LoRaWAN® Solenoid Valve Controller

IOT-C51x Series

User Guide

Revision History

Date	Doc Version	Description
Feb. 20, 2021	V 1.0	Initial version
Nov.26, 2021	V 1.1	Description Update
March 10, 2021	V 2.0	Update based on 2.0 hardware
June 15, 2022	V 2.1	1. Add internal interface description; 2. UC511 supports Class C to B mode; 3. GPIO supports selecting DI or pulse mode; 4. Update re-join mode and confirmed mode description.
Nov. 21, 2022	V 2.2	Add prevent jitter delay time when GPIO works as DI mode

Contents

1. Product Introduction

1.1 Overview

IOT-C51x series LoRaWAN® wireless solenoid valve controller is a device used to remotely control DC latching solenoids of the valve. It contains 2 solenoid interfaces and 2 GPIO interfaces, which can be easily controlled locally or remotely.

Besides ultra-low-power LoRaWAN® technology, IOT-C51x series also provides both solar and built-in battery power supply for uninterrupted operation. For outdoor applications, it equips with IP67-rated enclosure and M12 connectors to protect from water and dust under harsh environments.

1.2 Features

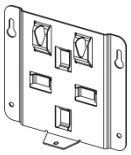
- Compatible with standard DC latching solenoids
- OPEN/CLOSE control by mobile App locally or commands remotely
- Two GPIO interfaces for flow monitoring or valve status monitoring
- Transmission distance up to 15 km with line of sight
- Waterproof design including IP67 case and M12 connectors
- Solar powered and built-in chargeable battery
- Quick wireless configuration via NFC
- Time and flow control via Milesight IoT Cloud

2. Hardware Introduction

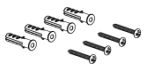
2.1 Packing List

1 × C51x Device

2 × Data Cables (30 cm)



1 × Mounting Bracket



4 × Wall Mounting Kits

2 × Hose Clamps

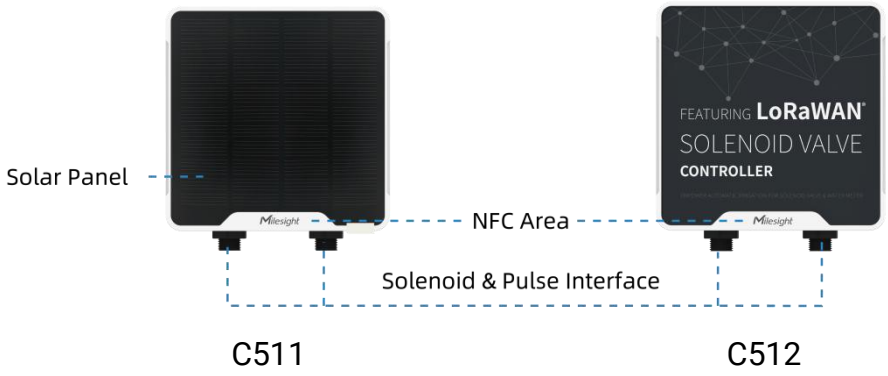
1 × Fixing Screw

1 × Quick Guide

1 × Warranty Card

If any of the above items is missing or damaged, please contact your sales Representative.

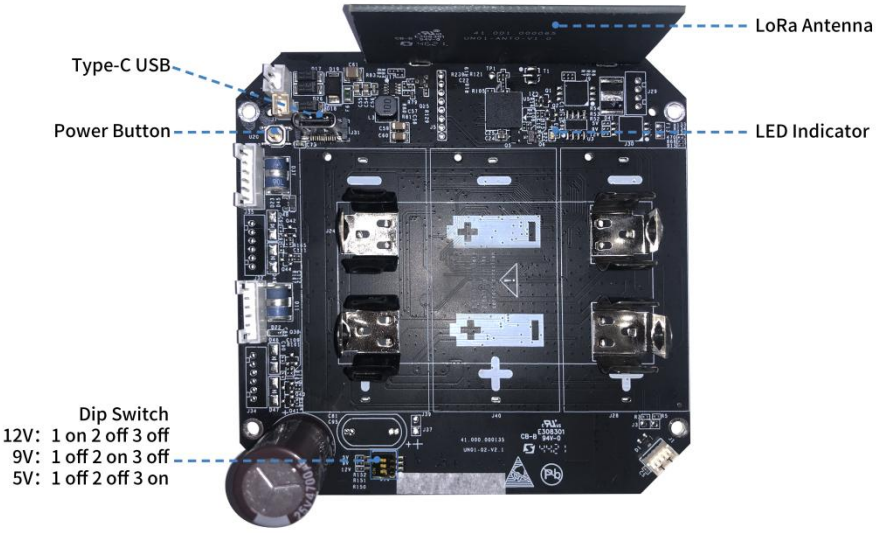
2.2 Hardware Overview



Interface 1&2:

Pin	Description
1	DC+/OUT1 of Solenoid Valve
2	DC-/OUT2 of Solenoid Valve
3	GND
4	INSERT BOOT[1]
5	GND
6	GPIO Interface

2.3 Internal Interfaces



[1] PIN3 and PIN4 do not need to connect, see "Solenoid Valve Switch" option in section 3.4.

DIP Switch:

Interface	DIP Switch
Solenoid Interface	12V: 1 on 2 off 3 off 9V: 1 off 2 on 3 off 5V: 1 off 2 off 3 on

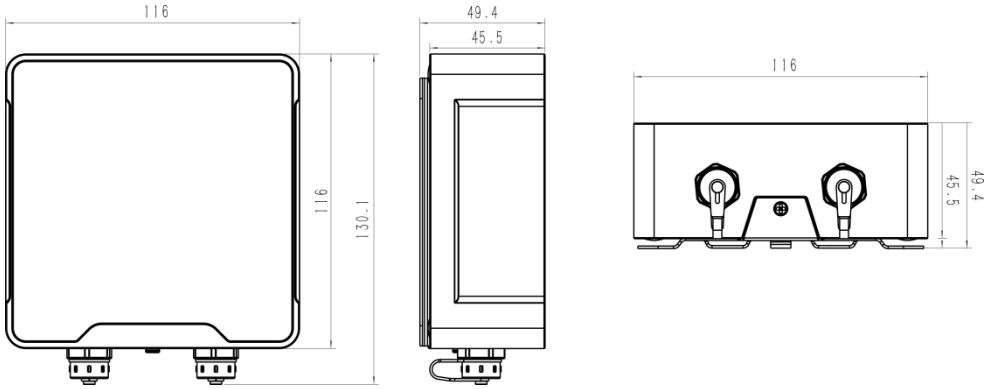
Note:

1) The DIP switch is set to 12VDC by default.
2) The DIP switch does not support setting two solenoid interfaces as different voltage types.

Power Button:

Function	Action	LED Indication
Turn On	Press and hold the button for more than 3s.	Off → On
Turn Off	Press and hold the button for more than 3s.	On → Off
Reset	Press and hold the button for more than 10s.	Blinks.
Check On/Off Status	Quickly press the power button.	Light On: Device is on. Light Off: Device is off.

2.4 Dimensions (mm)



3. Operation Guide

3.1 Log in the ToolBox

IOT-C51x series can be monitored and configured via ToolBox App or ToolBox software. Please select one of them to complete configuration.

3.1.1 NFC Configuration

1. Download and install “ToolBox” App from Google Play or Apple App Store.

2. Enable NFC on the smartphone and launch Milesight ToolBox.

3. Attach the smartphone with NFC area to the device to read basic information.

4. Basic information and settings of devices will be shown on ToolBox if it's recognized successfully. You can read and configure the device by tapping the button on the Device Status. In order to protect the security of devices, password validation is required when first configuration. Default password is **123456**.

Note:

1) Ensure the location of smartphone NFC area and it's recommended to take off phone case.

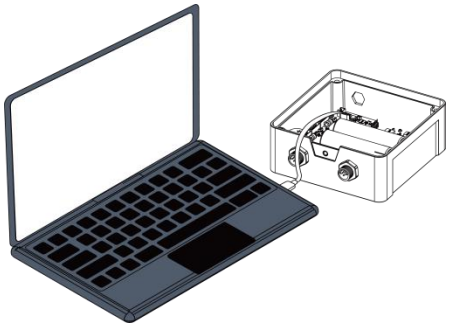
2) If the smartphone fails to read/write configurations via NFC, keep the phone away and back to try again.

