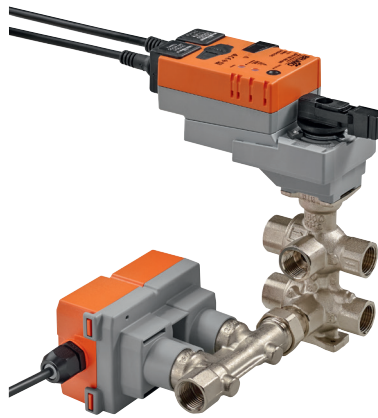


Characterised control valve with sensor-operated flow control, 6-way, Internal thread, PN 16 (EPIV)

- Nominal voltage AC/DC 24 V
- Control modulating, communicative
- Two sequences (cooling/heating) with one 90° rotary actuator
- Switching or modulating control on the water side of thermal heating/cooling elements
- For closed cold and warm water systems
- Communication via BACnet MS/TP, Modbus RTU, Belimo MP-Bus or conventional control


**Type overview**

Type	DN [ ]	Rp ["]	Vnom [ l/h]	Vmax low-n [ l/h]	kvs theor. [ m³/h]	PN [ ]
<b>EP015R-R6+BAC</b>	15	1/2	1260	840	1.2	16
<b>EP020R-R6+BAC</b>	20	3/4	2340	1620	2.3	16

kvs theor.: Theoretical kvs value for pressure drop calculation  
 Vmax low-n: Vmax for low-noise operation

**Technical data**

<b>Electrical data</b>	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	2.0 W
	Power consumption at rest	1.5 W
	Power consumption for wire sizing	4.5 VA
	Connection supply / control	Cable 1 m, 6 x 0.75 mm²
	Parallel operation	Yes (note the performance data)
<b>Functional data</b>	Torque motor	5 Nm
	Communicative control	MP-Bus (Details see separate document "Data-Pool Values") BACnet MS/TP (Details see separate document "PICS") Modbus RTU (Details see separate document "Modbus Register")
	Positioning signal Y	DC 0...10 V
	Positioning signal Y note	Input impedance 100 kΩ
	Operating range Y	DC 2...10 V
	Position feedback U	DC 2...10 V
	Sound power level motor	35 dB(A)
	Adjustable flow rate Vmax	5...100% of Vnom
	Control accuracy	±10% (of 25...100% Vnom) ±20...10% (of 10...25% Vnom)
	Control accuracy note	±6% (of 25...100% Vnom) @ 20 °C / Glycol 0% vol.
	Media	Cold and warm water, water with glycol up to max. 50% vol.
	Medium temperature	6...80 °C
	Permissible pressure ps	1600 kPa
	Differential pressure Δpmax	110 kPa
	Flow characteristic	Linear
	Leakage rate	Leakage rate A, air-bubble-tight (EN 12266-1)
	Pipe connector	Internal thread according to ISO 7-1
	Angle of rotation note	with room controller CRK24-B1 compelling sequence 1 = cooling and sequence 2 = heating
Installation position	Upright to horizontal (in relation to the stem)	
Maintenance	Maintenance-free	
Manual override	with push-button, can be locked	
<b>Flow measurement</b>	Measuring principle	Ultrasonic volumetric flow measurement

## Technical data

<b>Flow measurement</b>	Measuring accuracy	±6% (of 25...100% Vnom)
	Measuring accuracy note	±2% (of 25...100% Vnom) @ 20 °C / Glycol 0% vol.
	Min. flow measurement	1% of Vnom
<b>Safety</b>	Protection class IEC/EN	III Safety Extra-Low Voltage (SELV)
	Degree of protection IEC/EN	IP54
	EMC	CE according to 2014/30/EU
	Mode of operation	Type 1
	Rated impulse voltage supply / control	0.8 kV
	Control pollution degree	3
	Ambient temperature	-30...50 °C
	Non-operating temperature	-40...80 °C
<b>Materials</b>	Ambient humidity	95% r.h., non-condensing
	Housing	Brass body nickel-plated
	Measuring pipe	Brass body nickel-plated
	Closing element	chrome-plated brass
	Stem	Nickel-plated brass
	Stem seal	O-ring EPDM
	Ball seat	PTFE, O-ring EPDM

## 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 actuator and that is ensured that the ambient conditions remain at any time within the thresholds according to the data sheet.
- Only authorised specialists may carry out installation. All applicable legal or institutional installation regulations must be complied during installation.
- 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 final controlling device consists of three components: 6-way characterised control valve, measuring pipe with volumetric flow sensor and the actuator itself. The adjusted maximum flows for sequence 1 ( $\dot{V}_{max1}$ ) and sequence 2 ( $\dot{V}_{max2}$ ) are assigned to the positioning signal (2V/0% for sequence 1, 10V/100% for sequence 2). The performance device can be controlled communicatively or by an analogue signal. The medium 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.

