



UC51x Series

LoRaWAN® Solenoid Valve Controller

User Guide

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Chapter 1. Preface

Copyright Statement

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Milesight reserves the right to change this guide and the specifications without prior notice. The latest specifications and user documentation for all Milesight products are available on our official website <http://www.milesight.com>

Safety Instruction

These instructions are intended to ensure that users can use the product correctly to avoid danger or property loss. Milesight will not take responsibility for any loss or damage resulting from failure to follow the instructions in this operating guide.

**CAUTION:**

Injury or equipment damage may be caused if any of these cautions are neglected.

- Do not disassemble or remodel the device in any way.
- Do not expose the device to open flames.
- Do not operate the device outside its specified temperature range.
- Power off the device during installing or wiring.
- Take care to prevent electronic components from loosening or falling out when opening the enclosure.
- Do not subject the device to shock or impact.

Revision History

Release Date	Version	Revision Content
Feb. 29, 2024	V 4.0	Initial version on hardware 4.x

Release Date	Version	Revision Content
Jan. 8, 2025	V 4.1	1. Add DI status definition feature 2. Update UI of ToolBox App 3. Remove ToolBox software configuration
Nov. 21, 2025	V 4.2	1. Remove the feature of data storage, data retransmission and retrievability 2. Support timed switching of the LoRaWAN® work mode via downlink command 3. Add a new valve control command for rain special control 4. Support FUOTA feature 5. Optimized the upgrade speed, support iOS upgrade via ToolBox App
Apr. 30, 2026	V4.3	Support pressure collection feature

Chapter 2. Product Introduction

This chapter describes basic product information.

Overview

UC51x series LoRaWAN[®] 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. In addition, it also offers an optional version with an AI interface, which can connect to a pressure sensor to monitor water pressure during irrigation, enabling a more intelligent irrigation solution.

Besides ultra-low-power LoRaWAN[®] technology, UC51x series also provides a built-in solar panel and high-capacity battery power supply for long-term operation. For outdoor applications, it equips with an IP68-rated enclosure and M12 connectors, providing protection against water and dust under harsh environments.

UC51x series is widely used for agriculture valves, landscape irrigation systems, garden irrigation systems, etc.

The device has the following features:

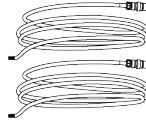
- Compatible with standard DC latching solenoids
- Waterproof design including IP68 case and M12 connectors
- Solar-powered and built-in chargeable batteries
- OPEN/CLOSE control by mobile App locally or commands remotely
- Support multiple local rules allows for flexible control without network
- Two GPIO interfaces for flow monitoring or valve status monitoring
- Transmission distance up to 15 km with line of sight
- Support Mulesight D2D protocol to enable ultra-low latency and direct control without gateways
- Equipped with NFC for easy configuration
- Time and flow control via Mulesight IoT Cloud or Mulesight Development Platform
- Support multicast for control in bulk
- Supports timed switching of work modes for easier device deployment and maintenance
- Support Firmware Upgrade Over the Air (FUOTA) feature

Packing List

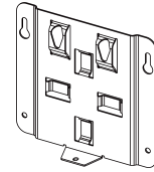
This section describes the packing list. After unboxing, please check that the following items are included in the package. If any of the below items are missing or damaged, please contact your sales representative.



1 × UC51x Device



2 × 1.5m M12 Data Cables



1 × Mounting Bracket



4 × Wall Mounting Kits



1 × Fixing Screw



2 × Hose Clamps



1 × Warranty Card



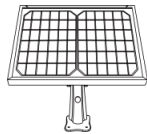
1 × Quick Guide Card

Optional Accessories Exclusively for External Antenna Version



1 × LoRaWAN®
Magnetic Antenna

Optional Accessories Exclusively for UC511 External Antenna Version



1 × Solar Panel Kit



1 × 30cm M12 DC Cable

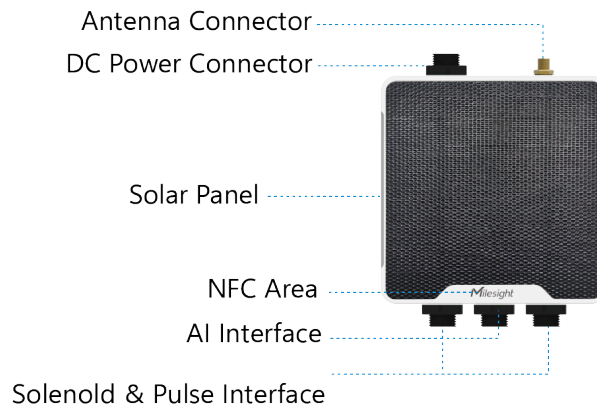
Optional Accessories Exclusively for AI Version



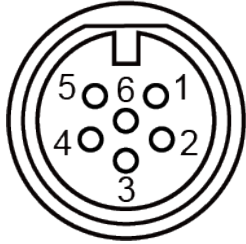
1 × Pressure Sensor

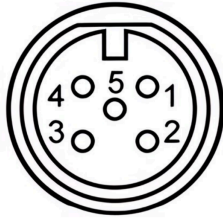
Hardware Introduction

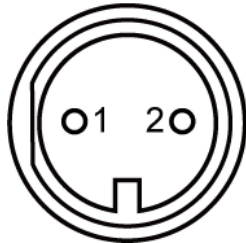
Hardware Overview



Name	Description
Antenna Connector (EA Version Only)	Allows for the attachment of an external antenna to enhance wireless communication range and reliability. The non-external antenna version features an integrated antenna.
DC Power Connector (UC511-EA Version Only)	Powers the device and supports battery charging.
Solar Panel (UC511 Only)	Powers the device, enabling extended operation without relying on external power sources.
NFC Area	Enables power on/off and wireless configuration via Milesight ToolBox App.
AI Interface (AI Version Only)	Connects to the pressure sensor.
Solenoid & Pulse Interface	Connects to the valve and flow meter, enabling precise control and real-time monitoring of water volume.

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

AI Interface (AI Version Only)		
Pin	Description	Figure
1	Reserved	
2	GND	
3	Reserved	
4	VCC OUT (12V)	
5	Analog input	

DC Power Connector (UC511-EA Only)		
Pin	Description	Figure
1	VCC(5-24V)	
2	GND	

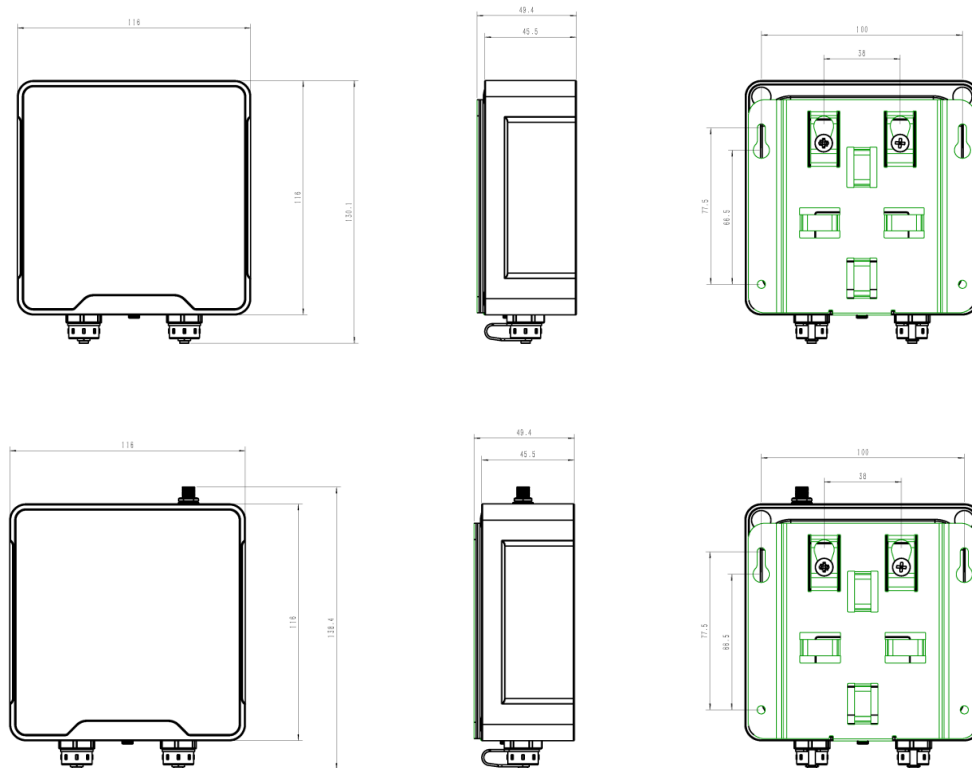
Power Button Descriptions

The device has an internal power button and an LED indicator for emergency reboot and reset functions. For the functions of the power button and the corresponding LED indicator status, refer to the following table.

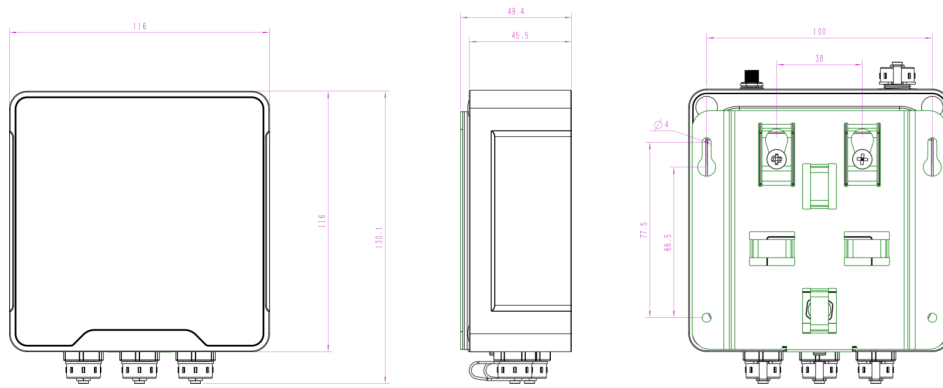
Function	Action	LED Indicator
Turn on	Long press the button for 3 seconds.	Off → on
Turn off	Long press the button for 3 seconds.	On → off
Reset	Long press the button for 10 seconds.	Blinks.
Check on/off status	Short press the button.	Light on: The device is powered on.
		Light off: The device is powered off.

Dimensions

The following figure shows the device dimensions (unit: mm).



AI Version



Chapter 3. Power Supply

This device supports multiple power supply methods.

Powered by Batteries

The device has built-in batteries installed by default. When the device runs out of power, please refer to the following requirement to properly replace the battery.

- The UC512 can only be powered by ER26500 Li-SOCl₂ batteries not alkaline batteries.
- When replacing the batteries, ensure the batteries direction is not reversed.
- Always replace with new batteries. Using old batteries may reduce battery life or lead to inaccurate power level calculations.

Powered by Solar Power (UC511 Only)

The UC511 also supports solar power supply and features a built-in solar panel. Additionally, the UC511-EA version supports an optional external solar panel.

**Tip:**

Clean the solar panel surface on schedule or according local environmental conditions. The solar panel may be affected by environmental factors such as dust, sand, and bird droppings, which can reduce their charge efficiency.

