Milesight

Wall Switch

WS50x

User Guide

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Contents

Chapter 1. Preface 4

Chapter 2. Product Introduction 6

Overview 6

Features 6

Chapter 3. Hardware Introduction 7

Packing List 7

Hardware Overview 7

LED Patterns 8

Dimensions 8

Wiring Diagram 9

Chapter 4. Installation 10

Chapter 5. Quick Start 11

Access the Sensor via NFC 11

Configure the Network Setting 11

Chapter 6. Operation Guide 13

LoRaWAN® Settings 13

Multicast Setting 15

General Settings 17

Milesight D2D Setting 18

Milesight D2D Controller 18

Milesight D2D Agent 20

Dual-Control Switch Example 21

Maintenance 22

Upgrade 22

Backup and Restore 23

Reset to Factory Default 25

Chapter 7. Uplink and Downlink 27

Overview.....27
Uplink Data.....27
Basic Information.....27
Periodic Report.....28
Switch Change Report.....28
Downlink Command.....29
Switch On/Off.....29
General Settings.....30
Task Settings.....31
Chapter 8. Services.....33

Chapter 1. Preface

Applicability

This guide is applicable to below models:

Model	Description
WS501 (PN: 3W-W12-US)	Neutral required version.
WS501 (PN: 3W-W11-EU)	
WS502 (PN: 3W-W11-EU)	

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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 user can use the product correctly to avoid danger or property loss. Milesight will not shoulder responsibility for any loss or damage resulting from not following the instructions of this operating guide.

Warning:

Serious injury or death may be caused if any of these warnings is neglected.

- The installation and maintenance must be conducted by a qualified service person and should strictly comply with the electrical safety regulations of the local region.
- Ensure the breaker is powered out during the installation.
- To avoid risk of fire and electric shock, do keep the product away from rain and moisture before installed.

CAUTION:

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

- Do not leave any object inside the switch box when installation.
- The device must not be modified in any way.
- In order to protect the security of the device, please change the device password when first configuration. The default password is 123456.
- Do not overload the maximum capacity to avoid damaging the device.
- The device is intended for indoor use only. Do not place the device where the temperature is below/above the operating range.
- Do not place the device close to naked flames, heat source (such as oven or sunlight), cold source, liquid, and objects with extreme temperature changes.
- Use the device in a clean environment only. Dusty or dirty environments may prevent the proper operation of this device.
- The device must never be subjected to physical shocks or strong vibration.

Revision History

Release Date	Version	Description
June 24, 2022	V 1.0	Initial version
October 26, 2022	V 1.1	Add 2-wire version model
Jan. 22, 2025	V 1.2	1. Remove 2-wire version model 2. Update ToolBox screenshots.
April 23, 2025	V 1.3	Add Milesight D2D Controller feature and dual-control example

Chapter 2. Product Introduction

Overview

WS50x is a smart LoRaWAN® wall switch for the local and remote control of lights and electrical appliances. It adopts two standard sizes for most of international wall switch types, which can replace the traditional wall switches directly. Compliant with Milesight LoRaWAN® gateway and Milesight IoT Cloud solution, WS50x can be monitored and controlled via webpage or mobile App remotely and triggered by other Milesight sensors.

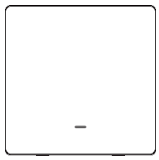
WS50x can be widely used for indoor applications in homes, offices, hotels, museums, etc.

Features

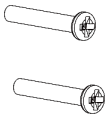
- Support local or remote control via high reliability relay
- Collect current, voltage, power, electrical consumption and support overload protection
- Built-in switch indicator, easy to use in dark environment
- Ultra-wide-distance wireless transmission up to line of sight of 15 km
- Equipped with NFC for one touch configuration and support card emulation mode
- Function well with standard LoRaWAN® gateways and network servers
- Compliant with Milesight IoT Cloud and Milesight Development Platform
- Support Milesight D2D protocol to enable ultra-low latency control without gateway
- Support multicast feature to control switches in bulk

Chapter 3. Hardware Introduction

Packing List



1 × WS50x Wall Switch



2 × Mounting Screws

1 × Quick Guide

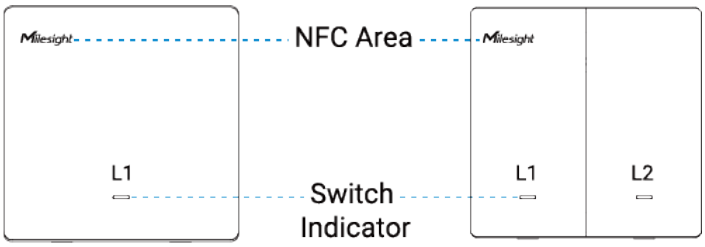
1 × Warranty Card

Note:

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

Hardware Overview

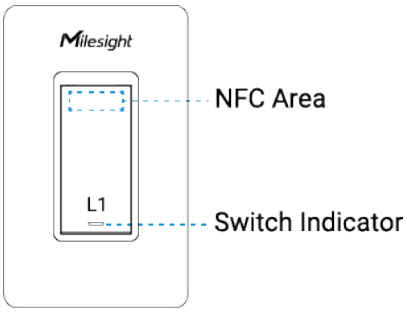
86 Type



WS501
(EU Version)

WS502
(EU Version)

