



LoRaWAN Soil NPK Sensor User Manual

Document Version: 1.0 Image Version: v1.0

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1.0	Release	2021-May-10



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1. Introduction

1.1 What is LoRaWAN Soil NPK Sensor

The Dragino LSNPK01 is a LoRaWAN Soil NPK Sensor for IoT of Agriculture. It is designed to measure the Soil Fertility Nutrient and provide a plant growing reference. The probe is IP68 waterproof and can be buried into soil for long term use.

LSNPK01 detects soil's Nitrogen, Phosphorus, and Potassium use TDR method, and uploads these values via wireless to LoRaWAN IoT Server.

The LoRa wireless technology used in LSNPK01 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.

LSNPK01 is powered by 8500mAh Li-SOCI2 battery, it is designed for long term use up to 5 years.

Each LSNPK01 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 Soil Nitrogen
- ♦ Monitor Soil Phosphorus
- ♦ Monitor Soil Potassium
- ♦ 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
- ♦ IP68 rate for the Sensor Probe
- ♦ 8500mAh Battery for long term use

1.3 NPK Probe Specification

- ♦ Range 1-1999 mg/kg
- ♦ Resolution: 1 mg/kg
- ♦ Accuracy: \pm 2%FS
- ♦ Material: Stainless Steel Probe
- ♦ IP68 Protection
- ♦ Length: 2 meters

1.4 Applications

♦ Smart Agriculture

1.5 Pin mapping and power on



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2. Configure LSNPK01 to connect to LoRaWAN network

2.1 How it works

The LSNPK01 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 LSNPK01. 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 <u>use AT Commands</u> to set the keys in the LSNPK01.

2.2 Quick guide to connect to LoRaWAN server (OTAA)

Following is an example for how to join the <u>TTN v3 LoRaWAN Network</u>. Below is the network structure; we use the <u>LG308</u> as a LoRaWAN gateway in this example.



The LG308 is already set to connected to <u>TTN network</u>, so what we need to now is configure the TTN server.

Step 1: Create a device in TTN with the OTAA keys from LSNPK01. Each LSNPK01 is shipped with a sticker with the default device EUI as below:

g .	RAGINO	
DEV ADDR	013135-6	n×n
APP KIN.	JF77ADE34BCAAD4	
APP KEY	\$74E27EABAECPEE	DED INCOMTAND IN
APPSKEY	C948A567212585248	R2EDSTFARDCORD
SETSKEY	FFA2F546BFFF65D	DALF PLANKARDS AV



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

Register the device

	Manually			
Preparation				
Activation mode *				
 Over the air activation (OTAA) 				
 Activation by personalization (ABP) 				
Multicast				
O not configure activation				
LoRaWAN version ⑦*				
MAC V1.0.3		~	1	
Network Server address				
eu1.cloud.thethings.network				
Application Server address				
eu1.cloud.thethings.network				
External Join Server 🗇				
Enabled				
Join Server address				

Add APP EUI and DEV EUI

From The LoRaWAN Device Repositor	y Manually		
Basic settings End device ID's, Name and Description	2 Network layer settings Frequency plan, regional parameters, end device class and session keys.	Join settings Root keys, NetID and kek labels.	
End device ID ⑦ *			
АррЕUT⑦* 	9		
DevEUI			
End device name			
End device description			
Description for my new end device			
Optional end device description; can als	to be used to save notes about the end device		

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Add APP EUI in the application

Register end device

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 ⑦ *		
Europe 863-870 MHz (SF12 for RX2)	· •	
LoRaWAN version ⑦*		
MAC V1.0.3		
Regional Parameters version ⑦*		
PHY V1.0.3 REV A		
LoRaWAN class capabilities 🕖		
Supports class B		
Supports class C		
Advanced settings 🗸		
 Basic settings 		Join settings >

Add

-		
Basic settings End device ID's, Name and Description	Network layer settings Frequency plan, regional parameters, end device class and session keys.	Join settings Root keys, NetID and kek labels.
Root keys AppKey ⑦ *		
BD 72 1D AC F3 CC AB 67 72 8	SD 7A F5 4D DF 30 8B	



Step 2: Power on LSNPK01

Put a Jumper on JP2 to power on the device. (The Switch must be in FLASH position).



Step 3: The LSNPK01 will auto join to the TTN network. After join success, it will start to upload messages to TTN and you can see the messages in the panel.

