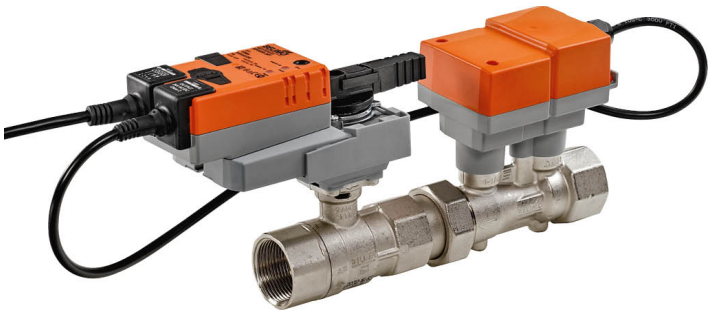
BELIMO

# Technical data sheet EP050R+MOD-N

**Characterised control valve with sensor-operated flow control, 2-way, Internal thread, PN 25 (EPIV)**

- Nominal voltage AC/DC 24 V
- Control modulating, communicative, hybrid
- For closed cold and warm water systems
- For modulating control of air-handling and heating systems on the water side
- Communication via BACnet MS/TP, Modbus RTU, Belimo-MP-Bus or conventional control
- Conversion of active sensor signals and switching contacts



## Type Overview

| Type | DN | Rp ["] | V'nom [l/s] | V'nom [l/min] | V'nom [m³/h] | kvs theor. [m³/h] | PN |
|---|---|---|---|---|---|---|---|
| EP050R+MOD-N | 50 | 2 | 6.3 | 378 | 22.68 | 32.0 | 25 |

kvs theor.: Theoretical kvs value for pressure drop calculation

## Technical data

| | | |
|---|---|---|
| **Electrical data** | Nominal voltage | AC/DC 24 V |
| | Nominal voltage frequency | 50/60 Hz |
| | Nominal voltage range | AC 19.2...28.8 V / DC 21.6...28.8 V |
| | Power consumption in operation | 4.5 W |
| | Power consumption in rest position | 1.4 W |
| | Power consumption for wire sizing | 7 VA |
| | Connection supply / control | Cable 1 m, 6 x 0.75 mm² |
| **Data bus communication** | Communicative control | BACnet MS/TP<br>Modbus RTU (default setting)<br>MP-Bus |
| | Number of nodes | BACnet / Modbus see interface description<br>MP-Bus max. 8 |
| **Functional data** | Operating range Y | 2...10 V |
| | Operating range Y variable | 0.5...10 V |
| | Position feedback U | 2...10 V |
| | Position feedback U note | Max. 1 mA |
| | Position feedback U variable | Start point 0.5...8 V<br>End point 2...10 V |
| | Sound power level Motor | 45 dB(A) |
| | Adjustable flow rate V'max | 30...100% of Vnom |
| | Control accuracy | ±5% (of 25...100% V'nom) @ 20°C / Glycol 0% vol. |
| | Control accuracy note | ±10% (of 25...100% V'nom) @ -10...120°C / Glycol 0...50% vol. |
| | Min. controllable flow | 1% of V'nom |
| | Fluid | Cold and warm water, water with glycol up to max. 50% vol. |
| | Fluid temperature | -10...120°C [14...248°F] |
| | Fluid temperature note | At a fluid temperature of -10...2°C, a spindle heater or a valve neck extension is recommended. |
| | Close-off pressure Δps | 1400 kPa |
| | Differential pressure Δpmax | 350 kPa |
| | Differential pressure note | 200 kPa for low-noise operation |

