Smart Radiator Thermostat

Featuring LoRaWAN®

WT101

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 disassembled or remodeled in any way.
- The device is not intended to be used as a reference sensor, and Milesight will not should responsibility for any damage which may result from inaccurate readings.
- Do not paint or clean the PIR lens, or it will affect the detection of the device.
- Do not place the device where the temperature is below/above the operating range.
- Do not place the device close to objects with naked flames, heat source (such as oven), or exposure to sunlight, cold source, liquid, and extreme temperature changes.
- Remove the battery from the device if it is not to be used for an extended period. Otherwise, the battery might leak and damage the device.
- The device must never be subjected to shocks or impacts.

Declaration of Conformity

WT101 is in conformity with the essential requirements and other relevant provisions of the CE and RoHS.

For assistance, please contact

Milesight technical support:

Email: iot.support@milesight.com

Support Portal: support.milesight-iot.com

Tel: 86-592-5085280

Fax: 86-592-5023065

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

Revision History

Date	Doc Version	Description
Sept. 15, 2023	V 1.0	Initial version

Contents

1. Product Introduction

1.1 Overview

WT101, a LoRaWAN® radiator thermostat to help with managing the heating-control system. With 1 pre-set date period and up to 16 customized heating plans, it enables the smart management of heating system and save unnecessary cost in a way. WT101 is a smart and highly environment-sensitive products, abnormal temperature difference and extreme-low temperature can quickly trigger it and it will take fast steps in correcting them by adjusting the valve opening.

Compliant with Milesight LoRaWAN® gateway and Milesight IoT Cloud solution, users can control the room temperature as well as triggering other sensors or appliances easily via webpage or mobile App remotely.

1.2 Key Features

- Adjust the room temperature automatically and manually with a time-controlled regulation
- Up to 16 heating schedules within 1 pre-set Date Period
- Built-in temperature sensor, enabling environmental detection and accurate control
- Intuitive and direction adjustment LED display to suit different installation environments
- Support open-window detection and freeze protection
- Equip with child-lock to enable tamper-proof in public area
- Tamper button design and theft-deterring collar for structural anti-theft protection
- Suit most common radiator valves with optional valve adapters for universal use
- Easy to install with simple lock design without further setting
- Equipped with NFC for one-touch configuration and support card emulation mode
- Function well with standard LoRaWAN® gateways and network servers

2. Hardware Introduction

2.1 Packing List

1 × WT101 Device
(With Valve Base Plate)

2 × Li-FeS$_2$ AA Batteries

1 × Hex Socket Cap Fixing Screw

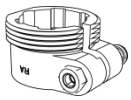
1 × Screw Cap

1 × Theft-deterring Collar Kit

1 × Quick Start Guide

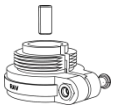
1 × Warranty Card

Valve Adapter (Optional)



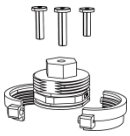
Danfoss RA

Danfoss RAVL



Danfoss RAV

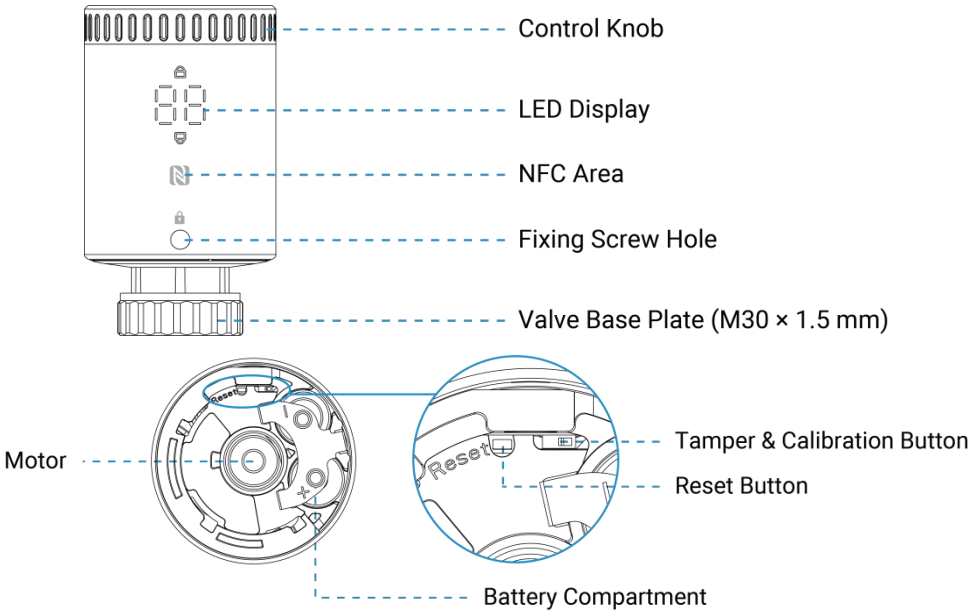
Giacomini



M28 (Comap, Herz, TA)

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

2.2 Hardware Overview

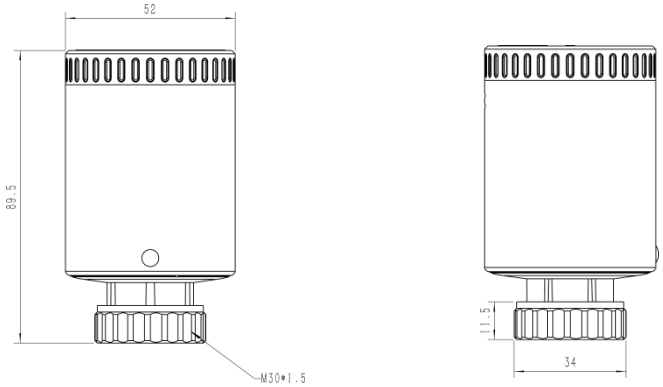


The motor is used to push the radiator values to open or close as required.