Powered by DC Cable (UC511-EA Only)

The device can also be powered directly by a DC cable (5-24V).

Chapter 4. Hardware Installation

This section describes how to install the accessories and device.

Connect the Interfaces

Prerequisites:

- M12 Data Cable

Steps:

1. Unscrew the waterproof protective cap on the interface.
2. Properly align and insert the M12 data cable into the corresponding interface, ensuring a stable connection.
3. Tighten the external waterproof connector.
4. Connect the bare wires at the other end of the data cable to the target device's terminals.



CAUTION:

- Prevent wires from touching during use to avoid device damage. Insulate any unused wires with tape.
- For outdoor use, ensure proper waterproofing of the bare wire connections.

Install the Antenna (EA Version Only)

Prerequisites:

- Magnetic Antenna

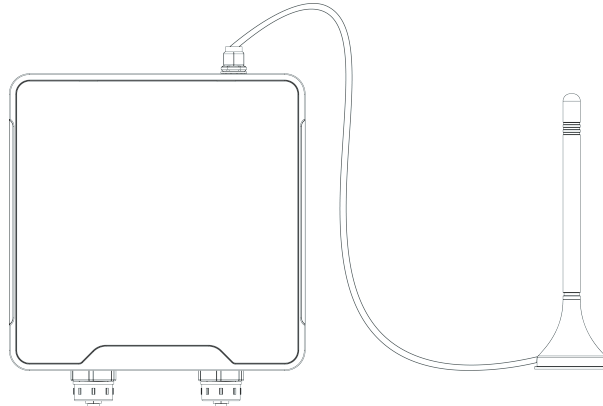
Installation Guidelines:

To ensure optimal signal performance, adhere to the following guidelines when deploying the antenna.

- Position the antenna away from walls and other obstructions. For indoor use, installation near a window is recommended.
- Maintain a minimum separation of 50 cm between multiple antennas.
- For superior coverage, install the antenna at the highest practical point.

Steps:

1. Screw the antenna into the antenna connector and hand-tighten it.
2. Secure the magnetic base of the antenna to a metal surface.
3. Orient the antenna vertically to ensure optimal performance.

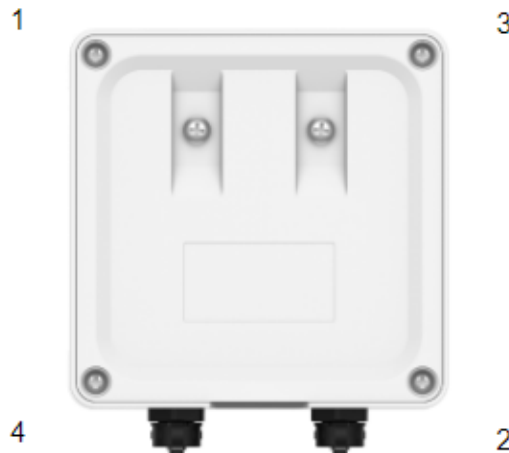


Install the Back Cover

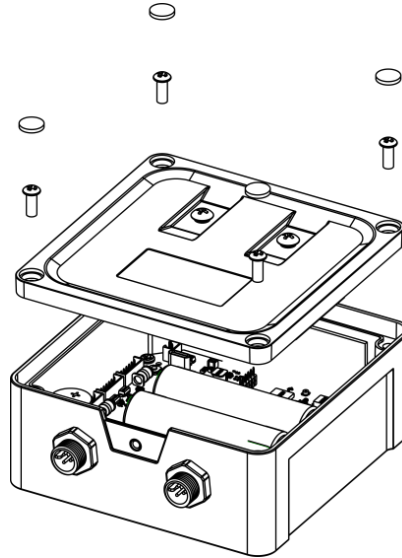
To maintain the device's waterproof rating, ensure the back cover is properly reinstalled after removal.

Steps:

1. Verify that the sealing ring is properly installed around the device, free from stains or foreign matters.
2. Orient the cover correctly and place it on the device
3. Hand-tighten the four screws in a crisscross pattern to ensure even pressure.



4. Using a torque screwdriver, initially tighten each screw to 80–90% of the final torque (4.5–5 kgf·cm).
5. Fully tighten all screws to the specified torque in the same crisscross sequence.
6. Install the screw caps onto the screws.



Install the Device

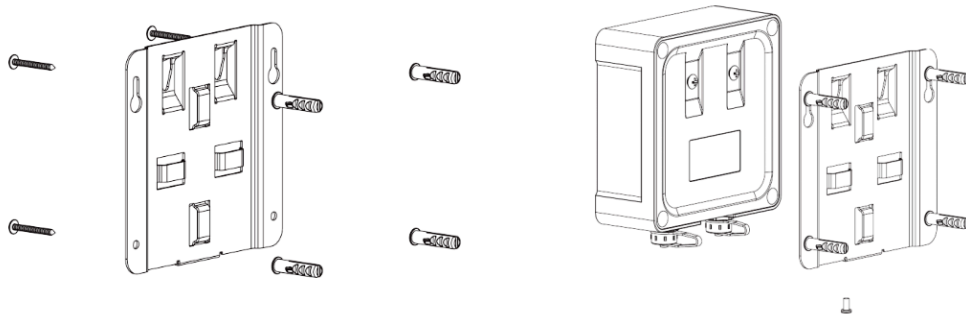
Wall Screw Mounting

Prerequisites:

- Mounting Bracket
- Wall Mounting Kits
- Screw Caps
- Electric Drill
- Fixing Screw

Steps:

1. Insert the wall plugs into the wall.
2. Secure the mounting bracket to the wall plugs and fasten it with the screws.
3. Position the device on the mounting bracket.
4. Secure the bottom of the device to the bracket with the fixing screw.



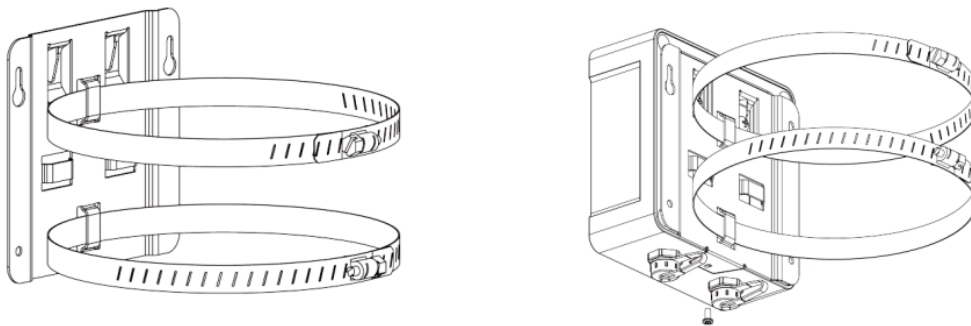
Pole Mounting

Prerequisites:

- Mounting Bracket
- Hose Clamps
- Fixing Screw

Steps:

1. Straighten the hose clamp and thread it through the rectangular rings on the mounting bracket.
2. Wrap the clamp securely around the pole.
3. Use a screwdriver to tighten the locking mechanism by turning it clockwise.
4. Position the device on the mounting bracket.
5. Secure the bottom of the device to the bracket with the fixing screw.



Chapter 5. ToolBox App Configuration

The Milesight ToolBox app can be used to configure the device. This chapter describes ToolBox related configuration.

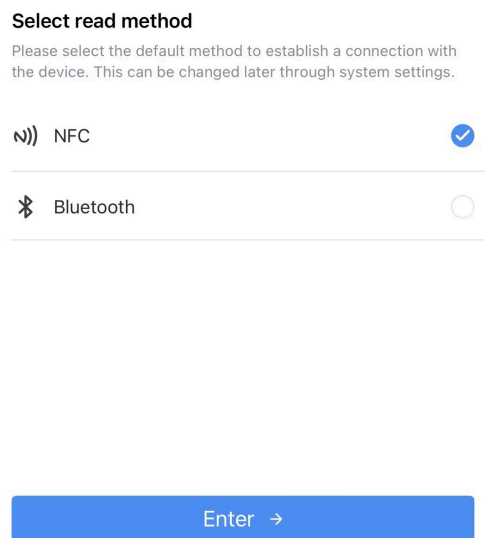
Access the Device Using NFC

This section describes how to access the device using NFC.

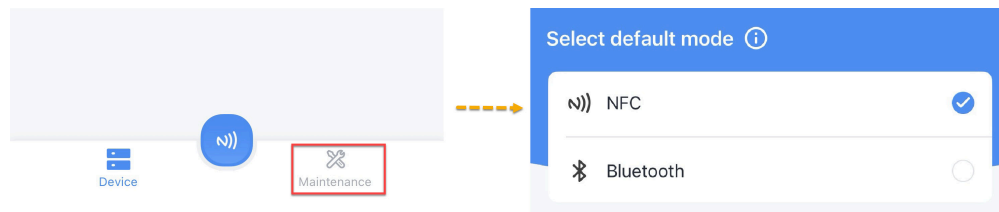
Prerequisites: The device is powered by internal or external power source.

Steps:

1. Download Milesight ToolBox app from Google Play or Apple Store.
2. Enable the NFC function on the smart phone.
3. Launch ToolBox.
 - a. Upon initial launch, the following page will appear. Select **NFC** and click **Enter**.



- b. Upon subsequent launches, Click **Maintenance** on the home page, and then select **NFC**.



4. (Optional) To locate the NFC detection areas of the phone and the device, click **Can't find the NFC location**.
5. Put the NFC detection area of the phone close to the NFC antenna of the device.



Tip:

It is recommended to remove the phone case.



6. Click . If the device is recognized successfully, the homepage is displayed.



Troubleshooting:

If read fails, move the phone away and reposition it close to the sensor to try again.

For a description of the homepage, refer to the following table.

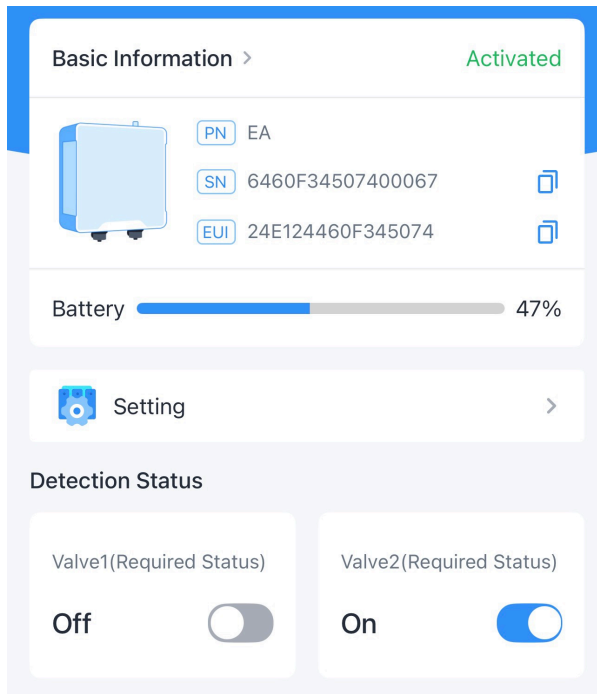
Item	Description
Basic Information	Show basic device information and sync the device time.
Setting	Set the device and network parameters.
	Import, add, export or delete a template.
	Select language, show NFC positions, check App version, etc..

