Configurable rotary actuator fail-safe and extended functionalities for adjusting dampers in technical building installations

- Air damper size up to approx. 1.2 m²
- Torque motor 6 Nm
- Nominal voltage AC/DC 24 V
- Control modulating 2...10 V variable
- Position feedback 2...10 V variable
- Running time motor 4 s variable

Picture may differ from product

## 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 | 22 VA |
| | Inrush current (Imax) | 20.0 A @ 5 ms |
| | Connection supply / control | Cable 1 m, 4x 0.75 mm² |
| | Parallel operation | Yes (note the performance data) |
| **Functional data** | Torque motor | 6 Nm |
| | Operating range Y | 2...10 V |
| | Input impedance | 100 kΩ |
| | Operating range Y variable | Start point 0.5...30 V<br>End point 2.5...32 V |
| | Operating modes optional | Open/close<br>Modulating (DC 0...32 V) |
| | Position feedback U | 2...10 V |
| | Position feedback U note | Max. 0.5 mA |
| | Position feedback U variable | Start point 0.5...8 V<br>End point 2.5...10 V |
| | Setting fail-safe position | 0...100%, adjustable in increments of 10%<br>(POP rotary knob on 0 corresponds to left end stop) |
| | Bridging time (PF) | 0 s |
| | Bridging time (PF) variable | 0...5 s |
| | Position accuracy | ±5% |
| | Direction of motion motor | selectable with switch 0/1 |
| | Direction of motion variable | electronically reversible |
| | Direction of motion fail-safe | selectable with switch 0...100% |
| | Direction of motion note | Y = 0 V: At switch position 0 (ccw rotation) /<br>1 (cw rotation) |
| | Manual override | with push-button |
| | Angle of rotation | Max. 95° |
| | Angle of rotation note | can be limited on both sides with adjustable mechanical end stops |
| | Minimum angle of rotation | Min. 30° |
| | Running time motor | 4 s / 90° |
| | Running time motor variable | 4...20 s |
| | Running time fail-safe | 4 s / 90° |
| | Sound power level, motor | 60 dB(A) |

## Technical data

| | | |
|---|---|---|
| **Functional data** | Sound power level, fail-safe | 60 dB(A) |
| | Adaptation setting range | manual (automatic on first power-up) |
| | Adaptation setting range variable | No action<br>Adaptation when switched on<br>Adaptation after pushing the manual override button |
| | Override control | MAX (maximum position) = 100%<br>MIN (minimum position) = 0%<br>ZS (intermediate position, AC only) = 50% |
| | Override control variable | MAX = (MIN + 32%)...100%<br>MIN = 0%...(MAX – 32%)<br>ZS = MIN...MAX |
| | Mechanical interface | Universal shaft clamp 8...26.7 mm |
| | Position indication | Mechanical, pluggable |
| **Safety data** | Protection class IEC/EN | III, Safety Extra-Low Voltage (SELV) |
| | Power source UL | Class 2 Supply |
| | Degree of protection IEC/EN | IP54 |
| | Degree of protection NEMA/UL | NEMA 2 |
| | Housing | UL Enclosure Type 2 |
| | EMC | CE according to 2014/30/EU |
| | Certification IEC/EN | IEC/EN 60730-1 and IEC/EN 60730-2-14 |
| | UL Approval | cULus according to UL60730-1A, UL60730-2-14 and CAN/CSA E60730-1<br>The UL marking on the actuator depends on the production site, the device is UL-compliant in any case |
| | Type of action | Type 1.AA |
| | Rated impulse voltage supply / control | 0.8 kV |
| | Pollution degree | 3 |
| | Ambient humidity | Max. 95% RH, non-condensing |
| | Ambient temperature | -30...50°C [-22...122°F] |
| | Storage temperature | -40...80°C [-40...176°F] |
| | Servicing | maintenance-free |
| **Weight** | Weight | 1.1 kg |
| **Terms** | Abbreviations | POP = Power off position / fail-safe position<br>PF = Power fail delay time / bridging time |

## Safety notes

- This device has been designed for use in stationary heating, ventilation and air-conditioning systems and must not be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Outdoor application: Only possible if no (sea) water, snow, ice, sunlight or aggressive gases act directly on the device and if it is ensured that the ambient conditions remain within the limit values specified in the data sheet at all times.
- Only authorised specialists may carry out installation. All applicable legal or institutional installation regulations must be complied with 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.
- To calculate the torque required, the specifications supplied by the damper manufacturers concerning the cross-section and the design, as well as the installation situation and the ventilation conditions must be observed.
- Self adaptation is necessary when the system is commissioned and after each adjustment of the angle of rotation (press the adaptation push-button once).
- 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

**Operating mode**

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 fail-safe position by means of stored electrical energy.

