



LoRaWAN Leaf Moisture Sensor User Manual

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1.0	Release	2021-May-10

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1. Introduction

1.1 What is LoRaWAN Leaf Moisture Sensor

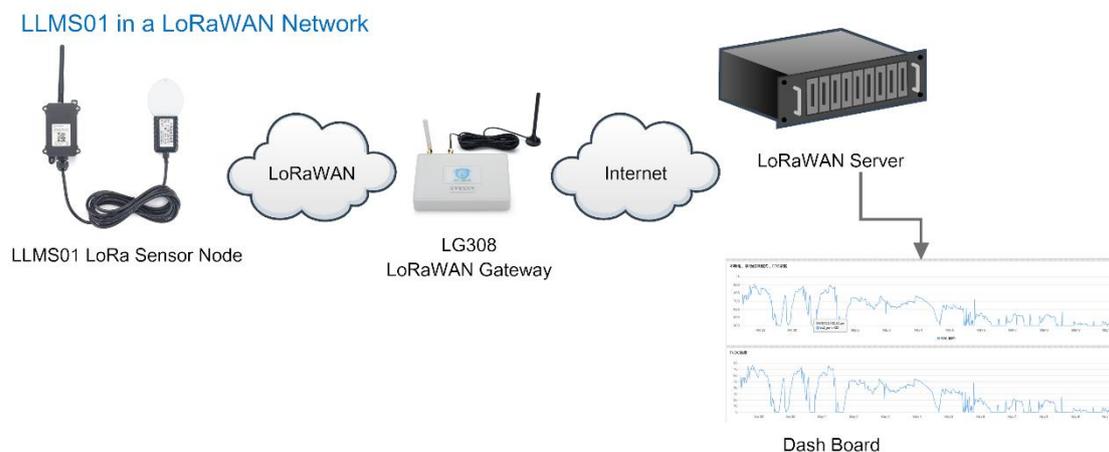
The Dragino LLMS01 is a **LoRaWAN Leaf Moisture Sensor** for IoT of Agriculture. It is designed to measure the leaf moisture and temperature, so to send to the platform to analyze the leaf status such as : watering, moisturizing, dew, frozen. The probe is IP67 waterproof.

LLMS01 detects leaf's **moisture and temperature** use FDR method, it senses the dielectric constant cause by liquid over the leaf surface, and cover the value to leaf moisture. The probe is design in a leaf shape to best simulate the real leaf characterizes. The probe has as density as 15 leaf vein lines per centimeter which make it can senses small drop and more accuracy.

The LoRa wireless technology used in LLMS01 allows device 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.

LLMS01 is powered by **8500mAh Li-SOCI2 battery**, it is designed for long term use up to 5 years.

Each LLMS01 is pre-load with a set of unique keys for LoRaWAN registrations, register these keys to local LoRaWAN server and it will auto connect after power on.



1.2 Features

- ✧ LoRaWAN 1.0.3 Class A
- ✧ Ultra-low power consumption
- ✧ Monitor Leaf moisture
- ✧ Monitor Leaf temperature
- ✧ Monitor Battery Level
- ✧ Bands: CN470/EU433/KR920/US915/EU868/AS923/AU915/IN865
- ✧ AT Commands to change parameters
- ✧ Uplink on periodically

- ✧ Downlink to change configure
- ✧ IP66 Waterproof Enclosure
- ✧ IP67 rate for the Sensor Probe
- ✧ 8500mAh Battery for long term use

1.3 Probe Specification

Leaf Moisture: percentage of water drop over total leaf surface

- ✧ Range 0-100%
- ✧ Resolution: 0.1%
- ✧ Accuracy: $\pm 3\%$ (0-50%) ; $\pm 6\%$ (>50%)
- ✧ IP67 Protection
- ✧ Length: 3.5 meters