Control the Solenoid Valve

The device supports to control the solenoid valve via ToolBox locally. Besides, this can also be executed via downlink commands or local rules. This section describes how to control the solenoid valve locally.

Steps:

1. On the homepage of ToolBox, see **Valve1** and **Valve2** in **Detection Status**.
2. Click **Off/On** to turn on/off the valve as need.



3. Put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

Related information

[Commands for Valve Setting](#)

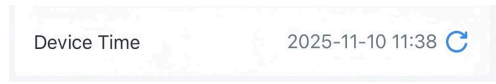
Synchronize Device Time

This section describes how to sync the device time.

Synchronize the Time Manually Through ToolBox App

The device time can be synced via Milesight ToolBox App.

1. On the homepage of ToolBox, click **Basic Information**.
2. Click  to synchronize the time.



3. Put the NFC detection area of the phone close to the NFC antenna of the device. If the time is synchronized successfully, the following page is displayed.



Sync successfully!

Synchronize the Time Automatically Through a LoRaWAN[®] Network Server

Prerequisite: The LoRaWAN[®] network server supports the device time synchronization feature.

Steps:

1. Set the LoRaWAN[®] version of the device to **V1.0.3**. For details, refer to [Configure LoRaWAN[®] Parameters](#).
2. Connect the device to the network server. Once the device successfully joins the network, it sends a MAC command to query the time from the network server.



Note:

- This only supports getting the time, but not the time zone. The time zone can be configured by ToolBox App or downlink command.
- The device will send the DeviceTimeReq command every 5 days since the last sync.

Configure LoRaWAN[®] Parameters

This section describes how to configure the device transmission parameters for the LoRaWAN[®] network.

Usually, it consists of the below steps:

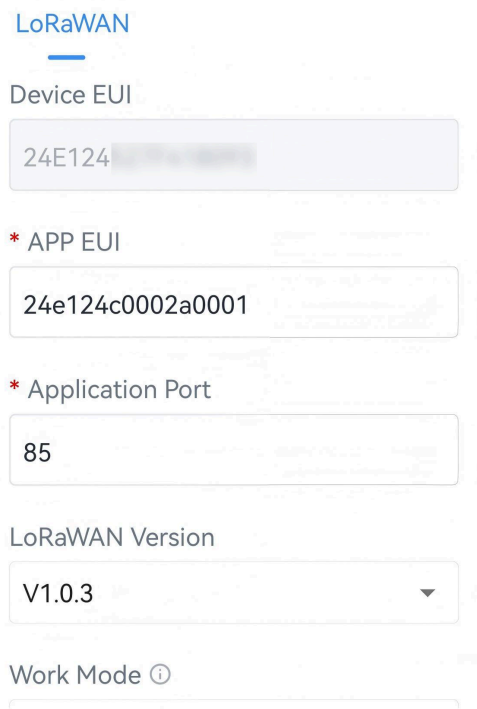
1. [Configure Join Type and Supported Frequency \(Necessary\)](#)
2. [Configure Other LoRaWAN® Parameters \(Optional\)](#)
3. [Configure Multicast Group \(Optional\)](#)

Configure Join Type and Frequency

It is necessary to configure the join type and the frequency to establish communication with LoRaWAN® gateways.

Steps:

1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. Navigate to the **LoRaWAN** page The **LoRaWAN** page is displayed, see the following figure.



LoRaWAN

Device EUI

24E124...

* APP EUI

24e124c0002a0001

* Application Port

85

LoRaWAN Version

V1.0.3

Work Mode ⓘ

3. From the **Join Type** selection box, select **OTAA** or **ABP** as needed.



Note:

OTAA is required if you connect the device to the [Milesight Development Platform](#).

4. Configure **Join Type** related parameters as needed. You can use default values unless otherwise specified.

- If **OTAA** is selected, configure **Application Key** and **Rejoin Mode** as needed. For details, refer to the following table.

Parameter	Description
Applica- tion Key	Appkey for OTAA mode. Default: Device EUI + Device EUI. Example: 24e124123456789024e1241234567890.  Tip: Contact sales before purchase if you need random App keys.
Rejoin Mode	Rejoin mode for OTAA mode. Reporting interval ≤ 35 minutes: The device sends a specific number of LinkCheckReq MAC packets at each reporting interval or every other reporting interval to verify connectivity. Reporting interval > 35 minutes: The device sends a specific number of LinkCheckReq MAC packets at each reporting interval to validate connectivity. If there is no response, the device will re-join the network. When Rejoin Mode is enabled, enter a number in the Set the number of detection signals sent text box. The actual sending number is the configured number +1.

- If **ABP** is selected, configure **Network Session Key**, **Application Session Key** and **Device Address** as needed. For details, refer to the following table.

Parameter	Description
Network Session Key	Nwkskey for ABP mode. Default: 5572404C696E6B4C6F52613230313823 .
Application Session Key	Appskey for ABP mode. Default: 5572404C696E6B4C6F52613230313823 .
Device Address	DevAddr for ABP mode. Default: 5 th to 12 th digits of SN.

5. Select a frequency from the **Support Frequency** selection box as needed. This must be the same as the frequency configured on the gateway's web GUI.

- If the **Supported Frequency** is **CN470**, **US915** or **AU915**, enter the channel index(es) 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: All channels are disabled



Tip:

Set the **Channel Index** to **8-15** when connecting to a Milesight LoRaWAN[®] gateway with default settings.

- If the **Supported Frequency** is **AS923**, select a channel plan and enable the frequencies as needed.
 - If the **Supported Frequency** is any option other than those listed above, enable the frequencies as needed.
6. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

Configure Other LoRaWAN[®] Parameters

Steps:

1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. Navigate to the **LoRaWAN** page The **LoRaWAN** page is displayed, see the following figure.

LoRaWAN

Device EUI

24E124

* APP EUI

24e124c0002a0001

* Application Port

85

LoRaWAN Version

V1.0.3

Work Mode ⓘ

3. Configure the following parameter as needed. You can use default values unless otherwise specified. For a description of the parameters, refer to the following table.

Parameter	Description
Device EUI	Unique ID of the device labelled on the device housing. <i>i</i> Tip: For bulk deployments, contact sales to request the device EUI list.
App EUI	The default App EUI (join EUI) is 24E124C0002A0001.
Application Port	Port used for sending and receiving data. Default: 85 .
LoRaWAN [®] Version	Options: V1.0.2 , V1.0.3 .
Work Mode	Options for UC511: Class A , Class B , Class C and Class C to B . Options for UC512: Class A and Class B .
Confirmed Mode	If the device does not receive ACK packet from network server, it will re-send data once.

Parameter	Description
Join Type	Refer to Configure Join Type and Supported Frequency .
Supported Frequency	Refer to Configure Join Type and Supported Frequency .
ADR Mode	Enables the network server to adjust the spreading factor, the bandwidth and the transmission power to optimize data rates, airtime and energy consumption in the network.
Spreading Factor	If ADR mode is disabled, the device sends uplink data using this spreading factor. A higher spreading factor increases transmission range but reduces data rate and increases power consumption. This parameter varies with Supported Frequency .
Tx Power	Defined by the LoRa Alliance. Specifies the strength of the radio signal transmitted by the device.
RX2 Data Rate	RX2 data rate to receive downlinks.
RX2 Frequency	RX2 frequency to receive downlinks. Unit: Hz
Multicast Group	Enable or disable multicast groups. For more details, see Configure Multicast Group .

4. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

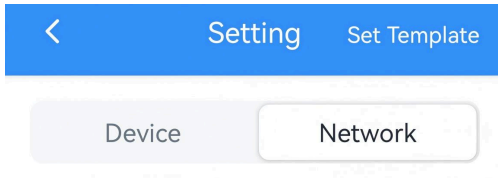
Configure Multicast Group

The device supports setting up multiple multicast groups to receive multicast commands from the network server, allowing users to control devices in bulk.

Prerequisites: The work mode of the device is **Class C**, **Class B** or **Class C to B**.

Step 1. Enable Multicast Group on the Device

1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Network** tab.



3. In the **LoRaWAN** page, ensure the **Application Port** of each device is the same.
4. Enable a **Multicast Group**, and configure the following parameter as needed. You can use default values unless otherwise specified. For a description of the parameters, refer to the following table.

Parameter	Description
Multicast Address	Unique 8-digit address to distinguish multicast groups.
McNetSKey	32-digit key. Default values: - Multicast Group 1: 5572404C696E6B4C6F52613230313823 - Multicast Group 2: 5572404C696E6B4C6F52613230313824 - Multicast Group 3: 5572404C696E6B4C6F52613230313825 - Multicast Group 4: 5572404C696E6B4C6F52613230313826
McAppSKey	32-digit key. Default values: - Multicast Group 1: 5572404C696E6B4C6F52613230313823 - Multicast Group 2: 5572404C696E6B4C6F52613230313824 - Multicast Group 3: 5572404C696E6B4C6F52613230313825 - Multicast Group 4: 5572404C696E6B4C6F52613230313826
Multicast Ping Slot Periodicity/s	The period to open the ping slot to receive multicast commands.
Multicast Data Rate	The data rate to receive multicast commands.
Multicast Frequency	The frequency to receive multicast commands. Unit: Hz

5. (Optional) To enable another multicast group, follow the above step to configure the corresponding group.
6. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.

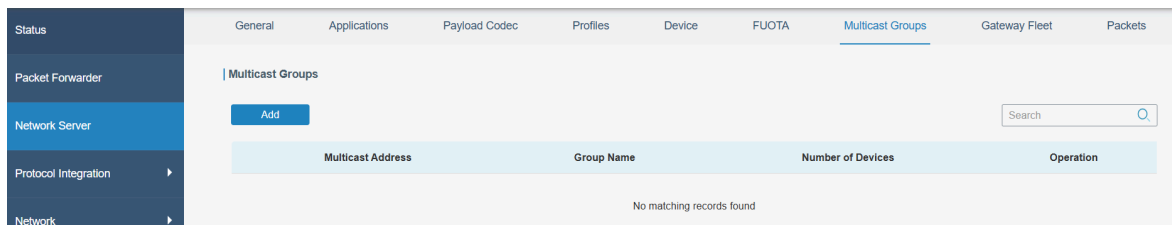


Write successfully!

Step 2. Add a Multicast Group on the Network Server

The following steps use a Milesight gateway as an example. For other network servers, please refer to corresponding guides.

1. Ensure the target devices are added to this gateway and have joined to the network.
2. On the gateway web GUI, navigate to **Network Server > Multicast Groups** page.



3. Click **Add** to add a multicast group.
4. Configure the multicast group parameters to match those configured on ToolBox and select the devices that you need to control.

Group Name	Device Control
Multicast Address	11111111
Multicast Network Session Key	5572404C696E6B4C6F526132
Multicast Application Session Key	5572404C696E6B4C6F526132
Class Type	Class C
Datarate	DR0 (SF12, 125kHz)
Frequency	869525000 Hz
Frame-counter	0
Selected Devices	
device1 x device2 x	

5. Click **Save** to save this multicast group.
6. Click **Packets** tab in the upper right corner.
7. In the **Send Data to Multicast Group** section, select the multicast group from the **Multicast Groups** drop-down list and configure the downlink command parameters.
8. Click **Send**. The network server broadcasts the command to all devices in this multicast group.