3) C51x series can also be configured by dedicated NFC reader, which can be purchased from Milesight IoT.

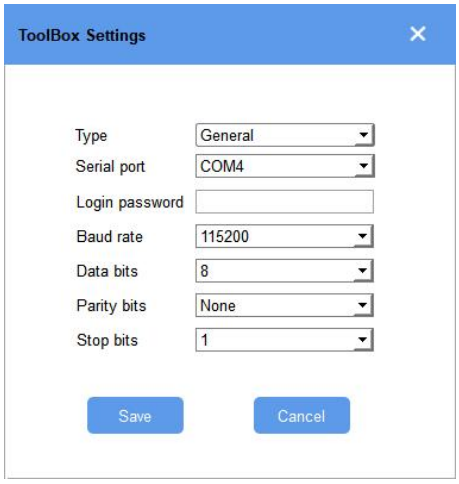
3.1.2 USB Configuration

1. Download ToolBox

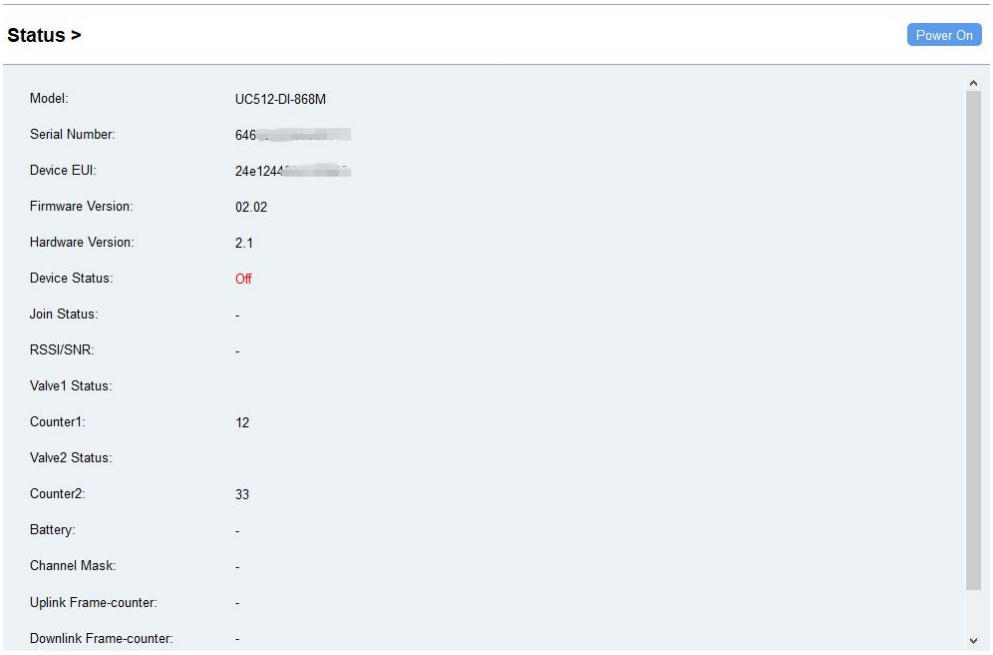
2. Open the case of C51x and connect the C51x to computer via type-C port.



3. Open the ToolBox and select type as "General", then click password to log in ToolBox. (Default password: **123456**)



4. After logging in the ToolBox, you can click “Power On” or “Power Off” to turn on/off device and change other settings.

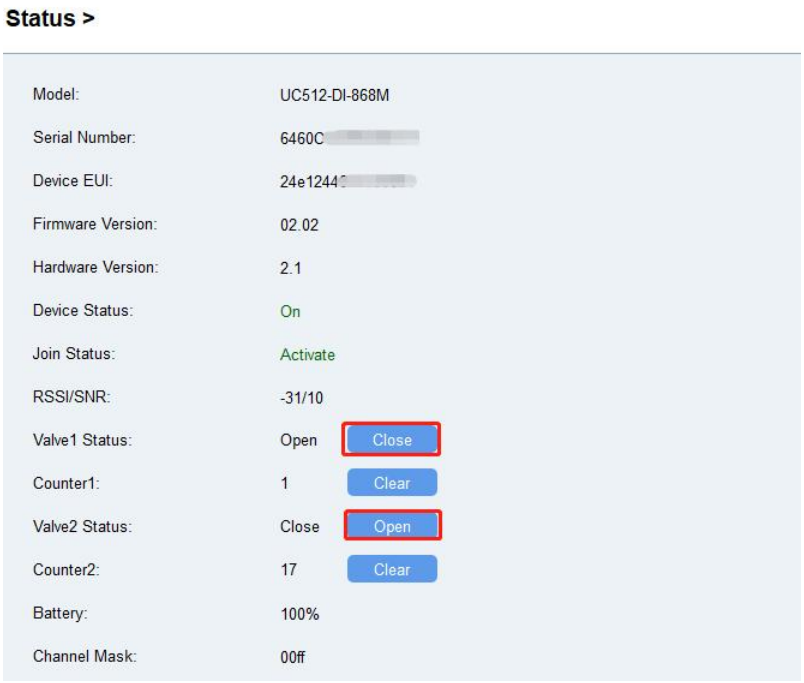


3.2 Solenoid Valve Control

Solenoid valve can be controlled by ToolBox App or ToolBox software locally.

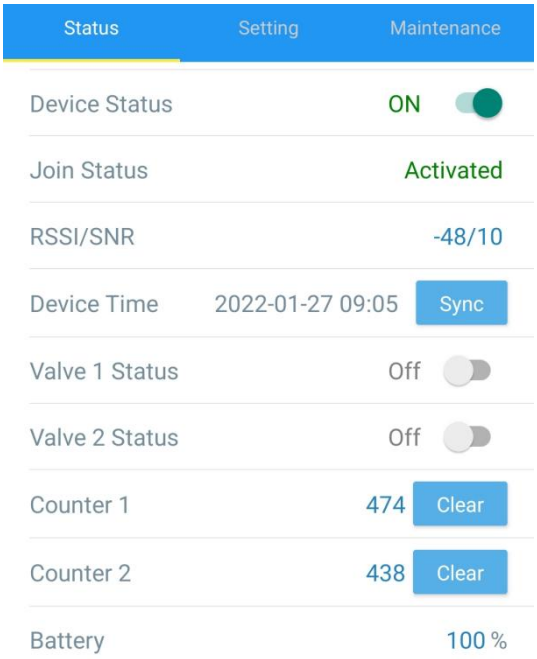
Via ToolBox Software:

Click “Open” or “Close” button on the “Status” page to change the status of solenoid valves.



Via ToolBox App:

Click buttons of Valve Status on the "**Device -> Status**" page, then attach the smart phone to device to change the status of solenoid valves.

