

# Outdoor Environment Monitoring Sensor

## IOT-S500 Series

USER MANUAL

**LINOVISION**

Updated on Apr 11, 2022

## Applicability

This guide is applicable to IOT-S500 series sensors shown as follows, except where otherwise indicated.

Model	
IOT-S500CO <sub>2</sub>	Carbon Dioxide Sensor
IOT-S500LGT	Light Sensor
IOT-S500PP	Pipe Pressure Sensor
IOT-S500PT-T200	PT100 Temperature Sensor
IOT-S500SMT	Soil Moisture Sensor
IOT-S500SWL	Submersible Level Sensor
IOT-S500UDL-W050	Ultrasonic Distance/Level Sensor

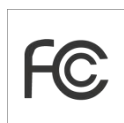
## Safety Precautions

Linovision will not shoulder responsibility for any loss or damage resulting from not following the instructions of this operating guide.

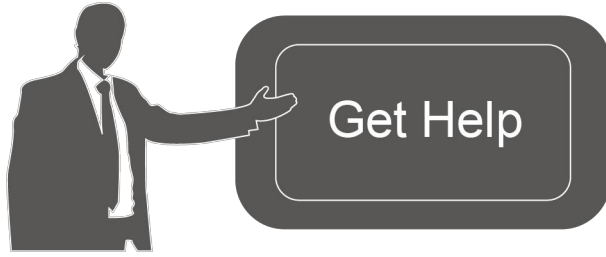
- ❖ The device must not be remodeled in any way.
- ❖ The device is not intended to be used as a reference sensor, and Linovision will not should responsibility for any damage which may result from inaccurate readings.
- ❖ Do not place the device close to objects with naked flames.
- ❖ Do not place the device where the temperature is below/above the operating range.
- ❖ Make sure electronic components do not drop out of the enclosure while opening.
- ❖ When installing the battery, please install it accurately, and do not install the reverse or wrong model.
- ❖ The device must never be subjected to shocks or impacts.

## Declaration of Conformity

IOT-S500 series is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.



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### Revision History

Date	Doc Version	Description
Nov. 23, 2020	V 1.0	Initial version

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# 1. Product Introduction

## 1.1 Overview

IOT-S500 series is a sensor mainly used for outdoor environment through wireless LoRa network. IOT-S500 device is battery powered and designed for multiple mounting ways. It is equipped with NFC (Near Field Communication) and can easily be configured by a smartphone or a PC software.

Sensor data are transmitted in real-time using standard LoRaWAN<sup>®</sup> protocol. LoRaWAN<sup>®</sup> enables encrypted radio transmissions over long distance while consuming very little power. The user can obtain sensor data and view the trend of data change through Cloud or through the user's own Network Server.

## 1.2 Features

- Up to 11km communication range
- Easy configuration via NFC
- Standard LoRaWAN<sup>®</sup> support
- Low power consumption with 19000mAh replaceable battery

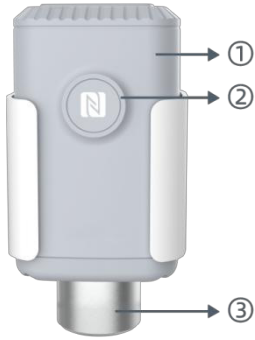
# 2. Hardware Introduction

IOT-S500 series sensors is made up of a LoRa transceiver and a sensor. Among them, ultrasonic sensors and gas sensors are combined with LoRa transceiver.

## 2.1 Hardware Overview

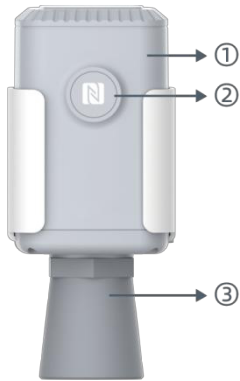


- Front View of IOT-S500:**
- ① LoRa Antenna (Internal)
  - ② NFC Area
  - ③ Water-proof Connector



