BELIMO

Technical data sheet P6..W..-C24E

Characterised control valve (CCV) with adjustable flow rate and sensor-operated flow control, 2-way, with flange PN 16

- **For closed cold and warm water systems**
- **For modulating water-side control of air purification and heating systems**
- **Nominal voltage AC/DC 24V**
- **Control: modulating DC 0.5 ... 10V or variable**
- **Position feedback: DC 0.5 ... 10V or variable**
- **Communication via BELIMO MP-Bus**
- **Conversion of (active) sensor signals**

Type overview

Type	$\dot{V}_{nom}$ [l/s]	$\dot{V}_{nom}$ [l/min]	k_{vs} [1)] [m³/h]	DN [mm]	DN [inches]	Δp_{max} [kPa]	p_s [kPa]	n(gl)	S_v
P6065W800-C24E	8	480	45	65	2 ½"	340	1600	3.2	>100
P6080W1100-C24E	11	660	65	80	3"	340	1600	3.2	>100
P6100W2000-C24E	20	1200	110	100	4"	340	1600	3.2	>100
P6125W3125-C24E	31.25	1875	170	125	5"	340	1600	3.2	>100
P6150W4500-C24E	45	2700	270	150	6"	340	1600	3.2	>100

1) Theoretical k_{vs} value for pressure drop calculation.

Technical data

Electrical data	Nominal voltage	AC 24 V, 50 Hz / DC 24 V
	Nominal voltage range	AC 19.2 ... 28.8 V / DC 21.6 ... 28.8 V
	Power consumption Operation	8.5 W (DN 65 ... 100) / 9 W (DN 125 ... 150)
	At rest	5.75 W (DN 65 ... 100) / 6.5 W (DN 125 ... 150)
	Dimensioning	11 VA (DN 65 ... 100) / 12 VA (DN 125 ... 150)
	Connection	Cable 1 m, 4 x 0.75 mm²
Functional data	Torque (nominal torque)	20 Nm (DN 65 ... 100) / 40 Nm (DN 125 ... 150)
	Control Control signal Y	DC 0 ... 10 V, typical input impedance 100 kΩ
	Operating range	DC 0.5 ... 10 V
	Adjustable flow rate $\dot{V}_{max}$	See «Type overview»
	Parameterisation setting	see page 7
	Position feedback	DC 0.5 ... 10 V, max. 1 mA (measuring voltage U)
	Manual override	Gearing latch with push-button (temporary-permanent)
	Running time	90 s / 90°
	Sound power level, actuator	45 dB (A)
	Position indication	Mechanical, plug-in
Safety	Protection class	**III** Extra low voltage / UL Class 2 Supply
	Degree of protection	IP54 in any mounting position NEMA 2, UL Enclosure Type 2
	EMC	CE according to 2004/108/EC
	Certification Actuator	cULus according to UL 60730-1A and UL 60730-2-14 and CAN/CSA E60730-1:02 Certified to IEC/EN 60730-1 and IEC/EN 60730-2-14
	Sensor	UL 2043
	Mode of operation	Type 1
	Rated impulse voltage	0.8 kV
	Control pollution degree	3
	Ambient temperature	–10°C ... +50°C
	Non-operating temperature	–20°C ... +80°C
	Ambient humidity	95% r.h., non-condensating
	Maintenance	Maintenance-free

Technical data *(continued)*

Functional data control valve sensor unit	Media	Cold and low temperature hot water, Water with max. 50% volume of glycol
	Medium temperature	– 2°C ... +120°C in the characterised control valve (CCV)
	Allowed working pressure p_s Differential Pressure Δp_{max}	See «Type overview» See «Type overview»
	Flow characteristic	Equal percentage (in accordance with VDI/VDE 2178) n(gl): see «Type overview», Optimised in the opening range
	Rangeability S_v	See «Type overview»
	Leakage rate	A: air bubble-tight (in accordance with EN 12266-1)
	Pipe connectors	Flange PN 16 (in accordance with EN 1092/1)
	Closing pressure Δp_s	690 kPa
	Min. pressure loss, valve	22 kPa @ $\dot{V}_{nom}$
	Angle of rotation	90°∢
	Installation position	Standing to lying (in relation to the stem)
	Maintenance	Maintenance-free
Materials	Fitting	EN-JL1040 (GG25 with protective paint)
	Valve cone	Stainless steel AISI 316
	Stem	Stainless steel AISI 304
	Stem seal	EPDM Perox
	Ball seat	PTFE, O-ring Viton
	Characterising disk	Stainless Steel
Standards	Pressure equipment directive	97/23/EC
Flow measurement	Measuring principle	Magnetic inductive medium speed measurement
	Measuring accuracy	±6% (of 25% ... 100% $\dot{V}_{nom}$)
	Control accuracy	±10%
	Min. flow measurement	2.5% @ $\dot{V}_{nom}$
	Measuring pipe	EN-GJS-500-7U (GGG50 with protective paint)
	Max. pressure drop measuring pipe	<20 kPa @ $\dot{V}_{nom}$
Dimensions / weights	See «Dimensions and weights» on page 8	

