# BELIMO®

Parameterisable linear SuperCap actuator with emergency control function and extended functionalities for adjusting dampers and slide valves in technical building installations and in laboratories

- Air damper size up to approx. 3 m²
- Actuating force 450 N
- Nominal voltage AC/DC 24 V
- Control modulating DC (0)2...10 V Variable
- Position feedback DC 2...10 V Variable
- Length of Stroke Max. 100 mm, adjustable in 20 mm increments
- Design life SuperCaps: 15 years
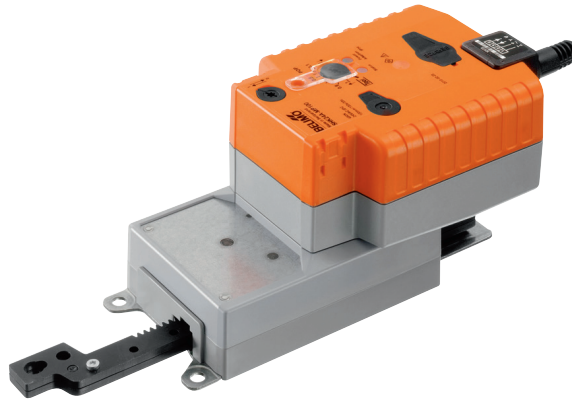
Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Nominal voltage range	AC 19.2...28.8 V / DC 21.6...28.8 V
	Power consumption in operation	11 W
	Power consumption in rest position	3 W
	Power consumption for wire sizing	21 VA
	Power consumption for wire sizing note	Imax 20 A @ 5 ms
	Connection supply / control	Cable 1 m, 4 x 0.75 mm²
	Parallel operation	Yes (note the performance data)
Functional data	Actuating force motor	Min. 450 N
	Positioning signal Y	DC 0...10 V
	Positioning signal Y note	Input impedance 100 kΩ
	Control signal Y variable	Open-close 3-point (AC only) Modulating (DC 0...32 V)
	Operating range Y	DC 2...10 V
	Operating range Y variable	Start point DC 0.5...30 V End point DC 2.5...32 V
	Position feedback U	DC 2...10 V
	Position feedback U note	Max. 0.5 mA
	Position feedback U variable	Start point DC 0.5...8 V End point DC 2.5...10 V
	Setting emergency setting position (POP)	0...100%, adjustable in increments of 10% (POP rotary knob on 0 corresponds to retracted gear rod)
	Setting emergency setting position (POP) variable	0...100%, adjustable
	Bridging time (PF)	2 s
	Bridging time (PF) variable	0...10 s
	Position accuracy	±5%
	Direction of motion motor	selectable with switch
	Direction of motion note	Y = 0 V: with switch 0 (retracted) / 1 (extended)
	Direction of motion variable	electronically reversible
	Direction of motion emergency control function	selectable with switch 0...100% (retracted 0 %)
	Manual override	with push-button
	Length of Stroke	Max. 100 mm, adjustable in 20 mm increments
	Stroke limitation	can be limited on both sides with mechanical end stops
	Running time motor	120 s / 100 mm
	Motor running time variable	90...150 s / 100 mm
	Running time emergency control position	35 s / 100 mm
	Running time emergency setting position note	<35 s @ 0...50°C
	Adaption setting range	manual
	Adaption setting range variable	No action Adaption when switched on Adaption after pushing the gear disengagement button

