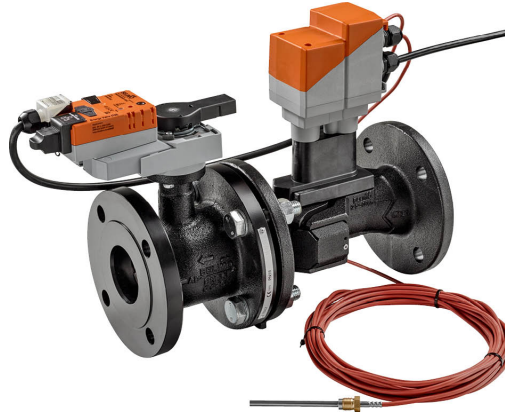


Characterised control valve with sensor-operated flow rate or power control with fail-safe, power and energy-monitoring function, 2-way, Flange, (Energy Valve)

- Nominal voltage AC/DC 24 V
- Control modulating, communicative, hybrid, Cloud
- For closed chilled and hot water systems
- For modulating control of air-handling and heating systems on the water side
- Ethernet 10/100 Mbit/s, TCP/IP, integrated web server
- Communication via BACnet, Modbus, Belimo MP-Bus or conventional control
- optional Belimo Cloud connection
- Glycol monitoring
- PWIS/LABS-compliant according to VDMA 24364



Type Overview

Type	DN	V'nom [l/s]	V'nom [l/min]	V'nom [m³/h]	Kvs theor. [m³/h]	ANSI Class
EV065F+KBAC-LA US	65	8	480	28.8	42	250
EV080F+KBAC-LA US	80	11.3	680	40.9	59	250
EV100F+KBAC-LA US	100	20	1200	72	108	250
EV125F+KBAC-LA US	125	31.2	1873	112.4	168	250
EV150F+KBAC-LA US	150	45	2700	162	229	250

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	16 W (DN 65, 80) 17 W (DN 100, 125, 150)
	Power consumption in rest position	6.5 W
	Power consumption for wire sizing	26 VA (DN 65, 80) 29 VA (DN 100, 125, 150)
	Connection supply / control	Cable 1 m, 6x 0.75 mm ²
	Connection Ethernet	RJ45 socket
	Parallel operation	Yes (note the performance data)
Data bus communication	Communicative control	BACnet/IP, BACnet MS/TP Modbus TCP, Modbus RTU MP-Bus
	Number of nodes	BACnet / Modbus see interface description MP-Bus max. 8
Functional data	Operating range Y	2...10 V
	Input impedance	100 kΩ
	Operating range Y variable	0.5...10 V
	Position feedback U	2...10 V
	Position feedback U note	Max. 1 mA

Functional data	Setting fail-safe position	NC/NO or adjustable 0...100% (POP rotary knob)
	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	30...100% of V'nom
	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
	Parametrisation	via integrated web server / ZTH EU
	Fluid	Chilled and hot water, water with glycol up to max. 50% vol.
	Fluid temperature	-10...120°C [14...248°F] (DN 65, 80, 100, 125) -10...110°C [14...230°F] (DN 150)
	Close-off pressure Δps	690 kPa
	Differential pressure Δpmax	340kPa
	Flow characteristic	equal percentage (VDI/VDE 2173), optimised in the opening range
	Flow characteristic note	switchable to linear (VDI/VDE 2173)
	Leakage rate	air-bubble tight, leakage rate A (EN 12266-1)
	Pipe connection	Flange
	Installation orientation	upright to horizontal (in relation to the stem)
	Servicing	maintenance-free
	Manual override	with push-button
Measuring data	Temperature sensor	Temperature sensor cable free of silicone Cable length external sensor T1: 10 m T2 integrated in flow sensor
Temperature measurement	Measuring accuracy absolute temperature	± 0.35°C @ 10°C (Pt1000 EN60751 Class B) ± 0.6°C @ 60°C (Pt1000 EN60751 Class B)
	Measuring accuracy differential temperature	±0.18 K @ ΔT = 10 K ±0.23 K @ ΔT = 20 K
	Resolution	0.05°C
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
Glycol monitoring	Measurement display glycol	0...40% or >40%
	Measuring accuracy glycolmonitoring	±4% (0...40%)
Safety data	Protection class IEC/EN	III, Protective Extra-Low Voltage (PELV)
	Degree of protection IEC/EN	IP40 IP54 when using protective cap or protective grommet for RJ45 socket
	Pressure equipment directive	CE according to 2014/68/EU
	EMC	CE according to 2014/30/EU

