AgroSense Valve & Water Flow

LoRaWAN® Manual

V1.0

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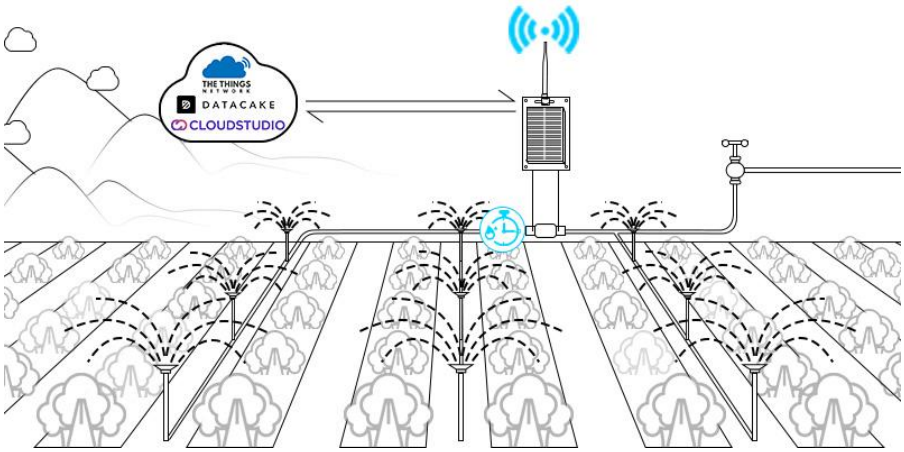
Contents

1 Product Description

1.1 Introduction

Product ModelThe AgroSense Valve & Water Flow sensor combines an ultra-low-power pulse solenoid valve with a high-precision YF-S201C Hall Effect Flow Sensor, enabling remote irrigation control and real-time water monitoring over the LoRaWAN® network. The pulse valve only consumes power during switching, retains its ON/OFF state after power loss, and responds within milliseconds, making it ideal for solar + battery-powered systems. The flow sensor provides accurate flow rate and cumulative consumption measurement (±3% accuracy), ensuring reliable water usage data even at low flow rates.

This product cased with IP67 case, solar panel powered, can be used long-term in filed application.



1.2 Feature

- Includes one valve and one flow meter.
- LoRaWAN version: LoRaWAN Specification 1.0.3. OTAA **Class C.**
- Monitor data and upload **real-time** data regularly.
- Modify the product parameters through **AT commands.**
- Support **downlink** to modify the time interval and control relay switch.
- Integrated data logging capability with a storage capacity of up to 3300 records.
- Compatible with Worldwide **LoRaWAN® Networks: Support** the universal frequency bands EU868/ US915.
- **Long Range:** Up to 2 kilometers in the city, up to 10 kilometers in the wilderness, receive sensitivity -137dBm , transmit power up to 22dBm.

- **Data encryption:** Provide end-to-end secure communication, including device authentication and network data encryption, to ensure the security of data transmission and prevent data theft and malicious attacks.
- **High stability and reliability:** good stability in noisy environments, able to penetrate buildings and obstacles, so it can maintain good communication quality in urban and suburban environments.

1.3 Parameter

1. General Parameters

Product Model	AGLWVF
Valve Working Fluid	water
Valve Range	0.02～1Mpa
Valve Process Connection	G1/2 (20mm)
Valve Thread Length	14.5 mm
Valve Operating Temperature	1～80℃
Flow Working Fluid	water
Flow Range	0～1.75Mpa
Flow Process Connection	G1/2 (20mm)
Flow Thread Length	12 mm
Flow Operating Temperature	1～80℃

2.Wireless Parameters

Communication Protocol	Standard LoRaWAN® protocol V1.0.3
Network Access/Operating Mode	OTAA **Class C**
MAX Transmit Power	22dBm
Receiver Sensitivity	-137dBm/125kHz SF=12
Frequency Band	EU868/US915

3.Physical Parameters

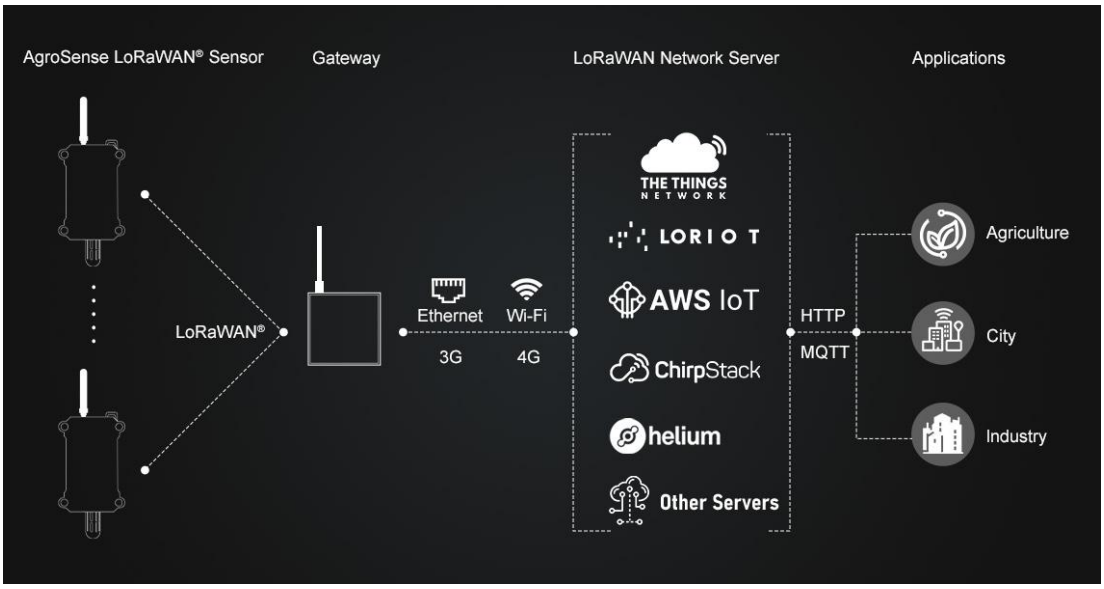
Batteries Power Supply	2 x 18650 3.7V Lion batteries
Solar Power Supply	6V1W
Operating Temperature	-40°C ~85°C
Protection Class	IP68
Dimensions	115 × 85 × 35 mm
Mounting	Wall Mounting

2 Technical route

2.1 System Framework

AgroSense Valve & Water Flow uses LoRAWAN technology, and it network architecture includes four parts: End Nodes, Concentrator/Gateway, Network Server and Application Server.

End Nodes	It is responsible for collecting sensing data and then transmitting it to Gateway via the LoRaMAC protocol.
Concentrator/Gateway	It is mainly responsible for transmitting node data to the server.
Network Server	Organize the data into JSON packets and decode them.
Application Server	Display the data.



Uplink:

1.Data Collection & Transmission

Sensor data and transmits it to the Gateway via LoRaWAN® protocol.

2.Gateway Forwarding

The Gateway packages the raw data and forwards to the Network Server.

3.Data Decoding & Routing

The Network Server decodes the payload and forwards it to the designated Application Server.

4.User Monitoring

The Application Server processes the data and updates the user interface (APP), allowing real-time monitoring of data.

Downlink:

1.Command Generation

A downlink commands generated in the Network Server or Application Server through a predefined API/interface. (Example: Set sampling interval to 10 minutes; Control Valve ON/OFF.)

2.Gateway Transmission

The command is encapsulated into a downlink packet and sent to the Gateway via the network.

3.End Node Execution

The Gateway transmits the downlink command to the target End Node using the wireless protocol. The End Node parses the command and performs the corresponding action (e.g., activate valve, modify configuration).

2.2 Regional frequency band

At the present moment, our product solely accommodates compatibility with the US915 and EU868.

area	frequency band	center frequency
China	470-510MHz	CN486MHz
America	902-928MHz	US915MHz
Europe	863-870MHz	EU868MHz
Korea	920-923MHz	KR922MHz
Australia	915-928MHz	AU923MHz
New Zealand	921-928MHz	NZ922MHz
Asia	920-923MHz	AS923MHz

3 Usage

3.1 Interface Specification

3.1.1 Plumbing the Flow Sensor and the Latching Solenoid Valve

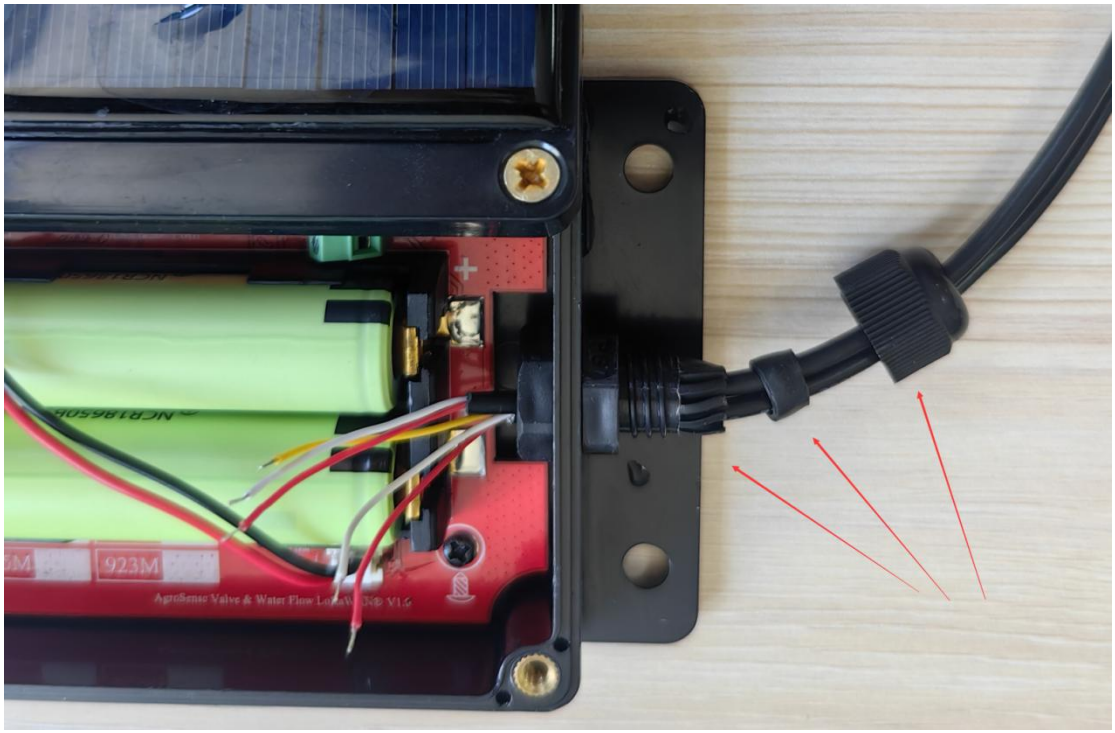
Tools & Materials: PTFE thread-seal tape, couplings, wrench

1. **Verify flow direction**. Align the device arrow with the actual flow. Reversed installation will degrade measurement accuracy and may affect valve operation.
2. Apply PTFE tape. Wrap the threads clockwise (in the tightening direction) with 6–10 turns of PTFE tape, keeping the bore unobstructed.
3. Make up the joints. Tighten by hand first, then use a wrench for additional ¼–½ turn. Do not overtighten to avoid damaging threads or seals.