SuperCap linear actuator, parameterisable, modulating,
AC/DC 24 V, 450 N

BELIMO®

Technical data

|			
Functional data	Override control	MAX (maximum position) = 100% MIN (minimum position) = 0% ZS (intermediate position, AC only) = 50%	
	Override control variable	MAX = (MIN + 5%)...100% MIN = 0%...(MAX − 5%) ZS = MIN...MAX	
	Sound power level motor	52 dB(A)	
	Sound power level emergency control position	61 dB(A)	
Safety	Protection class IEC/EN	III Safety Extra-Low Voltage (SELV)	
	Protection class UL	UL Class 2 Supply	
	Degree of protection IEC/EN	IP54	
	Degree of protection NEMA/UL	NEMA 2, UL Enclosure Type 2	
	EMC	CE according to 2014/30/EU	
	Certification IEC/EN	IEC/EN 60730-1 and IEC/EN 60730-2-14	
	Certification UL	cULus according to UL 60730-1A, UL 60730-2-14 and CAN/CSA E60730-1:02	
	Mode of operation	Type 1.AA	
	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	
	Maintenance	Maintenance-free	
Weight	Weight	1.6 kg	
Terms	Abbreviations	POP = Power off position / emergency setting position PF = Power fail delay time / bridging time	

Safety notes

- The device must not be used outside the specified field of application, especially not in aircraft or in any other airborne means of transport.
- Outdoor application: only possible in case that no (sea)water, snow, ice, insolation or aggressive gases interfere directly with the actuator and that is ensured that the ambient conditions remain at any time within the thresholds according to the data sheet.
- Only authorised specialists may carry out installation. All applicable legal or institutional installation regulations must be complied 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.
- Cables must not be removed from the device.
- The rotary supports and coupling pieces available as accessories must always be used if transverse forces are likely. In addition, the actuator must not be tightly bolted to the application. It must remain movable via the rotary support (refer to «Assembly notes»).
- If a rotary support and/or coupling piece is used, actuation force losses are to be expected.
- If the actuator is exposed to severely contaminated ambient air, appropriate precautions must be taken on the system side. Excessive deposits of dust, soot etc. can prevent the gear rod from being extended and retracted correctly.
- If not installed horizontally, the gear disengagement pushbutton may only be actuated when there is no pressure on the gear rod.
- To calculate the actuating force required for air dampers and slide valves, the specifications supplied by the damper manufacturers concerning the cross section, the design, the installation site and the ventilation conditions must be observed.
- Self adaptation is necessary when the system is commissioned or whenever the stroke limiting is adjusted (press the adaptation push-button).
- The device contains electrical and electronic components and must not be disposed of as household refuse. All locally valid regulations and requirements must be observed.

Product features

Mode of operation	The actuator moves the damper to the desired operating position at the same time as the integrated capacitors are charged. Interrupting the supply voltage causes the damper to be rotated back into the emergency setting position (POP) by means of stored electrical energy. The actuator is connected with a standard modulating signal of DC 0...10V and drives to the position defined by the positioning signal. Measuring voltage U serves for the electrical display of the damper position 0...100% and as slave control signal for other actuators.
Pre-charging time (start up)	The capacitor actuators require a pre-charging time. This time is used for charging the capacitors up to a usable voltage level. This ensures that, in the event of an electricity interruption, the actuator can move at any time from its current position into the preset emergency setting position (POP). The duration of the pre-charging time depends mainly on following factors: – Duration of the electricity interruption – PF delay time (bridging time)

Typical pre-charging time
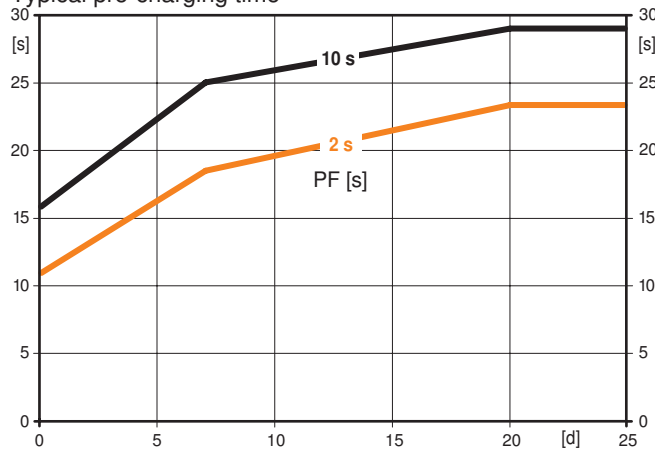
[d] = Electricity interruption in days
[s] = Pre-charging time in seconds
PF[s] = Bridging time
Calculation example: Given an electricity interruption of 7 days and a bridging time (PF) set at 2 s, the actuator requires a pre-charging time of 18 s after the electricity has been reconnected (see graphic).

