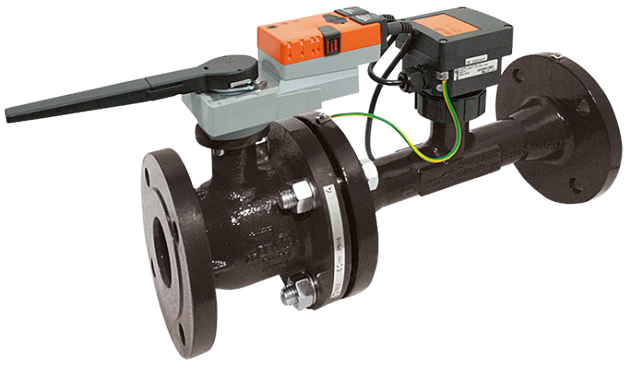
# Technical data sheet P6..W..E-MP

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

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



## Type overview

| Type | Vnom [ l/s] | Vnom [ l/min] | kvs theor. [ m³/h] | DN [ ] | DN [”] | ps [ kPa] | n(gl) [ ] |
|---|---|---|---|---|---|---|---|
| **P6065W800E-MP** | 8 | 480 | 45 | 65 | 2 1/2 | 1600 | 3.2 |
| **P6080W1100E-MP** | 11 | 660 | 65 | 80 | 3 | 1600 | 3.2 |
| **P6100W2000E-MP** | 20 | 1200 | 115 | 100 | 4 | 1600 | 3.2 |
| **P6125W3100E-MP** | 31 | 1860 | 175 | 125 | 5 | 1600 | 3.2 |
| **P6150W4500E-MP** | 45 | 2700 | 270 | 150 | 6 | 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 Hz |
| | Operating range | AC 19.2...28.8 V / DC 21.6...28.8 V |
| | Power consumption in operation | 9.5 W |
| | Power consumption in rest position | 6.5 W |
| | Power consumption for wire sizing | 13 VA |
| | Connection supply / control | Cable 1 m, 4 x 0.75 mm² |
| | Parallel operation | Yes (note the performance data) |
| **Functional data** | Torque motor | 20 Nm (DN 65 ... 80) / 40 Nm (DN 100 ... 150) |
| | 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<br>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<br>End point DC 2 ... 10 V |
| | Sound power level motor max. | 45 dB(A) |
| | Adjustable flow rate Vmax | 45...100% of V̇nom |
| | Control accuracy | ±10% (of 25...100% Vnom) |
| | Media | Cold and hot water, water with glycol up to max. 50% vol. |
| | Medium temperature | -10°C...120°C |
| | Closing pressure Δps | 690 kPa |
| | Differential pressure Δpmax | 340 kPa |
| | 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 | Flange PN 16 in accordance with EN 1092-1 |
| | 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 |

## Technical data

| | | |
|---|---|---|
| **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 | -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) |
| | Valve cone | Stainless steel AISI 316 |
| | Stem | Stainless steel AISI 304 |
| | Stem seal | EPDM Perox |
| | Valve seat | PTFE, O-ring Viton |

## Safety notes

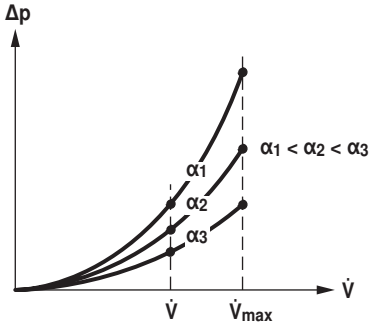
- The device has been designed for use in stationary heating, ventilation and air conditioning systems and is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Only authorised specialists may carry out installation. 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). 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).