3.1.2 Wiring Two Sensors (Cable Routing & Termination)

Goal: Route both harnesses through the cable gland and connect them to the internal terminals

1. **Open the enclosure.** Remove the **four screws** in a criss-cross pattern and lift the cover.
2. **Prepare the cable gland. Loosen** the gland cap and seal.
3. **Feed the cables.** Route the **flow sensor** and **latching solenoid valve** harnesses **through the cable gland** into the enclosure. Avoid nicking the jacket; keep a proper bend radius.



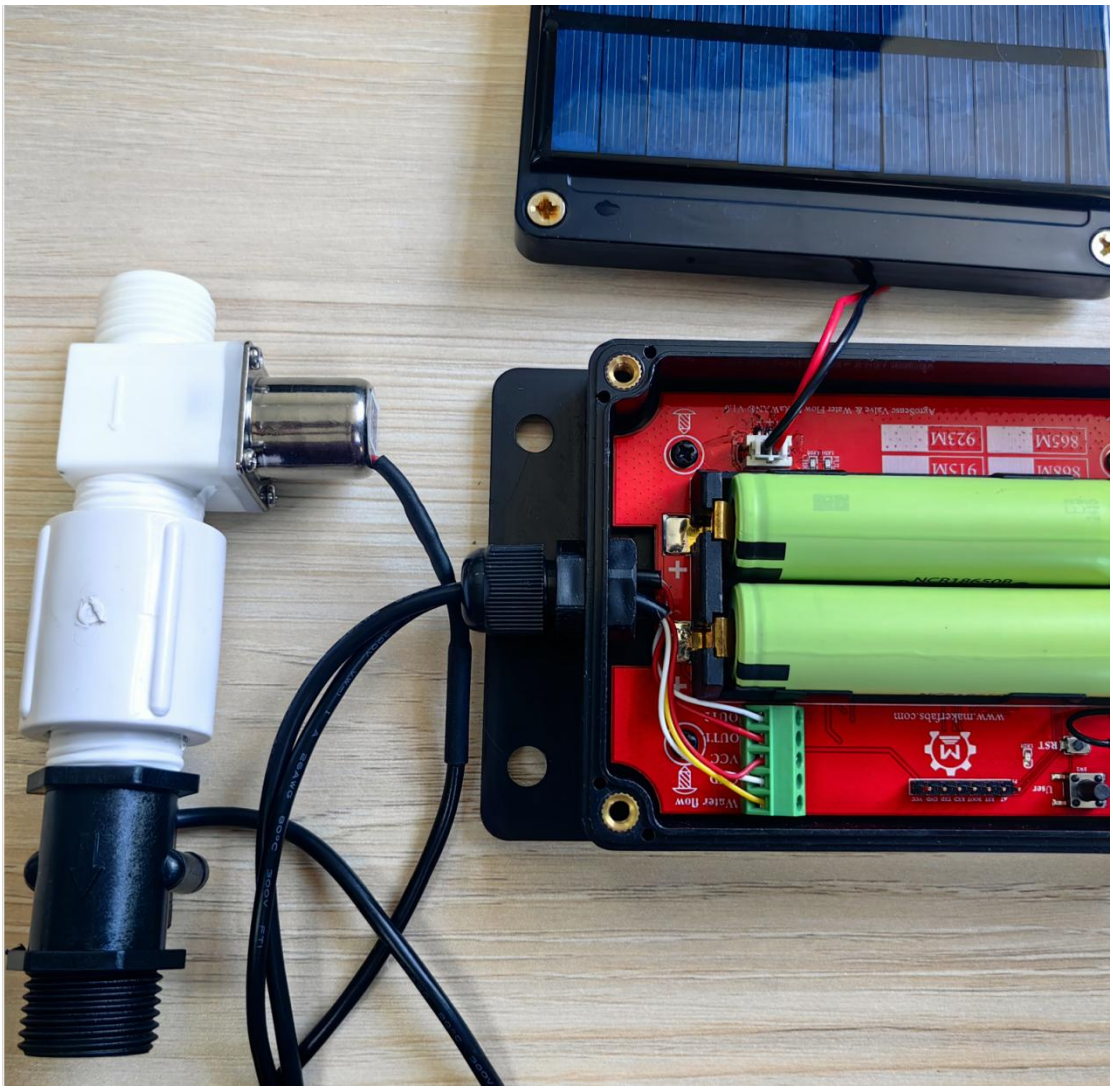
4. **Flow sensor (3-wire) connections:**
   - **WATER FLOW (signal) — Yellow**
   - **GND — White**
   - **VCC — Red**
5. **Latching solenoid valve (2-wire) connections:**
   - **OUT1 — Red**
   - **OUT2 — White**

The **polarity defines OPEN/CLOSE**. Connect only to OUT1/OUT2 on the controller; **do not** wire directly to VCC/GND.

6. **Strain relief & sealing.** Secure the harness with a tie inside the enclosure and **tighten the**

gland until the cable cannot slip and the seal is firm.

7. **Verification.** Cross-check each terminal; ensure no mis-wiring, no exposed strands, and all screws are tight.



3.1.3 Platform Registration, Solar Connection & Mounting

Goal: Register OTAA credentials and verify communication, connect the solar panel and close the enclosure, then secure the unit in place.

1. **Register on the platform and verify communication**

- In your LNS/platform, register **DevEUI / JoinEUI (AppEUI) / AppKey (OTAA)**.
- Power on the device and confirm a successful **join** (Join Accept) and the **first uplink** on the platform.

2. **Connect the solar panel and close the enclosure**

- Plug the **solar panel connector** into the device **PV input**, observing **polarity (+ / −)**.

- Tighten the **four cover screws** in a **criss-cross pattern**; check the gasket is seated to ensure **waterproofing**.

3. **Mount the device**

- Use **screws or cable ties** to secure the unit at the intended location; form a **drip loop** in the cable to prevent water ingress.
- Aim the **solar panel** toward good sunlight, avoiding shading; keep the **antenna** away from large metal surfaces (≥10 cm).
- Re-verify wiring and fasteners—no loose connections or exposed strands.

3.2 Usage with TTN &ThingSpeak

In the phase, We use The Things Network(TTN) as data server, and Thingspeak as console to display data& control the valve.

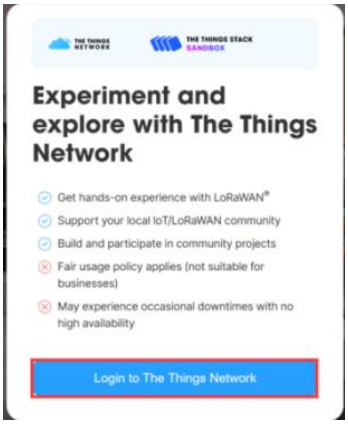
we need to configuration the country/area frequency, inputting DEV EUI/ APP EUI/ APP Key, decodes, and connect to ThingSpeak.

DEV EUI	Unique identification of device, authorized by IEEE
APP EUI	Unique identification of application
APP Key	One of the join network parameters on OTAA mode, calculated by DE EUI

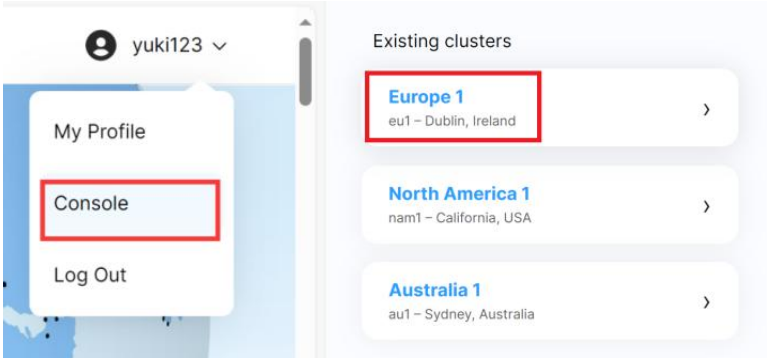
- End Nodes and Gateway: AgroSense Valve & Water Flow.(The AgroSense series is applicable)
- Network Server: The Things Network. (Datacake, Loriot, AWS IoT, ChirpStack, ect)
- Application Server: ThingSpeak.(Datacake, Blockbax, akenza, ect)

3.2.1 Network Server configuration

- Open The Things Network in your browser and login it. (Or register an account)

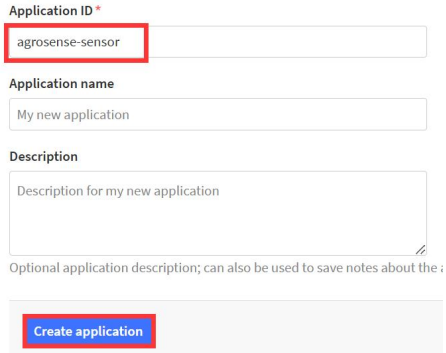


- Click “Console” and select clusters. (we take the European region for example.)

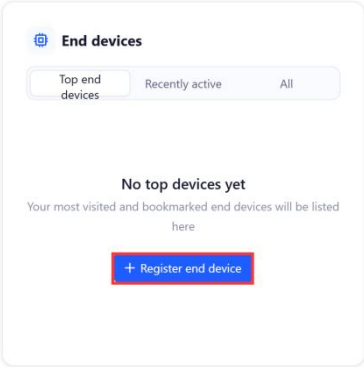


- Click “Go to applications” --> “+ Create application”.

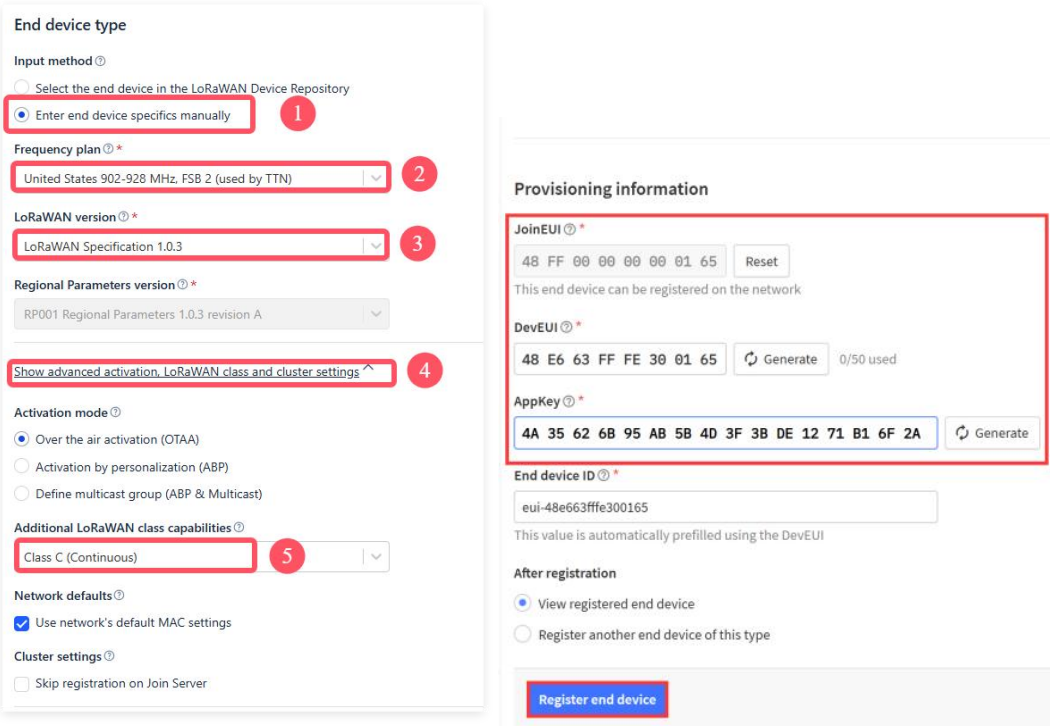
- Write the Application ID and click “Create application”.