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.**
- **It may only be installed by suitably trained personnel. Any legal regulations or regulations issued by authorities must be observed during installation.**
- **The device may only be opened at the manufacturer's site. It does not contain any parts that can be replaced or repaired by the user.**
- **The connection between the control valve and the measuring tube should not be separated.**
- **The cable must not be removed from the device.**
- **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.**

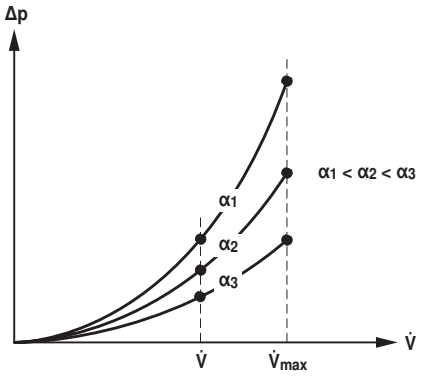
Product features

Mode of operation

The actuator is comprised of 3 components: characterised control valve (CCV), measuring pipe with medium velocity sensor and the actuator itself. First of all, the maximum flow rate ($\dot{V}_{max}$) is set on the actuator, whereby $\dot{V}_{max}$ is permitted to represent 45% to 100% of the greatest possible flow rate $\dot{V}_{nom}$. At the same time, the $\dot{V}_{max}$ value is assigned to the maximum control signal (typically 10V). Because of the fact that the characterised control valve (CCV) exhibits an equal percentage valve characteristic curve, the control signal for the flow rate is also depicted in equal percentages, i.e. 70% of the control signal corresponds to 38% of the $\dot{V}_{max}$ value.
In conventional operation, the actuator is connected to a standard DC 0.5 ... 10V signal. The medium flows in the measuring pipe with a velocity of > 0 to 2 m/s, is detected by the sensor and is applied as the flow value. The standard signal is compared in the actuator with the measured flow value. Depending on the deviation, the actuator moves the ball of the characterised control valve (CCV) into the required position and acts as a throttling device. The angle of rotation α varies, depending on the differential pressure, by means of the final controlling element (see Flow rate curves).

Product features *(continued)*

Flow rate curves



The angle of rotation (α) varies according to the differential pressure (Δp) and the required flow rate (V̇).

Converter for sensors

Connection option for a sensor (passive or 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.

Parameterisable actuators

The factory settings cover the most common applications. Input and output signals and other parameters can be altered with the ZTH-GEN or the BELIMO Service Tool, MFT-P.

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-proof, requires no limit switches and automatically stops when the end stop is reached.

Home position

When the supply voltage is switched on for the first time, i.e. at commissioning or after pressing the "gear disengagement" switch, the actuator moves to the home position.
Factory default: Y2 (counter-clockwise rotation)
The actuator then moves into the position defined by the control signal.

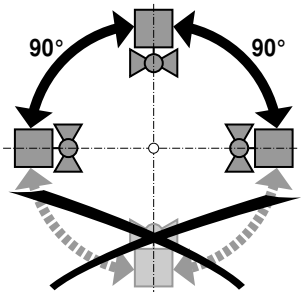
Hydraulic balancing

With the ZTH-GEN, the maximum flow rate can be adjusted on-site, simply and reliably, in less than 10 seconds. If the actuator is integrated in the management system via MP, then the balancing can be handled by the management system.

Installation notes

Recommended installation positions

The actuator can be installed **standing** to **lying**.
The characterised control valve (CCV) 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.
- Ball valves are sensitive control devices. The use of **dirt filters** is recommended in order to prolong their service life as modulating instruments.
- Minimal medium conductivity >20 µs/cm (completely desalinated or demineralised fill-up water is not permissible).

