TrackerD-LS -- LoRaWAN Asset Tracker User Manual

Last modified by Bei Jinggeng (/xwiki/bin/view/XWiki/Bei) on 2023/12/27 14:37

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1. Introduction

1.1 What is LoRaWAN Asset Tracker

TrackerD-LS is an **Open Source LoRaWAN Asset Tracker** based on **ESP32 MCU** and **Semtech LoRa Wireless Chip**. It can get the location data via GPS and set it to IoT server via LoRaWAN network.

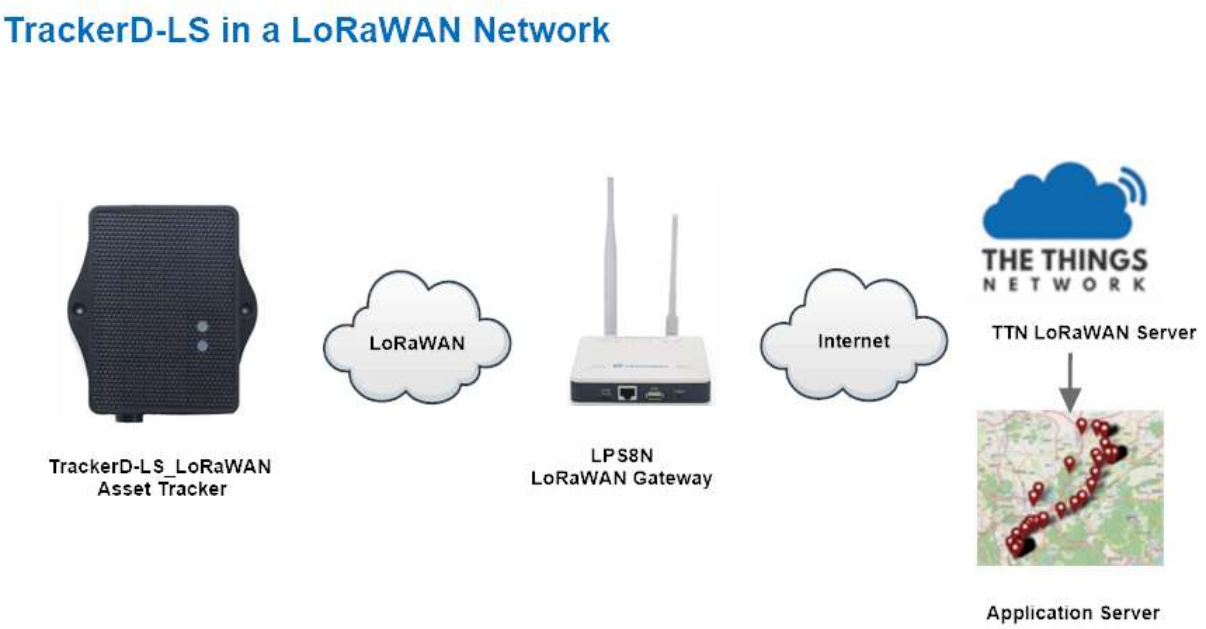
TrackerD-LS supports Motion Detection, when there is motion, TrackerD-LS can send data more frequently and it will save power when no motion is detected.

The LoRa wireless technology used in TrackerD-LS 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 minimizing current consumption. It targets professional tracking services.

When there is no LoRaWAN network, TrackerD-LS can save the location data. It will send these data to IoT server when there is LoRaWAN network coverage.

TrackerD-LS is equipped with a **3000mAh Li-on rechargeable battery + Solar Panel** which let the device can be used for many years. Each TrackerD-LS has a worldwide unique OTAA keys to join the LoRaWAN network.

TrackerD-LS is program friendly. Developers can use Arduino IDE to customize the software of TrackerD-LS to fit their IoT solution.



Note: LoRaWAN server can be a general LoRaWAN server other than TTN.

1.2 Specifications

Micro Controller:

- Espressif ESP32 PICO D4
- MCU: ESP32 PICO D4
- Integrated SPI flash : 4 MB
- RAM: 448 KB
- EEPROM: 520 KB
- Clock Speed: 32Mhz

Common DC Characteristics:

- Supply Voltage: 2.5v ~ 3.6v
- Operating Temperature: -40 ~ 60°C

LoRa Spec:

- Frequency Range, 168 dB maximum link budget.
  - Band 1 (HF): 862 ~ 1020 Mhz
- +20 dBm - 100 mW constant RF output vs.
- +14 dBm high efficiency PA.
- Programmable bit rate up to 300 kbps.
- High sensitivity: down to -148 dBm.
- Bullet-proof front end: IIP3 = -12.5 dBm.
- Excellent blocking immunity.
- Low RX current of 10.3 mA, 200 nA register retention.
- Fully integrated synthesizer with a resolution of 61 Hz.
- FSK, GFSK, MSK, GMSK, LoRaTM and OOK modulation.
- Built-in bit synchronizer for clock recovery.
- Preamble detection.
- 127 dB Dynamic Range RSSI.
- Automatic RF Sense and CAD with ultra-fast AFC.
- Packet engine up to 256 bytes with CRC.
- LoRaWAN 1.0.3 Specification

Battery:

- 3000mA Li-on Battery power

- Built-in Solar Panel

Power Consumption

- Sleeping Mode: 60uA
- LoRa Transmit Mode: 125mA @ 20dBm 44mA @ 14dBm
- Tracking: max: 38mA

1.3 Features

- LoRaWAN 1.0.3 Class A
- ESP32 PICO D4
- SX1276/78 Wireless Chip
- Arduino IDE Compatible
- Open source hardware / software
- Regular/ Real-time GPS tracking
- Built-in3 axis accelerometer.
- Motion sensing capability
- Power Monitoring
- Charging circuit via USB port
- 3000mA Rechargeable Li-on Battery + Solar Panel
- Datalog

1.4 Applications

- Logistics and Supply Chain Management

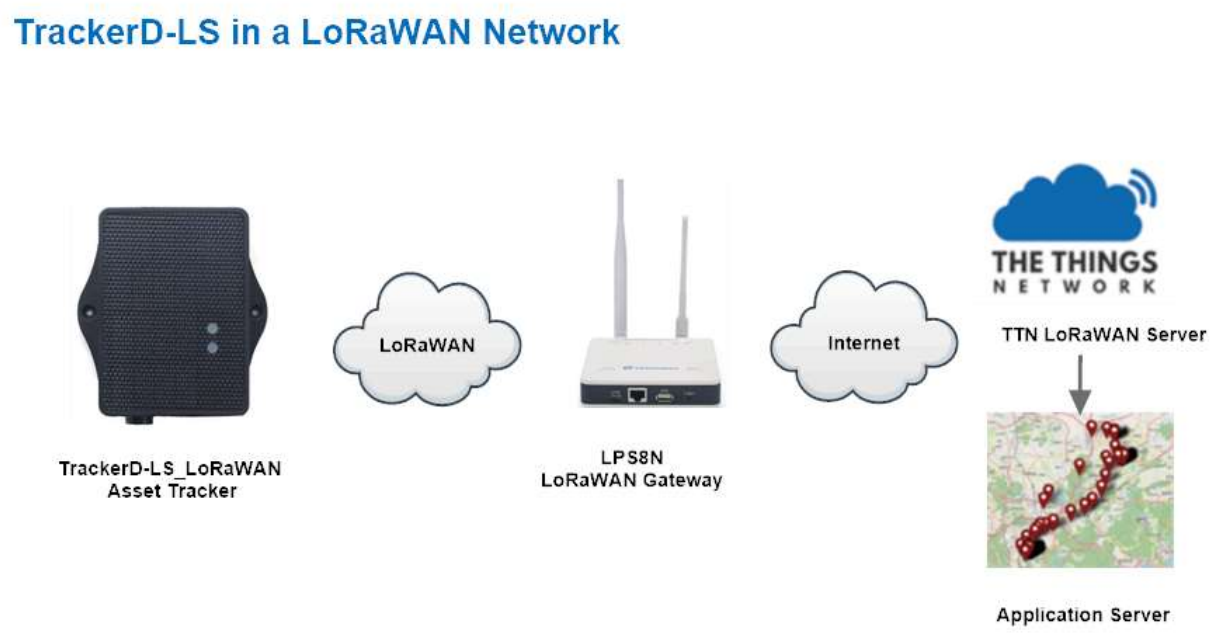
2. Use TrackerD-LS

2.1 How it works?

TrackerD-LS is configured as LoRaWAN OTAA Class A GPS tracker by default. It has OTAA keys to join LoRaWAN network. To connect a LoRaWAN network, user need to input the OTAA keys in the LoRaWAN IoT server and push reset button of TrackerD-LS (next to USB port). TrackerD-LS will wake up and auto join the network via OTAA.

2.2 Quick guide to connect to LoRaWAN server

Here is an example for how to join the TTNv3 LoRaWAN Network (https://eu1.cloud.thethings.network) . Below is the network structure, we use LPS8N as LoRaWAN gateway in this example.



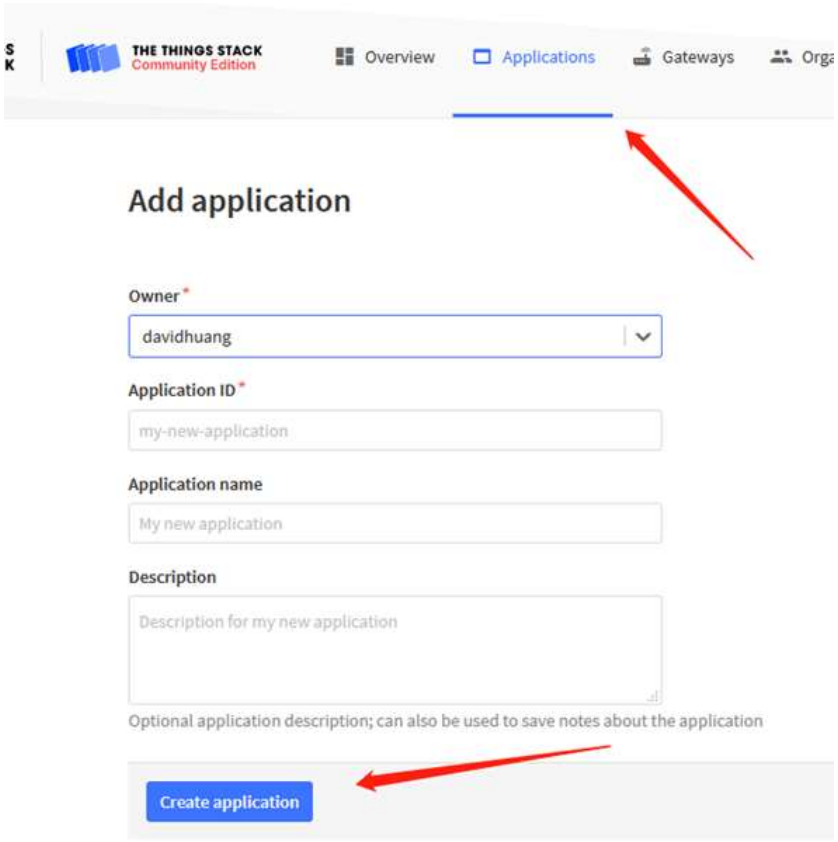
The LPS8N is already set to connect to TTN V3 network (https://eu1.cloud.thethings.network/) . What the rest need to is register this device in TTN V3:

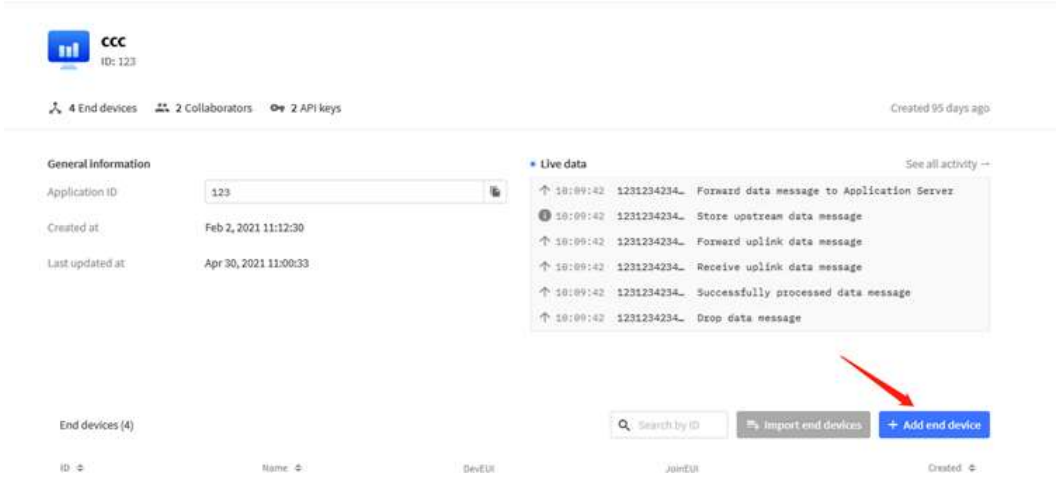
Step 1: Create a device in TTN V3 with the OTAA keys from TrackerD-LS.

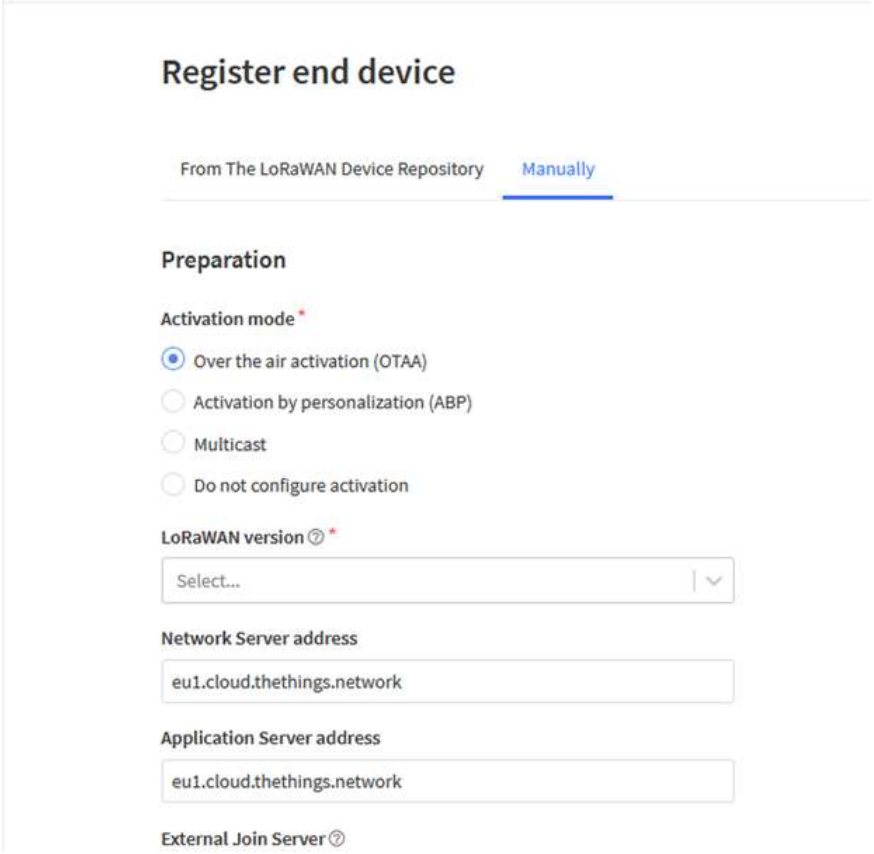
Each TrackerD-LS is shipped with a sticker with the default device EUI as below:

Input these keys to their LoRaWAN Server portal. Below is TTN V3 screen shot:

Add APP EUI in the application:







Add APP KEY and DEV EUI:

Step 2: Long press for 5 seconds to start.

Step 3: TrackerD-LS will auto join to the LoRaWAN network. After join success, TrackerD-LS will start to upload message to IoT server.

2.3 Positioning Mode(SMOD)

Users can set TrackerD-LS to different Positioning Mode for different applications. Below mod are supported.

- **GPS ONLY(Factory Settings):** Only get and uplink GPS location info.

Users can switch modes by changing SMOD.

2.4 Uplink Payload

2.4.1 Uplink FPORT=5, Device Status

Uplink the device configures with **FPORT=5**. Once TrackerD-LS Joined the network, it will uplink this message to the server. After the first uplink, TrackerD-LS will uplink Device Status every 12 hours.

Use can also get the Device Status uplink through the downlink command: **Downlink: 0x2301**

Size(bytes)	**1**	**2**	**1**	**1**	**2**	**1**	**1**
Value	Sensor Model	Firmware Version	Frequency Band	Sub-band	BAT	SMOD	Status

Example of Device Status: 13014001FF0FA24002

Sensor Model: For TrackerD-LS,this value is 0x13

Firmware Version: 0x0140,Means:v1.4.0 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

Sub-Band: value 0x00~0x08(only forAU915,US915,Others are 0xFF)

BAT: shows the battery voltage for TrackerD-LS.

Ex1: 0x0FA2 = 4002mV

Use can also get the Device Status uplink through the downlink command:

SMOD Field (total 1 byte): 0x40

Size(bit)	**1 bit**	**2 bits**	**4 bits**
Value	SMOD	GPS_Settings	BLE_Settings

SMOD:

1 : GPS ONLY

2 : BLE ONLY

3 : GPS/BLE Hybrid

GPS_MOD: Define how to send GPS payload

0 : Enable uploading on-board Temperature and humidity values

1 : Disable uploading on-board Temperature and humidity values

BLE_Settings:

1: BLE Positioning with Strongest iBeacon

2: WiFi Positioning with Strongest WiFi SSID

Status Field (total 1 byte): 0x02

Size(bit)	**5 Bits**	**1 Bit**	**1 Bit**	**1 Bit**
Value	Reserve	PNACKMD	LON	Transport Mode

2.4.2 Uplink FPORT=2, Realtime GNSS Positioning + Temperature & Humidity

Users can use **AT+SMOD=1,0,0** to enable uploading on-board Temperature and humidity values, and the total payload will be 15 bytes,

Size(bytes)	**4**	**4**	**2**	**1**	**2**	**2**
Value	Latitude	Longitude	Alarm & BAT	FLAG	Hum	Tem

Alarm & BAT:

Size(bit)	**1 bit**	**1 bit**	**14 bits**
Value	reserve	Alarm Indicate	BAT

FLAG:

Size(bit)	**2 bits**	**1 bit**
Value	MOD	LON

Example: Payload: 0x02863D68 FAC29BAF 4B45 60 0202 011A

Location info:

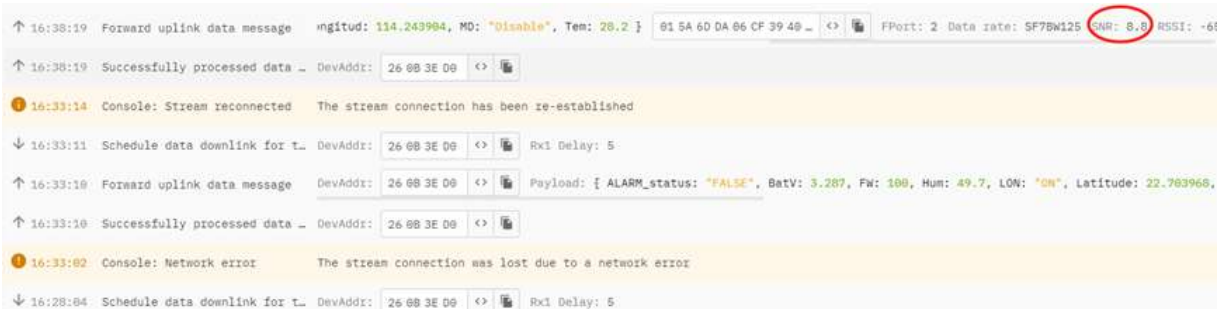
- Latitude: 02863D68 ⇒ *if (0x*02863D68*& 0x80000000 = 0):* *value = 02863D68 /1000000 = 42.351976*

- Longitude: FAC29BAF ⇒ *if (0x*FAC29BAF *& 0x80000000 = 1): value = (0x*FAC29BAF *– 0x 100000000)/1000000* =-87.909457

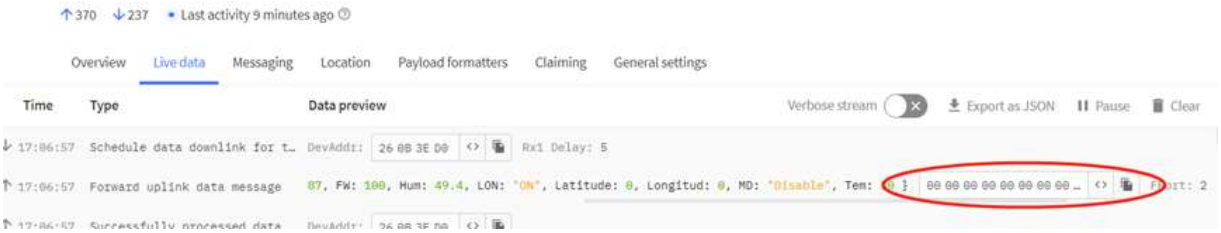
Important note:

1. When power is low (<2.84v), GPS won't be able to get location info and GPS feature will be disabled and the location field will be filled with 0x0FFFFFFF, 0x0FFFFFFF.