| | | |
|---|---|---|
| **Functional data** | Flow characteristic | equal percentage, optimised in the opening range (switchable to linear) |
| | Leakage rate | air-bubble tight, leakage rate A (EN 12266-1) |
| | Pipe connection | Internal thread according to ISO 7-1 |
| | Installation position | upright to horizontal (in relation to the stem) |
| | Servicing | maintenance-free |
| | Manual override | with push-button, can be locked |
| **Flow measurement** | Measuring principle | Ultrasonic volumetric flow measurement |
| | Measuring accuracy flow | ±2% (of 25...100% V'nom) @ 20°C / glycol 0% vol. |
| | Measuring accuracy flow note | ±6% (of 25...100% V'nom) @ -10...120°C / glycol 0...50% vol. |
| | Min. flow measurement | 0.5% of V'nom |
| **Safety data** | Protection class IEC/EN | III, Safety Extra-Low Voltage (SELV) |
| | Degree of protection IEC/EN | IP54 |
| | Pressure equipment directive | CE according to 2014/68/EU |
| | EMC | CE according to 2014/30/EU |
| | Mode of operation | Type 1 |
| | Rated impulse voltage supply / control | 0.8 kV |
| | Pollution degree | 3 |
| | Ambient humidity | Max. 95% RH, non-condensing |
| | Ambient temperature | -30...50°C [-22...122°F] |
| | Storage temperature | -40...80°C [-40...176°F] |
| **Materials** | Valve body | Nickel-plated brass body |
| | Flow measuring pipe | Brass body nickel-plated |
| | Closing element | Stainless steel |
| | Spindle | Stainless steel |
| | Spindle seal | EPDM O-ring |

## Safety notes

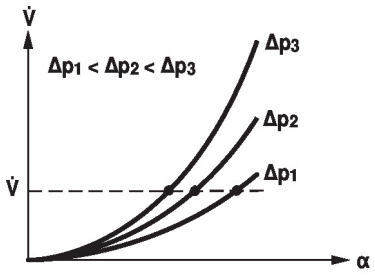
- This device has been designed for use in stationary heating, ventilation and air-conditioning systems and must not be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Outdoor application: only possible in case that no (sea) water, snow, ice, insolation or aggressive gases interfere directly with the device and that it is ensured that the ambient conditions remain within the thresholds according to the data sheet at any time.
- Only authorised specialists may carry out installation. All applicable legal or institutional installation regulations must be complied during installation.
- The connection between the control valve and the measuring tube should not be separated.
- The device contains electrical and electronic components and must not be disposed of as household refuse. All locally valid regulations and requirements must be observed.

## Product features

**Mode of operation**

The HVAC performance device is comprised of three components: characterised control valve (CCV), measuring pipe with flow sensor and the actuator itself. The adjusted maximum flow (V'max) is assigned to the maximum control signal (typically 100%). The HVAC performance device can be controlled via communicative signals. The fluid is detected by the sensor in the measuring pipe and is applied as the flow value. The measured value is balanced with the setpoint. The actuator corrects the deviation by changing the valve position. The angle of rotation α varies according to the differential pressure through the control element (see flow curves).

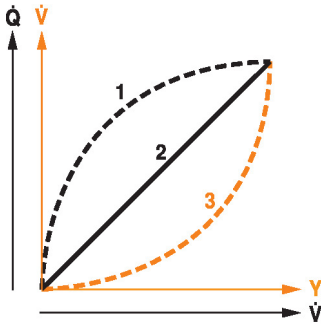
**Flow rate curves**




**Transmission behaviour HE**

Heat exchanger transmission behaviour

Depending on the construction, temperature spread, fluid characteristics and hydronic circuit, the power Q is not proportional to the water volumetric flow V' (Curve 1). With the classical type of temperature control, an attempt is made to maintain the control signal Y proportional to the power Q (Curve 2). This is achieved by means of an equal-percentage flow characteristic (Curve 3).



**Control characteristics**

The fluid velocity is measured in the measuring component (sensor electronics) and converted into a flow rate signal.