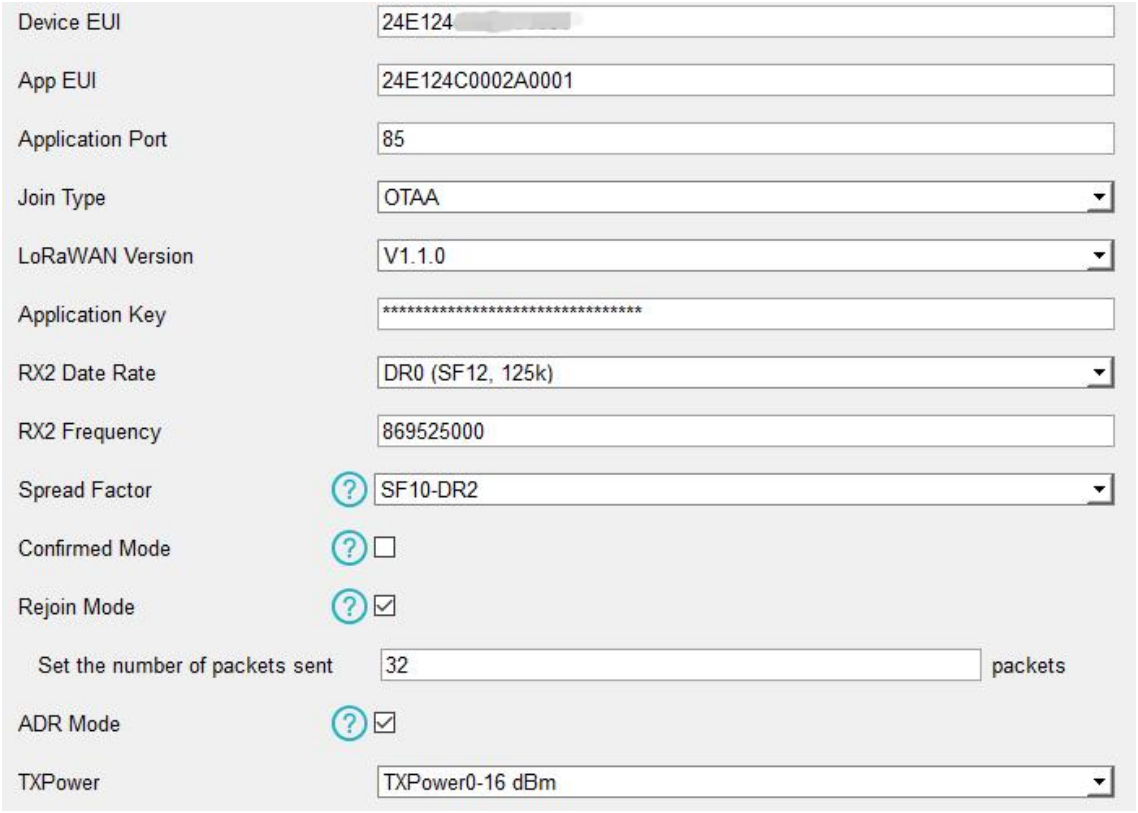


3.3 LoRaWAN Settings

LoRaWAN settings is used for configuring the transmission parameters in LoRaWAN® network.

Basic LoRaWAN Settings:

Go to "**LoRaWAN Settings -> Basic**" of ToolBox software or "**Setting -> LoRaWAN Settings**" of ToolBox App to configure join type, App EUI, App Key and other information. You can also keep all settings by default.



Parameters	Description
Device EUI	Unique ID of the device which can also be found on the label.
App EUI	Default App EUI is 24E124C0002A0001.
Application Port	The port used for sending and receiving data, default port is 85.
Join Type	OTAA and ABP mode are available.
LoRaWAN Version	V1.0.2, V1.0.3, V1.1 are available.
Application Key	Appkey for OTAA mode, default is 5572404C696E6B4C6F52613230313823.
Device Address	DevAddr for ABP mode, default is the 5th to 12th digits of SN.
Network Session Key	Nwkskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
Application Session Key	Appskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
RX2 Data Rate	RX2 data rate to receive downlinks.
RX2 Frequency	RX2 frequency to receive downlinks. Unit: Hz
Spread Factor	If ADR is disabled, the device will send data via this spread factor.
Confirmed Mode	If the device does not receive ACK packet from network server, it will resend data once.
Rejoin Mode	The device will send a specific number of LinkCheckReq MAC packets to the

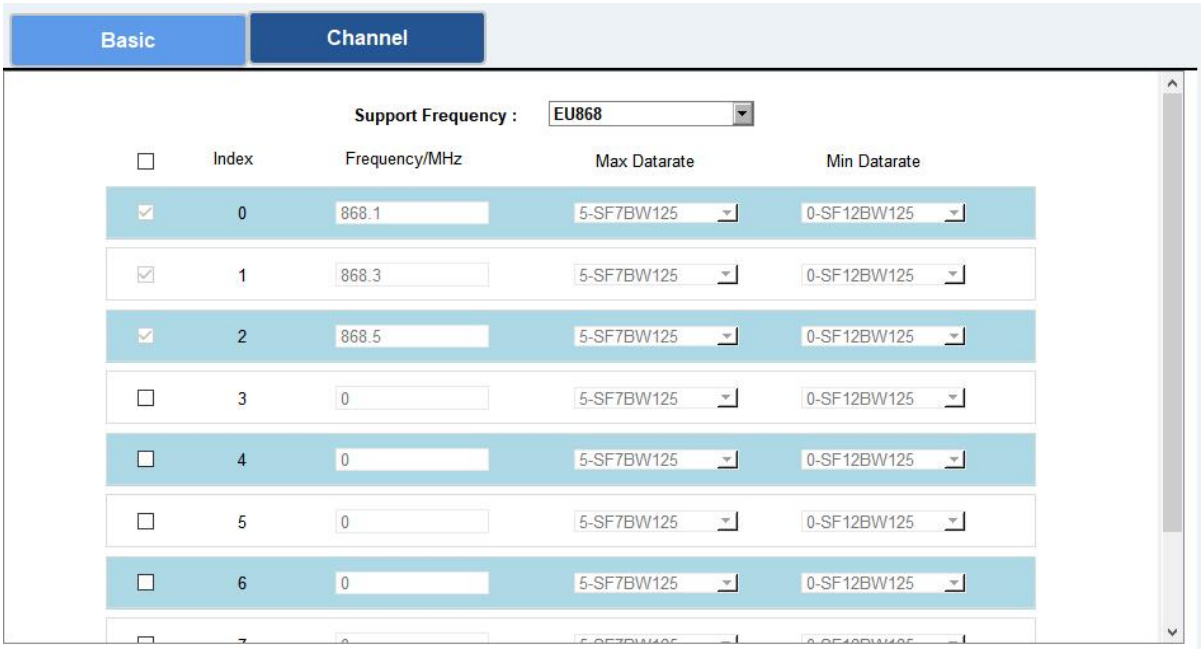
	network server every 30 mins to validate connectivity; If there is no response, the device will re-join the network.
Set the number of packets sent	When rejoin mode is enabled, set the number of LinkCheckReq packets sent.
ADR Mode	Allow network server to adjust datarate of the device.
Tx Power	Tx power of the device.

Note:

1) Please contact sales for device EUI list if there are many units.
2) Please contact sales if you need random App keys before purchase.
3) Select OTAA mode if you use Milesight IoT cloud to manage devices.
4) Only OTAA mode supports rejoin mode.

LoRaWAN Frequency Settings:

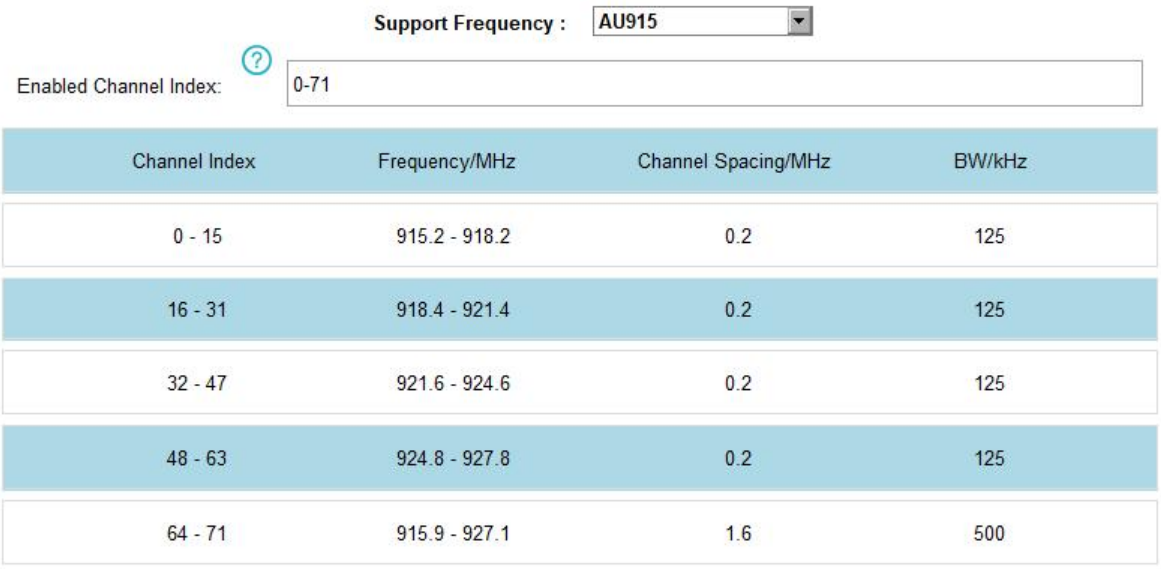
Go to "**LoRaWAN Settings-> Channel**" of ToolBox software or "**Setting -> LoRaWAN Settings**" of ToolBox APP to select supported frequency and select channels to send uplinks. Make sure the channels match the LoRaWAN® gateway.



If frequency is one of CN470/AU915/US915, you can enter the index of the channel that you want to enable in the input box, making them separated by commas.

