

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

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



## 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	3.7 W
	Transformer sizing	8.5 VA
	Connection supply/control	cable 3 ft. [1 m], 6x 0.75 mm <sup>2</sup>
	Parallel operation	Yes (note the performance data)
Data bus communication	Communicative control	BACnet MS/TP Modbus RTU MP-Bus
	Number of nodes	BACnet / Modbus see interface description MP-Bus max. 8
Functional data	Valve size [mm]	1" [25]
	Operating range Y	2...10 V
	Operating range Y variable	0.5...10 V
	Input impedance	100 kΩ
	Position feedback U	2...10 V
	Position feedback U note	Max. 1 mA
	Position feedback U variable	0...10 V 0.5...10 V
	Noise level motor	35 dB(A) dB(A)
	V'max adjustable	4.2...100% of V'nom
	Control accuracy	±5% (of 25...100% V'nom) @ 68°F [20°C] / Glycol 0% vol.
	Control accuracy note	±10% (of 25...100% V'nom) @ Glycol 0...60% vol.
	Fluid	Water, water with glycol up to max. 60% vol.
	Fluid temperature	43...176°F [6...82°C]
	Close-off pressure Δps	50 psi
	Differential pressure Δpmax	15 psi
	Body Pressure Rating	232 psi
	Leakage rate	0% leakage, leakage rate A (EN 12266-1)
	GPM	18.2
	Pipe connection	Internal thread according to ISO 7-1
	Installation orientation	upright to horizontal (in relation to the spindle)
	Servicing	maintenance-free
	Manual override	with push-button, can be locked

## Technical data

Flow measurement	Measuring principle	Ultrasonic flow measurement
	Measuring accuracy flow	±2% (of 20...100% V'nom) @ 68°F [20°C] / glycol 0% vol.
	Measuring accuracy flow note	±5% (of 20...100% V'nom) @ glycol 0...60% vol.
	Min. flow measurement	0.2% of V'nom
Safety data	Protection class IEC/EN	III, Protective Extra-Low Voltage (PELV)
	Degree of protection NEMA/UL	NEMA 2
	Housing	UL Enclosure Type 2
	Pressure equipment directive	CE according to 2014/68/EU
	EMC	CE according to 2014/30/EU
	Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02 CE acc. to 2014/30/EU and 2014/35/EU Listed to UL 2043- suitable for use in air plenums per Section 300.22(c) of the NEC and Section 602.2 of the IMC
	Type of action	Type 1
	Rated impulse voltage supply / control	0.8 kV
	Pollution degree	3
	Ambient humidity	Max. 95% RH, non-condensing
	Ambient temperature	-22...131°F [-30...55°C]
	Storage temperature	-40...176°F [-40...80°C]
Materials	Valve body	Nickel-plated brass body
	Flow measuring pipe	Nickel-plated brass body
	Valve plug	chrome-plated brass
	Stem	nickel-plated brass
	Stem seal	EPDM O-ring
	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 authorized specialists may carry out installation. All applicable legal or institutional installation regulations must be complied with 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

- Operating mode** The HVAC performance device consists of three components: 6-way characterized control valve, measuring pipe with flow sensor and the actuator itself. The set maximum flow rates for sequence 1 (V'max1) and sequence 2 (V'max2) are assigned to the control signal as follows:
- 2 V/0% = 100% for sequence 1
  - 10 V/100% = 100% for sequence 2
- The performance device can be controlled communicatively or by an analogue signal. 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.

## Product features

**Control characteristics** The specially configured control parameters in connection with the precise velocity sensor ensure a stable quality of control.

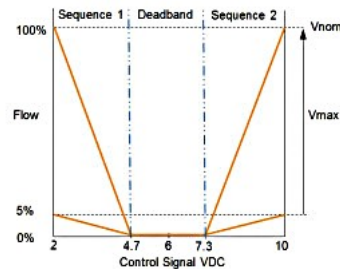
$V'_{nom}$  is the maximum possible flow. ( $V'_{nom}=V'_{nom1}=V'_{nom2}$ )

$V'_{max1}$  is the maximum flow rate which has been set with the smallest positioning signal, 2 V.

