACUTF=0,0,0
AT+CHS=0

OK

CMD1      = 01 03 0b b8 00 02 46 0a
RETURN1   = 90 02 6a 82 1a 04 20 2d 30 2e dd 9b 00
Payload   = 0c fc 01 90 02 82 1a 04 20 2e dd
```

Note:

AT+SEARCHx and AT+DATACUTx can be used together, if both commands are set, RS485-BL will first process AT+SEARCHx on the return string and get a temporary string, and then process

AT+DATACUTx on this temporary string to get the final payload. In this case, AT+DATACUTx need to set to format AT+DATACUTx=0,xx,xx where the return bytes set to 0.

Example:

AT+COMMAND1=11 01 1E D0,0

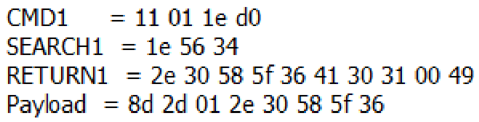
AT+SEARCH1=1,1E 56 34

AT+DATACUT1=0,2,1~5

Return string from AT+COMMAND1: 16 0c 1e 56 34 2e 30 58 5f 36 41 30 31 00 49

String after SEARCH command: 2e 30 58 5f 36 41 30 31 00 49

Valid payload after DataCUT command: 2e 30 58 5f 36



```
CMD1     = 11 01 1e d0
SEARCH1  = 1e 56 34
RETURN1  = 2e 30 58 5f 36 41 30 31 00 49
Payload  = 8d 2d 01 2e 30 58 5f 36
```

3.3.4 Compose the uplink payload

Through AT+COMMANDx and AT+DATACUTx we got valid value from each RS485 commands, Assume these valid value are RETURN1, RETURN2, .., to RETURNx. The next step is how to compose the LoRa Uplink Payload by these RETURNs. The command is **AT+DATAUP.**

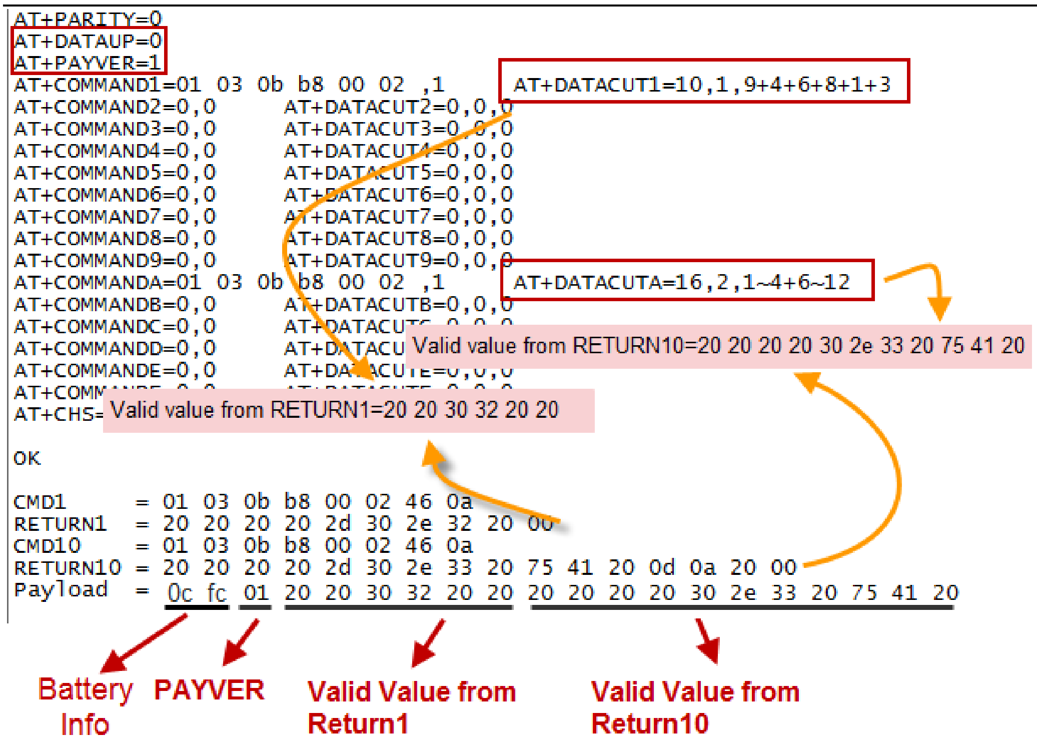
Examples: AT+DATAUP=0

Compose the uplink payload with value returns in sequence and send with **A SIGNLE UPLINK**.

Final Payload is

Battery Info+PAYVER + VALID Value from RETURN1 + Valid Value from RETURN2 + … + RETURNx

Where PAYVER is defined by AT+PAYVER, below is an example screen shot.



```
AT+PARITY=0
AT+DATAUP=0
AT+PAYVER=1
AT+COMMAND1=01 03 0b b8 00 02 ,1
AT+COMMAND2=0,0      AT+DATACUT2=0,0,0
AT+COMMAND3=0,0      AT+DATACUT3=0,0,0
AT+COMMAND4=0,0      AT+DATACUT4=0,0,0
AT+COMMAND5=0,0      AT+DATACUT5=0,0,0
AT+COMMAND6=0,0      AT+DATACUT6=0,0,0
AT+COMMAND7=0,0      AT+DATACUT7=0,0,0
AT+COMMAND8=0,0      AT+DATACUT8=0,0,0
AT+COMMAND9=0,0      AT+DATACUT9=0,0,0
AT+COMMANDA=01 03 0b b8 00 02 ,1
AT+COMMANDB=0,0      AT+DATACUTB=0,0,0
AT+COMMANDC=0,0      AT+DATACUTC=0,0,0
AT+COMMANDD=0,0      AT+DATACU
AT+COMMANDE=0,0      AT+DATACUTE=0,0,0
AT+COMMANDF=0,0      AT+DATACUTF=0,0,0
AT+CHS=

OK

CMD1     = 01 03 0b b8 00 02 46 0a
RETURN1  = 20 20 20 20 2d 30 2e 32 20 00
CMD10    = 01 03 0b b8 00 02 46 0a
RETURN10 = 20 20 20 20 2d 30 2e 33 20 75 41 20 0d 0a 20 00
Payload  = 0c fc 01 20 20 30 32 20 20 20 20 20 20 30 2e 33 20 75 41 20
```

AT+DATACUT1=10,1,9+4+6+8+1+3

AT+DATACUTA=16,2,1~4+6~12

Valid value from RETURN10=20 20 20 20 30 2e 33 20 75 41 20

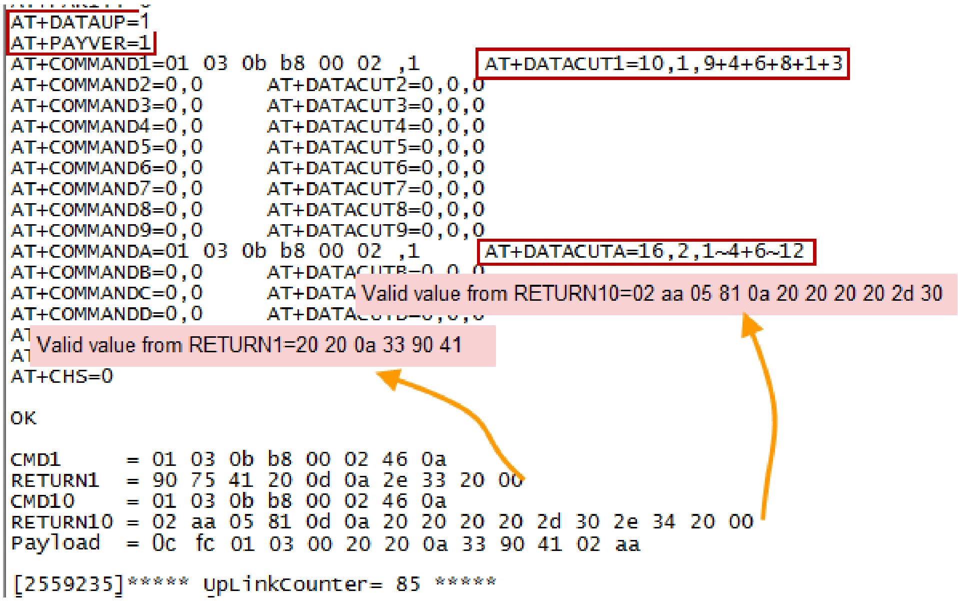
Valid value from RETURN1=20 20 30 32 20 20

Examples: AT+DATAUP=1

Compose the uplink payload with value returns in sequence and send with **Multiply UPLINKs**. Final Payload is

Battery Info+PAYVER + PAYLOAD COUNT + PAYLOAD# + DATA

1) Battery Info (2 bytes): Battery voltage
2) PAYVER (1 byte): Defined by AT+PAYVER
3) PAYLOAD COUNT (1 byte): Total how many uplinks of this sampling.
4) PAYLOAD# (1 byte): Number of this uplink. (from 0,1,2,3...,to PAYLOAD COUNT)
5) DATA: Valid value: max 6 bytes(US915 version here, Notice*!) for each uplink so each uplink <= 11 bytes. For the last uplink, DATA will might less than 6 bytes