The actuator is connected with an analogue control signal Y (note the operating range) and drives to the position defined. The measuring voltage U serves for the electrical display of the damper position 0...100% and as control signal for other actuators.

**Pre-charging time (start up)**

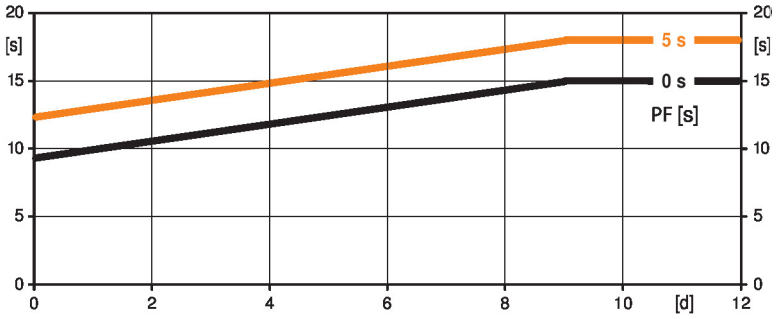
The capacitor actuators require a pre-charging time. This time is used for charging the capacitors up to a usable voltage level. This ensures that, in the event of a power failure, the actuator can move at any time from its current position into the preset fail-safe position.

The duration of the pre-charging time depends mainly on following factors:

– Duration of the power failure

– PF delay time (bridging time)

Typical pre-charging time




[d] = Power failure in days
[s] = Pre-charging time in seconds
PF[s] = Bridging time
Calculation example: Given a power failure of 3 days and a bridging time (PF) set at 5 s, the actuator requires a pre-charging time of 14 s after the power has been reconnected (see graphic).

| PF [s] | [d] | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 7 | ≥10 |
| 0 | 9 | 10 | 11 | 13 | 15 |
| 5 | 12 | 13 | 14 | 16 | 18 |
| | [s] | | | | |

**Delivery condition (capacitors)**

The actuator is completely discharged after delivery from the factory, which is why the actuator requires approximately 15 s pre-charging time before initial commissioning in order to bring the capacitors up to the required voltage level.

## Product features

**Bridging time**

Power failures can be bridged up to a maximum of 5 s. In the event of a power failure, the actuator will remain stationary in accordance with the set bridging time. If the power failure is greater than the set bridging time, the actuator drives to the selected fail-safe position.

The bridging time set at the factory is 0 s. This can be modified on site in operation by means 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.

**Setting fail-safe position (POP)**

The rotary knob fail-safe position can be used to adjust the desired fail-safe position 0...100% in 10% increments.

The rotary knob refers only to the adapted angle of rotation range 30°...95°. No set min. or max. values are observed.

In the event of a power failure, the actuator will move into the selected fail-safe position, taking into account the bridging time that has been set.

Settings: The rotary knob must be set to the «Tool» position for retroactive settings of the fail-safe position 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.

**Configurable device**

The factory settings cover the most common applications. Single parameters can be modified with Belimo Assistant 2 or ZTH EU.

**Simple direct mounting**

Simple direct mounting on the damper shaft with a universal shaft clamp, supplied with an anti-rotation mechanism to prevent the actuator from rotating.

**Manual override**

Manual control with push-button possible - temporary. The gear train is disengaged and the actuator decoupled for as long as the button is pressed.

**Adjustable angle of rotation**

Adjustable angle of rotation with mechanical end stops. A minimum permissible angle of rotation of 30° must be allowed for.

**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 an adaptation, which is when the operating range and position feedback adjust themselves to the mechanical setting range.

The detection of the mechanical end stops enables a gentle approach to the end positions, thus protecting the actuator mechanics.

The actuator then moves into the position defined by the control signal.

**Adaptation and synchronisation**

An adaptation can be triggered manually by pressing the "Adaptation" button or with the PC-Tool. Both mechanical end stops are detected during the adaptation (entire setting range).

A range of settings can be made using Belimo Assistant 2.

**Setting direction of motion**

When actuated, the direction of the rotation switch changes the running direction in normal operation. The direction of the rotation switch has no influence on the fail-safe position which has been set.

