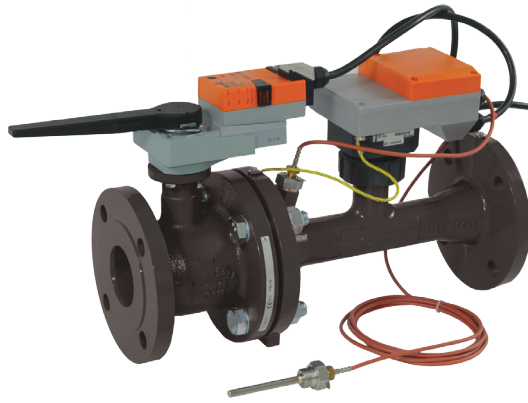


Characterised control valve (CCV) with sensor-operated flow rate or power control, power and energy-monitoring function, 2-way, PN 16 flange (Energy Valve)

- Nominal voltage AC/DC 24 V
- Control Modulating
- For closed cold and warm water systems
- For water-side modulating control of air-handling and heating systems
- Ethernet 10/100 Mbit/s, TCP/IP, integrated web server
- Communication via BACnet IP, BACnet MS/TP, Belimo MP-Bus or conventional control


Type overview

Type	DN []	DN ["]	Vnom [l/s]	Vnom [l/min]	kvs theor. [m ³ /h]	PN []	n(gl) []
P6065W800EV-BAC	65	2 1/2	8	480	40	16	3.2
P6080W1100EV-BAC	80	3	11	660	60	16	3.2
P6100W2000EV-BAC	100	4	20	1200	100	16	3.2
P6125W3100EV-BAC	125	5	31	1860	160	16	3.2
P6150W4500EV-BAC	150	6	45	2700	240	16	3.2

kvs theor.: Theoretical kvs value for pressure drop calculation

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50 Hz
	Nominal voltage range	AC 19.2...28.8 V / DC 21.6...28.8 V
	Power consumption in operation	10 W
	Power consumption in rest position	8.5 W
	Power consumption for wire sizing	14 VA
	Connection supply / control	Cable 1 m, 6 x 0.75 mm ²
	Connection control Ethernet	RJ45 socket
Parallel operation	Yes (note the performance data)	
Functional data	Torque motor	20 Nm (DN 65...80) / 40 Nm (DN 100...150)
	Communicative control	BACnet Application Specific Controller (B-ASC) BACnet IP, BACnet MS/TP (Details see separate document „PICS“) MP-Bus (Details see separate document „Data-Pool Values“)
	Positioning signal Y	DC 0...10 V
	Operating range Y	DC 2...10 V
	Operating range Y variable	DC 0.5...10 V
	Position feedback U	DC 2...10 V
	Position feedback U variable	DC 0...10 V DC 0.5...10 V
	Sound power level motor	45 dB(A)
	Adjustable flow rate Vmax	45...100% of Vnom
	Control accuracy	±10% (of 25...100% Vnom)
Functional data	Configuration	via integrated web server / ZTH EU
	Media	Cold and warm water, water with glycol up to max. 50% vol.
	Medium temperature	-10...120°C
	Permissible pressure ps	1600 kPa
	Closing pressure Δps	690 kPa
	Differential pressure Δpmax	340 kPa
	Flow characteristic	equal percentage (VDI/VDE 2178), optimised in the opening range (switchable to linear)
	Leakage rate	Leakage rate A, air-bubble-tight (EN 12266-1)
	Pipe connectors	Flange PN 16 according to EN 1092-2

Technical data

	Installation position	Upright to horizontal (in relation to the stem)
	Maintenance	Maintenance-free
	Manual override	Gear disengagement with push-button, can be locked
Flow measurement	Measuring principle	Magnetic inductive volumetric flow measurement
	Measuring accuracy	±6% (of 25...100% Vnom)
	Min. flow measurement	2.5% of Vnom
Temperature measurement	Measuring accuracy of the absolute temperature	± 0.6 °C @ 60 °C (PT1000 EN60751 Class B)
	Measuring accuracy of temperature difference	±0.23 K @ ΔT = 20 K
	Resolution	0.05 °C
Safety	Protection class IEC/EN	III Safety extra-low voltage
	Degree of protection IEC/EN	IP54 (for use of protective cap or grommet for RJ45 socket)
	EMC	CE according to 2004/108/EC
	Mode of operation	Type 1
	Rated impulse voltage supply / control	0.8 kV
	Control pollution degree	3
	Ambient temperature	-10...50 °C
	Non-operating temperature	-20...80 °C
	Ambient humidity	95% r.h., non-condensing
Materials	Housing	EN-JL1040 (GG25), with protective paint
	Measuring pipe	EN-GJS-500-7U (GGG50 with protective paint)
	Closing element	Stainless steel AISI 316
	Stem	Stainless steel AISI 304
	Stem seal	EPDM Perox
	Valve seat	PTFE, O-ring Viton
	Immersion sleeve	Stainless steel AISI 316Ti

