Milesight

Smart Thermostat

WT201 & WT211

User Guide

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Chapter 1. Preface

Copyright Statement

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

Safety Instruction

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

Warning:

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

- The installation must be conducted by a qualified person and should strictly comply with the electrical regulations of the local region.
- Before installation or maintenance, make sure to keep the power off. Failure to follow these steps may result in personal injury and/or death from electric shock.
- Make sure all wires are connected, and unused cables must be insulated and secured.
- Please contact the after-sales service for equipment failure, do not try to repair it yourself.

CAUTION:

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

- The device is intended only for indoor use.
- The device is not intended to be used as a reference sensor, and Milesight will not take responsibility for any damage which may result from inaccurate readings.
- The device must not be disassembled or 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.

- The device must never be subjected to shocks or impacts.
- To protect the security of the device, please change the device password when first configuring.
- To prevent heat accumulation, do not block air circulation around the device.
- Do not clean the device with detergents or solvents such as benzene or alcohol. To clean the device, wipe with a soft moistened cloth. Use another soft, dry cloth to wipe dry.

Revision History

Release Date	Version	Revision Content
Jan. 17, 2025	V2.0	Initial version based on hardware v2.x: 1. Change room card switch input type and name; 2. Add D2D data receiving feature; 3. Add compressor and auxiliary heat linkage feature; 4. Add Temperature Control Mode Enable and Target Temperature Resolution feature; 5. Add dual target temperature mode under Auto mode; 6. Add downlink feature: Temporary unlock, W2/Y2 auxiliary mode, Relay change report, Send humidity data. 7. Add schedule type: Occupied, Unoccupied, ECO. 8. Update the definition of O/B; 9. Update compressor protection to system protection; 10. Add temperature control mode and target temperature tolerance in the schedule; 11. Add FUOTA feature.
May 31, 2026	V2.1	1. Add WT211 model accessory and installation contents; 2. Support custom temperature control stages; 3. Add occupancy mode settings; 4. Add unilateral tolerance feature; 5. Add timezone offset feature; 6. Add offline unlock feature; 7. Optimize system protection and freeze protection.

Chapter 2. Product Introduction

This chapter describes basic product information.

2.1 Overview

WT2x1 is a LoRaWAN® thermostat used as an HVAC controller supporting a wide range of different heating and cooling systems, including heat pumps, AC, boilers, furnaces, AHU, and PTAC devices. The thermostat provides multiple modes including heat/cool, emergency heat, auto, and fan mode, enabling precise temperature adjustments in buildings. It allows for automatic control through scheduled programming and remote management via cloud system. Real-time monitoring ensures timely alerts for sudden temperature changes, prioritizing people's safety and protecting assets. Additionally, it has the capability to store up to 1000 pieces of data, providing ample data security.

With 4.2" LCD screen and embedded temperature and humidity sensor, the thermostat continuously displays the room status while monitoring the ambient temperature and humidity. Moreover, the thermostat seamlessly integrates with hotel room card systems, allowing for convenient remote management. Compatible with Milesight LoRaWAN® gateway and Milesight Development Platform solution, users can control the room temperature as well as trigger other sensors or appliances easily via webpage remotely and D2D protocol.

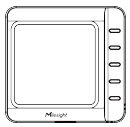
The device has the following features:

- Supports most 24VAC HVAC systems, including furnaces and air conditioners (2H/2C), heat pumps (4H/2C or 3H/2C + 1 stage AUX heat), boilers, and PTAC
- Supports an intuitive 4.2-inch display, allowing for showing temperature/humidity and status of the room clearly
- Built-in temperature and humidity sensor, enabling environmental detection and accurate control
- Compatible with hotel room card systems for convenient remote management
- Equips with RTC to keep time correct for 72 hours even without power supply
- Equips with NFC for one touch configuration
- Support 4 temperature control modes and 3 fan modes for flexible temperature control
- Adjust the room temperature manually or automatically with 7 working modes and allow up to 16 schedules for each mode
- Supports the child lock function and anti-theft installation for safety reasons
- Stores historical records locally and supports retransmission to prevent data loss
- Works well with standard LoRaWAN® gateways and network servers
- Compatible with BACnet system via Milesight LoRaWAN® gateways
- Compatible with Milesight Development Platform

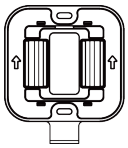
- Supports Milesight D2D protocol to enable ultra-low latency control without gateway
- Supports multicast for control in bulk
- Supports Firmware Update Over the Air (FUOTA)

2.2 Packing List

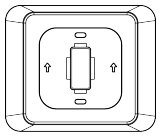
This section describes the packing list. After unboxing, please check that the following items are included in the package. If any of the below items are missing or damaged, please contact your sales representative.



1 × Smart Thermostat



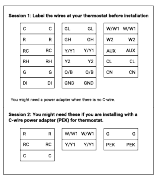
1 × Wiring Backplate



1 × Decorative Cover Plate

4 × Wall Mount Kits

1 × Fixing Screw



Session 1: Label the wires at your thermostat before installation

C	C	O1	O1	W/W1	W/W1
R	R	OH	OH	W2	W2
RC	RC	Y/Y1	Y/Y1	AUX	AUX
RH	RH	Y2	Y2	OL	OL
G	G	D/B	D/B	ON	ON
DI	DI	GND	GND		

You might need a power adapter when there is no C-wire.

Session 2: You might need these if you are installing with a C-wire power adapter (PCB) for thermostat.

R	R	W/W1	W/W1	G	G
RC	RC	Y/Y1	Y/Y1	PCK	PCK
C	C				

1 × Wire Label Sticker

1 × Warranty Card

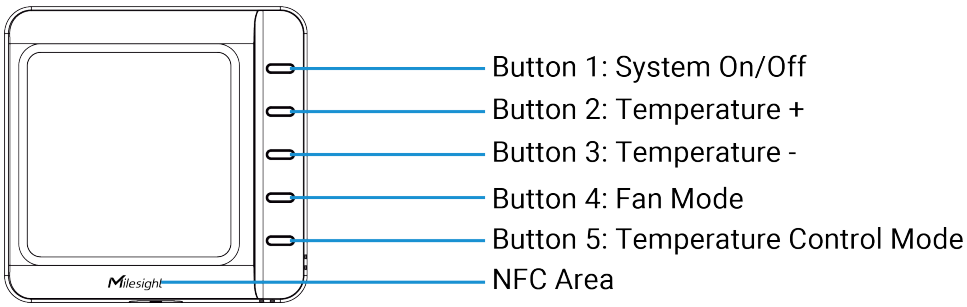
1 × Quick Guide

1 × Wire Crimp Cap (WT211 Only)

2.3 Hardware Introduction

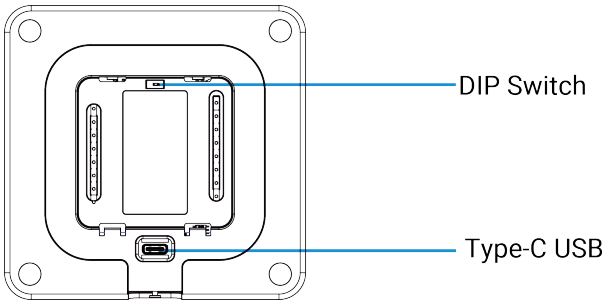
Hardware Overview

Front View



Part	Description
NFC Area	Enables wireless configuration via Milesight ToolBox App.
Button 1	Turn on/off the temperature control system.
Button 2	When control permission is **Thermostat**, each press adds the target temperature by 0.5 or 1 (depends on the Target Temperature Resolution).
Button 3	When control permission is **Thermostat**, each press reduces the target temperature by 0.5 or 1 (depends on the Target Temperature Resolution).
Button 4	When control permission is **Thermostat**, switch the fan mode.
Button 5	When control permission is **Thermostat**, switch the temperature control mode.

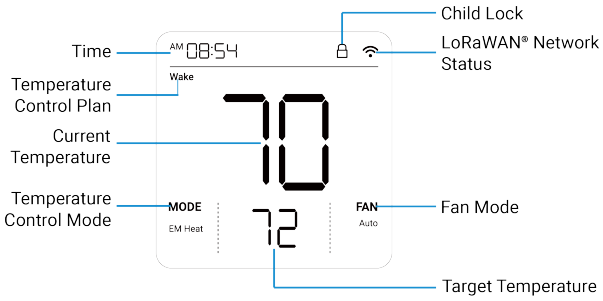
Back View



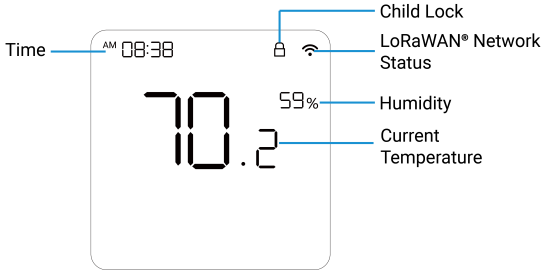
Part	Description
DIP Switch (WT201 Only)	Switch between **RC&RH** and **Only RC** according to the wiring system.
USB Type-C	Used for power supply during configuration or device console.

Screen Display

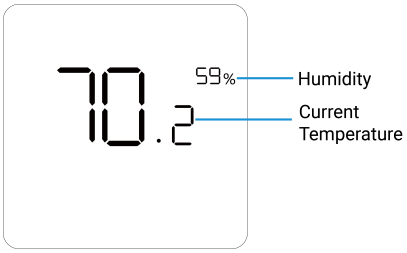
System On-Thermostat Mode:



System On-Remote Control Mode:



System Off:



Icon	Description
Time	Display the current time.
Child Lock	**All buttons locked:** Normal display. **Partial locked:** Display only when the locked button is pressed.
LoRaWAN® Network Status	Display network status. **Blinks:** The network is de-activated. **Static On:** The network is activated. **Blinks Twice:** Send a LoRaWAN® uplink packet.
Humidity	Display the ambient humidity.
Temperature	Display the ambient temperature.

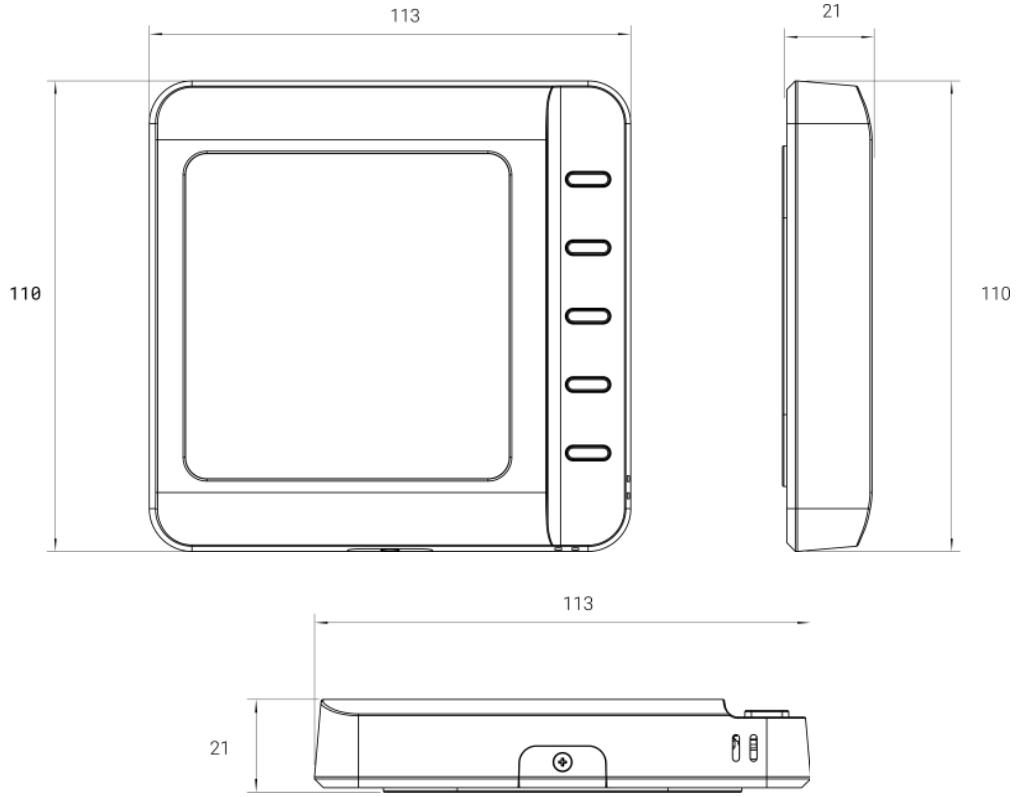
Icon	Description
Temperature Control Plan	Display current executed schedule name.
Temperature Control Mode	Display current temperature control mode.
Target Temperature	Display the target temperature.
Fan Mode	Display current fan mode.

Reboot and Reset Descriptions

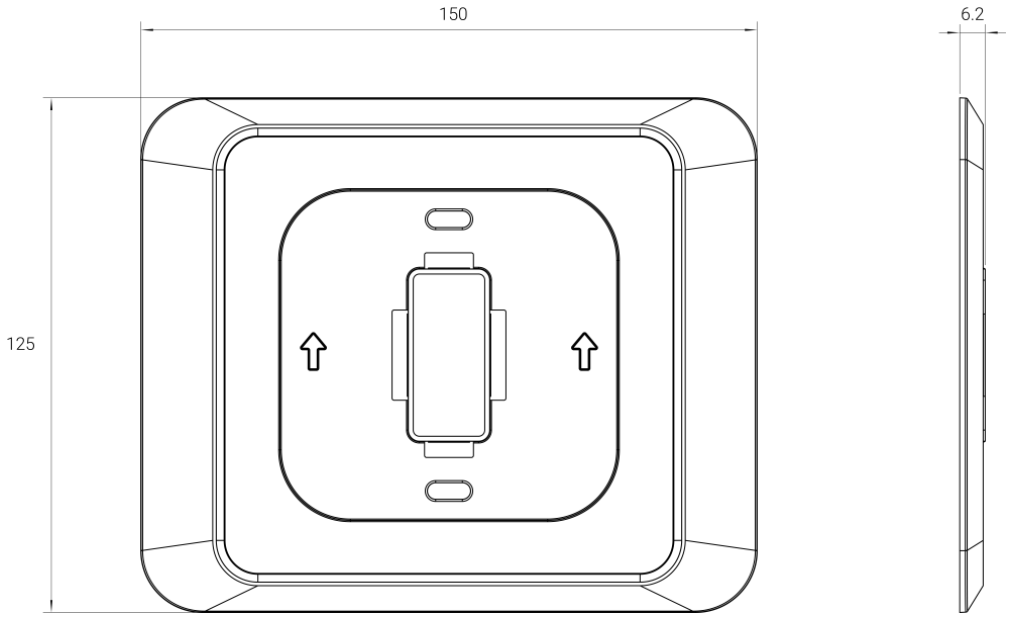
Function	Operation	Screen
Reboot	Press and hold the button 1 and button 5 for more than 3s.	Slowly Blinks
Reset to Factory Default	Press and hold the button 1 and button 5 for more than 10s.	Quickly Blinks

Dimensions

The following figures show the device dimensions (unit: mm).



The following figures show the decorative cover plate dimensions (unit: mm).



Chapter 3. Compatibility

This chapter introduces the device compatibility and describes the steps to check the compatible systems.

Compatible HVAC Systems

The thermostat is compatible with below systems:

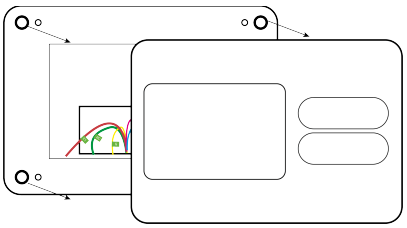
- Conventional HVAC System (Furnace/Boiler + Air Conditioner, up to 2-cool/2-heat)
- Heat Pump System (Up to 2-cool/4-heat, or 2-cool/3-heat + 1-AUX heat)
- PTAC

How to Check HVAC System Compatibility

1. Power off the HVAC system by using the master switch or circuit breaker.
2. To confirm power is off, adjust the temperature on the current thermostat and wait for a few minutes. If the system does not respond accordingly, the power is shut off successfully.

   Warning:
   Failure to follow these steps may result in personal injury and/or death from electric shock.

3. Remove the current thermostat cover from the wall.



4. If you see the system is labeled with wires L1 and L2, or any **high-voltage indicators** like 110V, 120V, or 240V, it means the thermostat is not compatible with this system. Otherwise, continue to the next step.
5. Recognize the used wires by the old thermostat wire labels or wire terminals.
6. Use Compatibility Checker to determine the system compatibility. Check whether all used wires are listed in the following table:

Wire Label	Description
C	Common wire of 24 VAC power. If no C wire,

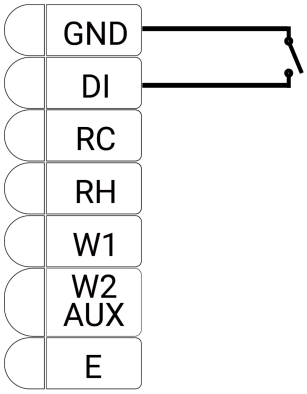
Wire Label	Description
	a. Check if this wire is labelled as other names (like B). b. It may need a C-wire Power Extender Kit. Please contact Milesight for the details.
R	Heating and cooling system power wire. If there is only one R wire, connect this wire to either RC or RH of the WT thermostat.
RH	If there are RC and RH wires, RH works as heating power wire for dual-transformer systems. If there is only one RH wire, RH works as both the heating and cooling power wire.
RC	If there are RC and RH wires, RC works as cooling power wire for dual-transformer systems. If there is only one RC wire, RC works as both the heating and cooling power wire.
Y/Y1 & Y2	In conventional systems, Y/Y1 controls the 1-stage cooling and Y2 controls the 2-stage cooling. In heat-pump systems, Y/Y1 controls the 1-stage compressor for cooling/heating and Y2 controls the 2-stage compressor for cooling/heating.
W or W1	In conventional systems, W/W1 controls the 1-stage heating. In heat-pump systems with auxiliary heat, W/W1 controls the 1-stage auxiliary heat.
W2 or AUX	In conventional systems, W2 controls the 2-stage heating. In heat-pump systems with auxiliary heat, W2/AUX controls the 2-stage auxiliary heat.
G or G1	G controls the fan.
GH & GL	In 2-speed fan system, GL controls low speed and GH controls high speed.
O/B	In heat pumps, O/B controls the reversing valve to switch between heating and cooling. If there is only one O wire or B wire, connect this wire to O/B of the WT thermostat.
E	Some heat pumps have an E terminal for emergency heat on/off. Emergency heat is only used on very cold days when the heat pump is unable to maintain the temperature.
AUX	In heat-pump systems with auxiliary heat source, AUX controls the auxiliary heat for cold days to rise the temperature quickly.