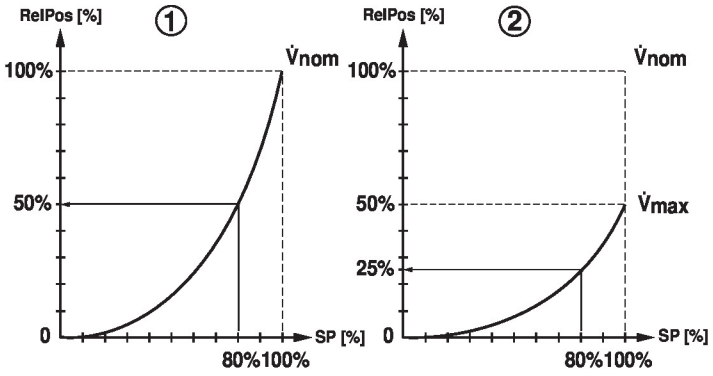
The control signal Y corresponds to the power requirement Q at the exchanger. The flow is regulated in the EPIV. The control signal Y is converted into an equal-percentage characteristic curve and provided with the V'max value as the new reference variable w. The momentary control deviation forms the control signal Y1 for the actuator.

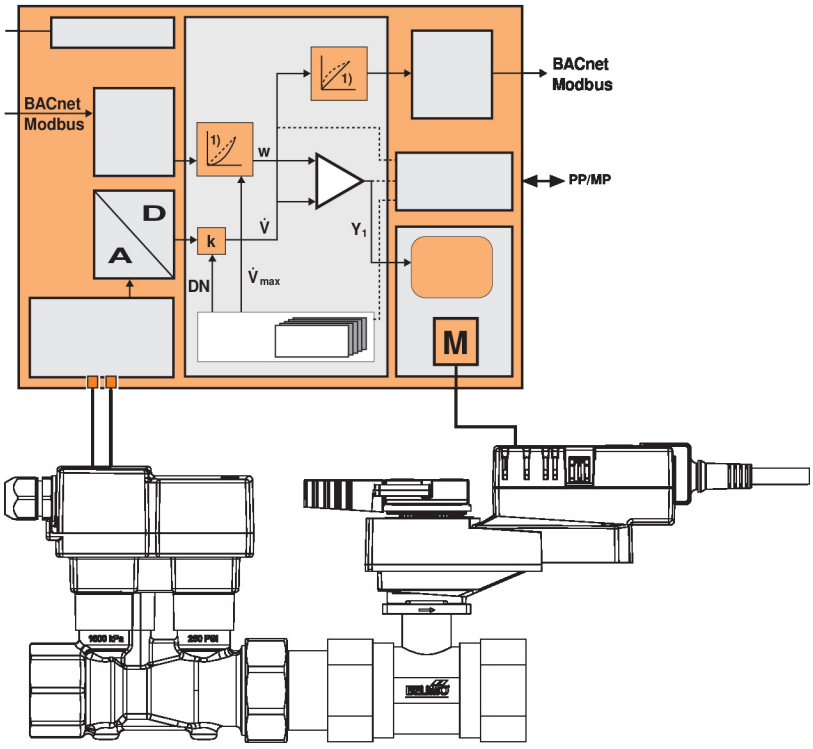
The specially configured control parameters in conjunction with the precise flow rate sensor ensure a stable control quality. They are however not suitable for rapid control processes, i.e. for domestic water control.

The measured flow rate is in l/min as an absolute flow output.

The absolute position sets the valve opening angle in %.

The relative position always refers to the nominal flow V'nom, i.e. if V'max is configured with 50% of V'nom, then the relative position at a setpoint of 100% is equal to 50% of V'nom.



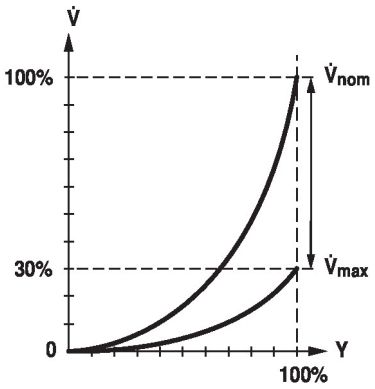



**Definition**

Flow control

V'nom is the maximum possible flow.

V'max is the maximum flow rate which has been set with the highest control signal. V'max can be set between 30% and 100% of V'nom.




