



AgroSense LoRaWAN®

4-Channel ADC 12 bits Manual

V1.0

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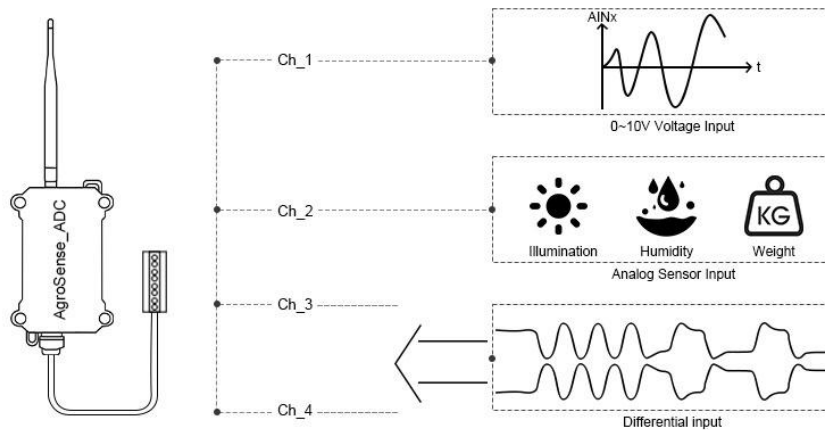
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1 Product Description

1.1 Introduction

AgroSense LoRaWAN® 4-Channel ADC 12 bits use ADS1015IDGSR chip, which is capable of connecting up to 4-channel devices and provides high-precision analogue-to-digital conversions (ADCs) of up to 12 bits. Also, the product has been rigorously tested for IP68 waterproof performance to ensure reliability and durability in a variety of harsh environments. The device supports voltage inputs, either directly or from other sensors, for a wide range of IoT applications. The built-in low-power 12-bit delta-sigma analogue-to-digital converter (ADC) provides a high degree of accuracy and stability. In addition, the 3/4 input channels of the AgroSense 4-Channel ADC can be configured in differential input mode, which greatly enhances its immunity to interference and ensures stable operation in complex electrical environments.



The sensor benefits from LoRaWAN, which ensures stability and reliability. It is capable of covering a long transmission range while maintaining low power consumption. Unlike wireline devices, it is battery-powered, reducing the workload and complexity of deployment, design and development for end-users that can work via powering it, and setting the configuration in the cloud server, for LoRaWAN® remote monitoring. It monitors the environmental data users need and report every 1 hour, with downlink users can manually adjust the reporting time.



1.2 Feature

- Includes a **high precision** sensor.
- Compatible with Worldwide **LoRaWAN® Networks**: Support the universal frequency bands EU868/ US915.
- LoRaWAN version: LoRaWAN Specification **1.0.3**.
- **Long Range**: Up to 2 kilometers in the city, up to 10 kilometers in the wilderness, receive sensitivity -137dBm , transmit power up to 21dBm.
- **Ultra-low power** consumption design, traditional AAA alkaline dry battery can be used for one year.
- **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.
- Suitable for **Harsh Environments**: Can work normally under the temperature of -40℃ ~ 85℃, IP68 waterproof, suitable for outdoor use in harsh conditions, high UV, dusty, heavy rain and other bad weather.
- Monitor data and upload **real-time** data regularly.
- Modify the product parameters through **AT commands**.
- Support **downlink** to modify the time interval, motion status on/off, motion status sensitivity.

1.3 Parameter

1. General Parameters

Product Model	AGLWMA01
Measurement Range	12-bit ADC
Measurement Accuracy	1/4096
channel count	4

2. Wireless Parameters

Communication Protocol	Standard LoRaWAN® protocol V1.0.3
Network Access/Operating Mode	OTAA Class A
MAX Transmit Power	21dBm

Receiver Sensitivity	-137dBm/125kHz SF=12
Frequency Band	EU868/US915

3.Physical Parameters

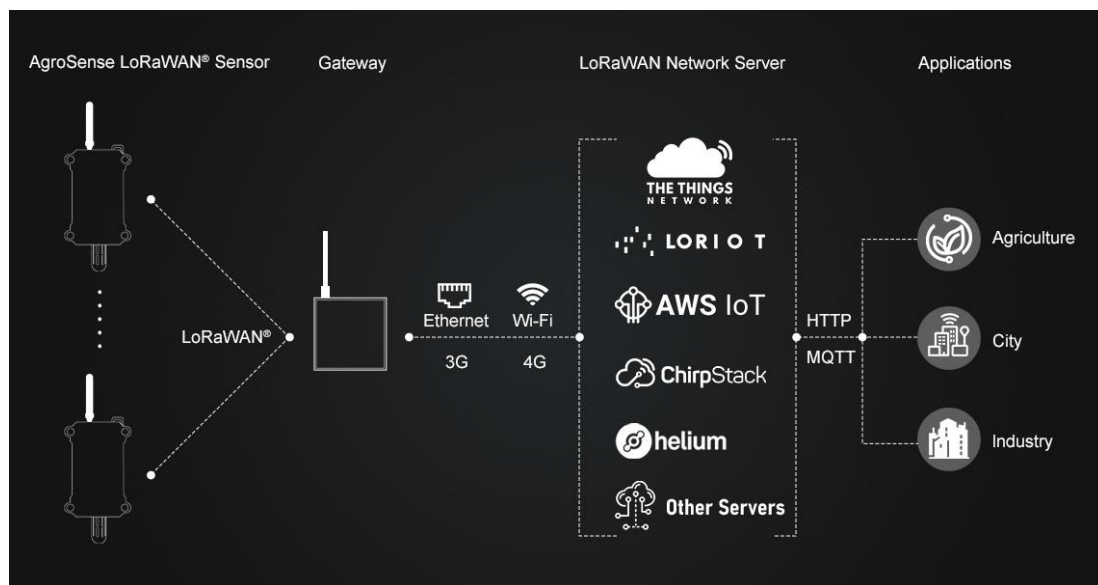
Power Supply	1 x 18650 3.7V Lion batteries
Operating Temperature	-40°C ~85°C
Protection Class	IP68
Dimensions	131 × 62.7 × 27.5 mm
Mounting	Wall Mounting

2 Technical route

2.1 System Framework

AgroSense 4-Channel ADC 12 bits Sensor uses LoRAWAN technology, and its 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.