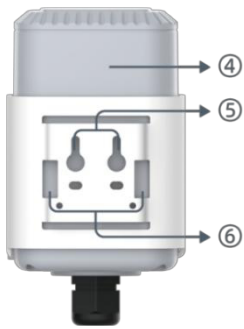
**Front View of IOT-S500CO2**

- ①LoRa Antenna (Internal)
- ②NFC Area
- ③Vent Tube



**Front View of IOT-S500UDL-W050**

- ①LoRa Antenna (Internal)
- ②NFC Area
- ③Ultrasonic Horn

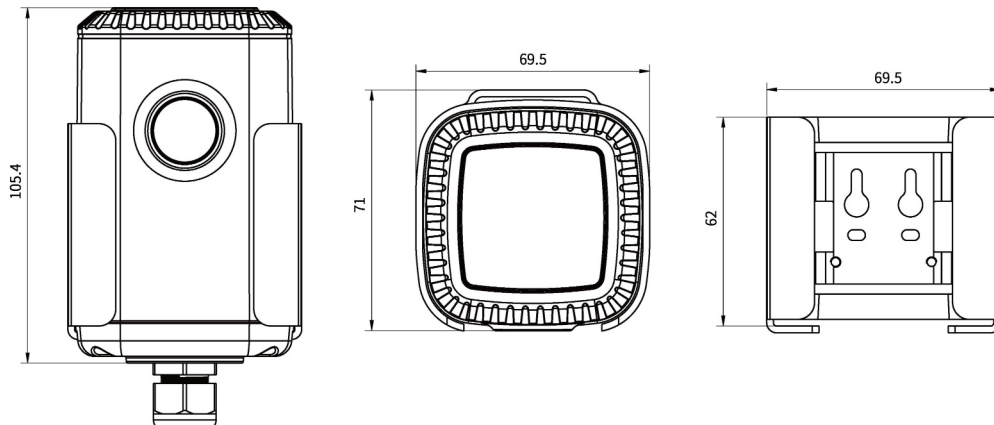


**Back View:**

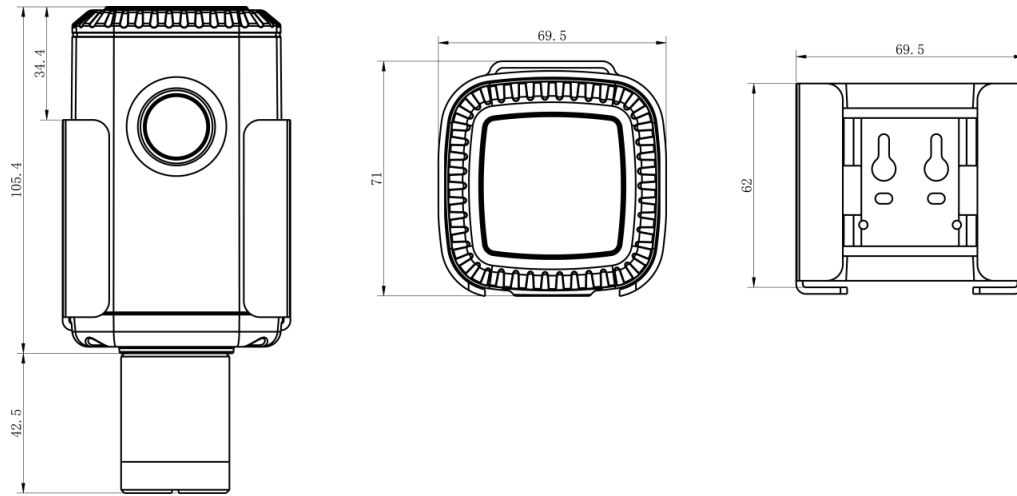
- ④Battery (Internal)
- ⑤Wall Mounting Holes
- ⑥Pole Mounting Holes