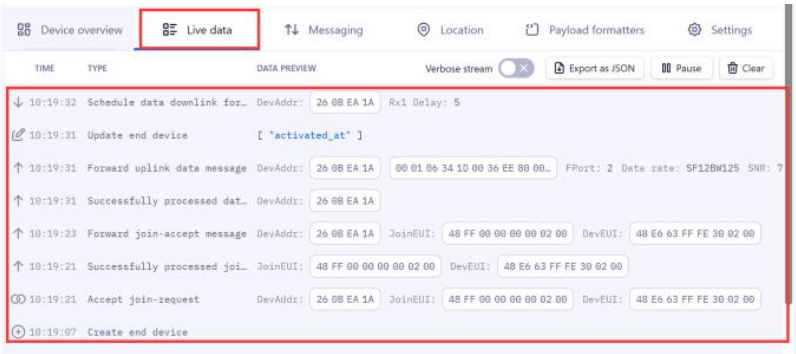
- Click “+ Register and device”.



- Fllowing the steps, **select class C** and input the DEV EUI/ APP EUI/ APP Key (notice: JoinEUI=APP EUI) and subsequently click on "Register end device" to complete the registration process.

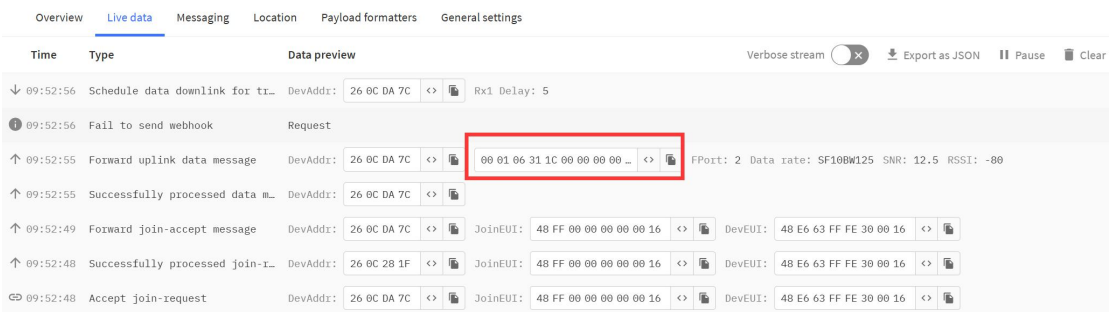


- Plug the battery and press RES button, you can see the device is connected successfully in the TTN.



3.2.2 Decoder

- Now, we need to decoder the data.



Data length	Data description	Value range	Explanation

byte 0	Data packet sequence number high 8 bits	0-0xFFFF	Counting starts from 0 and increments, resetting back to 0 after reaching 65535
byte 1	Data packet sequence number low 8 bits		
byte 2	Battery voltage		The value is amplified by a factor of 10. To get the actual value, divide it by 10. For example, if the value is 0x21 (33), the actual voltage is 3.3 V
byte 3	Valve state	0/1	0 is OFF, 1 is ON.
byte 4	Flow One-second pulse bits 8 to 15		Number of pulses per second of change in water flow velocity For example, if the value is 0x0021 = 33, then the value is 33.
byte 5	Flow One-second pulse bits 0 to 7		
byte 6	Valve open-close duration bits 24 to 31		Timing begins when the solenoid valve is opened, and once it closes, the recorded opening duration is uploaded. For example, if the value is 0x000000A8 = 168, then the valve open duration: 168 seconds.
byte 7	Valve open-close duration bits 16 to 23		
byte 8	Valve open-close duration bits 8 to 15		
byte 9	Valve open-close duration bits 0 to 7		
byte 10	data transmission interval bits 24 to 31		The time interval for data transmission has been increased by a factor of 1000. The unit is seconds.
byte 11	data transmission interval bits 16 to 23		
byte 12	data transmission interval bits 8 to 15		
byte 13	data transmission interval bits 0 to 7		
Downlink			
Fport 1	Change the data sending interval		10S-1440min
Fport 5	Upload the quantity of the latest local logged data		
Fport 6	Change the Valve	0/1	0 is OFF, 1 is ON.

	ON/OFF		

Example:0x00 0x01 0x24 0x01 0x00 0x21 0x00 0x00 0x00 0x00 0x00 0x09 0x27 0xC0

Data parsing：

Battery voltage is 3.6V.

Valve status is ON.

Flow One-second pulse change is 33.

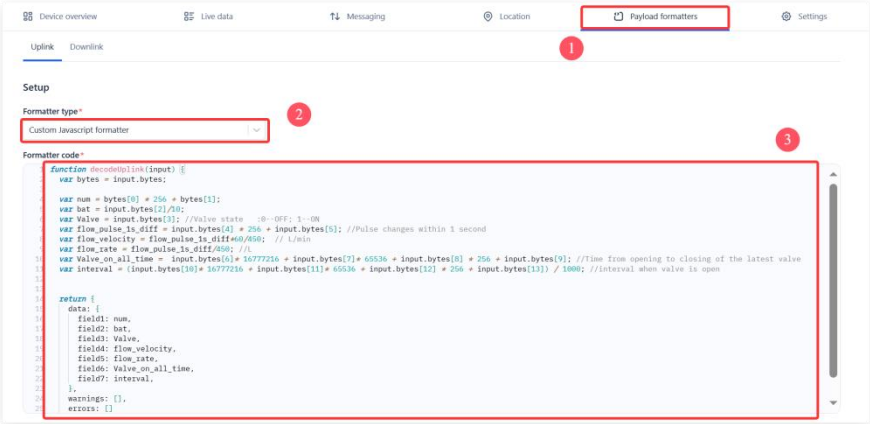
Valve open-close duration is 0.(The timing will be uploaded when the valve closes)

Data transmission interval value is 600s.

- Know how to decode it after, we need to write it in code. (You can check it out on Github)

```
function decodeUplink(input) {
  var bytes = input.bytes;
  var num = bytes[0] * 256 + bytes[1];
  var bat = input.bytes[2]/10;
  var Valve = input.bytes[3]; //Valve state      :0--OFF; 1--ON
  var flow_pulse_1s_diff = input.bytes[4] * 256 + input.bytes[5]; //Pulse changes within 1 second
  var flow_velocity = flow_pulse_1s_diff*60/450;    // L/min
  var flow_rate = flow_pulse_1s_diff/450; //L
  var Valve_on_all_time = input.bytes[6]* 16777216 + input.bytes[7]* 65536 + input.bytes[8] * 256 + input.bytes[9]; //Time from opening to closing of the latest valve
  var interval = (input.bytes[10]* 16777216 + input.bytes[11]* 65536 + input.bytes[12] * 256 + input.bytes[13]) / 1000; //interval when valve is open
  return {
    data: {
      field1: num,
      field2: bat,
      field3: Valve,
      field4: flow_velocity,
      field5: flow_rate,
      field6: Valve_on_all_time,
      field7: interval,
    },
    warnings: [],
    errors: []
  };
}
```

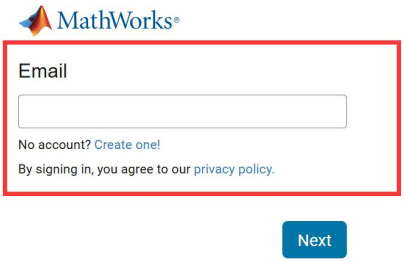
- Select “Payload formatters” and follow the steps.



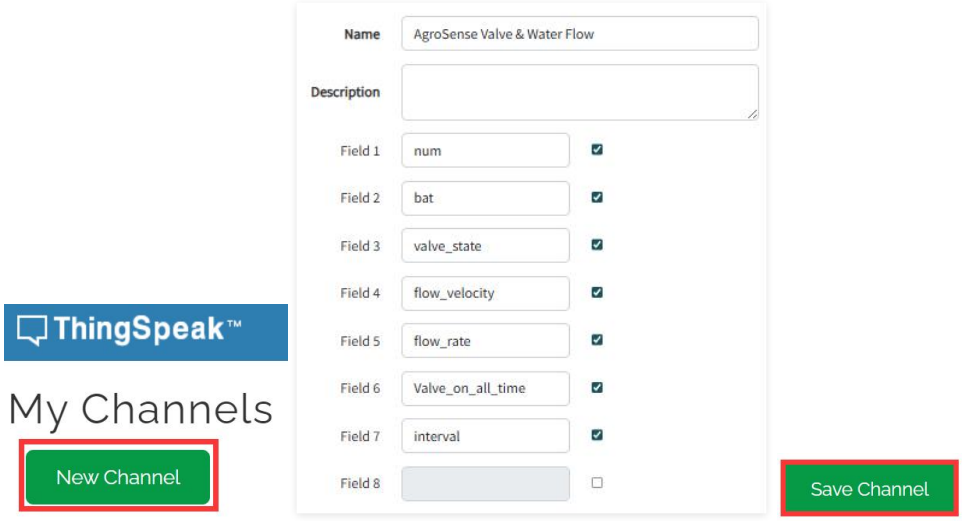
3.2.3 Application Server configuration

In the Application Server configuration, we need to create ThingSpeak channel and get Channel ID and API Key, this is the key to our connection to TTN.

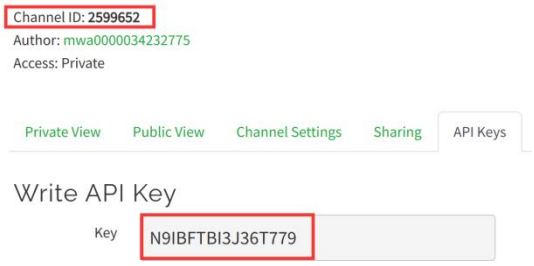
- Login to the ThingSpeak. (Or register an account)



- Click “New Channel”, fill in the Channel name and field names and click “Save Channel”.