2. In this mode, the total payload will be 15 bytes, while US915/AU915 DR0 accepts only 11 bytes payload. In this case, the payload on server will be ignore and shows as below:



3. While GPS can't get location info after timeout(FTIME Parameter), the latitude and longitude will be filled with all 0x00:



Alarm:

Example: 0x4B & 0x40 >> 6 = 0x01

BAT:

Example: 0x4B45 & 0x3FFF ⇒ 2885 (mV).

The battery info shows the battery voltage, User can use the below mapping to indicate the battery in percentage: \

- > 4.0v : 80% ~ 100%
- 3.85v ~3.99v: 60% ~ 80%
- 3.70v ~ 3.84v: 40% ~ 60%
- 3.40v ~ 3.69v: 20% ~ 40%
- < 3.39v: 0~20%

MOD:

Example: (0x60>>6) & 0x3f =1

Set the format of GPS data uplink link:

0x00: Enable uploading on-board Temperature and humidity values
0x01: Disable uploading on-board Temperature and humidity values

Set the format of BLE data uplink link:

0x01: BLE Positioning with Strongest iBeacon

LON:

Example: (0x60>>5) & 0x01=1.

Enable/Disable LED activity for uplink

0x00: Disable LED indicator.

0x01: Enable LED indicator (Default Value)

Hum:

0202 = *if (0x0202 & 0x8000 = 0): value =* 0x0202 / 100 = +514 ⇒ 51.4 degree

Tem:

011A =if (0x011A & 0x8000 = 1): value =(0x011A - 0x10000)/10(dec) ⇒ *-28.2 degree*

2.4.3 Uplink FPORT=3, Realtime GNSS Positioning (Default Mode)

The default uplink payload includes total 11 bytes (**AT+SMOD=1,1,0**). The payload is the first 11 bytes of Uplink FPORT=2, real-time GNSS positioning, (remove the temp and humidity)

Size(bytes)	**4**	**4**	**2**	**1**
Value	Latitude	Longitude	Alarm & BAT	FLAG

2.4.4 Uplink FPORT=7, Alarm information status

The upward link device is configured to FPORT = 7. Once TrackerD-LS alarm, it will upload the news to the server.

Size(bytes)	**2**	**1**
Value	Alarm & BAT	Mod+lon

alarm=(bytes[0] & 0x40) // Alarm status

batV=(((bytes[0] & 0x3f) <<8) | bytes[1])/1000; // Battery,units:V

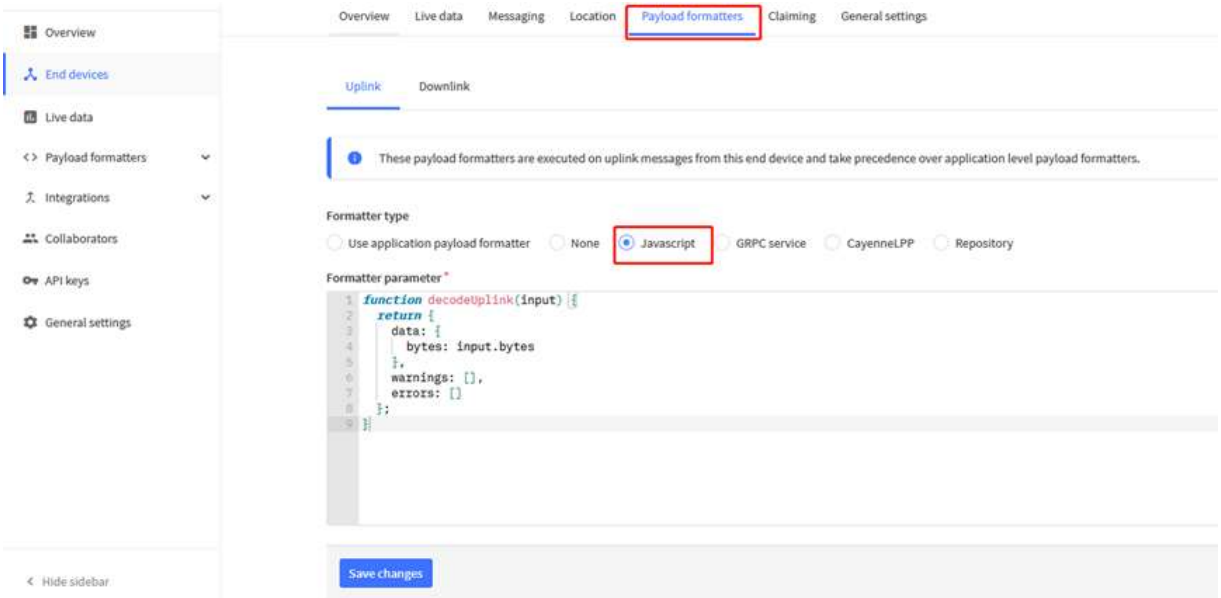
mod = bytes[2] & 0xC0;

Lon=(bytes[2] & 0x20)

2.4.5 Add Payload format in TTN V3

In TTN V3, user can add a custom payload so it shows friendly.

In the page **Applications --> Payload Formats --> Custom --> decoder**



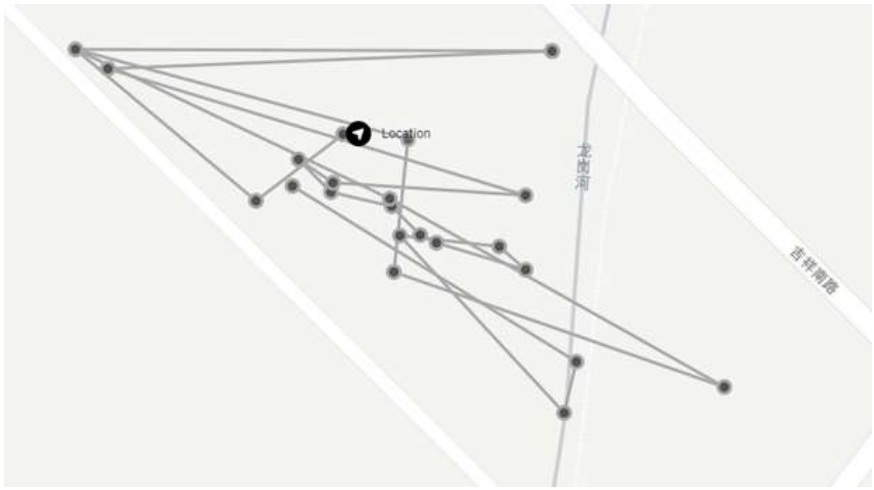
Add the decoder from this link: dragino-end-node-decoder/TrackerD at main · dragino/dragino-end-node-decoder (github.com) (https://github.com/dragino/dragino-end-node-decoder/tree/main/TrackerD)

Save the change the uplink message will be parsed. As below:

2.5 Integrate with Datacake

After TrackerD-LS sends data to LoRaWAN server such as TTN, use can pass the data to Datacake and plot out, currently only support GPS plot.

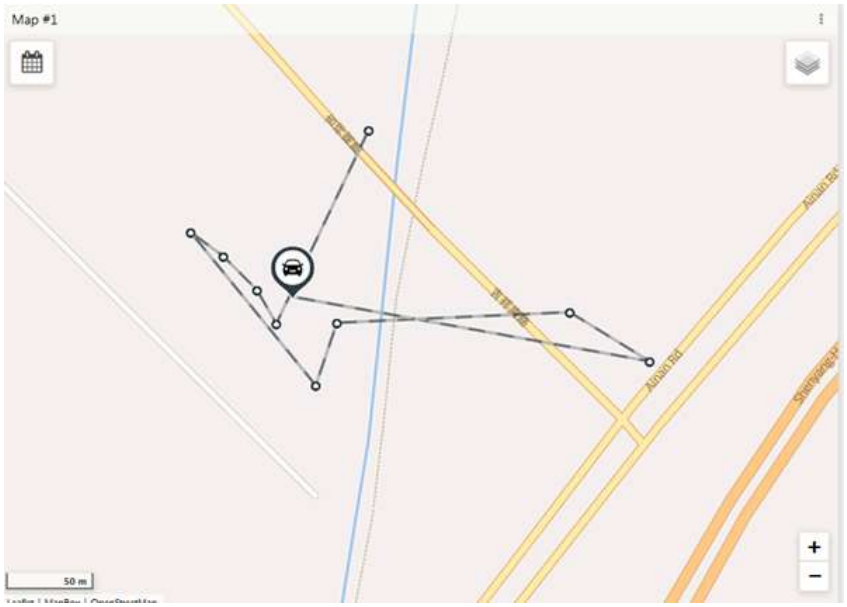
Instruction is here: http://wiki.dragino.com/xwiki/bin/view/Main/Notes%20for%20Data%20Cake/#H7.Example--AddTrackerDGPSTrackingInDataCake (http://wiki.dragino.com/xwiki/bin/view/Main/Notes%20for%20Data%20Cake/#H7.Example--AddTrackerDGPSTrackingInDataCake)



2.6 Integrate with Tago

After TrackerD-LS sends data to LoRaWAN server such as TTN, user can pass the data to Datacake and plot out, currently only support GPS plot.

Instruction is here: http://wiki.dragino.com/xwiki/bin/view/Main/Tago.IO/#H3.A0Example-CreateTrackerD2FLGT92positioningwidget (http://wiki.dragino.com/xwiki/bin/view/Main/Tago.IO/#H3.A0Example-CreateTrackerD2FLGT92positioningwidget)



2.7 Integrate with Node-red

1. Install node-red, please refer to the installation method in the link:

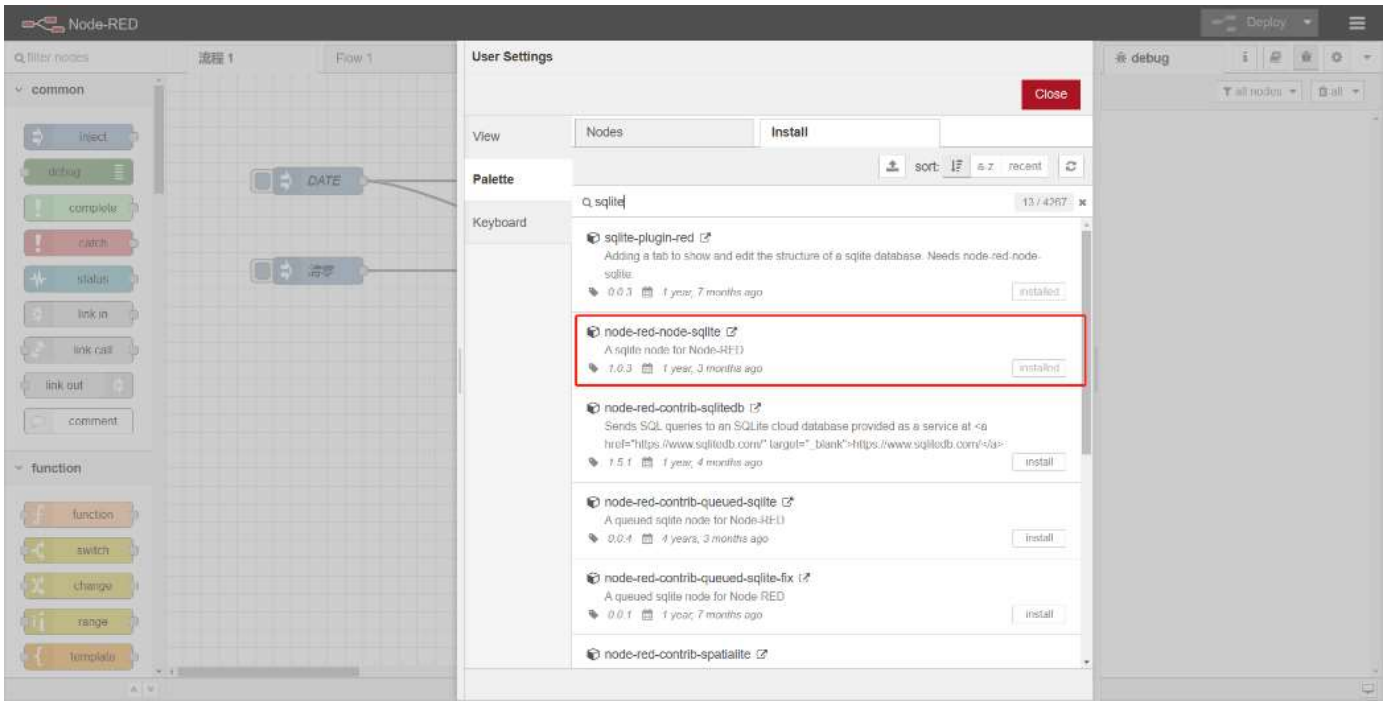
http://wiki.dragino.com/xwiki/bin/view/Main/Node-RED/#H1.A0Installation (http://wiki.dragino.com/xwiki/bin/view/Main/Node-RED/#H1.A0Installation)

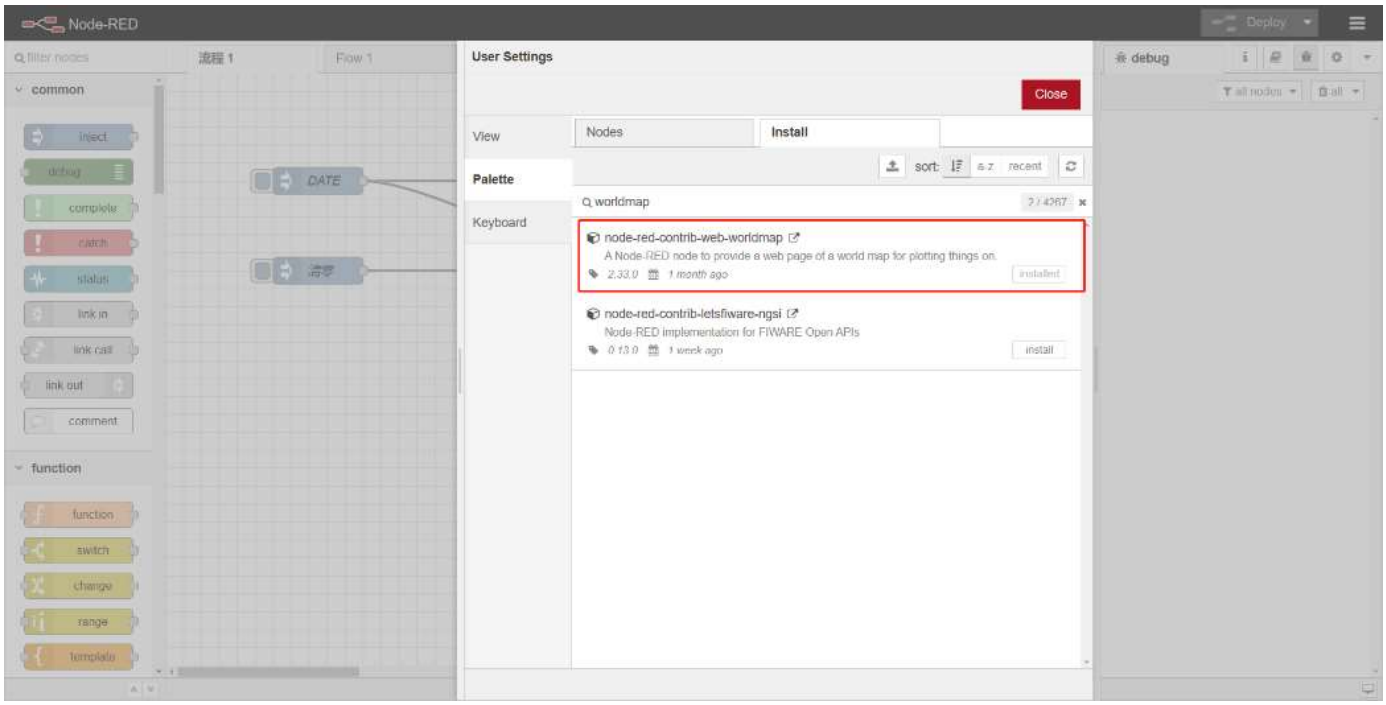
2. Import the created flow template, please refer to the import method in the link:

http://wiki.dragino.com/xwiki/bin/view/Main/Node-RED/#H3.A0Importsampleflow (http://wiki.dragino.com/xwiki/bin/view/Main/Node-RED/#H3.A0Importsampleflow)

The address of the flow template: dragino-end-node-decoder/TrackerD.json at main · dragino/dragino-end-node-decoder · GitHub (https://github.com/dragino/dragino-end-node-decoder/blob/main/Node-RED/TrackerD.json)

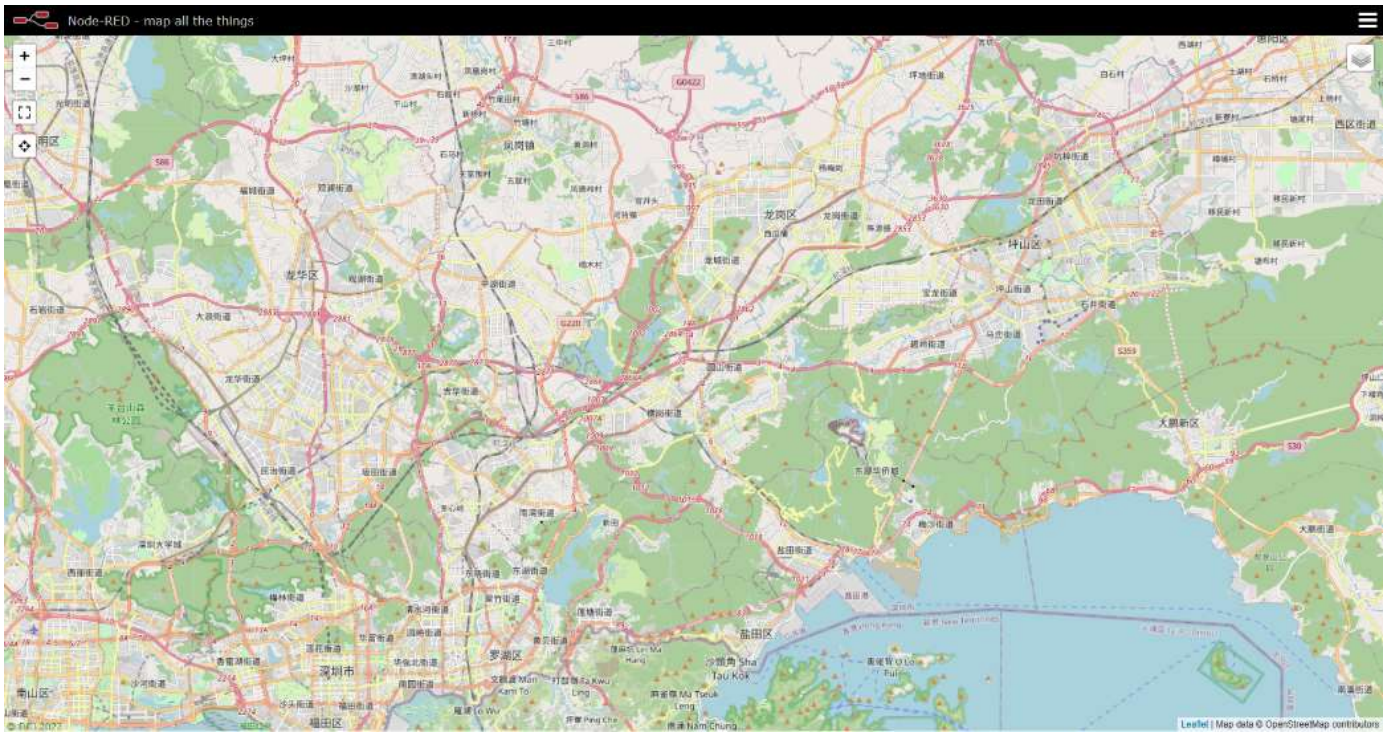
Note: If you are using NODE-RED for the first time, please search and install the two plug-ins in the figure below in node-red to fully use the flow template.