120 Type



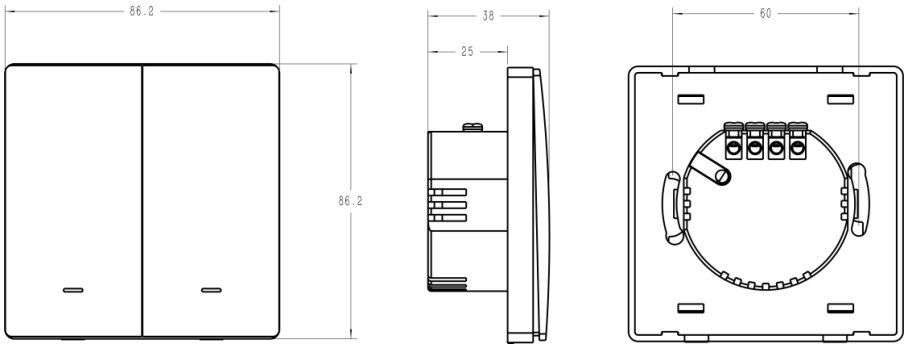
WS501
(US Version)

LED Patterns

Function	Action	Indicator
Power On	Supply the power to the device	Off → On
Network Status	Send a join network request packet	Blinks once quickly
	Joined the network successfully	All blinks twice slowly
Reset to Factory Default	Press and hold any button for more than 10s	Blinks

Dimensions

86 Type



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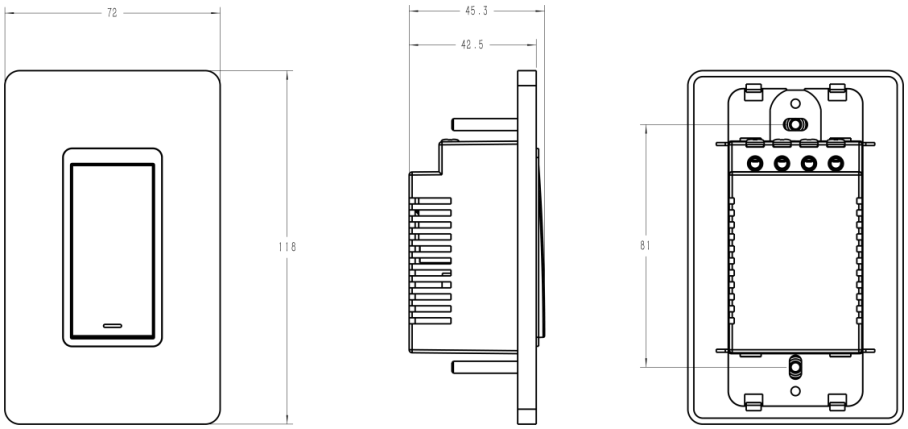
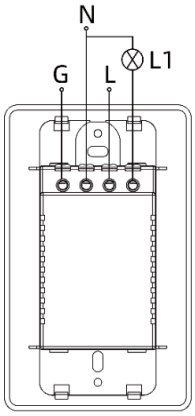
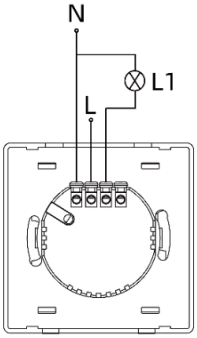


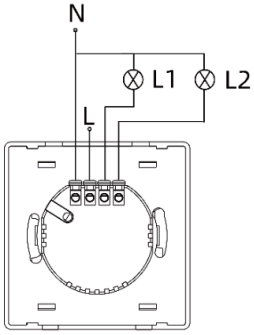
Wiring Diagram



WS501
(3W-W12-US)



WS501
(3W-W11-EU)



WS502
(3W-W11-EU)

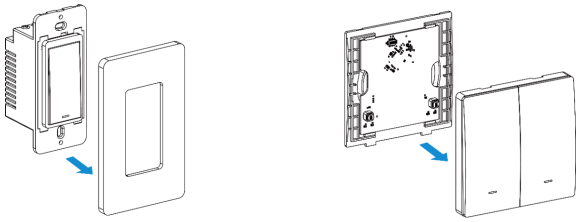
Chapter 4. Installation

Installation Location

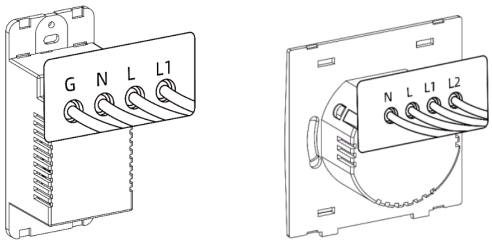
In order to realize the best data transmission, ensure the device is within the signal range of the LoRaWAN® gateway and keep it away from metal objects and obstacles.

Installation Steps

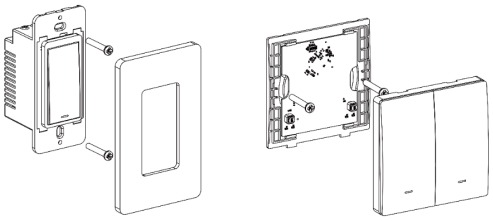
1. Ensure the circuit has been shut off and the old switch has been taken off.
2. Open the front panel of WS50x switch.



