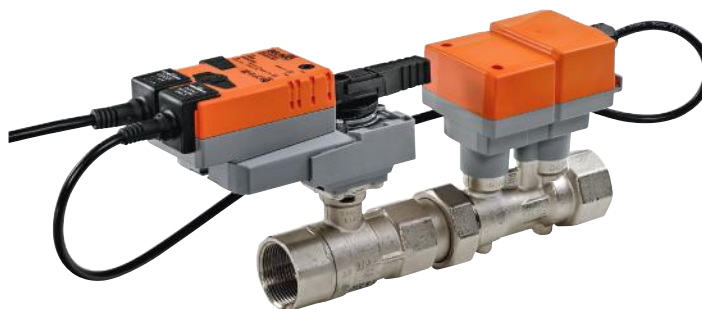


Characterised control valve (CCV) with sensor-operated flow control, 2-way, with internal thread

- Nominal voltage AC/DC 24V
- Control modulating
- For modulating water-side control of air handling units and heating systems
- Communication via Belimo MP-Bus or conventional control
- Conversion of (active) sensor signals and switching contacts



### Type overview

Model No.	Frequency [Hz]	$\dot{V}_{nom}$ [l/s]	$\dot{V}_{nom}$ [l/min]	kvs theor.* [m <sup>3</sup> /h]	DN [mm]	Rp ["]	PN [bar]	n(gl) [ ]
EP015R+MP	50/60	0.35	21	2.9	15	1/2	25	3.2
EP020R+MP	50/60	0.65	39	4.9	20	3/4	25	3.2
EP025R+MP	50/60	1.15	69	8.6	25	1	25	3.2
EP032R+MP	50/60	1.8	108	14.2	32	1 1/4	25	3.2
EP040R+MP	50/60	2.5	150	21.3	40	1 1/2	25	3.2
EP050R+MP	50/60	4.8	288	32.0	50	2	25	3.2
EP050R+MP-N	50/60	6.3	378	32.0	50	2	25	3.2

\* : Theoretical kvs value for pressure drop calculation

### Technical data

<b>Electrical data</b>	Nominal voltage	AC/DC 24V
	Nominal voltage frequency	50/60Hz
	Nominal voltage range	AC 19.2...28.8V / DC 21.6...28.8V
	Power consumption in operation	4.5W
	Power consumption in rest position	1.4W
	Power consumption for wire sizing	7VA
	Connection supply / control	Cable 1m, 4x 0.75mm <sup>2</sup>
	Parallel operation	Yes (note the performance data)
<b>Flow measurement</b>	Measuring principle	Ultrasonic volumetric flow measurement
	Measuring accuracy	±2% (of 25...100% $\dot{V}_{nom}$ at 20°C, Glycol 0% vol.)
	Min. flow measurement	0.5% of $\dot{V}_{nom}$
<b>Functional data</b>	Torque motor	5Nm (DN 15...25) / 10 Nm (DN 32 + 40) / 20Nm (DN 50)
	Positioning signal Y	DC 0...10V
	Operating range Y	DC 2...10V
	Operating range Y variable	Start point DC 0.5...24V End point DC 8.5...32V
	Position feedback U	DC 2...10V
	Position feedback U variable	Start point DC 0.5...8V End point DC 2...10V
	Sound power level motor max.	45dB(A)
	Adjustable flow rate Vmax	30...100% of $\dot{V}_{nom}$
	Control accuracy	±5% (of 25...100% $\dot{V}_{nom}$ at 20°C, Glycol 0% vol.)
	Media	Cold and hot water, water with glycol up to max. 60% vol.
	Media temperature	-10°C...120°C