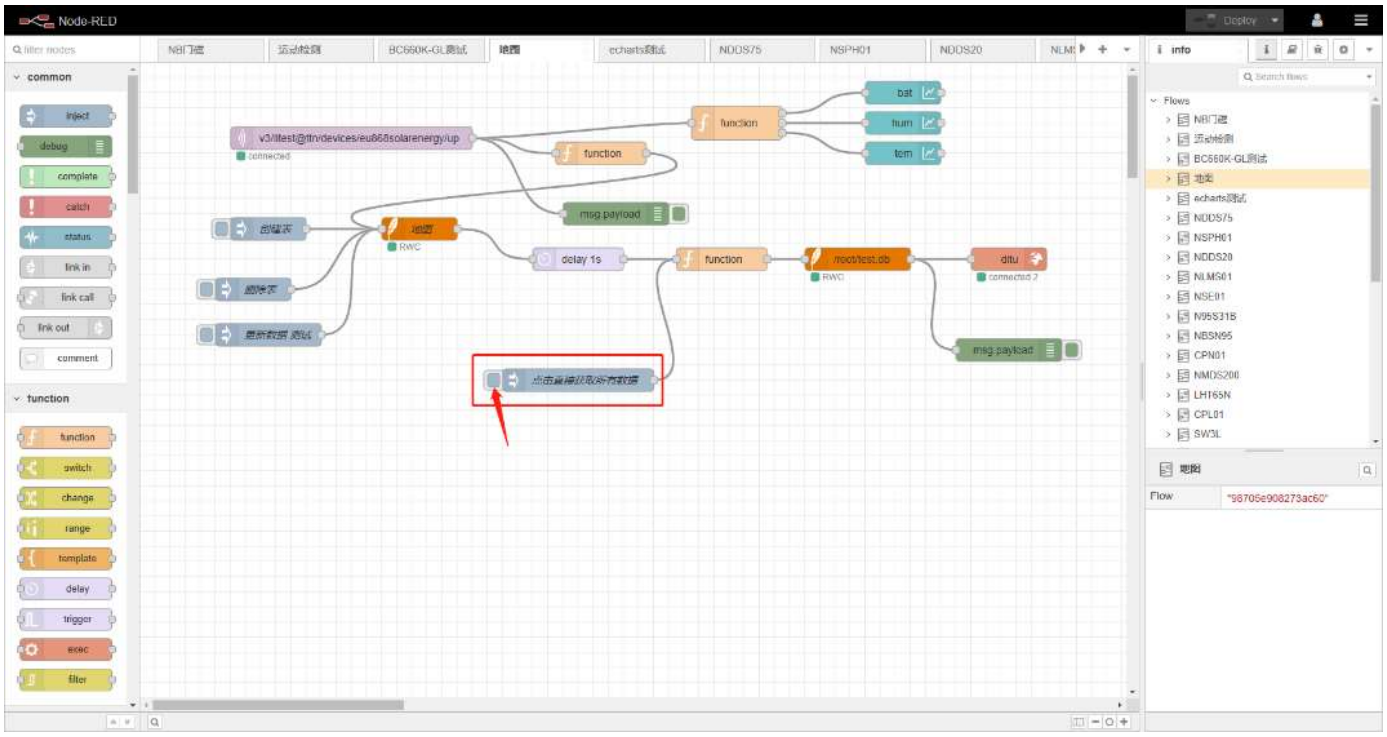


3. Display the map
   Enter the link to the map:

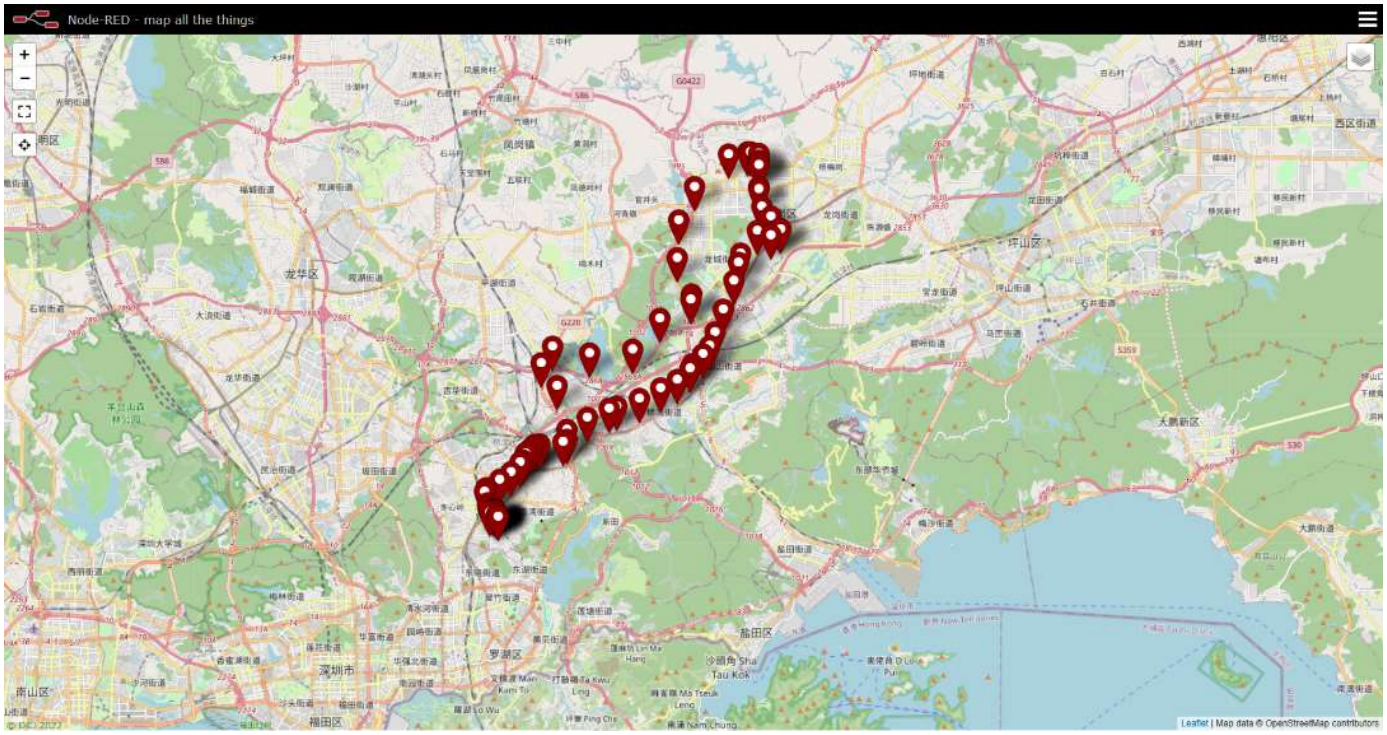
   Change its suffix to ditu： http://119.91.62.30:1880/**ditu/**



Hit all input in input stream



View map again

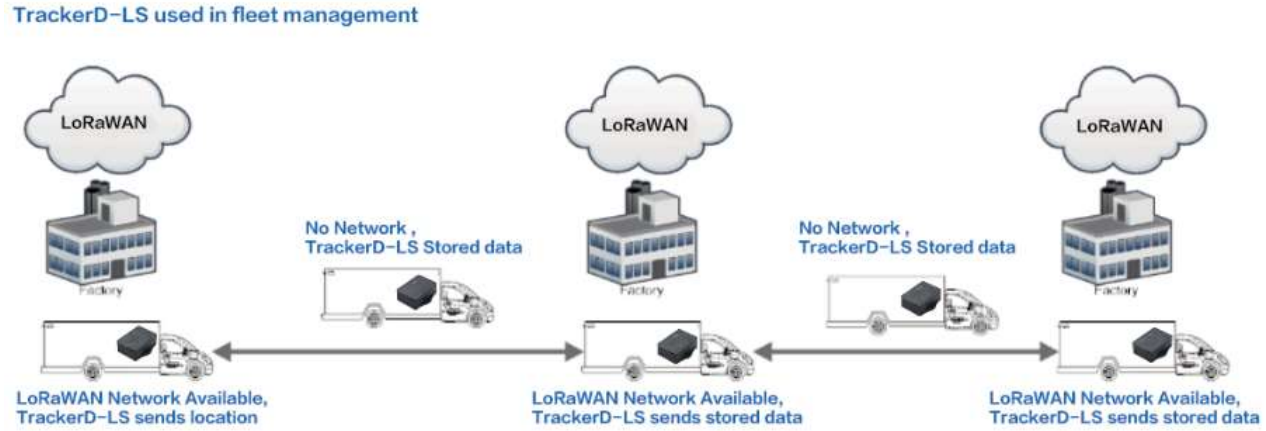


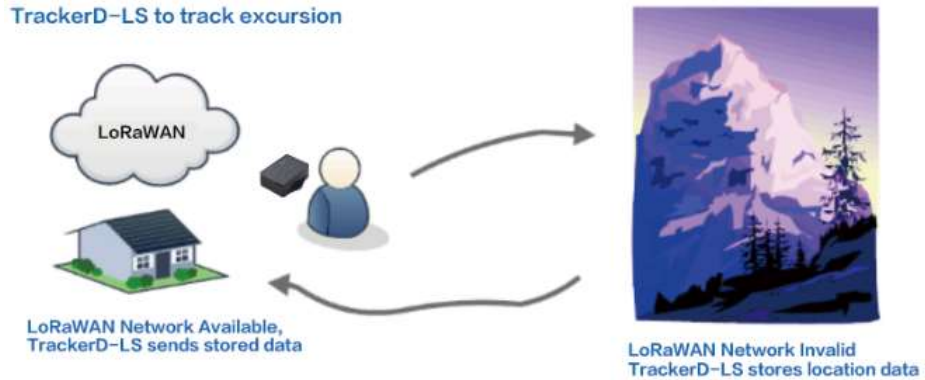
2.8 Datalog Feature

total 273 entries,by default,

User can set PNACKMD=1, to enable Datalog feature.

Example use case.





2.9 Transport Mode

In Transport Mode, TrackerD-LS will check if there is motion (threldhold defined by **PT)** . If there is no motion, device will send uplinks every 20 minutes (Defined by **TDC)** . If there is motion, device will send uplink every 5 minutes(defined by **MTDC)**.

When device is set in Transport Mode, it will uplink more frequenctly during moving.

- **MTDC** defines the Uplink Interval during transportation.
- **TDC** defines the uplink interval when TrackerD-LS is stactic.
- **PT** defines the threldhold to detect a motion.

2.10 LED Status

Event	**Action**	**AT+LON to control on/off**
Power On	**BLUE, RED , Green** flash once	N/A
Join request	**Green** led fast blink once (200ms)	Yes
Join Success	**Green** led on 5 second	N/A
Fixing Location	**BLUE** blinks 200ms per second	Yes
Fixed and uplink	**GREEN** blinks twice (200ms per blink)	Yes
Fail Fix and uplink	**RED** blinks twice (200ms per blink)	Yes
Get Downlink	**GREEN** led on 1 second	Yes
Movement Detect	**RED** led on 500ms	N/A

2.11 Button Function

Function	**Action**	**Description**
Factory settings wake up	Keep Pressing button for more than 5 seconds	Device restart
Enter Deep Sleep Mode	quickly press the device 5 times to enter deep sleep	This is the mode ship out from factory. CPU will be complete in sleep mode and no LoRa activity, only use before deploy.

2.12 USB Port Function

The USB interface of TrackerD-LS has below functions:

- Configure Device
- Upgrade Firmware

2.13 Sleep Mode

Sleep Mode: To prevent accidental touch of the red button during transportation or assembly, so the peripherals of the device are turned off and enter deep sleep.

There are two ways to put the device into sleep mode:

1. Quickly press the device 5 times to enter deep sleep.

2. Use the **AT+SLEEP** command to put the device into sleep.

In SLEEP mode, you need to reset by **reset button**.

3. Configure TrackerD-LS via AT command or LoRaWAN downlink

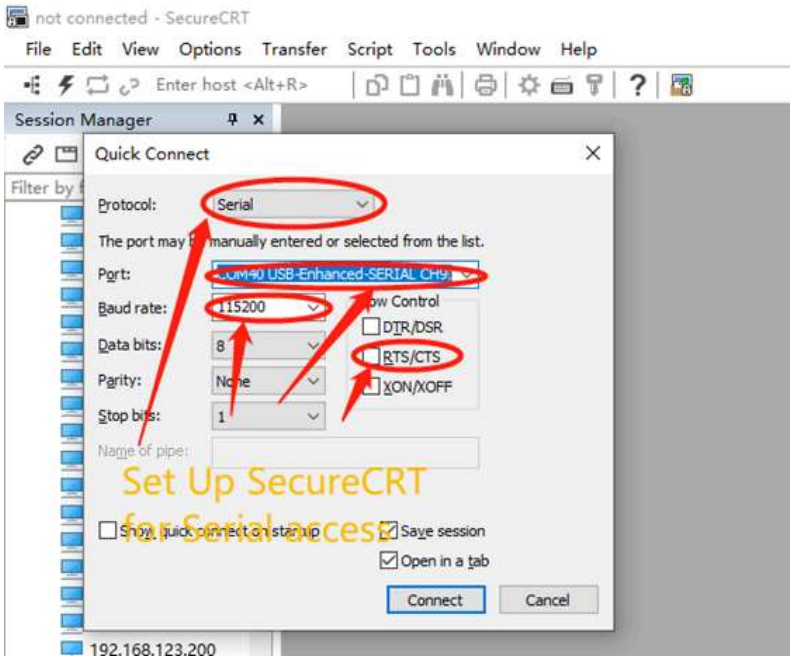
User can configure TrackerD-LS via AT Command or LoRaWAN Downlink.

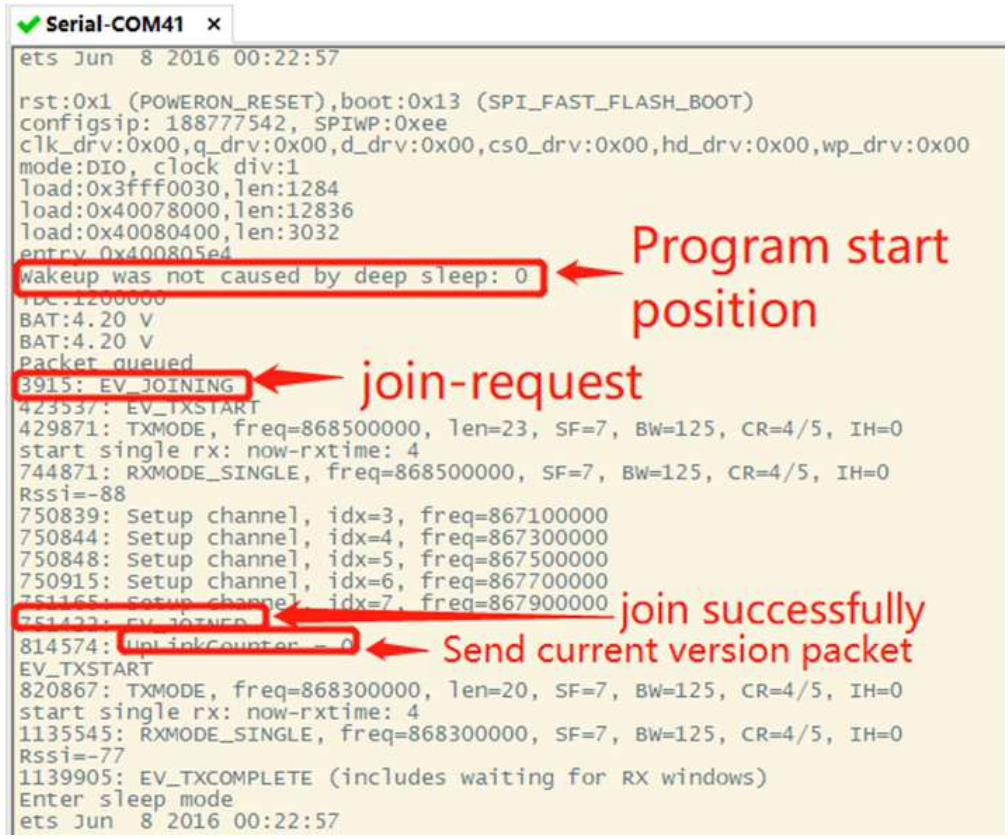
LoRaWAN Downlink instruction for different platforms: IoT LoRaWAN Server (/xwiki/bin/view/Main/)

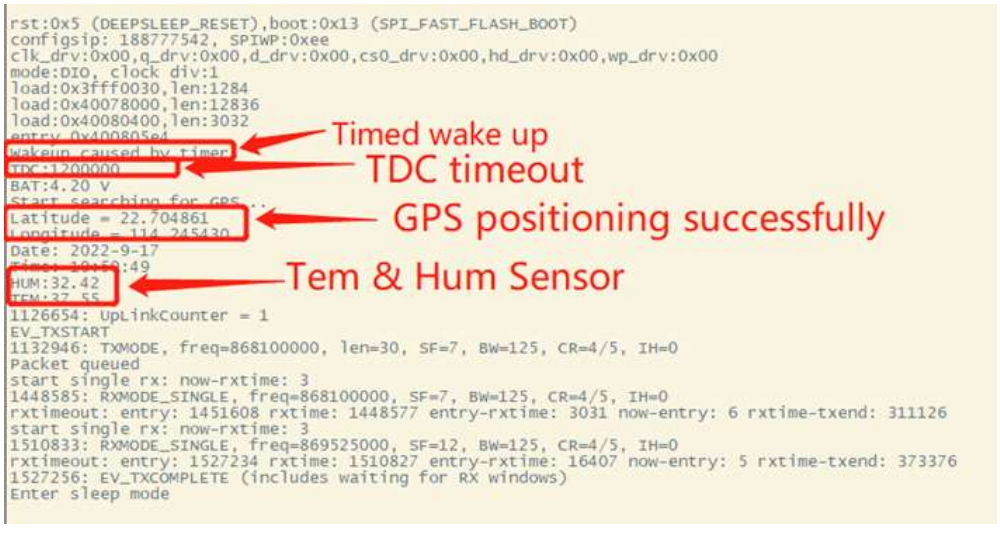
3.1 Access AT Command

TrackerD-LS supports the AT command set in stock firmware. User can connect to TrackerD-LS with TYPE-C cable to use AT commands as shown below.

In PC, User needs to set serial tool baud rate to **115200** to access serial console for TrackerD-LS. TrackerD-LS will output system info once power on and user will be able to send AT commands:


not connected - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Enter host <Alt+R>
Session Manager
Quick Connect
Protocol: Serial
The port may be manually entered or selected from the list.
Port:
Baud rate: 115200
Data bits: 8
Parity:
Stop bits: 1
Name of pipe:
DTR/DSR
RTS/CTS
XON/XOFF
Save session
Open in a tab
Connect
Cancel
192.168.123.200
Set Up SecureCRT
for Serial access


Serial-COM41
ets Jun 8 2016 00:22:57
rst:0x1 (POWERON_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 188777542, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3fff0030,len:1284
load:0x40078000,len:12836
load:0x40080400,len:3032
entry 0x400805e4
wakeup was not caused by deep sleep: 0
BAT:4.20 V
BAT:4.20 V
Packet queued
3915: EV_JOINING
423537: EV_TXSTART
429871: TXMODE, freq=868500000, len=23, SF=7, BW=125, CR=4/5, IH=0
start single rx: now-rxtime: 4
744871: RXMODE_SINGLE, freq=868500000, SF=7, BW=125, CR=4/5, IH=0
Rssi=-88
750839: Setup channel, idx=3, freq=867100000
750844: Setup channel, idx=4, freq=867300000
750848: Setup channel, idx=5, freq=867500000
750915: Setup channel, idx=6, freq=867700000
814574: UpLinkCounter = 0
EV_TXSTART
820867: TXMODE, freq=868300000, len=20, SF=7, BW=125, CR=4/5, IH=0
start single rx: now-rxtime: 4
1135545: RXMODE_SINGLE, freq=868300000, SF=7, BW=125, CR=4/5, IH=0
Rssi=-77
1139905: EV_TXCOMPLETE (includes waiting for RX windows)
Enter sleep mode
ets Jun 8 2016 00:22:57
Program start position
join-request
join successfully
Send current version packet


rst:0x5 (DEEPSLEEP_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 188777542, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3fff0030,len:1284
load:0x40078000,len:12836
load:0x40080400,len:3032
entry 0x400805e4
Wakeup caused by timer
TDC:1200000
BAT:4.20 V
Start searching for GPS ...
Latitude = 22.704861
Longitude = 114.245430
Date: 2022-9-17
Time: 10:50:49
HUM:32.42
TEM:27.55
1126654: UpLinkCounter = 1
EV_TXSTART
1132946: TXMODE, freq=868100000, len=30, SF=7, BW=125, CR=4/5, IH=0
Packet queued
start single rx: now-rxtime: 3
1448585: RXMODE_SINGLE, freq=868100000, SF=7, BW=125, CR=4/5, IH=0
rxtimeout: entry: 1451608 rxtime: 1448577 entry-rxtime: 3031 now-entry: 6 rxtime-txend: 311126
start single rx: now-rxtime: 3
1510833: RXMODE_SINGLE, freq=869525000, SF=12, BW=125, CR=4/5, IH=0
rxtimeout: entry: 1527234 rxtime: 1510827 entry-rxtime: 16407 now-entry: 5 rxtime-txend: 373376
1527256: EV_TXCOMPLETE (includes waiting for RX windows)
Enter sleep mode
Timed wake up
TDC timeout
GPS positioning successfully
Tem & Hum Sensor

3.2 Command Set

3.2.1 Set Transmit Interval

Set device uplink interval.

