

Characterised control valve with sensor-operated flow control with fail-safe, 2-way, Internal and external 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 Belimo MP-Bus or conventional control
- Conversion of active sensor signals and switching contacts



## Type Overview

Type	DN	Rp ["]	G ["]	V'nom [l/s]	V'nom [l/min]	V'nom [m³/h]	kvs theor. [m³/h]	PN
EP015R2+KBAC	15	1/2	3/4	0.42	25	1.5	2.8	25
EP020R2+KBAC	20	3/4	1	0.69	41.7	2.5	4.8	25
EP025R2+KBAC	25	1	1 1/4	0.97	58.3	3.5	8.1	25
EP032R2+KBAC	32	1 1/4	1 1/2	1.67	100	6	11.4	25
EP040R2+KBAC	40	1 1/2	2	2.78	166.7	10	17.1	25
EP050R2+KBAC	50	2	2 1/2	4.17	250	15	25	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 W (DN 15, 20, 25) 5 W (DN 32, 40, 50)
	Power consumption in rest position	3.7 W (DN 15, 20, 25) 3.9 W (DN 32, 40, 50)
	Power consumption for wire sizing	6.5 VA (DN 15, 20, 25) 7.5 VA (DN 32, 40, 50)
	Connection supply / control	Cable 1 m, 6 x 0.75 mm²
Data bus communication	Communicative control	BACnet MS/TP Modbus RTU MP-Bus
	Number of nodes	BACnet / Modbus see interface description MP-Bus max. 8
	MP-Bus compatibility mode	If the device is used as a EP..R-(K)MP replacement in an existing MP-Bus system, the unit can be set to the MP compatibility mode. The existing MP client will recognize the device as former EPIV device. The compatibility mode shall not be used for new projects.
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	0...10 V 0.5...10 V
	Setting fail-safe position	NC/NO or adjustable 0...100% (POP rotary knob)
	Bridging time (PF) variable	0...10 s

<b>Functional data</b>	Running time fail-safe	35 s / 90°
	Sound power level Motor	45 dB(A)
	Sound power level, fail-safe	61 dB(A)
	V'max adjustable	25...100% of V'nom
	Control accuracy	±5% (of 25...100% V'nom)
	Control accuracy note	±10% (of 25...100% V'nom) @ Glycol 0...60% vol.
	Min. controllable flow	1% of V'nom
	Parametrisation	via NFC, Belimo Assistant App
	Fluid	Cold and warm water, water with glycol up to max. 60% vol.
	Fluid temperature	-10...120°C [14...248°F]
	Close-off pressure Δps	1400 kPa
	Differential pressure Δpmax	350kPa
	Differential pressure note	200 kPa for low-noise operation
	Leakage rate	air-bubble tight, leakage rate A (EN 12266-1)
	Installation position	upright to horizontal (in relation to the stem)
	Servicing	maintenance-free
	Manual override	with push-button
<b>Flow measurement</b>	Measuring principle	Ultrasonic volumetric flow measurement
	Measuring accuracy flow	±2% (of 20...100% V'nom) @ 20°C / glycol 0% vol.
	Measuring accuracy flow note	±5% (of 20...100% V'nom) @ glycol 0...60% vol.
	Min. flow measurement	0.5% of V'nom
<b>Glycol monitoring</b>	Measurement display glycol	0...60% or >60%
	Measuring accuracy glycolmonitoring	±4% (0...60%)
<b>Safety data</b>	Protection class IEC/EN	III, Protective Extra-Low Voltage (PELV)
	Degree of protection IEC/EN	IP54
	Pressure equipment directive	CE according to 2014/68/EU
	EMC	CE according to 2014/30/EU
	Certification IEC/EN	IEC/EN 60730-1:11 and IEC/EN 60730-2-15:10
	Quality Standard	ISO 9001
	Type of action	Type 1.AA
	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]
<b>Materials</b>	Valve body	Brass
	Flow measuring pipe	Brass body nickel-plated
	Closing element	Stainless steel
	Spindle	Stainless steel
	Spindle seal	EPDM O-ring
<b>Terms</b>	Abbreviations	POP = Power off position / fail-safe position PF = Power fail delay time / bridging time

**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 device contains electrical and electronic components and must not be disposed of as household refuse. All locally valid regulations and requirements must be observed.