2.3 Button and LED Patterns

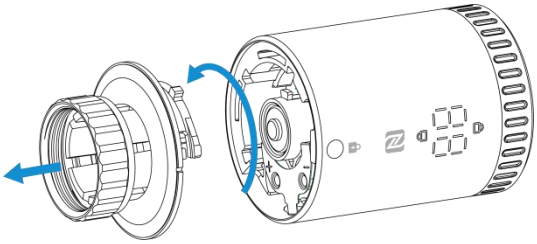
Function	Action	LED Display
Check On/Off Status	Quick press the reset button once or rotate the control knob.	Light On: Device is on. Light Off: Device is off.
Reboot	Press and hold the reset button for more than 3 seconds.	Blink slowly
Reset to Factory Default	Press and hold the reset button for more than 10 seconds.	Blink quickly
Motor Stroke Calibration	The device is installed and the tamper & calibration button is pressed.	Flashes in circle -> Blinks twice
Tamper	The device is removed and the tamper & calibration button is released.	Light on for 1s

2.4 Dimensions (mm)

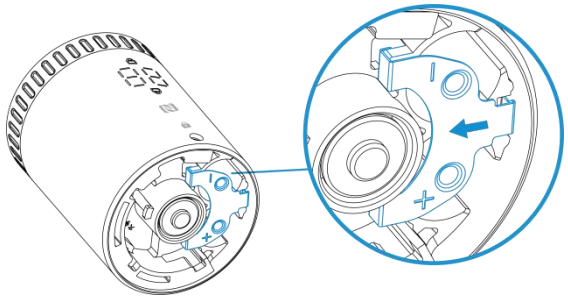


3. Power Supply

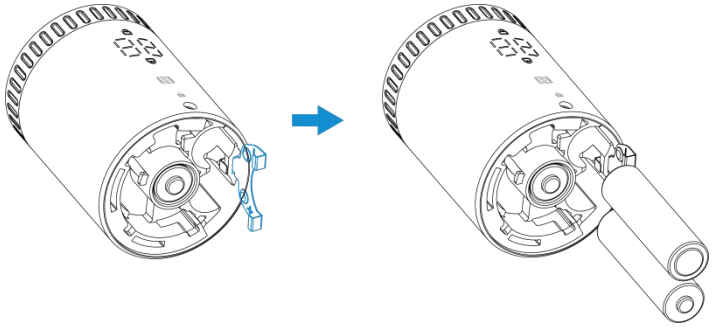
1. Separate the base plate from the device by rotating it anticlockwise.



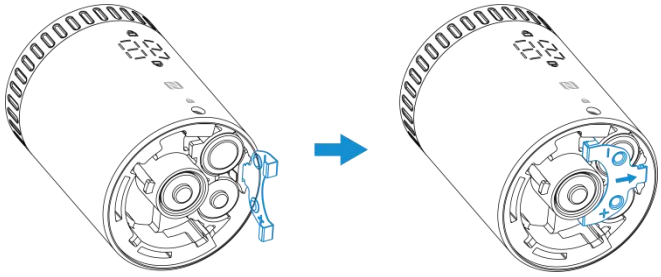
2. Open the metal battery cover by pushing it.



3. Install the two batteries with correct direction, which is shown on the battery cover.



4. Restore the battery cover in place. After installing the batteries, the device will turn on automatically and the LED display will light on for 3s.



Note:

1) The device can be powered by 1.5V AA Li-FeS_2 or alkaline batteries, not Li-$SoCl_2$ batteries. It is suggested to use Li-FeS_2 batteries which has longer battery life than alkaline batteries.

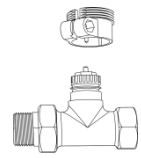
2) Make sure both batteries are newest when install, or battery life will be reduced.

3) After installing the batteries, the device will show and report battery level as 100% at the first time even for old batteries. The device will calculate the battery level after one hour.

4. Installation Instruction

4.1 Adapter Selection

The valve base plate can be used for all valves with a thread size of M30 × 1.5 mm from the most common manufacturers without any accessories. For other valve types, select the corresponding adapter and mount it on the valve.