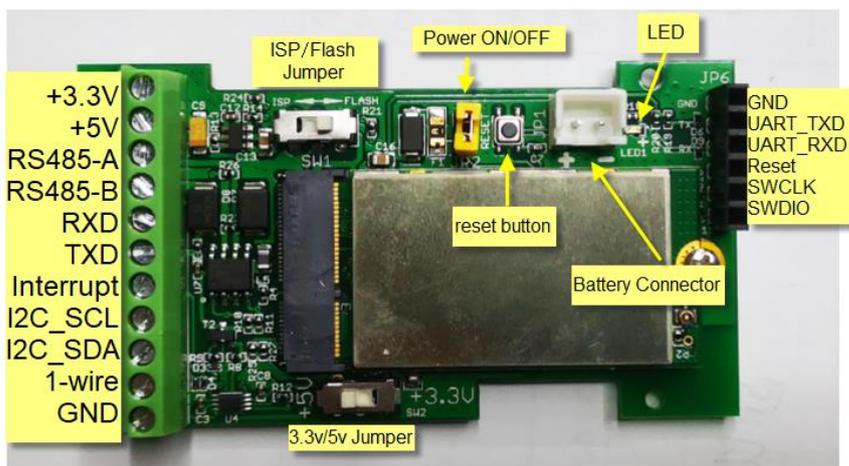
Leaf Temperature:

- ✧ Range $-50^{\circ}\text{C} \sim 80^{\circ}\text{C}$
- ✧ Resolution: 0.1°C
- ✧ Accuracy: $< \pm 0.5^{\circ}\text{C}$ ($-10^{\circ}\text{C} \sim 70^{\circ}\text{C}$), $< \pm 1.0^{\circ}\text{C}$ (others)
- ✧ IP67 Protection
- ✧ Length: 3.5 meters

1.4 Applications

- ✧ Smart Agriculture

1.5 Pin mapping and power on



2. Configure LLMS01 to connect to LoRaWAN network

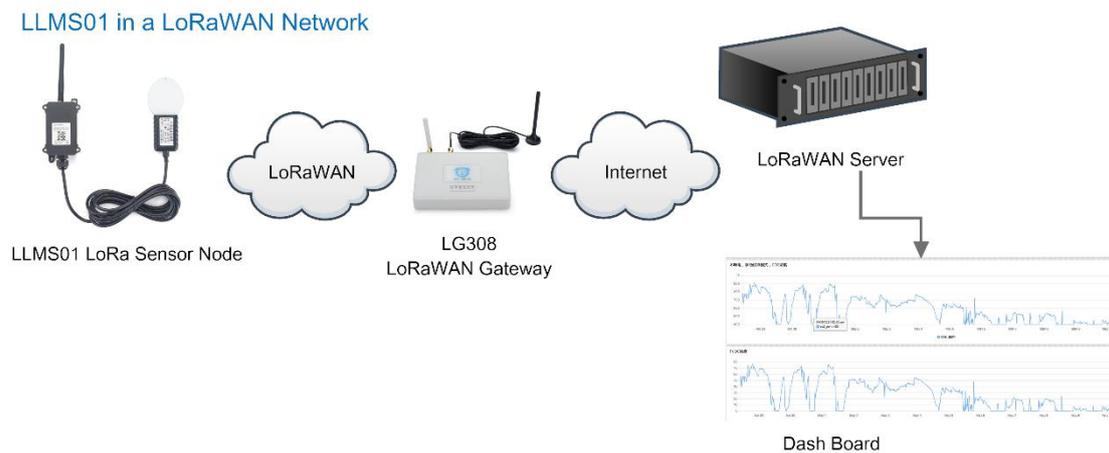
2.1 How it works

The LLMS01 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 power on the LLMS01. It will automatically join the network via OTAA and start to send the sensor value. The default uplink interval is 20 minutes.

In case you can't set the OTAA keys in the LoRaWAN OTAA server, and you have to use the keys from the server, you can [use AT Commands](#) to set the keys in the LLMS01.

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 [LG308](#) as a LoRaWAN gateway in this example.



The LG308 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 LLMS01.

Each LLMS01 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

Register end device

From The LoRaWAN Device Repository [Manually](#)

Preparation

Activation mode*

- Over the air activation (OTAA)
- Activation by personalization (ABP)
- Multicast
- Do not configure activation

LoRaWAN version ⓘ*

Network Server address

Application Server address

External Join Server ⓘ

 Enabled

Join Server address



Add APP EUI and DEV EUI

Register end device

From The LoRaWAN Device Repository [Manually](#)

- 1 **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.

End device ID ⓘ*

AppEUI ⓘ*

DevEUI ⓘ*

End device name

End device description

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

Add APP EUI in the application

Register end device

From The LoRaWAN Device Repository **Manually**

- 1 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

Register end device

From The LoRaWAN Device Repository **Manually**

- 1 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.

Root keys

AppKey ⓘ *

BD 72 1D AC F3 CC AB 67 72 8D 7A F5 4D DF 30 8B ↻

Advanced settings ▼

< Network layer settings Add end device

2.3.5 Interrupt Pin

This data field shows if this packet is generated by interrupt or not. [Click here](#) for the hardware and software set up.