## Technical data

<b>Functional data</b>	Closing pressure $\Delta p_s$	1380kPa
	Differential pressure $\Delta p_{max}$	350kPa
	Flow characteristic	Equal percentage (VDI/VDE 2178), linear
	Leakage rate	Air bubble-tight (Leakage rate A, EN12266-1)
	Pipe connections	Internal thread (ISO 7-1/ EN10226-1)
	Installation position	Upright to horizontal (in relation to the stem)
	Maintenance	Maintenance-free
	Manual override	Gear disengagement with push-button, can be locked
<b>Safety</b>	Running time	90s
	Protection class IEC/EN	III Safety extra-low voltage
	Degree of protection IEC/EN	IP54
	EMC	CE according to 2004/108/EC
	Mode of operation	Type 1
	Rated impulse voltage supply / control	0.8kV
	Control pollution degree	3
	Ambient temperature	-30...50°C
	Non-operating temperature	-40...80°C
	Ambient humidity	95% r.h., non-condensing
<b>Materials</b>	Housing	Brass body, nickel-plated
	Measuring pipe	Brass body, nickel-plated
	Ball	Stainless steel AISI 316
	Stem	Stainless steel AISI 304
	Stem seal	O-ring EPDM

## Safety notes

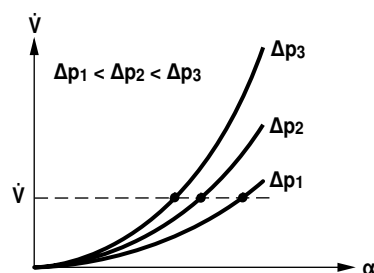


- The device has been designed for use in stationary heating, ventilation and air conditioning systems and is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Only authorised specialists may carry out installation. All applicable legal or institutional installation regulations must be complied with 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 three components: characterised control valve (CCV), measuring pipe with volumetric flow sensor and the actuator itself. The adjusted maximum flow ( $\dot{V}_{max}$ ) is assigned to the maximum positioning signal (typically 10V/100%). 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  $\alpha$  varies according to the differential pressure through the final controlling element (see volumetric flow curves).

Flow rate curves

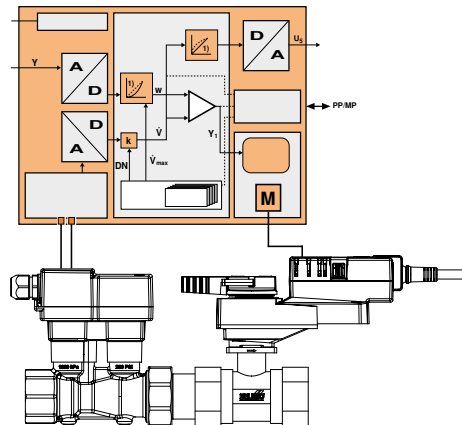


**Product features**

**Control characteristics**

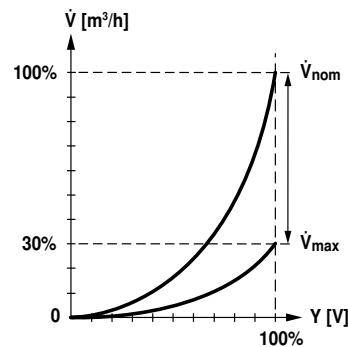
The velocity of the medium is measured in the measuring component (sensor electronics) and converted to a flow rate signal. The positioning signal Y corresponds to the power Q via the exchanger, the volumetric flow is regulated in the EPIV. The control signal Y is converted into an equal-percentage characteristic curve and provided with the  $\dot{V}_{max}$  value as the new reference variable w. The momentary control deviation forms the positioning signal Y1 for the actuator. The specially configured control parameters in connection with the precise flow rate 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 volumetric flow as voltage (factory setting). As an alternative, U5 can be used for displaying the valve opening angle.

Block diagram



**Definitions**

$\dot{V}_{nom}$  is the maximum possible flow.



$\dot{V}_{max}$  is the maximum flow rate which has been set with the greatest positioning signal, e.g. 10V.  $\dot{V}_{max}$  can be set to between 30% and 100% of  $\dot{V}_{nom}$ .

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

**Creep flow suppression**

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

**Opening valve**

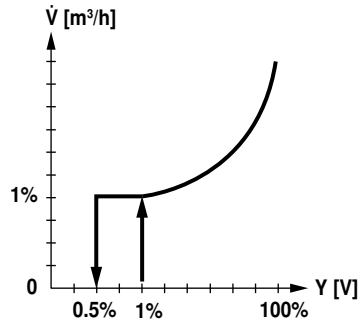
The valve remains closed until the volumetric flow required by the positioning signal Y corresponds to 1% of  $\dot{V}_{nom}$ . The control along the valve characteristic curve is active after this value has been exceeded.

