IoT Controller

Featuring LoRaWAN®

UC100

User Guide

Safety Precautions

Milesight will not shoulder responsibility for any loss or damage resulting from not following the instructions of this operating guide.

- The device must not be remodeled in any way.
- Do not place the device close to objects with naked flames.
- Do not place the device where the temperature is below/above the operating range.
- Power off the device when installing or wiring.
- Make sure electronic components do not drop out of the enclosure while opening.
- The device must never be subjected to shocks or impacts.

Declaration of Conformity

UC100 is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.

FCC Statement:

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator& your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

For assistance, please contact

Milesight technical support:

Email: iot.support@milesight.com

Tel: 86-592-5085280

Fax: 86-592-5023065

Address: Building C09, Software Park III, Xiamen 361024, China

Revision History

Date	Doc Version	Description
May 27, 2022	V 1.0	Initial version

Contents

1. Product Introduction

1.1 Overview

UC100 is an IoT controller used for remote control and data acquisition from Modbus RS485 devices via LoRaWAN® networks. It can read up to 16 Modbus RTU devices and support Modbus transparent transmission between server and RS485 devices as a Modbus to LoRaWAN® converter. Besides, UC100 supports multiple trigger conditions and actions which can work autonomously even when the network drops.

1.2 Features

- Easy to connect with diverse wired sensors through RS485 interfaces
- Support LoRaWAN® wireless communication
- Multiple triggering conditions and actions
- Embedded watchdog for work stability
- Industrial metal case design with a wide operating temperature range
- Compliant with standard LoRaWAN® gateways and network servers
- Quick and easy management with Milesight IoT Cloud solution

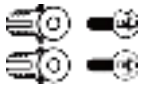
2. Hardware Introduction

2.1 Packing List

1 × UC100 Device

1 × Type-C Cable & Power Adapter

1 × Terminal Block

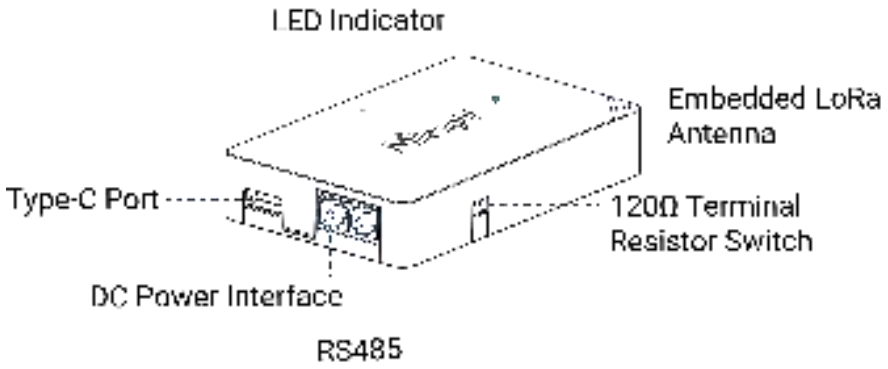


2 × Wall Mounting Kits

1 × Quick Guide

If any of the above items are missing or damaged, please contact your sales representative.

2.2 Hardware Overview

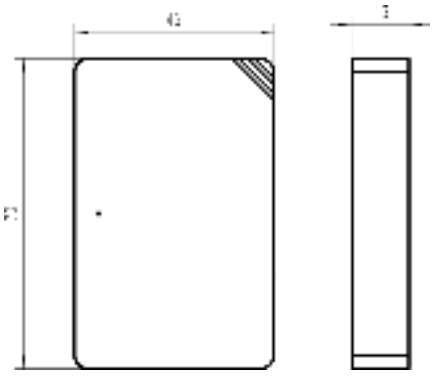


2.3 LED Patterns and Reset Button

The reset button is inside the device.

Device Status	LED Status
System is functioning properly	Static On
Reboot: hold the reset button inside the device for more than 3 seconds	Static On → Slowly Blinks
Reset to factory default: hold the reset button inside the device for more than 10 seconds	Static On → Quickly Blinks
Fail to acquire data from data interfaces	Slowly Blinks
Device upgrade or system error	Static On

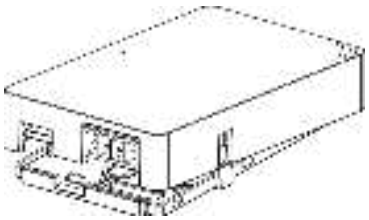
2.4 Dimensions (mm)



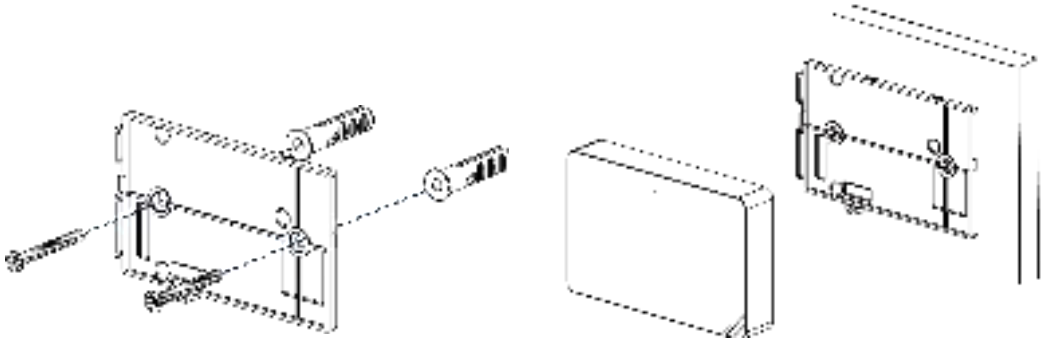
3. Device Installation

UC100 device can be placed on a desktop or mounted to a wall.