$V'_{max2}$  is the maximum flow rate which has been set with the highest control signal, 10 V.

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

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



**Condensation protection** When condensation is detected, the condensation switch is triggered and the device enters a warning state. Immediate action is delayed by a configurable timer (up to 3 hrs), allowing the Building Management System (BMS) enough time to adjust the supply temperature. If the timer expires and the issue persists, then the system will escalate the warning to an alarm. The condensation protection feature closes the valve at this stage. This feature is active by default and can be deactivated.

**Setpoint control modes** Single setpoint

In single setpoint mode, one setpoint is used to control the entire range of valve movement.

The operation of the valve is based on the control mode selected:

Position control: The valve position corresponds directly to the single setpoint input.

Flow control: The flow rate is calculated, based on the setpoint's position along the operating range.

Separate setpoints

In separate setpoints mode, two distinct setpoints are used for independent control of two sequences:

Setpoint 1 controls sequence 1 (e.g., cooling).

Setpoint 2 controls sequence 2 (e.g., heating).

The control mode adjusts within each sequence:

Position control: Each setpoint determines the valve's position within its respective sequence range.

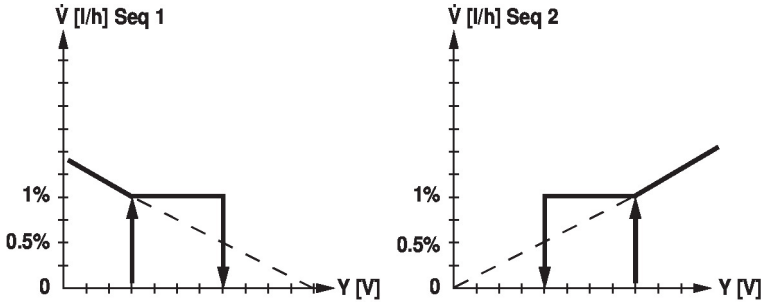
Flow control: The flow rate is calculated directly for each sequence, based on its corresponding setpoint.

Examples:

In single setpoint mode, if the setpoint is 80%, then the system calculates the flow rate or adjusts the valve position for the entire range.

In the separate setpoints mode, if setpoint 1 (cooling) is set to 80%, setpoint 2 (heating) must be set to 0%. The same applies if setpoint 2 is set to 80%, for example, then setpoint 1 must be set to 0% accordingly. If both setpoints are >0% at the same time, the valve closes.

**Product features**

<b>Creep flow suppression</b>	<p>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.</p> <p>Opening sequence</p> <p>The valve remains closed until the flow required by the control signal Y corresponds to 1% of V'nom. The control along the valve characteristic curve is active after this value has been exceeded.</p> <p>Closing sequence</p> <p>The control along the valve characteristic curve 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 reference variable Y, then the valve will close.</p>
	
<b>Converter for sensors</b>	<p>Connection option for a sensor (active or with switching contact). In this way, the analog sensor signal can be easily digitized and transferred to the bus systems BACnet, Modbus or MP-Bus.</p>
<b>Configurable Device</b>	<p>The factory settings cover the most common applications.</p> <p>Belimo Assistant 2 is required for configuration via Near Field Communication (NFC) and simplifies commissioning. Moreover, Belimo Assistant 2 provides a variety of diagnostic options.</p>
<b>Hydronic balancing</b>	<p>With Belimo Assistant 2, the maximum flow rates of sequence 1 and sequence 2 can be adjusted individually on-site in a few simple, reliable steps.</p>
<b>Combination analogue - communicative (hybrid mode)</b>	<p>With conventional control by means of an analogue control signal, BACnet or Modbus can be used for the communicative position feedback.</p>
<b>Manual override</b>	<p>Manual override with push-button possible (the gear train is disengaged for as long as the button is pressed or remains locked).</p>
<b>High functional safety</b>	<p>The actuator is overload protected, requires no limit switches and automatically stops when the end stop is reached.</p>
<b>Feedback signal</b>	<p>Regardless of the selected control mode, the following options are available for the feedback signal U5:</p> <ul style="list-style-type: none"> <li>- Valve position (range 0...10 V)</li> <li>- Flow rate in relation to V'max1 and V'max2</li> <li>- Fluid temperature range (-4...250°F)</li> </ul>
<b>Pressure compensation</b>	<p>In cases of combined heating/cooling control elements, the fluid remains in the control element when in the off position (no heating or cooling). The pressure of the enclosed fluid can rise or fall due to changes in fluid temperature caused by the ambient temperature. The 6-way characterized control valves have an integrated pressure relief function for the purpose of compensating for such pressure changes.</p> <p>The pressure relief function is active in the off 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 characterized control valve.</p>