The steps to achieve the detection of ADC is:

1. Collect the ADC data by sensor, and send the data from End Node to Gateway.
2. The Gateway packages node data and transmits it to the Network Server.
3. The Network Server decodes the data and sends it to the Applications.
4. Finally, user can monitor the ADC in the APP.

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

We use The Things Network as our Network Server, we need to configuration the country/ area frequency, inputting DEV EUI/ APP EUI/ APP Key, decodes, and connect to ThingSpeak or Datacake.

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 LoRaWAN® 4-Channel ADC 12 bits. (The AgroSense series is applicable)
- Network Server: The Things Network. (Lorient, AWS IoT, ChirpStack, ect)
- Application Server: ThingSpeak.(Datacake, Blockbax, akenza, ect)

We will use ADC1 as an example to collect the voltage of an adjustable resistor.

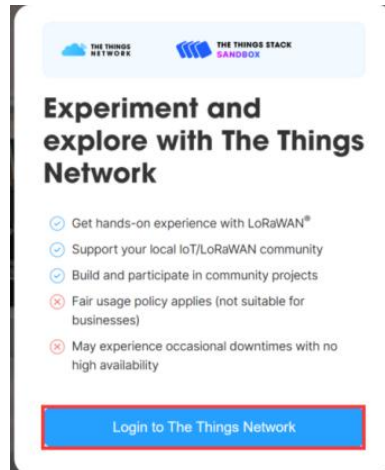


Agrosense	ADC model
IN1	OUT
3V3	VCC
GND	GND

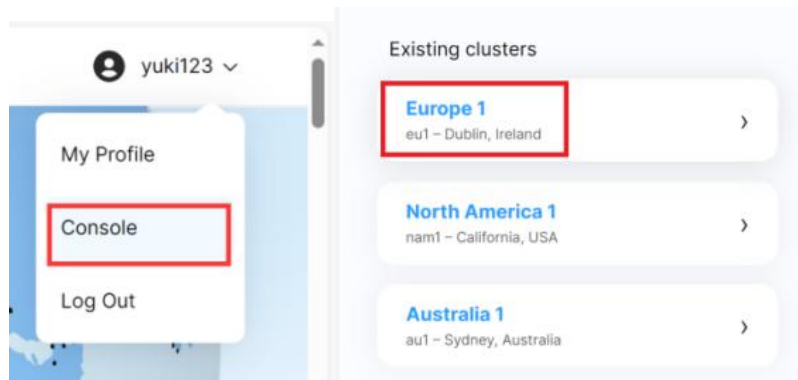
3.1 TTN and ThingSpeak

3.1.1 Network Server configuration

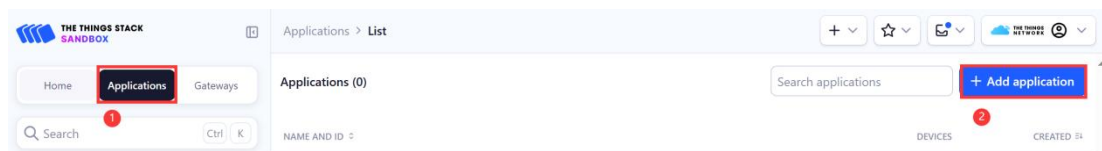
- Open The Things Network in your browser and login it. (Or register an account)



- 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”.

Application ID *

agrosense-sensor

Application name

My new application

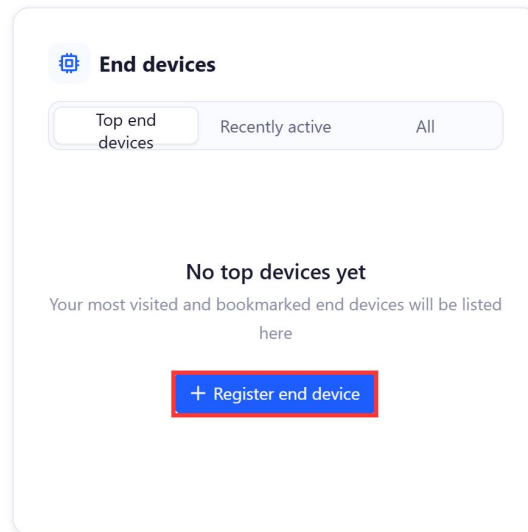
Description

Description for my new application

Optional application description; can also be used to save notes about the :

Create application

- Click “+ Register and device”.



- Following the steps, 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.

End device type

Input method ⓘ

☐ Select the end device in the LoRaWAN Device Repository

☒ Enter end device specifics manually 1

Frequency plan ⓘ *

Europe 863-870 MHz (SF9 for RX2 - recommended) | ▾

LoRaWAN version ⓘ *

LoRaWAN Specification 1.0.3 | ▾

Regional Parameters version ⓘ *

RP001 Regional Parameters 1.0.3 revision A | ▾ 2

[Show advanced activation, LoRaWAN class and cluster settings](#)

