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1. Introduction

1.1 What is LoRaWAN Temperature Transmitter

The Dragino LTC2-SI2 Industrial LoRaWAN Temperature Transmitter is designed to monitor temperature for different environment. It supports to read **PT100 probe** and convert the value to temperature and uplink to IoT server via LoRaWAN protocol.

LTC2-SI2 supports **Datalog feature**. User can retrieve the sensor value via LoRaWAN downlink command.

LTC2-SI2 is powered by **8500mA Li-SOCI2 battery** for long time measurement. The battery can run 2~10 years depends on the network environment and working mode.

Each Transmitter has **two internal 24-bit ADC interfaces** and are calibrated on 12 set resistors to make sure the accuracy measurement on wide range.

LTC2-SI2 is LoRaWAN v1.0.3 compatible. Each LTC2-SI2 is pre-load with a set of unique keys for LoRaWAN registration, register these keys to local LoRaWAN server and it will auto connect after power on.

1.2 Features

- LoRaWAN v1.0.3 Class A
- max: 2 x monitor temperature channels
- Support 3 -wire PT-100
- 8500mAh Li-SOCI2 Battery
- Firmware upgrade via console
- Wall Mountable
- Configurable via LoRa or UART
- Datalog and retrieve via LoRaWAN
- Use pre-load PT100 probe or 3rd PT100 probe
- Factory calibration for different resistance range
- Support accuracy measure of resistance and upload
- Battery Monitoring and upload

1.3 Applications

- Logistics and Supply Chain Management
- Food management
- Cold chains solution
- Industrial Monitoring and Control

1.4 Hardware Change log

LTC2-SI2 v1.0: Release.

1.5 Pin Definitions and Switch

1.5.1 Jumper JP2 (Power ON)

Put a jumper on JP2 will power on the LTC2-SI2.

1.5.2 LED

The LED will flash in below case.

1. Send an uplink packet

1.5.3 PT100 Interfaces

There are two independent channels to connect 2 x PT100 probes.

Each channel has 3-wire connection for 3-wire PT100 probes.

1.5.4 Reset Button

Press this button will reboot the LTC2-SI2

1.6 Probe Variant

LTC2-SI2 provide default probe version. See below for the variant:

Model	Photo	Description
LTC2-SI2		Standard IP68 Probe Version • LTC2-SI2 with 2 x Standard IP68 PT100 probe. • Installation: Insert • Cable Length : 2m • PT100 Class : Class A • Probe Dimension: 4*30mm • Measure Range: -50 ~ 200 °C • Suitable Environment: General environment
LTC2-LT		Low Temperature Version • LTC2-LT with 1 x Low Temperature PT100 probe. • Installation: Insert • Cable Length : 2m • PT100 Class : Class A • Probe Dimension: 4*30mm • Measure Range: -196 ~ 150 °C • Suitable Environment: Low temperature measurement, such as COVID vaccine transport
LTC2-FT		Flat Type Version • LTC2-FT with 1 x Flat Type PT100 probe. • Installation: Attached • Cable Length : 2m • PT100 Class : Class A • Probe Dimension: 8*25mm • Measure Range: -50 ~ 200 °C • Suitable Environment: Attached to the measure point.
LTC2-HT		High Temperature Version • LTC2-HT with 1 x high temperature PT100 probe. • Installation: Insert • Cable Length : 3m • PT100 Class : Class A • Probe Dimension: 4*30mm • Measure Range: -70 ~ 550 °C Suitable Environment: High Temperature

LTC2-FSA

Food Safety Version

LTC2-FSA with 1 x Food Safety PT100 probe. Installation:

Insert Cable Length：2m

PT100 Class：Class A

Probe Dimension: 4*150mm

Measure Range: -50 ~ 200 ℃

Suitable Environment: Food temperature measurement

LTC2-SI

Standard IP68 Probe Version

- LTC2-SI with 1 x Standard IP68 PT100 probe.
- Installation: Insert
- Cable Length : 2m
- PT100 Class : Class A
- Probe Dimension: 4*30mm
- Measure Range: -50 ~ 200 ℃
- Suitable Environment: General environment

LTC2-NA

- No Probe version:
  - • User can connect to their own PT100 Probe
  - • Grand Hole: M12
  - • Suitable Environment:
  - Connect to customized probe

2. How to use LoRaWAN Temperature Transmitter?

2.1 Connect to PT100 sensors

LoRaWAN Temperature Transmitter has different probe option provided for ordering, if user has LoRaWAN Temperature Transmitter with probe, just skip this step. If user want to connect to a 3rd party PT100 probe, please see CONNECT A 3rd PARTY PT100 probe.

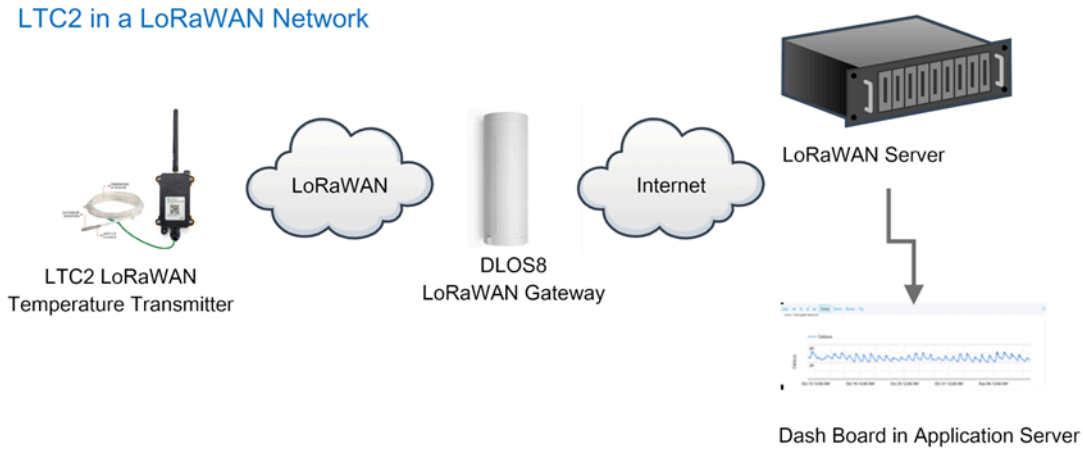
2.2 How it works?

The LoRaWAN Temperature Transmitter is working in LoRaWAN OTAA Class A mode. Each LoRaWAN Temperature Transmitter is shipped with a worldwide unique set of OTAA and ABP keys. User needs to input the OTAA or ABP keys in the LoRaWAN network server so to register. LoRaWAN Temperature Transmitter will join the LoRaWAN network and start to transmit data. The default period for each uplink is **20 minutes**.

On each uplink, LoRaWAN Temperature Transmitter will check its two ADC Interfaces and get the temperature from the sensor and send out to server.

2.3 Quick guide to connect to LoRaWAN server (OTAA)

Here is an example for how to join the TTN v3 LoRaWAN Server. Below is the network structure, in this demo we use DLOS8 as LoRaWAN gateway.

