

**Milesight**

# Smart Button

## Featuring LoRaWAN®

### WS101

User Guide



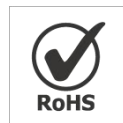
## Safety Precautions

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 modified in any way.
- ❖ In order to protect the security of the device, please change device the password when first configuration. The default password is 123456.
- ❖ 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.
- ❖ When installing the battery, please install it accurately, and do not install the reverse or wrong model.
- ❖ Remove the battery if the device will not be used for a period of time. Otherwise, the battery will leak and damage the device.
- ❖ The device must never be subjected to shocks or impacts.

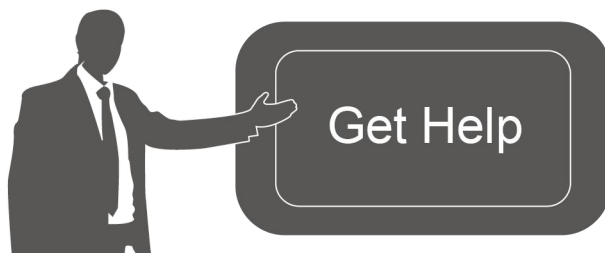
## Declaration of Conformity

WS101 is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.



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## Revision History

Date	Doc Version	Description
July 12, 2021	V 1.0	Initial version
Dec. 7, 2021	V 1.1	<ol style="list-style-type: none"> <li>1. Add Milesight D2D controller feature;</li> <li>2. Delete low power alarm interval, device only uplinks once when battery level is lower than 10%.</li> </ol>
Nov. 30, 2022	V 1.2	<ol style="list-style-type: none"> <li>1. Support double press enable or disable;</li> <li>2. Add downlink commands;</li> <li>3. Support LoRa uplink when Milesight D2D is enabled.</li> </ol>

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# 1. Product Introduction

## 1.1 Overview

WS101 is a LoRaWAN® based smart button for wireless controls, triggers and alarms. WS101 supports multiple press actions, all of which can be defined by the user to control devices or trigger scenes. Besides, Milesight also provides a red button version that is primarily used for emergency situation. Compact and battery-powered, WS101 is easy to install and carry everywhere. WS101 can be widely used in smart homes, smart offices, hotels, schools, etc.

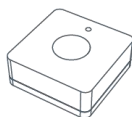
Sensor data are transmitted in real-time using the standard LoRaWAN® protocol. LoRaWAN® enables encrypted radio transmissions over long distances while consuming very little power. The user can get alarm through Milesight IoT Cloud or through the user's own Application Server.

## 1.2 Features

- Up to 15 km communication range
- Easy configuration via NFC
- Standard LoRaWAN® support
- Milesight IoT Cloud compliant
- Support multiple press actions to control devices, trigger a scene or send emergency alarms
- Compact design, easy to install or carry
- Built-in LED indicator and buzzer for press actions, network status, and low battery indication

