Dragino Docs

WQS-LB/LS

Contents

1. Introduction

1.1 Overview

1.2 Specifications

1.3 Features

1.4 Applications

1.5 Deep sleep mode and working mode

1.6 Button and LEDs

1.7 BLE connection

1.8 Pin definitions

1.8.1 SW2 Jumper (Define UART level to external Sensor)

1.9 Wiring of DS18B20 temperature sensor

1.10 Mechanical drawings

1.11 Cable drawings

1.12 Additional extension cable

2. Registering WQS-LB/LS with a LoRaWAN Network Server

2.1 Registration information

2.1.1 Registering with The Things Stack

2.1.2 Add WQS-LB/LS to The Things Stack

2.1.2.1 Creating an application

2.1.2.2 Adding manually

2.1.2.3 Power on the WQS-LB/LS

2.1.3 Uplink Decoder in The Things Stack

2.2 Uplink payload

2.2.1 Uplink FPort=5, Device status

2.2.2 Uplink FPort=2, Real time sensor value

2.3 Uplink FPort=3, Datalog

2.3.1 How datalog works

2.3.2 Enable Datalog

2.3.3 Unix TimeStamp

2.3.4 Datalog Uplink payload (FPORT=3)

2.4 Integrating data with IoT platforms

2.4.1 Integrate and show data on ThingsEye

2.4.1.1 Configuring The Things Stack

2.4.1.2 Configuring ThingsEye.io

2.4.1.3 Viewing integration details

2.4.1.4 Viewing events

2.4.1.5 Deleting an integration

2.4.1.6 Creating a dashboard

2.4.2 Integrate and show data on TagoIO

3. Configure the WQS-LB/LS using AT commands or LoRaWAN downlinks

3.1 Set transmit interval time

3.2 Set interrupt mode

3.3 Set power output duration

3.4 Sensor Calibration Commands

3.5 RS485 Test Command

4. Water Quality Sensors

4.1 pH Sensor

4.1.1 Features

4.1.2 Specifications

4.1.3 Dimensions

4.1.4 Installation

4.1.5 Maintenance

4.1.6 Calibration

4.2 EC Sensor

4.2.1 Features

4.2.2 Specifications

4.2.3 Dimensions

4.2.4 Installation

4.2.5 Maintenance

4.2.6 Calibration

4.3 ORP Sensor

4.3.1 Features

4.3.2 Specifications

4.3.3 Dimensions

4.3.4 Installation Note

4.3.5 Maintenance

4.3.6 Calibration

4.4 Dissolved Oxygen Sensor

4.4.1 Features

4.4.2 Specifications

4.4.3 Dimensions

4.4.4 Instructions for use and maintenance

4.4.5 Precautions

4.5 Turbidity Sensor

4.5.1 Features

4.5.2 Specifications

4.5.3 Dimensions

4.5.4 Instructions for use and maintenance

4.5.5 Calibration

4.5.6 Precautions

4.6 DR-CL Water CL Probe

4.6.1 Specification:

4.6.2 Mechinical Drawing

4.6.3 Maintenance

4.7 DR-COD Transmitter

4.7.1 Features

4.7.2 Specification:

4.7.3 Mechinical Drawing

4.7.4 Maintenance

6. More detailed information about water quality sensors

7. OTA Firmware update

8. FAQ

8.1 External Power Supply Connection (For Battery Depletion/Multi-Sensor Use)

8.2 Why is there no LED response when I press the button on the solar panel model?

8.3 Problem of nodes not being recognized after connecting sensors

8.4 Regarding the acquisition of calibration solution

8.5 Does the DR-CL specifically measure free chlorine residual only?

9. Order Info

9.1 Main Unit
9.2 Sensors
10. Support

Select a section in the PDF viewer to jump directly to that chapter.

WQS-LB/LS





1. Introduction

1.1 Overview

The Dragino WQS-LB/LS is an advanced LoRaWAN end device designed for comprehensive water quality monitoring across various applications. It is ideal for ensuring water quality in **tap water**, **industrial water**, **environmental water**, and **wastewater**, offering precise and reliable measurements to meet water quality standards.

Communication between **all water quality sensors and nodes** is implemented through the **RS485 bus** and the **Modbus protocol** is used as the communication standard. This design has **high reliability and strong anti-interference ability**, and is especially suitable for data acquisition and transmission in industrial environments or complex scenarios. The RS485 bus supports **multi-point communication** and can connect multiple sensors and node devices to form a stable data communication network. The system's **modular design** allows each water quality sensor to be **disassembled and installed independently**. When a sensor needs to be replaced or maintained, simply remove the target sensor from the current RS485 bus network. These sensors also allow **easy access to other reading devices that support the RS485 interface**. For example, you can install sensors into different data acquisition terminals, controllers, or monitoring systems **without additional hardware modifications or complex configuration tweaks**.

📘 **Note 1:** The method of use is that the probe is in direct contact with the water quality. Before using the sensor probe, its protective cover and blue foam cushioning pad must be completely removed. These protective components are designed for transportation and storage, and can effectively resist factors such as physical collision that damage the probe.

📘 **Note 2:** Because the probe needs to adapt to the new water quality environment, the data collected at the beginning will be inaccurate. After standing in the new water quality for two hour, the data collected by the equipment will be more accurate.

📘 **Note 3:** The warranty period for each sensor is six months from the date of purchase.

Key Features:

- **Supports 1 to 3 Probes:** Compatible with a range of water quality probes, including EC (Electrical Conductivity), pH, DO (Dissolved Oxygen), ORP (Oxidation-Reduction Potential), and TS (Total Solids) probes.
- **Wireless Data Transmission:** Measures water quality parameters and uploads the data wirelessly to a LoRaWAN server.
- **Easy Configuration and Updates:** Supports BLE (Bluetooth Low Energy) configuration and wireless OTA (Over-the-Air) updates for convenient setup and maintenance.
- **Long Battery Life:** Powered by an 8500mAh Li-$SOCl_2$ battery, designed for long-term use, with a lifespan of up to several years.

1.2 Specifications

Common DC Characteristics:

- Supply Voltage: Built-in Battery, 2.5v ~ 3.6v
- Operating Temperature: -40 ~ 85°C

I/O Interface:

- Battery controllable output (2.6v ~ 3.6v depends on battery)
- +12v controllable output
- 1 x RS485 Interface
- 1 x UART Interface , 3.3v or 5v or 12v
- 1 x Interrupt or Digital IN pins
- 1 x I2C Interface
- 1 x one wire interface

LoRa Spec:

- Frequency Range, Band 1 (HF): 862 ~ 1020 Mhz
- Max +22 dBm constant RF output vs.
- RX sensitivity: down to -139 dBm.
- Excellent blocking immunity

Battery:

- Li/SOCI2 un-chargeable battery
- Capacity: 8500mAh
- Self-Discharge: <1% / Year @ 25°C
- Max continuous current: 130mA
- Max boost current: 2A, 1 second

Power Consumption

- Sleep Mode: 5uA @ 3.3v
- LoRa Transmit Mode: 125mA @ 20dBm, 82mA @ 14dBm

1.3 Features

- LoRaWAN 1.0.3 Class A
- Frequency Bands: CN470/EU433/KR920/US915/EU868/AS923/AU915/IN865/RU864/MA869
- Ultra-low power consumption
- Measure water quality and provide information for water quality conditions
- Support EC / PH / DO / ORP / TS / CL Type Water Quality Probe
- Support 1 ~ 3 probes
- Support Bluetooth v5.1 and LoRaWAN remote configure
- Support wireless OTA update firmware
- AT Commands to change parameters
- Uplink on periodically
- Downlink to change configure
- 8500mAh Li/SOCI2 Battery (WQS-LB)
- Solar panel + 3000mAh Li-ion battery (WQS-LS)

1.4 Applications

- Smart Buildings & Home Automation
- Logistics and Supply Chain Management
- Smart Metering
- Smart Agriculture
- Smart Cities
- Smart Factory

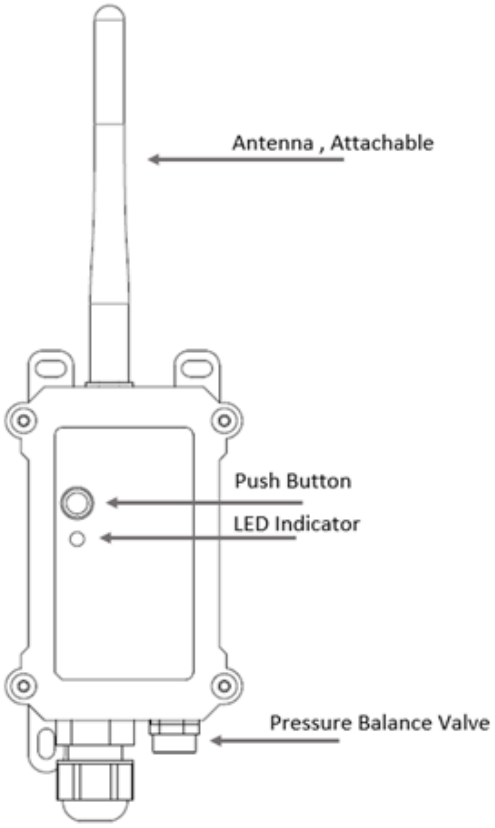
1.5 Deep sleep mode and working mode

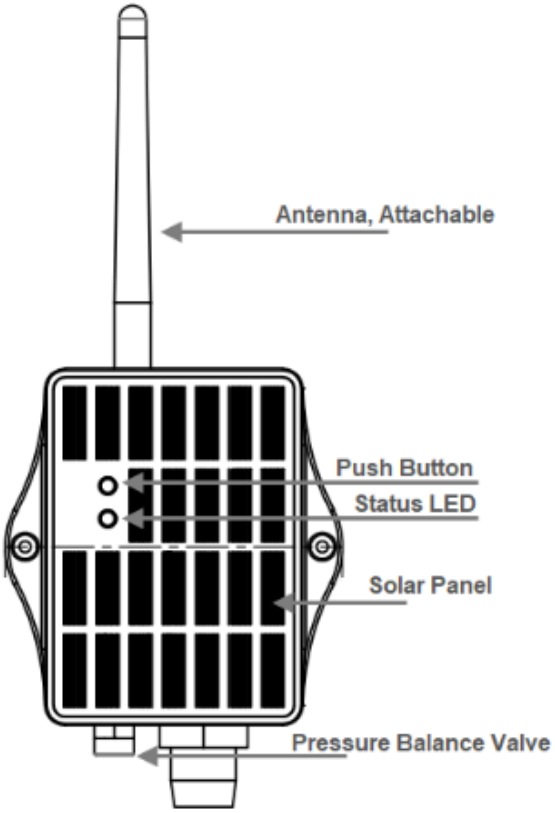
The WQS-LB/LS has two modes:

Deep Sleep Mode: In this mode, the sensor's LoRaWAN functionality is disabled. It is intended for storage and shipping to conserve battery life.

Working Mode : In this mode, the sensor operates as a LoRaWAN device, connecting to a LoRaWAN network and transmitting sensor data to a server. The sensor enters IDLE mode between each sampling, transmission (TX), and reception (RX) cycle. In IDLE mode, the sensor consumes the same amount of power as it does in Deep Sleep mode.

1.6 Button and LEDs





Behavior on ACT	Function	Action
1~3s	Send an uplink	If the sensor is already joined to a LoRaWAN network, it will send an uplink packet, and the blue LED will blink once. At the same time, the BLE module will activate, allowing the user to connect via BLE to configure the device.
>3s	Active Device	The GREEN LED will blink rapidly 5 times, indicating that the device has entered OTA mode for 3 seconds. It will then begin the process of joining the LoRaWAN network. Once the device successfully joins the network, the green LED will remain solid for 5 seconds. After the sensor is activated, the BLE module will be enabled, allowing the user to connect via BLE to configure the device, regardless of whether the device has joined the LoRaWAN network or not.
x5	Deactivate Device	The RED LED will remain solid for 5 seconds, indicating that the device is in Deep Sleep Mode.

1.7 BLE connection

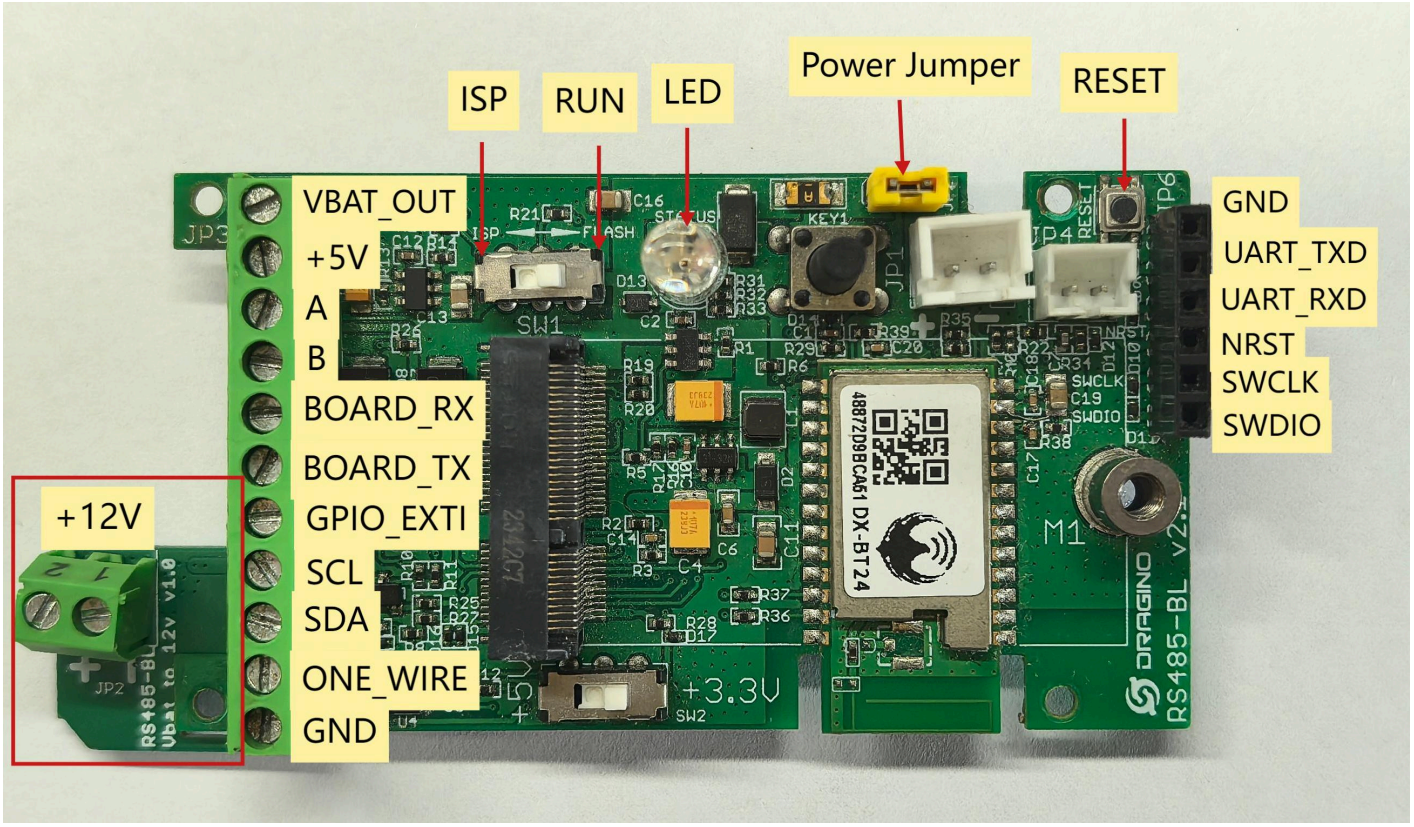
The WQS-LB/LS supports remote configuration via Bluetooth Low Energy (BLE). BLE can be used to configure sensor parameters and view console output from the sensor.

The BLE module activates in the following cases:

- When the button is pressed to send an uplink.
- When the button is pressed to activate the device.
- When the device powers on or resets.

If no BLE connection is established within 60 seconds, the sensor automatically disables the BLE module to enter low-power mode.

1.8 Pin definitions

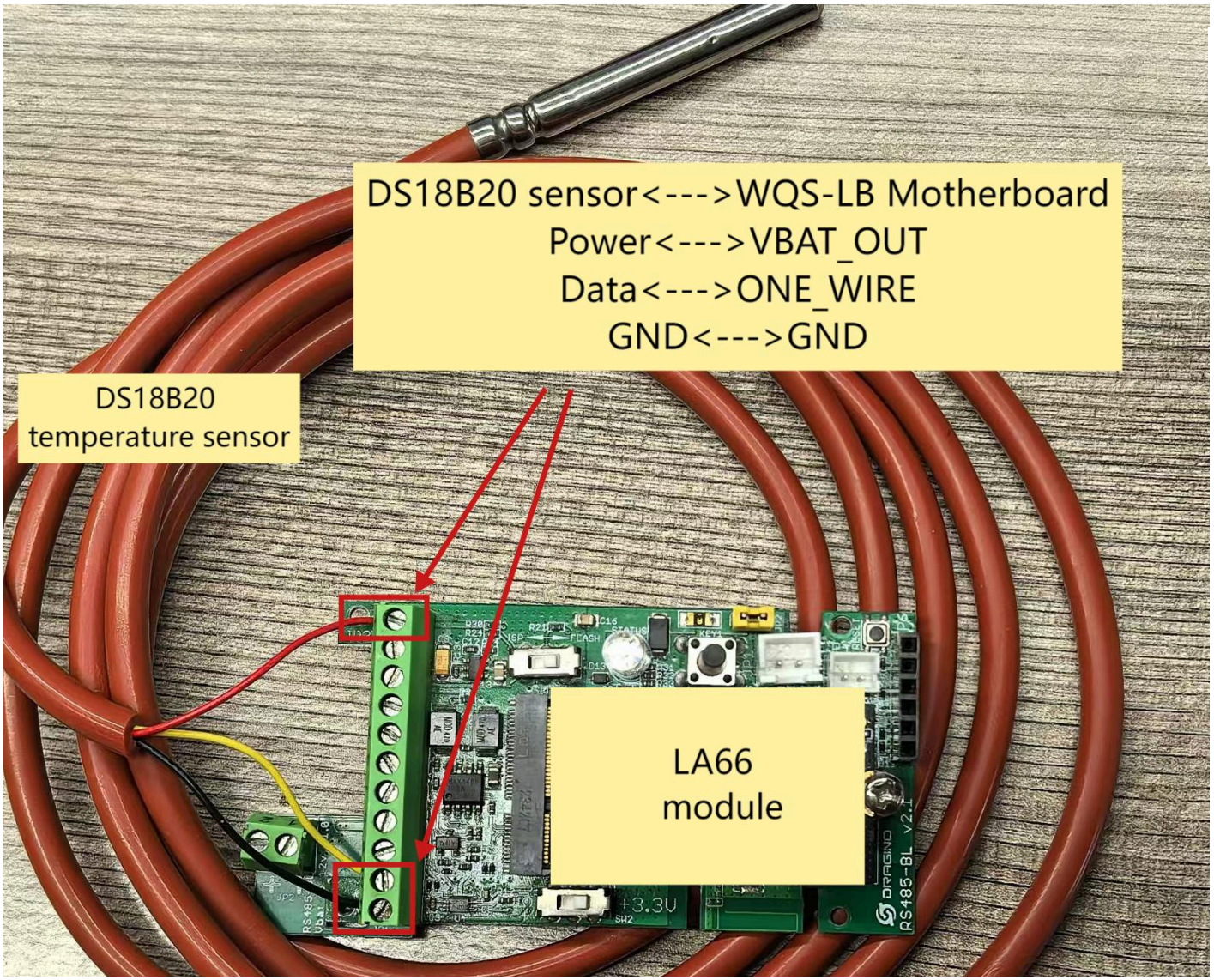


1.8.1 SW2 Jumper (Define UART level to external Sensor)

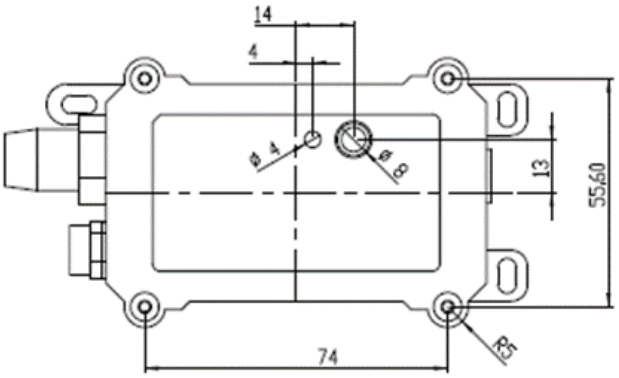
SW2 defines the voltage level of the **BOARD_RX** and **BOARD_TX** pins. It should match the voltage level of the external sensor.

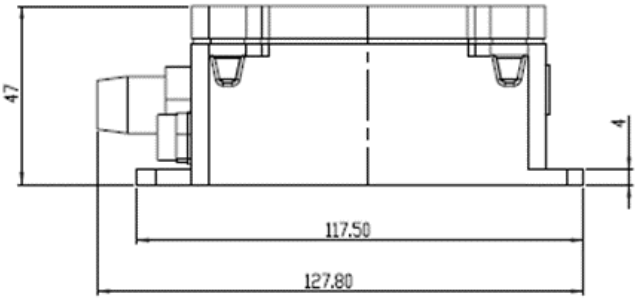
1.9 Wiring of DS18B20 temperature sensor

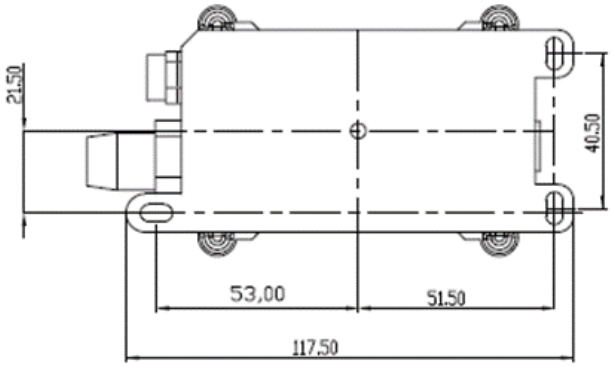
The WQS-LB/LS supports connection to the external temperature sensor DS18B20. The wiring method is as follows:


DS18B20 sensor<--->WQS-LB Motherboard
Power<--->VBAT_OUT
Data<--->ONE_WIRE
GND<--->GND
DS18B20
temperature sensor
LA66
module

1.10 Mechanical drawings

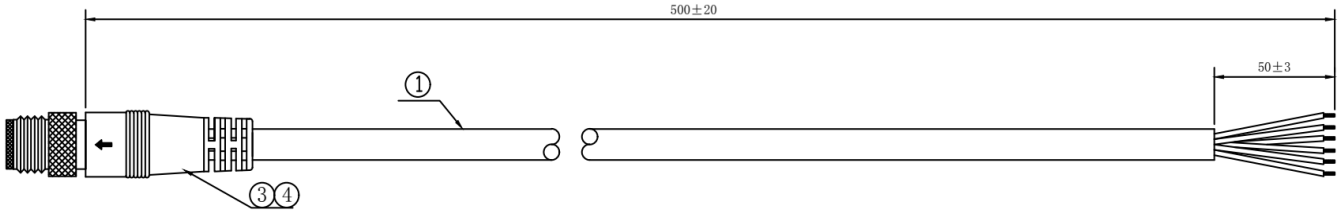


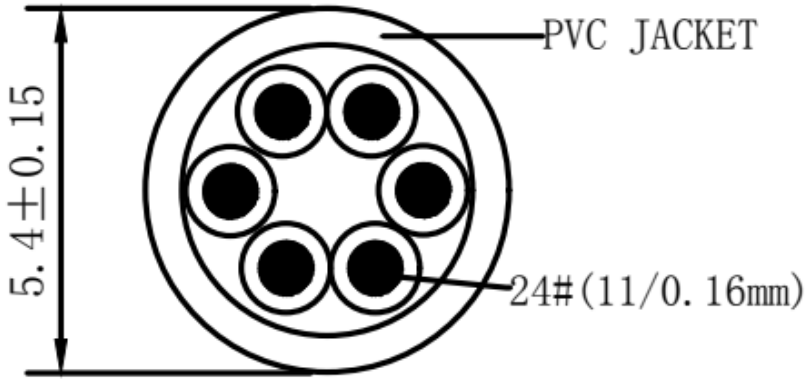


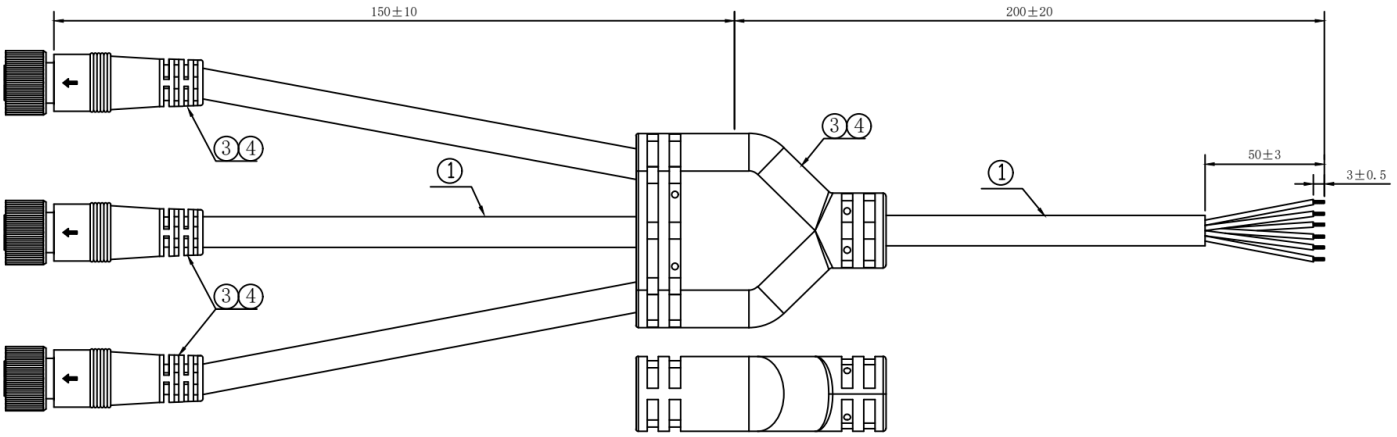


1.11 Cable drawings

- The wire length of WQS sensor products is 5 meters.