- **AT Command:**

AT+TDC=xxx

Example: AT+TDC=300000. Means set interval to 5 minutes(300 seconds)

- **Downlink Payload (prefix 0x01):**

0x01 00 01 2C // Same as AT+TDC=300000

3.2.2 Set Alarm Packet transmission interval

Set alarm packet transmit interval

- **AT Command:**

AT+ATDC=xx.

Example: AT+ATDC=60000 **-->** Set Alarm Packet Interval to 60 seconds. TrackerD-LS will send every 60 seconds in Alarm mode, Default Value: 60000

- **Downlink Payload (prefix 0xB1):**

0xB1 00 00 3C // Same as AT+ATDC=60000

3.2.3 Set Transport Mode Packet transmission interval

Set Transport Mode packet transmit interval

- **AT Command:**

AT+MTDC=xx.

Example: AT+MTDC=300000 **-->** Set Transport Mode Packet Interval to 300 seconds. TrackerD-LS will send every 300 seconds in Transport mode, Default Value: 300000

- **Downlink Payload (prefix 0x03):**

0x03 00 01 2C // Same as AT+MTDC=3000000

3.2.4 Exit Alarm

Server send downlink command to exit Alarm mode

- **AT Command: No AT Command**
- **Downlink Payload (prefix 0x02):**

0x02 01 // Exit Alarm Mode

3.2.5 Disable/Enable LED flash and buzzer

Disable/Enable LED for position, downlink and uplink

- **AT Command:**

AT+LON=xx. (Disable (0), Enable (1), default:1)

Example: AT+LON=0 **-->** Disable LED for position, downlink and uplink.

- **Downlink Payload (prefix 0xAE):**

0xAE 00 // Same as AT+LON=0

3.2.6 Disable/Enable Transport Mode

Users can use this feature to enable/disable Transport Mode.

- **AT Command:**

AT+INTWK=xx. (Disable (0), Enable (1), default:0)

Example: AT+INTWK=1 **-->** Enable Transport Mode.

- **Downlink Payload (prefix 0xAF):**

0xAF 01 // Same as AT+INTWK=1

3.2.7 Set Positioning Mode

SMOD define how TrackerD-LS scan and uplink data:

- **AT Command:**

AT+SMOD=aa,bb,cc

aa:

- **1: GPS ONLY(Factory Settings):** Only get and uplink GPS location info.

bb:

- **0 :** GPS+ BAT+ State+Tem&Hum
- **1 :** GPS +BAT State

Example:

AT+SMOD=1,0,0 --> GPS+ BAT+ State+Tem&Hum

AT+SMOD=1,1,0 --> GPS +BAT State

- **Downlink Payload (prefix 0xA5):**

0xA5 01 00 00 // Same as AT+SMOD=1,0,0

3.2.8 Set MAX GPS position time

Set max positioning time, default is 150 seconds. TrackerD-LS will try to get location info within this period. If fail to get position data within this time, TrackerD-LS will use 000000 for latitude and longitude.

If **AT+FTIME=0**. The GPS module will be always powered and positioning. This will highly increase the power consumption (up to 50mA). When AT+FTIME=0, it will improve fix accuracy and shorten the acquire time for next uplink.

- **AT Command:**

AT+FTIME=xx --> Set to use xx as max fix time.

Example: AT+FTIME=150

- **Downlink Payload (prefix 0xAA):**

0xAA 00 96 // Set AT+FTIME=150

3.2.9 Set PDOP value for GPS fix accuracy

PDOP(Position Dilution of Precision) filter, TrackerD-LS will only accept GPS data with a lower PDOP value than pre-configure PDOP value. If device can't get a valid GPS packet within FTIME timeout, it will use the GPS data with lowest PDOP value to server.

A GPS packet with lower PDOP has higher accuracy. PDOP default value is 2.0

- **AT Command:**

AT+PDOP=2.5 --> Set PDOP to 2.5

- **Downlink Payload (prefix 0xAD):**

0xAD 00 0A // Set AT+PDOP=1 (0x0A / 10 =1)

0xAD 00 19 // Set AT+PDOP=2.5 (0x19 / 10 =2.5)

0xAD 00 46 // Set AT+PDOP=7 (0x46 / 10 =7)

3.2.10 Disable/Enable the confirmation mode

- **AT Command:**

AT+CFM=xx

Example:

AT+CFM=0 **-->** Disable confirmation

AT+CFM=1 **-->** Enable confirmation

- **Downlink Payload (prefix 0x05):**

0x05 01 // Same as AT+CFM=1

3.2.11 Auto Send None-ACK messages

TrackerD-LS will wait for ACK for each uplink, If TrackerD-LS doesn't get ACK from the IoT server, it will consider the message doesn't arrive server and store it. TrackerD-LS keeps sending messages in normal periodically. Once TrackerD-LS 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: 0x34 01 // Same as AT+PNACKMD=1

3.2.12 Disable/Enable Information printing

Users can use this feature to enable/disable Information printing.

AT Command:

AT+SHOWID=XX // (Disable (0), Enable (1), default:0)

Example: AT+SHOWID=1 --> Enable Information printing.

3.2.13 Get or Set Eight Channels Mode, only for us915, AU915

The Channels Mode in the LORAWAN LMIC library is from 0 ~ 7. When CHE = 8, 72 channels will be accessible to the network.

AT Command:

AT+CHE=1 // set one channels mode

Downlink Payload:0X24

Example: 0x24 01 // Same as AT+CHE=1

3.2.14 Get or Set Threshold for motion detect

User can set the motion detect thredhold for transportation mode. The smaller the value, the more sensitivity to trigger a motion event.

AT Command:

AT+PT=xx

Example:

AT+PT=14 --> Set to detect car motion.

AT+PT=41 --> set to detect walk motion.

Downlink Payload:0xB4

0xB4 14 // Same as AT+PT=14

3.2.15 Set AT command window time

AT command window time setting, customers can set the required time according to their own operation mode.The unit is second.

AT Command:

AT+ATST=XX

Example:

AT+ATST=15 --> Set the time to 15 seconds

Downlink Payload:0XB5

0xB5 0F // Same as AT+ATST=15

3.2.16 Set the stepmeter mode

After setting the step counting mode, it cannot be interrupted by motion. This mode is very power consuming. Used on some special occasions.

AT Command:

AT+PM=xx

Example:

AT+PM=1 --> Turn on step counting mode

AT+PM=0 --> Turn OFF step counting mode

Downlink Payload:0XB6

0xB6 01 // Same as AT+PM=1

4. Upload Firmware

4.1 Firmware Change Log

See this link (https://github.com/dragino/TrackerD-LS)

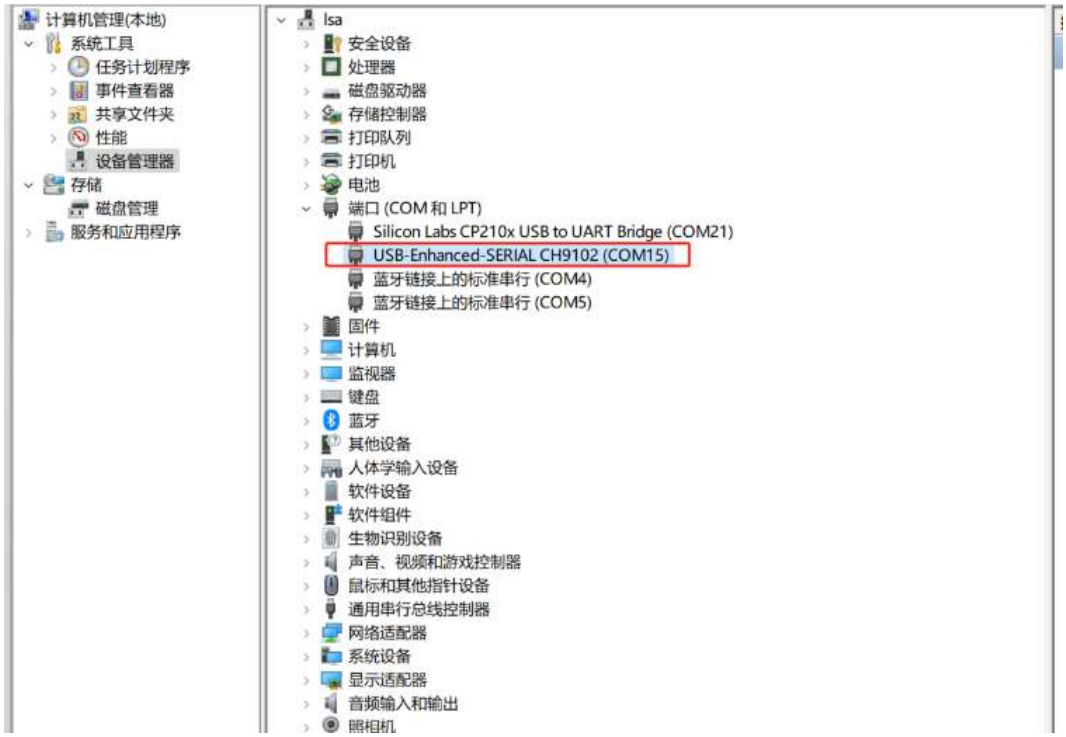
4.2 How to upgrade firmware

User can use the TrackerD-LS's USB port to upgrade firmware into it. The hardware connection for upgrade firmware is as below:

Step1: Connect TrackerD-LS and PC via USB cable shipped with TrackerD-LS.

Step2: Install CH9102 driver in the PC.

After installation of the driver and plug in TrackerD-LS, user should be able to see com port in PC's device manager.



Step3: Download and Install Flash Tool: https://www.espressif.com.cn/en/support/download/other-tools?keys=Flash%2BDownload%2BTools (https://www.espressif.com.cn/en/support/download/other-tools?keys=Flash%2BDownload%2BTools)

Step4: Run Flash Download Tool and configure chip type to ESP32

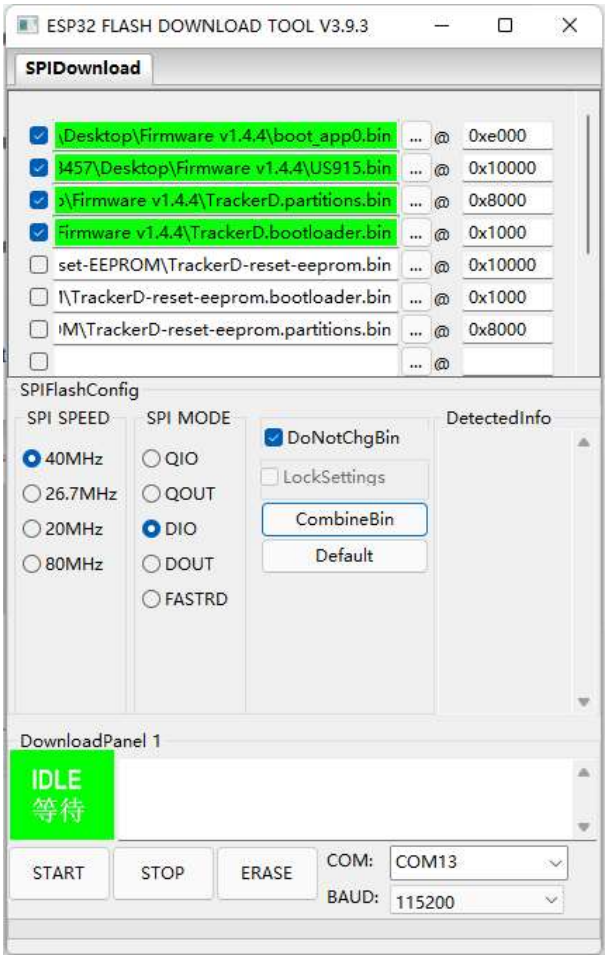
Step5: Select the firmware file (.bin format), com port and proper SPI configure. Clink Start. Bin file location:

https://github.com/dragino/TrackerD/releases (https://github.com/dragino/TrackerD/releases)

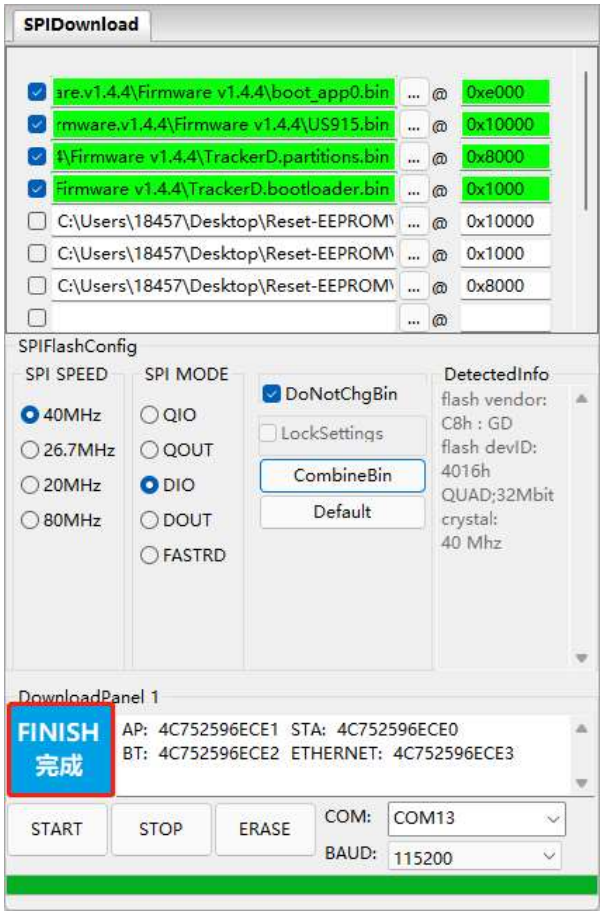
Users need to use below files:

boot_app0.bin @0e000

US915.bin @ 0x10000(Select the bin file of the frequency band you need)



After upgrade finish, it will show finish as below:



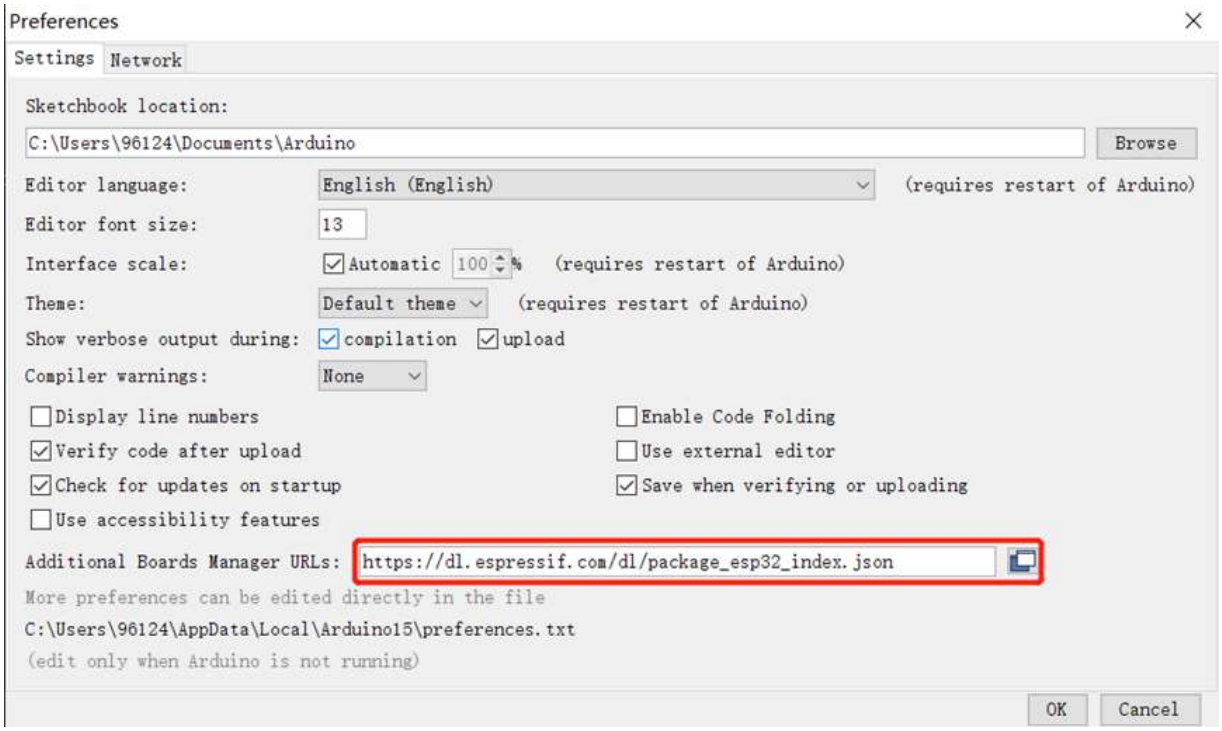
5. Developer Guide

5.1 Compile Source Code

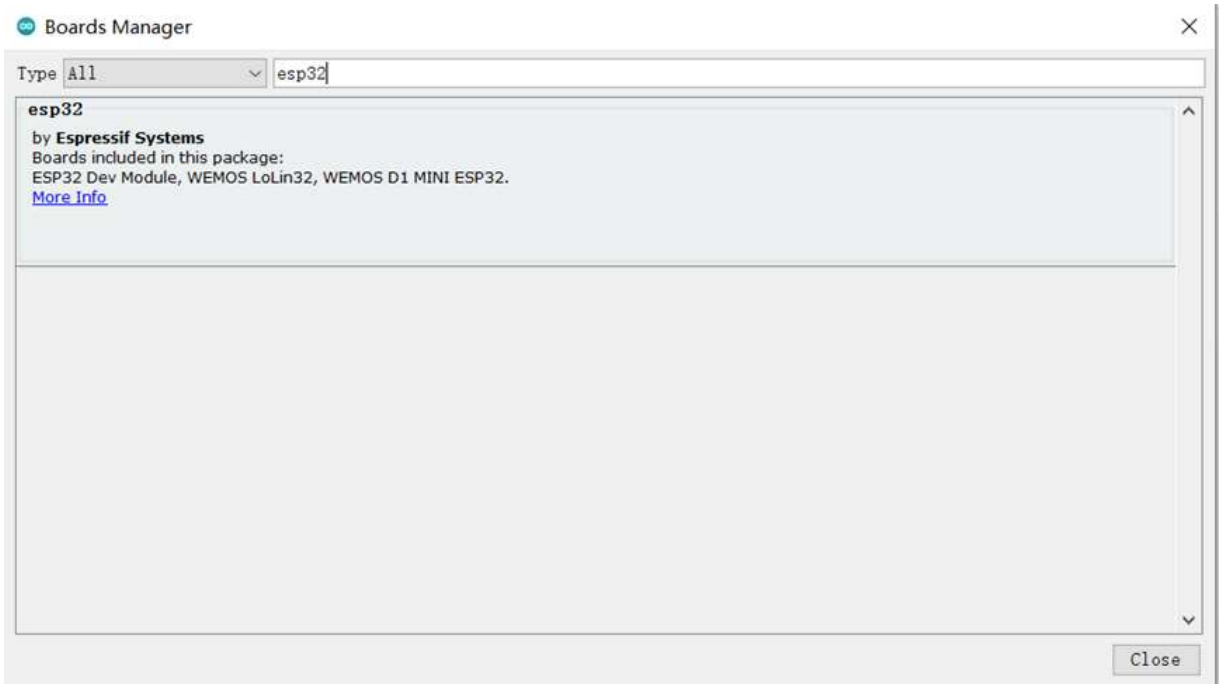
5.1.1 Set up ARDUINO compile environment