**Creep flow suppression**

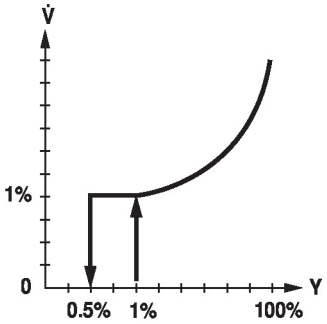
Given the very low flow speed in the opening point, this can no longer be measured by the sensor within the required tolerance. This range is overridden electronically.

Opening valve

The valve remains closed until the flow required by the control signal DDC corresponds to 1% of V'nom. The control along the flow characteristic is active after this value has been exceeded.

Closing valve

The control along the flow characteristic is active up to the required flow rate of 1% of V'nom. Once the level falls below this value, the flow rate is maintained at 1% of V'nom. If the level falls below the flow rate of 0.5% of V'nom required by the control signal DDC, then the valve will close.




**Converter for sensors**

Connection option for a sensor (active or with switching contact). In this way, the analogue sensor signal can be easily digitised and transferred to the bus systems BACnet, Modbus or MP-Bus.

**Configurable actuators**

The factory settings cover the most common applications. Single parameters can be modified with the Belimo Service Tools MFT-P or ZTH EU.

The communication parameters of the bus systems (address, baud rate etc.) are set with the ZTH EU. Pressing the "Address" button on the actuator while connecting the supply voltage, resets the communication parameters to the factory setting.

Quick addressing: The BACnet and Modbus address can alternatively be set using the buttons on the actuator and selecting 1...16. The value selected is added to the «Basic address» parameter and results in the effective BACnet and Modbus address.

**Hydronic balancing**

With the Belimo tools, the maximum flow rate (equivalent to 100% requirement) can be adjusted on-site, simply and reliably, in a few steps. If the device is integrated in the management system, then the balancing can be handled directly by the management system.

**Combination analogue - communicative (hybrid mode)**

With conventional control by means of an analogue control signal, BACnet or Modbus can be used for the communicative position feedback

**Manual override** Manual override with push-button possible (the gear train is disengaged for as long as the button is pressed or remains locked).

**High functional safety** The actuator is overload protected, requires no limit switches and automatically stops when the end stop is reached.

## Accessories

**Mechanical accessories**

| Description | Type |
|---|---|
| Valve neck extension for ball valve DN 15...50 | ZR-EXT-01 |
| Pipe connector for ball valve DN 50 | ZR2350 |

**Tools**

| Description | Type |
|---|---|
| Service Tool, with ZIP-USB function, for parametrisable and communicative Belimo actuators, VAV controller and HVAC performance devices | ZTH EU |
| Belimo PC-Tool, Software for adjustments and diagnostics | MFT-P |
| Adapter for Service-Tool ZTH | MFT-C |
| Connection cable 5 m, A: RJ11 6/4 ZTH EU, B: 6-pin for connection to service socket | ZK1-GEN |
| Connection cable 5 m, A: RJ11 6/4 ZTH EU, B: free wire end for connection to MP/PP terminal | ZK2-GEN |

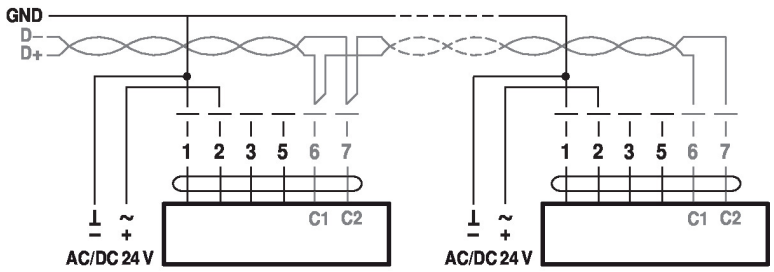
## Electrical installation

Supply from isolating transformer.

The wiring of the line for BACnet MS/TP / Modbus RTU is to be carried out in accordance with applicable RS-485 regulations.