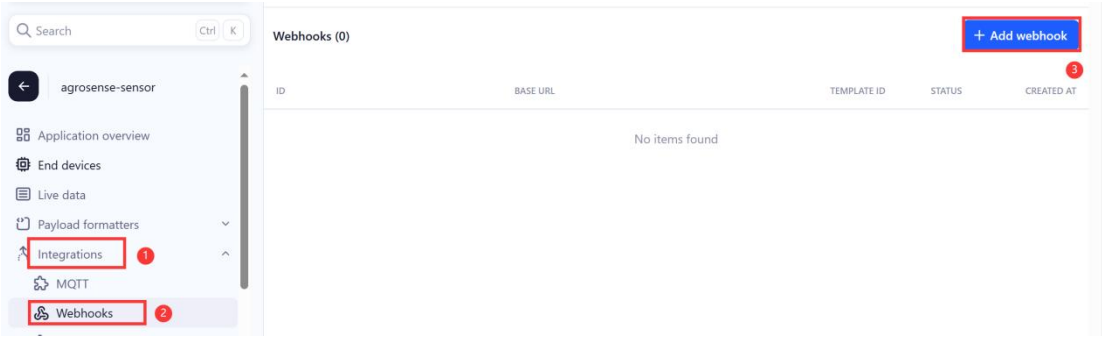


- After successful creation, copy the Channel ID and API Key.

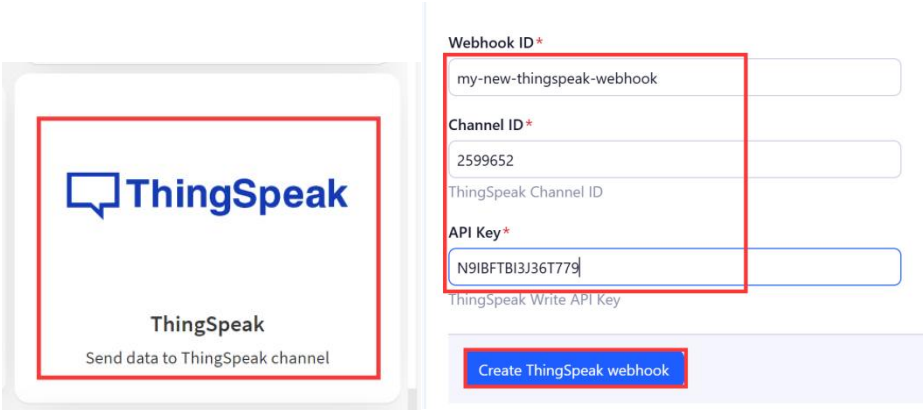


3.2.4 Connect the Network Server and Application Server

- In the TTN, click “integrations” --> “Webhooks” --> “+ Add webhook”.



- Select “ThingSpeak”, Fill in the Webhook ID and paste the Channel ID and API Key, click “Create ThingSpeak Webhook”.



- Press RST button, wait about a minute, you will successfully see the data in ThingSpeak.(You will recive the data every hour.)

3.2.5 Downlink

The downlink has two functions:

- Modification time interva (Fport1)

Modify the time interval for uploading data, the default is one hour.

- Upload the quantity of the latest local logged data (Fport5)

Users can view previous data based on this feature.

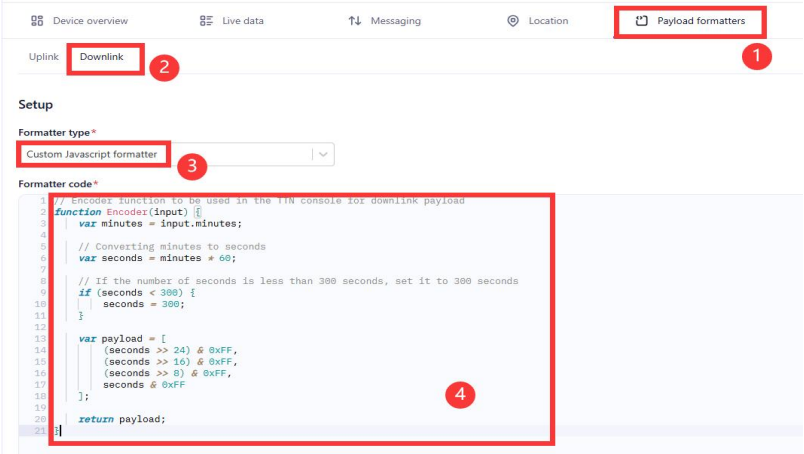
- Change the Valve ON/OFF (Fport6)

Modify the valve status, 0 is OFF, 1 is ON.

Modify the time interval :

1 、 If you need to change time Interval (Default 60 minutes), you can click “Payload formatters-->Downlink” and follow the steps.

Formatter code you can find in Github.

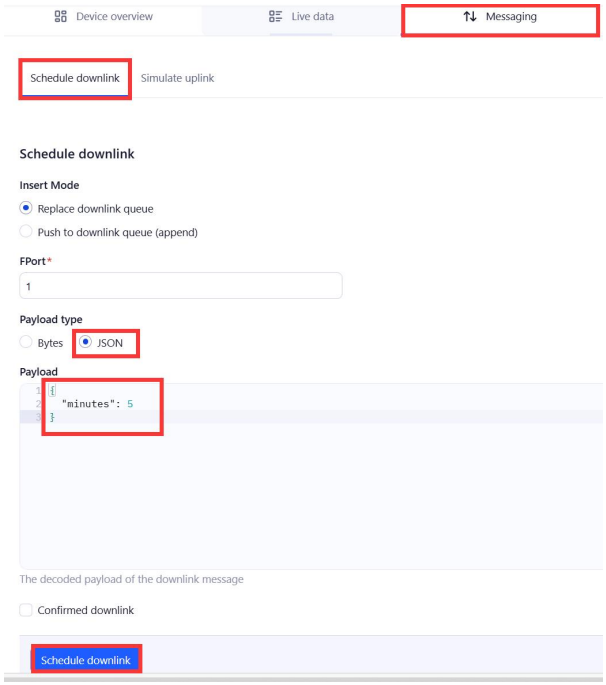


2、Click “Save changes”.

3、Click “Messaging-->Schedule downlink”.

Note: you must use this format:

```
{
  "minutes": 5
}
```

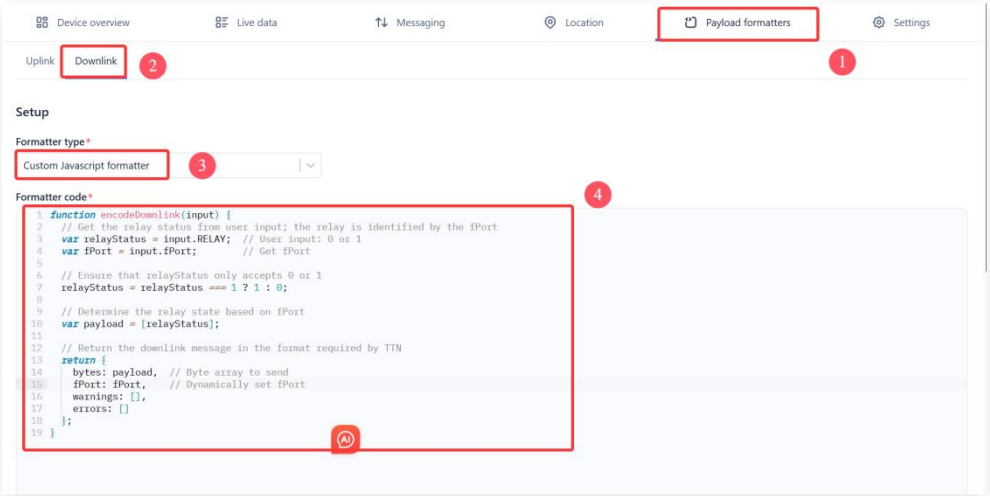


4、The modified interval will be updated after the next data upload.

Change the Valve ON/OFF:

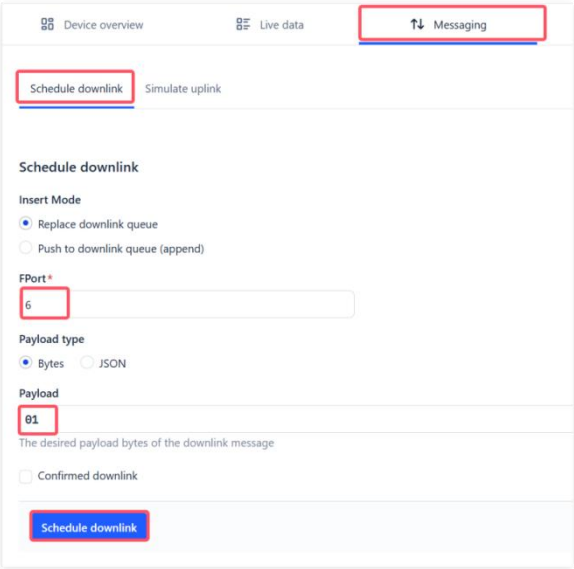
1、Click “Payload formatters-->Downlink” and follow the steps.

Formatter code you can find in Github.



2、Click “Save changes”.

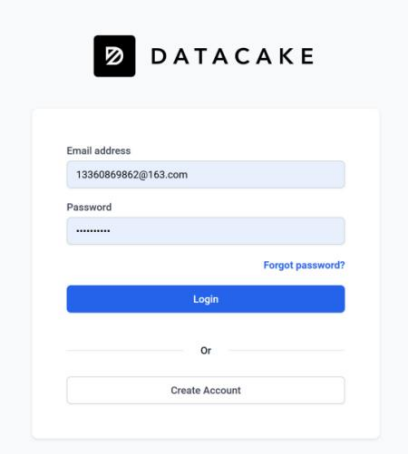
2、Click “Messaging-->Schedule downlink”. The valve will ON/OFF immediately after the modification. (00 is OFF, 01 is ON)



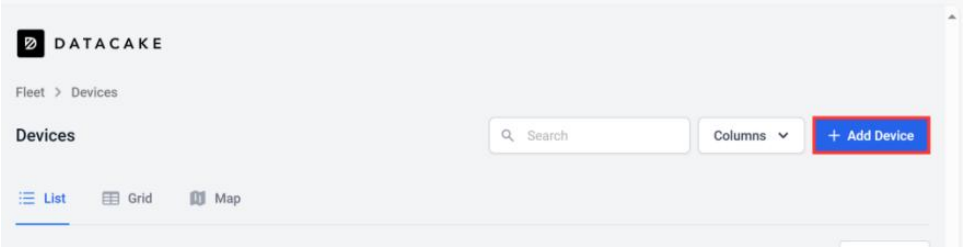
3.3 Usage with Datacake

In this phase, we use DataCake(https://datacake.co/) as the data server & console.