Example:

- 0x00: Normal uplink packet.
- 0x01: Interrupt Uplink Packet.

2.3.6 Message Type

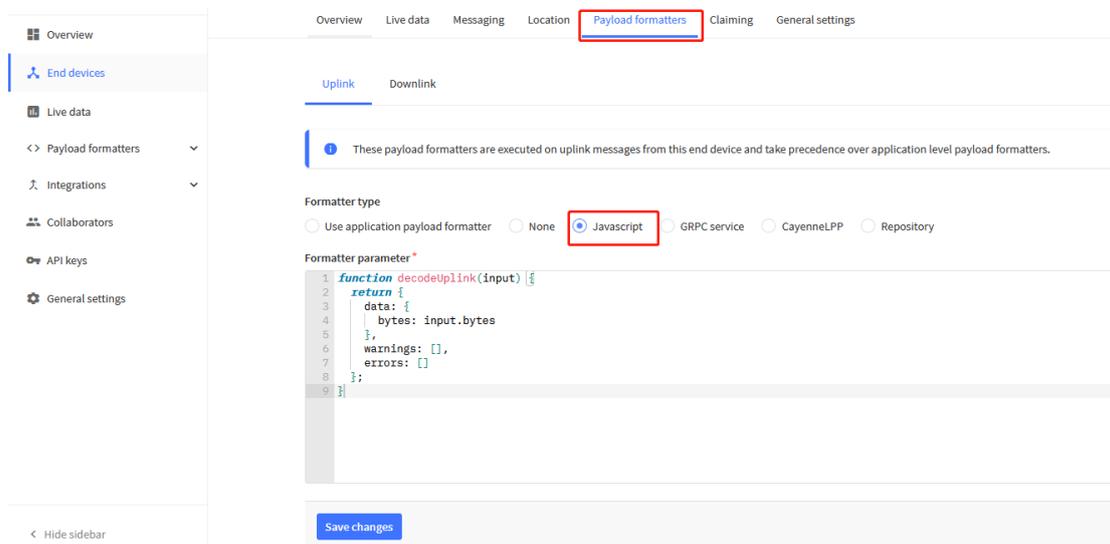
For a normal uplink payload, the message type is always 0x01.

Valid Message Type:

Message Type Code	Description	Payload
0x01	Normal Uplink	Normal Uplink Payload
0x02	Reply configures info	Configure Info Payload

2.3.7 Decode payload in The Things Network

While using TTN network, you can add the payload format to decode the payload.



The screenshot shows the 'Payload formatters' configuration page in the Dragino web interface. The 'Payload formatters' tab is selected. Under 'Formatter type', the 'Javascript' radio button is selected. The 'Formatter parameter' field contains the following JavaScript code:

```

1 function decodeUplink(input) {
2   return {
3     data: {
4       bytes: input.bytes
5     },
6     warnings: [],
7     errors: []
8   };
9 }

```

The payload decoder function for TTN is here:

LLMS01 TTN Payload Decoder:

https://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/LLMS01/Decoder/

2.4 Uplink Interval

The LLMS01 by default uplink the sensor data every 20 minutes. User can change this interval by AT Command or LoRaWAN Downlink Command. See this link:

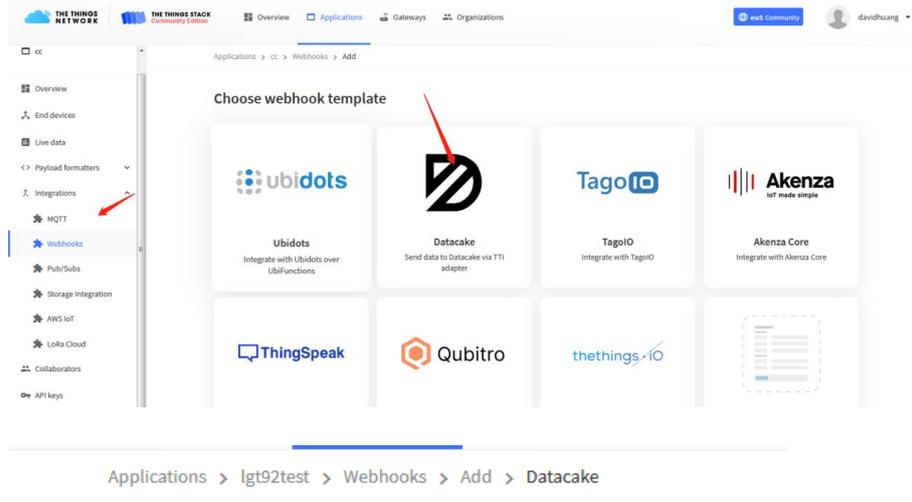
http://wiki.dragino.com/index.php?title=End_Device_AT_Commands_and_Downlink_Commands#Change_Uplink_Interval