Provisioning information

JoinEUI ⓘ *

48 FF 00 00 00 01 65 | Reset

This end device can be registered on the network

DevEUI ⓘ *

48 E6 63 FF FE 30 01 65 | Generate 0/50 used

AppKey ⓘ *

4A 35 62 6B 95 AB 5B 4D 3F 3B DE 12 71 B1 6F 2A | Generate

End device ID ⓘ *

eui-48e663ffe300165

This value is automatically prefilled using the DevEUI

After registration

☒ View registered end device

☐ Register another end device of this type

Register end device

Provisioning information

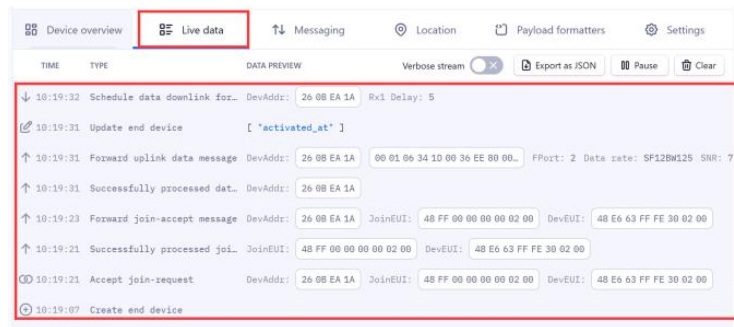
JoinEUI ⓘ *

48 FF 00 00 00 01 65 | Confirm 3

continue, please enter the JoinEUI 4 and device so we can determine onboarding

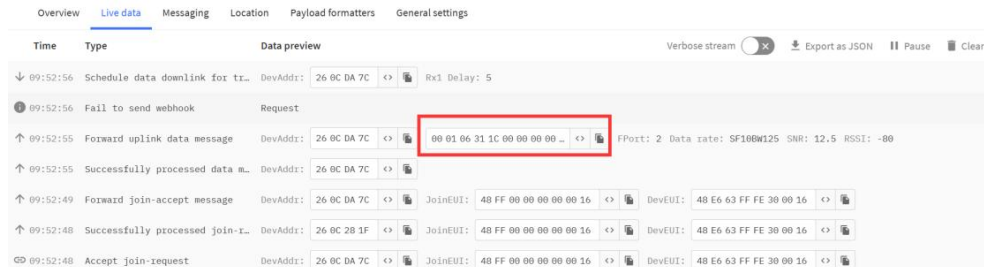


- Plug the battery and press RES button, you can see the device is connected successfully in the TTN.



3.1.2 Decoder

- Now, we need to decode 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 obtained by amplifying the data by 10 times, and the actual value needs to be divided by 10 to convert to the actual battery voltage. The purpose of multiplying by 10 is to retain one decimal place of the voltage value. For example, if the value is 0x21 = 33, then the battery voltage is 3.3V.
byte 3	ADC_0 bits 8 to 15		ADC value in millivolts
byte 4	ADC_0 bits 0 to 7		For example, if the value is 0x0CE4 = 3300, then the value is 3300mV.
byte 5	ADC_1 bits 8 to 15		ADC value in millivolts

AgroSense LoRaWAN® 4-Channel ADC 12 bits

byte 6	ADC_1 bits 0 to 7		For example, if the value is 0x0CE4 = 3300, then the value is 3300mV.
byte 7	ADC_2 bits 8 to 15		ADC value in millivolts For example, if the value is 0x0CE4 = 3300, then the value is 3300mV.
byte 8	ADC_2 bits 0 to 7		
byte 9	ADC_3 bits 8 to 15		ADC value in millivolts For example, if the value is 0x0CE4 = 3300, then the value is 3300mV.
byte 10	ADC_3 bits 0 to 7		
byte 11	ADC_Differentialbits 6 to 15		ADC value in millivolts For example, if the value is 0x0CE4 = 3300, then the value is 3300mV.
byte 12	ADC_Differentialbits 0 to 7		
byte 13	data transmission interval bits 24 to 31	0-0xFFFFFFFF	The time interval for data transmission has been increased by a factor of 1000. The unit is seconds.
byte 14	data transmission interval bits 16 to 23		
byte 15	data transmission interval bits 8 to 15		
byte 16	data transmission interval bits 0 to 7		
byte 17	The data validity flag	0/1	0 is invalid, 1 is valid.
Fport 1	Change the data sending interval		
Fport 5	Upload the quantity of the latest local logged data		
Fport 6	Turn on and off the corresponding ADC channels		
Fport 7	Set the third and fourth channels to differential input		0 is enable ADC3 and ADC4 , 1 is enable Differentialbits

Example: 0x00, 0x01, 0x28, 0x0C, 0xE4, 0x0C, 0xC4, 0x0A, 0xE4, 0x0A, 0xAA, 0x0B, 0xB4, 0x00, 0x36, 0xEE, 0x80, 0x01

Data parsing:

Battery voltage is 4V.

ADC_0 is 3300mV.

ADC_1 is 3268mV.

ADC_2 is 2788mV.

ADC_3 is 2730mV.

ADC_Differentialbits is 2996mV.

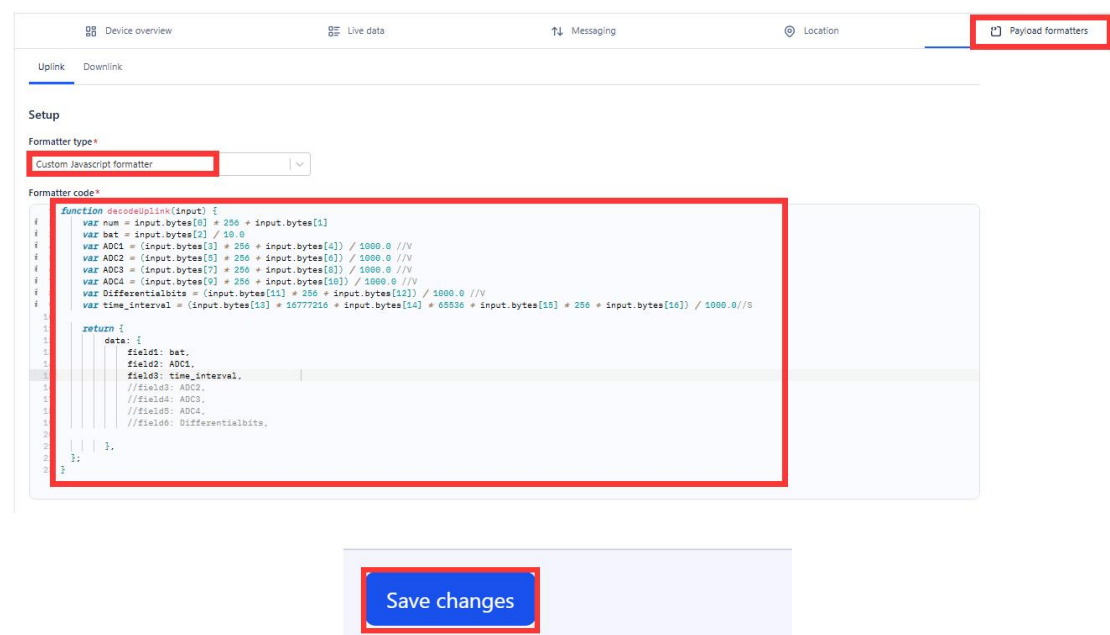
Data transmission interval value is 3600s.