Product features

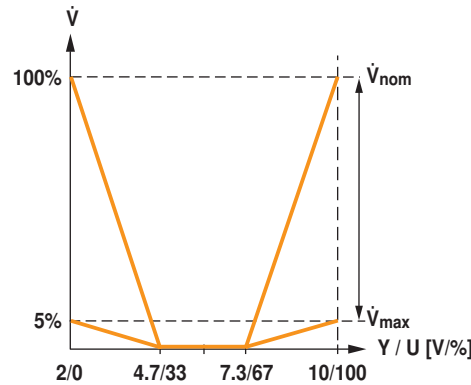
**Definition**  $\dot{V}_{nom}$  is the maximum possible flow. ( $\dot{V}_{nom} = \dot{V}_{nom1} = \dot{V}_{nom2}$ )

$\dot{V}_{max1}$  is the maximum flow rate which has been set with the smallest positioning signal, 2V / 0%.

$\dot{V}_{max2}$  is the maximum flow rate which has been set with the greatest positioning signal, 10V / 100%.

$\dot{V}_{max1}$  and  $\dot{V}_{max2}$  can be adjusted between 5% and 100% of  $\dot{V}_{nom}$ .

$\dot{V}_{min}$  0% (non-variable).



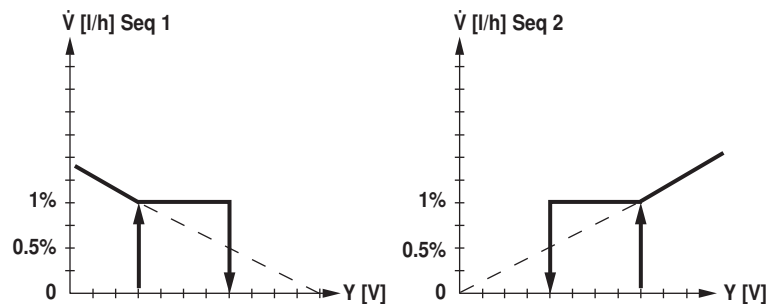
**Creep flow suppression** Given the very low flow speed in the opening point, this can no longer be measured by the sensor within the required tolerance. This range is overridden electronically.

Opening sequence

The valve remains closed until the volumetric flow required by the positioning signal  $Y$  corresponds to 1% of  $\dot{V}_{nom}$ . The control along the valve characteristic curve is active after this value has been exceeded.

Closing sequence

The control along the valve characteristic curve is active up to the required flow rate of 1% of  $\dot{V}_{nom}$ . Once the level falls below this value, the flow rate is maintained at 1% of  $\dot{V}_{nom}$ . If the level falls below the flow rate of 0.5% of  $\dot{V}_{nom}$  required by the reference variable  $Y$ , then the valve will close.



**Parameterisable actuators** The factory settings cover the most common applications.

**Hydraulic balancing** With the ZTH EU and the Belimo Assistant App, the maximum flow rates of sequence 1 and sequence 2 can be adjusted individually on-site in a few simple reliable steps.

**Combination analogue - communicative** BACnet, Modbus or MP-Bus can be used for the communicative position feedback with conventional control by means of an analogue positioning signal.

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

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

**Position feedback U5** Regardless of the setting of the control mode, the feedback signal U5 is always assigned to the flow  $\dot{V}_{max1}$  and  $\dot{V}_{max2}$ .

**Product features**

**Pressure compensation** In cases of combined heating/cooling control elements, the medium remains in the control element when in the closed position (no heating or cooling). The pressure of the enclosed medium can rise or fall due to changes in medium temperature caused by the ambient temperature. The 6-way characterised control valves have an integrated pressure relief function for the purpose of compensating for such pressure changes.  
 The pressure relief function is active in the closed position (45°) of the valve; reliable separation of Sequences 1 and 2 continues. For additional information, consult the notes for project planning for the 6-way characterised control valve.