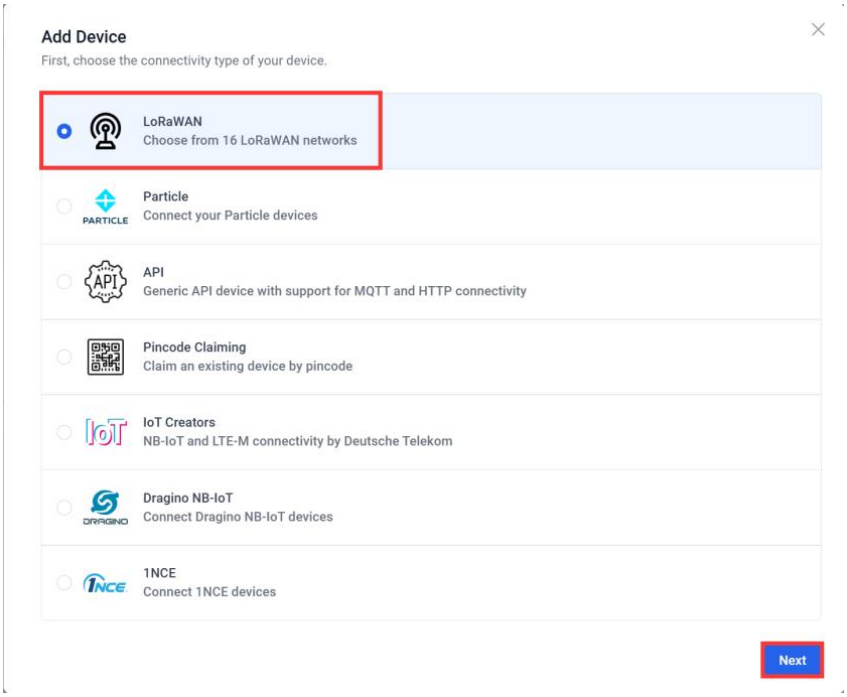
1、Login datacake or Create Account



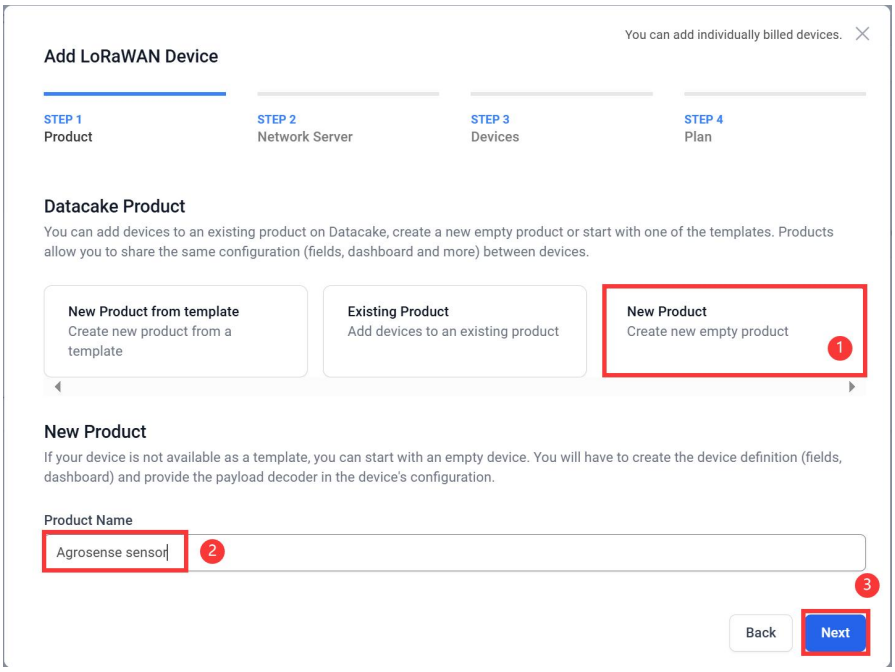
2、Click “Add Device”



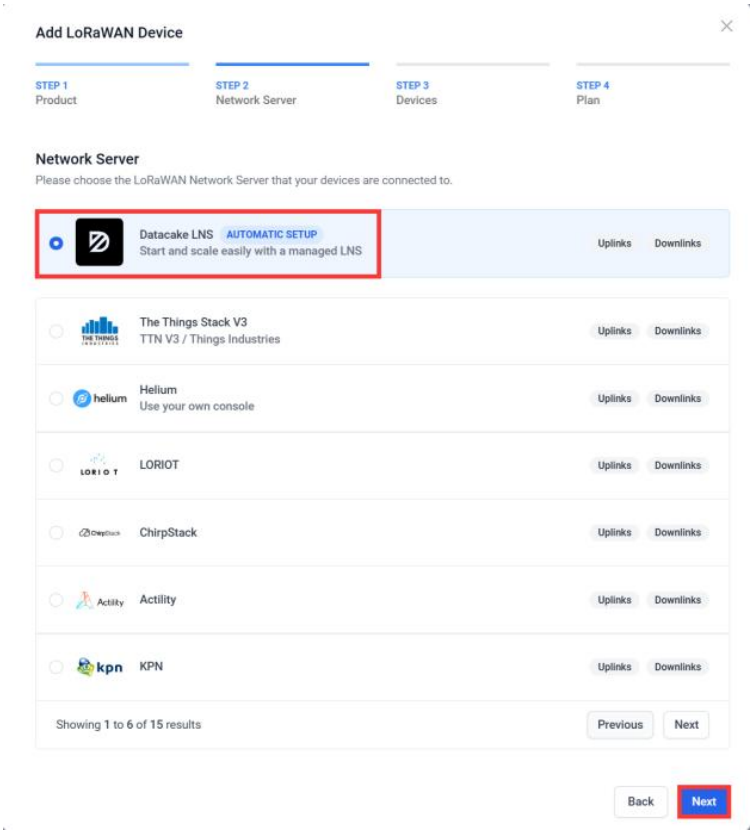
3、Select LoRaWAN and click “Next”



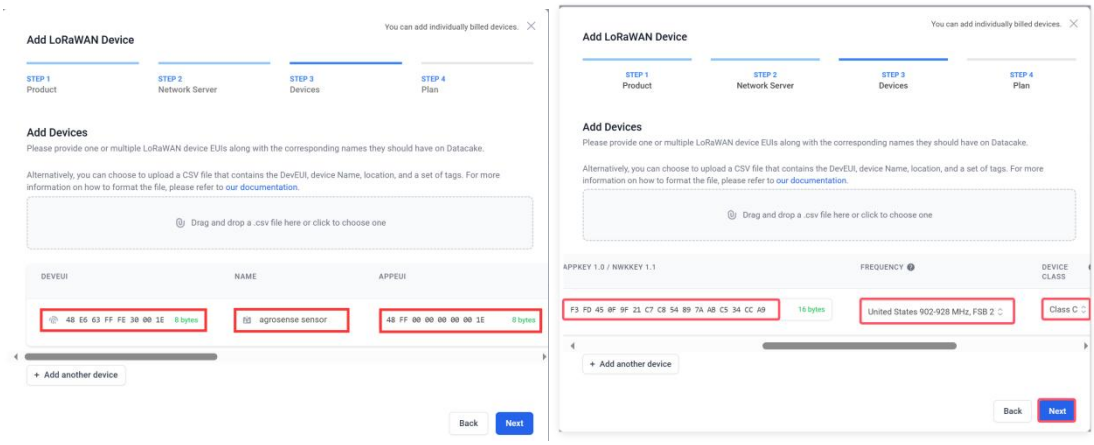
4、Select a Product based on your needs, take "Create new empty product" as an example.



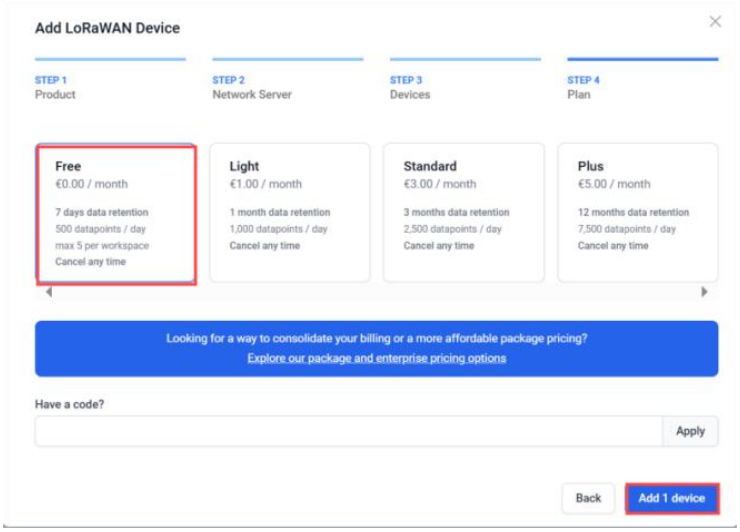
5、Select “Datacake LNS”



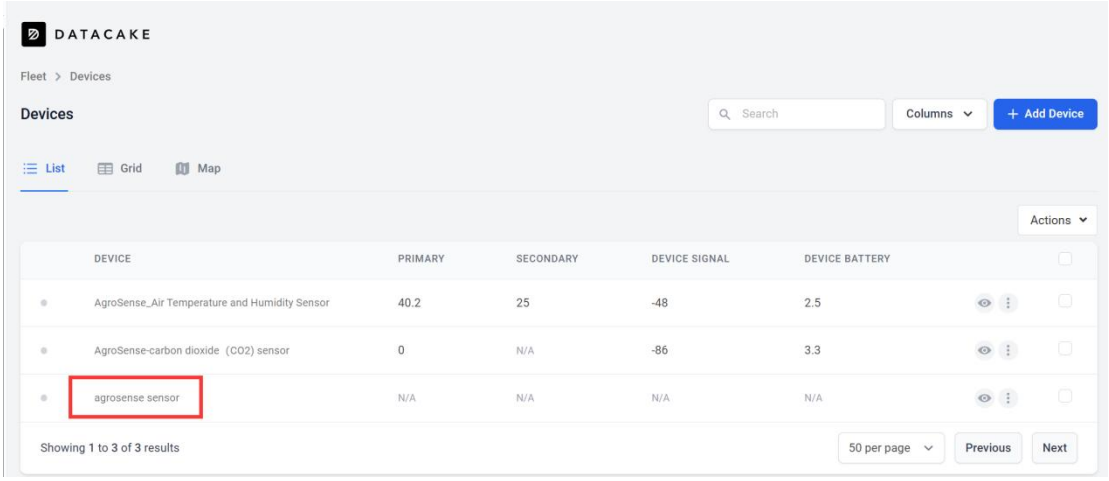
6、Enter DEVEUI、APPEUI、APPKEY、FREQUENCY(take 915 for example) and DEVICE CLASS.



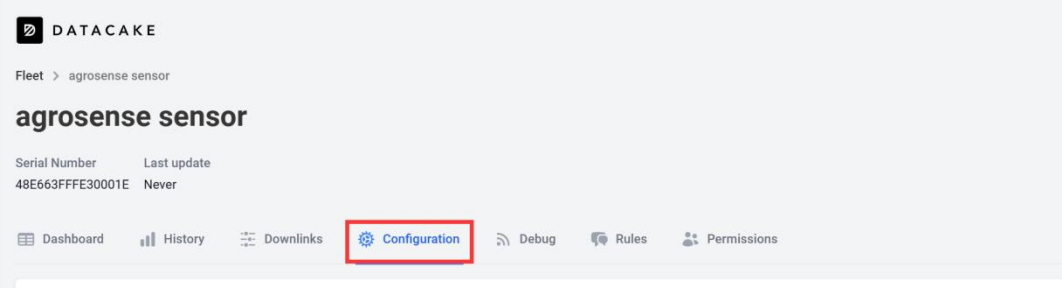
7、Choose the type according to your needs, and click “Add 1 device”.

