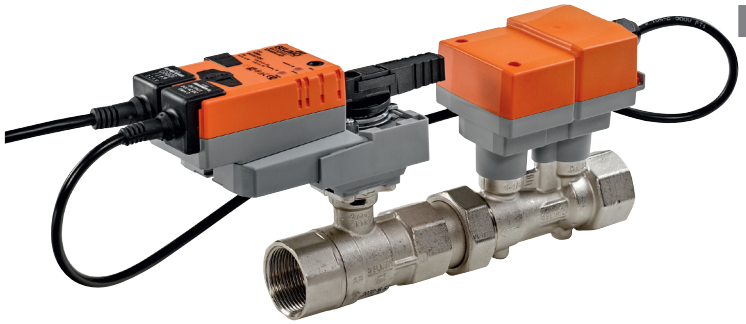
BELIMO

Technical data sheet EP..R+MP

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

- **Nominal voltage AC/DC 24 V**
- **Control modulating**
- **For closed cold and hot water systems**
- **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**



MP-BUS

Type overview

Type	Vnom [l/s]	Vnom [l/min]	kvs theor. [m³/h]	DN [ ]	DN [“]	ps [kPa]	n(gl) [ ]
EP015R+MP	0.35	21	2.9	15	1/2	1600	3.2
EP020R+MP	0.65	39	4.9	20	3/4	1600	3.2
EP025R+MP	1.15	69	8.6	25	1	1600	3.2
EP032R+MP	1.8	108	14.2	32	1 1/4	1600	3.2
EP040R+MP	2.5	150	21.3	40	1 1/2	1600	3.2
EP050R+MP	4.8	288	32.0	50	2	1600	3.2

kvs theor.: Theoretical kvs value for pressure drop calculation

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Operating range	AC 19.2...28.8 V / DC 21.6...28.8 V
	Power consumption in operation	DN 15...25 3.5 W / DN 32...50 4.5 W
	Power consumption in rest position	DN 15...25 1.3 W / DN 32...50 1.4 W
	Power consumption for wire sizing	DN 15...25 6 VA / DN 32...50 7 VA
	Connection supply / control	Cable 1 m, 4x 0.75 mm²
	Parallel operation	Yes (note the performance data)
Functional data	Torque motor	5 Nm (DN 15...25) / 10 Nm (DN 32 + 40) / 20 Nm (DN 50)
	Positioning signal Y	DC 0...10 V
	Operating range Y	DC 0.5...10 V
	Operating range Y variable	Start point DC 0.5 ... 24 V End point DC 8.5...32 V
	Position feedback U	DC 0.5...10 V
	Position feedback U variable	Start point DC 0.5 ... 8 V End point DC 2 … 10 V
	Sound power level motor max.	45 dB(A)
	Adjustable flow rate Vmax	30...100% of V̇nom
	Control accuracy	±10% (of 25...100% V̇nom)
	Control accuracy note	±6% (of 25...100% V̇nom) at 20°C / Glycol 0% vol.
	Media	Cold and hot water, water with glycol up to max. 50% vol.
	Medium temperature	-10°C...120°C
	Closing pressure Δps	1400 kPa
	Differential pressure Δpmax	350 kPa
	Differential pressure note	200 kPa for low-noise operation
	Flow characteristic	Equal percentage (VDI/VDE 2178), optimised in the opening range (can be switched to linear)
	Leakage rate	Air bubble-tight (Leakage rate A, EN12266-1)
	Pipe connections	Internal thread in accordance with ISO 7-1
	Installation position	Upright to horizontal (in relation to the stem)
	Maintenance	Maintenance-free
	Manual override	Gear disengagement with push-button, can be locked

Technical data

Flow measurement	Measuring principle	Ultrasonic volumetric flow measurement
	Measuring accuracy	±6% (of 25...100% V̇nom)
	Measuring accuracy note	±2% (of 25...100% V̇nom) at 20°C / Glycol 0% vol.
	Min. flow measurement	1% of V̇nom
Safety	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	0.8 kV
	Control pollution degree	3
	Ambient temperature	-30...50°C
	Non-operating temperature	-40...80°C
	Ambient humidity	95% r.h., non-condensing
Materials	Housing	Brass body, nickel-plated
	Measuring pipe	Brass body, nickel-plated
	Valve cone	Stainless steel
	Stem	Stainless steel
	Stem seal	O-ring EPDM
	Valve seat	PTFE, O-ring EPDM
	Characterising disk	TEFZEL