Safety notes

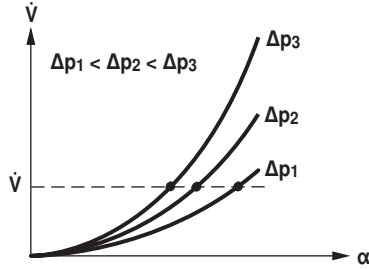


- This device has been designed for use in stationary heating, ventilation and air conditioning systems and is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Only authorised specialists may carry out installation. All applicable legal or institutional installation regulations must be complied during installation.
- The connection between the control valve and the measuring tube should not be separated.
- The device contains electrical and electronic components and is not allowed to be disposed of as household refuse. All locally valid regulations and requirements must be observed.

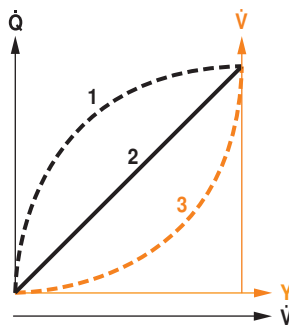
Product features

Mode of operation The actuator is comprised of four components: characterised control valve (CCV), measuring pipe with volumetric flow sensor, temperature sensors and the actuator itself. The adjusted maximum flow (\dot{V}_{max}) is assigned to the maximum positioning signal (typically 10 V / 100%). Alternatively, the positioning signal can be assigned to the valve opening angle or to the power required on the heat exchanger (see power control).
The actuator control can be either communicative or analogue. 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. The angle of rotation α varies according to the differential pressure through the final controlling element (see flow rate curves).

Flow rate curves



Flow characteristic of the characterised control valve Heat exchanger transmission behaviour
Depending on the construction, temperature spread, medium and hydraulic circuit, the power Q is not proportional to the water volumetric flow \dot{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 valve characteristic curve (Curve 3).



Power control Alternatively, the positioning signal Y can be assigned to the output power required on the heat exchanger.
Depending on the water temperature and air conditions, the Energy Valve ensures the amount of water required \dot{V} to achieve the desired power.

Maximum controllable power on heat exchanger in power control mode:

DN 65	700 kW
DN 80	1000 kW
DN 100	1700 kW
DN 125	2700 kW
DN 150	3800 kW

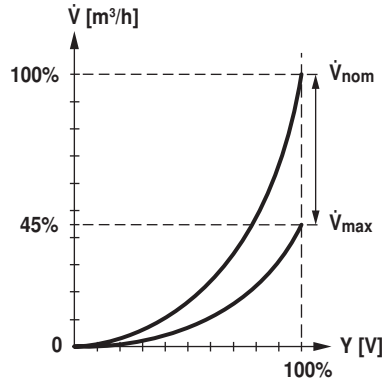
Control characteristics The specially configured control parameters in connection with the precise velocity sensor ensure a stable quality of control. They are however not suitable for rapid control processes, i.e. for domestic water control.

Product features

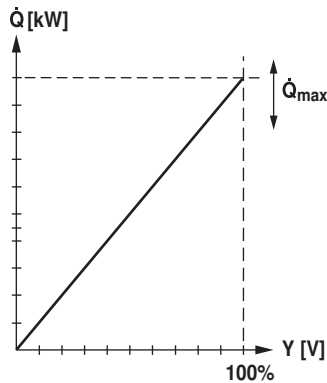
Definition of flow rate \dot{V}_{nom} is the maximum possible flow.

\dot{V}_{max} is the maximum flow rate which has been set with the greatest positioning signal, e.g. 10 V. \dot{V}_{max} can be set to between 45% and 100% of \dot{V}_{nom} .