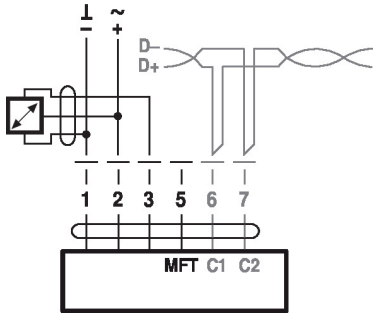
Modbus / BACnet: Supply and communication are not galvanically isolated. Connect earth signal of the devices with one another.

BACnet MS/TP / Modbus RTU



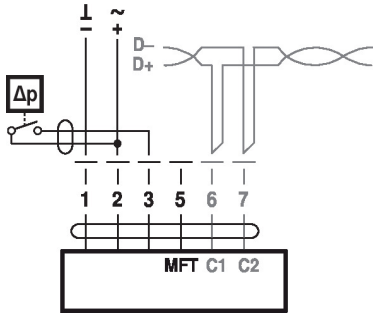

**Cable colours:**
1= black
2 = red
3 = white
5 = orange
6 = pink
7 = grey
BACnet / Modbus signal assignment:
C1 = D– = A
C2 = D+ = B

Connection with active sensor, e.g. 0...10 V @ 0...50°C



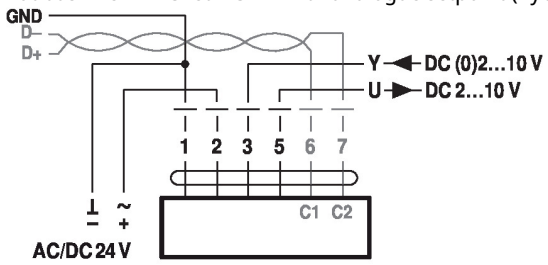

Possible voltage range:
0...32 V (resolution 30 mV)

Connection with switching contact, e.g. Δp monitor

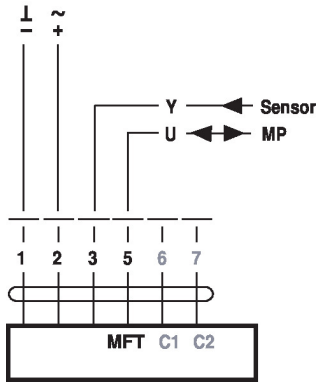



Requirements for switching contact:
The switching contact must be able to accurately switch a current of 16 mA @ 24 V.

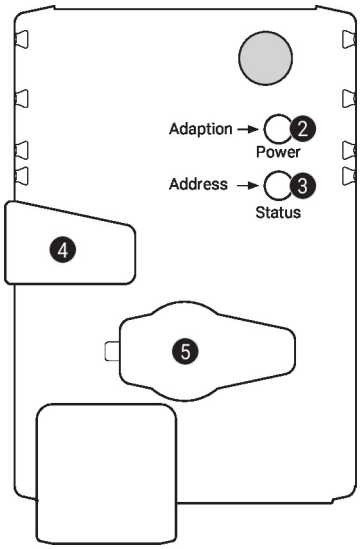
Modbus RTU / BACnet MS/TP with analogue setpoint (hybrid mode)




Operation on the MP-Bus



## Operating controls and indicators




**2 Push-button and LED display green**

| | |
|---|---|
| Off: | No power supply or malfunction |
| On: | In operation |
| Flashing: | In address mode: Pulses according to set address (1...16)<br>When starting: Reset to factory setting (Communication) |
| Press button: | In standard mode: Triggers angle of rotation adaptation<br>In address mode: Confirmation of set address (1...16) |

**3 Push-button and LED display yellow**

| | |
|---|---|
| Off: | Standard mode |
| On: | Adaptation or synchronisation process active<br>or actuator in address mode (LED display green flashing) |
| Flickering: | BACnet / Modbus communication active |
| Press button: | In operation (>3 s): Switch address mode on and off<br>In address mode: Address setting by pressing several times<br>When starting (>5 s): Reset to factory setting (Communication) |