7. If there is any wire label not present in the above list or it is hard to determine the compatibility, take a photo of the wires connected to the terminals of the old thermostat and send it to a local professional installer or Milesight.
8. Check if the relay current match the below conditions:

Model	Max. Current/Per Channel	Max. Current/Total
WT201	1A	1A
WT211	3A	5A

Key Card Switch Compatibility

The thermostat is equipped with a dry contact input for connection to a key card switch. By default, two connected contacts=insert card, two disconnected contacts=remove card.



Chapter 4. Install the Device

Limitation

The thermostat is designed for 24VAC systems only. Do not install it on high-voltage, high-current, or millivolt systems!

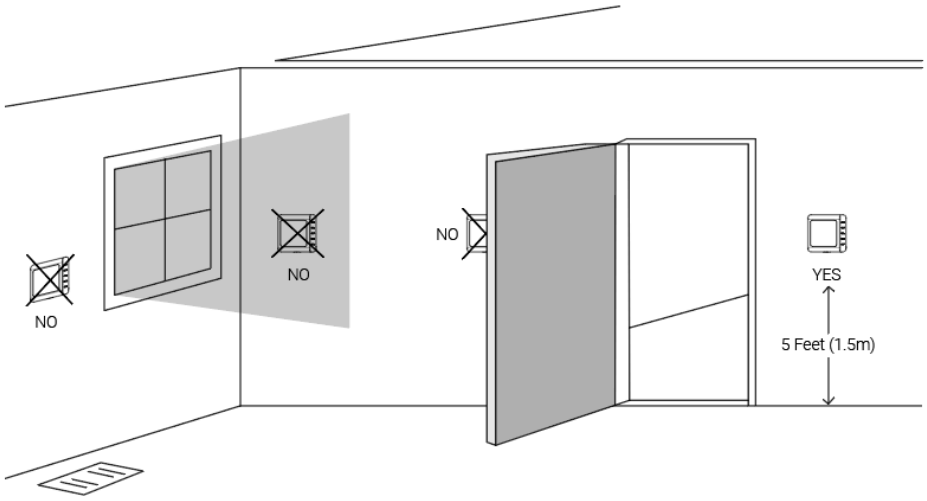
Prerequisites

- **Ensure the thermostat is compatible with the target HVAC system.**
- Ensure the wire diameter complies with the AWG 24-18 standard.
- Ensure there is a C wire or common wire. If no C wire, it may need a C-Wire Power Extender Kit.
- Check the default accessories in the box.
- Prepare the following additional tools: Screwdriver, Pencil, Drill (15/64" or 1/4" drill bits), Crimping pliers (for WT211)

Installation Location

The thermostat supports receiving ambient temperature and humidity data from either internal sensors or external servers/devices. It is important to choose appropriate installation locations to collect accurate environmental data and ensure precise control.

It is recommended to install the thermostat about 4-5 ft. (1.2-1.5m) above the floor, in an area with good air circulation at average temperature. If installation in an optimal location is not feasible, consider using external data sources.



Do not install the device where:

- Close to hot or cold sources like hot or cold air ducts;
- The place in direct sunlight;
- Dead spots or drafts (behind the doors and in corners);
- In areas that do not require conditioning;
- Close to concealed chimneys or pipes;
- Close to metal objects and large obstacles which affect the wireless transmission;
- The place with lots of electromagnetic interference;
- The place where strong vibration may happen or easy to be subjected to physical shock.

Installation Steps

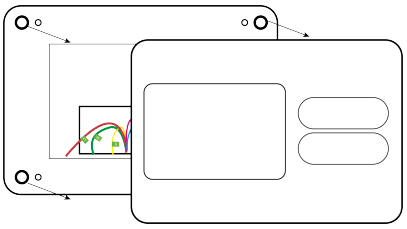
- Step 1. Remove the Old Thermostat
- Step 2. Install the Backplate of the New Thermostat
- Step 3. Adjust Power Jumper for New Thermostat
- Step 4. Wire the New Thermostat
- Step 5. Install the New Thermostat

Step 1. Remove the Old Thermostat

1. Power off the HVAC system by using the master switch or circuit breaker.
2. To confirm power is off, adjust the temperature on the current thermostat and wait for a few minutes. If the system does not respond accordingly, the power is shut off successfully.

> **Warning:**
> Failure to follow these steps may result in personal injury and/or death from electric shock.

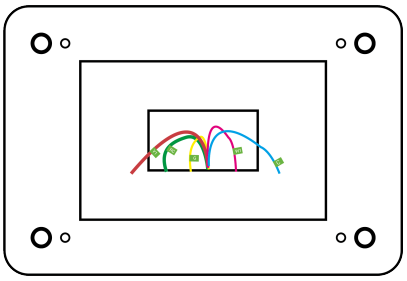
3. Remove the current thermostat cover from the wall.



4. Take a photo of the wires connected to the terminals of the old thermostat for reference.

CAUTION:
If you see the system is labeled with wires L1 and L2, or any high-voltage indicators like 110V, 120V, or 240V, it means the thermostat is not compatible with this system. DO NOT CONTINUE INSTALLATION.

5. Disconnect the wires from old thermostat and label the wires with stickers.

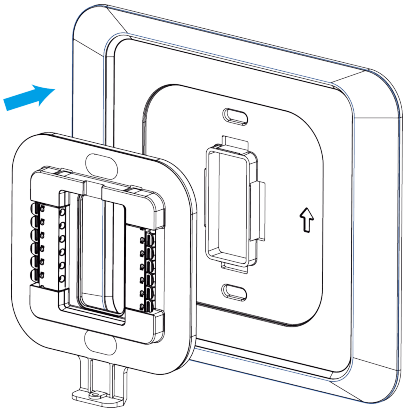


6. Unscrew the backplate of the old thermostat and remove it from the wall. Be careful not to let the wires fall into the wall holes.

Step 2. Install the Backplate of the New Thermostat

1. (Optional) Press the wiring backplate onto the decorative cover plate to fix them together. If you do not use the decorative cover plate, skip this step.

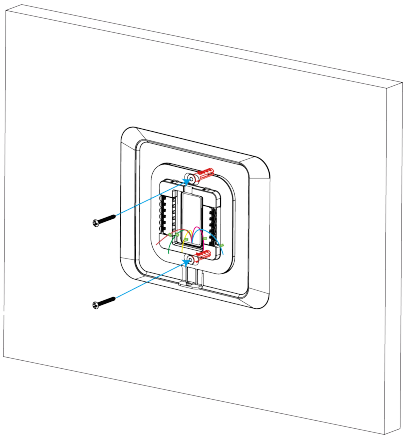
Tip:
It is recommended to use the decorative cover plate to cover the holes on the wall left by the old thermostat, and to reduce the airflow from the holes that affect the ambient temperature measurement of the new thermostat.



2. Position the wiring backplate against the wall to check if the wall anchors from the old thermostat align with the screw holes of the backplate.
3. If the backplate does not align with existing anchor holes, mark the new screw hole locations with a pencil. Then drill the two mounting holes.

> **Tip:**
> Use a level to ensure the thermostat is properly aligned before marking the screw hole locations.

4. Pass the wires through the middle opening in the backplate, then secure the backplate (with decorative cover plate) to the wall using the wall plugs and mounting screws.

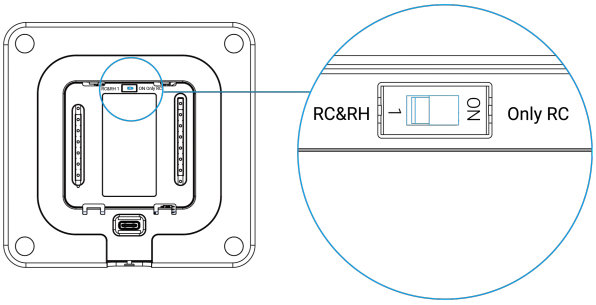


Step 3. Adjust Power Jumper for New Thermostat

WT201

1. Confirm your HVAC system type and wirings.
2. If you use a two-transformer HVAC system which has two independent power wires (like RC and RH), adjust the DIP switch of the thermostat to **RC&RH**; if you use a single-transformer HVAC system which has only one power wire (like R or RC), adjust the DIP switch to **Only RC**.

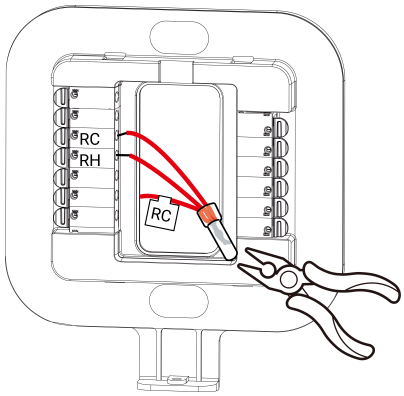
CAUTION:
Ensure the DIP switch positions match the HVAC system; otherwise, it may cause the thermostat to malfunction or even become damaged.



WT211

1. Confirm your HVAC system type and the wirings.
2. By default, there is a jumper between the terminal RC and RH. Follow the instructions according to your HVAC system:

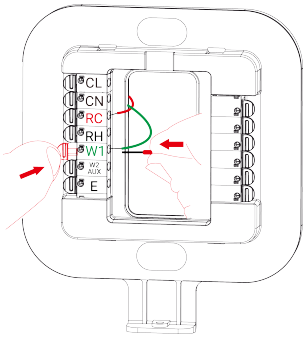
System Type	Step
Two-transformer HVAC system with two independent power wires (like RC and RH)	a. Hold the tabs of the terminal blocks to unplug the jumper.
Single-transformer HVAC system with only one power wire (like R or RC)	a. Make sure that there is a length of insulation stripped from the jumper and the power wire. b. Twist the jumper and the power wire together and cover them with the wire crimp cap.

System Type	Step
	c. Crimp the wire crimp cap with crimping pliers. 

CAUTION:
Ensure the jumper status matches the HVAC system; otherwise, it may cause the thermostat to malfunction or even become damaged.

Step 4. Wire the New Thermostat

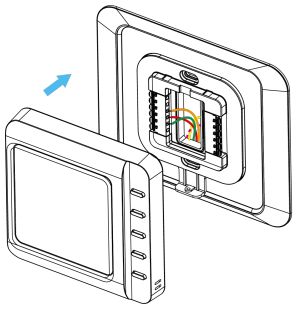
1. Make sure that about 6.5 mm of insulation is stripped from the end of the used wires.
2. According to the wiring diagram, hold the tabs and insert the wires into the side holes of the corresponding terminals on the wiring backplate until they are firmly in place. If you need to release the wires, press the terminal tabs again and pull out the wires.



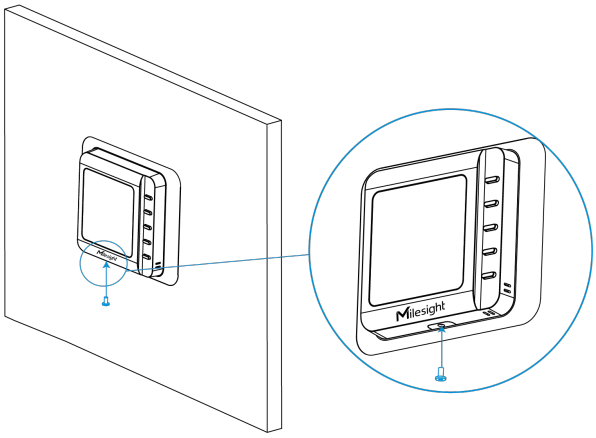
3. Gently tug the wires to ensure that they are securely connected.
4. Push the excess wires back into the hole on the wall and ensure no drafts are coming from it.

Step 5. Install the New Thermostat

1. Align the thermostat to the wiring backplate and push it until it clicks into place.



2. Power on the HVAC system by using the master switch or circuit breaker. After powering on, check the device as follows:
    - Whether the screen displays the temperature and humidity data.
    - Press the top button (Button 1) to check whether the HVAC system can be turned on or off.
    - Press buttons to switch temperature control mode and fan mode to check if the HVAC system responds correctly.
    - Check whether the network icon on the screen is static on to determine if the thermostat has joined the network.
    - (Optional) Whether the keycard switch works.
3. Fix the bottom of the thermostat to the wiring backplate with a fixing screw.



Chapter 5. Operation Guide

This chapter describes the steps and details for configuring and operating the device.

5.1 Access the Thermostat

This chapter describes the steps to access and configure the thermostat.

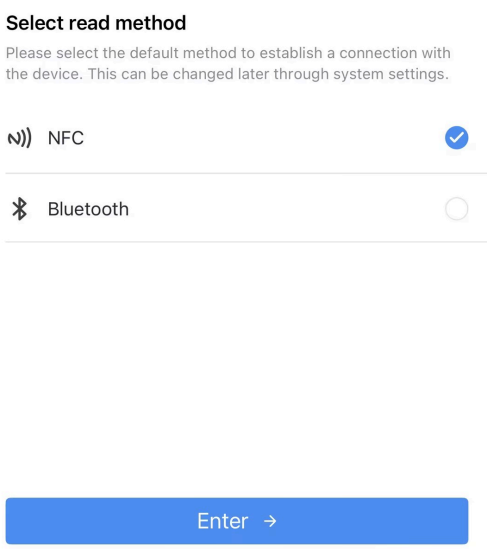
Configure the Thermostat using NFC

The thermostat can be accessed and configured locally using NFC.

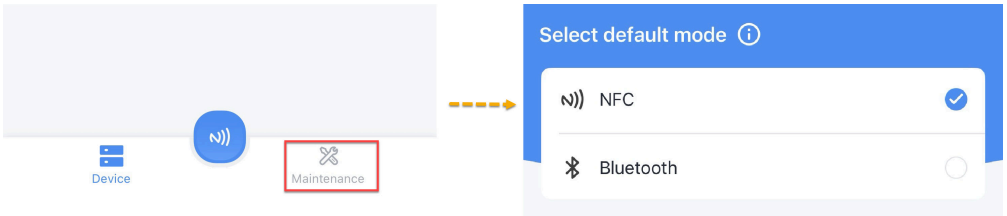
Prerequisites: The thermostat is powered by the USB port or HVAC system.

Steps:

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

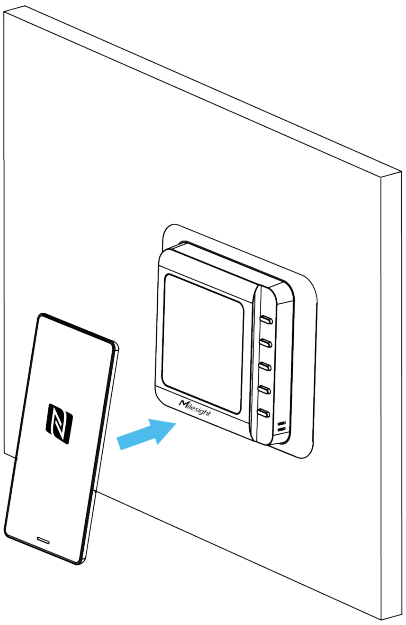


   b. Upon subsequent launches, Click **Maintenance** on the home page, and then select **NFC**.



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

> **Tip:**
> It is recommended to remove the phone case.



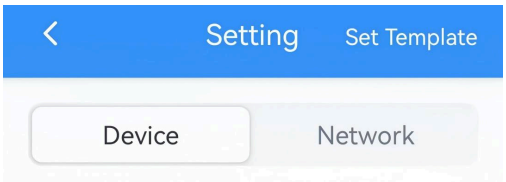
6. Click . If the device is recognized successfully, the homepage is displayed.

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

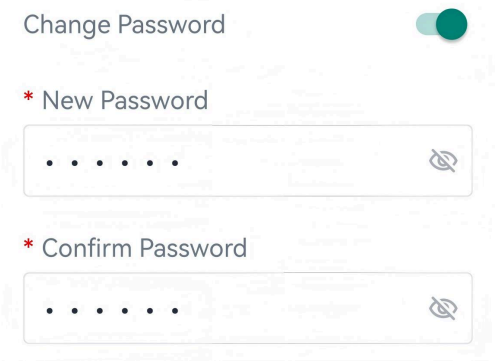
For a description of the homepage, refer to the following table.

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

7. (Optional) Change the device password for security purposes.
   a. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
   b. On the top bar, select **Device** tab.



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



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

   d. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the password was changed successfully, the following page is displayed.

Write successfully!

Configure the Thermostat Remotely

The thermostat can be configured remotely when it connects to a LoRaWAN® network server.

Prerequisites:

- The thermostat is powered on.
- A LoRaWAN® network server (or a LoRaWAN® gateway with a built-in network server).
- If you require BACnet configuration, it is necessary to use a Milesight LoRaWAN® gateway with the BACnet feature.

Steps:

1. Add the thermostat to the LoRaWAN® network server. The required device parameters can be found here.
2. Check if the device network status is **Activated** using the screen icon, ToolBox or the server.
3. Select one of the following methods to configure the device.

> **Tip:**
> Please search for the configuration command/object details in Communication Protocol document using the keywords provided in this guide.

