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LLDS40-LoRaWAN LiDAR ToF Distance Sensor User Manual

Last modified by Xiaoling (/xwiki/bin/view/XWiki/Xiaoling) on 2023/05/25 14:04



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(http://wiki.dragino.com/xwiki/bin/download/Main/User% LoRaWAN%20LiDAR%20ToF%20Distance%20Sensor 1.jpeg?width=574&height=574&rev=1.1)

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1. Introduction

1.1 What is LoRaWAN LiDAR ToF Distance Sensor

The Dragino LLDS40 is a LoRaWAN LiDAR ToF (Time of Flight) Distance Sensor for Internet of Things solution. It is capable of measuring the distance to objects as c laser induction technology for distance measurement.

The LLDS40 can be applied to scenarios such as horizontal distance measurement, parking management system, object proximity and presence detection, intelligent traobstacle avoidance, automatic control, sewer, etc.

It detects the distance between the measured object and the sensor, and uploads the value via wireless to LoRaWAN IoT Server.

The LoRa wireless technology used in LLDS40 allows device to send data and reach extremely long ranges at low data-rates. It provides ultra-long range spread spectru immunity whilst minimizing current consumption.

LLDS40 is powered by 8500mAh Li-SOCI2 battery, it is designed for long term use up to 5 years.

Each LLDS40 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.

LLDS40 in a LoRaWAN Network



Dash Board

1.2 Features

- LoRaWAN 1.0.3 Class A
- Ultra-low power consumption
- Laser technology for distance detection
- Measure Distance: 0.1m ~ 40m @ 90% Reflectivity
- Monitor Battery Level
- Bands: CN470/EU433/KR920/US915/EU868/AS923/AU915/IN865
- AT Commands to change parameters

- Uplink on periodically
- Downlink to change configure
- 8500mAh Battery for long-term use

1.3 Probe Specification

- Storage temperature: -30°C~80°C
- Operating temperature: -20°C~60°C
- Measure Distance:
 - 0.1m ~ 40m @ 90% Reflectivity
 - 0.1m ~ 13.5m @ 10% Reflectivity
- Distance resolution: 1cm
- Ambient light immunity: 100klux
- Enclosure rating : IP65
- Light source : VCSEL
- Central wavelength : 850nm
- FOV : 3°
- Material of enclosure : ABS+PC
- Wire length : 75cm

1.4 Probe Dimension



1.5 Applications

- Horizontal distance measurement
- Oil Tank
- Object proximity and presence detection
- Intelligent trash can management system
- Robot obstacle avoidance
- Automatic control
- Sewer

1.6 Pin mapping and power on



2. Configure LLDS40 to connect to LoRaWAN network

2.1 How it works

The LLDS40 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 server and power on the LLDS40. 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 LLDS

2.2 Quick guide to connect to LoRaWAN server (OTAA)

Following is an example for how to join the TTN v3 LoRaWAN Network (https://console.cloud.thethings.network/) . Below is the network structure; we use the LG308 (http://www.dragino.com/products/lora/item/140-lg308.html) as a LoRaWAN gateway in this example.

LLDS40 in a LoRaWAN Network



Dash Board

The LG308 is already set to connect to TTN network (https://console.cloud.thethings.network/) , so what we need to now is configure the TTN server.

Step 1: Create a device in TTN with the OTAA keys from LLDS40.

Each LLDS40 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 screenshot:

Register the device

Register end device

Preparation				
Activation mode*				
 Over the air activation (OTAA) 				
 Activation by personalization (ABP) 				
Multicast				
Do not configure activation				
LoRaWAN version 🗇 *				
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

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 🗇 *			
lsnpk01			
AppEUI () * 00 DevEUI () *			
End device name			
LSNPK01			
End device description			
Description for my new end device			
Optional end device description; can also	o be used to save notes about the end device	e	

Add APP EUI in the application

Register end device

End device ID's, Name and Description	Frequency plan, regional parameters, end device class and session keys.	Root keys, NetiD and kek labels.
Frequency plan ⑦*		
Europe 863-870 MHz (SF12 for RX2)		
LoRaWAN version ② *		
MAC V1.0.3		
Regional Parameters version 🔊 *		
PHY V1.0.3 REV A		
LoRaWAN class capabilities 🗇		
Supports class B		
Supports class C		
Advanced settings 🗸		
C C		