# 2. Hardware Introduction

## 2.1 Packing List



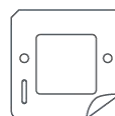
1 x

WS101 Sensor



2 x

Wall Mounting Kits



1 x

3M Tape



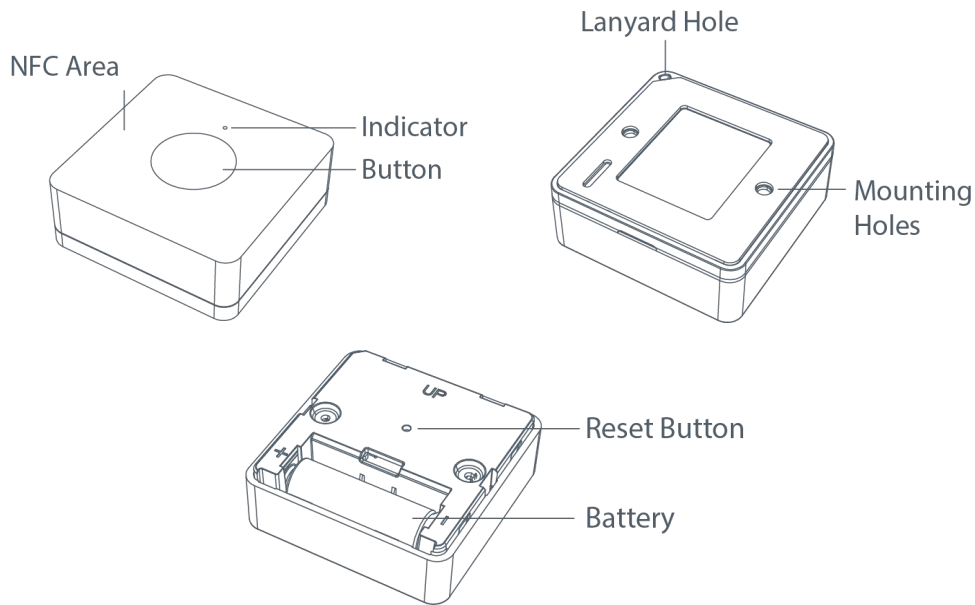
1 x

Quick Guide

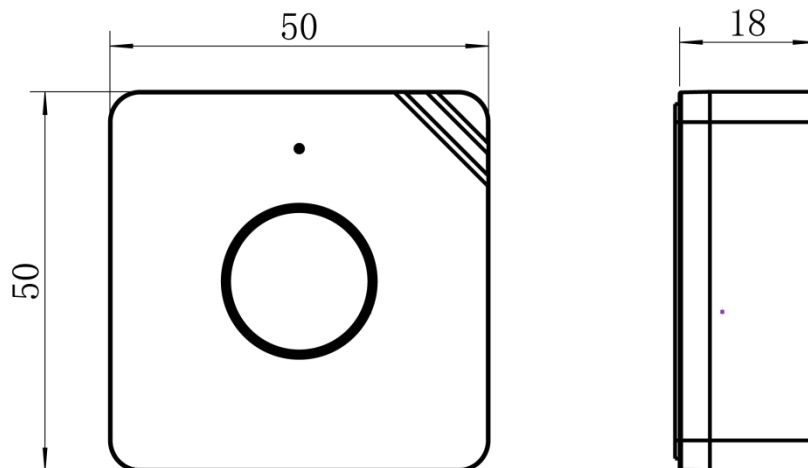


**If any of the above items is missing or damaged, please contact your sales representative.**

## 2.2 Hardware Overview



## 2.3 Dimensions (mm)



## 2.4 LED Patterns

WS101 equips with a LED indicator to indicate the network status and reset button features. Besides, when button is pressed, the indicator will light up at the same time. Red indicator means network is unregistered, while green indicator means device has registered on network.

Function	Action	LED Indicator
Network Status	Send join network requests	Red, blinks once
	Joined the network successfully	Green, blinks twice
Reboot	Press and hold the reset button for more than 3s	Slowly blinks
Reset to Factory Default	Press and hold the reset button for more than 10s	Quickly blinks

### 3. Operation Guide

#### 3.1 Button Mode

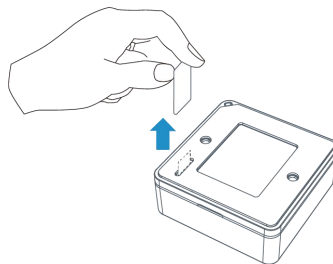
WS101 provides 3 kinds of pressing actions allowing users to define different alarms. Please refer to chapter 5.1 for detailed message of every action.

Mode	Action
Mode 1	Short press the button ( $\leq 3$ seconds).
Mode 2	Long press the button ( $> 3$ seconds).
Mode 3	Double press the button (press interval is within 3 seconds).

#### 3.2 NFC Configuration

WS101 can be configured via NFC-enabled smartphone.

1. Pull out the battery insulating sheet to power on the device. The indicator will light up in green for 3 seconds when device turns on.



2. Download and install "Milesight ToolBox" App from Google Play or App Store.
3. Enable NFC on the smartphone and open Milesight ToolBox.
4. Attach the smartphone with NFC area to the device to read device information.



5. Basic information and settings of devices will be shown on ToolBox if it's recognized successfully. You can read and configure the device by tapping the Read/Write button on the App. In order to protect the security of devices, password validation is required when first configuration. The default password is **123456**.

**Note:**

- 1) Ensure the location of smartphone NFC area and it's recommended to take off phone case.
- 2) If the smartphone fails to read/write configurations via NFC, move the phone away and back to try again.
- 3) WS101 can also be configured by ToolBox software via dedicated NFC reader provided by Milesight IoT, you can also configure it via TTL interface inside the device.