Configuration Method	Step
BACnet	a. Select the payload codec when adding the device to the gateway. b. Enable BACnet feature to integrate with your BMS system. c. Add the device BACnet objects to this gateway. d. Read or write the objects by your system.
JSON Command	a. Copy the device codec. b. Paste the device codec to one network server. c. Send JSON strings commands to check if it works.
Raw Command	a. Select the downlink format as HEX and send the commands directly.

5.2 Network Settings

This chapter describes the network settings for the device communication.

5.2.1 Configure LoRaWAN® Parameters

This section describes how to configure the device transmission parameters for the LoRaWAN® network. LoRaWAN® is enabled by default on this device.

Usually, it consists of the below steps:

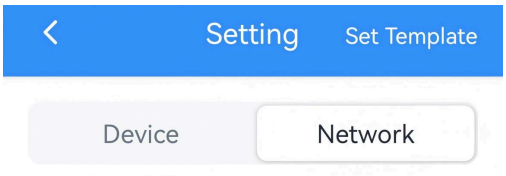
1. Configure Join Type and Supported Frequency (Necessary)
2. Configure Other LoRaWAN® Parameters (Optional)
3. Configure Multicast Group (Optional)

Configure Join Type and Frequency

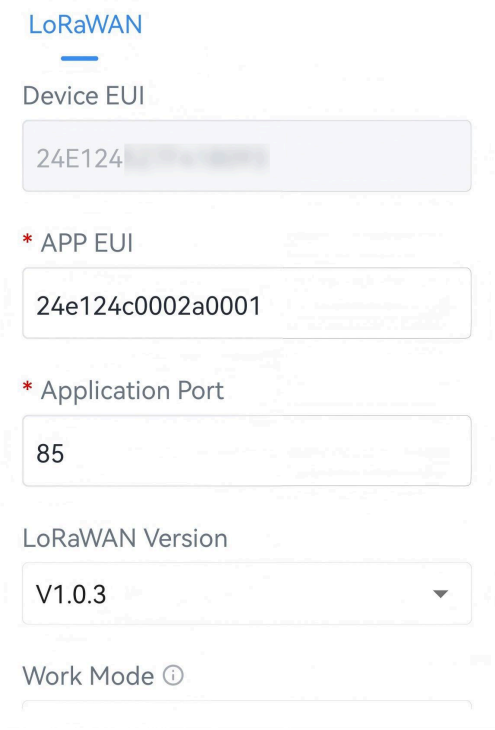
It is necessary to configure the join type and the frequency to establish communication with LoRaWAN® gateways.

Configure by ToolBox

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



3. Navigate to the **LoRaWAN** page The **LoRaWAN** page is displayed, see the following figure.



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

> **Note:**
> OTAA is required if you connect the device to the Milesight Development Platform.

5. Configure **Join Type** related parameters as needed. You can use default values unless otherwise specified.
   - If **OTAA** is selected, configure **Application Key** and **Rejoin Mode** as needed. For details, refer to the following table.

Parameter	Description
Application Key	Appkey for OTAA mode. Default: **Device EUI + Device EUI** (since Q4 of 2025). Example: 24e124123456789024e1241234567890. Default value of earlier devices: 5572404C696E6B4C6F52613230313823.

Parameter	Description
	Tip: For device security, it is recommended to modify the default value or contact sales before purchase to use random keys.
Rejoin Mode	Rejoin mode for OTAA mode. Reporting interval≤35 minutes: The device sends a specific number of LinkCheckReq MAC packets at each reporting interval or every other reporting interval to verify connectivity. Reporting interval > 35 minutes: The device sends a specific number of LinkCheckReq MAC packets at each reporting interval to validate connectivity. If there is no response, the device will re-join the network. When **Rejoin Mode** is enabled, enter a number in the **Set the number of detection signals sent** text box. The actual sending number is the configured number +1.

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

Tip:
For device security, it is recommended to modify the default values.

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

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

- If the **Supported Frequency** is **US915** or **AU915**, enter the channel index(es) separated by commas.

  Examples:

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

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

- If the **Supported Frequency** is **AS923**, select a channel plan and enable the frequencies as needed.
- If the **Supported Frequency** is any option other than those listed above, enable the frequencies as needed.

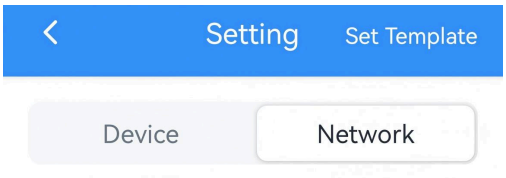
7. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.

Write successfully!

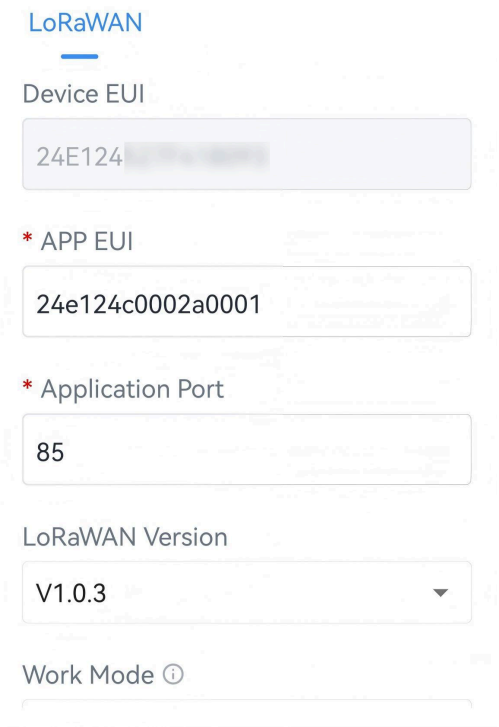
Configure Other LoRaWAN® Parameters

Configure by ToolBox

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



3. Navigate to the **LoRaWAN** page The **LoRaWAN** page is displayed, see the following figure.



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

Parameter	Description
Device EUI	Unique ID of the device labelled on the device housing. **Tip:** For bulk deployments, contact sales to request the device EUI list.
App EUI	The default App EUI (join EUI) is 24E124C0002A0001.
Application Port	Port used for sending and receiving data. Default: **85**.
LoRaWAN® Version	Options: **V1.0.2**, **V1.0.3**.
Work Mode	Fixed as Class C mode.
Confirmed Mode	If the device does not receive ACK packet from network server, it will re-send data once.
Join Type	Refer to Configure Join Type and Supported Frequency.

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

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

Write successfully!

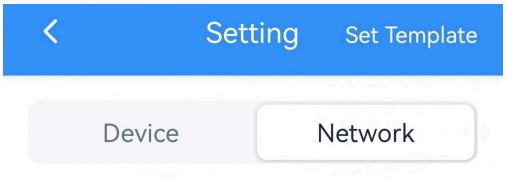
Configure Multicast Group

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

Step 1. Enable Multicast Group on the Device

Configure by ToolBox

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



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

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

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

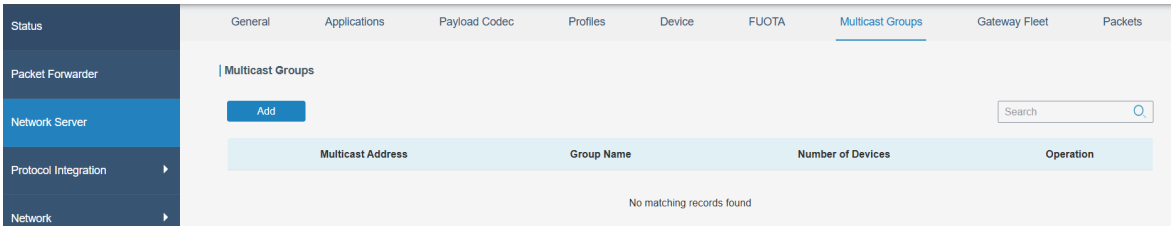
Configure by Downlink

- JSON Command: multicast_group_config
- Raw Hex Command: Multicast Group Enable/Disable

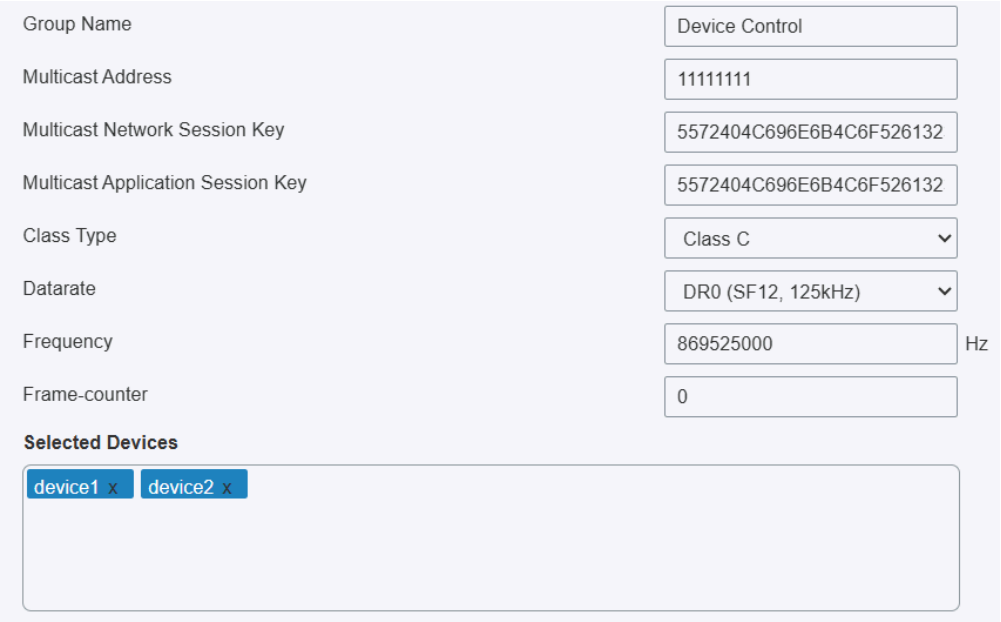
Step 2. Add a Multicast Group on the Network Server

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

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

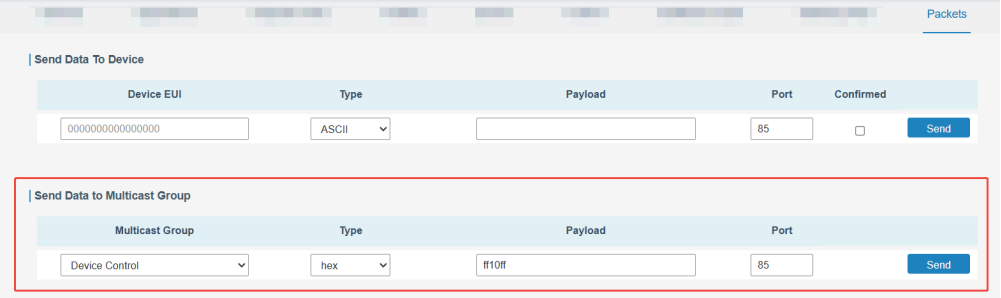


3. Click **Add** to add a multicast group.
4. Configure the multicast group parameters to match those configured on ToolBox and select the devices that you need to control.



5. Click **Save** to save this multicast group.
6. Click **Packets** tab in the upper right corner.

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



5.2.2 Configure Milesight D2D Parameters

Milesight D2D protocol is developed by Milesight and used for setting up transmission among Milesight devices without a gateway, which reduces the latency and enables quick control.

D2D Data Receiving Settings

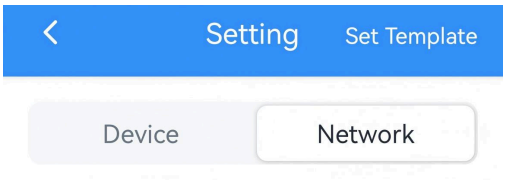
The device can receive temperature and humidity data from Milesight sensors directly via Milesight D2D to display on the screen and achieve accurate temperature control.

Prerequisites

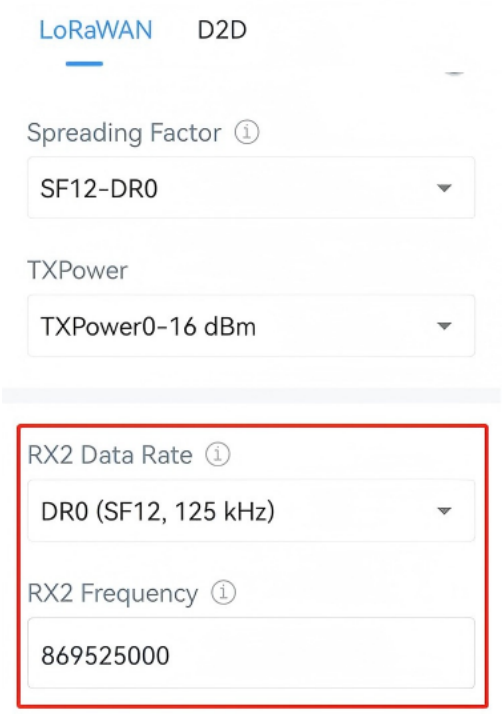
- The Milesight sensor already supports, or is upgraded to support **D2D Data Transmission** feature.
- The control permission is **Thermostat**.
- The data source is **D2D**.

Configure by ToolBox

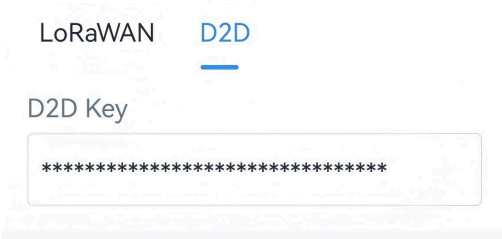
1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Network** tab.



3. On the **LoRaWAN** page, ensure the RX2 datarate and RX2 frequency are the same as the data transmission devices.

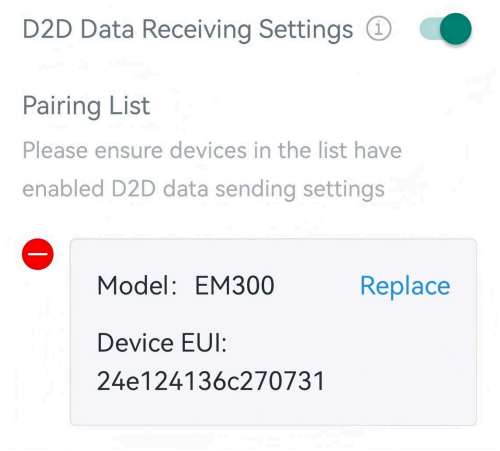


4. On the **D2D** page, set the D2D key to be the same as the data transmission devices. (Default D2D Key: 5572404C696E6B4C6F52613230313823)

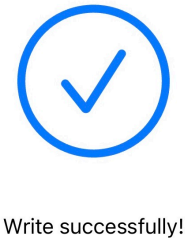


5. Enable **D2D Data Receiving Settings**.
6. Click Add, then attach the smartphone to NFC areas of Milesight sensors to add them to the device settings. If you need to replace the devices, click **Replace**, then attach the smartphone to another sensor.

> **Tip:**
> One device supports adding up to 5 sensors at most. When multiple sensors are added, the device will use the average values of multiple sensors.



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



Add D2D Transmission Devices by Downlink

- JSON Command: d2d_master_ids
- Raw Hex Command: D2D Data Receiving

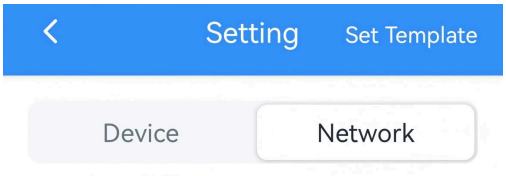
Milesight D2D Controller

The device can work as a D2D controller device to send commands to trigger D2D agent devices when a specific schedule plan is switched.

Prerequisites: The control permission is **Thermostat**.

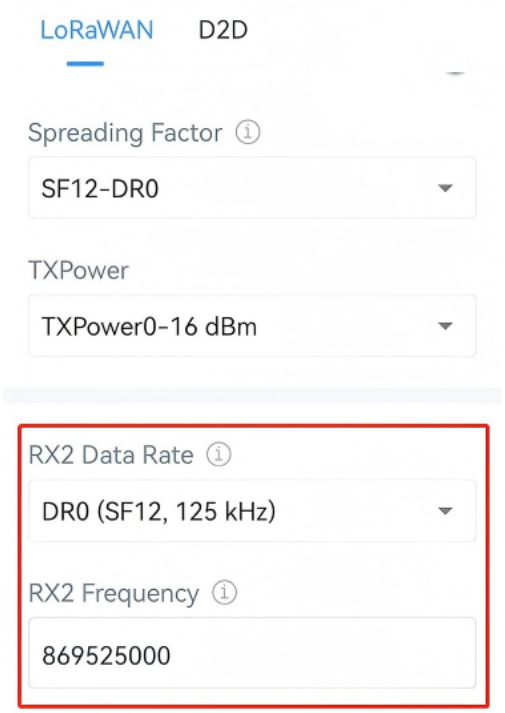
Configure by ToolBox

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

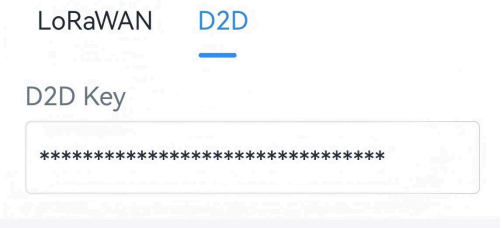


3. On the **LoRaWAN** page, configure the RX2 datarate and RX2 frequency.

> **Tip:**
> It is suggested to change the default values if there are many LoRaWAN® devices around.



