

Multifunctional rotary actuators for butterfly valves

- Torque 90 ... 500 Nm
- Nominal voltage 24 V
- Control: configurable
- Position feedback: configurable
- 2 Auxiliary switches
- State at loss of signal: unchanged
- Communication via Belimo MP-Bus
- Conversion of sensor signals


Overview of types

Type	Torque (Nominal torque)	Running time	Power consumption			Current consumption	Connection flange	Weight
			In operation	At rest	For wire sizing			
SY2-24-MP-T	90 Nm ¹⁾	15 s	70 W ²⁾	5.4 W	72 VA	3.0 A	ISO 5211 / F07	Approx. 11 kg
SY3-24-MP-T	150 Nm ¹⁾	22 s	70 W ²⁾	5.4 W	72 VA	3.0 A	ISO 5211 / F07	Approx. 11 kg
SY4-24-MP-T	400 Nm ¹⁾	16 s	180 W ²⁾	5.4 W	144 VA	6.0 A	ISO 5211 / F10	Approx. 22 kg
SY5-24-MP-T	500 Nm ¹⁾	22 s	180 W ²⁾	5.4 W	156 VA	6.5 A	ISO 5211 / F10	Approx. 22 kg

¹⁾ @ Nominal voltage

²⁾ @ Nominal torque

Technical data
Electrical data

Nominal voltage	AC 24 V, 50/60 Hz for 3-lead connection AC/DC 24 V, 50/60 Hz for 4-lead connection
Nominal voltage range	AC/DC 21.6 ... 26.4 V
Power consumption	See «Overview of types»
Current consumption	See «Overview of types»
Auxiliary switches	2 x SPDT, 5 A, AC 230 V I \neq Switching points: 90° \leftrightarrow
Connection	Terminals, 2 x 1.5 mm ² or 1 x 2.5 mm ²
Parallel operation	Not possible
Supply voltage	Possible only with 4-lead connection
Controller signals	

Functional data

		Variable	Setting
Torque (nominal torque)	See «Overview of types»		
Control	Control signal Y	Starting point DC 0.5 ... 30 V	
	Operating range	End point DC 2.5 ... 32 V
Control	Control signal Y	Non-variable	
Position feedback (measuring voltage U ₅)	DC 0 ... 10 V, max. 0.5 mA	Starting point DC 0.5 ... 8 V	
	DC 2 ... 10 V, max. 0.5 mA	End point DC 2.5 ... 10 V
	4 mA ... 20 mA	Non-variable	
Position accuracy	±5% absolute		
Manual override	Temporary with handwheel (not revolving)		
Angle of rotation	90° \leftrightarrow (internal limit switch)		
Angle of rotation limiting	MAX (maximum position) = 100% MIN (minimum position) = 0% ZS (intermediate position) = 50%	MAX = (MIN + 32°) ... 100% MIN = 0° ... (MAX - 32° \leftrightarrow) ZS = MIN ... MAX
Running time	See «Overview of types»		
Duty cycle	75% (e.g. 15 s / 5 s)		
Sound power level	Max. 70 dB (A)		
Position indication	Mechanical (integrated)		

Technical data		(continued)
Safety		
Protection class	III Safety extra-low voltage	
Degree of protection	IP67	
EMC	CE according to 2004/108/EC	
Low-voltage directive	CE according to 2006/95/EC	
Certification	Tested in accordance with EN 61000-6-2 : 2005 EN 61000-6-4 : 2007	
Mode of operation	Type 1	
Control pollution degree	4	
Ambient temperature	-20 ... +65°C	
Medium temperature	-20° ... +120°C (in the butterfly valve) Max. 130°C / 1 h	
Non-operating temperature	-30 ... +80°C	
Ambient humidity	95% r.h., non-condensating	
Maintenance	Maintenance-free	
Mechanical data		
Housing material	Cast aluminium	
Dimensions		
Dimensions	See «Dimensions» on page 8	
Weight	See «Overview of types»	

Safety notes



- The actuator 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 assembly.
- The device does not contain any parts that can be replaced or repaired by the user.
- 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	<p><i>Conventional mode (analog):</i> The actuator is connected with a standard modulating signal and travels to the position defined by the control signal. Measuring voltage U serves for the electrical display of the actuator position 0 ... 100% and as slave control signal for other actuators.</p> <p><i>Operation on the MP-Bus (digital):</i> The actuator receives its digital positioning signal from the higher level controller via the MP-Bus and travels to the position defined. Connection U serves as communication interface and does not supply an analogue measuring voltage.</p>
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	Input and output signals and other parameters can be altered with the BELIMO Service Tool, MFT-P.
Simple direct mounting	Simple direct mounting on the butterfly valve. The mounting position in relation to the butterfly valve can be selected in 90°-steps.
Manual override	The butterfly valve can be closed (turn clockwise) and opened (turn anticlockwise) with the handwheel. The handwheel does not move while the motor is running.
Internal heating	An internal heater prevents condensation buildup.
High functional reliability	Mechanical stops limit the actuator to -2° and 92°-steps. The internal limit switches interrupt the voltage supply to the motor. In addition, a motor thermostat provides overload protection because at 135°C it interrupts the voltage supply.
Combination butterfly valve actuators	Refer to the butterfly valve documentation for suitable butterfly valves, their permitted media temperatures and closing pressures.