```
AT+DATAUP=1
AT+PAYVER=1
AT+COMMAND1=01 03 0b b8 00 02 ,1     AT+DATACUT1=10,1,9+4+6+8+1+3
AT+COMMAND2=0,0      AT+DATACUT2=0,0,0
AT+COMMAND3=0,0      AT+DATACUT3=0,0,0
AT+COMMAND4=0,0      AT+DATACUT4=0,0,0
AT+COMMAND5=0,0      AT+DATACUT5=0,0,0
AT+COMMAND6=0,0      AT+DATACUT6=0,0,0
AT+COMMAND7=0,0      AT+DATACUT7=0,0,0
AT+COMMAND8=0,0      AT+DATACUT8=0,0,0
AT+COMMAND9=0,0      AT+DATACUT9=0,0,0
AT+COMMANDA=01 03 0b b8 00 02 ,1     AT+DATACUTA=16,2,1~4+6~12
AT+COMMANDB=0,0      AT+DATACUTB=0,0,0
AT+COMMANDC=0,0      AT+DATA
AT+COMMANDD=0,0      AT+DATACUTD=0,0,0
AT
AT
AT+CHS=0

OK

CMD1      = 01 03 0b b8 00 02 46 0a
RETURN1   = 90 75 41 20 0d 0a 2e 33 20 00
CMD10     = 01 03 0b b8 00 02 46 0a
RETURN10  = 02 aa 05 81 0d 0a 20 20 20 20 2d 30 2e 34 20 00
Payload   = 0c fc 01 03 00 20 20 0a 33 90 41

[2559235]***** UpLinkCounter= 85 *****
```

Valid value from RETURN10=02 aa 05 81 0a 20 20 20 20 2d 30

Valid value from RETURN1=20 20 0a 33 90 41

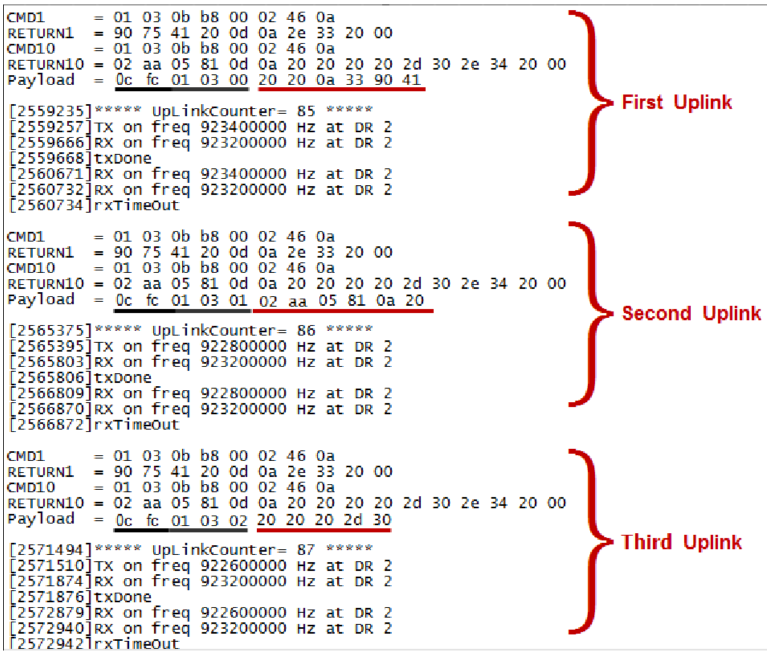
So totally there will be 3 uplinks for this sampling, each uplink includes 6 bytes DATA

DATA1=RETURN1 Valid Value = 20 20 0a 33 90 41

DATA2=1st ~ 6th byte of Valid value of RETURN10= 02 aa 05 81 0a 20

DATA3=7th ~ 11th bytes of Valid value of RETURN10 = 20 20 20 2d 30

Below are the uplink payloads:



```
CMD1      = 01 03 0b b8 00 02 46 0a
RETURN1   = 90 75 41 20 0d 0a 2e 33 20 00
CMD10     = 01 03 0b b8 00 02 46 0a
RETURN10  = 02 aa 05 81 0d 0a 20 20 20 20 2d 30 2e 34 20 00
Payload   = 0c fc 01 03 00 20 20 0a 33 90 41

[2559235]***** UpLinkCounter= 85 *****
[2559257]TX on freq 923400000 Hz at DR 2
[2559666]RX on freq 923200000 Hz at DR 2
[2559668]txDone
[2560671]RX on freq 923400000 Hz at DR 2
[2560732]RX on freq 923200000 Hz at DR 2
[2560734]rxTimeOut

CMD1      = 01 03 0b b8 00 02 46 0a
RETURN1   = 90 75 41 20 0d 0a 2e 33 20 00
CMD10     = 01 03 0b b8 00 02 46 0a
RETURN10  = 02 aa 05 81 0d 0a 20 20 20 20 2d 30 2e 34 20 00
Payload   = 0c fc 01 03 01 02 aa 05 81 0a 20

[2565375]***** UpLinkCounter= 86 *****
[2565395]TX on freq 922800000 Hz at DR 2
[2565803]RX on freq 923200000 Hz at DR 2
[2565806]txDone
[2566809]RX on freq 922800000 Hz at DR 2
[2566870]RX on freq 923200000 Hz at DR 2
[2566872]rxTimeOut

CMD1      = 01 03 0b b8 00 02 46 0a
RETURN1   = 90 75 41 20 0d 0a 2e 33 20 00
CMD10     = 01 03 0b b8 00 02 46 0a
RETURN10  = 02 aa 05 81 0d 0a 20 20 20 20 2d 30 2e 34 20 00
Payload   = 0c fc 01 03 02 20 20 20 2d 30