11:12:44	Store upstream data message	DevAddr:	26 08 1A 80		
↑ 11:12:44	Forward data message to Application S.,	DevAddr:	26 0B 1A 80	MAC payload: 00 E3 C8 10 A6 24 23 68 D2 C0 3E FPort: 2 SNR: 0.2 RSSI: -91 Bandwidth: 125000	
↑ 11:12:44	Forward uplink data message	DevAddr:	26 08 1A 80	Payload: { Bat: "3.338 V", Interrupt_flag: 0, K_SOIL: 0, Message_type: 1, N_SOIL: 161, P_SOIL: 220, TempC_DS18820: "0.00 *C" } 00 04 00 00 04 00 00 00 00 00 00	1
↑ 11:12:44	Receive uplink data message	DevAddr:	26 08 1A 80		
↑ 11:12:44	Successfully processed data message	DevAddr:	26 08 1A 80	FCnt: 3 FPort: 2 MAC payload: 00 E3 C8 10 A6 24 23 66 02 C0 3E Bandwidth: 126000 SNR: 0.2 RSSI: -91 Raw payload: 40 00 1A 00 26 62 03 00 03 07 02 00 E3 C8	4
⇔11:12:44	Link ADR accept received	DevAddr:	26 08 1A 80		
↑ 11:12:44	Receive data message	DevAddr:	26 08 1A 80	FCnt: 3 FPort: 2 MAC payload: 00 E3 C8 10 A6 24 23 66 02 C0 3E Bandwidth: 126000 SNR: 6.2 RSSI: -91 Raw payload: 40 80 1A 08 26 82 83 60 83 87 82 80 E3 C8	ł
⇔11:12:14	Link ADR request enqueued	DevAddr:	26 08 1A 80		
J. 44-42-44	Russessfully askeduled data devaliate	Daughdage -	24 00 44 00		



2.3 Uplink Payload

LSNPK01 will uplink payload via LoRaWAN with below payload format:

Uplink payload includes in total 11 bytes.

Size (bytes)	2		2	2	2	2	1
Value	<u>BAT</u>	<u>Tempe</u> (Optio	<u>rature</u> nal <u>)</u>	<u>Soil</u> <u>Nitrogen</u>	<u>Soil</u> Phosphorus	<u>Soil</u> <u>Potassium</u>	Digital Interrupt And Message Type
11:12:44 Store up	stream data messa	ge Dor	vAddr: 26 08 1A 80				
\uparrow 11:12:44 $$ Forward data message to Application S.		pplication S Dev	vAddr: 26 08 1A 80	MAC payload: OD E3 CB 10 A	6 24 23 68 D2 C0 3E FPort: 2 SNR: 8	.2 RSSI: -91 Bandwidth: 125000	
↑ 11:12:44 Forward uplink data message		ge Der	vAddr: 26 08 1A 80	Payload: { Bat: "3.338 V",	, Interrupt_flag: 0, K_SOIL: 0, Mess	age_type: 1, N_SOIL: 161, P_SOIL: 220,	TempC_DS18829: "0.00 *C" } OD 0A 00 00 A1 00 DC 00 00 1
↑ 11:12:44 Receive uplink data message		ge Der	vAddr: 26 08 1A 89				
↑ 11:12:44 Successfully processed data message		ta message Dom	vAddr: 26 08 1A 80	FCnt: 3 FPort: 2 MAC pa	ayload: 0D E3 C8 10 A6 24 23 68 D2 C0 3	Bandwidth: 125000 SNR: 8.2 RSSI:	-91 Ram payload: 40 80 1A 68 26 82 03 00 03 07 02 00 E3 CB 1
<⇒11:12:44 Link ADR	accept received	Der	vAddr: 26 08 1A 80				
↑ 11:12:44 Receive	data message	Der	vAddr: 26 08 1A 80	FCnt: 3 FPort: 2 MAC pa	ayload: 0D E3 C8 10 A6 24 23 68 D2 C0 3	Be Bandwidth: 125000 SNR: 8.2 RSSI:	-91 Raw payload: 40 80 1A 08 26 82 03 00 03 07 02 0D E3 CB 1
↔ 11:12:14 Link ADR	request enqueued	Der	vAddr: 26 08 1A 80				
J. 11-12-12-1		ta davaliak Do					

2.3.1 Battery Info

Check the battery voltage for LSNPK01. Ex1: 0x0B45 = 2885mV Ex2: 0x0B49 = 2889mV

2.3.2 DS18B20 Temperature sensor

This is optional, user can connect external DS18B20 sensor to the $\pm 3.3v$, 1 - wire and GND pin. and this field will report temperature.