## Accessories

Tools	Description	Type
	Service tool for wired and wireless setup, on-site operation and troubleshooting.	Belimo Assistant 2
	Belimo Assistant Link Bluetooth and USB to NFC and MP-Bus converter for configurable and communicative devices	LINK.10
Mechanical accessories	Description	Type
	Fixing bracket for 6-way valve DN 25	ZR-005

## 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 RS485 regulations.

Modbus / BACnet: Supply and communication are not a galvanic dry contact. COM and the ground of the devices must be connected.

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 digitized 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.

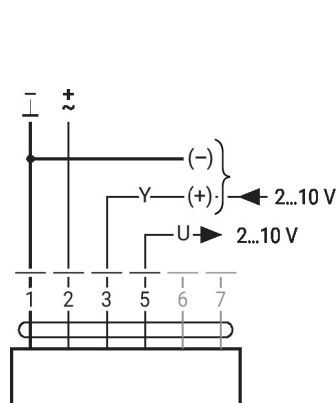
## Wire colors:

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

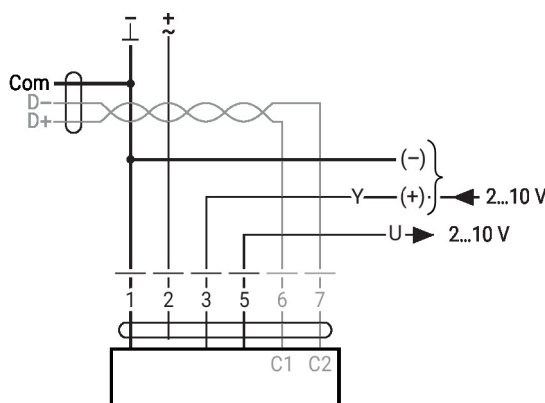
## Functions:

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

AC/DC 24 V, modulating

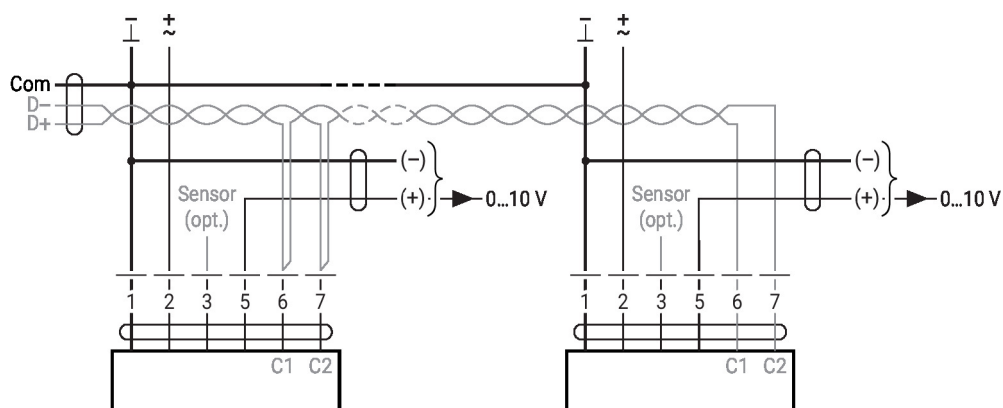


Modbus RTU / BACnet MS/TP with analog setpoint (hybrid operation)