Send Data To Device

Device EUI	Type	Payload	Port	Confirmed	
0000000000000000	ASCII		85	☐	Send

Send Data to Multicast Group

Multicast Group	Type	Payload	Port	
Device Control	hex	ff10ff	85	Send

Configure the Device Parameters

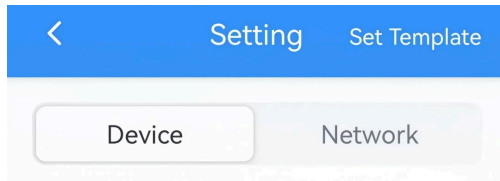
This section describes how to configure the device.

Change the Device Password

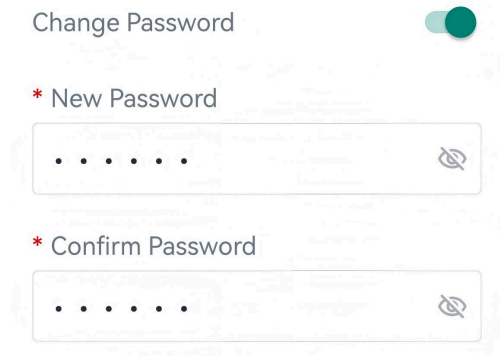
It is recommended to change the device password upon initial configuration for security purposes. This section describes how to change the device password.

Steps:

1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Device** tab.



3. In the **General** page, enable **Change Password** and enter the new password.



Parameter	Description
New Password	Enter a new password of 6 characters. Only letters, digits, and underscores are allowed.
Confirm Password	Enter the password again.

4. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

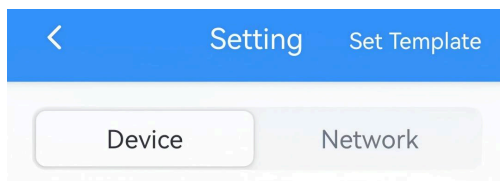
Configure General Parameters

This section describes how to configure the general parameters of the device, which includes:

- Reporting interval
- Data Storage
- Data Retransmission
- Auto-Confirmed Mechanism
- Wiring Switch
- Data Reporting
- When Power is Restored
- Working Mode
- Response Time
- Device Password

Steps:

1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Device** tab.



3. In the **General** page, configure the following device parameters as needed.

Parameter	Description
Reporting Interval	Reporting interval for transmitting data to the network server. Default: 360 mins, range: 1-1080 mins.
Data Storage	 Important: This feature is only supported in versions prior to V1.4. Disables or enables reporting data storage locally. For details, refer to Configure the Data Storage&Retransmission.

Parameter	Description
Data Re-transmission	 Important: This feature is only supported in versions prior to V1.4. Disables or enables data retransmission. For details, refer to Configure the Data Storage&Retransmission.
Auto-Confirmed Mechanism	When Auto-Confirmed Mechanism is enabled: ◦ If Confirmed Mode in NS is also enabled, the device will respond with an ACK containing a packet starting with "FE". ◦ If Confirmed Mode in NS is disabled, the device will send a packet starting with "FE". When Auto-Confirmed Mechanism is disabled: ◦ If Confirmed Mode in NS is enabled, the device will respond with an empty ACK. ◦ If Confirmed Mode in NS is disabled, the device will not send any up-link acknowledgment.
Wiring Switch	When this option is enabled, the UC51x will turn on automatically when a data cable is connected to any solenoid interface.
Data Reporting	Select the periodic packet report content. Options: All, Interface 1 Only, and Interface 2 Only.
When Power is Restored	This parameter configures the device to either automatically restart or remain off when power is restored after an outage. Options: Last Working Status, Device On, Valve Off, and Device On, Valve ON.
Working Mode	Working mode of LoRaWAN[®] device. Options for UC511: Class A, Class B, Class C and Class C to B. Options for UC512: Class A and Class B.

Parameter	Description
	i Tip: a. Class A targets maximum battery life. b. Class B caters to scheduled command reception. If the device does not receive beacons for more than 120 minutes, it will switch to Class A mode automatically. c. Class C enables real-time, low-latency communication. d. Class C to B balances real-time needs with power savings. If the device does not receive beacons for more than 30 minutes, it will switch to Class C mode automatically.
Response Time	When the class type is Class A: the device will send a blank packet to allow to receive the control commands at every Response Time interval. Range: 0-64800s, 0 means disabled. When the class type is Class B or Class C to B: the device will open the reception window according to the response time interval. i Tip: The shorter the response time, the shorter the battery life.
Device Password	Change the password for ToolBox App to write this device.

4. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

Related information[Commands for General Setting](#)[Commands for Work Mode Switching](#)

Configure Data Storage & Retransmission

**Important:**

This feature is only supported in versions prior to V1.4.

The device supports data storage and data retransmission to ensure data integrity. This section describes how to configure data storage and data retransmission.

Export the Local Data

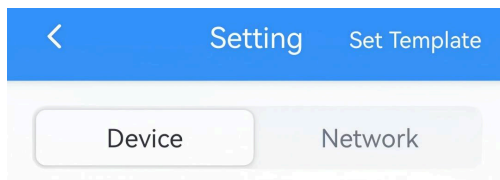
The device supports storing historical data records locally, which operates normally even when the network is deactivated.

Each device can store up to 1,000 data records.

Prerequisites: [Sync the time](#) to ensure the data is stored in correct time.

Steps:

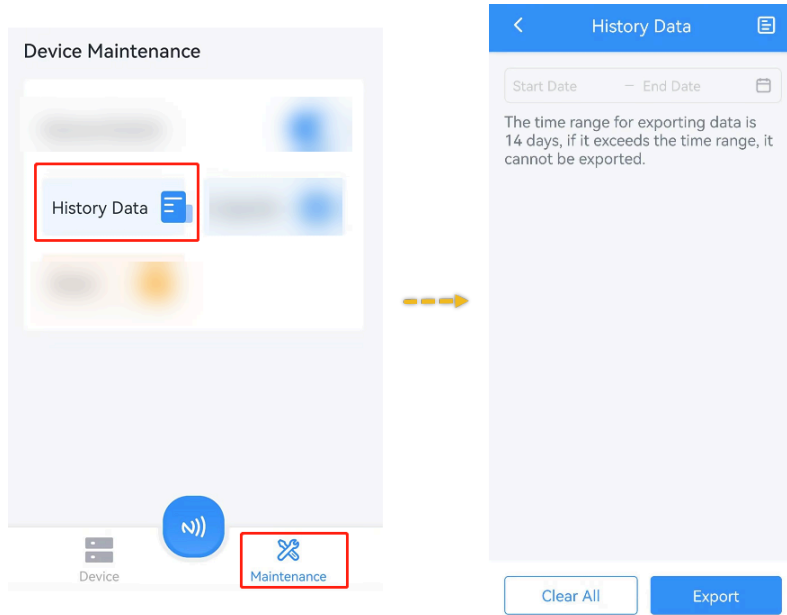
1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Device** tab.



3. In the **General** page, enable **Data Storage**.
4. Return to the homepage and click **Maintenance** in the lower right corner.
5. Click **History Data**, select the data time range and click **Export** to read data.

**Tip:**

- Since the ToolBox App's data export time range is limited to 14 days, you can export the complete data in segments if the required time range exceeds this limit.
- Click  in the top right to check the history export records.



6. Put the NFC detection area of the phone close to the NFC antenna of device. If the read succeeds, the history data will display.
7. Click **Export** to customize a file name, then click **OK** to save the history data as a CSV file to your smartphone.

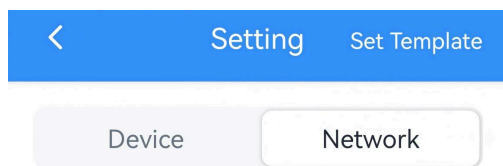
Enable Data Retransmission

Data retransmission allows the network server to receive data, even after temporary network outages.

Prerequisites: The device join type is **OTAA**.

Steps:

1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Network** tab.



3. In the **LoRaWAN** page, enable **Rejoin Mode** and set the number of packets sent.

LoRaWAN

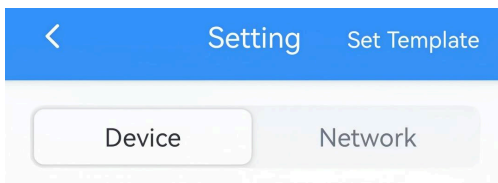
Rejoin Mode



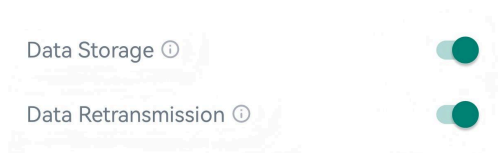
Set the number of detection signals sent ⓘ

32

4. On the top bar, select **Device** tab.



5. In the **General** page, enable **Data Storage** and **Data Retransmission**.



6. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

Result:

When the device detects the network status is deactivated via rejoin mode mechanism, the device will record a data lost time point and re-transmit the lost data according to data retransmission interval after device re-connects to the network. The reported format of retransmission data will include timestamps and is different from periodic report data.



Note:

- If the device reboots or re-power during data retransmission, it will resend the entire retransmission dataset after reconnecting to the network.
- If a new network disconnection occurs during an ongoing retransmission, only the data logged during this latest outage will be sent upon reconnection.
- The default report data retransmission interval is 600s, this can be changed via downlink command.

Query Historical Data

The device supports data retrievability feature to query historical data for a specific time range via downlink command. The retransmission data format includes timestamps and differs from the periodic report format. For details, refer to [Commands for Historical Data Query](#).

Configure the GPIO Interface Parameters

This section describes how to configure the GPIO interface.

Steps:

1. Connect device to GPIO pin on interface.
2. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
3. Click **GPIO**. The following page is displayed.

GPIO1 Working Mode ⓘ

Digital Input

DI Status Definition

Open Valve

High

Close Valve

Low

GPIO2 Working Mode

Digital Input

DI Status Definition

Open Valve

High

Close Valve

Low

Read Write

4. Set **GPIO1/2 Working Mode** to **Digital input** or **Water Volume Counter** as needed.

Interface Type	Description
Digital input	Detect the real state of the valve to know if valve control takes effect.
Water Volume Counter	Connect to pulse water meter to measure the water volume

5. Perform any of the following operations as needed.

- If **GPIO1/2 Working Mode** is set to **Digital input**, configure the following parameters as needed.

GPIO1 Working Mode ⓘ

Digital Input

DI Status Definition

Open Valve

High

Close Valve

Low

Parameter	Description
DI Status Definition	Set the Open Valve of Low/High status. The device will report the DI status according to this definition.
Prevent Jitter Delay Time (s)	The device will not upload GPIO status during this time to avoid frequent uplinks. This only works when GPIO working mode is Digital Input and this applies to both GPIO interfaces.

- If **GPIO1/2 Working Mode** is set to **Water Volume Counter**, configure the following parameters as needed.