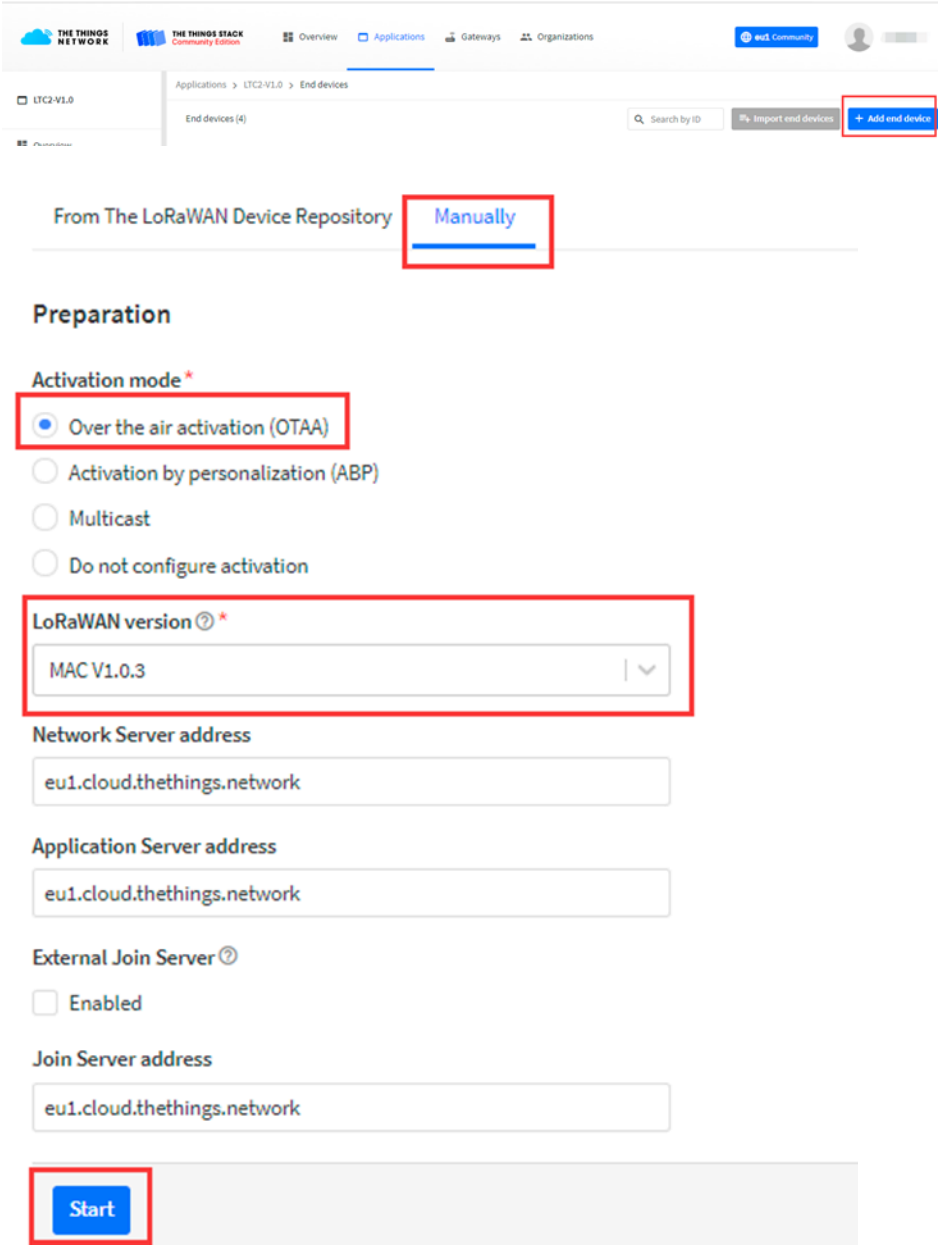


The DLOS8 is already set to connect to TTN . Rest we need to is register the LTC2-SI2 to TTN v3:

2.3.1 Step 1: Create a device in TTN with the OTAA keys from LTC2-SI2

Below is TTN screen shot:

- Create Application first.
- Manually Add a LoRaWAN End Device device. Choose **OTAA** and **MAC v1.0.3**

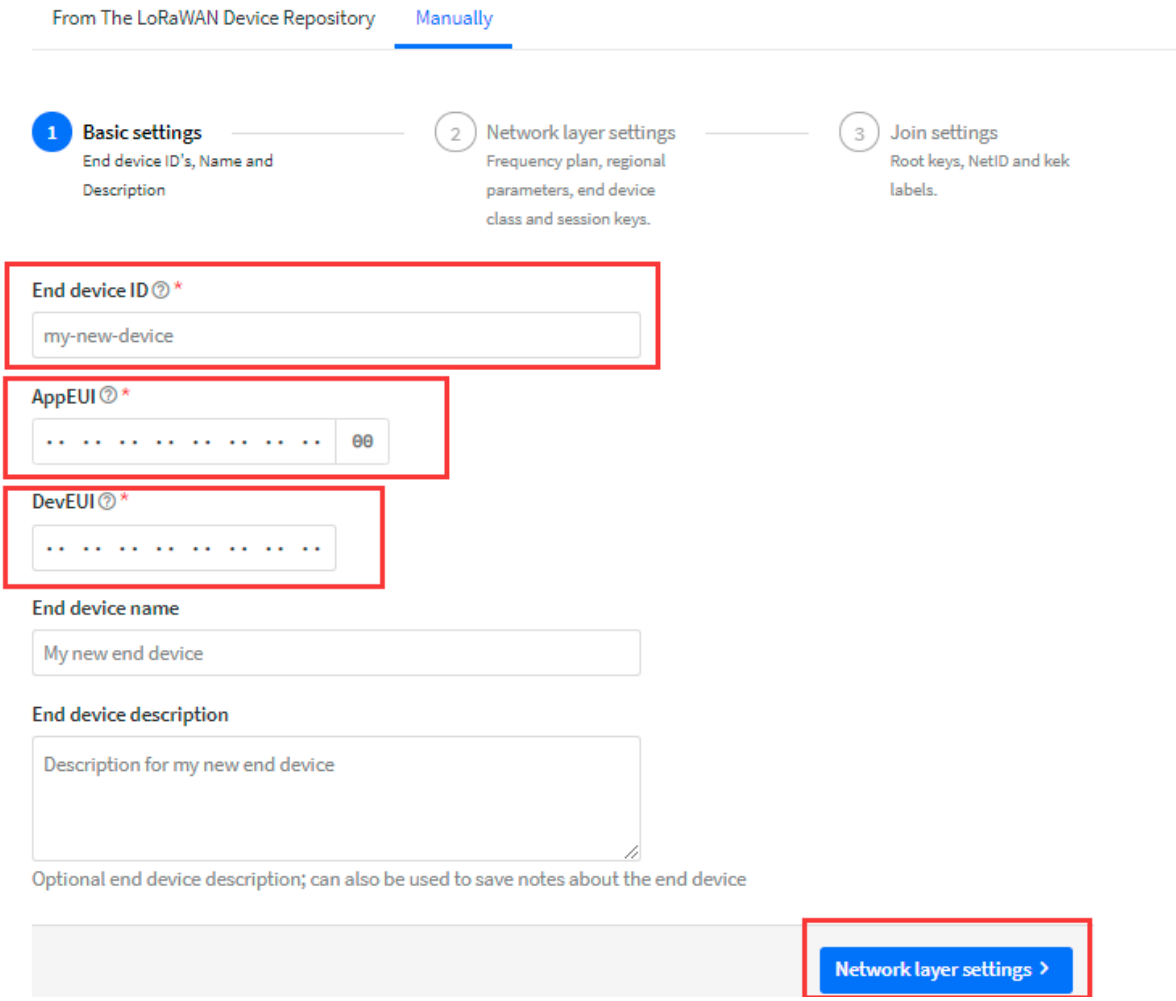


Input the OTAA keys for LTC2-SI2.