**Accessories**

	Description	Type
<b>Mechanical accessories</b>	Pipe connector to ball valve DN 15 Rp 1/2"	ZR2315
	Pipe connector to ball valve DN 20 Rp 3/4"	ZR2320
	Fastening angle, for 6-way control valves	ZR-004
<b>Service Tools</b>	<b>Description</b>	<b>Type</b>
	Smartphone app for easy commissioning, parameterising and maintenance	Belimo Assistant App
	Bluetooth / NFC converter	ZIP-BT-NFC
	Service tool for parametrisable and communicative Belimo actuators / VAV controller and HVAC performance devices	ZTH EU

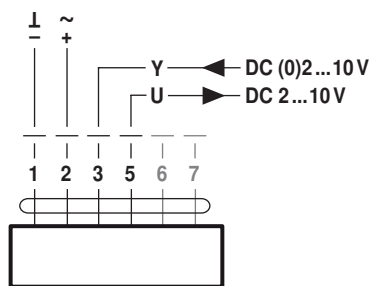
**Electrical installation**

**Notes**

- Connection via safety isolating transformer.
- Parallel connection of other actuators possible. Observe the performance data.
- The wiring of the line for Modbus (RTU) / BACnet (MS/TP) is to be carried out in accordance with applicable RS485 regulations.
- Modbus / BACnet: Supply and communication are not galvanically isolated. Connect earth signal of the devices with one another.

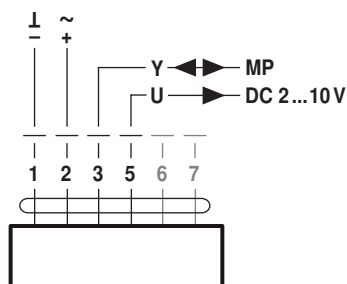
**Wiring diagrams**

AC/DC 24 V, modulating



- Cable colours:**
- 1 = black
  - 2 = red
  - 3 = white
  - 5 = orange
  - 6 = pink
  - 7 = grey

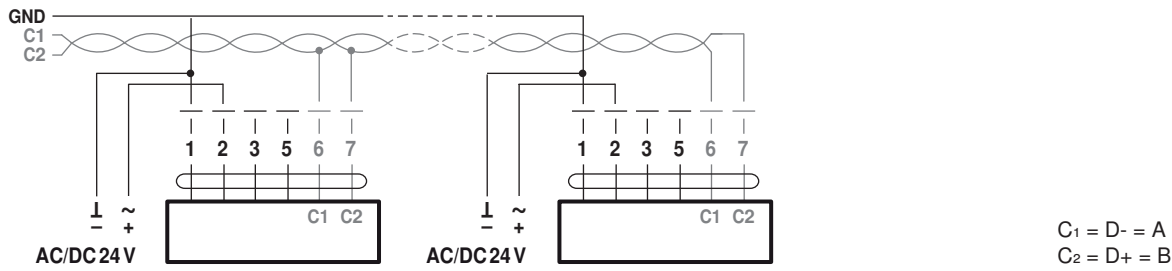
Operation on the MP-Bus



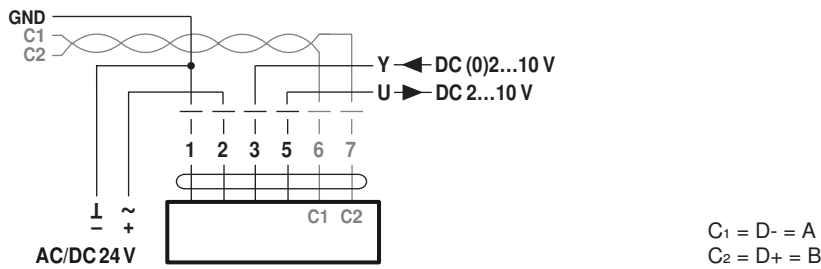
- Cable colours:**
- 1 = black
  - 2 = red
  - 3 = white
  - 5 = orange
  - 6 = pink
  - 7 = grey