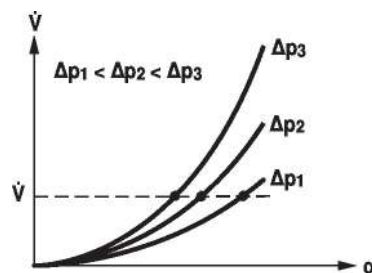
**Product features**

**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 ( $\dot{V}'_{\max}$ ) 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  $\alpha$  varies according to the differential pressure through the control element (see flow curves).

With the supply voltage the integrated condensers will be charged.

Interrupting the supply voltage causes the valve to be moved to the selected fail-safe position by means of stored electrical energy.

**Calibration certificate** There is a calibration certificate available in the Belimo Cloud for each device. If needed, it can be downloaded as a PDF through the Belimo Assistant App.

**Flow rate curves**


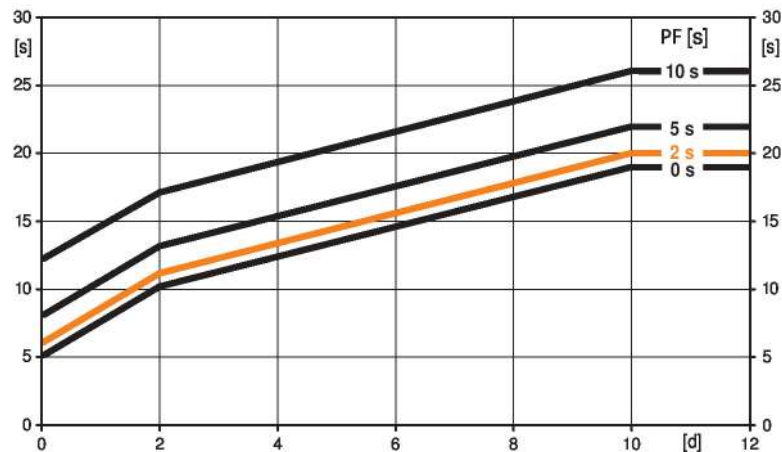
### Pre-charging time (start up)

The capacitor actuators require a pre-charging time. This time is used for charging the capacitors up to a usable voltage level. This ensures that, in the event of a power failure, the actuator can move at any time from its current position into the preset fail-safe position.

The duration of the pre-charging time depends mainly on following factors:

- Duration of the power failure
- PF delay time (bridging time)

Typical pre-charging time



[d] = Power failure in days

[s] = Pre-charging time in seconds

PF[s] = Bridging time

Calculation example: Given a power failure of 3 days and a bridging time (PF) set at 5 s, the actuator requires a pre-charging time of 14 s after the power has been reconnected (see graphic).

PF [s]	[d]				
	0	1	2	7	≥10
0	5	8	10	15	19
2	6	9	11	16	20
5	8	11	13	18	22
10	12	15	17	22	26
[s]					

### Delivery condition (capacitors)

The actuator is completely discharged after delivery from the factory, which is why the actuator requires approximately 20 s pre-charging time before initial commissioning in order to bring the capacitors up to the required voltage level.

### Bridging time

Power failures can be bridged up to a maximum of 10 s.

In the event of a power failure, the actuator will remain stationary in accordance with the set bridging time. If the power failure is greater than the set bridging time, the actuator will move into the selected fail-safe position.

The bridging time set at the factory is 2 s. It can be modified on site in operation by means of the Belimo service tool MFT-P.

Settings: The rotary knob must not be set to the "Tool" position!

For retroactive adjustments of the bridging time with the Belimo service tool MFT-P or with the ZTH EU adjustment and diagnostic device only the values need to be entered.