PF [s]	[d]		
	0	**7**	**≥20**
2	11	18	23
10	16	25	29

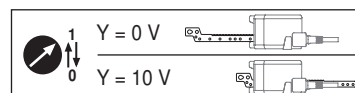|	
Delivery condition (capacitors)	The actuator is completely discharged after delivery from the factory, which is why the actuator requires approximately 20 s pre-charging time before initial commissioning in order to bring the capacitors up to the required voltage level.
Parameterisable actuators	The factory settings cover the most common applications. Single parameters can be modified with the Belimo Service Tools MFT-P or ZTH EU.
Simple direct mounting	The actuator can be directly connected with the application using the enclosed screws. The head of the gear rod is connected to the moving part of the ventilating application individually on the mounting side or with the Z-KS1 coupling piece provided for this purpose.
Manual override	Manual control with push-button possible - temporary. The gear is disengaged and the actuator decoupled for as long as the button is pressed.
Adjustable stroke	If a stroke limitation will be adjusted, the operating range on this side of the gear rod can be used starting with an extension length of 20 mm and then can be limited respectively in increments of 20 mm by means of the mechanical end stops Z-AS1.
High functional reliability	The actuator is overload protected, requires no limit switches and automatically stops when the end stop is reached.
Home position	The first time the supply voltage is switched on, i.e. at the time of commissioning, the actuator carries out a synchronisation. The synchronisation is in the home position (0%). The actuator then moves into the position defined by the positioning signal.

Product features

Direction of stroke switch	When actuated, the direction of stroke switch changes the running direction in normal operation. The direction of stroke switch has no influence on the emergency setting position (POP) which has been set.
Adaption and synchronisation	An adaption can be triggered manually by pressing the "Adaption" button or with the PC-Tool. Both mechanical end stops are detected during the adaption (entire setting range). A range of settings can be adapted using the PC-Tool (see MFT-P documentation)
Emergency setting position (POP) rotary knob	The rotary knob «Emergency setting position» can be used to adjust the desired emergency setting position (POP) between 0 and 100% in 10% increments. The rotary knob only refers to the adapted stroke range between 30 and 100 mm. No set Min or Max values are observed. In the event of an electricity interruption, the actuator will move into the selected emergency setting position (POP), taking into account the bridging time which was set. Settings: The rotary knob must be set to the «Tool» position for retroactive settings of the emergency setting position (POP) with the Belimo service tool MFT-P. Once the rotary knob is set back to the range 0…100%, the manually set value will have positioning authority.
Bridging time	Electricity interruptions can be bridged up to a maximum of 10 s. In the event of an electricity interruption, the actuator will remain stationary in accordance with the set bridging time. If the electricity interruption is greater than the set bridging time, then the actuator will move into the selected emergency setting position (POP). The bridging time set ex-works is 2 s. This can be modified on site in operation with the use of the Belimo service tool MFT-P. Settings: The rotary knob must not be set to the "Tool" position! For retroactive adjustments of the bridging time with the Belimo service tool MFT-P or with the ZTH EU adjustment and diagnostic device only the values need to be entered.

Accessories

	Description	Type
Electrical accessories	Digital position indicator for front-panel mounting, 0...99%, front mass 72 x 72 mm	ZAD24
	Range controller for wall mounting, adjustable electron. Min./max. angle of rotation limitation	SBG24
	Positioner for wall mounting, range 0...100%	SGA24
	Positioner in a conduit box, range 0...100%	SGE24
	Positioner for front-panel mounting, range 0...100%	SGF24
	Positioner for wall mounting, range 0...100%	CRP24-B1
	Connection cable 5 m, A+B: RJ12 6/6, To ZTH/ZIP-USB-MP	ZK1-GEN
	Connection cable 5 m, A: RJ11 6/4, B: Free wire end, To ZTH/ZIP-USB-MP	ZK2-GEN