Technical data

Safety data	PWIS/LABS-conformity	According to VDMA 24364 (test class C1) Approved for use in zone II Cleaning with low-pressure plasma treatment
	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	-10...40°C [14...104°F]
	Materials	Valve body
Flow measuring pipe		EN-GJL-250 (GG 25), with protective paint
Closing element		Stainless steel AISI 316
Spindle		Stainless steel AISI 304
Spindle seal		EPDM
Seat		PTFE, O-ring Viton
Immersion sleeve		Stainless steel AISI 316
Terms	Abbreviations	POP = Power off position / fail-safe position

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 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.
- PWIS/LABS-conformity is guaranteed as long as the packaging is unopened. Once the PWIS/LABS-compliant packaging has been opened, the proper handling of the products is the responsibility of the customer. PWIS/LABS-conformity of unopened products is guaranteed for a period of one year after cleaning, provided they are handled properly, professionally and cleanly. Proof of proper, professional and clean handling is the responsibility of the purchaser. Ensure that the required cleanliness of the products is maintained. Do not touch the products with bare hands. Belimo accepts no liability for the consequences resulting from the contamination of a product caused by the customer.

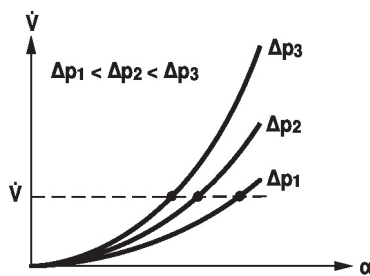
Product features

Operating mode The HVAC performance device is comprised of four components: characterised control valve (CCV), measuring pipe with flow sensor, temperature sensors and the actuator itself. The adjusted maximum flow (V_{max}) is assigned to the maximum control signal DDC (typically 10 V / 100%). Alternatively, the control signal DDC can be assigned to the valve opening angle or to the power required on the heat exchanger (see power control). The HVAC performance device can be controlled via communicative or analogue 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).

With the supply voltage the integrated capacitors will be charged.

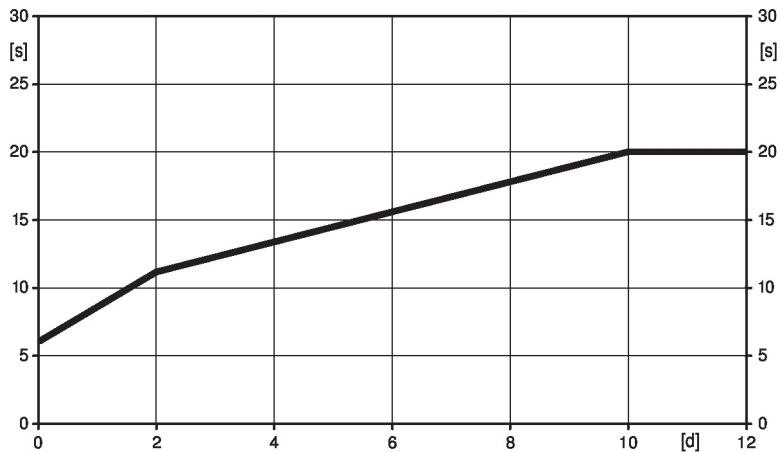
Interrupting the supply voltage causes the valve to be moved to the selected fail-safe position by means of stored electrical energy.

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 how long the power was interrupted.