Examples:

1, 40: Enabling Channel 1 and Channel 40
1-40: Enabling Channel 1 to Channel 40
1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60
All: Enabling all channels
Null: Indicates that all channels are disabled



Channel Index	Frequency/MHz	Channel Spacing/MHz	BW/kHz
0 - 15	915.2 - 918.2	0.2	125
16 - 31	918.4 - 921.4	0.2	125
32 - 47	921.6 - 924.6	0.2	125
48 - 63	924.8 - 927.8	0.2	125
64 - 71	915.9 - 927.1	1.6	500

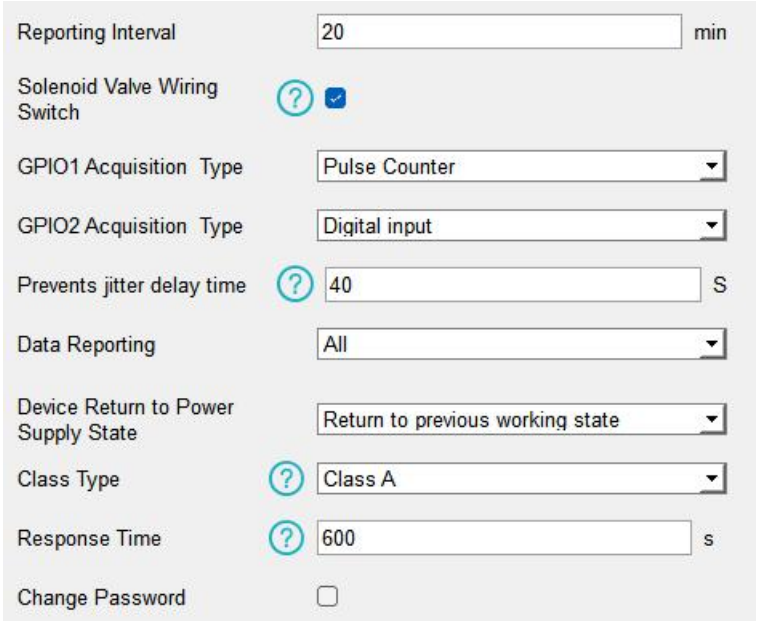
Note:

For -868M model, default frequency is EU868;

For -915M model, default frequency is AU915.

3.4 Solenoid Settings

Go to "**Device Settings -> Basic**" of ToolBox software or "**Setting -> General Settings**" of ToolBox App to change the reporting configurations.



Parameters	Description
Reporting Interval	Reporting interval of transmitting data to network server. Default: 20min, Range: 1-1080 mins.
Solenoid Valve Wiring Switch	After this parameter is enabled, when users connect the solenoid cable to any solenoid interface, the device will turn on automatically.

GPIO1/2 Acquisition Type	Select Digital Input or Pulse Counter. **Digital input:** detect the real state of valve to know if valve control takes effect. **Pulse counter:** connect water meter to measure the flow.
Prevent Jitter Delay Time	The device will not upload GPIO status during this time to avoid frequent uplinks. This only works when GPIO mode is DI and also applies to both GPIO interfaces.
Data Reporting	Select the contents to report to network server. All: Report all interface status; **Valve 1 & Water Meter 1:** Report the status of the Valve 1 interface and data of GPIO1; **Valve 2 & Water Meter 2:** Report the status of the Valve 2 interface and data of GPIO2.
Device Return to Power Supply State	If the device loses power and return to power supply, the device will be on or off according to this parameter.
Class Type	Working mode of LoRaWAN® device. UC511: Class A, Class B and Class C, Class C to B are available; UC512: Class A and Class B are available. **Note:** for Class B mode, if the device does not receive beacons for more than 30 minutes, it will switch to Class A mode automatically; for Class C to B mode, if the device does not receive beacons for more than 30 minutes, it will switch to Class C mode automatically.
Response Time	When the device works under Class A mode, it only receives control commands every reporting interval comes. In order to shorten the delay time of control, the device will send blank package to allow to receive the control commands every Response Time interval. **Note:** The shorter the response time, the shorter the battery life.
Ping Slot Periodicity	When the device works under Class B or Class C to B mode, set the interval to open the reception window.
Change Password	Change the password for ToolBox App or software to read/write this device.

Note:

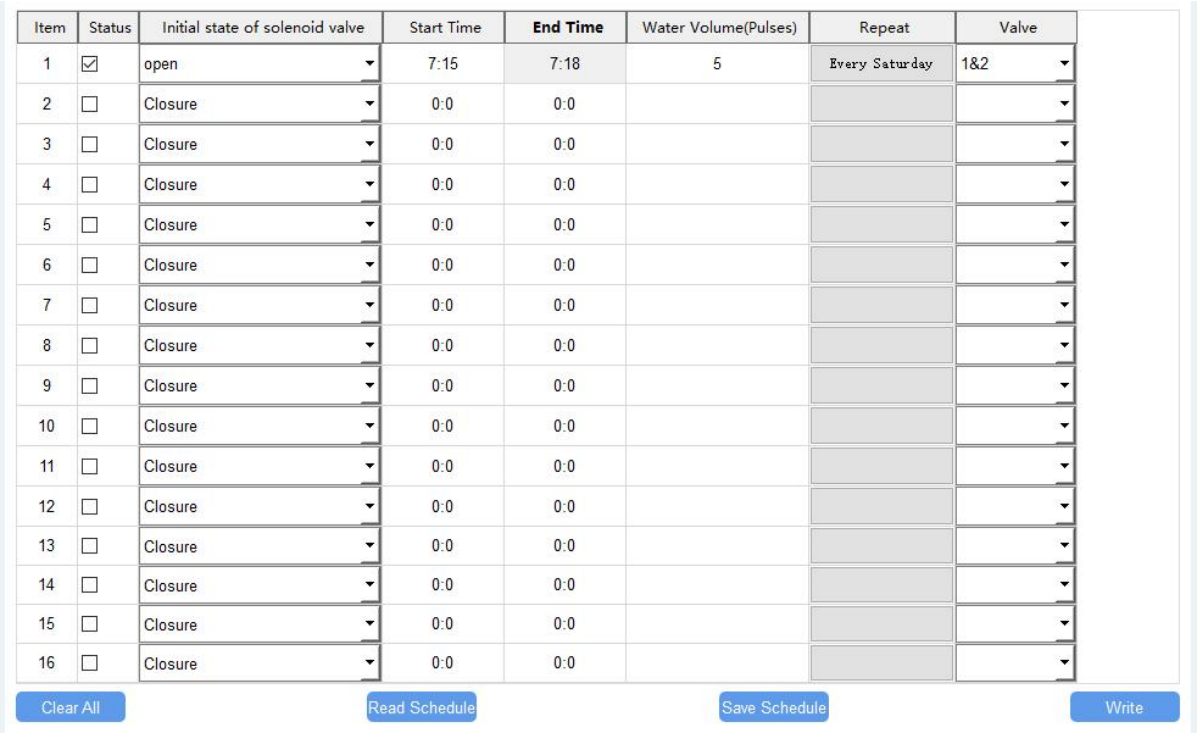
1) When device connects to network server of Milesight gateway, the blank package will take up the frame count but not show on the package list.

2) Reboot or re-join will not affect the counting.

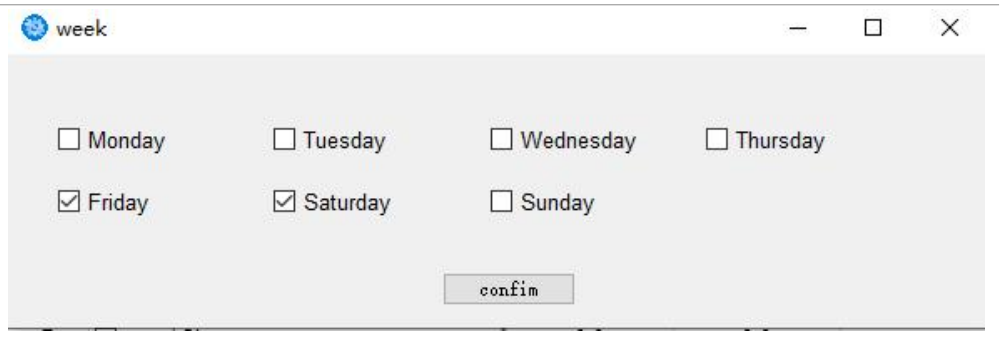
3.5 Schedule Settings

Go to "**Device Settings -> Schedule**" of ToolBox software or "**Setting -> Schedule**" of ToolBox App to configure the solenoid switch plans.