Accessories

	Description
Electrical accessories	PC-Tool MFT-P, beginning with v3.3
	Cable ZK6-GEN
	Cable ZK2-GEN

Restriktionen für (3-Leiter und) 4-Leiter Anschlussstechniken

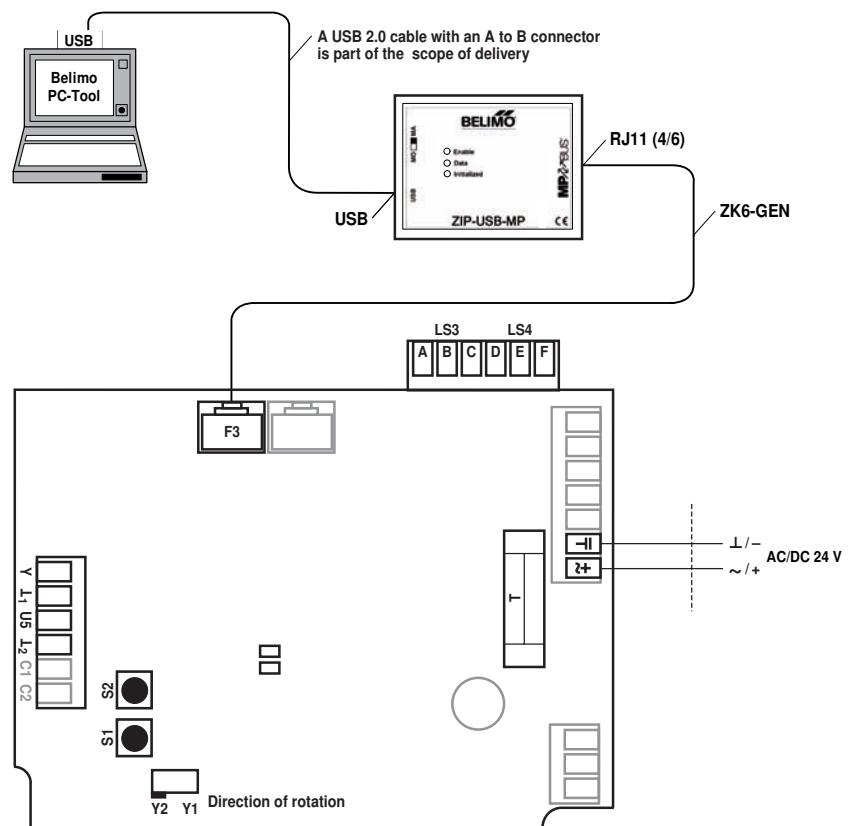
The following overview shows the differences between the 24 V actuator wiring options. The same PCB (Print) can be used for both wirings.

	3-lead connection	4-lead connection			
Description	Signal and connection to power supply have the same ground connection	Signal and connection to power supply have different ground connections			
Supply voltage	AC only	AC / DC			
Maximum cable length *	The maximum cable length is defined in the following connection diagram:				
Wire cross-section	0.75 mm ²	1 mm ²	1.5 mm ²	2.5 mm ²	No limitation
SY2	12 m	17 m	24 m	43 m	No limitation
SY3	12 m	17 m	24 m	43 m	No limitation
SY4	5 m	7 m	10 m	17 m	No limitation
SY5	5 m	7 m	10 m	17 m	No limitation
Measuring voltage U ₅	U ₅ is stable as soon as the actuator stops		No limitation		
Control signal mA	Not possible		The ground connection \perp must be wired to the actuator with mA control signal		

* The limitation regarding cable length is because of the large amounts of current required by the SY actuator. A high level of current will in turn have an influence on the signals.

MFT-P PC-tool connection

Local connection with ZIP-USB-MP via service socket of the SY actuator.



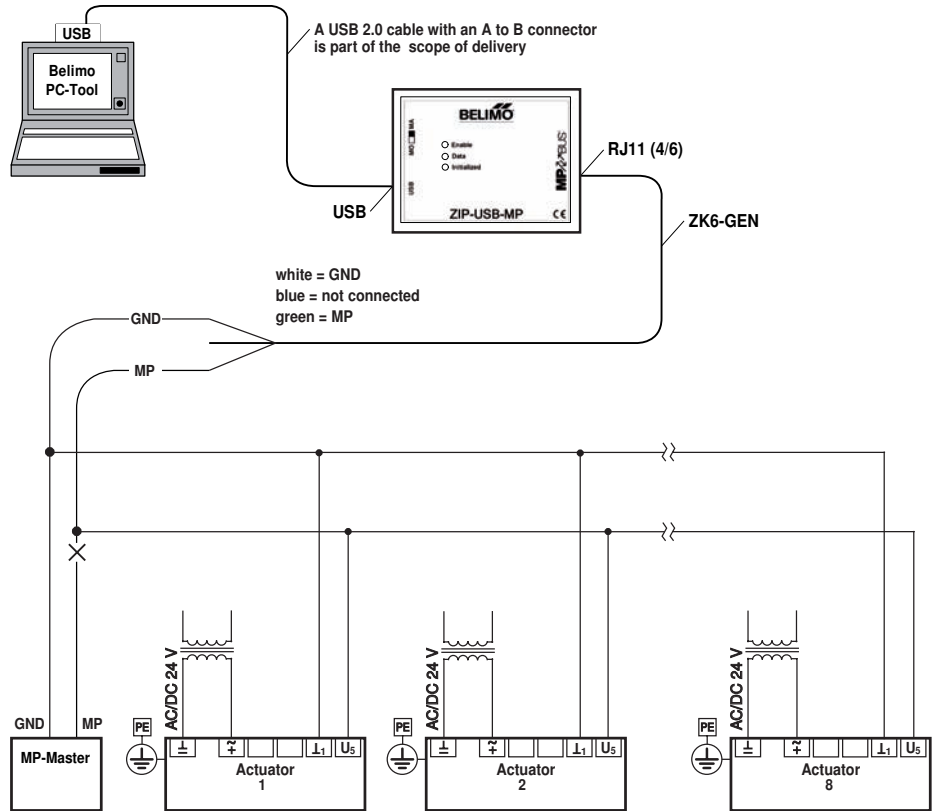
Note
The housing cover must be opened in order to access the connections.

Caution!
It is mandatory with 24 V supply that the GND signal be guided separately on the print.

MFT-P PC-tool connection

(continued)

Connection on the MP-Bus with ZIP-USB-MP

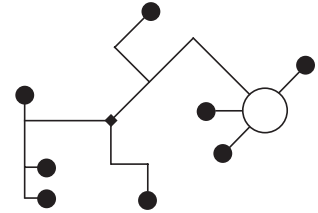


Note
Disconnect MP-Bus from MP-Master or control system!

Electrical installation MP-Bus (4-lead connection)

Power topology There are no restrictions for the network topology (star, ring, tree or hybrid forms are permitted).