**4 Manual override button**

| | |
|---|---|
| Press button: | Gear train disengages, motor stops, manual override possible |
| Release button: | Gear train engages, standard mode |

**5 Service plug**
For connecting parametrisation and service tools

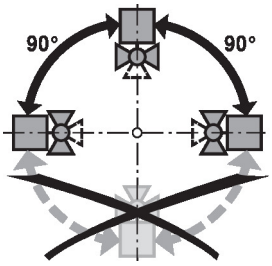
**Check power supply connection**

| | |
|---|---|
| 2 Off and 3 On | Possible wiring error in power supply |

## Installation notes

**Recommended installation positions**

The ball valve can be installed upright to horizontal. The ball valve may not be installed in a hanging position, i.e. with the spindle pointing downwards.




**Installation position in return**

Installation in the return is recommended.

**Water quality requirements**

The water quality requirements specified in VDI 2035 must be adhered to.

Belimo valves are regulating devices. For the valves to function correctly in the long term, they must be kept free from particle debris (e.g. welding beads during installation work). The installation of a suitable strainer is recommended.

**Servicing**

Ball valves, rotary actuators and sensors are maintenance-free.

Before any service work on the control element is carried out, it is essential to isolate the rotary actuator from the power supply (by unplugging the electrical cable if necessary). Any pumps in the part of the piping system concerned must also be switched off and the appropriate slide valves closed (allow all components to cool down first if necessary and always reduce the system pressure to ambient pressure level).

The system must not be returned to service until the ball valve and the rotary actuator have been correctly reassembled in accordance with the instructions and the pipeline has been refilled by professionally trained personnel.

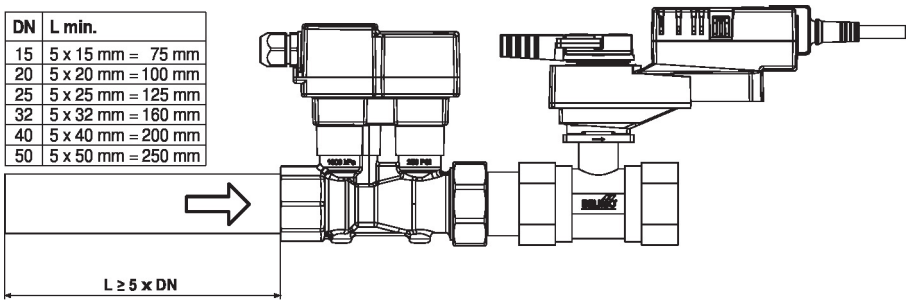
**Flow direction**

The direction of flow, specified by an arrow on the housing, is to be complied with, since otherwise the flow rate will be measured incorrectly.

**Inlet section**

In order to achieve the specified measuring accuracy, a flow-calming section or inflow section in the direction of the flow is to be provided upstream from the flow sensor. Its dimensions should be at least 5x DN.

| DN | L min. |
|---|---|
| 15 | 5 x 15 mm = 75 mm |
| 20 | 5 x 20 mm = 100 mm |
| 25 | 5 x 25 mm = 125 mm |
| 32 | 5 x 32 mm = 160 mm |
| 40 | 5 x 40 mm = 200 mm |
| 50 | 5 x 50 mm = 250 mm |




**Split installation**

The valve-actuator combination may be mounted separately from the flow sensor. The direction of flow must be observed.

## General notes

**Minimum differential pressure (pressure drop)**

The minimum required differential pressure (pressure drop through the valve) for achieving the desired volumetric flow V'max can be calculated with the aid of the theoretical kvs value (see type overview) and the below-mentioned formula. The calculated value is dependent on the required maximum volumetric flow V'max. Higher differential pressures are compensated for automatically by the valve.