1. Configure a plan as your request and enable it.



Condition	Description
Item	It supports adding 16 plans at most.
Status	Enable or disable this plan.
Initial State of Solenoid Valve	Control the solenoid to open or close the valve during the plan.
Start Time/End Time	Set the time range to execute this plan.
Water Volume (Pulses)	Set the amount of water flow through the valve during this plan, 0 means this condition will not work. Note: 1) Either time or water volume reaches the condition, the plan is completed and will stop executing. 2) When the GPIO type is not pulse counter, this condition will not work.
Repeat	Set the regularly weekly schedule to execute this plan. If none is selected, the plan will only execute once.

	
Valve	Select the valve you need to control.

2. Click “Write” to write the schedule plan setting into the device.
3. Click “Save Schedule” to backup the schedule plan settings as file; if you need to import this schedule from other devices, click “Read Schedule” to import the setting.
4. Click “Clear All” to reset all schedule plan settings in this device.

Note:

1) Ensure the device time is correct. After joining the network, the network server will assign the time to the device. You can also manually sync the time via ToolBox or downlink commands.
2) When the device has multiple schedule plan settings that are conflicted, the device will only execute one plan whose item number is largest.

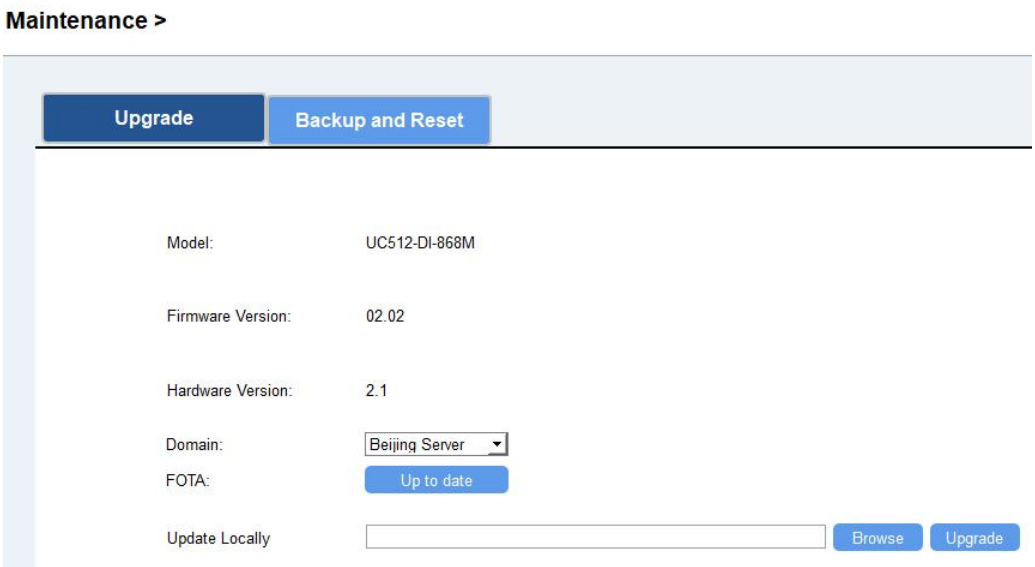
3.6 Maintenance

3.6.1 Upgrade

ToolBox Software:

1. Download firmware to your PC.

2. Go to “**Maintenance -> Upgrade”** of ToolBox software, click “**Browse”** to import firmware and upgrade the device. You can also click “**Up to Date”** to search for the latest firmware of the device and upgrade.

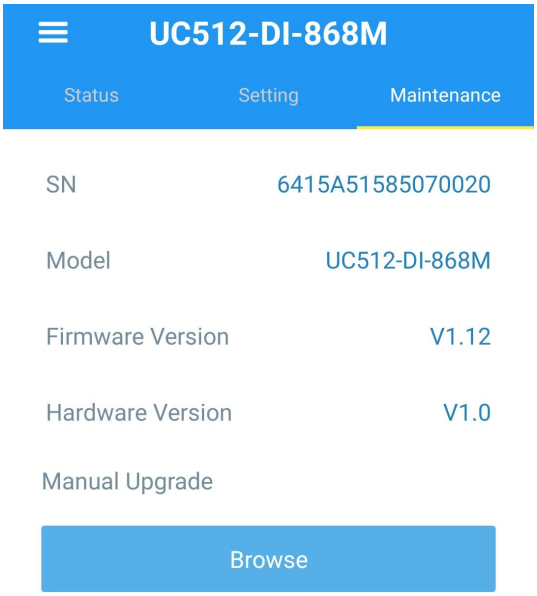


ToolBox App:

1. Download firmware from www.milesight-iot.com to your smartphone.
2. Open ToolBox App and click “Browse” to import firmware and upgrade the device.

Note:

1) Operation on ToolBox is not supported during the upgrade.
2) Only Android version ToolBox supports the upgrade feature.



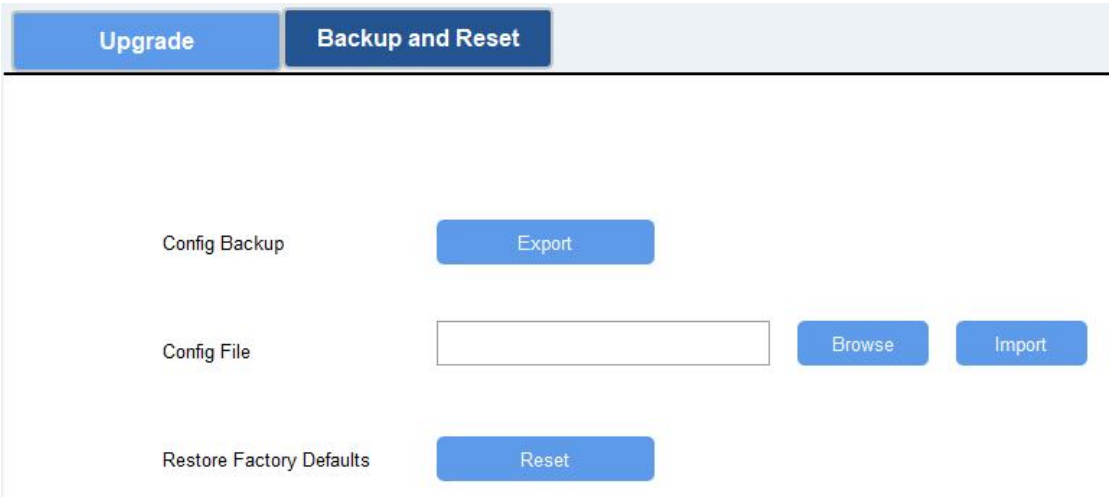
3.6.2 Backup

C51x devices support configuration backup for easy and quick device configuration in bulk. Backup is allowed only for devices with the same model and LoRa frequency band. Note that the backup file will not save schedule setting, please backup plan setting on “Schedule” page.

Please select one of following methods to backup device:

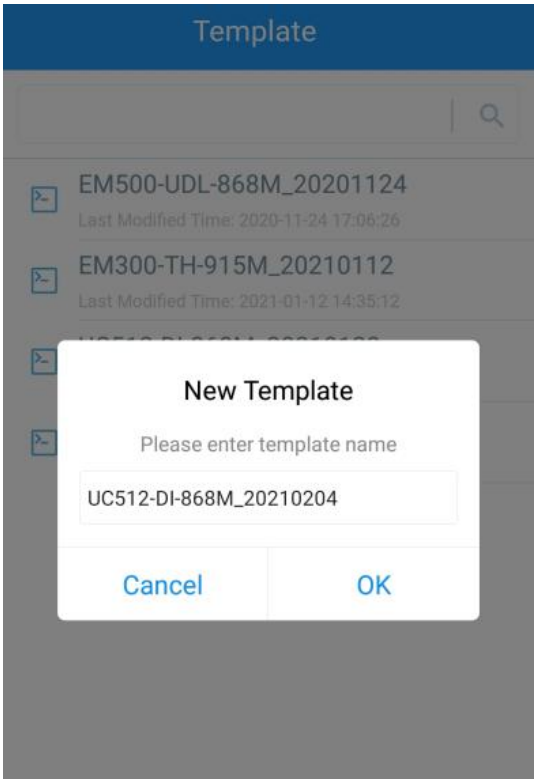
ToolBox Software:

1. Go to “**Maintenance -> Backup and Reset**”, click “Export” to save current configuration as json format backup file.
2. Click “Browse” to select backup file, then click “Import” to import the configurations.