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

```
function decodeUplink(input) {
    var num = input.bytes[0] * 256 + input.bytes[1]
    var bat = input.bytes[2] / 10.0
    var ADC1 = (input.bytes[3] * 256 + input.bytes[4]) / 1000.0 //V
    var ADC2 = (input.bytes[5] * 256 + input.bytes[6]) / 1000.0 //V
    var ADC3 = (input.bytes[7] * 256 + input.bytes[8]) / 1000.0 //V
    var ADC4 = (input.bytes[9] * 256 + input.bytes[10]) / 1000.0 //V
    var Differentialbits = (input.bytes[11] * 256 + input.bytes[12]) / 1000.0 //V
    var time_interval = (input.bytes[13] * 16777216 + input.bytes[14] * 65536 + input.bytes[15] * 256 +
input.bytes[16]) / 1000.0 //S

    return {
        data: {
            field1: bat,
            field2: ADC1,
            Field3: time_interval,
        },
    };
}
```

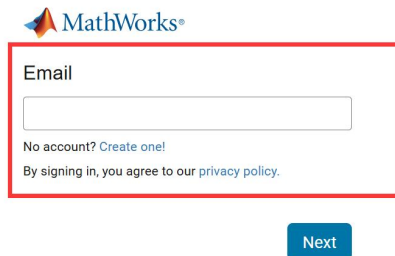
- Select “Payload formatters” and follow the steps.



3.1.3 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)



MathWorks®

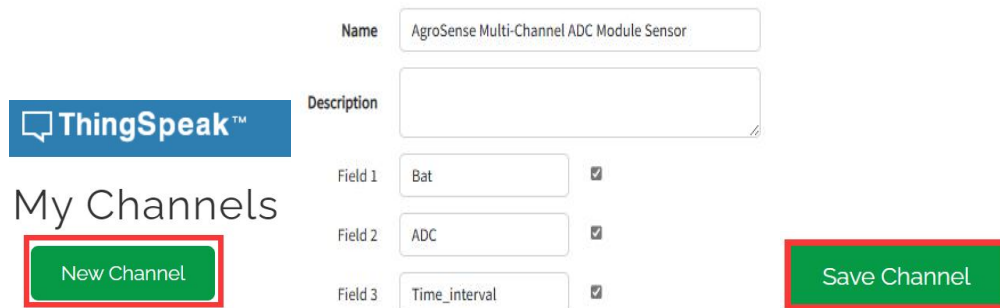
Email

No account? [Create one!](#)

By signing in, you agree to our [privacy policy](#).

Next

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



ThingSpeak™

My Channels

New Channel

Name: AgroSense Multi-Channel ADC Module Sensor

Description:

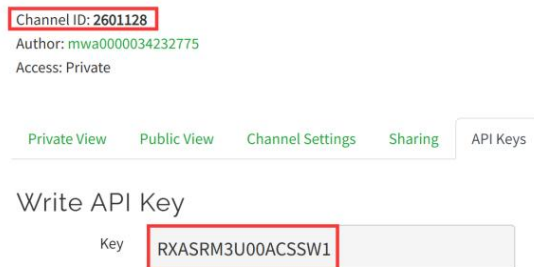
Field 1: Bat ☒

Field 2: ADC ☒

Field 3: Time_interval ☒

Save Channel

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



Channel ID: 2601128

Author: mwa0000034232775

Access: Private

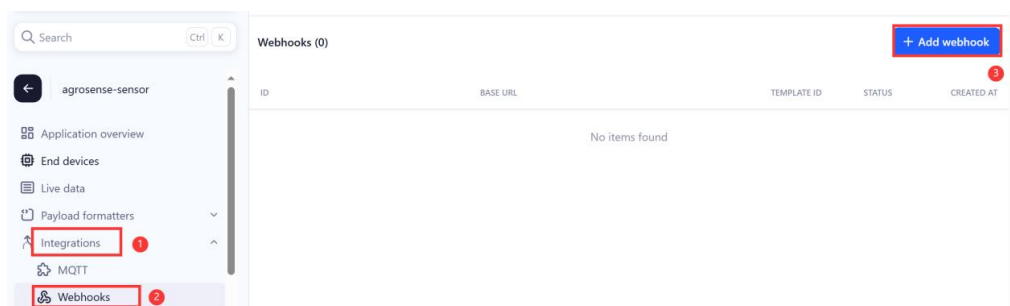
Private View Public View Channel Settings Sharing API Keys

Write API Key

Key: RXASRM3U00ACSSW1

3.1.4 Connect the Network Server and Application Server

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



Search Ctrl K

agrosense-sensor

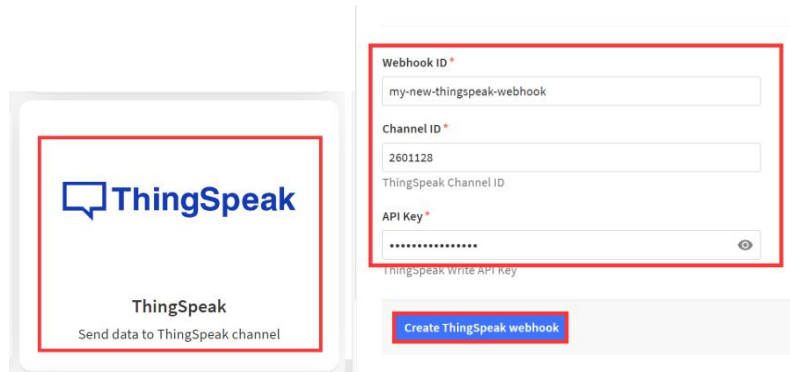
- Application overview
- End devices
- Live data
- Payload formatters
- Integrations 1
- MQTT
- Webhooks 2