### 3.3 LoRaWAN Settings

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

**Basic LoRaWAN Settings:**

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

Device EUI

\* APP EUI

\* Application Port      -    85    +

Join Type

\* Application Key

LoRaWAN Version

Work Mode

RX2 Data Rate

RX2 Frequency



Confirmed Mode (i)

Rejoin Mode

Set the number of detection signals sent (i)

ADR Mode (i)

Spreading Factor (i)

TXPower

Parameters	Description
Device EUI	Unique ID of the device which can also be found on the label.
App EUI	Default App EUI is 24E124C0002A0001.
Application Port	The port used for sending and receiving data, default port is 85.
Join Type	OTAA and ABP modes are available.
Application Key	Appkey for OTAA mode, default is 5572404C696E6B4C6F52613230313823.
Device Address	DevAddr for ABP mode, default is the 5 <sup>th</sup> to 12 <sup>th</sup> digits of SN.
Network Session Key	Nwkskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
Application Session Key	Appskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
LoRaWAN Version	V1.0.2, V1.0.3, V1.1 are available.
Work Mode	It's fixed as Class A.
RX2 Data Rate	RX2 data rate to receive downlinks or send Milesight D2D commands.
RX2 Frequency	RX2 frequency to receive downlinks or send Milesight D2D commands. 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 $\leq 30$ 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.

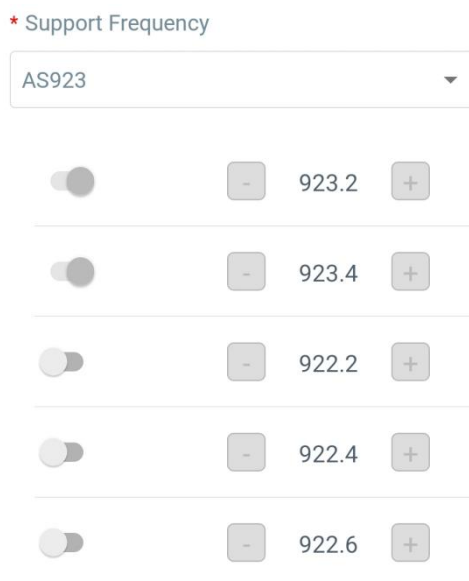
	Reporting interval > 30 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval to validate connectivity; If there is no response, the device will re-join the network.
Set the number of packets sent	When rejoin mode is enabled, set the number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

**Note:**

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

**LoRaWAN Frequency Settings:**

Go to **Setting > LoRaWAN Settings** of ToolBox App to select supported frequency and select channels to send uplinks. Make sure the channels match the LoRaWAN® gateway.



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

**Examples:**

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

\* Support Frequency

AU915

Enable Channel Index (i)

0-71

Index	Frequency/MHz <span style="color: blue;">(i)</span>
0 - 15	915.2 - 918.2
16 - 31	918.4 - 921.4
32 - 47	921.6 - 924.6
48 - 63	924.8 - 927.8

**Note:**

For -868M model, default frequency is EU868;

For -915M model, default frequency is AU915.

### 3.4 General Settings

Go to **Device > Setting > General Settings** of ToolBox App to change the reporting interval, etc.

Reporting Interval - 1080 + min

LED Indicator (i)

Buzzer

Double Press

Change Password

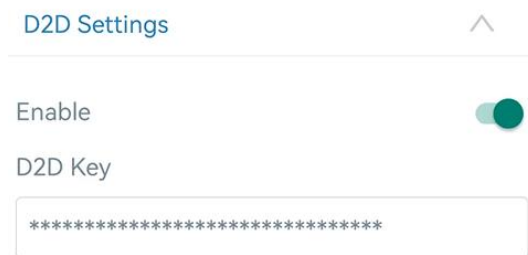
Parameters	Description
Reporting Interval	Reporting interval of battery level to network server. Default: 1080min, Range: 1-1080 mins
LED Indicator	Enable or disable the light indicating in chapter <a href="#">2.4</a> . <b>Note:</b> The indicator of reset button is not allowed to disable.
Buzzer	The buzzer will be triggering together with indicator if the device is registered to network.
Double Press	Enable or disable double press mode.

	<b>Note:</b> If double press is disabled, double press settings under Milesight D2D will also be hidden.
Change Password	Change the password for ToolBox App to write this device.

### 3.5 Milesight D2D Settings

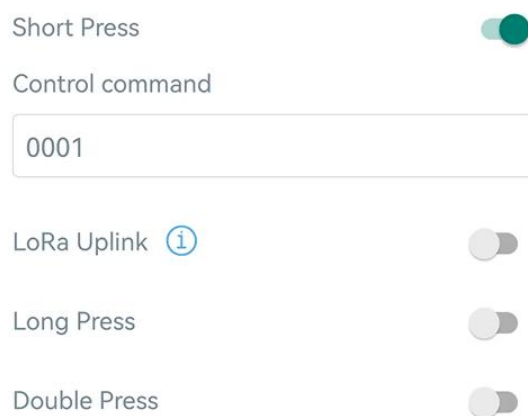
Milesight D2D protocol is developed by Milesight and used for setting up transmission among Milesight devices without gateway. When the Milesight D2D setting is enabled, WS101 can work as a Milesight D2D controller to send control commands to trigger Milesight D2D agent devices.