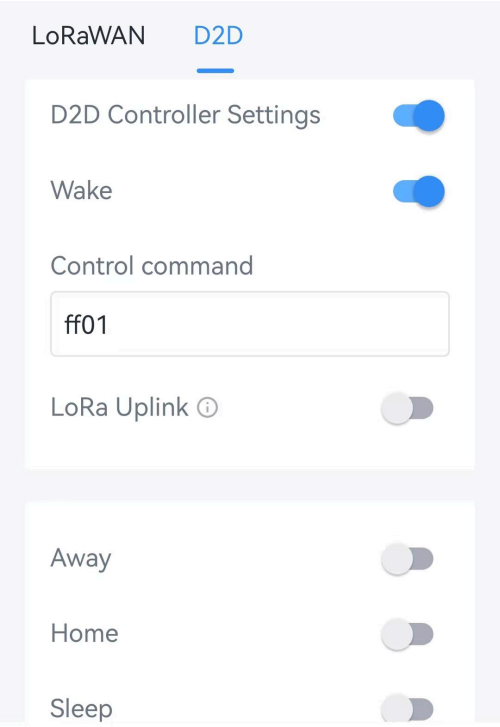
4. On the **D2D** page, define a unique D2D key. (Default D2D Key: 5572404C696E6B4C6F52613230313823)



5. Enable **D2D Controller Settings**.
6. Enable the schedule type as required and configure the related parameters.

Parameter	Description
Control Command	Define a 2-byte hexadecimal command to send to D2D agent devices.
LoRa Uplink	When enabled, an uplink packet that contains corresponding alarm status will be sent to LoRaWAN® gateway after sending the D2D control command packet. Otherwise, the packet will not be sent to the gateway.

Example: When the schedule is switched to Wake, the device will send command ff01 to D2D agent devices.



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

Write successfully!

Configure by Downlink

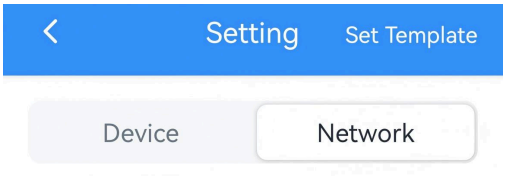
- JSON Command: d2d_master_enable, d2d_master_config
- Raw Hex Command: D2D Feature, D2D Controller

Milesight D2D Agent

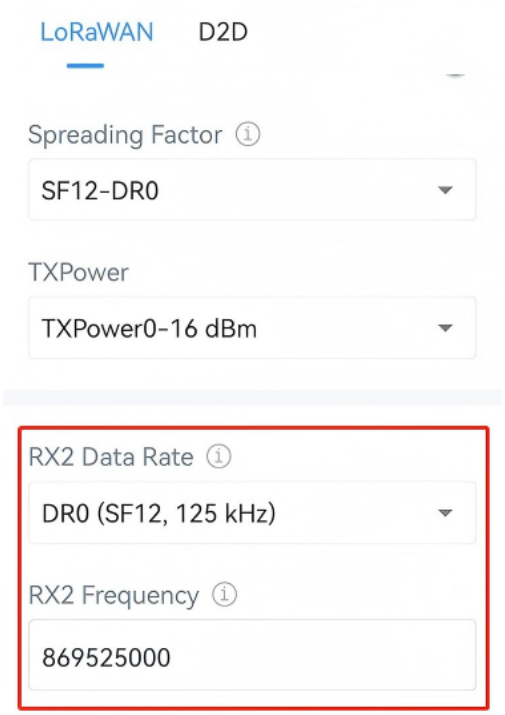
The device can work as a D2D agent device to receive commands from D2D controller devices to trigger the system on/off or switch the schedules.

Configure by ToolBox

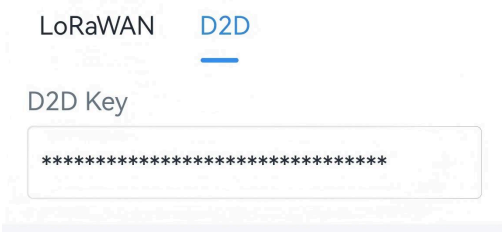
1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Network** tab.



3. In the **LoRaWAN** page, ensure the RX2 datarate and RX2 frequency are the same as the D2D controller devices.



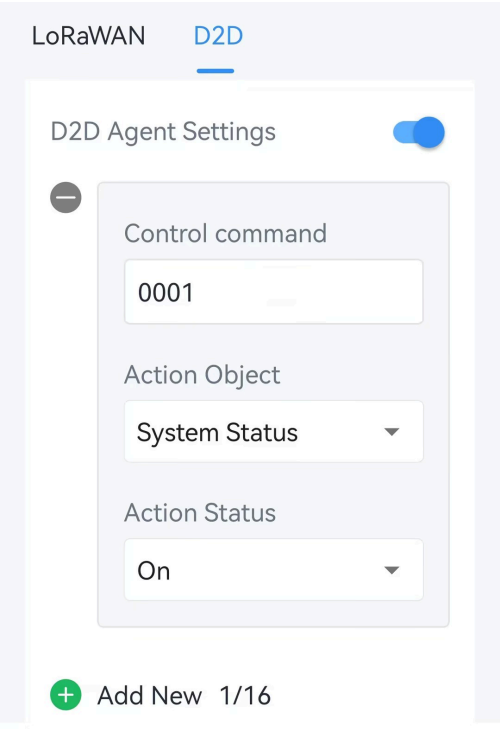
4. On the **D2D** page, set the D2D key to be the same as the D2D controller devices. (Default D2D Key: 5572404C696E6B4C6F52613230313823)



5. Enable **D2D Agent Settings**.
6. Click **Add New** to add a rule and configure the related parameters. The device can add up to 16 rules.

Parameter	Description
Control Command	Configure a 2-byte hexadecimal command to receive from D2D controller devices.
Action Object	Select the triggering action after receiving the control command. **Insert an Event**: Switch the schedule type. This can only be selected when control permission is **Thermostat**. **System Status**: Switch system on/off status.
Action Status	Select the status to execute.

Example: When receiving a command 0001, the device will switch the system on.



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

Write successfully!

Configure by Downlink

- JSON Command: d2d_slave_enable, d2d_slave_config
- Raw Hex Command: D2D Feature, D2D Agent

5.3 Temperature Control Settings

This chapter describes the critical features about temperature control.

5.3.1 Configure Data Source

This section introduces the data source selection for this device.

Introduction

It is necessary for the thermostat to know the ambient temperature and humidity to display on the screen and achieve the accurate control. The thermostat supports the following data sources:

- **Embedded (Default):** Use thermostat internal temperature and humidity sensors.
- **LoRa:** Receive temperature and humidity data from LoRaWAN® network server.
- **D2D:** Receive temperature and humidity data from Milesight sensors via Milesight D2D transmission.

When to change the data source

By default, the thermostat uses internal temperature and humidity sensors that suits most applications. However, if one of the following scenarios occurs, you may choose to use other data sources:

- The accuracy of the internal sensors does not match the requirement;
- There are unavoidable temperature influences at target installation location of the thermostat;
- The target installation location of the thermostat is not representative.

Configure by Downlink

1. Select the data source.
    - JSON Command: temperature_source_config, temperature_humidity_source
    - BACnet: Temperature Humidity Source
    - Raw Hex Command: Data Source + Timeout, Data Source
2. Configure the data source details.

   If the data source is LoRa, send commands from LNS.
    - JSON Command: temperature, humidity
    - Raw Hex Command: Temperature, Humidity

   If the data source is D2D, enable D2D Data Receiving Settings and configure the related parameters.
3. (Optional) Configure the offline mode if the data source is LoRa or D2D. By default, the thermostat will keep the current control status if it does not receive **temperature** data for preset timeout (10 minutes by default).

- JSON Command: offline_control_mode
- Raw Hex Command: Offline Control Mode

5.3.2 Configure Control Permission

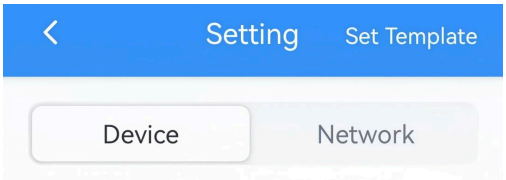
This section introduces the control permission settings.

The thermostat provides the following options for temperature control:

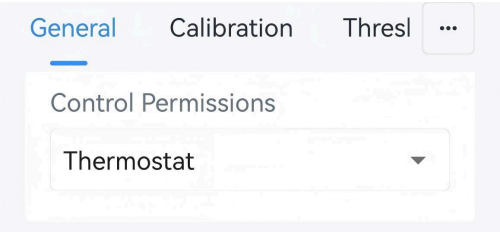
- **Thermostat**: Control the temperature using device's own algorithms and programs. It suits common room and hotel control applications and local automatic control.
- **Remote Control:** Control the relay's on/off status directly. It suits the applications which has their own BMS/platform with custom algorithm.

Configure by ToolBox

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



3. On the **General** page, select **Control Permissions** as required.



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

Write successfully!

Configure by Downlink

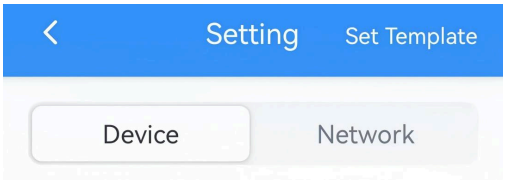
- JSON Command: control_permission
- Raw Hex Command: Control Permission

5.3.3 Configure System Status

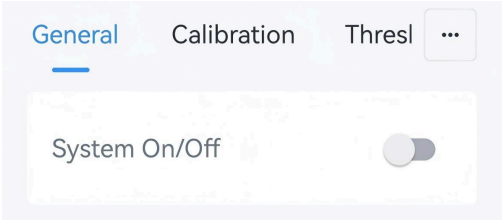
This section describes the steps to turn the system on/off.

Configure by ToolBox

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



3. On the **General** page, tap **System On/Off** as required.



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

Write successfully!

Configure by Downlink

- JSON Command: temperature_control_enable
- BACnet: System Status
- Raw Hex Command: System Status

5.3.4 Configure Thermostat Parameters

This chapter describes the settings when control permission is **Thermostat**.

5.3.4.1 Configure Installation Parameters

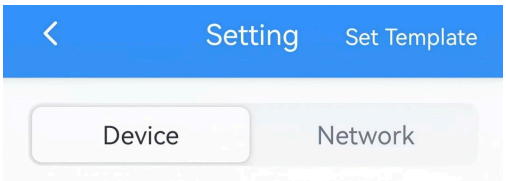
This section describes the settings related to the wirings.

Wiring Settings

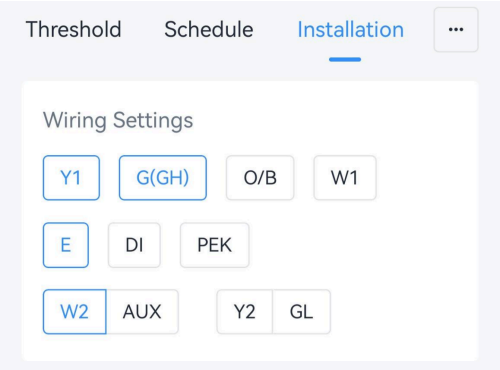
The wiring settings are used to control the software state of the relays and define the supported functions.

Configure by ToolBox

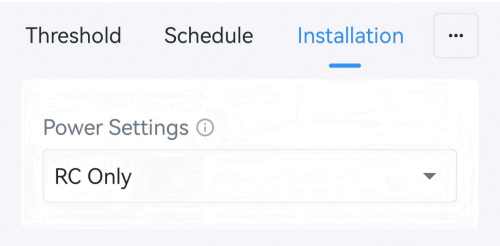
1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Device** tab.



3. On the **Installation** page, enable the wire terminals that match the wirings during the installation.



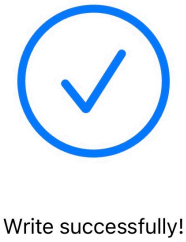
4. Select the **Power Setting** as RC Only or RC&RH the same as the settings during the installation.



5. Select the options according to the HVAC system.

Parameter	Wire	Description
Reversing Valve	O/B	Switch the O/B mode of a heat pump or PTAC. **Energize on Cool:** O/B relay closed=cool (default) **Energize on Heat:** O/B relay closed=heat
Heating System	W1/W2/AUX/E+G	Select a furnace or boiler.
Fan Control during Heating		Select **Thermostat** or **Furnace/Boiler**.

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



Configure by Downlink

- JSON Command: wires, reversing_valve, fan_control_during_heating
- BACnet: Reversing Valve
- Raw Hex Command: Wiring Settings, Reversing Valve, Fan Control during Heating

Result

By default, the thermostat will use the following control stages according to the enabled wires:

Control Stage	Used Relay in Conventional System	Used Relay in Heat Pumps/PTAC
Stage-1 Cool	Y1	Y1
Stage-2 Cool	Y2	Y2
Stage-1 Heat	W1	Y1 (+O/B)
Stage-2 Heat	W2	Y2 (+O/B)
Stage-3 Heat	/	W1
Stage-4 Heat	/	W2

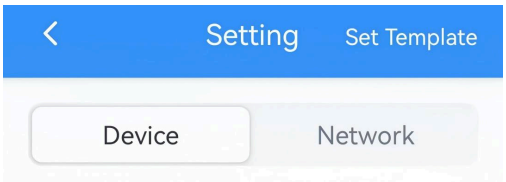
Custom Temperature Control Stage

The thermostat can customize the used relays for every stage if the default settings do not match your requirements.

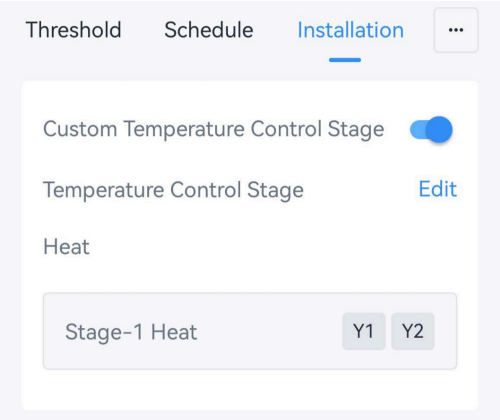
Prerequisites: Wiring Settings is configured.

Configure by ToolBox

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

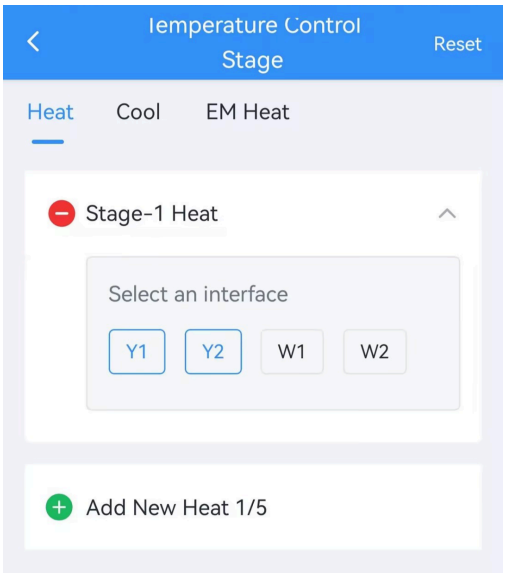


3. On the **Installation** page, enable **Custom Temperature Control Stage**.

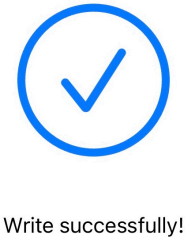


4. Click **Edit** to navigate to the control stage page.

5. Select the temperature control mode on the top bar, then click **Add** to add the supported control stages, and select the relay for every stage. The thermostat supports up to five heating stages, three cooling stages and one EM heat stage.



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



Write successfully!

Configure by Downlink

- JSON Command: custom_wiring_mode
- Raw Hex Command: Custom Temperature Control Stage Setting

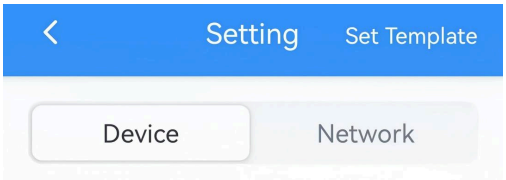
Auxiliary Heating Duration

The device supports limiting the auxiliary heating time to save energy.

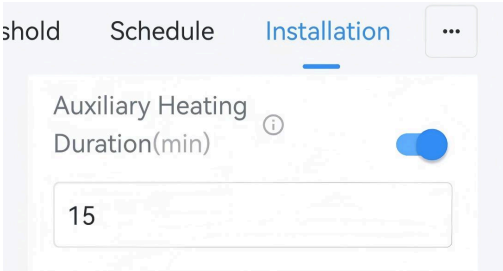
Prerequisites: **AUX** is selected in Wiring Settings.

Configure by ToolBox

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



3. On the **Installation** page, enable **Auxiliary Heating Duration** and configure the duration value.



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

Write successfully!

Result

When current temperature does not reach the target temperature even after heating for the auxiliary heating duration, report an Auxiliary Heating Timeout Alarm packet and switch back to lower stage heating mode.

Compressor and Auxiliary Heat Linkage

This feature is only for heat pump systems. After enabled, when the highest heating stage of compressor (Y1 or Y2) is not able to reach the target temperature, the device will use AUX heat first. Example:

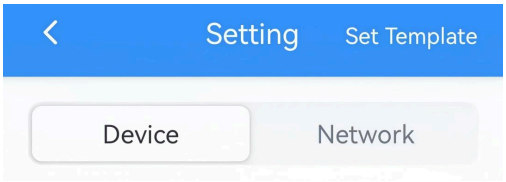
Heating Stage	1-stage	2-stage	3-stage	4-stage
Disable linkage	Y1+O/B	Y2+O/B	W1	W2

Heating Stage	1-stage	2-stage	3-stage	4-stage
Enable linkage	Y1+O/B	Y2+O/B	Y2+O/B+AUX	W1

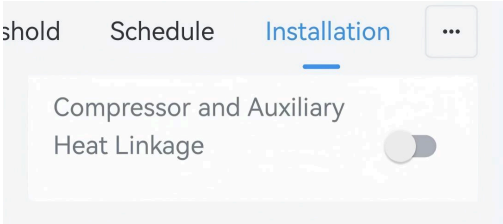
Prerequisites: Custom Temperature Control Stage is disabled, and **Y1/Y2 + O/B + AUX** are selected in Wiring settings.