ToolBox App:

1. Go to “Template” page on the App and save current settings as a template. You can also edit the template file.
2. Select this template and attach to another device to write configuration.

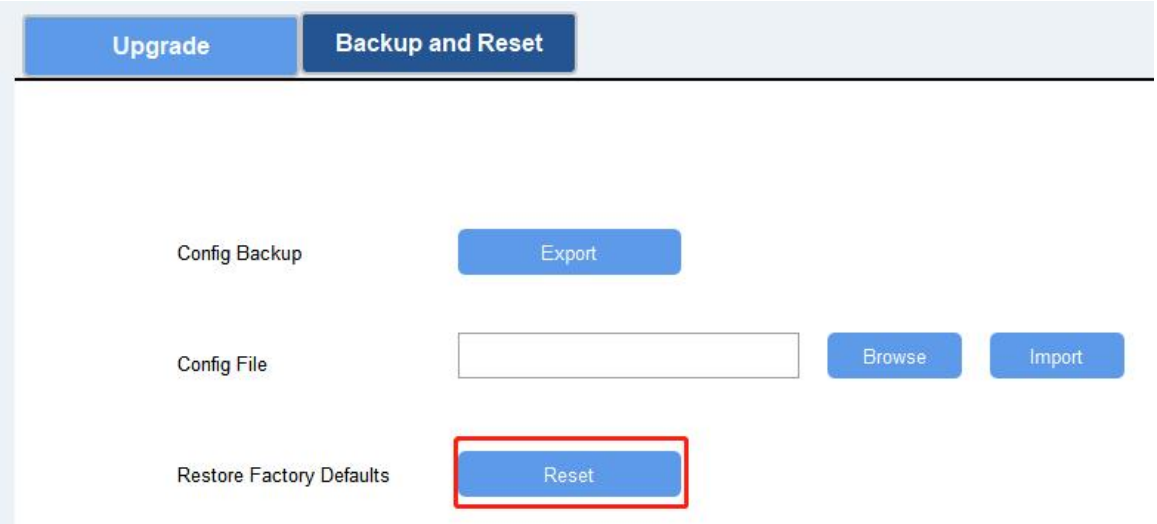


3.6.3 Reset to Factory Default

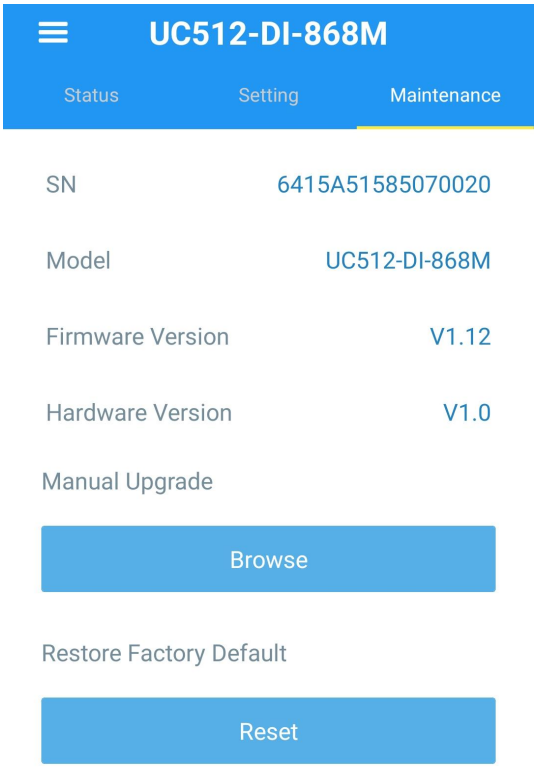
Please select one of following methods to reset device:

Via Hardware: Open the case of C51x and hold on power button more than 10s.

Via ToolBox Software: Go to “**Maintenance -> Backup and Reset**” to click “Reset”.



Via ToolBox App: Go to "**Device -> Maintenance**" to click "Reset", then attach smart phone with NFC area to UC51x to complete reset.

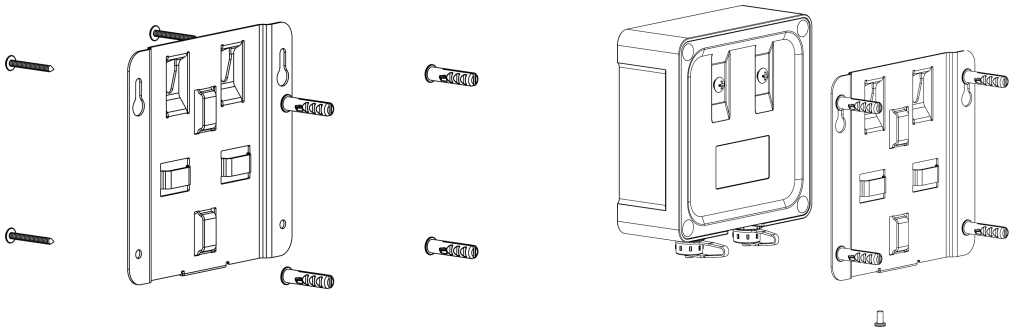


4. Installation

UC51x series support wall mounting or pole mounting. Before installation, make sure you have the mounting bracket, wall or pole mounting kits and other required tools.

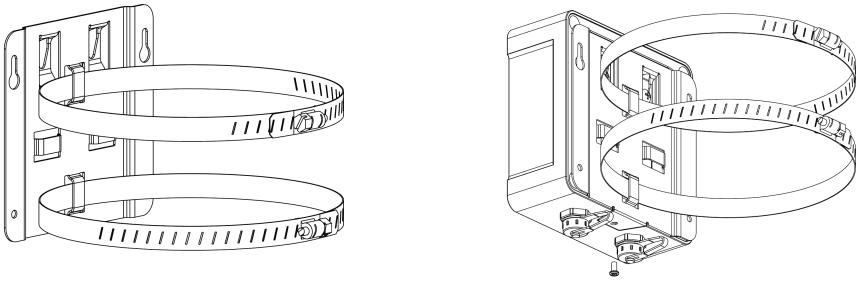
Wall Mounting:

1. Fix the wall plugs into the wall, then fix the mounting bracket to the wall plugs with screws.
2. Put the device on the mounting bracket, then fix the bottom of the device to the bracket with a fixing screw. It's necessary to fix this bracket to device, or it will affect the signal.



Pole Mounting:

1. Straighten out the hose clamp and slide it through the rectangular rings in the mounting bracket, wrap the hose clamp around the pole. After that use a screwdriver to tighten the locking mechanism by turning it clockwise.
2. Put the device on the mounting bracket, then fix the bottom of the device to the bracket with a fixing screw. It's necessary to fix this bracket to device, or it will affect the signal.