[2571494]***** UpLinkCounter= 87 *****
[2571510]TX on freq 922600000 Hz at DR 2
[2571874]RX on freq 923200000 Hz at DR 2
[2571876]txDone
[2572879]RX on freq 922600000 Hz at DR 2
[2572940]RX on freq 923200000 Hz at DR 2
[2572942]rxTimeOut
```

Notice: the Max bytes is according to the max support bytes in different Frequency Bands for lowest SF. As below:

* For AU915/AS923 bands, if UplinkDwell time=0, max 51 bytes for each uplink (so 51 -5 = 46 max valid date)

* For AU915/AS923 bands, if UplinkDwell time=1, max 11 bytes for each uplink (so 11 -5 = 6 max valid date).

* For US915 band, max 11 bytes for each uplink (so 11 -5 = 6 max valid date).

* For all other bands: max 51 bytes for each uplink (so 51 -5 = 46 max valid date).

3.3.5 Uplink on demand

Except uplink periodically, RS485-BL is able to uplink on demand. The server sends downlink command to RS485-BL and RS485 will uplink data base on the command.

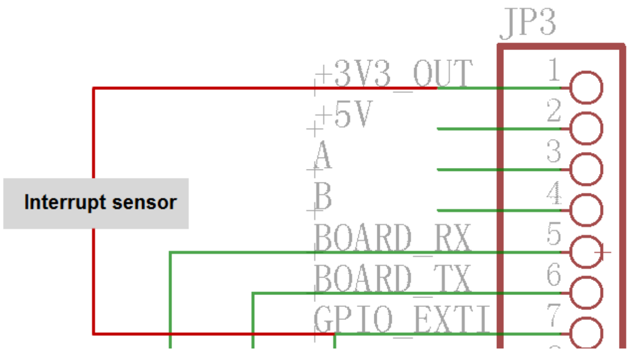
Downlink control command:

0x08 command: Poll an uplink with current command set in RS485-BL.

0xA8 command: Send a command to RS485-BL and uplink the output from sensors.

3.3.6 Uplink on Interrupt

Put the interrupt sensor between 3.3v_out and GPIO ext.



AT+INTMOD=0	Disable Interrupt
AT+INTMOD=1	Interrupt trigger by rising or falling edge.
AT+INTMOD=2	Interrupt trigger by falling edge. (Default Value)
AT+INTMOD=3	Interrupt trigger by rising edge.

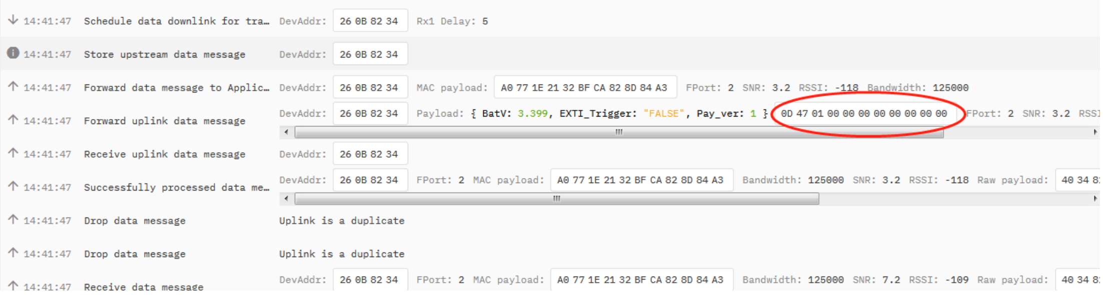
3.4 Uplink Payload

Size(bytes)	**2**	**1**	**Length depends on the return from the commands**
Value	Battery(mV) & Interrupt _Flag	PAYLOAD_VER	If the valid payload is too long and exceed the maximum support payload length in server, server will show payload not provided in the LoRaWAN server.

Below is the decoder for the first 3 bytes. The rest bytes are dynamic depends on different RS485 sensors.

```
function Decoder(bytes, port) {
//Payload Formats of RS485-BL Deceive
return {
        //Battery,units:V
        BatV:((bytes[0]<<8 | bytes[1])&0x7fff)/1000,
        //GPIO_EXTI
        EXTI_Trigger:(bytes[0] & 0x80)? "TRUE":"FALSE",
        //payload of version
        Pay_ver:bytes[2],
        };
    }
```

TTN V3 uplink screen shot.



```
↓ 14:41:47  Schedule data downlink for tra…  DevAddr: 26 0B 82 34  Rx1 Delay: 5
  14:41:47  Store upstream data message      DevAddr: 26 0B 82 34
↑ 14:41:47  Forward data message to Applic…  DevAddr: 26 0B 82 34  MAC payload: A0 77 1E 21 32 BF CA 82 8D 84 A3  FPort: 2  SNR: 3.2  RSSI: -118  Bandwidth: 125000
↑ 14:41:47  Forward uplink data message      DevAddr: 26 0B 82 34  Payload: { BatV: 3.399, EXTI_Trigger: "FALSE", Pay_ver: 1 } 0D 47 01 00 00 00 00 00 00 00 00  FPort: 2  SNR: 3.2  RSSI
↑ 14:41:47  Receive uplink data message      DevAddr: 26 0B 82 34
↑ 14:41:47  Successfully processed data me…  DevAddr: 26 0B 82 34  FPort: 2  MAC payload: A0 77 1E 21 32 BF CA 82 8D 84 A3  Bandwidth: 125000  SNR: 3.2  RSSI: -118  Raw payload: 40 34 8
↑ 14:41:47  Drop data message                Uplink is a duplicate
↑ 14:41:47  Drop data message                Uplink is a duplicate
↑ 14:41:47  Receive data message             DevAddr: 26 0B 82 34  FPort: 2  MAC payload: A0 77 1E 21 32 BF CA 82 8D 84 A3  Bandwidth: 125000  SNR: 7.2  RSSI: -109  Raw payload: 40 34 8
```

3.5 Configure RS485-BL via AT or Downlink

User can configure RS485-BL via AT Commands or LoRaWAN Downlink Commands

There are two kinds of Commands:

- ✓ **Common Commands**: They should be available for each sensor, such as: change uplink interval, reset device. For firmware v1.3, user can find what common commands it supports: http://wiki.dragino.com/index.php?title=End_Device_AT_Commands_and_Downlink_Commands
- ✓ **Sensor Related Commands**: These commands are special designed for RS485-BL. User can see these commands below:

3.5.1 Common Commands:

They should be available for each of Dragino Sensors, such as: change uplink interval, reset device. For firmware v1.3, user can find what common commands it supports: http://wiki.dragino.com/index.php?title=End_Device_AT_Commands_and_Downlink_Commands

3.5.2 Sensor related commands:

Choose Device Type (RS485 or TTL)

RS485-BL can connect to either RS485 sensors or TTL sensor. User need to specify what type of sensor need to connect.

- ➢ AT Command

  AT+MOD=1 // Set to support RS485-MODBUS type sensors. User can connect multiply RS485 , Modbus sensors to the A / B pins.

  AT+MOD=2 // Set to support TTL Level sensors, User can connect one TTL Sensor to the TXD/RXD/GND pins.

- ➢ Downlink Payload

  0A aa → same as AT+MOD=aa

RS485 Debug Command (AT+CFGDEV)

This command is used to configure the RS485 or TTL sensors; they won't be used during sampling.

- AT Command

AT+CFGDEV=xx xx xx xx xx xx xx xx xx xx xx xx,m

m: 0: no CRC; 1: add CRC-16/MODBUS in the end of this command.

- Downlink Payload

Format: A8 MM NN XX XX XX XX YY

Where:

- MM: 1: add CRC-16/MODBUS ; 0: no CRC
- NN: The length of RS485 command
- XX XX XX XX: RS485 command total NN bytes
- YY: How many bytes will be uplink from the return of this RS485 command, if YY=0, RS485-BL will execute the downlink command without uplink; if YY>0, RS485-BL will uplink total YY bytes from the output of this RS485 command

Example 1:

To connect a Modbus Alarm with below commands.

- ✓ The command to active alarm is: 0A 05 00 04 00 01 4C B0. Where 0A 05 00 04 00 01 is the Modbus command to read the register 00 40 where stored the DI status. The 4C B0 is the CRC-16/MODBUS which calculate manually.
- ✓ The command to deactivate alarm is: 0A 05 00 04 00 00 8D 70. Where 0A 05 00 04 00 00 is the Modbus command to read the register 00 40 where stored the DI status. The 8D 70 is the CRC-16/MODBUS which calculate manually.

So if user want to use downlink command to control to RS485 Alarm, he can use:

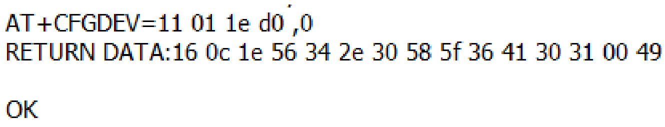
A8 01 06 0A 05 00 04 00 01 00: to activate the RS485 Alarm

A8 01 06 0A 05 00 04 00 00 00: to deactivate the RS485 Alarm

A8 is type code and 01 means add CRC-16/MODBUS at the end, the 3rd byte is 06, means the next 6 bytes are the command to be sent to the RS485 network, the final byte 00 means this command don't need to acquire output.

Example 2:

Check TTL Sensor return:



```
AT+CFGDEV=11 01 1e d0 ,0
RETURN DATA:16 0c 1e 56 34 2e 30 58 5f 36 41 30 31 00 49