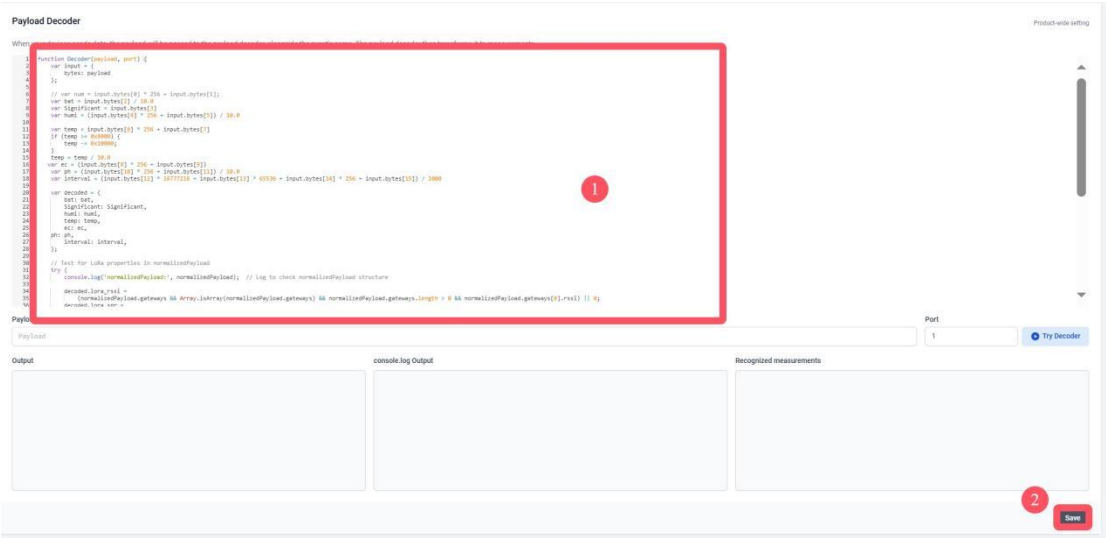


8、Click to go to the device you just added.



9、Click “Configuration”, enter Decoder and click “Save”.(You can check it out on Guihub)

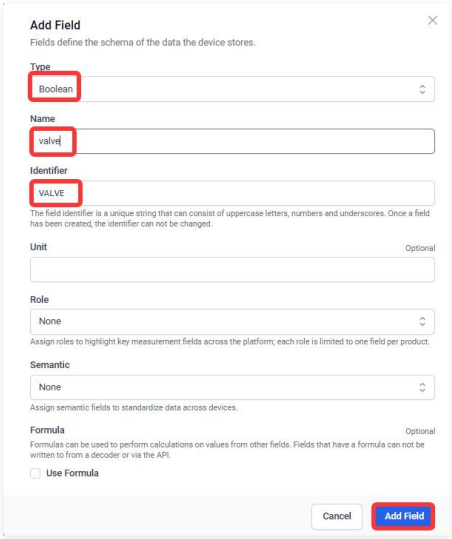





```
function Decoder(payload, port) {
    var input = {
        bytes: payload
    };
    var num = input.bytes[0] * 256 + input.bytes[1]
    var bat = input.bytes[2]/10
    var valve = input.bytes[3] //Valve state      :0--OFF; 1--ON
    var flow_pulse_1s_diff = input.bytes[4] * 256 + input.bytes[5] //Pulse changes within 1 second
    var flow_velocity = flow_pulse_1s_diff*60/450;    // L/min
    var flow_rate = flow_pulse_1s_diff/450; //L
    var Valve_on_all_time =    input.bytes[6]* 16777216 + input.bytes[7]* 65536 + input.bytes[8] * 256 +
input.bytes[9] //Time from opening to closing of the latest valve
    var interval = (input.bytes[10]* 16777216 + input.bytes[11]* 65536 + input.bytes[12] * 256 + input.bytes[13])
/ 1000 //interval when valve is open
    var decoded =
    {
        NUM:num
        BAT:bat
        VALVE:valve
        //FLOW_PULSE_1S_DIFF:flow_pulse_1s_diff
        FLOW_VELOCITY:flow_velocity
        FLOW_RATE:flow_rate
```

```
            VALVE_ON_ALL_TIME:Valve_on_all_time
            INTERVAL:interval
        };
        // Test for LoRa properties in normalizedPayload
  try {
    if (normalizedPayload.gateways && normalizedPayload.gateways.length > 0) {
        decoded.LORA_RSSI = normalizedPayload.gateways[0].rssi || 0;
        decoded.LORA_SNR = normalizedPayload.gateways[0].snr || 0;
    } else {
        decoded.LORA_RSSI = 0;
        decoded.LORA_SNR = 0;
    }
    decoded.LORA_DATARATE = normalizedPayload.spreading_factor
                                || normalizedPayload.data_rate
                                || (normalizedPayload.networks && normalizedPayload.networks.lora &&
normalizedPayload.networks.lora.dr)
                                || "unknown";
} catch (error) {
    console.log('LoRa property parsing error:', error);
    decoded.LORA_RSSI = 0;
    decoded.LORA_SNR = 0;
    decoded.LORA_DATARATE = "unknown";
}
return decoded;
}
```

10、Follow the steps to add a field. (Every fields is the same way)



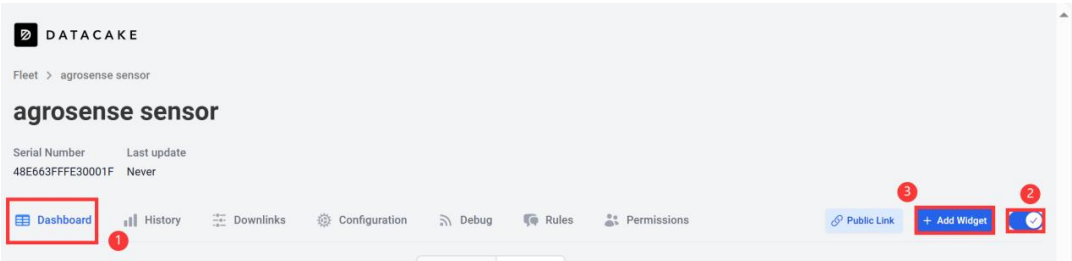
NAME	IDENTIFIER	TYPE
Interval	INTERVAL	Integer
Lora Datarate	LORA_DATARATE	String
Lora Rssi	LORA_RSSI	Integer
Lora Snr	LORA_SNR	Integer
bat	BAT	Float
num	NUM	Integer
Valve_on_all_time	VALVE_ON_ALL_TIME	Integer
valve	VALVE	Boolean
flow_rate	FLOW_RATE	Float
Flow Velocity	FLOW_VELOCITY	Float

11、Press RST button, wait until the sensor connects to the gateway successfully, you will see the data the sensor is currently reading.

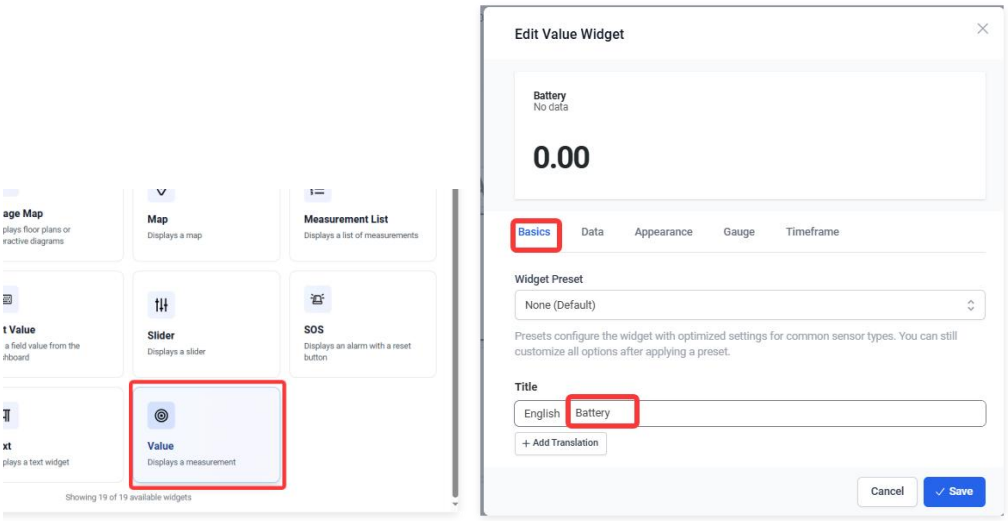
NAME	IDENTIFIER	TYPE	ROLE / SEMANTIC	CURRENT VALUE	LAST UPDATE
Interval	INTERVAL	Integer		3,600 s	23 seconds ago
Lora Datarate	LORA_DATARATE	String		SF10BW125.0	23 seconds ago
Lora Rssi	LORA_RSSI	Integer	Signal	-85 dBm	23 seconds ago
Lora Snr	LORA_SNR	Integer	Signal-to-Noise Ratio	6 dB	23 seconds ago
bat	BAT	Float		3.5	23 seconds ago
num	NUM	Integer		41	23 seconds ago
Valve_on_all_time	VALVE_ON_ALL_TIME	Integer		0	23 seconds ago
valve	VALVE	Boolean		False	23 seconds ago
flow_rate	FLOW_RATE	Float		0	23 seconds ago
Flow Velocity	FLOW_VELOCITY	Float		0	23 seconds ago

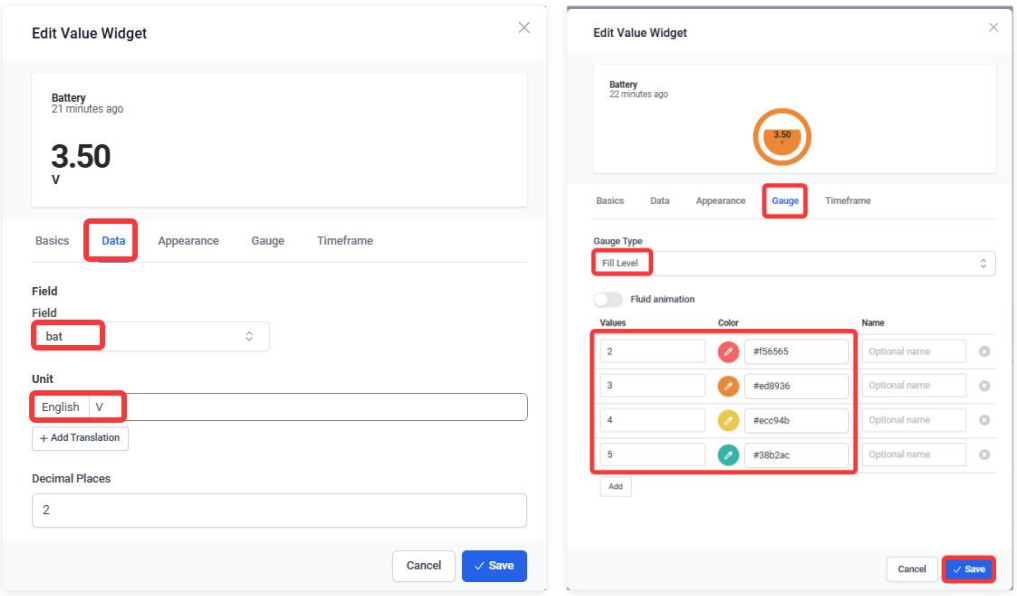
12、To get a better look at the data, we can add widget.