Add APP KEY

From The LoRaWAN Device Repository Manually Basic settings Image: Comparison of the setting set
Basic settings Network layer settings 3 Join settings
End device ID's, Name and Frequency plan, regional Root keys, NetID and kek Description parameters, end device labels. class and session keys. class and session keys. labels.
Root keys
AppKey ③ ⁻ BD 72 1D AC F3 CC AB 67 72 8D 7A F5 4D DF 30 8B

Step 2: Power on LLDS40

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



Step 3: The LLDS40 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.

	↑ 2	Ilds40 ID: Ilds40 ID: Ilds40	14 app ()			
	0	verview Live data Messaging	Location Payload formatters Claiming General settings			
ті	me	Туре	Data preview	Verbose stream 🔿	🛓 Export as JSON 🛛 🔢	Pause 📲 Clear
1 15	:54:20	Forward uplink data message	Bat: 3.357, Interrupt_flag: 0, Lidar_distance: 365, Lidar_signal:	211, Lidar_temp: 28,	Message_type: 1, TempC_D	518820: "NULL" }
↑ 15	54:20	Successfully processed data	DevAddz: 26 00 05 93 🗘 🐞			
↑ 15	52:20	Forward uplink data message	<pre>3at: 3.359, Interrupt_flag: 0, Lidar_distance: 361, Lidar_signal: 2</pre>	224, Lidar_temp: 28,	Message_type: 1, TempC_D	518820: "NULL" }

2.3 Uplink Payload

LLDS40 will uplink payload via LoRaWAN with below payload format:

Uplink payload includes in total 11 bytes.

Size(bytes)	2	2	2	2	1	1	1
Value	BAT	Temperature DS18B20	Distance	Distance signal strength	Interrupt flag	LiDAR temp	Message Type

1	D: Ilds40				
<u>†</u> 2	21 ↓ n/a • Last activity 31 second	is ago 🗇			
0	verview Live data Messaging	Location Payload formatters Claiming General settings			
Time	Туре	Data preview	Verbose stream	≜ Export as JSON III Pause	Clear
↑ 15:54:20	Forward uplink data message	Bat: 3.357, Interrupt_flag: 0, Lidar_distance: 365, Lidar_signal	211, Lidar_temp: 28, M	essage_type: 1, TempC_DS18820: *	NULL" }
↑ 15:54:20	Successfully processed data	DevAddz: 26 00 05 93 🗠 🐞			
↑ 15:52:20	Forward uplink data message	<pre>3at: 3.359, Interrupt_flag: 0, Lidar_distance: 361, Lidar_signal:</pre>	224, Lider_temp: 28, Me	Issage_type: 1, TempC_D518820: "	NULL" }

2.3.1 Battery Info

Check the battery voltage for LLDS40.

Ex1: 0x0B45 = 2885mV

Ex2: 0x0B49 = 2889mV

2.3.2 DS18B20 Temperature sensor

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

Indicates the distance value measured by the LLDS40. The default unit is cm and the range is 0-4000.

If the data you get from the register is 0x0B 0xEA, the distance between the sensor and the measured object is 0BEA(H) = 3050 (D)/10 = 305cm.

2.3.4 Distance signal strength

Refers to the signal strength, the default output value will be between 0-65535. When the ranging gear is fixed, the farther the ranging, the lower the signal strength.

In actual use, when the signal strength value Strength≤60, the measured value of Dist is considered unreliable, and the default output is 4500. When the signal strength is and the actual distance is 45~60m, the output value of Dist is 4500. When the signal strength is greater than 60 and the actual distance is more than 60m, there will be ov abnormal values.

Example:

If payload is: 01D7(H)=471(D), distance signal strength=471, 471>100,471≠65535, the measured value of Dist is considered credible.

Customers can judge whether they need to adjust the environment based on the signal strength.