**Electrical installation**

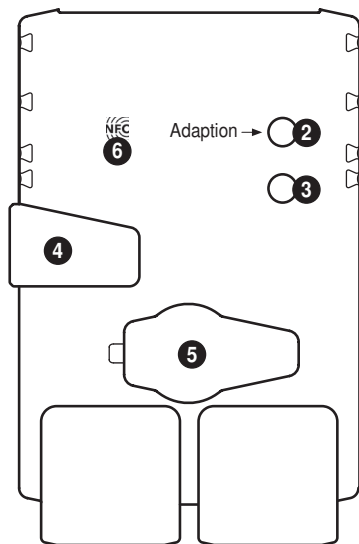
Modbus RTU / BACnet MS/TP



Modbus RTU / BACnet MS/TP with analog setpoint



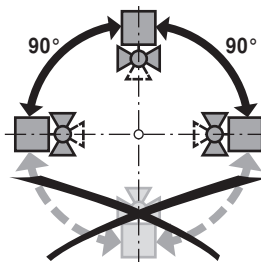
**Operating controls and indicators**



- 2 Push-button and LED display green**  
 Off: No power supply or malfunction  
 On: In operation  
 Press button: Triggers angle of rotation adaptation, followed by standard mode
- 3 Push-button and LED display yellow**  
 Off: Standard mode  
 Flickering: Modbus or BACnet communication active  
 On: Adaptation or synchronising process active  
 Press button: No function
- 4 Gear disengagement button**  
 Press button: Gear disengages, motor stops, manual override possible  
 Release button: Gear engages, synchronisation starts, followed by standard mode
- 5 Service plug**  
 For connecting ZTH
- 6 NFC logo**  
 Operated with Belimo Assistant App

**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 stem pointing downwards.



**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 suitable strainer is recommended.

Installation notes

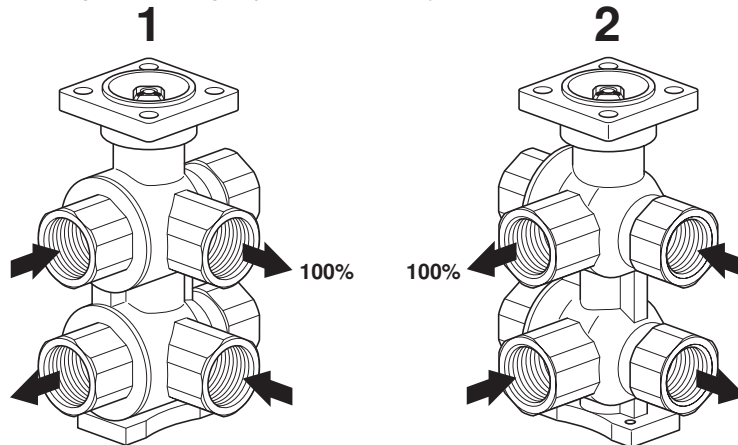
**Maintenance** Ball valves, rotary actuators and sensors are maintenance-free.

Before any service work on the final controlling device 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.

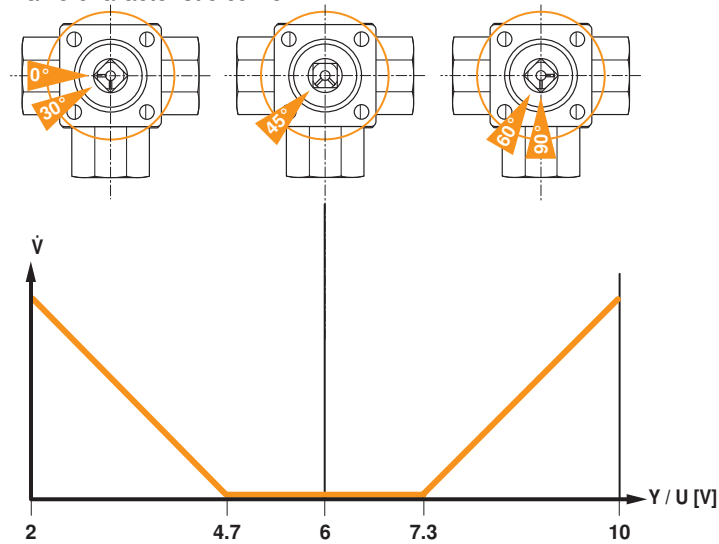
**Flow direction** The flow direction must be observed. The position of the ball can be identified from the L-marking on the stem.