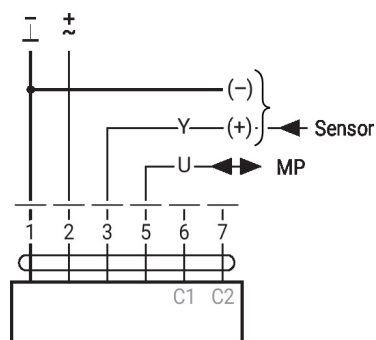


**Electrical installation**

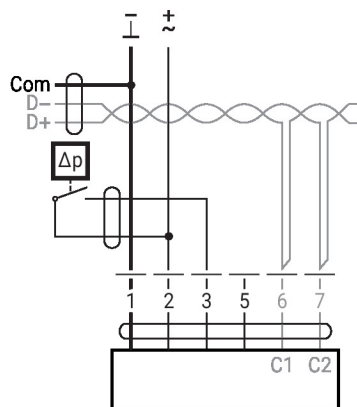
BACnet MS/TP / Modbus RTU



MP-Bus


**Converter for sensors**

Connection with switching contact, e.g., differential pressure switch

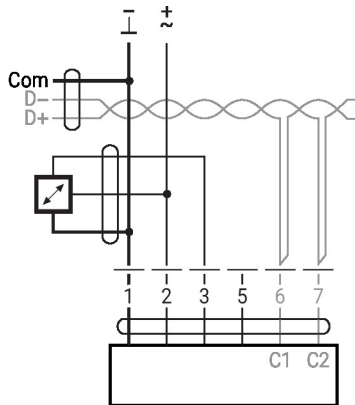


Switching contact requirements:  
The switching contact must be  
able to switch a current of 16 mA  
at 24 V accurately.

### Electrical installation

#### Converter for sensors

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

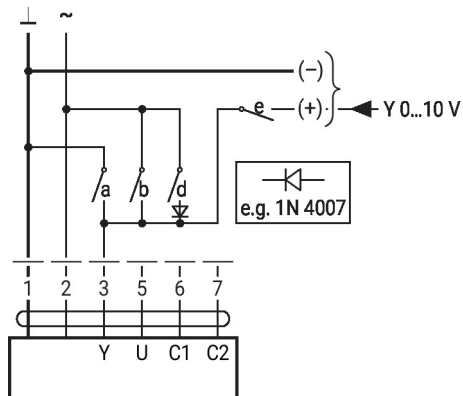


Possible voltage range: 0...32 V  
Resolution 30 mV

### Further electrical installations

#### Functions with specific parameters (configuration necessary)

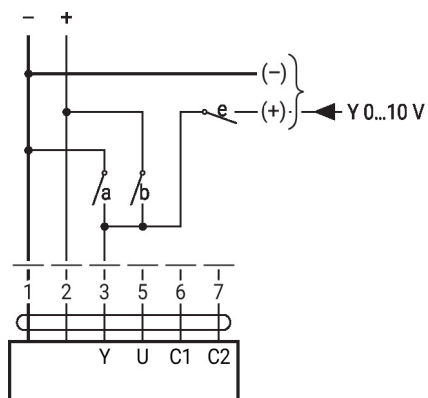
Override control and limiting with AC 24 V with relay contacts



1	2	a	b	d	e	
						Open S1 <sup>1)</sup>
						V' max S1 <sup>2)</sup>
						Open S2 <sup>1)</sup>
						V' max S2 <sup>2)</sup>
						Close
						Y