1.12 Additional extension cable

The WQS sensor comes with a default cable length of 5 meters.

If you require additional length, we offer 5-meter and 10-meter extension cables available for separate purchase.

5m extension cord SKU: DR-6P-YCX-5M

10m extension cord SKU: DR-6P-YCX-10M



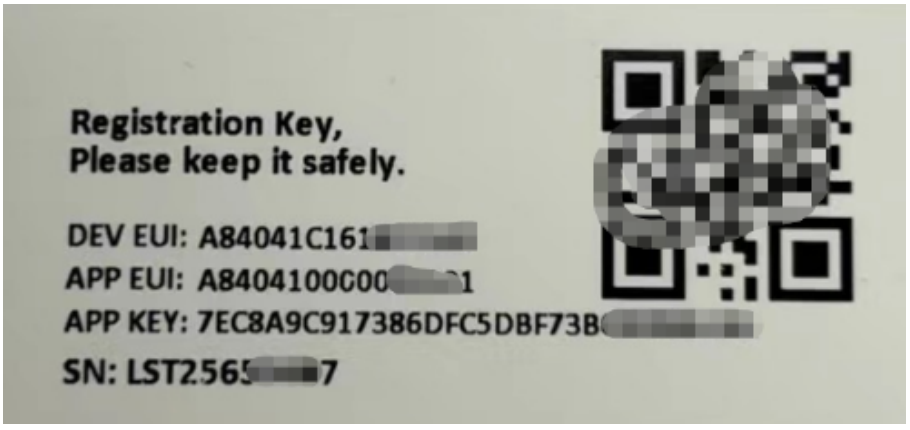
2. Registering WQS-LB/LS with a LoRaWAN Network Server

The WQS-LB/LS can be registered with any LoRaWAN network server. In this documentation, we use The Things Stack as an example, but similar settings may apply to other LoRaWAN network servers.

2.1 Registration information

The WQS-LB/LS is configured in LoRaWAN Class A mode by default. Each WQS-LB/LS is shipped with a unique global registration key that supports OTAA (Over-The-Air-Activation). To use the WQS-LB with a LoRaWAN network, you first need to register the device with the network using the provided registration keys for OTAA support.

The WQS-LB/LS's registration information can be found inside the device package.



The registration information includes the following:

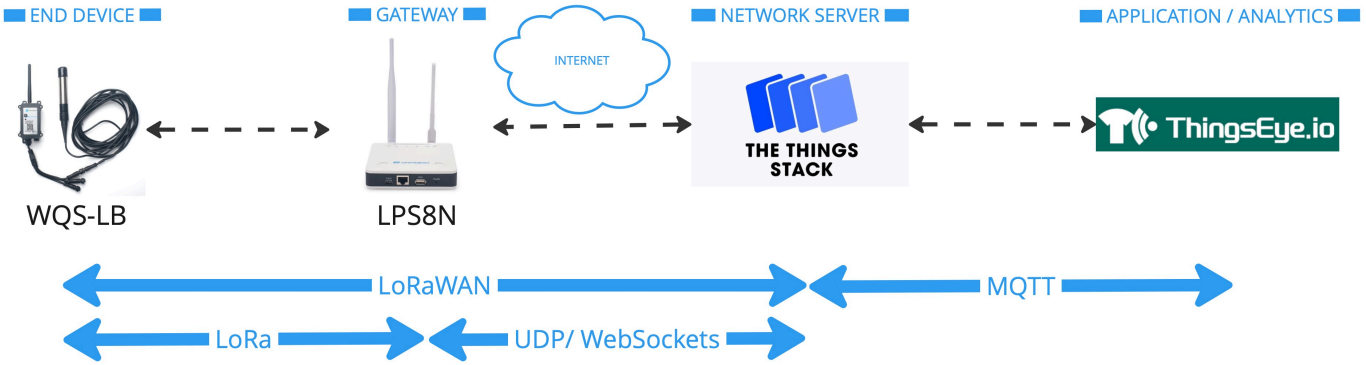
- DevEUI
- AppEUI
- AppKey

Once registered, if the WQS-LB/LS is within the coverage area of the LoRaWAN network, it can automatically join the network. After successfully joining, the WQS-LB/LS will begin measuring environmental temperature and humidity and will start transmitting sensor data to the LoRaWAN network server. The default uplink transmission interval is 20 minutes.

2.1.1 Registering with The Things Stack

In this section, we will guide you through on how to register the WQS-LB/LS with The Things Stack. If your area has **The Things Stack** community network coverage, you can use it without setting up your own network. If not, you can set up your own LoRaWAN network coverage by using our **LPS8N** LoRaWAN gateway.

The typical end-to-end network setup with WQS-LB/LS and LPS8N is shown below:



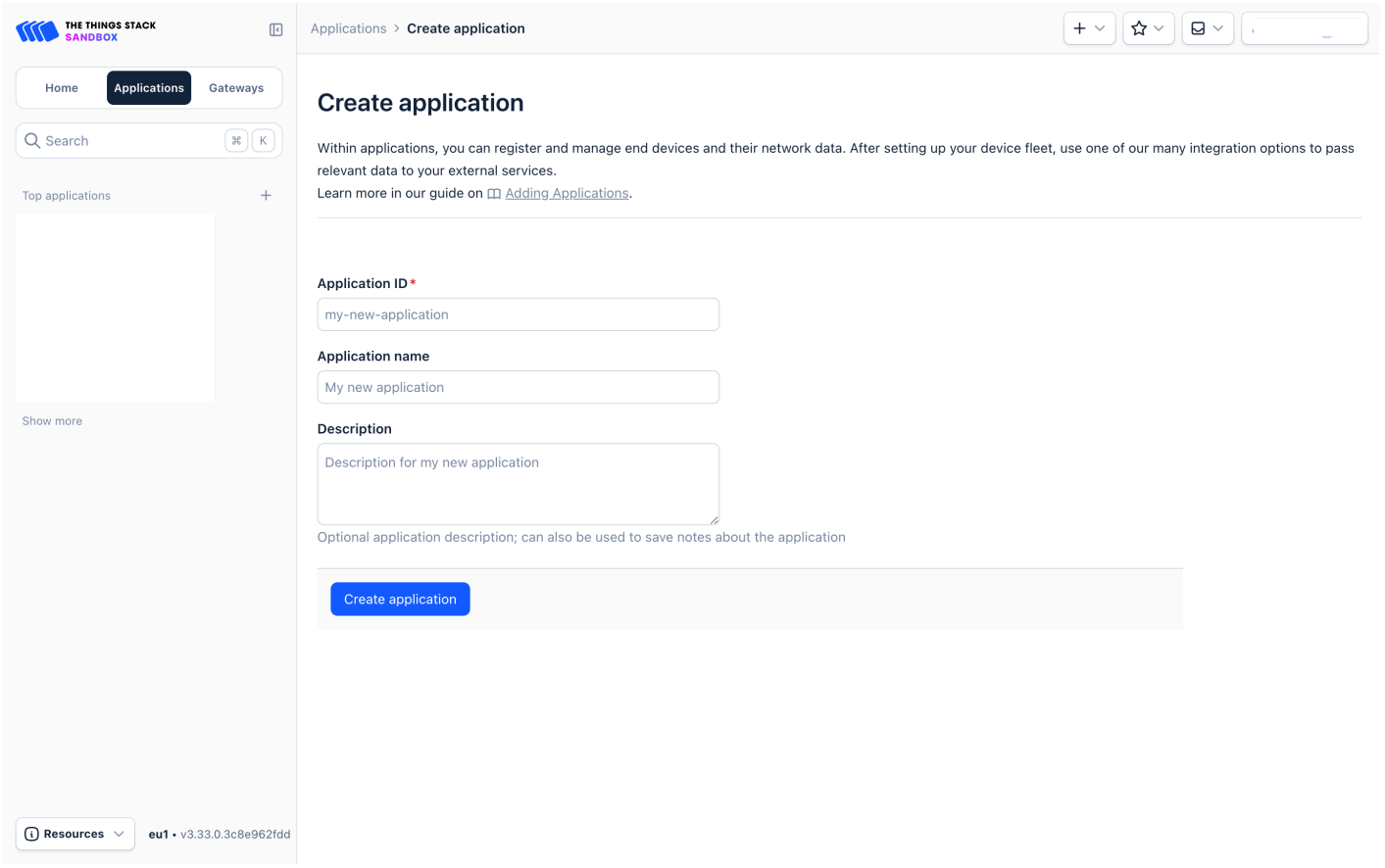
2.1.2 Add WQS-LB/LS to The Things Stack

Currently, WQS-LB/LS only supports manual registration with The Things Stack.

2.1.2.1 Creating an application

Sign up for a free account with The Things Stack Sandbox if you do not have one yet. Then, create an application as shown in the screenshots below.

Application ID: Provide a unique name to identify your application within The Things Stack, e.g., *dragino-docs*.



2.1.2.2 Adding manually

You can refer to the screenshots below to register your WQS-LB/LS using The Things Stack's manual option.

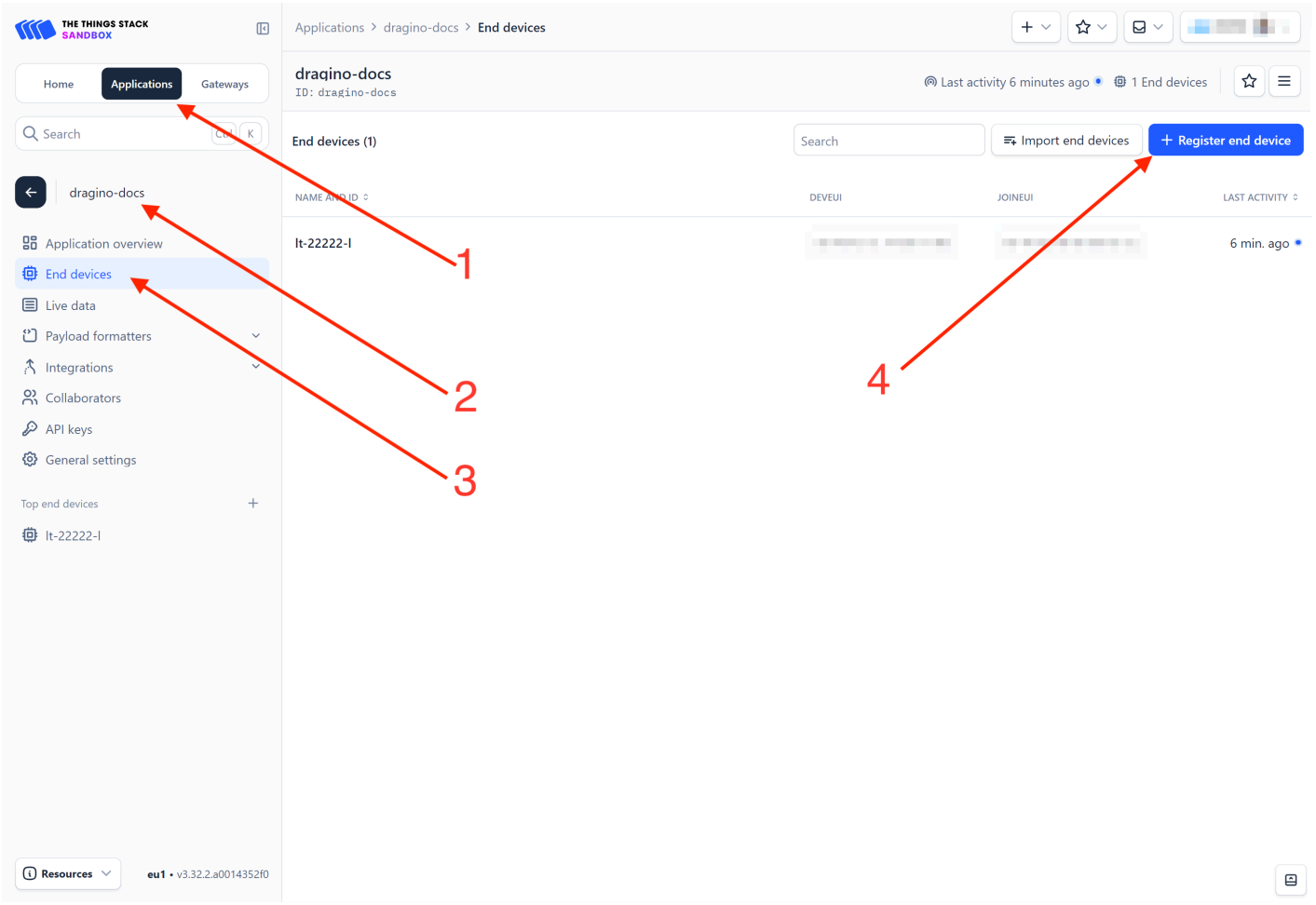
On The Things Stack console:

1. Click Applications .

2. Click < your application >. E.g. dragino-docs

3 Click End devices .

4. Click + Register end device button.

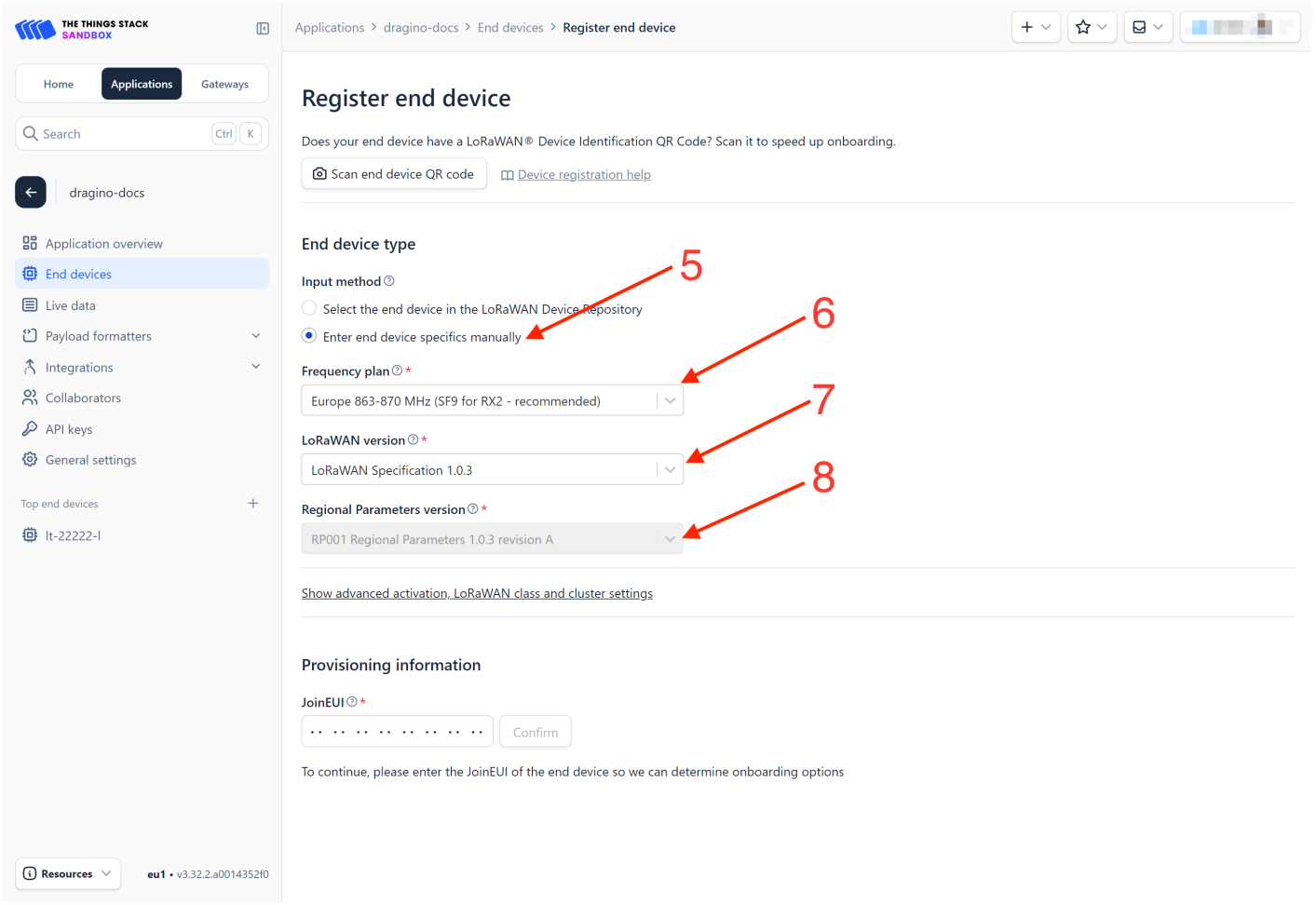


5. Select Enter end device specifies manually option.

6. Frequency plan : Select the frequency plan that matches your device. E.g.: Europe 863-870 MHz (SF9 for RX2 - recommended).

7. LoRaWAN version : LoRaWAN Specification 1.0.3

8. Regional Parameters version : You can't change it and it will select automatically.

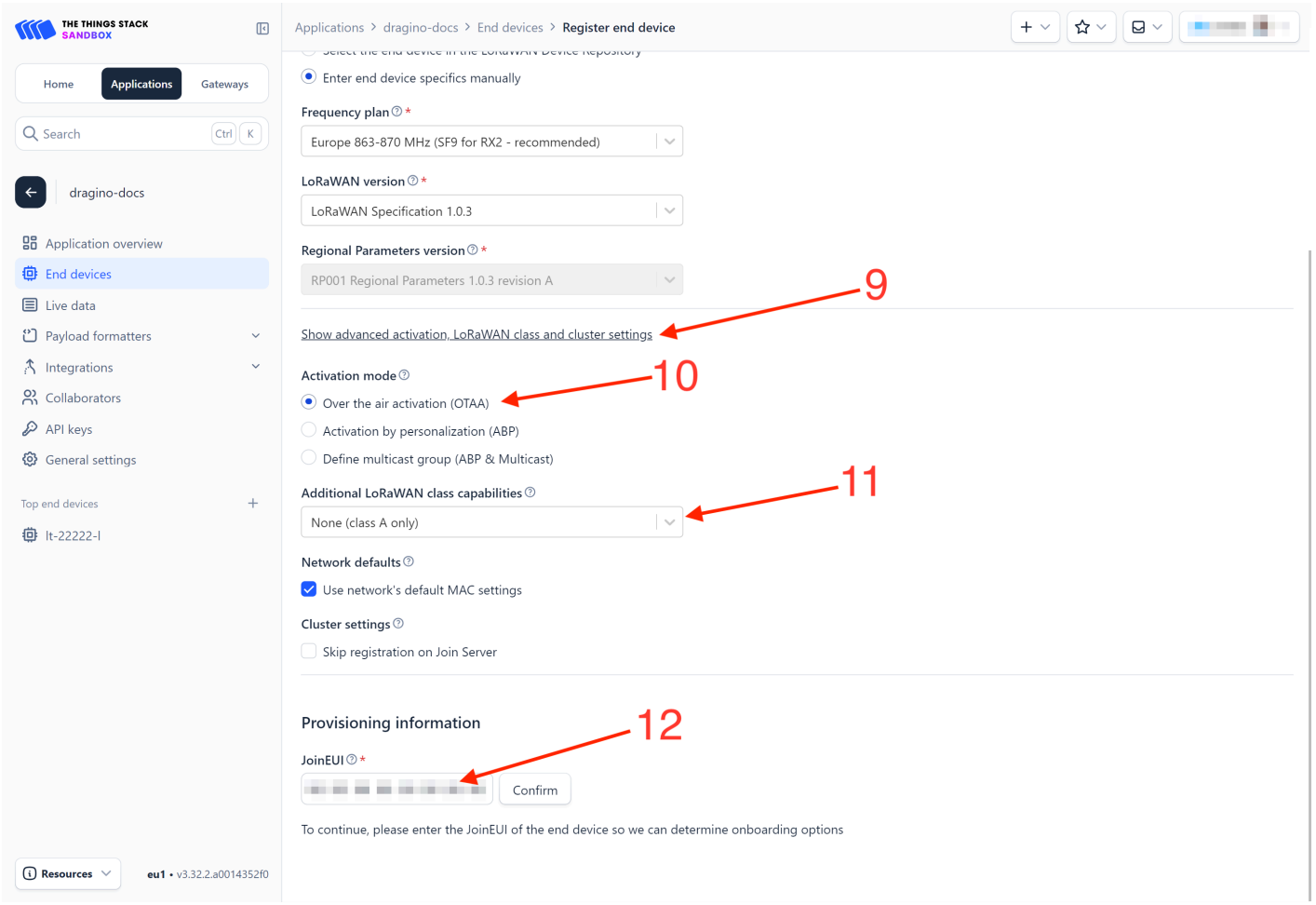


9. Click on the Show advanced activation, LoRaWAN class and cluster settings to expand the section.

10. Select Over the air activation (OTAA) option.

11. Select None (class A only) .

12. JoinEUI : Enter the AppEUI of the device (see the registration information sticker) and Click the Confirm button.



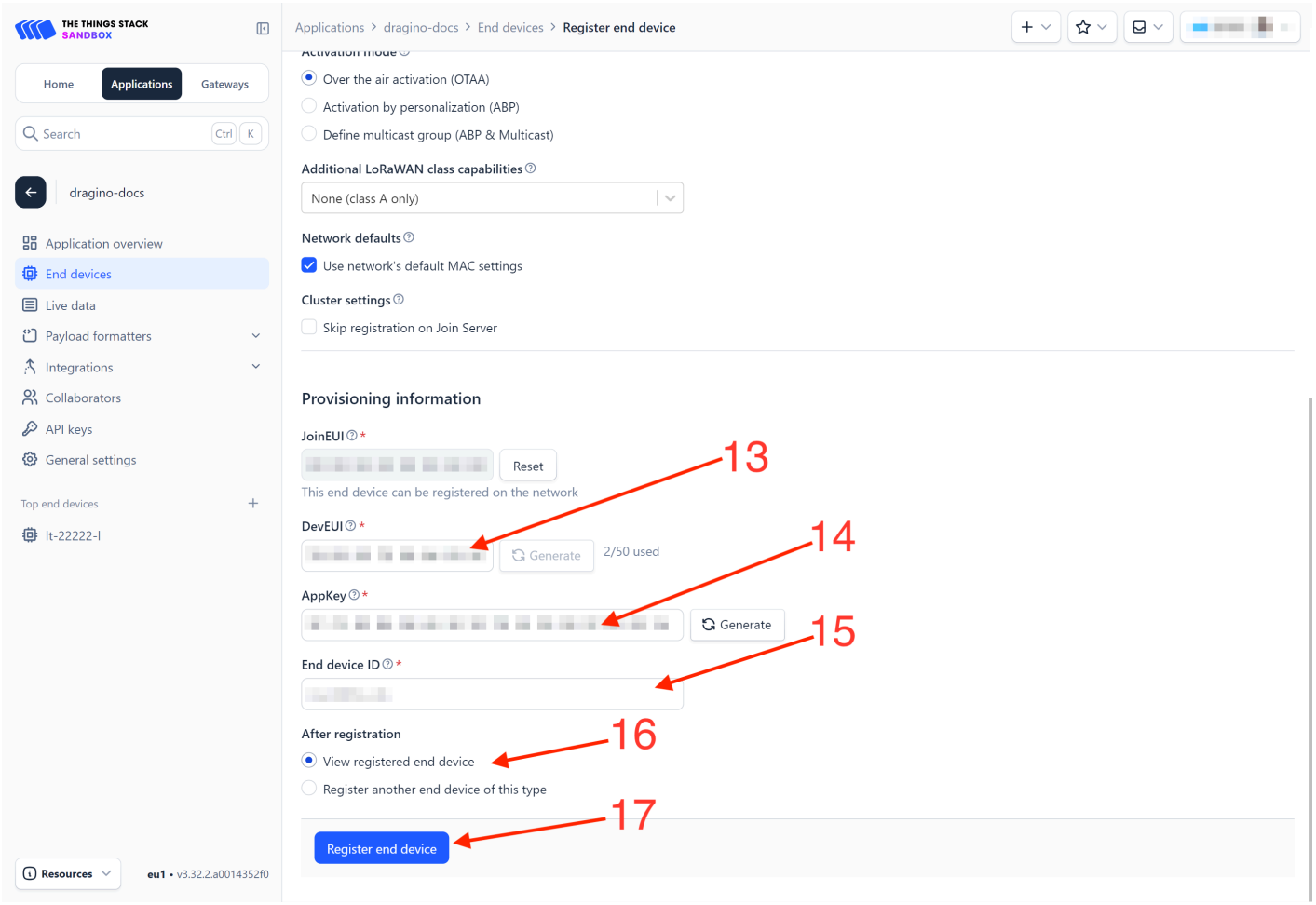
13. DevEUI : Enter the DevEUI of the device (see the registration information sticker).