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



Definition of power \dot{Q}_{max} is the set maximum power output on the heat exchanger (in power control mode)



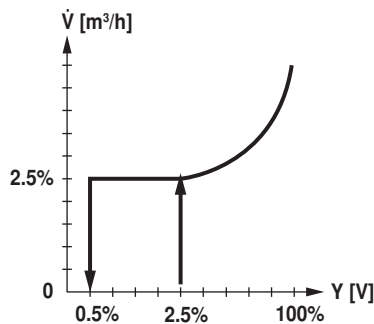
Creep flow suppression Given the very low flow speed in the opening point, this can no longer be measured by the sensor within the required tolerance. This range is overridden electronically.

Opening valve

The valve remains closed until the volumetric flow required by the positioning signal Y corresponds to 2.5% of \dot{V}_{nom} . The control along the valve characteristic curve is active after this value has been exceeded.

Closing valve

The control along the valve characteristic curve is active up to the required flow rate of 2.5% of \dot{V}_{nom} . Once the level falls below this value, the flow rate is maintained at 2.5% 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.



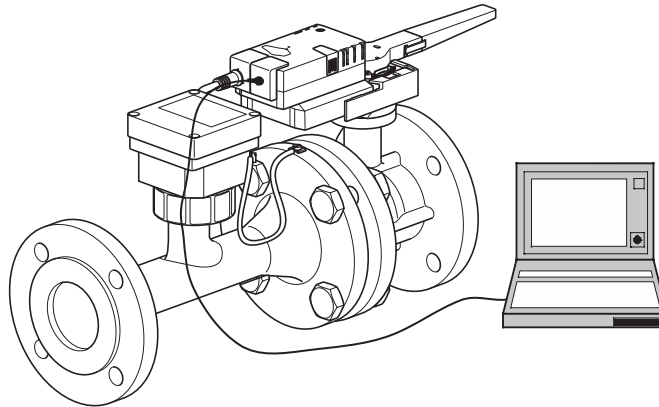
Product features

Communication The parameterisation 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»



Positioning signal inversion

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

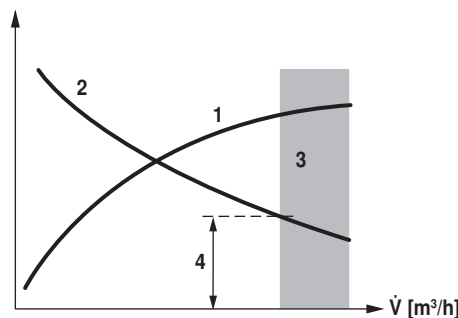
Hydraulic balancing

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 effectiveness. 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 control offers the user in addition 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.

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



Combination analogue - communicative

The integrated web server, BACnet IP, BACnet MS/TP or MP-Bus can be used for the communicative position feedback with conventional control by means of an analogue positioning signal. When the combination of positioning signal Y and communicative position feedback is used, it is imperative to ensure that the communicative path is used solely for data transfer from the Energy Valve to the higher-level management system. If the setpoint value is transferred communicatively via bus to the Energy Valve, then the analogue control will be automatically deactivated. This deactivation can be reversed by disconnecting the Energy Valve from the power supply.

Product features

- Power and energy monitoring function** The actuator 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 circulation on site. The sensors are used to record the medium temperature of the supply and return lines of the consumer (heat/cold register). As the water quantity is also known, thanks to the volumetric 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 (BACnet or MP-Bus).
- 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.
Download csv files through web browser.
- 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.
- Home position** The first time the supply voltage is switched on, i.e. at the time of commissioning, the actuator carries out an adaption, which is when the operating range and position feedback adjust themselves to the mechanical setting range.
After this process the actuator moves into the required position in order to ensure the flow rate defined by the positioning signal.