### Setting fail-safe position

The rotary knob fail-safe position can be used to adjust the desired fail-safe position 0...100% in 10% increments. The rotary knob always refers to the adapted angle of rotation range. In the event of a power failure, the actuator will move into the selected fail-safe position.

Settings: The rotary knob must be set to the «Tool» position for retroactive settings of the fail-safe position with the Belimo service tool MFT-P. Once the rotary knob is set back to the range 0...100%, the manually set value will have positioning authority.

### Control characteristics

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

The control signal Y corresponds to the power Q via the exchanger, the flow is regulated in the EPV. 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.

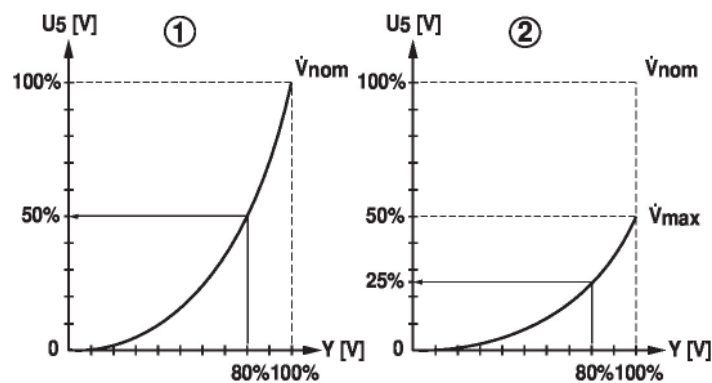
The specially configured control parameters in connection with the precise flow sensor ensure a stable quality of control. They are, however, not suitable for rapid control processes, i.e. for domestic water control. U5 displays the measured flow as voltage (factory setting).

Parametrising  $V'max$  with Belimo Assistant App:

U5 refers to the respective  $V'nom$ , i.e. if  $V'max$  is e.g. 50% of  $V'nom$ , then  $Y = 10\text{ V}$ ,  $U5 = 5\text{ V}$ .

As an alternative, U5 can be used for displaying the valve opening angle (position) or the fluid temperature.

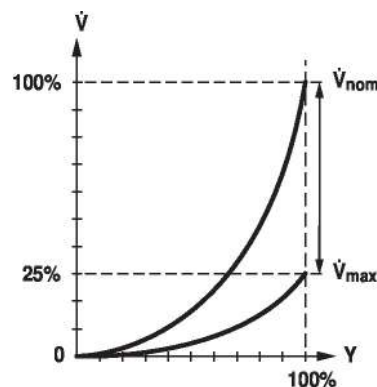
1. Standard equal percentage  $V'max = V'nom / 2$ . effect  $V'max < V'nom$



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 DDC.  $V'max$  can be set between 25% and 100% of  $V'nom$ .



### Creep flow suppression

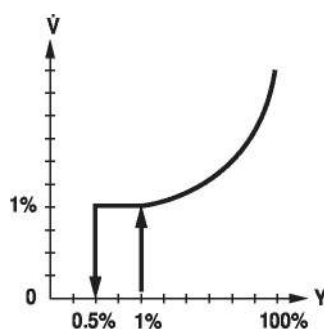
Given the very low flow speed in the opening point, this can no longer be measured by the sensor within the required tolerance. This range is overridden electronically.

#### 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.

### Control signal inversion

This can be inverted in cases of control with an analogue control signal. The inversion causes the reversal of the standard behaviour, i.e. at a control signal of 0%, regulation is to  $V_{max}$ , and the valve is closed at a control signal of 100%.

### 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 DDC, BACnet, Modbus or MP-Bus can be used for the communicative position feedback.

### Glycol monitoring

Glycol monitoring measures the actual glycol content, which is necessary for safe operation and optimised heat exchange.

### Manual override

Manual control with push-button possible - temporary. The gear train is disengaged and the actuator decoupled for as long as the button is pressed.