GPIO2 Working Mode

Water Volume Counter ▼

Counter 2

0 Confirm

Pulse Filter Setting ⓘ

250 us ▼

Parameter	Description
Counter	Set the initial counting value and click Confirm to save this value. Reboot or re-join will not affect the counting. The pulse value supports to clear manually via ToolBox or downlink command, or clear automatically when it calculates to max value: 4294967295 (0xffffffff).
Pulse Filter Setting	Filter the pulse counting values below this rate. This only works when GPIO working mode is Water Volume Counter and this applies to both GPIO interfaces.

6. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

Related information

[Commands for GPIO Setting](#)

Configure the Pressure Interface Parameters (AI Version Only)

This section describes how to configure the pressure interface.

Configure the Pressure Collection Parameters

Steps:

1. Connect a water pressure sensor to AI interface.
2. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
3. Click **Pressure** and enable the **Pressure Collection**. The following page is displayed.

Pressure Collection 

Pressure Unit

kPa 

Collection period - irrigation period(min) ⓘ

20

Collection period - non-irrigation period(min) ⓘ

120

Delay in first pressure measurement during irrigation(min)

10

Read

Write

4. Configure the following parameters of the water pressure sensor.

Parameters	Description
Unit	Option: kPa , bar , or MPa .
Collection Interval- Irrigation Period/Non-Irrigation Period	During irrigation, the default pressure collection interval is 20 minutes. During non-irrigation periods, the default pressure collection interval is 120 minutes. Interval range: 1-1080 minutes.  Note: - The device will collect pressure values at this interval only after the rule engine related to the pressure threshold is enabled. - When all valves are closed, the pressure collection interval follows the setting for non-irrigation periods.
Delay Time for First Pressure Collection During Irrigation	During irrigation, when the valve is first opened, the system will measure pressure after the configured delay time. Delay time range: 0-60, Unit: minutes.

5. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

Configure the Pressure Calibration Parameters

Steps:

1. Connect a water pressure sensor to AI interface.
2. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
3. Click **Calibration** and enable the **Pressure Calibration**.
4. Enter a **Calibration Value**. The Final Value = Current Value + Calibration Value.

Pressure Calibration

Current Value(kPa)

100

Final Value(kPa)

101

Calibration Value(kPa)

1

5. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

Related information

[Commands for Pressure Interface Setting](#)

Configure the Rule Engine

UC51x support multiple local rules allows for flexible control without network. Each device supports a maximum of 16 rules. This section describes how to configure rule.

Steps:

1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. Click **Rule Engine** and  Continue adding .
3. Set rule to **Time, Water volume, Every increases of water volume** and **D2D** as needed.

- If rule is set to **Time**, refer to [Time Sync](#) to ensure the device time is correct, then configure the related parameters as needed.

Example: During the time range 2025-11-10 8:00 to 2025-12-10 8:00, open the valve 1 at 0:00 for 5 minutes every 5 days.

The screenshot displays the configuration interface for a rule in the ToolBox App. It is divided into two main sections: 'If' and 'Then'.

If Section:

- A dropdown menu is set to 'Time'.
- A date range is specified as '2025/11/10 08:00' to '2025/12/10 08:00', with a calendar icon to the right.

Then Section:

- A dropdown menu is set to 'Valve1'.
- A second dropdown menu is set to 'Open'.
- A text input field for 'Duration(min)' contains the value '5'.
- A toggle switch for 'Is Loop' is turned on (green).
- A text input field for 'Loop Period' contains the value '5'.
- A dropdown menu for the unit is set to 'Day'.

- If rule is set to **Water volume**, configure the related parameters as needed.

Example: When the GPIO2 detects 20 pulses within 2 minutes, the device will report a status packet to network server, the max length of custom message is 8 characters.

If

Water Volume ▼

Water Volume Counter 2 ▼

Period(min)

2

Threshold(Pulses)

20

Then

Report counter value and valve status ▼

- If rule is set to **Every increases of water volume**, configure the related parameters as needed.

Example: Every time the counter of GPIO2 increases 20, the device will report a custom message to the network server, the max length of custom message is 8 characters.

The image shows a configuration interface for a rule, divided into two sections: 'If' and 'Then'.

If section:

- A dropdown menu is set to 'Every increase of water volume'.
- Another dropdown menu is set to 'Water Volume Counter 2'.
- A label 'Threshold(Pulses)' is followed by a text input field containing the value '20'.

Then section:

- A dropdown menu is set to 'Report customized message'.
- A label 'Message' is followed by a text input field containing the value 'alarm'.

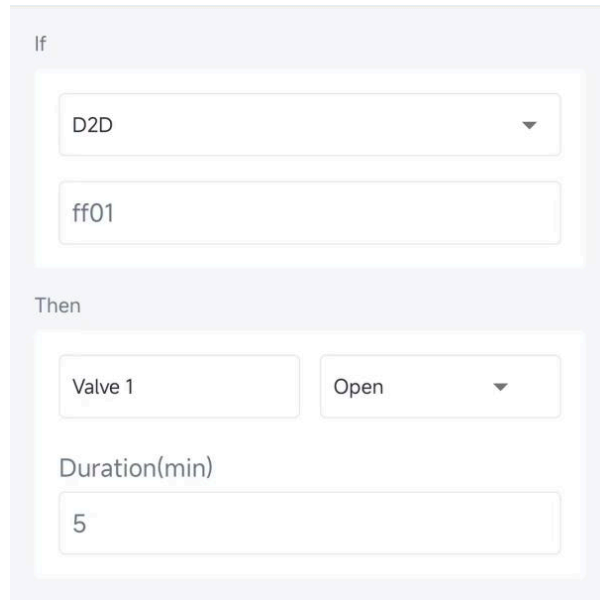
- If rule is set to **D2D**, configure the related parameters as needed.



Note:

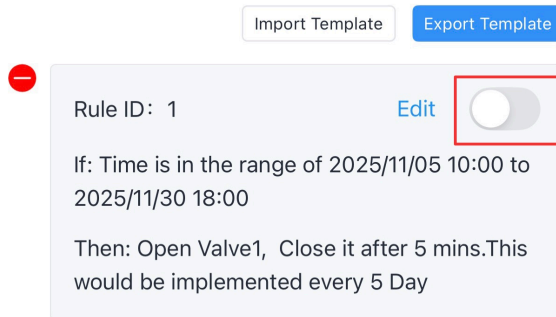
D2D rule has higher execute priority than other types of rules.

Example: When the device receives Milesight D2D command ff01, it can open solenoid valve1 for 5 minutes.



The screenshot shows a rule configuration interface. Under the 'If' section, there is a dropdown menu set to 'D2D' and a text input field containing 'ff01'. Under the 'Then' section, there is a dropdown menu set to 'Valve 1', another dropdown menu set to 'Open', and a text input field for 'Duration(min)' containing the value '5'.

4. Click **Save** to save the configuration.
5. Enable or disable the rules as required in **Rule Engine** page. When the device has multiple rules that are conflicted, the device will execute the rule with front **Rule ID** in priority.



The screenshot shows the 'Rule Engine' page. At the top, there are two buttons: 'Import Template' and 'Export Template'. Below them is a list of rules. The first rule is 'Rule ID: 1'. To its right is an 'Edit' button and a toggle switch. The toggle switch is currently in the 'off' position. Below the rule ID, the 'If' condition is 'Time is in the range of 2025/11/05 10:00 to 2025/11/30 18:00'. The 'Then' condition is 'Open Valve1, Close it after 5 mins.This would be implemented every 5 Day'.

6. To modify the rule configuration, click **Edit**.
7. (Optional) Click **Export Template** to back up the rule settings into the smartphone; if you need to import the rule settings from other devices, click **Import Template** to import the setting.

- Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

Related information

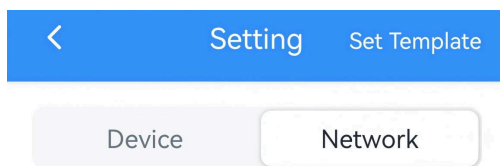
[Commands for Rule Setting](#)

Configure Milesight D2D Parameters (UC511 Only)

Milesight D2D protocol is developed by Milesight and used for setting up transmission among Milesight devices without gateway. When the Milesight D2D settings is enabled, the device can work as a D2D controller to send control commands to trigger Milesight D2D agent devices.

Steps:

- On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
- On the top bar, select **Network** tab.



- Set the **Work Mode** as **Class C**.
- Configure the **RX2 Data Rate** and **RX2 Frequency** to be the same as the settings of Milesight D2D controller.



Tip:

It is suggested to change the default values if there are many LoRaWAN[®] devices around.

Device

Network

LoRaWAN

D2D

Spreading Factor ⓘ

SF12-DR0

TXPower

TXPower0-16 dBm

RX2 Data Rate ⓘ

DR0 (SF12, 125 kHz)

RX2 Frequency ⓘ

869525000

- Click **D2D**. Enable Milesight D2D feature and define a unique D2D key that is the same as Milesight D2D controller. (Default D2D key: 5572404C696E6B4C6F52613230313823).

LoRaWAN

D2D

Enable

☒

D2D Key

- Set rule to work as a Milesight D2D agent. Refer to [Configure the Rule Engine](#).

7. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

Maintain the Device

This section describes how to maintain the device.

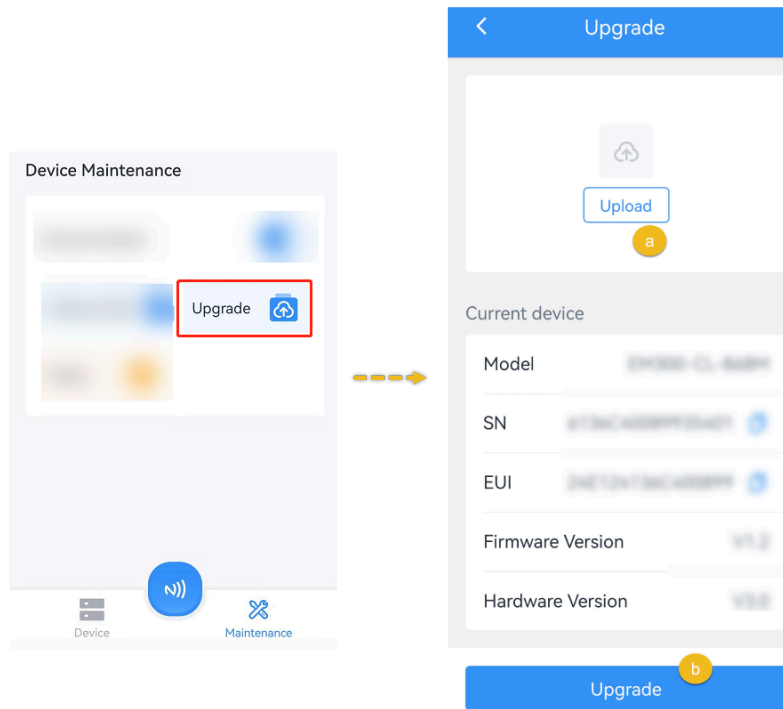
Upgrade the Device

This section describes how to upgrade the device locally.

Prerequisites: Download firmware from [Milesight official website](#) and save it to the smart phone. It is recommended to consult technical support before upgrading to ensure a safe and successful upgrade.

