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1. Introduction

1.1 What is SN50v3-LB LoRaWAN Generic Node

SN50V3-LB LoRaWAN Sensor Node is a Long Range LoRa Sensor Node. It is designed for outdoor use and powered by **8500mA Li/SOCI2 battery** for long term use.SN50V3-LB is designed to facilitate developers to quickly deploy industrial level LoRa and IoT solutions. It help users to turn the idea into a practical application and make the Internet of Things a reality. It is easy to program, create and connect your things everywhere.

SN50V3-LB wireless part is based on SX1262 allows the user 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 minimising current consumption.It targets professional wireless sensor network applications such as irrigation systems, smart metering, smart cities, and so on.

SN50V3-LB has a powerful 48Mhz ARM microcontroller with 256KB flash and 64KB RAM. It has multiplex I/O pins to connect to different sensors.

SN50V3-LB has a built-in BLE module, user can configure the sensor remotely via Mobile Phone. It also support OTA upgrade via private LoRa protocol for easy maintaining.

SN50V3-LB is the 3rd generation of LSN50 series generic sensor node from Dragino. It is an **open source project** and has a mature LoRaWAN stack and application software. User can use the pre-load software for their IoT projects or easily customize the software for different requirements.

1.2 Features

- LoRaWAN 1.0.3 Class A
- Ultra-low power consumption
- Open-Source hardware/software
- Bands: CN470/EU433/KR920/US915/EU868/AS923/AU915/IN865
- Support Bluetooth 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

Common DC Characteristics:

- Supply Voltage: built in 8500mAh Li-SOCI2 battery , 2.5v ~ 3.6v
- Operating Temperature: -40 ~ 85°C

I/O Interface:

- Battery output (2.6v ~ 3.6v depends on battery)
- +5v controllable output

- 3 x Interrupt or Digital IN/OUT pins
- 3 x one-wire interfaces
- 1 x UART Interface
- 1 x I2C Interface

LoRa Spec:

- Frequency Range, Band 1 (HF): 862 ~ 1020 Mhz
- RX sensitivity: down to -139 dBm.
- Excellent blocking immunity

Battery:

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

Power Consumption

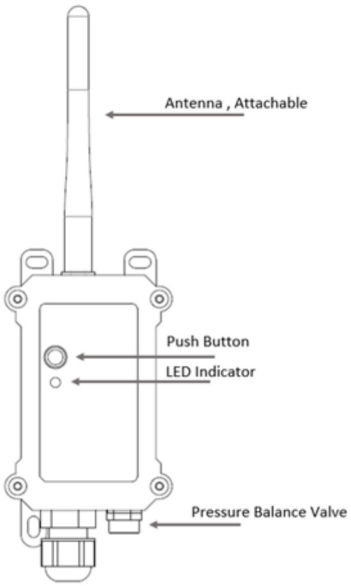
- Sleep Mode: 5uA @ 3.3v
- LoRa Transmit Mode: 125mA @ 20dBm, 82mA @ 14dBm

1.4 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.

1.5 Button & LEDs



Behavior on ACT	Function	Action

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

1.6 BLE connection

SN50v3-LB supports BLE remote configure.

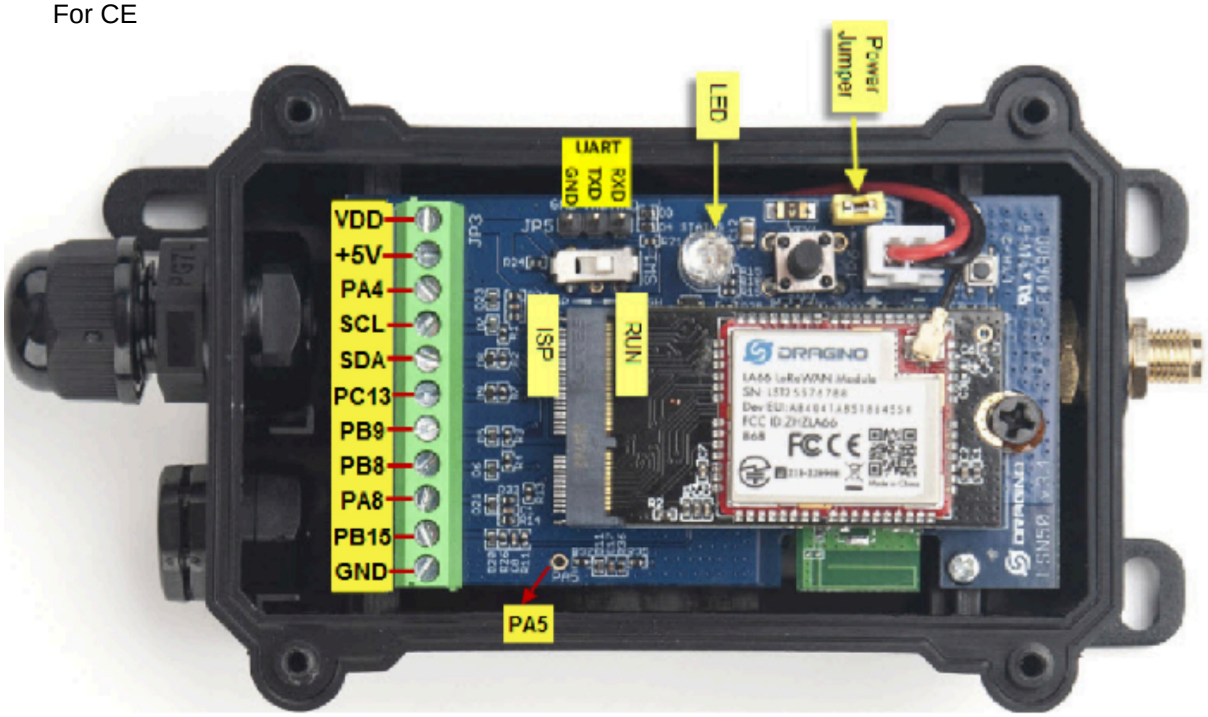
BLE can be used to configure the parameter of sensor or see the console output from sensor. BLE will be only activate on below case:

- Press button to send an uplink
- Press button to active device.
- Device Power on or reset.

