**Customizable Fail-Safe multifunction technology actuator for controlling dampers in typical commercial HVAC applications.**

- **Torque motor 270 in-lb [30 Nm]**
- **Nominal voltage AC/DC 24 V**
- **Control MFT/programmable**
- **Position feedback 2...10 V**



Picture may differ from product

5-year warranty

LISTED 94 D5 TEMP. IND. & REG. EQUIP.

BRUSHLESS dc motor

MFT

## 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 | 9.5 W |
| | Power consumption in rest position | 4.5 W |
| | Transformer sizing | 16 VA |
| | Electrical connection | 18 AWG appliance or plenum cables, 1 m, 3 m or 5 m, with or without 1/2" NPT conduit connector |
| | Overload Protection | electronic throughout 0...95° rotation |
| | Electrical Protection | actuators are double insulated |
| **Functional data** | Torque motor | 270 in-lb [30 Nm] |
| | Operating range Y | 2...10 V |
| | Operating range Y note | 4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor) |
| | Input impedance | 100 kΩ for 2...10 V (0.1 mA), 500 Ω for 4...20 mA, 1500 Ω for PWM, On/Off and Floating point |
| | Operating range Y variable | Start point 0.5...30 V<br>End point 2.5...32 V |
| | Operating modes optional | variable (VDC, PWM, on/off, floating point) |
| | Position feedback U | 2...10 V |
| | Position feedback U note | Max. 0.5 mA |
| | Position feedback U variable | VDC variable |
| | Direction of motion motor | selectable with switch 0/1 |
| | Direction of motion fail-safe | reversible with cw/ccw mounting |
| | Manual override | 5 mm hex crank (3/16" Allen), supplied |
| | Angle of rotation | Max. 95° |
| | Angle of rotation note | adjustable with mechanical end stop, 35...95° |
| | Running Time (Motor) | 150 s / 90° |
| | Running time motor variable | 60...150 s |
| | Running time fail-safe | <20 s @ -20...50°C, <60 s @ -30°C |
| | Sound power level motor | 45 dB(A) |
| | Sound power level, fail-safe | 71 dB(A) |
| | Adaptation Setting Range | off (default) |

## Technical data

| | | |
|---|---|---|
| **Functional data** | Override control | MIN (minimum position) = 0%<br>MID (intermediate position) = 50%<br>MAX (maximum position) = 100% |
| | Position indication | Mechanical |
| **Safety data** | Power source UL | Class 2 Supply |
| | Degree of protection NEMA/UL | NEMA 2 |
| | Housing | UL Enclosure Type 2 |
| | Agency Listing | cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2014/30/EU |
| | Quality Standard | ISO 9001 |
| | UL 2043 Compliant | Suitable for use in air plenums per Section 300.22(C) of the NEC and Section 602 of the IMC |
| | Ambient humidity | Max. 95% RH, non-condensing |
| | Ambient temperature | -22...122°F [-30...50°C] |
| | Storage temperature | -40...176°F [-40...80°C] |
| | Servicing | maintenance-free |
| **Weight** | Weight | 10 lb [4.6 kg] |
| **Materials** | Housing material | Die cast aluminium and plastic casing |

**Footnotes**

*Variable when configured with MFT options.

†Rated Impulse Voltage 800V, Type of action 1.AA, Control Pollution Degree 3

## Product features

**Default/Configuration**

Default parameters for 2 to 10 VDC applications of the EF..-MFT actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. The parameters are variable and can be changed by three means: Factory pre-set or custom configuration, set by the customer using PC-Tool software or the handheld ZTH US.

**Application**

For fail-safe, modulating control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer’s specifications. A feedback signal is provided for position indication or primary and secondary applications. Two EF's can be piggybacked for torque loads of up to 540 in-lbs. Minimum 3/4" diameter shaft. OR Maximum of three EF's can be piggybacked for torque loads of up to 810 in-lbs. Minimum 1" diameter shaft. primary and secondary wiring for either configuration.