14. AppKey : Enter the AppKey of the device (see the registration information sticker).

15. End device ID : Enter a name for your end device to uniquely identify it within this application.

16. Click View registered end device option.

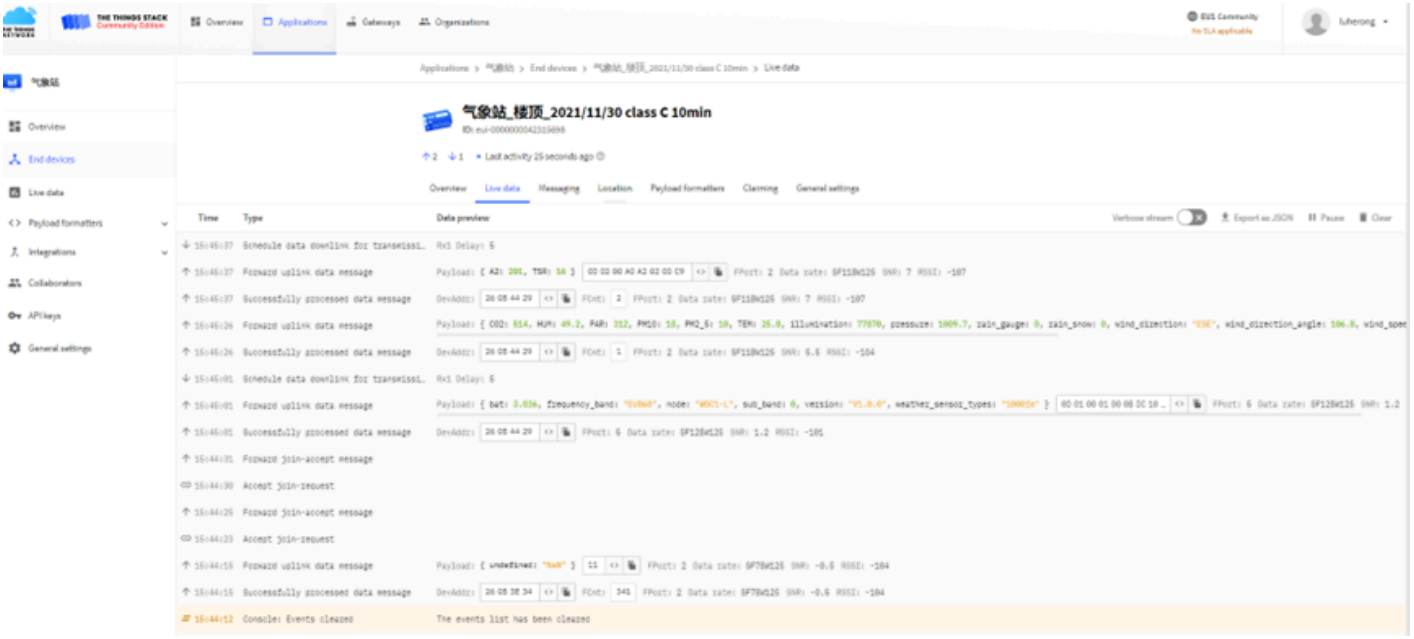
17. Click Register end device button.



You will be navigated to the Device overview page.

2.1.2.3 Power on the WQS-LB/LS

Power on the WQS-LB/LS. It will then join The Things Stack. Once successfully connected, the device will begin uplinking sensor data to The Things Stack, which can be viewed on the Live data panel.

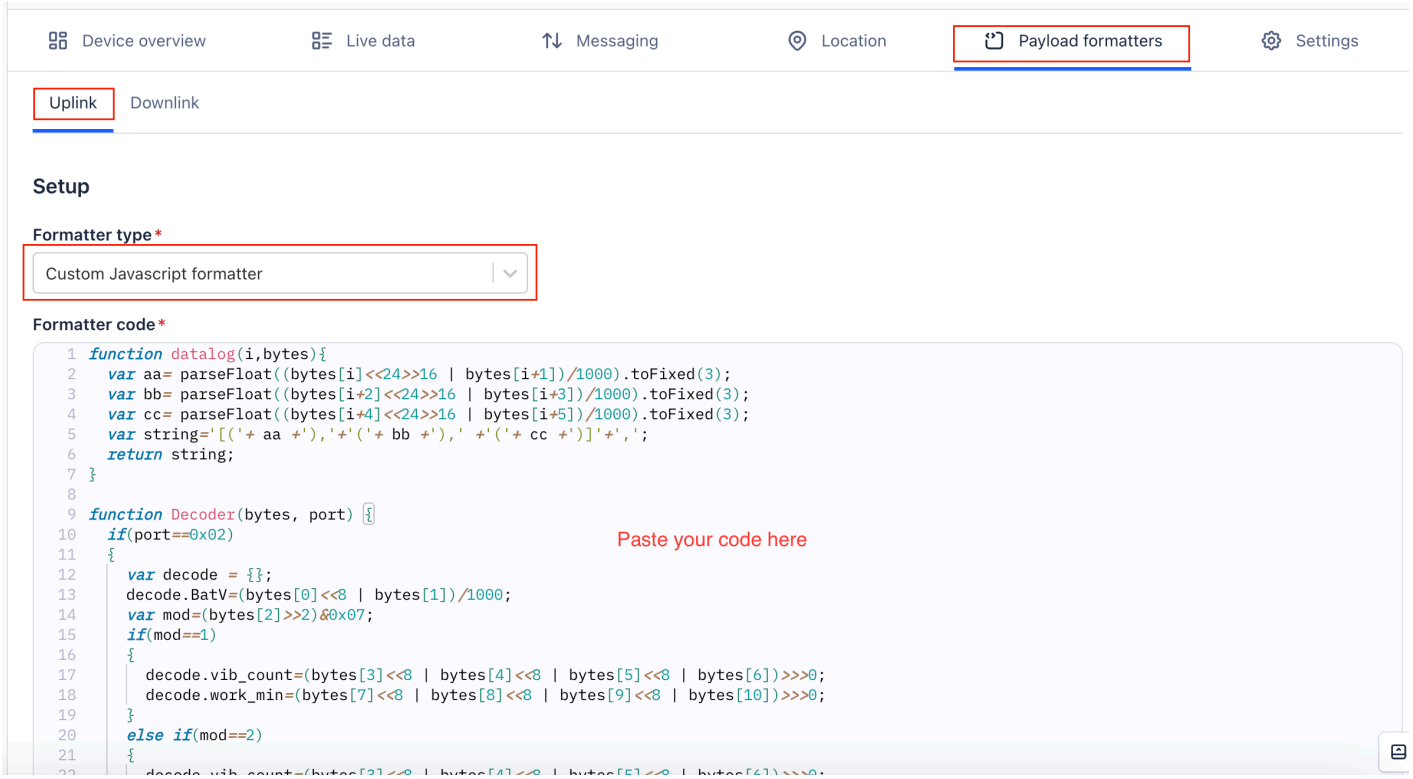


2.1.3 Uplink Decoder in The Things Stack

When the uplink payload arrives in The Things Stack, it is displayed in HEX format, which is not easy to read. You can add the WQS-LB/LS decoder in The Things Stack for easier readability of each sensor reading.

The uplink decoder can be added to the Payload Formatters of your device in The Things Stack. Refer to the screenshot below.

1. Click Uplink tab.
2. Formatter type: Select Custom Javascript formatter.
3. Formatter code : Copy the uplink payload formatter code from our dragino-end-node-decoder GitHub repository and paste it here.
4. Finally, click on the Save changes button.



2.2 Uplink payload

Uplink payloads include two types: Valid Sensor Values and other status/control commands.

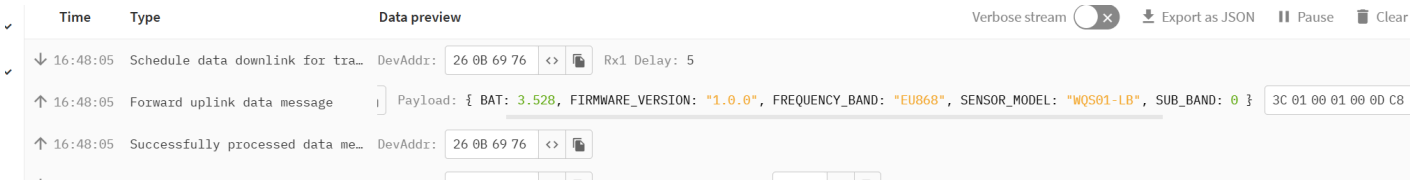
- **Valid Sensor Values**: Use FPort=2.
- **Other status/control commands**: Use FPort other than 2.

2.2.1 Uplink FPort=5, Device status

Uplink the device configuration with FPort=5. Once the WQS-LB/LS joins the network, it will send this message to the server. After the first uplink, the WQS-LB/LS will transmit the **device status** every 12 hours.

Users can also use the downlink command (0x2601) to request the WQS-LB/LS to resend this uplink.

Size(bytes)	1	2	1	1	2
Value	Sensor Model	Firmware Version	Frequency Band	Sub-band	BAT



Example payload (FPort=5): 3C 01 00 01 00 0D C8

Sensor Model: 1 byte

For WQS-LB, this value is 0x3C.

Firmware Version: 2 bytes

0x0100, Means: v1.0.0 version.

Frequency Band: 1 byte

0x01: EU868

0x02: US915

0x03: IN865

0x04: AU915

0x05: KZ865

0x06: RU864

0x07: AS923

0x08: AS923-1

0x09: AS923-2

0x0a: AS923-3

0x0b: CN470

0x0c: EU433

0x0d: KR920

0x0e: MA869

Sub-Band: 1 byte

value 0x00 ~ 0x08 (only for CN470, AU915,US915. Others are 0x00)

BAT: 2 bytes

shows the battery voltage for WQS-LB MCU.

Ex1: 0x0DC8/1000 = 3.528 V

2.2.2 Uplink FPort=2, Real time sensor value

The WQS-LB/LS will send this uplink after the Device Config uplink once it successfully joins the LoRaWAN network. It will then periodically send this uplink. The default interval is 20 minutes, but this can be changed .

The uplink uses FPort=2 and, by default, sends one uplink every 20 minutes.

The uplink length is dynamic and depends on the types of weather sensors connected. The uplink payload is composed of sensor segments, as shown below:

Size(bytes)	2	2	1	2	2	2	2	2	2	2	2	2
Value	BAT	temperature DS18B20	flag and Sensor Identifier	turbidity	dissolved oxygen	ORP	ECK10	ECK10_temp	ECK1	ECK1_temp	PH	PH_temp

r: 26 0B 4F 6D Payload: { BatV: 3.252, ORP: 2, PH: 7.34, PH_Temp: 27.3, i_flag: 0, temp_DS18B20: "327.60", turbidity: 251 } 0C B4 0C CC 29 09 CE 00 02 02 DE 01 11… FPort

Payload Example (FPort=2): 0CB4 0CCC 29 09CE 0002 02DE 0111

The WQS-LB/LS is connected to three sensors, PH, ORP, and turbidity.

BAT: 2 bytes

Shows the battery voltage for WQS-LB/LS MCU.

Ex1: 0x0CB4/1000 = 3.252 V

Temperature: 2 bytes

This is the data of the external DS18B20 temperature sensor.

If the DS18B12 sensor is not connected, it will display:0CCC/10 =327.60°C

Flag and Sensor Identifier: 1 byte （Version 1.3.1 is 2 bytes）

The Flag and Sensor Identifier uses a hexadecimal byte, which becomes 8 digits when converted to binary.

Example:

$$0x29\,(H) = 0010\ \ 1001\,(B)$$

00 indicates the interrupt identifier.

The remaining six digits represent the identifiers of the turbidity, dissolved oxygen, ORP, ECK10, ECK1, and pH sensors, in that order.

For example, 101001 means that the WQS-LB/LS has three sensors connected: turbidity, ORP, and pH.

Sensor data: each 2 bytes, total 6 bytes

turbidity: 0x09CE/10=251

ORP: 0x0002=2

pH: 0x02DE/100=7.34

pH_temp=0x0111/10=27.3

2.3 Uplink FPort=3, Datalog

Datalog Feature is to ensure IoT Server can get all sampling data from Sensor even if the LoRaWAN network is down. For each sampling, WQS-LB/LS will store the reading for future retrieving purposes.

2.3.1 How datalog works

WQS-LB/LS will wait for ACK for every uplink, when there is no LoRaWAN network,WQS-LB/LS will mark these records with non-ack messages and store the sensor data, and it will send all messages (10s interval) after the network recovery.

- a) WQS-LB will do an ACK check for data records sending to make sure every data arrive server.
- b) WQS-LB will send data in **CONFIRMED Mode**, but WQS-LB/LS won't re-transmit the packet if it doesn't get ACK, it will just mark it as a NONE-ACK message. In a future uplink if WQS-LB/LS gets a ACK, WQS-LB will consider there is a network connection and resend all NONE-ACK messages.

2.3.2 Enable Datalog

User need to make sure below two settings are enable to use datalog;

- **SYNCMOD=1(Default)** to enable sync time via LoRaWAN MAC command, click here (AT+SYNCMOD) for detailed instructions.
- **PNACKMD=1** to enable datalog feature, click here (AT+PNACKMD) for detailed instructions.

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

> 📘 **Note LoRaWAN Server need to support LoRaWAN v1.0.3(MAC v1.0.3) or higher to support this MAC command feature, Chirpstack,TTN V3 v3 and loriot support but TTN V3 v2 doesn't support. If server doesn't support this command, it will through away uplink packet with this command, so user will lose the packet with time request for TTN V3 v2 if SYNCMOD=1.**

2.3.3 Unix TimeStamp

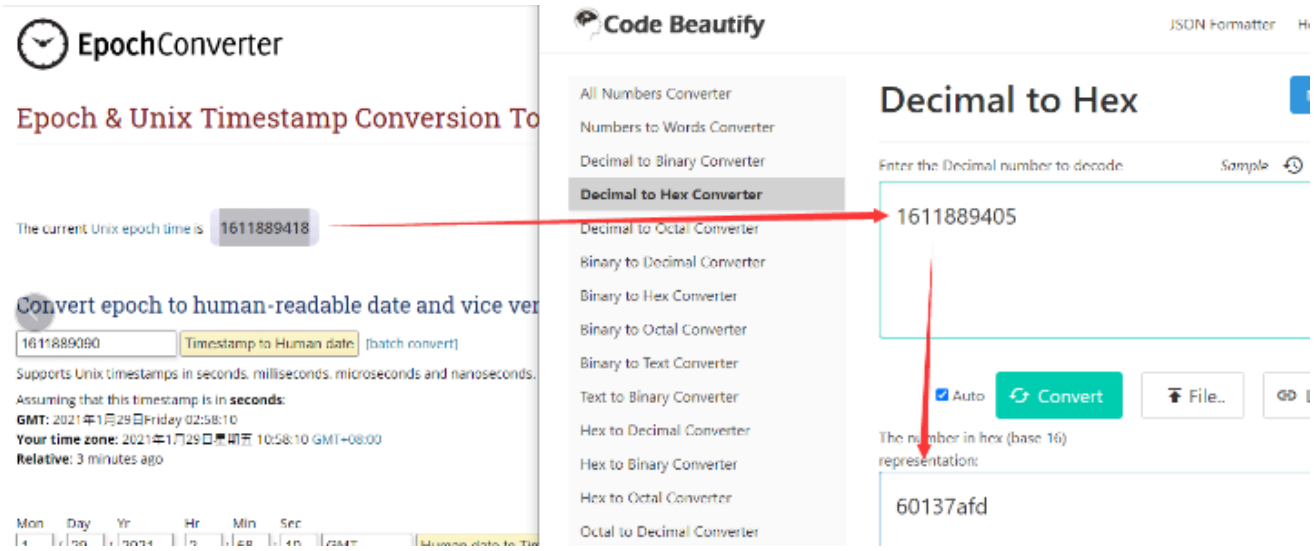
WQS-LB/LS uses Unix TimeStamp format based on

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

Figure 10 : DeviceTimeAns payload format

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

Below is the converter example



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

2.3.4 Datalog Uplink payload (FPORT=3)

The Datalog uplinks will use below payload format.

Retrieval data payload:

Note: WQS-LB/LS can be equipped with 3 optional sensors. The datalog is sorted in the following order.

Size(bytes)	2	2	2	2	2	2	4
Value	turbidity(Options)	dissolved oxygen(Options)	ORP(Options)	ECK10(Options)	ECK1(Options)	PH(Options)	Unix TimeStamp

Example:

The WQS-LB/LS will uplink this payload:

```
26 0B 62 D3  Rx1 Delay: 5
26 0B 62 D3  Payload: { DATALOG: "[11.63,318,9.04,2025-03-14 02:38:17],", PNACKMD: "True" }  04 8B 01
26 0B 62 D3
26 0B 62 D3  Rx1 Delay: 5
26 0B 62 D3  Payload: { BatV: 3.24, EC_K1: 312, PH: 9.05, dissolved_oxygen: 11.62, i_flag: 0, temp_DS
26 0B 62 D3
```

048B013E03889367D39699

Where the first 10 bytes is for the first entry:

048B013E03889367D39699

dissolved oxygen =0x048B/100=11.63

ECK1 =0x013E=318

PH =0x0388/100=9.04

Unix time is 0x67D39699=1741919897s=25/3/14 02:38:17

No ACK Message : 1: This message means this payload is fromn Uplink Message which doesn't get ACK from the server before (for PNACKMD=1 feature)

Poll Message Flag : 1: This message is a poll message reply.

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

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

a) DR0: max is 11 bytes so one entry of data

b) DR1: max is 53 bytes so devices will upload 4 entries of data (total 44 bytes)

c) DR2: total payload includes 11 entries of data

d) DR3: total payload includes 22 entries of data.

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

2.4 Integrating data with IoT platforms

The WQS-LB/LS sensor data can be integrated with other IoT platforms for better visualizing and analyzing the data. In this section, we will show you how to integrate sensor data from The Things Stack with some popular IoT platforms.

2.4.1 Integrate and show data on ThingsEye

The Things Stack application supports integration with ThingsEye.io. Once integrated, ThingsEye.io acts as an MQTT client for The Things Stack MQTT broker, allowing it to subscribe to upstream traffic and publish downlink traffic.

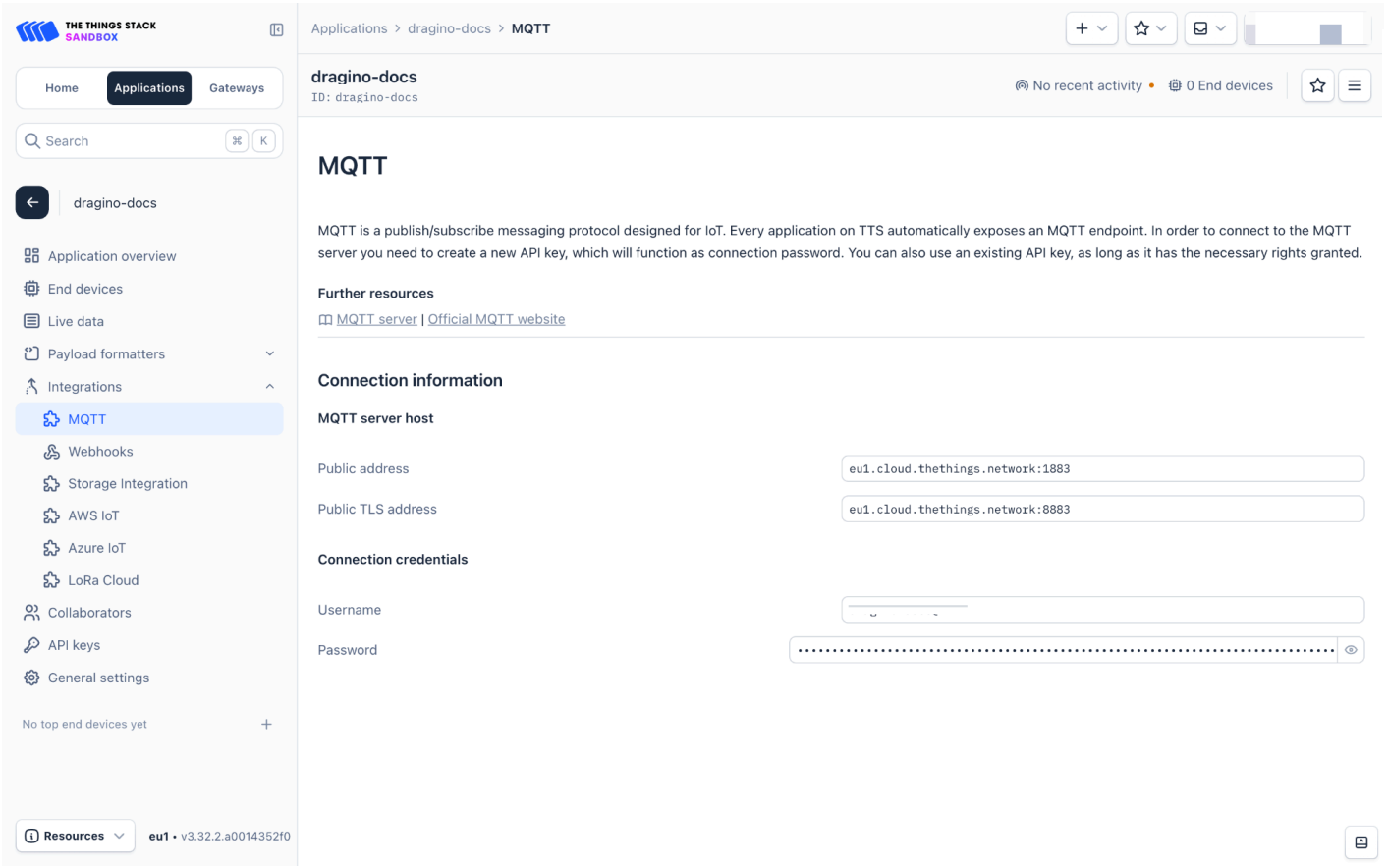
2.4.1.1 Configuring The Things Stack

We use The Things Stack Sandbox in this example:

- In **The Things Stack Sandbox**, go to the **Application**for the WQS-LB/LS you added.
- Select **MQTT** under **Integrations** in the left menu.
- In the **Connection information** section, under **Connection credentials**, The Things Stack displays an auto-generated **username**. You can use it or provide a new one.
- Click the **Generate new API key** button to generate a password. You can view it by clicking on the **visibility toggle/eye** icon. The API key works as the password.