Typical pre-charging time



[d] = Power failure in days
[s] = Pre-charging time in seconds

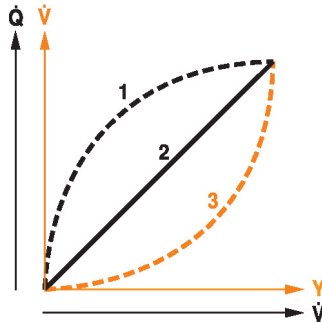
	[d]				
	0	1	2	7	≥10
[s]	6	9	11	16	20

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.

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.

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).



Power control Alternatively, the control signal DDC can be assigned to the output power required at the heat exchanger.

Depending on the water temperature and air conditions, the Energy Valve ensures the amount of water V' required to achieve the desired power.

Maximum controllable power on heat exchanger in power control mode:

DN 65	1700 kW
DN 80	2400 kW
DN 100	4200 kW
DN 125	6500 kW
DN 150	9500 kW

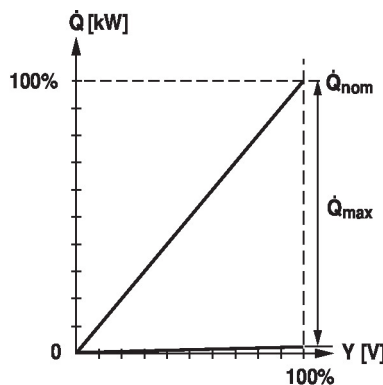
Control characteristics The specially configured control parameters in connection with the precise velocity sensor ensure a stable quality of control. They are, however, not suitable for rapid control processes, i.e. for domestic water control.

Power control

Q' nom is the maximum possible power output on the heat exchanger.

Q' max is the maximum power output on the heat exchanger which has been set with the highest control signal DDC. Q' max can be set between 1% and 100% of Q' nom.

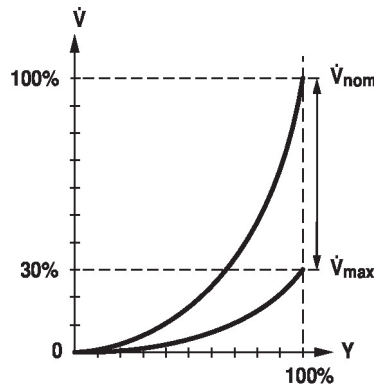
Q' min 0% (non-variable).



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} .



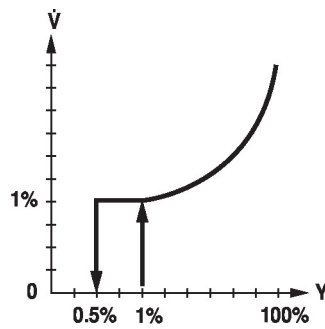
Creep flow suppression Given the very low flow speed in the opening point, this can no longer be measured by the sensor within the required tolerance. This range is overridden electronically.

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.



Parametrisable device The factory settings cover the most common applications. Single parameters can be modified with Belimo Assistant 2 or ZTH EU.

Communication

The parametrisation can be carried out through the integrated web server (RJ45 connection to the web browser) or by communicative means.

Additional information regarding the integrated web server can be found in the separate documentation.

"Peer to Peer" connection

http://belimo.local:8080

The Notebook must be set to "DHCP".

Make sure that only one network connection is active.

Standard IP address:

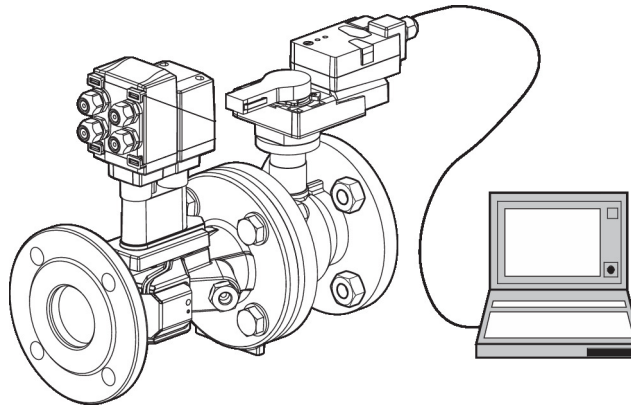
http://192.168.0.10:8080

Static IP address

Password (read-only):

User name: «guest»

Password: «guest»



Control signal inversion

This can be inverted in cases of control with an analogue control signal DDC. The inversion causes the reversal of the standard behaviour, i.e. at a control signal DDC of 0%, regulation is to V'max or Q'max, and the valve is closed at a control signal DDC of 100%.