### High functional safety

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

## Parts included

Parts included	Description	Type
	Insulation shell for EPIV / Belimo Energy Valve™ DN 15...25	Z-INSH15
	Insulation shell for EPIV / Belimo Energy Valve™ DN 32...50	Z-INSH32
	Insulation shell not included in Asia Pacific	

## Accessories

Mechanical accessories	Description	Type
	Pipe connector DN 15 Rp 1/2", G 3/4"	EXT-EF-15F
	Pipe connector DN 20 Rp 3/4", G 1"	EXT-EF-20F
	Pipe connector DN 25 Rp 1", G 1 1/4"	EXT-EF-25F
	Pipe connector DN 32 Rp 1 1/4", G 1 1/2"	EXT-EF-32F
	Pipe connector DN 40 Rp 1 1/2", G 2"	EXT-EF-40F
	Pipe connector DN 50 Rp 2", G 2 1/2"	EXT-EF-50F
	Insulation shell for EPIV / Belimo Energy Valve™ DN 15...25	Z-INSH15
	Insulation shell for EPIV / Belimo Energy Valve™ DN 32...50	Z-INSH32
	Valve neck extension for ball valve DN 15...50	ZR-EXT-01
	Pipe connector for ball valve DN 15 Rp 1/2"	ZR2315
	Pipe connector for ball valve DN 20 Rp 3/4"	ZR2320
	Pipe connector for ball valve DN 25 Rp 1"	ZR2325
	Pipe connector for ball valve DN 32 Rp 1 1/4"	ZR2332
	Pipe connector for ball valve DN 40 Rp 1 1/2"	ZR2340
	Pipe connector for ball valve DN 50 Rp 2"	ZR2350
Tools	Description	Type
	Converter Bluetooth / NFC	ZIP-BT-NFC

## Electrical installation



Supply from isolating transformer.

Parallel connection of other actuators possible. Observe the performance data.

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.

Sensor connection: An additional sensor can optionally be connected to the flow sensor. This can be an active sensor with output DC 0...10 V (max. DC 0...32 V with resolution 30 mV) or a switching contact (switching current min. 16 mA @ 24 V). Thus the analogue signal of the sensor can be easily digitised with the flow sensor and transferred to the corresponding bus system.

Analogue output: An analogue output (wire 5) is available on the flow sensor. It can be selected as 0...10 V, 0.5...10 V, 2...10 V or user defined. For example, the flow rate or the temperature of the temperature sensor (Pt1000 - EN 60751, 2-wire technology) can be output as an analogue value.

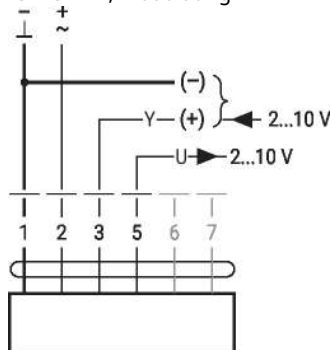
## Wire colours:

- 1 = black
- 2 = red
- 3 = white
- 5 = orange
- 6 = pink
- 7 = grey

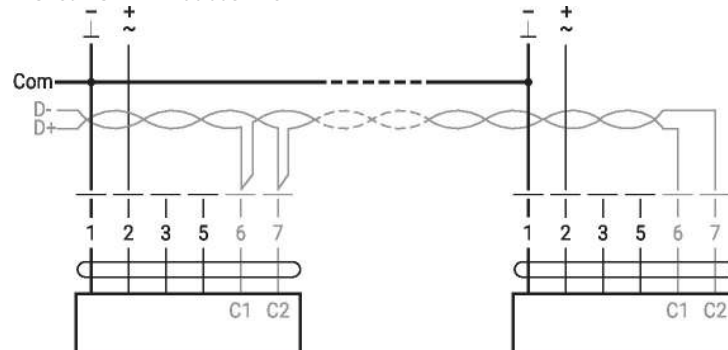
## Functions:

- C1 = D- = A (wire 6)
- C2 = D+ = B (wire 7)