Configure by ToolBox

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



3. On the **Installation** page, enable **Compressor and Auxiliary Heat Linkage**.



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

Write successfully!

Configure by Downlink

- JSON Command: compressor_aux_combine_enable
- Raw Hex Command: Compressor and Auxiliary Heat Linkage

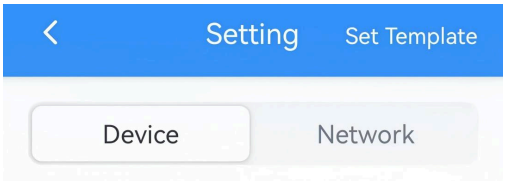
Emergency Heating Duration

The device supports limiting the emergency heating time to save energy.

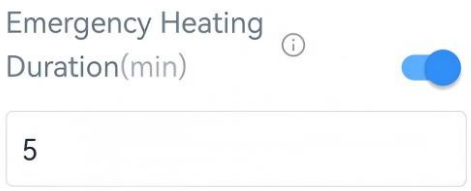
Prerequisites: **E** is selected in Wiring Settings.

Configure by ToolBox

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



3. On the **Installation** page, enable **Emergency Heating Duration** and configure the duration value.



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

Result

When the device operates in EM heat for longer than the duration, report an Emergency Heating Timeout Alarm packet and switch back to normal heat mode.

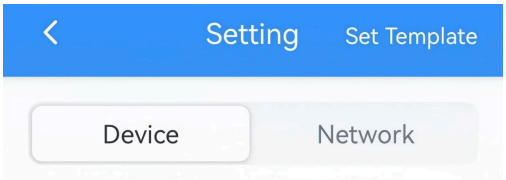
Freeze Protection

The device supports switching to EM Heat or Heat system to avoid freezing when detecting that the ambient temperature is too low. This feature takes effect even when the system is off.

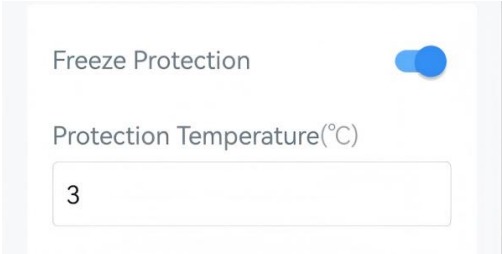
Prerequisites: Heat or EM Heat is supported. If both are supported, EM Heat will be used first.

Configure by ToolBox

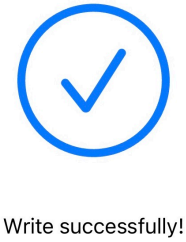
1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Device** tab.



3. On the **Installation** page, enable **Freeze Protection** and configure the protection temperature.



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



Configure by Downlink

- JSON Command: freeze_protection_config
- Raw Hex Command: Freeze Protection

Result

When the device detects that the ambient temperature is lower than protection temperature, it sends a freeze protection trigger packet and starts EM heat.

When the device detects that the ambient temperature is higher than freeze protection temperature, it sends a freeze protection release packet and switch to the previous status.

System Protection

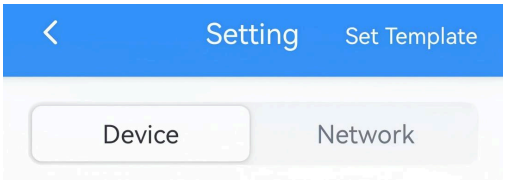
The device supports enabling system protection to avoid frequent switches. After enabled, the relay can only be switched after a specific time.

Note:
This does not take effect when switching between GH and GL.

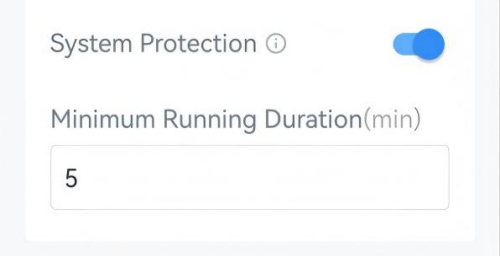
Prerequisites: Either **Y1/Y2/W1/ W2/AUX/E/ G** is selected in Wiring Settings.

Configure by ToolBox

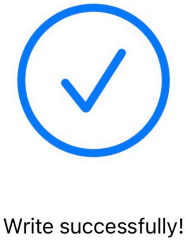
1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Device** tab.



3. On the **Installation** page, enable **System Protection** and configure the minimum running duration.



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



Write successfully!

Configure by Downlink

- JSON Command: system_protect_config
- Raw Hex Command: System Protection

Y2/W2 Auxiliary Mode

By default, Y2 and W2 work in standalone mode. The device supports switching Y2 or W2 to auxiliary mode. Example:

Heating Stage	1-stage	2-stage	3-stage	4-stage
Y2/W2 - standalone	Y1 (+O/B)	Y2 (+O/B)	W1	W2
Y2 - auxiliary mode	Y1 (+O/B)	Y1 + Y2 (+O/B)	W1	W2
W2 - auxiliary mode	Y1 (+O/B)	Y2 (+O/B)	W1	W1 + W2
Y2 and W2 - auxiliary mode	Y1 (+O/B)	Y1 + Y2 (+O/B)	W1	W1 + W2

Prerequisites: **Custom Temperature Control Stage** is disabled, and **Y2** or **W2** is selected in Wiring Settings.

Configure by Downlink

- JSON Command: aux_control_config
- Raw Hex Command: W2/Y2 Auxiliary Mode

5.3.4.2 Configure Temperature Control and Fan Parameters

This section describes the settings related to the temperature and fan control.

Prerequisites

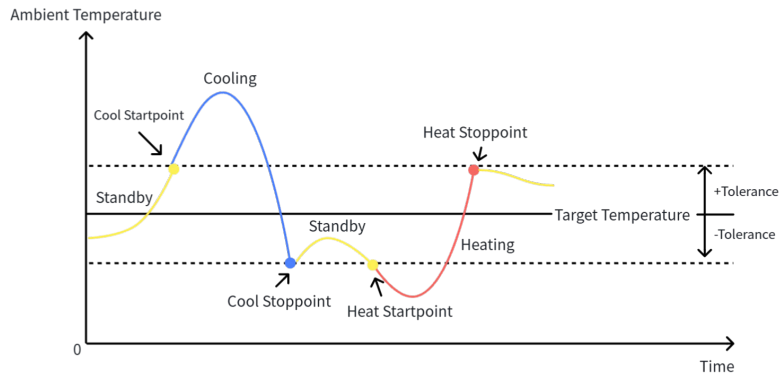
- Wiring settings are configured.
- The system is switched on.

Temperature Control Basic Settings

The thermostat supports the basic temperature control when no plan executing.

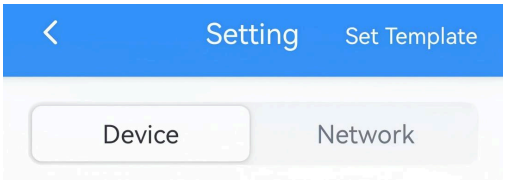
When the ambient temperature is outside the setpoint (target temperature) for a specific range, the thermostat will start heating or cooling until the ambient temperature returns to the setpoint. After

reaching the setpoint, the system will continue working to a higher/lower temperature to prevent frequent control.

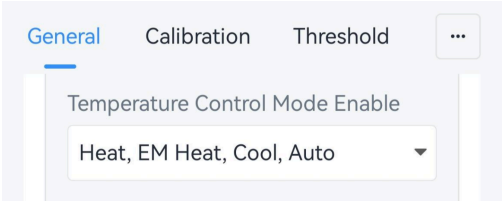


Configure by ToolBox

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



3. On the **General** page, select the **Temperature Control Mode Enable** options. The supported options depend on the Wiring settings.

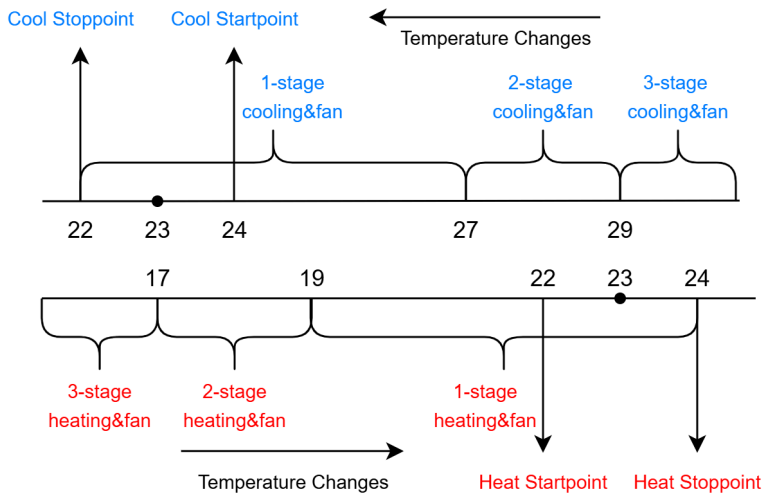


4. Select the **Temperature Control Mode** and configure the related parameters.
   - **Heat/EM Heat/Cool**: When the ambient temperature is outside the setpoint, start heating to raise the temperature or start cooling to lower the temperature. EM Heat only works when **E** terminal is connected.

Parameter	Description
Target Temperature Resolution	Select the resolution of the target temperature. Options: **0.5:** Increase or decrease target temperature by 0.5 each time. **1:** Increase or decrease target temperature by 1 each time.

Parameter	Description
Target Temperature	Set the setpoint temperature for device control. Range: 5~35 °C/41~95 °F.
Target Temperature Tolerance	Set the allowable value between the ambient temperature and the setpoint to prevent frequent cycling. This parameter, along with the target temperature, defines a setpoint tolerance range that determines when the temperature control starts and stops.
Target Temperature Regulation Range	Set the range to adjust target temperature. Range: 5~35 °C/41~95 °F.

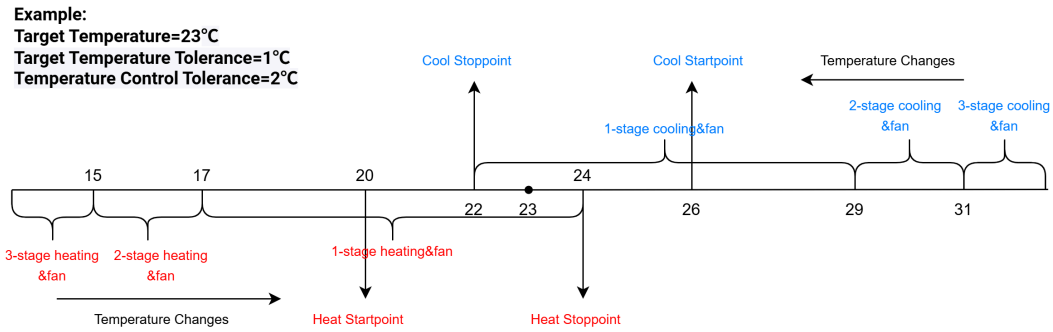
Example:
Target Temperature=23°C
Target Temperature Tolerance=1°C



- **Auto - Single Target Temperature**: When the ambient temperature does not reach the setpoint, start cooling or heating automatically. This mode uses the same setpoint for heating or cooling.

Parameter	Description
Target Temperature Resolution	Select the resolution of the target temperature. Options: **0.5:** Increase or decrease target temperature by 0.5 each time. **1:** Increase or decrease target temperature by 1 each time.

Parameter	Description
Target Temperature	Set the target temperature for both cooling and heating. Range: 5~35 °C/41~95 °F.
Target Temperature Tolerance	Set the allowable value between the ambient temperature and the setpoint to prevent frequent cycling. This parameter, along with the target temperature, defines a setpoint tolerance range that determines when the temperature control starts and stops.
Temperature Control Tolerance	Add the tolerance value based on the target temperature tolerance for start cooling/heating.
Target Temperature Regulation Range	Set the range to adjust target temperature. Range: 5~35 °C/41~95 °F.

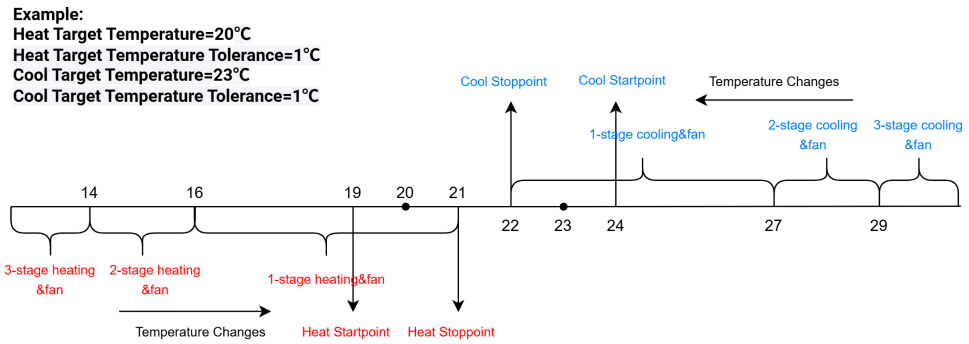


- **Auto - Dual Target Temperature**: When the ambient temperature does not reach the setpoint, start cooling or heating automatically. This mode uses different target temperatures for heating and cooling.

> **Note:**
> The values must follow the rule: Heat Target - Heat Tolerance < Cool Target - Cool Tolerance, Heat Target + Heat Tolerance < Cool Target + Cool Tolerance.

Parameter	Description
Target Temperature Resolution	Select the resolution of the target temperature. Options:

Parameter	Description
	0.5: Increase or decrease target temperature by 0.5 each time. **1:** Increase or decrease target temperature by 1 each time.
Heating Target Temperature	Set the target temperature for heating. Range: 5~35 °C/41~95 °F.
Heating Target Temperature Tolerance	Set the allowable deviation range between the ambient temperature and the target temperature to prevent frequent cycling.
Cooling Target Temperature	Set the target temperature for cooling. Range: 5~35 °C/41~95 °F.
Cooling Target Temperature Tolerance	Set the allowable deviation range between the ambient temperature and the target temperature to prevent frequent cycling.
Target Temperature Regulation Range	Set the range to adjust target temperature. Range: 5~35 °C/41~95 °F.



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

Write successfully!

Configure by Downlink

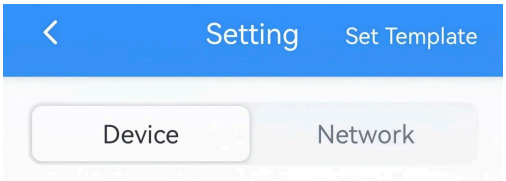
- JSON Command: see Temperature Control Basic Parameters
- BACnet: see Temperature Control Basic Parameters
- Raw Hex Command: see Temperature Control Basic Parameters

Occupancy Mode

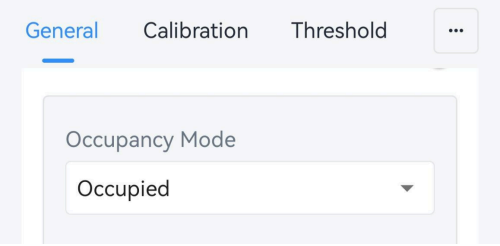
This thermostat supports Occupied and Unoccupied modes, each with its own set of temperature control parameters, including target temperature, tolerance values, and regulation ranges. Switching modes automatically applies different settings for comfort and energy saving. In addition, when Occupied or Unoccupied mode is selected, Heat, EM Heat, and Auto-Heat use the same parameters, while Cool and Auto-Cool use the same parameters as well.

Configure by ToolBox

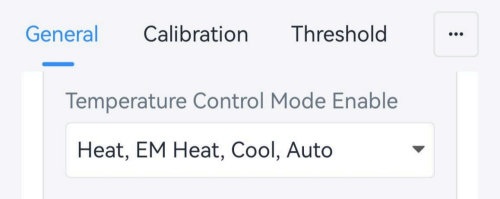
1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Device** tab.



3. On the **General** page, select the Occupancy mode as **Occupied** or **Unoccupied**.



4. Select the **Temperature Control Mode Enable** options. The supported options depend on the Wiring settings.



5. Configure the related temperature control parameters for this occupancy mode.

Parameter	Description
Temperature Control Mode	Select current temperature control mode.
Target Temperature Mode	When Temperature Control Mode is Auto, it's fixed as Dual Target Temperature.
Target Temperature Resolution	Select the resolution of the target temperature. Options: **0.5:** Increase or decrease target temperature by 0.5 each time. **1:** Increase or decrease target temperature by 1 each time.
Heating Target Temperature	Set the target temperature for heating. Range: 5~35 °C/41~95 °F.
Heating Target Temperature Tolerance	Set the allowable deviation range between the ambient temperature and the target temperature to prevent frequent cycling.
Cooling Target Temperature	Set the target temperature for cooling. Range: 5~35 °C/41~95 °F.
Cooling Target Temperature Tolerance	Set the allowable deviation range between the ambient temperature and the target temperature to prevent frequent cycling.
Deadband	Set the minimum difference between the heating target temperature and cooling target temperature.
Heat Target Temperature Regulation Range	Set the range to adjust heating target temperature. Range: 5~35 °C/41~95 °F.
Cool Target Temperature Regulation Range	Set the range to adjust cooling target temperature. Range: 5~35 °C/41~95 °F.

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

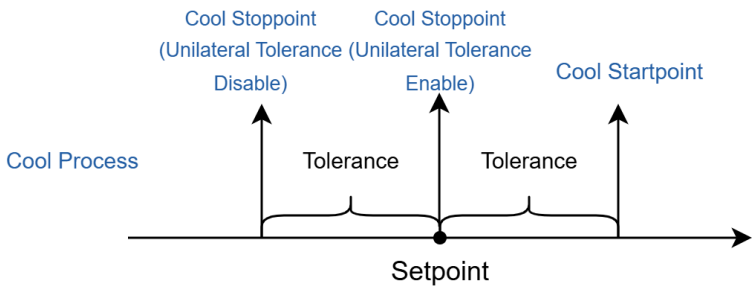
Write successfully!