Safety notes

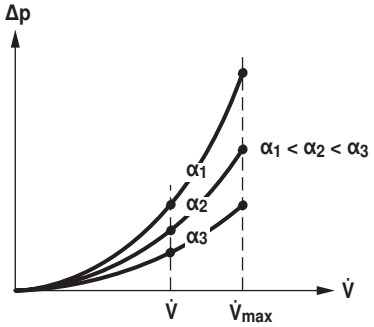
- The device has been designed for use in stationary heating, ventilation and air conditioning systems and is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Only authorised specialists may carry out installation. 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 (V̇max) is assigned to the maximum positioning signal (typically 10 V / 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 α varies according to the differential pressure through the final controlling element (see volumetric flow curves).

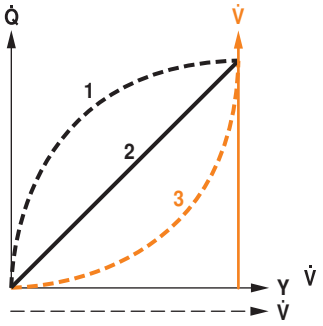
Flow rate curves



Product features

Flow characteristic of the characterised control valve

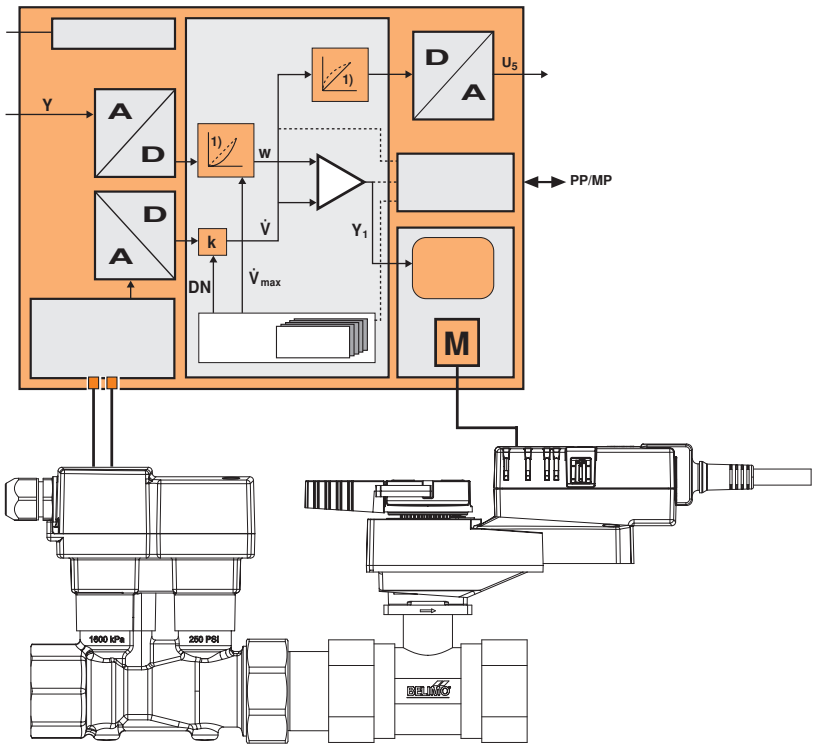
Heat exchanger transfer response
Depending on the construction, temperature spread, medium and hydraulic circuit, the power Q is not proportional to the volumetric flow of the water V̇ (curve 1). With the classical type of temperature control, an attempt is made to maintain the control signal Y proportional to the power Q (Curve 2) and is achieved by means of an equal-percentage valve characteristic curve (Curve 3).



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 V̇max 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



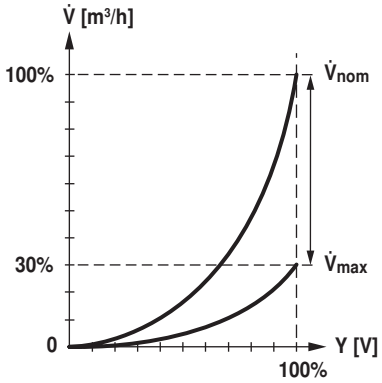
Product features

Definitions

V̇nom is the maximum possible flow.

V̇max is the maximum flow rate which has been set with the greatest positioning signal, e.g. 10 V. V̇max can be set to between 30% and 100% of V̇nom.

V̇min 0% (non-variable).