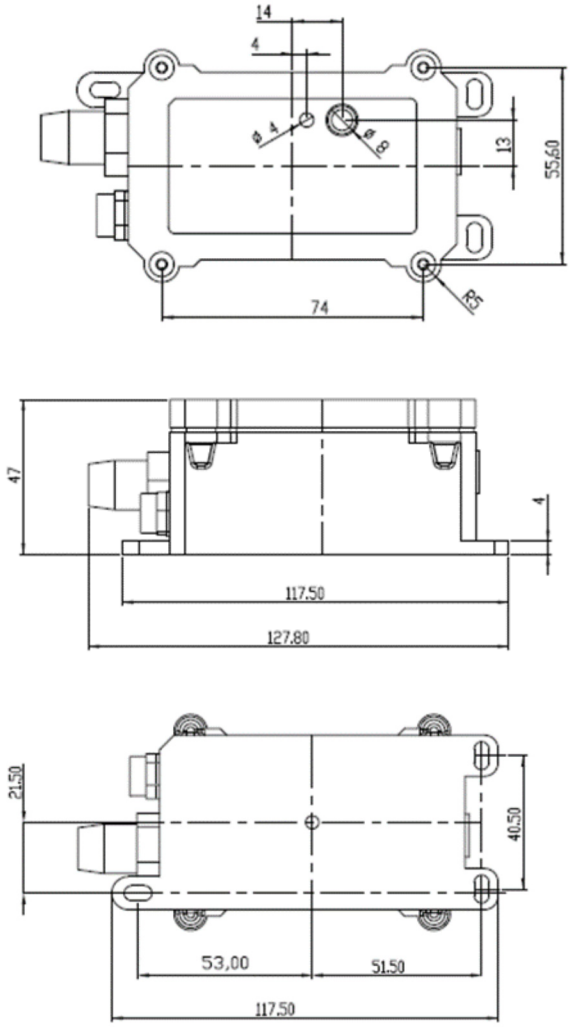
If there is no activity connection on BLE in 60 seconds, sensor will shut down BLE module to enter low power mode.

1.7 Pin Definitions

For CE

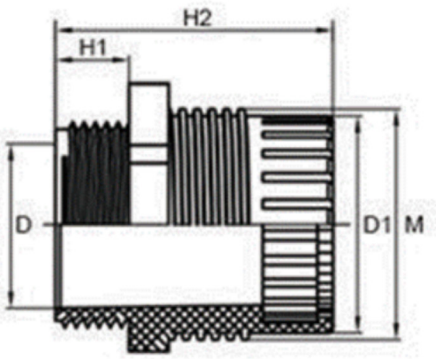


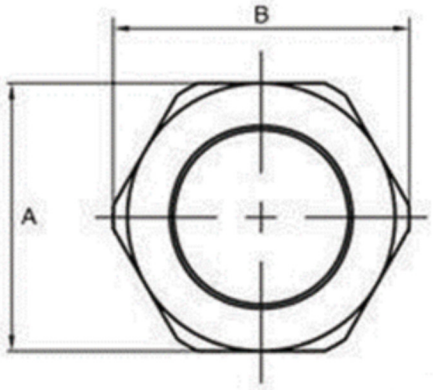
1.8 Mechanical



1.9 Hole Option

SN50v3-LB has different hole size options for different size sensor cable. The options provided are M12, M16 and M20. The definition is as below:





unit: mm

MODEL	H1	H2	M	M1	D	D1	A	B
M12*1.5	8	28.3	12.0	12.0	10.4	8.5±0.2	16±0.2	18±0.2
M16*1.5	8	30.7	15.1	16.0	13.5	10.9±0.2	18.8±0.2	20.6±0.2
M20*1.5	9	34.0	20.2	20.0	18.7	16.2±0.2	22.8±0.2	25.2±0.2

2. Configure SN50v3-LB to connect to LoRaWAN network

2.1 How it works

The SN50v3-LB is configured as **LoRaWAN OTAA Class A** mode by default. It has OTAA keys to join LoRaWAN network. To connect a local LoRaWAN network, you need to input the OTAA keys in the LoRaWAN IoT server and press the button to activate the SN50v3-LB. It will automatically join the network via OTAA and start to send the sensor value. The default uplink interval is 20 minutes.

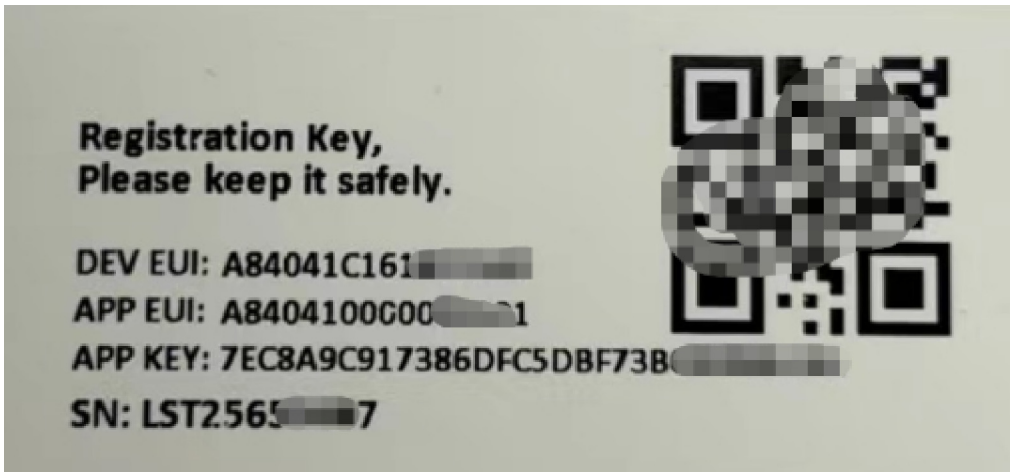
2.2 Quick guide to connect to LoRaWAN server (OTAA)

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.

