User Guide

Self-powered Thermostatic Radiator Valve, iTRV

Dear customer,

Thank you for choosing our product. Before starting up the device, please read the entire instructions carefully. Save the instructions for later reference and keep them together with the device if you pass it on to someone else.

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1 Use and Safety Recommendations

- The metallic part of the unit's housing serves as a heat sink. Be sure that the air circulation around it is not obstructed by furniture, curtains, plants, or other objects.
- If the device has been stored in a cold environment, make sure that it resumes close to room temperature before use. This is to prevent condensation from forming.
- The thermostatic radiator valve is designed for indoor use only. Do not allow the thermostatic radiator valve to get wet. Its sensitive electronics can be affected.
- The unit is best cleaned with a dry or slightly damp cloth. Do not use aggressive cleaning agents or solvents.
- Refrain from exposing the unit to environmental stress such as high mechanical forces (do not step on it), strong vibrations, direct sunlight or extreme temperatures.
- The unit must not be disassembled or modified. In case you are unsure how to use the unit, please get in touch with your beta test consultant.
- Be aware that correct operation can be affected by strong electromagnetic fields. Typical sources of such are mobile phones, 2-way radios, RC transmitters, microwave ovens, electric motors.
- The housing contains actuated springs that can lead to injuries if released. For servicing, refer to qualified service personnel.
- The thermostatic radiator valve has been designed and must solely be used for the purpose of controlling a M30 x 1.5 heater valve. Any other use may pose a hazard to the device itself, to the equipment involved, or to the health of the user.
- When operating the device in a workplace environment, be sure to observe the workplace regulations that may apply.

Read these instructions carefully and keep them for later reference.
Thank you.

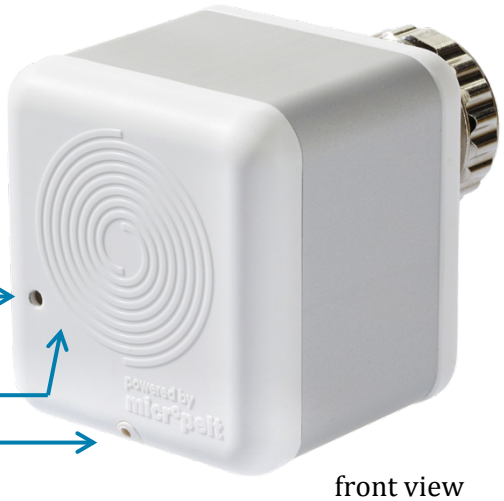
2 Included in the box

1. Self-powered thermostatic radiator valve actuator, one unit
   Type: MVA-002
2. Quick start instructions
   with web link to detailed user guide

MVA-002

Thermostatic radiator valve actuator

rear view



front view

The connection nut of the actuator can be used universally and fits all valves with a thread size of M30 x 1.5. This covers valves of the most popular manufacturers, without requiring accessories. For other valve types normally metal adapters are available.

Supported valves without adapter are: Heimeier, MNG, Junkers, Landis&Gyr (Duodyr), Honeywell-Braukmann, Oventrop Typ A, Oventrop AV6, Schlösser, Comap D805, Valf, Sanayii, Mertik Maxitrol, Watts, Wingenroth (Wiroflex) R.B.M, Tiemme, Jaga, Siemens, Idmar, plus several others.

Metal adapters are available for Danfoss valves. Please get in touch.

3 Overview

3.1 System Function

The MVA-002, a self-powered thermostatic radiator valve, is an electronic actuator for convection radiators (standard valve type M30 x 1.5). It is designed for single room temperature control.

For this purpose, the actuator is mounted on the radiator valve and linked by radio (EnOcean 868 MHz) to a suitable room controller. A connection process is used to pair the devices and a calibration cycle allows the actuator to automatically adapt its positioning range to the individual radiator valve.

With the room controller set up to control the actuator, the user can conveniently configure room temperature profiles using the room controller. By lowering the room temperature during periods of absence, heating cost can be reduced without loss of comfort.

The actuator itself does not have a way to monitor the temperature. Instead, it queries the room controller every 10 minutes and reports its current valve pin setpoint value. It also receives a new setpoint value between 0% (valve closed all the way) and 100% (valve open all the way). The actuator's servo motor then moves the valve pin to the new target position.

The actuator generates the energy it needs for operation (running the motor and radio communication) with a built-in thermoelectric generator (TEG). This generator draws its energy from the difference in temperature between the radiator heat and ambient air and therefore does not need an external power source, such as a battery or a wall socket, for operation.