## Accessories

**Tools**

| Description | Type |
|---|---|
| Service tool, with ZIP-USB function, for configurable and communicative Belimo actuators, VAV controller and HVAC performance devices | ZTH EU |
| Service tool for wired and wireless setup, on-site operation and troubleshooting. | Belimo Assistant 2 |
| Adapter for Service-Tool ZTH | MFT-C |
| Connecting cable 5 m, A: RJ11 6/4 LINK.10, B: 6-pin for connection to service socket | ZK1-GEN |
| Connecting cable 5 m, A: RJ11 6/4 LINK.10, B: free wire end for connection to MP/PP terminal | ZK2-GEN |

## Accessories

| | Description | Type |
|---|---|---|
| | Belimo Assistant Link Bluetooth and USB to NFC and MP-Bus converter for configurable and communicative devices | LINK.10 |

| Electrical accessories | Description | Type |
|---|---|---|
| | Auxiliary switch 1x SPDT add-on | S1A |
| | Auxiliary switch 2x SPDT add-on | S2A |
| | Feedback potentiometer 140 Ω add-on | P140A |
| | Feedback potentiometer 1 kΩ add-on | P1000A |
| | Feedback potentiometer 10 kΩ add-on | P10000A |
| | Adapter for auxiliary switch and feedback potentiometer, Multipack 20 pcs. | Z-SPA |
| | Signal converter voltage/current 100 kΩ 4...20 mA, Supply AC/DC 24 V | Z-UIC |
| | Positioner for wall mounting | SGA24 |
| | Positioner for built-in mounting | SGE24 |
| | Positioner for front-panel mounting | SGF24 |
| | Positioner for wall mounting | CRP24-B1 |

| Mechanical accessories | Description | Type |
|---|---|---|
| | Actuator arm for standard shaft clamp (one-sided) | AH-25 |
| | Shaft extension 240 mm ø20 mm for damper shaft ø8...22.7 mm | AV8-25 |
| | Mounting kit for linkage operation for flat installation | ZG-NMA |

* Adapter Z-SPA

It is imperative that this adapter will be ordered if an auxiliary switch or a feedback potentiometer is required.

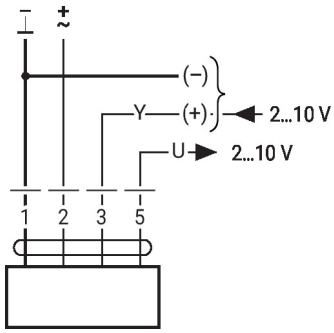
## Electrical installation

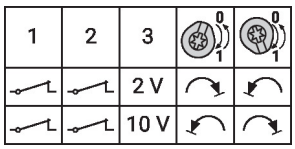
**Supply from isolating transformer.**

**Parallel connection of other actuators possible. Observe the performance data.**

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

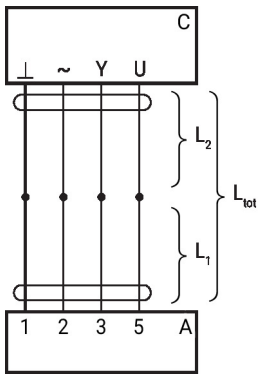
AC/DC 24 V, modulating



## Electrical installation

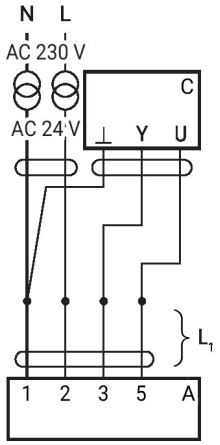
Signal cable lengths




| $L_2$ | $L_{tot} = L_1 + L_2$ | |
|---|---|---|
| ⊥ / ~ | 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 (controlling unit)
L1 = Connecting cable of the actuator
L2 = Customer cable
Ltot = Maximum signal cable length

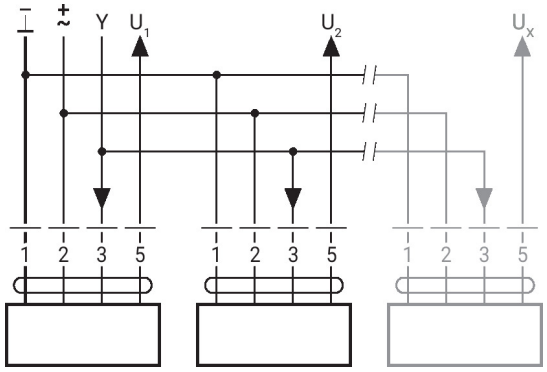
**Note:**
When several actuators are connected in parallel, the maximum signal cable length must be divided by the number of actuators.