- MP communication separate cable
- Supply separate cable
- On-site supply possible
- no shielding or twisting necessary
- no terminating resistors required

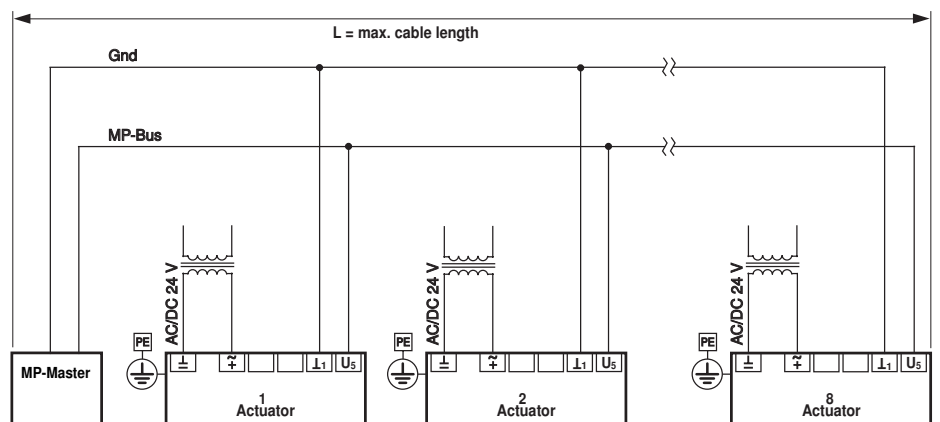


Note
In addition to the wiring diagrams, the protective earth (PE) must also be connected.

MP-Bus system connection

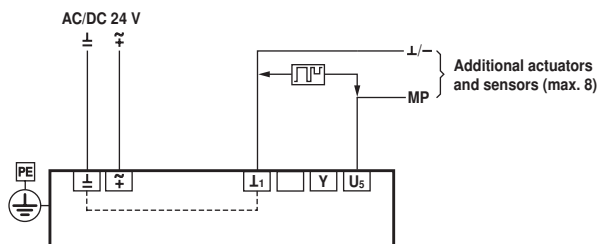
The actuators are supplied locally with AC 24 V via a separate transformer. The cable lengths of the MP cables indicated in the table apply regardless of the performance data of the connected actuators.

Wire Ø [mm ²]	L = max. cable length [m]
0.75	800
1.0	
1.5	
2.5	

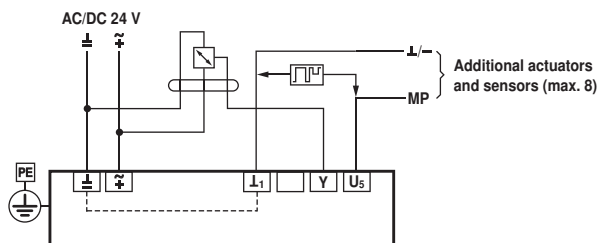


MP-Bus circuits with SY actuator

Connection without sensors

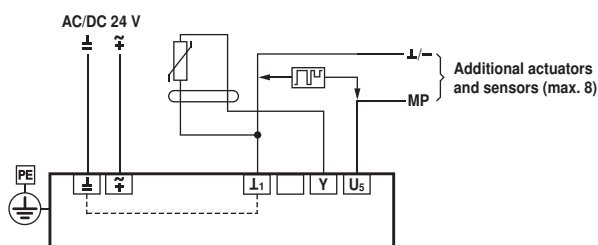


Connection of active sensors



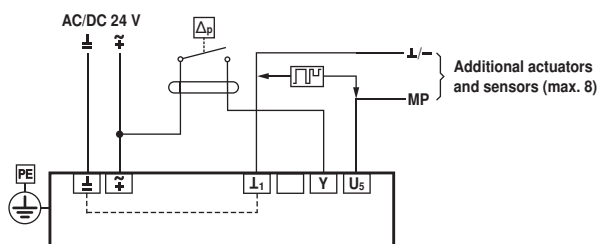
- Supply AC/DC 24 A
- Output signal DC 0 ... 10 V (max. DC 0 ... 32 V)
- Resolution 30 mV

Connection of passive sensors



Sensor	Temperature range	Resistance range	Resolution
Ni1000	-28 ... +98 °C	850 ... 1600 Ω	1 Ω
PT1000	-35 ... +155 °C	850 ... 1600 Ω	1 Ω
NTC	-10 ... +160 °C (depending on type)	200 Ω ... 60 kΩ	1 Ω

Connection of external switching contact



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

Caution!

It is mandatory with 24 V supply that the GND signal be guided separately on the print.

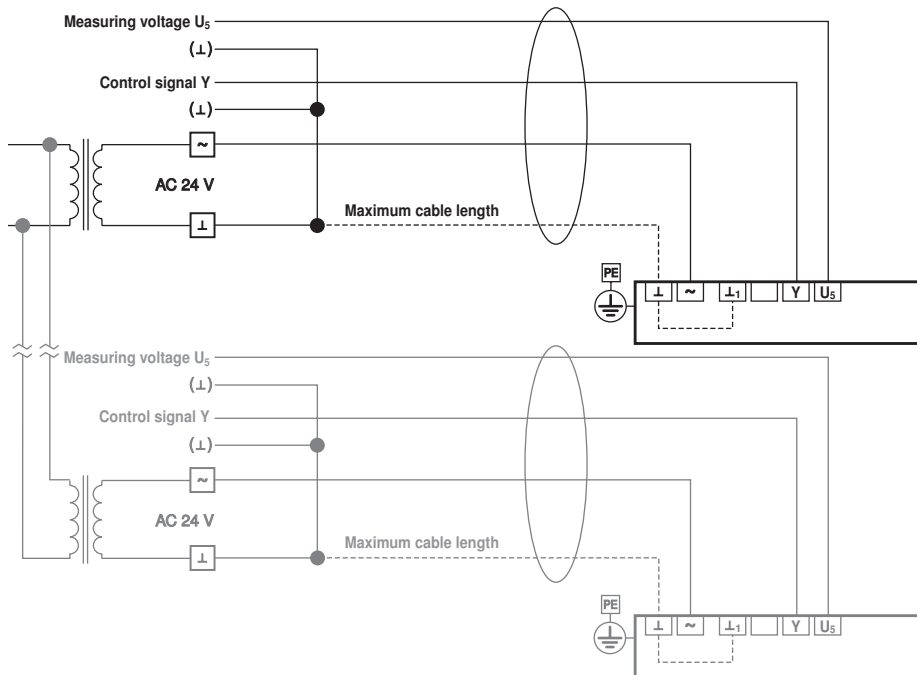
Restrictions for 3-lead (and 4-lead) connector techniques

The following overview shows the differences between the 24 V actuator wiring options. The same PCB (Print) can be used for both wirings.