Configure by Downlink

- JSON Command: see Occupancy Mode Parameters
- BACnet: see Occupancy Mode Parameters
- Raw Hex Command: see Occupancy Mode Parameters

Unilateral Tolerance

The thermostat supports enabling Unilateral Tolerance to add target temperature tolerance to the heat or cool startpoint only, and the stoppoint is the same as the target temperature. It's disabled by default.



Configure by Downlink

- JSON Command: unilateral_tolerance
- Raw Hex Command: Unilateral Tolerance

Fan Mode Settings

The thermostat supports controlling the fan when the schedule is not executing. Here introduces the basic parameters to achieve the fan control:

- **Fan Mode**: The mode to decide how the thermostat operate the fan in the system. The thermostat supports the following control modes:

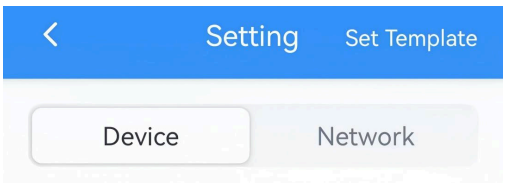
Mode	Description
Auto	Open when the system is cooling or heating, and close when the system stops cooling or heating.
On	Normally open.
Circulate	Open for a while when the system stops cooling or heating. It supports setting the operation time hourly.

- **Fan Delay**: Allow the fan to work for a preset duration after the system stops cooling or heating.
- **Regulate Humidity**: When the ambient humidity is outside the target range, the thermostat will open the fan for an interval per hour to dehumidify or humidify. This only works when fan mode is Auto.

Prerequisites: G wire is selected in Wiring settings.

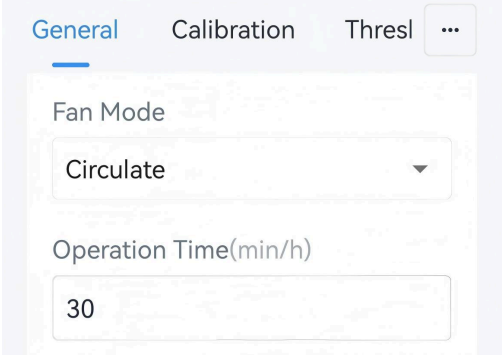
Configure by ToolBox

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



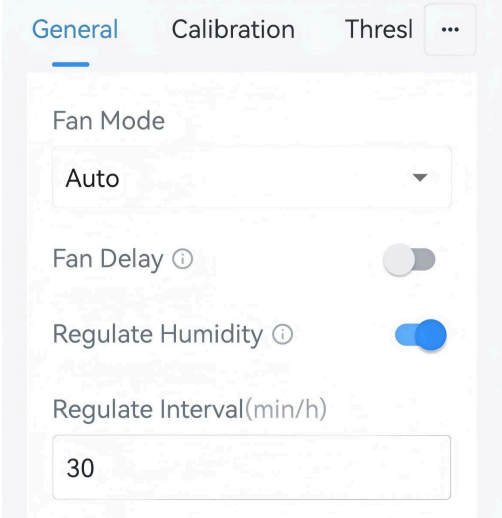
3. On the **General** page, select the **Fan Mode**.

   If the Fan Mode is Circulate, configure the fan **Operation Time** per hour.

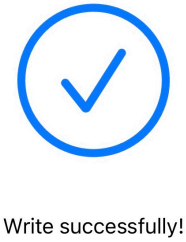


   Optional: If the Fan Mode is Auto, configure **Regulate Humidity** feature as the following steps:

a. Set the **Target Humidity Range**.
b. Enable **Regulate Humidity** and configure the interval as required.



4. (Optional) Enable **Fan Delay** and configure the time to delay the fan to close.
5. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



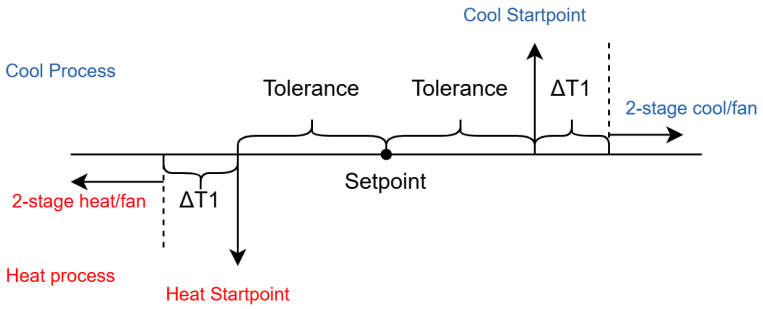
Configure by Downlink

- JSON Command: see Fan Mode Parameters
- BACnet: see Fan Mode Parameters
- Raw Hex Command: see Fan Mode Parameters

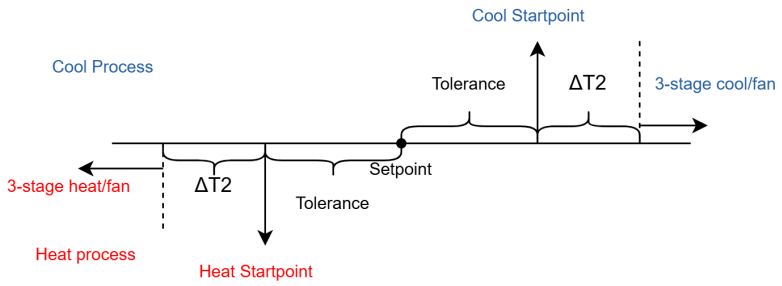
Temperature Control Stage Switch

When the thermostat connects to a HVAC system with multiple cooling or heating stage, it supports switching the stage automatically to achieve efficient control. Here introduces the parameters and features to achieve the automatic temperature control stage switching:

Second-stage Temperature Delta (ΔT1): When the difference between the ambient temperature and the cool/heat startpoint is greater than or equal to this value, the second-stage cooling/heating/fan starts; otherwise, use first-stage cooling/heating/fan. The default value is 3°C.



Third-stage Temperature Delta (ΔT2): When the difference between the ambient temperature and the cool/heat startpoint is greater than this value, the third-stage cooling/heating/fan starts. If the third-stage is not supported, it will use the current highest stage. The default value is 5°C and it must be larger than ΔT1.



Setforward: When enabled, the thermostat automatically switches to the higher stage based on temperature delta values; when disabled, the thermostat uses only the initial stage determined by the temperature delta until the setpoint is reached. It's enabled by default.

Setback: When enabled, the thermostat automatically switches to the lower stage based on temperature delta values; when disabled, the thermostat uses only the initial stage determined by the temperature delta until the setpoint is reached. It's enabled by default.

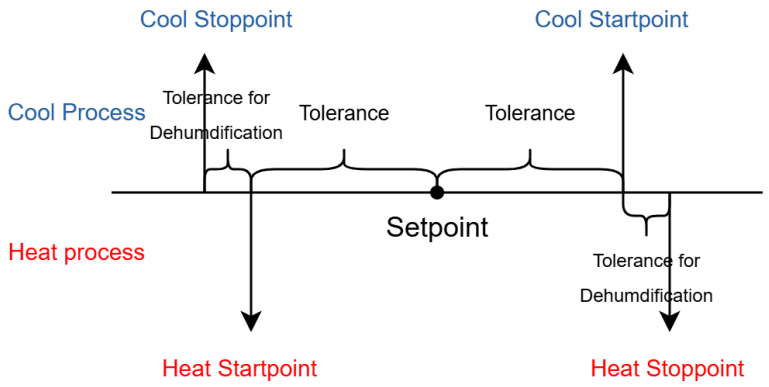
Stage-up Switch: If the ambient temperature does not change by 1 °C within 5 minutes in the current stage, the thermostat will switch to a higher stage. The change value and the time can be adjusted as required.

Configure by Downlink

- JSON Command: temperature_level_up_down_delta, temperature_up_down_enable, level_switch_settings
- BACnet: Temperature Control Delta
- Raw Hex Command: Temperature Delta, Setforward/Setback, Stage-up Switch

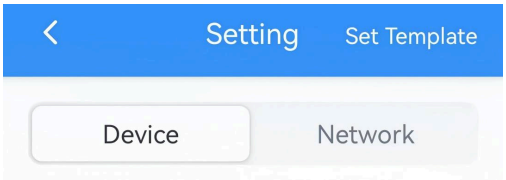
Temp. Control and Dehumidify

The thermostat provides the Temp. Control and Dehumidify feature to work with a dehumidifier to adjust the humidity. When the ambient humidity is higher than the target range, the system will continue working to a higher/lower temperature to dehumidify even after reaching the stoppoint.

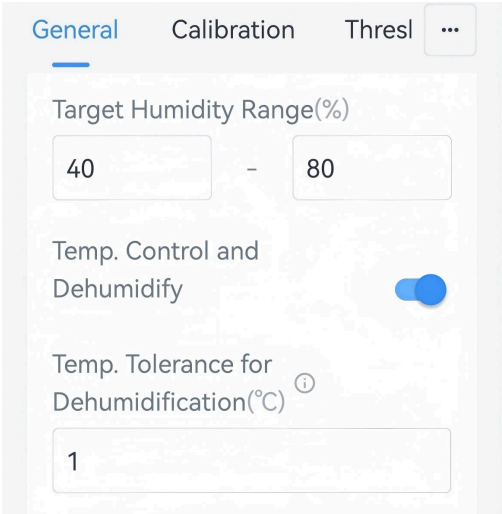


Configure by ToolBox

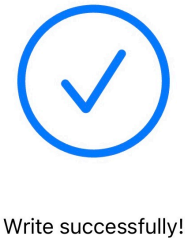
1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Device** tab.



3. On the **General** page, set the **Target Humidity Range**.
4. Enable **Temp. Control and Dehumidify** and set the tolerance value.



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



Configure by Downlink

- JSON Command: humidity_range, temperature_dehumidify
- Raw Hex Command: Target Humidity Range, Temp. Control and Dehumidify

5.3.4.3 Configure Schedule Parameters

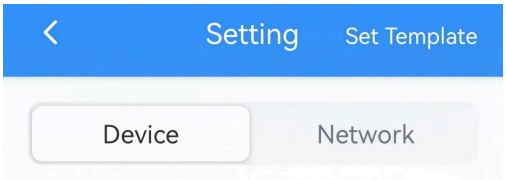
This section describes how to add and manage schedule events to achieve the automatic temperature control. The thermostat supports seven kinds of schedules for various scenarios: Wake, Away, Home, Sleep, Occupied, Unoccupied, and ECO.

Prerequisites: Ensure the device time is synchronized.

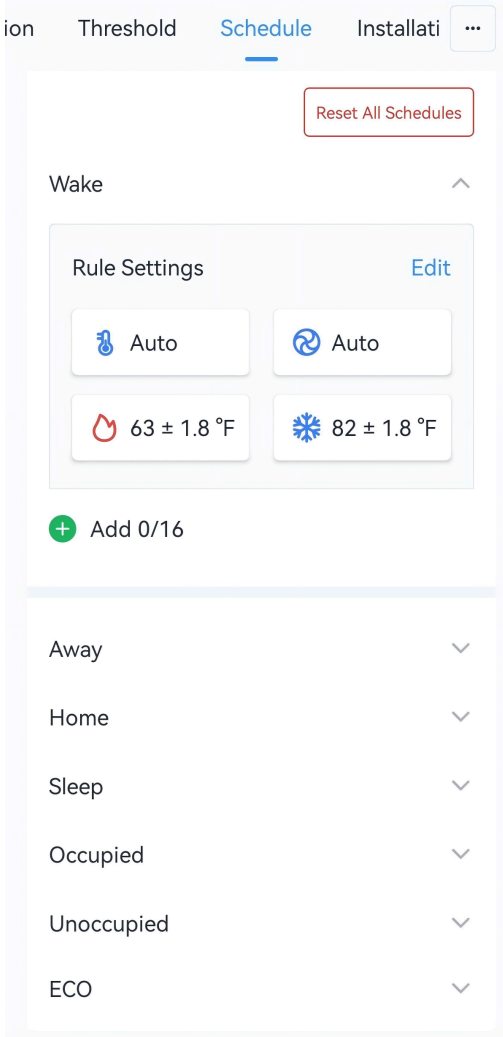
Limitation: When Occupancy Mode is Occupied or Unoccupied, the thermostat only supports Occupied and Unoccupied schedules, and the schedule parameters will be the same as corresponding occupancy mode parameters.

Configure by ToolBox

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



3. On the **Schedule** page, select the desired schedule type and click **Edit**.



4. Configure the rule parameters of this schedule event.

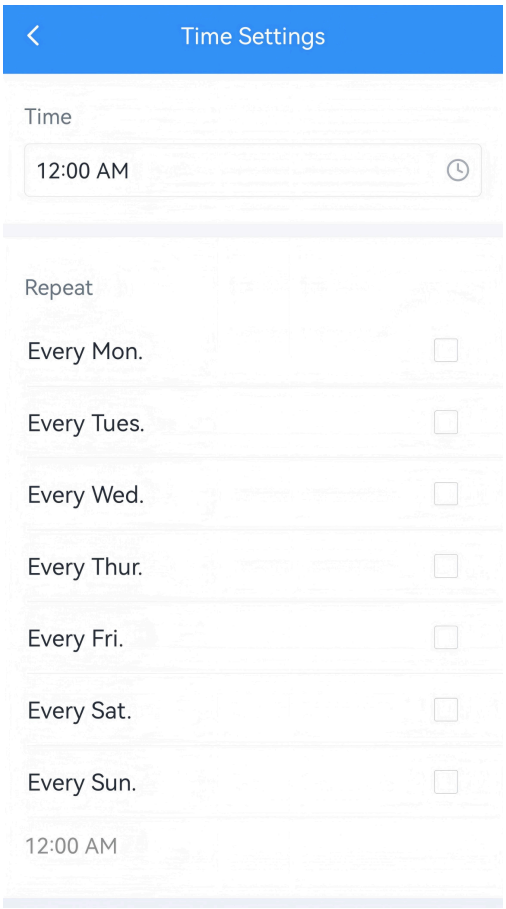
Parameter	Description
Temperature Control Mode	Select the temperature control mode.
Fan Mode	Select the fan mode.
Under Auto-Single Target Mode	
Target Temperature	Set the target temperature for both cooling and heating. Range: 5~35 °C/41~95 °F.
Target Temperature Tolerance	Set the allowable value between the ambient temperature and the setpoint to prevent frequent cycling. This parameter, along with the target temperature, defines a setpoint tolerance range that determines when the temperature control starts and stops.
Temperature Control Tolerance	Add the tolerance value based on the target temperature tolerance for start cooling/heating.
Other Cases	
Heating Target Temperature	Set the target temperature for heating. Range: 5~35 °C/41~95 °F.
Heating Target Temperature Tolerance	Set the allowable deviation range between the ambient temperature and the target temperature to prevent frequent cycling.
Cooling Target Temperature	Set the target temperature for cooling. Range: 5~35 °C/41~95 °F.
Cooling Target Temperature Tolerance	Set the allowable deviation range between the ambient temperature and the target temperature to prevent frequent cycling.

5. (Optional) Add a time period to execute a schedule event. Each schedule type supports up to 16 time periods.

> **Tip:**
> If the time period is not added, the schedule event can be switched via direct command, D2D agent setting, room card setting, etc.

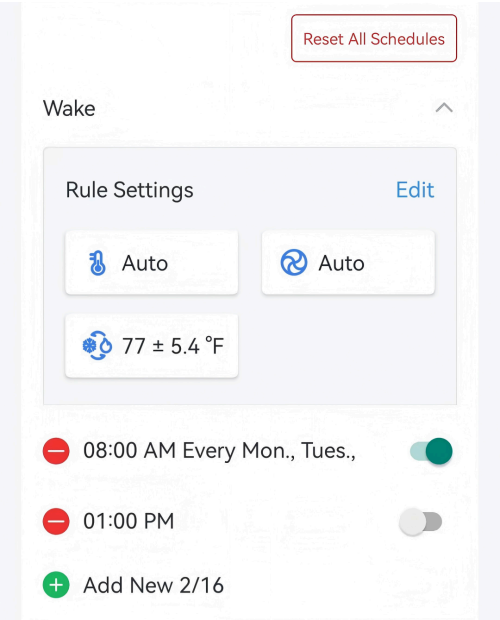
a. Click **Add** to add a time period.

b. Configure the time and repeat days. If the repeat day is not selected, it means the time period is only executed once.



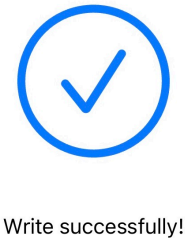
c. Click **Confirm** to save this time period setting.

d. Enable or disable the time period as required.



e. (Optional) Click ⊖ to delete a schedule event, or click **Reset All Schedules** to restore factory settings as required.

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



Write successfully!

Configure by Downlink

- JSON Command: see Configure Schedule Parameters
- Raw Hex Command: see Configure Schedule Parameters

5.3.5 Configure Remote Control Parameters

This chapter describes the settings when control permission is **Remote Control**.

Configure by Downlink

1. Configure the status of every relay.
    - JSON Command: wires_relay_config
    - Raw Hex Command: Relay Status
2. (Optional) Configure the offline mode. By default, the thermostat will keep the current control status if it does not receive relay status for preset timeout (10 minutes by default).
    - JSON Command: offline_control_mode
    - Raw Hex Command: Offline Control Mode

5.4 Auxiliary Features

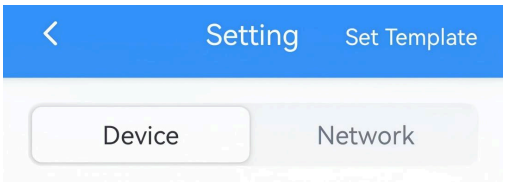
This chapter describes the auxiliary features of this device.