A = Actuator
C = Control unit (controlling unit)
L1 = Connecting cable of the actuator

**Note:**
There are no special restrictions on installation if the supply and the data cable are routed separately.

Parallel operation

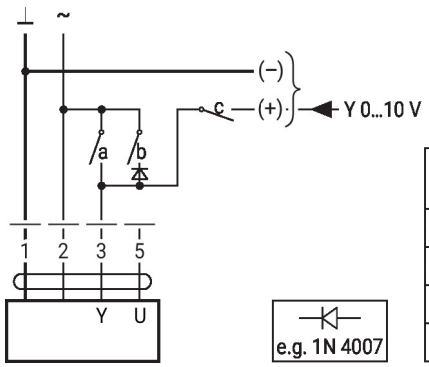



- Max. 8 actuators in parallel
- Parallel operation is permitted only on non-connected axes
- Do not fail to observe performance data with parallel operation

## Further electrical installations

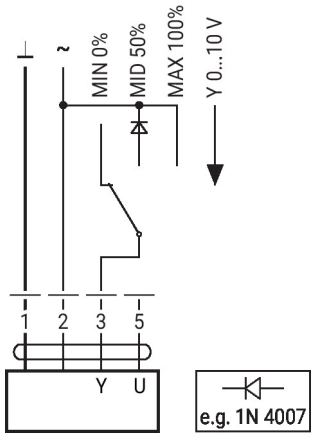
### Functions with basic values (conventional mode)

Override control with AC 24 V with relay contacts

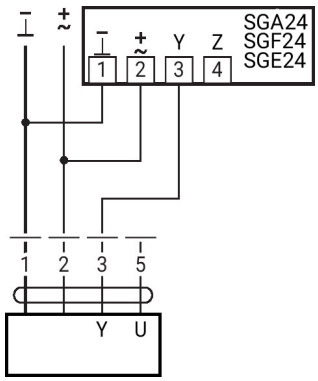



| 1 | 2 | a | b | c | |
|---|---|---|---|---|---|
| | | | | | 0 % |
| | | | | | ZS 50% |
| | | | | | 100% |
| | | | | | Y |

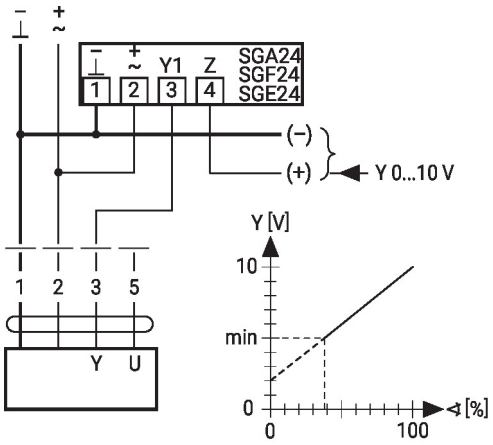
Override control with AC 24 V with rotary switch



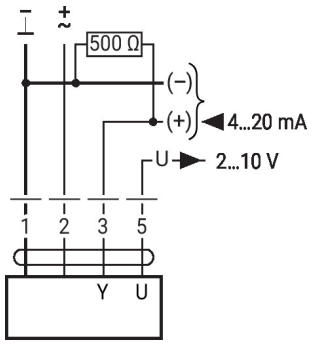

Control remotely 0...100% with positioner SG..




Minimum limit with positioner SG..

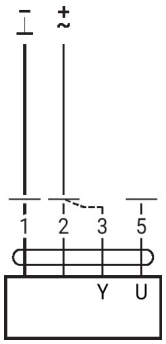



Control with 4...20 mA via external resistor




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

Functional check

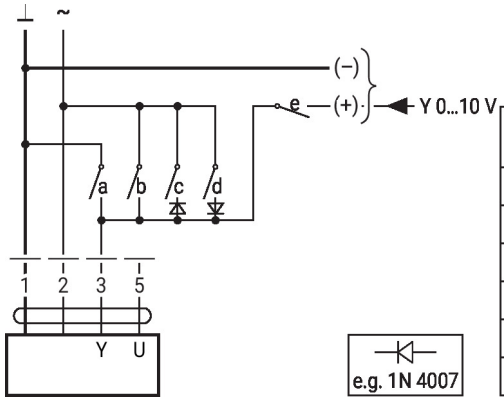



**Procedure**
1. Connect 24 V to connections 1 and 2
2. Disconnect connection 3:
– With direction of rotation 0: Actuator rotates to the left
– With direction of rotation 1: Actuator rotates to the right
3. Short-circuit connections 2 and 3:
– Actuator runs in opposite direction