## Product features

**Operation**

The EF..24-MFT actuator provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°. The actuator will synchronize the 0° mechanical stop or the physical damper mechanical stop and use this point for its zero position during normal control operations. A unique manual override allows the setting of any actuator position within its 95° of rotation with no power applied. This mechanism can be released physically by the use of a crank supplied with the actuator. When power is applied the manual override is released and the actuator drives toward the fail-safe position. The actuator uses a brushless DC motor which is controlled by an Application Specific Integrated Circuit (ASIC) and a microprocessor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and to know the actuator's exact position. The ASIC monitors and controls the brushless DC motor's rotation and provides a Digital Rotation Sensing (DRS) function to prevent damage to the actuator in a stall condition. The position feedback signal is generated without the need for mechanical feedback potentiometers using DRS. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. The EF..24-MFT is mounted directly to control shafts up to 1.05" diameter by means of its universal clamp and anti-rotation bracket. A crank arm and several mounting brackets are available for damper applications where the actuator cannot be direct coupled to the damper shaft. The spring return system provides minimum specified torque to the application during a power interruption. The EF..24-MFT actuator is shipped at 5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

Installation Note: Use flexible metal conduit. Push the UL listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuator's input wiring with UL listed flexible conduit. Properly terminate the conduit in a suitable junction box.

**Typical specification**

Spring return control damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05" diameter. The actuator must provide modulating damper control in response to a 2 to 10 VDC or, with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. The actuators must be designed so that they may be used for either clockwise or counter clockwise fail-safe operation. Actuators shall use a brushless DC motor controlled by a microprocessor and be protected from overload at all angles of rotation. Run time shall be constant, and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position feedback or primary and secondary applications. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Actuators shall be cULus listed and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

**Factory settings**

Default parameters for 2 to 10 VDC applications of the EF..-MFT actuator are assigned during manufacturing. If required, custom versions of the actuator can be ordered. The parameters are variable and can be changed by three means: Factory pre-set or custom configuration, set by the customer using PC-Tool software or the handheld ZTH US.

## Accessories

**Tools**

| Description | Type |
|---|---|
| Connecting cable 16 ft [5 m], A: RJ11 6/4 LINK.10, B: 6-pin for connection to service socket | ZK1-GEN |
| Connecting cable 16 ft [5 m], A: RJ11 6/4 LINK.10, B: free wire end for connection to MP/PP terminal | ZK2-GEN |
| Service tool, with ZIP-USB function, for configurable and communicative Belimo actuators, VAV controller and HVAC performance devices | ZTH US |
| Service tool for wired and wireless setup, on-site operation and troubleshooting. | Belimo Assistant 2 |
| Signal simulator, Power supply AC 120 V | PS-100 |

**Electrical accessories**

| Description | Type |
|---|---|
| | IRM-100 |
| Auxiliary switch, mercury-free | P475 |
| Auxiliary switch, mercury-free | P475-1 |
| Convert Pulse Width Modulated Signal to a 2...10 V Signal for Belimo Proportional Actuators | PTA-250 |