- **Download the latest Arduino software (IDE) from the Arduino official website: https://www.arduino.cc/en/Main/Software (https://www.arduino.cc/en/Main/Software)**

Install IDE on PC, open and click **File --> Preference**, add the following URL: https://dl.espressif.com/dl/package_esp32_index.json (https://links.jianshu.com/go?to=https%3A%2F%2Fdl.espressif.com%2Fdl%2Fpackage_esp32_index.json)



- **Go to tools --> Boards --> Boards Manager, find the esp32 information and install it.**

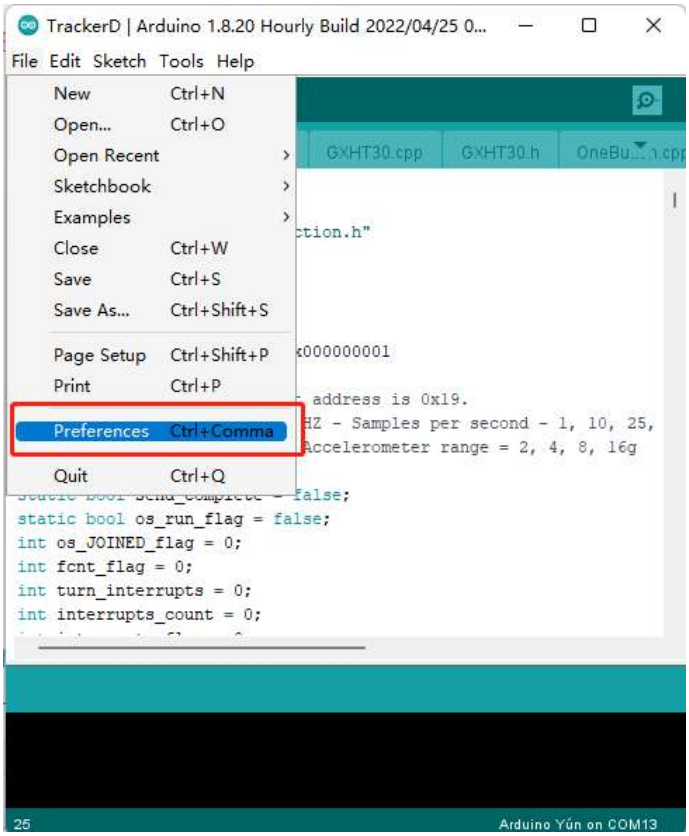


5.1.2 Build the development environment

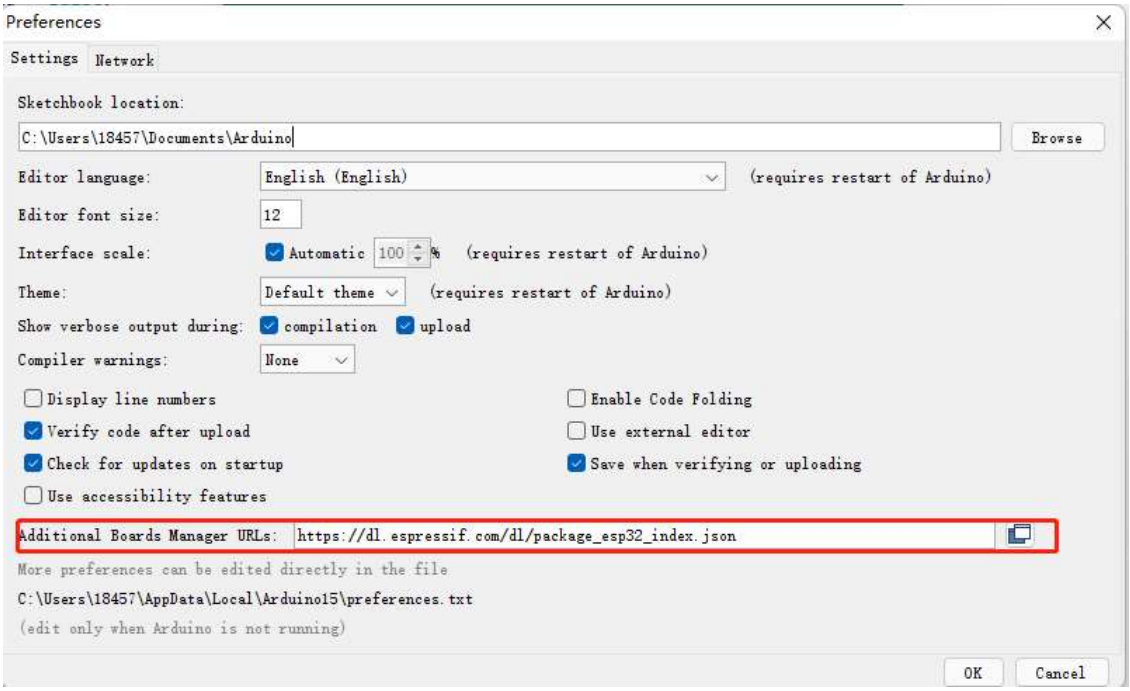
1. Download and install arduino IDE

https://www.arduino.cn/thread-5838-1-1.html (https://links.jianshu.com/go?to=https%3A%2F%2Fwww.arduino.cn%2Fthread-5838-1-1.html)

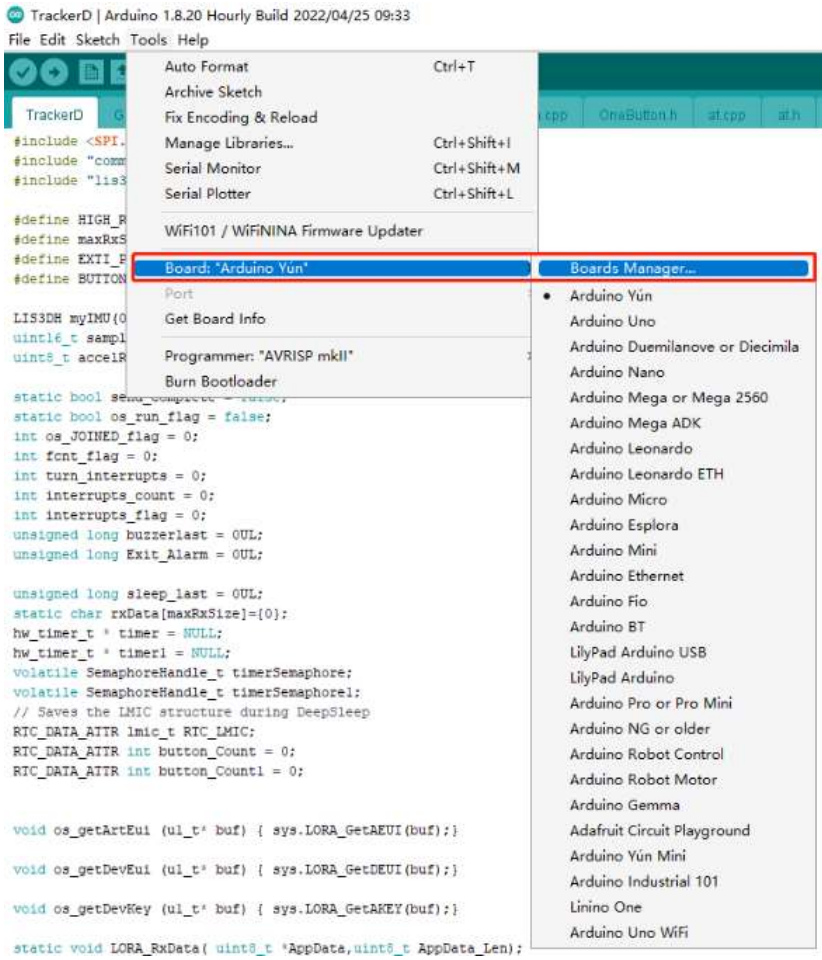
2. Download the ESP32 development package in the arduino IDE



Input: https://dl.espressif.com/dl/package_esp32_index.json (https://dl.espressif.com/dl/package_esp32_index.json)



Restart the IDE after the addition is complete, then:



Note: Currently version 1.04 is almost impossible to download, you can choose version 1.03.
Don't quit halfway.~! If you quit halfway, there is a high probability that it will freeze, and you will need to download again next time. (If you click to continue downloading, an error will be reported after completion)

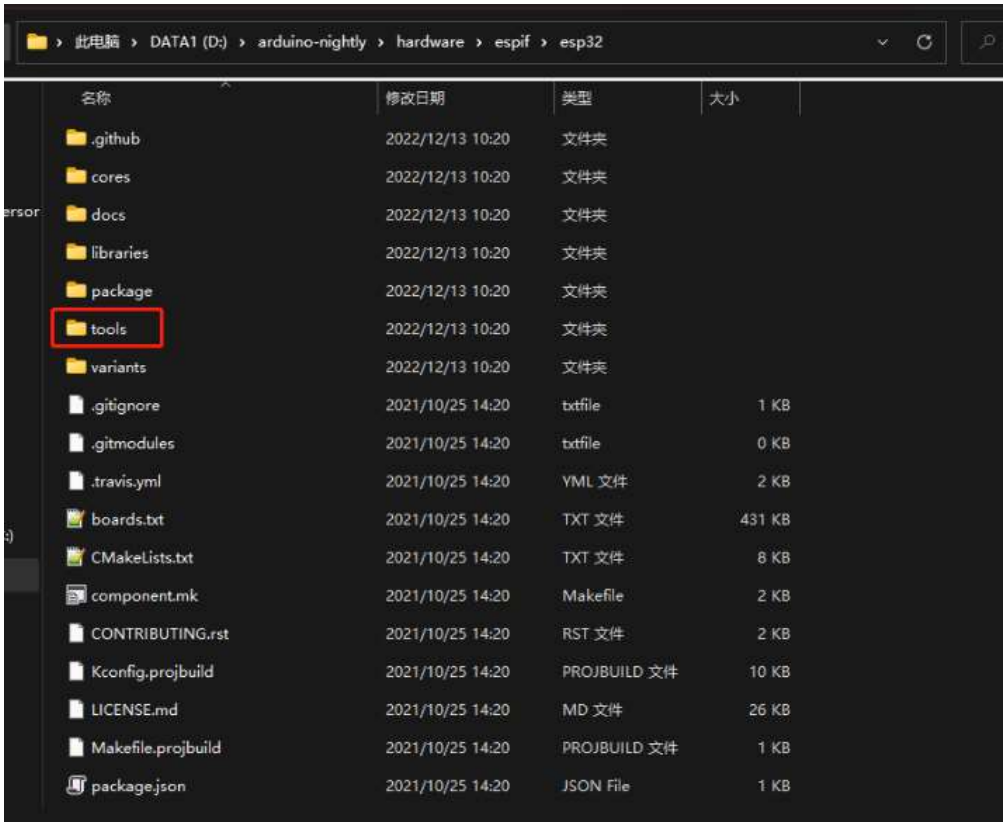
Then enter a long waiting process. If you don't want to wait, you can go to the Internet to download directly, and then import:

Methods as below:

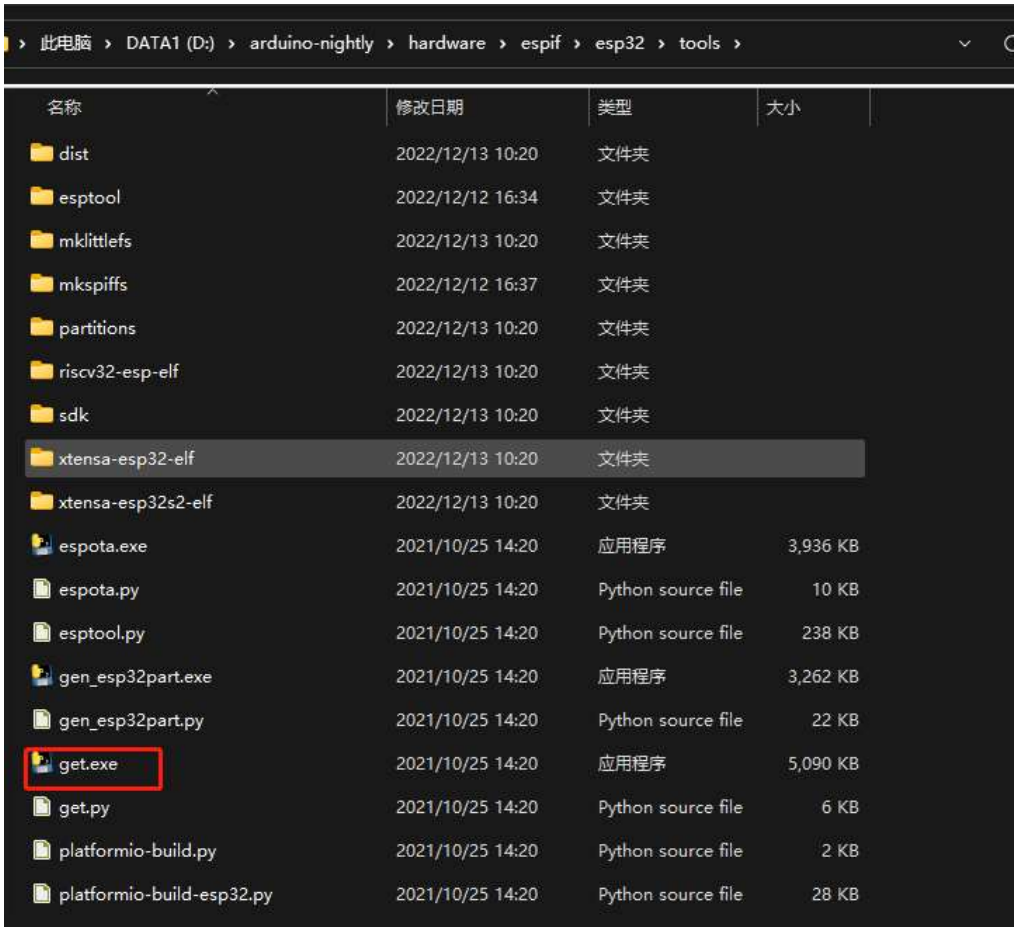
1. Download: https://github.com/dragino/TrackerD/releases/tag/v1.4.4 (https://github.com/dragino/TrackerD/releases/tag/v1.4.4)

2. Find the arduino installation path, hardware → create a new espressif folder → create a new esp32 folder, unzip the compressed package here.

Find the path of SP32 installation, find the file as shown in Figure 1, and change the SPI pin to the shown in Figure 2.



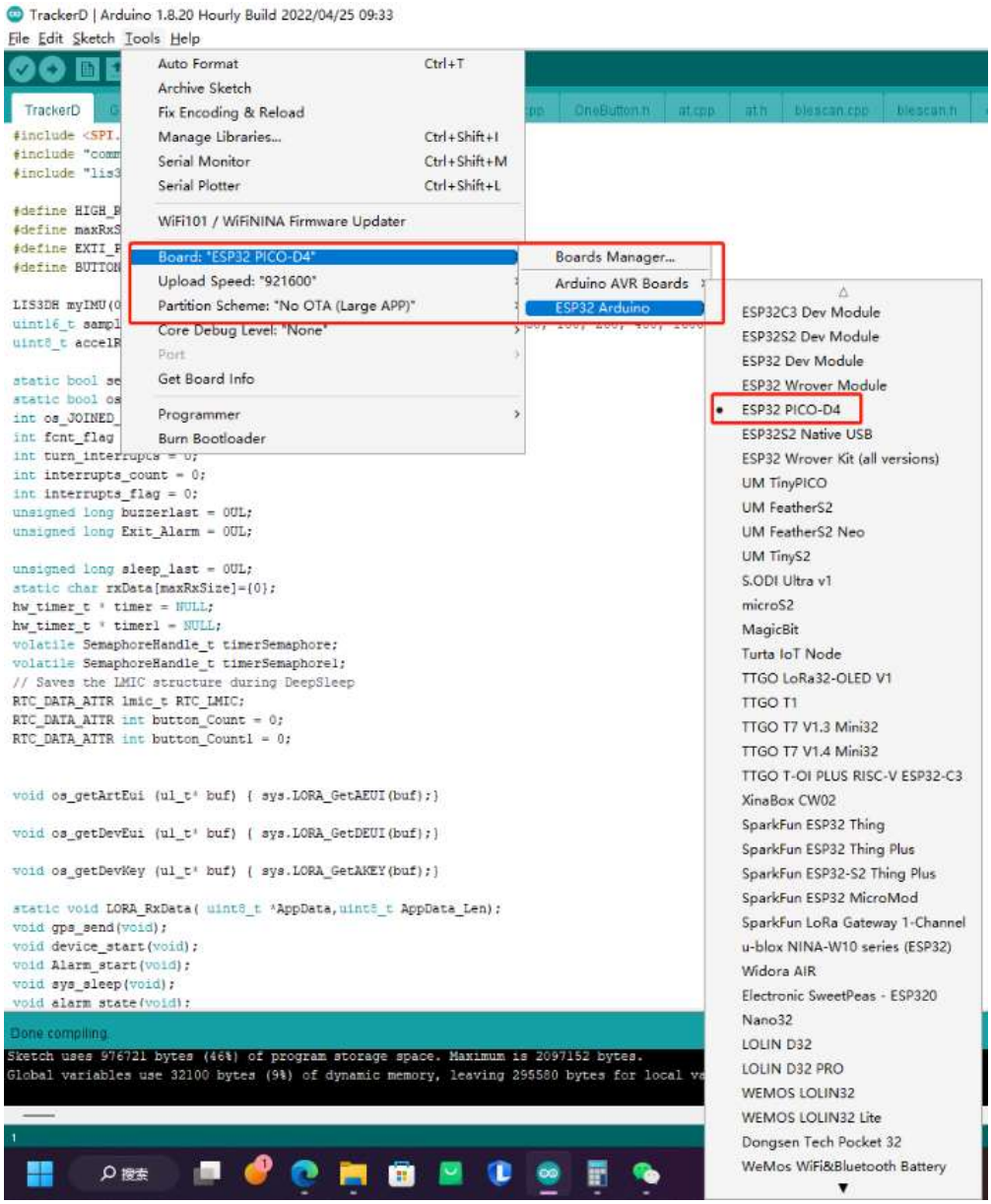
3. Find tools→get.exe in the decompressed file and run it (it will close automatically after completion)



Note: This step requires a python environment

Either way, in the end:

The final effect is to open the arduino and you can see the esp32


TrackerD | Arduino 1.8.20 Hourly Build 2022/04/25 09:33
File Edit Sketch Tools Help
Auto Format Ctrl+T
Archive Sketch
Fix Encoding & Reload
Manage Libraries... Ctrl+Shift+I
Serial Monitor Ctrl+Shift+M
Serial Plotter Ctrl+Shift+L
WiFi101 / WiFiNINA Firmware Updater
Board: "ESP32 PICO-D4"
Upload Speed: "921600"
Partition Scheme: "No OTA (Large APP)"
Core Debug Level: "None"
Port
Get Board Info
Programmer
Burn Bootloader
Boards Manager...
Arduino AVR Boards
ESP32 Arduino
ESP32C3 Dev Module
ESP32S2 Dev Module
ESP32 Dev Module
ESP32 Wrover Module
ESP32 PICO-D4
ESP32S2 Native USB
ESP32 Wrover Kit (all versions)
UM TinyPICO
UM FeatherS2
UM FeatherS2 Neo
UM TinyS2
S.ODI Ultra v1
microS2
MagicBit
Turta IoT Node
TTGO LoRa32-OLED V1
TTGO T1
TTGO T7 V1.3 Mini32
TTGO T7 V1.4 Mini32
TTGO T-OI PLUS RISC-V ESP32-C3
XinaBox CW02
SparkFun ESP32 Thing
SparkFun ESP32 Thing Plus
SparkFun ESP32-S2 Thing Plus
SparkFun ESP32 MicroMod
SparkFun LoRa Gateway 1-Channel
u-blox NINA-W10 series (ESP32)
Widora AIR
Electronic SweetPeas - ESP320
Nano32
LOLIN D32
LOLIN D32 PRO
WEMOS LOLIN32
WEMOS LOLIN32 Lite
Dongsen Tech Pocket 32
WeMos WiFi&Bluetooth Battery
Done compiling.
Sketch uses 976721 bytes (46%) of program storage space. Maximum is 2097152 bytes.
Global variables use 32100 bytes (9%) of dynamic memory, leaving 295580 bytes for local va