Example:

If payload is: 0105H: (0105 & FC00 == 0), temp = 0105H /10 = 26.1 degree If payload is: FF3FH : (FF3F & FC00 == 1), temp = (FF3FH - 65536)/10 = -19.3 degrees.

2.3.3 Soil Nitrogen

Got the Soil Nitrogen, Unit: mg/kg Example:

0x0020(H) = 32(D) = 32mg/kg

2.3.4 Soil Phosphorus

Got the Soil Phosphorus, Unit: mg/kg Example:

0x0025(H) = 37(D) = 37mg/kg

2.3.5 Soil Potassium

Got the Soil Potassium, Unit: mg/kg Example:

0x0030(H) = 48(D) = 48mg/kg



2.3.6 Interrupt Pin & Message Type

The lower four bits of this data field shows if this packet is generated by interrupt or not. <u>Click</u> <u>here</u> for the hardware and software set up.

Example:

0x(x0): Normal uplink packet. 0x(x1): Interrupt Uplink Packet.

The higher four bits of this data field shows the message type:

Message Type Code	Description	Payload
0x(1x)	Normal Uplink	Normal Uplink Payload
0x(2x)	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.

Overview	Overview Live data Messaging Location Payload formatters Claiming General settings
Lend devices	Uplink Downlink
1. Live data	
<> Payload formatters ~	These payload formatters are executed on uplink messages from this end device and take precedence over application level payload formatters.
久 Integrations 🗸	Formatter type
Collaborators	Use application payload formatter None Javascript GRPC service CayenneLPP Repository
↔ API keys ✿ General settings	<pre>Formatter parameter* 1 function decodeUplink(input) [4 2 return f 4 data: 1</pre>
< Hide sidebar	Save changes

The payload decoder function for TTN is here: LSNPK01 TTN Payload Decoder:

https://www.dragino.com/downloads/index.php?dir=LoRa End Node/LSNPK01/Dec oder/

2.4 Uplink Interval

The LSNPK01 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

<u>DATACAKE</u> provides a human friendly interface to show the sensor data, once we have data in TTN, we can use <u>DATACAKE</u> to connect to TTN and see the data in DATACAKE. 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 DATACAKE you will need to add integration. To add the DATACAKE integration, perform the following steps:

rview devices	Choose webhook templa	te		
re data yload formatters ~	🔅 ubidots	Ø	Тадо	III Akenza
MQTT Webhooks = Pub/Subs	Ubidots Integrate with Ubidots over UbiFunctions	Datacake Send data to Datacake via TTI adapter	TagoIO Integrate with TagoIO	Akenza Core Integrate with Akenza Core
Storage Integration AWS IoT LoRa Cloud laborators keen	☐ ThingSpeak	i Qubitro	thethings-10	

Add custom webhook

Template information

	Datacake Send data to Datacake via TTI adapter							
	About Datacake 🖾 Documentation 🖾							
Template set	tings							
Webhook ID*								
my-new-dataca	my-new-datacake-webhook							
Token*								
Datacake API Token								
Create datac	ake webhook							

Step 3: Create an account or log in Datacake. Step 4: Create LSNPK01 product.



\times Add Device ୍ୱ 0 AP) Particle PARTICLE PINCODE LoRaWAN API D Zero D Zero LTE STEP 1 STEP 2 STEP 3 STEP 4 Product Network Server Devices 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

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

npk

Next



\times Add Device (ବ) API 3 1 Particle PARTICLE LoRaWAN API D Zero D Zero LTE PINCODE STEP 1 STEP 2 STEP 3 STEP 4 Product Network Server Devices Plan

Network Server

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

The Things Stack V3 TTN V3 / Things Industries	Uplinks Downlinks
The Things Network V2 The old Things Network	Uplinks Downlinks
🔵 ø helium Helium	Uplinks Downlinks
	Uplinks Downlinks
kerlink Kerlink Wanesy	Uplinks
Showing 1 to 5 of 8 results	Previous Next



L

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Add I	Device						\times
	LoRaWAN	Particle PARTICLE	API	D Zero	D Zero LTE	PINCODE	
STEP 1 Produc	st	STEP 2 Network S	Server	STEP 3 Devices		<mark>STEP 4</mark> Plan	
Add I Enter o	Devices one or more Lo	RaWAN Device	EUIs and the	names they w	/ill have on Da	atacake.	