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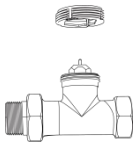
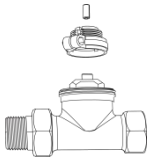
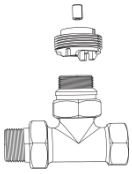


Danfoss RAVL



Danfoss RAV



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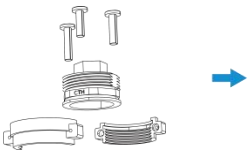
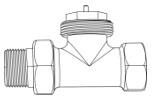
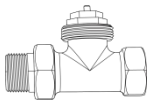




Comap



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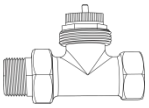

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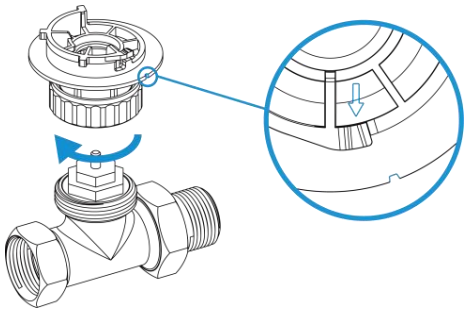
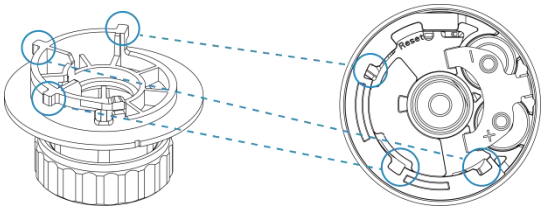
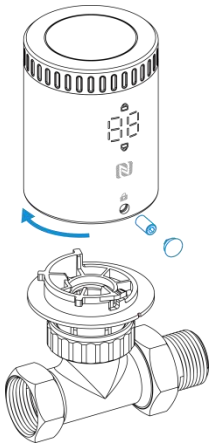
4.2 Thermostat Installation

1. Place the base plate on the valve or valve adapter and screw it tightly. The groove on the base plate should be faced to the direction of display.

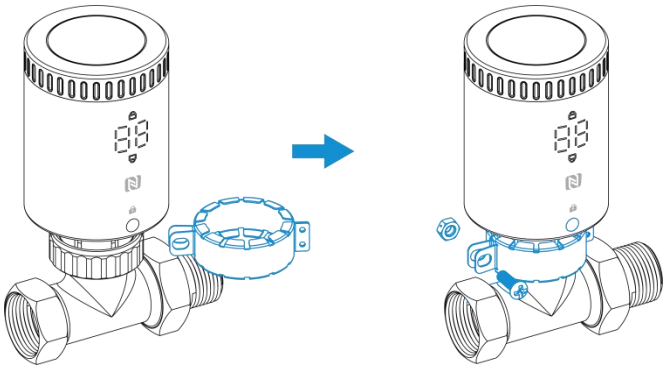


2. Rotate the device clockwise to secure it on the base plate and fix the hex socket cap fixing screw to the screw hole on the front of device. When rotating and device to base plate, the calibration & tamper button will be pressed and the motor on the device will start calibrating. When the LED displays the temperature with two blinks, the calibration is completed.
3. Cover the fixing screw with the screw cap.





4. Fix the theft-deterring collar to the base plate with screw and the nut.

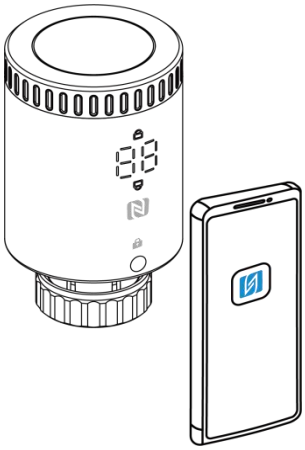


5. Operation Guide

5.1 NFC Configuration

WT101 can be monitored and configured via NFC. Please refer to the following configuration steps.

1. Download and install the Milesight ToolBox App from Google Play or Apple App Store.
2. Enable NFC on the smartphone and launch Milesight ToolBox.
3. Attach the NFC area of a smartphone to the device, and click **NFC Read** to read device information. The basic information and settings of the device will be shown on ToolBox App if it's recognized successfully. You can read and configure the device by tapping the Read/Write device on the App. In order to protect the security of the device, please change the password when first configuring. The default password is **123456**.



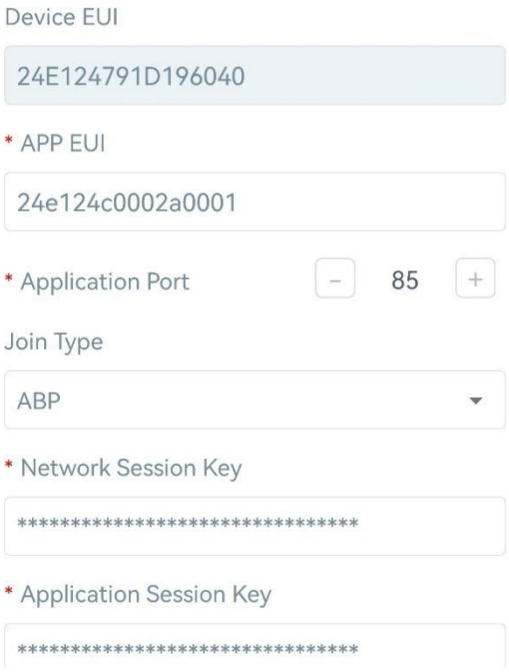
Note:

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

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

5.2 LoRaWAN® Settings

Configure AppEUI, Join Type, Application Key, and other basic LoRaWAN® information. You can also keep all settings by default.