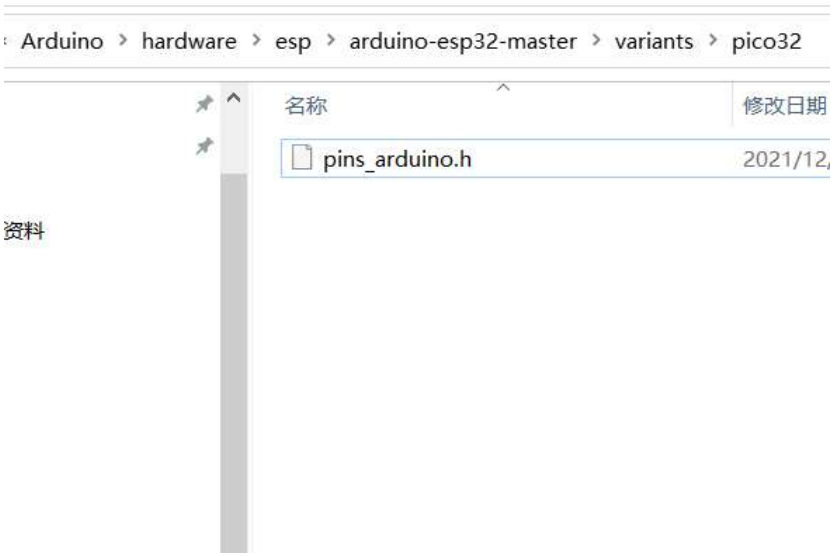

Arduino > hardware > esp > arduino-esp32-master > variants > pico32
名称
修改日期
pins_arduino.h
2021/12
资料

Figure1

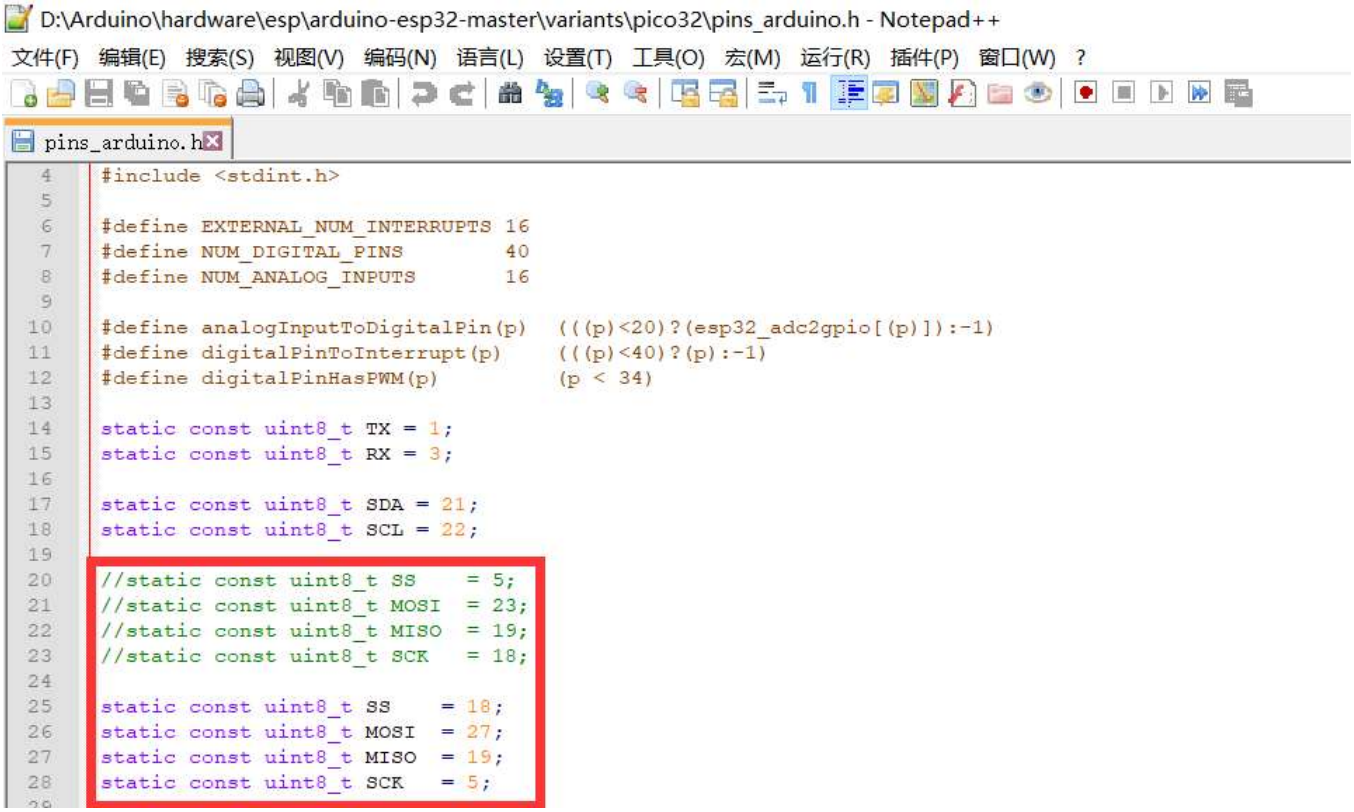
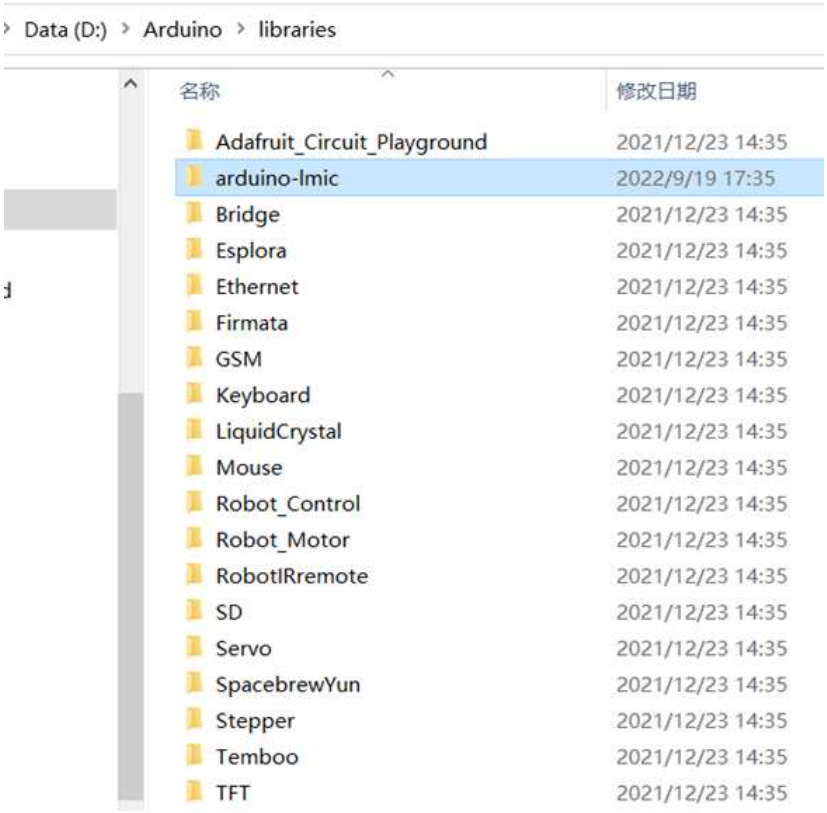


Figure2

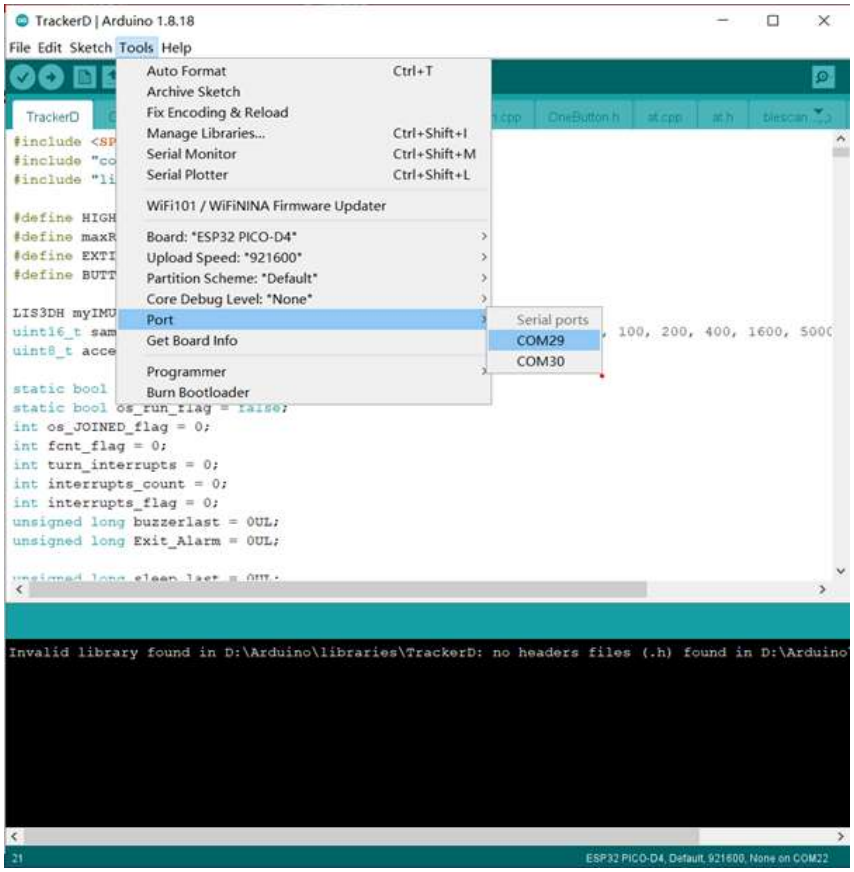
- **Download the latest TrackerD-LS from the dragino github: https://github.com/dragino/TrackerD-LS (https://github.com/dragino/TrackerD)**

Put the Library in the TrackerD-LS directory into the libraries file in the Arduino directory:

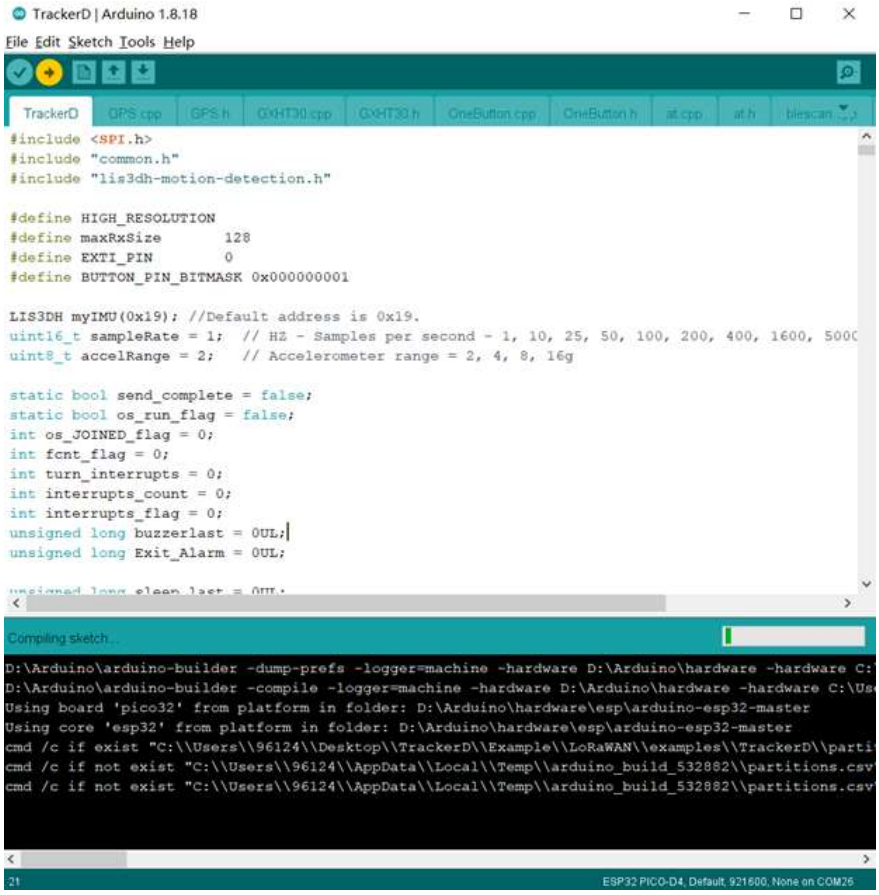


5.2 Source Code

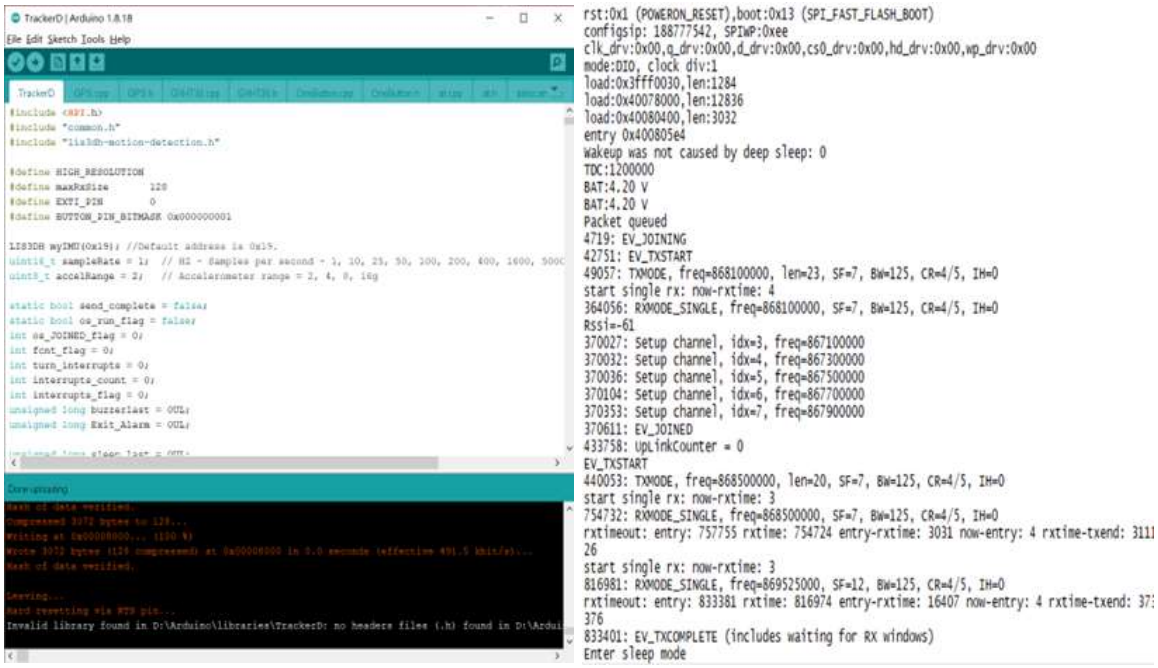
- **Open the example in the TrackerD-LS file, please select the correct port in the IDE, as shown below:**



- **Click to upload**



- **Check the result, if the upload is successful, as shown below, open the serial port to view the data**

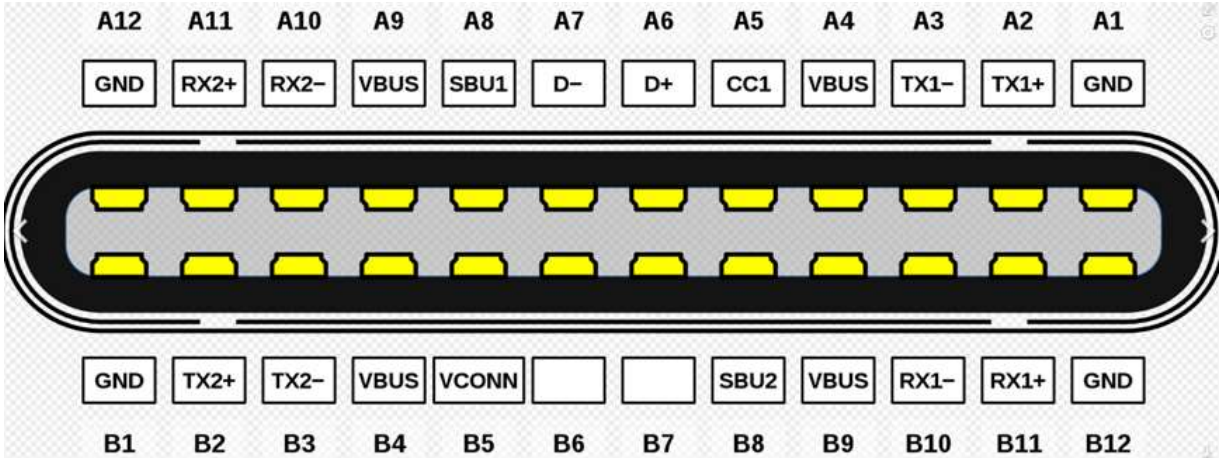


6. FAQ

6.1 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.

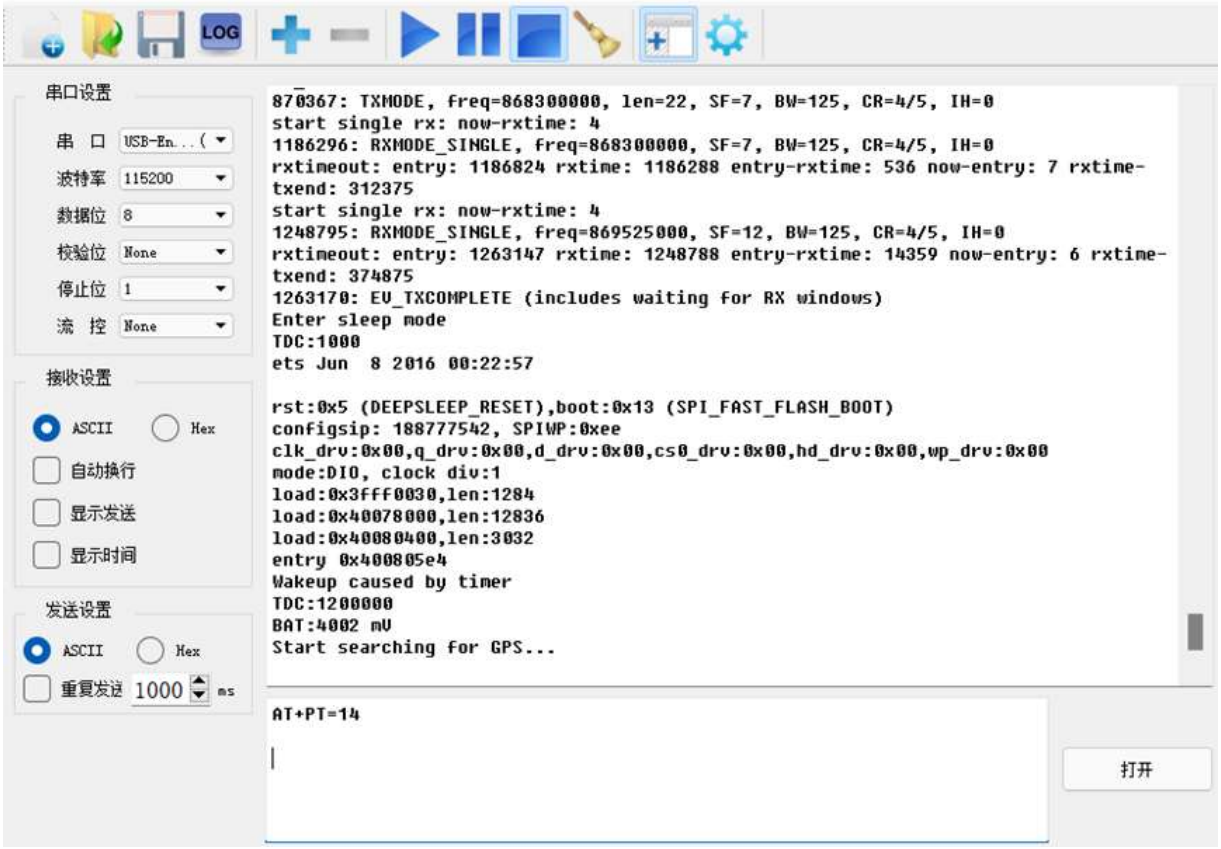
6.2 What is the pin mapping for the USB program cable?