DEVEUI	NAME
(示) 46 41 43 14 65 46 49 87 8 bytes	npk
+ Add another device Consis	tent with DEUI on TTN
	Back

Step 5: add payload decode Download Datacake decoder from: <u>https://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/LSNPK01/Decoder/</u>

Fleet > npk			
npk			
Location	Serial Number 4641431465464987	Last update Wed May 12 2021 15:43:35 GMT+0800	Product Slug © npk
Dashboard History Downlinks	Configuration Debug Rules Permissions		
General Configuration			
Name			
npk			
Location			



www.dragino.com

Payload Decoder	Product-wide setting
<pre>When your devices sends data, the puyload will be passed to the puyload decoder, alongside the event's name. The puyload decoder then transforms it to measurements. ***********************************</pre>	
Payload Port	Try Decoder

ields				Add
Name	Identifier	Туре	urrent alue	
BAT	BATTERY	Float	326	Mo
SOIL_N	SOIL_N	Integer	23	Mo
SOIL_P	SOIL_P	Integer	41	Mor
SOIL_K	SOIL_K	Integer	46	Mor

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

ok							
ation		Serial Number 46414314654649	87	Last o Wed	^{ipdate} May 12 2021 15:31:35	GMT+0800	Product Slug ⊕ npk
ashboard History Downlin	ks Configuration	Debug Rules Pe	rmissions				
BAT a few seconds ago							
3 2.5 2 1.5 1.5							
2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12
500 400 300 200 100 0 2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12
P a few seconds ago 400-							
300 200 100							
2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12
N a few seconds ago							
300 250 200 150 100							
2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12	2021/5/12

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2.6 Frequency Plans

The LSNPK01 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.

2.6.1 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)

2.6.2 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)

2.6.3 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

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507.7 - SF7BW125 to SF12BW125 507.9 - SF7BW125 to SF12BW125 508.1 - SF7BW125 to SF12BW125 505.3 - SF12BW125 (RX2 downlink only)

2.6.4 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)

2.6.5 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)

2.6.6 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)

2.6.7 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)

2.7 LED Indicator

The LSNPK01 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.

2.8 Installation in Soil

Measurement the soil surface



Choose the proper measuring position. Avoid the probe to touch rocks or hard things. Split the surface soil according to the measured deep. Keep the measured as original density. Vertical insert the probe into the soil to be measured. Make sure not shake when inserting.

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Dig a hole with diameter > 20CM. Horizontal insert the probe to the soil and fill the hole for long term measurement.





2.9 Firmware Change Log

Firmware download link:

http://www.dragino.com/downloads/index.php?dir=LoRa_End_Node/LSNPK01/Firmware/

Firmware Upgrade Method:

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



3. Configure LSNPK01 via AT Command or LoRaWAN Downlink

Use can configure LSNPK01 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 LSNPK01, 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 LSNPK01

These commands only valid for LSNPK01, as below:

3.1Set 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



3.2Set 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) 	ОК

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

3.3Get 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: <u>Configures info payload:</u>

Size (bytes)	1	1	1	2	1	4	1
Value	Software Type	Frequency Band	Sub-band	Firmware Version	Sensor Type	Reserve	Message Type Always 0x(2x)

Software Type: Always 0x03 for LSNPK01

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

4.1Battery Type

LSNPK01 is equipped with a <u>8500mAH ER26500 Li-SOCI2 battery</u>. 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 $+20^{\circ}C$ (Typical value)

LSNPK01 LoRaWAN Soil NPK Sensor User Manual



Minimum Working Voltage for the LSNPK01: LSNPK01: 2.45v ~ 3.6v

4.2Replace Battery

Any battery with range $2.45 \sim 3.6v$ can be a replacement. We recommend to use Li-SOCl2 Battery. And make sure the positive and negative pins match.

4.3Power 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.