3.2 Proper use of the device

The self-powered thermostatic radiator valve is suitable solely for controlling water-filled heating radiators. Any other use – including control of floor heating systems - is not permitted and can result in damage.

Do not disassemble or modify any part of the product. It is important to comply with the safety notice included in these operating instructions.

4 Usage

4.1 Default setting on delivery

On leaving the factory, the self-powered actuator is in mounting position (valve pin is retracted or can be pushed in all the way without force).

Its internal energy storage unit is fully charged, so there is more than enough energy for setting the unit up. When the heating system is running, the actuator is automatically powered by the heat from the heating circuit.

4.2 Setting up the actuator to connect to the room controller

The actuator must be controlled by a suitable room controller (supporting EnOcean Equipment Profile EEP A5-20-01). The link between the two is established by a bidirectional connection process:

First set the room controller to setup mode, as described in the instructions for the room controller. Then double-press the button on the actuator. After approximately 2 seconds, the actuator will send a telegram to the room controller, which in turn confirms the reception. Successful completion of the connection process is confirmed by a single LED flash.

If the connection operation fails, the LED flashes multiple times. In this case, repeat the operation. If multiple connection attempts fail, check whether the room controller is ready to receive, then repeat the connection operation.

NOTE: Double-pressing the button always causes a connection request to be sent. At the same time, it makes the actuator move to the mounting position and stops normal radio communication.

4.3 Setting the mounting position

Pressing the button twice will always bring the actuator into the mounting position (valve pin fully retracted or can be pushed in all the way without force).

This is also the default-position for storage and shipping, with power consumption being minimized since radio communication is disabled in this mode.

The primary use of the mounting position however, is attachment and removal of the actuator to/from the radiator valve (see Section 4.4).

4.4 Attaching / removing the valve actuator to the radiator

You do not need to interrupt the hot water circuit and water does not have to be drained, when mounting or removing the actuator. Instead, the radiator valve remains attached to the radiator while the actuator is screwed onto the valve, typically in lieu of a traditional thermostatic head.

Follow the steps below:

1. If necessary, remove the mounted thermostat by turning its union nut counterclockwise. To loosen the nut, it can be helpful to set the thermostat to maximum.
2. Remove any contamination (dust, paint) that may be present on the part of the valve that is going to attach to the actuator.
3. Be sure the actuator is in mounting position, e.g. the pin is either fully retracted or can be pushed in all the way without force. If not, then press the button twice and wait until the pin has fully moved in and the motor stops running.
4. Now place the actuator on the radiator valve. Screw on the connection nut and tighten it. Note that this step is critical to the energy harvesting performance.
5. The actuator should now rest firmly against the contact surface of the radiator valve, which is the transfer point of the heat flux to the thermoharvester. After mounting the actuator, try to gently rotate it back and forth on the valve. It should not move.

4.5 Calibration cycle and wireless operation

After attaching to the radiator valve, the actuator should be in the mounting position with wireless communication stopped.

Enter normal operation of the actuator, by pressing its button once. This initiates a calibration cycle, in which the 0% position of the valve is determined. Following this, the actuator requests a position from the room controller, immediately setting the valve opening accordingly. Wireless operation is now active, with the actuator asking the room controller for new instructions every 10 minutes. Avoid pressing the button now, since this may return the actuator to the mounting position, disrupting operation.

During normal wireless operation, bidirectional communication with the room controller and correction of the valve opening takes place every 10 minutes. The LED remains off, unless radio communication fails, e.g. because the room controller is down. In this case, the LED flashes 3 times. An immediate response can be extorted at any time through pressing the button only once.

NOTE: The pushbutton on the device is needed for setup and mounting / removal only. Frequent pressing of the button results in excessive valve actuation which can discharge the energy storage device and send the unit into a low-power sleep mode.

5 Additional Information

5.1 Powered by Energy Harvesting

Power to the actuator is supplied by a thermoelectric generator (TEG). This extracts electrical energy from the difference in temperature between the heating water flow and the ambient air. During periods of radiator activity, excess energy is buffered in the internal energy storage device. The energy stored during the colder months of the year is used to supplement or replace the harvester output in summer as well as the spring and autumn transition periods. The storage device is sized to power the unit throughout the year, under conditions of normal heating behavior.