3. Connect corresponding wires to the WS50x switch.



4. Fix the WS50x switch to the switch box with mounting screws, then fix the front panel back to the device.



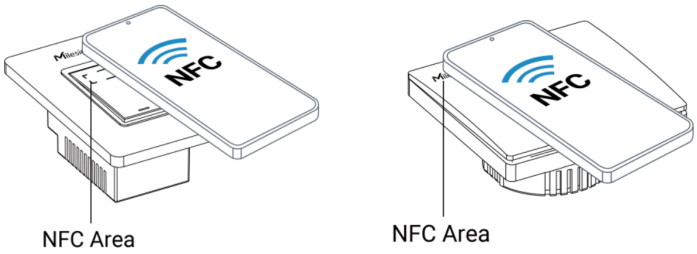
Chapter 5. Quick Start

Access the Sensor via NFC

1. Download and install “Milesight ToolBox” App from Google Play or Apple Store on an NFC-supported smartphone.
2. Enable NFC function on the smartphone.
3. Launch Milesight ToolBox, and select the default mode as NFC.
4. Attach the smart phone with NFC area to the device and click to read device information. Basic information, data, and settings of the device will be shown on the Milesight ToolBox App if it’s recognized successfully.
5. Adjust the settings on the App, then attach the smartphone with NFC area to the device and click **Write** to write the settings. After writing, reread the device to check if the configuration is written well.

Note:

- Ensure the location of smartphone NFC area and it’s recommended to take off phone case.
- If the smart phone fails to read/write configurations via NFC, keep the phone away and back to try again.
- The default device password is 123456. Please change a new password for security.



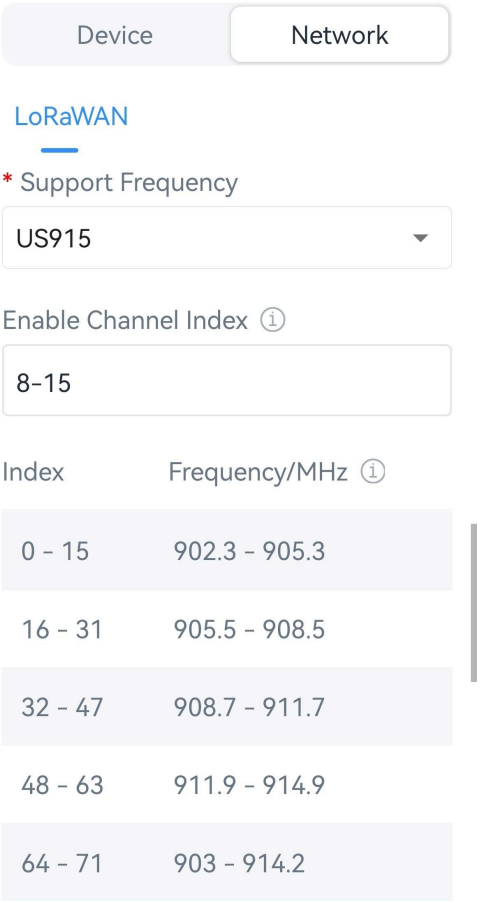
Configure the Network Setting

1. Go to **Network** settings page, select the join type as OTAA or ABP as required.

Note:
OTAA mode is required if you connect device to Milesight IoT Cloud or Milesight Development Platform.

2. Select supported frequency the same as LoRaWAN® gateway.

Note:
Set the channel index as 8-15 for US915 or AU915 if using default settings of Milesight gateways.



3. Keep other settings by default and click **Write** to save the settings.

Chapter 6. Operation Guide

LoRaWAN® Settings

This chapter describes the LoRaWAN® network settings of device.

Parameter	Description
Device EUI	Unique ID of the device which can be found on the device. **Note:** please contact sales for device EUI list if you have many units.
App EUI	The default App EUI (join EUI) is 24E124C0002A0001.
Application Port	The port used for sending and receiving data, the default port is 85.
LoRaWAN® Version	V1.0.2 and V1.0.3 are available.
Work Mode	It is fixed as Class C.
Confirmed Mode	If the device does not receive ACK packet from network server, it will re-send data once.
Join Type	OTAA and ABP mode are available. **Note:** it's necessary to select OTAA mode if connecting device to Milesight IoT Cloud or Milesight Development Platform.
Application Key	Appkey for OTAA mode, default value: "Device EUI" + "Device EUI" (since Q4 of 2025). Example: 24e124123456789024e1241234567890 **Note:** • The default value of earlier devices is 5572404C696E6B4C6F52613230313823. • Please contact sales before purchase if you require random App Keys.

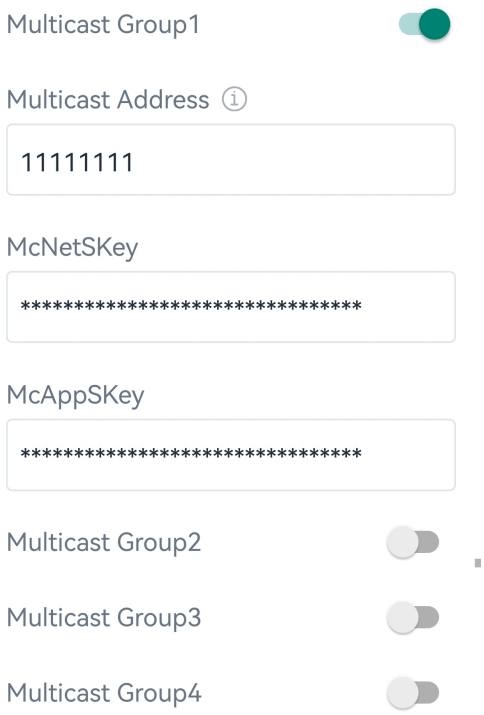
Parameter	Description
Network Session Key	Nwkskey for ABP mode, the default is 5572404C696E6B4C6F52613230313823.
Application Session Key	Appskey for ABP mode, the default is 5572404C696E6B4C6F52613230313823.
Device Address	DevAddr for ABP mode, default is the 5th to 12th digits of SN.
Rejoin Mode	Reporting interval≤35 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval or every double reporting interval to validate connectivity; If there is no response, the device will re-join the network. Reporting interval > 35 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. **Note:** 1. Only OTAA mode supports rejoin mode. 2. The actual sending number is **Set the number of packets sent** +1.
Supported Frequency	Enable or disable the frequency to send uplinks. If frequency is one of CN470/AU915/US915, enter the index of the channel to enable in the input box, making them separated by commas. **Examples:** 1, 40: Enabling Channel 1 and Channel 40 1-40: Enabling Channel 1 to Channel 40 1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60 All: Enabling all channels Null: Indicate that all channels are disabled