2.5 Show Data in DataCake IoT Server

[DATAKAKE](#) provides a human friendly interface to show the sensor data, once we have data in TTN, we can use [DATAKAKE](#) to connect to TTN and see the data in DATAKAKE. Below are the steps:

Step 1: Be sure that your device is programmed and properly connected to the network at this time.

Step 2: To configure the Application to forward data to DATAKAKE you will need to add integration. To add the DATAKAKE integration, perform the following steps:



Add custom webhook

Template information



Datacake

Send data to Datacake via TTI adapter

[About Datacake](#) | [Documentation](#)

Template settings

Webhook ID *

Token *

Datacake API Token

Create datacake webhook

Step 3: Create an account or log in Datacake.

Step 4: Create LLMS01 product.

Add Device ×



LoRaWAN



PARTICLE



API



D Zero



D Zero LTE



PINCODE

STEP 1
Product

STEP 2
Network Server

STEP 3
Devices

STEP 4
Plan

Datacake Product

You can add devices to an existing product on Datacake, create a new empty product or start with one of the templates. Products allow you to share the same configuration (fields, dashboard and more) between devices.

New Product from template
Create new product from a template

Existing Product
Add devices to an existing product

New Product
Create new empty product

New Product

If your device is not available as a template, you can start with an empty device. You will have to create the device definition (fields, dashboard) and provide the payload decoder in the device's configuration.

Product Name

Next

Add Device



LoRaWAN



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API



D Zero



D Zero LTE



PINCODE

STEP 1
Product

STEP 2
Network Server

STEP 3
Devices

STEP 4
Plan

Network Server

Please choose the LoRaWAN Network Server that your devices are connected to.

<input checked="" type="radio"/>		The Things Stack V3 TTN V3 / Things Industries	<input type="button" value="Uplinks"/>	<input type="button" value="Downlinks"/>
<input type="radio"/>		The Things Network V2 The old Things Network	<input type="button" value="Uplinks"/>	<input type="button" value="Downlinks"/>
<input type="radio"/>		Helium	<input type="button" value="Uplinks"/>	<input type="button" value="Downlinks"/>
<input type="radio"/>		LORIoT	<input type="button" value="Uplinks"/>	<input type="button" value="Downlinks"/>
<input type="radio"/>		Kerlink Wanesy	<input type="button" value="Uplinks"/>	
Showing 1 to 5 of 8 results			<input type="button" value="Previous"/>	<input type="button" value="Next"/>

Back

Next

Add Device



LoRaWAN



PARTICLE



API



D Zero



D Zero LTE



PINCODE

STEP 1
Product

STEP 2
Network Server

STEP 3
Devices

STEP 4
Plan

Add Devices

Enter one or more LoRaWAN Device EUIs and the names they will have on Datacake.

DEVEUI	NAME
46 41 43 14 65 46 49 87 8 bytes	LLMS01

+ Add another device

consistent with DEUI on TTN

Back

Next

Step 5: add payload decode

Download Datacake decoder from:

https://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/LLMS01/Decoder/

LLMS01

Location: - Serial Number: 4641431465464987 Last update: Thu May 13 2021 09:17:56 GMT+0800

Dashboard History Downlinks **Configuration** Debug Rules Permissions

General Configuration

Name: LLMS01

Location:

Payload Decoder

When your devices sends data, the payload will be passed to the payload decoder, alongside the event's name. The payload decoder then transforms it to measurements.

```

1 * function Decoder(bytes, port) {
2   // Decode an uplink message from a buffer
3   // (array) of bytes to an object of fields.
4   var value=(bytes[0]<0 | bytes[1]) & 0x3FFF;
5   var batValue=1000;//Battery,units:V
6
7   value=bytes[2]<0 | bytes[3];
8   if(bytes[2] & 0x00)
9     {value |= 0xFFFF0000};
10  var temp_D018020=(value/10).toFixed(2);//D018020,temperature
11
12  value=bytes[4]<0 | bytes[5];
13  var hum=(value/10).toFixed(1);
14
15  value=bytes[6]<0 | bytes[7];
16  var temp=(value/10).toFixed(1);
17
18  var i_flag = bytes[8];
19
20 *
21 *
22 *
23   {
24     field: "BATTERY",
25     value: batV
26   },
27   {
28     field: "LEAF_MOISTURE",
29     value: hum
30   },
31   {
32     field: "LEAF_TEMPERATURE",
33     value: temp
34   }
35 }