		How to use:									
	aragino	1.Please do not modify the formula in the table									
		2.After selecting the product number and model, then select the TDC unit, and finally enter the TDC, you can get the predicted battery life									
		3.Explanation of abbreviations : WD>Watchdog TX>Transimt RX>Receive									
Battery Life	e Calculator										
	Product	battery capacity(mah)									
	LDS01LoRaWAN_Door_Sensor	240		CUITTER	Ę	R	R				
	UNIT	TDC (Uplink Interval)	Work Mode		N DE	1	2 W				
		20		ma L	D sleep K		В	sleep			
	min	20	MOD=1	,	ime (ms)						
		Sleep power (mA*ms)	Sampling power (mA*ms)	TX power (mA*ms)	RX1 power (mA*ms)	RX2 power (mA*ms)	Watchdog power (mA*	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	
	DR4_SF8_125K_14dB	8400	427.16444	13210.2528	950.0943	4097.083	757.1706667	0.023192523	0	1	
	DR3_SF9_125K_14dB	8400	427.16444	23652.608	1068.0336	4097.083	757.1706667	0.031986736	0	9	8 .0
	DR2_SF10_125K_14dB	8400	427.16444	42244.125	1461.4876	4097.083	757.1706667	0.047792297	0	9	0.6
	DR1_SF11_125K_14dB	8400	427.16444	94013.4	2230.4828	4097.083	757.1706667	0.091509095	0	9	. 3
	DR0_SF12_125K_14dB	8400	427.16444	168081	4097.083	4097.083	757.1706667	0.154625338	0	(S	0.2
U\$915	DR3_SF7_125K_20dB	8400	427.16444	8441.476	681.61989	1587.135	757.1706667	0.016908376		1	
	DR2_SF8_125K_20dB	8400	427.16444	15170.785	913.6491	1587.135	757.1706667	0.022707198		1	.2
	DR1_SF9_125K_20dB	8400	427.16444	27254.383	941.388	1587.135	757.1706667	0.03279472		9	.8
	DR0 SF10 125K 20dB	8400	427.16444	48745.32	995.2243	1587.135	757.1706667	0.050735363		(

The battery related documents as below:

- Battery Dimension,
- <u>Lithium-Thionyl Chloride Battery</u> datasheet, <u>Tech Spec</u>
- 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 LSNPK01. 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 LSNPK01 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

LSNPK01 supports AT Command set in the stock firmware. You can use a USB to TTL adapter to connect to LSNPK01 for using AT command, as below.



In the PC, you need to set the serial baud rate to **9600** to access the serial console for LSNPK01. LSNPK01 will output system info once power on as below:

₩ 友善串口调试助手		×
文件(F) 编辑(E) 视图(V) 工具(T) 控制(C) 帮助(H)	
「串口设置	[238]***** UpLinkCounter= 0 *****	•
端 口 COM9	[239]TX on freq 868500000 Hz at DR 5 [304]txDone	
波特态 9699	[5293]RX on freq 868500000 Hz at DR 5	
	Rssi= -79	
数据位 8 ▼	JOINED	
校验位 None 👤	Join Accept: Devéddo:26 01 2a a6	
停止位 1 🔹	Rx1DrOffset:0	
流控 None 💌	ReceiveDelay1:1000 ms	
	ReceiveDelay2:2000 ms	
接收设置————————————————————————————————————	[5493]***** UpLinkCounter= 0 *****	
• ASCII • Hex	[6980]txDone	
□ 自动换行	[8010]RX on freq 868500000 Hz at DR 0 [8210]rxTimeOut	
□ 显示发送	[8975]RX on freq 869525000 Hz at DR 3	
□ 显示时间	ADR Message:	
	TxPower 0 change to 1	
┌──发送设置	NbRep 1 change to 1	
← ASCII C Hex	[9151]rxDone	
□ 自动重发 1000 ÷ ms	Incorrect Password	
	Correct Password	-
	There must be a new line	
		发送
	123456	•
COM9 OPENED, 9600, 8, NONE, 1, OFF	Rx: 778 Bytes Tx: 26 Bytes	

Valid AT Command please check <u>Configure Device</u>.



6. FAQ

6.1How to change the LoRa Frequency Bands/Region

You can follow the instructions for <u>how to upgrade image</u>. 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: LSNPK01-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:

LSNPK01 LoRaWAN Soil NPK 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