1. Take off the back cover of UC100 device, and fix the wall plugs into the wall according to the drilling position as referred.



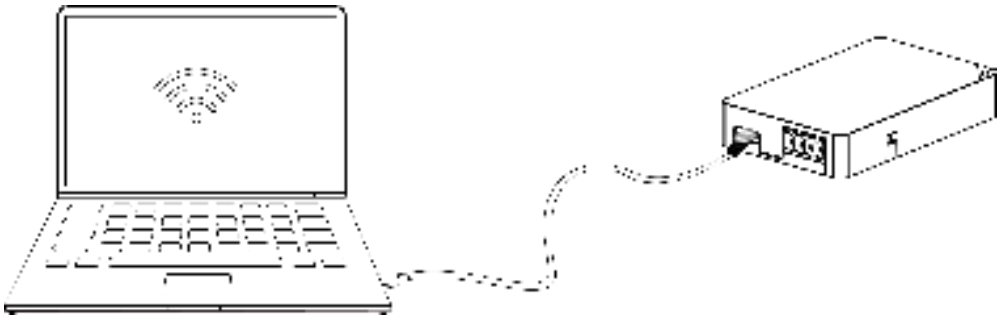
2. Screw the cover on the mounting positions and install back the device.



4. Operation Guide

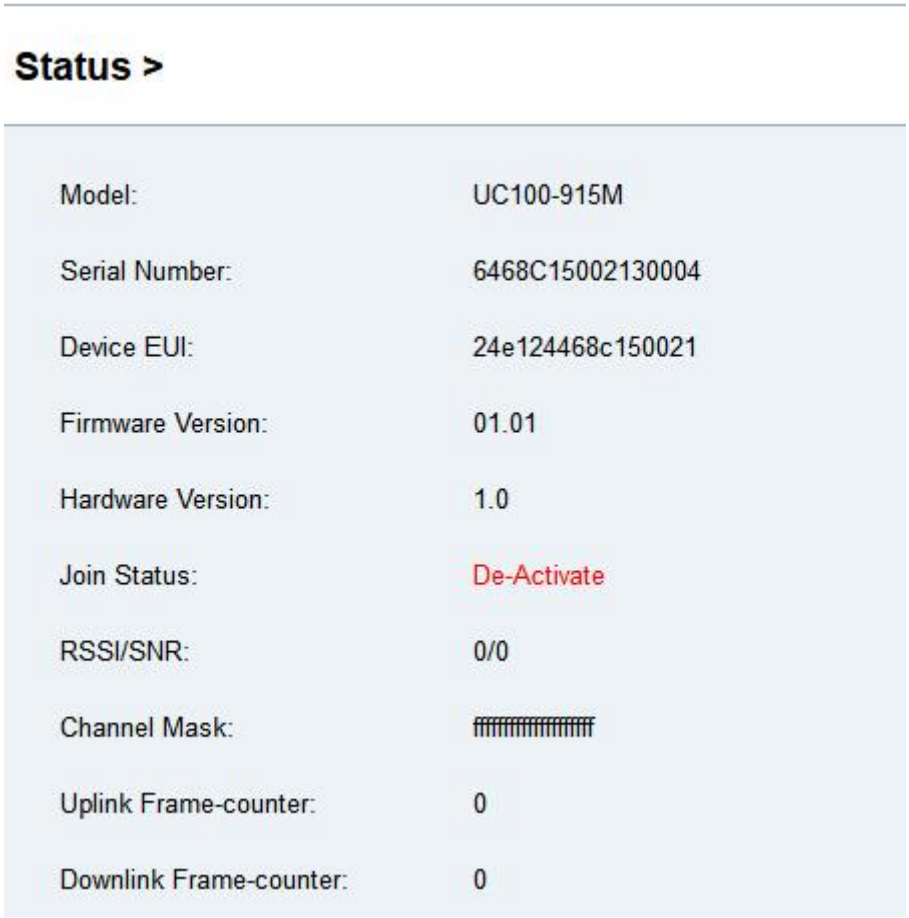
4.1 Log in the ToolBox

1. Download ToolBox software from Milesight IoT website.
2. Power on the UC100 device, then connect it to computer via the type-C port.



