MClimate T-Valve <> Server Communication protocol

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The document "T-Valve - High level specification" version 05 or higher must be read prior that document for full understanding.

1. **Structure of the packets sent from the application server towards the radio devices.**

With one packet of radio data one or more commands can be sent, as shown in table 1. The maximum available length of the packet payload is 50 bytes.

Index	Meaning
0	CMD-0 – Byte showing what command number 0 will execute
1	DATA-00 – Input data byte 0 for command 0
2	DATA-01 – Input data byte 1 for command 0
…	…
…	DATA-0n – Input data byte n for command 0
…	CMD-1 – Byte showing what command number 1 will execute
…	DATA-10 – Input data byte 0 for command 1
…	DATA-11 – Input data byte 0 for command 1
…	…
…	DATA-1j – Input data byte j for command 1
…	…
…	CMD-k – Byte showing what command number k will execute
…	DATA-k0 – Input data byte 0 for command k
…	DATA-k1 – Input data byte 1 for command k
…	…
49	DATA-km – Input data byte m for command k

Table 1

In table 2 each command – byte CMD-x – is described with its input data.

CMD-x, [hex]	Meaning	Input data
01	Valve opening/closing	Data byte 0 – valve opened time. Data byte 1 – valve closed time.
02	LEDs activation	Data byte 0 – LED ID: 0x00: LED responsible for Open; 0x01: LED responsible for Close; 0x02: LED responsible for Leakage; 0x03: LED responsible for Flood; Data byte 1 – LED behavior:

		0x01: ON;
		0x02: Blink fast;
		0x03: Blink slow;
		0x04: OFF;
		Data byte 2 – duration for the specified LED behavior in seconds. If zero, do it until next LED related command is received or the verify button is pressed.
03	Buzzer control	Data byte 0: Buzzer volume and frequency.
		Bits 7:4: Buzzer volume:
		0x0: Buzzer volume set to minimum available;
		0x1: …
		0x2: …
		0x3: …
		0x4: …
		0x5: …
		0x6: …
		0x7: …
		0x8: …
		0x9: …
		0xA: …
		0xB: …
		0xC: …
		0xD: …
		0xE: Buzzer volume set to maximum available;
		0xF: Buzzer is off.
		Bits 3:0 Buzzer frequency:
		0x0: Buzzer frequency is 1kHz;
		0x1: Buzzer frequency is 1.5kHz;
		0x2: Buzzer frequency is 2kHz;
		0x3: Buzzer frequency is 2.5kHz;
		0x4: Buzzer frequency is 3kHz;
		0x5: Buzzer frequency is 3.5kHz;
		0x6: Buzzer frequency is 4kHz;
		0x7: Buzzer frequency is 4.5kHz;
		0x8: Buzzer frequency is 5kHz;
		0x9: Buzzer frequency is 5.5kHz;
		0xA: Buzzer frequency is 6kHz;
		0xB: Reserved;
		0xC: Reserved;
		0xD: Reserved;
		0xE: Reserved;
		0xF: Reserved.
		Data byte 1: Time the buzzer to be active. Resolution – 1s. If

		zero, the buzzer will stay active until buzzer command with volume 0xF is received (buzzer turn-off) or the verify button is pressed. During this time the buzzer continuously alternate loud and silent states. Data byte 2: On time from the buzz loud-silent period. Resolution – 10ms. Data byte 3: Off time from the buzz loud-silent period. Resolution – 10ms.
04	Reload emergency openings	Data byte 0: Set allowed emergency openings of the valve. Maximum allowable value: 15.

05	Enable/disable manual valve open/close	Data byte 0:
		  Bit 0: Set it to 1 to enable manual valve open. Set it to 0 to disable it. Default value is 1;
		  Bit 1: Set it to 1 to enable the manual valve close. Set it to 0 to disable it. Default value is 1.

06	Set flood alarm time	Data byte 0 – alarm time value. Resolution is 10s. A zero value is forbidden. Default value is 30 (5 minutes).
07	Set radio packet send period	Data byte 0 – period for radio packet send. Resolution is 1 minute. Default value is 5.
08	Request to the device to send its full data with the next packet	None
09	Set the device allowed working voltage	Data byte 0, bits 7:0: The voltage value. It is calculated by the expression: $Bits\ 7:0 = \frac{\text{Voltage,[mV]}-1600}{8}$ When voltage lower than the allowed is measured by the device, the valve state is automatically set to open and can't be changed anymore. Default value for the device is 1850mV. **Setting out value less than 0x1F for Bits 7:0 has undefined behavior on the device operation, because the voltage drop may cause MCU or/and radio reset!**

0A	Enable/Disable device flood sensor	Data byte 0:
		  Bits 7:1: Reserved;
		
		  Bit 0: Set it to 1 to enable the device flood sensor. Set it to 0 to disable the device flood sensor. Default value is 1. If it will be never used, we advice to disable it, to reduce the battery discharging.