Parameter	Description
ADR Mode	Enable or disable network server to adjust Spreading Factor, Bandwidth an Tx Power to optimize data rates, airtime and energy consumption in the network.
Spreading Factor	If ADR mode is disabled, the device will send uplink data following this SF parameter. The higher the spreading factor, the longer the transmission distance, the slower the transmission speed and the more the consumption.
Tx Power	Tx power (transmit power) refers to the strength of the outgoing signal transmitted by the device. This is defined by LoRa alliance.
RX2 Data Rate	RX2 data rate to receive downlinks or send D2D messages.
RX2 Frequency	RX2 frequency to receive downlinks or send D2D messages. Unit: Hz
Multicast Group	Enable or disable the multicast groups to receive the multicast commands.

Multicast Setting

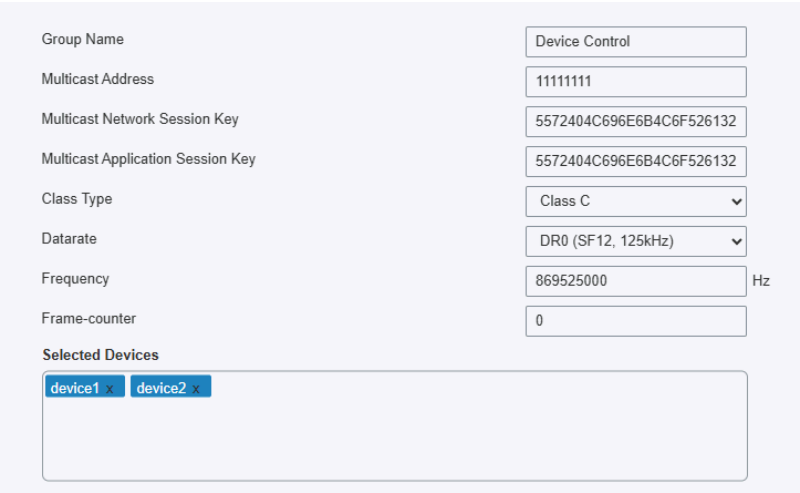
The device supports setting up several multicast groups to receive multicast commands from the network server, then users can use this feature to control devices in bulk.

1. Enable **Multicast Group**, and set unique multicast address and keys to distinguish other groups. You can also keep these settings by default.



Parameter	Description
Multicast Address	Unique 8-digit address to distinguish different multicast groups.
Multicast McNetSkey	32-digit key. Default values: Multicast Group 1: 5572404C696E6B4C6F52613230313823 Multicast Group 2: 5572404C696E6B4C6F52613230313824 Multicast Group 3: 5572404C696E6B4C6F52613230313825 Multicast Group 4: 5572404C696E6B4C6F52613230313826
Multicast McAppSkey	

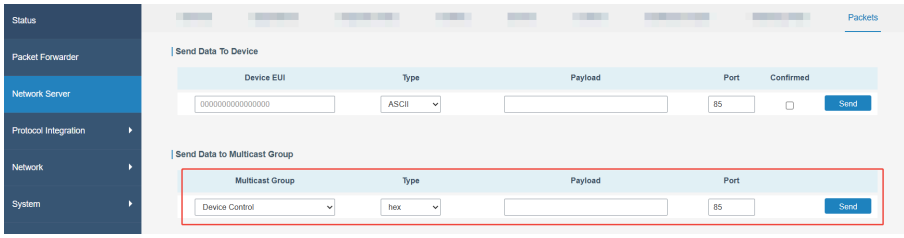
2. Add a multicast group on the LoRaWAN® network server. Take Milesight gateway as example, go to **Network Server > Multicast Groups** to add a multicast group and configure the group according to the device settings.



3. Go to **Network Server > Packets**, select the multicast group and fill in the downlink command, click **Send**. The network server will broadcast the command to devices that belong to this multicast group.

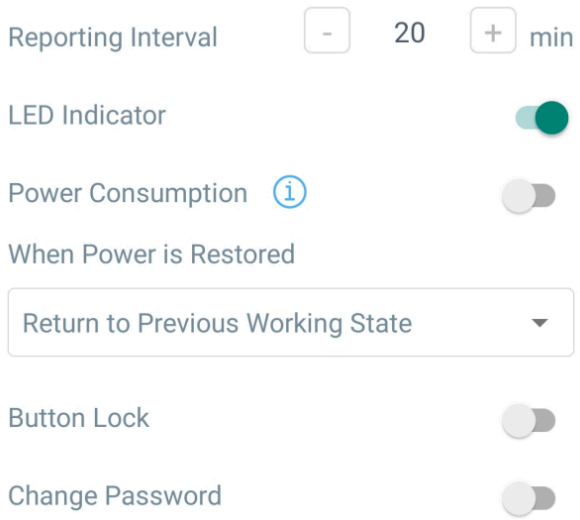
Note:

Ensure all devices' application ports are the same.