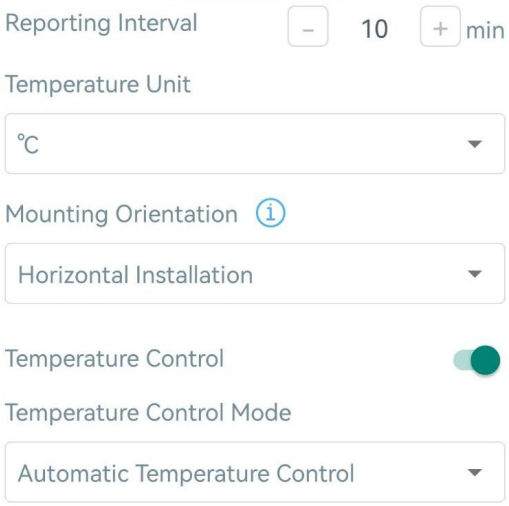
Parameters	Description
Device EUI	Unique ID of the device which can also be found on the label.
App EUI	The default App EUI is 24E124C0002A0001.
Application Port	The port is used for sending and receiving data, the default port is 85.
Join Type	OTAA and ABP modes are available.
Application Key	Appkey for OTAA mode, the default is 5572404C696E6B4C6F52613230313823.
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, the default is the 5th to 12th digits of the SN.
LoRaWAN® Version	V1.0.2 and V1.0.3 are available.
Work Mode	It's fixed as Class A.
RX2 Data Rate	RX2 data rate to receive downlinks.
RX2 Frequency	RX2 frequency to receive downlinks. Unit: Hz
Supported	Select the frequency plan and enable the frequencies to send uplinks.

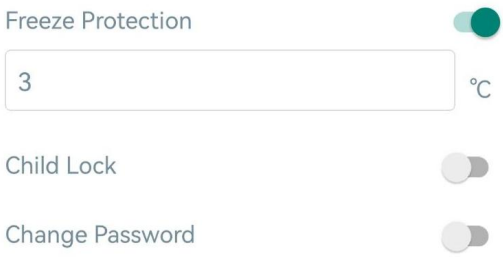
Frequency	
Confirmed Mode	If the device does not receive an ACK packet from the network server, it will resend data once.
Rejoin Mode	Reporting interval ≤ 35 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval or every double reporting 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.
Set the number of packets sent	When the rejoin mode is enabled, set the number of LinkCheckReq packets to send. Note: the actual sending number is **Set the number of packet sent** + 1.
ADR Mode	Allow network server to adjust data rate of the device.
Spread Factor	If ADR is disabled, the device will send data via this spread factor.
Tx Power	Transmit power of the device.

Note:

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

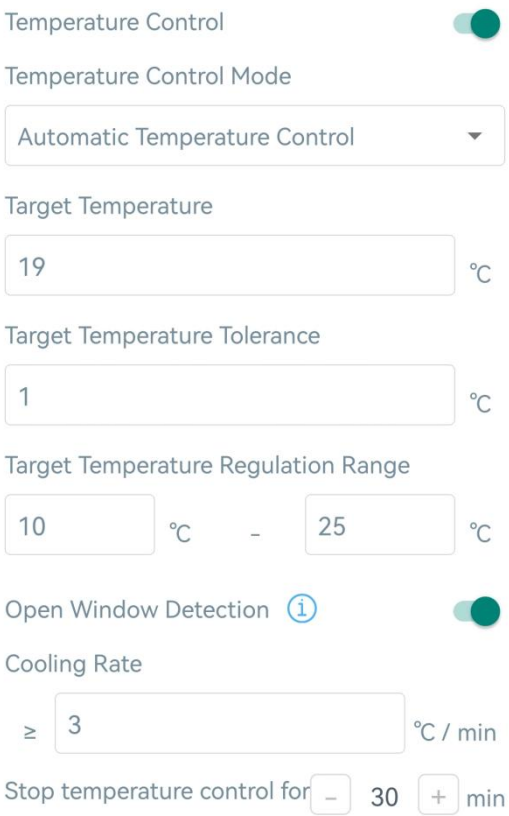
5.3 General Settings





Parameters	Description
Reporting Interval	The interval of reporting battery level, temperature, motor status to network server. Default: 10 min, Range: 1 - 1440 min
Temperature Unit	Set the unit of temperature displayed on the LED display and configuration page.
Mounting Orientation	Set the LED display direction to suit thermostat mounting orientation.   **Horizontal** **Vertical**
Temperature Control	Disable or enable the device to control the valve to adjust temperature. After enabled, the device will start calibrating the motor once.
Temperature Control Mode	Select from Automatic Temperature Control or Valve Opening Control.
Freeze Protection	When the device detects the temperature is lower than the threshold temperature, control the valve opening status every 10 minutes to adjust the temperature to threshold temperature (± target temperature tolerance).
Child Lock	Lock the control knob to control the valve. After enabled, the device can only control the valve via ToolBox App or downlink commands.
Change Password	Change the password for ToolBox App to write this device.

Automatic Temperature Control: set target temperature to control the valve opening status. When using this mode, the target temperature can be set via ToolBox App, control knob or downlink command.