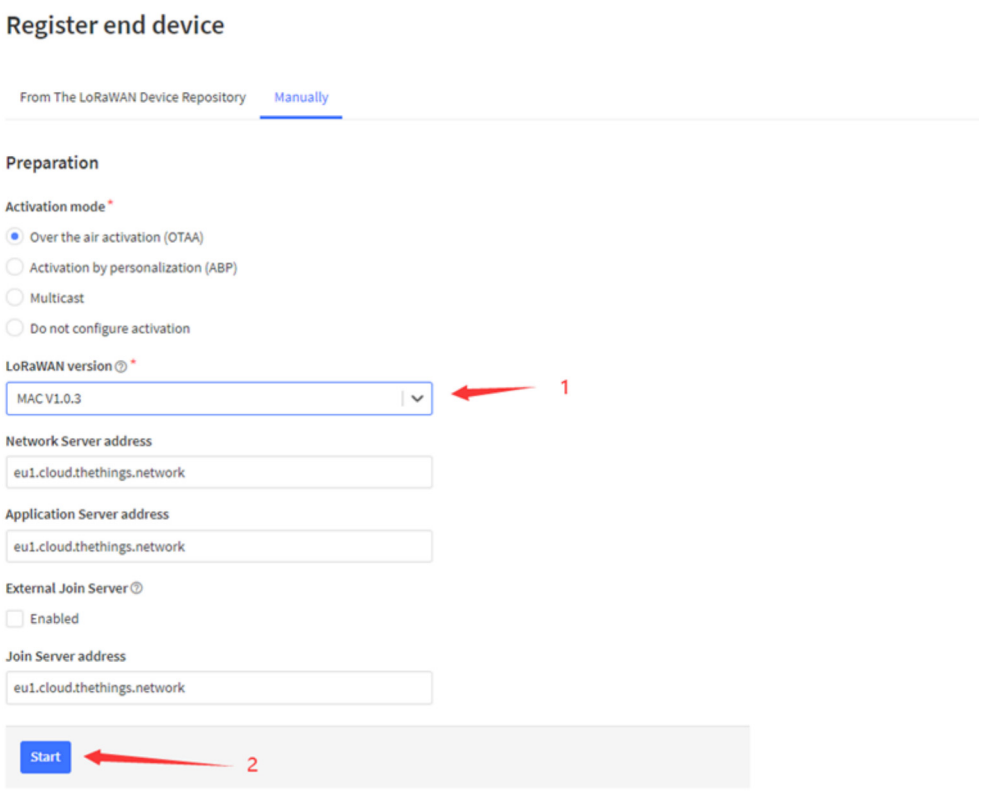
Step 1: Create a device in TTN with the OTAA keys from SN50v3-LB.

Each SN50v3-LB is shipped with a sticker with the default device EUI as below:

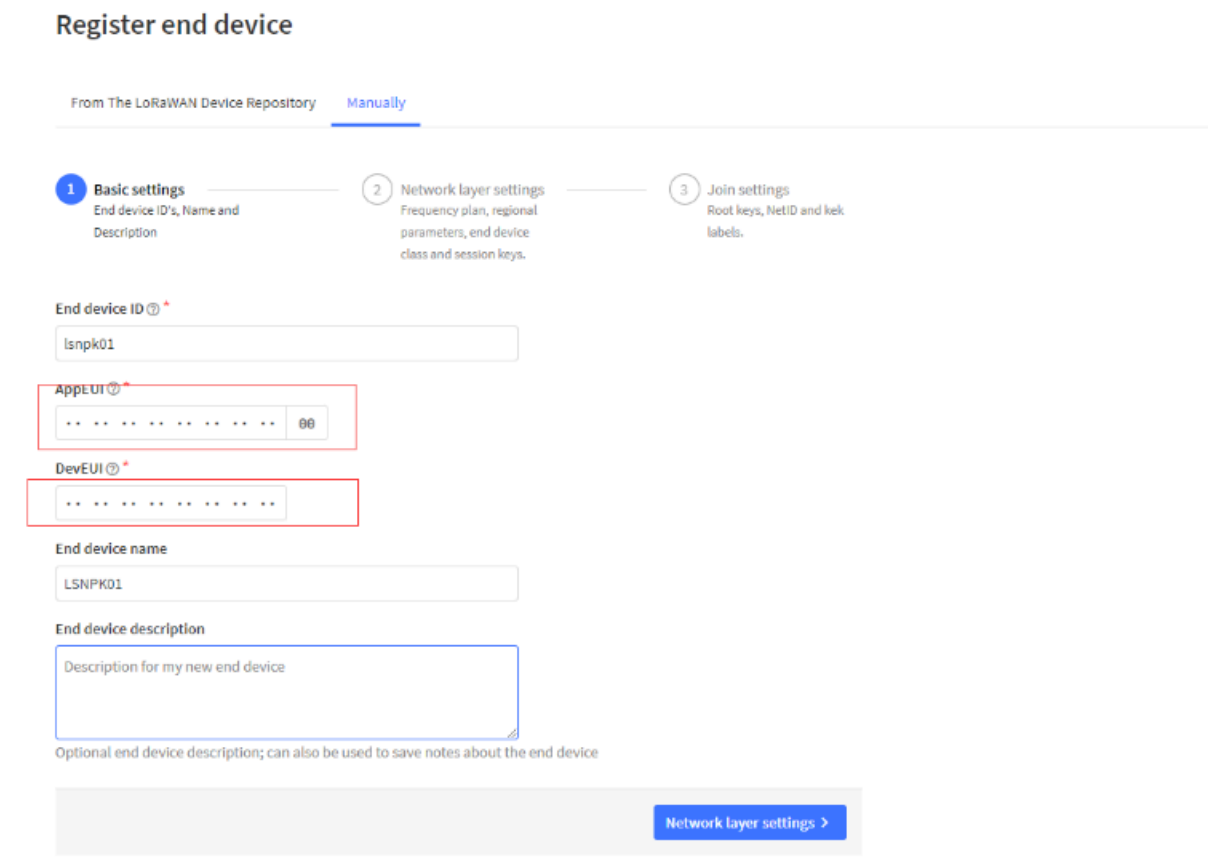


You can enter this key in the LoRaWAN Server portal. Below is TTN screen shot:

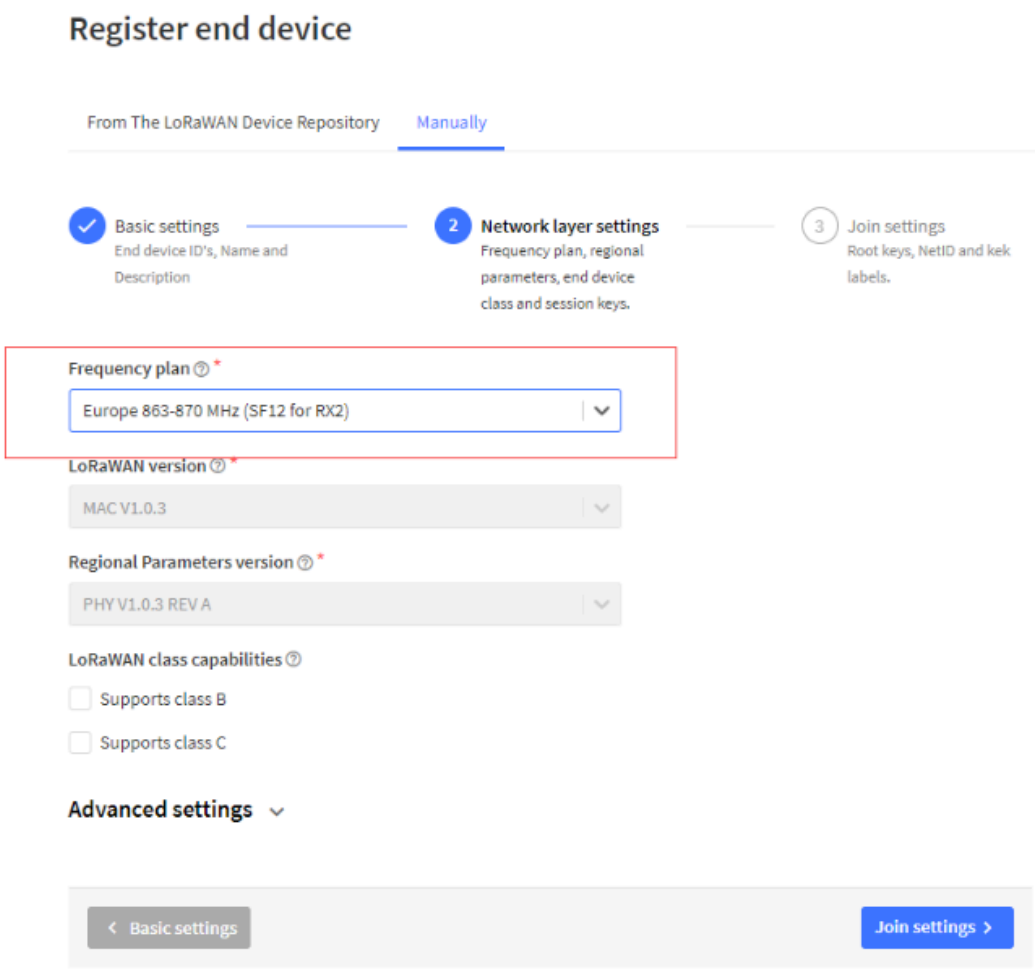
Register the device



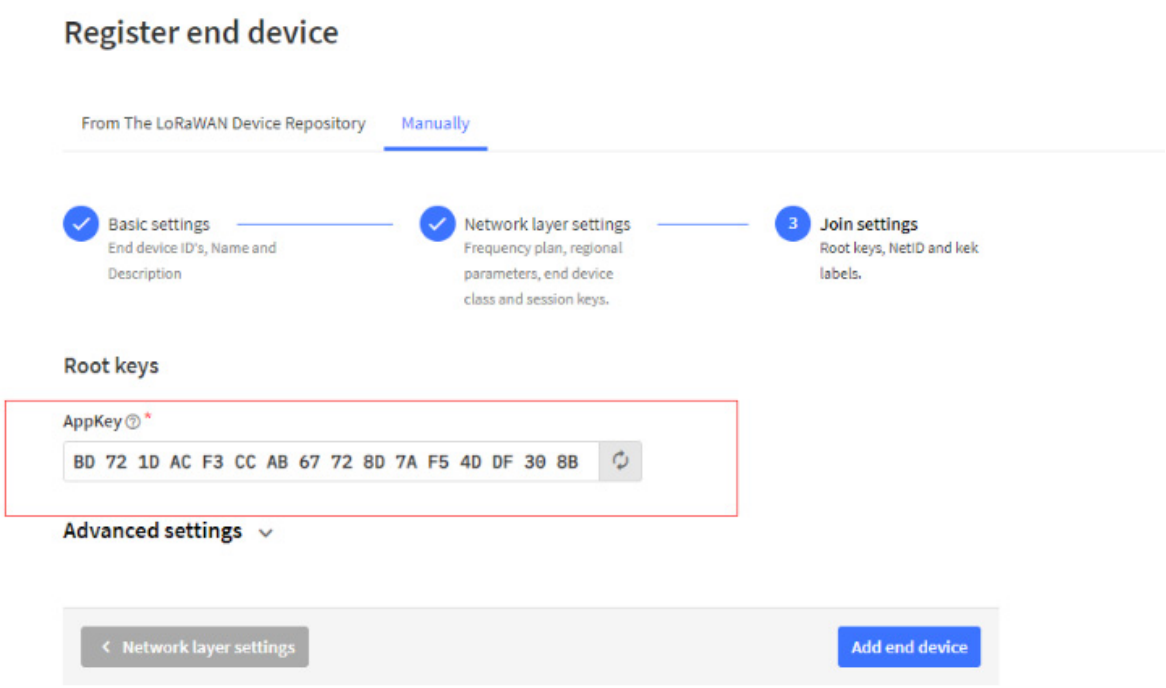
Add APP EUI and DEV EUI



Add APP EUI in the application


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

Add APP KEY



Step 2: Activate SN50v3-LB

Press the button for 5 seconds to activate the SN50v3-LB.

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

Users can use the downlink command(**0x26 01**) to ask SN50v3-LB to send device configure detail, include device configure status. SN50v3-LB 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 SN50v3-LB, this value is 0x1C

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 Working Modes & Sensor Data. Uplink via FPORT=2

SN50v3-LB has different working mode for the connections of different type of sensors. This section describes these modes. Use can use the AT Command **AT+MOD** to set SN50v3-LB to different working modes.