Hydronic balancing

Via the integrated web server, the maximum flow rate (equivalent to 100% requirement) can be adjusted on the device itself, 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.

Delta-T manager

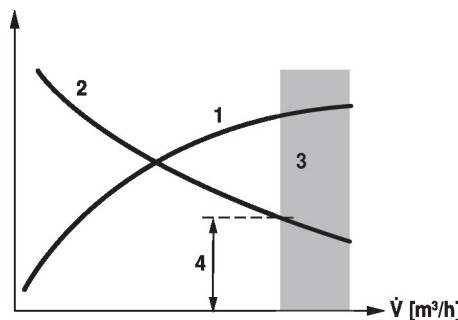
If a heating or cooling register is operated with a differential temperature that is too low and thus with a flow rate that is too high, this will not result in an increased power output. Nevertheless, heating or cooling machines must provide the energy at a lower degree of efficiency. This means, that pumps circulate too much water and increase energy consumption unnecessarily.

With the aid of the Energy Valve, it is simple to discover that operation is being carried out at a differential temperature that is too low, resulting in the inefficient use of energy.

Necessary setting adjustments can now be carried out quickly and easily at any time. The integrated differential temperature limiting offers the user the possibility of defining a low limit value. The Energy Valve limits the flow rate automatically to prevent the level from falling below this value.

The settings of the Delta-T manager can be made either directly on the web server or via the Belimo Cloud a direct analysis of the Delta-T behavior is carried out by Belimo experts.

- Power output of the heating or cooling registers 1
- Diff. temperature between supply and return 2
- Loss zone (heating or cooling register saturation) 3
- Adjustable minimum differential temperature 4



Combination analogue - communicative (hybrid mode)

With conventional control by means of an analogue control signal DDC, the integrated web server, BACnet, Modbus or MP-Bus can be used for the communicative position feedback.

Product features

Power and energy monitoring function

The HVAC performance device is equipped with two temperature sensors. One sensor (T2) is integrated in the measuring pipe, the second sensor (T1) is included with the system, prewired, and must be installed in the water circuit on site. The sensors are used to record the fluid temperature of the supply and return lines of the consumer (heating/cooling coil). As the water quantity is also known, thanks to the flow measurement integrated in the system, the power released from the consumer can be calculated. Furthermore, the heating/cooling energy is also determined automatically by means of the evaluation of the power over time. The current data, e.g. temperatures, volumetric flow volumes, exchanger energy consumption etc. can be recorded and accessed at any time by means of web browsers or communication.

Data recording

The recorded data (integrated data recording for 13 months) can be used for the optimisation of the overall system and for the determination of the performance of the consumer (heating/cooling coil).
Download csv files through web browser.

Belimo Cloud

Additional services are available if the Energy Valve is connected to the Belimo Cloud: for instance, several devices may be managed via Internet. Also, Belimo experts may help analyse the delta-T behaviour or provide written reports about the Energy Valve performance. Under certain conditions, the product warranty according to the applicable Terms and Conditions of Sale may be prolonged. The "Terms of Use for Belimo Cloud Services" in their currently valid version apply to the use of Belimo Cloud services. Further details may be found under [www.belimo.com/ext-warranty]

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.

Accessories

Tools	Description	Type
	Service tool, with ZIP-USB function, for parametrisable and communicative Belimo actuators, VAV controller and HVAC performance devices	ZTH EU
	Connecting cable 5 m, A: RJ11 6/4 ZTH EU, B: 6-pin for connection to service socket	ZK1-GEN
Electrical accessories	Description	Type
	Grommet for RJ connection module, Multipack 50 pcs.	Z-STRJ.1
	Stem heater flange F05 (30 W)	ZR24-F05

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. COM and ground of the devices must be connected to each other.