Click “Dashboard-->switch-->+ Add Widget”.

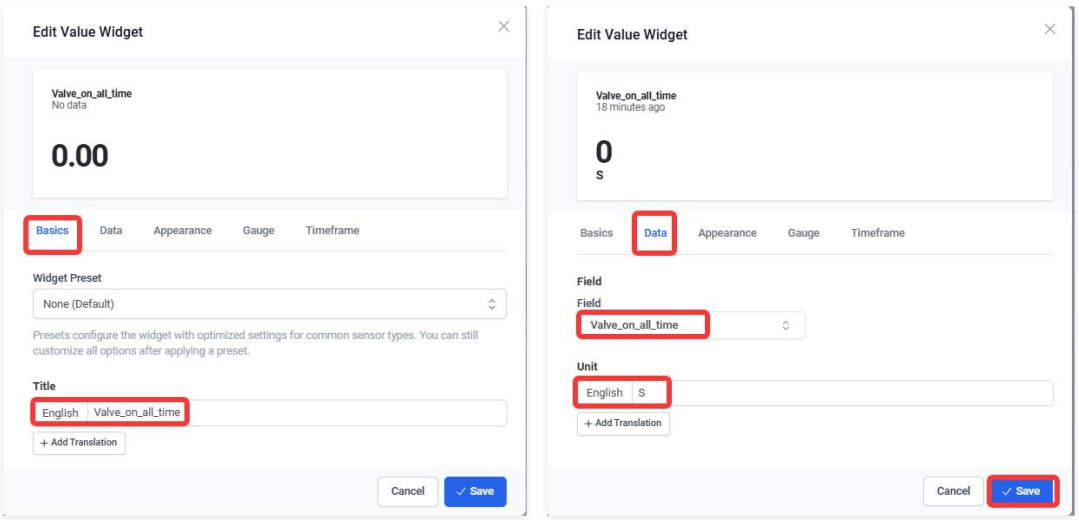


13、Add “Battery” field, Select “Value” and set Title.

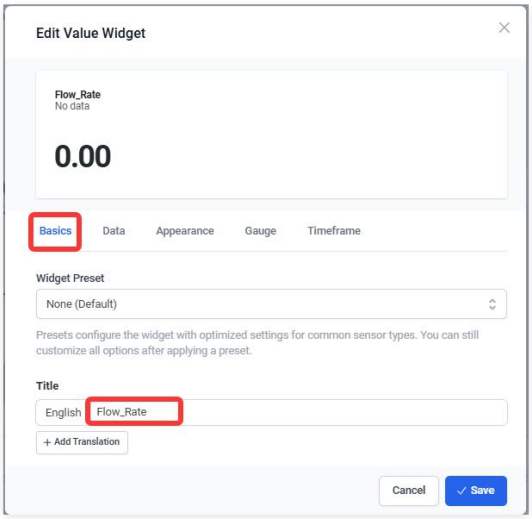


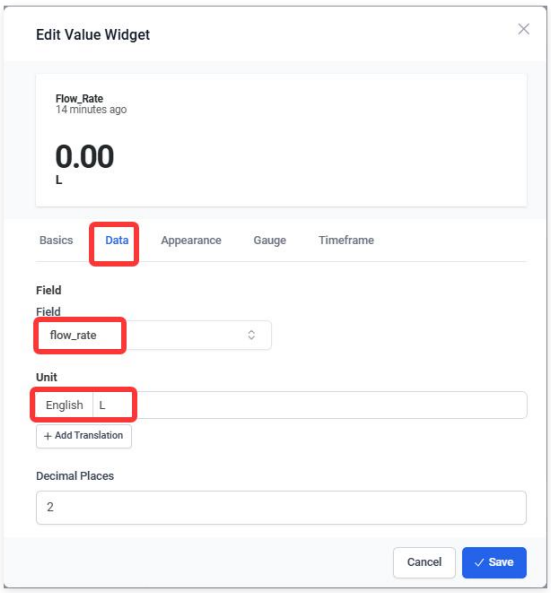


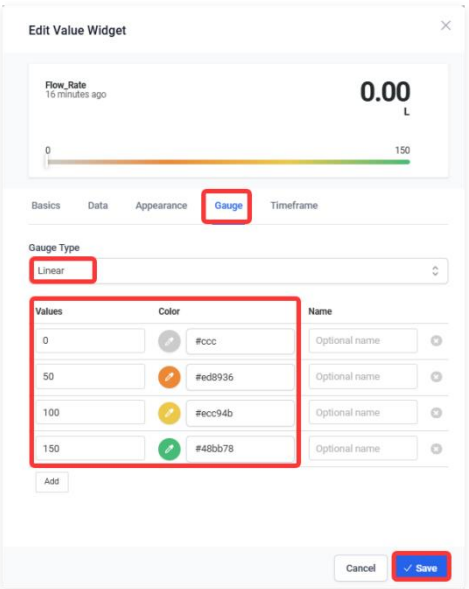
14、Add “Valve_on_all_time” field, Select “Value” and set Title.



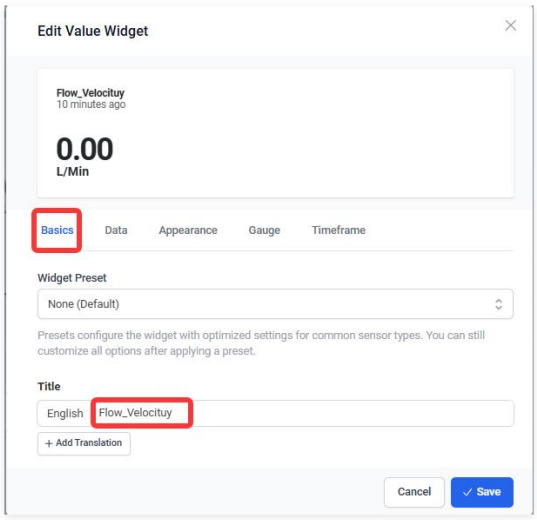
15、Add “Flow_Rate” field, Select “Value” and set Title.

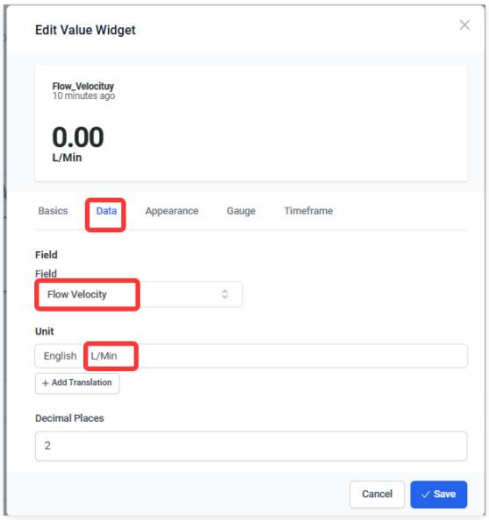


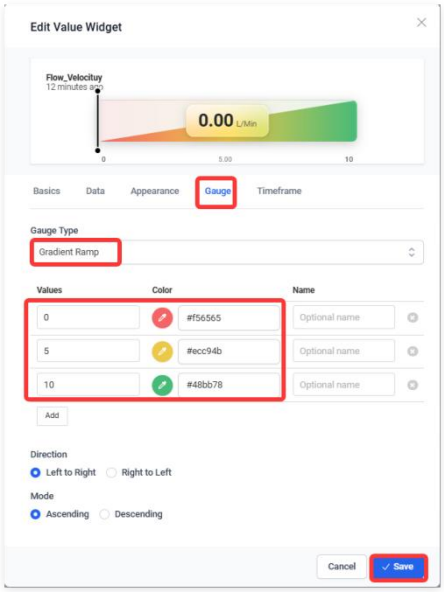




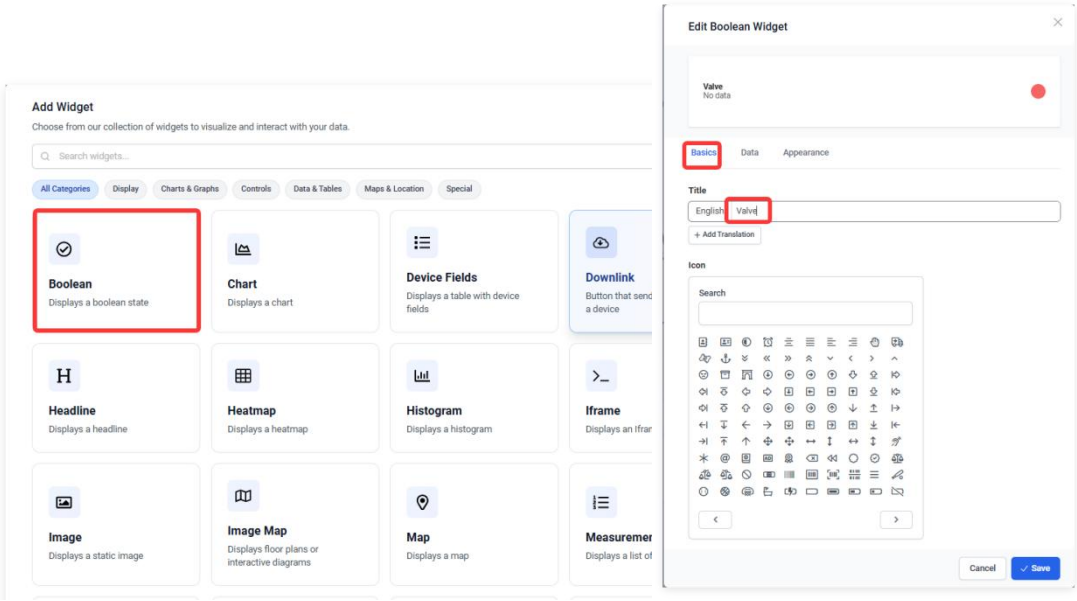
16、Add “Flow_Velocituy” field, Select “Value” and set Title.

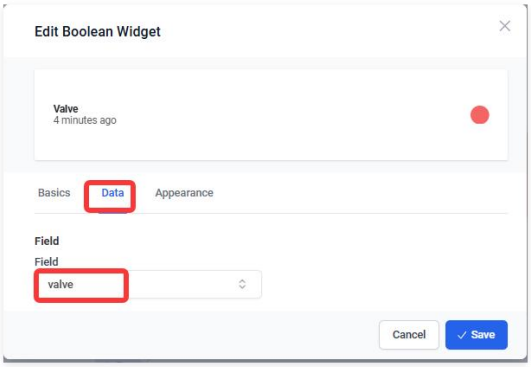


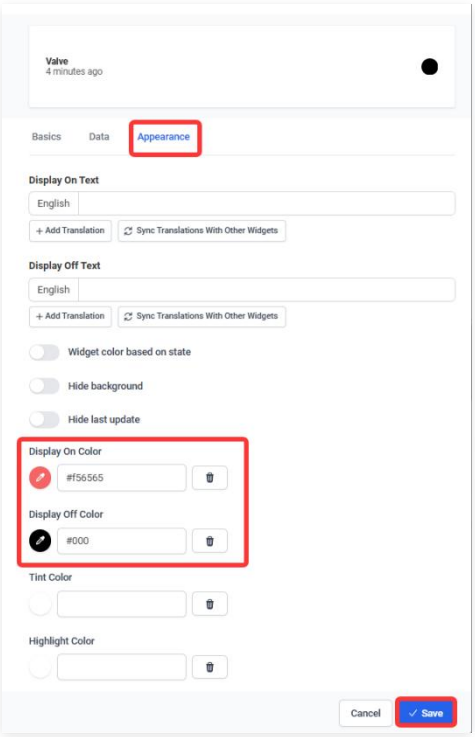




17、Add “Valve” field, Select “Boolean” and set Title, Field as well as the status color.