1) Position control  
2) Flow control  
S1 Sequence 1  
S2 Sequence 2

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



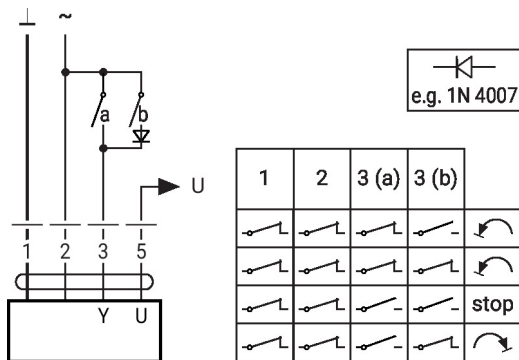
1	2	a	b	e	
					Open S1 <sup>1)</sup>
					V' max S1 <sup>2)</sup>
					Open S2 <sup>1)</sup>
					V' max S2 <sup>2)</sup>
					Close
					Y

1) Position control  
2) Flow control  
S1 Sequence 1  
S2 Sequence 2

### Further electrical installations

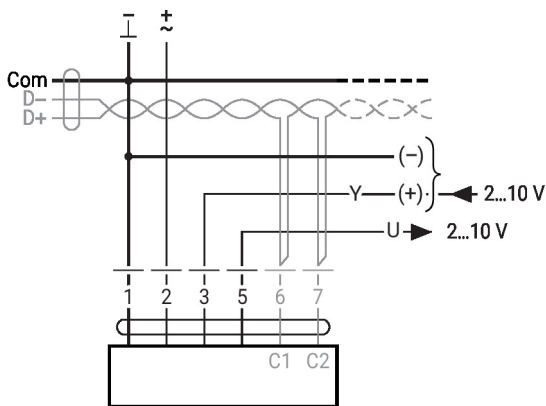
#### Functions with specific parameters (configuration necessary)

Control 3-point with AC 24 V

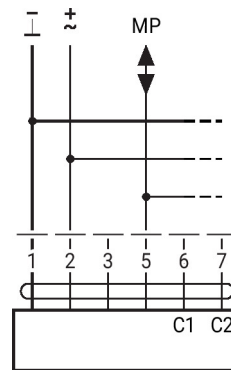


Position control: 90° = 100 s  
Flow control: V'max = 100 s

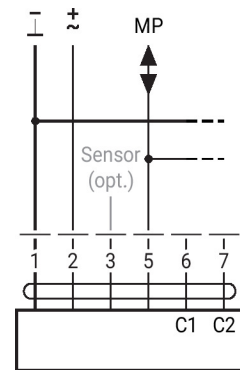
BACnet MS/TP / Modbus RTU with analogue setpoint (hybrid mode)