Maintenance

- Ball valves and rotary actuators are maintenance-free.
- Before any kind of service work is carried out, it is essential to isolate the rotary actuator from the power supply (by disconnecting the power lead). Any pumps in the part of the piping system concerned must also be switched off and the appropriate isolating fittings closed (allow everything to cool down first if necessary and reduce the pressure in the system to ambient levels).
- 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.

Direction of flow

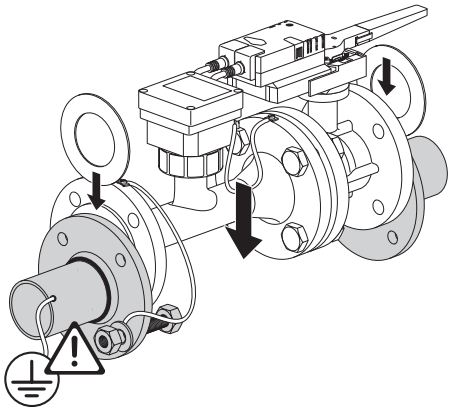
The direction of flow, specified by an arrow on the housing, is to be complied with, since otherwise the flow rate will be measured incorrectly.

Installation notes

(continued)

Earthing

It is imperative that the measuring pipe be correctly earthed in order to ensure that the medium velocity sensor does not make any unnecessary incorrect measurements.



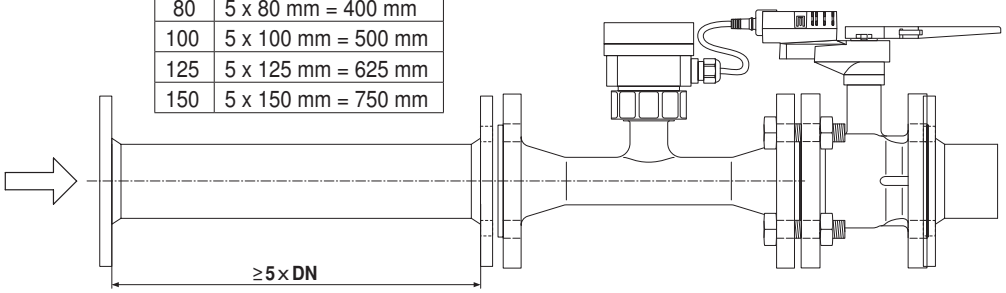
Installation in the return

As a general rule, the device is to be installed in the return.

Inlet section

In order to achieve the desired measurement tolerance, 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 5 x DN.

DN	Inlet section
65	5 x 65 mm = 325 mm
80	5 x 80 mm = 400 mm
100	5 x 100 mm = 500 mm
125	5 x 125 mm = 625 mm
150	5 x 150 mm = 750 mm



Valve selection

If no hydraulic data are available, then the same valve DN can be selected as the heat exchanger connection DN.
If the valve is assigned to the last consumer, then the pressure drop in the measuring pipe is 20 kPa with $\dot{V}_{nom}$. If the flow rate is 50% of the $\dot{V}_{nom}$, then the pressure drop for the length of the measuring pipe will be only ¼ and equals 5 kPa. (The measuring pipe/valve pressure drop ratio is 48:52)

Accessories

Electrical accessories

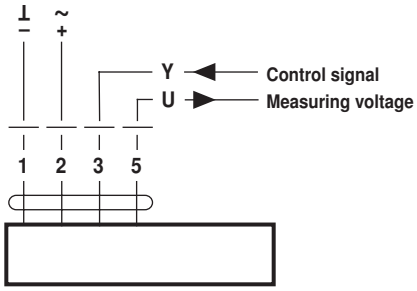
Description	Data sheet
Auxiliary switch S..A..	T2 - S..A..
Feedback potentiometer P..A..	T2 - P..A..
PC-Tool MFT-P starting with Version V3.5	T2 - MFT-P
ZTH-GEN	M9 - ZTH-GEN

Electrical installation

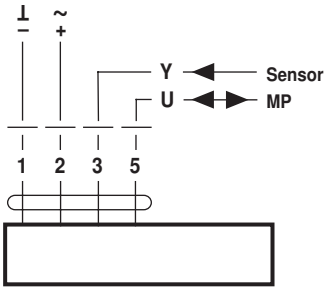
Wiring diagrams

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

Conventional operation:

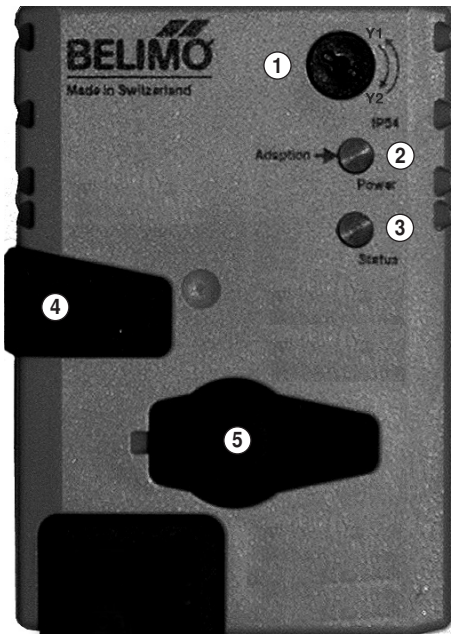


Operation on the MP-Bus



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

Operating controls and indicators



① **Direction of rotation switch**
Switching over: The factory setting Y2 cannot be altered.

② **Push-button and green LED display**
Off: No voltage supply or fault
Illuminated: Operation
Press key: Switches on angle of rotation adaptation followed by standard operation

③ **Push-button and yellow LED display**
Off: Standard operation without MP-Bus
Flickering: MP communication active
Illuminated: Adaptation or synchronising process active
Flashing: Addressing request sent to MP master
Press key: Confirmation of the addressing

④ **Gear disengagement key**
Press key: Gear disengaged, motor stops, manual override possible
Release key: Gear engaged, synchronisation starts, followed by standard operation

⑤ **Service plug**
For connecting parameterising and service tools

Check voltage supply connection

a) ② Off and ③ Illuminated
b) ② Flashing and ③ Flashing
} Check the supply connections. ⏚ and ~ may possibly have been switched.

Tool connection

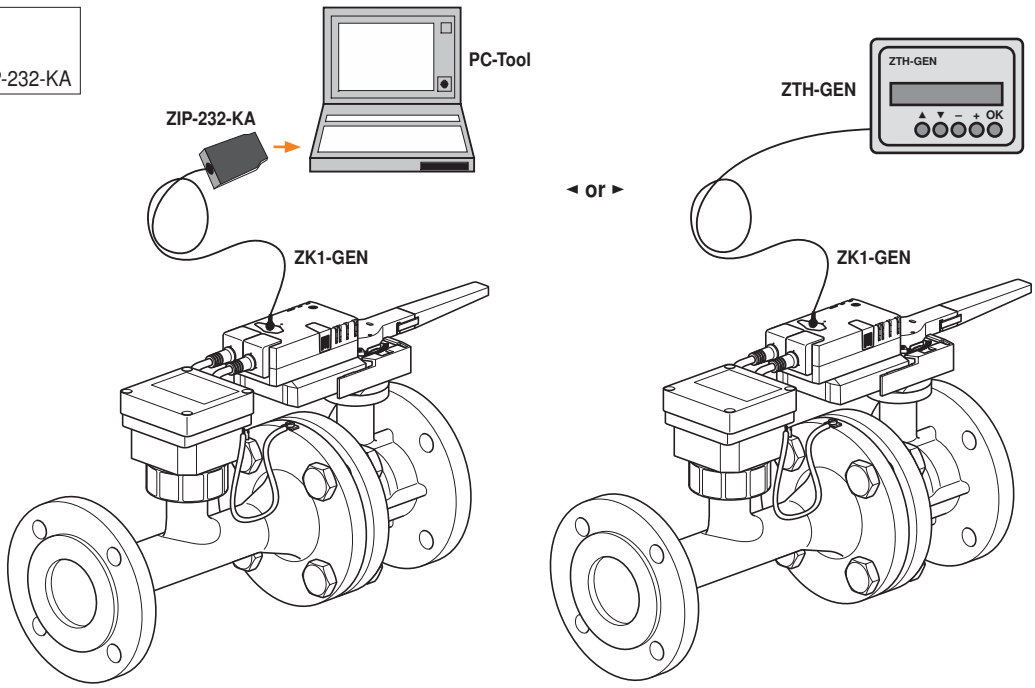
Settings and diagnostics

The settings and diagnostics of the connected actuator can – thanks to MP-Bus technology – be checked and adjusted easily and rapidly with the Belimo PC-Tool or with the ZTH-GEN manual control unit.