**Closing valve**

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

**Product features**

**Creep flow suppression**



**Converter for sensors**

Connection option for a sensor (active sensor or switching contact). The MP actuator serves as an analogue/digital converter for the transmission of the sensor signal via MP-Bus to the higher level system.

**Adjustable-parameter actuators**

The factory settings cover the most common applications. Individual parameters can be altered with the Belimo service tool MFT-P or with the service tool ZTH AP.

**Positioning signal inversion**

This can be inverted in cases of control with 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**

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.

**Manual override**

Manual override with push-button possible - temporary, permanently. The gear is disengaged and the actuator decoupled for as long as the button is pressed / latched.

**High functional reliability**

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

**Home position**

The actuator moves to the home position when the supply voltage is switched on for the first time, i.e. at the time of commissioning or after pressing the "gear disengagement" key. The actuator then moves into the required position in order to ensure the flow rate defined by the positioning signal.

**Accessories**

	Description	Type
<b>Electrical accessories</b>	Gateway MP to KNX/EIB, AC/DC 24 V, EIBA certified	UK24EIB
	Gateway MP for LonWorks®, AC/DC 24 V, LonMark-certified	UK24LON
	Gateway MP to Modbus RTU, AC/DC 24 V	UK24MOD
	Gateway MP to BACnet MS/TP, AC/DC 24 V	UK24BAC
<b>Service Tools</b>	Service tool, for MF/MP/Modbus/LonWorks actuators and VAV controller	ZTH AP
	Belimo PC-Tool, software for adjustments and diagnostics	MFT-P

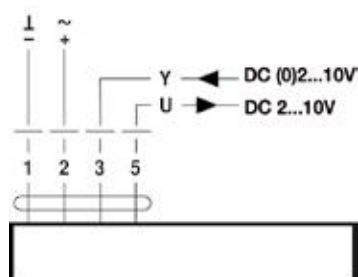
**Electrical installation**

**Notes**

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

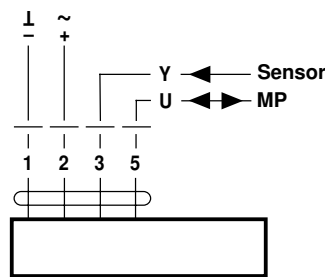
**Wiring diagrams**

**AC/DC 24 V, modulating**



**Cable colours:**  
 1 = black  
 2 = red  
 3 = white  
 5 = orange

**Operation on the MP-Bus**

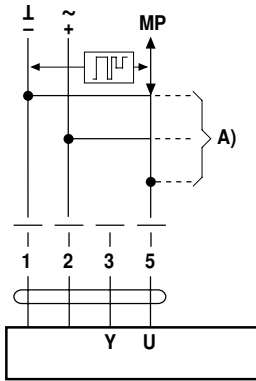


**Cable colours:**  
 1 = black  
 2 = red  
 3 = white  
 5 = orange

**Functions**

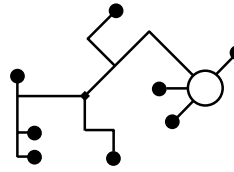
**Functions when operated on MP-Bus**

**Connection on the MP-Bus**



A) Additional actuators and sensors (max. 8)

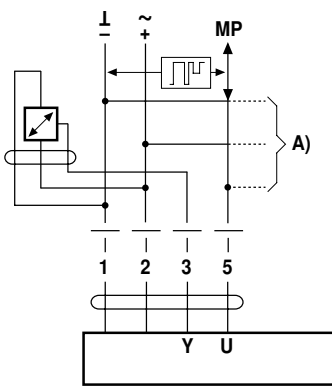
**Power topology**



There are no restrictions for the network topology (star, ring, tree or mixed forms are permitted). Supply and communication in the same 3-wire cable

- no shielding or twisting required
- no terminating resistor required

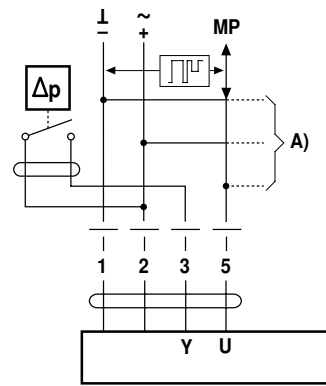
**Connection of active sensors**



A) Additional actuators and sensors (max. 8)