	Description	Type
Mechanical accessories	End stop set for SH	Z-AS1
	Rotary support for compensation of transverse forces	Z-DS1
	Coupling piece M8 for SH, galvanised steel	Z-KS1

	Description	Type
Service Tools	Service tool for parametrisable and communicative Belimo actuators / VAV controller and HVAC performance devices	ZTH EU
	Belimo PC-Tool, software for adjustments and diagnostics	MFT-P
	Adapter to Service Tool ZTH	MFT-C

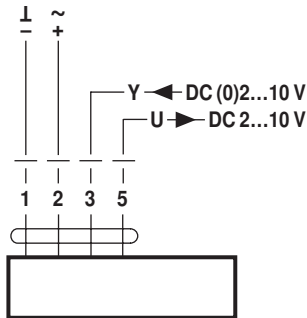## Electrical installation

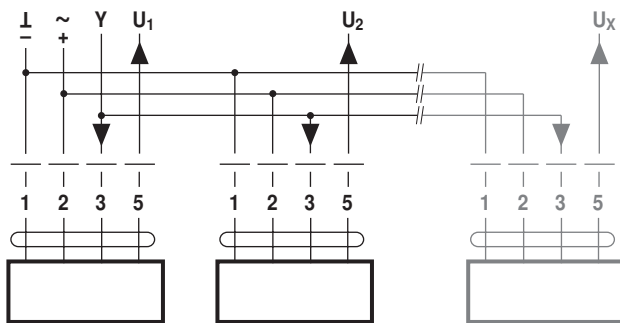|		
⚠	**Notes**	• Connection via safety isolating transformer. • Parallel connection of other actuators possible. Observe the performance data.

Electrical installation

Wiring diagrams

AC/DC 24 V, modulating

Y ◄— DC (0)2...10 V
U ►— DC 2...10 V

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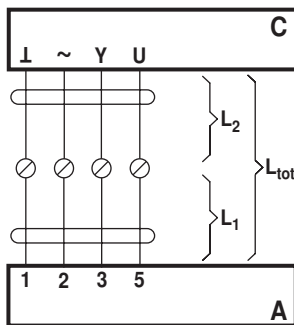2 = red
3 = white
5 = orange

Parallel operation

Notes
• A maximum of eight actuators can be connected in parallel.
• Parallel operation is permitted only on non-connected axes.
• Do not fail to observe performance data with parallel operation.

Signal cable lengths

L₂	Lₜₒₜ = L₁ + L₂	
⊥ / ~	AC	DC
0.75 mm²	≤30 m	≤5 m
1.00 mm²	≤40 m	≤8 m
1.50 mm²	≤70 m	≤12 m
2.50 mm²	≤100 m	≤20 m

A = actuator
C = control unit
L1 = actuator connecting cable
L2 = customer cable
Ltot = maximum signal cable length

Note:
In the event of several actuators switched in parallel, the maximum signal cable length is to be divided by the number of actuators.

N L
AC 230 V
AC 24 V
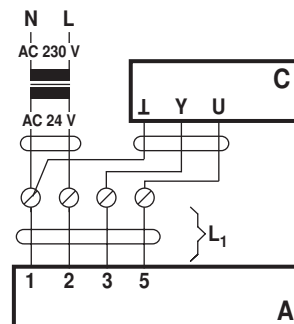
A = actuator
C = control unit
L1 = actuator connecting cable

Note:
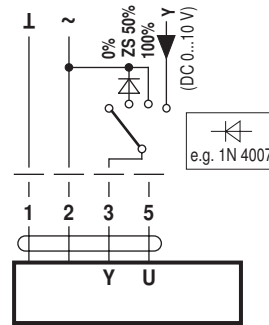If supply and data line are handled separately, then no special limitations apply for the installation.