1) When the sensor detects valid data:

1		1s40 Ilds40								
	↑ 29 ↓ 2	 Last activity 	ty 1 minute ago	0						
	Overview	Live data	Messaging	Location	Payload formatters	Claiming	General settings			
Time	Туре			Data preview	I.			Verbose stream 🔿 🗙	Export as JSON I	
▶ 16:01:	20 Forward	uplink data	a message	Bat: 3.359	9, Interrupt_flag: 6), Lidar_dis	tance: <mark>353</mark> , Lidar_signa	l: 240, Lidar_temp: 29, №	lessage_type: 1, Temp	(

2) When the sensor detects invalid data:

4	iD: I	s40 Ilds40										
-	29 🗸 2	 Last activit 	y 16 seconds a	igo 💿								
	Overview	Live data	Messaging	Location	Payload formatters	Claiming	General set	tings				
Time	Туре			Data preview					Verbose str	eam 🔿 🗙	🛓 Export as	JSON
↑ 16:14:3	9 Forward	uplink data	message	Bat: 3.359,	Interrupt_flag: 0,	Lidar_dist	ance: 4500,	Lidar_signal:	65535, Lid	lar_temp: 29,	Message_ty	ре: 1 , Те

3) When the sensor is not connected:

	ild ID:	1s40 Ilds40									
	↑ 29 ↓2	 Last activi 	ty 3 minutes ag	go ②							
	Overview	Live data	Messaging	Location	Payload formatters	Claiming	General setting	<u>zs</u>			
Time	Туре			Data preview					Verbose stream 🔵	🗴 生 Expor	t as JSON
↑ 16:02:	24 Forward	uplink dat	a message	{ Bat: 3.359	, Interrupt_flag:	0, Lidar_di	stance: 0, Lida	ar_signal:	65534, Lidar_temp: 0	, Message_ty	pe: 1, Temp

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.

Note: The Internet Pin is a separate pin in the screw terminal. See pin mapping.

Example:

0x00: Normal uplink packet.

0x01: Interrupt Uplink Packet.

Characterize the internal temperature value of the sensor.

Example:

If payload is: 1C(H) <<24>>24=28(D),LiDAR temp=28°C. If payload is: F2(H) <<24>>24=-14(D),LiDAR temp=-14°C.

2.3.7 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

2.3.8 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
🙏 End devices		Uplink Downlink
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	~	s Eormitter hune
Collaborators		Use application payload formatter None Javascript GRPC service CayenneLPP Repository
↔ API keys		<pre>Formatter parameter* 1 function decodeUplink(input) { 3 data: { 4 bytes: input.bytes 5 }, 6 warnings: [], 7 errors: [] 8 }; 9 }</pre>
< Hide sidebar		Save changes

The payload decoder function for TTN is here:

LLDS40 TTN Payload Decoder: https://github.com/dragino/dragino/end-node-decoder/tree/main/LLDS40 (https://github.com/dragino/dragino-end-node-decoder/tree/main/LLDS40 (https://github.com/dragino

2.4 Uplink Interval

The LLDS40 by default uplink the sensor data every 20 minutes. User can change this interval by AT Command or LoRaWAN Downlink Command. See this link: Change (/xwiki/bin/view/Main/End%20Device%20AT%20Commands%20and%20Downlink%20Command/)

2.5 Show Data in DataCake IoT Server

DATACAKE (https://datacake.co/) provides a human friendly interface to show the sensor data, once we have data in TTN, we can use DATACAKE (https://datacake.cc 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 a

view levices	Choose webhook templa	ite		
fata ad formatters v rations	🔅 ubidots	Ø	Tago	
ebhooks e ub/Subs	Ubidots Integrate with Ubidots over UbiFunctions	Datacake Send data to Datacake via TTI adapter	TagolO Integrate with TagolO	Akenza Core Integrate with Akenza Core
orage integration NS IoT IRa Cloud Jorators	C ThingSpeak	i Qubitro	thethings-10	

Add custom webhook

Template information



Datacake Send data to Datacake via TTI adapter About Datacake 2 | Documentation 2

Template settings

Webhook ID* my-new-datacake-webhook Token* Datacake API Token Create datacake webhook

Step 3: Create an account or log in Datacake.

Step 4: Create LLDS40 product.