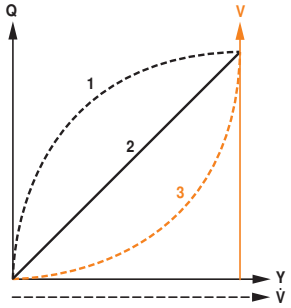
On-board service connection

The service connection integrated in the actuator enables a rapid connection of the operating device used.

Belimo operating and service devices
– ZTH-GEN manual control unit
– Belimo PC-Tool, with level converter ZIP-232-KA



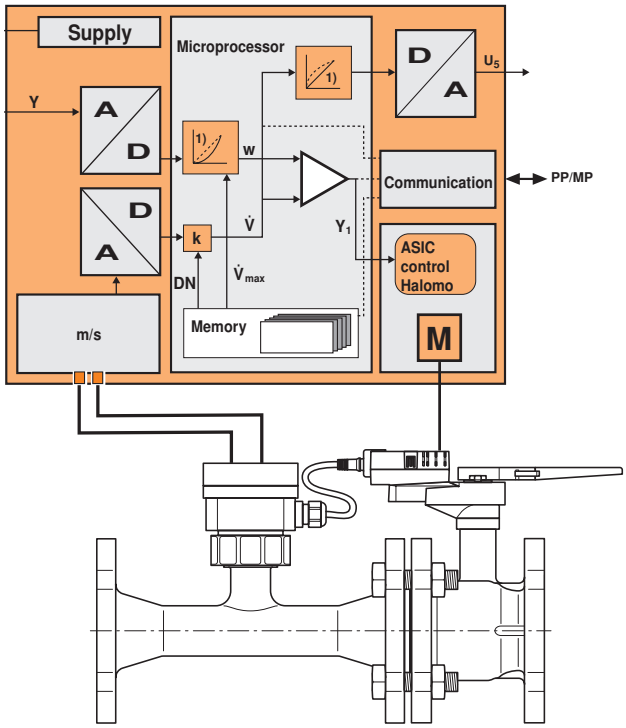
Flow rate measurement/setting



Principle of operation EPIV

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).



Block diagram

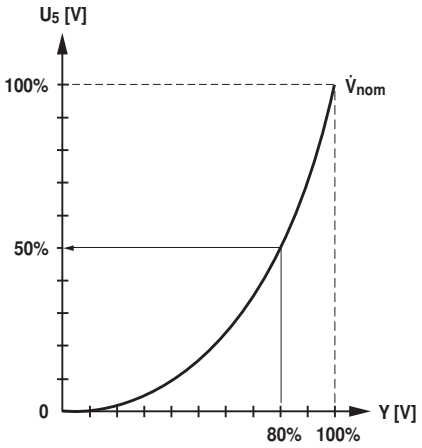
The velocity of the medium is measured in the measuring component (sensor electronics), with the flow rate factor k of the measuring pipe (DN) multiplied and converted to a flow rate signal.

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 Y_1 for the actuator.

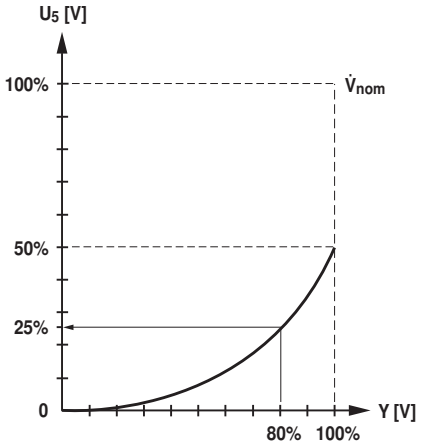
The specially configured control parameters (PI response with approximately 90 sec. compensation time) – in connection with the precise velocity sensor – ensure a stable quality of control. They are however not suitable for rapid control processes, i.e. for domestic water control.

U_5 displays the measured volumetric flow as voltage (factory setting). It is always in reference to the respective $\dot{V}_{nom}$, i.e. if $\dot{V}_{max}$ is e.g. 50% of $\dot{V}_{nom}$, then Y = 10V, U5 = 5V.