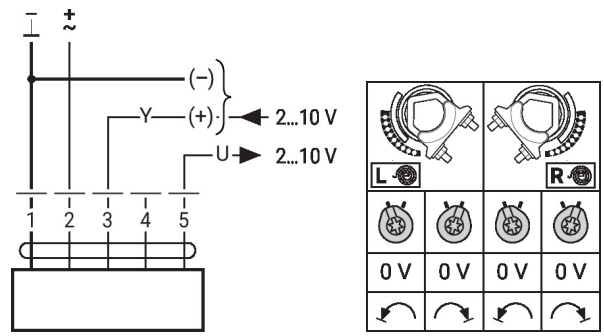
## Accessories

| | Description | Type |
|---|---|---|
| | Positioner for wall mounting | SGA24 |
| | Positioner for front-panel mounting | SGF24 |
| | Cable conduit connector 1/2" | TF-CC US |
| | Gateway MP to BACnet MS/TP | UK24BAC |
| | Gateway MP to LonWorks | UK24LON |
| | Gateway MP to Modbus RTU | UK24MOD |
| | Resistor, 500 Ω, 1/4" wire resistor with 6" pigtail wires | ZG-R01 |
| | Resistor kit, 50% voltage divider | ZG-R02 |
| | Transformer, AC 120 V to AC 24 V, 40 VA | ZG-X40 |
| **Mechanical accessories** | **Description** | **Type** |
| | Shaft extension 240 mm ø20 mm for damper shaft ø8...22.7 mm | AV8-25 |
| | | EF-P |
| | End stop indicator | IND-EFB |
| | Shaft clamp reversible, clamping range ø12...26.7 mm [1/2...1"] | K9-2 |
| | Ball joint suitable for damper crank arm KH8 / KH10 | KG10A |
| | Damper crank arm Slot width 8.2 mm, clamping range ø14...25 mm [1/2...1"] | KH10 |
| | Actuator arm Slot width 8.2 mm | KH-EFB |
| | Push rod for KG10A ball joint L 36", 3/8" diameter | SH10 |
| | Wrench 0.512 in. [13 mm] | TOOL-07 |
| | Mounting bracket for AF.. | ZG-100 |
| | | ZG-120 |
| | | ZG-121 |
| | | ZG-DC1 |
| | | ZG-DC2 |
| | Mounting kit for linkage operation for flat and side installation | ZG-EFB |
| | | ZG-JSA-3 |

## Electrical installation

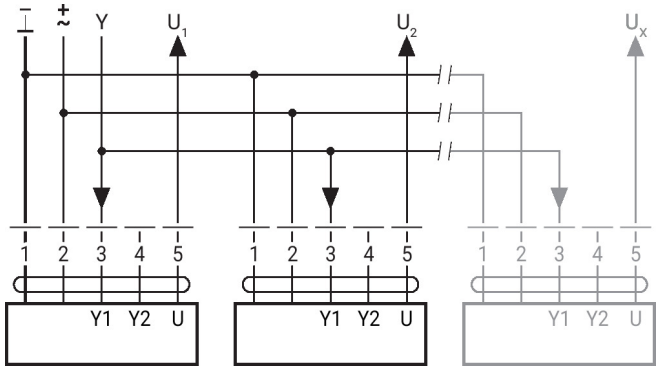
**Wire colors:**
1 = black
2 = red
3 = white
4 = pink
5 = orange

AC/DC 24 V, modulating



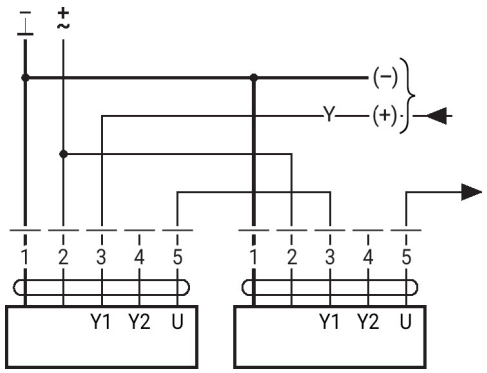
## Electrical installation

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

Wiring diagram piggy-back operation (mechanically coupled actuators)

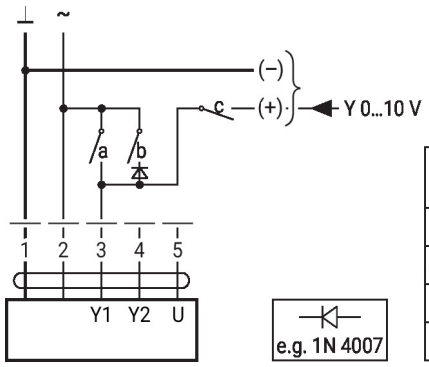



Max. 2 actuators in primary/secondary operation
Primary/secondary operation is permitted only on one fixed shaft or on two mechanically coupled shafts
The programming of the primary actuator is adopted by the secondary actuator

## Further electrical installations

### Functions with basic values (conventional mode)

Override control with AC 24 V with relay contacts

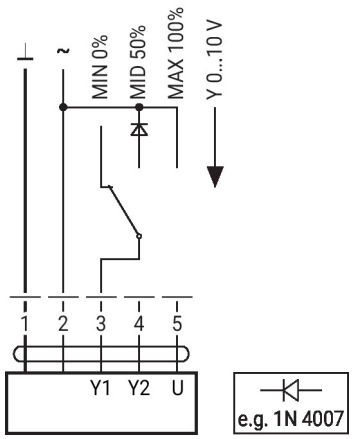



| 1 | 2 | a | b | c | |
|---|---|---|---|---|---|
| | | | | | 0 % |
| | | | | | ZS 50% |
| | | | | | 100% |
| | | | | | Y |