0.000			
STEP 1 Product	STEP 2 Network Server	STEP 3 Devices	STEP 4 Plan
Datacake Prod	uct		
You can add device	es to an existing product on	Datacake, create a	new empty product or start
one of the template more) between dev	es. Products allow you to si ices.	nare the same config	guration (fields, dashboard
New Product fr	om Existing	Product	New Product
template	Add dev	ices to an	Create new empty
from a templat	duct existing	product	product
New Product			
If your device is not	available as a template, ye	ou can start with an	empty device. You will have
create the device device device de	etinition (tields, dashboard) and provide the pa	yload decoder in the devic
Product Name			
LLDS12			

Add Device



Network Server

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

The Things Stack V3 TTN V3 / Things Ind	ustries C	ownlinks
The Things Network	V2 vork	Downlinks
🔿 🧑 helium Helium	Uplinks C	Downlinks
LORIOT	Uplinks	Downlinks
kerlink Kerlink Wanesy		Uplinks
Showing 1 to 5 of 8 results	Previous	Next
	Back	Next

×

Add Device				×	
6	🖌 (im)		050		
ሟ	Particle				
LORAWAN	PARTICLE API	D Zero D Zer	TO LIE PINCODE	- 11	
STEP 1 Product	STEP 2 Network Server	STEP 3 Devices	STEP 4 Plan		
Enter one or more	LoRaWAN Device EUIs and th	e names they will have	e on Datacake.		
DEVEUI		NAME			
(m) 21 21 2	24 25 35 34 14 8 bytes	🛍 LLDS12			
+ Add another	device			_	
			Back		

Step 5: add payload decode

Location -	Serial NA840	Number 4166A18219CF	Last update Mon May 31 2021 19 GMT+0800	27:51 Product Slug (D) dragino-Idds75-6	
Dashboard new	Legacy Dashboard	History Downlinks	Configuration Debug Ru	les Permissions	
General Configura	tion				
Name					
ldd75-test					
Location			Ň		
Tags You can use tags to organ	nize your devices and create f	ilters on the dashboard			
Add tag					
Metadata Metadata is displayed on	the device overview and can	be used in dashboards	æ		

Payload Decoder				Product-wide setting
When your devices sends data, the payload will be passed to the payload decoder,	alongside the event's name. The payload decoder then tr	insforms it to measurements.		
<pre>' function Decoder()Uters, purt) { ' // (error) of bytes to an object of 'fields. ' // (error) of bytes to an object of 'fields. ' ' within-(tytes[0](0] tytes[1]) & decoder() ' within the tytes[1](0] tytes[1](0</pre>				
Padoad			Port	
Payload			1	Try Decoder
Output	console.log Output	Recognized measuremen	ts	0

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

Location	Serial Number A8404166A18219CF	Last update Mon May 31 2 GMT+0800	021 19:27:51	© © dragino-Idds75-6	
Dashboard new	Legacy Dashboard History Downlink	s Configuration Debu	g Rules Perm	issions	
We have introduce	ed a new and more powerful way to create dash	boards. Try out the new dashl	board builder by click	ing the first Dashboard tab above.	
Distance			Battery Volta	ige	
	2,799 mm			3 Volt	
	Last Update: 19 minutes ago			Last Update: 19 minutes ago	
Sensor Status					
		Sens	sor OK		
		Last Update	e: 19 minutes ago		
Trend					
3000					
1500 - 750 -					C

2.6 Frequency Plans

The LLDS40 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:

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-ba 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 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-ba 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 LLDS40 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 transmits a packet.

2.8 Firmware Change Log

Firmware download link: https://www.dropbox.com/sh/zjrobt4eb6tju89/AADPX7jC7mLN2dlvV-Miz3nFa?dl=0 (https://www.dropbox.com/sh/zjrobt4eb6tju89/AADPX7jC7 Firmware Upgrade Method: Firmware Upgrade Instruction (/xwiki/bin/view/Main/Firmware%20Upgrade%20Instruction%20for%20STM32%20base%20products/)

3. LiDAR ToF Measurement

3.1 Principle of Distance Measurement

The LiDAR probe is based on TOF, namely, Time of Flight principle. To be specific, the product emits modulation wave of near infrared ray on a periodic basis, which will I product obtains the time of flight by measuring round-trip phase difference and then calculates relative range between the product and the detection object, as shown below



Figure 1 Schematics of TOF Principle

3.2 Distance Measurement Characteristics

The detection angle of the LLDS40 is 3 degrees, and the size of the light spot at different distances is the side length of the detection range. The size of the light spot at d detection range. The side length of the detection range (the shape is square), as shown.