1. Standard equal percentage



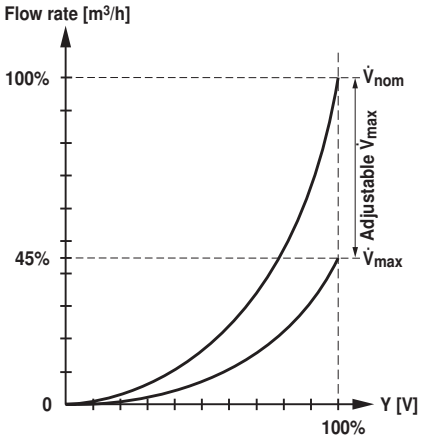
2. Effect $\dot{V}_{max} < \dot{V}_{nom}$



Flow rate measurement/setting *(continued)*

If the volumetric flow is required in the management system for signalisation, then it is recommended that the actuator be operated as MP or that the characteristic curve be parameterised as linear (see [1]) in the PC-Tool. (Y = U_5 and corresponds to the volumetric flow $\dot{V}$)

For the control itself, one can choose between the traditional control signal or MP-Bus, depending on the application.

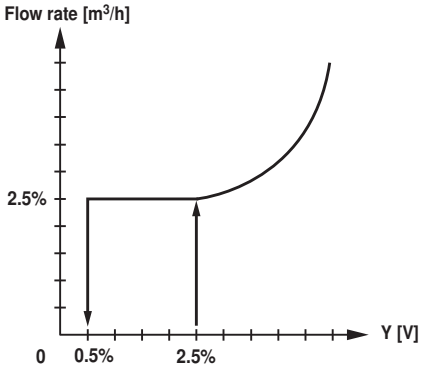


Definitions

$\dot{V}_{nom}$ Is the maximum possible flow rate and corresponds to approximately 2 to 2.4 m/s medium velocity in the connection pipe with the same DN size. (For DN 65, the cross-section is approximately 0.065 m^2 x Pi /4 = 0.0033 m2 and for 2.4 m/s medium velocity, this results in 480 L/min or 28.8 m^3/h)

$\dot{V}_{max}$ Is the maximum flow rate which has been set, e.g. 10V. The V_{max} can be set to between 45% and 100% of the V_{nom}.

$\dot{V}_{min}$ The factory setting is 0% and cannot be changed.



Creep flow suppression

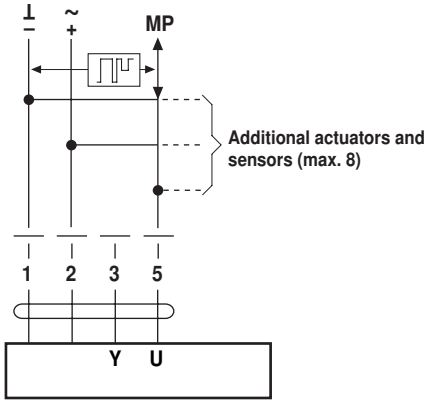
The medium velocity is < 0.06 m/s in the opening point and can no longer be measured by the sensor within a reasonable tolerance. With a reference variable of < 2.5%, the flow rate is registered as 2.5%, whereby the valve continues to close. For a reference variable under 0.5%, the valve closes and the flow rate display also shows 0%.

Parameterisation setting

Functional data actuator		Factory settings	Variable	Setting
Control	Control signal Y	DC 0.5 … 10V, input impedance 100 kΩ	Modulating (DC 0 ... 32V)	.....
	Operating range	DC 0.5 ... 10V	Start point DC 0.5 ... 30V End point DC 2.5 ... 32V	.....
Position feedback (Measuring voltage U)		DC 0.5 ... 10V, max. 0.5 mA	Start point DC 0.5 ... 8V End point DC 2.5 ... 10V	.....
Flow rate setting		V_{max} 45 ... 100% (V_{nom})		.....

Functions when operated on MP-Bus

Connection on the MP-Bus



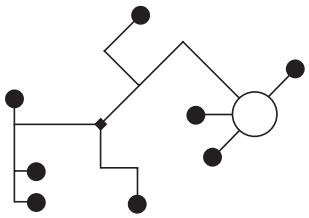
Supply and communication

in the same 3-wire cable

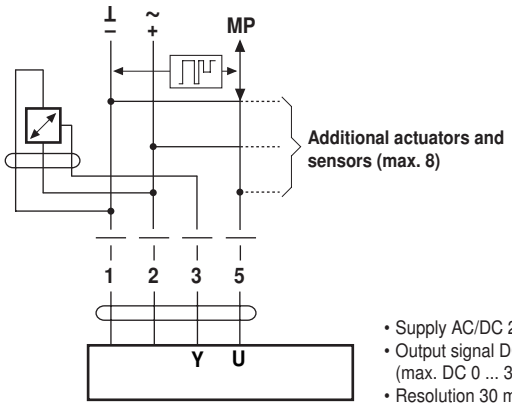
- no shielding or twisting necessary
- no terminating resistors required

Power topology

There are no restrictions for the power topology (star, ring, tree or mixed forms are permitted).