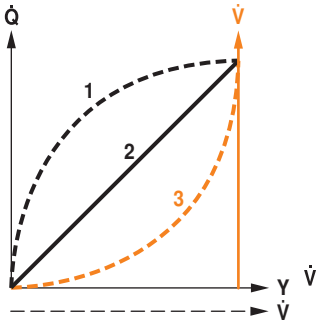
Flow rate curves



## Product features

**Flow characteristic of the characterised control valve**

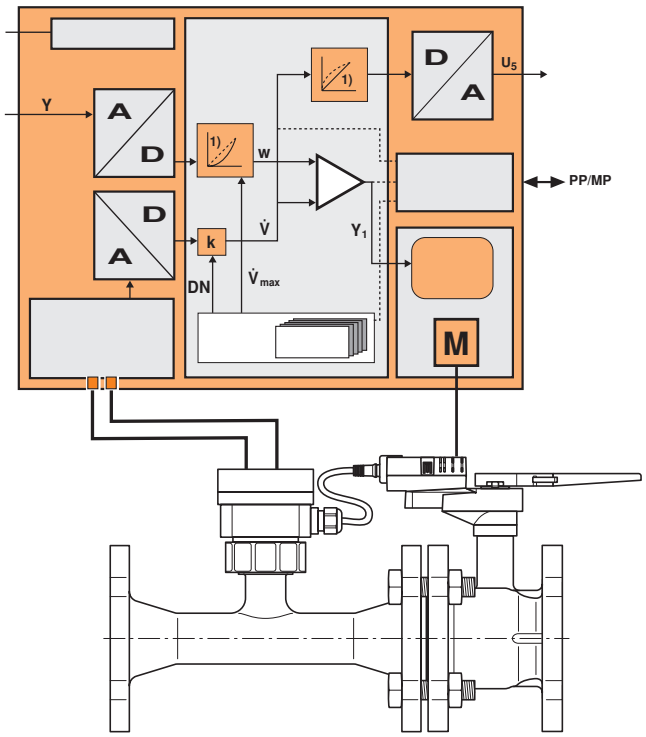
Heat exchanger transfer response
Depending on the construction, temperature spread, medium and hydraulic circuit, the power Q is not proportional to the volumetric flow of the water V̇ (curve 1). With the classical type of temperature control, an attempt is made to maintain the control signal Y proportional 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



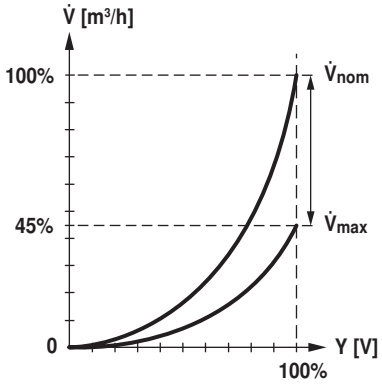
## Product features

**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 45% and 100% of V̇nom.

V̇min 0% (non-variable).

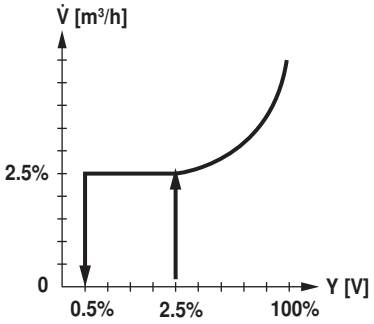



**Creep flow suppression**

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 2.5% 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 2.5% of V̇nom. Once the level falls below this value, the flow rate is maintained at 2.5% 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 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

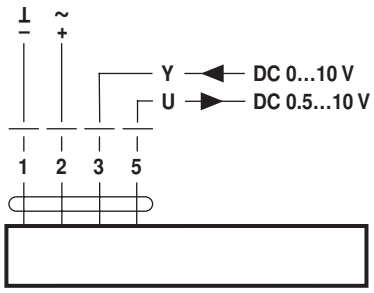
| | Description | Type |
|---|---|---|
| **Electrical accessories** | Gateway MP to KNX/EIB, AC/DC 24 V, EIBA certified | UK24EIB |
| | Gateway MP for LonWorks®, AC/DC 24 V, LonMark-certified | UK24LON |
| | Gateway MP to Modbus RTU, AC/DC 24 V | UK24MOD |
| | Gateway MP to BACnet MS/TP, AC/DC 24 V | 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. Observe the performance data.

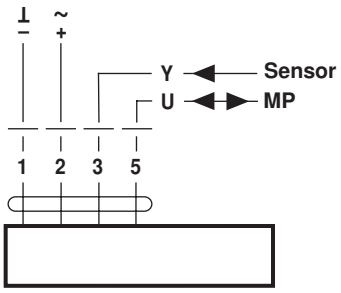
### Wiring diagrams

**AC/DC 24 V, modulating**




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

**Operation on the MP-Bus**

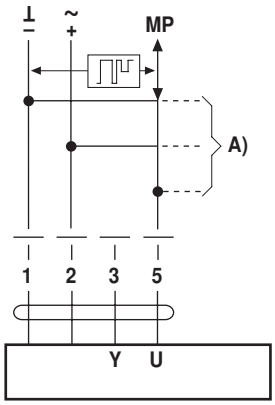



**Cable colours:**
1 = black
2 = red
3 = white
5 = orange

## Functions

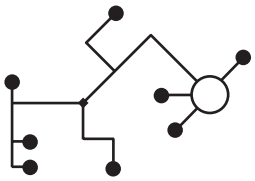
### Functions when operated on MP-Bus

**Connection on the MP-Bus**




A) Additional actuators and sensors (max. 8)