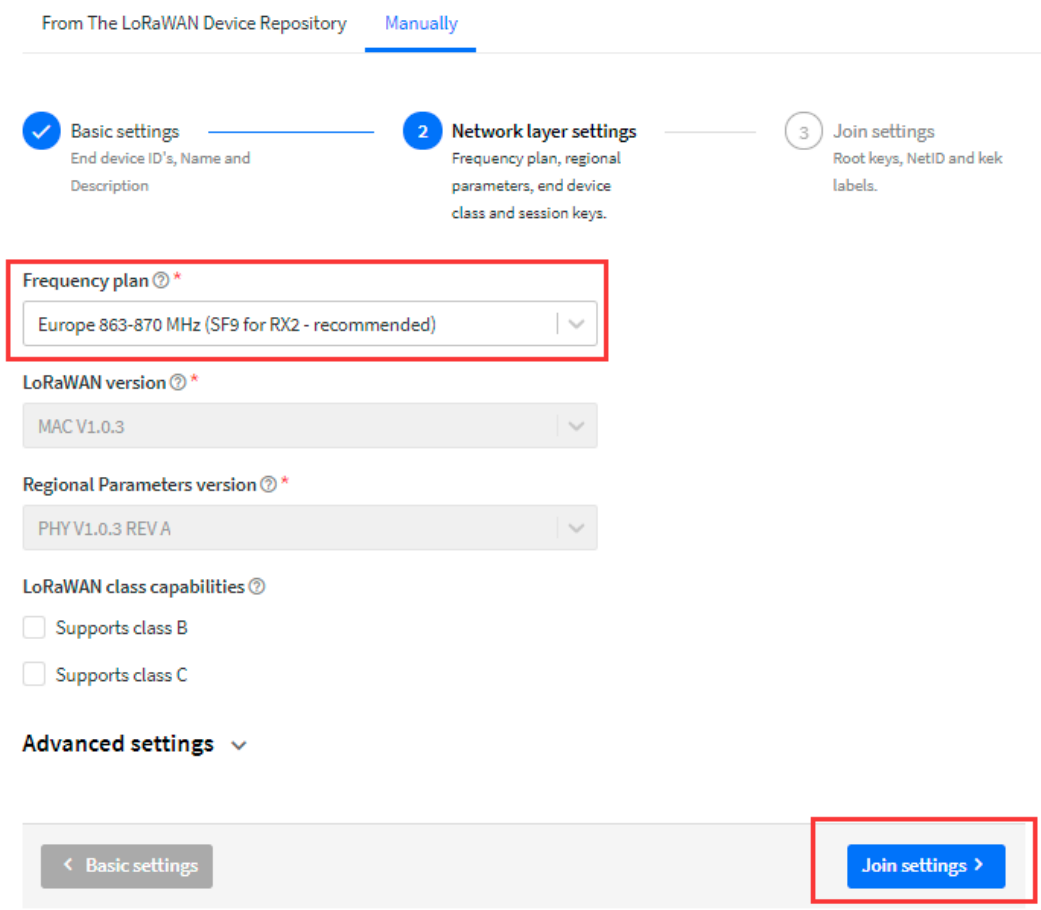
Each LTC2-SI2 is shipped with a sticker with the default device EUI as

below:

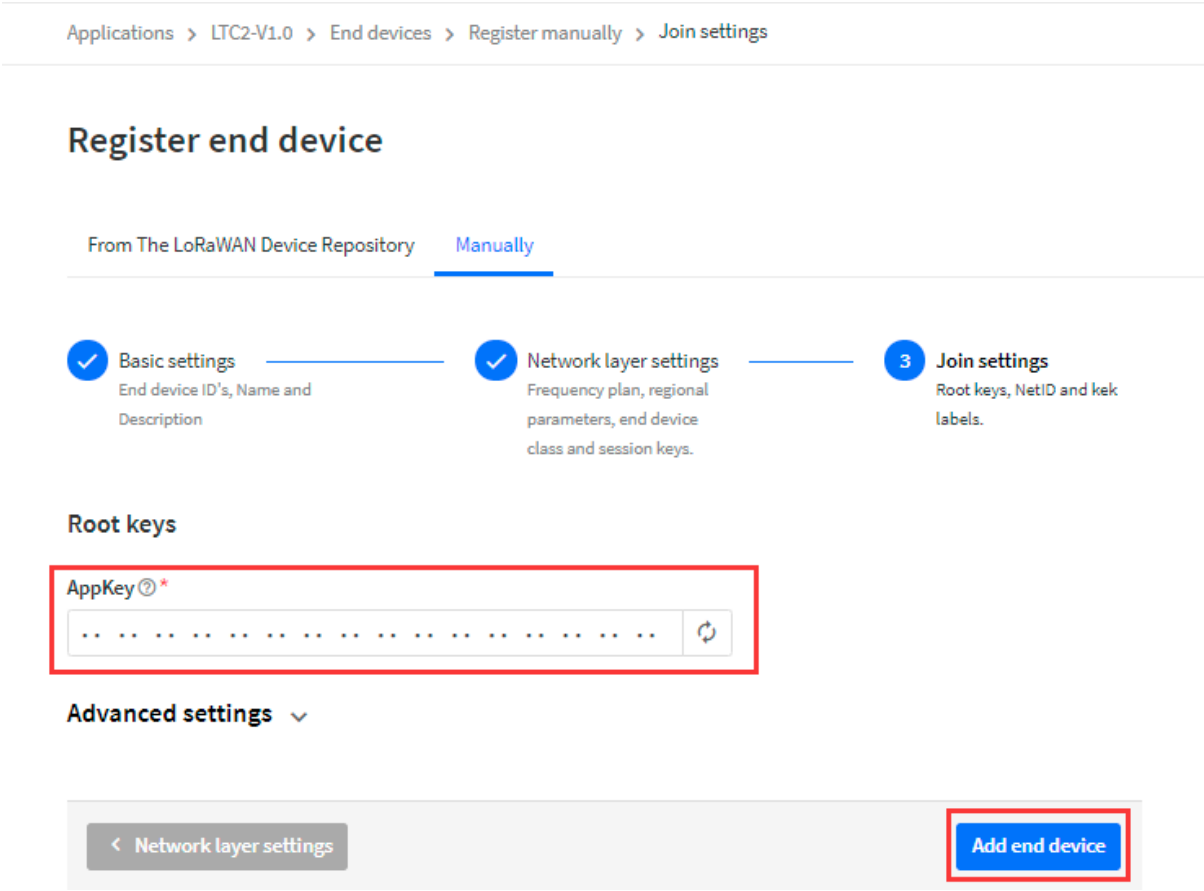
- **Input these keys to device portal.**



- **Choose the Frequency band for this end node.**

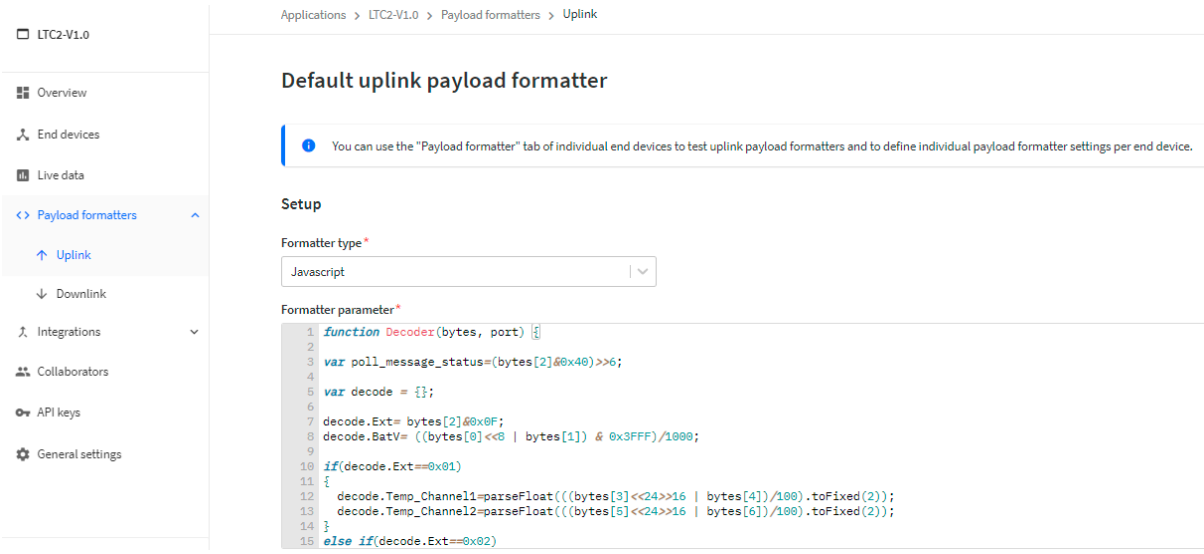


- **Input APP Key in this page as well.**



Add payload formatter So TTNv3 knows how to parse the LTC2-SI2 upload value.