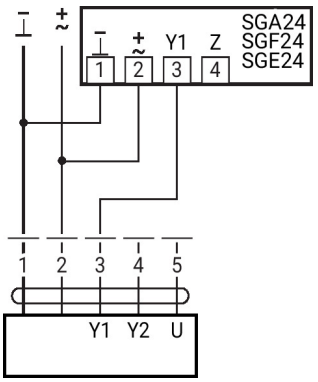
## Further electrical installations

### Functions with basic values (conventional mode)

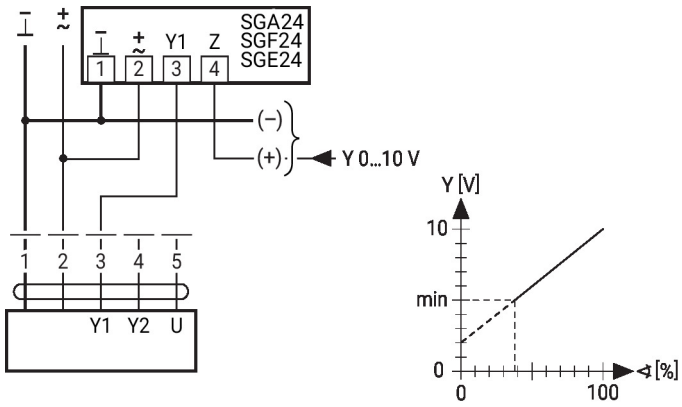
Override control with AC 24 V with rotary switch



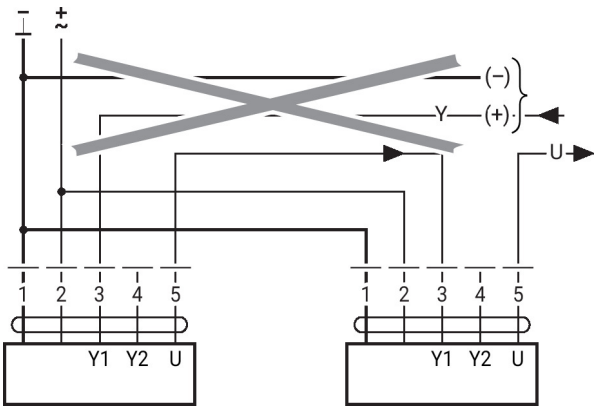

Control remotely 0...100% with positioner SG..



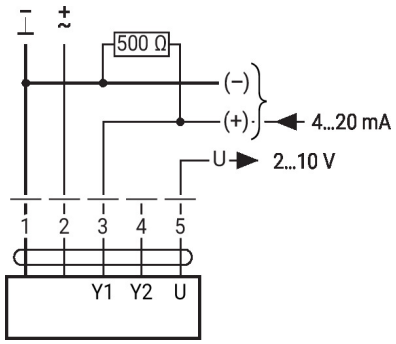

Minimum limit with positioner SG..



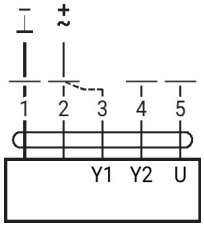

Primary/secondary operation (position-dependent)




Control with 4...20 mA via external resistor




Functional check



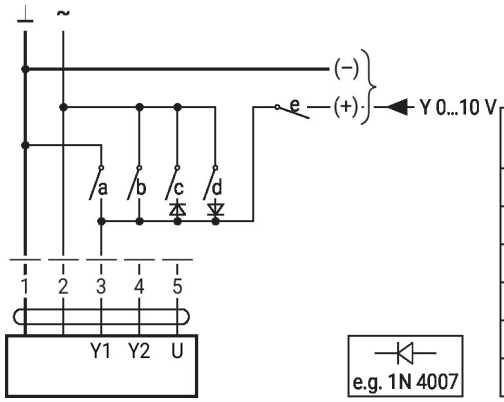

**Procedure**

1. Apply 24 V to connection 1 and 2
2. Disconnect connection 3:
- with upwards direction of motion: closing point at top
- with downwards direction of motion: closing point at bottom
3. Short circuit connections 2 and 3:
- Actuator runs in the opposite direction