OK
```

Set Payload version

This is the first byte of the uplink payload. RS485-BL can connect to different sensors. User can set the PAYVER field to tell server how to decode the current payload.

- AT Command:

  AT+PAYVER: Set PAYVER field = 1

- Downlink Payload:

  0xAE 01 → Set PAYVER field = 0x01

  0xAE 0F → Set PAYVER field = 0x0F

Set RS485 Sampling Commands

AT+COMMANDx, AT+DATACUTx and AT+SEARCHx

These three commands are used to configure how the RS485-BL polling data from Modbus device. Detail of usage please see : polling RS485 device.

- AT Command:

AT+COMMANDx: Configure RS485 read command to sensor.

AT+DATACUTx: Configure how to handle return from RS485 devices.

AT+SEARCHx: Configure search command

- Downlink Payload:

0xAF downlink command can be used to set AT+COMMANDx or AT+DATACUTx.

Note: if user use AT+COMMANDx to add a new command, he also need to send AT+DATACUTx downlink.

Format: AF MM NN LL XX XX XX XX YY

Where:

- MM: the ATCOMMAND or AT+DATACUT to be set. Value from 01 ~ 0F,
- NN: 0: no CRC; 1: add CRC-16/MODBUS ; 2: set the AT+DATACUT value.
- LL: The length of AT+COMMAND or AT+DATACUT command
- XX XX XX XX: AT+COMMAND or AT+DATACUT command
- YY: If YY=0, RS485-BL will execute the downlink command without uplink; if YY=1, RS485-BL will execute an uplink after got this command.

Example:

AF 03 01 06 0A 05 00 04 00 01 00: Same as AT+COMMAND3=0A 05 00 04 00 01,1

AF 03 02 06 10 01 05 06 09 0A 00: Same as AT+DATACUT3=**16**,**1**,**5+6+9+10**

AF 03 02 06 0B 02 05 07 08 0A 00: Same as AT+DATACUT3=**11**,**2**,**5~7+8~10**

0xAB downlink command can be used for set AT+SEARCHx

Example: **AB aa 01 03 xx xx xx** (03 here means there are total 3 bytes after 03) So

- AB aa 01 03 xx xx xx same as AT+SEARCHaa=1,xx xx xx

- AB aa 02 03 xx xx xx 02 yy yy(03 means there are 3 bytes after 03, they are xx xx xx;02 means there are 2 bytes after 02, they are yy yy) so the commands
  AB aa 02 03 xx xx xx 02 yy yy same as **AT+SEARCHaa=2,xx xx xx+yy yy**

Fast command to handle MODBUS device

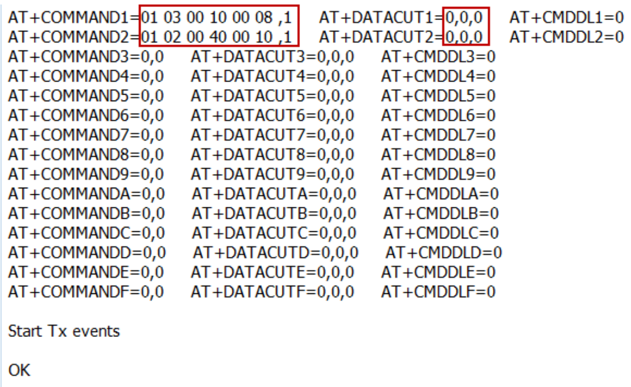
AT+MBFUN is valid since v1.3 firmware version. The command is for fast configure to read Modbus devices. It is only valid for the devices which follow the MODBUS-RTU protocol.
This command is valid since v1.3 firmware version

AT+MBFUN has only two value:

- AT+MBFUN=1: Enable Modbus reading. And get response base on the MODBUS return
  AT+MBFUN=1, device can auto read the Modbus function code: 01, 02, 03 or 04. AT+MBFUN has lower priority vs AT+DATACUT command. If AT+DATACUT command is configured, AT+MBFUN will be ignore.
- AT+MBFUN=0: Disable Modbus fast reading.

Example:

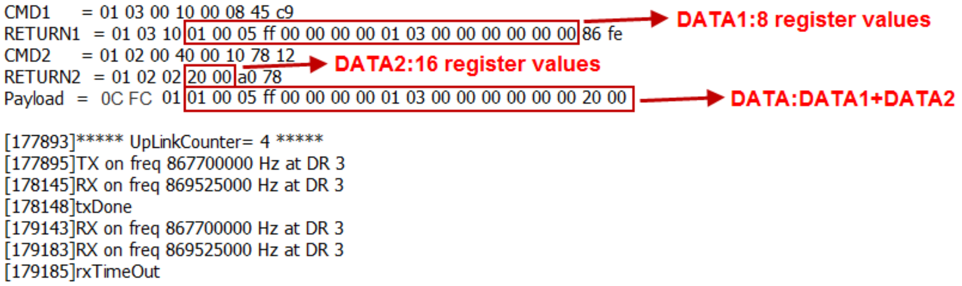
- AT+MBFUN=1 and AT+DATACUT1/AT+DATACUT2 are not configure (0,0,0).
- AT+COMMAND1= 01 03 00 10 00 08,1 --> read slave address 01 , function code 03, start address 00 01, quantity of registers 00 08.
- AT+COMMAND2= 01 02 00 40 00 10,1 --> read slave address 01 , function code 02, start address 00 40, quantity of inputs 00 10.



```
AT+COMMAND1=01 03 00 10 00 08 ,1    AT+DATACUT1=0,0,0    AT+CMDDL1=0
AT+COMMAND2=01 02 00 40 00 10 ,1    AT+DATACUT2=0,0,0    AT+CMDDL2=0
AT+COMMAND3=0,0    AT+DATACUT3=0,0,0    AT+CMDDL3=0
AT+COMMAND4=0,0    AT+DATACUT4=0,0,0    AT+CMDDL4=0
AT+COMMAND5=0,0    AT+DATACUT5=0,0,0    AT+CMDDL5=0
AT+COMMAND6=0,0    AT+DATACUT6=0,0,0    AT+CMDDL6=0
AT+COMMAND7=0,0    AT+DATACUT7=0,0,0    AT+CMDDL7=0
AT+COMMAND8=0,0    AT+DATACUT8=0,0,0    AT+CMDDL8=0
AT+COMMAND9=0,0    AT+DATACUT9=0,0,0    AT+CMDDL9=0
AT+COMMANDA=0,0    AT+DATACUTA=0,0,0    AT+CMDDLA=0
AT+COMMANDB=0,0    AT+DATACUTB=0,0,0    AT+CMDDLB=0
AT+COMMANDC=0,0    AT+DATACUTC=0,0,0    AT+CMDDLC=0
AT+COMMANDD=0,0    AT+DATACUTD=0,0,0    AT+CMDDLD=0
AT+COMMANDE=0,0    AT+DATACUTE=0,0,0    AT+CMDDLE=0
AT+COMMANDF=0,0    AT+DATACUTF=0,0,0    AT+CMDDLF=0

Start Tx events

OK
```



```
CMD1     = 01 03 00 10 00 08 45 c9
RETURN1  = 01 03 10 01 00 05 ff 00 00 00 00 01 03 00 00 00 00 00 00 86 fe
CMD2     = 01 02 00 40 00 10 78 12
RETURN2  = 01 02 02 20 00 a0 78
Payload  =  0C FC  01 01 00 05 ff 00 00 00 00 01 03 00 00 00 00 00 00 20 00

[177893]***** UpLinkCounter= 4 *****
[177895]TX on freq 867700000 Hz at DR 3
[178145]RX on freq 869525000 Hz at DR 3
[178148]txDone
[179143]RX on freq 867700000 Hz at DR 3
[179183]RX on freq 869525000 Hz at DR 3
[179185]rxTimeOut
```

- Downlink Commands:

A9 aa -→ Same as AT+MBFUN=aa

RS485 command timeout

Some Modbus device has slow action to send replies. This command is used to configure the RS485-BL to use longer time to wait for their action.
Default value: 0, range: 0 ~ 5 seconds

- AT Command:
  AT+CMDDLaa=hex(bb cc)
  Example:
  AT+CMDDL1=1000 to send the open time to 1000ms

- Downlink Payload:
  0x AA aa bb cc
  Same as: AT+CMDDLaa=hex(bb cc)
  Example:
  0xAA 01 03 E8 → Same as **AT+CMDDL1=1000 ms**

Uplink payload mode

Define to use one uplink or multiple uplinks for the sampling.
The use of this command please see: Compose Uplink payload

- AT Command:
  AT+DATAUP=0
  AT+DATAUP=1

- Downlink Payload:
  0xAD 00 → Same as AT+DATAUP=0
  0xAD 01 → Same as AT+DATAUP=1

Manually trigger an Uplink

Ask device to send an uplink immediately.

- Downlink Payload:
  0x08 FF, RS485-BL will immediately send an uplink.

Clear RS485 Command

The AT+COMMANDx and AT+DATACUTx settings are stored in special location, user can use below command to clear them.

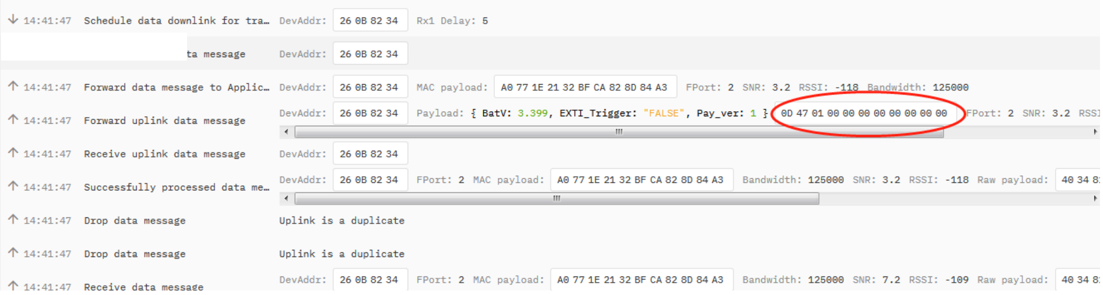
- AT Command:

AT+CMDEAR=mm,nn mm: start position of erase ,nn: stop position of erase

Etc. AT+CMDEAR=1,10 means erase AT+COMMAND1/AT+DATACUT1 to AT+COMMAND10/AT+DATACUT10

Example screen shot after clear all RS485 commands.

The uplink screen shot is:



```
↓ 14:41:47  Schedule data downlink for tra…  DevAddr: 26 0B 82 34  Rx1 Delay: 5
                          ta message         DevAddr: 26 0B 82 34
↑ 14:41:47  Forward data message to Applic…  DevAddr: 26 0B 82 34  MAC payload: A0 77 1E 21 32 BF CA 82 8D 84 A3  FPort: 2  SNR: 3.2  RSSI: -118  Bandwidth: 125000
↑ 14:41:47  Forward uplink data message      DevAddr: 26 0B 82 34  Payload: { BatV: 3.399, EXTI_Trigger: "FALSE", Pay_ver: 1 } 0D 47 01 00 00 00 00 00 00 00 00  FPort: 2  SNR: 3.2  RSSI
↑ 14:41:47  Receive uplink data message      DevAddr: 26 0B 82 34
↑ 14:41:47  Successfully processed data me…  DevAddr: 26 0B 82 34  FPort: 2  MAC payload: A0 77 1E 21 32 BF CA 82 8D 84 A3  Bandwidth: 125000  SNR: 3.2  RSSI: -118  Raw payload: 40 34 8
↑ 14:41:47  Drop data message                Uplink is a duplicate
↑ 14:41:47  Drop data message                Uplink is a duplicate
↑ 14:41:47  Receive data message             DevAddr: 26 0B 82 34  FPort: 2  MAC payload: A0 77 1E 21 32 BF CA 82 8D 84 A3  Bandwidth: 125000  SNR: 7.2  RSSI: -109  Raw payload: 40 34 8
```

- ➢ Downlink Payload:

  0x09 aa bb same as AT+CMDEAR=aa,bb

Set Serial Communication Parameters

Set the Rs485 serial communication parameters:

- ➢ AT Command:

Set Baud Rate:

AT+BAUDR=9600 // Options: (1200,2400,4800,14400,19200,115200)

Set UART parity

AT+PARITY=0 // Option: 0: no parity, 1: odd parity, 2: even parity

Set STOPBIT

AT+STOPBIT=0 // Option: 0 for 1bit; 1 for 1.5 bit ; 2 for 2 bits

- ➢ Downlink Payload:

A7 01 aa bb: Same AT+BAUDR=hex(aa bb)*100

Example:

- ✧ A7 01 00 60 same as AT+BAUDR=9600
- ✧ A7 01 04 80 same as AT+BAUDR=115200

A7 02 aa: Same as AT+PARITY=aa (aa value: 00 , 01 or 02)

A7 03 aa: Same as AT+STOPBIT=aa (aa value: 00 , 01 or 02)

Control output power duration

User can set the output power duration before each sampling.

- ➢ AT Command:

Example:

AT+3V3T=1000 // 3V3 output power will open 1s before each sampling.

AT+5VT=1000 // +5V output power will open 1s before each sampling.

- LoRaWAN Downlink Command:

  07 01 aa bb   Same as AT+5VT=(aa bb)

  07 02 aa bb   Same as AT+3V3T=(aa bb)

3.6 Buttons

Button	Feature
RST	Reboot RS485-BL

3.7 +3V3 Output

RS485-BL has a Controllable +3V3 output, user can use this output to power external sensor. The +3V3 output will be valid for every sampling. RS485-BL will enable +3V3 output before all sampling and disable the +3V3 after all sampling.

The +3V3 output time can be controlled by AT Command.

AT+3V3T=1000

Means set +3v3 valid time to have 1000ms. So, the real +3v3 output will actually have 1000ms + sampling time for other sensors.

By default, the AT+3V3T=0. This is a special case, means the +3V3 output is always on at any time

3.8 +5V Output

RS485-BL has a Controllable +5V output, user can use this output to power external sensor. The +5V output will be valid for every sampling. RS485-BL will enable +5V output before all sampling and disable the +5v after all sampling.

The 5V output time can be controlled by AT Command.

AT+5VT=1000

Means set 5V valid time to have 1000ms. So, the real 5V output will actually have 1000ms + sampling time for other sensors.

By default, the AT+5VT=0. If the external sensor which require 5v and require more time to get stable state, user can use this command to increase the power ON duration for this sensor.

3.9 LEDs

LEDs	Feature
LED1	Blink when device transmit a packet.

3.10 Switch Jumper

Switch Jumper	Feature
SW1	ISP position: Upgrade firmware via UART Flash position: Configure device, check running status.
SW2	5V position: set to compatible with 5v I/O. 3.3v position: set to compatible with 3.3v I/O.,

+3.3V: is always ON

+5V: Only open before every sampling. The time is by default, it is AT+5VT=0. Max open time. 5000 ms.

4. Case Study

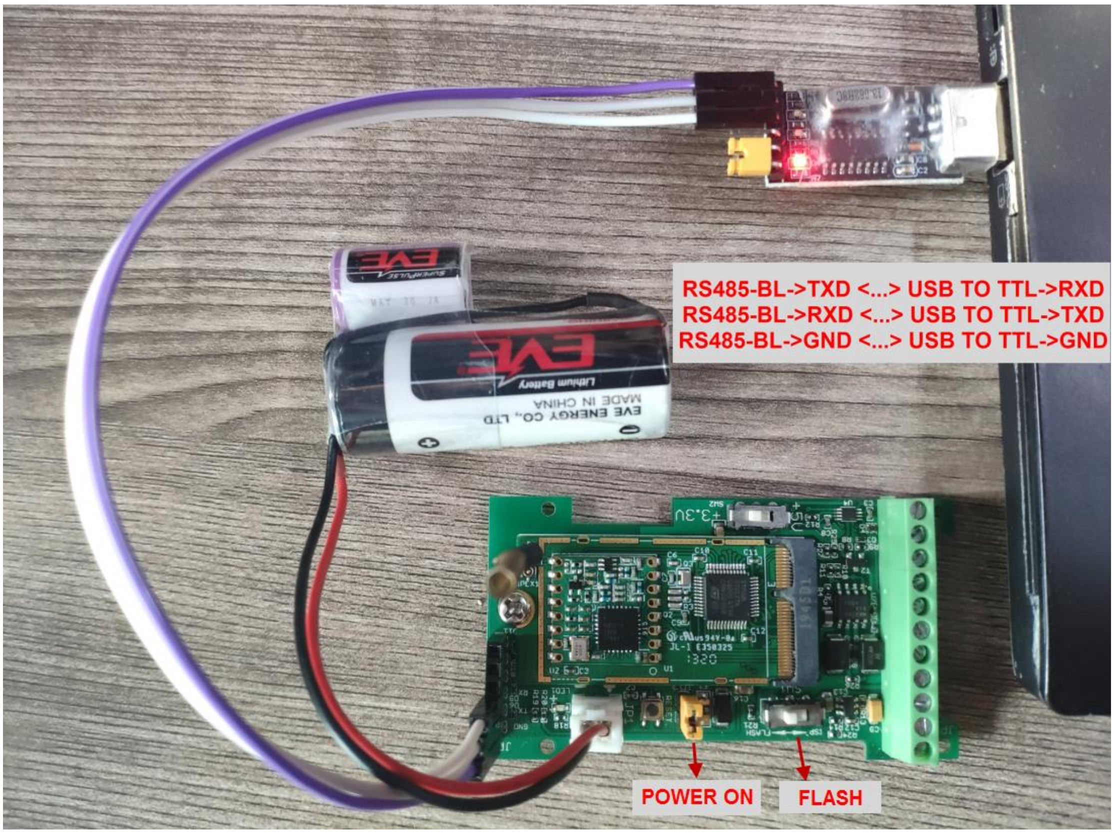
User can check this URL for some case studies.

http://wiki.dragino.com/index.php?title=APP_RS485_COMMUNICATE_WITH_SENSORS

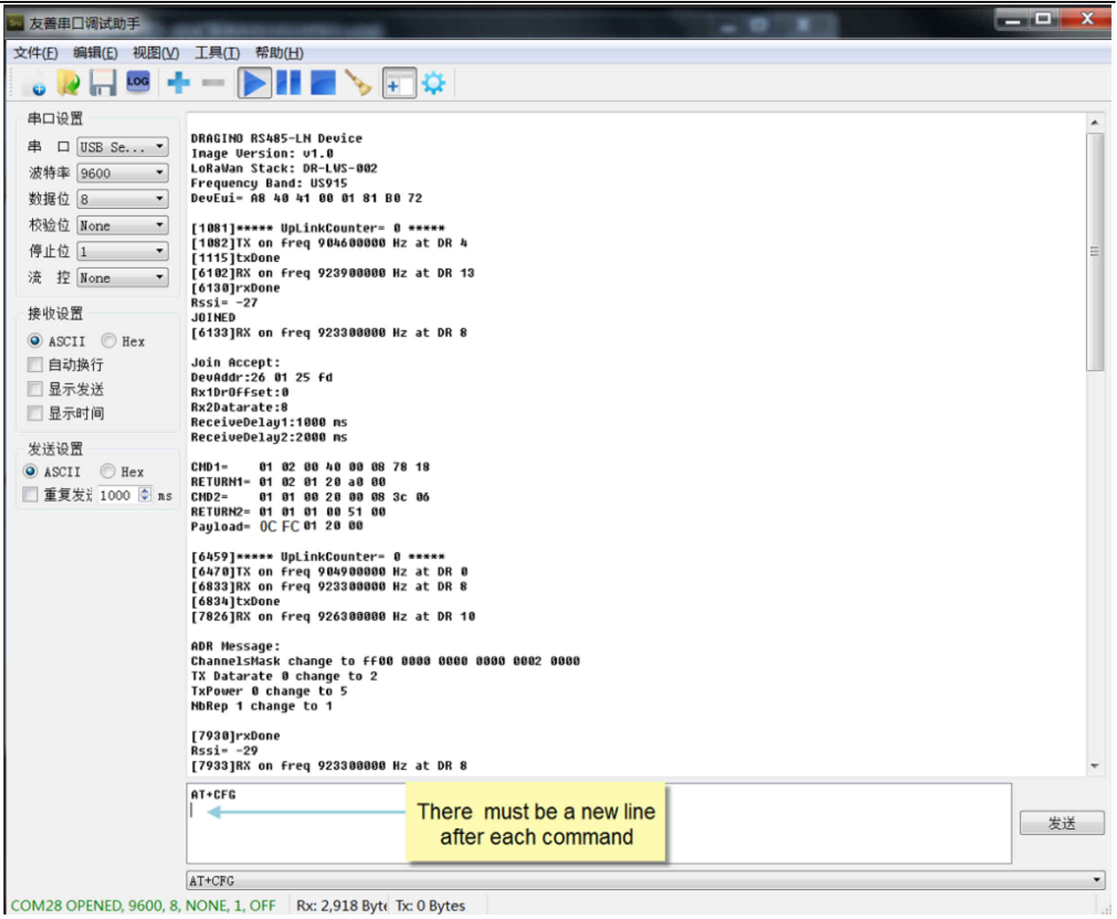
5. Use AT Command

5.1 Access AT Command

RS485-BL supports AT Command set. User can use a USB to TTL adapter plus the 3.5mm Program Cable to connect to RS485-BL to use AT command, as below.


RS485-BL->TXD <...> USB TO TTL->RXD
RS485-BL->RXD <...> USB TO TTL->TXD
RS485-BL->GND <...> USB TO TTL->GND
POWER ON
FLASH

In PC, User needs to set **serial tool**(such as putty, SecureCRT) baud rate to **9600** to access to access serial console of RS485-BL. The default password is 123456. Below is the output for reference:



串口设置
串 口 USB Se...
波特率 9600
数据位 8
校验位 None
停止位 1
流 控 None

接收设置
● ASCII ○ Hex
□ 自动换行
□ 显示发送
□ 显示时间

发送设置
● ASCII ○ Hex
□ 重复发送 1000 ms