0B	Deactivates the device to save power. To activate it again press 5 sequential times the OK button.	None.

<p align="center">Table 2</p>

2. Structure of the packet sent from the radio devices.

There are two types of radio packets send from the radio device. They distinguish by the sent payload bytes. In Table 3 this is summarized.

Packet payload, [Bytes]	Description
2	Sent constantly at given periods (Set with command 0x07 from the server). The packet contains the device temperature sensors data from the last measurement and the water valve state. Temperature measurement is done once per hour.
5	Full device data. Such a packet is send from the device on certain events (will be described below) or by server request with command 0x08 or once per day.

<p align="center">Table 3</p>

The application server can use either of these packets to send some command towards the device in the response (According to the LoRaWAN protocol).

2.1 Structure of the full device data packet (5 bytes payload).

In Table 4 the packet is fully described.

Byte index	Bit index	Meaning
0	7:5	Reason to send the packet: 0b000: Requested by server command 0x08 or one day elapsed; 0b001: Device test switches combination is pressed; 0b010: Flood detected by device sensor; 0b011: "Open" or "Close" push-button is pressed; 0b100: Fraud detected – box tamper switch or magnetic sensor.
	4	Reserved.
	3	Box tamper status: 0: No box tamper detected; 1: Box tamper detected.

Byte index	Bit index	Meaning
	2	Flood detector wire status: 0: The wire is working; 1: The wire is broken.
	1	Flood detection status: 0: No flood detected; 1: Flood detected.
	0	Magnet detection status: 0: No magnet presence is detected; 1: Magnet presence is detected.
1	7	Alarm validated indicator. That bit is set to 1 when the user press the "Verify" button when leakage alarm is active. After, on any response from the application server that bit is cleared.
	6	Manual valve open indicator: 0: Manual open of the valve isn't enabled; 1: Manual open of the valve is enabled.
	5	Manual valve close indicator: 0: Manual close of the valve isn't enabled; 1: Manual close of the valve is enabled.
	4:0	Device software version.
2	7:0	In reduced access mode controls the valve close time. The resolution is in minutes.
3	7:0	In reduced access mode controls the valve open time. The resolution is in minutes.
4	7:0	Battery voltage. It is calculated by the formula: Battery voltage, [mV] = (bits7:0)*8 + 1600.

Table 4

2.2 Structure of the temperature data packet (2 bytes payload).

In Table 5 the packet is fully described.

Byte index	Bit index	Meaning
0	7:0	Temperature measured by sensor 1. This sensor measures the water temperature, thus only positive values are expected. The resolution is 0.5°C. The temperature is calculated by the expression: $$T, [°C] = \frac{\text{Bits}[7:0]}{2}$$
1	7	Valve state: 0: The valve is closed – water isn't flowing; 1: The valve is open – water is flowing.
	6:0	Temperature measured by sensor 2. This sensor measures the ambient temperature. The measurement range is (-10°C:50°C) and the resolution is

		0.5°C. The temperature is calculated by the expression:

$$T, [°C] = \frac{Bits[6:0] - 20}{2}$$

Examples:
T = (20 - 20) / 2 = 0°C;
T = (120 - 20) / 2 = 50°C;
T = (0 - 20) / 2 = -10°C;
T = (75 - 20) / 2 = 27.5°C.

<div align="center">Table 5</div>

3. Example packets.

3.1 Packets sent from the device.

Example 1: Long packet sent.
Data, [Hex]: 64620000A4

Example 2: Short packet sent.
Data, [Hex]: 0044

3.2 Packets sent from the server.

Example 1: This example sends…
020203FF 03E4FF2060 040F 0704

4. Revision history

DATE	VERSION	AUTHOR	COMMENT
14 January 2019	V1	Martin Peevski	Initial draft
1 February 2019	V1	Lyubomir Yanchev	MClimate Corporate Template edit
17 April 2019	V1	Martin Peevski	− Add command to set the radio packet send period. − Add software version in the device send radio packet.
1 December 2019	V1.2	Martin Peevski	New kinds of sent packets described.
14 February 2020	V1.3	Martin Peevski	Change the sent packets content.

26 February 2020	V1.4	Martin Peevski	Added command to set the device allowed working voltage.
22 May 2020	V1.5	Martin Peevski	– Change the data represented in the device sent packets. – Add command to enable/disable the device flood sensor.
17 June 2020	V1.6	Martin Peevski	– Command 09 at Table 2 updated. – Document formatted.
20 April 2021	V1.7	Martin Peevski	– Commands 0A, 0B at Table 2 added. – Chapter 3 – Example packets - added.