The payload for TTN can be found at below link: ttps://github.com/dragino/dragino-end-node-decoder

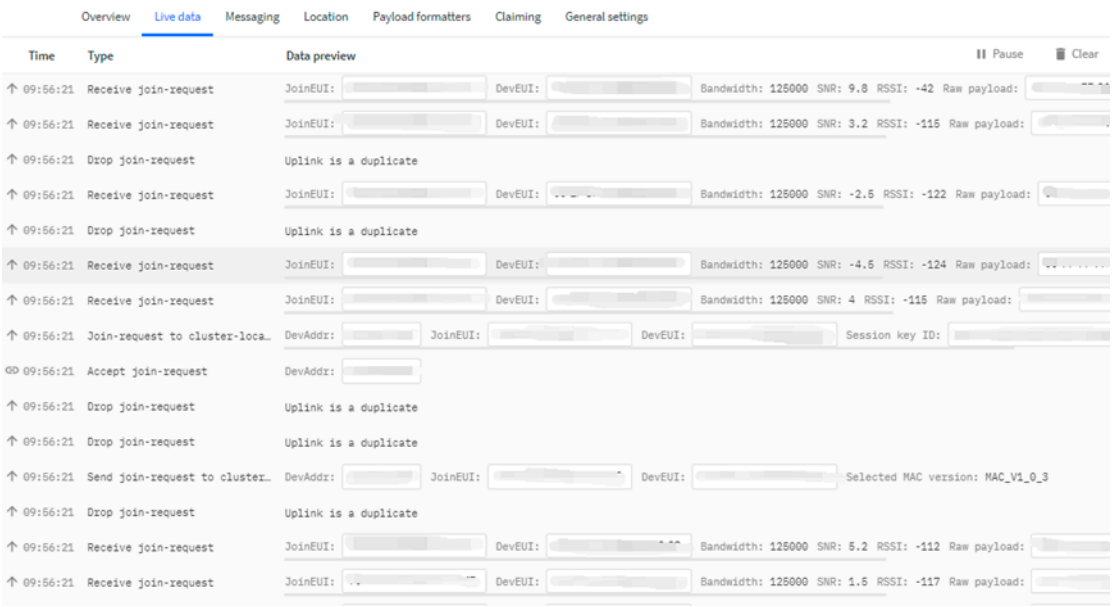


2.3.2 Step 2: Power on LTC2-SI2

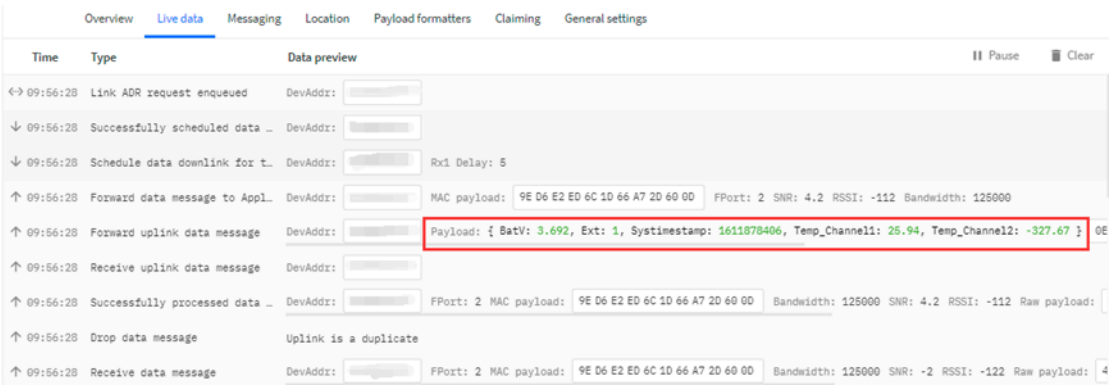
LTC2-SI2 is power off when ship from factory. Put a Jumper on JP2 to power on the device.

After power on, LTC2-SI2 will auto join to TTN network via the LoRaWAN coverage by DLOS8. After join success, LTC2-SI2 will start to update message to IoT server.

Below is an example uplink message which shows the LTC2-SI2 is sending Join Request to TTNv3.



After join successful, LTC2-SI2 will send uplink message with the sensor value.



Above value shows Channel1 detect 25.94 degree. There is no PT100 connected on Channel 2, so it shows -327.67.

2.4 Uplink Payload

Below is the uplink payload which shows

Size(bytes)	2	1	2	2	4
Value	BAT	Status & EXT	Channel 1 data	Channel 2 data	Unix TimeStamp

BAT

Ex1: 0x0E3C ⇒ 3644 (mV) = 3.644 V

Status & EXT

Bits	7	6	5	4	[3:0]
Status & Ext	Not Defined	Poll Message Flag	Sync time OK	Unix Time Request	Ext: 0b(1001)

- **Poll Message Flag**: 1: This message is a poll message reply, 0: means this is a normal uplink.
- **Sync time OK**: 1: Set time ok, 0: N/A. After time SYNC request is send, device will set this bit to 0 until got the time stamp from application server.
- **Unix Time Request**: 1: Request server downlink Unix time, 0 : N/A. In this mode, LTC2-SI2 will set this bit to 1 every 10 day to request a time SYNC. (AT+SYNCMOD to set this)
- **EXT**: The decode method for Channel 1 data and Channel 2 data
  - 0b(0001): Upload PT100 temperature, with 2 decimals, range: **-327.67 ~ 327.67 ℃**
  - 0b(0010): Upload PT100 temperature, with 1 decimals, range: **-3276.7 ~ 3276.7 ℃**
  - 0b(0011): Upload Resistance instead of Temperature, range: **-327.67~ 327.67 ohm**

Channel1 data and Channel 2 data

Example Payload on channel 1 or channel 2	Sensor Value when EXT=0b(0001)	Sensor Value when EXT=0b(0010)	Sensor Value when EXT=0b(0011)
0x1422	0x1422/100 = 51.54℃	0x1422/10 = 515.4℃	0x1422/100 = 51.54Ω
0xEC2D	(0xEC2D-65536)/100 = -50.75 ℃	(0xEC2D-65536)/10 = -507.5 ℃	0xEC2D/100 = 604.61Ω

Unix TimeStamp

Refer to Datalog feature.

Example Uplink Payload:

Uplink payload example 1: 0CE9011422EC2D6073E83B

- Bat voltage:0x0CE9 =3305mV
- Ext=0x01
- Channel1 temp=0x1422/100=51.54 ℃
- Channel2 temp=(0xEC2D-65536)/100=-50.75 ℃
- System timestamp=0x6073E83B= 1618208827(UTC)

Uplink payload example 2: 0CED020203FE056073E697

- Bat voltage:0x0CED =3309mV
- Ext=0x02
- Channel1 temp=0x0203/10=515.4 ℃
- Channel2 temp=(0xFE05-65536)/10=-507.5 ℃
- System timestamp=0x6073E697=1618208407(UTC)

Uplink payload example 3 : 0CE9032EDE1F406073E967

- Bat voltage:0x0CE9 =3305mV
- Ext=0x03
- Channel1 res=0x2EDE/100=119.98 ohm
- Channel2 res=0x1F40/100=80.00 ohm
- System timestamp=0x6073E967= 1618209127(UTC)

2.5 Datalog Feature

LTC2-SI2 will auto get the time from LoRaWAN server during Join, and each uplink will then include a timestamp. When user want to retrieve sensor value, user can send a poll command from the IoT platform to ask sensor to send value in the required time slot.