```

Payload:
 Port:
[Try Decoder](#)

Output: console.log Output Recognized measurements

[Save](#) [Add Field](#)

Name	Identifier	Type	Current Value
BAT	BAT	Float	0
Leaf Moisture	LEAF_MOISTURE	Float	0
Leaf Temperature	LEAF_TEMPERATURE	Float	0

Interpretation

After added, the sensor data arrive TTN, it will also arrive and show in Mydevices.

LLMS01

Location: - Serial Number: 4641431465464987 Last update: Thu May 13 2021 09:41:08 GMT+0800 Product Slug: llms01

[Dashboard](#) [History](#) [Downlinks](#) [Configuration](#) [Debug](#) [Rules](#) [Permissions](#)

BAT
a few seconds ago

Legend: BAT

TEM
a few seconds ago

Legend: Leaf Temperature

HUM
a few seconds ago

Legend: Leaf Moisture

2.6 Installation

LLMS01 probe has two sides. The side without words are the sense side. Please be ware when install the sensor.



2.7 Frequency Plans

The LLMS01 uses OTAA mode and below frequency plans by default. If user want to use it with different frequency plan, please refer the AT command sets.

2.7.1 EU863-870 (EU868)

Uplink:

- 868.1 - SF7BW125 to SF12BW125
- 868.3 - SF7BW125 to SF12BW125 and SF7BW250
- 868.5 - SF7BW125 to SF12BW125
- 867.1 - SF7BW125 to SF12BW125
- 867.3 - SF7BW125 to SF12BW125
- 867.5 - SF7BW125 to SF12BW125
- 867.7 - SF7BW125 to SF12BW125
- 867.9 - SF7BW125 to SF12BW125
- 868.8 - FSK

Downlink:

- Uplink channels 1-9 (RX1)
- 869.525 - SF9BW125 (RX2 downlink only)

2.7.2 US902-928(US915)

Used in USA, Canada and South America. Frequency band as per definition in LoRaWAN 1.0.3 Regional document.

To make sure the end node supports all sub band by default. In the OTAA Join process, the end node will use frequency 1 from sub-band1, then frequency 1 from sub-band2, then frequency 1 from sub-band3, etc to process the OTAA join.

After Join success, the end node will switch to the correct sub band by:

- Check what sub-band the LoRaWAN server ask from the OTAA Join Accept message and switch to that sub-band
- Use the Join successful sub-band if the server doesn't include sub-band info in the OTAA Join Accept message (TTN v2 doesn't include)

2.7.3 CN470-510 (CN470)

Used in China, Default use CHE=1

Uplink:

486.3 - SF7BW125 to SF12BW125
486.5 - SF7BW125 to SF12BW125
486.7 - SF7BW125 to SF12BW125
486.9 - SF7BW125 to SF12BW125
487.1 - SF7BW125 to SF12BW125
487.3 - SF7BW125 to SF12BW125
487.5 - SF7BW125 to SF12BW125
487.7 - SF7BW125 to SF12BW125

Downlink:

506.7 - SF7BW125 to SF12BW125
506.9 - SF7BW125 to SF12BW125
507.1 - SF7BW125 to SF12BW125
507.3 - SF7BW125 to SF12BW125
507.5 - SF7BW125 to SF12BW125
507.7 - SF7BW125 to SF12BW125
507.9 - SF7BW125 to SF12BW125
508.1 - SF7BW125 to SF12BW125
505.3 - SF12BW125 (RX2 downlink only)

2.7.4 AU915-928(AU915)

Frequency band as per definition in LoRaWAN 1.0.3 Regional document.

To make sure the end node supports all sub band by default. In the OTAA Join process, the end node will use frequency 1 from sub-band1, then frequency 1 from sub-band2, then frequency 1 from sub-band3, etc to process the OTAA join.