- Supply AC/DC 24V
- Output signal DC 0 ... 10V (max. DC 0 ... 32V)
- Resolution 30mV

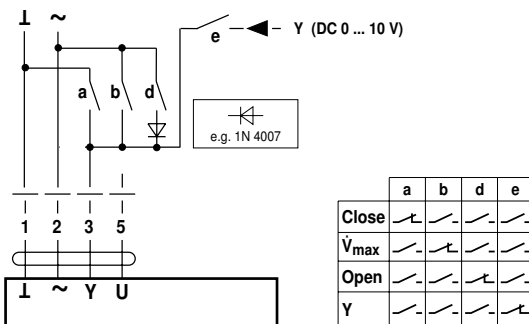
**Connection of external switching contact**



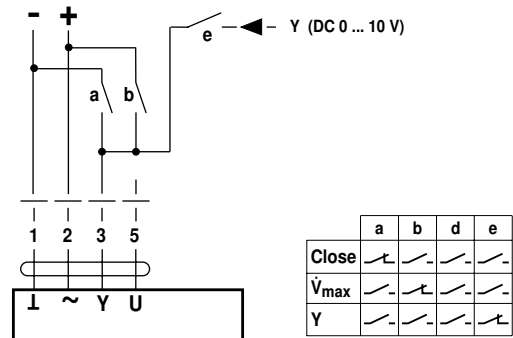
A) Additional actuators and sensors (max. 8)

- Switching current 16 mA @ 24V
- Start point of the operating range must be parameterised on the MP actuator as  $\geq 0.6$  V

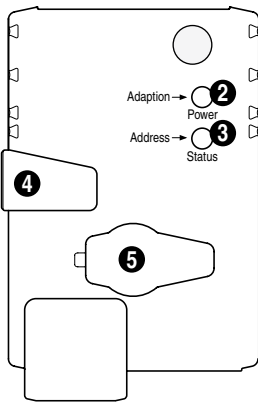
**Functions for actuators with specific parameters**  
**Override control and limitation with AC 24 V with relay contacts**



**Override control and limitation with DC 24 V with relay contacts**



**Operating controls and indicators**



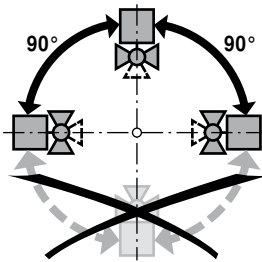
- ② Pushbutton and green LED display**  
 Off: No voltage supply or malfunction  
 Illuminated: Operation  
 Press button: Switches on angle of rotation adaption followed by standard operation
- ③ Pushbutton and yellow LED display**  
 Off: Standard operation without MP-Bus  
 Illuminated: Adaption or synchronising process active  
 Blinking: Addressing request sent to MP master  
 Press button: Acknowledgment of addressing  
 Flickering: MP communication active
- ④ Gear disengagement switch**  
 Press button: Gear disengaged, motor stops, manual operation possible  
 Release button: Gear engaged, synchronisation starts, followed by standard operation
- ⑤ Service plug**  
 For connecting parameterising and service tools

**Check voltage supply connection**

- ② Off and ③ illuminated: Check the supply connections.  
 Possibly  $\perp$  and  $\nabla$  are swapped over.

**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.

**Water quality requirements** The water quality requirements specified in VDI 2035 must be adhered to. Ball valves are regulating devices. The use of dirt filters is recommended in order to prolong their service life for performing control tasks.

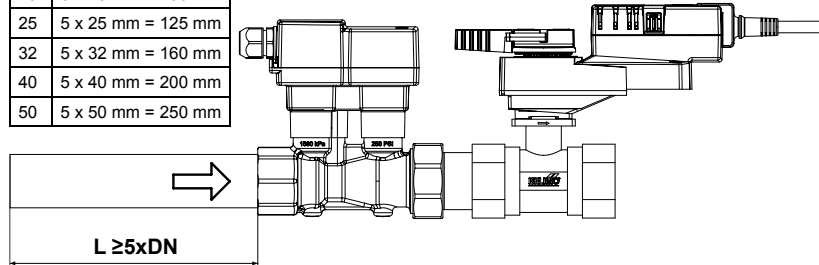
**Maintenance** Ball valves, rotary actuators and sensors are maintenance-free.  
 Before any kind of service work is carried out on the actuator, it is essential to isolate the rotary actuator from the power supply (by disconnecting the electrical cable). Any pumps in the part of the piping system concerned 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 pipelines have 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.