Webhooks (0)

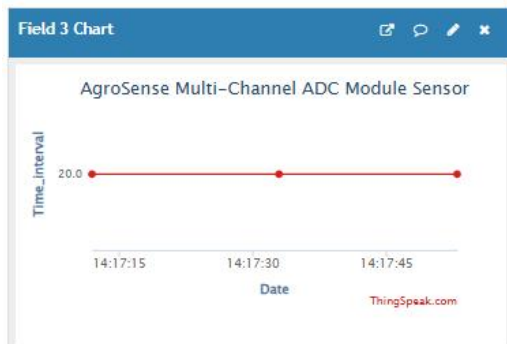
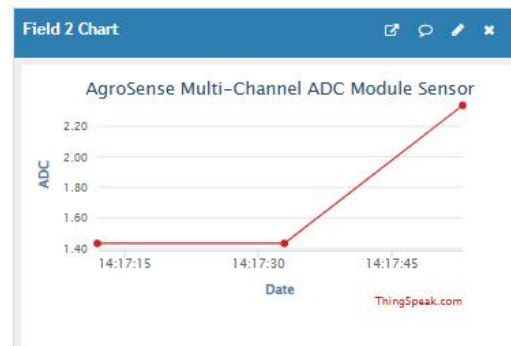
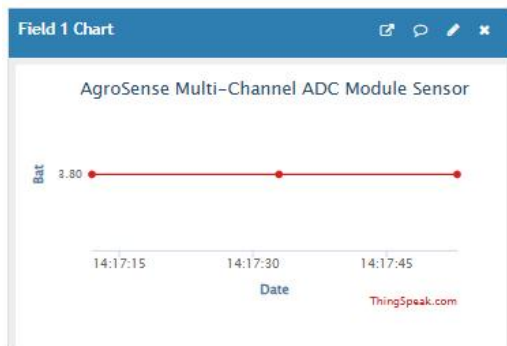
+ Add webhook 3

ID	BASE URL	TEMPLATE ID	STATUS	CREATED AT
No items found				

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



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



3.1.5 Downlink

The downlink has four functions:

- Modification time interval (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.

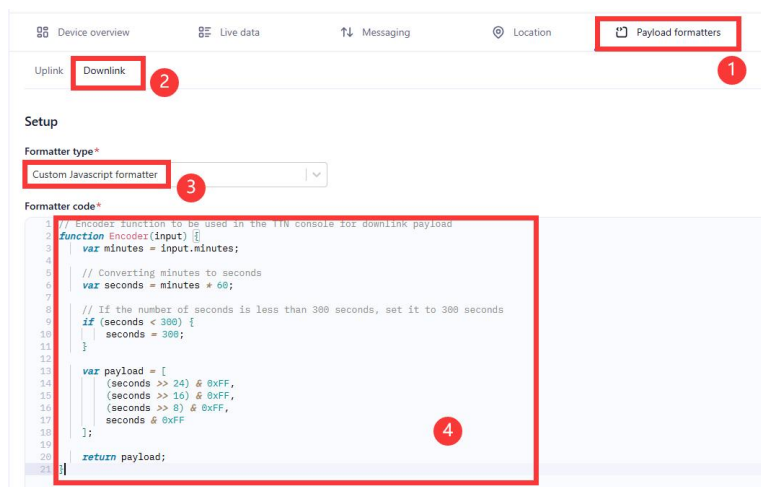
- Turn on or off the corresponding ADC channel (Fport6, the default is all on);

Differentialbits	ADC4	ADC3	ADC2	ADC1	Note
0	0	0	0	1	0x01 =enable the ADC1 channel
0	0	0	1	0	0x02 =enable the ADC2 channel
0	0	1	0	0	0x04 =enable the ADC3 channel
0	1	0	0	0	0x08 =enable the ADC4 channel
1	0	0	0	0	0x10 =enable the Differentialbits channel, At this point, FPort7 must be set to 1
0	0	0	0	0	0x00 =Turn off all channels
1	1	1	1	1	0x1F =enable all channels

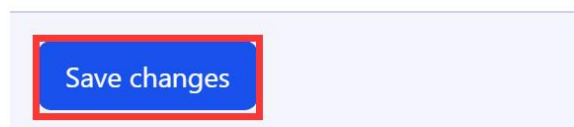
- Set the third and fourth channels as differential inputs (Fport7)

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
}
```


Device overview
Live data
Messaging

Schedule downlink
Simulate uplink

Schedule downlink

Insert Mode

☒ Replace downlink queue
☐ Push to downlink queue (append)

FPort*

1

Payload type

☐ Bytes
 ☒ JSON

Payload