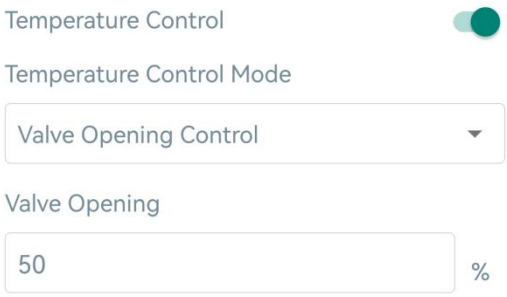
Parameters	Description
Target Temperature	Set target environment temperature. The device will adjust the valve every 10 minutes if the gap between target temperature and current temperature is more than tolerance value.
Target Temperature Tolerance	Set the tolerance value between target temperature and current temperature.
Target Temperature Regulation Range	Set the range for control knob to adjust the target temperature. Max range: 16 - 35 °C, min range: 5 - 15 °C, default range: 10 - 28 °C.
Open Window Detection	When the device detects the temperature drops over cooling rate, it will stop temperature control and report open window status; when the device detects the temperature rising for 10 minutes or reaching target temperature, it will start temperature control and report normal status.
Cooling Rate	Set the detecting condition of window open.
Stop temperature control for..	The device will start temperature control even it still detects the window open after this interval.

Valve Opening Control: control valve opening status to adjust the temperature. 0% means valve is all closed and 100% means valve is all open. When using this mode, the valve opening percentage can be set via ToolBox App, control knob or downlink command.

Note:

1) When rotating the control knob, the LED display will show corresponding valve opening percentage and current temperature. Every rotating step is 5%.

2) When setting the valve opening percentage as 100%, the LED display will only show 99.

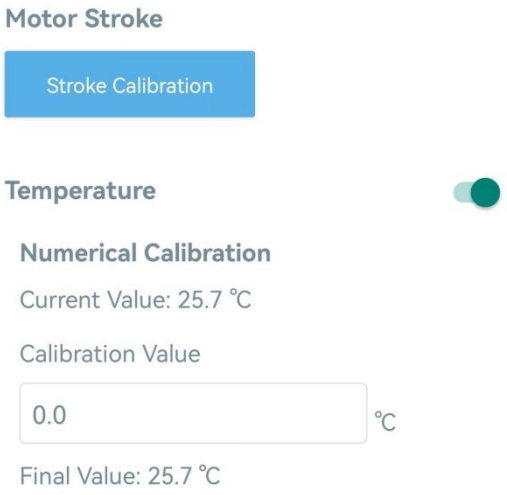


5.4 Advanced Settings

5.4.1 Calibration Settings

Motor Stroke Calibration: click to calibrate the motor stroke when the device is installed to the valve. After calibration, the device will report a calibration result packet.

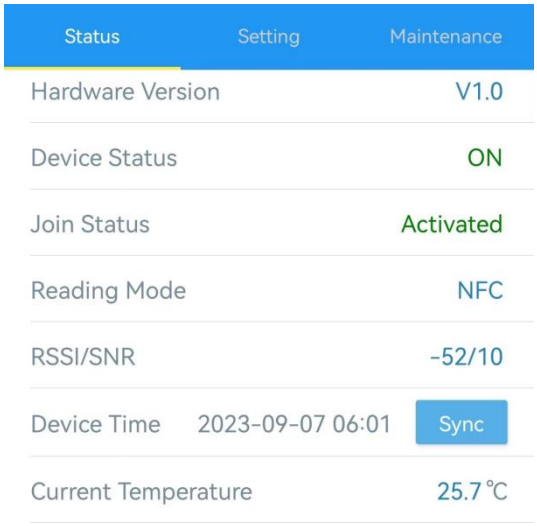
Temperature Calibration: set the calibration value, the device will add calibration value to the current temperature value and report the final value.



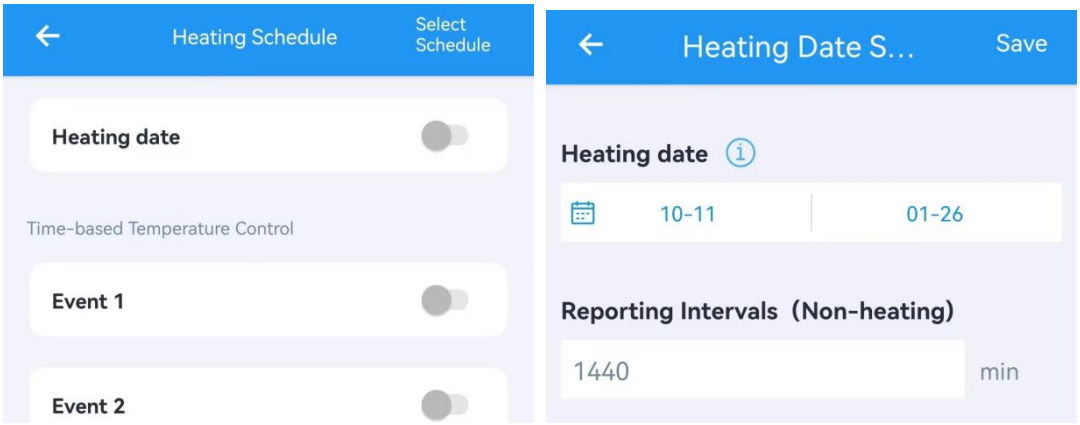
5.4.2 Heat Schedule

WT101 supports to set at most 16 heat schedules within 1 pre-set date period.