In rare situations, the reservoir may run low. The actuator then reports this condition to the room controller and moves the valve into a protected position (50% valve opening or current position, if this is greater). The actuator then enters sleep mode and waits for the storage unit to recharge from the thermoelectric generator. Once sufficient electrical energy has been gathered, the actuator resumes operation.

The above-mentioned safe position ensures that the radiator valve does not calcify in one of its end positions, that pipes do not freeze, and that the thermoelectric generator is being heated once hot water starts flowing again. While in the safe position, the room temperature may fluctuate slightly.

5.2 Status indicators and LED flash patterns

As part of the implemented EnOcean standard protocol, the actuator uses two flags to transmit to the room controller the status of the thermogenerator (1: charging; 0: not charging) and that of the energy storage unit (1: sufficiently charged; 0: charge low).
Error codes are not transmitted.

LED flash patterns:

- 1 flash: Connection process (teach-in) successful
- 3 quick flashes: Communication with room controller has failed (e.g. room controller down)
- 6 quick flashes: Connection process has failed

5.3 Notes on radio operation

5.3.1 Transmission range

The radio transmission range is limited by both the distance between transmitter and receiver, and by interference. Indoors, building materials play an important role. Major reflections and signal losses are due to metallic parts, such as reinforcements in walls and metallized foils, which are used on thermal insulation products.

Penetration of radio signals:

Material	**Penetration**
Wood, gypsum, uncoated glass	90..100 %
Brick, chipboard	65.. 95 %
Reinforced concrete	10.. 90 %
Metal, aluminum facings	0.. 10 %

For an evaluation of the environment, please see guide values listed below:

Conditions	**Range / penetration**
Line-of-sight	Typ 30 m range in passages, up to 100 m in halls
Plasterboard and wood walls	Typ 30 m range through max. 5 walls
Brick and foamed concrete walls	Typ 20 m range through max. 3 walls
Reinforced concrete walls & ceilings	Typ 10 m range through max. 1 ceiling

Supply blocks and lift shafts should be treated as shields.

In addition, the angle at which the signal enters the wall has to be considered. A shallow angle increases the effective wall strength as well as the attenuation of the signal. Whenever possible, signals should enter walls perpendicularly. Alcoves should be circumvented.

NOTE: For additional information, refer to the EnOcean White Paper "EnOcean Wireless Systems – Range Planning Guide".

5.3.2 Other interference sources

Common sources of interference are devices that generate high-frequency signals. These are typically computers, audio-/video systems, electronic transformers and ballasts. The distance of the actuator to such devices should be more than 0.5 m.

5.3.3 Loss of communication with the room controller

If the actuator cannot establish a dependable radio communication with the room controller, i.e. more than 3 times in sequence the room controller does not receive a radio signal, then the actuator switches to a reduced radio pattern. The typical 10 minute radio period is extended to one transmission every hour, reducing the energy consumption while radio contact is interrupted. In addition, the actuator enters the safe position as described in Section 5.1.

Once the radio contact to the room controller recovers, the actuator reverts to requesting instructions from the controller every 10 minutes.

6 Radio Protocol

Bidirectional radio communication occurs periodically according to the EnOcean Equipment Profile “EEP A5-20-01” (Battery Powered Actuator). Communication is triggered by the actuator.

6.1 Protocol Data Overview

Transmit mode from MVA-002 to controller/ gateway/ server	
DB_3	Current valve position 0..100%, linear n=0..100
DB_2.Bit_7	Not used
DB_2.Bit_6	Active energy harvesting (valve is hot)
DB_2.Bit_5	Energy storage sufficiently filled
DB_2.Bit_4-0	Not used
DB_1	Internal temperature of MVA
DB_0.Bit_7-4	Not used
DB_0.Bit_3	LRN Bit, defined for data telegram
DB_0.Bit_2-0	Not used

Receive mode from controller / gateway / server to MVA-002	
DB_3	New valve position 0..100% linear
DB_2	Room temperature from room sensor
DB_1.Bit_7-4	Not used
DB_1.Bit_3	Summer mode, transmit / receive time interval 8 hours
DB_1.Bit_2-0	Not used
DB_0.Bit_7-4	Not used
DB_0.Bit_3	LRN Bit, defined for data telegram
DB_0.Bit_2-0	Not used

6.2 Description of individual functions

6.2.1 Control value in actuator mode (DB_3)

From the external radio master a control value of 0..100% is transmitted and the valve actuator executes a valve movement (0% = valve closed / 100% = valve open).