**2.2 Dimensions(mm)**

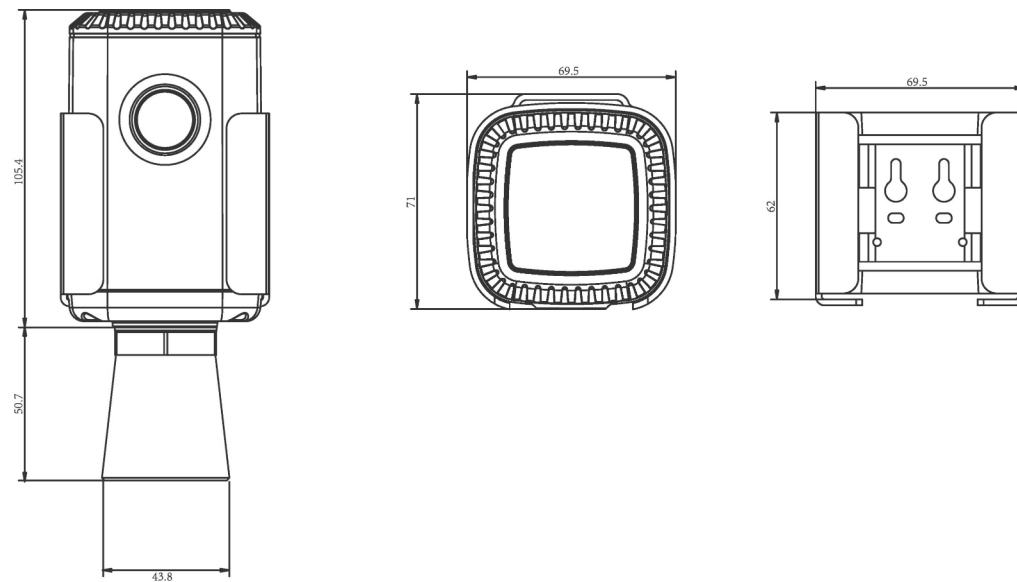
**IOT-S500**



## IOT-S500CO2



## IOT-S500UDL-W050



## 2.3 Power Button Descriptions

**Note:** IOT-S500 can also be turned on/off and reset via Mobile APP or Toolbox.

Function	Action	LED Indication
Turn On	Press and hold the button for more than 3s.	Off → Static Green
Turn Off	Press and hold the button for more than 3s.	Static Green → Off
Reset	Press and hold the button for more than 10s. <b>Note:</b> IOT-S500 will automatically power on	Blink 3 times.
Check On/Off Status	after reset. Quickly press the power button.	Light On: Device is on. Light Off: Device is off.

### 3. Basic Configuration

In order to protect the security of sensor, password validation is required when configuring via unused phone . Default password is **123456**.

#### 3.1 Configuration via Smartphone APP

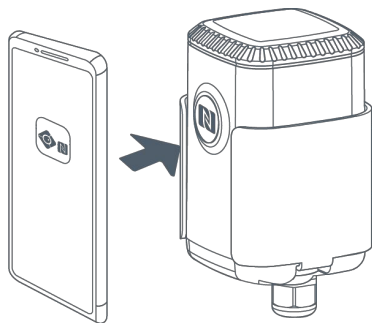
##### Preparation:

- Smartphone (NFC supported)
- Toolbox APP: download and install from Google Play or Apple Store.

##### 3.1.1 Read/Write Configuration via NFC

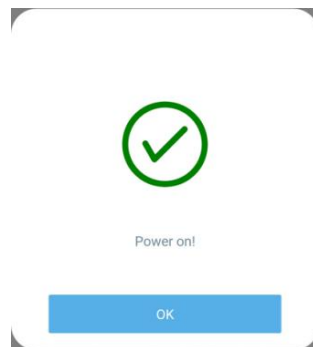
1. Enable NFC on the smartphone and open “Toolbox” APP.
2. Attach the smartphone with NFC area to the device to read basic information.