1. Configure RX2 datarate and RX2 frequency in LoRaWAN<sup>®</sup> settings, it is suggested to change the default value if there are many LoRaWAN<sup>®</sup> devices around.
2. Enable Milesight D2D feature.
3. Define a unique Milesight D2D key which is the same as Milesight D2D agent devices, then select the frequency and spreading factor. (Default Milesight D2D Key: 5572404C696E6B4C6F52613230313823)



4. Enable one of WS101 button mode and configure a 2-byte hexadecimal command (This command is pre-defined in Milesight D2D agent device). When you press as this button mode, WS101 will send the control command to corresponding Milesight D2D agent devices.

**Note:** When LoRa Uplink feature is enabled, a LoRaWAN<sup>®</sup> uplink packet that contains the info of button status will be sent to gateway after the Milesight D2D control command packet.



### 3.6 Maintenance

#### 3.6.1 Upgrade

1. Download firmware from Milesight website to your smartphone.
2. Open ToolBox App and click **Browse** to import firmware and upgrade the device.

**Note:**

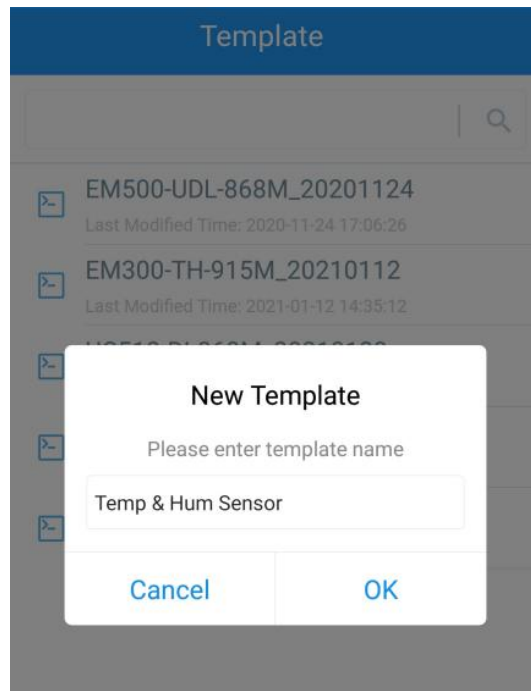
- 1) Operation on ToolBox is not supported during upgrade.
- 2) Only Android version ToolBox supports the upgrade feature.

Status	Setting	Maintenance
SN		6535B1712972
Model		WS101-915M
Firmware Version		V1.1-a01
Hardware Version		V1.0
Manual Upgrade		
<div style="background-color: #007bff; color: white; padding: 10px; display: inline-block; border-radius: 5px;">Browse</div>		

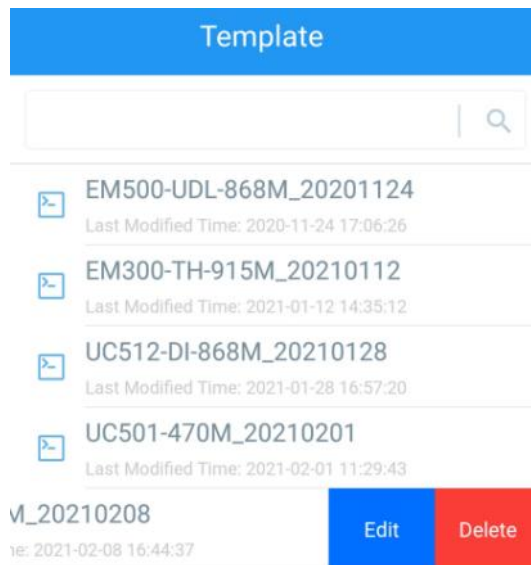
#### 3.6.2 Backup

WS101 supports configuration backup for easy and quick device configuration in bulk. Backup is allowed only for devices with the same model and LoRaWAN® frequency band.

1. Go to **Template** page on the App and save current settings as a template. You can also edit the template file.
2. Select one template file that saved in the smartphone and click **Write**, then attach it to another device to write configuration.