Functions

Functions with basic values (conventional mode)
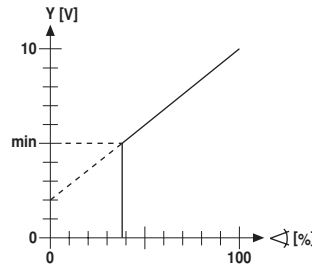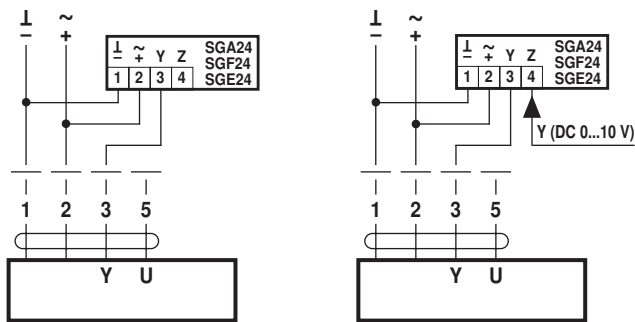
Override control with AC 24 V with relay contacts

Y (DC 0...10 V)

e.g. 1N 4007

	a	b	c
0%			
ZS 50%			
100%			
Y			
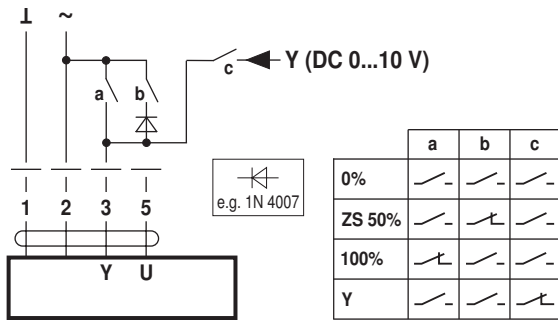
Override control with AC 24 V with rotary switch

e.g. 1N 4007

Remote control 0...100% with positioner SG..

				SGA24
⊥	~	Y	Z	SGF24
1	2	3	4	SGE24

Minimum limit with positioner SG..

				SGA24
⊥	~	Y	Z	SGF24
1	2	3	4	SGE24

Y (DC 0...10 V)

Position indication

			ZAD24
−	+		
1	2	3	4

(1) Adapting the direction of rotation
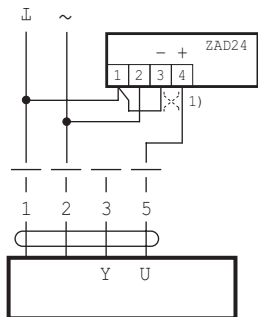
Control with 4...20 mA via external resistor

500 Ω

(−)
(+)   4...20 mA
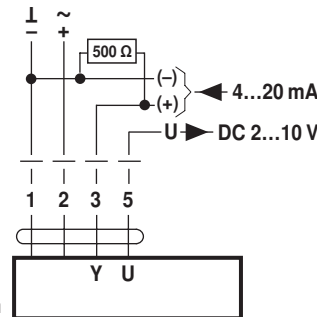
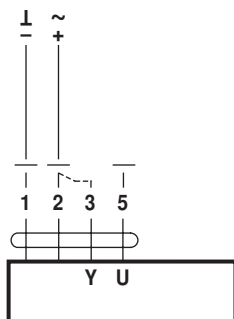U → DC 2...10 V

Caution:
The operating range must be set to DC 2...10 V.
The 500 Ω resistor converts the 4...20 mA current signal to a voltage signal DC 2...10 V

Functional check

Procedure
1. Apply 24 V to connection 1 and 2
2. Disconnect connection 3:
- for direction of stroke 0: Actuator travels in the direction "retracted"
- for direction of stroke 1: Actuator travels in the direction "extended"
3. Short circuit connections 2 and 3:
- Actuator runs in the opposite direction