Steps:

1. On the homepage of ToolBox, click **Maintenance** in the lower right corner.
2. Click **Upgrade** to go to **Upgrade** page.
3. Click **Upload** to select the firmware from the local path of the smartphone.
4. Click **Upgrade** to upgrade the device.



5. Put the NFC detection area of the phone close to the NFC antenna of device for a few minutes.



CAUTION:

Any operation on ToolBox is not allowed during upgrading, otherwise the upgrading will be interrupted, or even the device will break down.

Configure a Template for Configuration Backup

This device supports configuration backup, which enables quick and easy batch configuration. This section describes how to backup the device configuration and write to other devices.



Note:

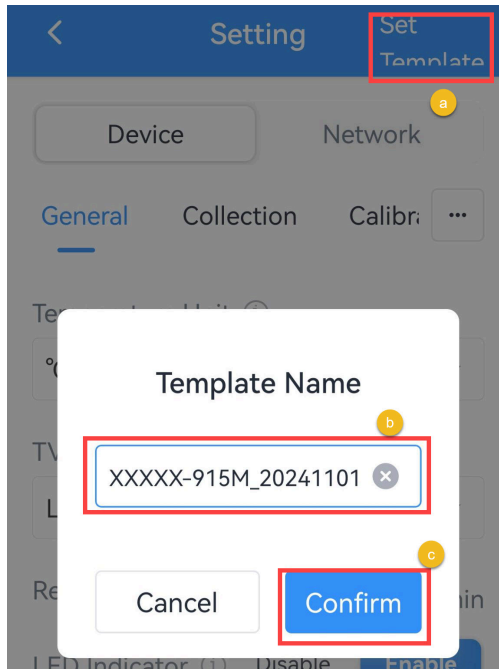
The backup file will not save rule setting, please refer to [Configure the Rule Engine](#) backup rule settings.

Prerequisites: The backup device and the device importing the backup are exactly the same model.

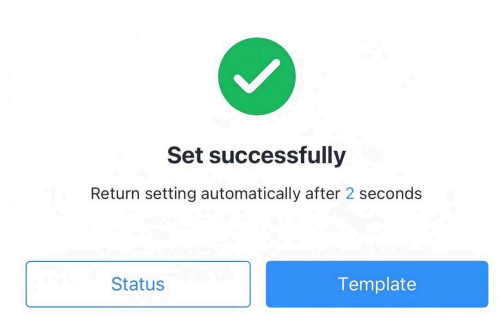
Step 1. Set a Template

1. Access the device via ToolBox App.
2. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.

3. Edit the device parameters as required, click **Set Template** in the top right corner.
4. Customize a template name, click **Confirm** to save the current configuration as a template.



5. If the save is successfully, the following page is displayed. The template will be saved to the ToolBox App.

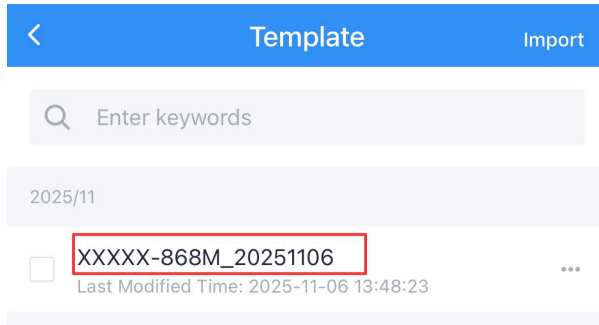


Step 2. Write Template Configuration to the Target Device

1. On the homepage of ToolBox, click **Device** in the lower left corner.
2. Click Template icon in the top right corner to go to **Template** page.



3. Click the saved template. Do not select the template.



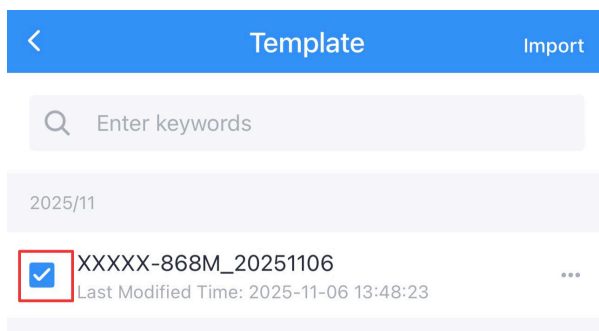
4. In the displayed page, click **Write** in the bottom and put the NFC detection area of the phone close to the NFC antenna of the target device. If the configuration is written to the target device, the following page is displayed.



Write successfully!

Step 3. Export or Delete a Template (Optional)

1. Select the checkbox of the target template as shown in the following figure.



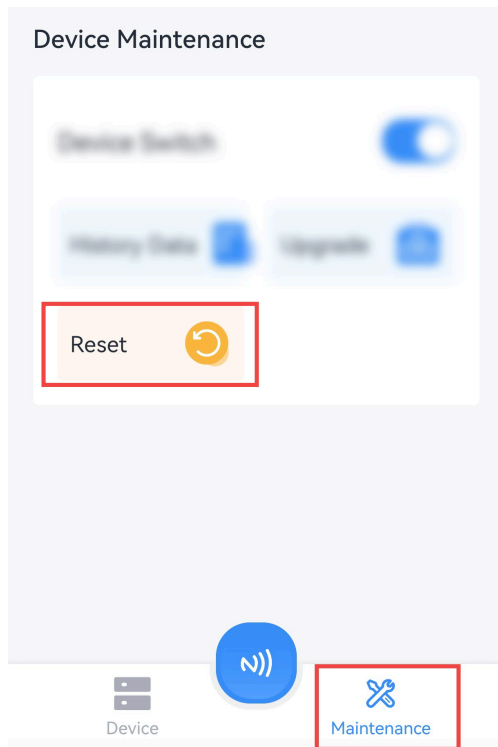
2. Click **Export** in the lower left corner to export this template as a JSON format file and save it to the smart phone.
3. Click **Delete** in the lower right corner, then click **Confirm** to delete this template from ToolBox.

Reset the Device

This section describes how to reset the device.

Steps:

1. On the homepage of ToolBox, click **Maintenance** in the lower right corner. The **Maintenance** page is displayed, see the following figure.



2. Click **Reset**.
3. In the displayed dialog box, click **Confirm**.
4. Put the NFC detection area of the phone close to the NFC antenna of the device.

If the device is successfully reset, the following page is displayed.



Reset successfully!



Note:

If unable to read or write devices normally using the ToolBox, perform a [hardware reset](#).

Chapter 6. Uplink Packets and Downlink Commands

All messages follow the following format (HEX), the Parameter/Data field must follow **little-endian** byte order:

Channel1	Type1	Data1	Channel2	Type2	Data2	Channel3	...
1 Byte	1 Byte	N Bytes	1 Byte	1 Byte	N Bytes	1 Byte	...

For decoder and encoder examples, please find files on <https://github.com/Milesight-IoT/SensorDecoders>. For details of uplink reports and downlink commands please refer to the sections below.

Uplink Packets

This section describes the uplink packets reported by the device.

Basic Information Packet

After joining the network, the device reports a packet containing the basic device information.

Packet description:

Item	Channel	Type	Byte	Description
Power On	ff	0b	1	Device is on
Protocol Version	ff	01	1	Example: 01=V1
Hardware Version	ff	09	2	Example: 03 10 = V3.1
Software Version	ff	0a	2	Example: 03 01 = V3.1
Device Type	ff	0f	1	00: Class A, 01: Class B, 02: Class C, 03: Class C to B
Serial Number	ff	16	8	16 digits
TSL Version	ff	ff	2	Example: 01 00=>V1.0
Reset Event	ff	fe	1	ff, only report when the device resets

Example:

ff0bff ff0101 ffff0401 ff166415a51585070020 ff090100 ff0a0101 ff0f00		
Channel	Type	Value
ff	0b	Power On: ff(Reserved)
ff	01	Protocol Version: 01=>V1
ff	ff	TSL Version: 0401=>V4.1
ff	16	Device SN: 6415a51585070020
ff	09	Hardware Version: 0100 = V1.0
ff	0a	Firmware Version: 0101 = V1.1
ff	0f	Device Type: 00: Class A

Periodically Reported Data Packet

Normally Periodic Data Packet

The device reports a sensor data packet at a configured interval.

Packet description:

Item	Channel	Type	Byte	Description
Battery Level	01	75	1	UINT8, Unit: %
Valve 1	03	01	1	00 = closed, 01 = open
Counter 1 (GPIO1)	04	c8	4	UINT32
Valve 2	05	01	1	00 = closed, 01 = open
Counter 2 (GPIO2)	06	c8	4	UINT32
Digital Input (GPIO1)	07	01	1	00 = closed, 01 = open
Digital Input (GPIO2)	08	01	1	00 = closed, 01 = open
Pressure Value	09	7b	2	UINT16, Unit: Kpa, Range: 0~1600 Kpa  Note: It is available only on AI version.

Examples:

1. The device reports its battery level upon initial network join and subsequently at intervals of 6 hours (UC511) or 12 hours (UC512).

01 75 5a		
Chan- nel	Type	Value
01	75	Battery level: 5a => 90%

2. The device reports a periodically packet at a configured interval (360min by default).

030101 04c84f000000 050100 080100		
Channel	Type	Value
03	01	Valve 1: 01 => Open
04	c8	Pulse counter of GPIO1: 4f 00 00 00 => 00 00 00 4f = 79
05	01	00 => Closed (Valve 2)
08	01	Digital input of GPIO2: 00 => Closed

Historical Periodic Data Report



Important:

This feature is only supported in versions prior to V1.4.

When [data retransmission](#) is triggered, the device will report a historical periodic report a at data retransmission interval.

Packet description:

Channel	Type	Description
20	ce	Data time stamp (4B) + Interface Status (1B) + Pulse Counter (4B)
21	ce	Data time stamp (4B) + Pressure Value (2B)

Channel	Type	Description
		 Note: It is available only on AI version.

Interface Status:

Bit	Description
7-5	000
4	0: valve 1, 1: valve 2
3	1
2	DI status, 0: closed, 1: open
1	Work Mode, 0: Counter, 1: DI
0	Valve Status, 0: closed, 1: open

Examples:

20ce3fa10964009800000020ce3fa109641700000000			
Channel	Type	Time Stamp	Value
20	ce (Historical Data)	3fa10964 => 2023/03/09 17:05:00	00: Valve 1 close 98 00 00 00 => 00 00 00 98 = pulse counter of GPIO1 is 152 17=10111=>Valve 2 open, DI status of GPIO2 is open

Alarm Packet

UC51x series support to report the following several types of alarm packets.