**Note:** Ensure the location of smartphone NFC area and it is recommended to take off phone case before using NFC.



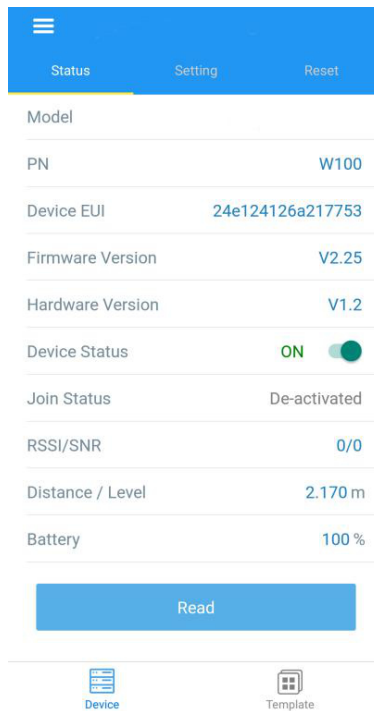
☰		
Status	Setting	Reset
SN	6126A21775363003	
Model		
PN	W100	
Device EUI	24e124126a217753	
Firmware Version	V2.25	
Hardware Version	V1.2	
Device Status	Off	<input type="checkbox"/>

3. Change the on/off status or parameters, then attach the smartphone with NFC area to the device until the APP shows a successful prompt.



4. Go to “Device > Status” to tap “Read” and attach the smartphone with NFC area to the device to read real-time data of sensor.



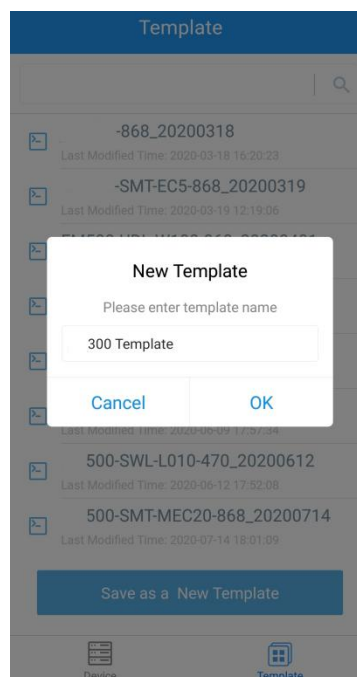


### 3.1.2 Template Configuration

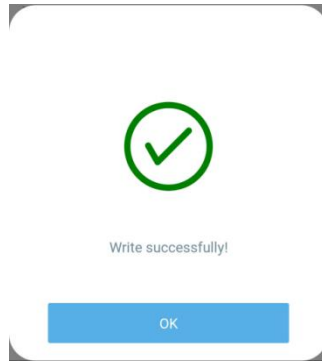
Template settings only work for easy and quick device configuration in bulk.

**Note:** Template function is allowed only for sensors with the same model and LoRa frequency band.

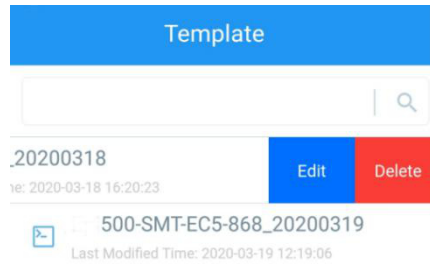
1. Go to “Template” page on the APP and save current settings as a template.



2. Attach the smartphone with NFC area to another device.
3. Select the template file from Toolbox APP and tap “Write”, keep the two devices close until the APP shows a successful prompt.



4. Slide the template item to the left to edit or delete the template.



## 4. Advanced Feature Description

### 4.1 LoRaWAN Settings

Parameters	Description	Default
Device EUI	Unique ID of the sensor. It can be found on the label.	On the label
App EUI	App EUI of the sensor.	24E124C0002A0001
Application Port	The port used for sending or receiving data. Default:	85
Join Type	OTAA or ABP mode. <b>Note:</b> If you use cloud to manage sensors, please select OTAA mode.	OTAA
Application Key	Appkey of the sensor.	5572404C696E6B4C6F
Network ID	NetID of the sensor used for identifying LoRaWAN networks.	526132303138230x010203
Device Address	DevAddr of the sensor.	The 5 <sup>th</sup> to 12 <sup>th</sup> digits of SN.
Network Session Key	Nwkskey of the sensor.	5572404C696E6B4C6F
Application	Appskey of the sensor. 5572404C696E6B4C6F	52613230313823