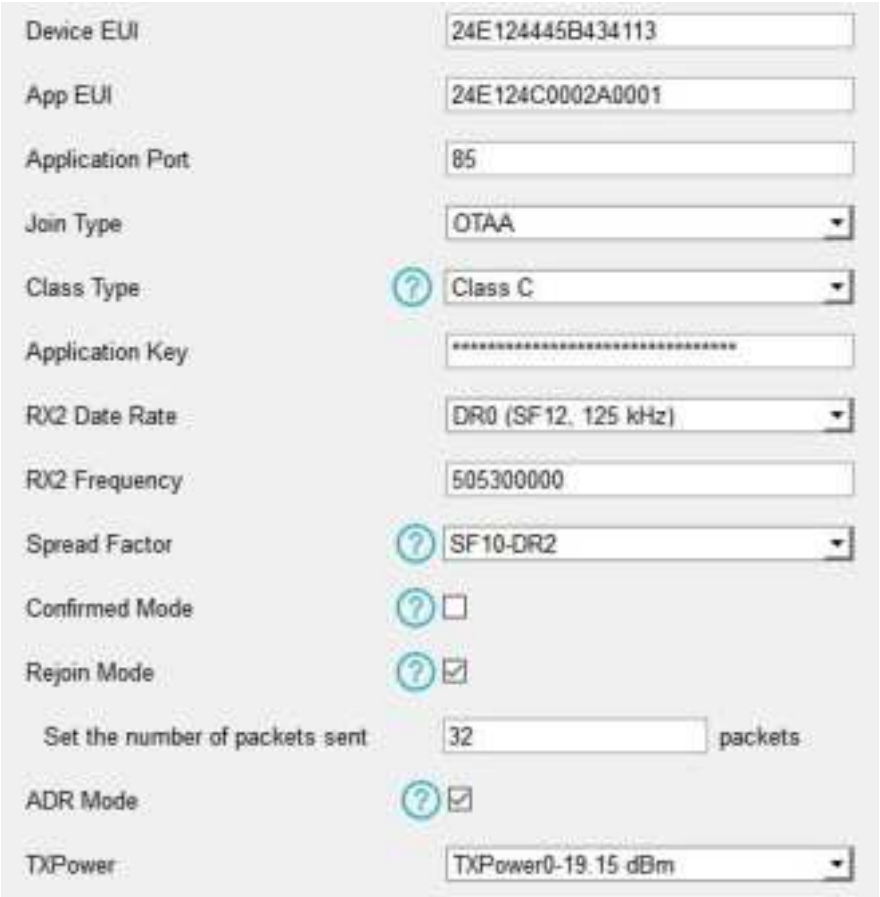
3. Open the ToolBox and select type as “General”, then click password to log in ToolBox. (Default password: **123456**)

4. After logging in the ToolBox, you can change device settings.



4.2 LoRaWAN Settings

Go to "**LoRaWAN Settings -> Basic**" 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 on the label.
App EUI	Default App EUI is 24E124C0002A0001.
Application Port	The port is used for sending and receiving data, the default port is 85.
Working Mode	Fixed as Class C.
Join Type	OTAA and ABP modes 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.

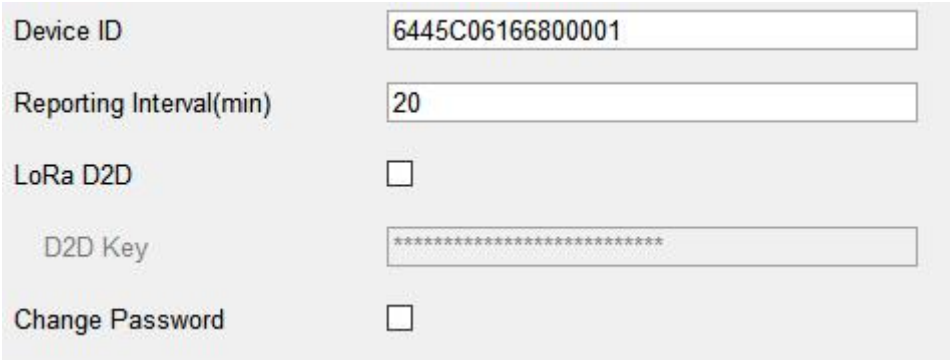
Rejoin Mode	Reporting interval ≤ 30 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every 30 mins to validate connectivity; If there is no response, the device will re-join the network. Reporting interval > 30 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval 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 the network server to adjust datarate of the device.
Tx Power	Transmit power of 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 purchasing.
3) Select OTAA mode if you use Milesight IoT Cloud to manage devices.
4) Only OTAA mode supports rejoin mode.