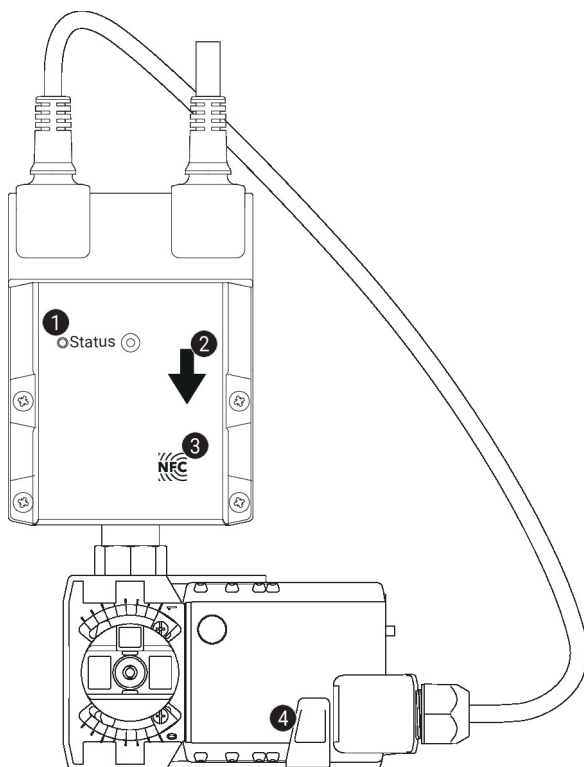
MP-Bus, supply via 3-wire connection



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

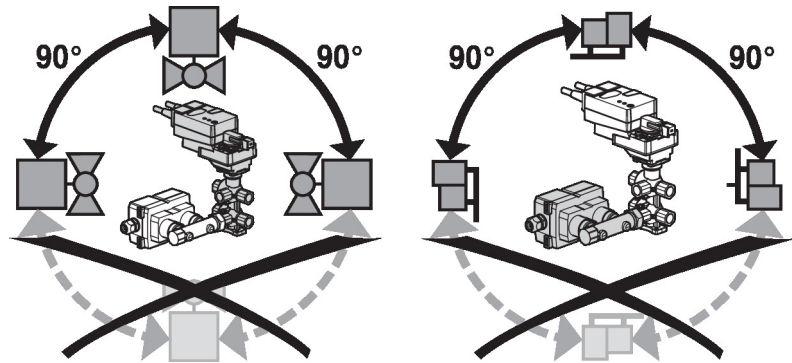
#### 4 Manual override button

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



**Installation notes**

**Permissible installation orientation** 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 a suitable strainer is recommended.

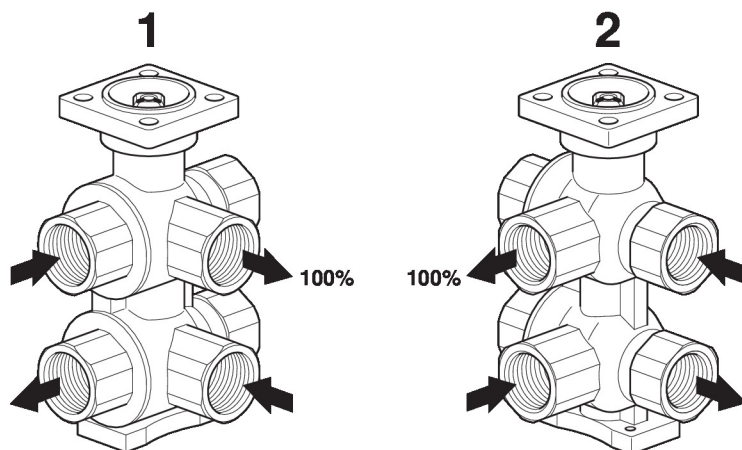
**Servicing** Ball valves, rotary actuators and sensors are maintenance-free.

Before any service work on the control element is carried out, it is essential to isolate the device 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 shut off (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 device has 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 damper shaft.