For example:

AT+MOD=2 // will set the SN50v3 to work in MOD=2 distance mode which target to measure distance via Ultrasonic Sensor.

Important Notice:

1. Some working modes has payload more than 12 bytes, The US915/AU915/AS923 frequency bands' definition has maximum 11 bytes in **DR0**. Server sides will see NULL payload while SN50v3-LB transmit in DR0 with 12 bytes payload.

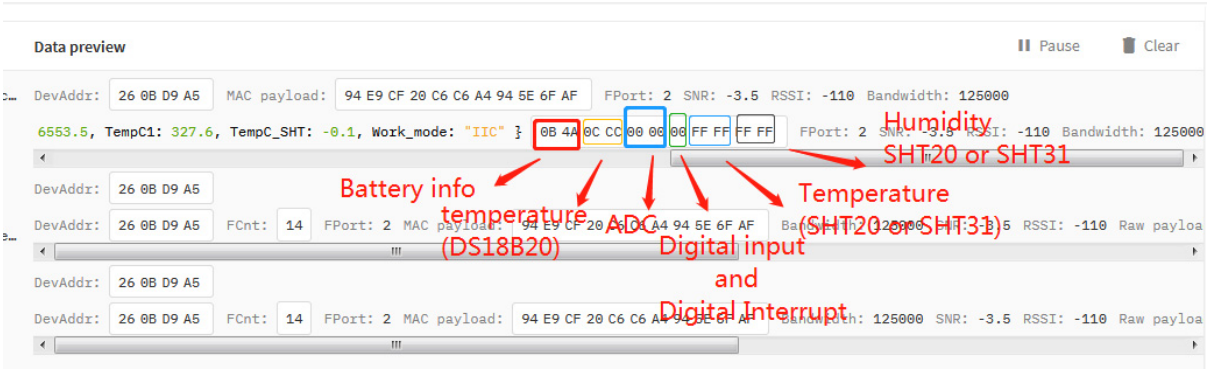
2. All modes share the same Payload Explanation from HERE.

3. By default, the device will send an uplink message every 20 minutes.

2.3.2.1 MOD=1 (Default Mode)

In this mode, uplink payload includes in total 11 bytes. Uplink packets use FPORT=2.

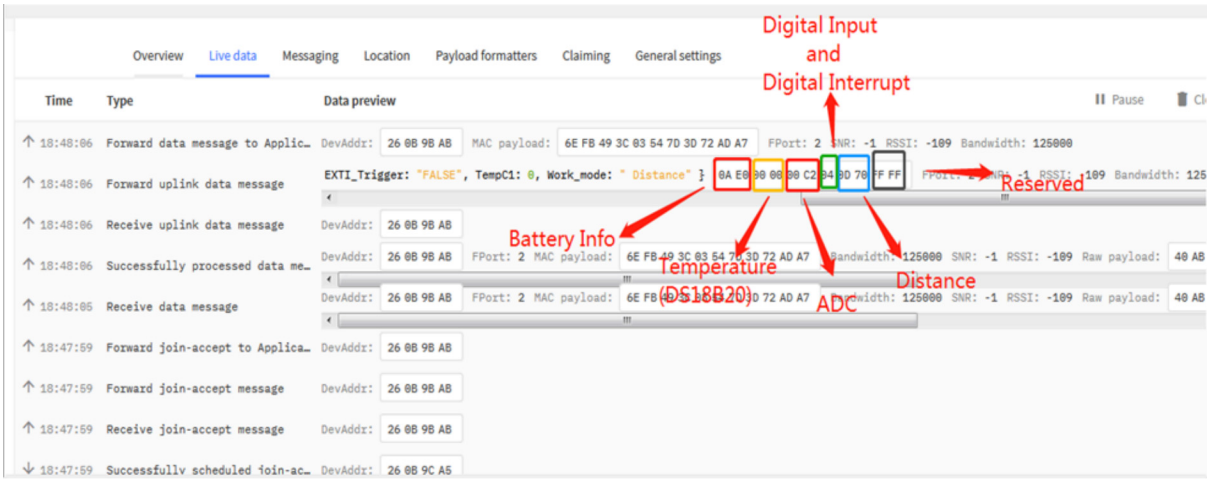
Size(bytes)	2	2	2	1	2	2
Value	Bat	Temperature(DS18B20) (PC13)	ADC(PA4)	Digital in(PB15)&Digital Interrupt(PA8)	Temperature(SHT20 or SHT31 or BH1750 Illumination Sensor)	Humidity(SHT20 or SHT31)