General Settings

General settings include the basic parameters of the device.



Parameter	Description
Reporting Interval	Reporting interval of transmitting current sensor values to network server. Default: 20 mins, Range: 1-1080 mins.
LED Indicator	Enable or disable the light of switch button. This will not affect the blinks when you hold on switch buttons to reset the device.
Power Consumption	Record the power consumption. If disabled, the device will stop recording and the power consumption value will stop updating.
When Power is Restored	If the device is powered off and restored, the device will change according to this parameter.
Button Lock	If enabled, all switch buttons will not be allowed to turn on/off or reset to factory default.
Change Password	Change the password for ToolBox App to write this device.

Milesight D2D Setting

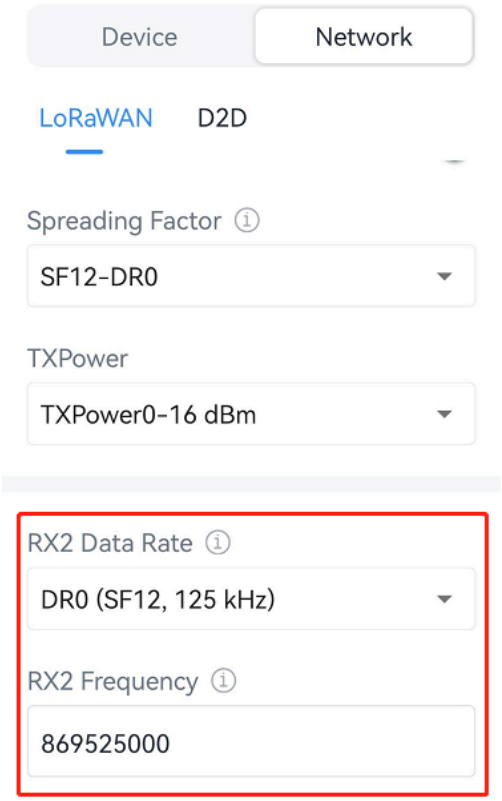
Milesight D2D protocol is developed by Milesight and used for setting up transmission among Milesight devices without gateway, which is able to reduce the latency and achieve the quick control.

Milesight D2D Controller

When D2D controller setting is enabled, the device can work as Milesight D2D controller device to send commands to trigger D2D agent devices.

1. Configure the RX2 datarate and RX2 frequency.

Note:
It is suggested to change the default RX2 frequency to avoid conflicts with other devices and set RX2 datarate between SF7 to SF10 to ensure better performance.



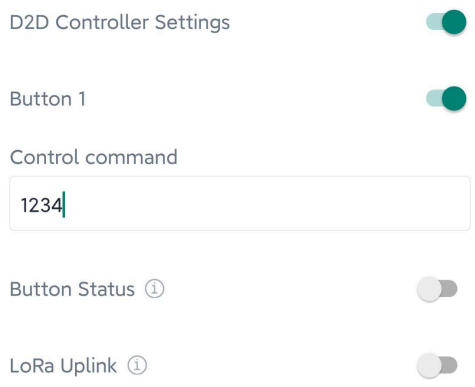
2. Enable **D2D Controller Settings**, and define a unique D2D key to be the same as D2D agent devices. (Default D2D Key: 5572404C696E6B4C6F52613230313823)

3. Enable one of statuses and configure 2-byte hexadecimal Milesight D2D command. When you press this button, WS50X will send the control command to corresponding D2D agent devices. Besides, this button can also control the light at the same time.

Note:

1. If **Button Status** is enabled, the D2D control command packet will contain the info of button status. This is usually used for dual control applications.
2. If **LoRa Uplink** is enabled, a LoRaWAN® uplink packet that contains corresponding alarm status will be sent to gateway after the Milesight D2D command packet. Otherwise, the packet will not send to LoRaWAN® gateway.
3. Please do not press button frequently which may bring bad experience such as conflict and stuck key, as the button is pressed before D2D packet is completely sent.

Example: When pressing the button 1, the device will turn on L1 and send the command 1234 to Milesight D2D agent devices.

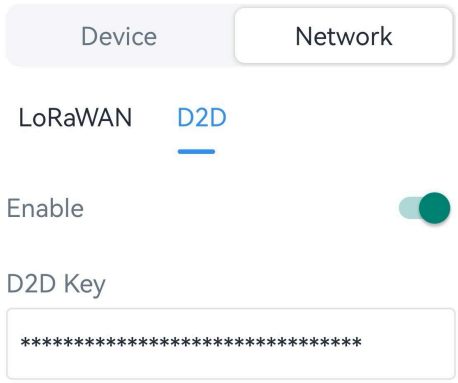


Milesight D2D Agent

When D2D agent setting is enabled, the device can work as the Milesight D2D agent device to receive commands from Milesight D2D controller devices.

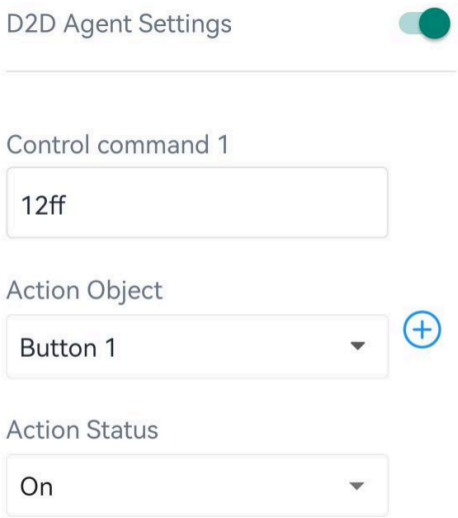
1. Ensure the RX2 datarate and RX2 frequency in LoRaWAN® settings are the same as the D2D controller device.