Distance(m)	1	2	3	5	7	10	20	30	40
Detection range side length (cm)	5	10	16	26	37	52	105	156	208

Note that generally, the side length of the detected target object should be greater than the side length of the detection range of the LLDS40; when the detected object is length; when the detected object is smaller than the detection range side length, the effective range of the radar will be reduced.

3.3 Notice of usage:

Possible invalid /wrong reading for LiDAR ToF tech:

- Measure high reflectivity object such as: Mirror, Smooth ceramic tile, static milk surface, will have possible wrong readings.
- While there is transparent object such as glass, water drop between the measured object and the LiDAR sensor, the reading might be wrong.
- The LiDAR probe is cover by dirty things; the reading might be wrong. In this case, need to clean the probe.
- The sensor window is made by Acrylic. Don't touch it with alcohol material. This will destroy the sensor window.

3.4 Reflectivity of different objects:

Item	Material	Relectivity
1	Black foam rubber	2.4%
2	Black fabric	3%

3	Black rubber	4%
4	Coal (different types of coal)	4~8%
5	Black car paint	5%
6	Black Jam	10%
7	Opaque black plastic	14%
8	Clean rough board	20%
9	Translucent plastic bottle	62%
10	Carton cardboard	68%
11	Clean pine	70%
12	Opaque white plastic	87%
13	White Jam	90%
14	Kodak Standard Whiteboard	100%
15	Unpolished white metal surface	130%
16	Glossy light metal surface	150%
17	stainless steel	200%
18	Reflector plate, reflective tape	>300%

4. Configure LLDS40 via AT Command or LoRaWAN Downlink

Use can configure LLDS40 via AT Command or LoRaWAN Downlink.

- AT Command Connection: See FAQ.
- LoRaWAN Downlink instruction for different platforms: IoT LoRaWAN Server (/xwiki/bin/view/Main/)

There are two kinds of commands to configure LLDS40, 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 ((/xwiki/bin/view/Main/End%20Device%20AT%20Commands%20and%20Downlink%20Command/)

Commands special design for LLDS40

These commands only valid for LLDS40, as below:

4.1 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

4.2 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)	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

4.3 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 LLDS40

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 0x07: LLDS40

5. Battery & Power Consumption

LLDS40 uses ER26500 + SPC1520 battery pack. See below link for detail information about the battery info and how to replace. Battery Info & Power Consumption Analyze (http://wiki.dragino.com/xwiki/bin/view/Main/How%20to%20calculate%20the%20battery%20life%20of%20Dragino%20sen

6. Use AT Command

6.1 Access AT Commands

LLDS40 supports AT Command set in the stock firmware. You can use a USB to TTL adapter to connect to LLDS40 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 LLDS40.

LLDS40 will output system info once power on as below:



Valid AT Command please check Configure Device.

7. FAQ

7.1 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.

8. Trouble Shooting

8.1 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 set the send key, user need to add ENTER in their string.

8.2 Significant error between the output distance value of LiDAR and the actual distance

Cause ①: Due to the physical principles of The LiDAR probe, the above phenomenon is likely to occur if the detection object is the material with high reflectivity (such as transparent substance (such as glass and water, etc.)

Troubleshooting: Please avoid use of this product under such circumstance in practice.

 $\textbf{Cause} \ \textcircled{2}: \text{The IR-pass filters are blocked}.$

Troubleshooting: please use dry dust-free cloth to gently remove the foreign matter.

9. Order Info

Part Number: LLDS40-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

10. Packing Info

Package Includes:

• LLDS40 LoRaWAN LiDAR Distance Sensor x 1

Dimension and weight:

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

11. 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 answe 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 (http://././././D:%5C%E5%B8%82%E5%9C%BA%E8%B5%84%E6%96%99%5C%E8%AF%B4%E6%98%8E%E4%B9%A6%5CLoRa%5CLT%E7%B3%BB%

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