After Join success, the end node will switch to the correct sub band by:

- Check what sub-band the LoRaWAN server ask from the OTAA Join Accept message and switch to that sub-band
- Use the Join successful sub-band if the server doesn't include sub-band info in the OTAA Join Accept message (TTN v2 doesn't include)

2.7.5 AS920-923 & AS923-925 (AS923)

Default Uplink channel:

923.2 - SF7BW125 to SF10BW125

923.4 - SF7BW125 to SF10BW125

Additional Uplink Channel:

(OTAA mode, channel added by JoinAccept message)

AS920~AS923 for Japan, Malaysia, Singapore:

922.2 - SF7BW125 to SF10BW125

922.4 - SF7BW125 to SF10BW125

922.6 - SF7BW125 to SF10BW125

922.8 - SF7BW125 to SF10BW125

923.0 - SF7BW125 to SF10BW125

922.0 - SF7BW125 to SF10BW125

AS923 ~ AS925 for Brunei, Cambodia, Hong Kong, Indonesia, Laos, Taiwan, Thailand,

Vietnam:

923.6 - SF7BW125 to SF10BW125

923.8 - SF7BW125 to SF10BW125

924.0 - SF7BW125 to SF10BW125

924.2 - SF7BW125 to SF10BW125

924.4 - SF7BW125 to SF10BW125

924.6 - SF7BW125 to SF10BW125

Downlink:

Uplink channels 1-8 (RX1)

923.2 - SF10BW125 (RX2)

2.7.6 KR920-923 (KR920)

Default channel:

922.1 - SF7BW125 to SF12BW125

922.3 - SF7BW125 to SF12BW125

922.5 - SF7BW125 to SF12BW125

Uplink: (OTAA mode, channel added by JoinAccept message)

922.1 - SF7BW125 to SF12BW125

922.3 - SF7BW125 to SF12BW125

922.5 - SF7BW125 to SF12BW125

922.7 - SF7BW125 to SF12BW125

922.9 - SF7BW125 to SF12BW125

923.1 - SF7BW125 to SF12BW125

923.3 - SF7BW125 to SF12BW125

Downlink:

Uplink channels 1-7(RX1)

921.9 - SF12BW125 (RX2 downlink only; SF12BW125 might be changed to SF9BW125)

2.7.7 IN865-867 (IN865)

Uplink:

865.0625 - SF7BW125 to SF12BW125

865.4025 - SF7BW125 to SF12BW125

865.9850 - SF7BW125 to SF12BW125

Downlink:

Uplink channels 1-3 (RX1)
866.550 - SF10BW125 (RX2)

2.8 LED Indicator

The LLMS01 has an internal LED which is to show the status of different state.

- The sensor is detected when the device is turned on, and it will flash 4 times quickly when it is detected.
- Blink once when device transmit a packet.

2.9 Firmware Change Log

Firmware download link:

http://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/LLMS01/Firmware/

Firmware Upgrade Method:

http://wiki.dragino.com/index.php?title=Firmware_Upgrade_Instruction_for_STM32_base_products#Introduction

3. Configure LLMS01 via AT Command or LoRaWAN Downlink

Use can configure LLMS01 via AT Command or LoRaWAN Downlink.

- AT Command Connection: See [FAQ](#).
- LoRaWAN Downlink instruction for different platforms:
http://wiki.dragino.com/index.php?title=Main_Page#Use_Note_for_Server

There are two kinds of commands to configure LLMS01, 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:

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

- **Commands special design for LLMS01**

These commands only valid for LLMS01, as below:

3.1 Set Transmit Interval Time

Feature: Change LoRaWAN End Node Transmit Interval.

AT Command: AT+TDC

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

Downlink Command: 0x01

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

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

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

3.2 Set Interrupt Mode

Feature, Set Interrupt mode for GPIO_EXIT.

AT Command: AT+INTMOD

Command Example	Function	Response
AT+INTMOD=?	Show current interrupt mode	0 OK the mode is 0 = No interruption
AT+INTMOD=2	Set Transmit Interval 0- (Disable Interrupt), 1- (Trigger by rising and falling edge), 2- (Trigger by falling edge) 3- (Trigger by rising edge)	OK

Downlink Command: 0x06

Format: Command Code (0x06) followed by 3 bytes.

This means that the interrupt mode of the end node is set to 0x000003=3 (rising edge trigger), and the type code is 06.

- Example 1: Downlink Payload: 06000000 // Turn off interrupt mode
- Example 2: Downlink Payload: 06000003 // Set the interrupt mode to rising edge trigger

3.3 Get Firmware Version Info

Feature: use downlink to get firmware version.