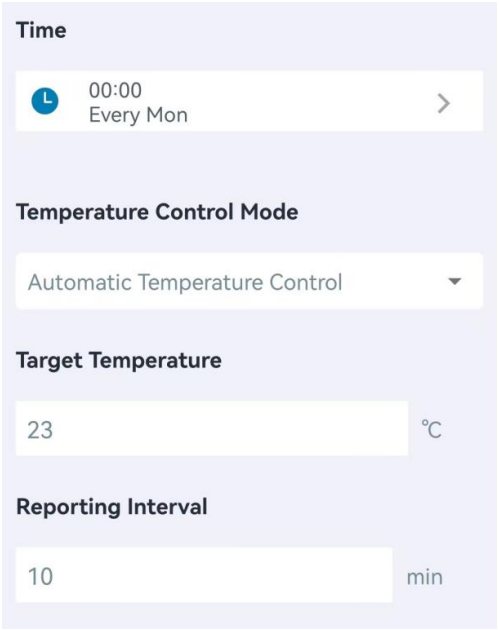
1. Sync the device time via ToolBox App. Besides, the device can also ask for the time from network server when setting LoRaWAN version as 1.0.3.

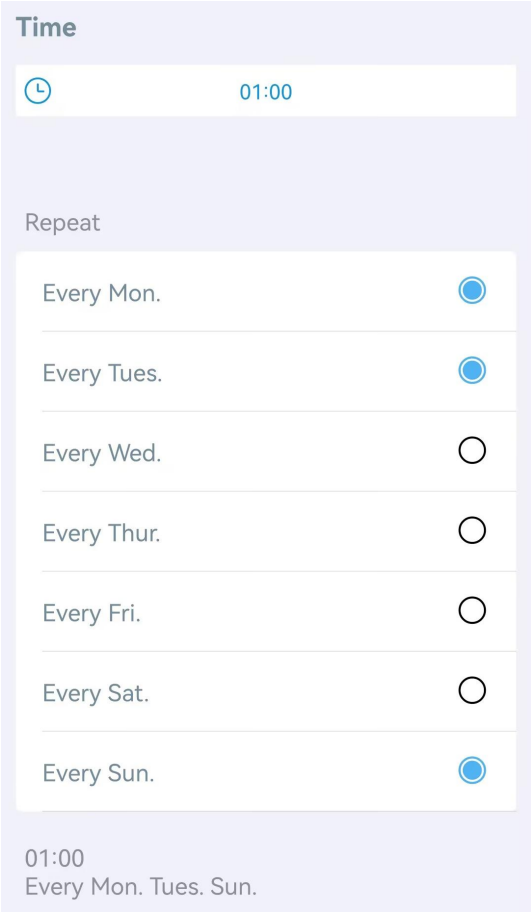


2. Set a heating date period, and the reporting interval except the heating date period. Temperature control will stop during non-heating period.

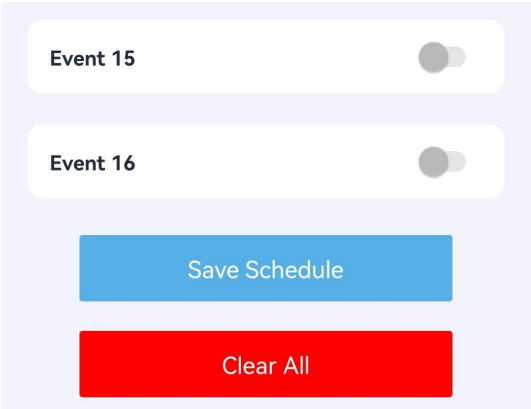


3. Set time-based control events and these events only execute within the heating date period. If the repeat day is not selected, this event will only execute once.

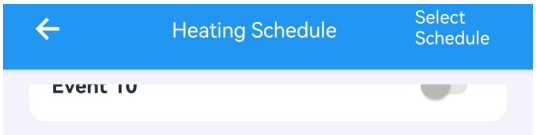




4. Click **Save Schedule** to export above settings as a schedule file.



Click **Select Schedule** to import the schedule file to another device.



5.5 Maintenance

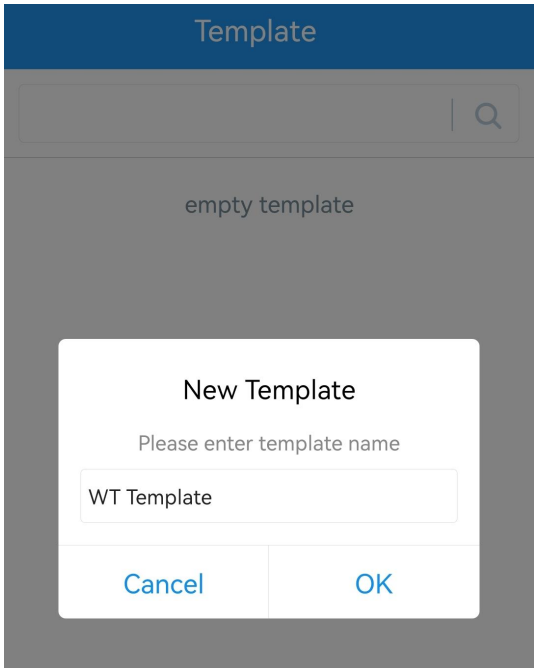
5.5.1 Backup

WT101 supports backup templates for easy and quick configuring devices in bulk. The backup

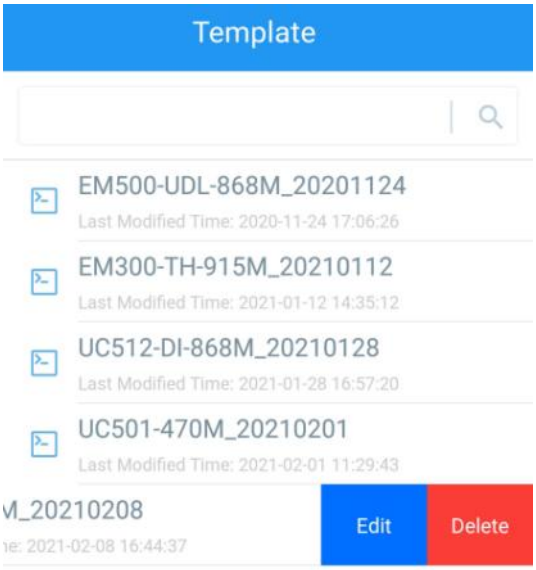
feature is only for devices with the same model and LoRaWAN® frequency band.