4.3 General Settings

4.3.1 Basic Settings

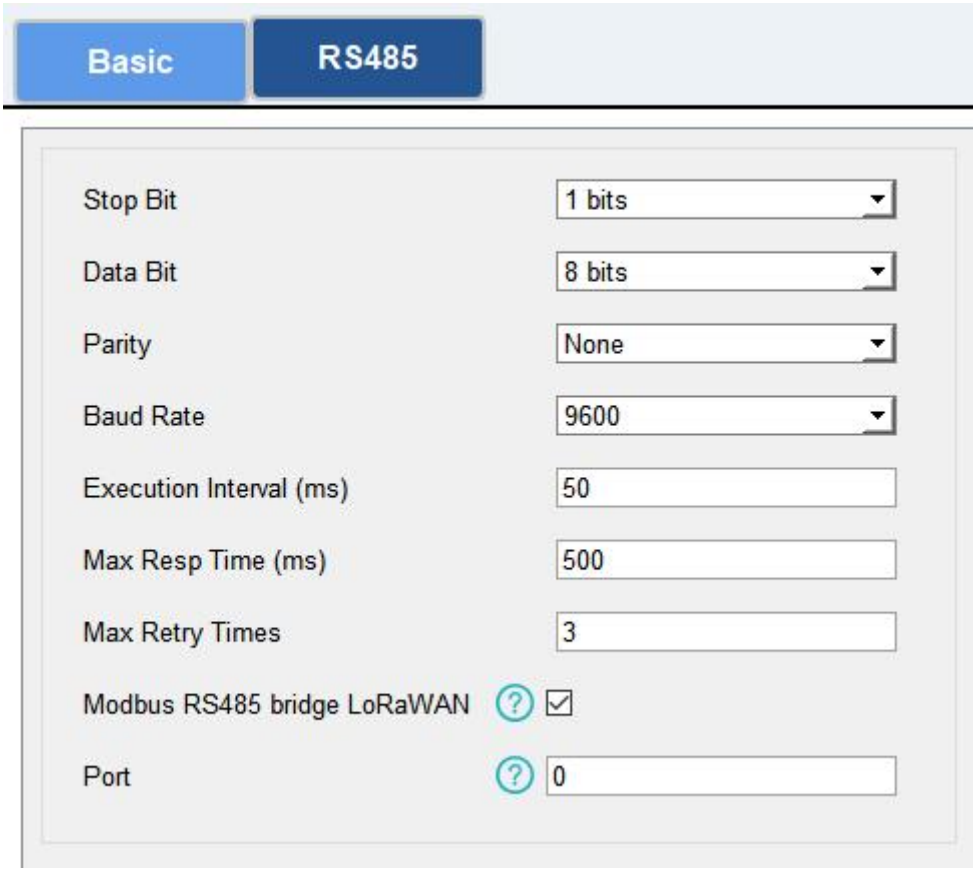


Parameters	Description
Device ID	Show the SN of the device.
Reporting Interval	Reporting interval of transmitting data to the network server. Range: 1-1080 mins, default: 20 mins
LoRa D2D	See details on chapter 4.5.
Change Password	Change the password to log in ToolBox.

4.3.2 RS485 Settings

UC100 has one RS485 port for Modbus RTU device connection.

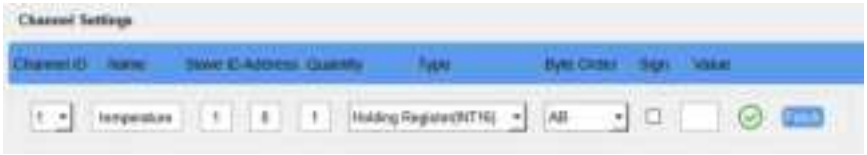
1. Connect RS485 device to RS485 port.
2. Go to "**General -> RS485**" to enable RS485 and configure serial port settings. Serial port settings should be the same as the RS485 terminal devices.



Parameters	Description
Stop Bit	1 bit/2 bit are available.
Data Bit	8 bit is available.
Parity	None, Odd and Oven are available.
Baud Rate	1200/2400/4800/9600/19200/38400/57600/115200 are available.
Execution Interval (ms)	The execution interval between each Modbus channel command.
Max Resp Time (ms)	The maximum response time that the UC100 waits for the reply to the command. If it does not get a response after the max response time, it is determined that the command has timed out.
Max Retry Time (ms)	Set the maximum retry times after the device fails to read data from RS485 terminal devices.

Modbus RS485 bridge LoRaWAN	If this mode is enabled, the device will transmit Modbus RTU commands from the network server to RS485 terminal devices transparently and send Modbus reply originally back to the network server. **Port:** Select from 2-84, 86-223.

3. Click ⊕ to add Modbus channels, then save configurations.

Parameters	Description
Channel ID	Select the channel ID you want to configure from 16 channels.
Name	Customize the name to identify every Modbus channel.
Slave ID	Set Modbus slave ID of a terminal device.
Address	The starting address for reading.
Quantity	Set read how many digits from starting address, it fixes to 1.
Type	Select the data type of Modbus channels.
Byte Order	Set the Modbus data reading order if you configure the type as Input register or holding register. INT32/Float: ABCD, CDBA, BADC, DCBA INT16: AB, BA
Sign	The tick indicates that the value has a plus or minus sign.
Fetch	After clicking, UC100 will send Modbus read command to test if it can read correct values. **Example:** as this setting, the device will send command: 01 03 00 00 00 01 84 0A 

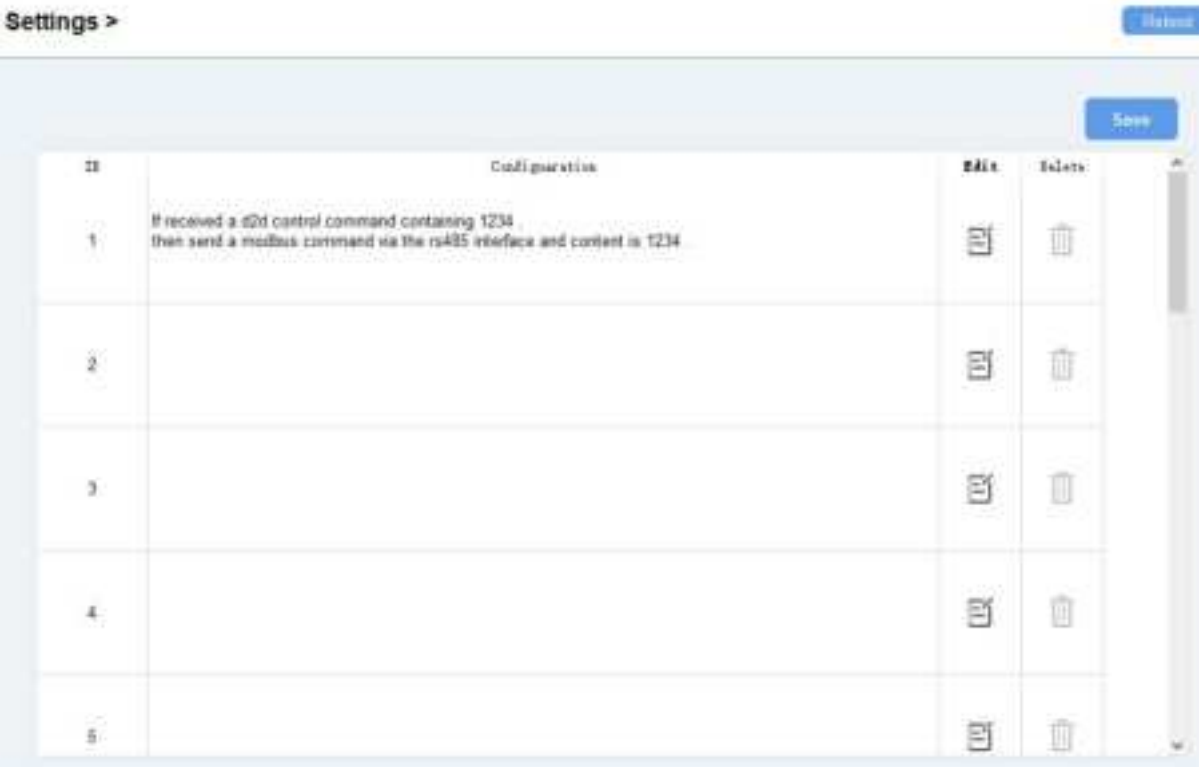
4. Click “Fetch” to check if UC100 can read correct data from terminal devices.