```
DRAGINO RS485-LN Device
Image Version: v1.0
LoRaWan Stack: DR-LWS-002
Frequency Band: US915
DevEui= A8 40 41 00 01 81 B0 72

[1081]***** UpLinkCounter= 0 *****
[1082]TX on freq 904600000 Hz at DR 4
[1115]txDone
[6102]RX on freq 923900000 Hz at DR 13
[6130]rxDone
Rssi= -27
JOINED
[6133]RX on freq 923300000 Hz at DR 8

Join Accept:
DevAddr:26 01 25 fd
Rx1DrOffset:0
Rx2Datarate:8
ReceiveDelay1:1000 ms
ReceiveDelay2:2000 ms

CMD1=     01 02 00 40 00 08 78 18
RETURN1=  01 02 01 20 a0 00
CMD2=     01 01 00 20 00 08 3c 06
RETURN2=  01 01 01 00 51 00
Payload=  0C FC 01 20 00

[6459]***** UpLinkCounter= 0 *****
[6470]TX on freq 904900000 Hz at DR 0
[6833]RX on freq 923300000 Hz at DR 8
[6834]txDone
[7826]RX on freq 926300000 Hz at DR 10

ADR Message:
ChannelsMask change to ff00 0000 0000 0000 0002 0000
TX Datarate 0 change to 2
TxPower 0 change to 5
NbRep 1 change to 1

[7930]rxDone
Rssi= -29
[7933]RX on freq 923300000 Hz at DR 8
```

```
AT+CFG
```

There must be a new line after each command

AT+CFG

COM28 OPENED, 9600, 8, NONE, 1, OFF Rx: 2,918 Byte Tx: 0 Bytes

More detail AT Command manual can be found at AT Command Manual

5.2 Common AT Command Sequence

5.2.1 Multi-channel ABP mode (Use with SX1301/LG308)

If device has not joined network yet:

```
AT+FDR
AT+NJM=0
ATZ
```

If device already joined network:

```
AT+NJM=0
ATZ
```

5.2.2 Single-channel ABP mode (Use with LG01/LG02)

AT+FDR Reset Parameters to Factory Default, Keys Reserve

AT+NJM=0 Set to ABP mode

AT+ADR=0 Set the Adaptive Data Rate Off

AT+DR=5 Set Data Rate

AT+TDC=60000 Set transmit interval to 60 seconds

AT+CHS=868400000 Set transmit frequency to 868.4Mhz

AT+RX2FQ=868400000 Set RX2Frequency to 868.4Mhz (according to the result from server)

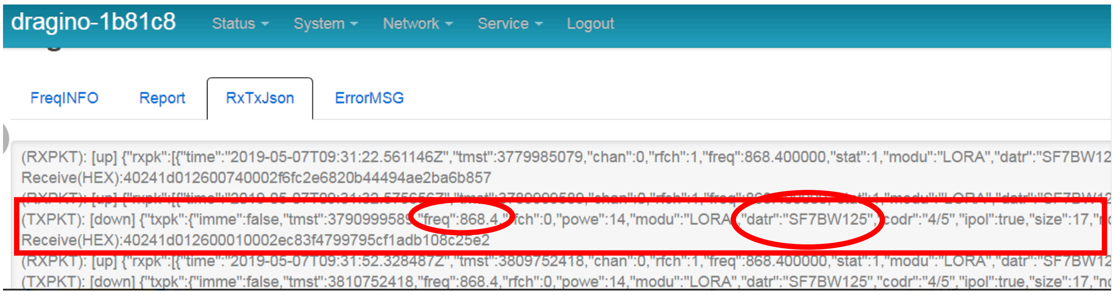
AT+RX2DR=5 Set RX2DR to match the downlink DR from server. see below

AT+DADDR=26 01 1A F1 Set Device Address to 26 01 1A F1, this ID can be found in the LoRa Server portal.

ATZ Reset MCU

Note:

1. Make sure the device is set to ABP mode in the IoT Server.
2. Make sure the LG01/02 gateway RX frequency is exactly the same as AT+CHS setting.
3. Make sure SF / bandwidth setting in LG01/LG02 match the settings of AT+DR. refer this link to see what DR means.
4. The command AT+RX2FQ and AT+RX2DR is to let downlink work. to set the correct parameters, user can check the actually downlink parameters to be used. As below. Which shows the RX2FQ should use 868400000 and RX2DR should be 5