1. Go to **Template** page on the App and save the current settings as a template. The saved templates are also editable.

2. Select one saved template and click **Write**, then attach the smartphone to another device via NFC to reuse the template.



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



5.5.2 Upgrade

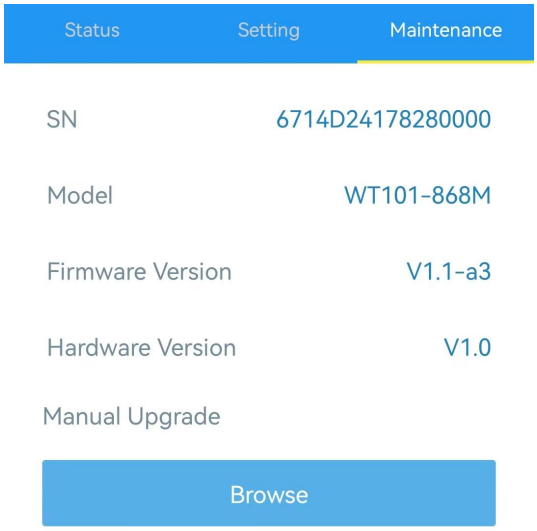
1. Download firmware from the Milesight website to your smartphone.

2. Go to **Device > Maintenance** of ToolBox App, tap **Browse** to import firmware and upgrade the device.

Note:

1) Operation on ToolBox is not supported during the upgrade.

2) Only the Android version of ToolBox supports the upgrade feature.

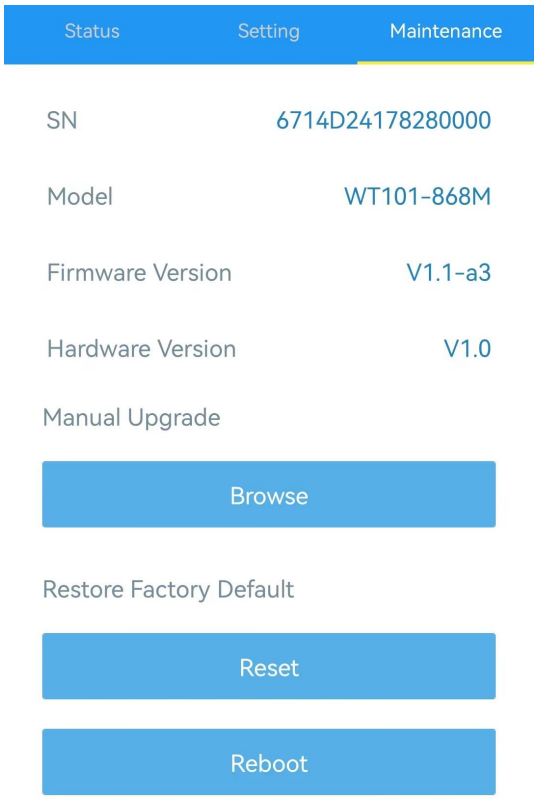


5.5.3 Reset to Factory Default

WT101 supports two methods to reset the device which are as following:

Via Hardware: Press and hold the reset button for more than 10s until the LED display blinks quickly.

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



6. Device Payload

All the data is based on the following format (HEX), the Data field should follow the 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 please find the files on https://github.com/Milesight-IoT/SensorDecoders.

6.1 Basic Information

WT101 reports basic information whenever joining the network.

Channel	Type	Description
ff	0b (Power On)	Device is on
	01(Protocol Version)	01=>V1
	16 (Device SN)	16 digits
	09 (Hardware Version)	01 40 => V1.4
	0a (Software Version)	01 14 => V1.14
	0f (Device Type)	00: Class A, 01: Class B, 02: Class C

Example:

ff0bff ff0101 ff166791d19604050005 ff090100 ff0a0101 ff0f00					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	0b (Power On)	ff (Reserved)	ff	01 (Protocol Version)	01 (V1)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	16 (Device SN)	6791d19604050005	ff	09 (Hardware Version)	0100 (V1.0)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	0a (Software Version)	0101 (V1.1)	ff	0f (Device Type)	00 (Class A)

6.2 Sensor Data

Item	Channel	Type	Description
Battery Level	01	75	UINT8, Unit: % **Note:** the device will report a low battery packet when it drops to 10%.
Current Temperature	03	67	INT16, Unit: °C, Resolution: 0.1 °C
Target Temperature	04	67	INT16, Unit: °C, Resolution: 0.1 °C
Valve Opening Percentage	05	92	UINT8, Unit: %
Tamper Status	06	00	00: Installed, 01: Uninstalled
Open Window Detection	07	00	00: Normal, 01: Open
Motor Calibration Result	08	e5	00: Success 01: Fail, out of range 02: Fail, uninstalled 03: Calibration cleared 04: Temperature control disabled
Motor Stroke	09	90	UINT16
Freeze Protection	0a	00	00: Back to Normal, 01: Triggered
Motor Position	0b	90	UINT16, current motor position **Note:** when motor position =motor stroke, the valve is all closed; when motor position is 0, the valve is all open.