Information

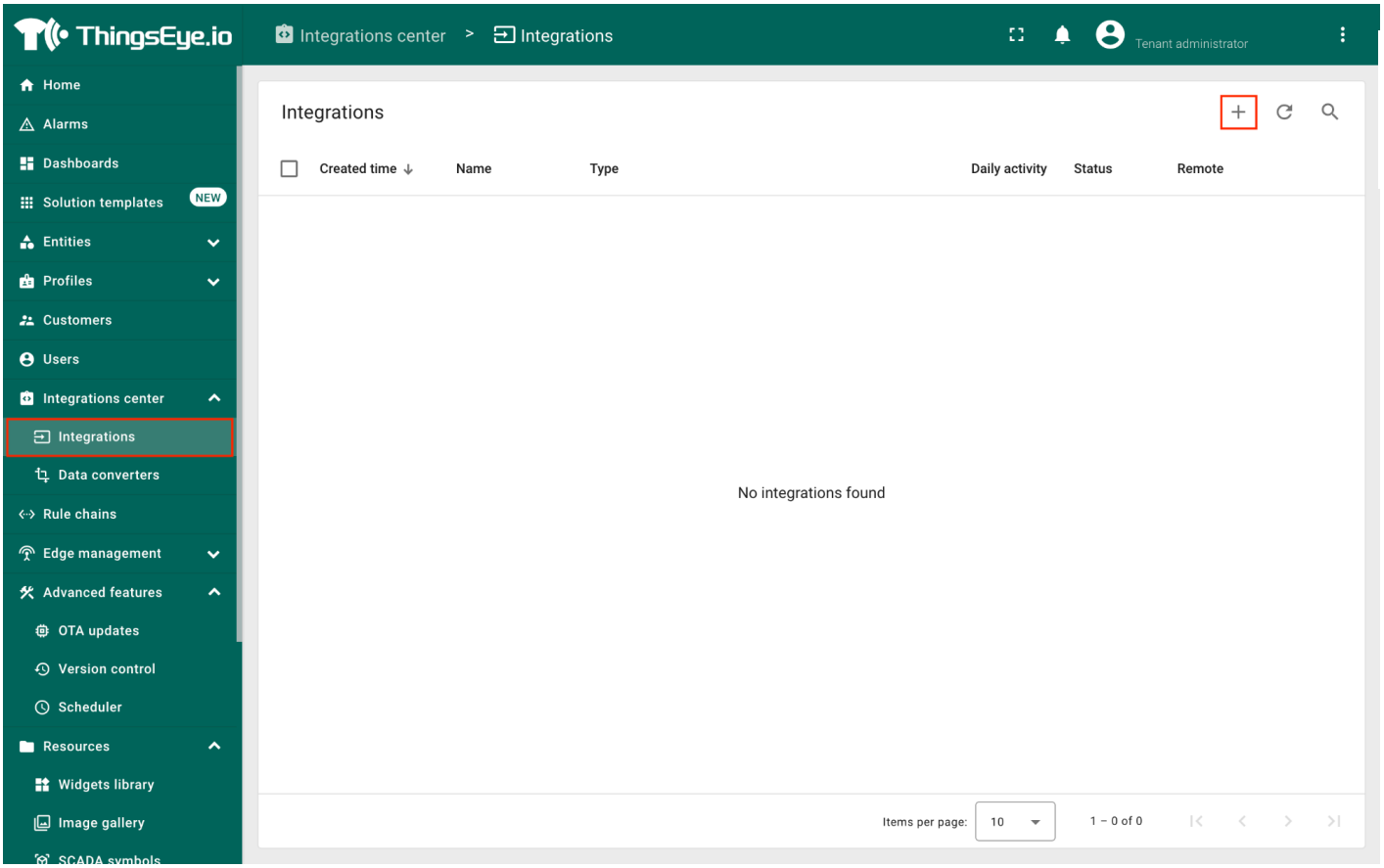
The username and password (API key) you created here are required in the next section.



2.4.1.2 Configuring ThingsEye.io

The ThingsEye.io IoT platform is not open for self-registration at the moment. If you are interested in testing the platform, please send your project information to admin@thingseye.io, and we will create an account for you.

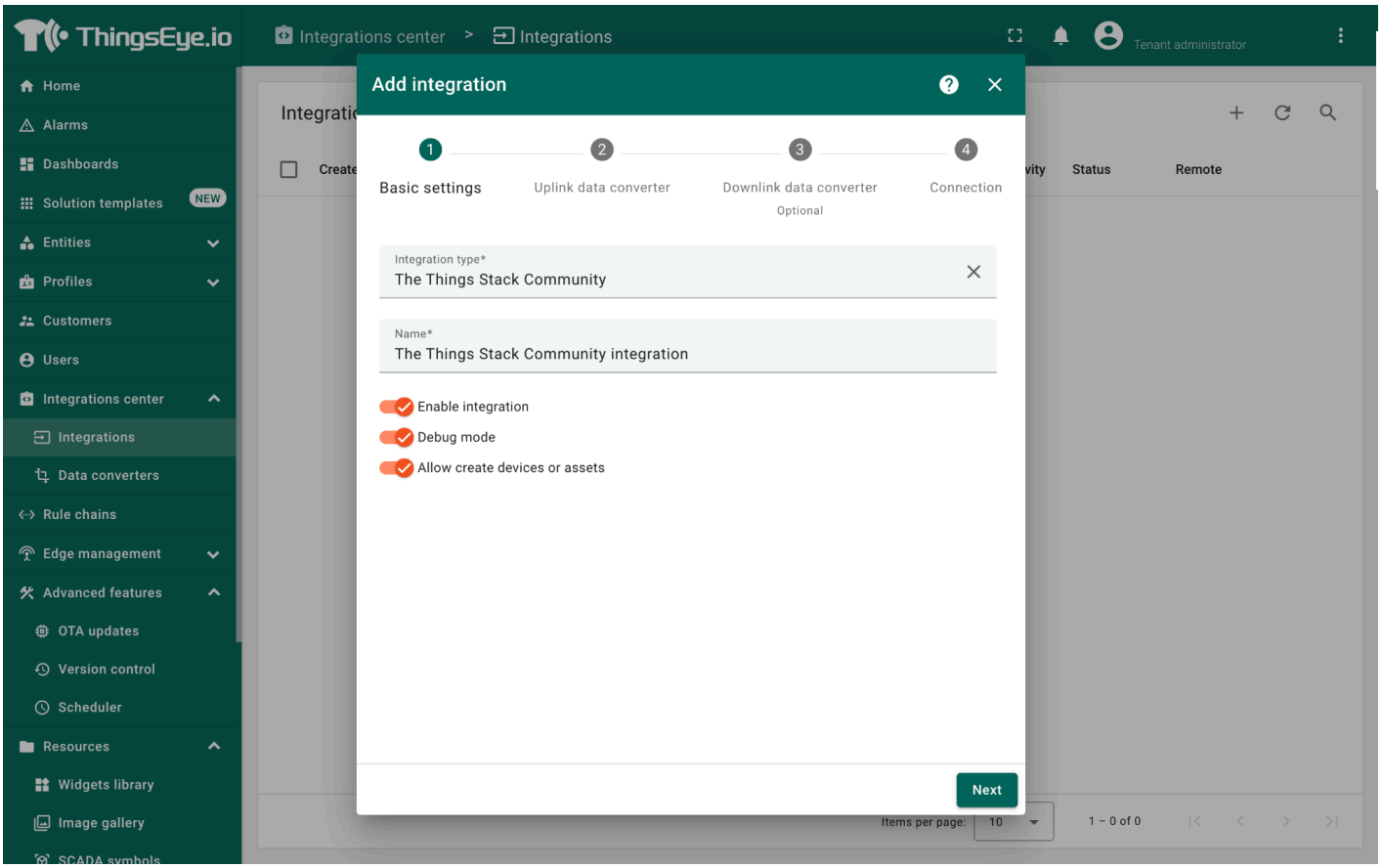
- Login to your ThingsEye.io account.
- Under the Integrations center , click Integrations .
- Click the Add integration button (the button with the + symbol).



On the Add integration window, configure the following:

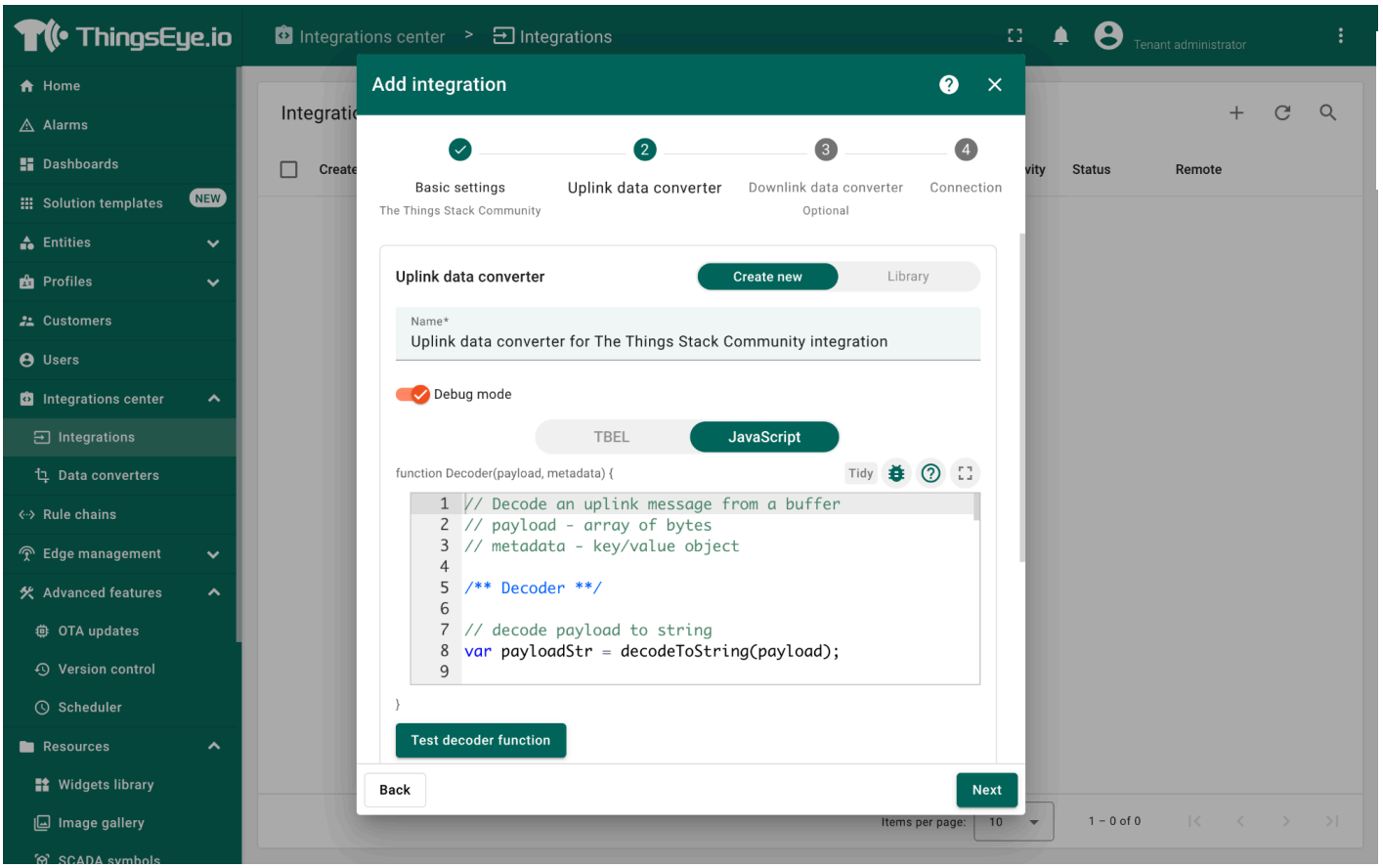
Basic settings:

- Select The Things Stack Community from the Integration type list.
- Enter a suitable name for your integration in the Name text box or keep the default name.
- Ensure the following options are turned on. Enable integration Debug mode Allow create devices or assets
- Click the Next button. you will be navigated to the Uplink data converter tab.



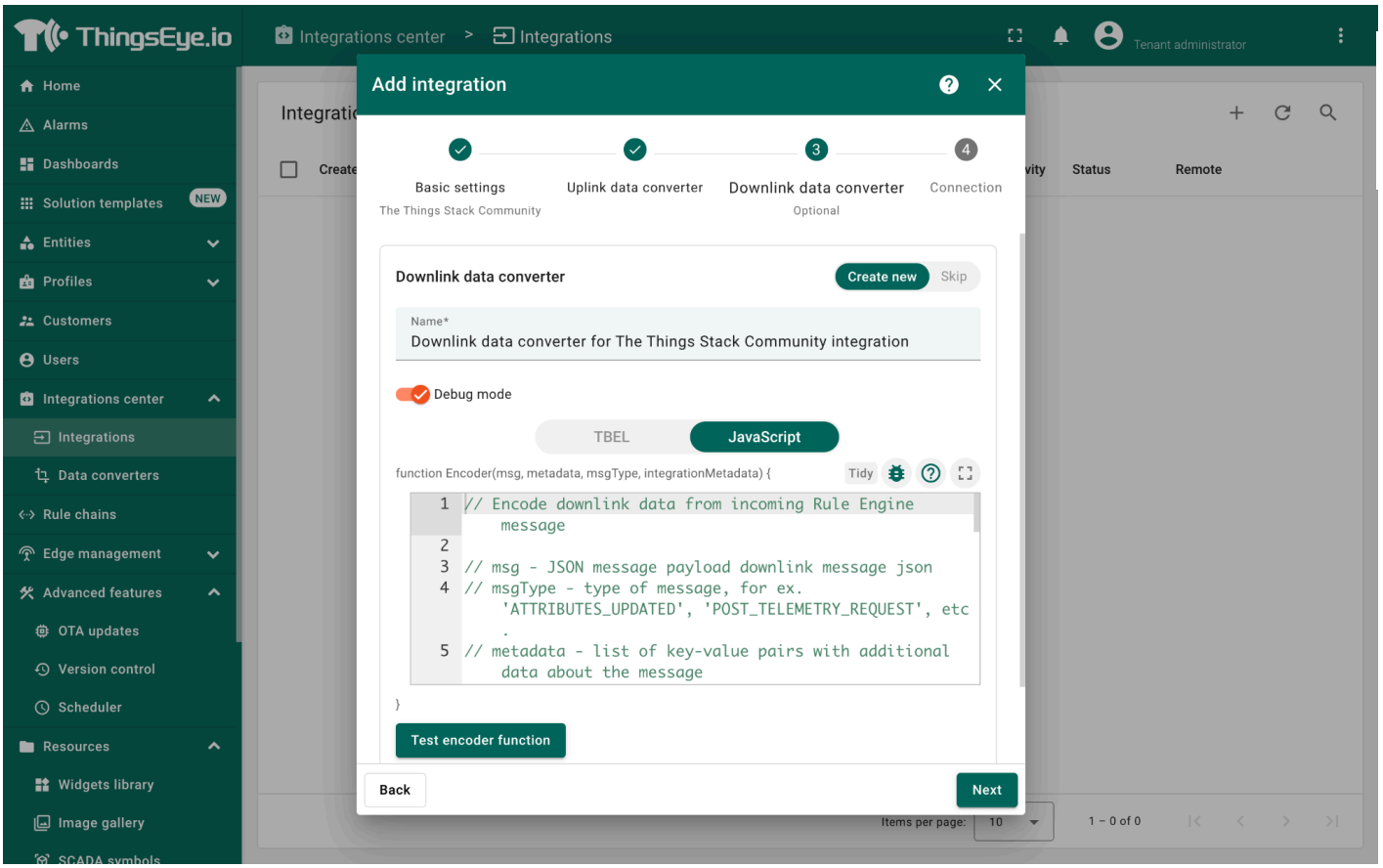
Uplink data converter:

- Click the Create new button if it is not selected by default.
- Enter a suitable name for the uplink data converter in the Name text box or keep the default name.
- Click the JavaScript button.
- Paste the uplink decoder function into the text area (first, delete the default code). The demo uplink decoder function can be found here .
- Click the Next button. You will be navigated to the Downlink data converter tab.



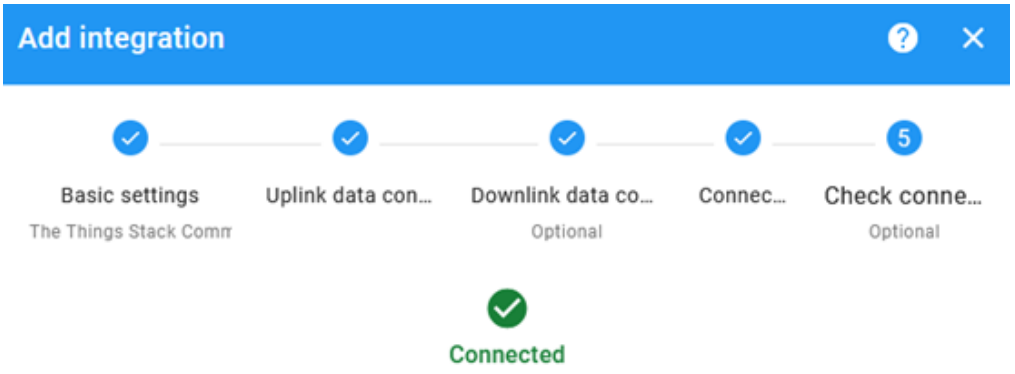
Downlink data converter (this is an optional step):

- Click the Create new button if it is not selected by default.
- Enter a suitable name for the downlink data converter in the Name text box or keep the default name.
- Click the JavaScript button.
- Paste the downlink decoder function into the text area (first, delete the default code). The demo downlink decoder function can be found here .
- Click the Next button. You will be navigated to the Connection tab.

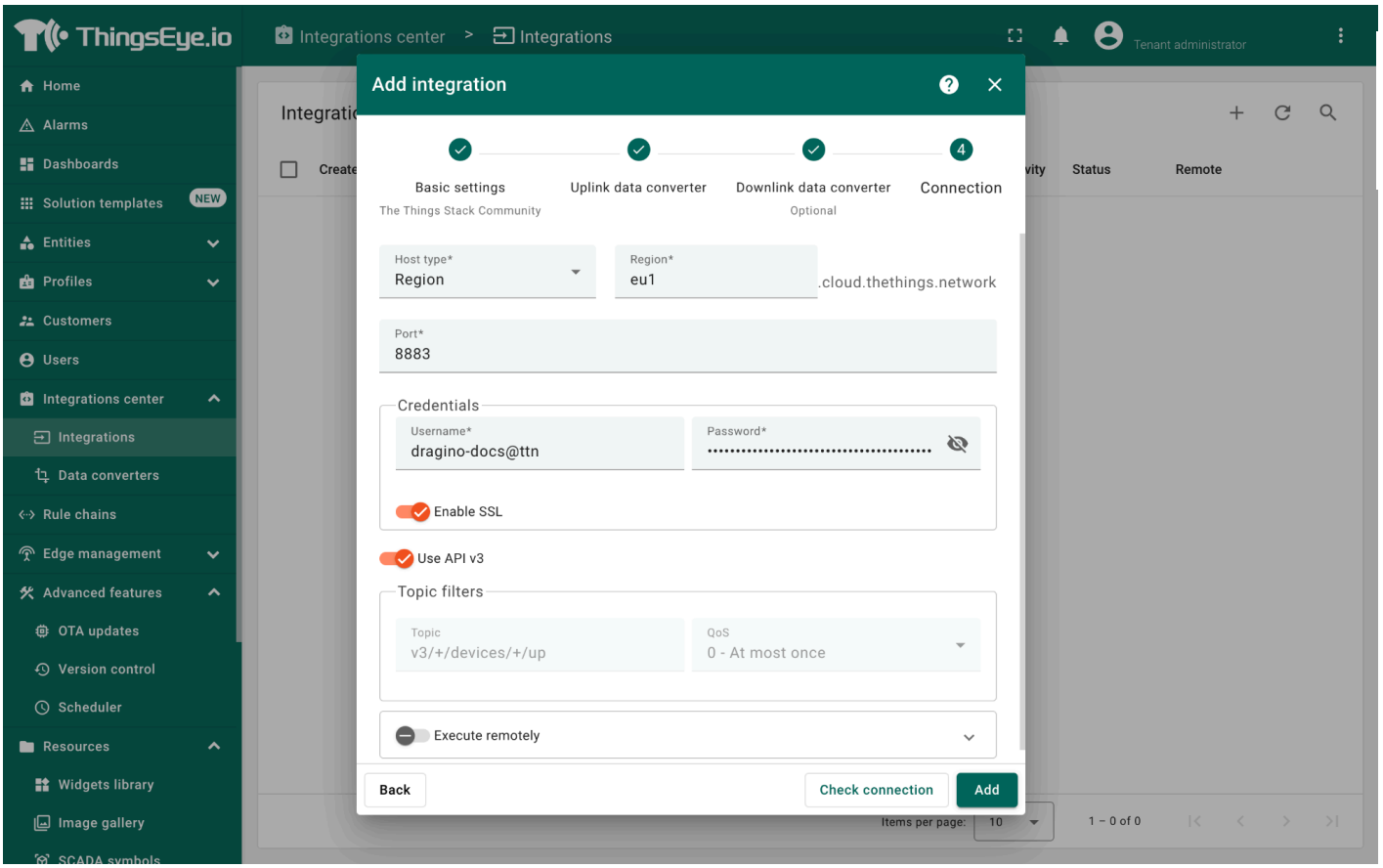


Connection:

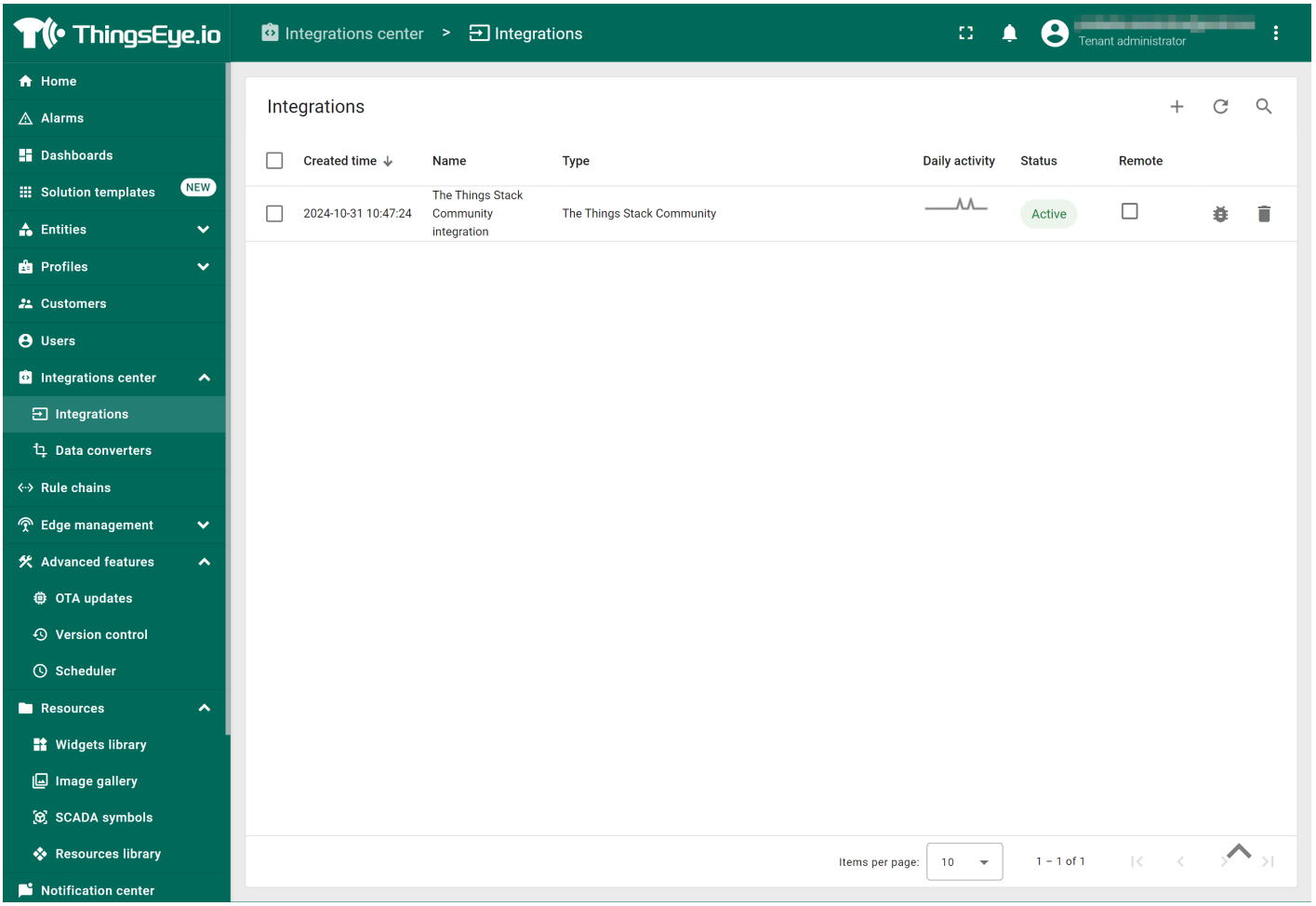
- Choose Region from the Host type .
- Enter the cluster of your The Things Stack in the Region textbox. You can find the cluster in the url (e.g., https:// eu1 .cloud.thethings.network/...).
- Enter the Username and Password of the MQTT integration in the Credentials section. The username and password can be found on the MQTT integration page of your The Things Stack account (see 3.5.1 Configuring The Things Stack).
- Click the Check connection button to test the connection. If the connection is successful, you will see the message saying Connected .