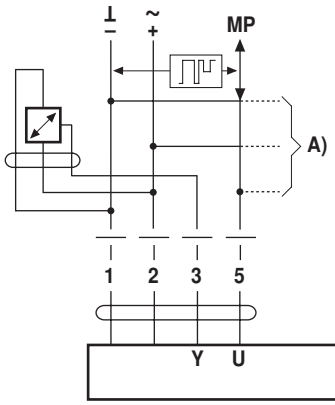
**Power topology**



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 resister required

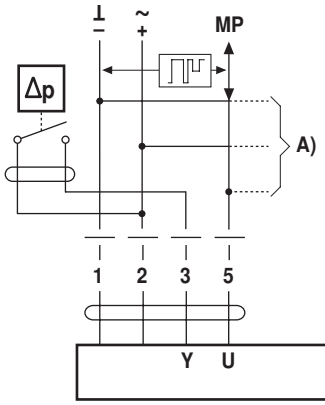
## Functions

### 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

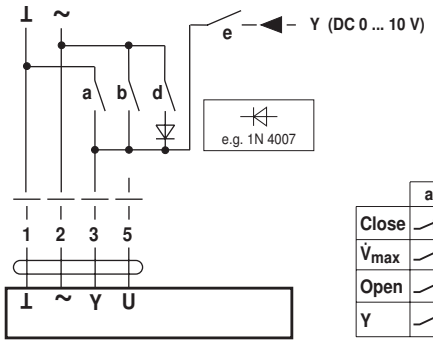
### Connection of external switching contact




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

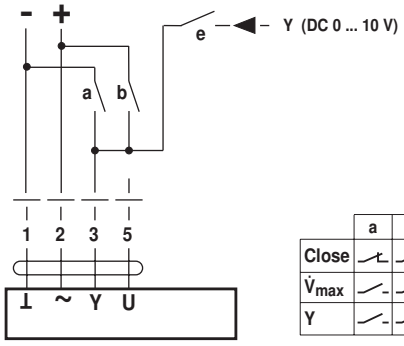
### Functions for actuators with specific parameters

#### Override control and limitation with AC 24 V with relay contacts



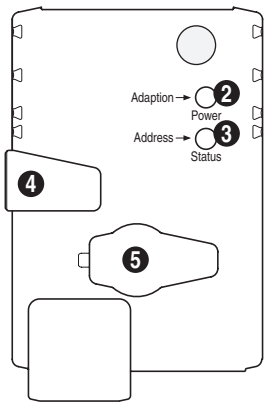

| | a | b | d | e |
|---|---|---|---|---|
| Close | t | | | |
| $\dot{V}_{max}$ | | t | | |
| Open | | | t | |
| Y | | | | t |

#### 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

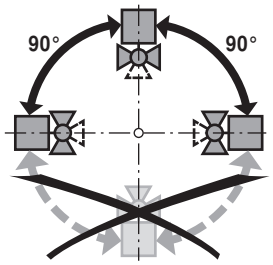
**Check voltage supply connection**

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.
Belimo valves are regulating devices. In order for these control tasks to be able to be carried out in the long run as well, they are to be kept free of solid particles (e.g. welding beads during installation work).
The installation of correspondingly sufficient dirt catchers is recommended.
The water must exhibit a conductivity ≥ 20 µS/cm during operation for correct functioning. It should be noted that, under normal circumstances, even filling water with a lower calibration value will experience an elevation of its calibration value to above the minimum required value during filling and that the system can thus be put into operation.
Calibration value elevation 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

**Maintenance**

Ball valves, rotary actuators and sensors are maintenance-free.