Examples:

1. Automatic Temperature Control periodic packet: report as reporting interval (10 minutes by default).

017564 0467e600 03670701 0b903a02 09903a02					
Channel	Type	Value	Channel	Type	Value
01	75	64=>100%	03	67	Temp: 07 01=>01 07=263*0.1=26.3°C
Channel	Type	Value	Channel	Type	Value
04	67	Target Temp: e6 00=>00 e6=230 *0.1=23°C	09	90	Motor Stroke: 3a 02=>02 3a=570
Channel	Type	Value			
0b	90	Motor Position: 3a 02=>02 3a=570			

2. Valve Opening Control periodic packet: report as reporting interval (10 minutes by default).

017564 03670f01 05925f 0b901c00 09904002					
Channel	Type	Value	Channel	Type	Value
01	75	64=>100%	03	67	Temp: 0f 01=>01 0f=271*0.1=27.1°C
Channel	Type	Value	Channel	Type	Value
05	92	5f=>95%	09	90	Motor Stroke: 40 02=>02 40=576
Channel	Type	Value			
0b	90	Motor Position: 1c 00=>00 1c=28			

3. Motor calibration packet: report when the motor start calibrating.

08e500 09903a02					
Channel	Type	Value	Channel	Type	Value
08	e5	00=success	09	90	Motor Stroke: 3a 02=>02 3a=570

4. Open Window Detection: reports when detecting the window open or returns back to normal status.

070001 03679600					
Channel	Type	Value	Channel	Type	Value
07	00	01=open	03	67	Temperature: 96 00 =>00 96 = 150 * 0.1 = 15 °C

5. Freeze Protection: report when freeze protection is triggered or released.

0a0001 03671500 05925f					
Channel	Type	Value	Channel	Type	Value
0a	00	01=freeze protection is triggered	03	67	Temperature: 15 00 =>00 15 = 21 * 0.1 = 2.1 °C
Channel	Type	Value			
05	92	5f=>95%			

6. Tamper packet: report when the device is removed from base plate.

060001 08e503					
Channel	Type	Value	Channel	Type	Value
06	00	01=uninstalled	08	e5	03=Calibration cleared

6.3 Downlink Commands

WT101 supports downlink commands to configure the device. The application port is 85 by default.

Channel	Type	Description
ff	10 (Reboot)	ff
	17 (Time Zone)	2 Bytes, UTC timezone * 10
	8e (Reporting Interval)	3 Bytes, Byte 1: 00 Byte 2-3: interval time, unit: min
	ab (Temperature Calibration)	3 Bytes, Byte 1: 00-disable, 01-enable Byte 2-3: calibration value*10
	b3 (Temperature Control)	00-disable, 01-enable
	ae (Temperature Control Mode)	00: Automatic Temperature Control 01: Valve Opening Control
	b1 (Target Temperature)	3 Bytes, Byte 1: target temperature, unit: °C Byte 2-3: target temperature tolerance*10, unit: °C
	af (Open Window Detection)	3 Bytes, Byte 1: 00-disable, 01-enable Byte 2: cooling rate*10, unit: °C/min Byte 3-4: stop temperature control time,

		unit: min
	57 (Release Open Window Status)	ff
	b4 (Valve Opening Percentage)	1 Byte, unit: %
	b0 (Freeze Protection)	3 Bytes, Byte 1: 00-disable, 01-enable Byte 2-3: threshold temperature*10, unit: °C
	25 (Child Lock)	00-disable, 01-enable

Examples:

1. Reboot the device.

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

2. Set reporting interval as 2 minutes.

ff8e 00 0200		
Channel	**Type**	**Value**
ff	8e (Reporting Interval)	02 00=>00 02=>2 mins

3. Enable temperature and set calibration value.

ffab01fdff		
Channel	**Type**	**Value**
ff	ab (Temperature Calibration)	01=Enable fdff=>fffd=-3*0.1=-0.3

4. Set time zone.

ff17ecff		
Channel	**Type**	**Value**
ff	17	ec ff => ff ec = -20 the time zone is UTC-2

5. Set target temperature.

ffb1190100		
Channel	**Type**	**Value**
ff	b1 (Target Temperature)	Target temperature: 19 =>25 °C Temperature Tolerance: 0100=>00 01*0.1=0.1°C

6. Set open window detection.

ffaf011e 3c00		
Channel	**Type**	**Value**
ff	af (Open Window Detection)	01=enable Cooling rate: 1e=30*0.1=3 °C/min Stop control time: 3c00=>00 3c=60 minutes

7. Set valve opening percentage.

ffb432		
Channel	**Type**	**Value**
ff	b4 (Valve Opening Percentage)	32=>50%

8. Set freeze protection.

ffb0011e00		
Channel	**Type**	**Value**
ff	b0 (Freeze Protection)	01=enable Threshold temperature: 1e00=>00 1e=30*0.1=°C

-END-