- Click the Add button.

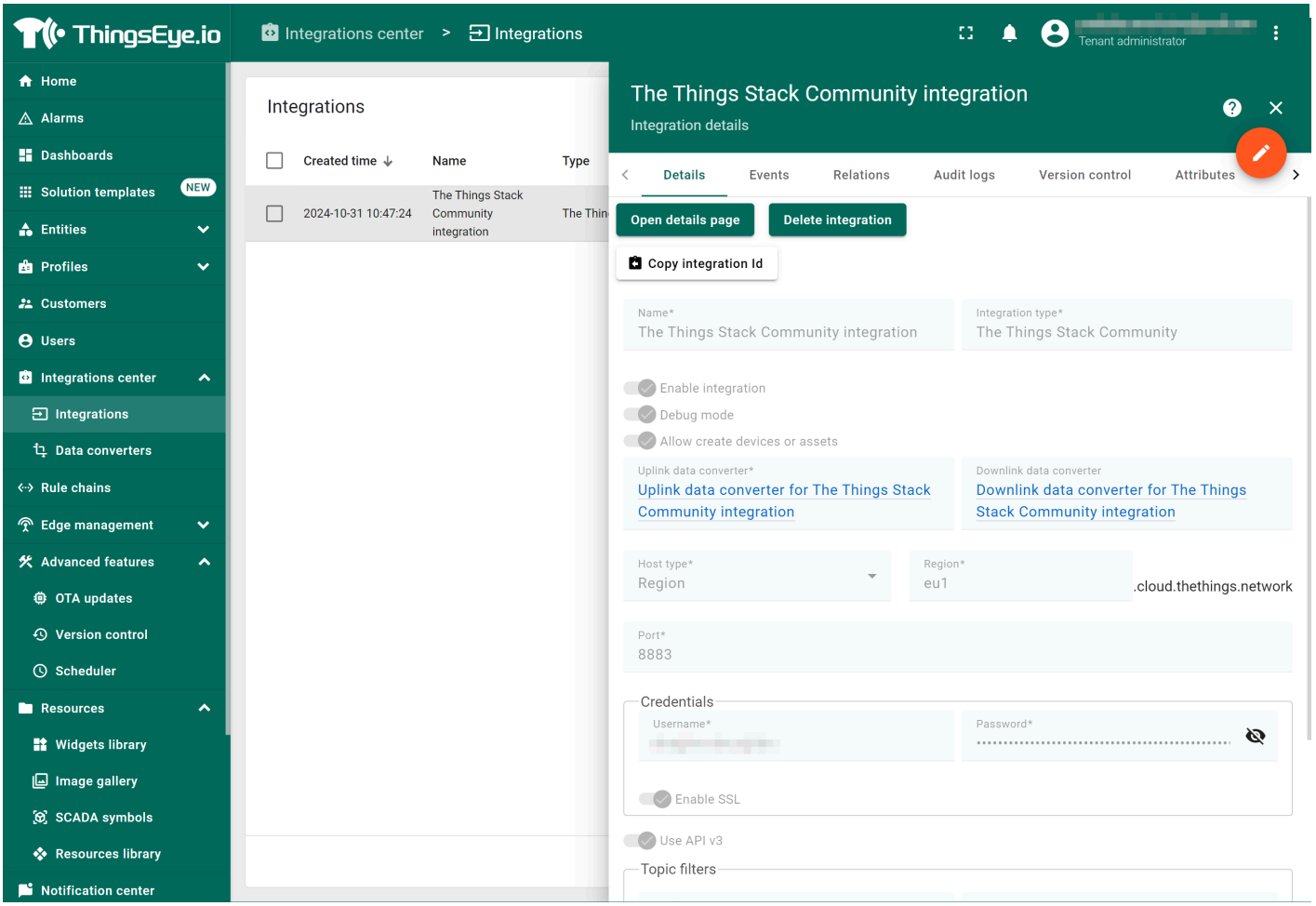


Your integration has been added to the Integrations list and will be displayed on the Integrations page. Check whether the status is shown as Active . If not, review your configuration settings and correct any errors.



2.4.1.3 Viewing integration details

Click on your integration from the list. The **Integration details** window will appear with the **Details**tab selected. The **Details**tab shows all the settings you have provided for this integration.



If you want to edit the settings you have provided, click on the **Toggle edit mode** button. Once you have done click on the **Apply changes**button.

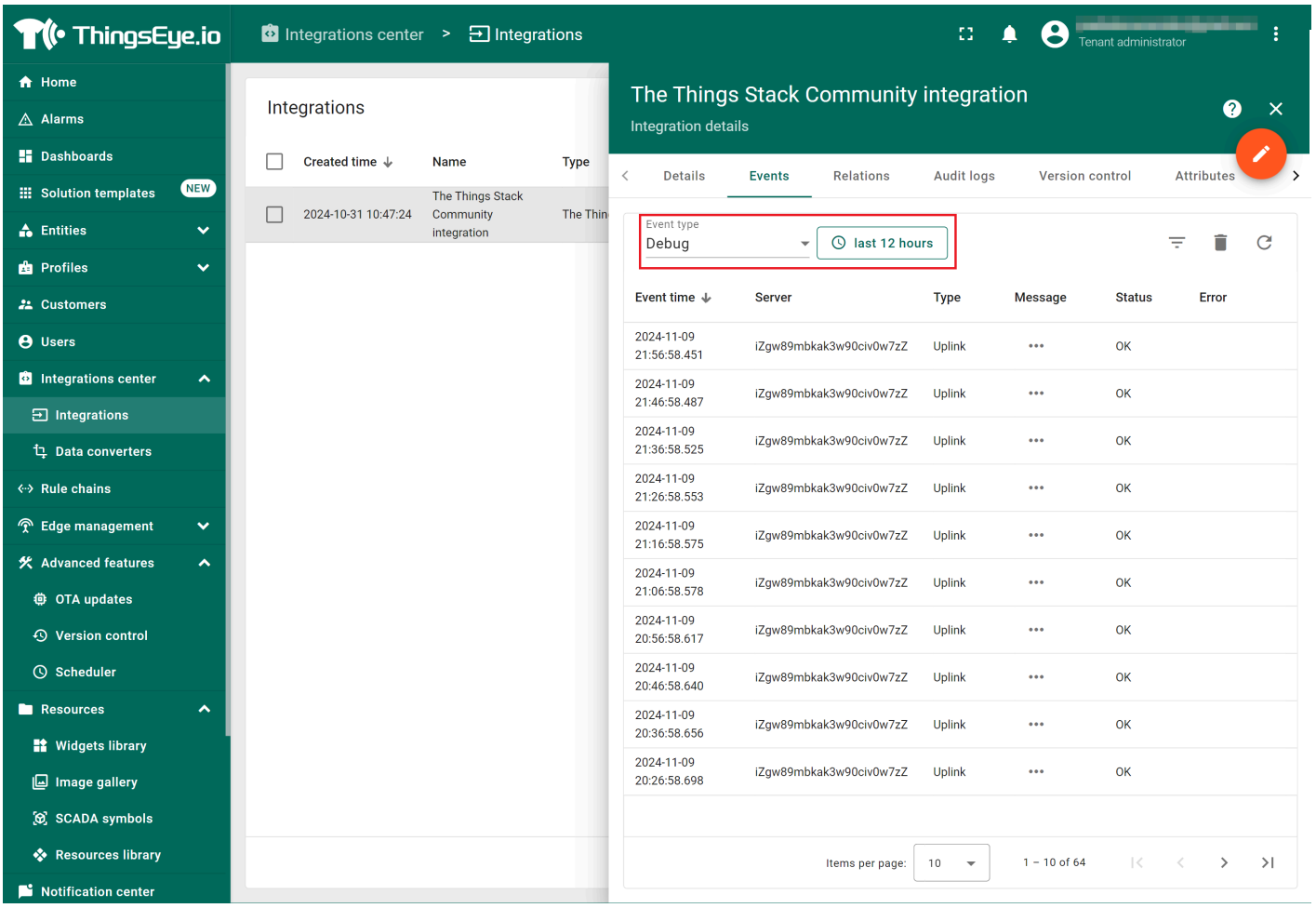
Information

See also ThingsEye documentation.

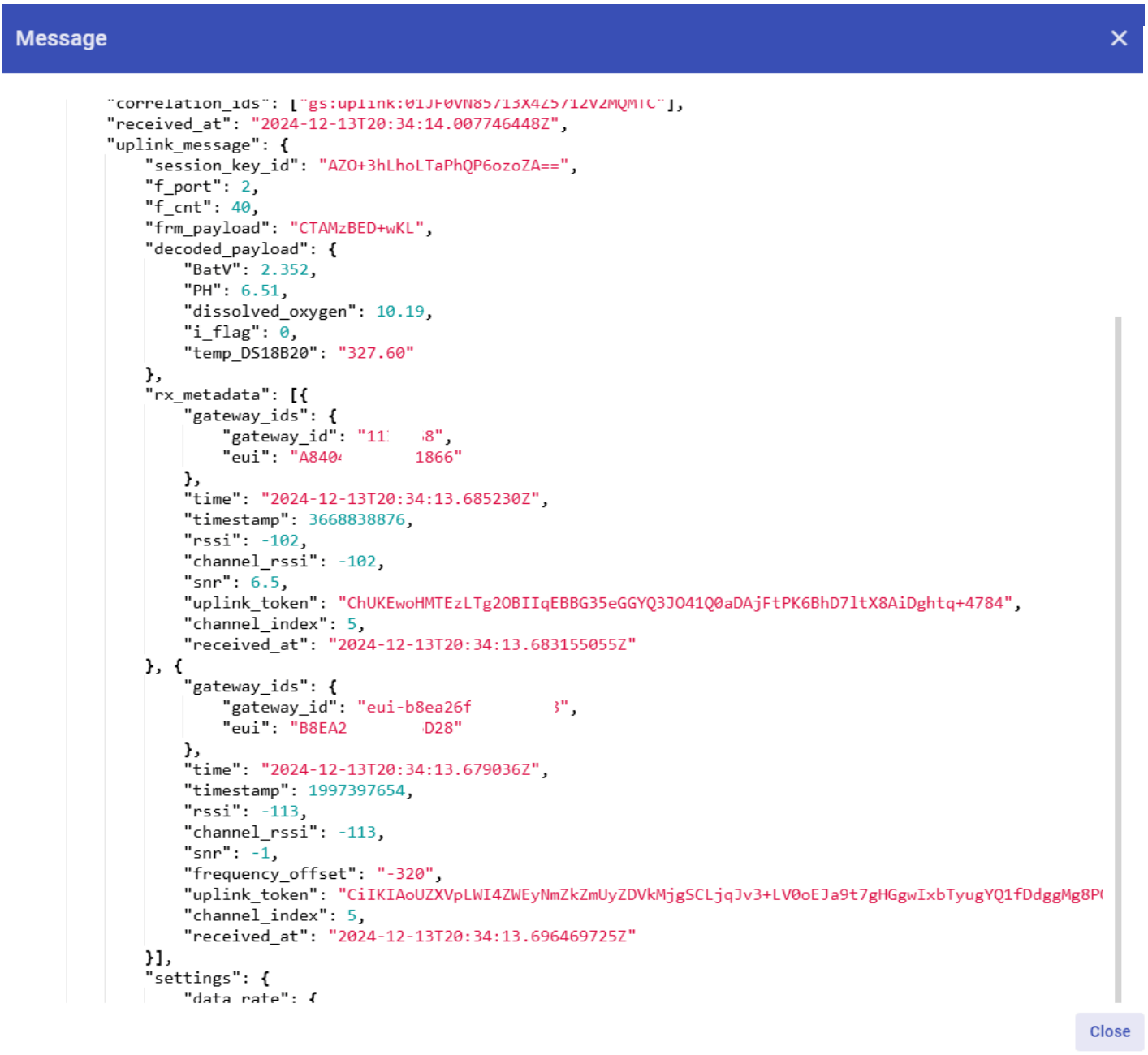
2.4.1.4 Viewing events

The **Events** tab displays all the uplink messages from the WQS-LB/LS.

- Select **Debug** from the **Event type** dropdown.
- Select the **time frame** from the **time window**.



- To view the **JSON payload** of a message, click on the **three dots (...)** in the Message column of the desired message.

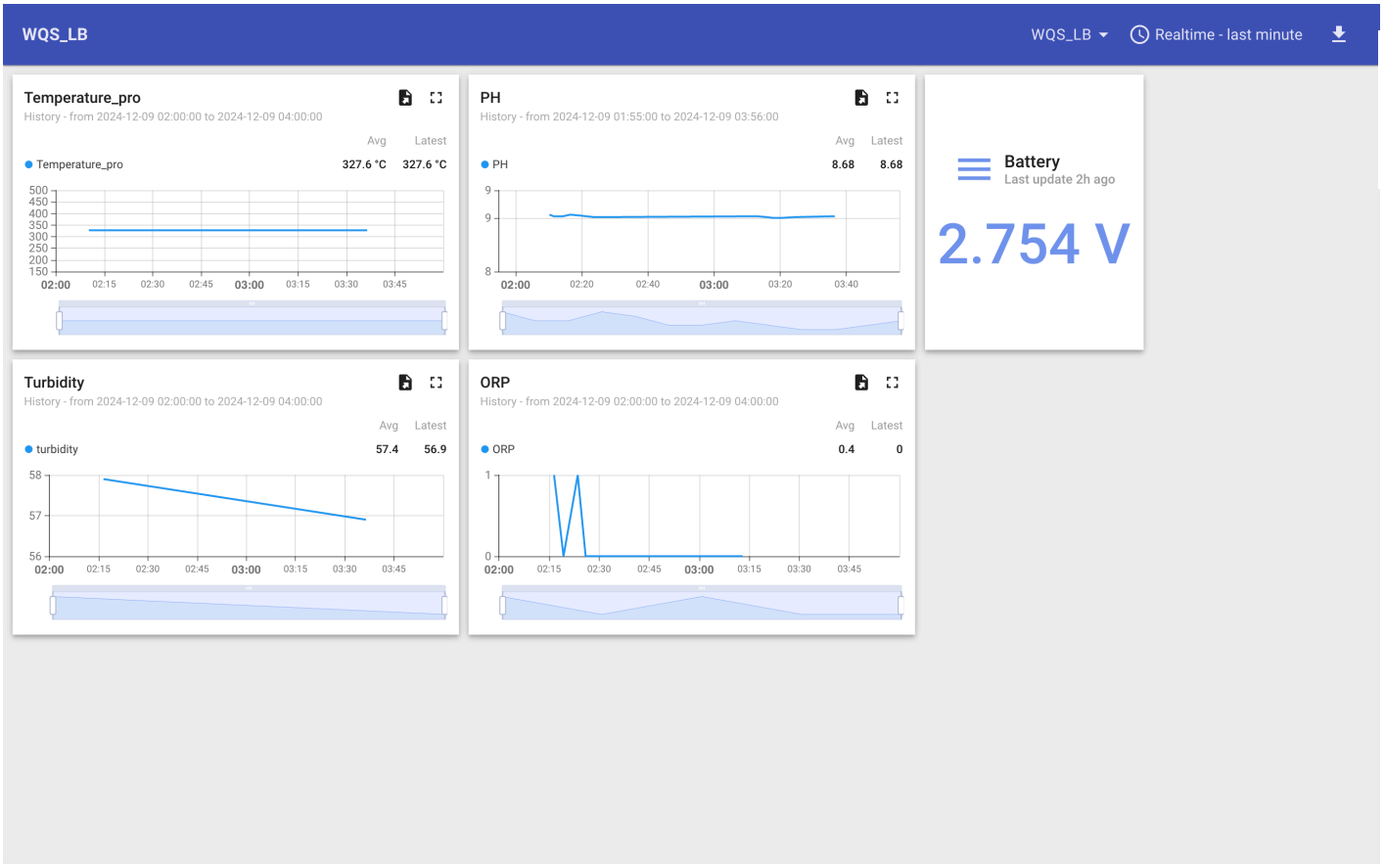


2.4.1.5 Deleting an integration

If you want to delete an integration, click the **Delete integratio** n button on the Integrations page.

2.4.1.6 Creating a dashboard

The following image shows a dashboard created using ThingsEye to display sensor data on widgets, allowing users to analyze and visualize the data.



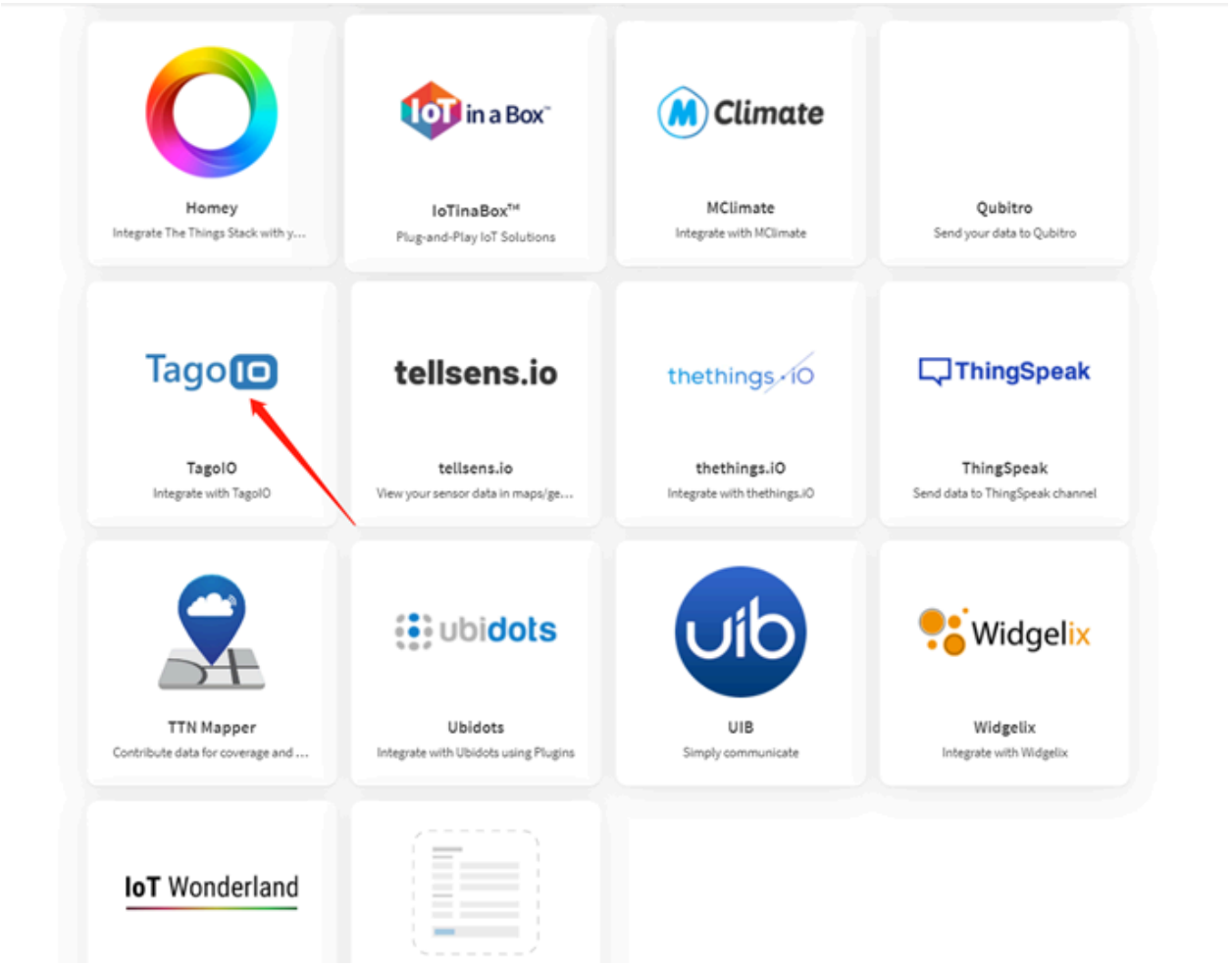
2.4.2 Integrate and show data on TagoIO

TagoIO is a scalable IoT platform that allows easily build scalable IoT solutions **. The Things Stack** application supports integration with **TagoIO** using **webhooks**.

- Ensure that WQS-LB/LS is properly connected to The Things Stack.
- Then configure your The Things Stack application to forward data to TagoIO by adding an integration with webhooks.
- In The Things Stack console, navigate to **Applications → <your application> → Integrations → Webhooks → + Add webhook.**

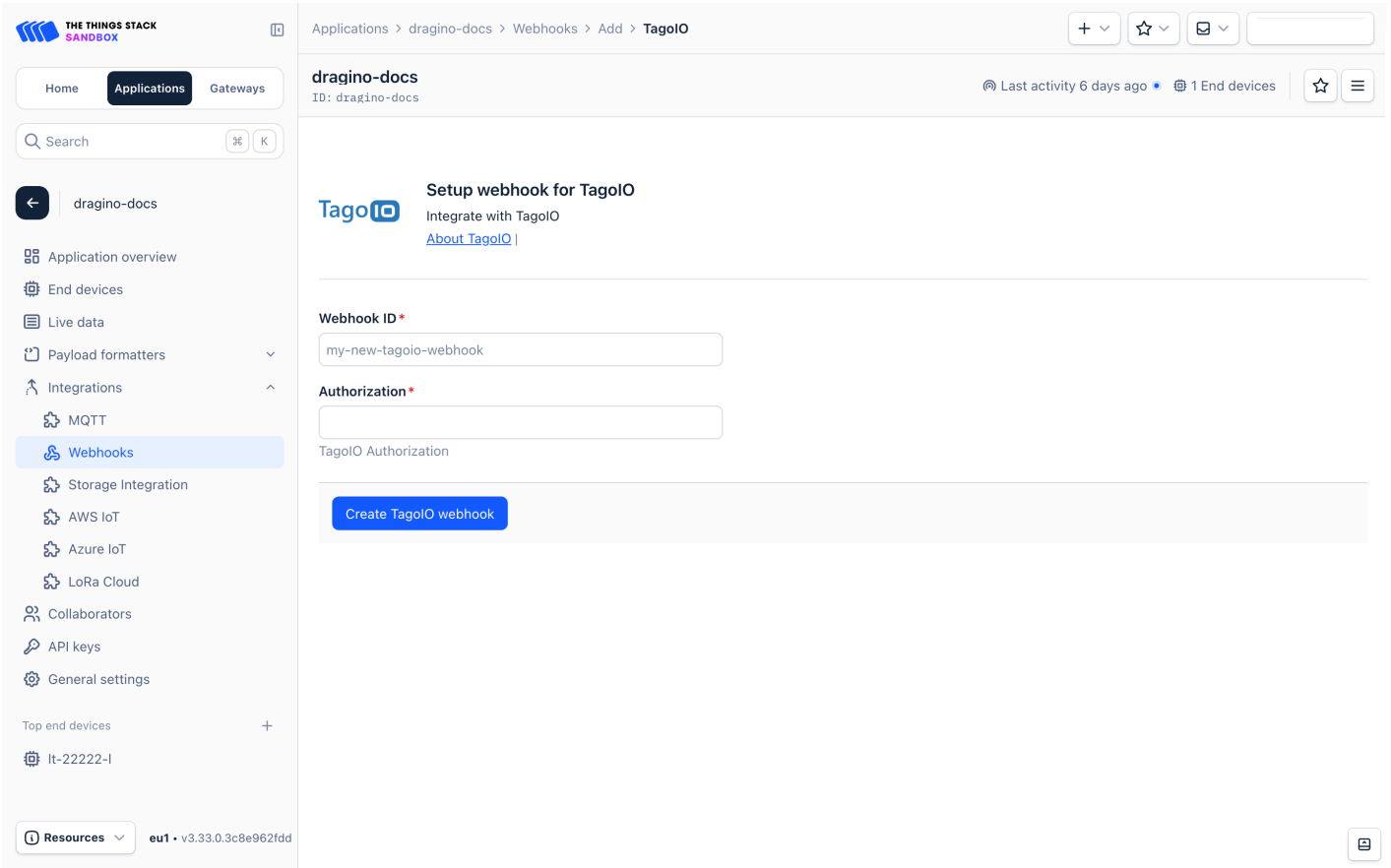
Step 1: Be sure that your device is programmed and properly connected to the LoRaWAN network.