```
(RXPKT): [up] {"rxpk":[{"time":"2019-05-07T09:31:22.561146Z","tmst":3779985079,"chan":0,"rfch":1,"freq":868.400000,"stat":1,"modu":"LORA","datr":"SF7BW12
Receive(HEX):40241d012600740002f6fc2e6820b44494ae2ba6b857
(RXPKT): [up] {"rxpk":[{"time":"2019-05-07T09:31:32.575656Z","tmst":3789999589,"chan":0,"rfch":1,"freq":868.400000,"stat":1,"modu":"LORA","datr":"SF7BW12
(TXPKT): [down] {"txpk":{"imme":false,"tmst":3790999589,"freq":868.4,"rfch":0,"powe":14,"modu":"LORA","datr":"SF7BW125","codr":"4/5","ipol":true,"size":17,"n
Receive(HEX):40241d012600010002ec83f4799795cf1adb108c25e2
(RXPKT): [up] {"rxpk":[{"time":"2019-05-07T09:31:52.328487Z","tmst":3809752418,"chan":0,"rfch":1,"freq":868.400000,"stat":1,"modu":"LORA","datr":"SF7BW12
(TXPKT): [down] {"txpk":{"imme":false,"tmst":3810752418,"freq":868.4,"rfch":0,"powe":14,"modu":"LORA","datr":"SF7BW125","codr":"4/5","ipol":true,"size":17,"n
```

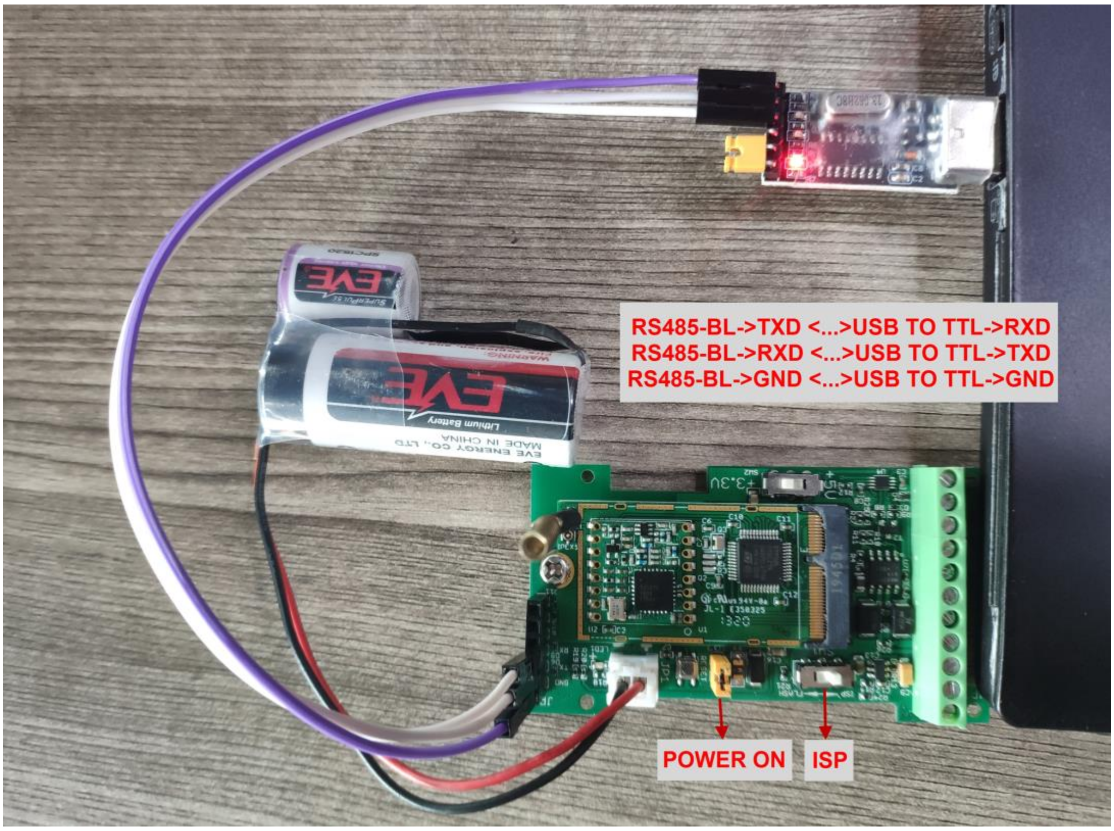
6. FAQ

6.1 How to upgrade the image?

The RS485-BL LoRaWAN Controller is shipped with a 3.5mm cable, the cable is used to upload image to RS485-BL to:

- ✓ Support new features
- ✓ For bug fix
- ✓ Change LoRaWAN bands.

Below shows the hardware connection for how to upload an image to RS485-BL:

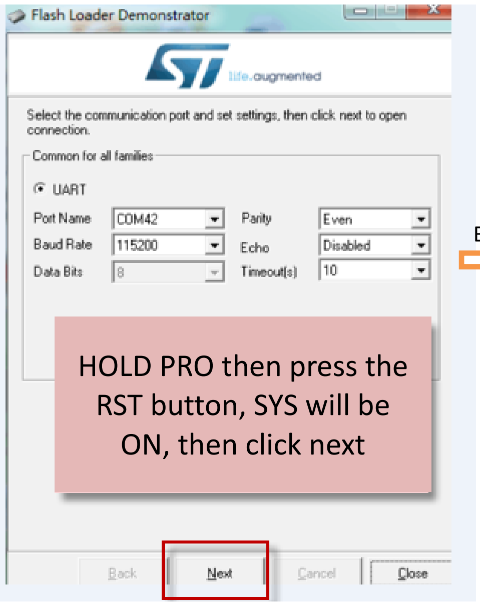


RS485-BL->TXD <...>USB TO TTL->RXD
RS485-BL->RXD <...>USB TO TTL->TXD
RS485-BL->GND <...>USB TO TTL->GND
POWER ON
ISP

Step1: Download flash loader.

Step2: Download the LT Image files.

Step3: Open flashloader; choose the correct COM port to update.



Select the communication port and set settings, then click next to open connection.

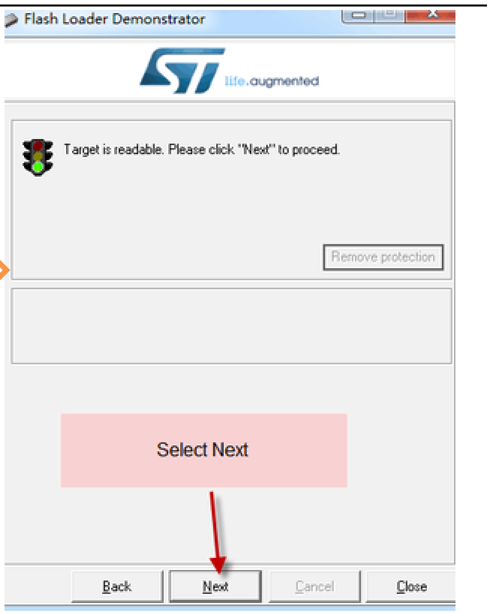
Common for all families

● UART

Port Name	COM42	Parity	Even
Baud Rate	115200	Echo	Disabled
Data Bits	8	Timeout(s)	10

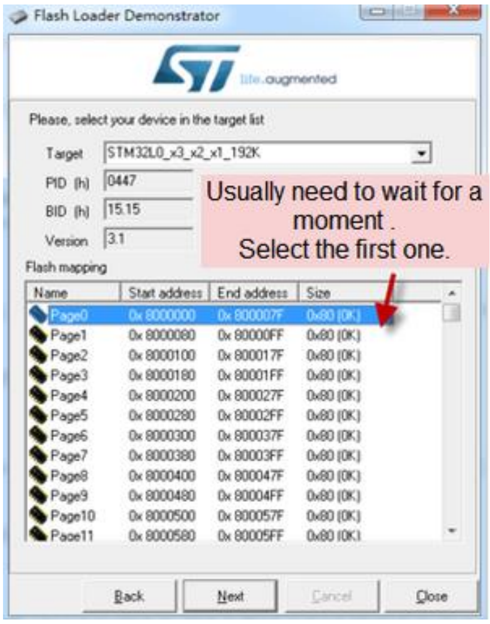
HOLD PRO then press the RST button, SYS will be ON, then click next

Board detected



Target is readable. Please click "Next" to proceed.

Select Next



Please, select your device in the target list

Target: STM32L0_x3_x2_x1_192K

PID (h): 0447

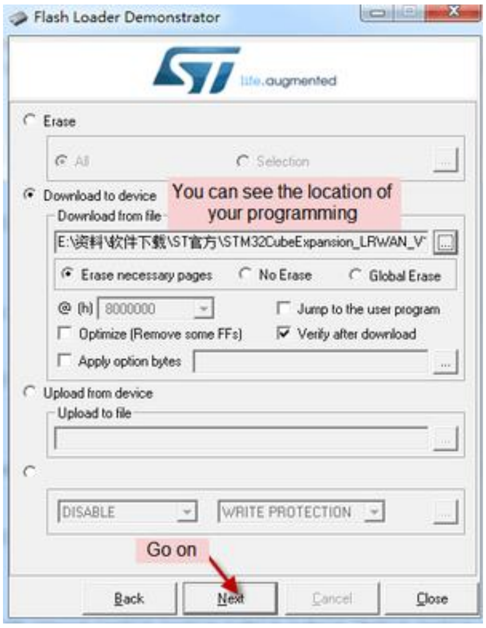
BID (h): 15.15

Version: 3.1

Usually need to wait for a moment .
Select the first one.

Flash mapping

Name	Start address	End address	Size
Page0	0x 8000000	0x 800007F	0x80 (OK)
Page1	0x 8000080	0x 80000FF	0x80 (OK)
Page2	0x 8000100	0x 800017F	0x80 (OK)
Page3	0x 8000180	0x 80001FF	0x80 (OK)
Page4	0x 8000200	0x 800027F	0x80 (OK)
Page5	0x 8000280	0x 80002FF	0x80 (OK)
Page6	0x 8000300	0x 800037F	0x80 (OK)
Page7	0x 8000380	0x 80003FF	0x80 (OK)
Page8	0x 8000400	0x 800047F	0x80 (OK)
Page9	0x 8000480	0x 80004FF	0x80 (OK)
Page10	0x 8000500	0x 800057F	0x80 (OK)
Page11	0x 8000580	0x 80005FF	0x80 (OK)



○ Erase

● All ○ Selection

● Download to device