2.5.1 Unix TimeStamp

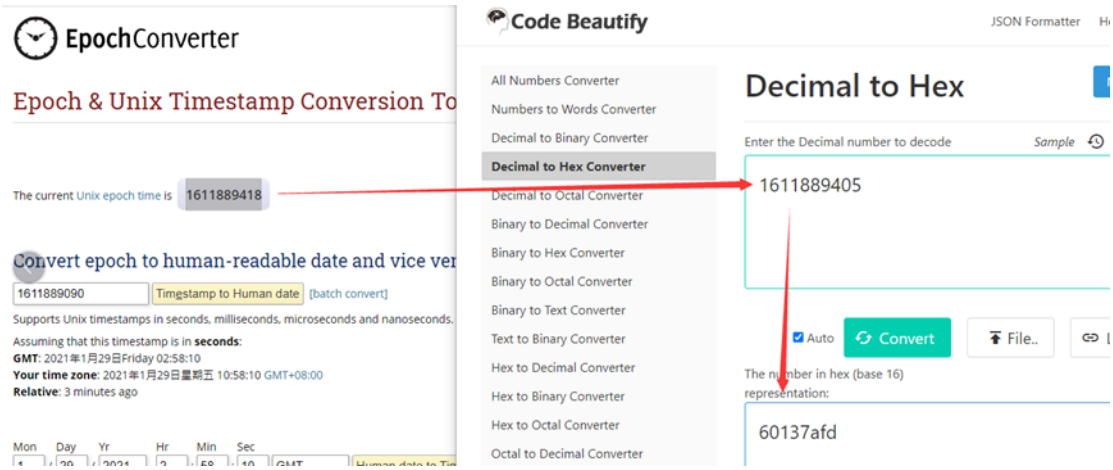
LTC2-SI2 uses Unix TimeStamp format based on

Size (bytes)	4	1
DeviceTimeAns Payload	32-bit unsigned integer : Seconds since epoch*	8bits unsigned integer: fractional-second in ½^8 second steps

Figure 10 : DeviceTimeAns payload format

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

Below is the converter example



So, we can use AT+TIMESTAMP=1611889405 or downlink 3060137afd00 to set current time 2021 – Jan -- 29 Friday 03:03:25

2.5.2 Set Device Time

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

1. Through LoRaWAN MAC Command (Default settings)

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

Once LTC2-SI2 Joined LoRaWAN network, it will send the MAC command (DeviceTimeReq) and server will reply with (DeviceTimeAns) to send the current time to LTC2-SI2. If LTC2-SI2 fails to get the time from server, LTC2-SI2 will use the internal time and wait for next time request (AT+SYNCTDC to set time request period, default is 10 days).

Note: LoRaWAN Server needs to support LoRaWAN v1.0.3(MAC v1.0.3) or higher to support this MAC command feature, Chirpstack,TTN v3 and loriot support but TTN v2 doesn't support. If server doesn't support this command, it will through away uplink packet with this command, so user will lose the packet with time request for TTN v2 if SYNCMOD=1.

2. Manually Set Time

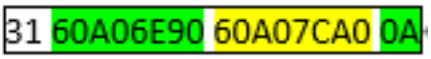
Users need to set SYNCMOD=0 to manual time, otherwise, the user set time will be overwritten by the time set by the server.

2.5.3 Poll sensor value

Users can poll sensor values based on timestamps. Below is the downlink command.

Downlink Command to poll Open/Close status (0x31)			
1byte	**4bytes**	**4bytes**	**1byte**
31	Timestamp start	Timestamp end	Uplink Interval

Timestamp start and Timestamp end use Unix TimeStamp format as mentioned above. Devices will reply with all data log during this time period, use the uplink interval.

For example, downlink command 

Is to check 2021/5/16 01:00:00 to 2021/5/16 02:00:00's data

Uplink Internal =10s, means LTC2-SI2 will send one packet every 10s. range 5~255s.

2.5.4 Datalog Uplink payload

When server senser a datalog polling to LTC2-SI2 will reply with one or more uplink messages as reply. Each uplink message includes multiply data entries value. Each entry has the same payload format as normal uplink payload.

Note:

- Poll Message Flag is set to 1.
- Each data entry is 11 bytes, to save airtime and battery, devices will send max bytes according to the current DR and Frequency bands.

For example, in US915 band, the max payload for different DR is:

1. **DR0:** max is 11 bytes so one entry of data
2. **DR1:** max is 53 bytes so devices will upload 4 entries of data (total 44 bytes)
3. **DR2:** total payload includes 11 entries of data
4. **DR3:** total payload includes 22 entries of data.

If devise doesn't have any data in the polling time. Device will uplink 11 bytes of 0

Example:

If LTC2-SI2 has below data inside Flash:

Flash Addr	Unix Time	Ext	BAT voltage	Value
8021630	systime= 2021/5/16 01:17:44	1	3684	Temp1=28.89 Temp2=-327.67
8021640	systime= 2021/5/16 01:37:44	1	3681	Temp1=28.79 Temp2=-327.67
8021650	systime= 2021/5/16 01:57:44	1	3681	Temp1=28.67 Temp2=-327.67
8021660	systime= 2021/5/16 02:17:44	1	3684	Temp1=28.60 Temp2=-327.67
8021670	systime= 2021/5/16 02:37:44	1	3684	Temp1=28.56 Temp2=-327.67
8021680	systime= 2021/5/16 02:57:44	1	3684	Temp1=28.52 Temp2=-327.67
8021690	systime= 2021/5/16 03:17:44	1	3684	Temp1=28.51 Temp2=-327.67
80216A0	systime= 2021/5/16 03:37:44	1	3684	Temp1=28.50 Temp2=-327.67
80216B0	systime= 2021/5/16 03:57:44	1	3684	Temp1=28.46 Temp2=-327.67

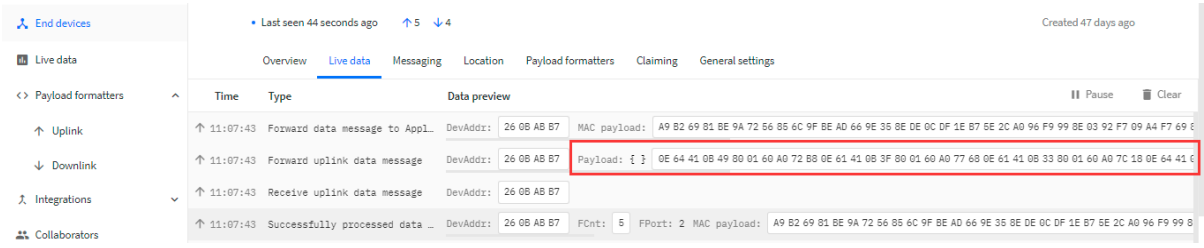
If user send below downlink command:

3160A06E9060A098C00A

Where : Start time: 60A06E90 = time 21/5/16 01:00:00

Stop time: 60A098C0 = time 21/5/16 04:00:00

LTC2-SI2 will uplink this payload.



0E64410B49800160A072B80E61410B3F800160A077680E61410B33800160A07C180E64410B2C800160A080C80E64410B288

Where the first 11 bytes is for the first entry:

0E64410B49800160A072B8

Bat voltage:0x0E64 =3684mV

poll message flag & Ext=0x41,means reply data,Ext=1

Channel1 temp=0x0B49/100=28.89℃

Channel2 temp=0x8001/100=-327.67℃

System timestamp=0x60A072B8= 1621127864(UTC)

2.6 Alarm Mode

LTC2-SI2 can monito the temperature in every CTTEMP time, when the temperature exceed the limit , it will uplink the sensor value immediately.

Detail commands see:

- **Enable Alarm Mode**
- **Config Alarm Sampling Time**
- **Set Alarm Threshold**

3. Configure LTC2-SI2 via AT Command or LoRaWAN Downlink

Use can configure LTC2-SI2 via AT Command or LoRaWAN Downlink.

- AT Command Connection: See FAQ.
- LoRaWAN Downlink instruction for different platforms: IoT LoRaWAN Server

There are two kinds of commands to configure LTC2-SI2, they are:

- **General Commands**.

These commands are to configure:

- General system settings like: uplink interval.
- LoRaWAN protocol & radio related command.

They are same for all Dragino Device which support DLWS-005 LoRaWAN Stack. These commands can be found on the wiki: End Device AT Commands and Downlink Command

- **Commands special design for LTC2-SI2**

These commands only valid for LTC2-SI2, as below:

3.1 Set Transmit Interval Time

Feature: Change LoRaWAN End Node Transmit Interval.

AT Command: AT+TDC

Command Example	Function	Response
AT+TDC=?	Show current transmit Interval	30000 OK the interval is 30000ms = 30s
AT+TDC=60000	Set Transmit Interval	OK Set transmit interval to 60000ms = 60 seconds

Downlink Command: 0x01

Format: Command Code (0x01) followed by 3 bytes time value.

If the downlink payload=0100003C, it means set the END Node's Transmit Interval to 0x00003C=60(S), while type code is 01.