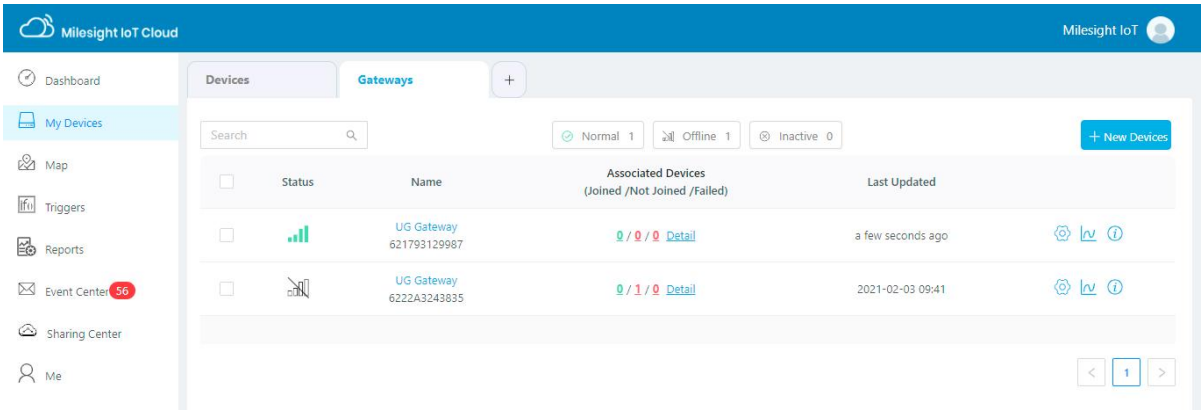


5. IoT Cloud Management

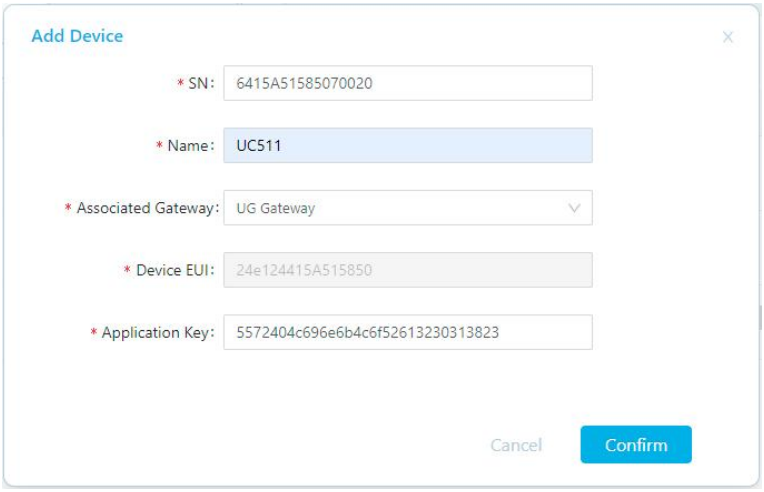
C51x series can be managed by IoT Cloud platform. IoT cloud is a comprehensive platform that provides multiple services including device remote management and data visualization with the easiest operation procedures. Please register a IoT Cloud account before operating following steps.

5.1 Add C51x to Cloud

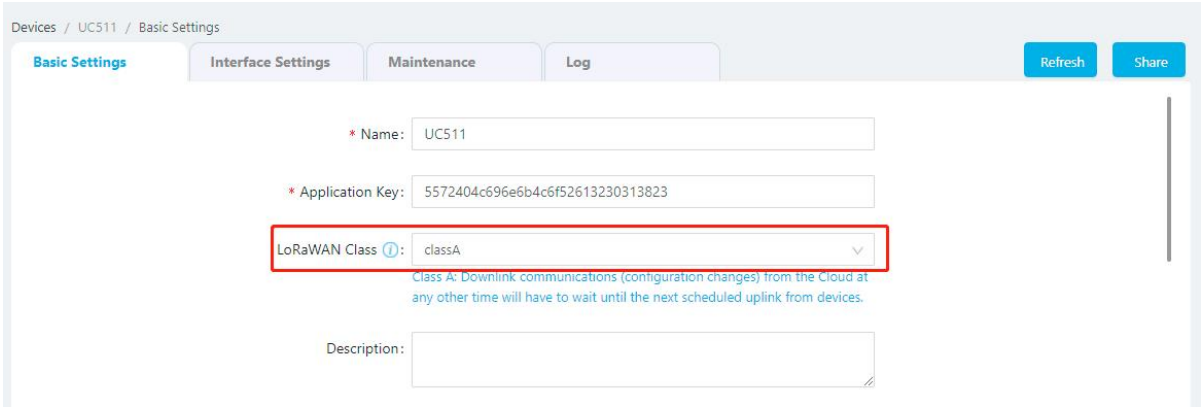
1. Ensure Linovision LoRaWAN® gateway is online in Linovision IoT Cloud.
For more info about connecting gateway to cloud please refer to gateway's user guide.



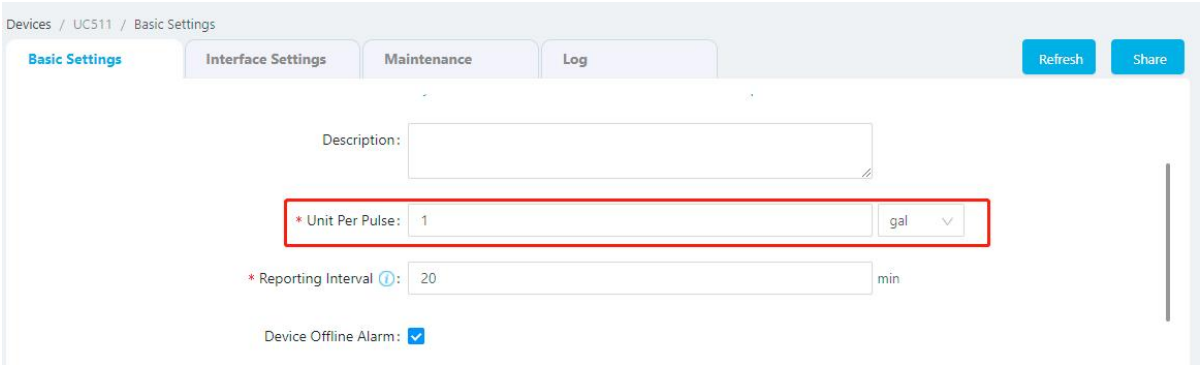
2. Go to “My Devices” page and click “+New Devices”. Fill in the SN of UC51x and select associated gateway.



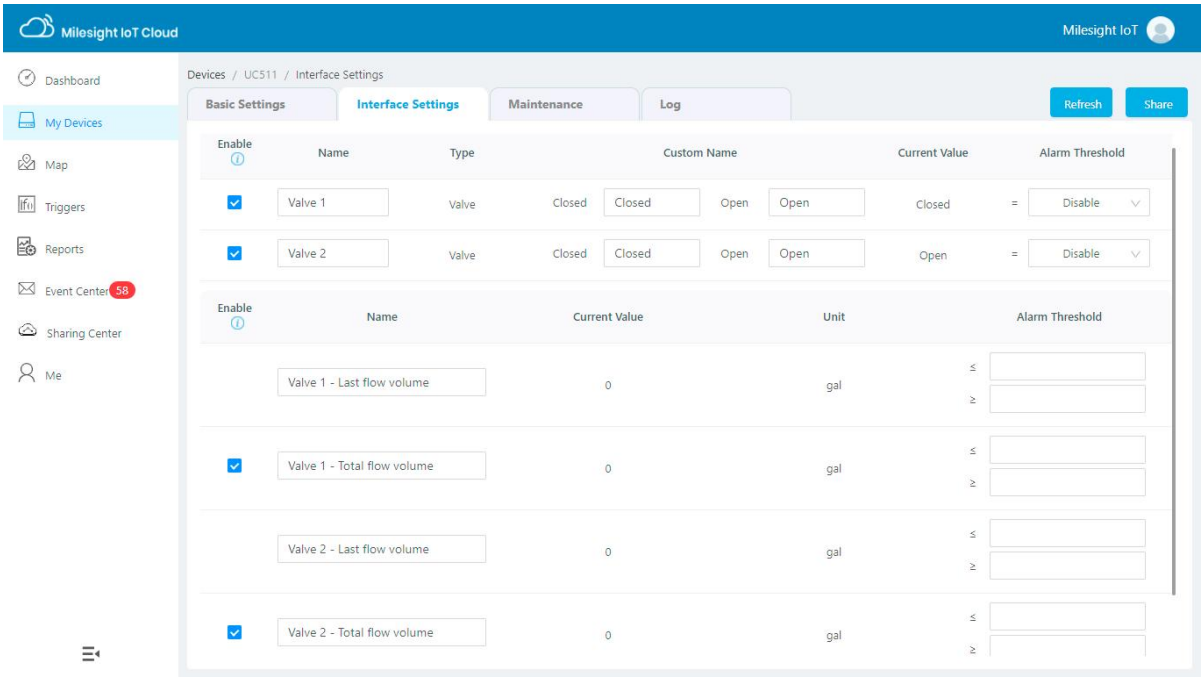
3. Click  and go to “Basic Settings” to change class type the same as device settings.



Besides, configure the unit of per pulse if you connect the water meter.