```

1 {
2   "minutes": 5
3 }
    
```

The decoded payload of the downlink message

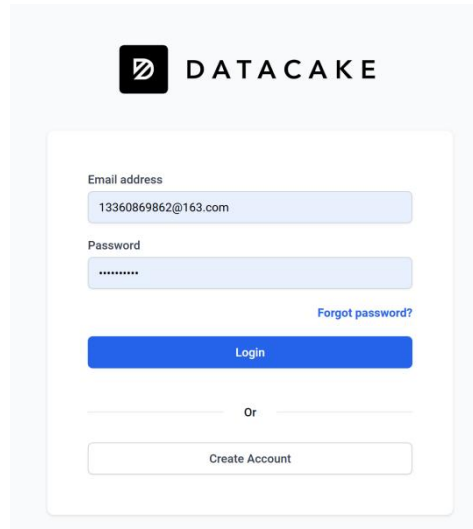
☐ Confirmed downlink

Schedule downlink

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

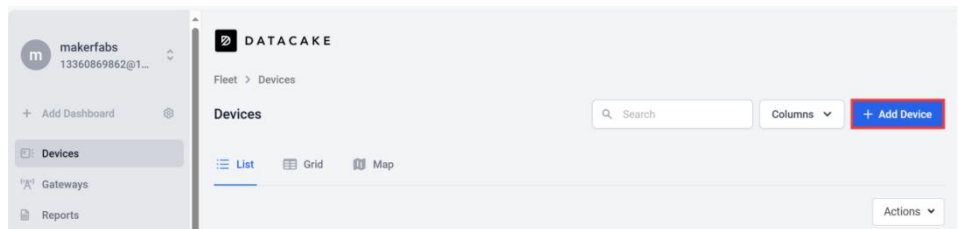
3.2 Datacake

1、Login datacake or Create Account

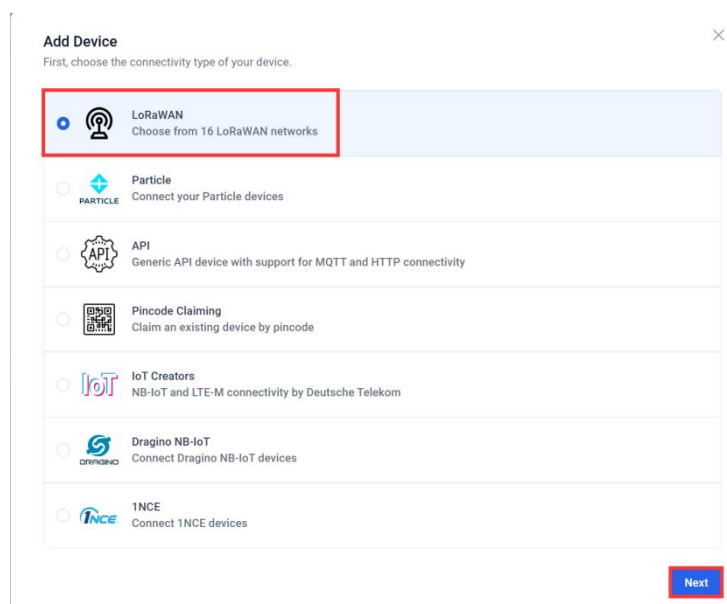


The image shows the Datacake login and registration interface. At the top is the Datacake logo. Below it is a form with two input fields: 'Email address' containing '13360869862@163.com' and 'Password' with masked characters. A 'Forgot password?' link is next to the password field. Below the fields is a blue 'Login' button. Underneath is an 'Or' separator, followed by a 'Create Account' button.

2、Click “Add Device”



3、Select LoRaWAN and click “Next”



The image shows the 'Add Device' dialog box. It has a title 'Add Device' and a subtitle 'First, choose the connectivity type of your device.' Below this is a list of connectivity options, each with a radio button and an icon:

- LoRaWAN** (selected, highlighted with a red box): Choose from 16 LoRaWAN networks
- Particle: Connect your Particle devices
- API: Generic API device with support for MQTT and HTTP connectivity
- Pincode Claiming: Claim an existing device by pincode
- IoT Creators: NB-IoT and LTE-M connectivity by Deutsche Telekom
- Dragino NB-IoT: Connect Dragino NB-IoT devices
- 1NCE: Connect 1NCE devices

 At the bottom right is a red-bordered 'Next' button.

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.

DEVICE	PRIMARY	SECONDARY	DEVICE SIGNAL	DEVICE BATTERY
AgroSense_Air Temperature and Humidity Sensor	40.2	25	-48	2.5
AgroSense-carbon dioxide (CO2) sensor	0	N/A	-86	3.3
agrosense sensor	N/A	N/A	N/A	N/A

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

Payload Decoder

When your devices sends data, the payload will be passed to the payload decoder, alongside the event's name. The payload decoder then transforms it to measurements.

```

1 function decoder(payload, port) {
2   var input = {
3     bytes: payload
4   };
5
6   // var num = input.bytes[0] * 256 + input.bytes[1];
7   var bat = input.bytes[0] / 1000;
8   var ADC1 = (input.bytes[2] * 256 + input.bytes[3]) / 1000.0; //V
9   var ADC2 = (input.bytes[4] * 256 + input.bytes[5]) / 1000.0; //V
10  var ADC3 = (input.bytes[6] * 256 + input.bytes[7]) / 1000.0; //V
11  var ADC4 = (input.bytes[8] * 256 + input.bytes[9]) / 1000.0; //V
12  var Differentialbits = (input.bytes[10] * 256 + input.bytes[11]) / 1000.0; //V
13  var time_interval = (input.bytes[12] * 256 + input.bytes[13]) * 65536 + input.bytes[14] * 256 + input.bytes[15] / 1000.0; //S
14
15  var decoded = {
16    bat: bat,
17    ADC1: ADC1,
18    ADC2: ADC2,
19    ADC3: ADC3,
20    ADC4: ADC4,
21    Differentialbits: Differentialbits
22  };
23
24  // Test for LoRa properties in normalizedPayload
25  try {
26    console.log('normalizedPayload', normalizedPayload); // Log to check normalizedPayload structure
27
28    decoded.lora_rssi =
29      (normalizedPayload.gateways && Array.isArray(normalizedPayload.gateways) && normalizedPayload.gateways.length > 0 && normalizedPayload.gateways[0].rssi) || 0;
30    decoded.lora_sn =
31      (normalizedPayload.gateways && Array.isArray(normalizedPayload.gateways) && normalizedPayload.gateways.length > 0 && normalizedPayload.gateways[0].snr) || 0;
32    decoded.lora_data_rate = normalizedPayload.data_rate || 'not retrievable';
33  } catch (error) {
34    console.log('error occurred while decoding LoRa properties: ' + error);
35  }
36 }
    