Note: Do not click “Fetch” frequently since the response time to reply is differ for every terminal device.

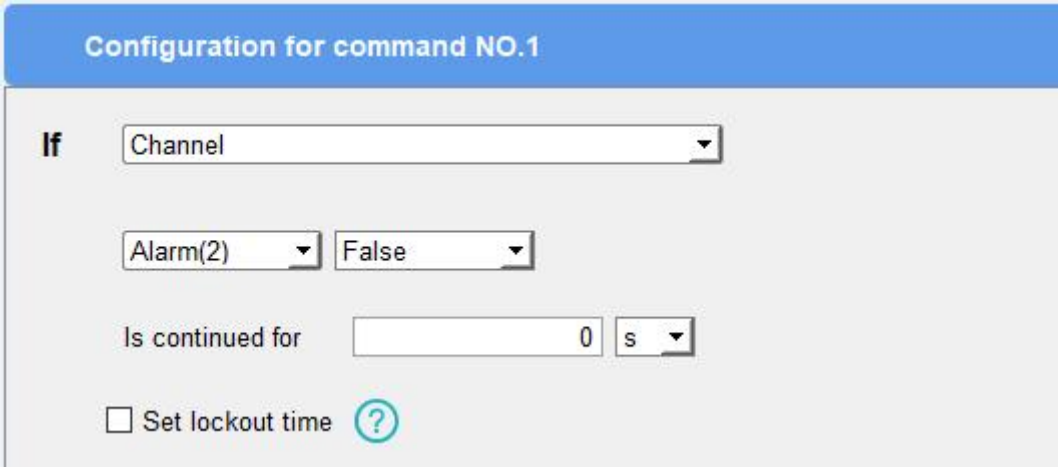
4.4 IF-THEN Command

UC100 supports configuring locally IF-THEN commands to do some actions automatically even without a network connection. One device can be added 16 commands at most.

1. Go to “Command” page, and click “Edit” to add commands.



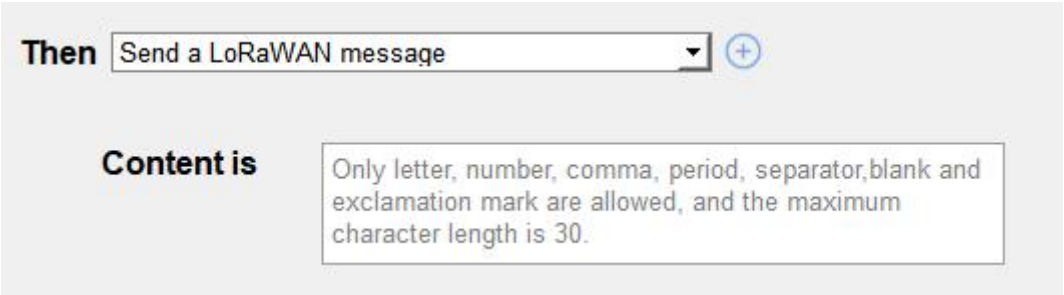
2. Set an IF condition based on the terminal device data or UC100 device status.



Condition	Description
Channel	When UC100 device gets certain response (False, True, Above, Below, Within) in certain RS485 channel (Channel Name + Channel ID), this command is

	triggered. **Is continued for**: the updated value should last for some time that is longer than a sole reporting interval. **Set lockout time:** after the lockout time, UC100 will check if the latest RS485 response matches the condition still. 0 means this IF condition will only be detected once.
Received a D2D control command	This only works with the LoRa D2D feature enabled. See details on chapter 4.5.