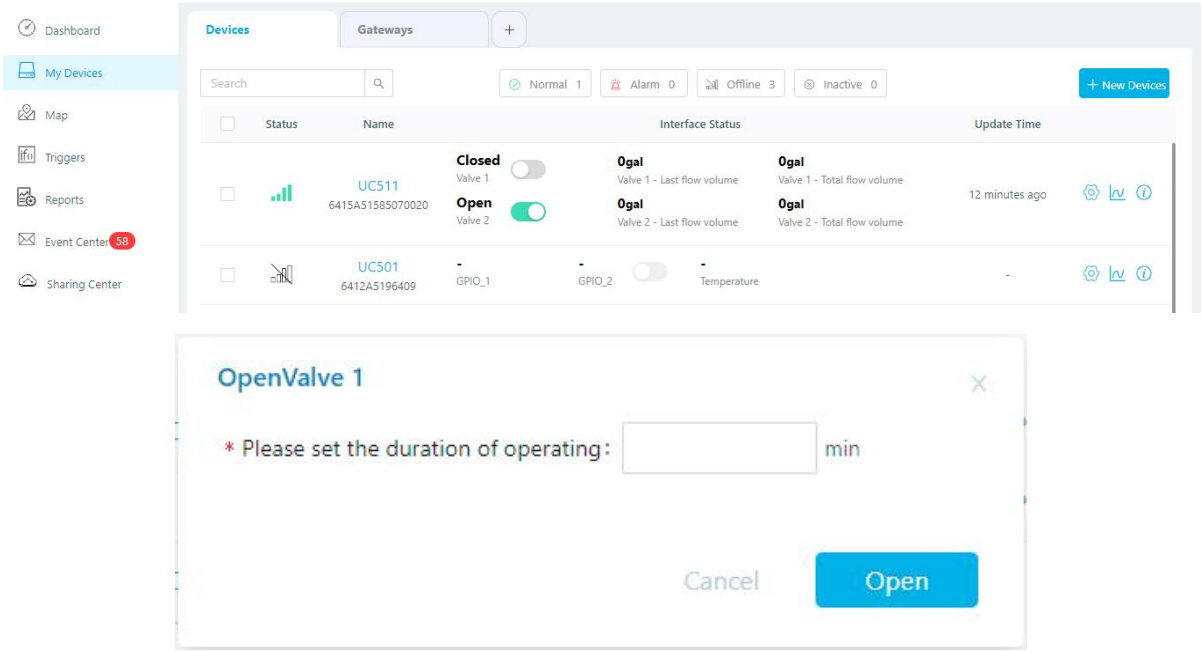
4. Click  and go to “Interface Settings” to select used interfaces and customize the name and thresholds.



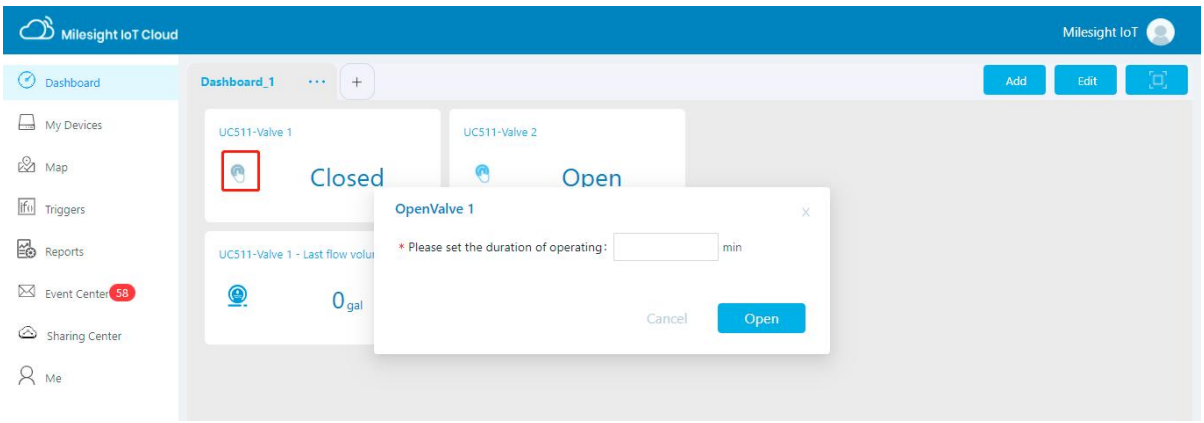
5.2 Solenoid Valve Control

Solenoid valve can be controlled by Milesight IoT cloud webpage or App.

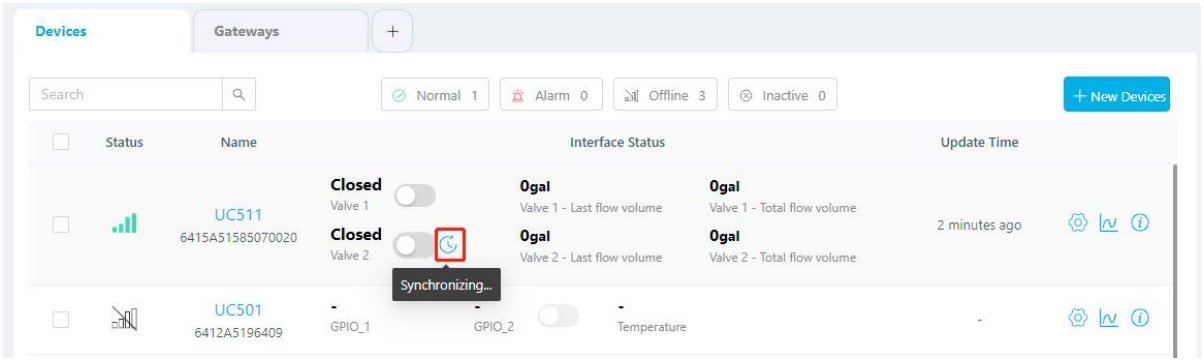
1. Click to open the solenoid valve and configure the duration. Note that if you enable any local plan on UC51x device, this control will not work.



You can also add a switch on the dashboard to control the status of solenoid valves.

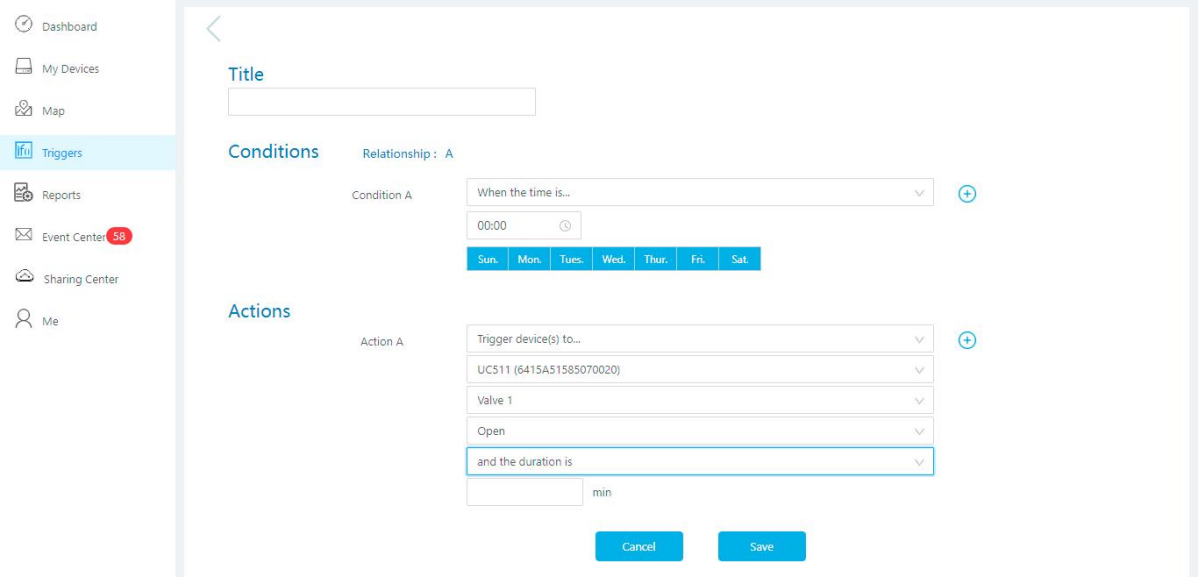


Note: If the working mode of UC51x is LoRaWAN® Class A, control commands will delay until the time icon disappear.



2. Go to “Triggers” page to add actions to trigger the solenoid valve to open for a period of time or a specific volume of water.

Note: Water volume control is only worked when you connect water meter to UC51x device.



6. Device Payload

UC51x Series use the standard Milesight IoT payload format based on IPSO. Please refer to the ***UC51x Series Communication Protocol***, for decoders of Milesight IoT products please clic

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