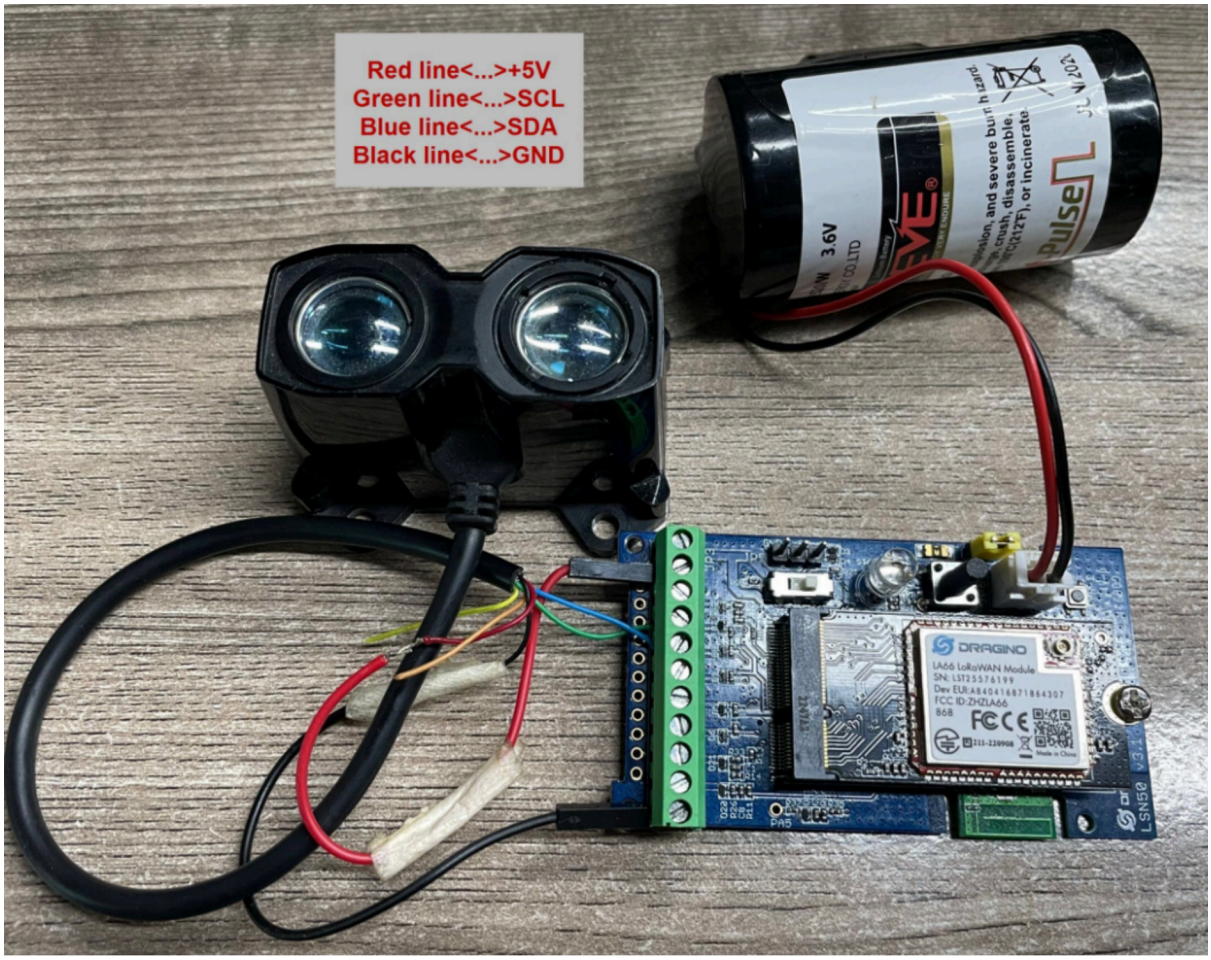
2.3.2.2 MOD=2 (Distance Mode)

This mode is target to measure the distance. The payload of this mode is totally 11 bytes. The 8th and 9th bytes is for the distance.

Size(bytes)	2	2	2	1	2	2
Value	BAT	Temperature(DS18B20) (PC13)	ADC(PA4)	Digital in(PB15) & Digital Interrupt(PA8)	Distance measure by: 1) LIDAR-Lite V3HP Or 2) Ultrasonic Sensor	Reserved