## Further electrical installations

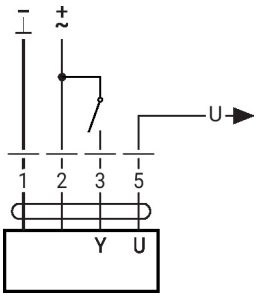
### Functions with specific parameters (configuration necessary)

Override control and limiting with AC 24 V with relay contacts

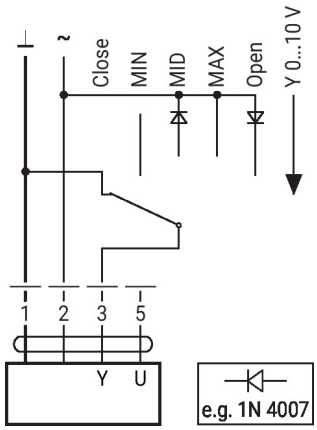



| 1 | 2 | a | b | c | d | e | |
|---|---|---|---|---|---|---|---|
| | | | | | | | Close |
| | | | | | | | MIN |
| | | | | | | | ZS |
| | | | | | | | MAX |
| | | | | | | | Open |
| | | | | | | | Y |

Control open/close

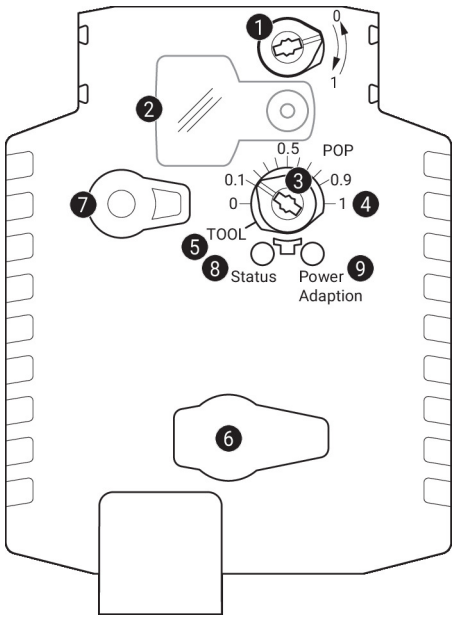



Override control and limiting with AC 24 V with rotary switch




**Caution:**
The "Close" function is only guaranteed if the start point of the operating range is defined as min. 0.5 V.

## Operating controls and indicators




**1 Direction-of-rotation switch**

Switch over: Direction of rotation changes

**2 Cover, POP button**

**3 POP button**

**4 Scale for manual adjustment**

**5 Position for adjustment with tool**

**6 Service plug**
For connecting configuration and service tools

**7 Manual override button**

Press button: Gear train disengages, motor stops, manual override possible
Release button: Gear train engages, standard mode

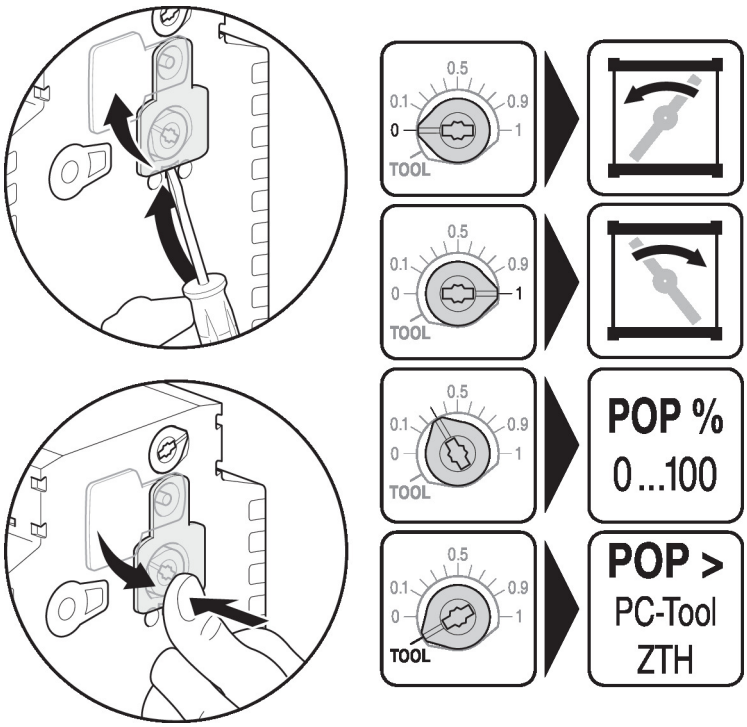
**9 Push-button** (LED green)