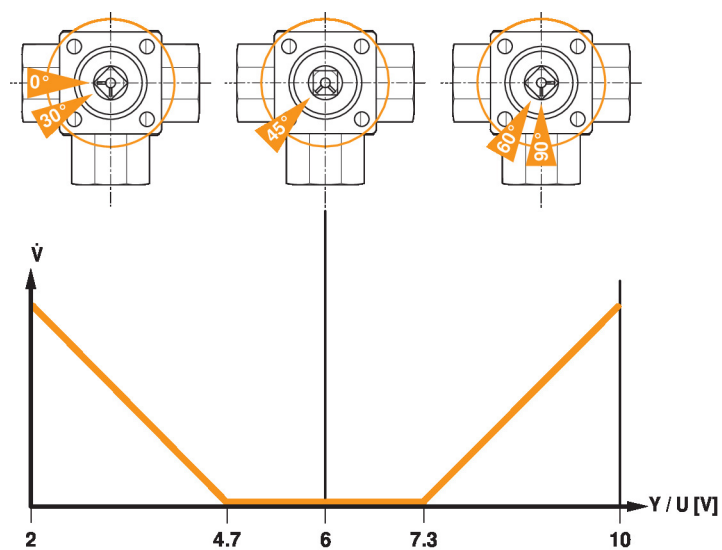
Flow sequence 1 and sequence 2



**Installation notes**

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

Valve characteristic curve

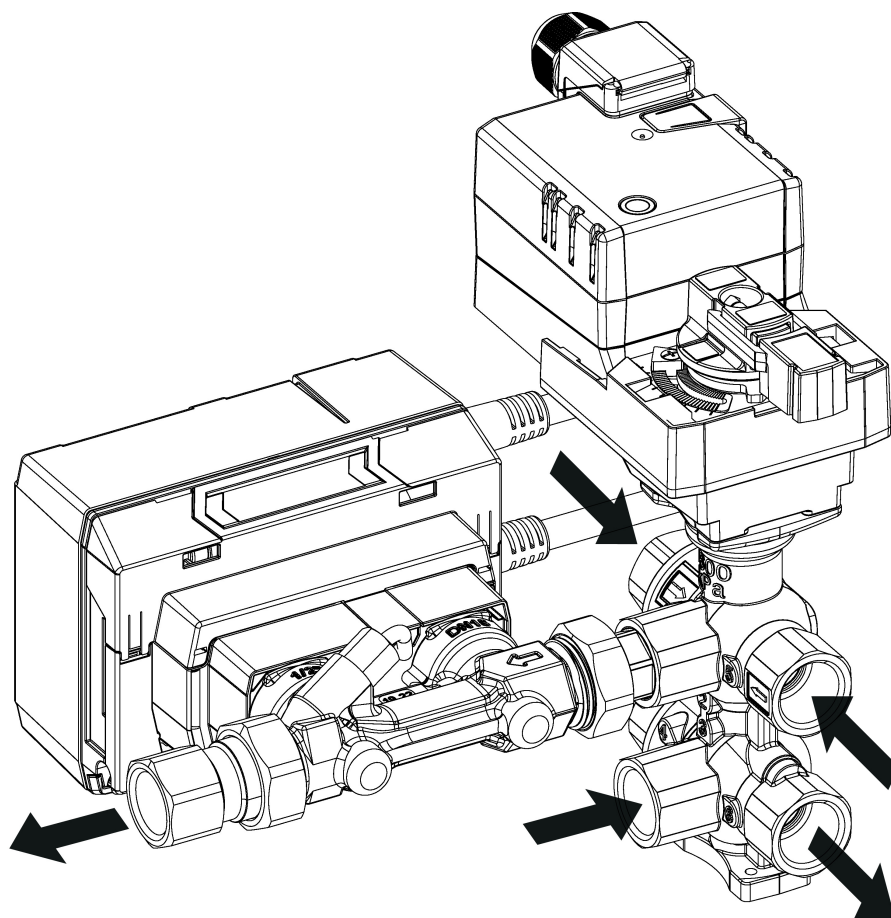


**Inlet section** There are no requirements for straight inlet sections prior to the flow sensor. Product has been tested to and fulfills the requirements of EN1434-4:2022