Downlink Command: 0x26

Downlink Control Type	FPort	Type Code	Downlink payload size(bytes)
Get Firmware Version Info	Any	26	2

- Reply to the confirmation package: 26 01
- Reply to non-confirmed packet: 26 00

Device will send an uplink after got this downlink command. With below payload:

Configures info payload:

Size (bytes)	1	1	1	1	1	5	1
Value	Software Type	Frequency Band	Sub-band	Firmware Version	Sensor Type	Reserve	Message Type Always 0x02

Software Type: Always 0x03 for LLMS01

Frequency Band:

*0x01: EU868

- *0x02: US915
- *0x03: IN865
- *0x04: AU915
- *0x05: KZ865
- *0x06: RU864
- *0x07: AS923
- *0x08: AS923-1
- *0x09: AS923-2
- *0xa0: AS923-3

Sub-Band: value 0x00 ~ 0x08

Firmware Version: 0x0100, Means: v1.0.0 version

Sensor Type:

- 0x01: LSE01
- 0x02: LDDS75
- 0x03: LDDS20
- 0x04: LLMS01
- 0x05: LSPH01
- 0x06: LSNPK01

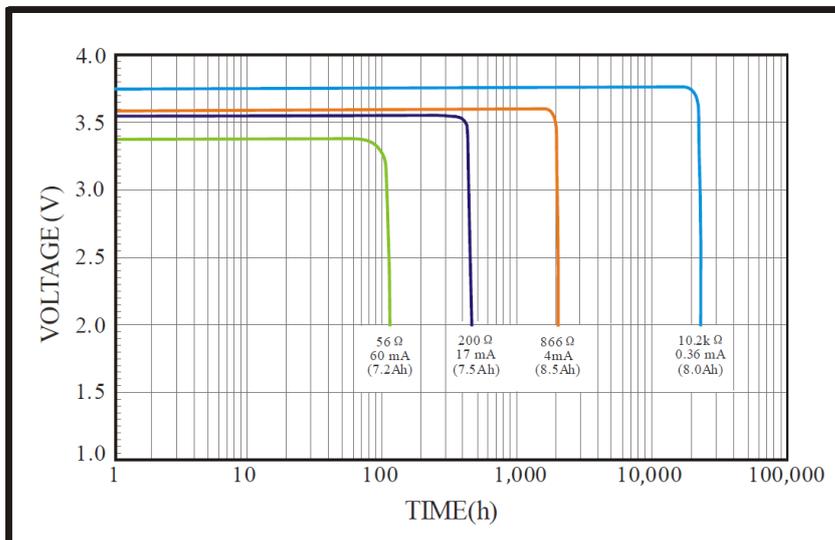
4. Battery & How to replace

4.1 Battery Type

LLMS01 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 °C (Typical value)



Minimum Working Voltage for the LLMS01:
LLMS01: 2.45v ~ 3.6v

4.2 Replace Battery

Any battery with range 2.45 ~ 3.6v can be a replacement. We recommend to use Li-SOCI2 Battery. And make sure the positive and negative pins match.

4.3 Power Consumption Analyze

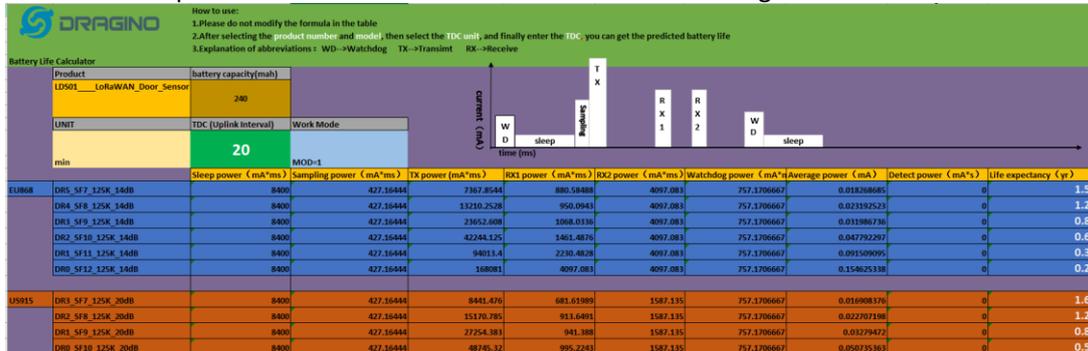
Dragino Battery powered product are all runs in Low Power mode. We have an update battery calculator which base on the measurement of the real device. User can use this calculator to check the battery life and calculate the battery life if want to use different transmit interval.