	3-lead connection	4-lead connection																				
Description	Signal and connection to power supply have the same ground connection	Signal and connection to power supply have different ground connections																				
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Maximum cable length *	The maximum cable length is defined in the following connection diagram:																					
Wire cross-section	<table border="1"> <thead> <tr> <th>0.75 mm²</th> <th>1 mm²</th> <th>1.5 mm²</th> <th>2.5 mm²</th> </tr> </thead> <tbody> <tr> <td>12 m</td> <td>17 m</td> <td>24 m</td> <td>43 m</td> </tr> <tr> <td>12 m</td> <td>17 m</td> <td>24 m</td> <td>43 m</td> </tr> <tr> <td>5 m</td> <td>7 m</td> <td>10 m</td> <td>17 m</td> </tr> <tr> <td>5 m</td> <td>7 m</td> <td>10 m</td> <td>17 m</td> </tr> </tbody> </table>	0.75 mm ²	1 mm ²	1.5 mm ²	2.5 mm ²	12 m	17 m	24 m	43 m	12 m	17 m	24 m	43 m	5 m	7 m	10 m	17 m	5 m	7 m	10 m	17 m	No limitation
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Control signal mA	Not possible	The ground connection ⊥ must be wired to the actuator with mA control signal																				

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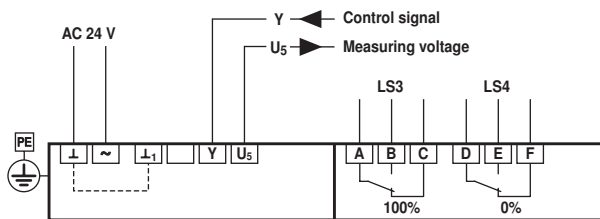
3-lead system connection



Note
 (⊥) of the control signal Y and (⊥) of the measuring voltage U₅ can be connected together.

Electrical installation for 3-lead connection

Wiring diagram

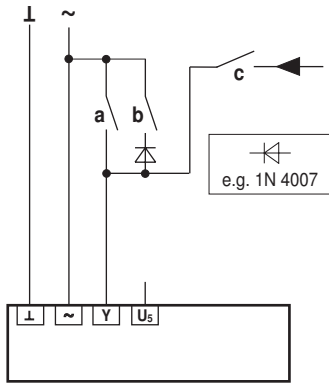


Actuator	Butterfly valve
Y1	A - AB = 100%
Y2	A - AB = 0%

Auxiliary switch	Position	Butterfly valve
LS3	100%	Open
LS4	0%	Closed

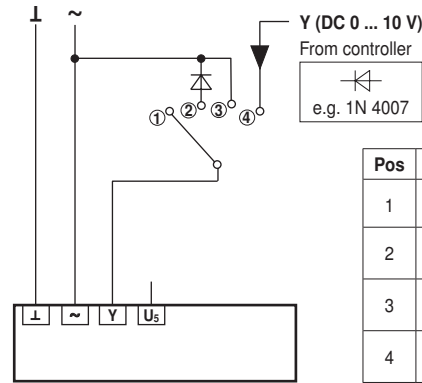
Functions with basic values – 3-lead connection technology

Override control with AC 24 V with relay contacts



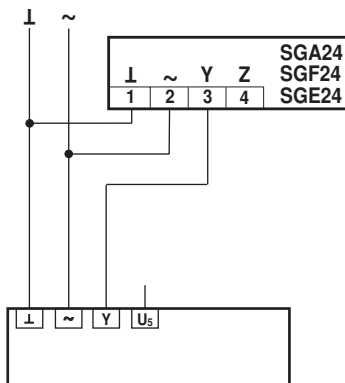
Functions	a	b	c
Loss of control signal: CLOSED → 0% ↯	—	—	—
ZS 50% ↯ (intermediate position)	—	—	—
100% ↯	—	—	—
Control mode in accordance with Y	—	—	—

Override control with AC 24 V with rotary control switch



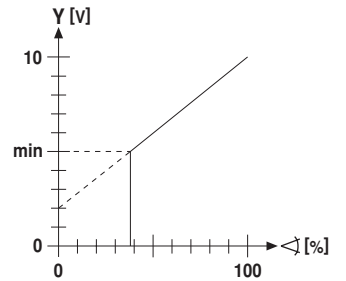
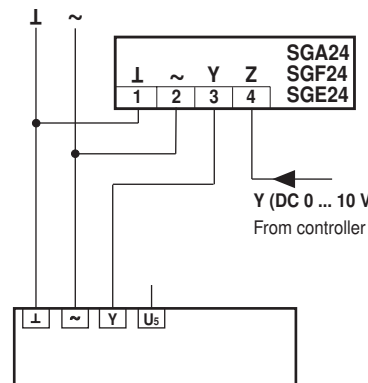
Pos	Functions
1	Loss of control signal: CLOSED → 0% ↯
2	ZS 50% ↯ (intermediate position)
3	100% ↯
4	Control mode in accordance with Y