Step 2: Configure your Application to forward data to Datacake you will need to add integration. Go to TTN V3 Console —> Applications -> Integrations —> Add Integrations.

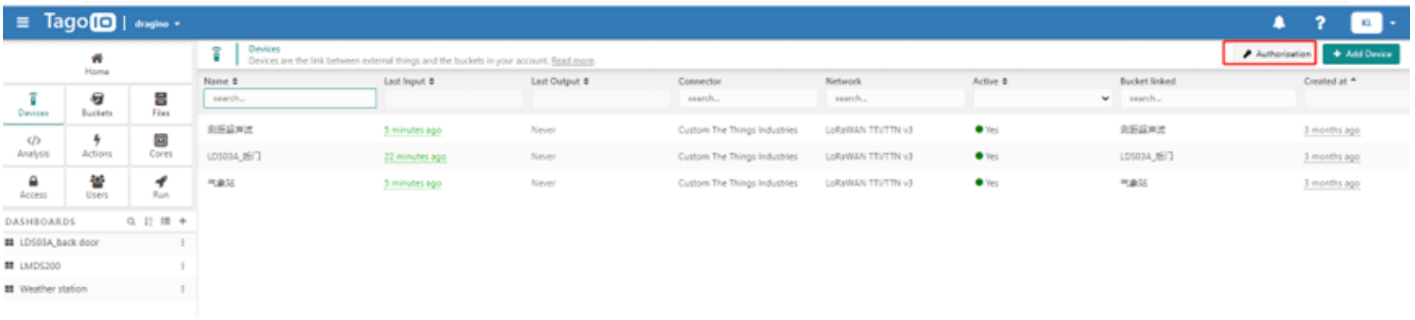


In the **Setup webhook for TagoIO** page:

- **Webhook ID** - enter a name to identify your webhook.
- **Authorization**: Paste the authorization code copied from the TagoIO.
- Click **Create TagoIO webhook** button.



Authorization:



In TagoIO console (https://admin.tago.io//), add WQS-LB/LS:



3. Configure the WQS-LB/LS using AT commands or LoRaWAN downlinks

You can configure the WQS-LB/LS using AT Commands or LoRaWAN Downlinks.

- AT Commands: See FAQ .
- LoRaWAN Downlink instruction for different platforms: Use Note for Server (IoT LoRaWAN Server)

There are two types of commands to configure the WQS-LB/LS:

1. General Commands - They are the same for all Dragino devices that support the DLWS-005 LoRaWAN Stack (Note**). These commands can be found on the wiki: End Device Downlink Command . These commands are used to configure:

- General system settings, such as the uplink interval.
- LoRaWAN protocol and radio-related settings.

Note : Please refer to the earlier user manual if you don't have firmware version 1.8.0.

2. Commands Specifically Designed for the WQS-LB/LS These commands are valid only for the WQS-LB/LS, as shown below:

3.1 Set transmit interval time

Feature : Set the uplink interval.

AT command:

Command	AT+TDC
Parameters	time : uplink interval in milliseconds
Get	AT+TDC=?
Response	time in milliseconds OK
Set	AT+TDC=<time>
Response	OK
Example	AT+TDC=60000 Set uplink interval to 60 seconds

Downlink command:

Prefix	0x01
Parameters	time : uplink interval in seconds, 3 bytes in hexadecimal.
Payload	<prefix><time>
Example	01 00003C Set uplink interval to 60 seconds

3.2 Set interrupt mode

Feature : Set the interrupt mode.

AT command:

Command	AT+INTMOD
Parameters	interrupt_mode : 0 : Disable interrupt 1 : Trigger by rising and falling edge 2 : Trigger by falling edge 3 : Trigger by rising edge
Get	AT+INTMOD=?
Response	interrupt mode OK
Set	AT+INTMOD=<interrupt_mode>
Response	OK
Example	AT+INTMOD=2 Set the interrupt mode to 'trigger by falling edge'

3.3 Set power output duration

Feature : Set power output duration

AT Command:

Command	AT+5VT
Parameters	time : power output duration in milliseconds
Get	AT+5VT=?
Response	time OK
Set	AT+5VT=<time>
Response	OK
Example	AT+5VT=1000 Close after a delay of 1000 milliseconds

Downlink Command:

Prefix	0x07
Parameters	time : power output duration in seconds, 2 bytes in hexadecimal
Payload	<prefix><time>
Example	07 0000 Set to 0 07 01F4 Set to 500 milliseconds

3.4 Sensor Calibration Commands

Specific operation steps

1. Put the sensor into the corresponding calibration liquid.
2. Restart the device.
3. Send calibration instructions.
4. Receive the byte corresponding to return.
5. Received OK is a successful calibration.

6.For EC200 calibration, please refer to 4.2.6

Command Example	Function	Response
AT+CALPH=xx	Parameter 4 6 9 downlink: 0xFB XX	4:10 06 00 22 ff ff 2b 31 6:10 06 00 21 ff ff db 31 9:10 06 00 20 ff ff 8a f1
AT+CALORP=xx	Parameter 86 256 downlink: 0xFC XX XX	86:13 06 00 24 ff ff cb 03 256:13 06 00 25 ff ff 9a c3
AT+CALEC=xx	Parameter 1 10 downlink: 0xFD XX	1:12 10 00 26 00 02 a2 a0 10:11 10 00 26 00 02 a2 93
AT+CALZD2=xx AT+CALZD4=xx	Parameters 0 2 downlink: 0xF1 00 downlink: 0xF1 01 Parameters 0 4 downlink: 0xF2 00 downlink: 0xF2 01	0:19 10 10 10 00 02 47 15 2:19 10 10 10 00 02 47 15 0:20 10 10 10 00 02 42 7c 4:20 10 10 10 00 02 42 7c
AT+CALNTU=xx	Parameters 0 2 4 6 8 10 downlink: 0xFE 00 downlink: 0xFE 02 downlink: 0xFE 04 downlink: 0xFE 06 downlink: 0xFE 08 downlink: 0xFE 0a	0:15 06 00 5e 00 01 2a cc 2:15 06 00 5e 00 02 6a cd 4:15 06 00 5e 00 03 ab 0d 6:15 06 00 5e 00 04 ea cf 8:15 06 00 5e 00 05 2b 0f 10:15 06 00 5e 00 06 6b 0e

3.5 RS485 Test Command

AT Command:

Command Example	Function	Response
AT+RSWRITE=xxxxxx	Send command to 485 sensor. Range : no more than 10 bytes	OK

Eg: Send command 01 03 00 00 00 01 84 0A to 485 sensor

AT+RSWRITE=0103000001840A

Downlink Command:

- 0xE20103000001840A Same as: AT+RSWRITE=0103000001840A

4. Water Quality Sensors

4.1 pH Sensor

The PH01 is a device used to measure the pH value (hydrogen ion concentration index), indicating the acidity or alkalinity of a solution. It features an integrated design, making it lighter, simpler in structure, and more convenient to use. The device has an IP68 waterproof rating. The reference electrode uses a double salt bridge design, providing enhanced resistance to pollution. This product is ideal for applications in industrial sewage, domestic sewage, agriculture, aquaculture, and other settings involving non-corrosive weak acid and weak alkali environments.

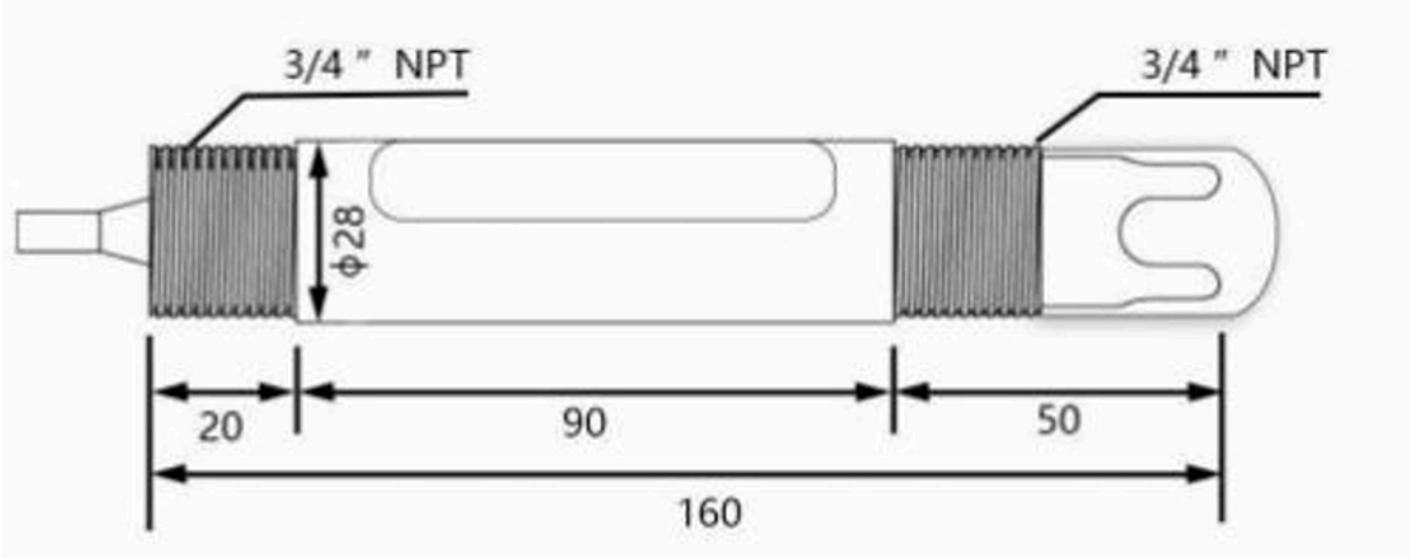
4.1.1 Features

- pH measurement range: 0–14 pH, with a resolution of 0.01 pH.
- One-piece design with a light, simple structure, making it easy to use.
- The reference electrode features a double salt bridge design, offering stronger anti-pollution resistance and an IP68 waterproof rating.
- The device uses a wide voltage power supply, ranging from DC 7V to 30V.

4.1.2 Specifications

- **Power supply**: DC 7–30V
- **Power consumption**: ≤ 0.5W
- **Communication interface**: RS485, standard MODBUS-RTU protocol; communication baud rate: default 9600
- **pH measurement range**: 0–14.00 pH; resolution: 0.01 pH
- **pH measurement error**: ± 0.15 pH
- **Repeatability error**: ± 0.02 pH
- **Working environment:**
  - Ambient Temperature: 0–60°C
  - Relative Humidity: <85% RH(Specifically refers to the cable male and female)
- **Waterproof rating**: IP68
- **Pressure resistance**: 0.6 MPa
- **Wire length**: 5 meters
- **Lifespan**:1 years under normal use

4.1.3 Dimensions



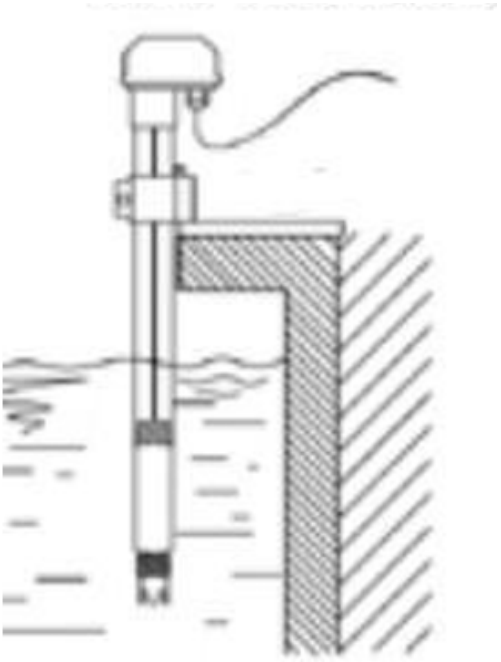
4.1.4 Installation

Do not power on while connecting the cables. Double-check the wiring before powering it on.

Installation diagrams are shown below for your reference (see submerged installation and pipeline installation):

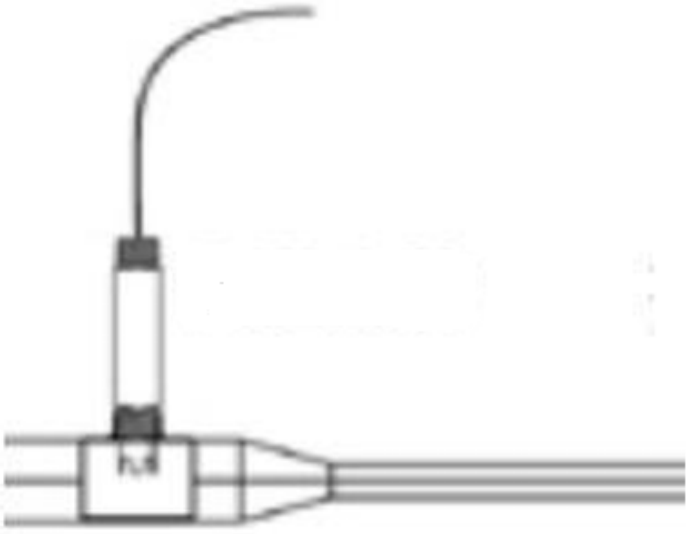
Submerged installation:

The lead wire of the equipment passes through the waterproof pipe, and the 3/4-inch thread on the top of the device is connected to the 3/4-inch thread of the waterproof pipe using thread seal tape. Ensure that the top of the equipment and the device wire are not exposed to water.



Pipeline installation:

Connect the device to the pipeline using the 3/4-inch thread.



Sampling:

Take representative water samples according to the sampling requirements. If it is inconvenient to take samples, you can also place the electrode into the solution to be tested and read the output data. After some time, remove the electrode and clean it.

Measure the pH of the water sample:

First, rinse the electrode with distilled water, then with the water sample. Immerse the electrode in the sample, gently shake the test cup or stir to accelerate the electrode's stabilization. Allow it to stand and record the pH value once the reading stabilizes.

4.1.5 Maintenance

- **General Maintenance**: The equipment generally does not require daily maintenance. However, if an obvious fault occurs, please do not attempt to open or repair it yourself. Contact us as soon as possible!

- **Soaking Solution**: There is an appropriate amount of soaking solution in the protective bottle at the front end of the electrode. The electrode head is soaked in it to keep the glass bulb and liquid junction active. When measuring, loosen the bottle cap, pull out the electrode, and rinse it with pure water before use.

  Preparation of Electrode Soaking Solution:

  - Take a packet of pH 4.00 buffer, dissolve it in 250 ml of pure water, and soak it in 3M potassium chloride solution.
  - To prepare the solution: dissolve 25 grams of analytical-grade potassium chloride in 100 ml of pure water.

- **Handling of the Electrode**: The glass bulb at the front end of the electrode should not come into contact with hard objects. Any damage or scratches will make the electrode ineffective.

- **Before Measurement**: Shake off any bubbles in the electrode's glass bulb, as they will affect the measurement. While measuring, the electrode should be stirred in the sample solution, then allowed to rest to accelerate the response.

- **Cleaning**: The electrode should be cleaned with deionized water before and after each measurement to ensure accuracy.

  Passivation of the pH Electrode: After long-term use, the pH electrode may become passivated, which is characterized by a decrease in sensitivity, slow response, and inaccurate readings.

  - In this case, soak the bulb at the bottom of the electrode in 0.1M dilute hydrochloric acid for 24 hours (0.1M dilute hydrochloric acid preparation: dilute 9 ml of hydrochloric acid to 1000 ml with distilled water), and then soak it in 3.3M potassium chloride solution for 24 hours.
  - If the electrode is seriously passivated and soaking in 0.1M hydrochloric acid has no effect, the pH electrode bulb can be soaked in 4% HF (hydrofluoric acid) for 3-5 seconds, washed with pure water, and then soaked in 3.3M potassium chloride solution for 24 hours to restore its performance.

- **Contamination and Blockage**: Contamination of the glass bulb or blockage of the liquid junction can also cause electrode passivation. In this case, clean the electrode with an appropriate solution based on the nature of the contaminant.

- **Calibration**: The equipment should be calibrated before each use. For long-term use, it is recommended to calibrate every 3 months. The calibration frequency should be adjusted based on different application conditions (e.g., degree of dirt, deposition of chemical substances).

- **Electrode Replacement**: After prolonged use, replace the electrodes in a timely manner.

4.1.6 Calibration

This device uses a three-point calibration, requiring the preparation of three known pH standard solutions.

The steps are as follows:

1. Wash the electrode with distilled water and place it in the 9.18 standard buffer solution. Once the data stabilizes, enter the following calibration command to complete the 9.18 calibration: `AT+CALPH=9` **Downlink**: 0xFB 09
2. Wash the electrode with distilled water and place it in the 6.86 standard buffer solution. Once the data stabilizes, enter the following calibration command to complete the 6.86 calibration: `AT+CALPH=6` **Downlink**: 0xFB 06
3. Wash the electrode with distilled water and place it in the 4.01 standard buffer solution. Once the data stabilizes, enter the following calibration command to complete the 4.00 calibration: `AT+CALPH=4` **Downlink**: 0xFB 04

4.2 EC Sensor

EC K1/K10/200 is a device used for measuring the conductivity of solutions. It adopts an integrated design, making it lighter, simpler in structure, and more convenient to use.

EC K1/K10 has a waterproof rating of IP68 and can be widely used in continuous monitoring of the conductivity of aqueous solutions such as cross-section water quality, aquaculture, sewage treatment, environmental protection, pharmaceuticals, food, and tap water.

ECK1/K10 cannot be used in seawater. EC200 can be used in high conductivity environments such as seawater.

4.2.1 Features

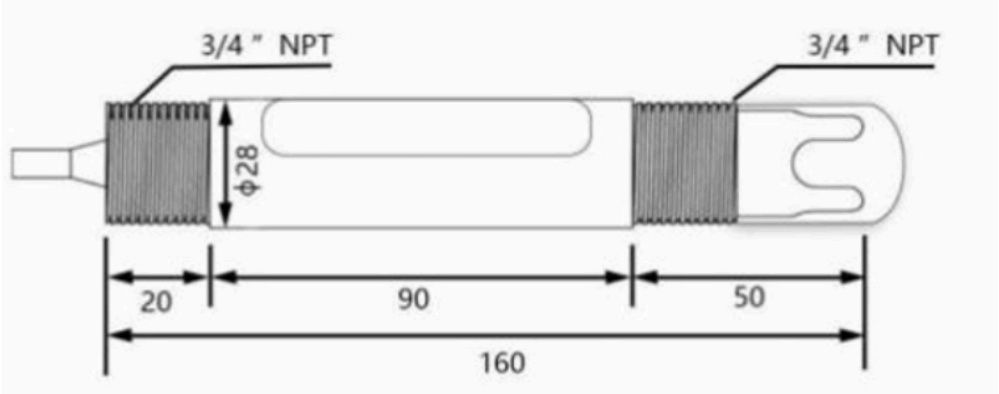
- Conductivity measurement range: 0-2000 µS/cm; 10-20000 µS/cm;1-200000 µS/cm.
- Integrated design with a light and simple structure, easy to use.
- Waterproof grade: IP68.
- RS485 communication interface: Modbus RTU protocol, easily connected to a computer for monitoring and communication.
- Modbus communication address can be set, and baud rate can be modified.
- Wide voltage power supply: DC 7-30V is supported.

4.2.2 Specifications

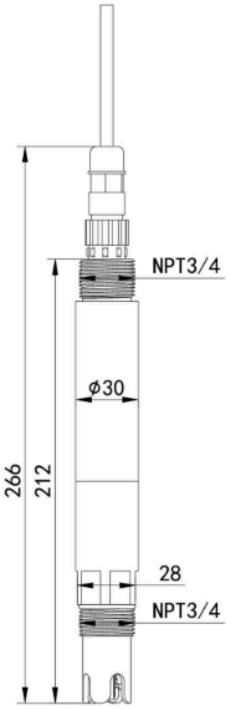
- Power supply : DC 7-30V
- Power consumption : ≤ 0.5W
- Communication interface : RS485; standard MODBUS-RTU protocol; communication baud rate: default 9600
- Conductivity measurement range : K=1: 0-2000 µS/cm; resolution: 1 µS/cm K=10: 10-20000 µS/cm; resolution: 10 µS/cm 200:1-200000 µS/cm; resolution: 1 µS/cm
- Conductivity measurement error : ±1% FS
- Working environment: Ambient Temperature: 0-60°C Relative Humidity: <85% RH(Specifically refers to the cable male and female)
- Waterproof grade : IP68
- Pressure resistance : 0.6 MPa
- Wire length : 5 meters
- EC200Salinity measurement range : 0-70 PSU, resolution: 0.1 PSU Temperature measurement range : ECK1/ECK10:-20 ~ +60°C, resolution: 0.1°C EC200:-5 ~ +80°C, resolution: 0.1°C Temperature measurement error : ±0.5°C Temperature compensation range : ECK1/ECK10:0 ~ 60°C (default compensation temperature: 25°C) ECK1/ECK10:-5-+80°C (default compensation temperature: 25°C) Default temperature compensation coefficient : 0.02
- Lifespan :1 years under normal use