3. Set THEN action according to your request. You can add at most 3 actions in one command.

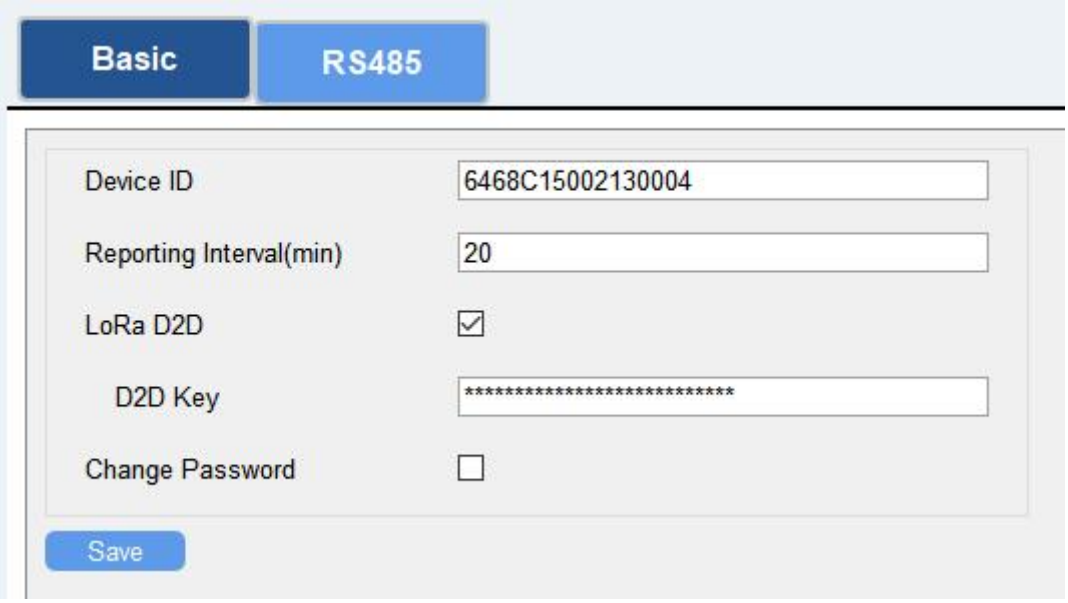


Action	Description
Send a LoRaWAN message	Send a custom message to the network server.
Restart the Device	Reboot the device.
Send a D2D control command	This only works with LoRa D2D feature enabled. See details on chapter 4.5.
Send a Modbus command via the RS485 interface	This only works with LoRa D2D feature enabled. See details on chapter 4.5.

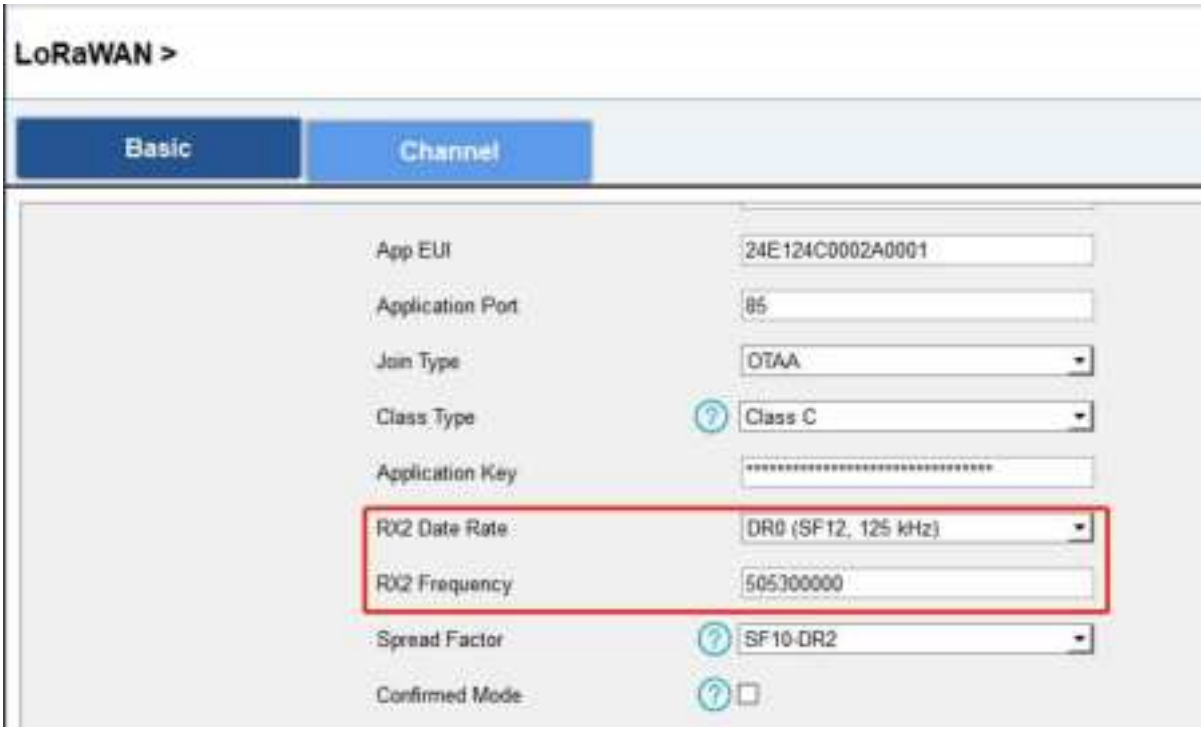
4.5 LoRa D2D Settings

LoRa D2D protocol is developed by Milesight and used for setting up transmission among Milesight devices without a gateway. When the LoRa D2D setting is enabled, UC100 can work as a LoRa D2D controller to send control commands to other devices or work as a LoRa D2D agent to receive commands to trigger a reboot or message to the network server.

1. Go to "**General -> Basic**" page, enable LoRa D2D feature, and define a unique LoRa D 2D key which is the same as LoRa D2D controller or agent devices. (Default LoRa D2D Key: 5572404C696E6B4C6F52613230313823)