Remote control 0 ... 100 %

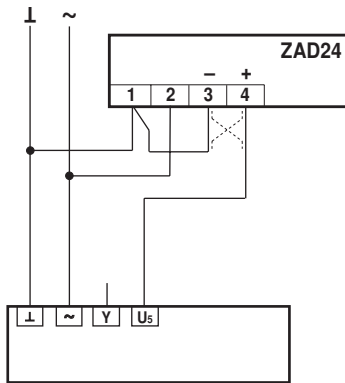


DIP-switch on Y2	DIP-switch on Y1
Y = 2 V	Y = 2 V

Minimum limit

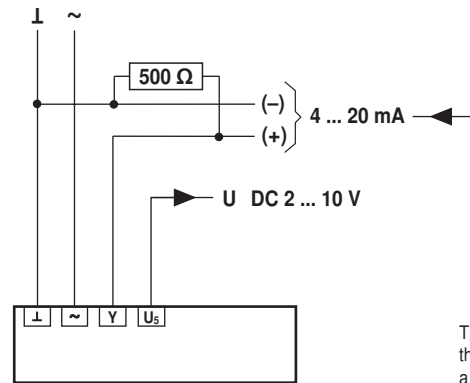


Position indication



Adapting the direction of rotation

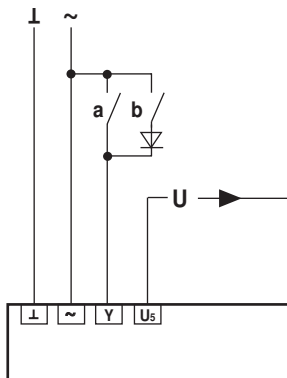
Control with 4 ... 20 mA via external resistance



The 500 Ω-resistor converts the 4 ... 20 mA current signal to a voltage signal DC 2 ... 10 V

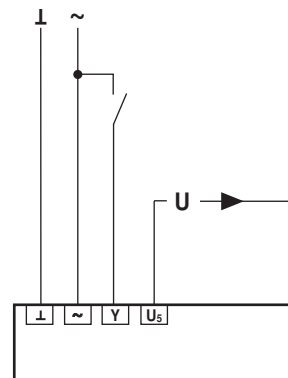
Functions for MP actuators with specific parameters

3-point control



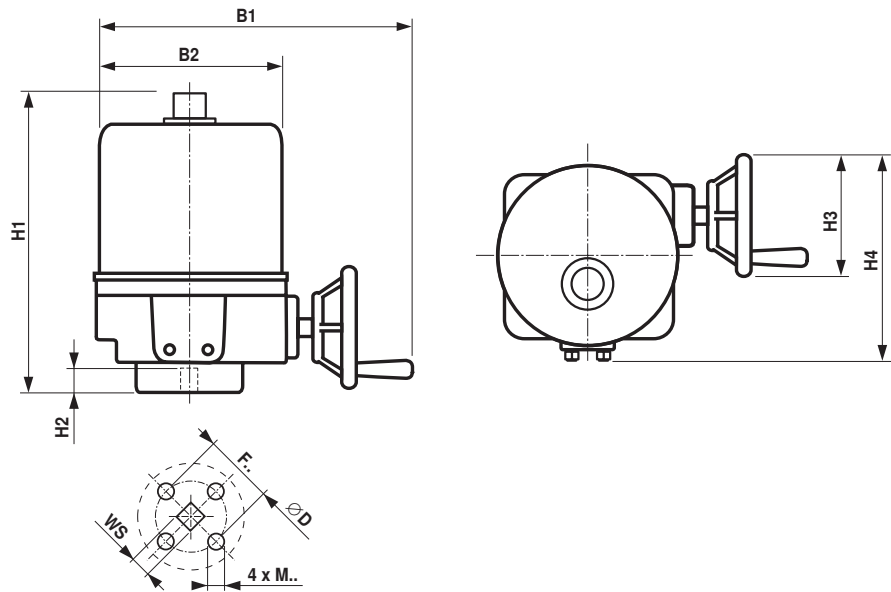
Direction of rotation switch			
a	b	Y2	Y1
—	—	↻	↻
—	—	Stop	Stop
—	—	↻	↻
—	—	↻	↻

Open-close control



Dimensions [mm]

Dimensional drawings



Type	H1 [mm]	H2 [mm]	H3 [mm]	H4 [mm]	B1 [mm]	B2 [mm]	F. ISO 5211	D [mm]	WS [mm]	M..
SY2-24-MP-T	289	30	123	203	326	180	F07	70	22	M8
SY3-24-MP-T	289	30	123	203	326	180	F07	70	22	M8
SY4-24-MP-T	317	40	194	290	394	217	F10	102	35	M10
SY5-24-MP-T	317	40	194	290	394	217	F10	102	35	M10

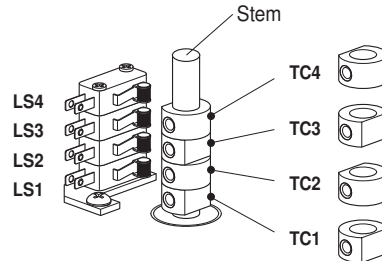
Settings

Setting cam

The setting cams for limit and auxiliary switches can be accessed by removing the housing cover. Optionally, auxiliary switches LS4 / LS3 can be connected for signalling. Limit switches LS2 / LS1 interrupt the voltage to the motor and are controlled by setting cams TC.. The setting cams turn with the stem. The butterfly valve closes when the stem is turning clockwise (cw) and opens when the stem is turning counterclockwise (ccw).

Important!

Settings are only allowed to be made by authorised specialist personnel.

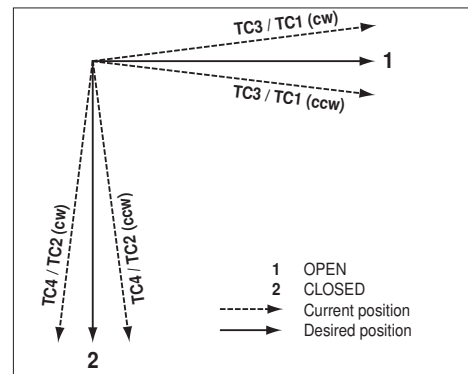


Settings of setting cams TC..

- TC4 for auxiliary switch position closed (factory setting $3^\circ \leftarrow$).
- TC3 for auxiliary switch position open (factory setting $87^\circ \leftarrow$).
- TC2 for limit switch closed (factory setting $0^\circ \leftarrow$).
- TC1 for limit switch open (factory setting $90^\circ \leftarrow$).

Adjusting setting cams

- 1 Use a 2.5 mm Allen key to unscrew the corresponding setting cams TC..
- 2 Turn the setting cam using the Allen key
- 3 Set as shown in the illustration below
- 4 Use the Allen key to tighten the corresponding setting cams



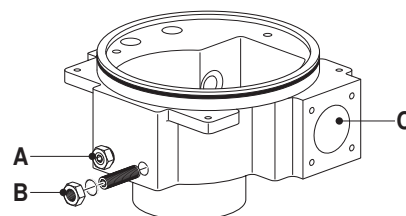
Adaption

An adaptation must take place after the TC1 and TC2 have been adjusted.