2. Define an unique D2D key to be the same as the setting in D2D controller devices. (Default D2D Key: 5572404C696E6B4C6F52613230313823)



3. Enable **D2D Agent Settings**, define a 2-byte hexadecimal control command (0x0000 to 0xffff) and command action. One device supports at most 16 control commands.

Example: When receiving the command 12ff from Milesight D2D controller devices, turn on button 1.

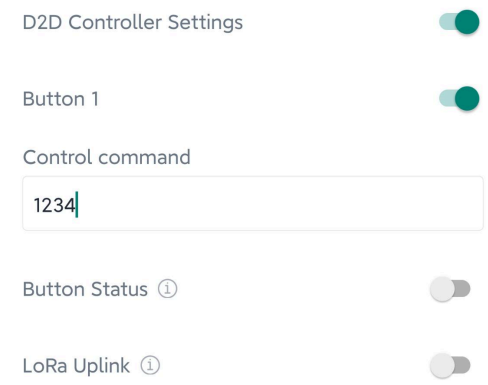


Dual-Control Switch Example

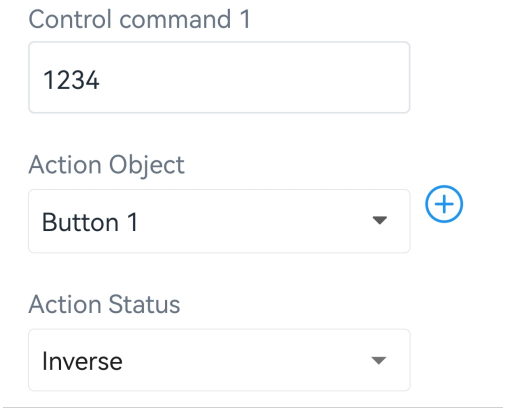
WS50x supports dual or more switches to control one terminal by Milesight D2D feature. Here takes an example to describe the settings of dual switches.

1. Ensure the RX2 datarate, RX2 frequency, and D2D key of both devices are the same.

2. Enable D2D Controller settings on switch 1, then select one button to configure the control command.



3. Enable D2D Agent settings on switch 2 and configure the command the same as switch 1, then select the action status as **Inverse**.



Maintenance

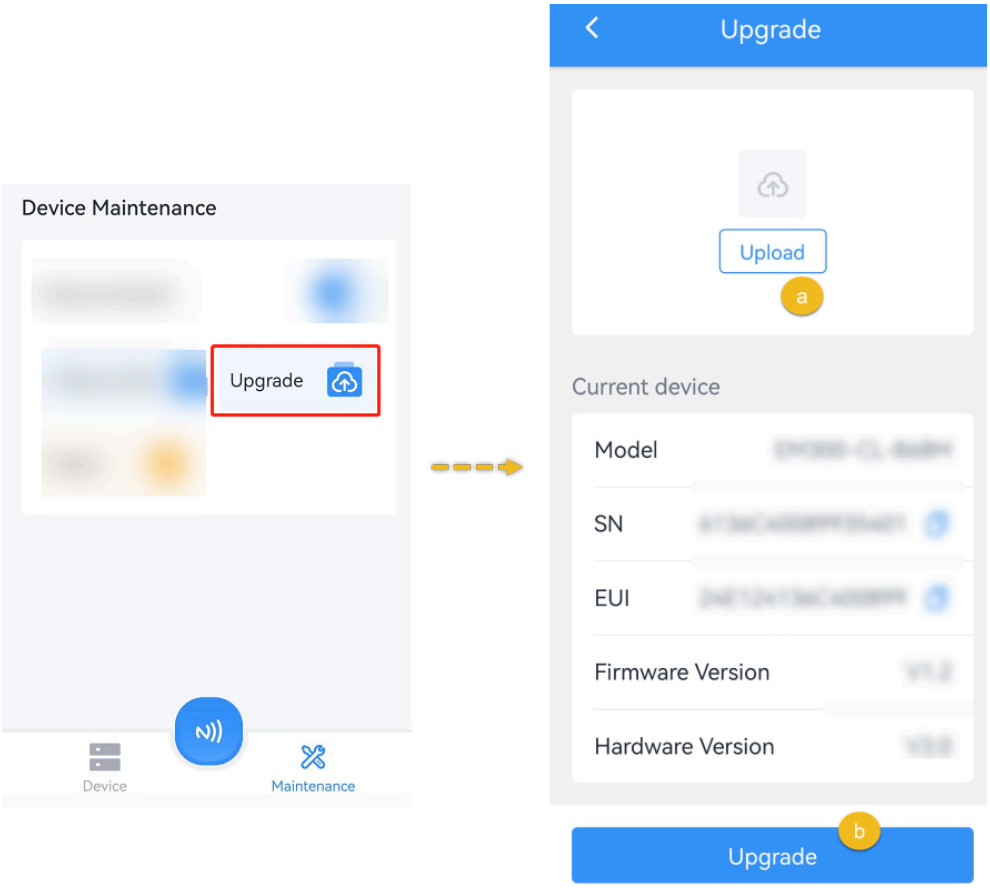
Upgrade

This chapter describes the steps to upgrade the device via ToolBox App.

1. Download firmware from Milesight official website to your smartphone.
2. Read the target device via ToolBox App, click **Upgrade** to upload the firmware file.
3. Click **Upgrade** to upgrade the device.