Session Key		52613230313823
Spread Factor	Select spread factor from SF7 to SF12.	SF10-DR2
Confirmed Mode	If the sensor does not receive ACK package from network server, it will resend data 3 times most.	Disabled
Rejoin Mode	Sensor will send specific mounts of LoRaMAC packages to check connection status regularly. If no reply after specific packages, the sensor will re-join.	Enabled, 8 packages
ADR Mode	Allow network server to adjust datarate of the sensor.	Enabled
Support Frequency	LoRaWAN region.	EU868 AU915
Channel	<p>Enable or disable LoRa channels. If frequency is one of CN470/AU915/US915, you can enter the index of the channel that you want to enable in the input box, making them separated by commas.</p> <p><b>Examples:</b> 1, 40: Enabling Channel 1 and Channel 40 1-40: Enabling Channel 1 to Channel 40 1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60 All: Enabling all channels Null: Indicates that all channels are disabled</p>	<a href="#">Appendix</a>

## 4.2 Basic Settings

Parameters	Description
Reporting Interval	Interval of sending sensor data. Default: 10min.
Change Password	Change the password of logging Toolbox (Windows) and parameter modify(mobile APP).

## 4.3 Calibration

Parameters	Description
Distance / Level Calibration <input checked="" type="checkbox"/> Current Raw Value 6.895 m Calibration Value <input type="text" value="-1"/> m Final Value 5.895 m	After saving the calibration value, the sensor will add the calibration value to raw value and send the final value.

Measure Outliers Calibration <input checked="" type="checkbox"/> Maximum Range 10 m Outlier Range <input type="text" value="± 2"/> % Outlier Value <input type="text" value="± 200"/> mm	If current value exceeds the outlier range/values, the sensor will re-collect the value. <b>Note:</b> This item is only for IOT-S500UDL-W050.
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## 4.4 Threshold and Alarm

Parameters	Description
Over/Below	Maximum/minimum data to trigger the alarm. After triggered, sensor will send current data ignoring report interval.
Data Collecting Interval	The sensor will detect and check whether the value is triggered again after data collecting interval.

## 5. Cloud Management

### 5.1 Add a Linovision Gateway

1. Enable “Linovision” type network server and “Cloud” mode in gateway web GUI.

**Note:** Ensure gateway has accessed the Internet.

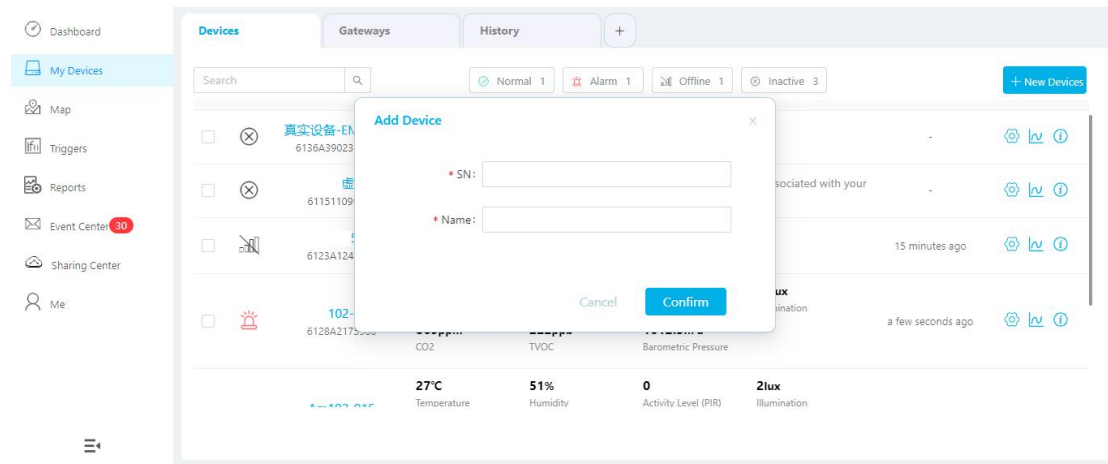
The top screenshot shows the 'General Setting' page for a gateway. The 'Multi-Destination' table is as follows:

ID	Enable	Type	Server Address	Operation
0	Enabled		localhost	<input type="button" value="edit"/> <input type="button" value="delete"/>
<input type="button" value="add"/>				

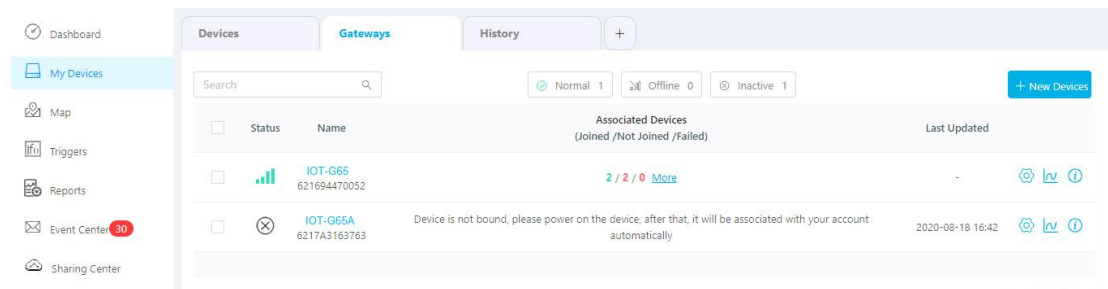
The bottom screenshot shows the 'General Setting' page for a gateway. The 'Enable' and 'Cloud' checkboxes are checked and highlighted with a red box.

Enable	<input checked="" type="checkbox"/>
Cloud	<input checked="" type="checkbox"/>
NetID	<input type="text" value="010203"/>
Join Delay	<input type="text" value="5"/> sec
RX1 Delay	<input type="text" value="1"/> sec
Lease Time	<input type="text" value="8760-0-0"/> hh-mm-ss
Log Level	<input type="text" value="info"/>

2. Go to “My Devices” page and click “+New Devices” to add gateway to Cloud via SN. Gateway will be added under “Gateways” menu.



3. Check if gateway is online in Cloud.



## 5.2 Add IOT-S500 to Cloud

1. Go to “My Devices” page and click “+New Devices”. Fill in the SN of IOT-S500 and select associated gateway.

SN: 6127/

Name:

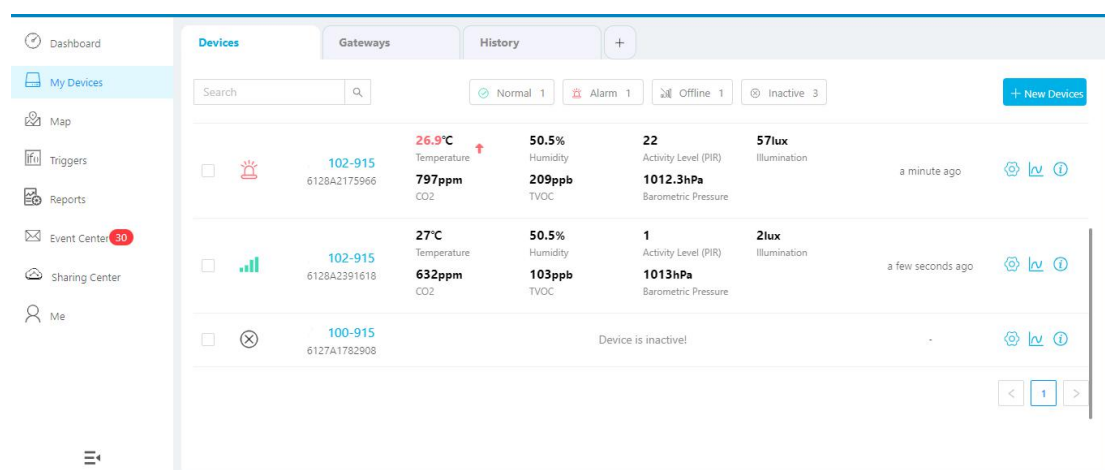
Associated Gateway: 231 (621790401000)

Device EUI: 24e124127/

Application Key: 5572404c696e6b4c6f52613230313f

2. After IOT-S500 is connected to Cloud, you could check the device information and data and create

dashboard for it.