**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 must be at least 5 x DN.

DN	L min.
15	5 x 15 mm = 75 mm
20	5 x 20 mm = 100 mm
25	5 x 25 mm = 125 mm
32	5 x 32 mm = 160 mm
40	5 x 40 mm = 200 mm
50	5 x 50 mm = 250 mm



**General information**

**Valve design**

The valve is determined using the maximum flow required  $\dot{V}_{max}$ . A calculation of the kvs value is not required.  
 $\dot{V}_{max} = 30 \dots 100\%$  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 via 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 (DN25 with the desired maximum flow rate = 50%  $\dot{V}_{nom}$ )

EP025R+MP  
 kvs theor. = 8.6 m<sup>3</sup>/h  
 $\dot{V}_{nom} = 69 \text{ l/min}$   
 50% \* 69 l/min = 34.5 l/min = 2.07 m<sup>3</sup>/h

$$\Delta p_{min} = 100 \times \left( \frac{\dot{V}_{max}}{k_{vs \text{ theor.}}} \right)^2 = 100 \times \left( \frac{2.07 \text{ m}^3/\text{h}}{8.6 \text{ m}^3/\text{h}} \right)^2 = 6 \text{ kPa}$$

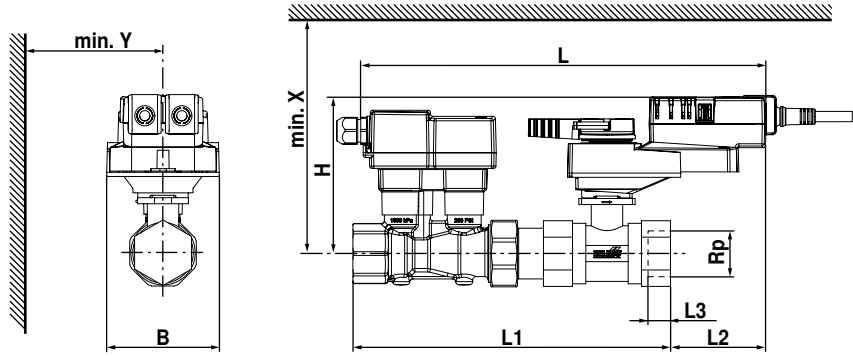
Example (DN100 with the desired maximum flow rate = 50%  $\dot{V}_{nom}$ )

P6100W2000E-MP  
 kvs theor. = 115 m<sup>3</sup>/h  
 $\dot{V}_{nom} = 1200 \text{ l/min}$   
 50% \* 1200 l/min = 600 l/min = 36 m<sup>3</sup>/h

$$\Delta p_{min} = 100 \times \left( \frac{\dot{V}_{max}}{k_{vs \text{ theor.}}} \right)^2 = 100 \times \left( \frac{36 \text{ m}^3/\text{h}}{115 \text{ m}^3/\text{h}} \right)^2 = 10 \text{ kPa}$$

Dimensions [mm] / weight

Dimensional drawings



Type	DN [mm]	L [mm]	L1 [mm]	L2 [mm]	L3 [mm]	B [mm]	H [mm]	X [mm]	Y [mm]	Weight approx. [kg]
EP015R+MP	15	275	192	81	13	75	125	195	77	1.5
EP020R+MP	20	291	211	75	14	75	125	195	77	1.8
EP025R+MP	25	295	230	71	16	75	127	197	77	2.0
EP032R+MP	32	323	255	68	19	85	131	201	77	2.8
EP040R+MP	40	325	267	65	19	85	141	211	77	3.3
EP050R+MP	50	343	288	69	22	95	142	212	77	4.4
EP050R+MP-N	50	343	288	69	22	95	142	212	77	4.4