Accessories

	Description	Type
Electrical accessories	Stem heating flange ISO 5211, F05 (30W)	ZR24-F05
	Description	Type
Service Tools	Service Tool, for MF/MP/Modbus/LonWorks actuators and VAV-Controller	ZTH EU

Electrical installation

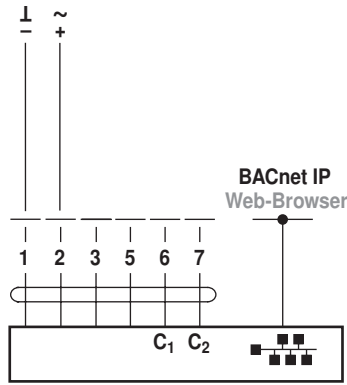


Notes

- Connection via safety isolating transformer.
- Parallel connection of other actuators possible. Observe the performance data.

Wiring diagrams

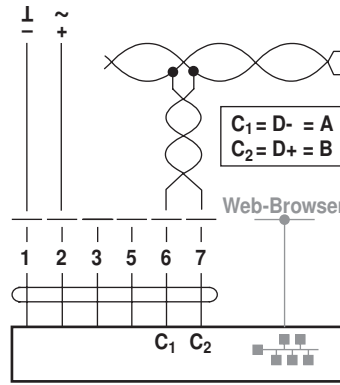
BACnet IP



Cable colours:

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

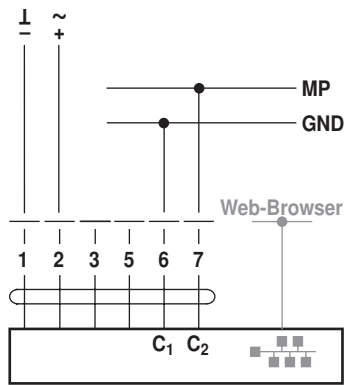
BACnet MS/TP



Cable colours:

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

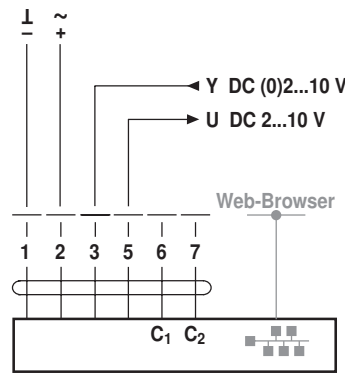
MP bus



Cable colours:

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

Conventional operation



Cable colours:

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



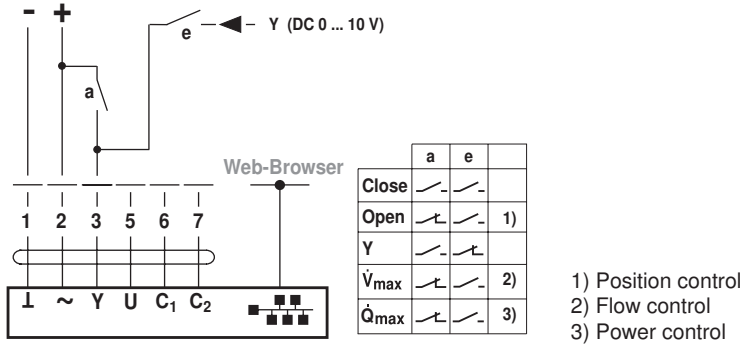
Connection of a notebook for parameterisation and manual control via RJ45.

Optional connection via RJ45 (direct connection Notebook / connection via Intranet or Internet) for access to the integrated webserver

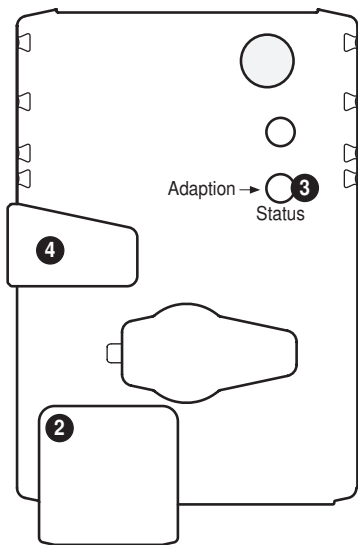
Functions

Functions for actuators with specific parameters (Parametrisation with web server necessary)

Override control and limiting with DC 24 V with relay contacts (only with conventional control)



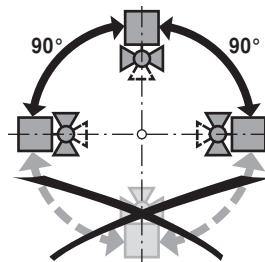
Operating controls and indicators



- 2 LED display green**
Off: No power supply or wiring errors
On: In operation
Flickering: Internal communication (Valve/Sensor)
- 3 Push-button and LED display yellow**
On: Adaptation process active
Press button: Triggers angle of rotation adaptation, followed by standard mode
- 4 Gear disengagement button**
Press button: Gear disengages, motor stops, manual override possible
Release button: Gear engages, synchronisation starts, followed by standard mode

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.