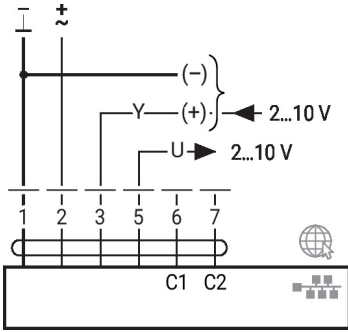
Wire colours:

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

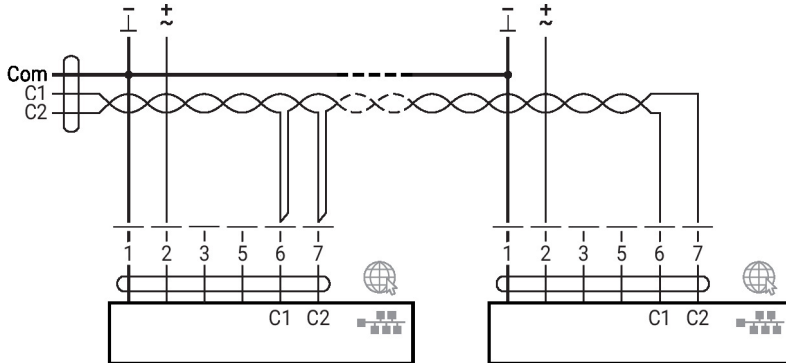
Functions:

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

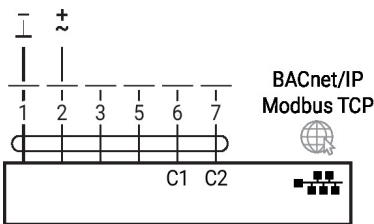
Electrical installation



BACnet MS/TP / Modbus RTU



BACnet/IP / Modbus TCP

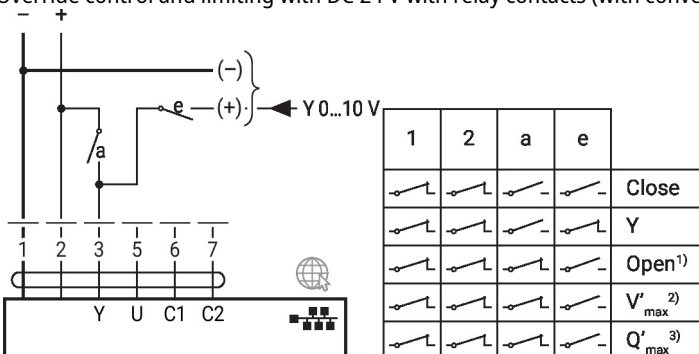


Optional connection via RJ45 (direct connection to notebook / connection via Intranet or Internet) for access to the integrated web server

Further electrical installations

Functions with specific parameters (parametrisation necessary)

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

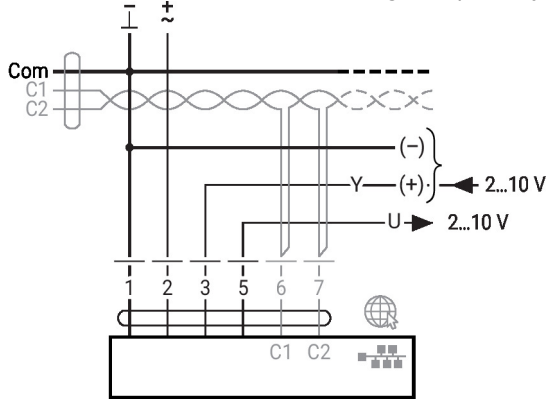


- 1) Position control
- 2) Flow control
- 3) Power control

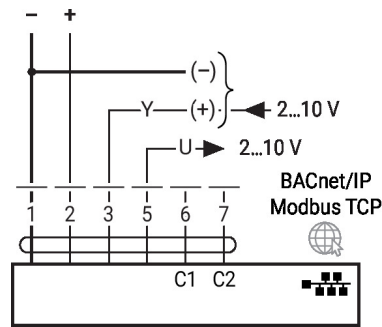
Further electrical installations

Functions with specific parameters (parametrisation necessary)