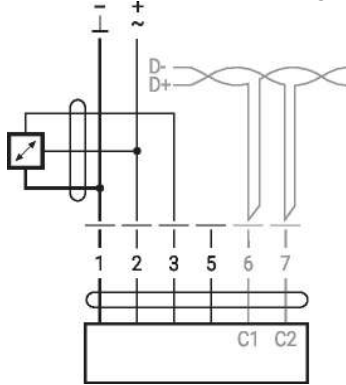
AC/DC 24 V, modulating



BACnet MS/TP / Modbus RTU

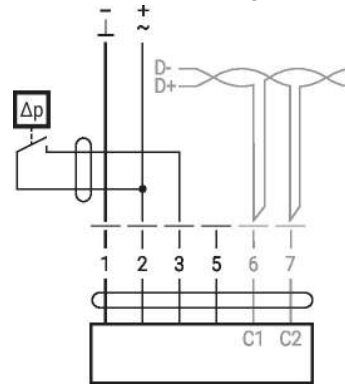


Connection with active sensor, e.g. 0...10 V @ 0...50°C



Possible voltage range: 0...32 V  
Resolution 30 mV

Connection with switching contact, e.g.  $\Delta p$  monitor

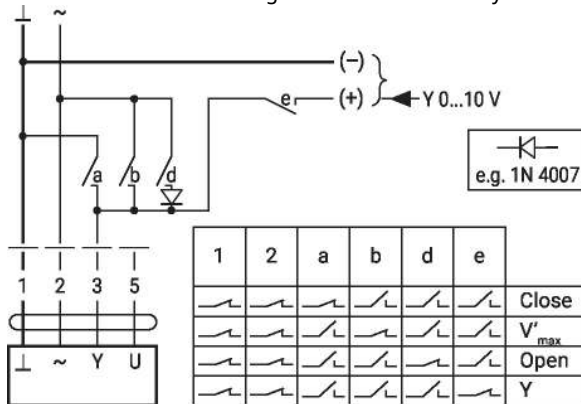


Switching contact requirements: The switching contact must be able to switch a current of 16 mA at 24 V accurately.

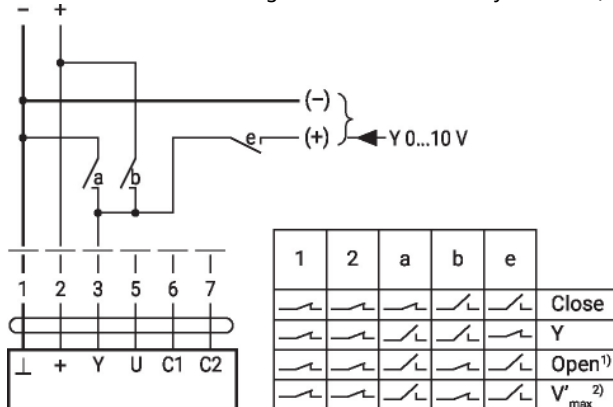
## Functions

### Functions with specific parameters (Parametrisation necessary)

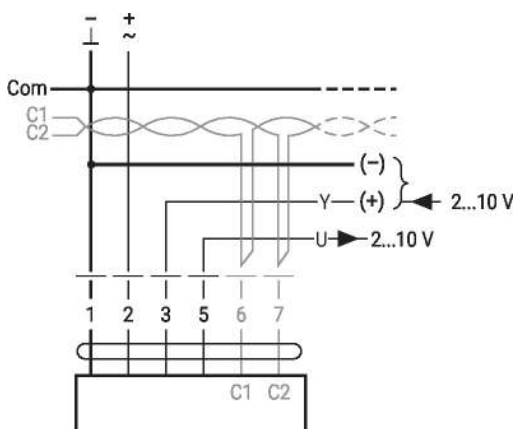
Override control and limiting with AC 24 V with relay contacts