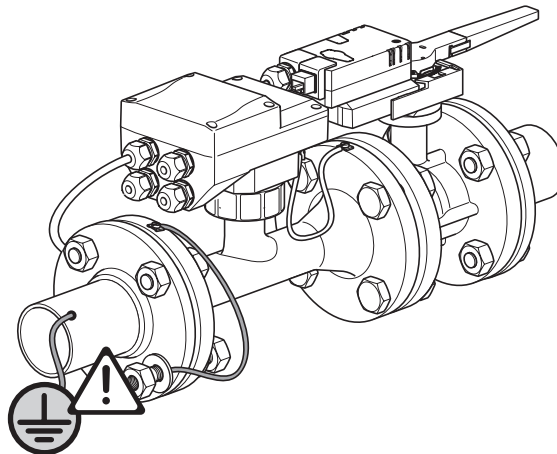


Installation position in return Installation in the return is recommended.

Installation notes

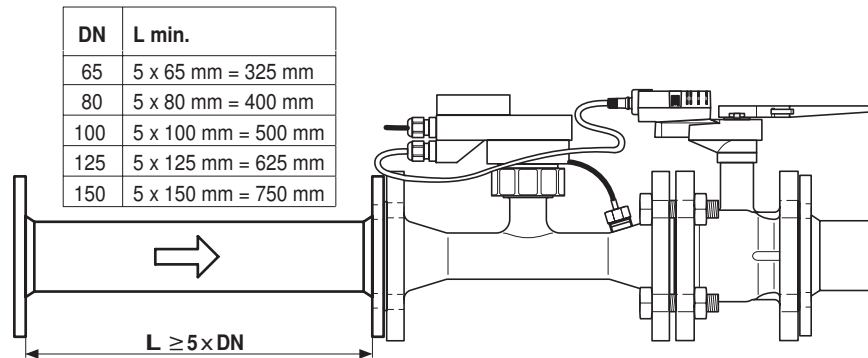
- Water quality requirements** The water quality requirements specified in VDI 2035 must be adhered to. Belimo valves are regulating devices. For the valves to function correctly in the long term, they must be kept free from particle debris (e.g. welding beads during installation work).
The installation of suitable strainer is recommended.
The water must exhibit a conductivity $\geq 20 \mu\text{S}/\text{cm}$ during operation for correct functioning. It should be noted that, under normal circumstances, even filling water with a lower conductivity will experience an elevation of its conductivity to above the minimum required value during filling and that the system can thus be put into operation.
Elevation of conductivity during filling caused by:
- untreated residual water from pressure test or pre-rinsing
- metal salts (e.g. surface rust) dissolved out of the raw material
- Stem heating** In cold water applications and warm humid ambient air can cause condensation in the actuators. This can lead to corrosion in the gear box of the actuator and causes a breakdown of it. In such applications, the use of a stem heating is provided.
The stem heating must be enabled only when the system is in operation, because it does not have temperature control.
- Maintenance** Ball valves, rotary actuators and sensors are maintenance-free.

Before any kind of service work is carried out on the actuator, it is essential to isolate the rotary actuator from the power supply (by unplugging the electrical cable). Any pumps in the part of the piping system concerned must also be switched off and the appropriate slide valves closed (allow everything to cool down first if necessary and 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 properly reassembled in accordance with the instructions and the pipeline has been refilled in the proper manner.
- 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.
- Earthing** It is imperative that the measuring pipe be correctly earthed in order to ensure that the volumetric flow sensor does not make any unnecessary incorrect measurements.



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 measuring pipe flange. Its dimensions should be at least 5x DN.