Note:

- Operation on ToolBox is not supported during an upgrade.
- Only Android version ToolBox supports the upgrade feature.

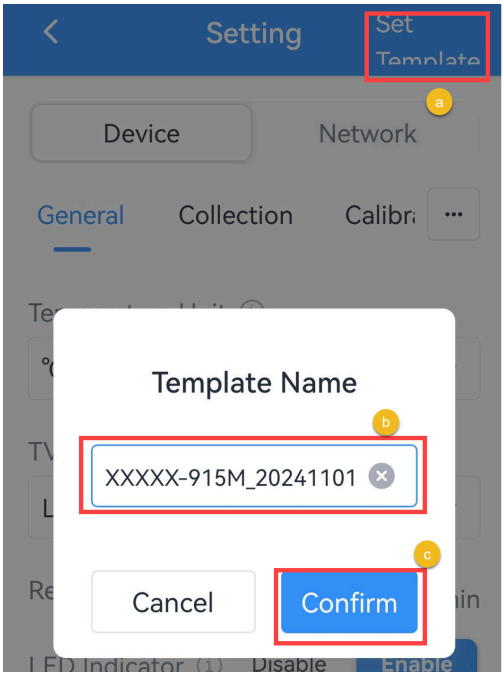


Backup and Restore

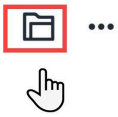
This device supports configuration backup for easy and quick device configuration in bulks. Backup and restore is allowed only for devices with the same model and frequency band.

Backup and Restore

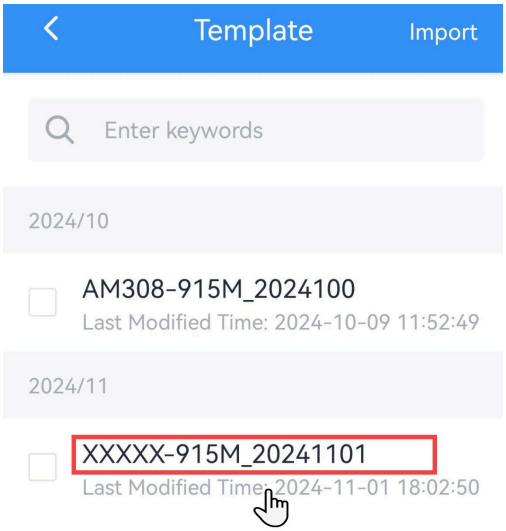
1. Launch ToolBox App, attach the NFC area of smartphone to the device to read the configuration.
2. Edit the configuration as required, click **Set Template** to save current configuration as a template to the ToolBox App.



3. Go to **Device >Template** page.

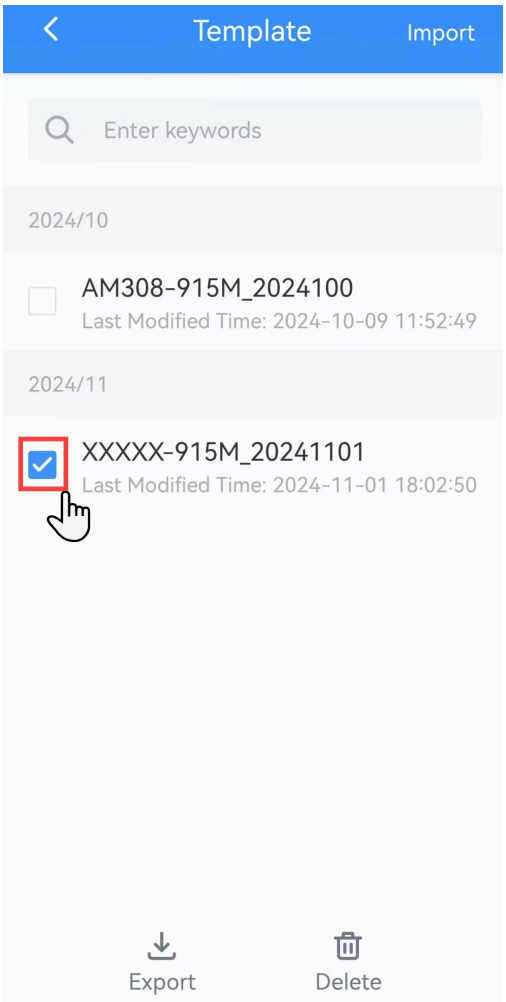


4. Select and click the target template, click **Write** to import the configuration to target devices.



Export and Delete Template

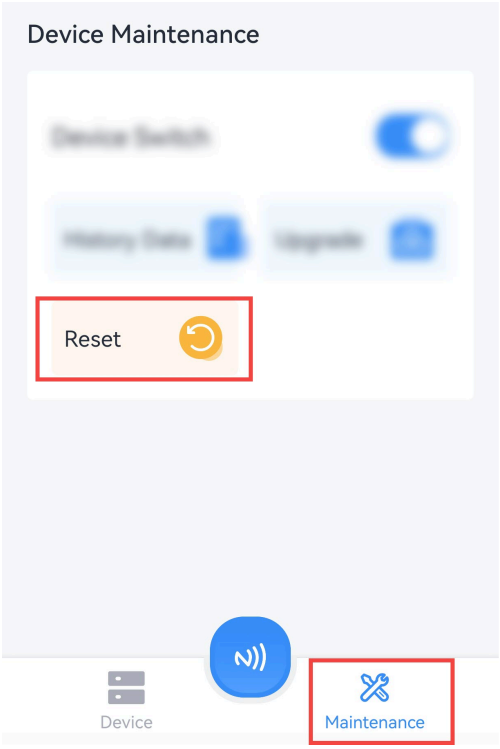
1. Check the box of the target template.
2. Click **Export** to export this template as JSON format file and save it to the smartphone, click **Delete** to delete this template from your ToolBox App.