```

Payload

Port: 1

Output

console.log Output

Recognized measurements

Save

```
function Decoder(payload, port) {
    var input = {
        bytes: payload
    };

    // var num = input.bytes[0] * 256 + input.bytes[1];
    var bat = input.bytes[2] / 10.0;
    var ADC1 = (input.bytes[3] * 256 + input.bytes[4]) / 1000.0 //V
    var ADC2 = (input.bytes[5] * 256 + input.bytes[6]) / 1000.0 //V
    var ADC3 = (input.bytes[7] * 256 + input.bytes[8]) / 1000.0 //V
    var ADC4 = (input.bytes[9] * 256 + input.bytes[10]) / 1000.0 //V
    var Differentialbits = (input.bytes[11] * 256 + input.bytes[12]) / 1000.0 //V
    var time_interval = (input.bytes[13] * 16777216 + input.bytes[14] * 65536 + input.bytes[15] * 256 +
input.bytes[16]) / 1000.0//S

    var decoded = {
        bat: bat,
        ADC1: ADC1
        ADC2: ADC2
        ADC3: ADC3
        ADC4: ADC4
        Differentialbits: Differentialbits
    };

    // Test for LoRa properties in normalizedPayload
    try {
        console.log('normalizedPayload:', normalizedPayload); // Log to check normalizedPayload structure

        decoded.lora_rssi =
            (normalizedPayload.gateways    &&    Array.isArray(normalizedPayload.gateways)    &&
normalizedPayload.gateways.length > 0 && normalizedPayload.gateways[0].rssi) || 0;
        decoded.lora_snr =
            (normalizedPayload.gateways    &&    Array.isArray(normalizedPayload.gateways)    &&
normalizedPayload.gateways.length > 0 && normalizedPayload.gateways[0].snr) || 0;
        decoded.lora_datarate = normalizedPayload.data_rate || 'not retrievable';
    } catch (error) {
        console.log('Error occurred while decoding LoRa properties: ' + error);
    }

    return [
        { field: "bat", value: decoded.bat },
        { field: "ADC1", value: decoded.ADC1 },
        //{ field: "ADC2", value: decoded.ADC2 },
        //{ field: "ADC3", value: decoded.ADC3 },
    ]
}
```