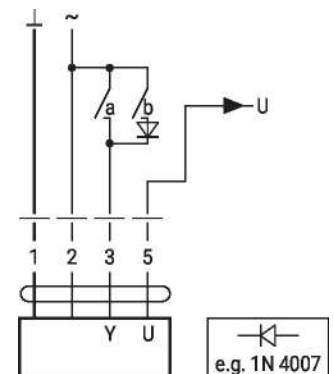
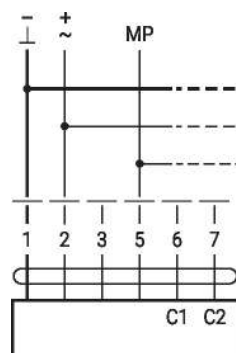
Override control and limiting with DC 24 V with relay contacts (with conventional control or hybrid mode) Control 3-point



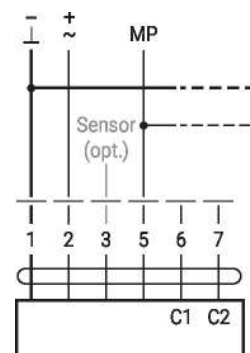
BACnet MS/TP / Modbus RTU with analogue setpoint (hybrid mode)



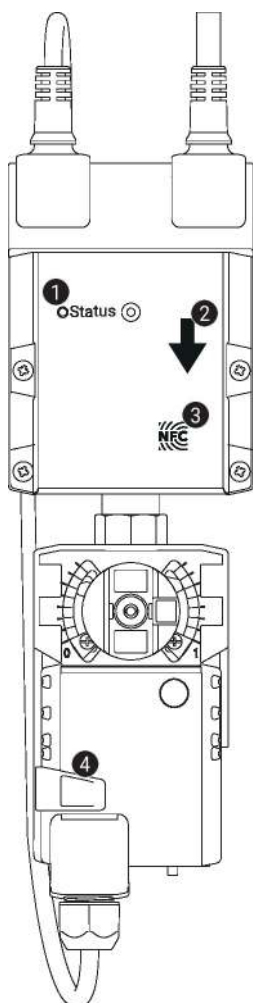
MP-Bus, supply via 3-wire connection



MP-Bus via 2-wire connection, local power supply





**Operating controls and indicators**

**1 LED display green**

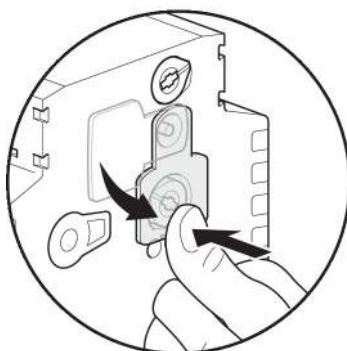
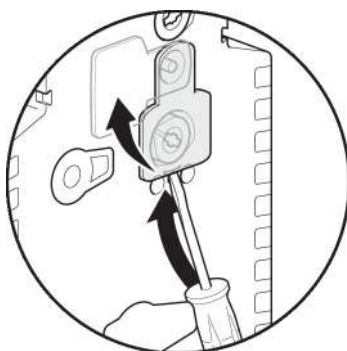
On:	Device starting up
Off:	No power supply or wiring error
Flashing:	In operation (Voltage ok)

**2 Flow direction**
**3 NFC interface**
**4 Manual override button**

Press button:	Gear train disengages, motor stops, manual override possible
Release button:	Gear train engages, standard mode. Device performs synchronisation.

Setting fail-safe position

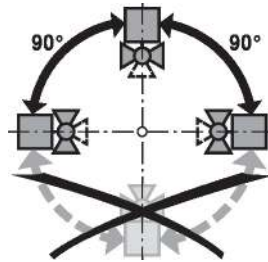
Setting emergency setting position (POP)



	<b>A – AB</b> <b>100%</b>
	<b>A – AB</b> <b>0%</b>
	<b>A – AB</b> <b>0 ... 100%</b>
	<b>POP</b> <b>PC-Tool</b> <b>ZTH</b>