Packet description:

Item	Channel	Type	Byte	Description
Battery Level	01	75	1	UINT8, Unit: %
Valve 1	03	01	1	00 = closed, 01 = open
Counter 1 (GPIO1)	04	c8	4	UINT32
Valve 2	05	01	1	00 = closed, 01 = open
Counter 2 (GPIO2)	06	c8	4	UINT32
Digital In- put (GPIO1)	07	01	1	00 = closed, 01 = open
Digital In- put (GPIO2)	08	01	1	00 = closed, 01 = open
Pressure Alarm	0b	f5	9	Byte 1: Pressure condition • 00: Change • 01: Valve 1 open • 02: Valve 2 open • 03: Valve 1 open or Valve 2 open Byte 2: Threshold condition • 01: Below • 02: Above • 03: Within • 04: Beyond Byte 3-4: Min. threshold value, Unit: kPa, range 0-1600 kPa Byte 5-6: Max. threshold value, Unit: kPa, range 0-1600 kPa Byte 7-8: Pressure value, Unit: kpa, Range: 0~1600kpa Byte 9: Alarm status

Item	Channel	Type	Byte	Description
				• 00: Release • 01: Trigger
Pressure Alarm	b9	7b	1	01 = Collection Error
Custom Alarm Message	ff	12	1-8	ASCII characters

Examples:

1. When the battery level drops to 1%, a battery level alarm is triggered.

01 75 01		
Channel	Type	Value
01	75	Battery level: 01 => 1%

2. When the valve status changes, a valve status alarm is triggered.

030101 04c84f000000		
Channel	Type	Value
03	01	Valve 1: 01 => Open
04	c8	Pulse counter of GPIO1: 4f 00 00 00 => 00 00 00 4f = 79

3. When the pressure value changes, a pressure alarm packet is triggered.

0bf5000300006400110001		
Channel	Type	Value
0b	f5	00=>Change
		03=>Within
		0000=>Min. threshold value=0
		6400=>0064: Max. threshold value=100
		1100=>0011: Pressure=17

0bf5000300006400110001		
Channel	Type	Value
		01=>Alarm triggered

4. Custom alarm message. Add a rule, every time the counter of GPIO2 increases 20, the device will report "alarm" to the network server.

If

Every increase of water volume

Water Volume Counter 2

Threshold(Pulses)

20

Then

Report customized message

Message

alarm

ff12 616c61726d		
Channel	Type	Value
ff	12	Hex to Ascii: 61 6c 61 72 6d=>=alarm

Downlink Commands

Downlink commands can be used for remote control of device through a network server. The downlink port (application port) is 85 by default and can be configured through ToolBox.

For details of downlink commands please refer to the sections below.

Commands for General Setting

The device supports multiple commands for general setting.

Command description:

Item	Channel	Type	Byte	Description
Collect Interval	ff	02	2	UINT16, Unit: s
Report Interval	ff	03	2	UINT16, Unit: s
Reboot	ff	10	1	ff
UTC Time Zone	ff	17	2	INT16/10
Sync with with LNS	ff	4a	1	ff
Enquiry Cur- rent Data	ff	28	1	ff
Auto-confirmed Mechanism	ff	f3	1	00: disable, 01: enable
Response Time of Class A	ff	1e	4	UINT32, unit: s, range: 0-64800s

Example:

1. Reboot the device.

ff10ff

2. Set report interval as 20 minutes.

ff03b004		
Channel	Type	Value
ff	03	b004=>04b0=1200s=20 minutes

3. Set the time zone as UTC-2.

ff17ecff		
Channel	Type	Value
ff	17	ecff=>ff ec=-20/10=-2

Related information[Configure General Parameters](#)

Commands for Work Mode Switching

The device supports command for timed switching of the LoRaWAN[®] work mode. This feature is suitable for water-saving system demonstration or device debugging.

Command description:

Channel	Type	Byte	Description
f9	a4	8	Byte 1-4: start time, timestamp, unit: s Byte 5-6: duration, Unit: min, range: 1-1440 Byte 7: • 00: Class A • 01: Class B • 02: Class C • 03: Class C to B • ff: cancel Byte 8: 00  Note: If the duration is not specified or the start time is earlier than the current time, it will be treated as an immediate start.

Reply:

Channel	Type	Byte	Description
f8	4a	9	Byte 1-8: same as issued Byte 9: • 00: success • 01: invalid parameter

Channel	Type	Byte	Description
			• 02: start time is before the year 2000 and the time-stamp is not zero, invalid • 16: duration is 0, the device does not support • 17: duration is greater the maximum allowed • 18: instruction expired

Example:

Starting from 2025-07-05 09:00:00, switches the working mode to Class C mode for a duration of 10 minutes.

f9a4 10796868 0a000200		
Channel	Type	Value
f9	a4	10796868 => 2025-07-05 09:00:00 0a 00 => 000a=10 mins 02: Class C

Reply:

f9a4 10796868 0a000200 00		
Channel	Type	Value
f8	a4	10796868 => 2025-07-05 09:00:00 0a 00 => 000a=10 mins 02: Class C 00: success

Related information

[Configure General Parameters](#)

Commands for Valve Setting

The device supports command for valve setting.

Valve Control

This section describes how to control the valve.

Basic format 1 is used for time and flow control:

Channel	Type	Control Field (1B)	Sequence (1B)	Time Control (Option, 3B)	Flow Control (Option, 4B)
ff	1d	See Control format	Range: 1-255	Unit: s	Pulse counter

Control format:

Bit	Description
7	0: Disable time control, 1: Enable time control
6	0: Disable flow control, 1: Enable flow control
5	0: Valve close, 1: Valve open
4-2	000
1-0	00: Valve 1, 01: Valve 2

Basic format 2 is used for special control during rainy days:

Channel	Type	Control Field (1B)	Sequence (1B)	Time Control (Option, 3B)	Start Time (Option, 4B)
ff	1d	See Control format	Range: 1-255	Unit: min, Range: 0-1440	Timestamp, unit: s

Control format:

Bit	Description
7	0
6	0
5	0: Valve close, 1: Valve open

Bit	Description
4-3	10: Enable rain special control , 01: Disable rain special control
2-0	000: Valve1, 001: Valve 2, 111: All valve


Note:

1. If you set the sequence as 01 to ff, the sequence number should be incremented each time it is used in one command sent to devices. For example, if you use command ff 1d 20 01 (sequence 01) to control the valve successfully, the next command should be ff 1d 20 02 (sequence 02). An incorrect sequence number will cause the command to be invalid.
2. If the sequence is up to ff (255), please restart the sequence from 01.
3. If the control command take effects, the device will report the status packet of corresponding interface; if control fails, the device will not report the packet.

Examples:

1. Open the valve 2 for 60s.

ff1d a1 02 3c0000				
Channel	Type	Control Field	Sequence	Time Control
ff	1d	a1 => 1010 0001 Bit 7: 1 => enable time control Bit 5: 1 => valve open Bit 0-2: 001 => valve 2	02	3c 00 00=>00 00 3c=60s

2. Open the valve 1 until the 60s passes or pulse counter 1 increases 16 pulses.

ff1d e0 04 3c0000 10000000					
Channel	Type	Control Field	Se- quence	Time Control	Flow Control
ff	1d	e0 => 1110 0000 Bit 7: 1 => en- able time control Bit 6: 1 => en- able flow control Bit 5: 1 => valve open Bit 0-2: 000 => valve 1	04	3c 00 00=>00 00 3c=60s	10 00 00 00 => 00 00 00 10 = 16

3. Cancel the local rules scheduled by the device from 2025-10-23 10:50 to 2025-10-23 10:56.

ff1d 17 00 060000 d897f968					
Channel	Type	Control Field	Sequence	Time Control	Start Time
ff	1d	17=>0001 0111 Bit 5: 0 => valve close Bit 4-3: 10 => en- able rain spe- cial control Bit 2-0: 111= all valve	00	06 00 00=>00 00 06=6 mins	d8 97 f9 68=> 2025-10-23 10:50

Related information

[Control the Solenoid Valve](#)

Enquire the Valve Status

Enquire format:

Channel	Type	Byte	Description
f9	a5	1	00: valve1, 01: valve2

Reply format:

Item	Channel	Type	Byte	Description
Enquire Result	f8	a5	2	Byte 1: • 00: valve1 • 01: valve2 Byte 0: • 00: success • 01: invalid parameter • 02: valve index out of range
Valve1 Task	0e	af	3	Byte 1: • 00: free • 01: local rule • 02: local rule with the highest execution priority • 03: rain special control • 04: time or flow control Byte 2: • 00 = valve closed • 01 = valve open Byte 3: • 00 = command on • 01 = command off
Valve2 Task	0f	af	3	Byte 1:

Item	Channel	Type	Byte	Description
				• 00: free • 01: local rule • 02: local rule with the highest execution priority • 03: rain special control • 04: time or flow control Byte 2: • 00 = valve closed • 01 = valve open Byte 3: • 00 = command on • 01 = command off

Example:

Query the valve 1 task status.

f9 a5 00		
Channel	Type	Value
f9	a5	00: valve 1

Reply: Query success, the valve is under rain special control, valve 1 is closed, and the command is off.

f8 a5 00 00		
Channel	Type	Value
f8	a5	00: valve1
		00: success

0e af 0300000		
Channel	Type	Value
0e	af	03: rain special control 00: valve1 close 00: command off

Commands for GPIO Setting

The device supports multiple commands for GPIO setting.

Command description:

Item	Channel	Type	Byte	Description
Counter Reset	ff	4e	2	GPIO 1 Counter: 0100, GPIO 2 Counter: 0200
Initial Value of Counter	ff	92	5	Byte 1: GPIO1=01, GPIO2=02 Byte 2-5: Initial Value, UINT32
Prevent Jitter Delay Time	ff	46	1	UINT8, unit:s
Pulse Filter	ff	52	4	Byte 1-2: 0002 Byte 3-4: Filter Time, UINT16, unit: ms

Examples:

1. Reset the counting value of GPIO1 when it works as pulse counter.

ff4e0100		
Channel	Type	Value
ff	4e	0100: counter 1

2. Set the initial counting value of GPIO2 when it works as pulse counter.

ff920210000000		
Channel	Type	Value
ff	92	02=GPIO2 10 00 00 00=> 00 00 00 10=16

Related information

[Configure the GPIO Interface Parameters](#)

Commands for Pressure Interface Setting

The device supports command for pressure collection setting.

Command description:

Item	Channel	Type	Byte	Description
Pressure Collection	f9	a8	7	Byte 1: 01=Valve 1, 02=Valve 2 Byte 2: 00 = Collection disabled, 01 = Collection enabled Byte 3-4: Collection interval during non-irrigation, unit: s, range: 10-64800 Byte 5-6: Collection interval during irrigation, unit: s, range: 10-64800 Byte 7: Time delay for first collection after valve is opened, unit: min, range: 0-60
Pressure Calibration	ff	ab	3	Byte 1: 00=disable, 02=enable Byte 2-3: INT16, calibration value, unit: kPa

Examples:

1. Enable the pressure collection function for Valve 1 and set the collection interval to 10 seconds during irrigation, 60 seconds during non-irrigation periods. The time delay for first collection after valve is opened is set to 5 minutes.

f9a801013c000a0005		
Channel	Type	Value
f9	a8	0101= Valve 1 collection enabled Collection interval during non-irrigation: 3c00 => 003c = 60s Collection interval during irrigation: 0a00 => 000a = 10s Time delay: 05 = 5 min

2. Enable the pressure calibration function, with a calibration value of +1 kPa.

ffab010100		
Channel	Type	Value
ff	ab	01=enable Calibration value: 0100=>0001=1 kPa

Related information

[Configure the Pressure Interface Parameters \(AI Version Only\)](#)

Commands for D2D Setting

The device supports multiple commands for D2D setting. About the D2D rule setting please refer to Rule Settings.