Functions

Functions for actuators with specific parameters (Parametrisation with PC-Tool necessary)
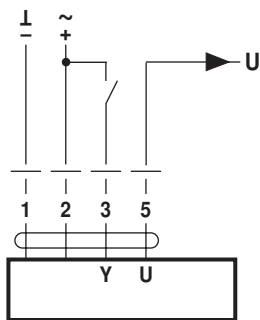
Override control and limiting with AC 24 V with relay contacts

	a	b	c	d	e
Close [1]					
MIN					
ZS					
MAX					
Open					
Y					

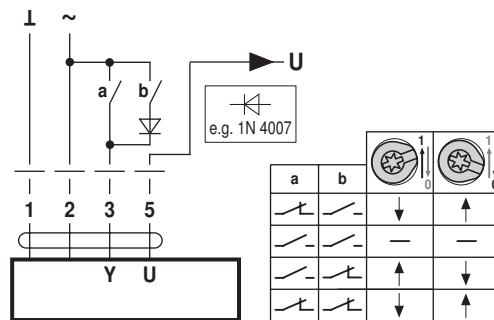Override control and limiting with AC 24 V with rotary switch
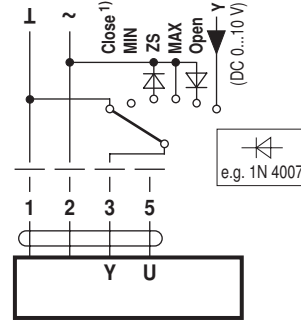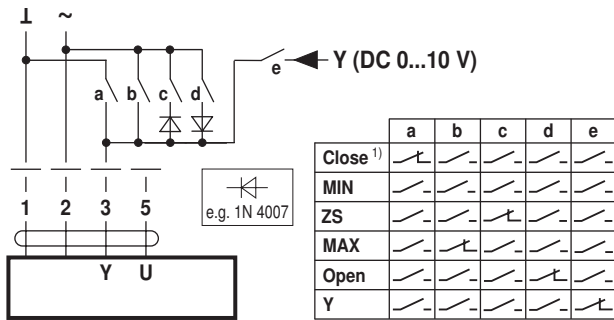
1) **Caution:** This function is only guaranteed if the start point of the operating range is defined as min. 0.5 V.
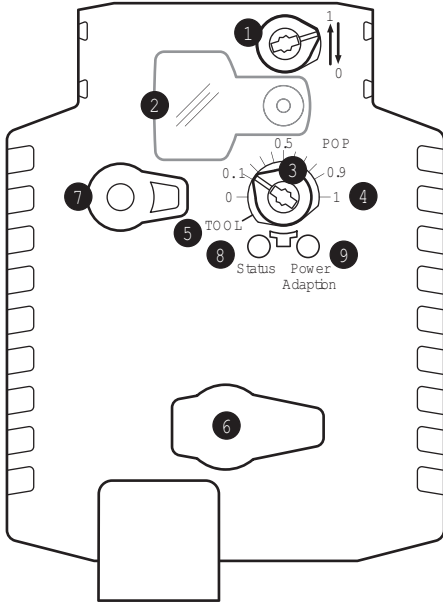
Control open-close

Control 3-point

|	a	b		
			↓	↑
			—	—
			↑	↓
			↓	↑

Operating controls and indicators

1. Direction of stroke switch
2. Cover, POP button
3. POP button
4. Scale for manual adjustment
5. Position for adjustment with tool
6. Tool socket
7. Disengagement button

LED displays		Meaning / function
8 yellow	**9** green	
Off	On	Operation OK / without fault
Off	Flashing	POP function active
On	Off	Fault
Off	Off	Not in operation
On	On	Adaptation procedure running
Flashing	On	Communication with programming tool