Mechanical angle of rotation limitation

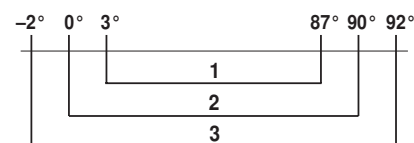
The mechanical angle of rotation is set at the factory to $94^\circ \leftarrow$ and cannot be changed. The handwheel is rotated by means of a worm gear in a planetary gear unit. The gearing is stopped mechanically by means of two setscrews **A** and **B** ($1\frac{1}{2}$ rotations of the setscrews correspond to $2^\circ \leftarrow$).

Both limit switches LS 2 /LS 1 are set to $90^\circ \leftarrow$ and must always switch off the motor before the mechanical angle of rotation limitation.



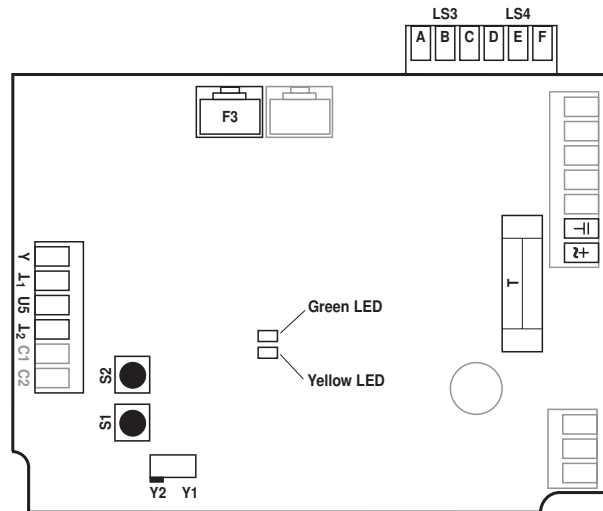
- A** Angle of rotation limiting OPEN ($90^\circ \leftarrow$)
- B** Angle of rotation limiting CLOSED ($0^\circ \leftarrow$)
- C** Connection of handwheel for angle of rotation limiting

Relationship between mechanical angle of rotation limiting, limit and auxiliary switches



- 1 Auxiliary switch TC3 / TC4
- 2 Limit switch TC1 / TC2
- 3 Mechanical angle of rotation limitation (A + B)