- Example 1: Downlink Payload: 0100001E // Set Transmit Interval (TDC) = 30 seconds
- Example 2: Downlink Payload: 0100003C // Set Transmit Interval (TDC) = 60 seconds

3.2 Enable PT100 channels

Feature: Enable PT100 channels. Default only Enable Channel 1

AT Command: AT+ENPTCHNUM

Command Example	Function	Response
AT+ENPTCHNUM=?	Get current ENPTCHNUM settings	1
AT+ ENPTCHNUM =1	Enable channel 1	OK
AT+ ENPTCHNUM =2	Enable channel 1 and 2	

Downlink Command: 0xA1

Total bytes: 2 bytes

Example:

- 0xA101: same as AT+ENPTCHNUM =1
- 0xA102: same as AT+ENPTCHNUM =2

3.3 Set External Sensor Mode

Feature: Change External Sensor Mode.

Downlink Command: AT+EXT

Command Example	Function	Response
AT+EXT=?	Get current EXT settings	1
AT+EXT=1	Set EXT to 0b(0001)	OK
AT+EXT=2	Set EXT to 0b(0010)	
AT+EXT=3	Set EXT to 0b(0011)	

Downlink Command: 0xA2

Total bytes: 2 bytes

Example:

- 0xA201: same as AT+EXT=1

3.4 Quit AT Command

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

AT Command: AT+DISAT

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

Downlink Command:

No downlink command for this feature.

3.5 Set system time

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

AT Command:

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

Downlink Command:

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

3.6 Set Time Sync Mode

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

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

AT Command:

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

Downlink Command:

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

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

3.7 Set Time Sync Interval

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

AT Command:

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

Downlink Command:

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

3.8 Retrieve data

Feature: Retrieval data for specify time slot.

AT Command:

No AT Command, only valid for downlink command.

Downlink Command:

See Poll Sensor Value.

3.9 Enable Alarm mode

Feature: Enable Alarm Mode.

AT Command: AT_WMOD

Total bytes: 2

Example:

0xA500: AT+WMOD=0(default)

0xA501: AT+WMOD=1(alarm mode)

Downlink Command:

See Poll Sensor Value.

3.10 Alarm check time

Feature: The time interval to check sensor value for Alarm.

AT Command: AT+CITEMP

Total bytes: 3

Example:

0xA60001: AT+CITEMP=1(default)

Set collection interval in 1min,only in alarm mode

Downlink Command:

See Poll Sensor Value.

3.11 Set Alarm Threshold

Feature: Set Alarm Threshold.

AT Command: AT+ARTEMP

Total bytes: 9 Unit: ℃

Example:

A7FF380320FF380320

AT+ARTEMP=-200,800,-200,800

A7000A0064000A0065

AT+ARTEMP=10,100,10,101

Channel 1 operating temp:10~100

Channel 2 operating temp:10~101

Downlink Command:

See Poll Sensor Value.

3.12 Set Calibrate Value

Feature: Set Calibrate value for PT100 cable. Detail of use of this command please see connect to a customized PT100 Probe.

AT Command: AT+RCABLE

Total bytes: 5

Example:

AT+RCABLE=296,300

Channel 1 rcable=0x0128/1000=0.296R

Channel 2 rcable=0x012C/1000=0.300R

Downlink Command:

0xA80128012C --> Same as AT+RCABLE=296,300

3.13 Poll Calibrate Value

Feature: Poll Calibrate value. LTC2-SI2 will reply with this command send an uplink to server. **AT Command: No AT Command.**

Downlink Command:

Example: A901

End nodes will send racable config to server

Like uplink payload: 010128012C

3.14 Print data entries base on page

Feature: Print the sector data from start page to stop page (max is 400 pages).

AT Command: AT+PDTA

Command Example	Response
AT+PDTA=259,260 Print page 259 to 260	Stop Tx events when read sensor data 8021600 systime= 2021/5/16 00:17:44 1 3684 Temp1=28.71 Temp2=-327.67 8021610 systime= 2021/5/16 00:37:44 1 3685 Temp1=28.78 Temp2=-327.67 8021620 systime= 2021/5/16 00:57:44 1 3684 Temp1=28.83 Temp2=-327.67 8021630 systime= 2021/5/16 01:17:44 1 3684 Temp1=28.89 Temp2=-327.67 8021640 systime= 2021/5/16 01:37:44 1 3681 Temp1=28.79 Temp2=-327.67 8021650 systime= 2021/5/16 01:57:44 1 3681 Temp1=28.67 Temp2=-327.67 8021660 systime= 2021/5/16 02:17:44 1 3684 Temp1=28.60 Temp2=-327.67 8021670 systime= 2021/5/16 02:37:44 1 3684 Temp1=28.56 Temp2=-327.67 8021680 systime= 2021/5/16 02:57:44 1 3684 Temp1=28.52 Temp2=-327.67 8021690 systime= 2021/5/16 03:17:44 1 3684 Temp1=28.51 Temp2=-327.67 80216A0 systime= 2021/5/16 03:37:44 1 3684 Temp1=28.50 Temp2=-327.67 80216B0 systime= 2021/5/16 03:57:44 1 3684 Temp1=28.46 Temp2=-327.67 80216C0 systime= 2021/5/16 04:17:44 1 3684 Temp1=28.40 Temp2=-327.67 80216D0 systime= 2021/5/16 04:37:44 1 3683 Temp1=28.37 Temp2=-327.67 80216E0 systime= 2021/5/16 04:57:44 1 3684 Temp1=28.36 Temp2=-327.67 80216F0 systime= 2021/5/16 05:17:44 1 3685 Temp1=28.32 Temp2=-327.67 Start Tx events OK

Downlink Command:

No downlink commands for feature

3.15 Print last few data entries

Feature: Print the last few data entries

AT Command: AT+PLDTA

Command Example	Response
AT+PLDTA=5 Print last 5 entries	Stop Tx events when read sensor data 1 systime= 2021/5/17 03:12:37 1 3681 Temp1=26.01 Temp2=-327.67 2 systime= 2021/5/17 03:17:37 1 3682 Temp1=26.02 Temp2=-327.67 3 systime= 2021/5/17 03:22:37 1 3687 Temp1=25.94 Temp2=-327.67 4 systime= 2021/5/17 03:27:37 1 3684 Temp1=25.95 Temp2=-327.67 5 systime= 2021/5/17 03:32:37 1 3684 Temp1=26.20 Temp2=-327.67 Start Tx events OK

Downlink Command:

No downlink commands for feature

3.16 Clear Flash Record

Feature: Clear flash storage for data log feature.

AT Command: AT+CLRDTA

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

Downlink Command: 0xA3

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

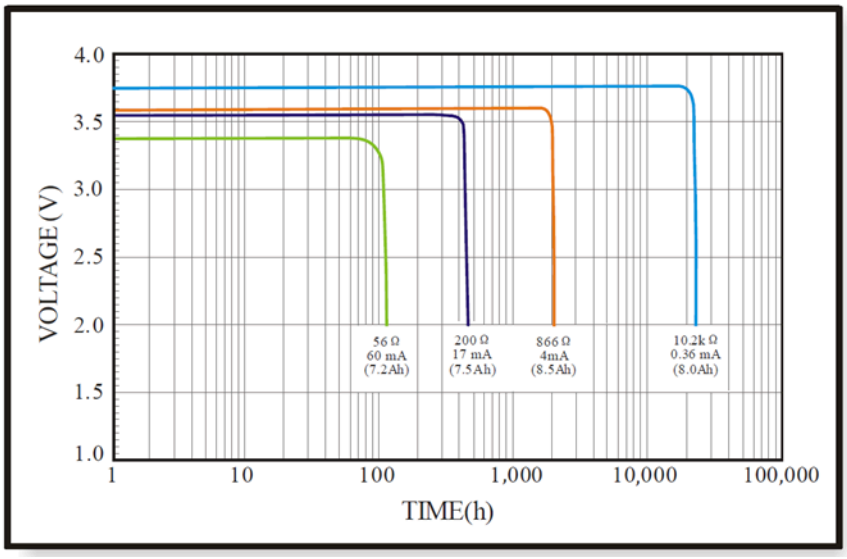
4. Battery & How to replace

4.1 Battery Type

LTC2-SI2 is equipped with a 8500mAH ER26500 Li-SOCI2 battery. The battery is un-rechargeable battery with low discharge rate targeting for 8~10 years use. This type of battery is commonly used in IoT target for long-term running, such as water meter.