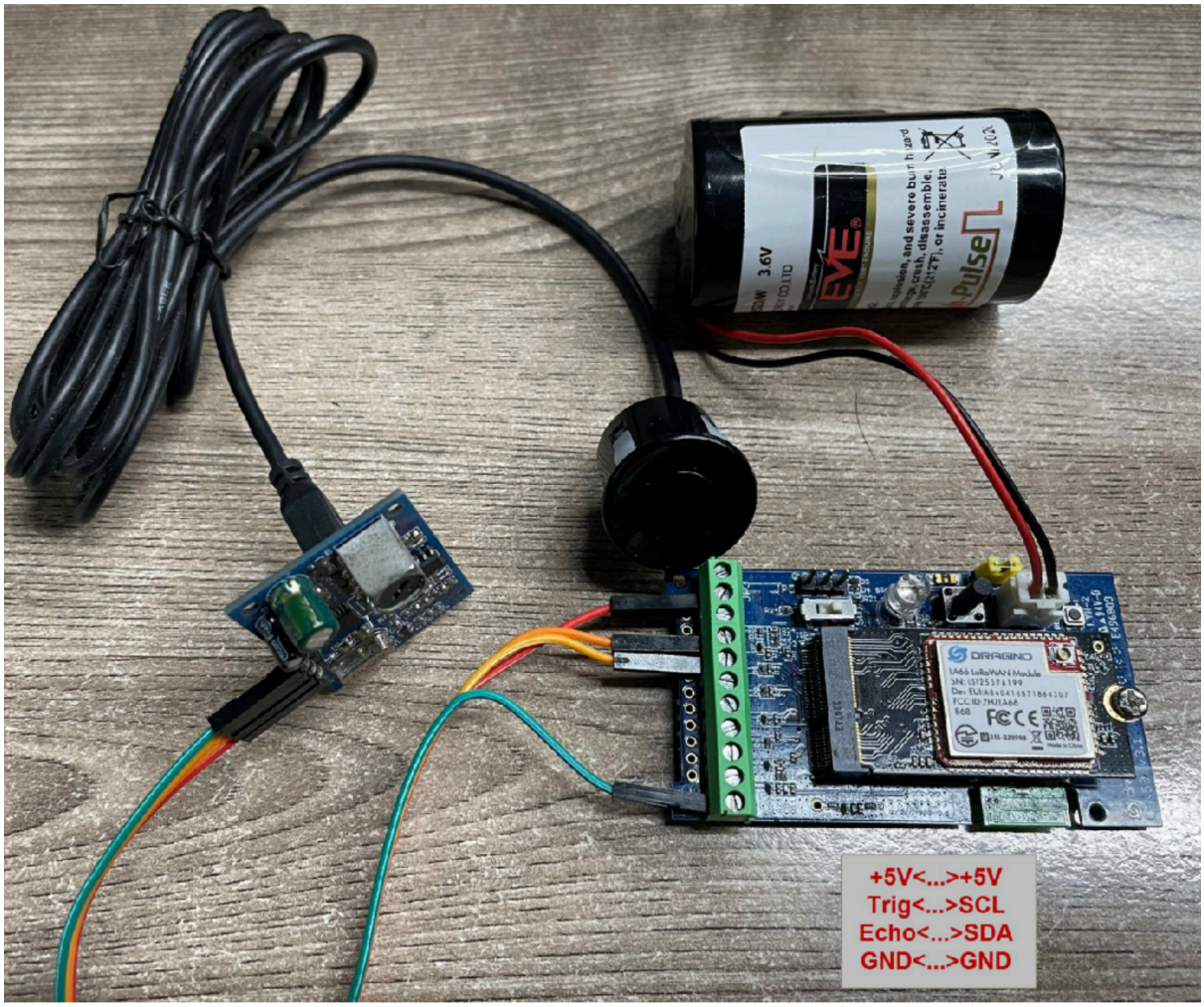


Connection of LIDAR-Lite V3HP:



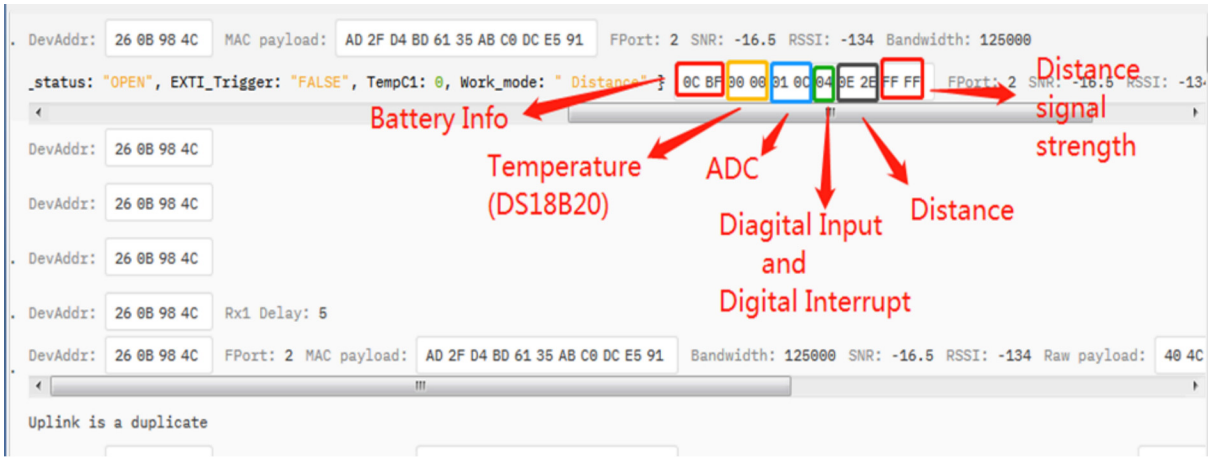
Connection to Ultrasonic Sensor:

Need to remove R1 and R2 resistors to get low power,otherwise there will be 240uA standby current.