**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).

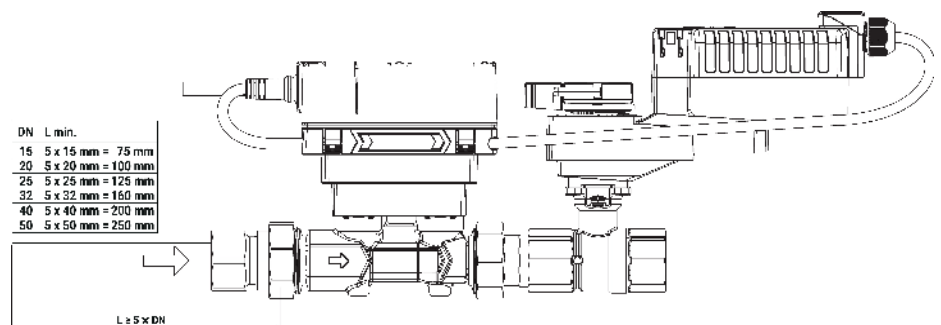
The system must not be returned to service until the ball valve and the rotary actuator have been correctly reassembled in accordance with the instructions and the pipeline has been refilled by professionally trained personnel.

**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.


**Split installation**

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

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

$\Delta p_{\min}: \text{kPa}$   
 $V'_{\max}: \text{m}^3/\text{h}$   
 $k_{vs \text{ theor.}}: \text{m}^3/\text{h}$

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

EP025R2+KBAC

kvs theor. = 8.1 m<sup>3</sup>/h

V'nom = 69 l/min

50% \* 69 l/min = 34.5 l/min = 2.07 m<sup>3</sup>/h

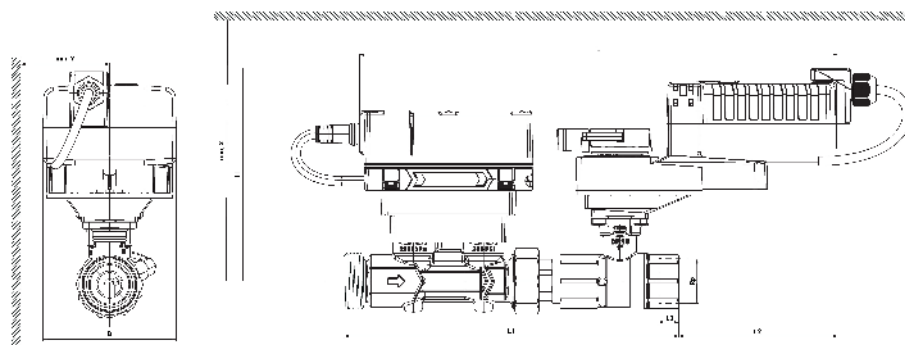
$$\Delta p_{\min} = 100 \times \left( \frac{V'_{\max}}{k_{vs \text{ theor.}}} \right)^2 = 100 \times \left( \frac{2.07 \text{ m}^3/\text{h}}{8.1 \text{ m}^3/\text{h}} \right)^2 = 6.5 \text{ kPa}$$

## 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.

## Dimensions

## Dimensional drawings



Type	DN	Rp ["]	G ["]	L [mm]	L1 [mm]	L2 [mm]	L3 [mm]	B [mm]	H [mm]	X [mm]	Y [mm]	kg
EP015R2+KBAC	15	1/2	3/4	428	195	128	13	90	156	226	80	2.1
EP020R2+KBAC	20	3/4	1	440	230	123	14	90	158	228	80	2.8
EP025R2+KBAC	25	1	1 1/4	447	246	117	16	90	158	228	80	2.7
EP032R2+KBAC	32	1 1/4	1 1/2	459	267	110	19	90	162	232	80	4.0
EP040R2+KBAC	40	1 1/2	2	465	281	106	19	90	162	232	80	4.8
EP050R2+KBAC	50	2	2 1/2	473	294	100	22	90	168	238	80	5.2

## 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
- Installation instructions for actuators and/or ball valves