Press button: Triggers angle-of-rotation adaptation, followed by standard mode

LED displays

| Yellow 8 | Green 9 | Meaning / function |
|---|---|---|
| Off | On | Operation OK |
| Off | Flashing | POP function active |
| On | Off | Fault |
| Off | Off | Not in operation |
| On | On | Adaptation process active |
| Flickering | On | Communication with programming tool |

Setting fail-safe position (POP)

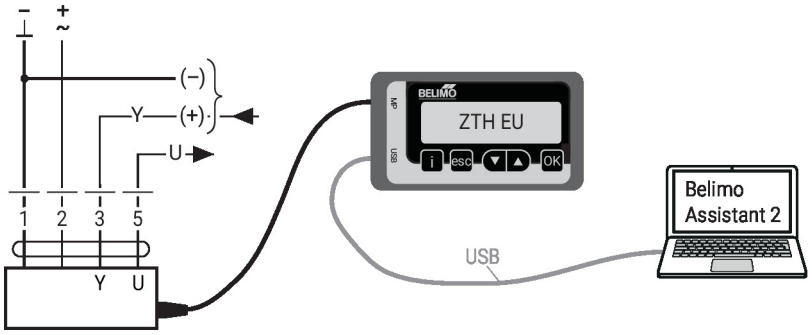


## Service

**Wired connection**

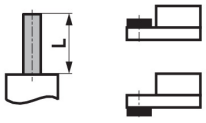
The device can be configured by ZTH EU via the service socket.
For an extended configuration, Belimo Assistant 2 can be connected.

Connection ZTH EU / Belimo Assistant 2




## Dimensions

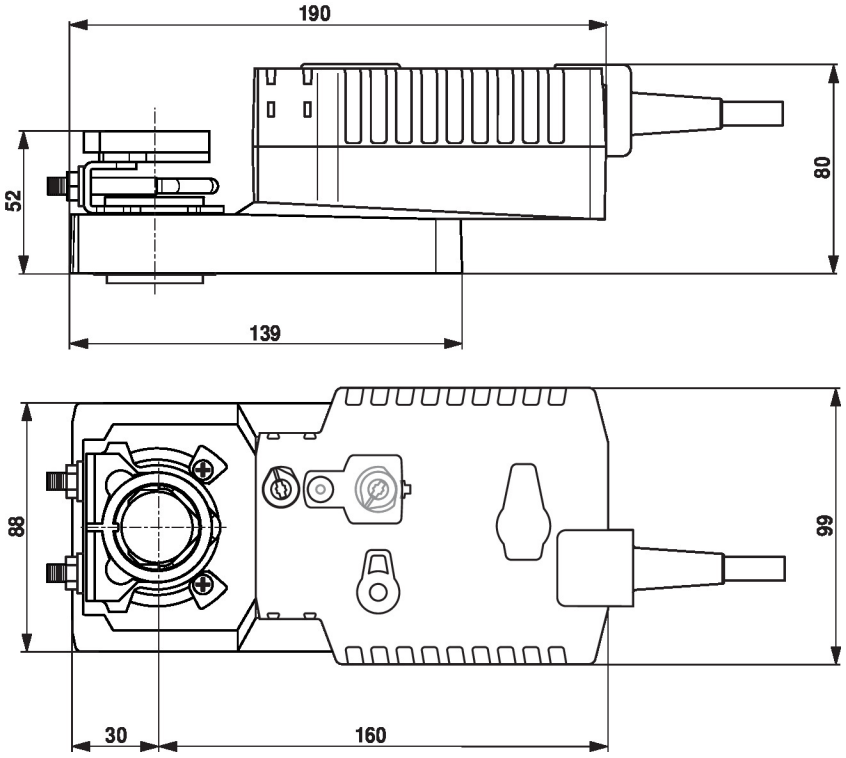
### Shaft length

| | |
|---|---|
|  | Min. 42 |
| | Min. 20 mm [0.75"] |

### Clamping range

| | | | |
|---|---|---|---|
| | 8...26.7 | ≥8 | ≤26.7 |
| * | 8...20 | ≥8 | ≤20 |

*Option: Shaft clamp mounted below: If an auxiliary switch or a feedback potentiometer is used the adapter Z-SPA is required.




## Further documentation

• Quick Guide – Belimo Assistant 2