5.4.1 Configure General Parameters

This section describes the general parameters.

Configure by ToolBox

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



3. In the **General** page, configure the following parameters.

Parameter	Description
Reporting Interval	The interval to report data to the network server. Range: 1~1440 min, Default: 10 min.
Temperature Unit	Select the temperature unit displayed on the ToolBox and the screen. Default: °F. **Note:** After changing the unit, it is necessary modify the temperature-related settings.
Control Permissions	Refer to Configure Control Permission.

Parameter	Description
System On/Off	Turn on or off the system. For more details refer to Configure System Status. If control permission is Thermostat, refer to Configure Temperature Control and Fan Parameters to check the parameters after system on.
Child Locks	Refer to Configure Child Lock Parameters.
Time Mode	Refer to Configure Screen Parameters.
Time Zone	Refer to Configure Time Parameters.
Daylight Saving Time	
Data Storage	Refer to Configure Data Storage & Retransmission.
Change Password	Change the password for ToolBox App to write this device.

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

Write successfully!

Configure by Downlink

Configuration	Report Interval	Temperature Unit
JSON Command	report_interval	temperature_unit
BACnet	Report Interval	Temperature Unit
Raw Hex Command	Reporting Interval	Temperature Unit

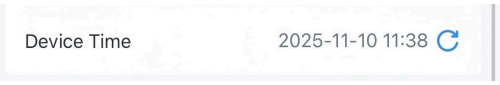
5.4.2 Configure Time Parameters

This section describes how to configure the time parameters to ensure the correct time.

Synchronize the Device Time

Synchronize by ToolBox

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



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

Synchronize by LoRaWAN® Network Server

Prerequisites: The LoRaWAN® network server supports the device time synchronization feature.

Limitation: This only supports time retrieval; the time zone is not included.

1. Set the LoRaWAN® version of the device to **V1.0.3**.
2. Connect the device to the network server. Once the device successfully joins the network, it sends a MAC command to query the time from the network server.

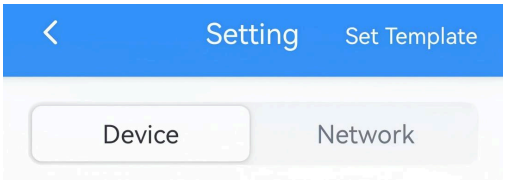
Note:
The device will send the DeviceTimeReq command every 5 days since the last sync. You can also send downlink command to ask the device to send the DeviceTimeReq command immediately.

- JSON Command: synchronize_time
- BACnet: Synchronize Time
- Raw Hex Command: Sync Time from LNS

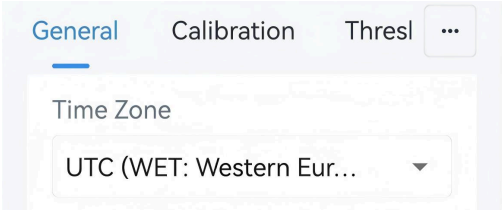
Configure the Time Zone

Configure by ToolBox

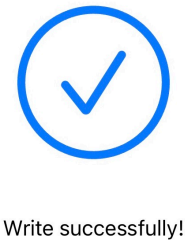
1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Device** tab.



3. On the **General** page, select **Time Zone** as required.



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



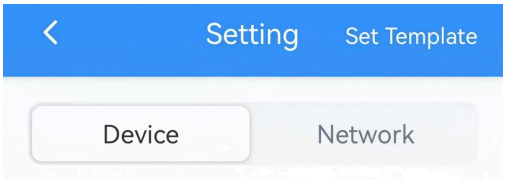
Configure by Downlink

- JSON Command: time_zone, timezone_index
- BACnet: Timezone Index
- Hex Command: Time Zone, Timezone Index

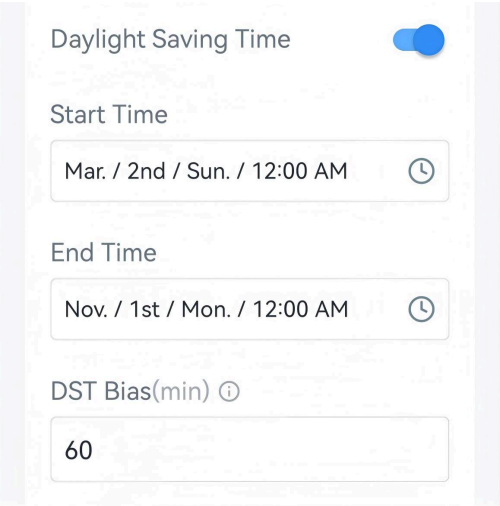
Configure Daylight Saving Time

Configure by ToolBox

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



3. On the **General** page, enable **Daylight Saving Time** and configure the related parameters.



Parameter	Description
Start Time	The start time of DST time range.
End Time	The end time of DST time range.
DST Bias	The DST time will be faster according to this bias.

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

Write successfully!

Configure by Downlink

- JSON Command: dst_config
- Raw Hex Command: Daylight Saving Time

Configure Time Zone Offset

The device supports adding an offset to the current time for flexible time adjustment.

> **Note:**
> After setting this offset to a non-zero value, Daylight Saving Time will be disabled, and vice versa.

Configure by Downlink

- JSON Command: timezone_offset
- BACnet: Timezone Offset
- Raw Hex Command: Time Zone Offset

5.4.3 Configure Child Lock Parameters

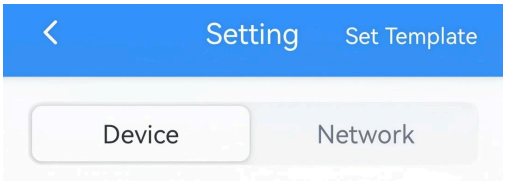
This section introduces the child lock settings.

Child Lock

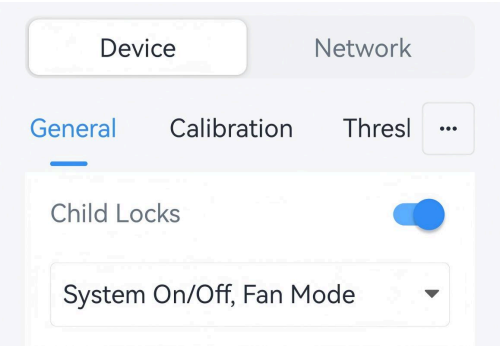
The thermostat supports a child lock feature to lock the buttons to prevent accidental touch. When the button is locked, the corresponding feature can only be controlled by ToolBox or downlink commands.

Configure by ToolBox

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



3. On the **General** page, enable **Child Locks** and select the features to lock.



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

Write successfully!

Configure by Downlink

- JSON Command: child_lock_config, children_locks_enable
- BACnet: Children Locks Enable
- Raw Hex Command: Child Lock Setting, Child Lock Enable

Temporary Unlock

The thermostat supports configuring 2-5 button combinations to release the child locks temporarily for professional debugging. When this feature is configured, users can press the combination buttons to release the lock for a short time.

Configure by Downlink

- JSON Command: unlock_config
- BACnet: Temporary Unlock Settings
- Raw Hex Command: Temporary Unlock

Offline Unlock

The thermostat supports receiving heartbeat packets from the server regularly to check connectivity. If it does not receive heartbeat packets within an offline timeout, the child lock will not work, and the thermostat can be controlled via the buttons. This feature is disabled by default.

Configure by Downlink

- JSON Command: heartbeat, offline_timeout
- BACnet: Heartbeat, Offline Timeout
- Hex Command: Offline Unlock Heartbeat, Offline Timeout

5.4.4 Configure Screen Parameters

This section introduces the screen related settings.

Screen Display

By default, the screen display is enabled and screen content can be referred here. The device supports disabling the display of all contents, schedule plan name or time.

Configure by Downlink

- JSON Command: screen_display_mode, screen_time_enable
- Raw Hex Command: Screen Display, Screen Time Display

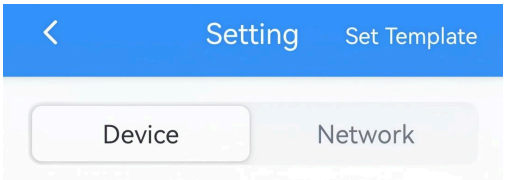
Time Display Mode

When the system is on, the screen will display the time according to the time mode.

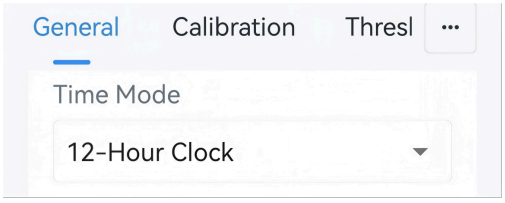
Prerequisites: Sync the time for the device.

Configure by ToolBox

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



3. In the **Calibration** page, select **Time Mode** as **12-Hour Clock** or **24-Hour Clock**.



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

Configure by Downlink

- JSON Command: time_format
- BACnet: Time Format
- Raw Hex Command: Time Mode

5.4.5 Configure Data Storage & Retransmission

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

Export the Local Data

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

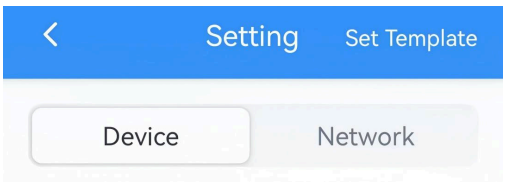
Each device can store up to 1,000 data records.

Limitation: When control permission is Remote Control, the device will stop storing data.

Prerequisites: Sync the time to ensure the data is stored in correct time.

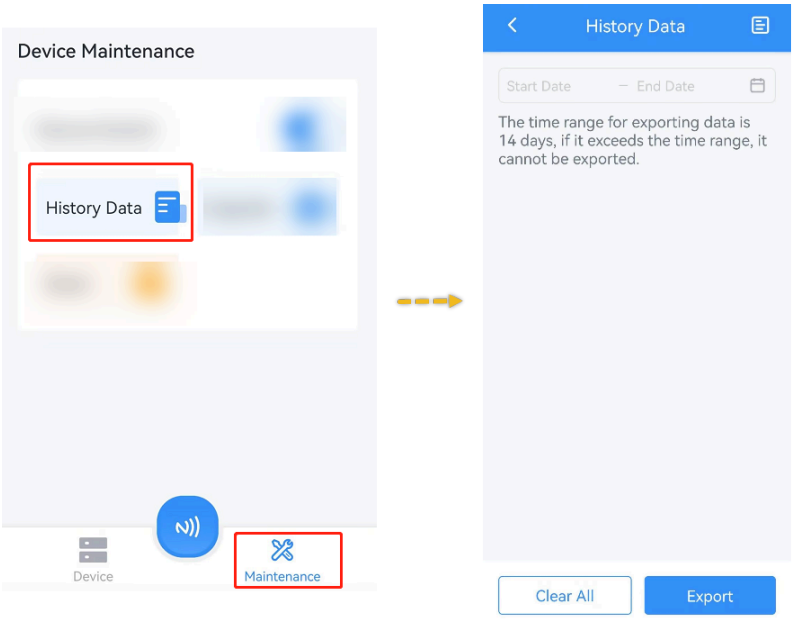
Configure by ToolBox

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



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

> **Tip:**
> Since the ToolBox App's data export time range is limited to 14 days, you can export the complete data in segments if the required time range exceeds this limit.



6. Put the NFC detection area of the phone close to the NFC antenna of device. If the read succeeds, the history data will be displayed.
7. Click **Export** to customize a file name, then click **OK** to save the history data as a CSV file to your smartphone.
8. (Optional) To check the exported record, click in the top right corner.

Configure by Downlink

- JSON Command: history_enable
- Raw Hex Command: Data Storage

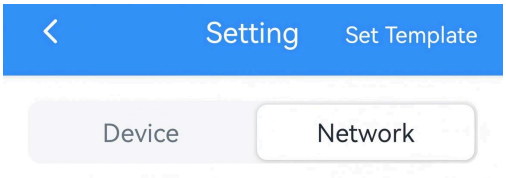
Enable Data Retransmission

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

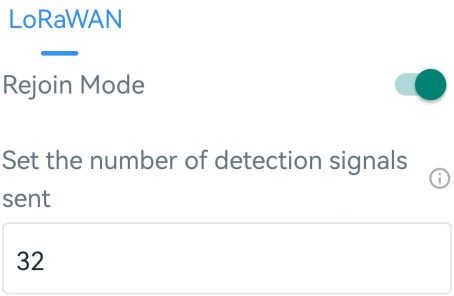
Prerequisites: The device join type is **OTAA**.

Configure by ToolBox

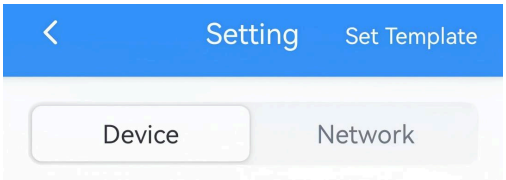
1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Network** tab.



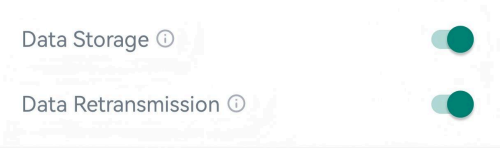
3. On the **LoRaWAN** page, enable **Rejoin Mode** and set the number of packets sent.



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



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



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

Write successfully!

Configure by Downlink

- JSON Command: retransmit_enable
- Raw Hex Command: Data Retransmission

Result:

- When the device detects that the network status is deactivated via the rejoin mode mechanism, it records a data loss time point. Upon reconnection, the device retransmits the lost data according to the data retransmission interval. Retransmission data is reported with timestamps and uses a different format from periodic report data.
- If the device reboots or is repowered during data retransmission, it will resend the entire retransmission dataset once it reconnects to the network.
- If a new network disconnection occurs during an ongoing retransmission, only the data logged during this latest outage will be sent upon reconnection.

Note:

- Data retransmission increases the uplink traffic and consumes device energy quickly.
- The default report data retransmission interval is 600s, this can be changed via downlink command.

Query Historical Data

The device supports data retrievability feature to query historical data for a specific time range via downlink command. The retransmission data format includes timestamps and differs from the periodic report format. For details, refer to the Payload Protocol document.

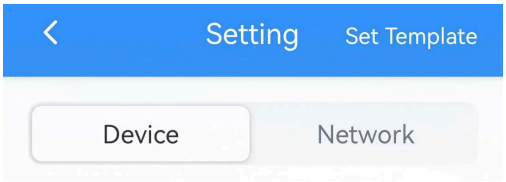
5.4.6 Configure Calibration Parameters

This section describes how to configure the temperature and humidity calibration parameters.

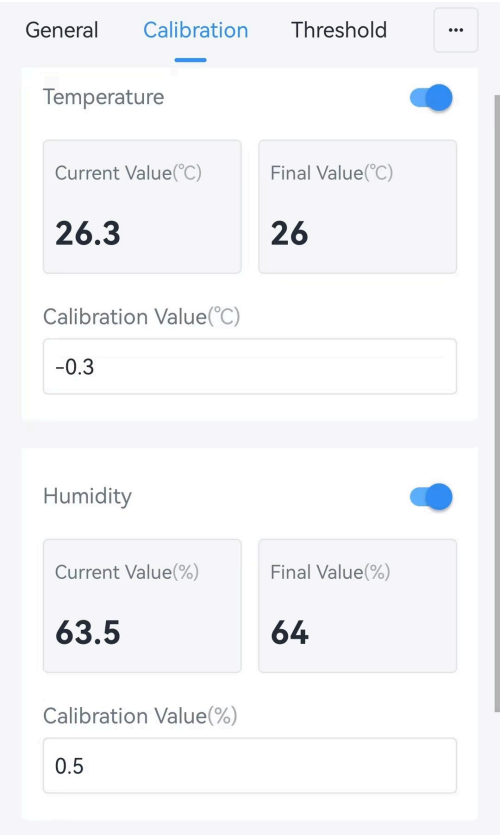
Prerequisites: Ensure the data source is **Embedded**.

Configure by ToolBox

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



3. In the **Calibration** page, enable **Temperature** or **Humidity** as required, and enter a **Calibration Value**. The following page is displayed.



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

Write successfully!

Configure by Downlink

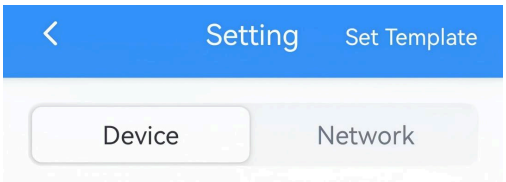
- JSON Command: temperature_calibration_settings, humidity_calibration_settings
- Raw Hex Command: Temperature Calibration, Humidity Calibration

5.4.7 Configure Temperature Threshold Parameters

This section describes how to configure temperature threshold parameters.