Reset to Factory Default

Via Hardware: Hold on any button for more than 10s until the LED indicator quickly blinks.

Via ToolBox App: Click **Reset** and attach the smartphone to device to reset the device.


Device Maintenance
Reset
Device
Maintenance

Chapter 7. Uplink and Downlink

Overview

All messages are based on following format (HEX), the Data field should follow little-endian:

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

For decoder examples please find files on https://github.com/Milesight-IoT/SensorDecoders.

Uplink Data

This chapter describes the reported data of the device.

Basic Information

The device will report a basic information packet whenever joining the network.

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
Serial Number	ff	16	8	16 digits

Example:

ff0bff ff0101 ff090100 ff0a0101 ff166771c21070911328		
Channel	**Type**	**Value**
ff	0b	ff
ff	01	01=V1
ff	09	Hardware: 0200=V2.0
ff	0a	Software: 0101=V1.1

ff0bff ff0101 ff090100 ff0a0101 ff166771c21070911328		
Channel	**Type**	**Value**
ff	16	SN: 6771c21070911328

Periodic Report

Item	Channel	Type	Byte	Description
Voltage	03	74	2	UINT16/10, Unit: V
Active Power	04	80	4	UINT32, Unit: W
Power Factor	05	81	1	UINT8, Unit: %
Power Consumption	06	83	4	UINT32, Unit: Wh
Total Current	07	c9	2	UINT16, Unit: mA
Switch Status	08	29	1	Bit 0: status of L1, 0=Off, 1=On Bit 1: status of L2 (WS502 Only), 0=Off, 1=On Bit 2-7: 000000

Example:

Report data according to reporting interval (20mins by default).

082903 058164 07c90200 0374b208 068301000000 048001000000		
Channel	**Type**	**Value**
08	29	03= 0000 0011 => switch 1 and 2 on
05	81	Power Factor: 64=> 100%
07	c9	Current: 02 00=>00 02=2mA
03	74	Voltage: b2 08=>08 b2=2226 /10=222.6V
06	83	Power Consumption: 01 00 00 00=>00 00 00 01=1 Wh=0.001 kWh

Switch Change Report

The device will report a switch status packet when any switch status changes.

Channel	Type	Byte	Description
08	29	1	Bit 0: status of L1, 0=Off, 1=On Bit 1: status of L2 (WS502 Only), 0=Off, 1=On Bit 2-3: reserved Bit 4: changing status of L1 Bit 5: changing status of L2 (WS502 Only) Bit 6-7: reserved

Example:

082913		
Channel	**Type**	**Value**
08	29	13= 00010011 => L1 changes to on, L2 remains on

Downlink Command

This device supports downlink commands for configuration and control. The downlink application port is 85 by default.

Switch On/Off

Channel	Type	Byte	Description
08	-	2	**Byte 1:** • 10 - Switch off L1 • 11 - Switch on L1 • 20 - Switch off L2 • 22 - Switch on L2 • 30 - Switch off L1 and L2 • 33 - Switch on L1 and L2 **Byte 2:** ff

Example:

1. Switch off the L1.

0810ff		
Channel	**Type**	**Value**
08	-	10ff = Switch off L1

General Settings

Item	Channel	Type	Byte	Description
Reboot	ff	10	1	ff
Report Interval	ff	03	2	UINT16, Unit: s
Button On/Off Lock	ff	25	2	0080-disable to turn on/off via button, 0000-enable to turn on/off via button
Power Consumption	ff	26	1	00-disable, 01-enable
Reset Power Consumption	ff	27	1	ff
Enquire Electrical Status	ff	28	1	ff
LED Indicator	ff	2f	1	00-disable 01-enable (Indicator on when button is off) 02-enable (Indicator on when button is on)
Button Reset Lock	ff	5e	1	00-enable to reset via button 01-disable to reset via button

Example:

1. Reboot the device.

ff10ff

2. Set reporting interval as 20 minutes.

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

3. Disable button indicators.

ff2f00		
Channel	**Type**	**Value**
ff	2f	00=Disable

4. Disable the collection and upload of power consumption.

ff2600		
Channel	**Type**	**Value**
ff	26	00=Disable

Task Settings

Item	Channel	Type	Byte	Description
Add Delay Task	ff	22	4	**Byte 1:** 00 **Byte 2-3:** delay time, unit: s **Byte 4:** • 10 - Switch off L1 • 11 - Switch on L1 • 20 - Switch off L2 • 22 - Switch on L2 • 30 - Switch off L1 and L2 • 33 - Switch on L1 and L2 **Note:** The device supports adding only one task. Later command will cover previous command.

Item	Channel	Type	Byte	Description
Delete Delay Task	ff	23	2	00ff

Example:

Add a delay task: switch on L1 after 1 minute.

0f22 003c0011		
Channel	**Type**	**Value**
ff	22	Byte 1:00 Byte 2-3: 3c 00 => 00 3c = 60 s = 1 min Byte 4: 11 => Switch on L1

Chapter 8. Services

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

Technical Support Mailbox: iot.support@milesight.com

Online Support Portal: https://support.milesight-iot.com

Resource Download Center: https://www.milesight.com/iot/resources/download-center/

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