The discharge curve is not linear so can't simply use percentage to show the battery level. Below is the battery performance.

1. Typical discharge profile at +20℃(Typical value)



Minimum Working Voltage for the LTC2-SI2: 3.0v ~ 3.6v

4.2 Replace Battery

Any battery with 3.6v can be a replacement. We recommend to use Li-SOCl2 Battery.

And make sure the positive and negative pins match.

4.3 Power Consumption Analyze

Dragino Battery powered product are all runs in Low Power mode. We have an update battery calculator which base on the measurement of the real device. User can use this calculator to check the battery life and calculate the battery life if want to use different transmit interval.

Instruction to use as below:

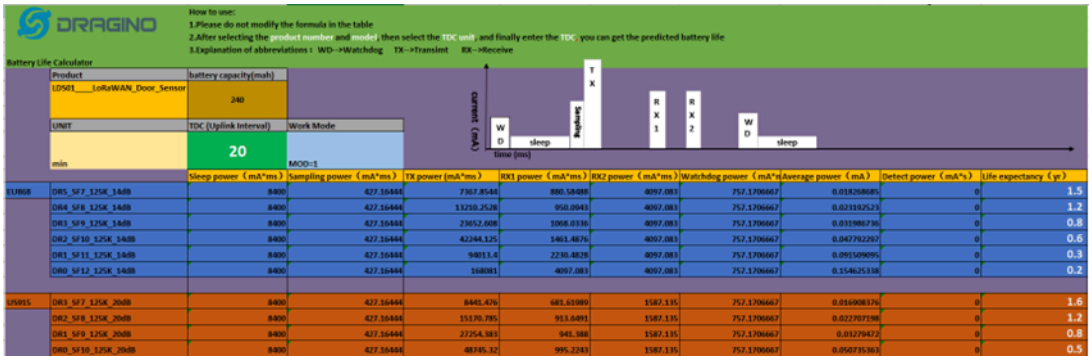
Step 1 : Downlink the up-to-date DRAGINO_Battery_Life_Prediction_Table.xlsx from:

https://www.dragino.com/downloads/index.pHp?dir=LoRa_End_Node/Battery_Analyze/

Step 2 : Open it and choose

- Product Model
- Uplink Interval
- Working Mode

And the Life expectation in difference case will be shown on the right.



		Sleep power（mA*ms）	Sampling power（mA*ms）	TX power (mA*ms)	RX1 power（mA*ms）	RX2 power（mA*ms）	Watchdog power（mA*ms）	Average power（mA）	Detect power（mA*s）	Life expectancy（yr）
EU868	DR5_SF7_125K_14dB	8400	427.16444	7367.8544	880.58488	4097.083	757.1706667	0.018268685	0	1.5
	DR4_SF8_125K_14dB	8400	427.16444	13250.2528	950.0043	4097.083	757.1706667	0.021192523	0	1.2
	DR3_SF9_125K_14dB	8400	427.16444	23652.608	1068.0336	4097.083	757.1706667	0.031986736	0	0.8
	DR2_SF10_125K_14dB	8400	427.16444	42244.125	1461.4876	4097.083	757.1706667	0.047792297	0	0.6
	DR1_SF11_125K_14dB	8400	427.16444	94013.4	2230.4828	4097.083	757.1706667	0.091509095	0	0.3
	DR0_SF12_125K_14dB	8400	427.16444	168081	4097.083	4097.083	757.1706667	0.154625338	0	0.2
US915	DR3_SF7_125K_20dB	8400	427.16444	8441.476	681.61989	1587.135	757.1706667	0.016908376	0	1.6
	DR2_SF8_125K_20dB	8400	427.16444	15170.785	913.6491	1587.135	757.1706667	0.022707198	0	1.2
	DR1_SF9_125K_20dB	8400	427.16444	27254.383	941.388	1587.135	757.1706667	0.01279472	0	0.8
	DR0_SF10_125K_20dB	8400	427.16444	48745.32	995.2243	1587.135	757.1706667	0.050735363	0	0.5

5. Firmware Change Log and Upload Firmware

User can use ST-Link v2 to upgrade firmware into LTC2-SI2 for bug fix or new features. The hardware connection for upgrade firmware is as below:

Connection:

- **ST-LINK v2 GND <--> LTC2-SI2 GND**
- **ST-LINK v2 RESET <--> LTC2-SI2 NRST**
- **ST-LINK v2 SWCLK <--> LTC2-SI2 SWCLK**
- **ST-LINK v2 SWDIO <--> LTC2-SI2 SWDIO**
- **LTC2-SI2 power must be on.**

Firmware Location and Change Log: https://www.dropbox.com/sh/8ghh32xavvsr98l/AADg-NbTnq80Re4Bcj7uekJFa?dl=0

6. FAQ

6.1 How to use AT Command to configure LTC2-SI2

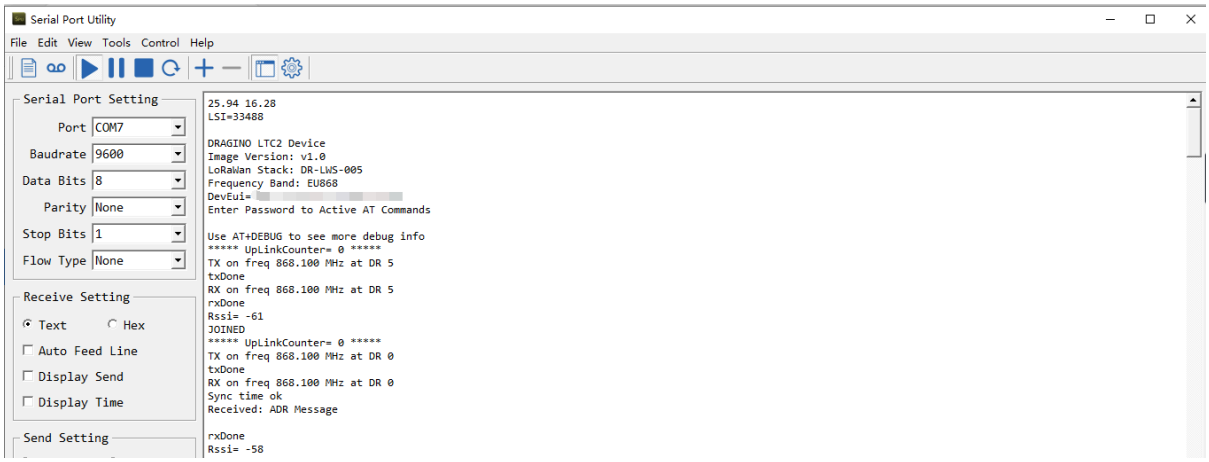
LTC2-SI2 supports AT Command set. User can use a USB to TTL adapter plus the Program Cable to connect to LTC2-SI2 for using AT command, as below.

Connection:

- **USB to TTL GND <--> LTC2-SI2 GND**
- **USB to TTL RXD <--> LTC2-SI2 TXD**
- **USB to TTL TXD <--> LTC2 RXD**

In PC, User needs to set **serial tool**(such as putty, SecureCRT) baud rate to **9600** to access to access serial console for LTC2-SI2. The AT commands are disable by default and need to enter password (default: **123456**) to active it. Timeout to input AT Command is 5 min, after 5-minute, user need to input password again. User can use AT
+DISAT command to disable AT command before timeout.