Pin	Color	USB Pin
A4,B4,A9,B9	Red	VCC
A7,B7	White	D- (N/A)
A6,B6	Green	D+(N/A)
A1,B1,A12,B12	Black	GND
A5	Purple	MTDC/GOIO13
B5	Blue	MTDC/GPIO12
A8	Yellow	MTMS/GPIO14
B8	Grey	MTDO/GPIO15

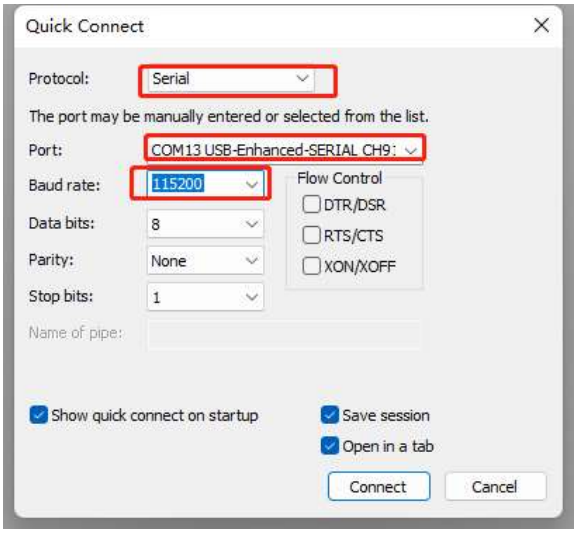
6.3 Notes on using different serial port tools for TrackerD-LS

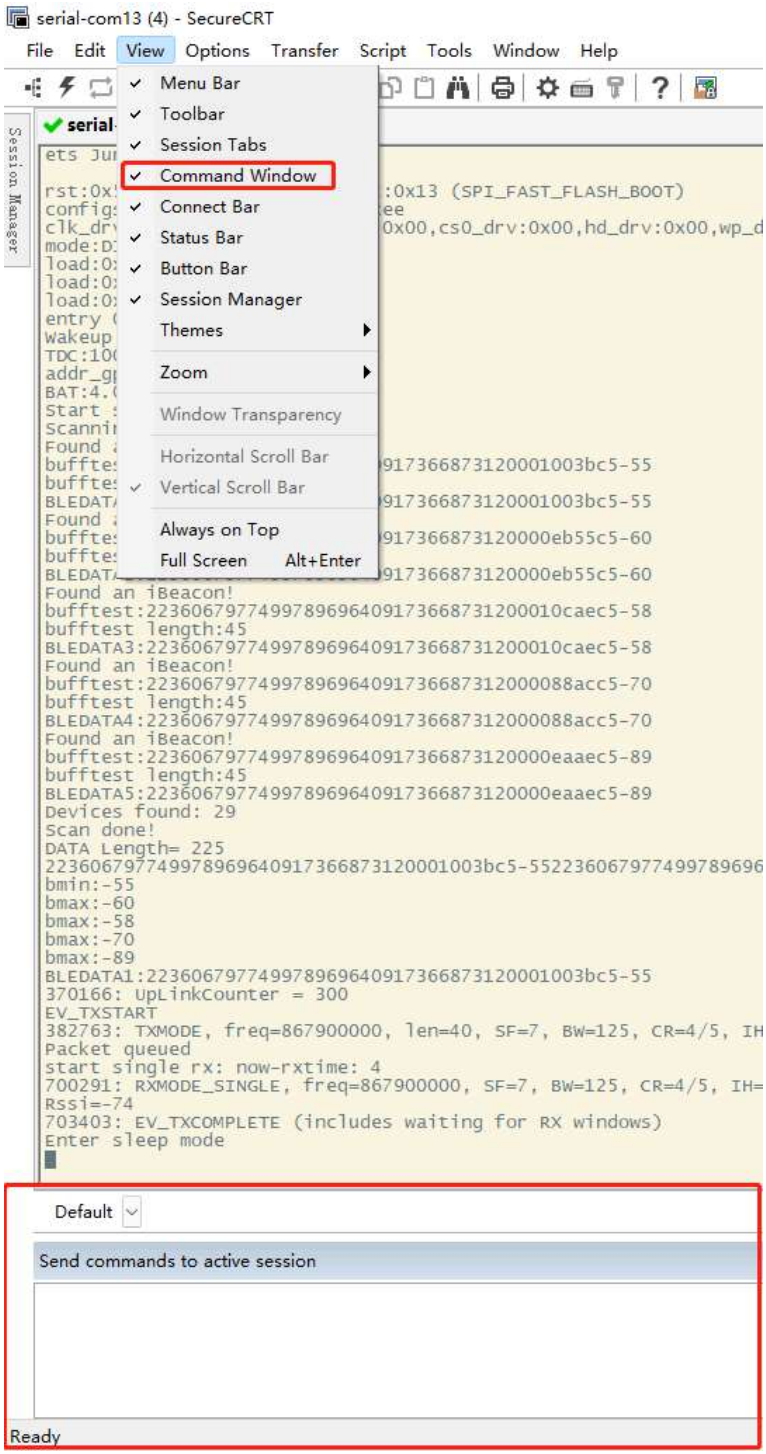
6.3.1 Serial port utility



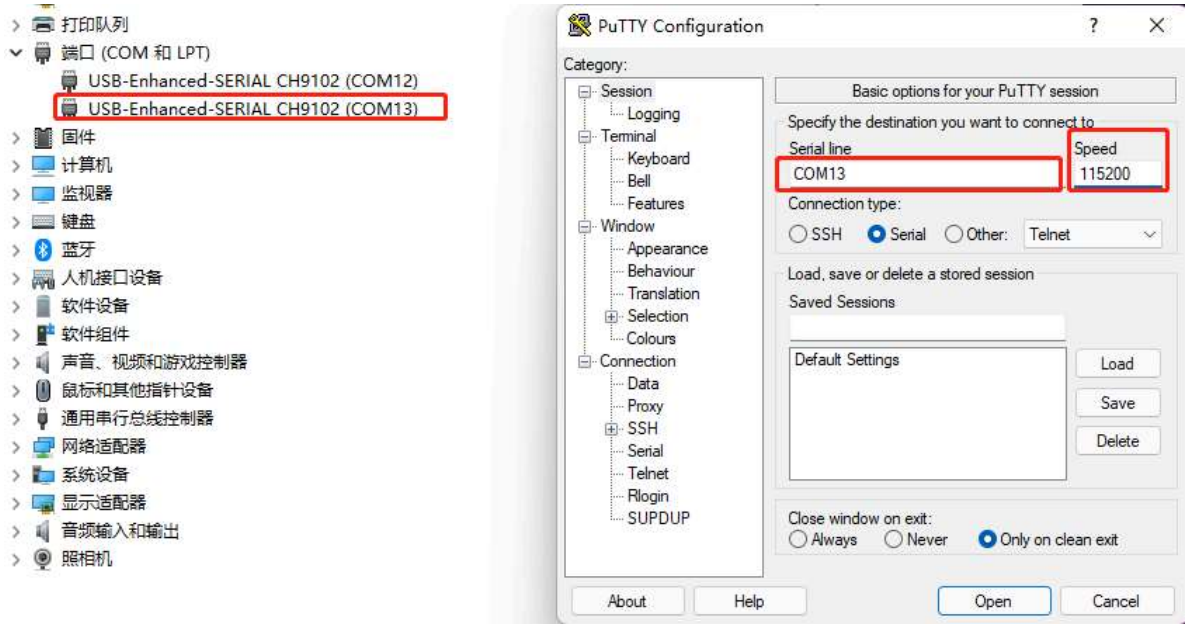
6.3.2 SecureCRT

The default command window of SecureCRT is not displayed. Entering a command requires a complete input of the entire command. You can open the command window in the view.

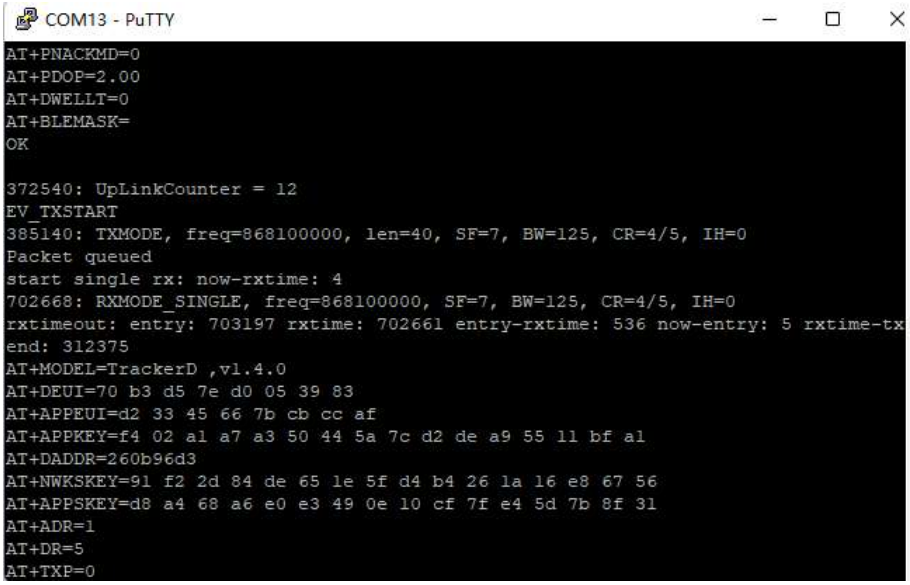



serial-com13 (4) - SecureCRT
File Edit View Options Transfer Script Tools Window Help
Menu Bar
Toolbar
Session Tabs
Command Window
Connect Bar
Status Bar
Button Bar
Session Manager
Themes
Zoom
Window Transparency
Horizontal Scroll Bar
Vertical Scroll Bar
Always on Top
Full Screen Alt+Enter
Found an iBeacon!
bufftest length:45
Found an iBeacon!
bufftest length:45
Found an iBeacon!
bufftest length:45
Devices found: 29
Scan done!
DATA Length= 225
bmin:-55
bmax:-60
bmax:-58
bmax:-70
bmax:-89
370166: UpLinkCounter = 300
EV_TXSTART
Packet queued
start single rx: now-rxtime: 4
Rssi=-74
703403: EV_TXCOMPLETE (includes waiting for RX windows)
Enter sleep mode
Default
Send commands to active session
Ready

6.3.3 PUTTY



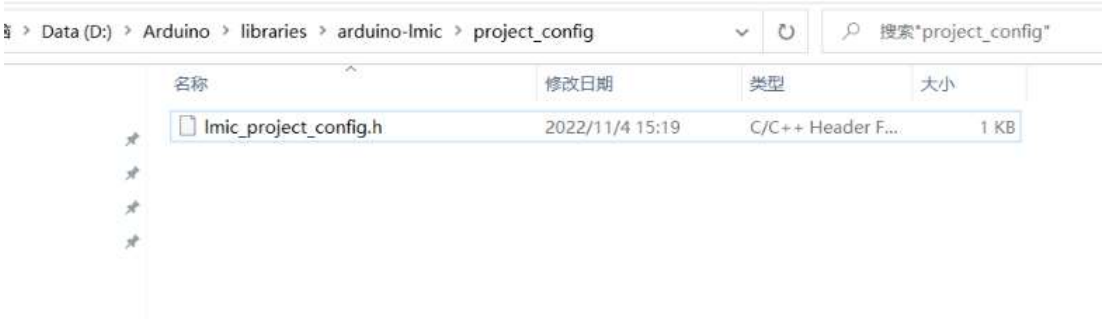
Since putty does not have a command window, you need to fill in the complete command externally, and then copy it to putty.The information copied outside can be pasted by right-clicking the mouse in putty.



6.4 How to modify source code to compile different frequency band bin file?

> **Important**: Developer **MUST** follow the Arduino Environment Instruction exactly include change the SPI pin mappings.
> See : **Set Up Arduino Compile Environment for TrackerD-LS**.

1. When compiling the frequency band, you need to find LMIC_PROJECT_CONFIG.H file.



2. Open LMIC_PROJECT_CONFIG.H, find the corresponding macro definition and open it(AS923_2,AS923_3,AS923_4 except).

lmic_project_config.h

```
// project-specific definitions
#define CFG_eu868 1
//#define CFG_us915 1
//#define CFG_au915 1
//#define CFG_as923 1
// #define LMIC_COUNTRY_CODE LMIC_COUNTRY_CODE_JP      /* for as923-JP; also define CFG_as923 */
//#define CFG_kr920 1
//#define CFG_in866 1
//#define CFG_kz865 1
//#define CFG_ru864 1
//#define CFG_ma869 1
#define CFG_sx1276_radio 1

#define LMIC_DEBUG_LEVEL 2
//#define LMIC_USE_INTERRUPTS

```

3. Compile the AS923_JP band, please refer to the intention shown

lmic_project_config.h lorabase_as923.h

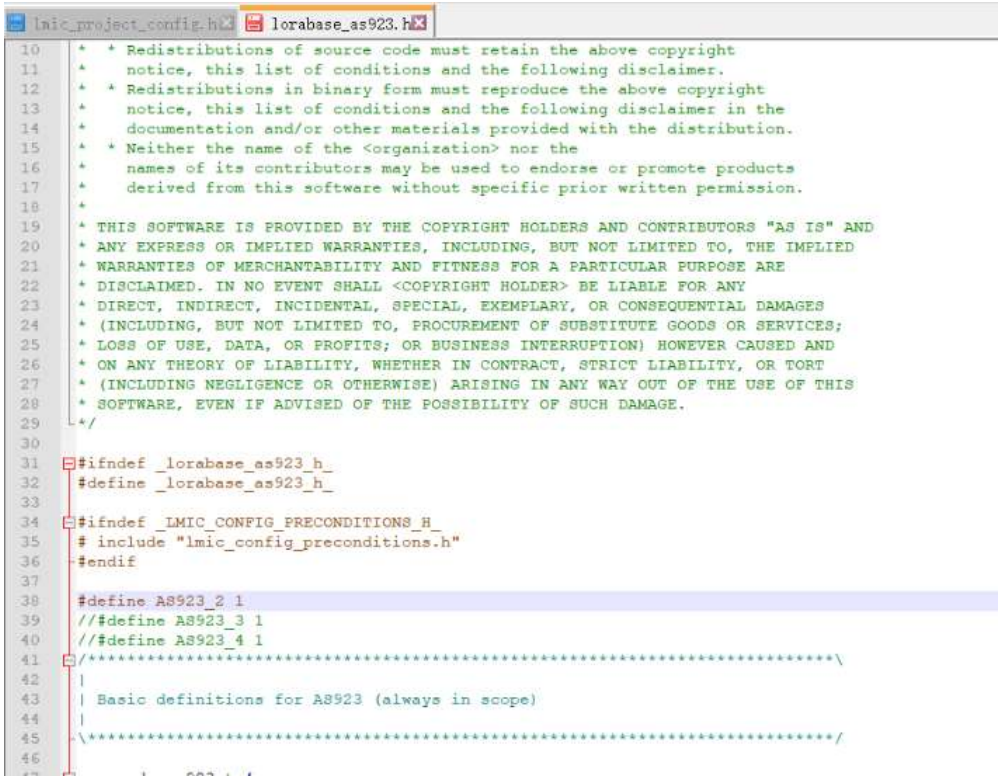
```
// project-specific definitions
//#define CFG_eu868 1
//#define CFG_us915 1
//#define CFG_au915 1
#define CFG_as923 1
#define LMIC_COUNTRY_CODE LMIC_COUNTRY_CODE_JP      /* for as923-JP; also define CFG_as923 */
//#define CFG_kr920 1
//#define CFG_in866 1
//#define CFG_kz865 1
//#define CFG_ru864 1
//#define CFG_ma869 1
#define CFG_sx1276_radio 1

#define LMIC_DEBUG_LEVEL 2
//#define LMIC_USE_INTERRUPTS

```

4. In other frequency bands in AS923, you need to find Lorabase_as923.H, path arduino-lmic \ src \ lmic, as shown in the figure below.

Data (D:) › Arduino › libraries › arduino-lmic › src › lmic

搜索"lmic"

名称	修改日期	类型	大小
lmic_bandplan_kr920.h	2021/10/11 11:38	C/C++ Header F...	4 KB
lmic_bandplan_kz865.h	2022/8/26 17:48	C/C++ Header F...	4 KB
lmic_bandplan_ma869.h	2022/8/29 15:00	C/C++ Header F...	4 KB
lmic_bandplan_ru864.h	2022/8/29 14:18	C/C++ Header F...	4 KB
lmic_bandplan_us915.h	2021/10/11 11:38	C/C++ Header F...	4 KB
lmic_channelshuffle.c	2021/10/11 11:38	C Source File	7 KB
lmic_compat.h	2021/10/11 11:38	C/C++ Header F...	5 KB
lmic_compliance.c	2021/10/11 11:38	C Source File	22 KB
lmic_compliance.h	2021/10/11 11:38	C/C++ Header F...	5 KB
lmic_config_preconditions.h	2022/8/29 15:55	C/C++ Header F...	12 KB
lmic_env.h	2021/10/11 11:38	C/C++ Header F...	8 KB
lmic_eu_like.c	2021/10/11 11:38	C Source File	12 KB
lmic_eu_like.h	2021/10/11 11:38	C/C++ Header F...	5 KB
lmic_eu868.c	2021/10/11 11:38	C Source File	14 KB
lmic_in866.c	2021/10/11 11:38	C Source File	10 KB
lmic_kr920.c	2021/10/11 11:38	C Source File	11 KB
lmic_kz865.c	2022/8/29 14:35	C Source File	10 KB
lmic_ma869.c	2022/8/29 16:14	C Source File	10 KB
lmic_ru864.c	2022/8/29 14:13	C Source File	13 KB
lmic_us_like.c	2021/10/11 11:38	C Source File	15 KB
lmic_us_like.h	2021/10/11 11:38	C/C++ Header F...	6 KB
lmic_us915.c	2021/10/11 11:38	C Source File	10 KB
lmic_util.c	2021/10/11 11:38	C Source File	10 KB
lmic_util.h	2021/10/11 11:38	C/C++ Header F...	1 KB
lorabase.h	2022/8/29 15:46	C/C++ Header F...	28 KB
lorabase_as923.h	2022/8/31 10:30	C/C++ Header F...	6 KB
lorabase_au915.h	2022/9/2 11:20	C/C++ Header F...	4 KB
lorabase_eu868.h	2021/10/11 11:38	C/C++ Header F...	4 KB



6.5 Are there example python example for BLE Indoor Positioning?

Operating instructions for BLE indoor positioning (/xwiki/bin/view/Main/User%20Manual%20for%20LoRaWAN%20End%20Nodes/TrackerD/Example%20of%20BLE%20indoor%20positioning%20python/)

6.6 Can alert mode and transport mode be used together?

Yes, you can also press the panic button to sound the alarm if set to transport mode

7 Trouble Shooting

7.1 TDC is changed to 4294947296 and cause no uplink.

Before firmware v1.4.0: When the Transport Mode is enabled (**AT+INTWK=1**), the **TDC** needs to be greater than **MTDC**, otherwise, TDC setting will because 4294947296 after wakre up from motion. This bug is fixed in firmware v1.4.1

7.2 Device not able get AT Command or show output after wake up from deep sleep mode

ESP32 is not able to accept the Interrupt from UART after wake up from deep sleep mode. User need to press the button (one click) and TrackerD-LS will be able to accept UART command, it there is no action in UART for 15 seconds. it will go to deep sleep mode.