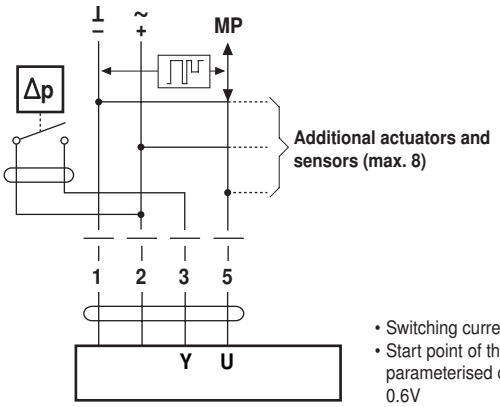


Connection of active sensors



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

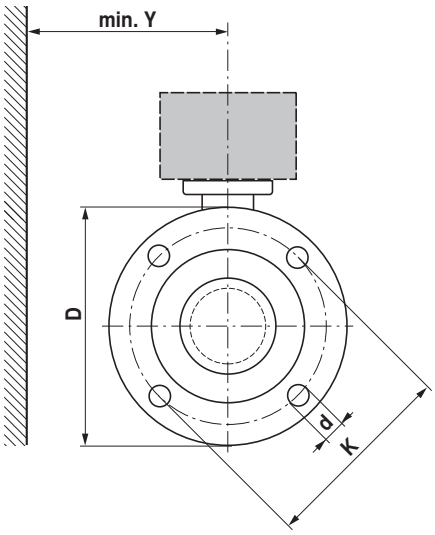
Connection of external switching contact

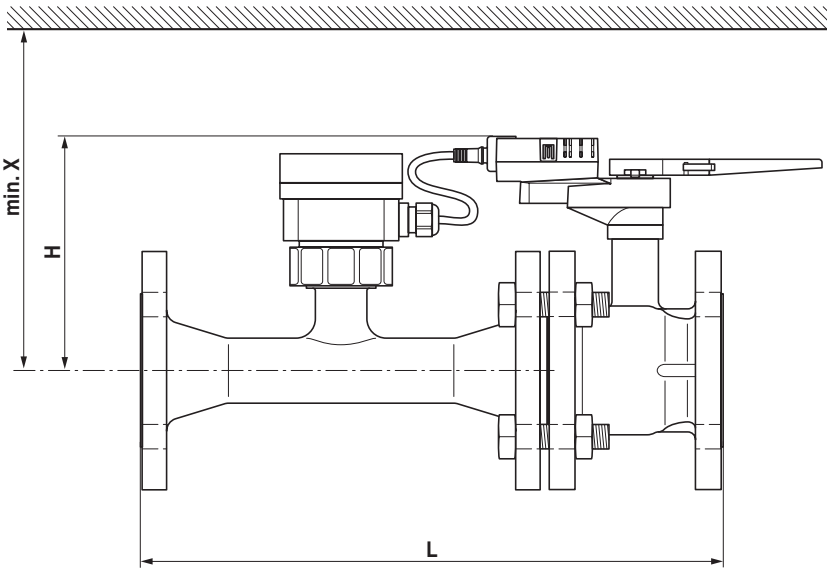


- Switching current 16 mA @ 24V
- Start point of the operating range must be parameterised on the MP actuator as ≥ 0.6V

Dimensions and weights

Dimensional drawings





DN [mm]	L [mm]	H [mm]	D [mm]	K [mm]	d [mm]	X [1] [mm]	Y [1] [mm]	Weight [kg]
65	454	113	185	145	4 x 19	311	150	23.2
80	499	113	200	160	8 x 19	311	150	28.3
100	582	208	229	180	8 x 19	228	165	40.1
125	640	240	254	210	8 x 19	260	180	54.3
150	767	240	282	240	8 x 24	260	180	69.6

[1] Minimum distance with respect to the valve centre.
[2] The actuator dimensions can be found on the respective actuator data sheet.