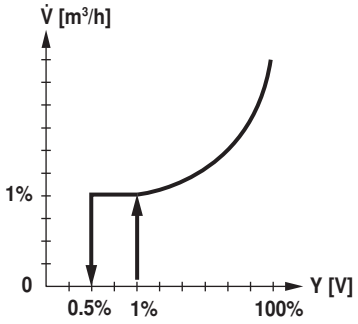


Creep flow suppression

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 V̇nom. 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 V̇nom. Once the level falls below this value, the flow rate is maintained at 1% of V̇nom. If the level falls below the flow rate of 0.5% of V̇nom required by the reference variable Y, then the valve will close.



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 EU.

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 V̇max or Qmax, 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.

Product features

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
Electrical accessories	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
Service Tools	Service tool, for MF/MP/Modbus/LonWorks actuators and VAV controller	ZTH EU
	Belimo PC-Tool, software for adjustments and diagnostics	MFT-P

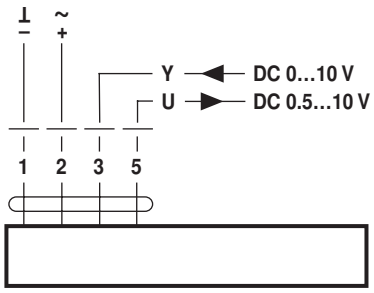
Electrical installation

Notes

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

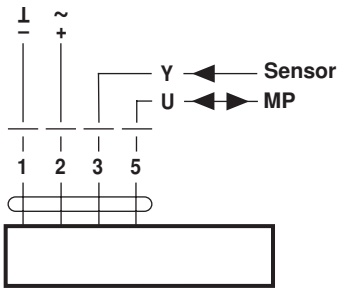
Wiring diagrams

AC/DC 24 V, modulating



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

Operation on the MP-Bus



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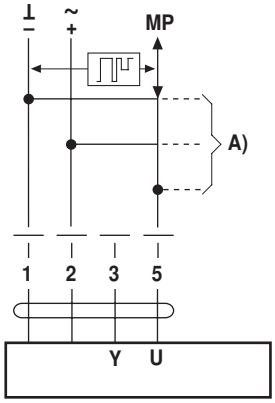
Functions

Functions when operated on MP-Bus

Connection on the MP-Bus



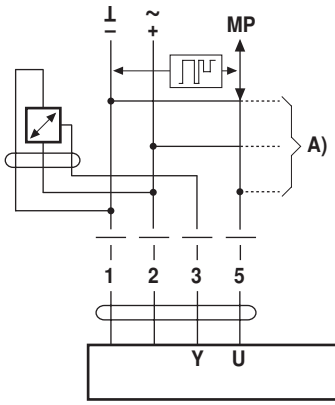
A) Additional actuators and sensors (max. 8)

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 resister required

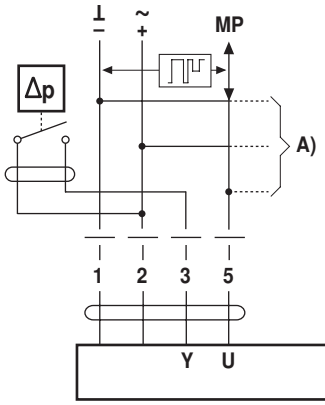
Functions

Connection of active sensors



A) Additional actuators and sensors (max. 8)
- Supply AC/DC 24 V
- Output signal DC 0 ... 10 V (max. DC 0 ... 32 V)
- Resolution 30 mV

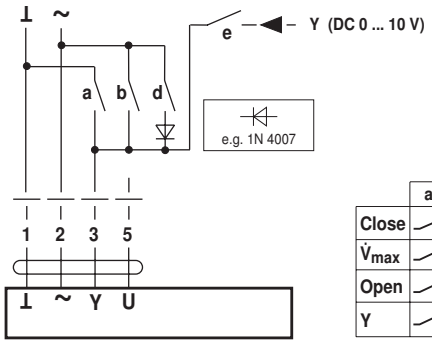
Connection of external switching contact



A) Additional actuators and sensors (max. 8)
- Switching current 16 mA @ 24 V
- Start point of the operating range must be parameterised on the MP actuator as ≥ 0.6 V

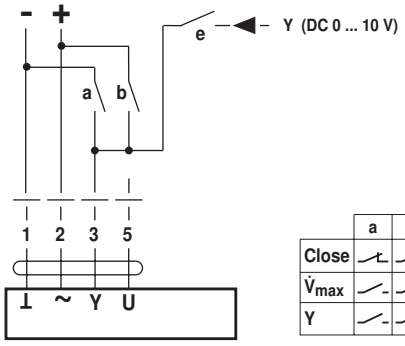
Functions for actuators with specific parameters