**Note:** Slide the template item to the left to edit or delete the template. Click the template to edit the configurations.



### 3.6.3 Reset to Factory Default

Please select one of the following methods to reset device:

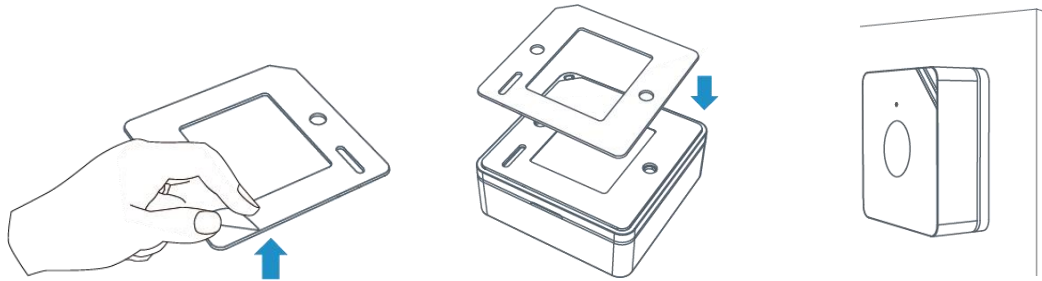
**Via Hardware:** Hold on the reset button for more than 10s. After reset complete, the indicator will blink in green twice and device will reboot.

**Via ToolBox App:** Go to **Device > Maintenance** to tap **Reset**, then attach smartphone with NFC area to device to complete reset.

## 4. Installation

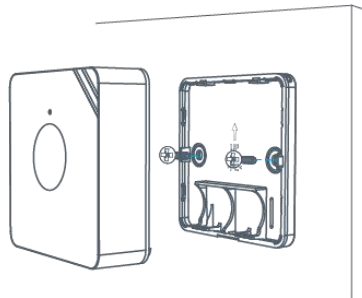
### 3M Tapes Fix:

Paste 3M tape to the back of the button, then tear the other side and place it on a flat surface.



### Screw Fix:

Remove the back cover of the button, screw the wall plugs into the wall and fix the cover with screws on it, then install back the device.



### Lanyard:

Pass the lanyard through the aperture near the edge of the button, then you can hang the button onto keychains and the like.

## 5. Device Payload

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

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

For decoder examples you can find at <https://github.com/Milesight-IoT/SensorDecoders>.

### 5.1 Basic Information

WS101 reports basic information of button whenever joining the network.

Channel	Type	Description
ff	01(Protocol Version)	01=> V1
	08 (Device SN)	12 digits
	09 (Hardware Version)	01 40 => V1.4
	0a (Software Version)	01 14 => V1.14
	0b (Power On)	Device is on
	0f (Device Type)	00: Class A, 01: Class B, 02: Class C

**Example:**

ff0bff ff0101 ff086538b2232131 ff090100 ff0a0102 ff0f00					
Channel	Type	Value	Channel	Type	Value
ff	0b (Power On)	ff (Reserved)	ff	01 (Protocol Version)	01 (V1)
ff	08(Device SN)	6538b22321 31	ff	09 (Hardware version)	0100 (V1.0)
ff	0a (Software version)	0102 (V1.2)	ff	0f (Device Type)	00 (Class A)

## 5.2 Button Message

WS101 reports battery level according to reporting interval (1080 mins by default) and button message when button is pressed. Besides, when battery level is lower than 10%, it will upload battery packet once.

Channel	Type	Description
01	75(Battery Level)	UINT8, Unit: %
ff	2e(Button Message)	01: Mode 1(short press) 02: Mode 2 (long press) 03: Mode 3 (double press)

**Examples:**

01 75 64		
Channel	Type	Value
01	75 (Battery)	64 => 100%

ff 2e 01		
Channel	Type	Value
ff	2e(Button Message)	01 => short press



### 5.3 Downlink Commands

WS101 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)
	2f (Set LED Indicator)	00: Disable 01: Enable
	74 (Set Double Press Mode)	00: Disable 01: Enable
	3e (Set Buzzer)	00: Disable 01: Enable

**Examples:**

1. Set reporting interval as 20 minutes.

ff03b004		
Channel	Type	Value
ff	03 (Set Reporting Interval)	b0 04 => 04 b0 = 1200s = 20 minutes

2. Reboot the device.

ff10ff		
Channel	Type	Value
ff	10 (Reboot)	ff (Reserved)

3. Disable double press mode.

ff7400		
Channel	Type	Value
ff	74 (Set Double Press)	00 => Disable

**-END-**