Formula

$$\Delta p_{min} = 100 \times \left( \frac{\dot{V}_{max}}{k_{vs\ theor.}} \right)^2$$

$\Delta p_{min}$: kPa
$\dot{V}_{max}$: m³/h
$k_{vs\ theor.}$: m³/h

Example (DN 25 with the desired maximum flow rate = 50% V'nom)

EP025R+MOD
kvs theor. = 8.6 m³/h
V̇nom = 69 l/min
50% * 69 l/min = 34.5 l/min = 2.07 m³/h

$$\Delta p_{min} = 100 \times \left( \frac{\dot{V}_{max}}{k_{vs\ theor.}} \right)^2 = 100 \times \left( \frac{2.07\ m^3/h}{8.6\ m^3/h} \right)^2 = 6\ kPa$$

**Behaviour in case of sensor failure**

In case of a flow sensor error, the EPIV will switch from flow control to position control.

Once the error disappears, the EPIV will switch back to the normal control setting.

## Service

**Quick addressing**

1. Press the "Address" button until the green "Power" LED is no longer illuminated. LED flashes in accordance with the previously set address.
2. Set the address by pressing the "Address" button the corresponding number of times (1...16).
3. The green LED flashes in accordance with the address that has been entered (...16). If the address is not correct, then this can be reset in accordance with Step 2.
4. Confirm the address setting by pressing the green "Adaptation" button.

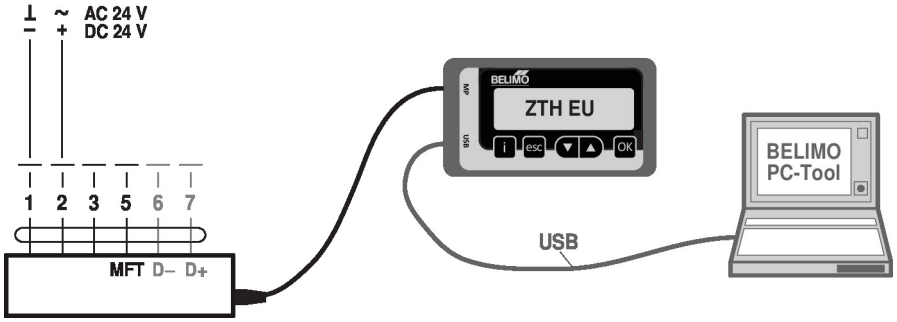
If no confirmation occurs for 60 seconds, then the address procedure is ended. Any address change that has already been started will be discarded.

The resulting BACnet MS/TP and Modbus RTU address is made up of the set basic address plus the short address (e.g. 100+7=107).

**Tools connection**

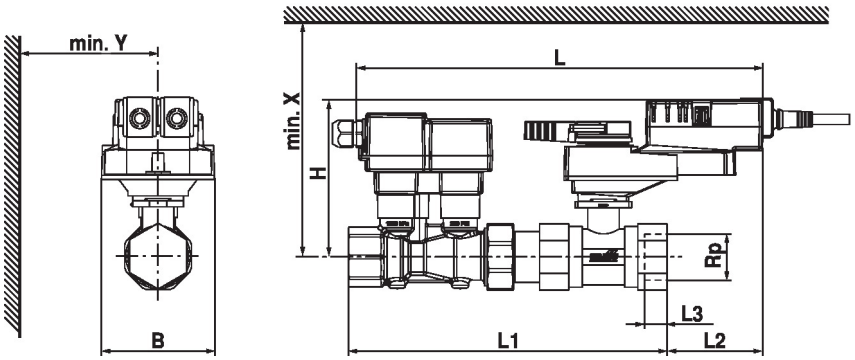
The actuator can be parametrised by ZTH EU via the service socket.

For an extended parametrisation the PC tool can be connected.




## Dimensions

**Dimensional drawings**




| Type | DN | Rp [“] | L [mm] | L1 [mm] | L2 [mm] | L3 [mm] | B [mm] | H [mm] | X [mm] | Y [mm] | kg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EP050R+MOD-N | 50 | 2 | 343 | 288 | 69 | 22 | 95 | 142 | 212 | 77 | 4.5 |

## Further documentation

- Tool connections
- BACnet Interface description
- Modbus Interface description
- Overview MP Cooperation Partners
- MP Glossary
- Introduction to MP-Bus Technology
- General notes for project planning