Connection and function elements

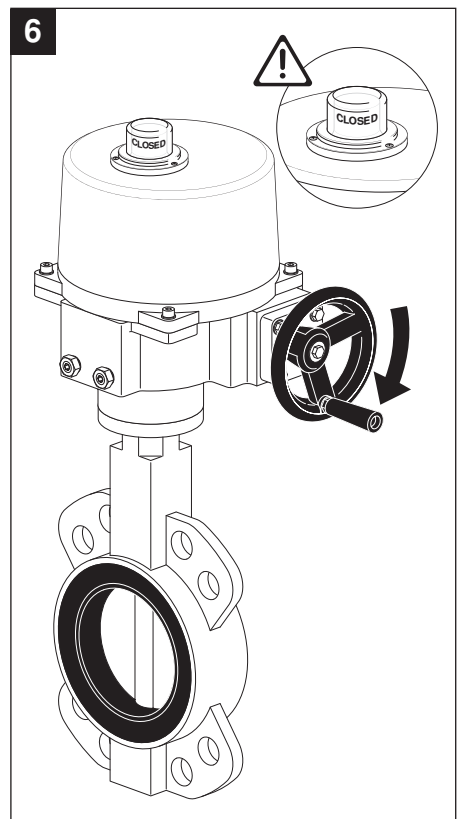
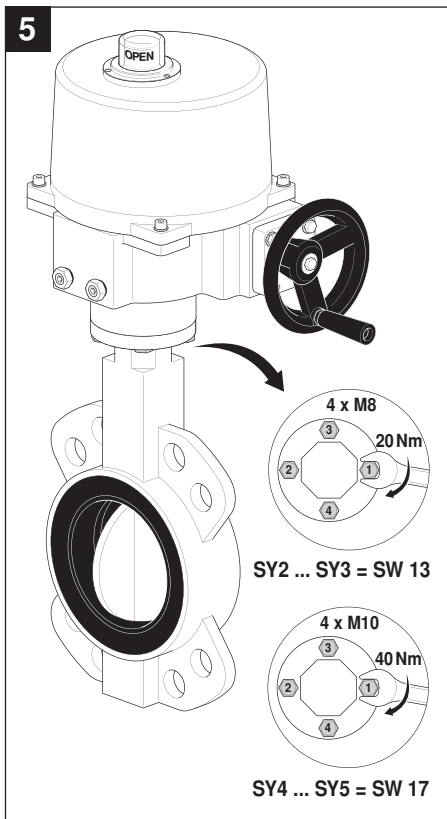
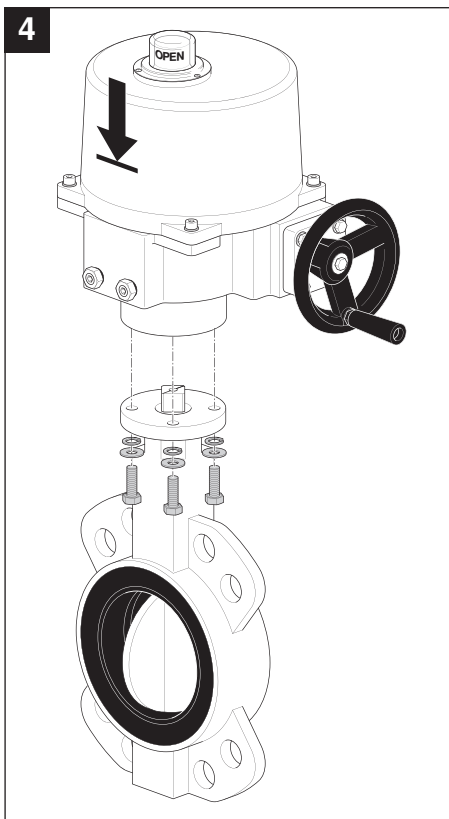
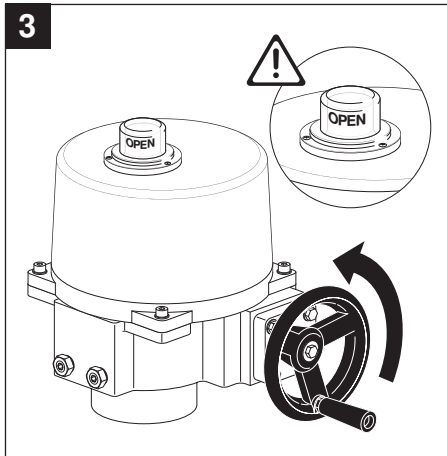
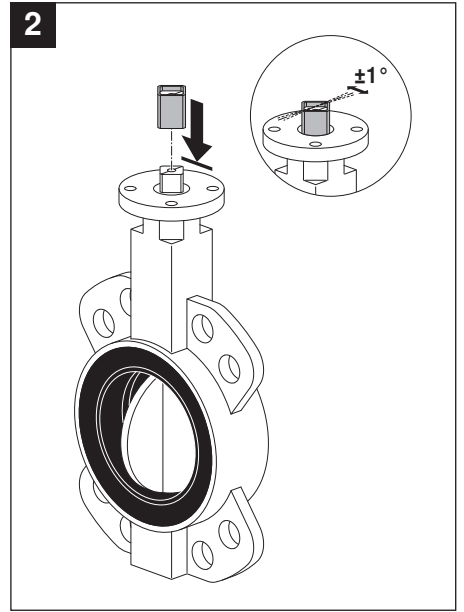
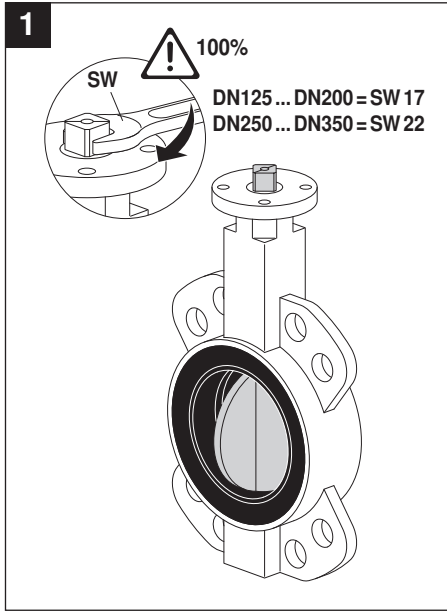
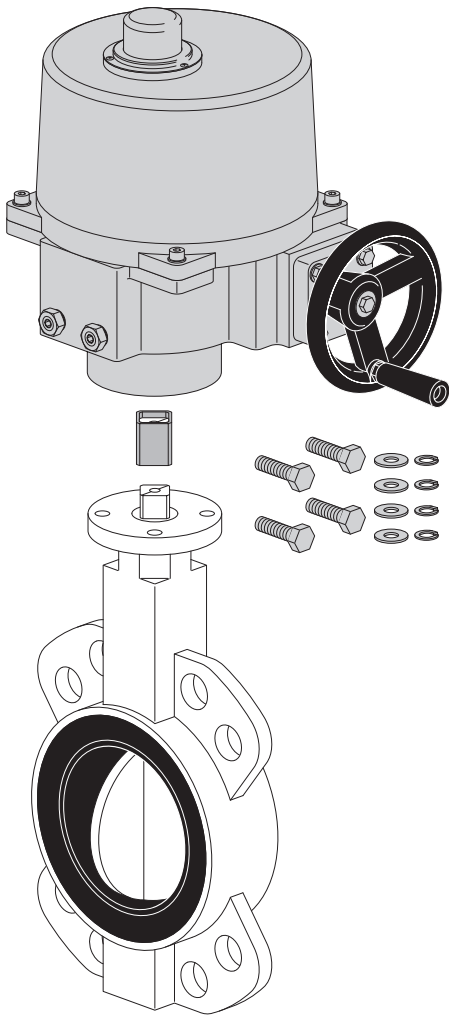


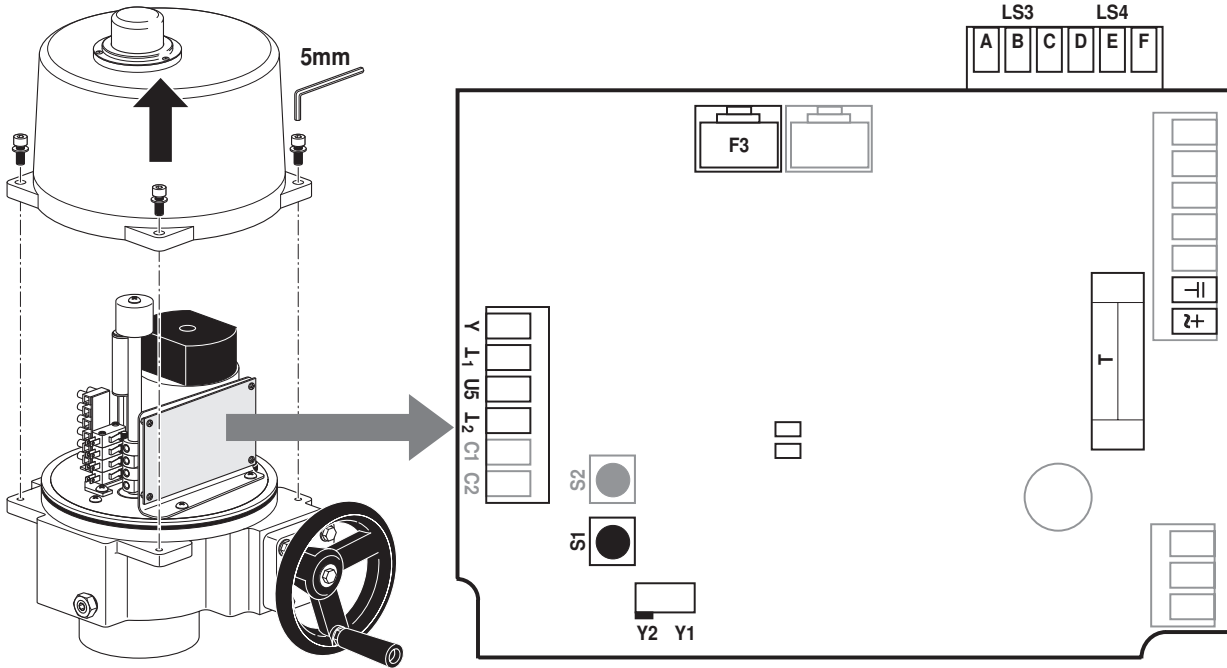
\perp / $\overline{\perp}$	Power supply voltage	
Y1	Direction of rotation switch	Actuator rotates anticlockwise (ccw), valve opens
Y2	Direction of rotation switch	Actuator rotates clockwise (cw) valve closes
Y	Control signal	
U5	Position feedback	
L1 / L2	0-lead (ground)	
F3	PC-tool connection	
S1	Adaptation button	Adaptation procedure is started (press S1 for 3 s) Adaptation must take place after the TC1 and TC2 have been adjusted.
S2	Adaptation button	Addressing procedure is started (press S2 for 3 s)
Yellow LED	On	Adaptation procedure activated
	Off	Standard operation
Green LED	On	In operation
	Off	No voltage supply or fault
T	Plug-in fuse	Type T10A250V
LS3	Auxiliary switch	Factory setting 87° ↺
LS4	Auxiliary switch	Factory setting 3° ↺
C1 / C2	Not used	