4.2.3 Dimensions

EC K1/K10

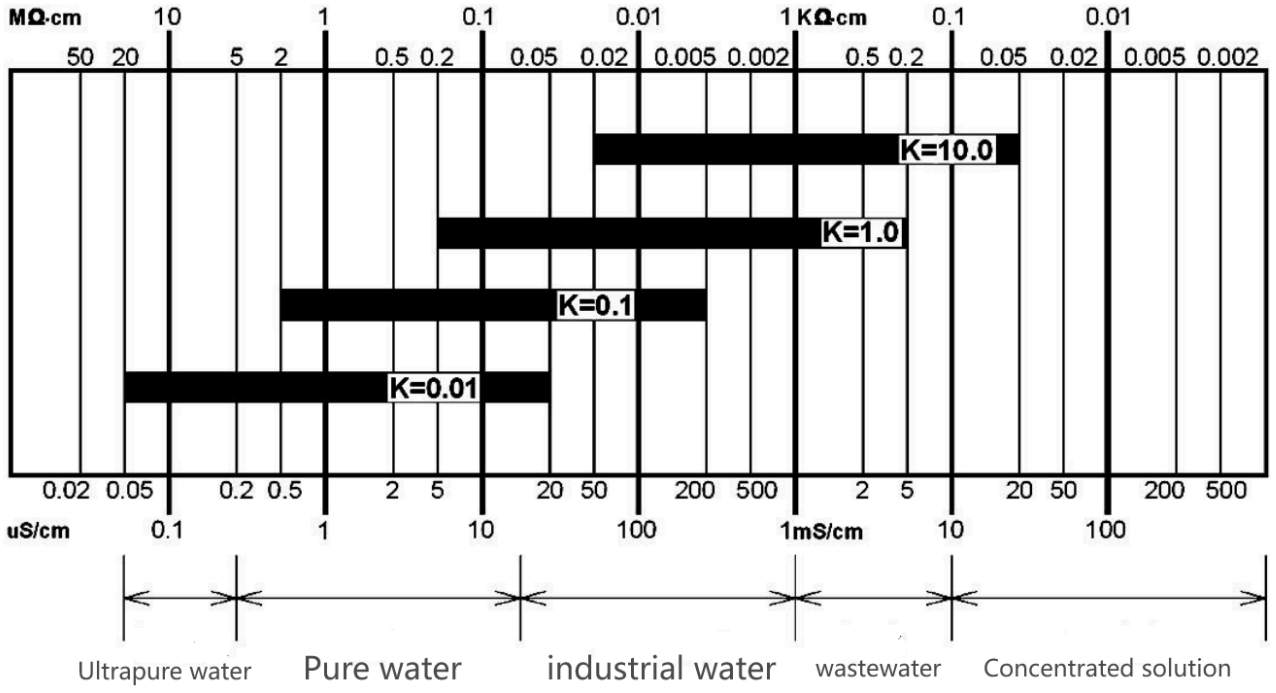


EC200



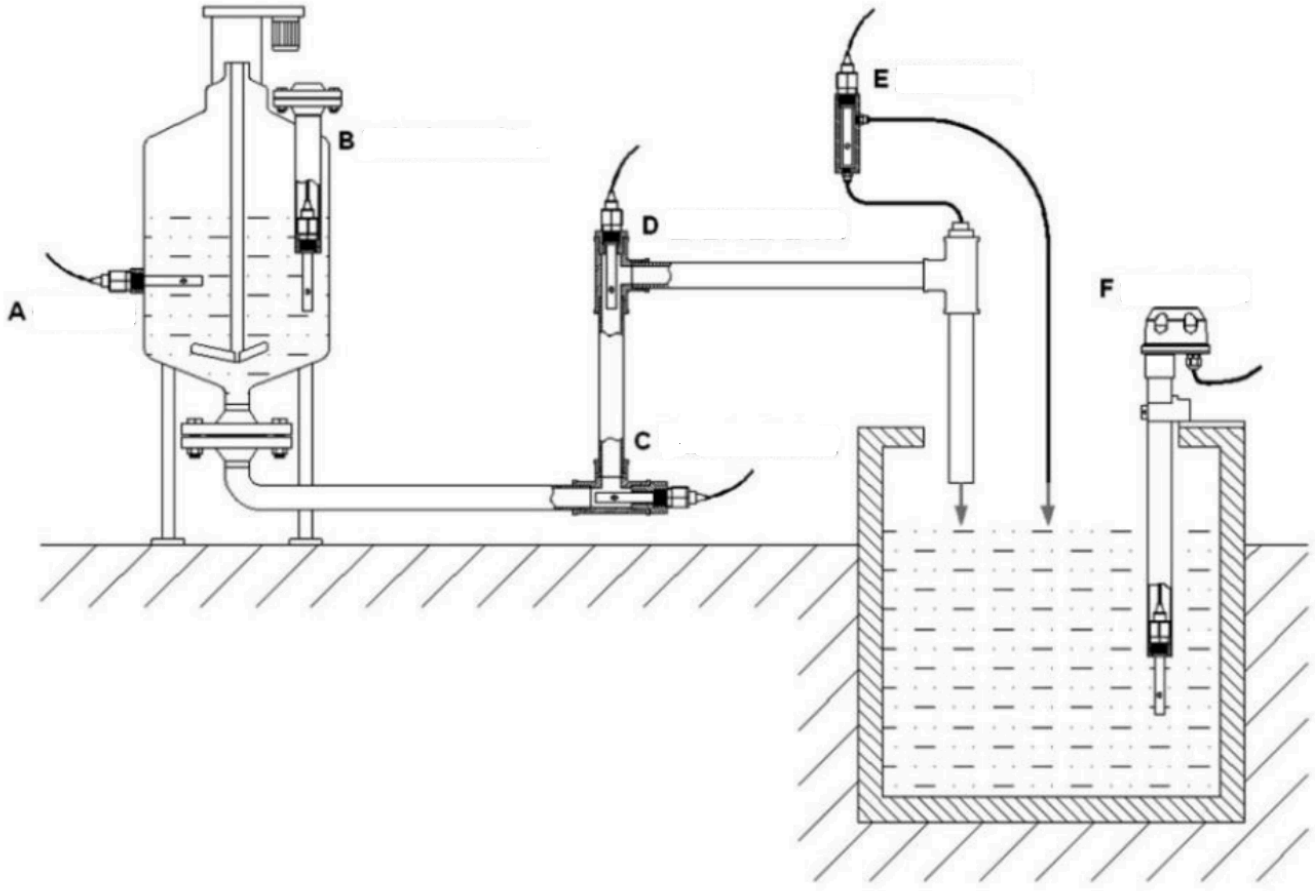
4.2.4 Installation

Selection of matching electrode constant:



Electrode Installation Types

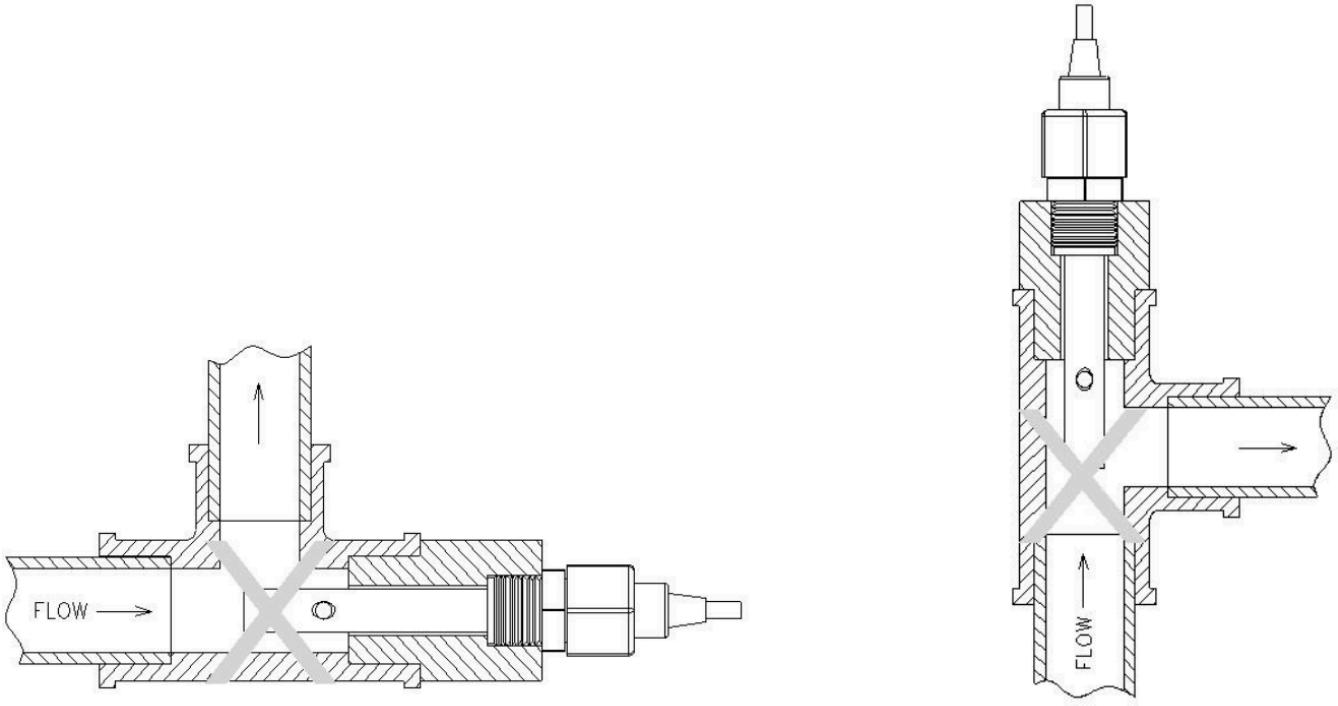
- A: Side wall installation
- B: Top flange installation
- C: Pipeline bend installation
- D: Another pipeline bend installation
- E: Flow-through installation
- F: Submerged installation



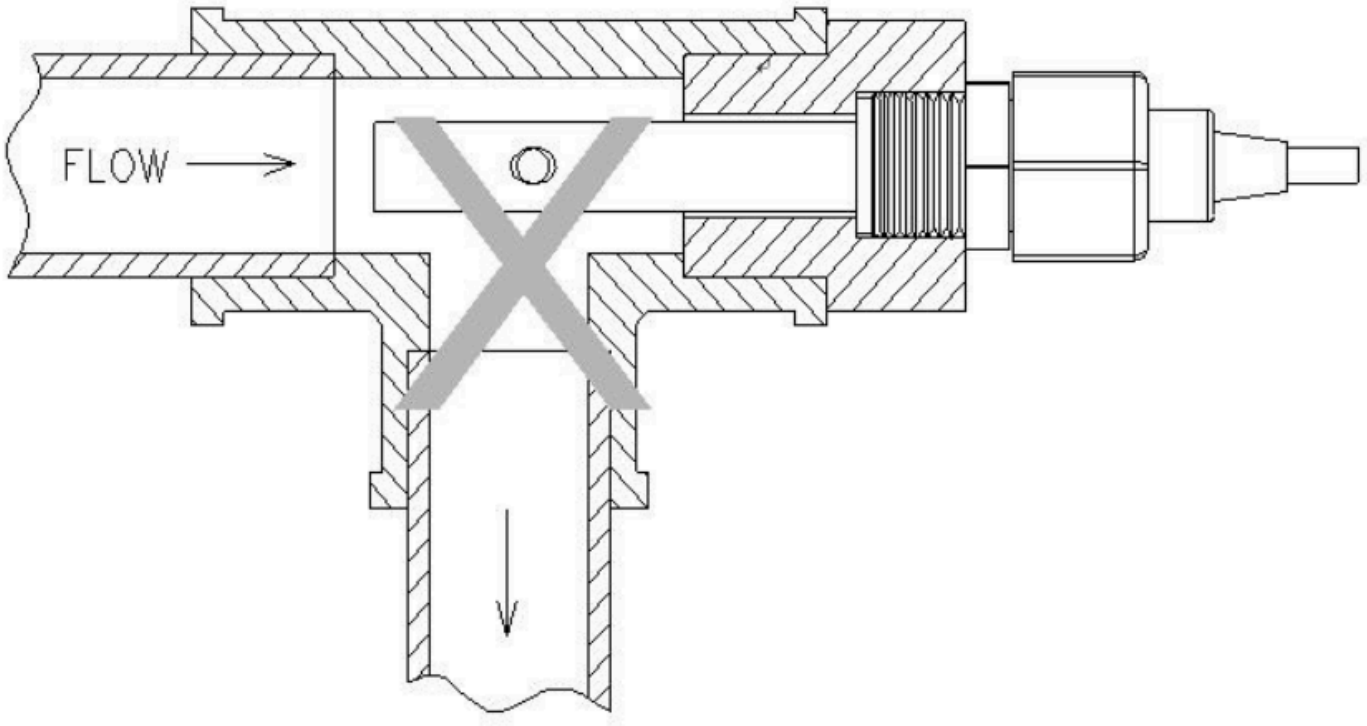
Several Common Installation Methods for Electrodes

When installing the sensor on-site, you should strictly follow the correct installation method shown in the following picture. Incorrect installation methods can cause data deviation.

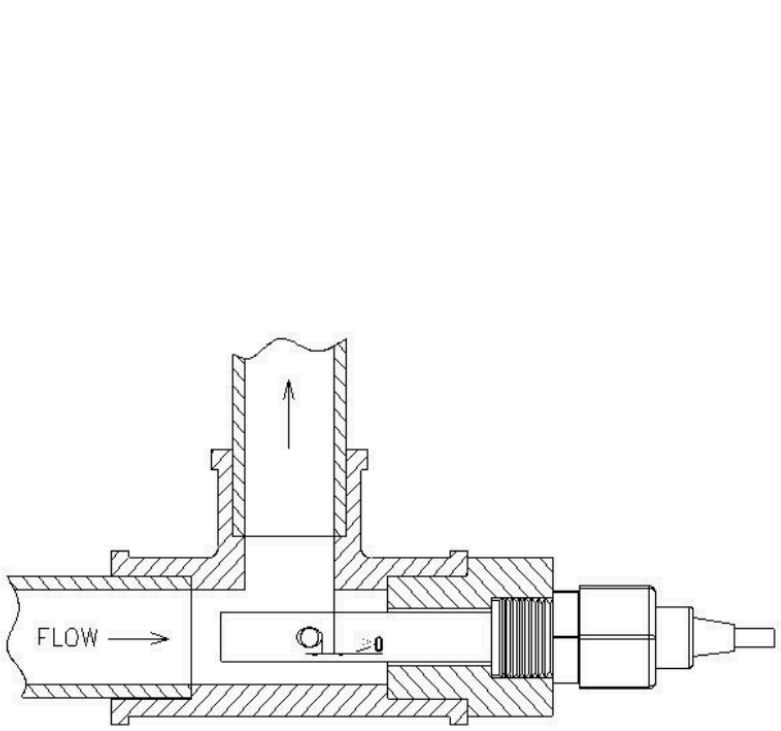
A. Several common incorrect installation methods:

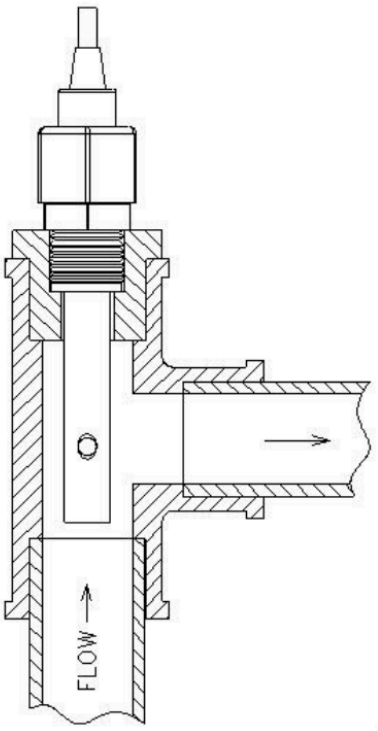


Error cause: The electrode joint is too long, and the extension part is too short. This causes the sensor to form a dead cavity, resulting in measurement errors.



Error cause: Measurement errors or instability may occur if the water flow cannot fill the pipe or if air accumulates at high altitudes. **B. Correct installation method**





4.2.5 Maintenance

- The equipment itself generally does not require daily maintenance. When an obvious fault occurs, please do not attempt to open or repair it yourself; instead, contact us as soon as possible.
- If the electrode is not used for an extended period, it can generally be stored in a dry place. However, it must be placed (or stored) in distilled water for several hours before use to activate the electrode. Electrodes that are frequently used can be stored in distilled water.
- **Cleaning of conductivity electrodes:** Organic stains on the electrode can be cleaned with warm water containing detergent or alcohol. Calcium and magnesium precipitates are best cleaned with 10% citric acid. The electrode plate or pole should only be cleaned using chemical methods or by shaking in water. Wiping the electrode plate will damage the coating (platinum black) on the electrode surface.
- The equipment should be calibrated before each use. For long-term use, it is recommended to calibrate it every 3 months. The calibration frequency should be adjusted appropriately based on different application conditions (e.g., degree of dirt in the application, deposition of chemical substances, etc.).

4.2.6 Calibration

This device uses one-point calibration, and you need to prepare a known E standard solution. When the range is K=1 (1–2000), use a 1413 µS/cm standard solution. When the range is K=10 (10–20000), use a 12.88 mS/cm standard solution.When calibrating the EC200, you can use either 1413 µS/cm or 111310 µS/cm.

The steps are as follows:

1. Put the electrode in distilled water to clean it. When the range is 1–2000, use the 1413 µS/cm standard solution. After the data is stable, enter the following calibration command: `AT+CALEC=1` Downlink: **0xFD 01**

2. Put the electrode in distilled water to clean it. When the range is 10–20000, use the 12.88 mS/cm standard solution. After the data is stable, enter the following calibration command: `AT+CALEC=10` Downlink: **0xFD 10**

3. Put the electrode in distilled water to clean it. When the range is 0–200000, use the 1413 µS/cm standard solution. After the data is stable, enter the following calibration command: `AT+RSWRITE=161001200003060001000058529F2` Downlink: **0xE2161001200003060001000058529F2** Then, place it in a 111310µS/cm solution for the second calibration. After the data is

stable, enter the following calibration command: `AT+RSWRITE=161001200003060002000 1b2ce0bF5` Downlink: **0xE216100120000306000200 01b2ce0bF5**

4.

```
If you're not satisfied with the calibrated data and need further adjustments, you can send the
following command.
```

```
Example: If the conductivity output is 9900 and you want to correct it to 10000, the difference is
10000 - 9900 = 100. 0100 => 64H.
(Hexadecimal) Register contents: **00000064** (Specifically, you want to calibrate the data and then
add the check digit and send it.)

`AT+RSWRITE=`16100051000204 **00000064** 7800
Downlink: **0xE2161000510002040000000647800**
```

4.3 ORP Sensor

The ORP01 is a device for measuring the redox potential of a solution. It features a high-purity platinum ORP composite electrode with strong resistance to acids and alkalis, excellent antioxidant capacity, high measurement accuracy, fast response, and good stability.

The electrode automatically compensates for temperature, making it suitable for online monitoring of the redox potential in cyanide-containing and chromium-containing wastewater.

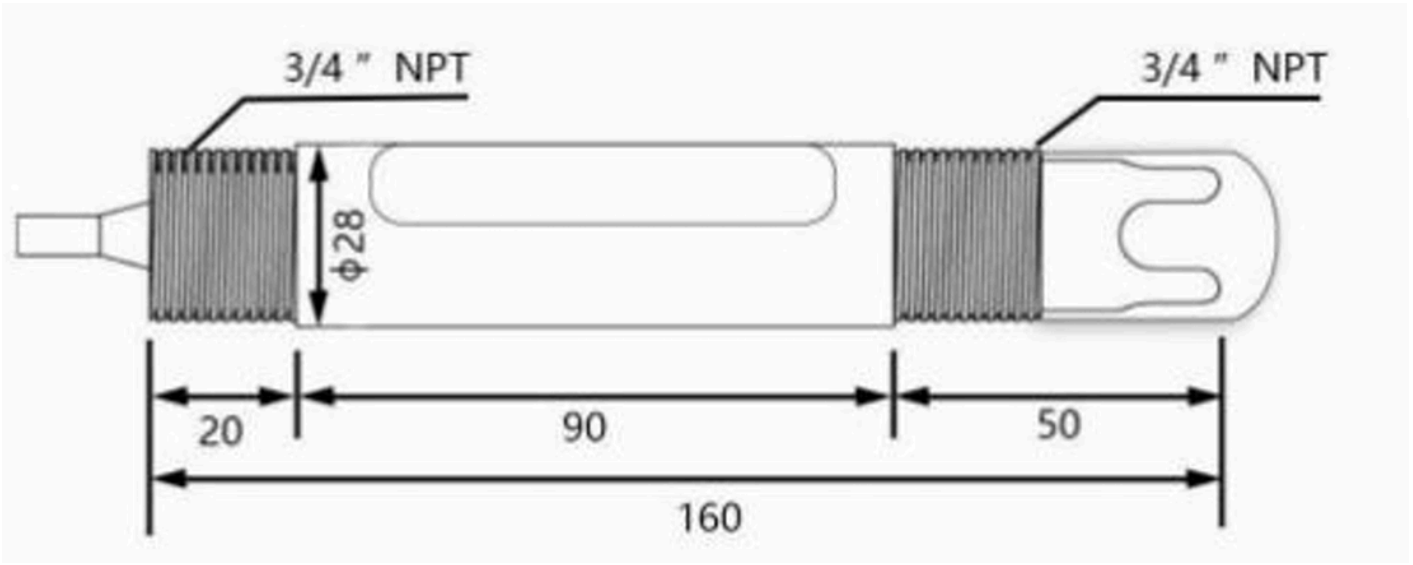
4.3.1 Features

- **ORP Measurement Range**: -1999~1999 mV, resolution: 1 mV.
- **Applicable Electrode Temperature**: 0~80°C.
- **Electrode Material**: Made of high-purity platinum, offering strong resistance to acids and alkalis, excellent antioxidant capacity, high measurement accuracy, fast response, and good stability.
- **RS485 Communication Interface**: The ModBus-RTU communication protocol enables easy connection to a computer for monitoring and communication.
- **ModBus Features**: The communication address is configurable, and the baud rate can be modified.
- **Power Supply**: Operates with a wide voltage range, DC 7~30 V.

4.3.2 Specifications

- **Measuring Range**: -1999~1999 mV
- **Resolution**: 1 mV
- **Output Signal**: RS485
- **Measurement Error**: ±3 mV
- **Stability**: ≤2 mV/24 hours
- **Working environment:**
  - Ambient Temperature: 0-60°C
  - Relative Humidity: <85% RH(Specifically refers to the cable male and female)
- **Waterproof Grade**: IP68
- **Pressure Resistance**: 0.6 MPa
- **Wire length**: 5 meters
- **Lifespan**:1 years under normal use

4.3.3 Dimensions



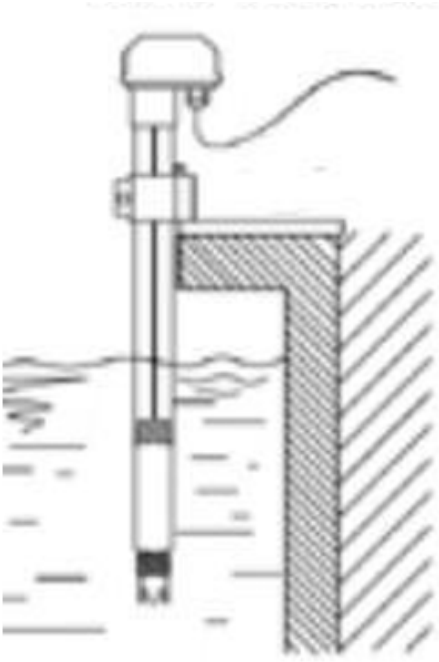
4.3.4 Installation Note

Do not power on while connecting the cables. Double-check the wiring before powering it on.

Installation diagrams are shown below for your reference (see submerged installation and pipeline installation):

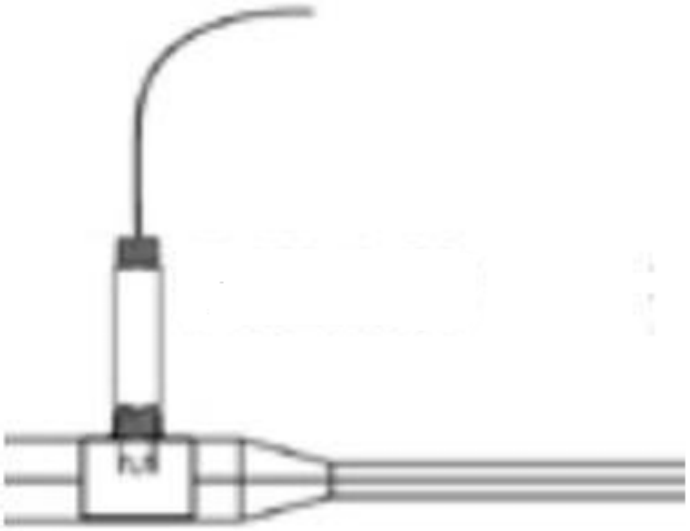
Submerged installation:

The equipment's lead wire passes through a waterproof pipe, and the 3/4-inch thread on the top of the equipment is connected to the 3/4-inch thread of the waterproof pipe using raw tape. Ensure that both the top of the equipment and the equipment wire remain dry and are not submerged.



Pipeline installation:

Connect the equipment to the pipeline using the 3/4-inch thread.



4.3.5 Maintenance

- The equipment itself generally does not require daily maintenance. If a significant fault occurs, do not attempt to open or repair it yourself. Please contact us as soon as possible.
- ORP electrodes typically do not require calibration and can be used directly. However, if there are concerns about the electrode's quality or test results, the electrode potential can be checked using an ORP standard solution. This will help determine whether the electrode meets measurement requirements. If necessary, recalibrate or replace the electrode. The frequency of electrode calibration or inspection depends on the application conditions, such as the level of dirt or the deposition of chemical substances.
- The protective bottle at the front end of the electrode contains an appropriate soaking solution to ensure the activation of the platinum sheet and the liquid junction. Before measuring, loosen the bottle cap, remove the electrode, and rinse it with pure water.
- **Preparation of Electrode Soaking Solution**: Dissolve 25 grams of analytical-grade potassium chloride in 100 ml of pure water to prepare a 3.3M potassium chloride solution.
- Before measuring, ensure there are no air bubbles in the electrode's glass bulb, as they can affect measurements. Shake off any bubbles, stir the electrode in the solution being measured, and then let it sit to accelerate the response.
- Clean the electrode with deionized water before and after each measurement to maintain accuracy.
- After long-term use, the ORP electrode may become passivated, resulting in reduced sensitivity, slower response, or inaccurate readings. To restore performance, soak the platinum sheet at the bottom of the electrode in 0.1M dilute hydrochloric acid for 24 hours (prepare by diluting 9 ml of hydrochloric acid with distilled water to 1000 ml). Then, soak the electrode in 3.3M potassium chloride solution for another 24 hours.
- Contamination or blockage of the liquid junction can also cause passivation. Clean the electrode using an appropriate solution based on the type of contaminant. If the platinum surface is severely contaminated with an oxide film, apply toothpaste to the surface and gently scrub to restore its luster.
- Calibrate the equipment before each use. For long-term use, calibration is recommended every three months, with the frequency adjusted based on application conditions (e.g., dirt levels or chemical deposition). Replace aging electrodes promptly.