Heating and cooling in position accuracy



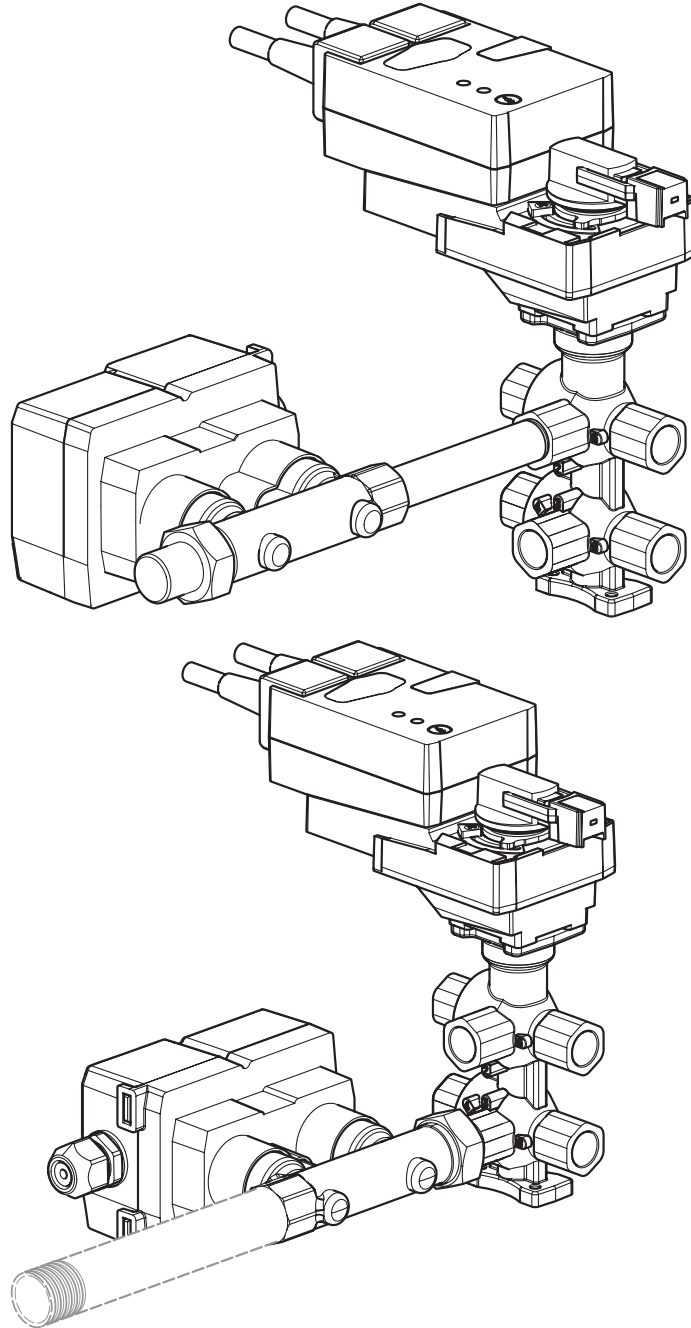
**Valve characteristic curve** The lower diagram shows the flow characteristic depending on the control signal.

Valve characteristic curve



**Installation notes**

**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.

**Types of installation**

General notes

**Valve selection** The valve is determined using the maximum required flow rate  $\dot{V}_{max}$ . A calculation of the kvs value is not required.  $\dot{V}_{max} = 5...100\%$  of  $\dot{V}_{nom}$

**Minimum differential pressure (pressure drop)** The minimum required differential pressure (pressure drop through the valve) for achieving the desired volumetric flow  $\dot{V}_{max}$  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  $\dot{V}_{max}$ . Higher differential pressures are compensated for automatically by the valve.

Formula

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

$\Delta p_{min}$ : kPa
$\dot{V}_{max}$ : m <sup>3</sup> /h
$k_{vs \text{ theor.}}$ : m <sup>3</sup> /h

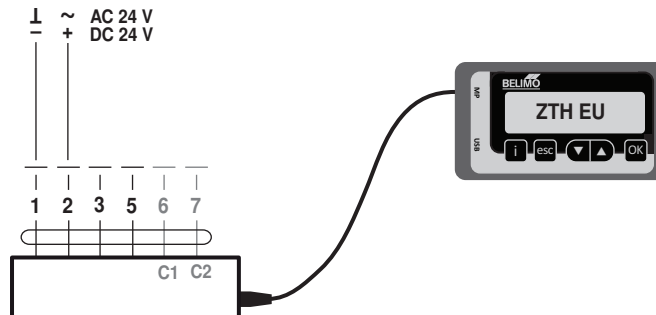
Example (DN15 with the desired maximum flow rate = 30%  $\dot{V}_{nom}$ )  
 EP015R-R6+BAC  
 kvs theor. = 1.2 m<sup>3</sup>/h  
 $\dot{V}_{nom} = 1260$  l/h  
 30% \* 1260 l/h = 378 l/h = 0.378 m<sup>3</sup>/h

$$\Delta p_{min} = 100 \times \left( \frac{\dot{V}_{max}}{k_{vs \text{ theor.}}} \right)^2 = 100 \times \left( \frac{0.378 \text{ m}^3/\text{h}}{1.2 \text{ m}^3/\text{h}} \right)^2 = 10 \text{ kPa}$$