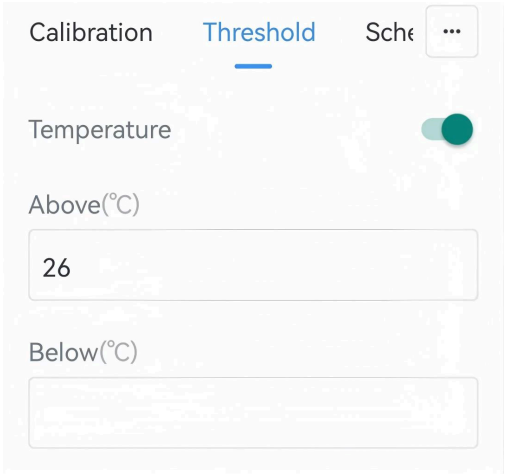
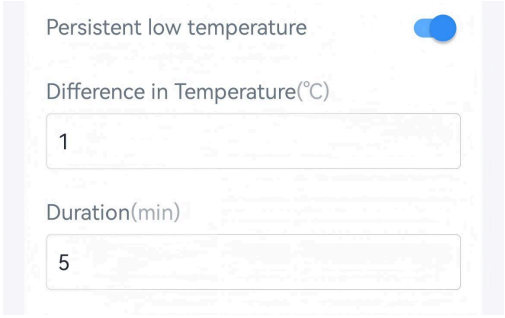
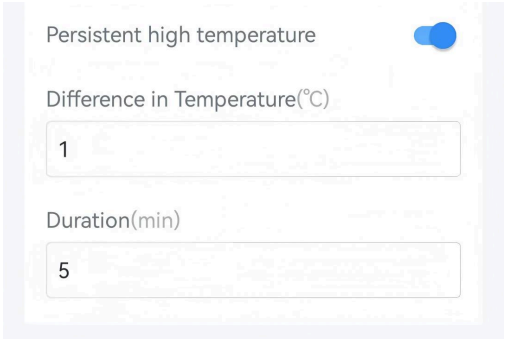
Configure by ToolBox

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



3. On the **Threshold** page, select the threshold alarm type to enable and configure the threshold parameters.

Alarm Type	Description
Temperature	When the ambient temperature is above or below the threshold value, report a threshold alarm packet instantly. Only when the threshold is released and re-triggered, will the device report the alarm again.

Alarm Type	Description
	
Persistent Low Temperature	When the ambient temperature is below the target temperature by a difference value and lasts for a duration, report a threshold alarm packet instantly. When the threshold is released, report an alarm release packet. 
Persistent High Temperature	When the ambient temperature is above the target temperature by a difference value and lasts for a duration, report a threshold alarm packet instantly. When the threshold is released, report an alarm release packet. 

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

Configure by Downlink

- JSON Command: temperature_alarm_config
- Raw Hex Command: Configure Temperature Threshold Parameters

5.4.8 Configure Room Card Parameters

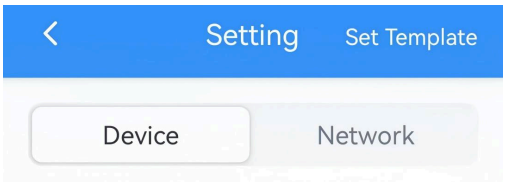
This section describes the parameters when the DI interface is connected to a room card switch.

Prerequisites

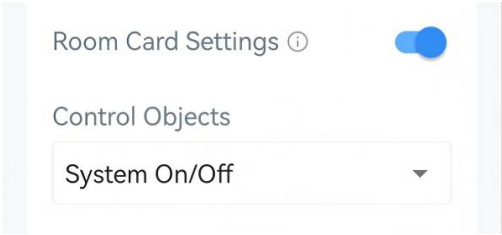
- A room card switch is connected to the thermostat according to the wiring diagram.
- The control permission is selected.

Configure by ToolBox

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



3. Enable **Room Card Settings** and configure the related parameters.



If control permission is **Thermostat**:

a. On the **Installation** page, enable **DI** in Wiring Settings.

b. Enable **Room Card Settings**.

c. Select the control object. The default settings for these control objects are as follows:

System On/Off: Insert card=System On, Remove card=System Off

Insert an Event: Insert card=Home schedule, Remove card=Away schedule

If control permission is **Remote Control**:

a. On the **General** page, enable **Room Card Settings**. The default settings for this control object are as follows:

System On/Off: Insert card=System On, Remove card=System Off

Configure by Downlink

- JSON Command: card_config
- Raw Hex Command: Configure Room Card Parameters

5.5 Maintain the Device

This section describes how to maintain the device.

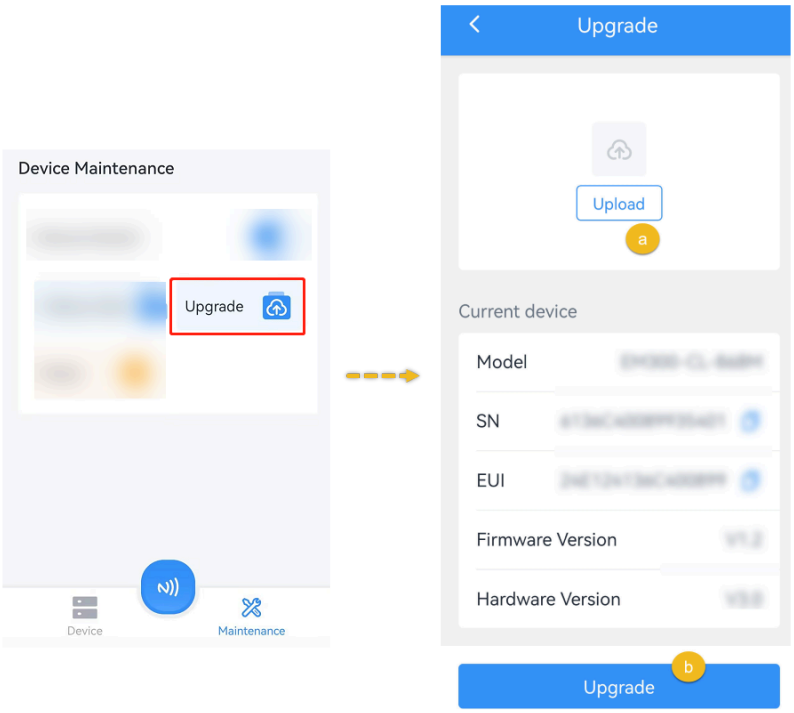
5.5.1 Upgrade the Device

The device supports local upgrade via ToolBox App or FUOTA via remote LoRaWAN® network servers. For the details of FUOTA, please refer to corresponding server guides. This section describes how to upgrade the device locally.

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

Steps:

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



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

> **CAUTION:**
> Do not perform any operations in ToolBox during upgrade, otherwise, the upgrade will be interrupted or the device may malfunction.

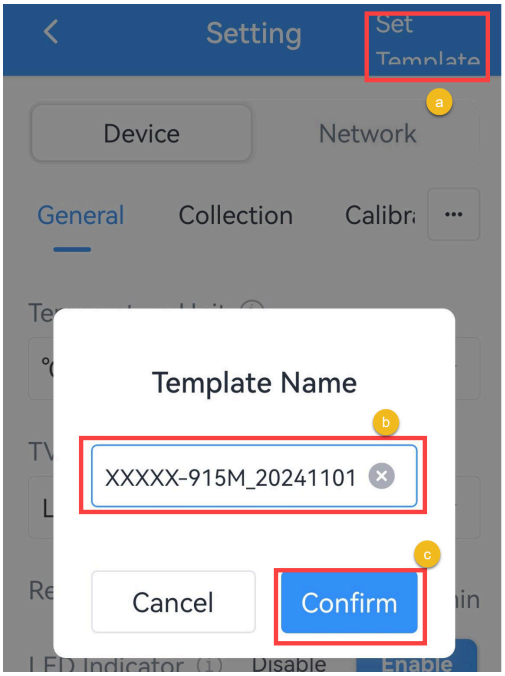
5.5.2 Configure a Template for Configuration Backup

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

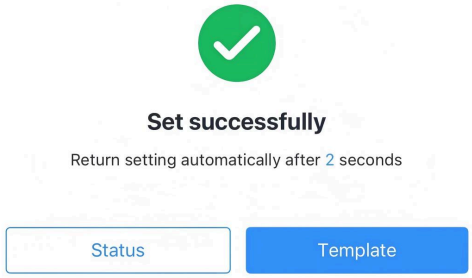
Prerequisites: The backup device and the device importing the backup are exactly the same model.

Step 1. Set a Template

1. Access the device via ToolBox App.
2. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
3. Edit the device parameters as required, click **Set Template** in the top right corner.
4. Customize a template name, click **Confirm** to save the current configuration as a template.

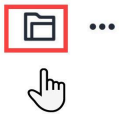


5. If the template is saved successfully, the following page is displayed. The template will be saved to the ToolBox App.

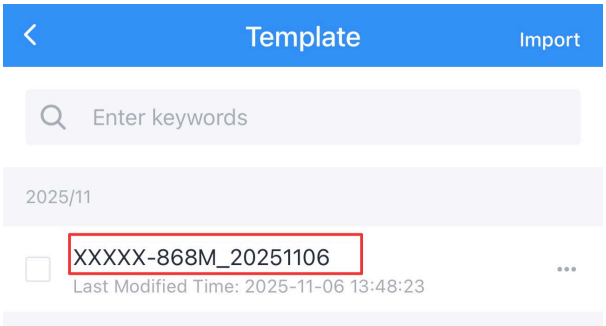


Step 2. Write Template Configuration to the Target Device

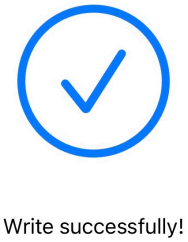
1. On the homepage of ToolBox, click **Device** in the lower left corner.
2. Click Template icon in the top right corner to go to **Template** page.



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



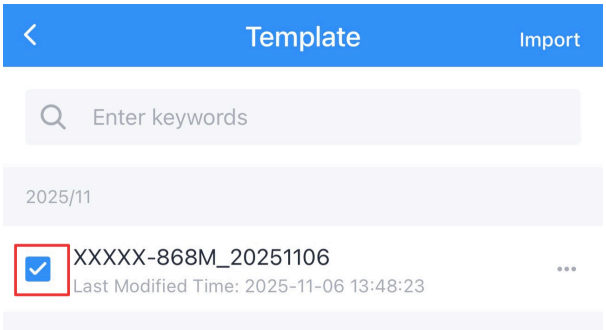
4. On the displayed page, click **Write** at the bottom and put the NFC detection area of the phone close to the NFC antenna of the target device. If the configuration is written to the target device successfully, the following page is displayed.



Write successfully!

Step 3. Export or Delete a Template (Optional)

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



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

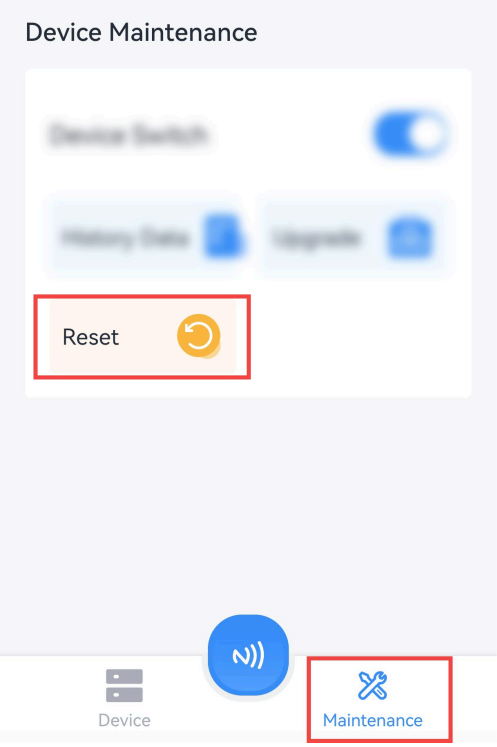
5.5.3 Reset the Device

This section describes how to reset the device.

Note:
If you are unable to read from or write to devices normally using the ToolBox, perform a hardware reset.

Steps:

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



2. Click **Reset**.
3. In the displayed dialog box, click **Confirm**.

4. Put the NFC detection area of the phone close to the NFC antenna of the device. If the device is successfully reset, the following page is displayed.

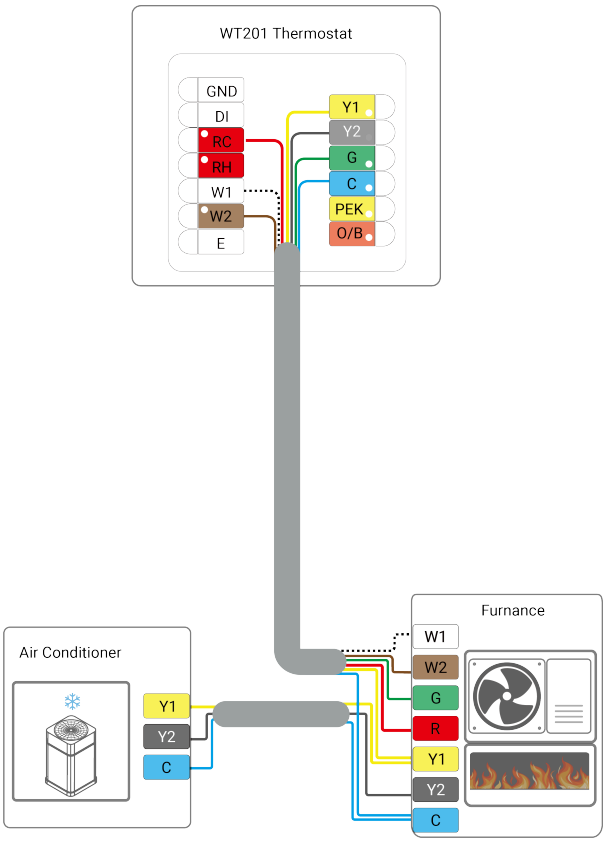
Reset successfully!

Chapter 6. Appendix: Wiring Diagrams

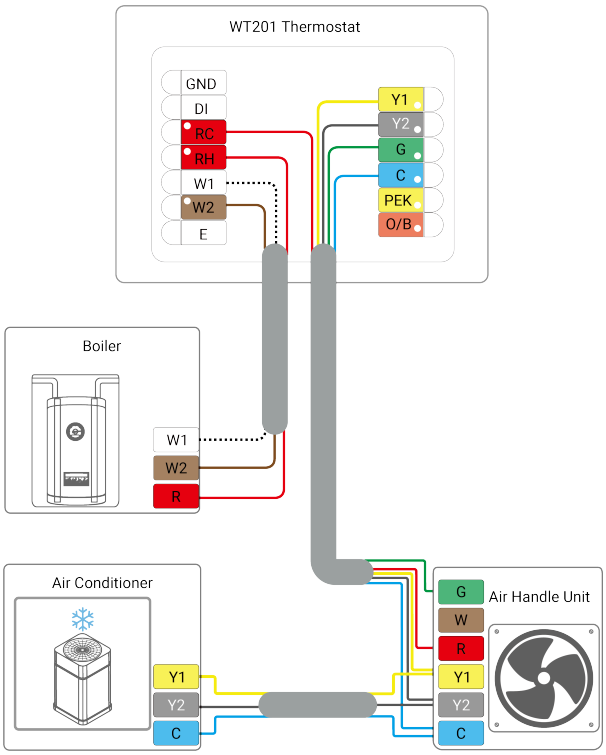
This chapter describes the wiring diagrams of the thermostat if there is a C wire. If there is no C wire or common wire, it is possible to use a Power Extension Kit (PEK). For details, please contact Milesight.

Wiring for Conventional Systems

1. Furnace + Air Conditioner (Up to 2-heat/2-cool)

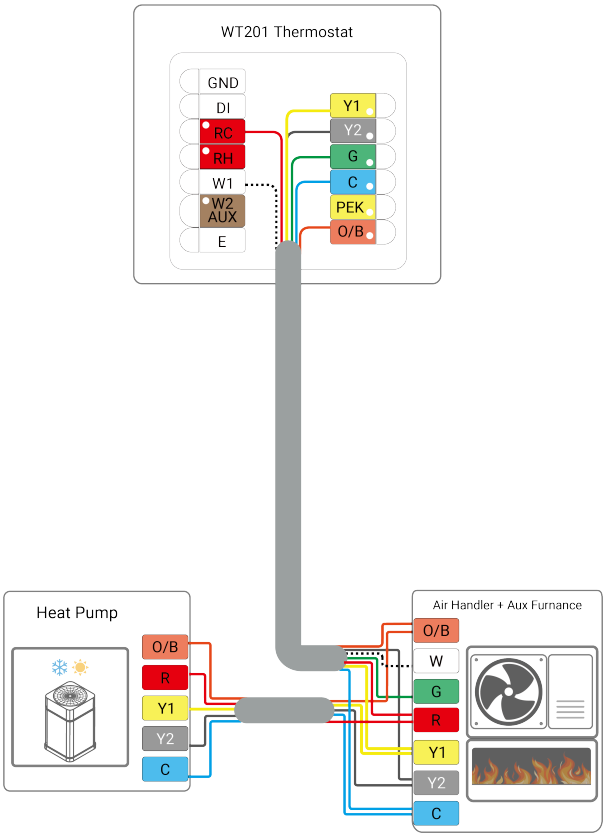


2. Boiler + Air Conditioner (2-heat/2-cool, 2 transformers)

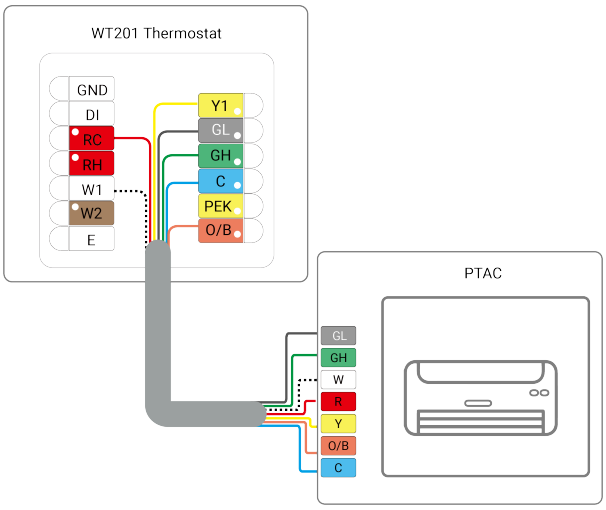


Wiring for Heat Pumps

Heat Pump with Auxiliary Heat



Wiring for PTAC



Chapter 7. Services

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

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/

MILESIGHT CHINA

TEL: +86-592-5085280

FAX: +86-592-5023065

Add: Building C09, Software Park Phase III, Xiamen 361024, Fujian, China