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.



The battery related documents as below:

- [Battery Dimension](#),
- [Lithium-Thionyl Chloride Battery](#) datasheet, [Tech Spec](#)
- [Lithium-ion Battery-Capacitor](#) datasheet, [Tech Spec](#)



4.3.1 Battery Note

The Li-SiCO battery is designed for small current / long period application. It is not good to use a high current, short period transmit method. The recommended minimum period for use of this battery is 5 minutes. If you use a shorter period time to transmit LoRa, then the battery life may be decreased.

4.3.2 Replace the battery

You can change the battery in the LLMS01. The type of battery is not limited as long as the output is between 3v to 3.6v. On the main board, there is a diode (D1) between the battery and the main circuit. If you need to use a battery with less than 3.3v, please remove the D1 and shortcut the two pads of it so there won't be voltage drop between battery and main board.

The default battery pack of LLMS01 includes a ER26500 plus super capacitor. If user can't find this pack locally, they can find ER26500 or equivalence, which will also work in most case. The SPC can enlarge the battery life for high frequency use (update period below 5 minutes)

5. Use AT Command

5.1 Access AT Commands

LLMS01 supports AT Command set in the stock firmware. You can use a USB to TTL adapter to connect to LLMS01 for using AT command, as below.



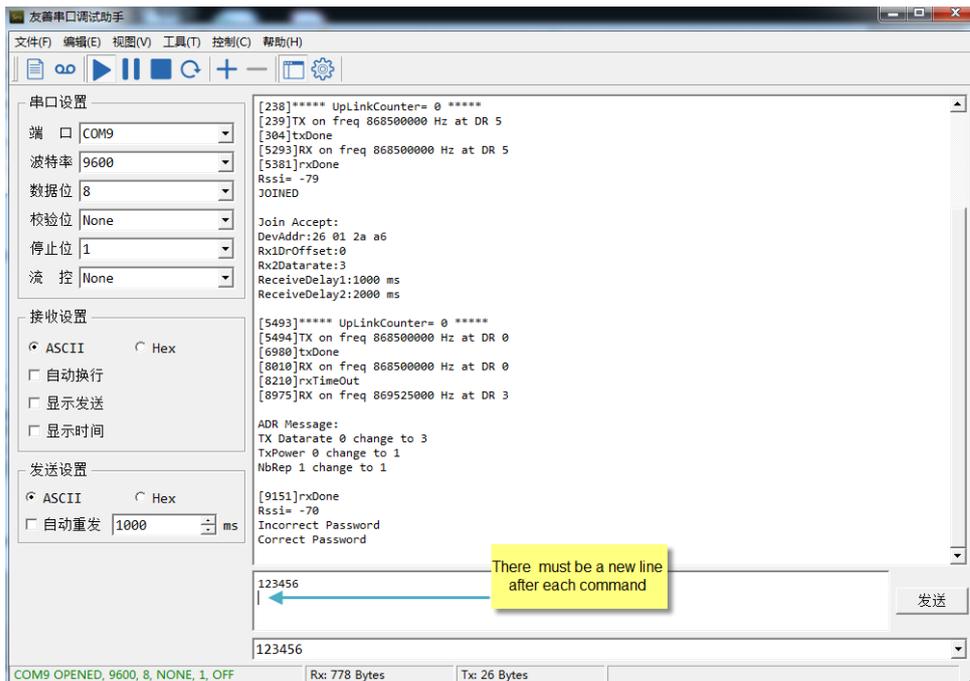
Connection:

USB TTL GND <----> GND

USB TTL TXD <----> UART_RXD

USB TTL RXD <----> UART_TXD

In the PC, you need to set the serial baud rate to **9600** to access the serial console for LLMS01. LLMS01 will output system info once power on as below:



Valid AT Command please check [Configure Device](#).

6. FAQ

6.1 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 Commands 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.

8. Order Info

Part Number: **LLMS01-XX**

XX: The default frequency band

- **AS923**: LoRaWAN AS923 band
- **AU915**: LoRaWAN AU915 band
- **EU433**: LoRaWAN EU433 band
- **EU868**: LoRaWAN EU868 band
- **KR920**: LoRaWAN KR920 band
- **US915**: LoRaWAN US915 band
- **IN865**: LoRaWAN IN865 band
- **CN470**: LoRaWAN CN470 band

9. Packing Info

Package Includes:

- LLMS01 LoRaWAN Leaf Moisture Sensor 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