

# THERMOSTAT LORAWAN USER MANUAL

## BASIC INFORMATION / PRODUCT DESCRIPTION

First, an application on server must be created with keys labeled on devices. If creating application on server is finished, the device can be turned on and initiate JOIN procedure. After the device has been successfully JOINED to the server, it can start sending and receiving messages to/from server.

## THERMOSTAT COMMANDS

There are three commands which Thermostat sends to the server and two commands which server sends to the Thermostat.

Device commands are:

1. Sending current configuration, command is 0xFF,

<0xFF><lora\_period><temp\_span><temp\_sampling><deired\_temp\_1><desired\_temp\_2><battery\_status>

*0xFF* – Current configuration command.

*lora\_period* – (expected value 0 or 3 – 240), represent period of mandatory communication in minutes.

*temp\_span* – (expected value (5, 10, 15, 20)) represent temperature span for regulation (0,5°C, 1°C, 1,5°C and 2°C).

*temp\_sampling* – (expected value 3 – 10), represent period of time in minutes for sampling temperature.

*desired\_temp\_1* and *desired\_temp\_2* – (expected value 50 – 350 with step 5), 2 bytes which represent current desired temperature on device.

*battery\_status* – (expected value 0 – 100 (%)), which represent current battery state on device.

2. Sending current data (current temperature, relay status and set temperature) – command is 0x00,
3. Setting desired temperature – command is 0x01.

Message format of these two commands:

- First byte is a command,
- Next two bytes are current temperature,
- Fourth byte is state of relay (0 or 1),
- Fifth and sixth bytes are set temperature
- Seventh byte is battery status

The temperature being sent is multiplied by 10 with a resolution of 5. Meaning, if desired temperature is 27, we must send 270.

Reason why two bytes are being used for set and current temperature is because uint8 max is 255 but the range for temperature is from 5 – 35, meaning 50 – 350.

Commands which server sends to the device:

1. Setting the temperature from the server. First byte is command - recommended to use 0x01 but every byte except 0x02 (byte reserved for different command) can be used. On the last two places (fifth and sixth bytes) the temperature is being set. The places in between are not important and it is recommended to send 0x00 for them.

Command example:

0x01 0x00 0x00 0x00 0x04 0x01 and the set temperature is 26 degrees

0x04 0x01 is 260 ( $0x04 + 256 * 0x01 = 260$ ), and  $260/10$  is 26.

0x01 0x00 0x00 0x00 0xF0 0x00 and the set temperature is 24 degrees

0xF0 0x00 is 240 ( $0xF0 + 256 * 0x00 = 240$ ), and  $240/10$  is 24.

2. Setting configuration. First byte is command and it is 0x02, followed by one byte from 0x03 to 0xF0 which represents period of minutes after the device will communicate with the server). Next byte represent Temperature span for regulation (5, 10, 15, 20, which represent 0,5°C, 1°C, 1,5°C and 2°C). Next byte represent time period in minutes for sampling temperature in room, it can be value from 3 to 10. Last two bytes are for setting temperature.

Command example:

0x02 0xF0 0x0A 0x05 0xC8 0x00– device will communicate with the server every 240 minutes. The temperature span for regulation is 1°C, sampling room temperature in 5 minutes, and set temperature to 20°C (0xC8 0x00 = 200).

If communication period is set to 0, for example, 0x02 0x00 0x05 0x03 0xF0 0x00, it means that the device will communicate with the server when temperature has been changed by 0,5°C or when new temperature has been set.

**Sending current configuration** is first message which device sending after successful Join procedure.

## COMMUNICATION FLOW

Thermostat communicates with the server in three cases:

1. Temperature has been changed by 0,5°C or more,
2. New set temperature has been changed,
3. Period of communication occurs which has been set from the server

In order for Thermostat to have active radio icon, on every communication with the server, server should echo received message from Thermostat back to Thermostat if there are no other messages in queue.

If both server and Thermostat are sending command for set temperature, the advantage has Thermostat, because user is controlling the set temperature command from Thermostat.

It is recommended that, if messages are sent from the server, downlink messages should be sent at least three times in order for the device to gather downlink message.