```

    //{ field: "ADC4", value: decoded.ADC4 },
    //{ field: "Differentialbits", value: decoded.Differentialbits },
    { field: "lora_rssi", value: decoded.lora_rssi },
    { field: "lora_snr", value: decoded.lora_snr },
    { field: "lora_datarate", value: decoded.lora_datarate }
  ];
}

```

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

Fields
 Fields describe the data the device will store.

+ Add Field

Add Field
 Fields define the schema of the data the device stores.

Type

Float

Name

bat

Identifier

BAT

Unit

Role

None

Formula

Use Formula

NAME	IDENTIFIER	TYPE
Lora Snr	LORA_SNR	Float
Adc1	ADC1	Float
Lora Datarate	LORA_DATARATE	String
Lora Rssi	LORA_RSSI	Integer
bat	BAT	Float

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

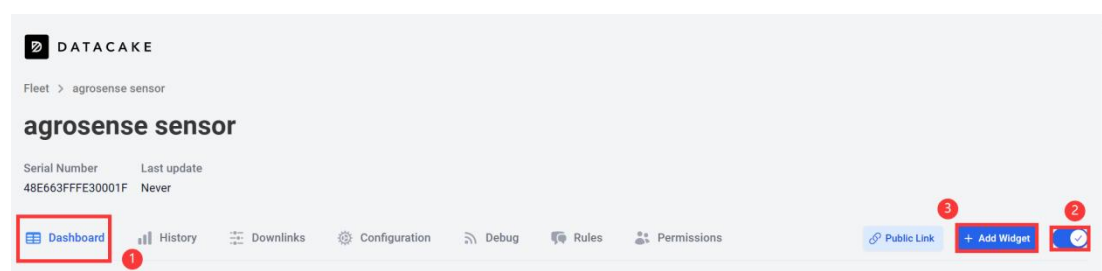
Fields
 Fields describe the data the device will store.

+ Add Field

NAME	IDENTIFIER	TYPE	ROLE	CURRENT VALUE	LAST UPDATE
Lora Snr	LORA_SNR	Float	N/A	10.2	0 seconds ago
Adc1	ADC1	Float	N/A	1.92	1 seconds ago
Lora Datarate	LORA_DATARATE	String	N/A	SF7BW125.0	0 seconds ago
Lora Rssi	LORA_RSSI	Integer	N/A	-77	0 seconds ago
bat	BAT	Float	N/A	3.8	1 seconds ago

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

Click "Dashboard-->switch-->+ Add Widget".



13、Select “Value” and set Title, Field and presentation form as well as the interval color.

The first screenshot shows the 'Edit Value Widget' dialog with the 'Value' widget selected in the left panel. The title is 'ADC' and the language is 'English'. The second screenshot shows the 'Gauge' tab selected, with 'Circular' gauge type and a color palette for values 0, 1, 2, and 3.3.

14、Select Chart and set Title, Field, Kind, Line Thickness and click “save”.

The first screenshot shows the 'Edit Chart Widget' dialog with the 'Chart' widget selected in the left panel. The title is 'ADC' and the language is 'English'. The second screenshot shows the 'Basic' tab selected, with 'ADC' in the title and 'English' in the language.

Basic **Data** Appearance Axes Timeframe Reference Lines Events

Field: Adc1

Values: Absolute Change

Label: Adc1

Kind: Line Chart **Area Chart** Bar Chart

Color: #48bb78

Interpolation Type: Linear

Y Axis: Axis 1

+ Add Cancel **Save**

15、Select Device Fields, check “Fields” and click “Save”.

Edit Device Fields Widget

Map Displays a map

Text Displays a text widget

Value Displays a measurement

Switch Displays a switch widget

Slider Displays a slider

Downlink Button that sends a message to a device

Image Displays a static image

Image Map Display floor plans or interactive diagrams

Iframe Displays an iframe

Device Fields Displays a table with device fields

Online status Displays the online status of the device

Basics **Data** Appearance

Fields

☒ Lora Snr

☒ Adc1

☒ Lora Datarate

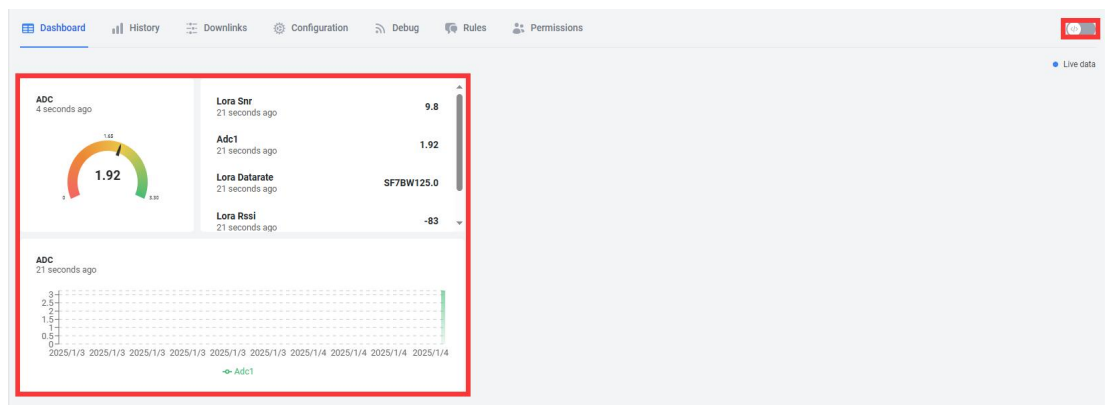
☒ Lora Rssi

☒ bat

Cancel **Save**

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

17、The steps for humidity are the same as above, and you can add your own.



3.2.1 Downlink

The downlink has four functions:

- Modification time interval (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.

- Turn on or off the corresponding ADC channel (Fport6, the default is all on);

Differentialbits	ADC4	ADC3	ADC2	ADC1	Note
0	0	0	0	1	0x01 =enable the ADC1 channel
0	0	0	1	0	0x02 =enable the ADC2 channel
0	0	1	0	0	0x04 =enable the ADC3 channel
0	1	0	0	0	0x08 =enable the ADC4 channel
1	0	0	0	0	0x10 =enable the Differentialbits channel, At this point, FPort7 must be set to 1
0	0	0	0	0	0x00 =Turn off all channels
1	1	1	1	1	0x1F =enable all channels

- Set the third and fourth channels as differential inputs (Fport7)

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

Add Field

Fields define the schema of the data the device stores.

Type:

Name:

Identifier:

The field identifier is a unique string that can consist of uppercase letters, numbers and underscores. Once a field has been created, the identifier can not be changed.

Unit: Optional

Role:

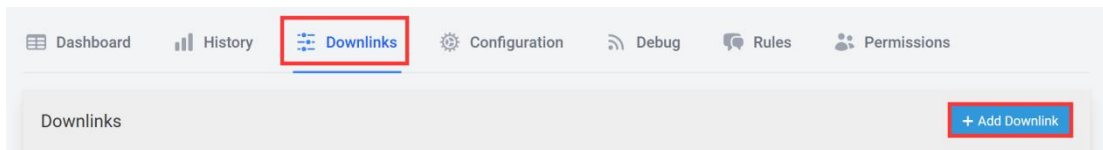
You can define the role of a field, which are unique per product and can be used to add context to global visualisations and reports.

Formula: Optional

Formulas can be used to perform calculations on values from other fields. Fields that have a formula can not be written to from a decoder or via the API.

☐ Use Formula

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](#).

Configure Downlink

Name

Description

Fields used

If your encoder function takes input from the device's fields, you can specify them here. They will be used to create the form for the downlink generator.

☐ Trigger on measurements

If activated, each time the device records a measurement in one of the fields used, the downlink will be sent automatically.

Port

Payload Encoder

```

1 function Encoder(measurements, port) {
2   var interval = measurements["SENDING_TIME_INTERVAL"].value * 60;
3   if (interval < 300) {
4     interval = 300;
5     console.log("Interval < 300 Seconds / 5 Minutes not allowed!");
6   }
7   // Convert to hexadecimal only from interval
8   return interval.toString(16).padStart(4, '0').match(/.{2}/g).map(function(f) {return parseInt(f, 16)});
9 }
10 /**
11  * String.prototype.padStart() polyfill
12  * https://github.com/uxitten/polyfill/blob/master/string.polyfill.js
13  * https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/String/padStart
14  */
15 if (!String.prototype.padStart) {
16   String.prototype.padStart = function padStart(targetLength,padString) {
17     targetLength = targetLength>>0; //truncate if number or convert non-number to 0;
18     padString = String((typeof padString !== 'undefined' ? padString : ' '));
19     if (this.length > targetLength) {
20       return String(this);
21     }
22     else {
23       targetLength = targetLength-this.length;
24       if (targetLength > padString.length) {
25         padString += padString.repeat(targetLength/padString.length); //append to original to ensure
26       }
27       return String(this).padStart(targetLength,padString);
28     }
29   };
30 }

```

3、Click "Dashboard-->switch-->+ Add Widget".

Select "Downlink" and setting as follow image.

The image shows two side-by-side screenshots of the 'Edit Downlink Widget' dialog. The left screenshot shows the 'Basics' tab with the title 'User-Defined Time Interval(5Min-1440Min)' highlighted. The right screenshot shows the 'Data' tab with the 'Downlink' dropdown set to 'Set User-Defined Sending Time Interval' and the 'Save' button highlighted.

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

The image shows two screenshots. The first screenshot shows the 'User-Defined Time Interval(5Min-1440Min)' widget. The second screenshot shows the 'Sending Time Interval' dialog with the value '1' highlighted and the 'Save measurements and send downlink' button highlighted.