Service

Service Tools connection

ZTH EU connection





**Dimensions / Weight**

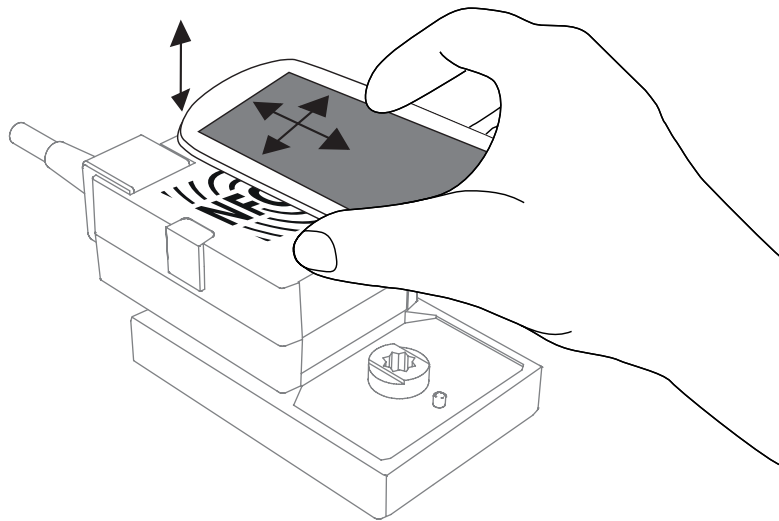
**NFC connection** Belimo equipment marked with the NFC logo can be operated with the “Belimo Assistant App”.

Requirement:

- NFC- or Bluetooth-capable smartphone
- Belimo Assistant App (Google Play & App Store)

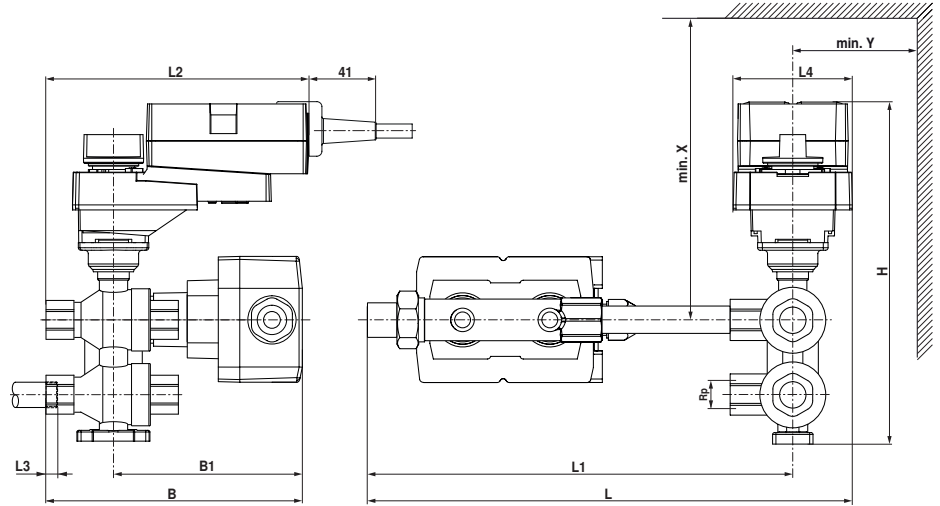
Align NFC-capable smartphone on the actuator so that both NFC antennas are superposed.

Connect Bluetooth-enabled smartphone via the Bluetooth-to-NFC Converter ZIP-BT-NFC to the actuator. Technical data and operation instructions are shown in the ZIP-BT-NFC data sheet.



Dimensions / Weight

Dimensional drawings



The volumetric flow sensor and the pipeline element can also be connected to port 3 (see installation notes).

Type	DN [ ]	Rp ["]	L [ mm]	L1 [ mm]	L2 [ mm]	L3 [ mm]	B [ mm]	B1 [ mm]	H [ mm]	L4 [ mm]	X [ mm]	Y [ mm]	Weight [ kg]
EP015R-R6+BAC	15	1/2	258	241	187	13	150	110	201	65	200	40	2.4
EP020R-R6+BAC	20	3/4	312	276	198	14	161	110	238	65	230	40	3.5

Further documentation

- General notes for project planning
- Overview MP Cooperation Partners
- Tool connections
- Description Modbus register
- Description Data-Pool Values
- Description Protocol Implementation Conformance Statement PICS
- Introduction to MP-Bus Technology