18、Click the switch to save, and you can see the data visually.

3.3.1 Downlink

The downlink has the following functions:

- Modification time interva (Fport1)

Modify the time interval for uploading data, the default is one hour.

- Upload the quantity of the latest local logged data (Fport5)

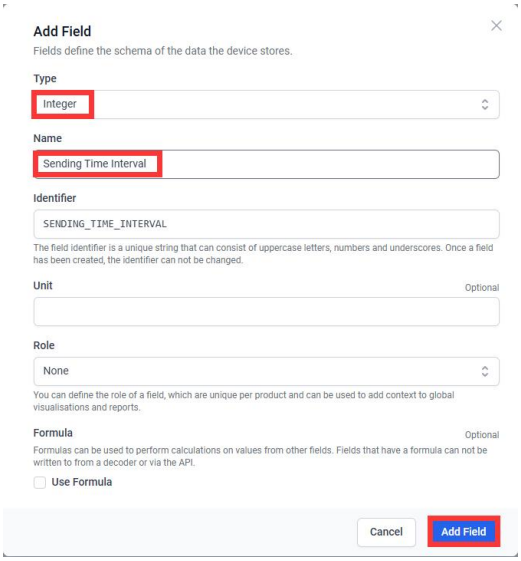
Users can view previous data based on this feature.

- Change the Valve ON/OFF (Fport6)

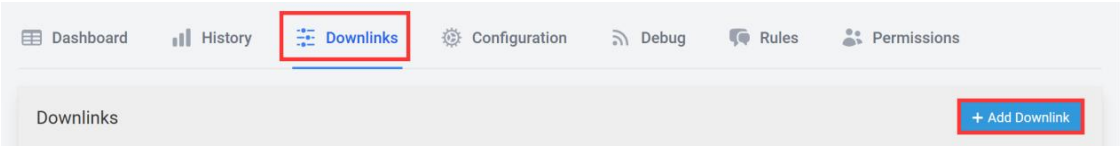
Modify the valve status, 0 is OFF, 1 is ON.

Modify the time interval :

1 、 If you need to change time Interval (Default 60 minutes), you can click “Configuration-->Fields-->+Add Field”



2、Click ”Downlink-->Add Downlink”.

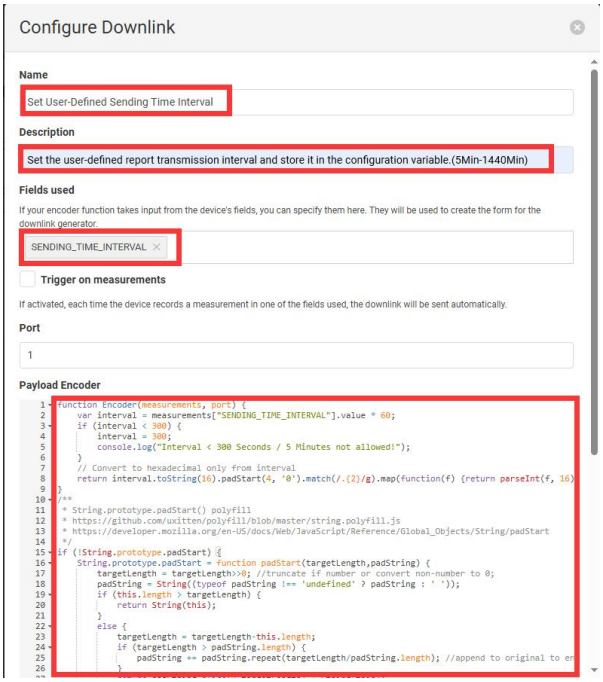


Enter name、description、fields used and payload encoder respectively.

Name: Set User-Defined Sending Time Interval

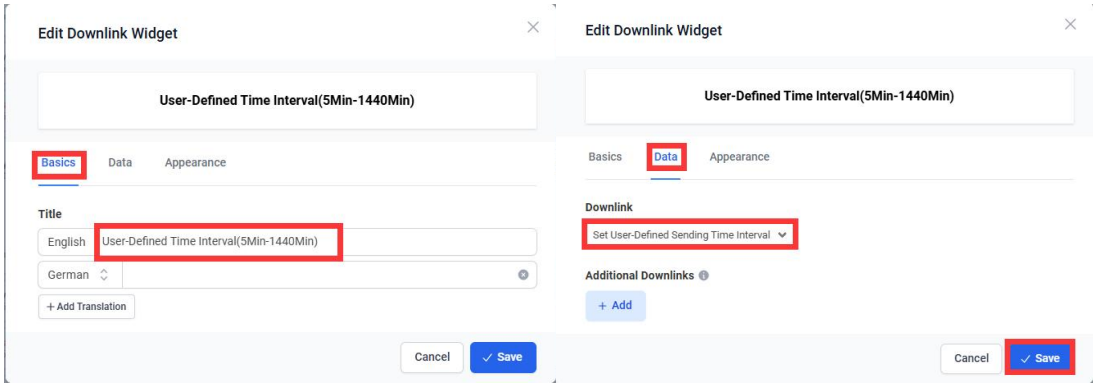
Description: Set the user-defined report transmission interval and store it in the configuration variable.(5Min-1440Min)

Payload Encoder: copy in Github.

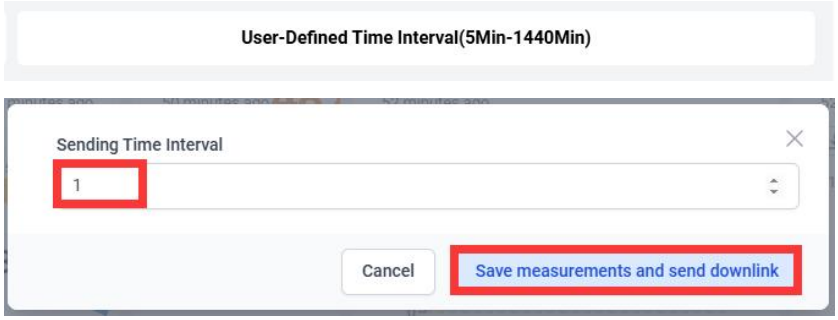


3、Click “Dashboard-->switch-->+ Add Widget”.

Select “Downlink” and setting as follow image.

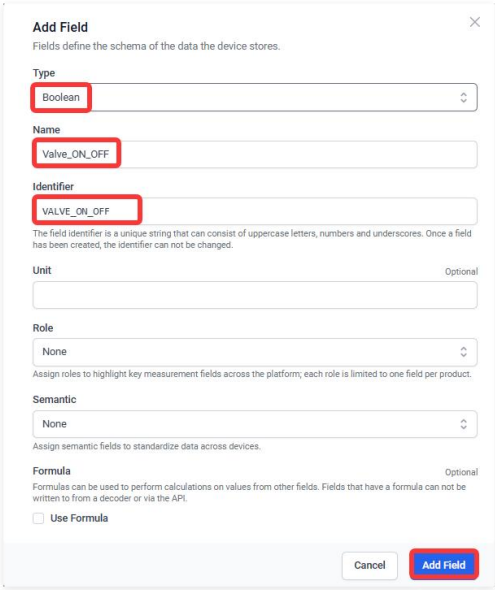


4、Click the switch to save, and you can click to change your time Interval.

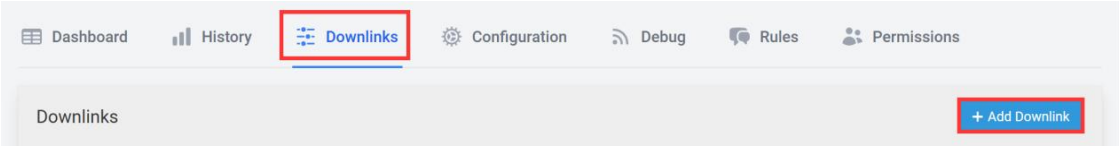


Change the Valve ON/OFF:

1、Click “Configuration-->Fields-->+Add Field”.

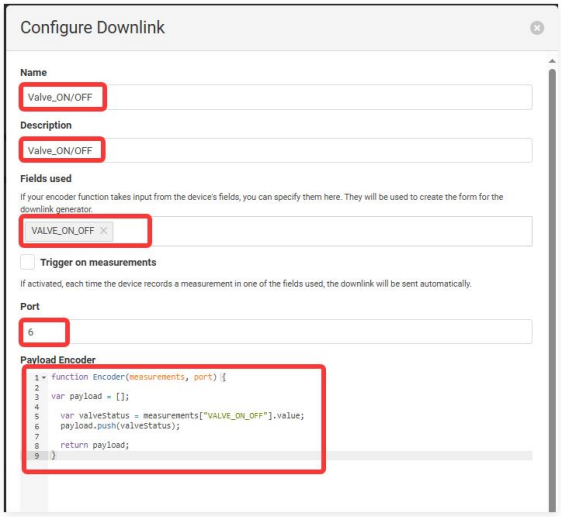


2、Click ”Downlink-->Add Downlink”.



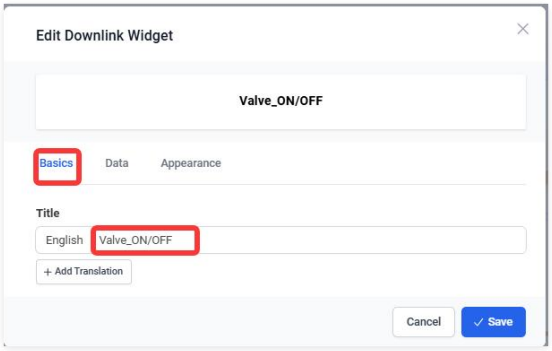
Enter name、description、fields used and payload encoder respectively.

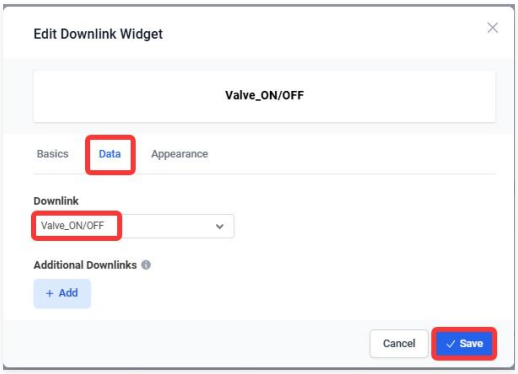
Payload Encoder: copy in Github.



3、Click “Dashboard-->switch-->+ Add Widget”.

Select “Downlink” and setting as follow image.





4、Click the switch to save, and you can click to change Valve_ON/OFF.

(Check the box to turn it on, otherwise it's off.)