4.3.6 Calibration

The OPR01 uses two-point calibration. To perform the calibration, you need two known ORP standard solutions.

Clean the electrode with distilled water. Place it in an 86 mV standard buffer, wait for the data to stabilize, and then enter the following calibration command to complete the 86 mV point calibration:

AT+CALORP=86

downlink: 0xFC 00 56

Clean the electrode with distilled water again. Place it in a 256 mV standard buffer, wait for the data to stabilize, and then enter the following calibration command to complete the 256 mV point calibration:

AT+CALORP=256

downlink: 0xFC 01 00

4.4 Dissolved Oxygen Sensor

The fluorescence dissolved oxygen sensor is a newly developed online digital sensor, utilizing imported components, advanced production technology, and surface-mounting technology.

It features an IP68 waterproof rating, and its cable is seawater-proof. The sensor can be directly submerged in water without a protective tube, ensuring long-term stability, reliability, and accuracy.

The fluorescence dissolved oxygen sensor operates based on the principle of quenching active fluorescence by specific substances in physics.

A blue light emitted by a light-emitting diode (LED) shines on the fluorescent material located on the inner surface of the fluorescent cap.

This fluorescent material is excited and emits red light.

By detecting the phase difference between the red light and the blue light and comparing it with the internal calibration value, the concentration of oxygen molecules is calculated. The final value is automatically compensated for temperature and air pressure.

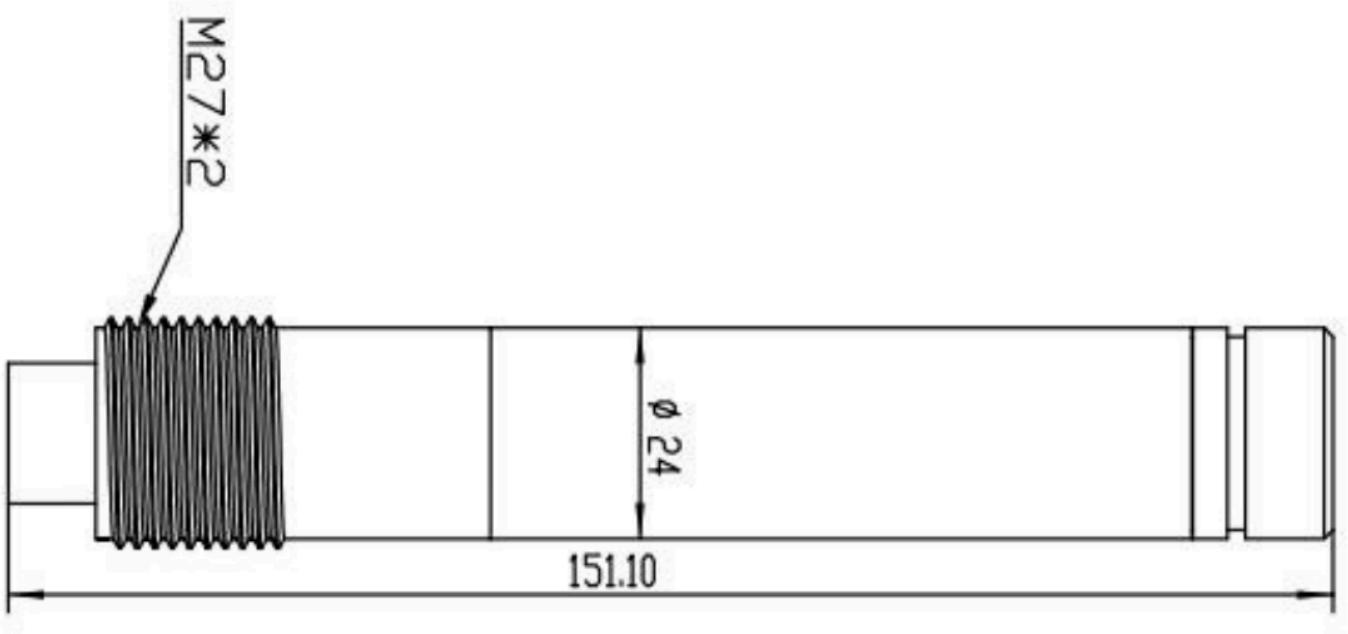
4.4.1 Features

- Compact size, low power consumption, and easy portability.
- Achieves low cost, low price, and high performance.
- High integration, long lifespan, and high reliability.
- Supports up to four isolations, resistant to complex interference conditions on-site, with a waterproof rating of IP68.
- The electrode uses a high-quality, low-noise cable, enabling the signal output length to exceed 20 meters.
- DO1 is for use in ordinary waters.
- DO2 is suitable for seawater.

4.4.2 Specifications

- **Measuring range:** 0–20 mg/L, 0–50℃
- **Accuracy:** ±3%, ±0.5℃
- **Resolution:** 0.01 mg/L, 0.01℃
- **Maximum operating pressure:** 6 bar
- **Output signal:**
  - **A:** 4–20 mA (current loop)
  - **B:** RS485 (standard Modbus-RTU protocol, default device address: 01)
- **Power supply voltage:** 5–24 V DC
- **Working environment:**
  - Ambient Temperature: 0–60°C
  - Relative Humidity: <85% RH(Specifically refers to the cable male and female)
- **Power consumption:** ≤0.5 W
- **Wire length**: 5 meters
- **Lifespan**:1 years under normal use

4.4.3 Dimensions



4.4.4 Instructions for use and maintenance

- Sampling: Take representative water samples following the sampling requirements.
- Determine dissolved oxygen in water samples: Rinse the electrode three times with distilled water, then rinse it three times with the water sample. Immerse the electrode in the sample, carefully shake the test cup or stir the solution to accelerate electrode stabilization. Let the sample stand and record the dissolved oxygen when the reading becomes stable.
- Alternative measurement method: If taking samples is inconvenient, place the electrode directly in the measured solution. Wait for the reading to stabilize, record the output data, and remove the electrode after a period of time. Clean the electrode afterward.
- Post-measurement care: After measuring the sample, rinse the electrode three times with distilled water. Store the electrode upright in the protective solution.

Note: When measuring multiple samples, clean the electrode before proceeding to the next sample to avoid contamination and ensure accurate results.

Additional Tip: If the water conditions are complex and precise data is required, clean the sensor probe frequently.

4.4.5 Precautions

- To ensure accurate measurements on the pipeline, avoid bubbles in the measuring cells, as they can cause data inaccuracies.
- Verify that the packaging is intact and that the product model matches the selected model.
- Do not connect the wires while the power is on. Turn on the power only after completing and verifying the wiring.
- Avoid altering components or wires that were soldered at the factory when using the product.
- The sensor is a precision device. Do not disassemble it, or allow the sensor surface to come into contact with sharp objects or corrosive liquids, to prevent damage.

4.5 Turbidity Sensor

This basic digital turbidity transmitter for routine water quality monitoring utilizes the proven 90° scattered light principle, an infrared LED light source, and a fiber-optic optical path. An internal filtering algorithm provides strong resistance to external light interference. A built-in temperature transmitter provides automatic temperature compensation, making it suitable for long-term online monitoring.

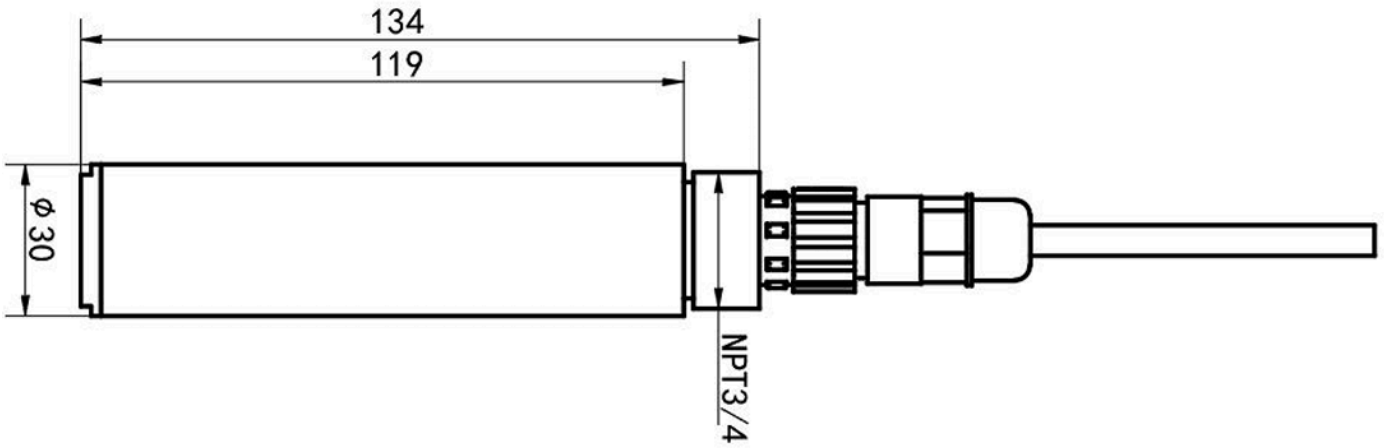
4.5.1 Features

- Turbidity measurement range: TS200: 0200 NTU; TS4000: 0 4000NTU; TS01
- Waterproof rating: IP68.
- Light filtering algorithm, strong resistance to external light interference, and automatic temperature compensation make it suitable for long-term online monitoring environments.
- RS485 communication interface: MODBUS RTU communication protocol allows for convenient connection to a computer for monitoring and communication.
- The ModBus communication address and baud rate are configurable.
- The device accepts a wide voltage supply, supporting DC 10-30V operation.

4.5.2 Specifications

- **Measuring range:** TS200: 0200 NTU; TS4000: 0 4000NTU; TS01:0~1000NTU
- **Accuracy:** ±5%FS（25℃）；±0.5℃(TS1 has no temperature related parameters)
- **Resolution:** Turbidity 0.1 NTU/1NTU;temperature 0.1°C
- **Operating temperature**: 0-40°C
- **Power supply**: DC 10-30V
- **Power consumption**: 0.2W
- **Communication interface**: RS485; standard MODBUS-RTU protocol; Baud rate: Default: 9600 (configurable to 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200)
- **Measurement principle**: 90° light scattering
- **Lifespan**:1 years under normal use
- **Waterproof rating**: IP68
- **Electrode cable length**: 5m by default
- **Casing material**: corrosion-resistant plastic

4.5.3 Dimensions



4.5.4 Instructions for use and maintenance

- The sensor can be directly submerged in water without requiring a protective tube, ensuring long-term stability, reliability, and accuracy.
- If water conditions are complex and accurate data is needed, the sensor probe should be wiped frequently.

4.5.5 Calibration

For turbidity calibration, you only need to prepare a solution. You can choose from 0 NTU, 200 NTU, 4000 NTU, and then enter the corresponding calibration command.

"AT+CALZD2=0" downlink:0xF1 00 0NTU turbidity solution

"AT+CALZD2=1" downlink:0xF1 01 200NTU turbidity solution

"AT+CALZD4=0" downlink:0xF2 00 0NTU turbidity solution

"AT+CALZD4=1" downlink:0xF2 01 4000NTU turbidity solution

The following applies to the calibration of the TS01 sensor:

"AT+CALNTU=0" downlink:0xFE 00 0NTU turbidity solution

"AT+CALNTU=2" downlink:0xFE 02 2 00NTU turbidity solution

"AT+CALNTU=4" downlink:0xFE 04 400NTU turbidity solution

"AT+CALNTU=6" downlink:0xFE 06 6 00NTU turbidity solution

"AT+CALNTU=8" downlink:0xFE 08 8 00NTU turbidity solution

"AT+CALNTU=10" downlink:0xFE 0A 1 000NTU turbidity solution

4.5.6 Precautions

- To ensure the electrode measures correctly on the pipeline, avoid bubbles between the measuring cells, as they may cause data inaccuracies.
- Check whether the packaging is intact and whether the product model matches the selected model.
- Do not connect the wires while the power is on. Turn on the power only after the wiring has been completed and verified.
- Do not alter the components or wires that have been factory-welded when using the product.
- The sensor is a precision device. Do not disassemble it or allow the sensor surface to come into contact with sharp objects or corrosive liquids, as this may damage the product.
- Do not power on while connecting the cables. Double-check the wiring before turning on the power.

4.6 DR-CL Water CL Probe

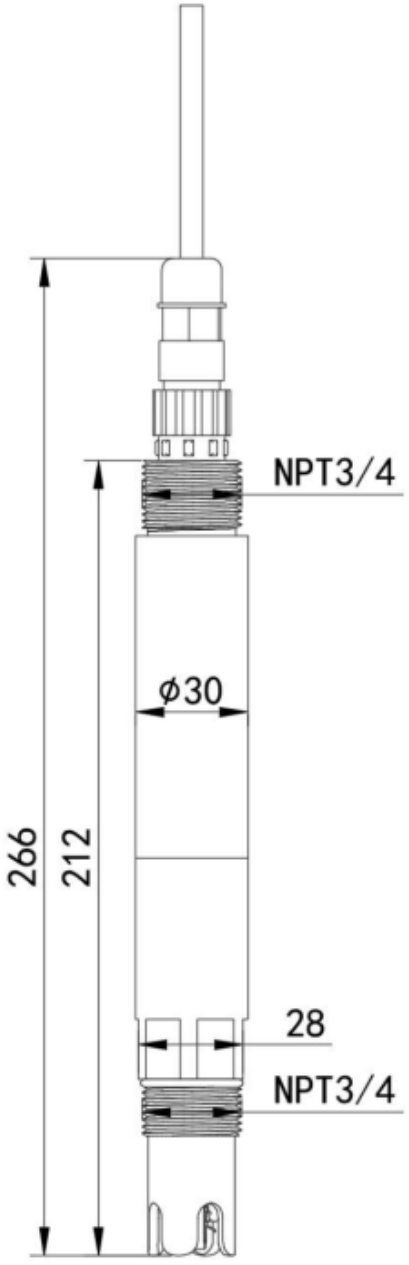
DR-CL is a device for measuring the residual chlorine concentration (hypochlorous acid, hypochlorite ion concentration) in water.

4.6.1 Specification:

- Power Input : DC7~30
- Power Consumption : 0.19W
- Interface : RS485. 9600 Baud Rate
- CL Range & Resolution: CL2ML: 0-2mg/L CL10ML: 0-10mg/L Resolution: 0.01mg/L
- CL Accuracy : ±5% FS
- Temperature Accuracy: ±0.5 °C

- Working environment: Ambient Temperature: 0–50°C pH:4-9 Flow rate: 30L/h~60L/h (flow tank installation)
- IP Rated : IP68
- Max Pressure : 0.6MPa
- Wire length : 5 meters
- Lifespan :1 years under normal use

4.6.2 Mechinical Drawing



4.6.3 Maintenance

- The device itself generally does not require daily maintenance. When an obvious fault occurs, please do not open it and repair it yourself, and contact us as soon as possible!
- After using the electrode, please clean the electrode head with clean water and cover it with a protective cover.
- When measuring the device, the measured liquid should flow and the flow rate should be uniform, and there should be no bubbles attached to the measuring end of the device.

- If the electrode diaphragm is attached with dirt and mineral components, the sensitivity will be reduced, and it may not be possible to perform sufficient measurement. Please ensure that the platinum ring is clean.
- The platinum induction ring of a good residual chlorine electrode should always be kept clean and bright. If the platinum ring of the electrode becomes rough or covered with pollutants after measurement, please clean it according to the following method: (For reference) Inorganic pollution: immerse the electrode in 0.1mol/L dilute hydrochloric acid for 15 minutes, gently wipe the platinum ring of the residual chlorine electrode with a cotton swab, and then wash it with tap water.
- Organic or oil pollution: immerse the electrode in tap water with a small amount of detergent, such as dishwashing liquid, and thoroughly clean the sensing surface of the electrode sensor. Gently wipe the platinum ring of the electrode with a cotton swab, then rinse with tap water, and the cleaning is complete. If the platinum ring of the electrode has formed an oxide film, please use toothpaste or 1000-grit fine sandpaper to properly polish the sensing surface, and then clean it with tap water. The platinum ring is connected to the glass, so please handle it carefully when polishing. The electrode has a service life of about one year, and a new electrode should be replaced in time after aging.
- Before the cable plug and the device plug are locked, do not put the plug part into water.

4.7 DR-COD Transmitter

This digital chemical oxygen demand (COD) transmitter for routine water quality monitoring utilizes the proven dual-wavelength UV absorption method, requiring no chemical reagents. A modulated light signal reduces visible light interference, while a dual-optical path system provides turbidity compensation. A built-in temperature transmitter provides automatic temperature compensation, making it suitable for long-term online monitoring.

4.7.1 Features

Measurement range: COD: 0500 mg/L equiv. KHP; Turbidity: 0200 NTU.

Waterproof rating: IP68.

Modulated light signal for reduced visible light interference, dual-path turbidity compensation, and automatic temperature compensation make it suitable for long-term online monitoring environments.

RS485 communication interface: MODBUS RTU communication protocol allows for convenient connection to a computer for monitoring and communication.

The ModBus communication address and baud rate are configurable.

The device accepts a wide voltage supply, supporting DC 12-30V operation.

4.7.2 Specification:

- **Power Input:** DC 12~~30V
- **Power Consumption:** 0.6W (Normal); 4.5W (Self-cleaning active)
- **Interface:** RS485. 4800 Baud Rate (Default)

COD & Turbidity Range & Resolution:

- **COD Range:** 0–500mg/L
- **Turbidity Range:** 0–200NTU
- **COD Resolution:** 0.1mg/L
- **Turbidity Resolution:** 0.1NTU
- **Temperature Resolution:** 0.1°C

Accuracy:

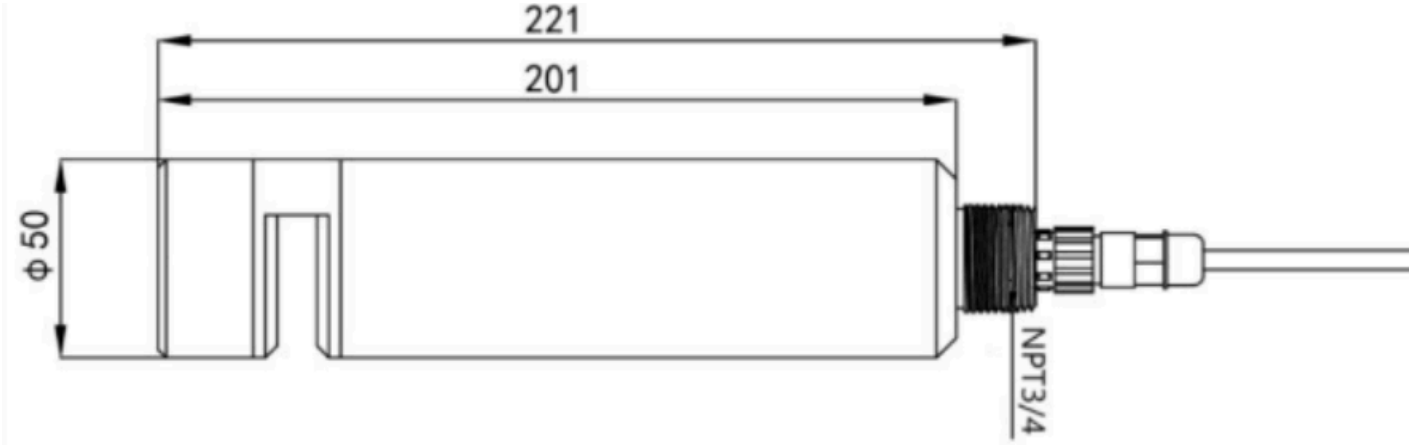
- **COD Accuracy:** ±5% FS equiv. KHP (25°C)

- **Turbidity Accuracy:** ±5% FS (25°C)
- **Temperature Accuracy:** ±0.5°C
- **Repeatability:** ±1% FS equiv. KHP (25°C)

Working environment:

- **Ambient Temperature:** 0–40°C
- **Flow rate:** <3m/s
- **Max Installation Depth:** 2 meters
- **IP Rated:** IP68
- **Max Pressure:** <0.1MPa
- **Wire length:** 5 meters (Default)
- **Lifespan:** 18 months (Self-cleaning mechanism)

4.7.3 Mechinical Drawing



4.7.4 Maintenance

- **Measurement Window Cleaning:** Regularly check the measurement window for attachments, oil films, or scaling based on the actual operating environment. Wash the window with tap water and wipe gently with a damp, soft cloth. For stubborn oil or dirt, add a small amount of household detergent to the water or wipe gently with alcohol. **Do not scratch the optical measurement window**.
- **Self-cleaning Brush Care:** Periodically check if the self-cleaning brush functions normally and remains undamaged. **Do not force the rotation of the self-cleaning brush shaft manually**, as this may damage the internal motor mechanism.
- **Factory Maintenance:** After approximately **18 months** of continuous use, the transmitter must be returned to the factory to replace the dynamic sealing device of the self-cleaning mechanism. This interval can be adjusted depending on the configured cleaning frequency.
- **Calibration Frequency:** It is recommended to calibrate the sensor every **3 months** during long-term deployment. The calibration frequency should be optimized according to the fouling severity and chemical deposition rate of the water body.
- **Troubleshooting Unstable Data:** If the measured COD or turbidity values become abnormally high, low, or continuously fluctuate, immediately check whether the optical measurement window is clean or blocked by air bubbles.
- **Waterproof Precautions:** Ensure the cable plug and the device plug are completely locked and tightened before submerging the connector portion into water.
- **Handling and Storage:** The transmitter contains highly sensitive optical and electronic components. Avoid subjecting the device to severe mechanical shocks, excessive cable tension, or prolonged exposure to direct sunlight. Do not touch the measurement window with bare hands.

6. More detailed information about water quality sensors

Water Quality Sensors

7. OTA Firmware update

User can change firmware WQS-LB/LS to:

- Change Frequency band/ region.
- Update with new features.
- Fix bugs.

Firmware and changelog can be downloaded from : Firmware download link

Methods to Update Firmware:

- (Recommended way) OTA firmware update via wireless: Firmware OTA Update for LoRaWAN End Node
- Update through UART TTL interface: **Instruction**.

8. FAQ

8.1 External Power Supply Connection (For Battery Depletion/Multi-Sensor Use)

The WQS-LB/LS system includes a 1-to-3 splitter cable for connecting multiple water quality sensors simultaneously. Please be aware that power consumption increases with each additional sensor connected. External power is strongly recommended when:

- The battery is depleted
- Operating 2-3 sensors simultaneously
- For extended monitoring periods

Connection Method:

- Disconnect the battery wires
- Use a power supply with 3.3V voltage and 2A current rating, connecting it to the battery terminals

Recommended Power Specifications: 3.3V/2A external supply

Compatible Power Adapter:



Connector Type:



8.2 Why is there no LED response when I press the button on the solar panel model?

If the LED does not light up when you press the button, it may be because the battery has entered protection mode.

Solution: To reactivate the battery, simply expose the solar panel to direct sunlight. For more details, please refer to: Battery Protection State (Apply to Solar Panel + Li-ion battery)

8.3 Problem of nodes not being recognized after connecting sensors

After a new sensor is connected to the node, the node needs to be restarted.

Press and hold the ACT button for five seconds to reset the node and allow it to re-identify the sensor.

8.4 Regarding the acquisition of calibration solution

Please note that due to strict international air freight and shipping regulations, we are unable to transport or export any liquid substances. Therefore, the standard calibration liquids (buffer solutions) required for the sensor's calibration process must be sourced and prepared locally by the end-user.

8.5 Does the DR-CL specifically measure free chlorine residual only?

This sensor is designed specifically for measuring free residual chlorine (free chlorine) and cannot measure total residual chlorine or combined chlorine.

9. Order Info

9.1 Main Unit

Part Number: **WQS-LB/LS-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

9.2 Sensors

Sensor Model	Part Number
PH Sensor	DR-PH01
EC K1 Sensor	DR-ECK1.0
EC K10 Sensor	DR-ECK10.0
EC 200 Sensor	DR-EC200
ORP Sensor	DR-ORP1
Dissolved Oxygen Sensor	DR-DO1
Turbidity Sensor	DR-TS1
Turbidity 200 Sensor	DR-TS200
Turbidity 4000 Sensor	DR-TS4000
CL 2ML sensor	DR-CL-2ML
CL 10ML sensor	DR-CL-10ML

10. Support

- Support is available Monday to Friday, from 09:00 to 18:00 GMT+8 . Due to different time zones, we are unable to offer live support. However, your questions will be answered as soon as possible during the aforementioned hours. Please provide as much information as possible regarding your inquiry (e.g., product models, a detailed description of the issue, and steps to replicate it), and send an email to support@dragino.com .