Command description:

Item	Channel	Type	Byte	Description
D2D Key	ff	35	8	The first 16 digits of D2D key, and the last 16 digits are fixed as 0.
D2D Feature	ff	84	1	00: Disable, 01: Enable

Example:

Set Mulesight D2D key as 12345678123456780000000000000000.

ff35 1234567812345678 0000000000000000		
Channel	Type	Value
ff	35	12 34 56 78 12 34 56 78 00 00 00 00 00 00 00 00

Related information

[Configure Mulesight D2D Parameters \(UC511 Only\)](#)

Commands for Rule Setting

The device supports setting schedule plan to open or close valves at specific time.

Set the Rule

Basic format:

Channel	Type	Rule ID	Enable	Control Field (13B) + Action Field (13B)
ff	55	01~10(1~16)	00: disable 01: enable	Optional: Time , Receive D2D command , Water Volume , Every increase of water volume

**Note:**

1. D2D rule has higher execute priority than types of rules.
2. When the device has multiple rules that are conflicted, the device will execute the rule with front number ID in priority.

Condition: Time**Condition Field:**

Byte	Description
1	01
2-5	Start Time Stamps

Byte	Description												
6-9	End Time Stamps												
10	Is Loop, 00: disable, 01: enable												
11	Loop Period, 00=month, 01=day, 02=week												
12-13	Month/day /week interval												
	If loop period is week, Byte 12 : Repeat weekday, per bit 0=Disable, 1=Enable												
	<table><tr><th>Bit</th><th>7</th><th>6</th><th>5</th><th>...</th><th>0</th></tr><tr><td></td><td>0</td><td>Sun.</td><td>Sat.</td><td>...</td><td>Mon.</td></tr></table>	Bit	7	6	5	...	0		0	Sun.	Sat.	...	Mon.
	Bit	7	6	5	...	0							
	0	Sun.	Sat.	...	Mon.								

Action Field:

Byte	Description
1	02
2	01: valve 1 02: valve 2
3	00: close 01: open
4	Time Control, 00: disable 01: enable
5-8	Duration (s)
9	Flow Control, 00: disable 01: enable
10-13	Water Volume (Pulse)

Example:

During the time range 2024-3-1 0:00 to 2024-9-1 0:00, open the valve 1 at 0:00 for 5 minutes every 2 days.

If

Time

2024/03/01 00:00 — 2024/09/01 00:00

Then

Valve1

Open

Duration(min)

5

Is Loop ☒

Loop Period

2

Day

ff55 0101 0100aae065003ed36601010200 020101012c0100000000000000					
Channel	Type	Rule ID	Enable	Condition Field	Action Field
ff	55	01	01=enable	Start time: 00aae065=>65e0aa00 = 1709222400 =2024/03/01 00:00:00 End time: 003ed366=>66d33e 00=1725120000=2024/ 0 9/01 00:00:00 01=enable loop, loop period: 01=day 02 00=>00 02=2 days	0101= valve 1 open 01=time con- trol enable 2c 01 00 00=>00 00 01 2c=300s=5 minutes

Condition: Receive D2D command

Condition Field:

Byte	Description
1	02
2-3	D2D Command
4-13	00....00

Action Field:

Byte	Description
1	01
2	01: valve 1 02: valve 2
3	00: close 01: open
4	Time Control, 00: disable 01: enable
5-8	Duration (s)
9	Flow Control, 00: disable 01: enable
10-13	Water Volume (Pulse)

Example:

When the device receives Milesight D2D command 0001, it can open solenoid valve2 for 5 minutes.

If

D2D

0001

Then

Valve2

Open

Duration(min)

5

ff55 0a01 020100000000000000000000 010201012c0100000000000000					
Channel	Type	Rule ID	Enable	Condition Field	Action Field
ff	55	0a=>10	01=enable	0100=>00 01 D2D command is 0001	02=valve 2, 01=open 01=time control enable 2c 01 00 00=>00 00 01 2c=300s=5 minutes

Condition: Water Volume

Condition Field:

Byte	Description
1	03
2	01: GPIO1 02: GPIO2
3-4	Period (min)
5-8	Threshold (Pulses)
9-13	00....00

Action Field:

When the action is "Report Interface Status":

Byte	Description
1	03
2	01: Report Interface 1 Status, 02: Report Interface 2 Status
3-13	00...00

When the action is "Custom message content":

Byte	Description
1	03
2	03
3-10	Custom message content

Byte	Description
11-13	000000

Example:

When the GPIO2 detects 20 pulses within 2 minutes, the device will report a alarm packet to network server.

If

Water Volume

Water Volume Counter 2

Period(min)
2

Threshold(Pulses)
20

Then

Report counter value and valve status

ff55 0500 03020200 140000000000000000 0303616c61726d00000000000000					
Channel	Type	Rule ID	Enable	Condition Field	Action Field
ff	55	05=>5	00=disable	02=GPIO2, 0200=>00 02=2 minutes, 14 00 00 00=>00 00 00 14=20 pulses	Send message: 61 6c 61 72 6d=> 97 108 97 114 109=alarm (hex to ascii)

Condition: Every increase of water volume

Condition Field:

Byte	Description
1	03
2	01: GPIO1 02: GPIO2
3-6	Threshold (Pulses)
7-13	00....00

Action Field:

When the action is "Report Interface Status":

Byte	Description
1	03
2	01: Report Interface 1 Status, 02: Report Interface 2 Status
3-13	00...00

When the action is "Custom message content":

Byte	Description
1	03
2	03
3-10	Custom message content
11-13	000000

Example:

Every time the counter of GPIO2 increases 20, the device will report a custom message to the network server.

If

Every increase of water volume

Water Volume Counter 2

Threshold(Pulses)

20

Then

Report customized message

Message

alarm

ff55 0600 0402140000000000000000000000 0303616c61726d00000000000000					
Channel	Type	Rule ID	Enable	Condition Field	Action Field
ff	55	06=>6	00=disable	02=GPIO2 1c 00 00 00=>00 00 00 14=20 pulses	Send message: 61 6c 61 72 6d=> 97 108 97 114 109=alarm (hex to ascii)

Related information

[Configure the Rule Engine](#)

Enquire the Rule Content

Enquire format:

Channel	Type	Value
ff	53	Rule ID (range: 1-16)

Reply format:

Channel	Type	Rule ID	Enable	Condition Field	Action Field
fe	53	01~10 (1~16)	00: disable 01: enable	See Set the Rule	See Set the Rule

Example: Check rule 10 content.

ff530a		
Channel	Type	Value
ff	53	0a = rule 10

Reply:

fe53 0a01 020100000000000000000000 010201012c0100000000000000					
Channel	Type	Rule ID	Enable	Condition Field	Action Field
fe	53	0a = rule 10	01: enable	0100=>00 01 D2D com- mand is 0001	02=valve 2, 01=open 01=time con- trol enable 2c 01 00 00=>00 00 01 2c=300s=5 minutes

Enquire and Set the Rule Status

The device supports multiple commands for enquiring or setting the rule status. When the device has multiple schedule plan settings that are conflicted, the device will only execute one plan whose item number is largest.

Basic format 1:

Channel	Type	Command	Value
ff	4b	00: get rule status 01: set rule status 02: delete rule	2 Bytes (16 bits), every bit indicate one rule 1: enable ; 0: disable or delete

Basic format 2:

Channel	Type	Command	Rule ID	Enable
ff	4b	03: set one rule status 04: delete rule plan	01~10(1~16)	01: enable 00: disable or delete

Examples:

1. Check rule enable or disable status.

ff4b000000			
Channel	Type	Command	Value
ff	4b	00: get rule status	0000

Reply:

fe4b000200			
Channel	Type	Command	Value
fe	4b	00: get rule status	02 00 => 00 02 = 0000 0000 0000 0010 => Only rule 2 is enabled, other are disabled or do not have content

2. Set rule 2 as enable and others as disabled.

Type 1:

ff4b010200			
Channel	Type	Command	Value
ff	4b	01: set rule status	02 00 => 00 02 = 0000 0000 0000 0010 => Rule 2 are enabled and other are disabled

Type 2:

ff4b030201				
Channel	Type	Command	Number	Value
ff	4b	03: set one rule status	02	01 = enabled

3. Delete rule 10.

Type 1:

ff4b02fffd				
Channel	Type	Command	Value	
ff	4b	02: delete rule	ff fd => fd ff = 1111 1101 1111 1111 => Delete plan 10	

Type 2:

ff4b030201				
Channel	Type	Command	Number	Value
ff	4b	04: delete rule	0a = 10	00 = deleted

Commands for Historical Data Query



Important:

This feature is only supported in versions prior to V1.4.

The device can query historical data for a specified time point or range through downlink commands. The specified time point can use [Unix Timestamp Converter](#) to calculate. The prerequisites are that the device time is correct and the **data storage function** is enabled. The device uploads a maximum of 300 data records per range query.

When querying data for a specific time point, the device uploads the record closest to the requested time within the current reporting interval. For example, with a 10-minute reporting interval, a query for 17:00 will return the exact record if it exists. Otherwise, the device searches for data within a tolerance of ± 10 minutes (16:50 to 17:10) and uploads the record closest to 17:00.

Command description:

Item	Byte	Command	Description
Query data for a specified time point	fd	6b	4 Bytes, Unix timestamp
Query data for a specified time range	fd	6c	Start time (4 bytes) + end time (4 bytes), Unix timestamp
Stop data query report	fd	6d	ff
Report interval	ff	6a	3 bytes Byte 1: 01 Byte 2-3: interval time, unit:s, range: 30-1200 s, default: 60s

Reply format:

Channel	Type	Description
fc	6b/6c	00: data query success 01: invalid time point or time range 02: no data for this time point or time range
20	ce	Data time stamp (4B) + Interface Status (1B) + Pulse Counter (4B)
21	ce	Data time stamp (4B) + Pressure Value (2B)  Note: It is available only on AI version.

Interface Status:

Bit	Description
7-5	000
4	0: valve 1, 1: valve 2

Bit	Description
3	1
2	DI status, 0: closed, 1: open
1	Work Mode, 0: Counter, 1: DI
0	Valve Status, 0: closed, 1: open

Example:

fd6c 10a00964 90a20964		
Channel	Type	Value
fd	6c (Enquire data in time range)	Start time: 10a00964 => 6409a010 = 1678352400 =2023/03/09 17:00:00 End time: 90a20964 => 6409a290 = 1678353040 =2023/03/09 17:10:40

Reply:

fc6c00		
Channel	Type	Value
fc	6c (Enquire data in time range)	00: data enquiry success

20ce3fa10964009800000020ce3fa109641700000000			
Channel	Type	Time Stamp	Value
20	ce (Historical Data)	3fa10964 => 2023/03/09 17:05:00	00: Valve 1 close 98 00 00 00 => 00 00 00 98 = pulse counter of GPIO1 is 152 17=10111=>Valve 2 open, DI status of GPIO2 is open

Related information

[Configure Data Storage & Retransmission](#)

Chapter 7. Services

Milesight provides customers with timely and comprehensive technical support services. End-users can contact their local dealer to obtain technical support. Distributors and resellers can contact Milesight directly for technical support.

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