You can see the location of your programming

Download from file: E:\资料\软件下载\ST官方\STM32CubeExpansion_LRWAN_V

● Erase necessary pages ○ No Erase ○ Global Erase

@ (h) 8000000 □ Jump to the user program

□ Optimize (Remove some FFs) ☑ Verify after download

□ Apply option bytes

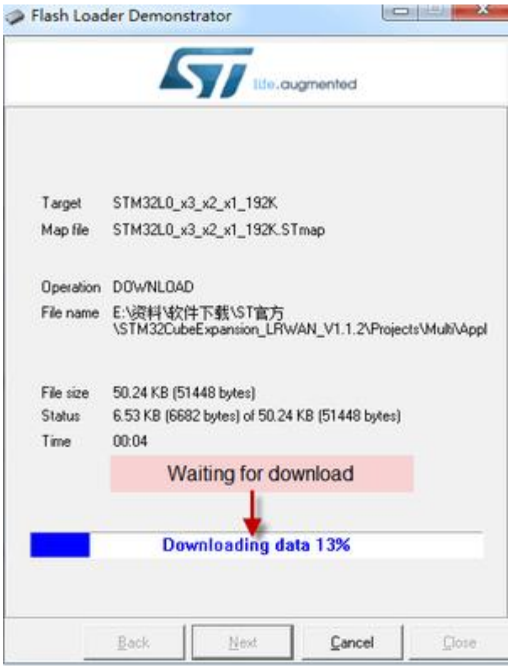
○ Upload from device

Upload to file

○

DISABLE WRITE PROTECTION

Go on



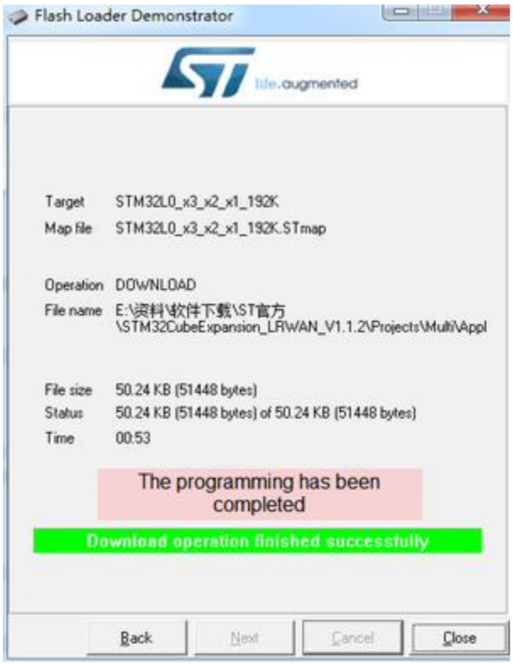
Target STM32L0_x3_x2_x1_192K
Map file STM32L0_x3_x2_x1_192K.STmap

Operation DOWNLOAD
File name E:\资料\软件下载\ST官方\STM32CubeExpansion_LRWAN_V1.1.2\Projects\Multi\Appl

File size 50.24 KB (51448 bytes)
Status 6.53 KB (6682 bytes) of 50.24 KB (51448 bytes)
Time 00:04

Waiting for download

Downloading data 13%



Target STM32L0_x3_x2_x1_192K
Map file STM32L0_x3_x2_x1_192K.STmap

Operation DOWNLOAD
File name E:\资料\软件下载\ST官方\STM32CubeExpansion_LRWAN_V1.1.2\Projects\Multi\Appl

File size 50.24 KB (51448 bytes)
Status 50.24 KB (51448 bytes) of 50.24 KB (51448 bytes)
Time 00:53

The programming has been completed

Download operation finished successfully

6.2 How to change the LoRa Frequency Bands/Region?

User can follow the introduction for how to upgrade image. When download the images, choose the required image file for download.

6.3 How many RS485-Slave can RS485-BL connects?

The RS485-BL can support max 32 RS485 devices. Each uplink command of RS485-BL can support max 16 different RS485 command. So RS485-BL can support max 16 RS485 devices pre-program in the device for uplink. For other devices no pre-program, user can use the downlink message (type code 0xA8) to poll their info.

7. Trouble Shooting

7.1 Downlink doesn't work, how to solve it?

Please see this link for debug:
http://wiki.dragino.com/index.php?title=Main_Page#LoRaWAN_Communication_Debug

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

It might about the channels mapping. Please see for detail.
http://wiki.dragino.com/index.php?title=LoRaWAN_Communication_Debug#Notice_of_US915.2FCN470.2FAU915_Frequency_band

8. Order Info

Part Number: RS485-BL-XXX

XXX:

- **EU433**: frequency bands EU433
- **EU868**: frequency bands EU868
- **KR920**: frequency bands KR920
- **CN470**: frequency bands CN470
- **AS923**: frequency bands AS923
- **AU915**: frequency bands AU915
- **US915**: frequency bands US915
- **IN865**: frequency bands IN865
- **RU864**: frequency bands RU864
- **KZ865:** frequency bands KZ865

9. Packing Info

Package Includes:

- ✓ RS485-BL x 1
- ✓ Stick Antenna for LoRa RF part x 1
- ✓ Program cable x 1

Dimension and weight:

- ✓ Device Size: 13.5 x 7 x 3 cm
- ✓ Device Weight: 105g
- ✓ Package Size / pcs : 14.5 x 8 x 5 cm
- ✓ Weight / pcs : 170g

10. Support

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

support@dragino.com