6.2.2 Summer Mode (DB_1.Bit_3)

When the actuator receives the status message „Summer mode ON“ from the external radio master, then the valve opens and the transmit/receive interval is increased from 10 minutes to 8 hours. It is possible to wake up the iTRV through 1 x pressing the push button. Then the iTRV receives the new setting from the room controller.

6.2.3 Recognition of valve position

The valve actuator recognizes during the teach-in the closing position of the valve. During operation the valve actuator does a full stroke (self-calibration) after every 30 movements, to avoid malfunction of the valve. It is not intended to trigger the recognition of the valve position via room controller.

6.3 Example of a radio protocol

Radio protocol of valve actuator MVA-002 **to server /controller /gateway**

Example in HEX "0x32 0x60 0x89 0x08"

- DB.3 = 0x32 = 50: valve position is 50%
- DB.2 = 0x60: DB2.Bit_5 = 1 (Energy storage charged) / DB2.Bit_6 = 1 (Harvesting active)
- DB.1 = 0x89 = 137: Internal temperature = 40*DB.1/255 = 40*137/255 = 21,5 °C
- DB.0 = 0x08: Data telegram

Radio protocol from server /controller /gateway **to valve actuator**

Example in HEX "0x05 0x81 0x00 0x08"

- DB.3 = 0x05 = 5: new valve position is 5%
- DB.2 = 0x81 = 129: room temperature = 40*DB.2/255 = 40*129/255 = 20,2 °C
- DB.1 = 0x00: DB_1.Bit_3 = 0: regular radio cycle 10 Minutes (no summer mode)
- DB.0 = 0x08: Data telegram

NOTE: The current version of the valve actuator, MVA-002, does not evaluate the room temperature.

7 Technical data

Maximum inlet temperature	70 °C
Valve type	M30 x 1.5 / others via adapters
Linear travel of pin / max. calibration range	>3.8 mm
Operating range (0 – 100%)	2.3 mm
Positioning time / positioning speed	0.2 mm/s
Step width	< 0.1 mm
Safety position	Valve open > 50%
Noise, normal operation	28 .. 32dBa
Force of pin, normal operation	>100 N
Self-calibration	automatically
Anti-freeze safety position	95% valve open when T ambient < 5 °C Normal operation when T ambient > 5 °C
Radio protocol	EnOcean EEP A5-20-01, valve position in % (not temperature !)
Carrier frequency	868 MHz
Radio range	approx. 30 m, depending on room situation
Feedback	State of charge, thermogenerator activity, valve position
Radio interval, normal operation	Every 10 minutes
Indicator	LED (for teach-in of valve actuator)
Control and temperature measurement	External
IP protection class	IP4X according to DIN EN / IEC 60529
Ambient temperature during operation	0 – 50 °C
Shipping and storage conditions	0 – 70 °C
Weight	260 g
Dimensions	59 x 64 x 59 mm (l x h x d) w/o valve adapter

Class 3 appliance (SELV)

Subject to change without notice !

8 Help and troubleshooting

Issue/indication	Cause	Remedy
The motor makes a distinct sound during operation	The gear has not yet finished acoustic optimization.	None
No response after pressing the button or Radiator stays hot, does not cool down	Energy storage device is discharged	Wait (if necessary overnight) until the energy storage device is recharged again by the heat of the valve.
Radiator does not cool down	Valve does not close all the way	Check mounting. Repeat calibration cycle. Test the valve with a standard thermostat head. If defective, contact your heating service or your property manager. Inappropriate valve adapter to M30 x 1.5. In this case please contact Micropelt.
Radiator does not heat up	Air in the radiator Is the boiler water temperature okay ? Is the heating pump on ? The valve won't open. Is it calcified ?	Vent the radiator and, if necessary, check the water pressure in the heating system. Correct the boiler water temperature/turn on the heating pump. Remove the actuator, press in the valve pin on the radiator several times with your hand or a tool.
Unexpected response after pressing the button.	Malfunction of the internal microcontroller	Reset the valve actuator: Press and hold the pushbutton for 10 seconds, then wait 3 minutes for the actuator to recover

9 Care and maintenance

Use a dry or slightly damp cloth for cleaning the actuator. Never use harsh cleansers or chemical solutions.

10 Disposal

Do not discard the device with your household waste. Instead, drop it at an authorized collection center for scrap electronic equipment, in compliance with the Waste Electrical and Electronic Equipment Directive.