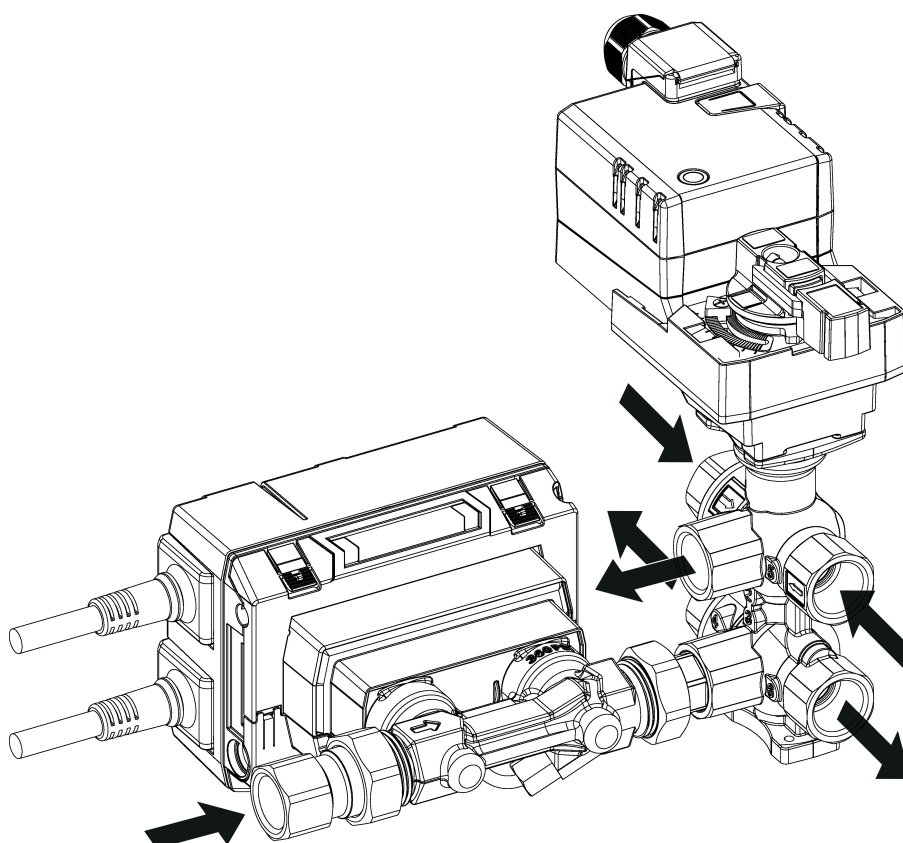
## Installation notes

## Types of installation

Flow sensor in supply



Flow sensor in return

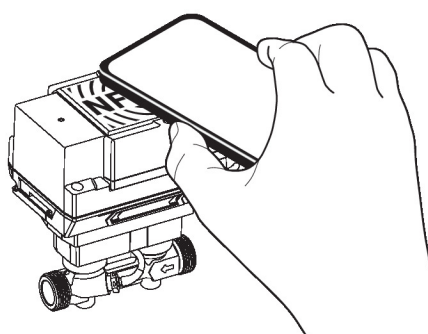
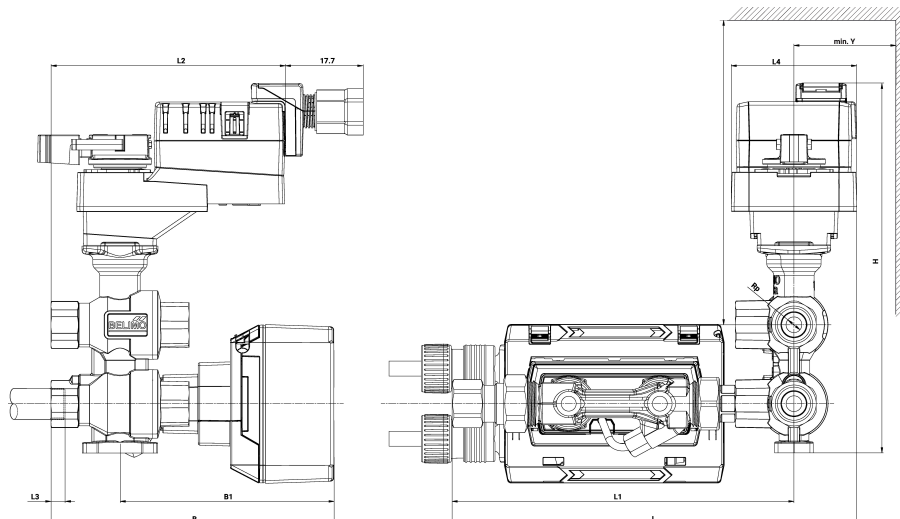


**General notes**

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

**Service**

**Wireless connection** Belimo devices marked with the NFC logo can be operated with the Belimo Assistant 2.  
Requirement:  
- NFC- or Bluetooth-capable smartphone  
- Belimo Assistant 2 (Google Play and Apple AppStore)  
Align NFC-capable smartphone on the device so that both NFC antennas are superposed.  
Connect Bluetooth-enabled smartphone via the Bluetooth-to-NFC converter ZIP-BT-NFC to the device. Technical data and operating instructions are shown in the ZIP-BT-NFC data sheet.


**Dimensions**


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

DN	B [mm]	B1 [mm]	L [mm]	L1 [mm]	L2 [mm]	L3 [mm]	L4 [mm]	H [mm]	X [mm]	Y [mm]	Weight
1" [25]	186	126	293	250	159	16	86	265	225	78	12.3 lb [5.6 kg]