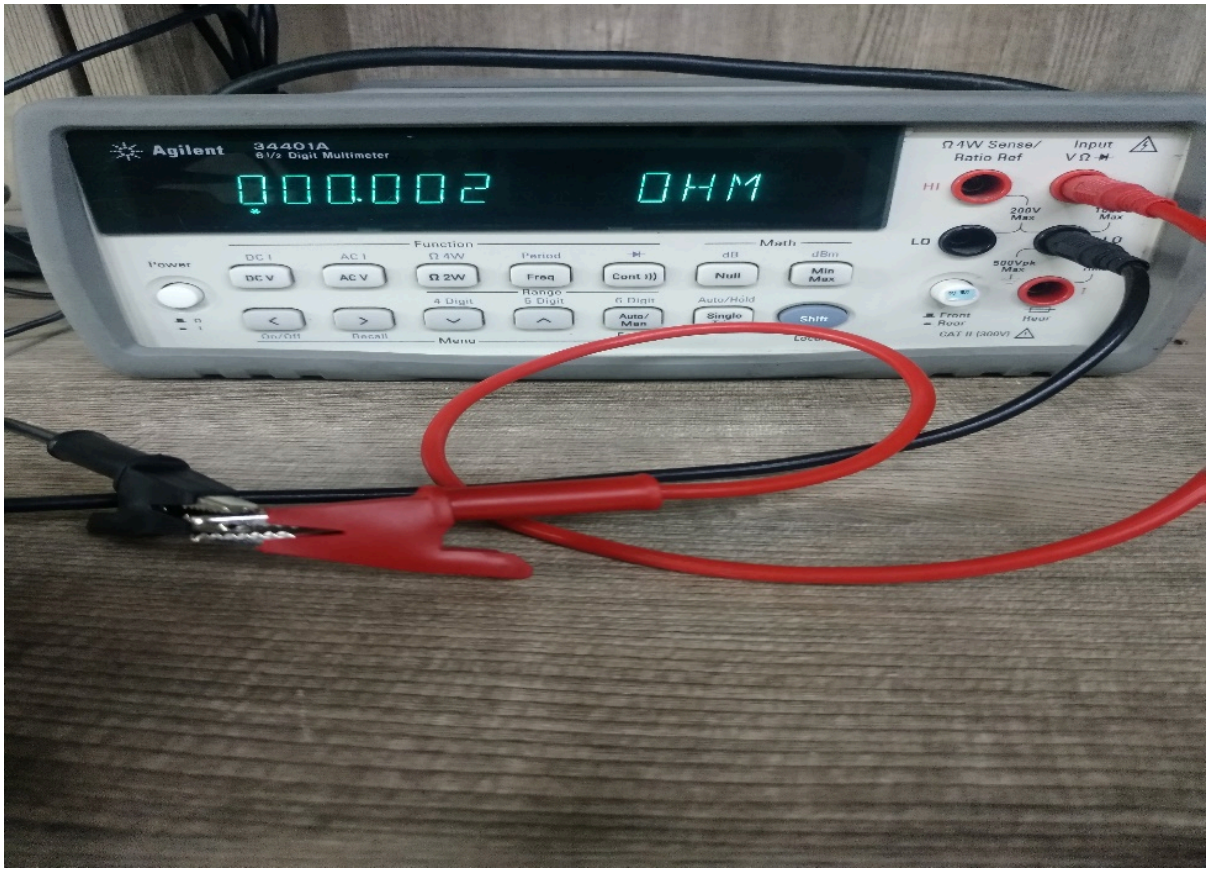
Input password and ATZ to activate LTC2-SI2,As shown below:



6.2 How to connect a customized PT100 cable?

The LTC2-SI2 has two channels means it can connect 2 x PT100 cables. Besides use the PT100 cables provided by Dragino, User can connect their PT100 probes. When connect to a user PT100 probe, we recommend that user do a calibration to eliminate the effect from the cables so to get the best accuracy. Below is the step for calibrate on a **three wire PT100** probes. There is no step for 2 wire probe calibration at the moment.

Step 1: You need a multimeter can measure the accuracy of 0.001 ohm. We use Agilent 34401A digit multimeter. And will do test to make sure the multimeter accuracy before the measurement. Check the shortcut resistance of the multimeter.



We know that the Multimeter has a shortcut resistance 0.002 ohm.

Step 2: Measure the resistance between the two shorted wires of PT100 Probe.

As example, in this step, we check the shorted wire (both red) with 0.594 ohm, So we know that each wire of PT100 has (0.594-0.002)/2=0.296R (Where 0.002 is the value we got from step 1) .

Step 3: Run Calibrate Command.

Run this command to both channels to use 0.296R calibrate resistance.

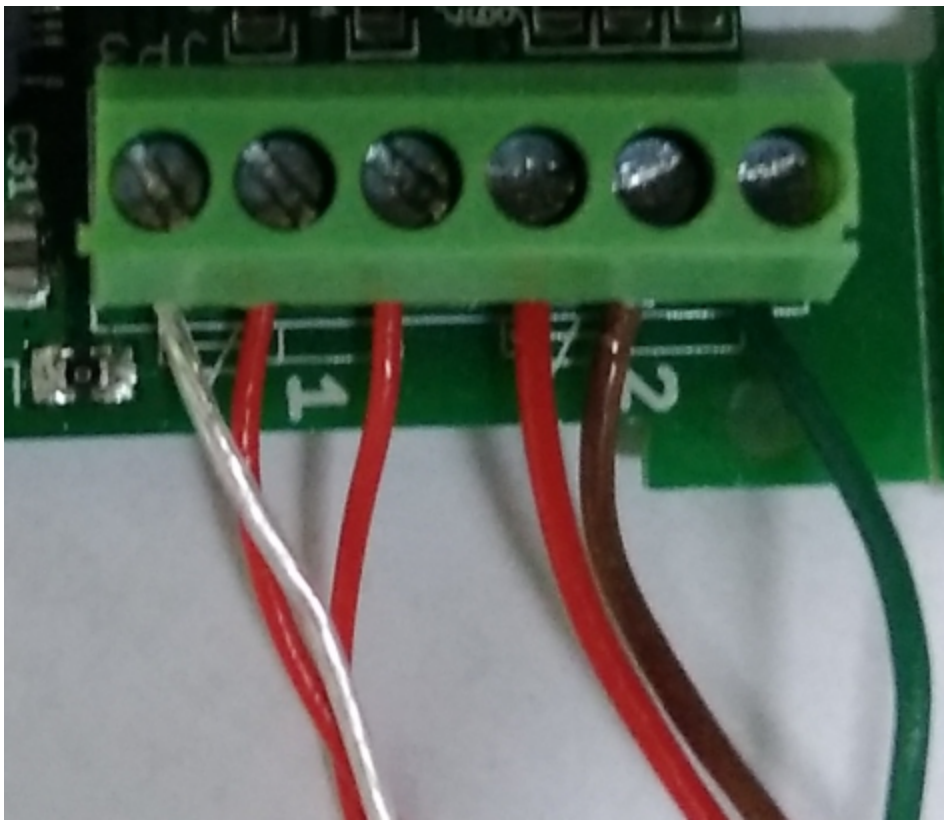
AT+RCABLE=296,0 --> Calibrate Channel 1 with 0.296R

Or use LoRaWAN downlink command (0xA8 Code to set:

0xA801280000

User can use 0xA9 downlink command to poll the current calibration value.

Step 4: Connect the PT100 to LTC2-SI2



For a 3 wire PT100, there are two wire are shortcut, for example, as per above photo Channel 1, there are two red wire , which are shortcut in PT100, connect them as the photo. The 3rd wire (white wire connect to the left pin of Channel -1.

6.3 What is the frequency range of LTC2-SI2 LoRa part?

Different LTC2-SI2 version supports different frequency range, below is the table for the working frequency and recommend bands for each model:

6.4 How to change the LoRa Frequency Bands/Region

You can follow the instructions for how to upgrade image.
When downloading the images, choose the required image file for download.

7. Trouble Shooting

7.1 AT Command input doesn't work

In the case if user can see the console output but can't type input to the device. Please check if you already include the **ENTER** while sending out the command. Some serial tool doesn't send **ENTER** while press the send key, user need to add ENTER in their string.

- LTC2-SI2 LoRaWAN Temperature Transmitter x 1

Dimension and weight:

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

FCC Caution:

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

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
FCC Radiation Exposure Statement:
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment .This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help.