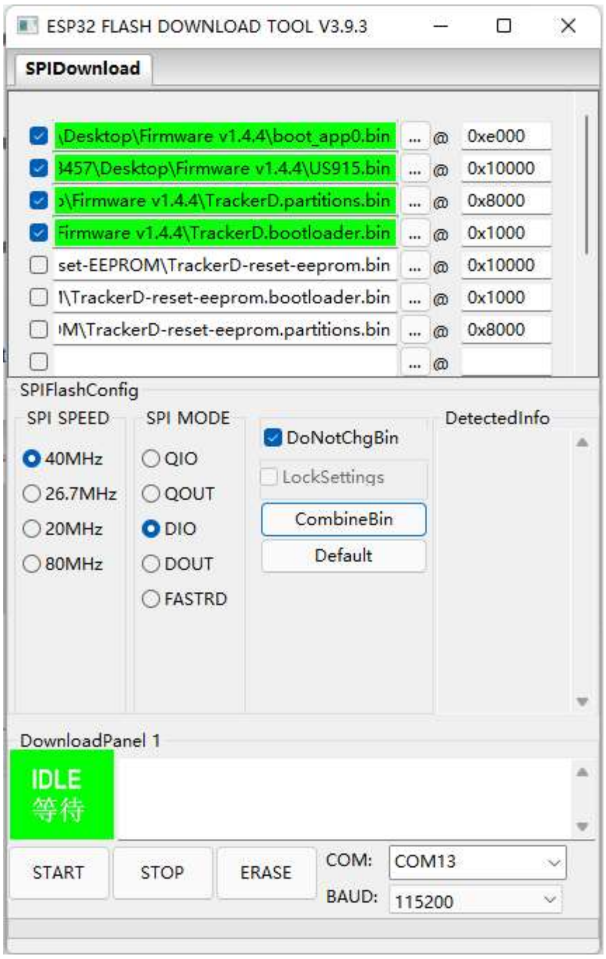
7.3 Problem after Upgrading Firmware

7.3.1 "rst: (0x3 SW_RESET)" and Continue Restart after upgrading

Error Output

```
mode:DIO, clock div:1
load:0x3fff0030,len:1284
load:0x40078000,len:12836
load:0x40080400,len:3032
entry 0x400805e4
ets Jun  8 2016 00:22:57

rst:0x3 (SW_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 188777542, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3fff0030,len:1284
load:0x40078000,len:12836
load:0x40080400,len:3032
entry 0x400805e4
ets Jun  8 2016 00:22:57

rst:0x3 (SW_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 188777542, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3fff0030,len:1284
load:0x40078000,len:12836
load:0x40080400,len:3032
entry 0x400805e4
ets Jun  8 2016 00:22:57

rst:0x3 (SW_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
configsip: 188777542, SPIWP:0xee
clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:0x00,wp_drv:0x00
mode:DIO, clock div:1
load:0x3fff0030,len:1284
load:0x40078000,len:12836
load:0x40080400,len:3032
entry 0x400805e4
```

Some partition is missed during upgrade, please upgrade below four files as example:



7.3.2 TrackerD-LS's led light is always GREEN on after upgrading

It is because the partitions are different when upgrading versions above 1.4.1, and a new partition file needs to be added. Please refer to the operation steps in chapter 7.3.1

7.3.3 "flash read err" after upgrade firmware

Error shows below, user might erase the entire flash include u-boot partition which cause this issue.

User need to upgrade again with below four files to solve this issue.

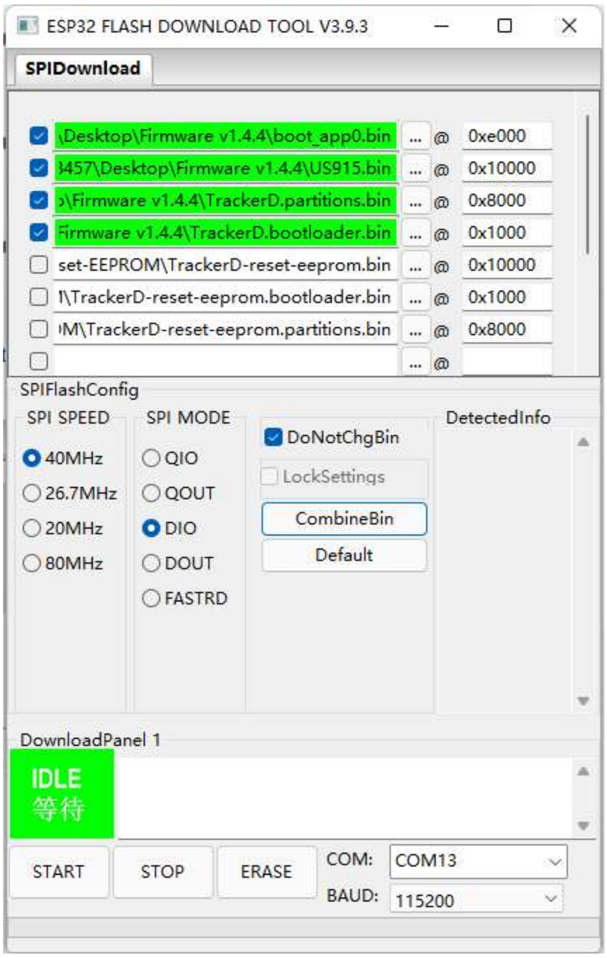


Figure 2

7.3.4 "Device Key become ff ff ff ff ff ff ff ff " after upgrade firmware

User might erase the entire flash include keys and default settings which cause this issue.

After the upgrade is completed, enter **AT+CFG** as shown in the figure below.

```
100750: TxMode, Freq=903700000, len=23, SF=10, BW=125, CR=4/5, IH=0
AT+MODEL=TrackerD ,v1.4.2
AT+DEUI=FF FF FF FF FF FF FF FF
AT+APPEUI=FF FF FF FF FF FF FF FF
AT+APPKEY=FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
AT+DADDR=FFFFFFFF
AT+NWKSKEY=FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
AT+APPSKEY=FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
AT+ADR=0
AT+DR=255
AT+TXP=255
AT+SMOD=255,255,255
AT+TDC=4294967295
AT+MTDC=4294967295
AT+ATDC=4294967295
AT+FTIME=4294967295
AT+INTWK=255
AT+LON=255
AT+CHE=255
AT+NMEA353=255
AT+NMEA886=255
AT+CFM=255
AT+PNACKMD=255
AT+PDOP=255.00
AT+DWELLT=255
AT+SHOWID=0
AT+BLEMASK=
AT+wifiMASK=

OK
```

Please **AT+FDR** which will reset all settings to factory settings. , and then input the following keys by the information on the label.

After AT+FDR. please set

- **AT+PDOP=7**
- **AT+FTIME=180000**

Example:

AT+PDOP=7.00

AT+FTIME=180

AT+DEUI=70B3D57ED0053981

AT+APPEUI=D23345667BCBCCAF

AT+APPKEY=F402A1A7A350445A7CD2DEA95511BFA1

AT+DADDR=260b4dce (no need for OTAA)

AT+NWKSKEY=71cb7672441f573a53d4f34d307fc61d (no need for OTAA)

AT+APPSKEY=dacce2299ecd97a73ee3f80b5a46a559 (no need for OTAA)

7.4 When positioning, it will restart or the PDOP setting is unsuccessful

Please download version 1.4.2 again

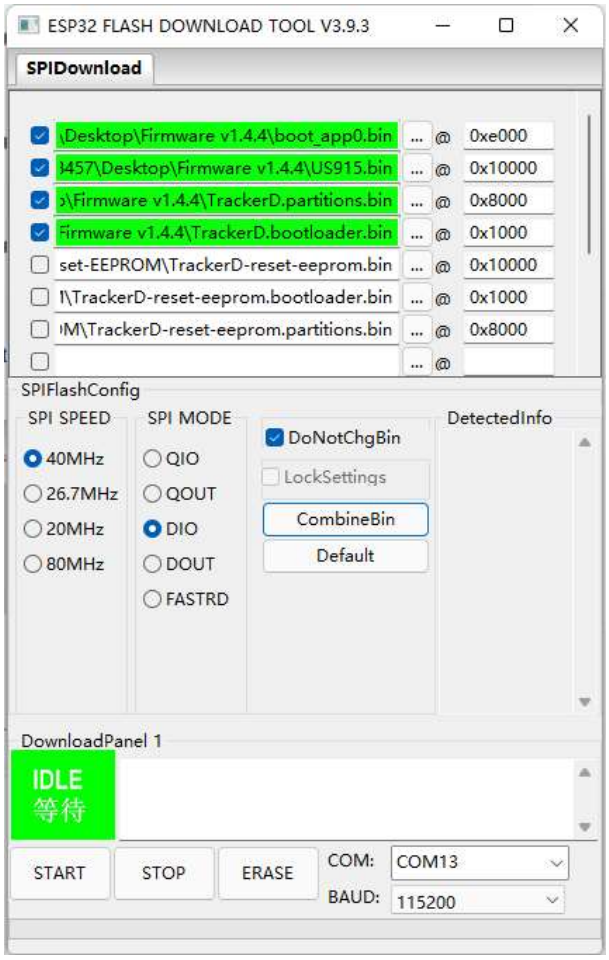
7.5 How to deal with unsuccessful GPS positioning?

1) Make Sure the device is in Open Area where can see the sky.
2) Set PDOP to a higher value.
   - **AT+PDOP=2** (can be positioned precisely.)
   - **AT+PDOP=7** (Quickly locate in open spaces)
   - **AT+PDOP=14.7** (Positioning can be acquired in complex environments)

Please refer to this link on how to set up PDOP

7.6 When upgrading the firmware, the data is not completely erased, and the information does not return to normal after multiple resets

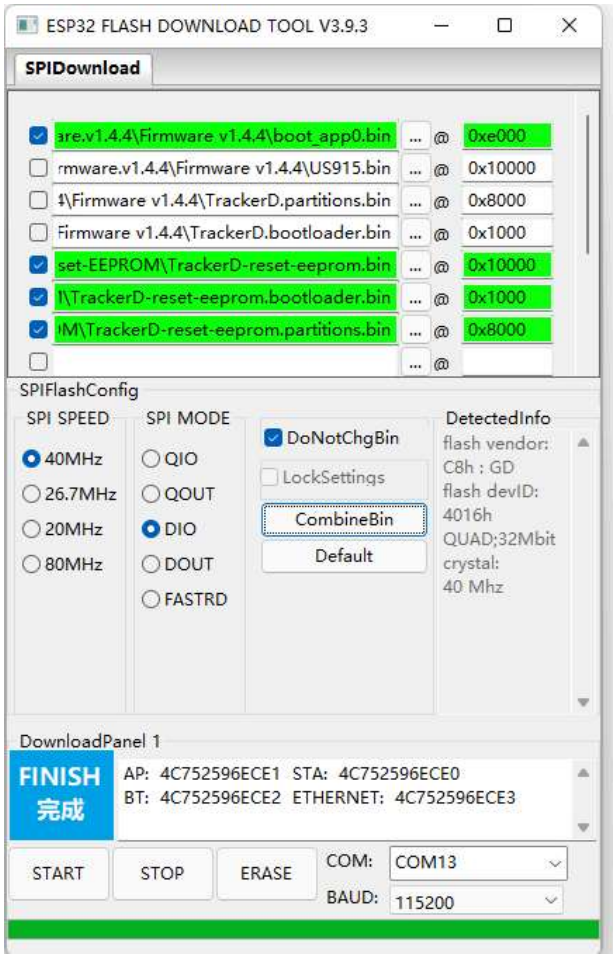
When upgrading, use the erase button to upgrade



The parameters are displayed abnormally and cannot be fixed using AT+FDR

```
[17:10:39.865] AT+CFG

[17:10:39.874] AT+MODEL=TrackerD ,v1.4.3
[17:10:39.877] AT+DEUI=ff ff ff ff ff ff ff aa
[17:10:39.877] AT+APPEUI=ff ff ff ff ff ff ff aa
[17:10:39.887] AT+APPKEY=ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff aa
[17:10:39.887] AT+DADDR=260b5151
[17:10:39.887] AT+NWKSKEY=a9 b5 f6 84 d4 26 7a b0 6e a3 b7 26 31 7f 3d 4f
[17:10:39.896] AT+APPSKEY=fd a0 3d c0 69 c3 60 de 12 fb 30 5f 90 e9 b4 8f
[17:10:39.906] AT+ADR=0
[17:10:39.906] AT+DR=255
[17:10:39.906] AT+TXP=255
[17:10:39.906] AT+SMOD=1,0,0
[17:10:39.906] AT+TDC=60
[17:10:39.906] AT+MTDC=4294967295
[17:10:39.906] AT+ATDC=4294967295
[17:10:39.917] AT+FTIME=180000
[17:10:39.917] AT+INTWK=255
[17:10:39.917] AT+LON=255
[17:10:39.917] AT+CHE=255
[17:10:39.917] AT+NMEA353=255
[17:10:39.917] AT+NMEA886=255
[17:10:39.917] AT+CFM=255
[17:10:39.917] AT+PNACKMD=255
[17:10:39.920] AT+PDOP=7.00
[17:10:39.926] AT+DWELLT=255
[17:10:39.926] AT+SHOWID=0
[17:10:39.926] AT+BLWMASK=
```

Please upgrade these four files,link (The boot_app0 file is in the version folder you need)



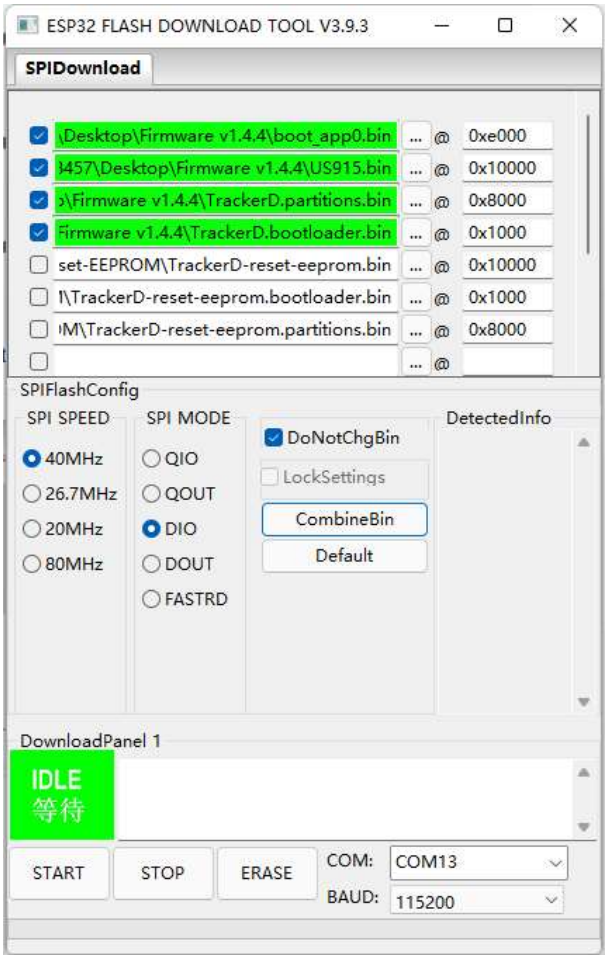
Reboot information after upgrade

```
[11:00:27.377] ets Jun  8 2016 00:22:57
[11:00:27.380]
[11:00:27.380] rst:0xc (SW_CPU_RESET),boot:0x13 (SPI_FAST_FLASH_BOOT)
[11:00:27.390] configsip: 188777542, SPIWP:0xee
[11:00:27.390] clk_drv:0x00,q_drv:0x00,d_drv:0x00,cs0_drv:0x00,hd_drv:
0x00,wp_drv:0x00
[11:00:27.390] mode:DIO, clock div:1
[11:00:27.401] load:0x3fff0030,len:1284
[11:00:27.401] load:0x40078000,len:12836
[11:00:27.401] load:0x40080400,len:3032
[11:00:27.401] entry 0x400805e4
[11:00:27.562] Wakeup was not caused by deep sleep: 0
[11:00:27.589] sys.alarm:0
[11:00:27.591] gps_start:1
[11:00:27.591] gps_count:0
[11:00:27.591] TDC:1200000
[11:00:27.591] addr_gps_write:0
[11:00:27.591] BAT:4.00 V
[11:00:27.591] BAT:4.00 V
[11:00:27.591] Packet queued
[11:00:27.591] 3619: EV_JOINING
[11:00:31.254] 233218: UpLinkCounter = 0
[11:00:31.360] TX on freq: 868.5MHz  LMIC.datarate: 5  LMIC.txpow: 14
[11:00:31.371] Received nack
[11:00:31.371] EV_TXSTART
[11:00:31.371] 239568: TXMODE, freq=868500000, len=23, SF=7, BW=125,
```

Use **AT+FDR** command to reset and then use **AT+CFG** to check whether the configuration is back to normal

```
CR=4/5, IH=0
[11:00:33.060] AT+CFG

[11:00:33.070] AT+MODEL=LGT92 ,v1.0.0
[11:00:33.071] AT+MOD=0
[11:00:33.071] AT+SMOD=1
[11:00:33.071] AT+DEUI=ff ff ff ff ff ff ff ff
[11:00:33.081] AT+APPEUI=ff ff ff ff ff ff ff ff
[11:00:33.081] AT+APPKEY=ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
[11:00:33.092] AT+DADDR=2608b913
[11:00:33.092] AT+NWKSKEY=ea 59 a8 59 d2 fa 15 68 44 da 2e 7d 06 42 e2 1d
[11:00:33.101] AT+APPSKEY=c8 22 d2 b8 19 11 a4 22 80 8a 85 2a d8 15 62 1f
[11:00:33.102] AT+ADR=1
[11:00:33.102] AT+DR=0
[11:00:33.102] AT+TXP=0
[11:00:33.102] AT+TDC=1200000
[11:00:33.102] AT+FTIME=180000
[11:00:33.102] AT+LON=1
[11:00:33.102] AT+CHE=0
[11:00:33.102] AT+FRAME=0
[11:00:33.102]
[11:00:33.102] OK
[11:00:33.102]
[11:00:36.420] start single rx: now-rxtime: 4
[11:00:36.422] 555819: RXMODE_SINGLE, freq=868500000, SF=7, BW=125,
```

After the parameters return to normal, upgrade to the version you need again



At this point, the parameters return to normal after running AT+FDR again

```
[11:02:58.155] AT+CFG

[11:02:58.165] AT+MODEL=TrackerD ,v1.4.3
[11:02:58.166] AT+DEUI=ff ff ff ff ff ff ff ff
[11:02:58.166] AT+APPEUI=ff ff ff ff ff ff ff ff
[11:02:58.176] AT+APPKEY=ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
[11:02:58.176] AT+DADDR=2608baec
[11:02:58.176] AT+NWKSKEY=fa 71 c6 da 68 76 6a 68 09 1d 24 50 4e af 29 a9
[11:02:58.186] AT+APPSKEY=28 6e 1e 76 2e 96 d6 5d d7 84 87 e7 5e e8 2d 9a
[11:02:58.196] AT+ADR=1
[11:02:58.196] AT+DR=5
[11:02:58.196] AT+TXP=1
[11:02:58.196] AT+SMOD=1,0,0
[11:02:58.196] AT+TDC=1200000
[11:02:58.196] AT+MTDC=1280
[11:02:58.196] AT+ATDC=131073
[11:02:58.206] AT+FTIME=180000
[11:02:58.206] AT+INTWK=0
[11:02:58.206] AT+LON=32
[11:02:58.206] AT+CHE=0
[11:02:58.206] AT+NMEA353=0
[11:02:58.206] AT+NMEA886=0
[11:02:58.206] AT+CFM=0
[11:02:58.206] AT+PNACKMD=0
[11:02:58.206] AT+PDOP=7.00
[11:02:58.206] AT+DWELLT=0
[11:02:58.217] AT+SHOWID=0
```

7.7 If you encounter the following problems, please upgrade to the latest version

1. Press and hold the red button (more than 5 seconds), and the device and server do not respond.

2. Send some commands through the serial port to prompt an error (Example: AT+SMOD=1,0,1)

7.8 Why when using some serial consoles, only inputting the first string port console will return "error"?

Need to enter the entire command at once, not a single character.
User can open a command window or copy the entire command to the serial console.

8. Order Info

Part Number: **TrackerD-LS-XXX**

XXX: The default frequency band

- **EU433**: Default frequency band EU433
- **EU868**: Default frequency band EU868
- **IN865**: Default frequency band IN865
- **KR920**: Default frequency band KR920
- **AS923**: Default frequency band AS923
- **AU915**: Default frequency band AU915
- **US915**: Default frequency band US915

9. Packing Info

Package Includes:

- TrackerD-LS LoRaWAN Asset Tracker x 1
- Solar charging & program cable x 1

Dimensions and Weight:

- Device Size: mm
- Weight: g

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 (file:///D:/市场资料/说明书/LoRa/LT系列/support@dragino.com) .

11. Reference

- **Firmware in Bin format** (https://www.dropbox.com/sh/9oi0fvpfs7z25qb/AACqAy9Y_x_JLkmEWJ28CdTxa?dl=0)
- **Source Code (https://github.com/dragino/TrackerD-LS)**
- **Hardware Source** (https://www.dropbox.com/sh/8cunfpcrxumxb6i/AABs-WIm670VtZDViZXx7V0pa?dl=0)

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