Installation of immersion sleeve and temperature sensor

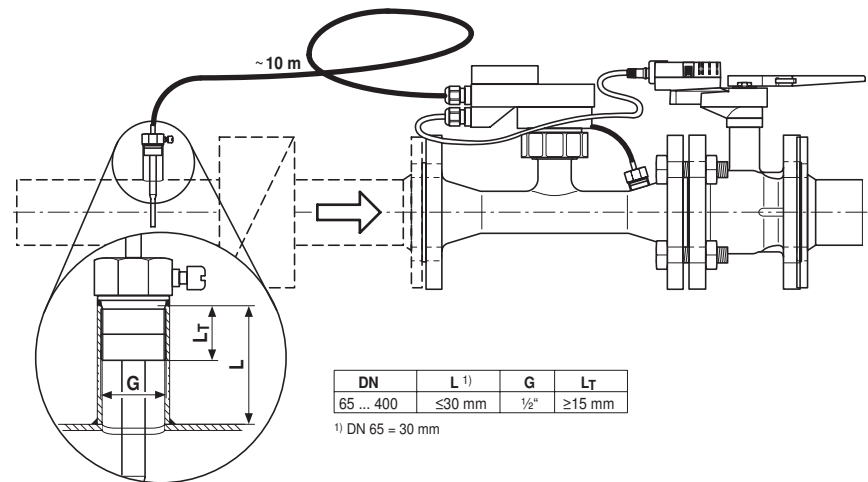
The valve is equipped with two temperature sensors:

- 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.

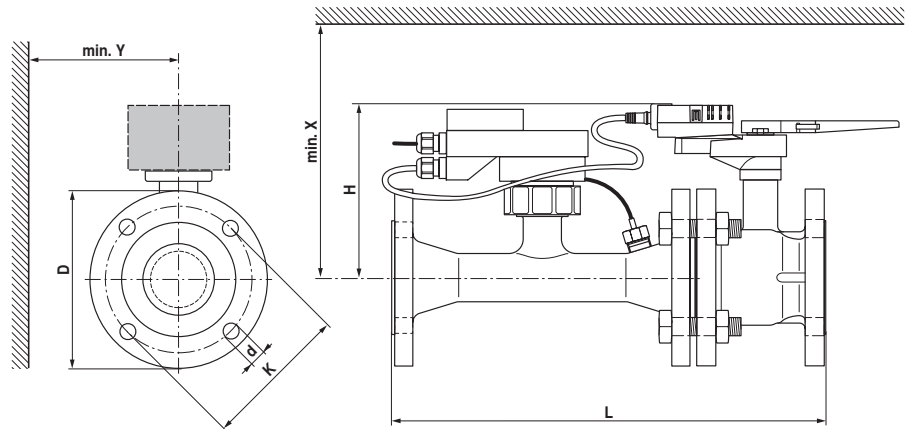
Note

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



Dimensions / Weight

Dimensional drawings



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

Type	DN []	L [mm]	H [mm]	D [mm]	d [mm]	K [mm]	X [mm]	Y [mm]	Weight approx. [kg]
P6065W800EV-BAC	65	454	200	185	4 x 19	145	220	150	27
P6080W1100EV-BAC	80	499	200	200	8 x 19	160	220	160	33
P6100W2000EV-BAC	100	582	220	229	8 x 19	180	240	175	44
P6125W3100EV-BAC	125	640	240	252	8 x 19	210	260	190	59
P6150W4500EV-BAC	150	767	240	282	8 x 23	240	260	200	75

General note

Valve selection The valve is determined using the maximum flow required \dot{V}_{max} . A calculation of the kvs value is not required.
 $\dot{V}_{max} = 45 \dots 100\%$ of \dot{V}_{nom}
 If no hydraulic data are available, then the same valve DN can be selected as the heat exchanger nominal diameter.

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

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

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

Example (DN100 with the desired maximum flow rate = 50% \dot{V}_{nom})

P6100W2000EV-BAC
 kvs theor. = 100 m³/h
 V_{nom} = 1200 l/min
 50% * 1200 l/min = 600 l/min = 36 m³/h

$$\Delta p_{min} = 100 \times \left(\frac{\dot{V}_{max}}{k_{vs \text{ theor.}}} \right)^2 = 100 \times \left(\frac{36 \text{ m}^3/\text{h}}{100 \text{ m}^3/\text{h}} \right)^2 = 13 \text{ kPa}$$

Further documentation

- General notes for project planning
- Instruction Webserver Belimo Energy Valve
- Description Data-Pool Values
- Description Protocol Implementation Conformance Statement PICS