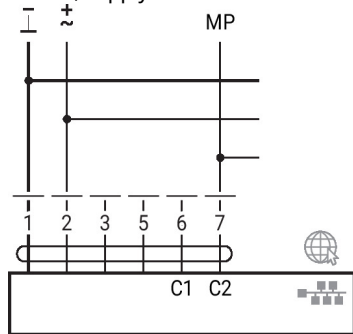
BACnet MS/TP / Modbus RTU with analogue setpoint (hybrid mode)



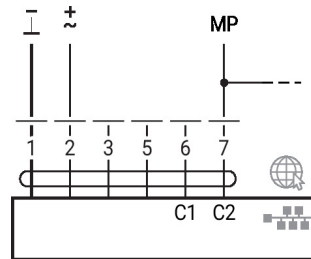
BACnet/IP / Modbus TCP with analogue setpoint (hybrid mode)



MP-Bus, supply via 3-wire connection

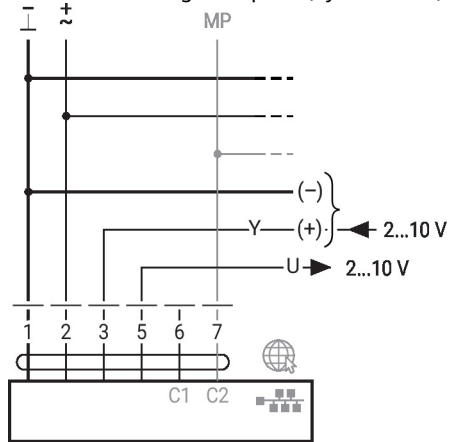


MP-Bus via 2-wire connection, local power supply

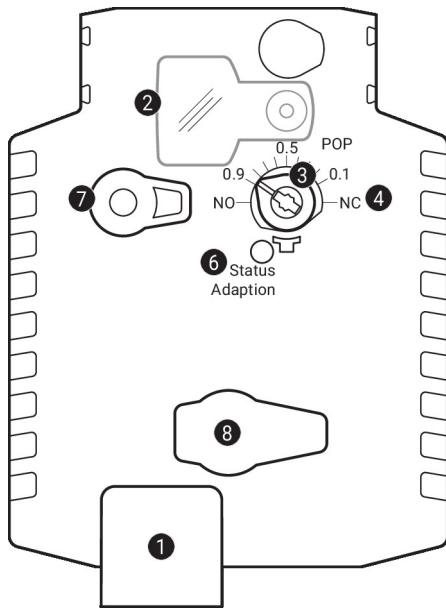


Max. 8 additional MP-Bus nodes

MP-Bus with analogue setpoint (hybrid mode)



Operating controls and indicators



1 LED display green

- Off: No power supply or wiring error
- On: In operation
- Flickering: Internal communication (Valve/Sensor)

2 Cover, POP button

3 POP button

4 Scale for manual adjustment

6 Push-button and LED display yellow

- On: Adaptation or synchronisation process active
- Flashing: POP function active
- Off: Not in operation, pre-charging time SuperCap, fault SuperCap
- Press button: Triggers angle of rotation adaptation, followed by standard mode