## Further electrical installations

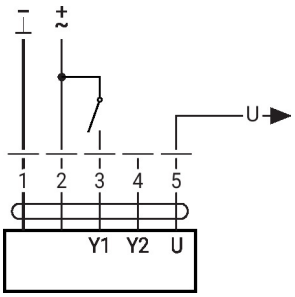
### Functions with specific parameters (configuration necessary)

Override control and limiting with AC 24 V with relay contacts

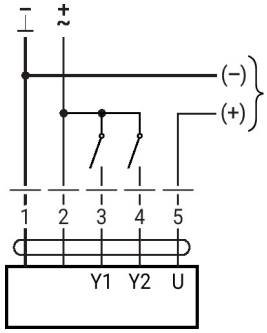



| 1 | 2 | a | b | c | d | e | |
|---|---|---|---|---|---|---|---|
| | | | | | | | Close[1)] |
| | | | | | | | MIN |
| | | | | | | | ZS |
| | | | | | | | MAX |
| | | | | | | | Open |
| | | | | | | | Y |

Control on/off

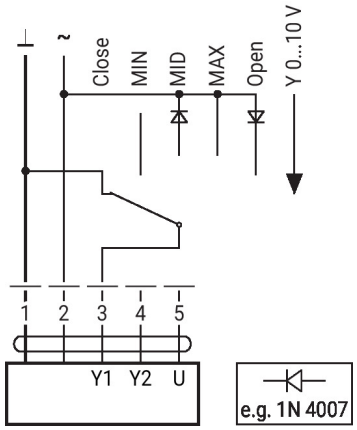



Control floating point




| 1 | 2 | 3 (a) | 3 (b) | L | | R | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | stop | stop | stop | stop |
| | | | | | | | |

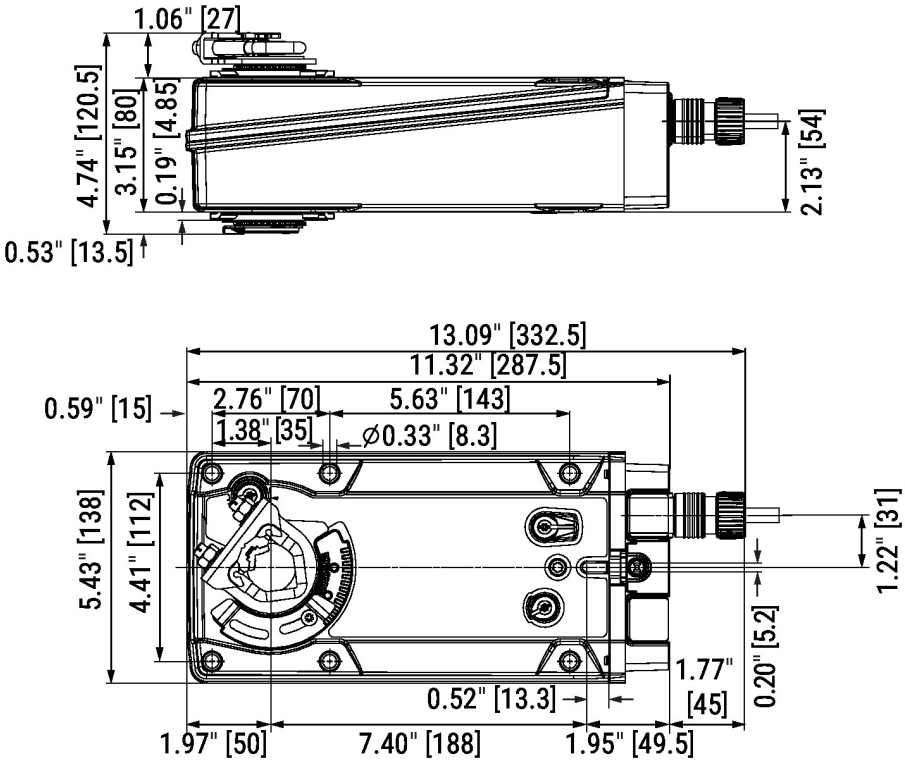
Override control and limiting with AC 24 V with rotary switch




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

## Dimensions

PC




## Further documentation

• Quick Guide – Belimo Assistant 2