Weiterführende Dokumentationen

- Complete overview «The complete range of water solutions»
- Data sheets, butterfly valves
- Installation instructions for actuators and/or butterfly valves, respectively
- Notes for project planning (hydraulic characteristic curves and circuits, installation regulations, commissioning, maintenance, etc.)

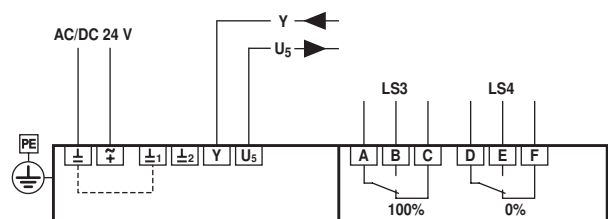
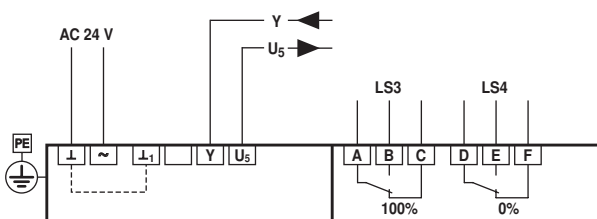
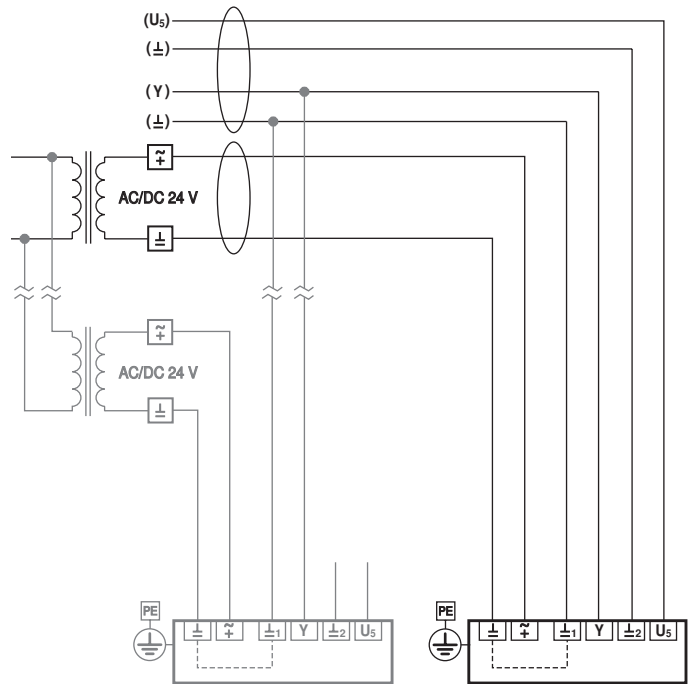
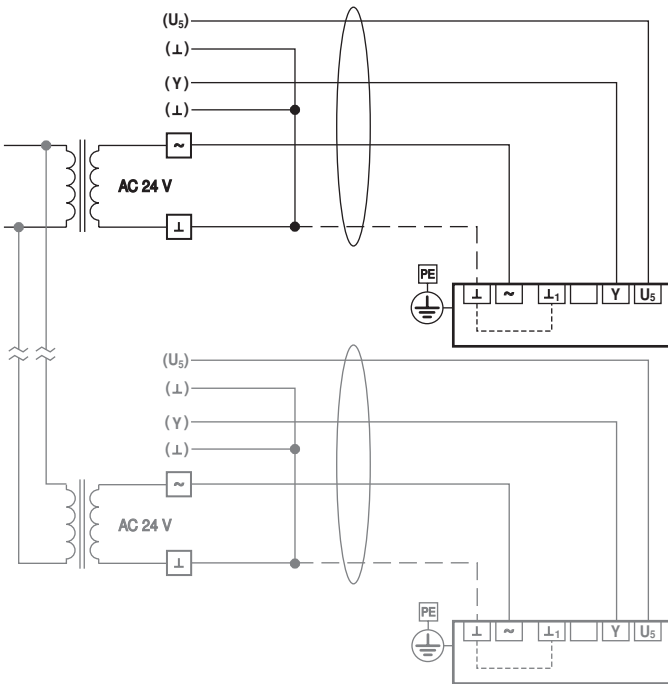
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SY..-24-SR-T / SY..-24-MF-T

SY..-24-SR-T / SY..-24-MF-T



Y1 ↙	A - AB = 100%
↘ Y2	A - AB = 0%

Y1 ↙	A - AB = 100%
↘ Y2	A - AB = 0%