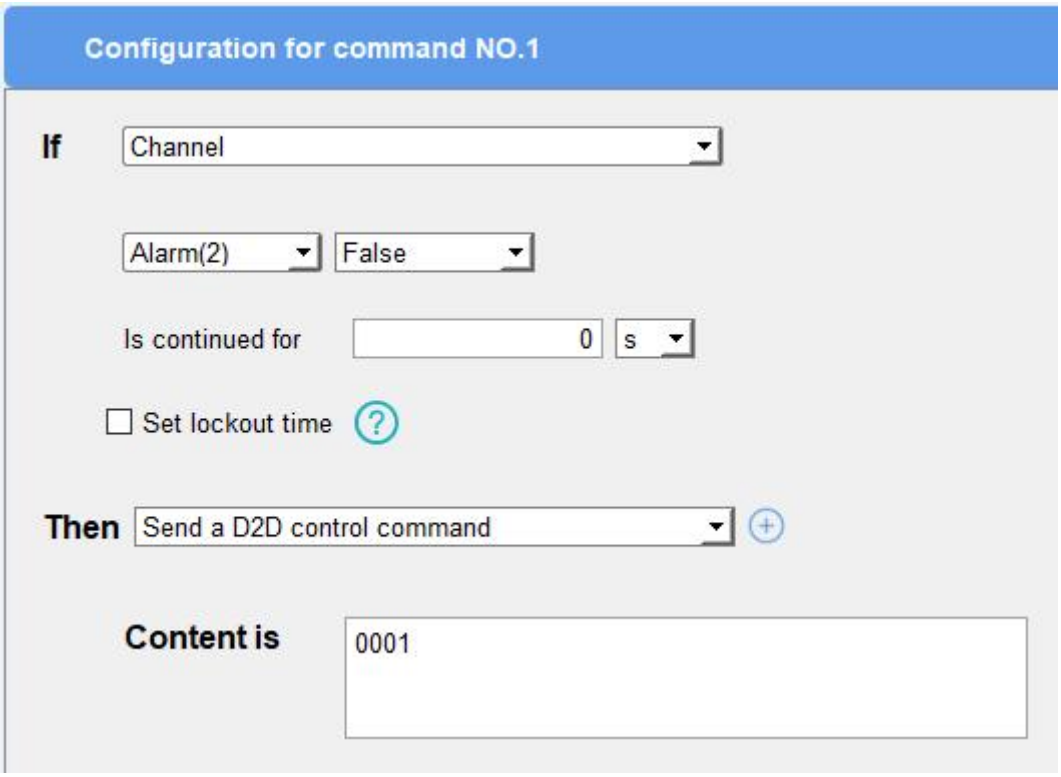


2. Go to "**LoRaWAN Settings -> Basic**" to configure the RX2 datarate and RX2 frequency. When UC100 works as LoRa D2D controller, it will send commands as RX2 settings.

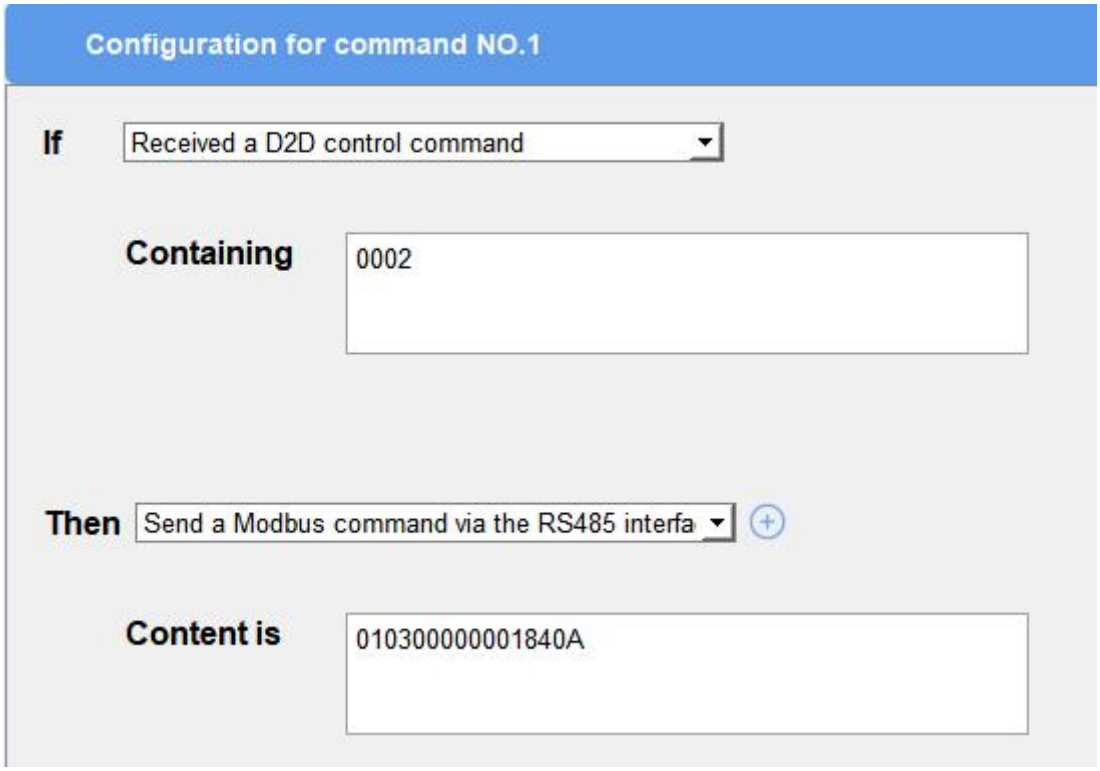


3. Go to "Command" page to set corresponding operations.

When the RS485 channel triggers, UC100 can work as LoRa D2D controller to send a control command to control the LoRa D2D agent device. The command should be a 2-byte hexadecimal number.



When UC100 receives a LoRa D2D command, it can work as a LoRa D2D agent to reboot the device or send Modbus command to RS485 terminal devices.



4.6 Maintenance

4.6.1 Upgrade

UC100 supports upgrade firmware locally via ToolBox software.