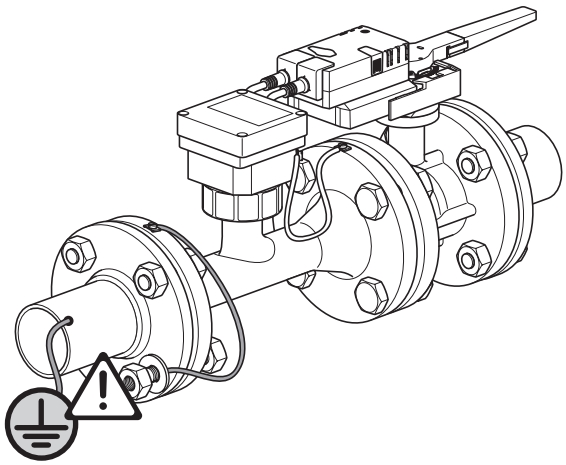
Before any kind of service work is carried out on the actuator, it is essential to isolate the rotary actuator from the power supply (by disconnecting the electrical cable). Any pumps in the part of the piping system concerned must also be switched off and the appropriate slide valves closed (allow everything to cool down first if necessary and reduce the system pressure to ambient pressure level).
The system must not be returned to commissioning 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.

**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.

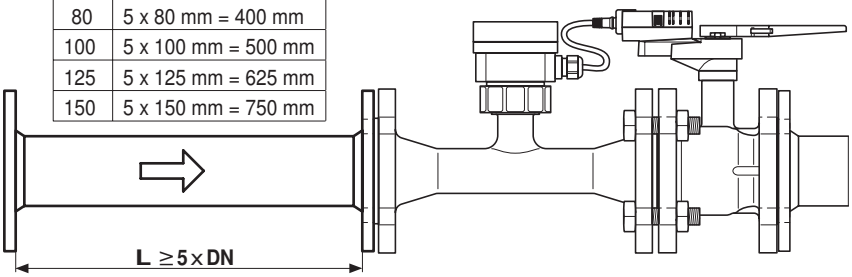


## Installation notes

**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 must be at least 5 x DN.

| DN | L min. |
|---|---|
| 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 |




## General information

**Valve design**

The valve is determined using the maximum flow required V̇max.
A calculation of the kvs value is not required.
V̇max = 45 … 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

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

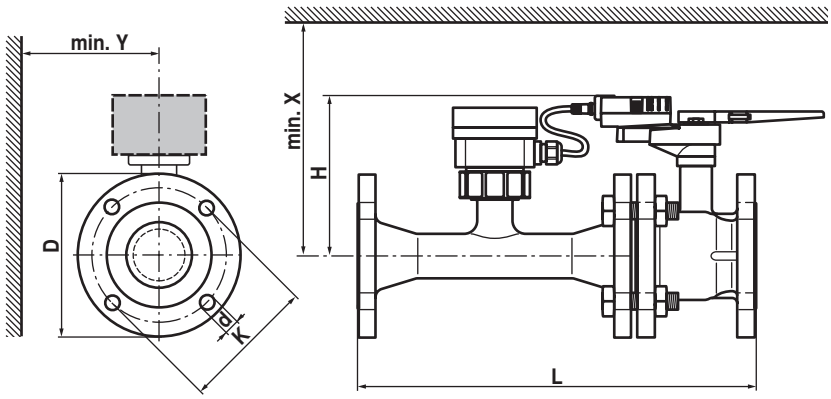
$\Delta p_{min}$: kPa
$\dot{V}_{max}$: $m^3/h$
$k_{vs\ theor.}$: $m^3/h$

Example (DN100 with the desired maximum flow rate = 50% V̇nom)
P6100W2000E-MP
kvs theor. = 115 $m^3/h$
V̇nom = 1200 l/min
50% * 1200 l/min = 600 l/min = 36 $m^3/h$

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

## Dimensions [mm] / 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] |
|---|---|---|---|---|---|---|---|---|---|
| **P6065W800E-MP** | 65 | 454 | 200 | 185 | 4 x 19 | 145 | 220 | 150 | 23.2 |
| **P6080W1100E-MP** | 80 | 499 | 200 | 200 | 8 x 19 | 160 | 220 | 160 | 28.3 |
| **P6100W2000E-MP** | 100 | 582 | 220 | 229 | 8 x 19 | 180 | 240 | 175 | 41.2 |
| **P6125W3100E-MP** | 125 | 640 | 240 | 252 | 8 x 19 | 210 | 260 | 190 | 54.3 |
| **P6150W4500E-MP** | 150 | 767 | 240 | 282 | 8 x 23 | 240 | 260 | 200 | 69.6 |

## Further documentation

- General notes for project planning