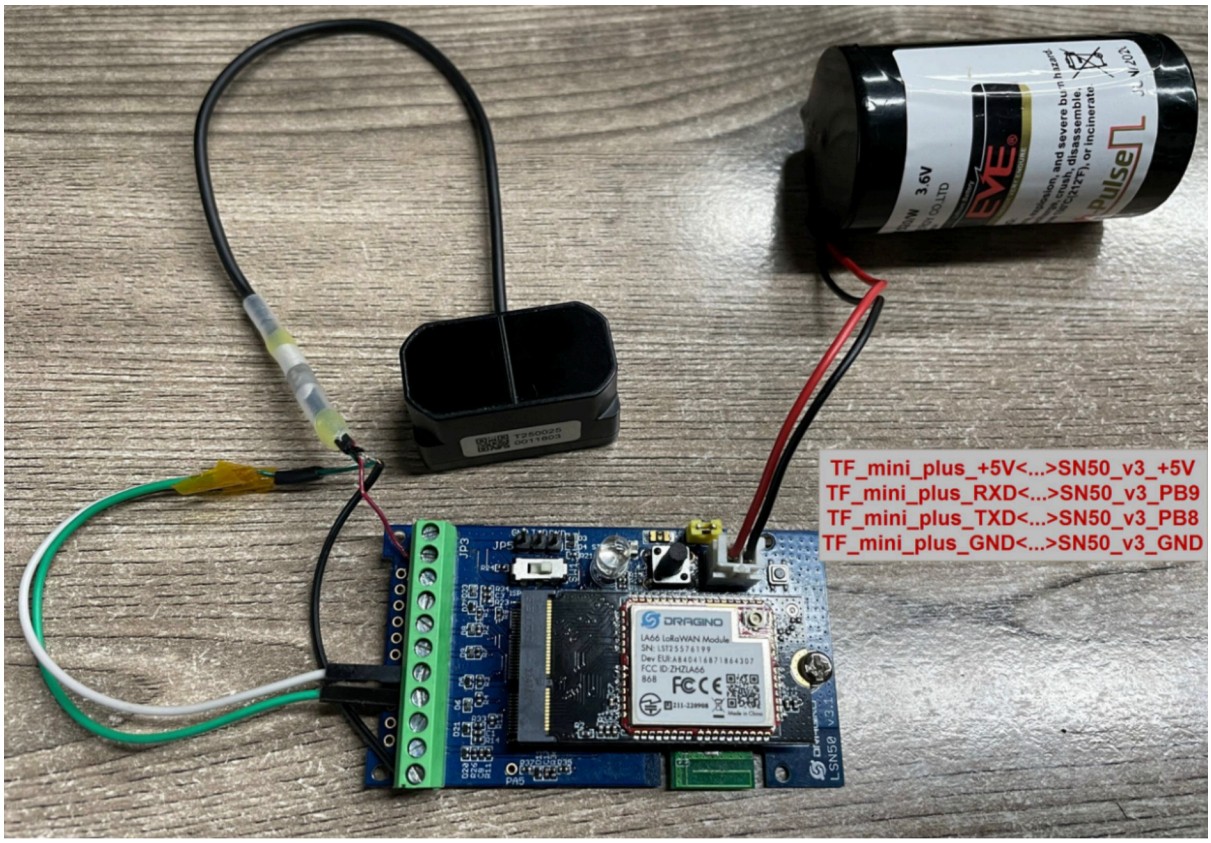
For the connection to TF-Mini or TF-Luna , MOD2 payload is as below:

Size(bytes)	2	2	1	2	2	2
Value	BAT	Temperature(DS18B20)(PC13)	Digital in(PB15) & Digital Interrupt(PA8)	ADC(PA4)	Distance measure by:1)TF-Mini plus LiDAR Or 2) TF-Luna LiDAR	Distance signal strength



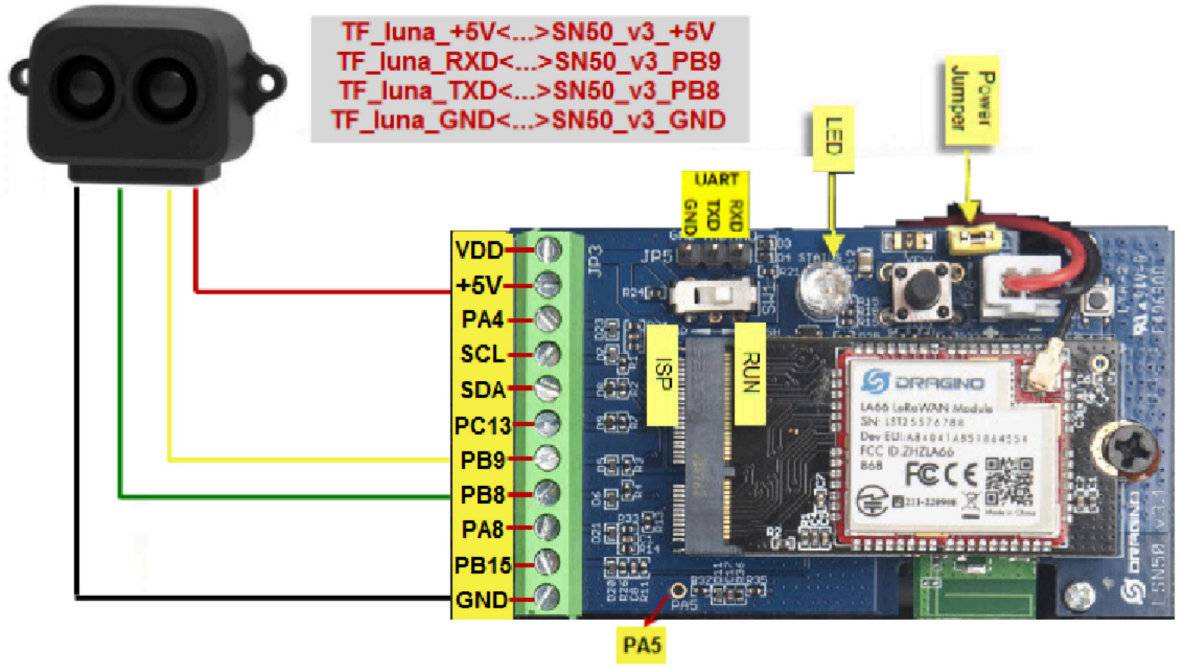
Connection to [TF-Mini plus](#) LiDAR(UART version):

Need to remove R3 and R4 resistors to get low power,otherwise there will be 400uA standby current.



Connection to TF-Luna LiDAR (UART version):

Need to remove R3 and R4 resistors to get low power,otherwise there will be 400uA standby current.



2.3.2.3 MOD=3 (3 ADC + I2C)

This mode has total 12 bytes. Include 3 x ADC + 1x I2C

Size(bytes)	2	2	2	1	2	2	1
Value	ADC1(PA4)	ADC2(PA5)	ADC3(PA8)	Digital Interrupt(PB15)	Temperature(SHT20 or SHT31 or BH1750 Illumination Sensor)	Humidity(SHT20 or SHT31)	Bat