1. Download firmware from www.milesight-iot.com to your PC.

2. Go to **"Maintenance -> Upgrade"**, 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.

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

4.6.2 Backup

UC100 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.

1. Go to **"Maintenance -> Backup and Reset"**, and click "Export" to save the current configuration as json format backup file.

2. Click "Browse" to select the backup file, then click "Import" to import the configurations.

4.6.3 Reset to Factory Default

Please select one of following methods to reset device:

Via Hardware: Open the case of UC100, and hold the reset button for more than 10s until the LED blinks.

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

5. Device Payload

All data are based on the following format (HEX):

Channel1	Type1	Data1	Channel2	Type2	Data2	Channel 3	...
1 Byte	1 Byte	N Bytes	1 Byte	1 Byte	M Bytes	1 Byte	...

Among them, Data field are shown as little endian. For decoder examples, you can find them at https://github.com/Milesight-IoT/SensorDecoders.

5.1 Device Information

UC100 reports basic device information of device every time joining the network.

Channel	Type	Data Size/Byte	Description
ff	01 (Protocol Version)	1	01 => V1
	09 (Hardware Version)	2	01 20 => V1.2
	0a (Software Version)	2	01 01 => V1.1
	0b (Power event)	1	ff => powered on
	16 (Device SN)	8	64 45 B4 34 11 30 00 01 => SN is 64 45 B4 34 11 30 00 01

Example:

ff0bff ff0101 ff166445b43411300001 ff090100 ff0a0101		
Channel	**Type**	**Value**
ff	0b (Power Event)	ff (powered on)
ff	01 (Protocol Version)	01 (V1)
ff	16 (Device SN)	64 45 B4 34 11 30 00 01
ff	09 (Hardware Version)	0100 (V1.0)
ff	0a (Software Version)	0101 (V1.1)

5.2 Sensor Data

UC100 reports RS485 sensor data according to reporting interval (20 mins by default).

<table>
<tr><th>Channel</th><th>Type</th><th>Byte</th><th>Description</th></tr>
<tr><td>ff</td><td>19 (RS485)</td><td>Mutable (4-7)</td><td>Total: Byte 1+Byte 2+Byte 3+Value
Byte 1: Channel ID
Byte 2: Data Size
Byte 3: Data Type
<table>
<tr><th>Code</th><th>Data Type</th></tr>
<tr><td>00</td><td>Coil</td></tr>
<tr><td>01</td><td>Discrete</td></tr>
<tr><td>02</td><td>Input16</td></tr>
<tr><td>03</td><td>Hold16</td></tr>
<tr><td>04</td><td>Hold32</td></tr>
<tr><td>05</td><td>Hold_float</td></tr>
<tr><td>06</td><td>Input32</td></tr>
<tr><td>07</td><td>Input_float</td></tr>
<tr><td>08</td><td>Input_int32_with upper</td></tr>
</table></td></tr>
</table>

			<table><tr><td></td><td>16 bits</td></tr><tr><td>09</td><td>Input_int32_with lower 16 bits</td></tr><tr><td>0a</td><td>Hold_int32_with upper 16 bits</td></tr><tr><td>0b</td><td>Hold_int32_with lower 16 bits</td></tr></table>
ff	15 (Modbus collecting exception)	1	Channel ID of failed Modbus collection.

Note: Channel ID can be configured in ToolBox.

Channel ID	Description
00	RS485 (Modbus Master) Channel 1
01	RS485 (Modbus Master) Channel 2
02	RS485 (Modbus Master) Channel 3
...	...
0f	RS485 (Modbus Master) Channel 16

Examples:

ff 19 07 02 03 15 00					
Channel	**Type**	**Channel ID**	**Data Size**	**Data Type**	**Value**
ff	19 (RS485)	07 => Channel 8	02 => 2 bytes	03 => Hold 16	15 00 => 00 15 = 21

Note: When data type is holding register or input register, ToolBox can set different byte orders. Take below Modbus register response from RS485 sensors as example:

Register Address	Value (Hex)
0	00 15
1	00 20

When using different byte orders, you can use ToolBox to fetch different results, and the device will upload data with little endian order.

Data Type	Byte Order	Fetch Result	Uplink (HEX)
Holding/Input Register (INT16)	AB	21 (0x15)	15 00 (BA)
	BA	5376 (0x1500)	00 15 (AB)
Holding/Input Register (INT32)	ABCD	1376288 (0x00150020)	20 00 15 00 (DCBA)
	CDAB	2097173 (0x00200015)	15 00 20 00 (BADC)
	BADC	352329728 (0x15002000)	00 20 00 15 (CDAB)

	DCBA	536876288 (0x20001500)	00 15 00 20 (ABCD)
Holding/Input Register (INT32 with upper 16 bits)	/	21 (0x15)	15 00 00 00
Holding/Input Register (INT32 with lower 16 bits)	/	32 (0x20)	20 00 00 00

If UC100 fails to connect the Modbus data, it will send an error message.

ff 15 00		
Channel	**Type**	**Value**
ff	15 (Poll Failed)	00 => Channel 1

5.3 Downlink Command

UC100 supports downlink commands to configure the device. The application port is 85 by default.

Channel	Type	Description
ff	03(Set Reporting Interval)	2 Bytes, unit: s
	10 (Reboot)	ff (Reserved)

Examples:

1. Reporting Interval

ff 03 b0 04		
Channel	**Type**	**Value**
ff	03 (Set Reporting Interval)	b0 04 => 04 b0 = 1200 s = 20 mins

2. Reboot the device

ff 10 ff		
Channel	**Type**	**Reserved**
ff	10 (Reboot)	ff

-END-