9. Press button: Triggers stroke adaption, followed by standard operation

Setting emergency setting position (POP)
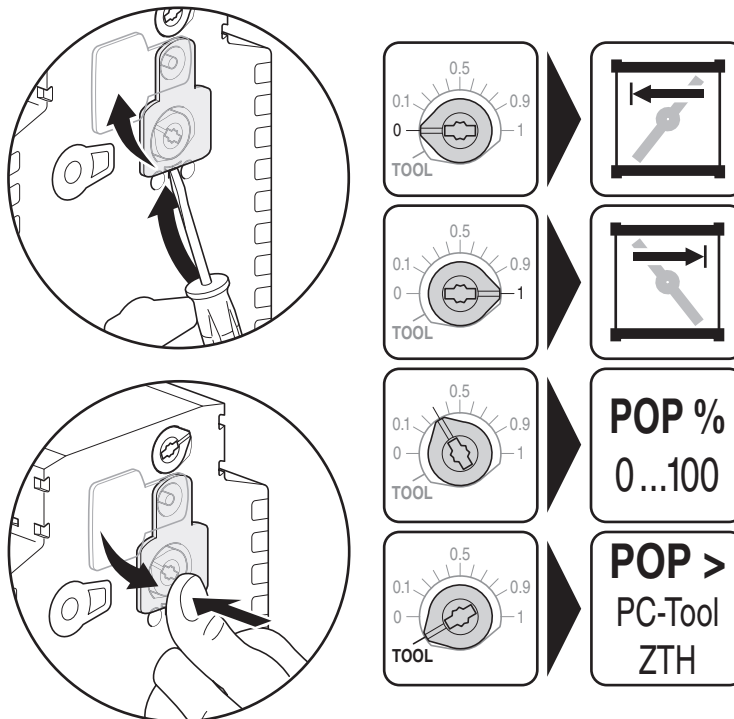
Installation notes

⚠ **Notes**	• If a rotary support and/or coupling piece is used, losses in the actuation force losses are to be expected.

Applications without transverse force

The linear actuator is screwed directly to the housing at three points. Afterwards, the head of the gear rod is fastened to the moving part of the ventilation application (e.g. damper or slide valve).

Applications with transverse forces

The coupling piece with the internal thread (Z-KS1) is connected to the head of the gear rod. The rotary support (Z-DS1) is screwed to the ventilation application. Afterwards, the linear actuator is screwed to the previously mounted rotary support with the enclosed screw. Afterwards, the coupling piece, which is mounted to the head of the gear rod, is attached to the moving part of the ventilating application (e.g. damper or slide valve). The transverse forces can be compensated for to a certain limit with the rotary support and/or coupling piece. The maximum permissible swivel angle of the rotary support and coupling piece is 10° (angle), laterally and upwards.

Stroke limitation

If the stroke limitations are used on the gear rod, the mechanical operating range on this side of the gear rod can be used starting with an extension length of 20 mm.

Service

Service Tools connection

The actuator can be parameterised by ZTH EU via the service socket.
For an extended parameterisation the PC tool can be connected.

Connection ZTH EU / PC-Tool

SuperCap linear actuator, parameterisable, modulating, AC/DC 24 V, 450 N
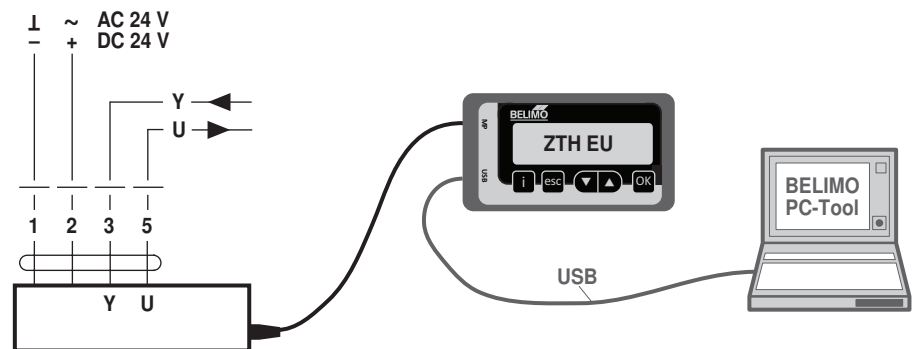
Dimensions [mm]

Dimensional drawings