7 Manual override button

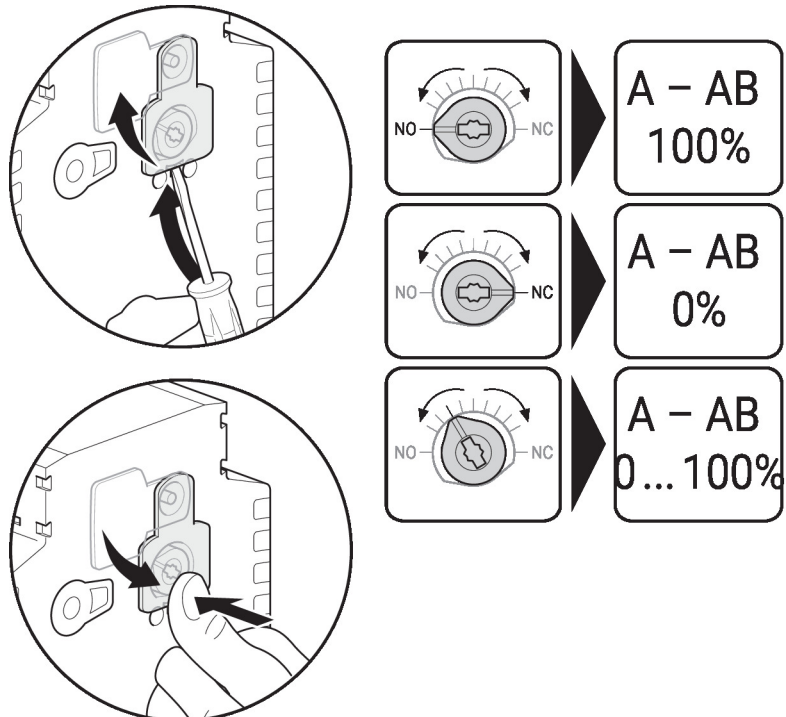
- Press button: Gear train disengages, motor stops, manual override possible
- Release button: Gear train engages, followed by standard mode

8 Service plug

For connecting parametrisation and service tools

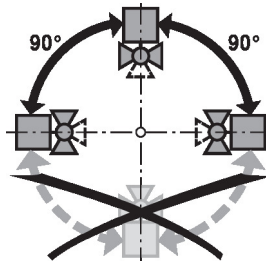
Setting fail-safe position

Setting fail-safe position (POP)



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 spindle pointing downwards.



Installation location in return Installation in the return is recommended.

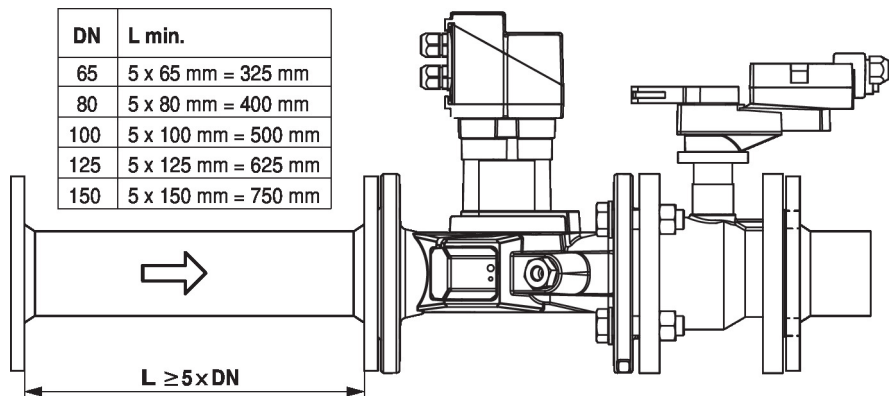
Water quality requirements The water quality requirements specified in VDI 2035 must be adhered to. Belimo valves are regulating devices. For the valves to function correctly in the long term, they must be kept free from particle debris (e.g. welding beads during installation work). The installation of a suitable strainer is recommended.

Spindle heater In cold water applications and warm humid ambient air, condensation can be caused in the actuators. This can lead to corrosion in the gear train of the actuator and a breakdown of the actuator. In such applications, the use of a spindle heater is recommended. The spindle heater must only be activated when the system is in operation because it does not have a temperature controller.

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.



Installation notes

Mounting of immersion sleeve and temperature sensor

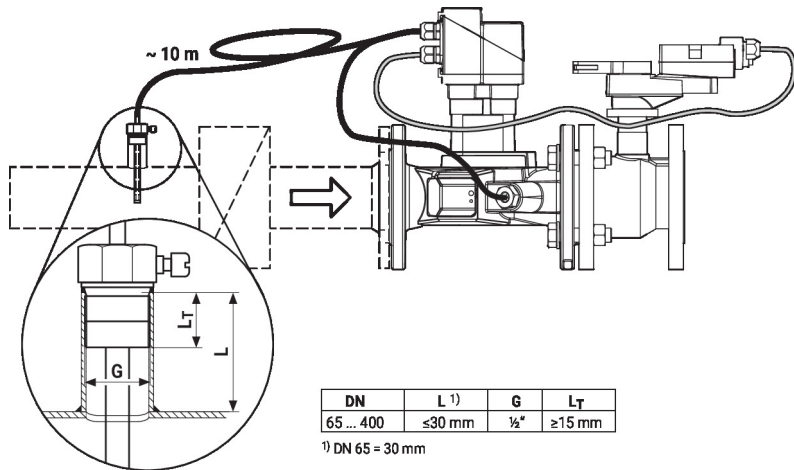
The valve is equipped with two temperature sensors:

- T2: One sensor is already installed in the valve unit.
- T1: The second sensor must be mounted at the installation site ahead of the consumer (valve in the return line; recommended) or after the consumer (valve in the supply line). The immersion sleeve required is supplied with the valve unit.

The temperature sensor is already wired with the valve.

Note

The cable between valve unit and temperature sensor may not be either shortened or lengthened.



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

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

Δp_{min}: kPA
 V'_{max}: m³/h
 K_{vs theor.}: m³/h

Example (DN 100 with the desired maximum flow rate = 50% V'nom)

EV100F+KBAC

K_{vs theor.} = 127 m³/h

V'_{nom} = 1200 l/min

50% * 1200 l/min = 600 l/min = 36 m³/h

$$\Delta p_{min} = 100 \times \left(\frac{V'_{max}}{K_{vs \text{ theor.}}} \right)^2 = 100 \times \left(\frac{36 \text{ m}^3/\text{h}}{127 \text{ m}^3/\text{h}} \right)^2 = 8 \text{ kPa}$$

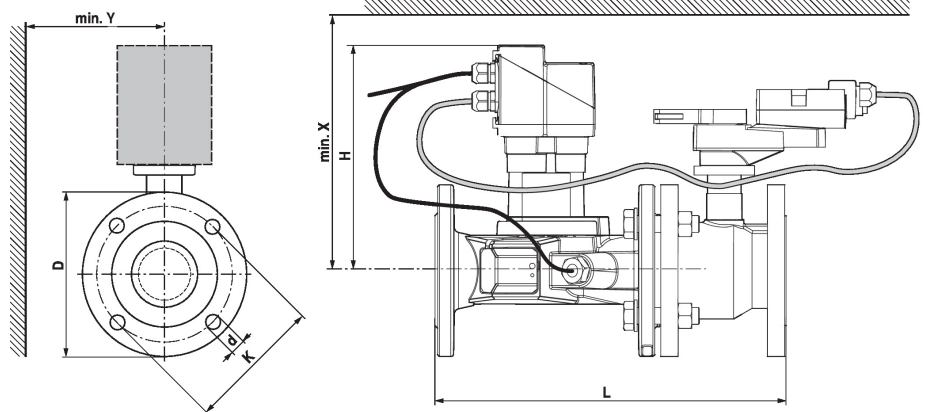
Behaviour in case of sensor failure

In case of a flow sensor error, the Energy Valve will switch from either power or flow control to position control (Delta-T manager will be deactivated).

Once the error disappears, the Energy Valve will switch back to the normal control setting (Delta-T manager activated)

Dimensions

Dimensional drawings



If $Y < 180$ mm, the extension of the hand crank must be demounted as necessary.

Type	DN	L [mm]	H [mm]	D [mm]	d [mm]	K [mm]	X [mm]	Y [mm]	 kg
EV065F+KBAC-LA US	65	391	243	190	8 x 22	149	265	155	30
EV080F+KBAC-LA US	80	433	251	210	8 x 22	168	275	165	39
EV100F+KBAC-LA US	100	474	256	254	8 x 22	200	280	190	62
EV125F+KBAC-LA US	125	581	267	280	8 x 22	235	290	200	83
EV150F+KBAC-LA US	150	653	276	320	12 x 22	270	300	220	111

Further documentation

- Tool connections
- BACnet Interface description
- Modbus Interface description
- Description Data-Pool Values
- Overview MP Cooperation Partners
- MP Glossary
- Introduction to MP-Bus Technology
- General notes for project planning
- Instruction Webserver