Override control and limitation with AC 24 V with relay contacts



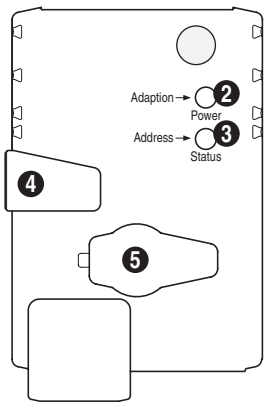
	a	b	d	e
Close	t	–	–	–
$\dot{V}_{max}$	–	t	–	–
Open	–	–	t	–
Y	–	–	–	t

Override control and limitation with DC 24 V with relay contacts



	a	b	d	e
Close	t	–	–	–
$\dot{V}_{max}$	–	t	–	–
Y	–	–	–	t

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

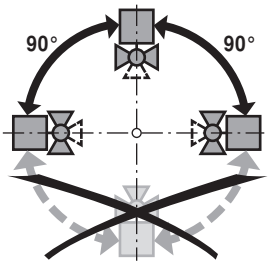
Check voltage supply connection

② Off and ③ illuminated: Check the supply connections.
Possibly ⏚ and ⏦ 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.

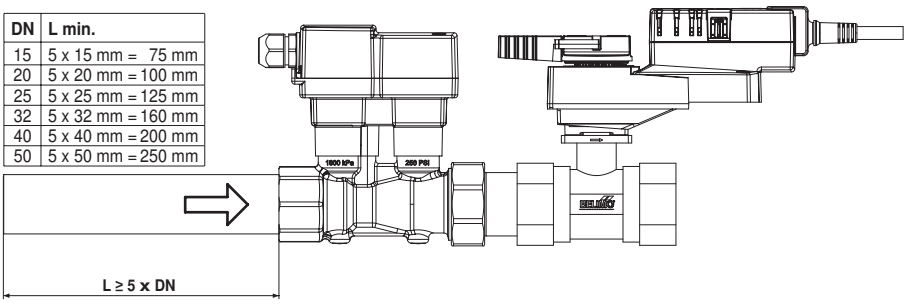
Flow direction

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.

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 V̇max.
A calculation of the kvs value is not required.
V̇max = 30…100% of V̇nom
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 V̇max 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 V̇max. Higher differential pressures are compensated for automatically by the valve.

Formula

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

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

General information

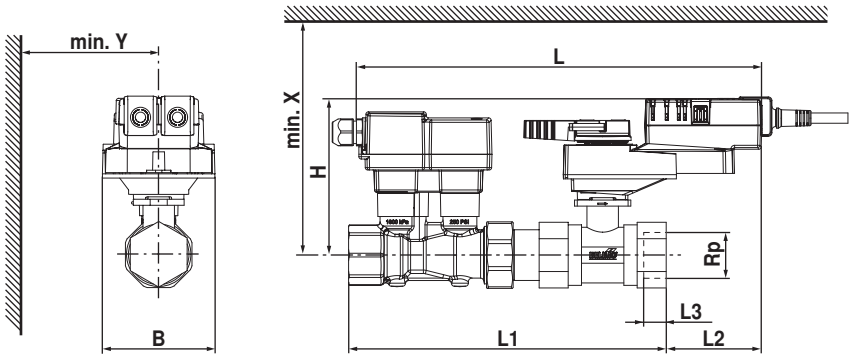
Example (DN25 with the desired maximum flow rate = 50% V̇nom)

EP025R+MP
kvs theor. = 8.6 m^3/h
V̇nom = 69 l/min
50% * 69 l/min = 34.5 l/min = 2.07 m^3/h

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

Dimensions [mm] / weight

Dimensional drawings



Type	DN [ ]	L [mm]	L1 [mm]	L2 [mm]	L3 [mm]	B [mm]	H [mm]	X [mm]	Y [mm]	Weight approx. [kg]
EP015R+MP	15	276	191	81	13	75	125	195	77	1.5
EP020R+MP	20	283	203	75	14	75	125	195	77	1.8
EP025R+MP	25	296	231	71	16	75	127	197	77	2.0
EP032R+MP	32	322	254	68	19	75	131	201	77	2.8
EP040R+MP	40	332	274	65	19	75	141	211	77	3.3
EP050R+MP	50	339	284	69	22	75	142	212	77	4.4

Further documentation

- General notes for project planning