## 6. Sensor Payload

All data are based on following format(HEX):

Channel1	Type1	Data1	Channel2	Type2	Data2	Channel 3	...
1 Byte	1 Byte	N Bytes	1 Byte	1 Byte	M Bytes	1 Byte	...

### 6.1 Basic Information

IOT-S500 sensors report basic information of sensor everytime joining the network.

Channel	Type	Data Example	Description
ff	01(Protocol Version)	01	V1
	09 (Hardware Version)	01 40	V1.4
	0a(Software Version)	01 14	V1.14
	0f(Device Type)	00	Class A
	16 (Device SN)	64 10 90 82 43 75 00 01	Device SN is 6410908243750001

### 6.2 Sensor Data

IOT-S500 sensors report sensor data according to reporting interval (10min by default). Battery level is reported every 24 hours.

#### IOT-S500CO<sub>2</sub>

Channel	Type	Data Example	Description
01	75(Battery Level)	64	64=>100 Battery level =100%

03	67 (Temperature)	10 01	10 01 => 01 10 = 272 Temp=272*0.1=27.2°C
04	68(Humidity)	71	71=>113 Hum=113*0.5=56.5%
05	7d (CO <sub>2</sub> )	67 04	67 04 => 04 67 =1127 ppm
06	73 (Barometric Pressure)	68 27	68 27=>27 68=10088 Pressure=10088*0.1=1008.8hPa

### IOT-S500LGT

Channel	Type	Data Example	Description
01	75(Battery Level)	64	64=>100 Battery level =100%
03	94 (Light)	50 00 00 00	50 00 00 00=>00 00 00 50=80 lux

### IOT-S500PP

Channel	Type	Data Example	Description
01	75(Battery Level)	64	64=>100 Battery level =100%
03	7b (Pressure)	0a 00	0a 00=>00 0a=10kPa

### IOT-S500PT-T200

Channel	Type	Data Example	Description
01	75(Battery Level)	64	64=>100 Battery level =100%
03	67 (Temperature)	10 01	10 01 => 01 10 = 272 Temp=272*0.1=27.2°C

### IOT-S500SMT

Channel	Type	Data Example	Description
01	75(Battery Level)	64	64=>100 Battery level =100%

03	67 (Temperature)	10 01	10 01 => 01 10 = 272 Temp=272*0.1=27.2°C
04	68(Moisture)	71	71=>113 Hum=113*0.5=56.5%
05	7d (Conductivity)	f0 00	f0 00 => 00 f0 =240 µs/cm

## IOT-S500SWL

Channel	Type	Data Example	Description
01	75(Battery Level)	64	64=>100 Battery level =100%
03	77 (Water Level)	02 00	02 00=>00 02=2cm

## IOT-S500UDL-W050

Channel	Type	Data Example	Description
01	75(Battery Level)	64	64=>100 Battery level =100%
03	82 (Distance)	1e 00	1e 00=>00 1e=30mm

## 6.3 Downlink Commands

IOT-S500 sensors support downlink commands to configure the device. Application port is 85 by default.

Channel	Type	Data Example	Description
ff	03(Set Reporting Interval)	b0 04	b0 04 => 04 b0 = 1200s

## Appendix

### Default LoRaWAN Parameters

DevEUI	24E124 + 2 <sup>nd</sup> to 11 <sup>th</sup> digits of SN e.g. SN = 61 26 A1 01 84 96 00 41 Then Device EUI = 24E124126A101849
AppEUI	24E124C0002A0001



Appport	0x55
NetID	0x010203
DevAddr	The 5 <sup>th</sup> to 12 <sup>th</sup> digits of SN e.g. SN = 61 26 A1 01 84 96 00 41 Then DevAddr = A1018496
AppKey	5572404C696E6B4C6F52613230313823
NwkSKey	5572404C696E6B4C6F52613230313823
AppSKey	5572404C696E6B4C6F52613230313823

**-END-**